Gordons Reloading Tool

Interior ballistic simulation
for reloading cartridge ammunition

Version 2021
https://www.grtools.de

Documentation & User manual

http://youtube.com/GordonsReloading

Gordons Reloading Tool

User manual & Handbook

This is the documentation and the user-manual for the inner-ballistic simulation software **"Gordons Reloading Tool"** , in short **"GRT"** .

Please do read carefully, before using this software!

What is GRT?

The Gordons Reloading Tool "GRT" is a software for handloaders and ammunition designers. It simulates combustion characterisics, pressures and bullet speeds through ballistic parameters and formulas.

GRT's purpose is to provide additional means to develop loads for handloaders and ammunition designers and to avoid excessive loads, weapons disintegration/fragmentation and/or injuries.

The most important features

- Individual loading data
- Bullet database
- Propellant database
- Calibre specifications according to CIP standard incl. automatically generated drawings
- Download & view official caliber specification documents
- Individual report output of the calculation results incl. printing
- Convert units and set individually
- Inspector for detection of input errors
- Quick help for input fields
- Input wizards
- Loading ladder incl. simultaneous display in diagram, interactive
- Automatic recoil and impulse calculation
- Powder comparison tables
- Parametric powder search
- Generic tolerance synthesis of charges
- Cross-sectional area calculation of barrels
- Black powder calculator
- Saving notes, images or other data in the load file
- Shot group analysis
- Automated tool for Optimal Barrel Time (OBT)
- PressureTrace II support: Display of pressure curve as overlay via simulation
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- ...

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7. Manufacturer/Contact:

GORDONS RELOADING CHANNEL (Gordon, private person)

gordon@grtools.de
https://www.grtools.de
https://youtube.com/GordonsReloading

Safety Notes & Warnings

The algorithms and data implemented in this program for the calculation/simulation of the burn-up behaviour are developed and tested with the greatest care, but are based on data and physical equations which for practical reasons contain theoretical assumptions as well as average values and approximations from empirical measurements.

Not every gun or component is the same! The components, from the chamber, barrel, case, bullet to the propellant powder vary from gun to gun and manufacturer and date of manufacture (lot). The results can therefore deviate greatly from the real conditions existing with them.

Compare the results with tested loading tables and/or manufacturer's recommendations. In case of doubt, e.g. if loading tables, manufacturer's specifications and simulation calculations all differ, you should have your hand-loaded ammunition tested by a institute!

- Check used dimensions, volumes and quantities
- Mark hand-loaded ammunition with sufficient information.
- Avoid confusion
- Do not use loading data of other reloaders unchecked
- Compare with loading boards and manufacturer's specifications
- Do not use hand-loaded ammunition in weapons for which the manufacturer refuses to do so, or which provide inadequate safety features and/or do not fully support the cartridge in the chamber. For example, there are guns where, in the event of failure, the breech can be blown back towards the face of the shooter (e.g. certain straight-pull rifles), causing serious injury to the shooter or bystanders!

As a reloader you act on your own responsibility!

Preamble

WHY DID THE GRT COME INTO BEING?

An internal ballistics (IB) program has the potential to remove a lot of guess work and can be an invaluable tool for reloaders. A private initiative was started. Initially out of pure interest, the author (Gordon) of GORDONS RELOADING CHANNEL decided to deal with the topic of interior ballistic simulation calculation and to develop his own software after studying the relevant literature. Experience in thermodynamics, physics and also software development from his professional career were helpful. The author built a development team from a couple of reloading/programming enthusiasts, and created an IB program called Gordon's Reloading Tool, GRT for short. GRT is supplied for free, community supported, and is a cross platform application.

ALGORITHMS

After the dry reading, many examples were first reproduced, tried out and implemented in evaluation software. The algorithms could then be better understood and extended bit by bit. Through the development of a comprehensive formalism, all possibilities were now open.

The GRT is the result of this research, study and work on the interior ballistic calculation on the basis of a mathematical simulation model - not to forget also thanks to the numerous data collectors, sponsors of the measurement data and the testers who participate in this project.

ALTERNATIVE

The commercially available software "QuickLoad" was our standard. We support and respect the outstanding work of Mr. Brömel with his software.

We still have many ideas for the GRT. Our intention was and is not only to create an alternative, but also a platform that can grow by a community.

IMPORTANT TOOL

From our point of view, in-ballistic simulation software is an important, *supplementary* tool which, when used correctly, can increase safety and reduce the risk of "blowing yourself up" and/or others. In this respect, an alternative from our point of view is an enrichment for reloaders.

Interior ballistic model, Powder modeling & Sources

Interior Ballistic Model

The interior ballistic model used in the GRT is a custom development on the basis of the information given in the book *"Waffentechnisches Taschenbuch"* by Rheinmetall ASIN: B002FOOB8G , in the books *"Ballistik - Theorie und Praxis"* by Beat P. Kneubuehl [1)], as well as *"Ballistik"* by Richard Emil Kutterer [2)] and also be influenced by IBHVG2 "lumped-parameter model" [3)].

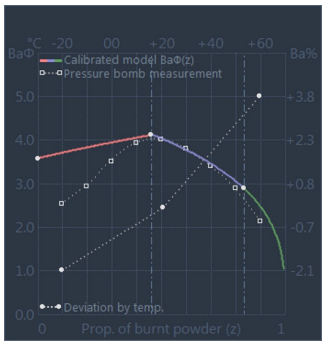
DIFFERENT BURNING CHARACTERISTICS

The various propellants or powders have different burning characteristics, i.e. depending on the manufacturer and type, the powder burns at **different** speeds during pressure development! Such powders behave either progressive, degressive or a specific combination of both. The traditional terms used to advertise powder behavior – e.g. "progressive" and "offensive" do not contradict this, because even offensive powders can be very progressive.

To differentiate burn behavior for propellant selection, creates opportunities to increase projectile acceleration in a longer barrel and keep pressures low at the same time.

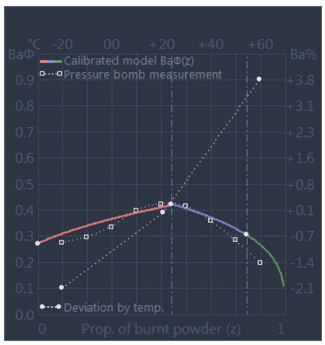
Form functions & mapping

This powder burn-up characteristic is mathematically simulated in the simulation calculation by so-called form functions. This form function mathematically represents and approximates the behaviour of the powder during the burning process.



The mathematical representation of a powder characteristic is based on a standardized measurement, e.g. with a calorimeter bomb or closed vessel (pressure bomb / manometric bomb), which has a specific volume. Several measurements are then taken and recorded with a fixed test quantity delta of a propellant powder.

The parameters of the form functions are changed so that they model the measurement curve. Subsequently, a calibration with ballistic data must be performed, because the propellant can act differently in the dynamic behavior of a gun.



After adaptation and calibration, the mathematical representation does not necessarily correspond to the original measurement data, since the propellant charge behaves dynamically differently than in the static closed vessel. Without a closed vessel measurement, it is possible to create an reengineered model using ballistic data including pressure equipment directly on the barrel over a calibre spectrum and bullet weights.

The closed vessel measurement is therefore one of the most important initial data for a powder model. As a rule, powder manufacturers perform this measurement for research and quality control purposes.

The value **Ba** given in the powder data is the **start** of this curve, which is composed of two or more sections. In contrast to the other software, **GRT** has a **three-step** representation of the burn-up behavior which accounts for multi base propellant behaviors and partially for additives of propellants nowadays like anti-copper-fouling and temperature-stabilizers etc.

DETERMINATION OF POWDER CHARACTERISTICS

The calculations of internal ballistics depend on these powder characteristics. To determine the powder characteristics there is either the possibility of thermodynamic calculation [4)], or experimental determination. The experimental determination of most powder characteristics can be performed using a *closed vessel (manometric bomb)* .

THE CLOSED VESSEL

Pressure in the closed vessel (manometric bomb)

The basic idea behind the closed vessel is that a certain amount of propellant powder **mc** is burnt in a fixed volume **V_mb** . At *combustion* a maximum pressure **p_mb** depending on powder and quantity is reached.

```
p_mb * ( V_mb - b * mc ) = mc * R * T_ex
```

mc is the powder mass, **b** is the covolume, **R** the gas constant and **T_ex** the explosion temperature (flame temperature) of the combustion gases (usually calculated thermodynamically).

Powder constant, specific energy

The *specific energy* **F_se** is obtained from the product of gas constant **R** and explosion temperature **T_ex** :

```
F_se = R * T_ex
```

This specific energy represents the pressure energy during the burning of the powder, which is available for conversion into mechanical energy.

Abel's equation

The English chemist *F. A. Abel* released investigations and an equation published in 1874, proposing to use the general equation of state at high pressures. This is the reason, why the Van-der-Waals equation are not used here. In the case of conditions occurring in ballistics and explosives, the intrinsic volume of the gas molecules must be also considered (covolume **b**). If the charge density **delta** is calculated from the ratio of powder mass **mc** and combustion chamber **V_mb (mc/V_mb)** , the equation known in ballistics as *Abel's equation* is obtained:

```
p_mb = (delta * F_se) / (1 - delta * b)
```

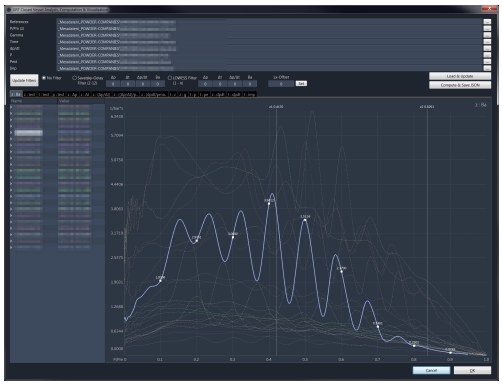
MEASUREMENTS

Charge density in the combustion chamber of a manometric bomb must not exceed a maximum value in order to achieve uniform combustion from measurement to measurement and thus an evaluable pressure curve. The maximum value itself depends on the specific explosion heat **Qex** of the powder used. After the investigations of *Gallwitz* experience has shown that about **delta * Qex = 545 kcal/dm³** has to be. [5)]

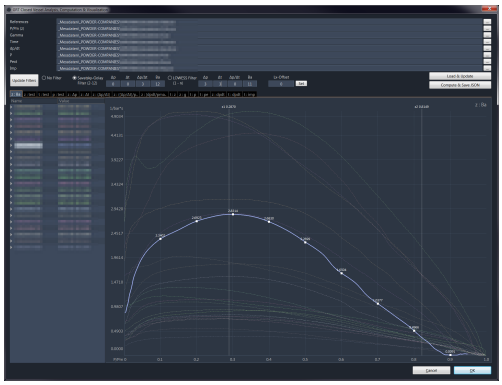
Raw data & processing

In practice, however, due to ubiquitous and unavoidable scattering, measurements must be carried out with different charge densities. Specific energy and covolume are then determined by linear regression. The reciprocal values of the measurements performed form pairs of values. The slope of the regression line gives the reciprocal of the specific energy **F_se** , from which the covolume **b** can be determined.

In the measurement, the pressure is recorded as a function of time, where **z(t)** is the proportion of the converted charge. As said, the problem here is the unavoidable scattering and noise of the signal:



The recorded data is analysed & processed aftermath e.g. using filters like Savatsky-Golay or LOWESS. The results can vary dependent on the filters and parameters used. That is the reason why the values used in a GRT powder model can be slightly different from the figures published by the manufacturer, because the manufacturer may use different filters or parameters for theyr analysis.



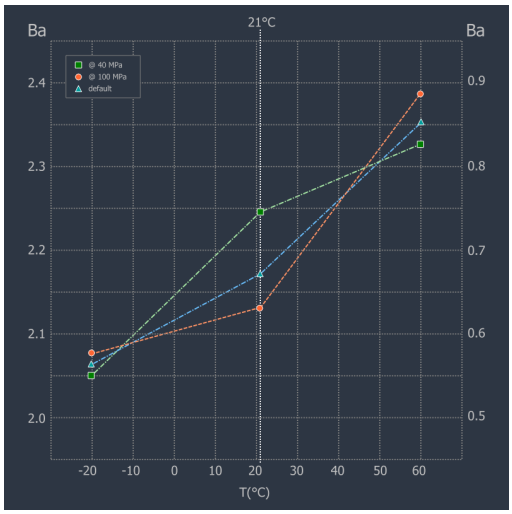
If the law of combustion is used instead of **z(t)** , it can be resolved according to the product of *dynamic vivacity* and *form function* **phi(z)** (see image/diagram above, Y-axis).

```
( Ba * phi(z) ) / p0 = (ppunkt(t) / p(t)) *
( (1- b*z(t)*delta - (1-z(t))*delta/pc)² / (delta * F_se * (1-delta/pc)) )
```

b is the covolume, **delta** the ratio of powder mass and combustion chamber **mc/V_mb** and **pc** the density (mass density) of the powder substance.

TEMPERATURE INFLUENCE ON PROPELLANTS

In the GRT, the change in the combustion behaviour due to the influence of powder temperature is represented by temperature coefficients, which separately represent the range below and above the default temperature of 21°C (see picture on the right, not to scale).



The user has the possibility to change the propellant temperature from the default value within a limited range in order to take account of environmental influences.

In general, the temperature drift of the propellants is represented by generally accepted analyses and algorithms. [6)7)8)9)] Some manufacturers give temperature coefficients from specific measurements for their propellant powders, which improves the results, otherwise the internal default coefficients are used.

To determine the coefficients, the vivacity measurements are repeated at a given temperature and then calculated as follows:

Cold Temperature Coefficient (tcc)

```
tcc = (Ba(T= +21°C) - Ba(T= -20°C)) / (21+20)
```

Hot Temperature Coefficient (tch)

```
tch = (Ba(T= +60°C) - Ba(T= +21°C)) / (60-21)
```

ENERGIES AT THE SHOT

The chemical energy released by the conversion of the propellant charge is essentially divided into the following quantities when the shot is fired:

- The translational projectile energy
- The rotational projectile energy
- Flow energy of the powder gases
- Internal energy of the powder gases
- Heat losses at tube, bullet and sleeve
- Gas losses, friction and acoustics (vibration behavior)
- the work against the pull-out resistance
- The work of pressing the bullet into the lands
- Energy of the recoiling weapon parts
- Energy for cycling (semi-)automatic weapons

LOSSES

The friction losses on the projectile are represented in the algorithm by models, where frictional resistances are primarily specified by the bullet manufacturer if available. The experienced user is given the possibility of manual adjustment.

The flow energy of the powder gases can be calculated by adding a proportion of the charge (carrying factor, "Sebert-factor") to the bullet mass to be accelerated. As is usual in other areas of physics, an effective mass is calculated. Also other energy losses can be considered here in the effective mass, e.g. the energy losses by heat input.

The gas losses due to constructive conditions such as the cylinder gap of revolvers can amount to **up to 20%** . They can be specified by the experienced user with the help of a wizard.

The portion of the gun recoil , as well as the propulsion energy of automatic weapons is neglected.

Data

The caliber, bullet and propellant powder data provided by the GRT are laboriously created by the GRT development team and the community and manually entered data, whereby the data of the propellant powders are based on the measurement data provided by the respective manufacturers, as well as data which have been and will be determined by GRT laboratory and the community on the basis of its own measurements.

Special thanks go to the companies (in alphabetical order):

- Brownells - https://www.brownells.com
- Explosia - https://www.explosia.cz
- Reload Swiss - https://www.reload-swiss.com
- RHEINMETALL - https://www.rheinmetall.com
- RUAG - https://www.ruag.com
- SOMCHEM - https://www.somchemreload.com/

- VIHTAVUORI - https://www.vihtavuori.com

IMPORTANT NOTE

Due to manufacturing fluctuations and tolerances, it is important to compare the data provided with the real conditions and adjust them if necessary. In particular: case volume and bullet length must always be checked and measured. No guarantee is given for the correctness of the data provided!

1) "Ballistik - Theorie und Praxis", Beat P. Kneubuehl, ISBN: 978-3-662-58299-2

2) "Ballistik", Richard Emil Kutterer, ISBN: 978-3-663-02335-7

3) "IBHVG2 - Interior Ballistics of High Velocity Guns, Version 2", ASIN: B00CQCV310

4) Köhler et al., 2008, Akhavan, 2008

5) "Explosivstoffe", J. Köhler, R. Meyer, ISBN: 9783527660070

6) Karim et al. (2015). "Influence of Firing Temperature on Properties of Gun Propellants."

7) STANAG 4115. 1997. "Definition and Determination of Ballistic Properties of Gun Propellants. North Atlantic Council."

8) STANAG 4489. 1999. "Explosives, Impact Sensitivity Tests. NATO Standardization Agreement."

9) Clifford, W. 1982. "Temperature Sensitivity of Aircraft Cannon Propellants. AFATL-TR-82-72."

Usage

Installation & First start

The Gordons Reloading Tool (GRT) is a portable Software and is delivered in an archive. The archive contains all necessary files and components.

IMPORTANT: The archive file has to be extracted before you can start GRT! You cannot start GRT within the archive!

INSTALLATION

EXTRACT the archive into a folder of your choice, e.g. onto "C:\" It is also possible to copy the unpacked archive to a thumb drive and run the program from there.

Settings that you make in the program are stored in the file *GordonsReloadingTool.cfg* in the program directory of the GRT.

GRT ARCHIVE FILE (DOWNLOAD FILE)

The GRT archive file usually has the following structure (using Windows as an example):

- ***GordonsReloadingTool-***
  - ***/doku*** - Directory for documentation files and templates used by the program.
  - ***/libs*** - Directory of program libraries
  - ***/loads*** - Directory of (sample) laboratory files/loaded data files
  - ***/Resources*** - Directory of program language files
  - *GordonsReloadingTool.cfg* - Configuration file, in this file the program saves its settings.
  - *GordonsReloadingTool.db* - local Database
  - *GordonsReloadingTool.exe* - program file
  - *LICENSE.TXT* - License (english)
  - *LIESMICH.TXT*
  - *LIZENZ.TXT* - Original License (german)
  - *README.TXT*

SYSTEM REQUIREMENTS

Resolution:	HD 1080p
Memory:	100 MB
Work Memory (RAM):	1 GB
Operating system:	Windows or Linux (x86/x86_64)

WINDOWS:

Windows 7 SP1, Vista, 8.1, 10 in 32 or 64 Bit.

LINUX:

- **Recommended: Linux Mint 20 - 64 Bit (Debian)**

It may be necessary to install required dependencies (execute commands one after the other):

```
$ sudo dpkg --add-architecture i386
$ sudo apt-get update
```

```
$ sudo apt-get install lib32stdc++6
$ sudo apt-get install libgtk2.0-0:i386
$ sudo apt-get install gtk2-engines-pixbuf:i386
$ sudo apt-get install gtk2-engines-murrine:i386
$ sudo apt-get install gnome-themes-extra:i386
$ sudo apt-get install libcurl4-openssl-dev:i386
```

If you want to identify necessary libraries, the command ***ldd*** can help. You can run this command from Terminal in the GordonsReloadingTool directory to return a list of the libraries required by the GordonsReloadingTool and their status on the system:

```
ldd GordonsReloadingTool
```

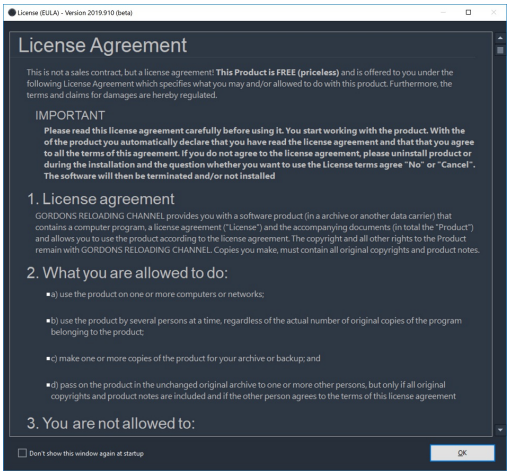
Please note:

GRT is not developed under Linux, so it is a cross-compiled application and is only tested extensively with the recommended system mentioned above. If you have problems running GRT on your distribution, please consult your Linux help on how to run Standard 32-bit Gtk applications on your specific distribution.

First program start

License

When the program is started for the first time a window with the license agreement appears. You must agree to the terms & conditions of the licence agreement in order to continue. **Read the license agreement carefully before proceeding!**

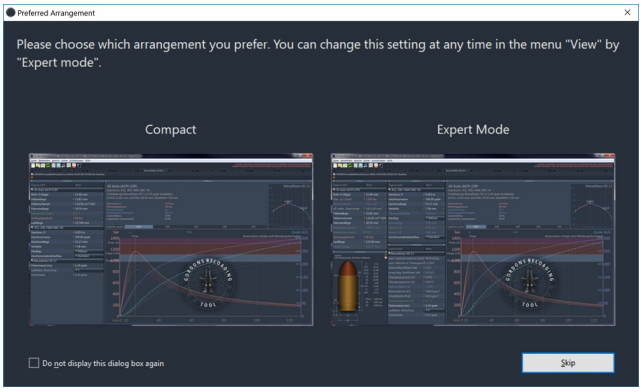


If you do not agree, select the button **"[Cancel]"** , the program will not continue.

If you agree with the license agreement, check the box **"[ ] Understood and Accepted "** which will release the button **"[OK]"** to continue.

Arrangement selection

Then, an dialogue to select the preferred layout/arrangement appears. The arrangement can be changed at any time in the program itself. Two modes are available: Compact Mode or Expert mode



- **Compact Mode:**
  The compact layout is best for beginners, who have little experience with internal ballistic simulation software, or users who prefer a more compact presentation. Newcomers tend to choose this mode, in order are not to get overwhelmed. **However, the compact display hides many details**

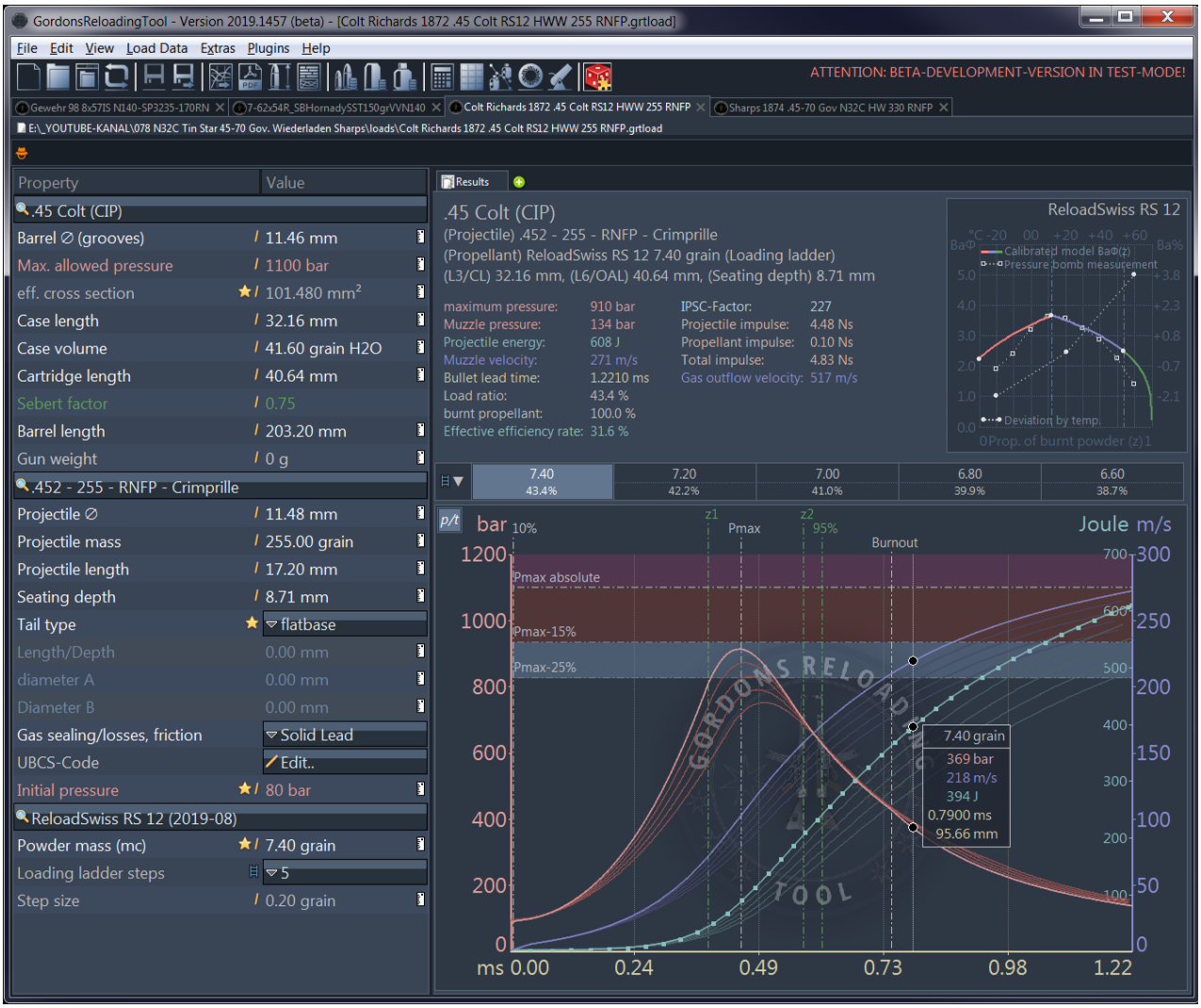
- **Expert Mode:**
  The expert mode is the regular **full view** with all input data & options. This mode is useful if you are already experienced and if you have already got to know other internal ballistic simulation software.

Click on one of the pictures to select the desired arrangement.

If you check **"[ ] Do not display this dialog box again"** , the selection will not be shown at the next program start. You can also change this setting in the main program.

Overview compact mode

In compact mode, the most important input options are summarized in a single input window (left).



Detailed value entries, such as powder-specific coefficients and constants, are **hidden** in this mode.

INPUT WINDOW (LEFT)

Use the buttons with the magnifying glass to select or search for calibre, bullet and propellant powder.

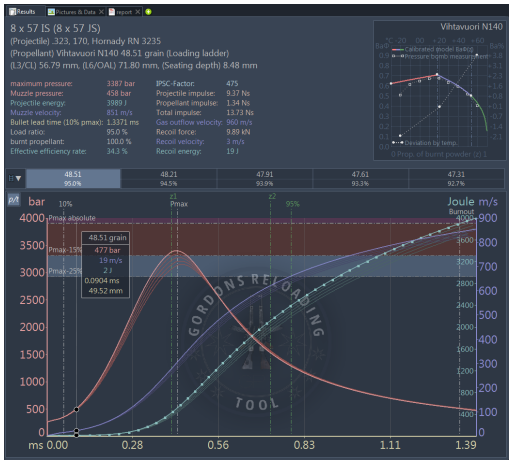
Input fields in which you can enter or change values are marked with a small **pen symbol** . **Click in the input field** to edit a value. If you have made a mistake and want to restore the original value, press the **ESC** key or the **Ctrl-Z** key combination for a step-by-step undo. To confirm the entered value, you can click outside the input field or press the **ENTER/RETURN** key.

A small ruler symbol is located to the right at the edge of a field. By clicking on this symbol, you can switch the displayed units. The setting is saved and therefore remains in this position.

As soon as you have accepted/changed a value , a new simulation calculation is **automatically** performed and displayed in the output window.

⇒ **More detailed information** and important notes on the input fields and the values to be entered can be found in chapter Input fields & values.

OUTPUT WINDOW (RIGHT)



In the output window the simulation results as well as helpful additional information are displayed. **Safety instructions & error messages** also appear here if the input parameters appear implausible, wrong or dangerous to the program.

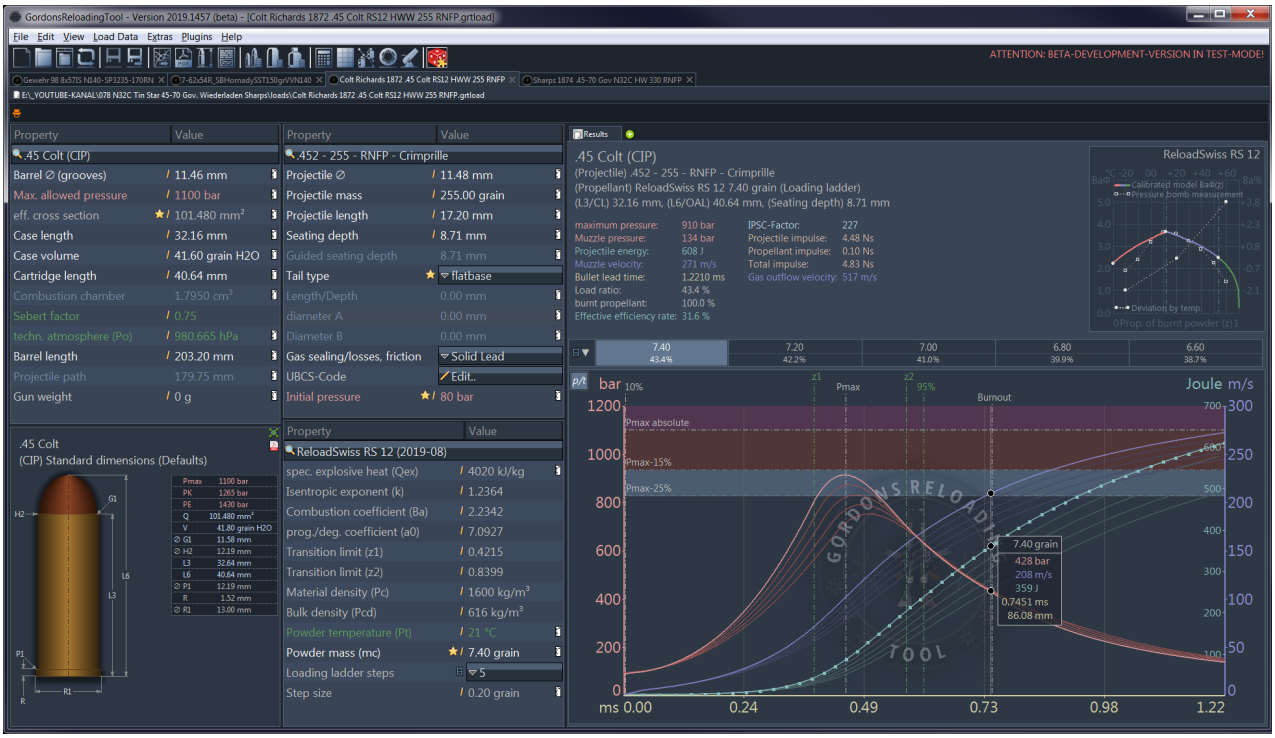
Do not blindly rely on error messages! It is possible to enter nonsensical values, which lead to wrong results!

- Therefore, check your entries several times.
- **Measure it!** e.g. case volume and bullet length from the database are **average values** . They vary from manufacturer, lot and in case of used cases also by the weapon used and processing of the case.

⇒ **A detailed description** of the output window can be found in chapter Result & Output Field.

Overview Expert Mode

In expert mode, **all** input parameters/options are displayed in separate input windows.



EXPERT MODE

Each input window provides and/or displays all **detailed value entries,** such as all powder-specific coefficients and constants. In addition, the cartridge drawing of the original **(CIP-) caliber specification** including all dimensions is visible in a separate window.

INPUT WINDOW (CALIBER, PROJECTILE, PROPELLANT CHARGE)

Use the buttons with the magnifying glass to select or search for calibre, bullet and propellant powder.

Input fields in which you can enter or change values are marked with a small **pen symbol** . **Click in the input field** to edit a value. If you made a mistake and want to restore the original value, press the key **ESC** , or for a step-by-step undo, press the key combination **Ctrl-Z** . To confirm the entered value, you can click outside the input field or press the **ENTER/RETURN** key.

A small ruler symbol **is located to the right of the edge** of a field. By clicking on this symbol, you can switch the displayed units. The setting made is saved and therefore remains in this position.

Note: If the window is too small to display all list entries, a scroll bar appears that can hide the icon. You can resize the columns at the top to make them visible again.

The yellow star indicates that an input assistant is available for the current and any subsequent associated values (see paragraph "Tools & Assistants" at the main page).

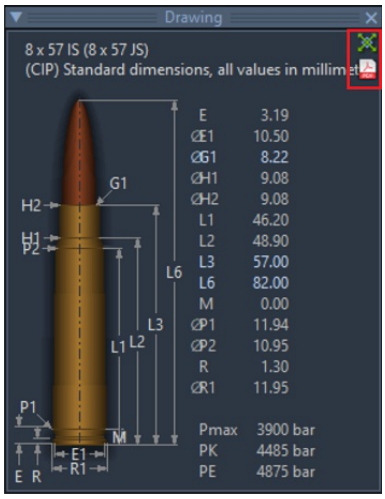
AUTOMATIC REFRESH

As soon as you have accepted/changed a value , a new simulation calculation is **automatically** performed and

displayed in the output window.

⇒ **More detailed information** and important notes on the input fields and the values to be entered can be found in chapter Input fields & values.

CARTRIDGE DRAWING



The cartridge drawing in the area of the input window shows the **original specification** incl. all **original dimensions** in reduced view.

In the upper right corner you will find two symbols. The upper one opens the large view of the drawing in a separate window. The lower (PDF symbol) is the PDF document provided by the standardization organization (e.g. CIP).

Note that the PDF documents are only (automatically) downloaded from the organization's website if the document has not yet been cached locally.

Once you have downloaded/displayed the document, it will be stored in the folder ***/pdf*** in the GRT program directory and will be available the next time you call it up.

OUTPUT WINDOW (RIGHT)

In the output window the simulation results as well as helpful additional information are displayed. **Safety instructions & error messages** also appear here if the input parameters appear implausible, wrong or dangerous to the program.

- **Do not blindly rely on error messages! It is possible to enter nonsensical values that lead to wrong results!**
- Therefore, check your entries several times.
- Measure it! e.g. case volume and bullet length from the database are **average values** . They vary from manufacturer, lot and in case of used cases also by the weapon used and processing of the case.

⇒ **A detailed description** of the output window can be found in chapter Result & output field].

Toolbar

We designed and consider the main menu mostly self-explanatory, so only the toolbar icons are explained here in greater detail:

The toolbar is used to select the most frequently used functions and is located below the main menu.

Let the mouse hoover over an icon for a short description of its function. All icon functions are also available through the main menu.

FUNCTIONS (FROM LEFT TO RIGHT)

FILE FUNCTIONS

(Functions from the "File" menu)

- Create New File (Loading Data)
- Load/open existing file in new tab
- Load/open an existing file in a completely new window
- Reread current file, unsaved changes will be discarded
- Save current file
- Save current file under a (new) name

FUNCTIONS FOR THE CURRENT FILE (LOADING DATA)

(Functions from the "Loading data" menu)

- Open the PDF document provided by the standardization organization (e.g. CIP).
  - **Note** that PDF documents are only downloaded from the organization's website (after manual confirmation) if the document has not been already downloaded in the past and stored locally.
  - **Once you have downloaded/displayed** the pdf document, it will be stored in the folder ***/pdf*** in the GRT program directory and will be available the next time you call it up.
- Open the large view of the cartridge drawing. **The cartridge drawing** shows the **original specification** including all **original dimensions** .
- Results-Report open (printout and customization possible).

GENERAL TOOLS

(Functions from the "Extras" menu)

- Caliber Database
- Projectile Database
- Propellant Database

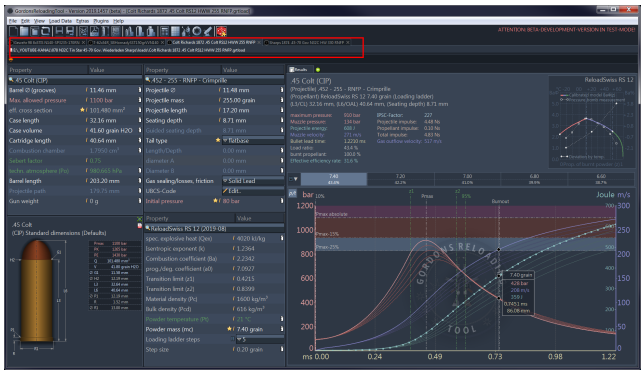
- Convert units of measurement
- Table of propellant relative burn ratio

-  Calculator for effective cross section of the caliber/barrel
-  Black powder calculator
-  Shot group analysis
-  Optimal Barrel Time (OBT)
-  Parametric powder search and generic tolerance synthesis
-  Cartridge-Designer

PLUGINS

The standard toolbar icons are followed by the icons of the plugins in theyr load order.

File tab (tabs)



Several files can be opened in parallel in each GRT main window , which then appear next to each other in their own tab.

To change simply click on the desired tab.

To close each tab has a small (x)-symbol. This allows you to close the tab (and thus the opened file). If there are still unsaved changes, a corresponding warning appears. The last tab, i.e. if only **a** tab is still open, cannot be closed **for technical reasons.**

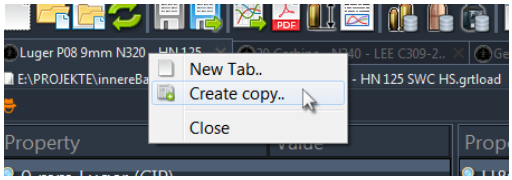
To rearrange the tabs , click on a tab and keep the mouse button pressed. Now you can move the tab to another position.

Below the tabs, the **file path** of the current file is displayed.

CONTEXT MENU

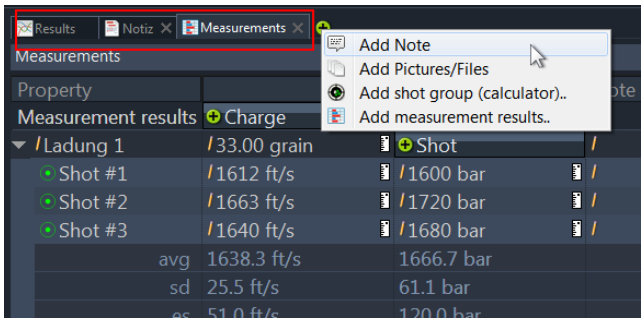
A right click on a tab opens a context menu.

The context menu offers functions for creating a new charge, or for creating a copy of the current charge file.



Result-Field Tabs

The result field of the load file has its own tab bar. Here you can add various additional information to your load file, even multiple times.

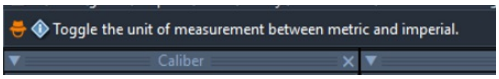


To add tabs, click the **plus icon** . A menu appears with several items to choose from:

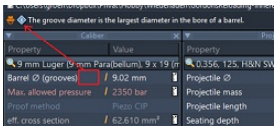
- Notes (Text)
- Files & Images, automatically as gallery
- analyse shotgroups
- Measurement results documentation & evaluation (universal). Additional options to import **Caldwell** , **Labradar** and **MagnetoSpeed** files (via context menu).

Inspector

The inspector is a text line below the tabs. It shows helpful information about input fields or general short notes.



BRIEF DESCRIPTIONS



Hold (hoover) the mouse over a field for about 1/2 second. A short description will be displayed in the text line of the inspector.

General usage instructions for data entry.

There are four windows in this view in expert mode. Data entry fields are contained in three of them:

- Caliber/Cartridge
- Projectile (Bullet)
- Propellant (Powder)

An additional window contains:

- Drawing (a caliber illustration)

Input Rows

Each edit windowrowcontains two columns: ***Property*** *and* ***Value***

The property column lists all input field parameters. The value column contains the corresponding value along with its dimension. Fields marked with a "pen" symbol can be edited. Fields without a pen symbol contain computed or non-editable values. The "ruler" can be used for switching through alternative dimensions (metric / imperial) and / or modes of calculation.

Different colors are used for these entry fields. Parameter, fields and values for pressure are marked red. Temperature and Sebert-factor ("Sebert'scher Faktor") in green. Any user entry will change the fields color to yellow and the font to italic, if there was no save to the changes. In this case, the tab header will change the name of the charge to red. After saving changes, the fields will return to their original color and font. Values in dark grey cannot be changed. Values in white identify a value of major importance, while those in light grey correspond to them as minor factors or details. Decimal delimiter is always a dot, even when an input field is in metric mode.

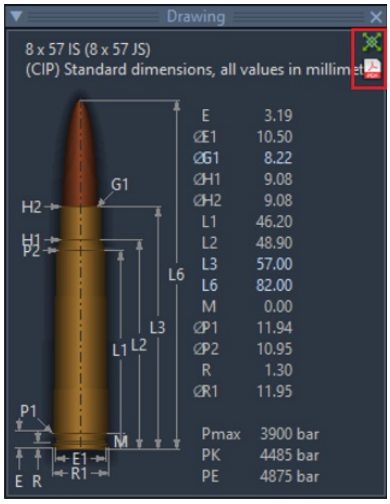
Assistants

Input fields with a preceding yellow asterisk, additionally provide input help via a wizard/assistant. Click on the asterisk to open the respective wizard. In most cases, the wizards provide direct help with a short description.

If not self-explanatory, you will find a detailed description of the respective wizard via the table of contents in the section *"Tools & Assistants"* .

Drawing Window

Illustration of a round in the selected caliber this window also contains the original specifications for measures (lengths, radius, angels and pressures) in a compact view.



In the **upper right corner** , two symbols are shown to open either a full-size view in another window (upper symbol) or to open a .pdf document containing the original specs from the originating body (lower symbol).

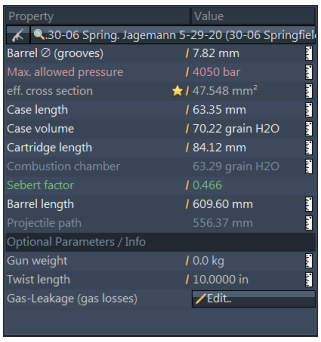
Please Note: original specification documents will be loaded automatically from the respective website and stored in the ***/pdf*** folder, if they have not previously been stored locally.

Once retrieved the original specification documents will be stored locally and be available for future reference without reoccurring download.

CALIBER WINDOW

Most caliber data are derived from offical standardization bodies, such as CIP (COMMISSION INTERNATIONALE PERMANENTE POUR L'EPREUVE DES ARMES A FEU PORTATIVES, CIP). Values shown contain maximum and minimum values for physical dimensions and pressueres.

The following input fiels are contained in the caliber window:



- **Caliber Selection (first drop down)**
  By selecting a caliber from the caliber database, all values will be set to default as providet for the individual caliber. If necessary, the following values can be changed:

- **Barrel-Diameter (Groove Diameter)**
  This value represents the groove diameter of a rifled barrel in the given diameter according to spec. If your barrel happens to have an out-of-spec / different from average groove diameter, the measured out-of-spec value can be entered here.

- **Max. Allowed Pressure**
  This value contains the max. pressure specified for the selected caliber. This should not be altered, as the value is used to automatically generate Pmax allowed (and above), Pmax allowed until Pmax-15%, and Pmax-15% until Pmax-25%, and possible warnings in the diagram.

- **Effective Crosssection**
  The effective cross-section indicates the physically effective cross-sectional area on which the combustion pressure acts on. This value is predetermined by the specification for the caliber. This value depends on the number and construction of the rifling. You can adjust the value to your particular circumstances using the assistant (yellow star), for example, if your barrel has 6 grooves instead of 4.

- **Case Length**
  Enter here the **self-measured length** of the cases ready prepared for the reloading process. The value is pre-filled with the maximum case length according to the official caliber specification. **This value needs regularly to be replaced by own measures of the reloader.**

- **Case Volume**
  Enter here the average case volume **from a FIRED case** . Only, if measured correctly, GRT's simulations will calculate accurate results. **This value needs regularly to be replaced by own measures of the reloader.**

- **Cartridge Length**
  Over-All Length (OAL) of the Round. The total length (e.g. "OAL", or "L6" according to CIP) is the distance between the tip of the bullet and the base of the case of a given cartridge. This value is calculated based on actual case length, the length of the projectile minus the seating depth of the bullet into the mouth of the case.

- **Combustion Chamber**
  This volume shows the available space, available for powder gases, inside the cardridge with a seated bullet.

- **Sebert Factor**
  The Sebert factor defines the amount of powder mass flowing together with the bullet through the barrel. Depending on caliber it is a value between 0.1 und 1.0.

- **Barrel Length**
  The length of the barrel of the gun, the simulation is calculated for. **This value needs regularly to be replaced by own measures of the reloader.**

- **Projectile Path**
  The distance, traveled by the projectile, until it leaves the barrel.

OPTIONAL PARAMETERS / INFO

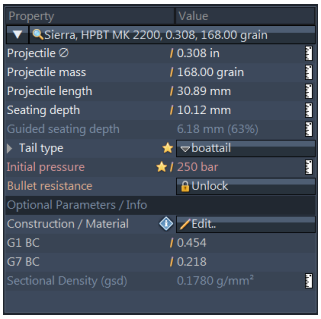
- **Gun weight**
  The gun weight is used for the recoil calculation.

- **Twist length**
  Die Dralllänge wird für sekundäre Anforderungen verwendet, z.B. einem Bullet-Stability-Plugin, nach Bedarf bearbeiten.

- **Gas leakage**
  Definition and edit of gas leakages in the guided bullet-path of the barrel, e.g. the cylinder gap of revolvers. **Be sure to read the notes in the editing window!**

PROJECTILE WINDOW

The projectile window has the following fields:



All measurements in the original database where either submitted by the respective manufacturer or measured by contributing hand loaders. Projectiles of the same brand and/or model can and will have different geometries (depending on weight)

- **Projectile Selection (first dropdown)**
  By selecting a projectile from the database, all values will be set to standard values for the given bullet.

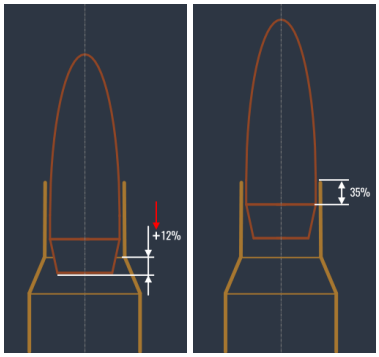
- **Projectile Diameter**
  The (ideally self-measured) average diameter for the bullet on its widest part

- **Projectile Mass**
  The average weight of the bullet (best results, if measured by the hand loader)

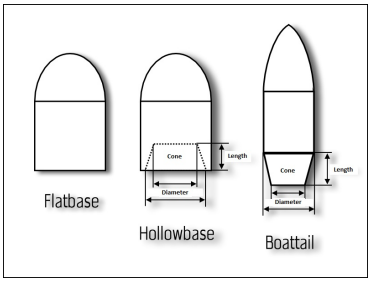
- **Projectile Length**
  The average length of the bullet **please take your own measurements!**

- **Seating Depth**
  The total seating depth of the bullet into the case - that is the distance of the bullets tail to the mouth of the case.

- **Guided Seating Depth**
  The "Guided Seating Depth" is the **contact length of the cylindrical projectile part** and is therefore identical to the seating depth for flat-base and hollow-base projectiles.
  For boattail projectiles additionally the percentage by which the projectile base is seated in the case mouth is shown in parentheses in relation to the case mouth length. **A leading "+"** indicates that the bullet base extends into the case shoulder.



- **Tail Type**
  GRT recognizes different tail configurations/features for bullets (this will influence the available combustion volume in some cases): ***"flatbase"*** (flat tail / base of the bullet - not influencing cartridge combustion volume), ***"hollowbase"*** (Tail with an cone shaped insert (cavity) into the bullet's tail (similar to open lead core bullets) - this will increase the available cartridge combustion volume inside the case. Finally ***"boattail"*** (a bullet with a prolonged cone tail, with decreasing diameter. - this will decrease the available cartridge combustion volume inside the case. For accurate simulation results with bullets featuring hollowbase or boattail configurations, the following parameters are essential:



  - **Cone Length**
    The lenght of the cone or depth of the cavity
  - **Cone Diameter A & B**

If *boattail* this is the diameter, definig the begin or the end of the cone. If *hollowbase* it is the diameter of the surface marking the begin or end of the cavity. Entering larger or smaller value as A or B is to the discretion of the hand loader, as GRT will calculate the appropriate cone or cavity automatically.

- **Initial Pressure**
  The initial gas pressure (IP) is used to adjust the internal ballistic start parameters. Primary parameters are the pressure at which the bullet should start to move, the press-in pressure in the barrel grooves, pull-out resistance, primer type, powder variations and other tolerances. If you have projectile velocity and/or gas pressure measurements, you can use it to adjust the simulation to the real world. Note, however, that any adjustment only refers to the weapon used and the current load.

Pistol-/Revolver Ammunition	
Standard Jacketet Bullets	80-150 bar
Lead Bullets (standard)	50-80 bar
Lead Bullets (soft)	20-50 bar
Rifle Caliber	
Standard Jacketet Bullets	250 bar
Lead Bullets (soft)	20-80 bar
Lead Bullets (standard to brittle)	80-150 bar
Copper/-Brass (Solid), **Value depends on construction & material used!**	250-750 bar
Copper/-Brass (Solid), bullets with a bullet body diameter equal to the **lands diameter** ("BORE RIDER") and **NARROW** driving bands. **NOTE:** Projectiles with **grooved rings as relief grooves** are ***NOT*** such projectiles!	50-150 bar
Copper/-Brass (Solid), bullets with a bullet body diameter equal to the **lands diameter** ("BORE RIDER") and **WIDE** driving bands. **NOTE:** Projectiles with **grooved rings as relief grooves** are ***NOT*** such projectiles!	100-250 bar
Slugs/Shotgun Shells	
with shot cup/ sabot	10-60 bar
Full-Bore-Slugs	30-80 bar

- **Bullet resistance**
  The Bullet resistance (BR) is a value that is usually determined and provided only by the bullet manufacturer. It is recommended to change the value only if you use a special bullet construction or material and know its value, or if you have determined the value experimentally! **DO NOT use this function for regular standard jacketed bullets!**

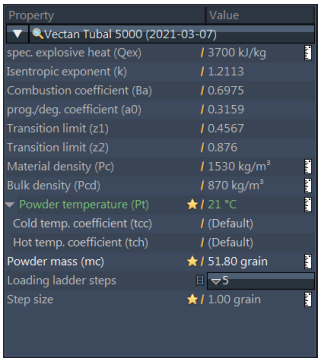
  The input value *"bullet resistance / friction"* , which is *independent* of the barrel length , changes the resistance the bullet has against the combustion pressure as it moves through a barrel. Set this value to ZERO to use the default value. The default value is part of the energy losses considered in the simulation core and depends on the bullet length and the effective cross section.

  Since the input value "bullet resistance / friction" is ***relative*** to the default value, you can also enter a ***negative*** value to reduce the resistance. A warning message appears in the simulation output if you fall below physical

limits.

- **Construction / Material**
  The Universal Bullet Classification Scheme UBCS-Code (follow link for more information) is a scheme to classify bullets by purpose, geometry, external and internal features. It is used to simplify the task of finding alternative bullet types by application and/or intended purpose. **This value has no influence on the simulation.**

PROPELLANT WINDOW



The data provided contains all necessary values to describe the characteristics of a given propellant. All fields are editable, but it is highly recommended to refrain from doing so.

The propellant window contains the following fields:

- **Propellant (Powder) Selection (first drop-down)**
  By selecting a powder from the propellants database, all values ar set to manufacturers standards.

- **Spec. Explosive Heat (Qex)**
  This value (Qex) describes the total contained amount of explosive energy of the powder taken by caliometric measurements.

- **Isotropic Exponent (k)**
  This value (κ) describes the heat-capacity of gases created by the powder at constant pressure (Cp) and volume (Cv)

- **Combution Coefficient (Ba)**
  This value (Ba) describes the "vitality" of the powder during the ignition process.

- **prog./degr. Coefficient (a0)**
  This value (a0) is a reference, whether the powder reacts progressive or degressive when combusted.

- **Transition Limit (z1)**
  This value (z1) is the boundary, where the powders progressive combustion translates into *primary-degressive* combustion.

- **Transition Limit (z2)**
  This value (z2) is the boundary, where the powders *primary-degressive* combustion translates into *secondary-degressive* combustion

- **Material Density (Pc)**
  The density of material (pc) describes the mass/density of the material, the powder is made from.

- **Bulk Density (Pcd)**
  Bulk density (pcd) describes the mass/density of the powder, in its final physicall appearance per volume (including air pockets in cavities and between flakes or filaments)

- **Powder Temperature (Pt)**
  The temperature of the propellant. This temperature has some influence of the combustion behaviour of the propellant itself.

- **Powder Mass (mc)**
  The amount of powder dispensed into a case/round. This is the central editable field to explore changes in

pressure, velocity and muzzle energy in the output diagrams to aquire a suitable charge.

- **Loading Ladder**
  This field is used to tell GRT, if multiple graphs for pressure, velocity and energy should be used in the main output diagram as a load development ladder. If no stepping (=1) is applied selected, only single graphs (corresponding to the selected powder mass) for pressure, energy and velocity will be drawn. If stepping (n>1) is applied, multiple graphs are generated. Those reflect the maximum charge, based on the selected powder mass and additional n graphs for n times reduced amounts of powder (see step size).

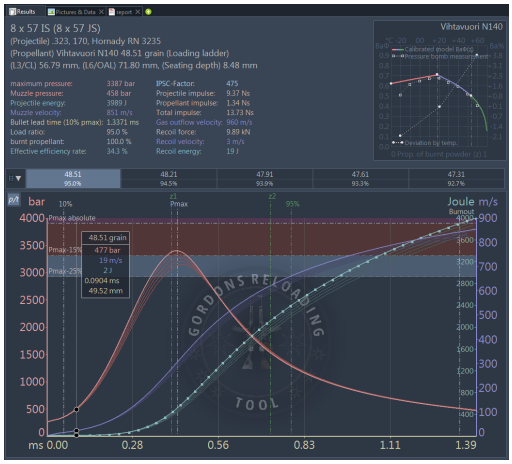
- **Step Size**
  This defines the offset for the reduced charges in load development ladder mode

NOCACHE

Results and output fields

Window: Results

The result and output fields contain multiple information (starting top left to bottom right):



- Summaries / description of substantial simulation data (caliber, powder type, powder mass, OAL and seating depth, specific and representative [max] values of the simulation
- A characteristic diagram to display the "vivaciousness" of the powder in its three simulation phases
- A combined diagram including the calculated values of pressure, energy and projectile velocity (selection fields for the load development ladder)

NOTES, IMAGES & FILES:

The result and output field has a **tab bar** at the top. By clicking on the "+" symbol, **notes, images and files** can be added to the current load file (*.grtload). The added data is stored in the load file.

AREA: SUMMARY

First, the caliber is being picked from the caliber database. This choice is independent from the CIP maximal values assigned to the relevant caliber which may have been changed (e.g. pressure)

- **projectile**
  The next label determines the projectile picked from the projectile database including the description stored in the database (manufacturer, product name, bullet weight in grain).
- **propellant charge**
  This label describes the powder picked from the powder database including the relevant description stored in the database (manufacturer, product name). These data sets are completed by maximal powder mass provided in the powder load window (in grain).
- **load development ladder**
  Contains no further information but an indication that the diagram includes a load development ladder.
- **L3/CL**
  Displays the inserted case length.
- **L6/OAL**
  Provides the inserted or calculated overall length of the cartridge.
- **seating debth**
  Contains inserted or calculated seating depth (depending on L3 and L6)

AREA: RESULT

- **Maximal pressure:**
  The highest relevant value calculated is displayed in the diagram split into the chosen steps (in case that a load development ladder is being used)
- **Muzzle pressure:**
  The calculated value of the muzzle pressure in the determined load development ladder steps (if applicable). The calculated value depends strongly on the inserted barrel length.
- **Projectile energy:**

The calculated energy level of the projectile when exiting the barrel in the steps chosen (if a load development ladder is being used) depending on the specific barrel length inserted.

- **Muzzle velocity:**
  The calculated speed of the projectile when exiting the barrel in the steps chosen (if a load development ladder is being used) depending on the specific barrel length inserted.
- **Bullet throughput time:**
  The calculated time between ignition and moment which the projectile exits the barrel in the steps chosen (if a load development ladder is being used) depending on the specific barrel length inserted.
- **Load ratio:**
  The ratio of the volume of the powder charge over the inserted inner case volume in the diagram depending on the caliber and chosen steps (if a load development ladder is being used)
- **Burnt propellant:**
  The burned powder percentage in the diagram which is used for the acceleration of the bullet before it leaves the barrel.
- **Effective efficiency:**
  The ratio of the kinetic energy contained at the muzzle in the projectile and the theoretically available energy of the powder mass used.
- **IPSC factor:**
  The IPSC factor is calculated from the product of bullet weight (grains) multiplied by the average muzzle velocity (feet per second) divided by 1000

AREA: POWDER DIAGRAM

The powder burn-up characteristics are mathematically simulated with so called form functions. The GRT uses a three-stage image for the display. Each step is colorized individually in the vivaciousness diagram. The powder burn-up characteristics and vivaciousness of each powder type are taken from validated data sets provided by the original powder manufacturers and form the base for the diagram calculation. The illustrated graph is the result of a GRT-specific simulation taking the previously mentioned data sets as an input. The hereby calculated figures represent the powder values used for the following inner-ballistic simulations.

See also: Formalism, Sources & Powder model

AREA: LOAD DEVELOPMENT LADDER (GRAIN)

A point-and-click tab-sequence which (if selected) shows the powder volumes (in grain values) of the load development ladder in the chosen steps. When clicking on the volume values, the corresponding graph in the diagram below is selected.

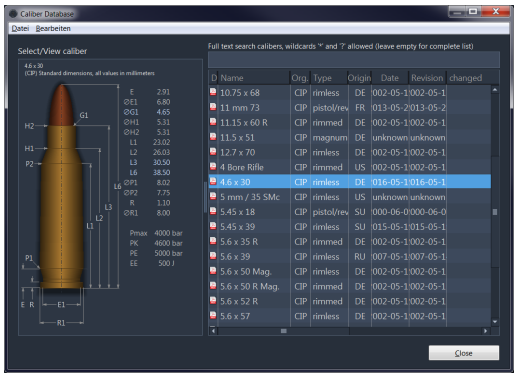
AREA: SIMULATION DIAGRAM

Responsive diagrams (multiple graphs if a load development ladder was chosen) displaying pressure in the barrel, bullet energy and velocity as a result of the inner-ballistic simulation. Caliber, projectile and powder values determine the results of the previous simulation. Corresponding values are being displayed in a context menu when hovering over the graphs.

Tools & Assistants

Caliber Database

Caliber Database is an archive of all calibers and their respective specifications, released by official bodies (such as CIP). After GRT installation, a default set is included. This can however be extended or edited.



There are two main windows and a search-form:

- Select/View caliber
- Search-Form: "full-text search"
- List of Calibers

SELECT/VIEW CALIBER

This is an automatically generated drawing (illustration) of the cartridge of the selected caliber. It contains all relevant measurements.

SEARCH-FORM

This can be used for searching for any text in the caliber database. Wildcards are "*" for any number of letters and "?" for single letters.

List of Calibers

- **Datasheet**
  This icon represents the datasheet for the caliber. It will be opened, when clicked and available locally. If no version of the datasheet is found locally, the sheet will be automatically downloaded from the official website.

- **Name**
  Designated name for the given caliber (chosen by official standardization bodies, such as CIP)

- **Org.**
  Official standardization body for the caliber

- **Type**
  Type of caliber: "rimmed", "rimless", "rimfire", "magnum", "pistol / revolver" or "shotshell"

- **Origin**
  The country of origin of the caliber

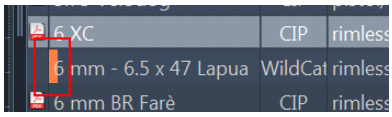
- **Date**
  Date, the specification was published

- **Revision**
  Revision of the published information

- **Changes**

Date, the data was altered (changed) locally in the database.

User files



Files that have been modified or newly created by the user are marked with a color. They are also stored as a backup in the user directory of the system. When a newer GRT version is started, the data is automatically imported/restored.

The files are normal XML files that contain the data records changed or newly created by the user.

Depending on the system, the files are located in the following directory:

- **Windows:**
  "C:\Users\\AppData\Roaming\GordonsReloadingTool\"
- **Linux:**
  "home//GordonsReloadingTool/"

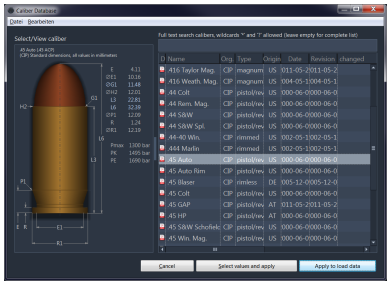
Call from curr. loading file

If you access the caliber database using the button in your load instead of the tool icon in the toolbar, you can also apply a selected caliber to your current load.

By double-clicking, the caliber can be selected and applied with all data to the load file.

In addition, buttons appear in the window for transferring to the load file:

[Apply to loading data]
The selected caliber is completely applied to the load file as if you were double-clicking on a list entry.



[Apply to loading data (Select values)]
Click on this button displays the dialog "Select values to be applied..." with a list. The desired values to be transferred to the load file can be selected by checkboxes.

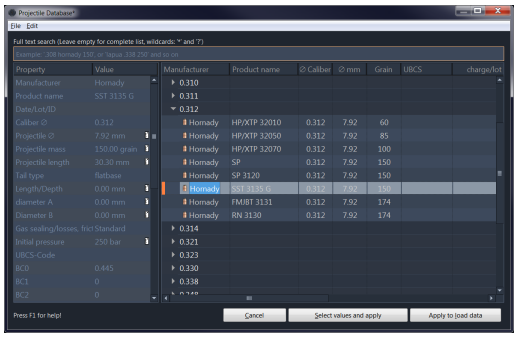
The "Cancel" button closes the dialog for caliber selection without applying data.

Context Menu

Right-clicking the caliber offes the following functions:

- **New** - create new (local) caliber entry
- **Neu with copy** - create new (local) caliber entry, based on the selected caliber
- **Edit** - Edit any of the calibers values
- **Delete** - Delete the selected caliber from the (local) database. There will be a dialog requesting a confirmation, if this was really intended "OK" or not "Cancel".

Projectile Database



This is an archive for all available projectiles (bullets), which have been contributed by manufacturer and hand loaders to the project. During installation, the most current version is installed and can then be edited or extended.

The Projectile Database's main window contains a menu bar, a search dialog, and two vertically arranged list areas:

- Menu "File"
- Form: "Full text search"
- List of Bullets - select / view bullet
- Properties

MENU FILE

this Menu offers al functions offered by right -clicking into the **List of bullets** (New, New with copy, Export, Edit, Delete- see below).

Additionally, the following functions are available:

- Save changes - this becomes available, after changes were made to the database, which have not been saved yet. If selected, all changes to the database will be saved.
- Export - export bullet data to an XML-file in GRT-format

FULL TEXT SEARCH

This can be used for searching for any text in the projectile database. Wildcards are "*" for any number of letters and "?" for single letters.

List of Bullets

This contains a list of all available bullets, sorted by their manufacturer’s names. Clicking on a manufacturer, reveals all bullet diameters, available by that specific manufacturer. The list can be further expanded by clicking on a specific diameter to view the manufacturers designated bullet/product names and the following information

- **Manufactuer**
  the name of the manufacturer

- **Product name**
  the product name / manufacturer'S designation of the bullet

- ⌀ **Caliber**
  the diameter of the caliber, the bullet is intended for in inch

- ⌀ **mm**
  the diameter of the projectile in mm

- **Grain**
  the weight of the projectile in grains

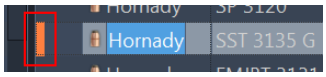
- **UBCS**
  UBCS-Code of the bullet

- **charge/lot**
  the lot number / ID of the measurements taken

- **created**
  date of the dataset where created/update into the database

- **changed**
  the name of the author, applying any changes (grtuser will show up, if something was manually edited or changed)

User files



Files that have been modified or newly created by the user are marked with a color. They are also stored as a backup in the user directory of the system. When a newer GRT version is started, the data is automatically imported/restored.

The files are normal XML files that contain the data records changed or newly created by the user.

Depending on the system, the files are located in the following directory:

- **Windows:**
  "C:\Users\\AppData\Roaming\GordonsReloadingTool\"
- **Linux:**
  "home//GordonsReloadingTool/"

By clicking on the "Cancel" button, the projectile selection is canceled.

By clicking on the "Apply to load data" button, the associated values are returned to the main window of the simulation.

By clicking on the "Apply to load data (select values)" button, the values to be returned to the main window of the simulation can be selected.

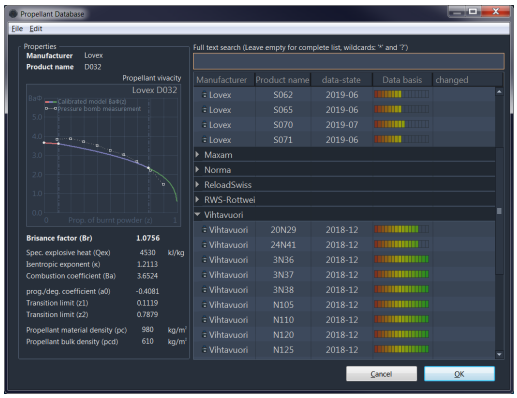
Context Menu

Right-clicking a entry offers the following functions in a context menu:

- New - create new (local) projectile entry
- Neu with copy - create new (local) projectile entry, based on the selected projectile
- Export - export selected projectile data in an XML-file in GRT-format
- Edit - Edit any of the projectile values
- Delete - Delete the selected projectile from the (local) database. There will be a dialog requesting a confirmation, if this was really intended "OK" or not "Cancel".

Propellant Database

The propellant database is an archive of all propellant powders available in GRT. The powder data can be extended and modified.



The propellant's database main window contains a menu bar, a search dialog, and two horizontally arranged areas:

- Menu "File"
- Form: "Search"
- Properties with Propellant brisance diagram and details
- List of propellants (powders) view / edit

MENU FILE

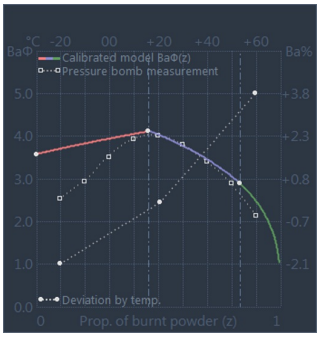
This menu provides all functions which are also available in the window **List of powders** with a right click (New, New with copy, Export, Edit, Delete - see below). Additionally, the following functions are available:

- Save changes - this becomes available, after changes were made to the database, which have not been saved yet. If selected, all changes to the database will be saved.
- Import - import powder data from an XML file in GRT format

SEARCH-FORM

This can be used for searching for any text in the projectile database. Wildcards are "*" for any number of letters and "?" for single letters.

VIVACITY DIAGRAM / POWDER MODEL DATA



The powder burn-up characteristic in the simulation calculation is determined by so-called form functions. The GRT implements a three-level representation for this purpose. These three steps are colored in the vivacity diagram. The measured data of the powder manufacturers on the burning characteristics and vivacity of the respective powder form the basis.

If a closed bomb (manometric bomb, pressure bomb) measurement is available, an additional, dotted, monochrome diagram line of this measurement is displayed.

Note, that this is just a visual representation and not a mathematically usable diagram. The graphic powder diagram is not intended to derive exact measured values for licensing reasons, e.g. with regard to the closed bomb measurement data. The pressure bomb measured values (dotted line) are only schematically contained.

See also: Formalism, Sources & Powder Model

List of Propellants

This contains a list of all available propellants (powders), sorted by their manufacturer's names. Clicking on a manufacturer, reveals all powders, available by that specific manufacturer, sorted by their respective product designation/name and the following information in columns:

- ***Manufacturer*** - Name of manufacturer

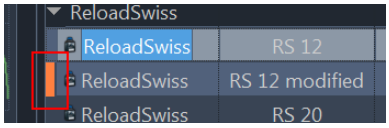
- ***Product name*** - Trade name / designation of the powder

- ***data-state*** - the age of the record, should be as current as possible.

- ***calibration*** - Colored progress-bar of the underlying data-basis for the powder model development/calibration process.
  A powder model is mathematically created on the basis of the (pressure bomb) measurement and ballistics data. The model is then continuously further calibrated on the basis of newballistics data. The more ballistics data there are, the more accurate the model will be.
  
  - [red] = data basis urgently requires real-life measurements of your loads to calibrate the powder-model,
  - [yellow] = the data basis requires further measurement data of your loads,
  - [green] = good to very good data basis and representation

- ***modified*** - Name and date of the last user modification

User files



Files that have been modified or newly created by the user are marked with a color. They are also stored as a backup in the user directory of the system. When a newer GRT version is started, the data is automatically imported/restored.

The files are normal XML files that contain the data records changed or newly created by the user.

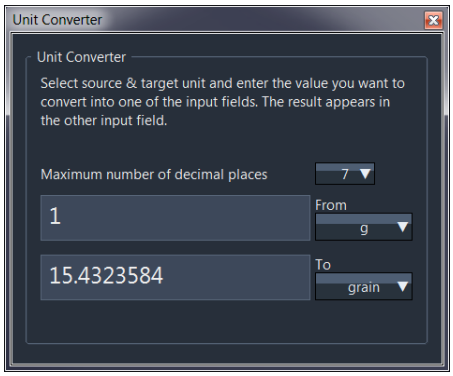
Depending on the system, the files are located in the following directory:

- **Windows:**
  "C:\Users\\AppData\Roaming\GordonsReloadingTool\"
- **Linux:**
  "home//GordonsReloadingTool/"

By clicking on the "Cancel" or "Close" button, the propellant selection is canceled, and the database is closed. By clicking on the "OK" button, the associated values are returned to the main window of the simulation. Right-clicking the propellant offers the following functions:

- New - create new (local) propellant entry
- Neu with copy - create new (local) propellant entry, based on the selected caliber
- Export - export selected propellant data in an XML-file in GRT-format
- Edit - Edit any of the propellant values
- Delete - Delete the selected propellant from the (local) database. There will be a dialog requesting a confirmation, if this was really intended "OK" or not "Cancel".

Unit-of-measure calculator



With this tool you can convert the frequently used units of measurement to each other.

To do this, select the desired source and target unit of measurement on the right and then type the value in the input fields that you want to convert into the other unit.

Selecting the number of decimal places allows you to round the result to a certain number of decimal places.

The window of the unit of measurement calculator under Windows is a so-called "floating" window, i.e. it always remains in the foreground in the program while you are working. This way you can convert a unit during operation without having to search for the window.

Table for relative burning rate

The table shows the relative combustion of all propellant powders in the database.

There is no standard for sorting such a table. In the published tables of different powder manufacturers or dealers, it is often very different, depending on the preference of the manufacturer. The most frequently used sorting method is **progressivity** .

The table therefore allows different sorting according to different factors, which you can select above the table with buttons.

Important Note

The table for the relative burning rate serves only as a rough overview between the different manufacturers. The table makes no statement about how vivacious a powder actually is in the pressure characteristic!

A powder listed in the table at the same level does not therefore mean that it is a 1:1 substitute for a specific powder! It only means that it is probably suitable for a similar application.

SORTS

PROGRESSIVITY

Sorts the table by the progressivity factor ***Bp*** of a propellant powder. The progressivity factor and its equation is GRT specific and calculated:

```
Bp = sqrt( (2 * (k - 1)) * pow(Ba * phi(z1) * Qex,2) ) / 10000;
```

BRISANCE

Sorts the table by the (initial) explosive factor ***Br*** of a propellant powder. The explosive factor and its equation is GRT-specific and calculated:

```
Br = sqrt( (2 * (k - 1)) * pow(Ba * Qex,2) ) / 10000;
```

BRISANCE & PROGRESSIVITY (COMBINED)

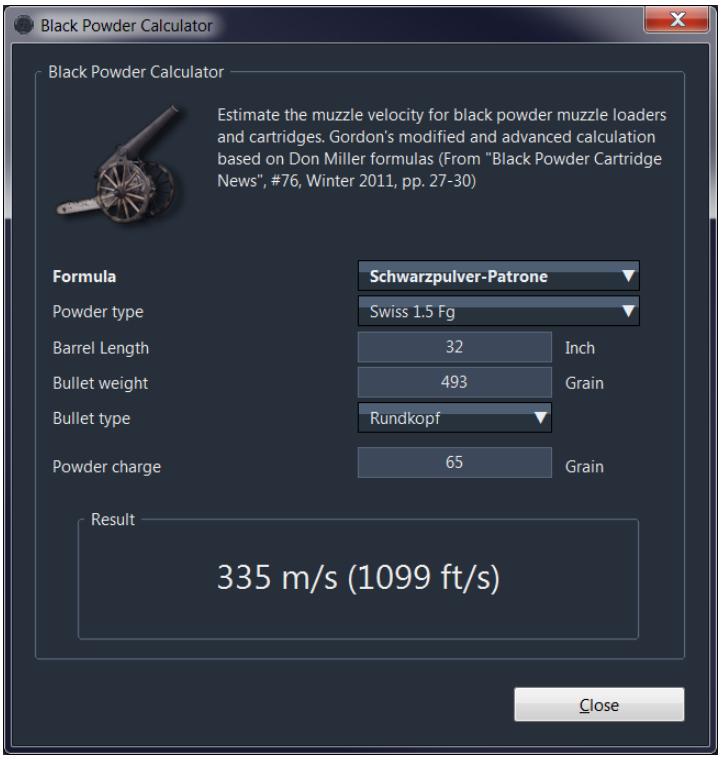
Sorts the table using the combined Brisance & Progressivity factor ***Brp*** of a propellant powder. The combined factor and its equation is GRT specific and is the *second absolute moment* [1] of both single factors:

```
Bp = sqrt( ( pow(Br,2) + pow(Bp,2) ) / 2 );
```

By combining both factors, a more practicable approximation of the behavior of different propellant powders should be achieved.

1) the quadratic mean

Black Powder Calculator



Internal ballistic simulation calculations with black powder are unknown / nonexistent, therefore only rough estimates can be made. The black powder calculator provides the functions for estimating the muzzle velocity.

The equations for estimation are a further development of the calculation bases presented by Don Miller in the magazine "Black Powder Cartridge News" #76 (2011, pp. 27-30). The GRT further development of the respective equations includes an adjustment of the factors on the basis of own measurements, including additional bullet variants and black powder varieties.

- **Formula**
  Here you select the equation to be used.

- **Powder type**
  Here you select the used black powder.

- **Barrel length**
  Enter the length of the barrel in inches here.

- **Projectile weight**
  Enter the bullet weight in grain here.

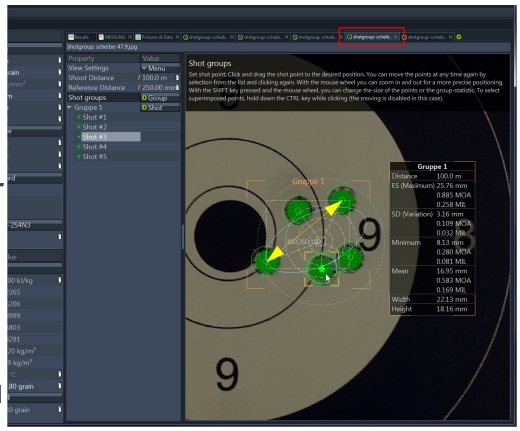
- **Projectile type**
  Select the projectile type used here. For example, it is also permissible to set a minié bullet or a round bullet for a black powder cartridge.

- **Powder charge**
  Enter your powder charge in grain here.

The calculation takes place automatically after changing a parameter.

Shot group analysis

The shot group analysis is a tool for the analysis of hits on targets.



Shot Group Analysis is available as Tab with direct reference to the loading file (*.grtload), or alternatively as a separate tool for the independent Analysis of groups of shots on a target image. **A shot group tab will be stored in the loading file (*.grtload), as all other Tabs of the result field**

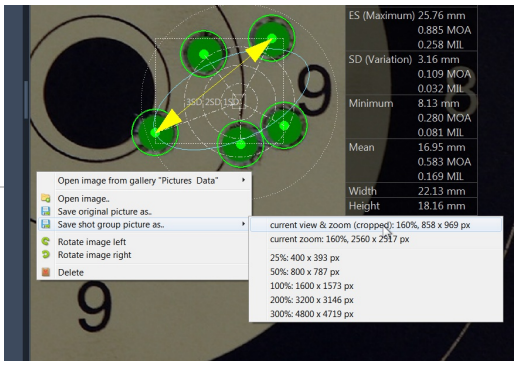
The separate shot group analysis is available via the Toolbar/Symbol bar

The usage is the same, but the shot group analysis can be loaded and stored as a separate file. You can also use it to save groups of shots from a saved grtload file and save it as a separate shot group file. The separate tool is independent of your current load file (*.grtload).

Application

A picture of a target with the bullet holes serves as the basis for this shot group analysis. The image should be of sufficient size. The larger the resolution of the image, the better is the accuracy with which the distances can be measured later.

To add an image, drag & drop an image file onto the free space, or select the corresponding menu item from the context menu (right click).



ZOOM IN/OUT

Use the mouse wheel to enlarge or reduce the image view/zoom. As long as an open hand appears as mouse pointer, you can move the image or later also individual elements.

1. REFERENCE DISTANCE

At first specify a reference distance, e.g. the distance between the elements of a target-circle or a target-grid. To do so, click on the list entry "Reference distance". A short instruction appears at the top of the screen to set the reference distance.

2. SHOOTING DISTANCE

Second specify the shooting distance.

3. GROUPS & HITS

Then click on the ***"(+) Group"*** button to add a new shot group. You can add multiple groups if needed.

Click on the ***"(+) Shot"*** button to add a shot point to a group.

Click and drag the point to a hit in the image. As a rule, the size of the hit point is the projectile diameter by default, but you can resize the diameter of the points by holding down the CTRL key and turning the mouse wheel. Follow the short instructions at the top of the screen.

NOTES

Click the ***"(+) note"*** button to add a group note. The group note can be positioned freely by clicking and dragging. A click on the button ***"edit"*** , or a double click on a note in the shot group picture opens the note editor. In the note

editor you have the possibility to insert placeholders (pragmas) for the calculated values of the group.

OPTIONS

After expanding ***"Options"*** you can enable or disable various options.

STATISTICS

The statistics of the hits are displayed next to the group. It can be moved with the mouse.

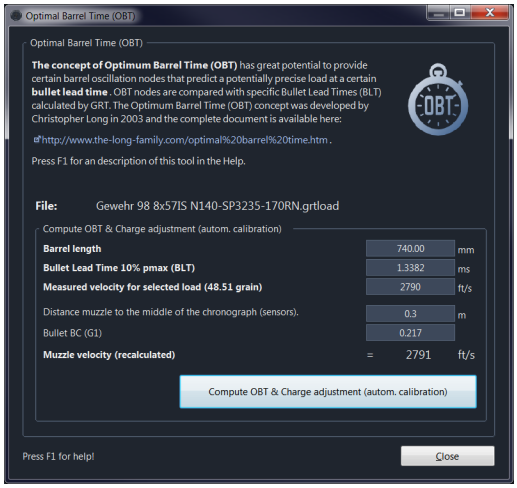
STATISTIC VALUES

ES (Maximum)	Maximum hit distance (ES = Extreme Spread)
SD (Variation)	Variation/Standard Deviation of the hits (SD = Standard Deviation)
Minimum	Smallest distance between hits
Mean	Mean distance between hits
Width	Width of the whole group over centres of hits
Height	Height of the whole group over the centre of the hits
Deviation POA	Deviation of the point of aim from the weighted center of the group (POA = Point Of Aim)

Optimal Barrel Time (OBT)

Optimal Barrel Time (OBT) Is a theory that predicts certain nodes of **muzzle diameter** stability during cartridge combustion. This theory is **NOT** about **"Barrel whip/harmonic"** or **"Running Vibration"** !

Optimal Barrel Time (OBT) concentrates on the diameter at the muzzle at bullet exit time, caused by the combustion pressure longitudinal waves in the barrel material.



The concept of Optimum Barrel Time (OBT) has great potential to predict these oscillation nodes. GRT's **"Bullet Lead Time"** (BLT) is the predicted time the projectile remains in motion wihtin the barrel after ignition. OBT nodes can therefore be compared with the predicted Bullet Lead Times (BLT) calculated by GRT, and a correction can be applied to force the prediction to match the OBT nodes.

GRT will precalculate the OBT nodes, by using the **barrel length** measurement the user enters in his cartridge file. The GRT user should save this data to a .grtload file. A loading ladder file is preferred.

Potentially accurate loads are achieved by adjusting the amount of propellant until the calculated BLT matches an OBT node. The true **barrel length** and actual **measured velocity** must be used to calculate the BLT/OBT match. This tool automatically performs that matching process, saving user time and frustration.

The Optimum Barrel Time (OBT) concept was developed by Christopher Long in 2003 and the complete document is available here:

http://www.the-long-family.com/optimal%20barrel%20time.htm

WHAT IS THE BENEFIT OF OBT?

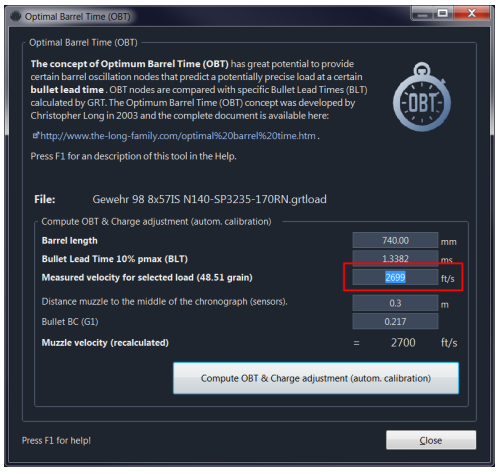
- **OBT claims to achieve an accuracy of at least 1 MOA.**
- From there you have to vary only a little up or down in the charge to get the best accuracy for that node.
- The advantage is that you save time, labor and money instead of performing extensive loading ladders.

Short description - How it works?

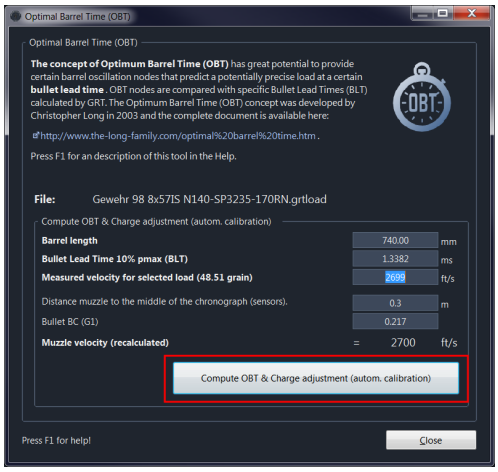
Requirement: You have selected a starting charge and have the actual **Bullet velocities** measured. The starting charge is usually at the beginning, or in the middle range of recommended manufacturer loads. Experienced users can use any load they have confidence in according to their own experience.

- **Step 1**

  Open the OBT tool and your current load file and (set load ladder) powder quantity should be displayed.
  Now enter the real measured bullet velocity of this charge here:



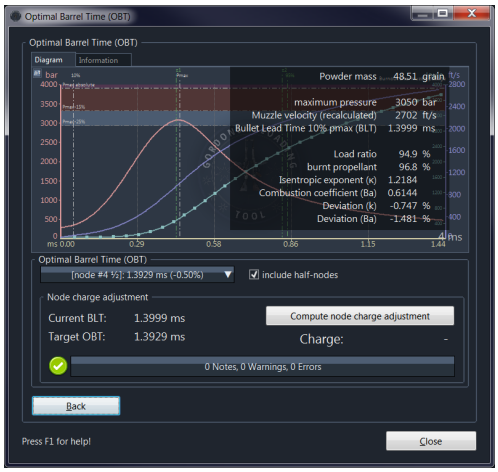
- **Step 2**



Click on the button **[Compute OBT & charge adjustment (autom. calibration)]**

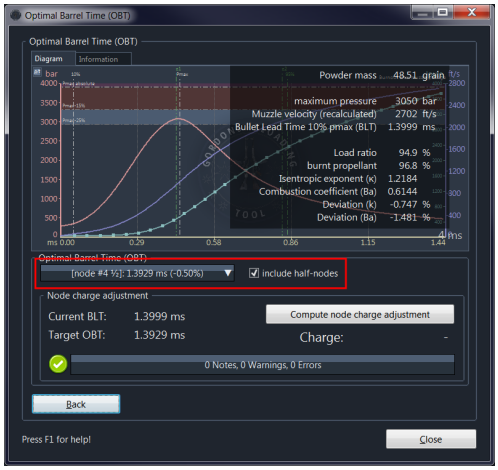
- **Step 3**

Calibration of the simulation to the real measured speed is now done by the OBT-Tool **automatically.**
(Without this OBT Tool, the users would have to a attempt to manually set the powder coefficients **k** *and* **Ba** *until the simulation velocity matches the measured velocity.)*



Note: if the calibration fails due to a too high Initial Pressure (IP), then just go back to your load file, lower the IP and try again!

- **Step 4**

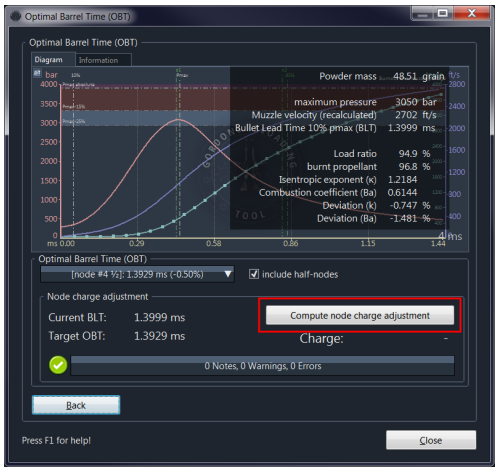


The OBT-Tool now calculates on the basis of the calibrated BLT (bullet lead time at 10% pmax) the valid OBT nodes. You can now select the desired node from the option button to determine the proper powder charge required to match that node.

It is important to know that the lead time (BLT) is inversely related to changes in powder quantity. Also, the user has the option of including so-called *half nodes* . It has been reported that some users have discovered accuracy around "split, or half nodes". The GRT OBT tools provides this option for the users who desire to explore this observation. This may be weapon construction dependent.

The Half-Nodes are a GRT-specific extension of Christopher Long's theories by Gordon and are based on the idea of Cassie Nienaber (GRT powder development team).

- **Step 5**

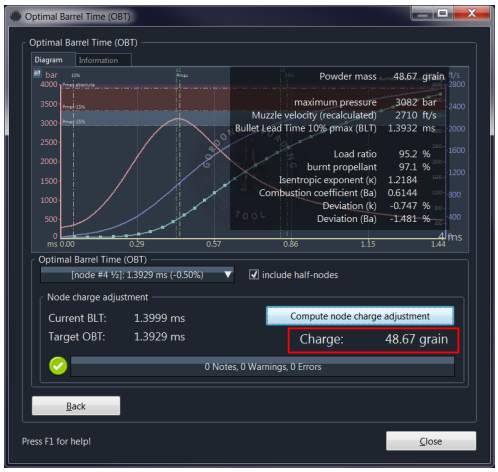


Click on the button
[Compute Node Charge Adjustment]

The OBT-Tool then **automatically** calculates the powder charge, which adjusts the calculated BLT-Time to the selected OBT node.

Note: if the calculation fails due to a too high Initial Pressure (IP), then just go back to your load file, lower the IP and try again!

- **Result**



This is the amount of powder you would need to load your cartridges with, to get, in theory, a usable precise charge **of at least 1 MOA** .

Starting from this calculated charge, you should now be within (+/- 0.1 to 0.2 grains) of finding a load that will exibit maximum precision.

You can select another OBT node at any time and calculate the charge quantity again.

IMPORTANT: Please be sure to observe the warnings and error messages, if any!

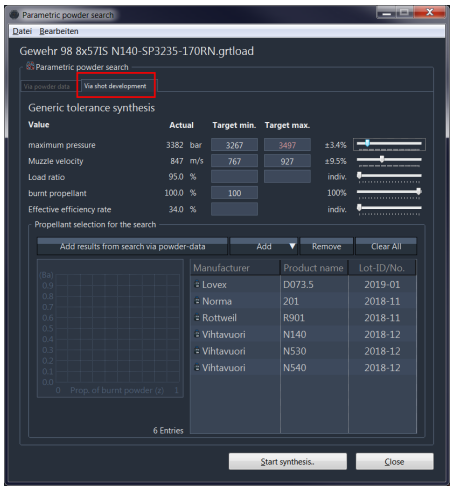
Parametric powder search & generic tolerance synthesis

This powerful tool consists of two parts, the ***Parametric Powder Search*** and the ***Generic Tolerance Synthesis*** . In combination, you can search for propellant powders based on your **current load file** in real time using various criteria and/or perform internal ballistic simulations with different propellant powders. Here you specify the tolerance ranges.

NOTE

If you call this tool, the data of your current load file in the foreground will be used, e.g. the current powder is already preselected.

Parametric Powder Search



Parametric Powder Search is used to find propellant powders that have similarities to the currently selected powder within the specified tolerance ranges. This is comparable to the table for the relative burning rate, with the difference that you also have the possibility to select and set detailed tolerance windows for individual factors of a powder.

If you click on the button with the currently selected propellant powder, you can specify another powder as the base for the search.

Use the button above the sliders to select the maximum range of the tolerance window. Here you can specify whether the search should be carried out in both directions or only in the positive or negative range.

The sliders below can be used to set the tolerance windows of the respective values or factors individually. The result of the search is automatically displayed at the bottom of the list.

For a similarity search the selection *"[x] Similarity search"* with the factor *"Brisance/Progressivity (Brp)"* is recommended.

Note that "similar" propellant powders can exhibit completely different behavior. In this case, each of the selected powders would have to be tested individually for suitability, which means that the charge of each propellant powder would have to be adjusted accordingly, **but:**

to simplify this work, there is the Generic Tolerance Synthesis.

Generic Tolerance Synthesis

Generic tolerance synthesis performs internal ballistic simulations based on the selected powders and tolerance windows and uses recursive generic adaptation to determine the next possible charge to the selected powder depending on all set criteria **simultaneously!**

I.e. you define in which pressure range and/or e.g. muzzle velocity the charge should move and the synthesis calculates for all powders listed below the charge which best meets the criteria.

Depending on the selection of the limiting tolerance windows and the selected propellant powders, the charges can exceed the specified maximum pressures, or represent no sensible charge or even a dangerous one!

TOLERANCE WINDOW

In order to perform the synthesis, certain tolerance windows must be specified. If an incomplete or incorrect input is

detected, the corresponding input field is framed in red.

If you do not enter a minimum value for the loading ratio , this can **slow down the calculation considerably** , especially for long gun calibers, since the synthesis then has to pass through a larger powder range. Keep in mind that many internal ballistic calculations are performed for each individual propellant powder.

If the maximum pressure tolerance window is selected and the limit of -15% or the maximum specified pressure is exceeded, the text is automatically highlighted.

Above the list of propellants you will find the buttons and functions to make your choice. Here you also have the possibility to add the propellants found with the *Parametric Powder Search* to the list.

START SYNTHESIS

With a click on the button [Start synthesis] , the generic tolerance synthesis is started. Now many individual internal ballistic calculations are performed for all powders selected in the list in conjunction with the desired tolerance parameters on the basis of their current charge with the specified case volume, projectile etc., the simulation results are set in relation to the specified tolerances and restarted with modified powder quantity. All this until as many criteria as possible have been met at the same time.

The results of each individual synthesis are then written to a list in the Results tab (see picture on the right) and the current calculation is displayed graphically in real time during the process.

After completion, you can click on an entry to display a short preview of the results above. By clicking on the small diagram image of a list entry, the complete result diagram is displayed. Detailed warnings can be found as usual in the diagram screen and also in the results list after the export.

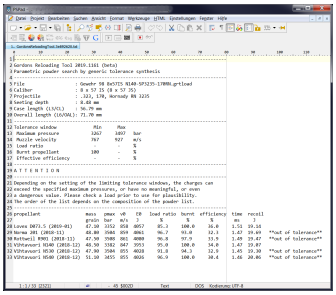
LOAD/SAVE CONFIGURATION

You can save and load the configuration of your current settings with the corresponding functions from the menu. In combination with your load file (*.grtload) you can restore and restart the synthesis later using the stored parameters.

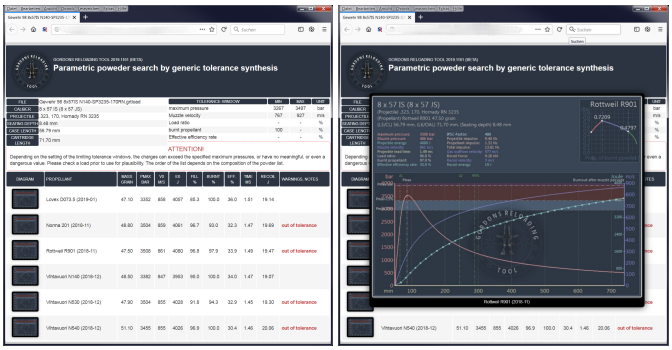
RESULT EXPORT

To export the results you can select the export formats Text, HTML and Image from the menu, where **HTML** contains a complete result list, **including all diagram images** . The graphics are stored in the HTML document itself, i.e. it is only a single file which you can share.

EXPORT AS TEXT



EXPORT AS HTML


Parametric powder search by generic tolerance synthesis
ATTENTION!
Rottweil RS01

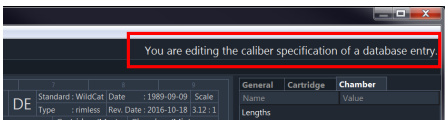
Cartridge-Designer

The Cartridge Designer is a powerful tool for designing and editing caliber specifications. This includes the definition of the cartridge and also that of the cartridge chamber, exactly as in the simple editing window of a caliber in the caliber database.

In the Cartridge Designer, however, you additionally have the real-time updating representation of a technical drawing of the specifications.

NOTE

It depends from where you call this tool.



The behavior is displayed in the upper right corner of the window.

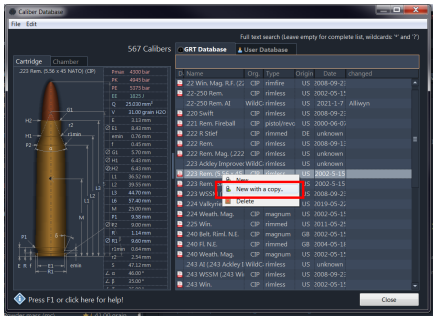
- **If you select the Cartridge Designer** from the ***toolbar or menu*** , you only edit the caliber specification stored in your currently active grtload file.
- **If you call the Cartridge Designer** from the ***Caliber Database*** , then you edit the respective entry from the caliber database.

Create New

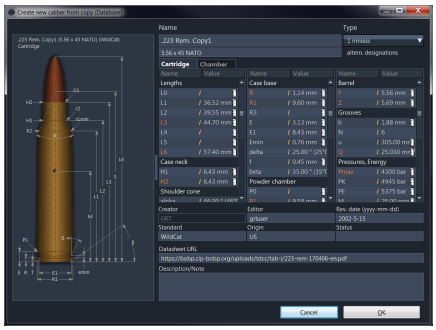
If you want to create a completely new Cartridge/Caliber specification, it is recommended, that due to the abundance of the necessary input parameters, you select a similar already existing specification as a basis and create a copy of it.

To do so, open the caliber database,

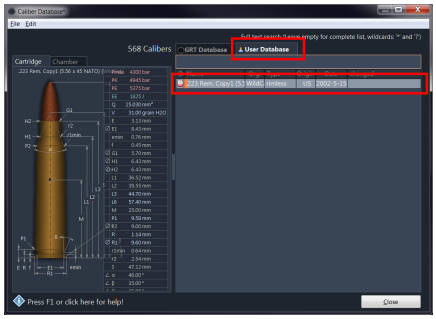
- select the desired entry, right-click and select "New with copy" to create a copy:



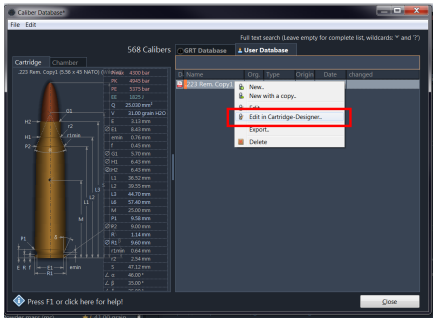
- The simple cartridge edit shows up:



- Save it right away and it appears as user created file:



- select "Edit in Cartridge Designer" again by right-clicking on the newly created entry.:

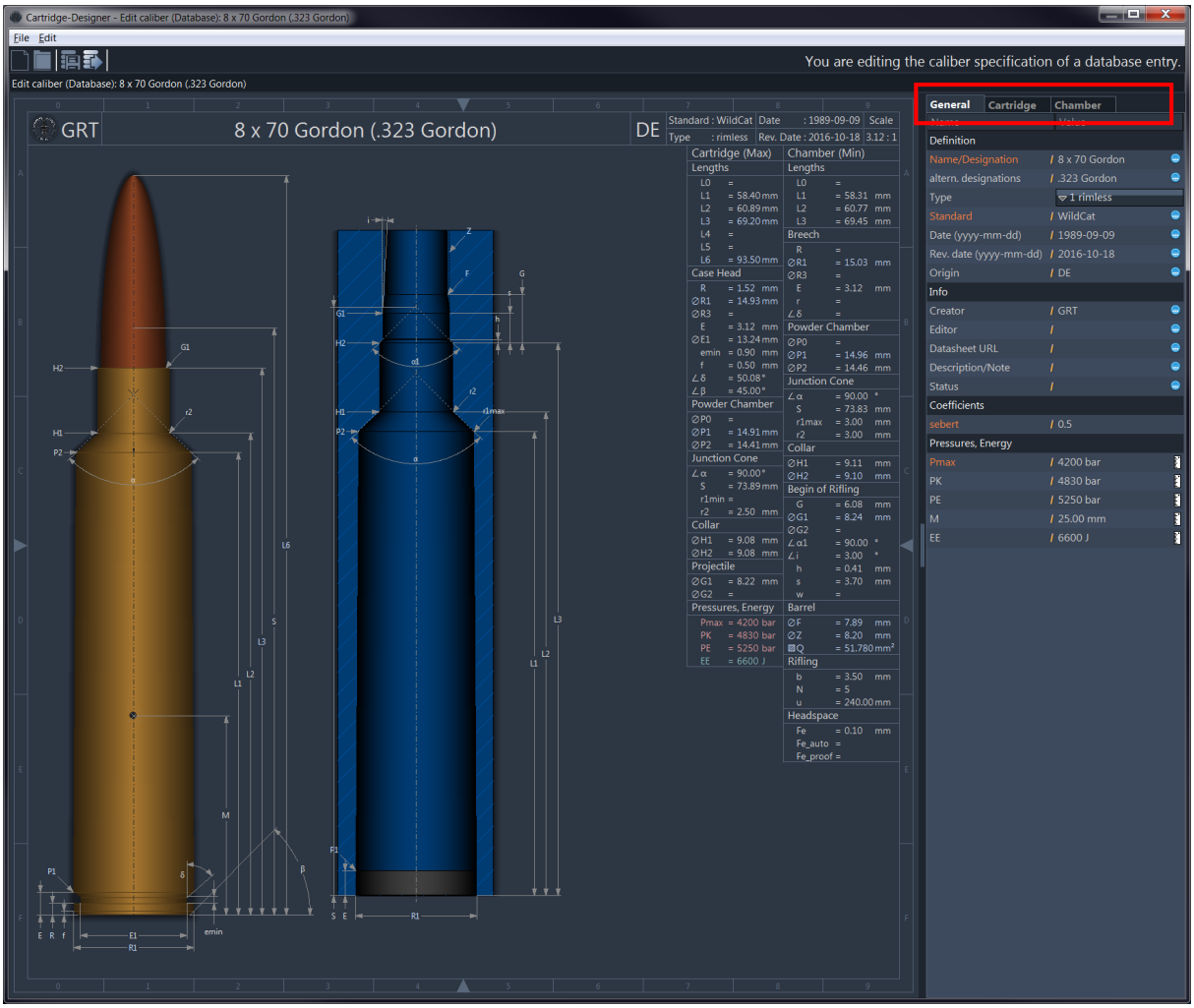


Edit

Editing the individual Symbols/Dimensions is done in three tabs on the right side of the window.

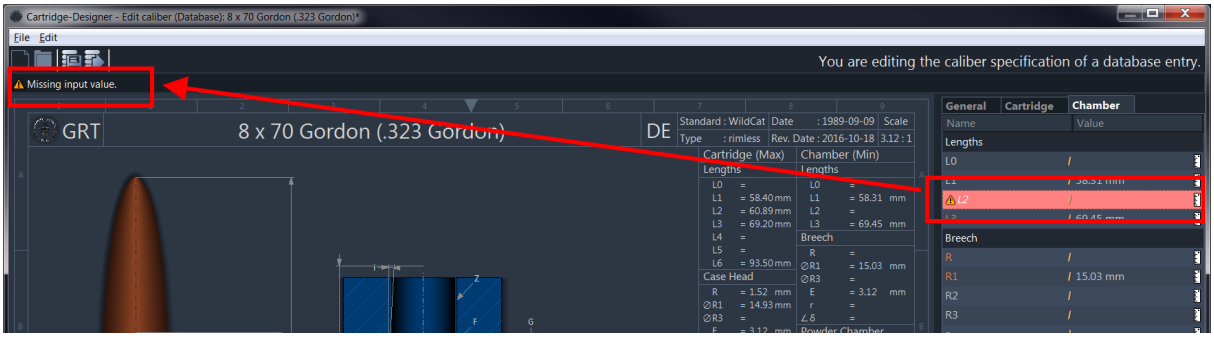
The meaning of the individual symbols such as "L1" or "G1" can be found in the table at the bottom under "Meaning of the Symbols".

- **General** - Edit the general data.
- **Cartridge** - Edit the cartridge/case.
- **Chamber** - Edit the cartridge chamber.

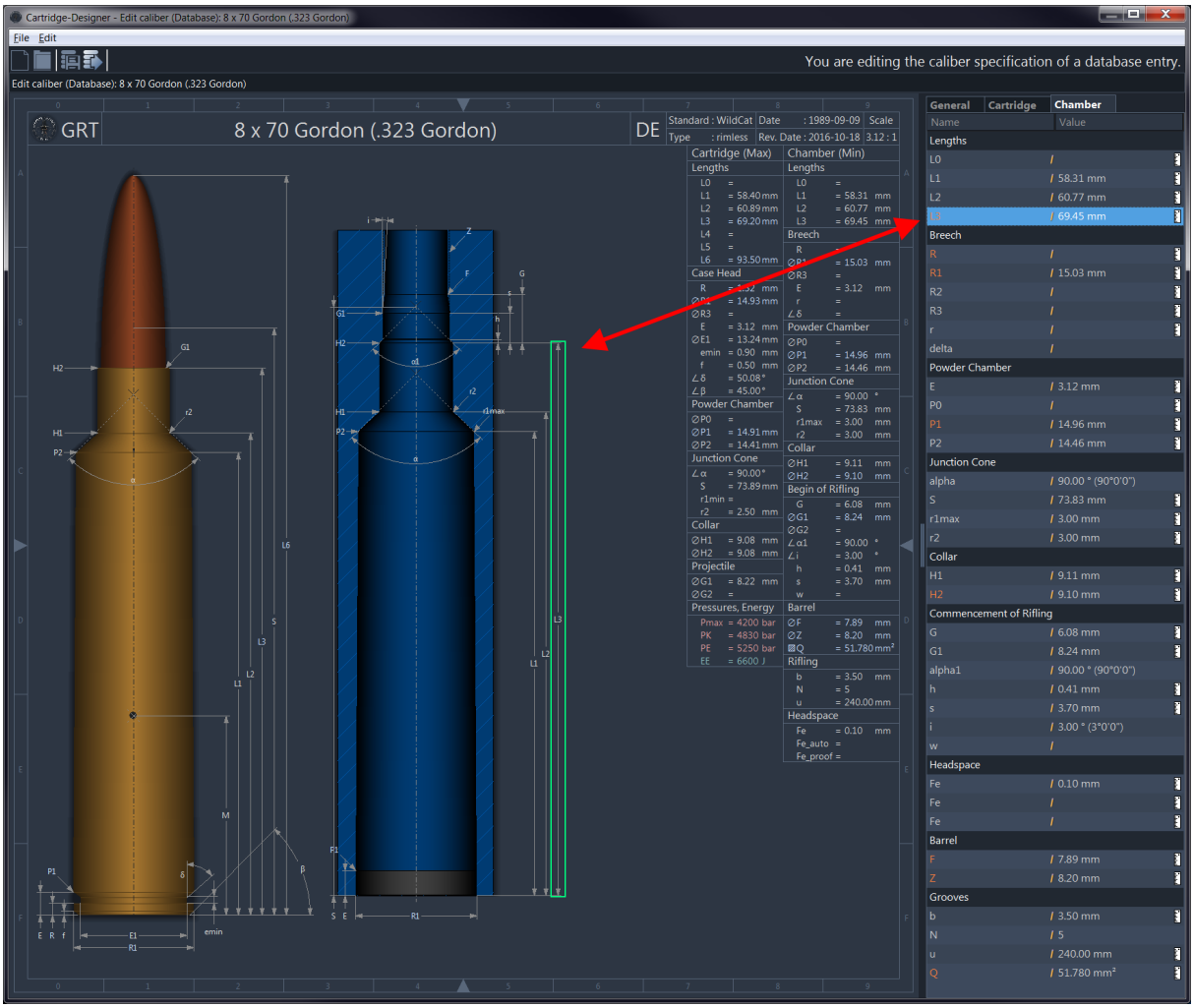


By editing the respective values of the symbols, you will change the dimensions of the drawing in real time.

If errors are detected, the corresponding fields are highlighted. Hold the mouse over an error line to get a description of the error at the top of the information bar.



You can click on a dimension directly in the drawing. The corresponding value in the list on the right list on the right and turned over automatically.



Meaning of the Symbols

CARTRIDGE

Lengths	
L1	Length from case bottom to diameter ***P2***
L2	Length from bottom of sleeve to diameter ***H1*** of sleeve neck
L3	Total length of the sleeve
L4	Length from bottom of sleeve to diameter ***G2***
L5	Length from bottom of sleeve to diameter ***F***
L6	Total length of cartridge
Case Head	
R	Rim thickness
R1	Rim diameter
R3	Belt diameter
E	Case Base Thickness
E1	Diameter of milled groove
emin	Width of the groove
δ	Half angle of the milled groove (between ***E1*** and ***P1***)
f	Height of the phasing of the edge
β	Angle of the phasing of the edge

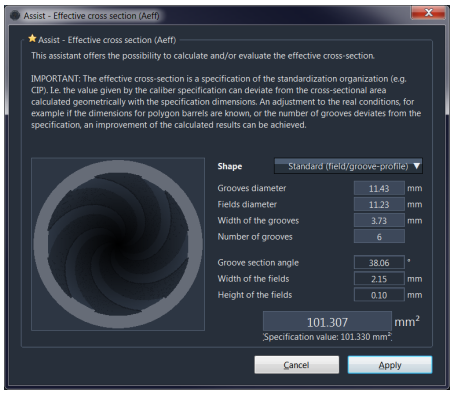
Powder Chamber	
P1	Diameter at the end of the rim, before milling or at a distance ***E*** from the bottom of the sleeve
P2	Diameter of sleeve at distance ***L1***
Shoulder	
α	Shoulder angle
S	Length to top of shoulder
r1min	Radius of transition at end of ***P2***
r2	Radius of the transition between the shoulder and the neck of the sleeve
Case Neck	
H1	Diameter at case neck at distance ***L2***
H2	Diameter at case mouth at distance ***L3***
Bullet	
G1	Bullet diameter at case mouth
G2	Bullet diameter at distance ***L4***
F	Bullet diameter at distance ***L5***
Pressures (Energy)	
Pmax	Mean maximum allowable pressure
PK	Maximum allowable single statistical pressure = ***Pmax + 15%***
PE	Mean impingement pressure = ***Pmax + 25%***
EE	Minimum impingement energy (joules)
M	Position of the borehole in the case for pressure sensor position of proof barrels

CHAMBER

Barrel	
F	Lands diameter of the barrel
Z	Grooves diameter of the barrel
Lengths	
L1	Length of chamber at diameter ***P2***
L2	Length of chamber at diameter ***H1***
L3	Length of chamber at diameter ***H2***
Breech	
R	Distance from breech face to the backward edge of barrel
R1	Diameter of the breech
R2	Depth of the breech
r	Junction radius at the chamber mouth
R3	Diameter before the breech for belted cartridges
Powder Chamber	
E	Distance from butt plate to entrance of chamber
P1	Diameter at entrance of cartridge chamber or at distance ***E***
P2	Diameter at beginning of transition cone at distance ***L1***
Junction Cone	
α	Angle of junction cone
S	Length to intersection of junction cone

r1max	Radius at end of diameter ***P2***
r2	Transition radius at junction at collar
Collar	
H1	Diameter at beginning of collar at distance ***L2***
H2	Diameter at distance ***L3***
Transition	
G1	Diameter at the beginning of the transition
G	Distance between ***H2*** and ***F***
α1	Junction angle between ***H2*** and ***G1***
h	Distance between ***H2*** and ***G1*** (angle: ***α1***)
s	Distance between H2 and beginning of transition at diameter ***G1***
i	Half angle of transition slope
Grooves	
b	Width of grooves
N	Number of grooves
u	Twist length
Q	Effective barrel cross section

Calculator for the effective cross-section



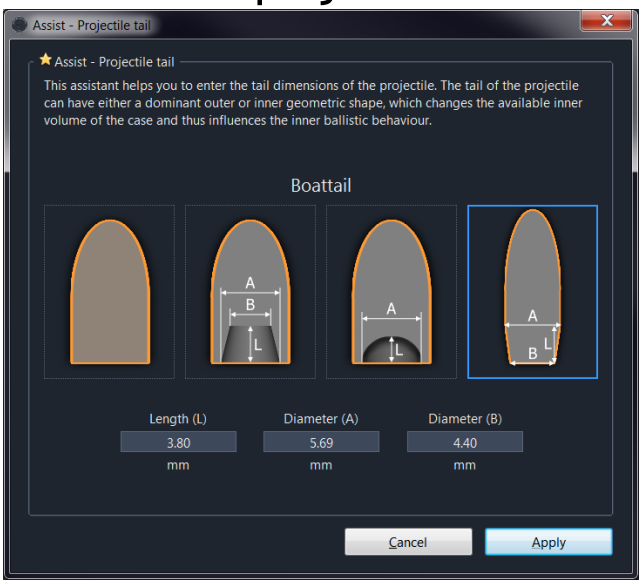
This tool or assistant, helps in calculating the effective cross-sectional area of a caliber or barrel based on your own measurments. Effective cross-section means the physically effective area of the projectile on which the combustion pressure acts while the projectile is moving through the barrel.

The effective cross-section is in many cases specified by the standardization body / organization (e.g. CIP). In this case, the value given by the caliber specification can deviate from the result calculated with this assistant.

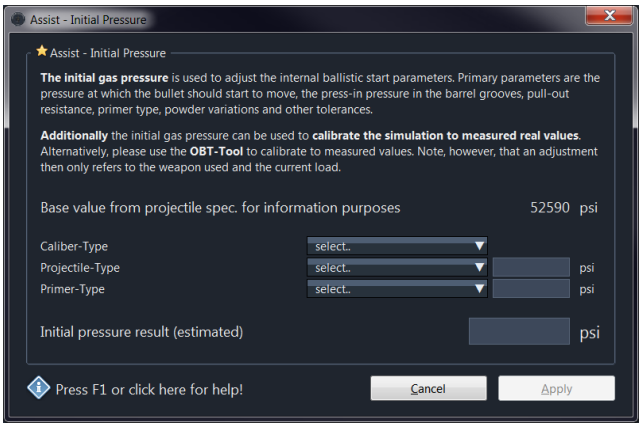
An adjustment to actual measurements, for example the dimensions for a polygon barrel or the individual number of grooves in your guns barrel, will improve the calculated results.

If started from the current load **via the star symbol** , the assistants input fields are automatically prefilled with values matching the selected caliber specification (see picture above).

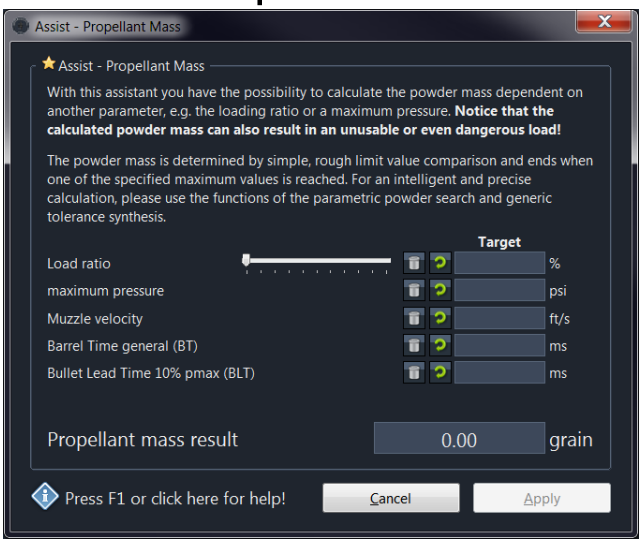
Assistant for projectile tail



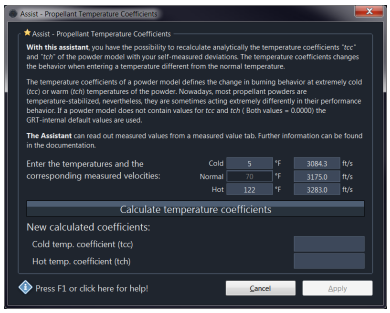
Assistant for Initial Pressure



Assistant for powder mass



Assistant for powder temperature coefficients



With this assistant , you have the possibility to recalculate analytically the temperature coefficients *"tcc"* and *"tch"* of the powder model with your self-measured deviations. The temperature coefficients changes the behavior when entering a temperature different from the normal temperature.

This is very useful if you want to simulate charges at different temperatures as accurately as possible.

The temperature coefficients of a powder model defines the change in burning behavior at extremely cold (*tcc*) or warm (*tch*) temperatures of the powder. Nowadays, most propellant powders are temperature-stabilized, nevertheless, they are sometimes acting extremely differently in their performance behavior. If a powder model does not contain values for *tcc* and *tch* (Both values = 0.0000) the GRT-internal default values are used.

The Assistant can read out measured values from a measured value tab. Alternatively, you can enter the measured values manually.

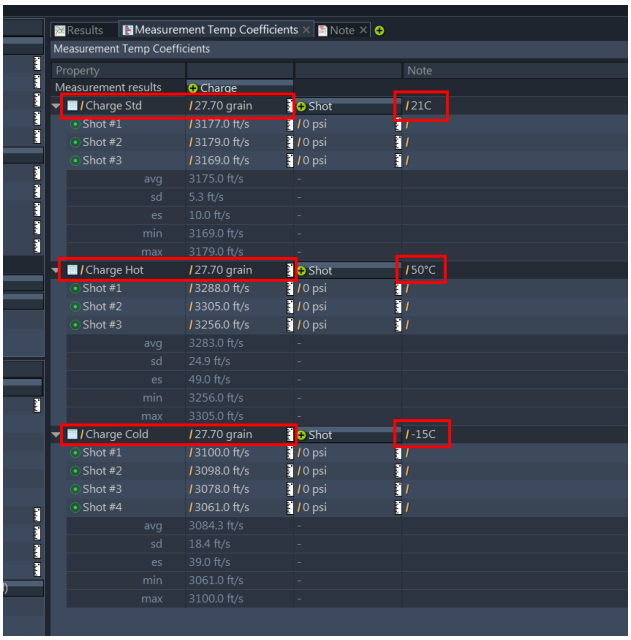
AUTOMATIC READOUT OF THE MEASURED VALUES

To automatically read out the measurements , simply create a **Measurement tab** , which contains **three** measurements of the same charge **at different temperatures** :

- Charge Cold, e.g. -10°C.
- Charge Normal +21°C (default, **must** be 21°C / 70°F entered!)
- Charge Hot, e.g. +50°C

1. CREATE A MEASUREMENT TAB

Enter your measurement results:



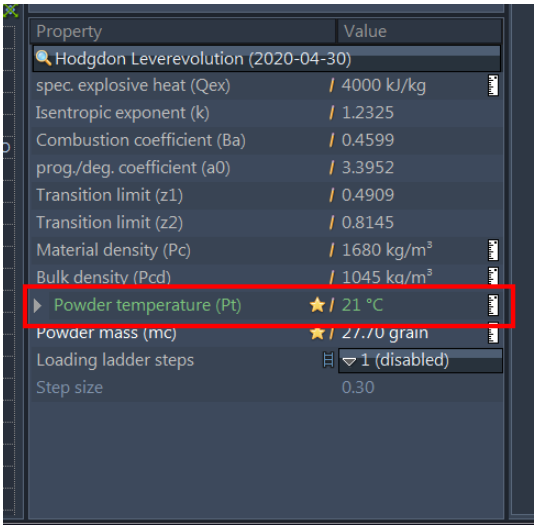
The temperatures you enter in the name or note column, can be in ***"C"*** or ***"°C"*** for degrees Celsius, or ***"F"*** or ***"°F"*** for degrees Fahrenheit as units.

For the measurement result at normal temperature, 21°C or 70°F MUST be entered!

2. CALLING UP THE ASSISTANT

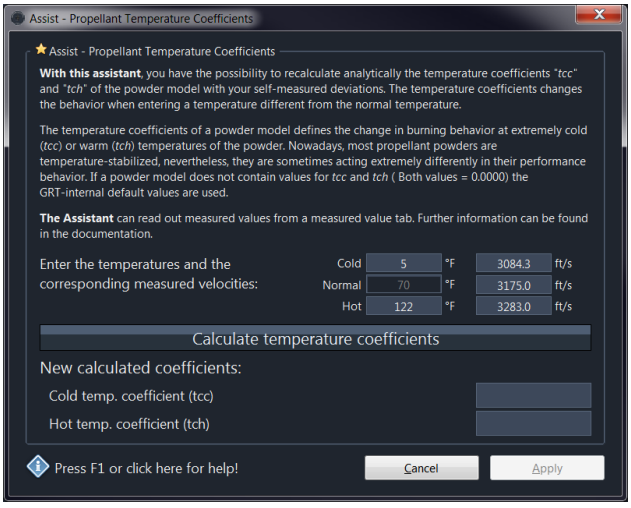
Make sure that your powder temperature of the charge is at normal temperature before starting the assistant!

Then click on the yellow star to open the assistant.



3. CALCULATE

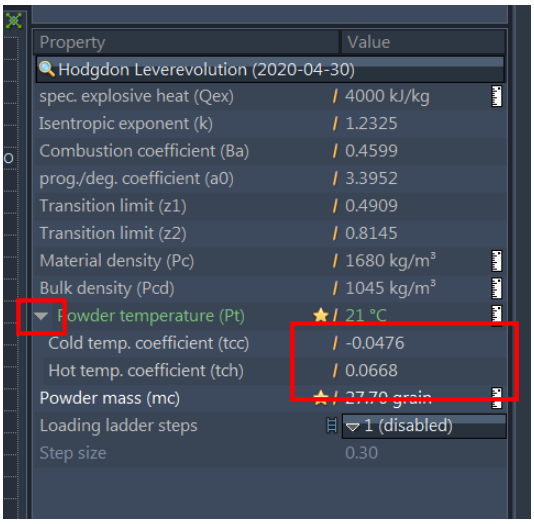
The measured values are automatically taken over from the measurement tab you created.



Then click on the button ***[Calculate temperature coefficients]***

4. APPLY

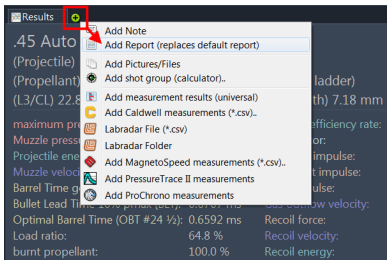
By clicking on the ***[Apply]*** button, the calculated coefficients are transferred to your powder data of the load.


Property
Value
Hodgdon Leverevolution (2020-04-30)
spec. explosive heat (Qex)
4000 kJ/kg
Isentropic exponent (k)
1.2325
Combustion coefficient (Ba)
0.4599
prog./deg. coefficient (a0)
3.3952
Transition limit (z1)
0.4909
Transition limit (z2)
0.8145
Material density (Pc)
1680 kg/m³
Bulk density (Pcd)
1045 kg/m³
Powder temperature (Pt)
21 °C
Cold temp. coefficient (tcc)
-0.0476
Hot temp. coefficient (tch)
0.0668
Powder mass (mc)
Loading ladder steps
1 (disabled)
Step size
0.30

Report & Doku

Results-Report

The result report displays the input data, calculated results and diagrams in a summary.



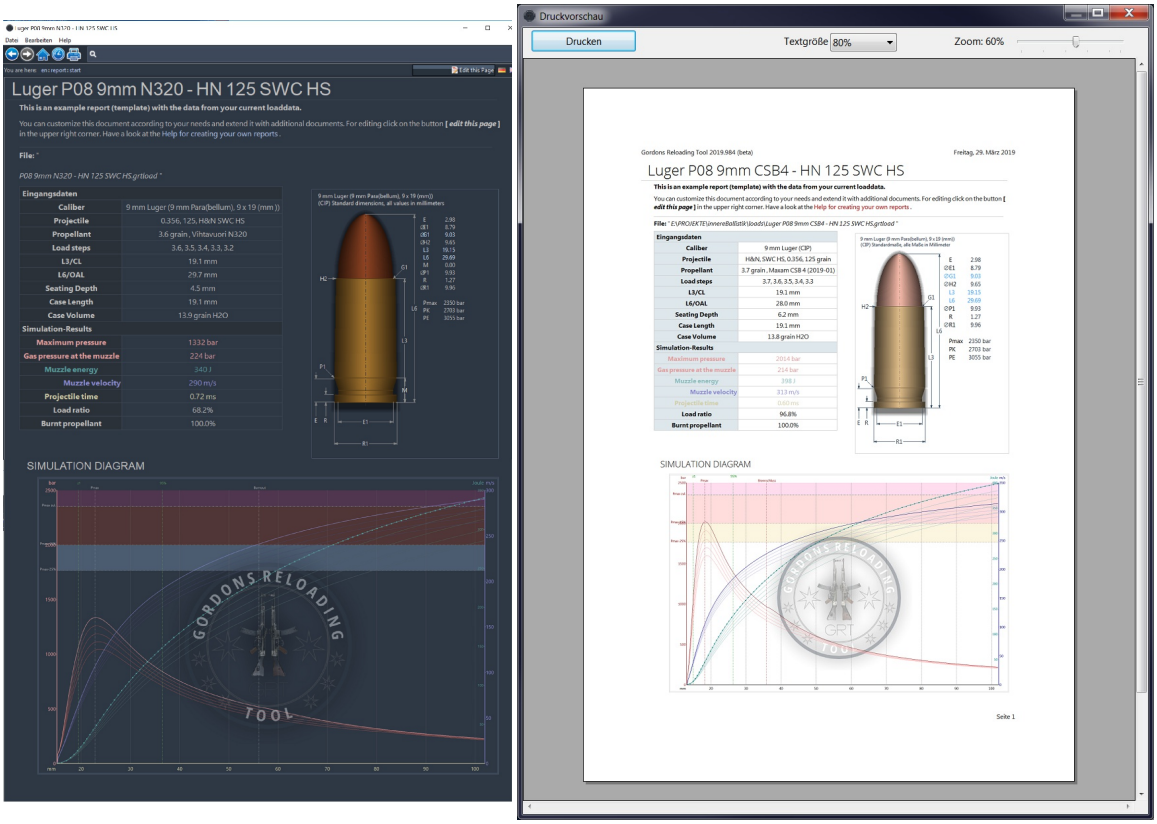
You can add custom reports to your load file. Just add a new tab in the result window: click on the "+" symbol and select "Add report" from the context menu.

See also: Help for creating your own reports.

Example

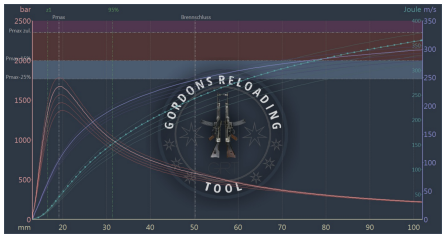
This is what a report looks like.

On the left the view when calling the report in the GRT and on the right the print preview of a report.



Custom Reports

GENERAL



The pages you see here are available as text files (*.txt) in the folder ***doku//report/*** . is the respective ISO code, e.g. ***"en"*** . English files in the folder ***doku/en/report/*** .

Changes to the pages are also saved in the respective files. When creating new pages, the corresponding folder structure is created automatically (if possible).

New pages can be created by simply writing a link to the (not yet) existing page in a current page and then calling this link. After that edit and save. **To delete a page, simply save it empty** .

Images and other media files should be stored in a subfolder ***media*** . For reports therefore e.g. under ***doku/en/report/media/***

This **doku system** is of course also be used for other things than reports, e.g. help pages, or tips & tricks.

TEXT FORMATTING & PRAGMA'S (PLACEHOLDERS)

- Displaying and Trying Syntax Descriptions
- Pragma's (Placeholders) to embed values

HOW DOES IT WORK?

These document pages are dynamically drawn documents, similar to an HTML page, only with a much *simpler syntax* . Click on the link to the page **Syntax** to see the examples. You can see the source code of each page and also edit.

For editing click on the button **[*edit this page*]** in the upper right corner.

Pragma's (Placeholders)

VALUES & RESULTS FROM THE CURRENT LOADDATA

The values from the current loaddata and their results can be embedded in document pages. A value is read out with a so-called **"Pragma "** . A pragma is an instruction enclosed by double tilde symbols ("~~").

The values are arranged in *sources* . Each source has different *properties* / (values) which can be read out. To read a provided value, specify the ***source*** followed by a ***point*** and the ***property name*** :

SOURCE CODE

```
~~source.property~~
```

The values provide either *text* or *number values* . Values that provide *number values* can be formatted in the output. If a number formatting is desired, the **Format string** are additionally specified as parameter in *parentheses* and *quotes* :

SOURCE CODE

```
~~source.property~~              //automatically, incl. units
~~source.property("#.000")~~     //with formatting without unit
~~source.property("#.000 mm²")~~ //with formatting and unit you want
```

SOURCES AND PROPERTIES

- **Source "File"**
- **Source "Work"**
- **Source "Result"**
- **Source "Caliber"**

NOTE

Please note that numerical values are output according to the **ISO** standard, i.e. the decimal point is actually a **point** ! The so called notation with "comma" as decimal point is **not** used here.

Source "File"

The source "File" are file information on the current loaddata.

Source.Property	Description	Type
Caption	The file name *without* file extension	text
Name	The file name with file extension	text
Path	The complete file path	text

Format string

The number formatting is controlled by the following placeholders (characters)

Character	Description
#	Placeholder that displays the digit of the value, if any. If fewer placeholders are used than the result is rounded.
0	Placeholder indicating the digit of the value, if any. If no digit is present, 0 (zero) is displayed in its place
.	Placeholder for the position of the decimal point
,	Placeholder specifying that the number is to be formatted with thousands separators.
%	Displays the number multiplied by 100.
(	Displays an open parenthesis.
)	Displays a closing parenthesis.
+	Displays the plus sign to the left of the number if the number is positive, or a minus sign if the number is negative.
-	Displays a minus sign to the left of the number if the number is negative. No effect for positive numbers.
E	Displays the number in scientific notation.

Source "Work"

The source "Work " are all current input values set by the user from the input fields "Caliber", "Projectile" and "Propellant".

Source.Property	Description	Type
Field *"Caliber"*		
work.CaliberName	Calibre designation	text
work.Dz	Bore diameter	number
work.pmaxZul	Max. all. pressure	number
work.Aeff	Eff. cross section	number
work.caselen	Case length (L3/CL)	number
work.casevol	Case volume	number
work.oal	Cartridge length (L6/OAL)	number
work.Vb	Combustion chamber eff.	number
work.sebert	Sebert-Factor	number
work.xe	Barrel length	number
work.xeEff	Projectile path	number

Field *"Projectile"*		
work.ProjectileName	Manufacturer/Name	text
work.caliber	Caliber (numeric designation)	number
work.Dbul	Diameter	number
work.mp	Mass	number
work.ps	Initial pressure	number
work.glen	Length	number
work.gdepth	Seating depth	number
work.gdepthc	Guided seating depth	number
work.gtailtype	Tail type	text
work.gtailh	Tail length	number
work.gtaildiaA	Cone dia A	number
work.gtaildiaB	Cone dia B	number
work.gmaterial	Material	text
work.gUBCS	Univ. identification code	text
work.g1bc	Bullet "G1-BC"	number
work.g7bc	Bullet "G7-BC"	number

Field *"Propellant"*		
work.PropellantName	Manufacturer/Name	text
work.Qex	Spec. explosive heat	number
work.k	Isentropic exponent	number
work.Ba	Combustion coefficient	number
work.a0	prog./deg. coefficient	number
work.z1	Transition limit 1	number
work.z2	Transition limit 2	number
work.pc	Material density	number

work.pcd	Bulk density	number
work.pt	Powder temperature	number
work.mc	Poweder mass (charge)	number
work.laddercnt	Loading ladder steps	number
work.laddermc	Step size	number

Source "Result"

The source "Result " are selected values from the simulation calculation of the current laboratory.

Source.Property	Description	Type
Result.MaxPressure	Maximum pressure	number
Result.MuzzlePressure	Gas pressure at the muzzle	number
Result.MuzzleEnergy	Projectile energy at the muzzle	number
Result.MuzzleVelocity	Projectile velocity at the muzzle	number
Result.MuzzleTime	Projectile lead time	number
Result.MuzzleTime10	Geschosslaufzeit ab 10% pmax	number
Result.LoadRatio	Load ratio	number
Result.BurnRatio	Burnt propellant	number
Result.BurnOutTime	Burn-out time	number
Result.BurnOutPos	Burn-out position	number
Result.Efficiency	Effective efficiency rate	number
Result.IPSCFactor	IPSC-Factor (IPSC & BDS)	number
Result.MIPFactor	MIP-Factor (DSB minimum impulse)	number
Result.ImpulseProjectile	Projectile impulse	number
Result.ImpulsePropellant	Propellant impulse	number
Result.Impulse	Overall impulse	number
Result.OutflowVelocity	Gas outflow velocity	number
Result.RecoilForce	Recoil force	number
Result.RecoilVelocity	Recoil velocity	number
Result.RecoilEnergy	Recoil energy	number
Graphics		
Result.diagramm.png	complete result diagram	image
Result.diagramCurves.png	only curve diagram	image
Result.diagramPropellant.png	only propellant diagramm	image
Notes from result field appendix		
Result.Notes	insert all notes	text
Result.Note(*"mynote"*)	insert note only with titel ***"mynote"***	text
Pictures from the gallery of the result field appendix		
Result.picture. *imagename*	insert picture from the gallery of result the field appendix. "imagename" is the file name of the picture in the gallery.	image

Source "Caliber"

The source "Caliber " is the unchanged original caliber data from the database. The values are only available if the selection has been made from the database. For *imported* loading data, the assignment is tried automatically, but may not contain an assignment to the database.

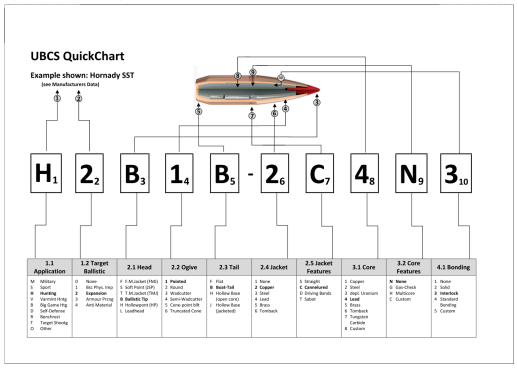
The source "Caliber" is available so that additional information is available, e.g. special individual dimensions stored in the database, the link to the CIP data sheet or the cartridge drawing created by the GRT from the standard dimensions.

Source.Property	Description	Type
mname	Manufacturer	text
pname	Product name	text
drawing.png	Cartridge drawing	image

UBCS

Universal Bullet Classification Scheme (UBCS)

Request for comments (RFC) for an Universal Bullet Classification Scheme (UBCS) v1.1b 190129



(by Andi & Barney from GRT Development Team)

A bullet is a kinetic projectile and the component of firearm ammunition that is expelled from the gun barrel during shooting.

Handloading or reloading is the process of loading firearm cartridges or shotgun shells by assembling the individual components (case/hull, primer, powder, and bullet/shot), rather than purchasing completely assembled, factory-loaded ammunition.

As there is a million of different bullet types and constructions available for different calibres and physical parameters, such as weight, diameter, length and aspects of external/internal construction and composition, there is a need to classify them to provide a solution for the means of searching, identifying and comparison for the modern handloader.

Bullets are manufactured for different purposes and processes by a variety of commercial producers and still as of today, some are produced by handloaders themselves. This variety and more often than sometimes conflicting commercial interests lead to a nomenclature which is all but consistent and useful to identify specific types and construction of a bullet for a given purpose.

This RFC takes on to the challenge to provide means of identifying bullets solely by geometric and constructional features without taking individual calibre-specific parameters (such as weight, calibre, external or internal dimensions) into account. It's purpose only needs to suit the needs to identify a TYPE of bullet over the individual specifications of a given bullet for a individual application in a given calibre.

When taking up to this challenge, some obvious general parameters come up without being too specific to a certain bullet type manufactured and branded by individuals or commercial operations. These are:

- **Purpose**
  Is this bullet intended for hunting or target shooting? Is it designed and enhanced to produce special target ballistic effects or solely for a precision flight path?
- **Geometry**
  How and why are different physical parameters chosen, which make up the outer appearance of the bullet
- **Construction**
  What is the recipe, which assembles the bullets components in a designated way? (Jacket, core, bonding mechanism, materials)

RFC DOCUMENT (PDF)

Please read the RFC for details about the current specification: UBCS-RFC_v1.1b.pdf

Plugins

GRT-Plugin "GRTLab"

The plugin "GRTLab" is part of every GRT version on all platforms.

GRTLab Basics

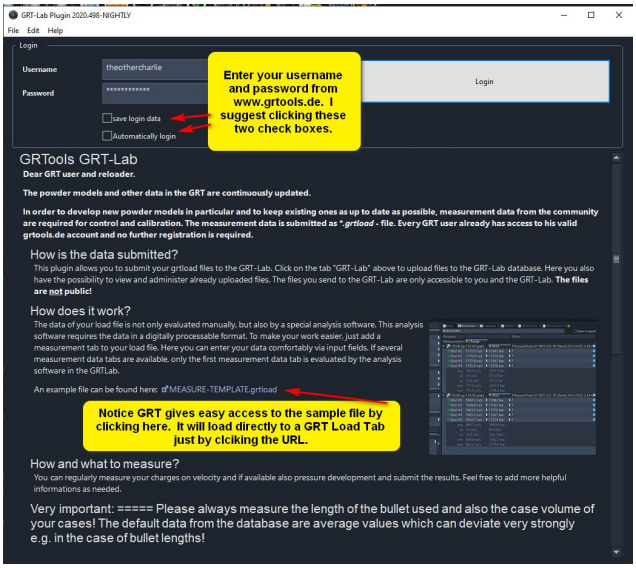
GRT provides a LAB Plugin app so users can conveniently contribute data to GRT in order to improve many of the GRT features. Primarily it is intended to allow users to submit results of user loads with velocity and maybe pressure data as actually recorded on velocity and pressure measuring equipment. Before a User can start to use the GRTLab he will have to have his login credentials as established at www.grtools.de. If you are a User that came to GRT via Patreon, and did not start from the website, you will need to establish an account on the website. The GRTLab and www.grtools.de are linked. Once you have your credentials you may proceed to the next step of launching the GRTLab.

LAUNCH

Launching the GRTLab is very easy, simply click the appropriate Menu or Toolbar icons as per this picture.

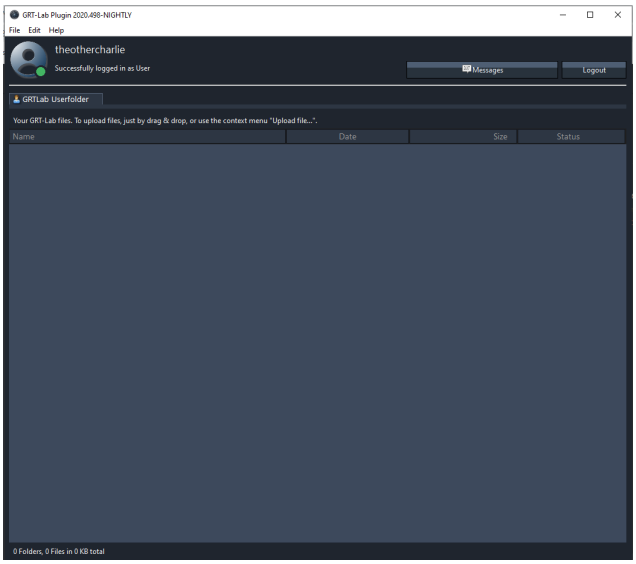
LOGIN

You should see a screen similar to this next picture. Just enter your credentials from www.grtools.de and click Login.



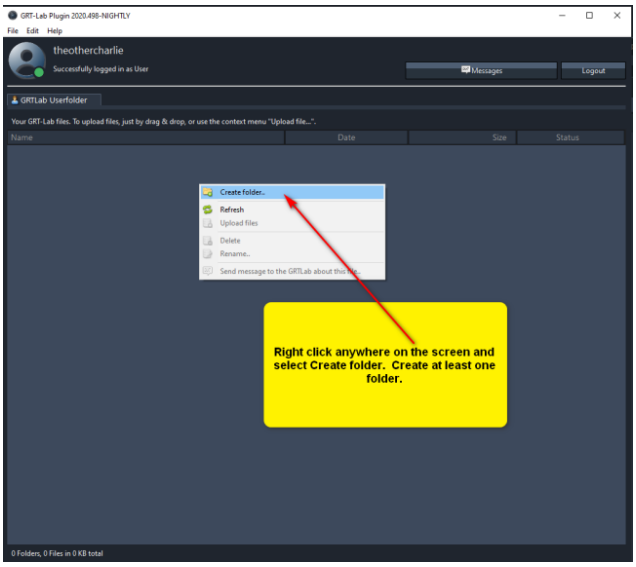
ROOT FOLDER

First time Users should be presented with a blank screen like this.

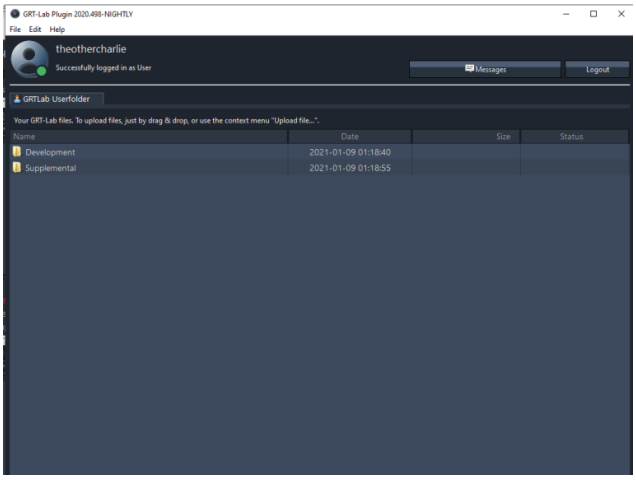


CREATE A FOLDER

The User should create at lease one folder appropriately named for its purpose. Example - Development, and/or Supplemental. "Development" for starting new propellant models, and "Supplemental" for improving existing propellant models. These are suggested names only.

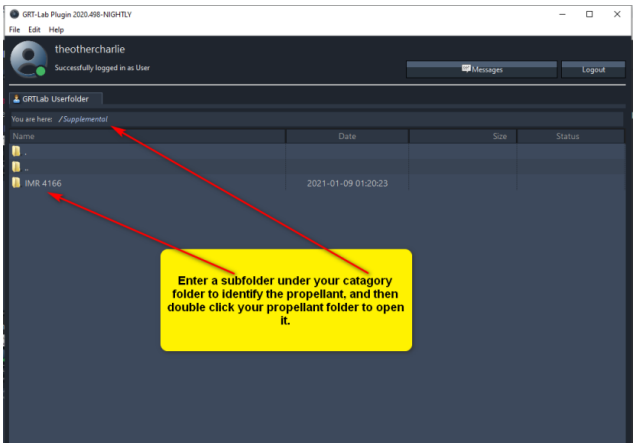


Similar to this sample.



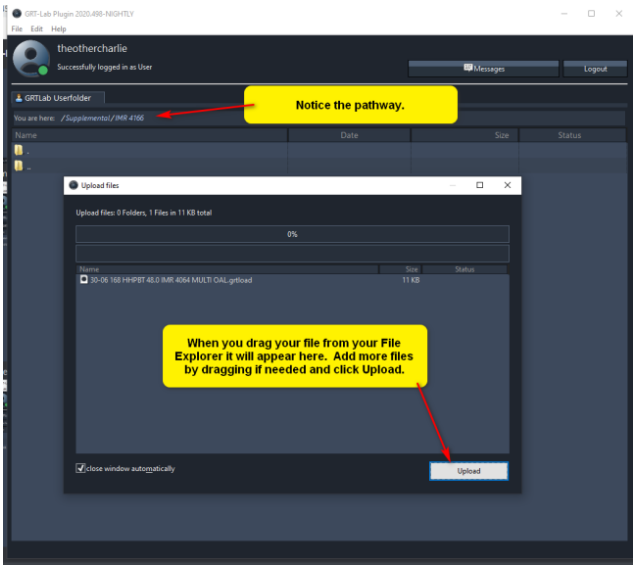
The double click your Category folder to open it, and add a folder for the propellant you are submitting data for. See

this picture.



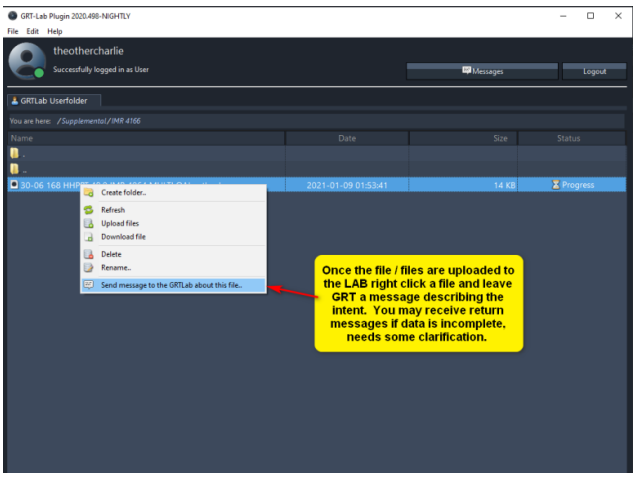
DRAG & DROP FILES

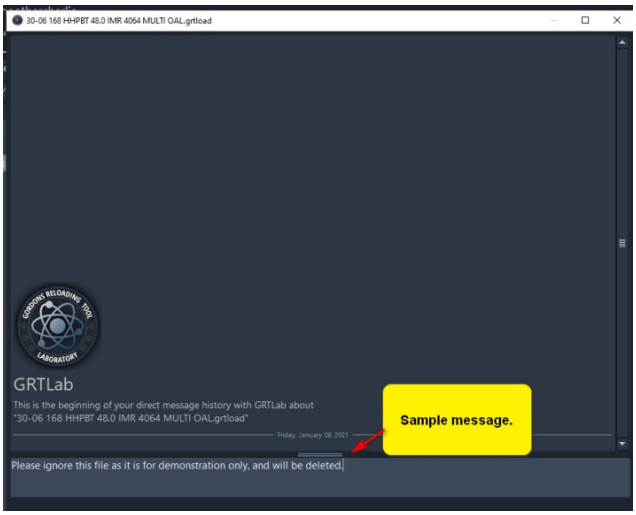
Once you have double clicked on the propellant named fold, simply drag and drop your .grtload file to this window.



MESSAGES

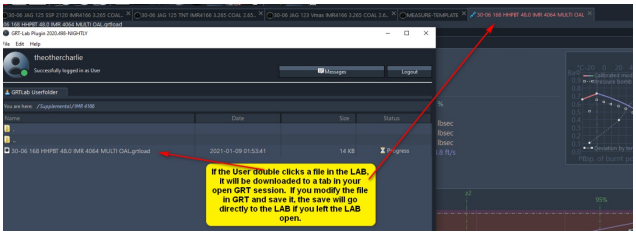
Once the uploads are completed, you can optionally leave a message describing the intent of the data. There is also status column to show the progress in the processing.

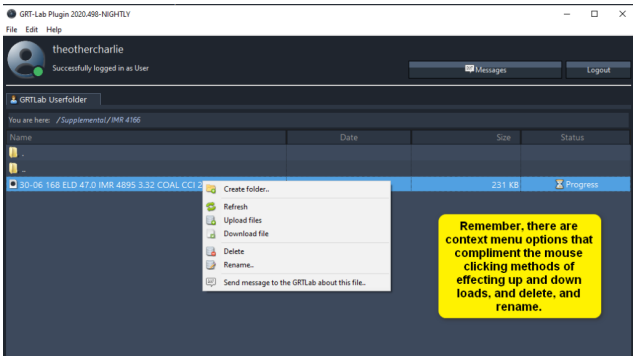




FILES

The User may modify files in his Lab, and if modified and saved, the save goes to the Lab. If the User wants to keep a local copy of this file it is suggested to make a copy and save that locally. Some times the User may have to try the download twice to establish a good connection.





GRT-Plugin "GRTrace"

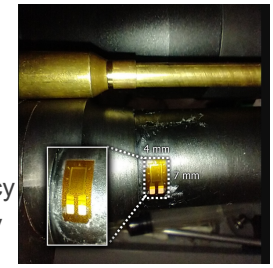
The "GRTrace" client software and the starter-plugin is part of every GRT version (currently Windows only). GRTrace can be run standalone or via the respective plugin entry/icon in GRT.

What is GRTrace?

GRTrace is a full featured, standalone client software for strain gage based, direct on rifle/barrel pressure measurement systems and comes with an additional starter-plugin for GRT. GRT supports directly the recorded traces made with GRTrace and can overlay the pressure curves onto the simulation curves. GRT supports also the direct import of traces made with GRTrace into a measurement tab and can reference that automatically with the simulation setup.

GRTrace currently supports the product "PressureTrace II" by RSI and is a **direct replacement for the original software** that comes with the device, other may follow.

HOW IT WORKS



A strain gage is a small foil-type sensor with a fine conductive grid on its surface and used to measure strain on an object.

The gage is glued on a barrel and as steel around the barrel expands by pressure, the gage is stretched. The stretching causes a small resistance change of the gage, which can be measured. A oscilloscope-like measuring device samples these changes at a high frequency and stores it in a memory buffer. The raw data of around 3 Milliseconds is then automatically downloaded to the PC via a serial connection where it is analyzed and plotted by GRTrace.

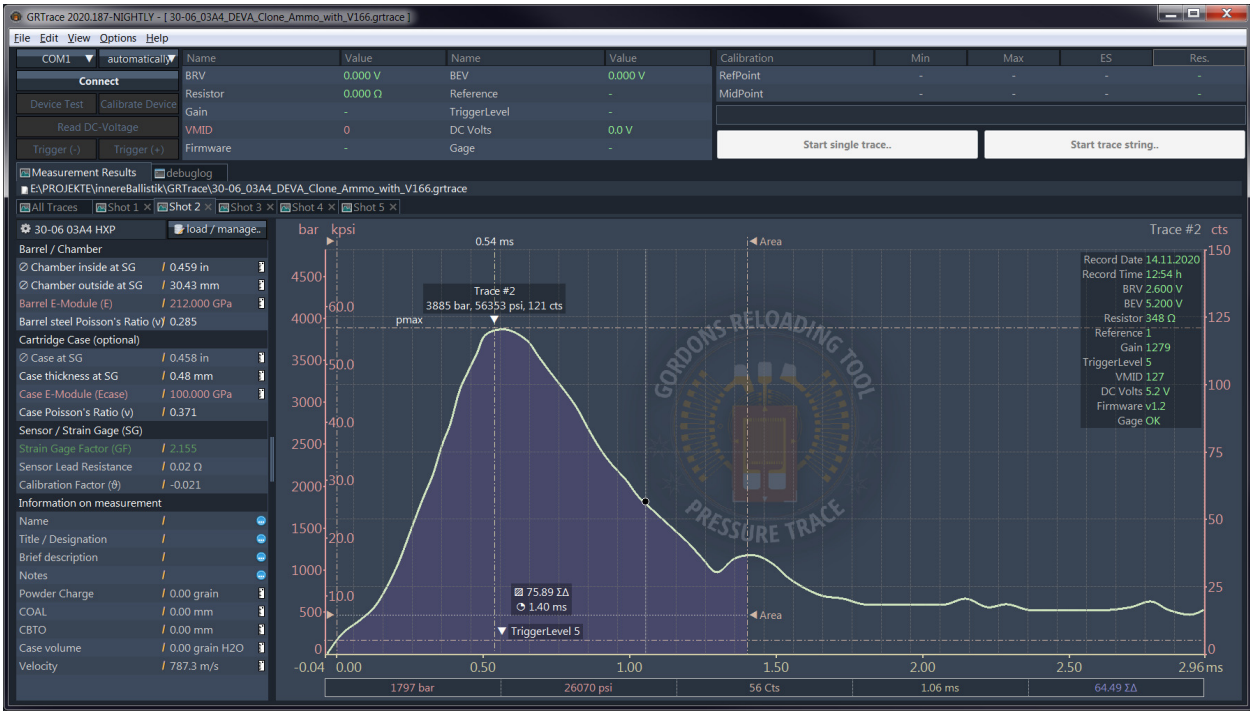
- GRTrace implements the latest technology/equations for calculation
- With GRTrace you can enter your specific material specs of your barrel if known and it will calculate the pressure values from the raw data according to your specific barrel.
- You can record as many traces into one grtrace-file as fits on the screen.
- For calibration GRTrace provides a simple and easy to use calibration factor value called "theta".
- GRTrace has a built-in simulator which simulates measurement hardware connected to a virtual rifle for evaluation/testing.
- GRTrace provides audio-commands and messages which helps you to record multiple shots in a string (Gordons voice, currently english only).

THE MAIN WINDOW - "ALL TRACES" VIEW

This is how GRTrace appears after start with an opened file. In the screenshot is the tab "all traces" selected, which shows all recorded traces together. GRTrace creates an average trace curve automatically and all important statistical data is displayed.

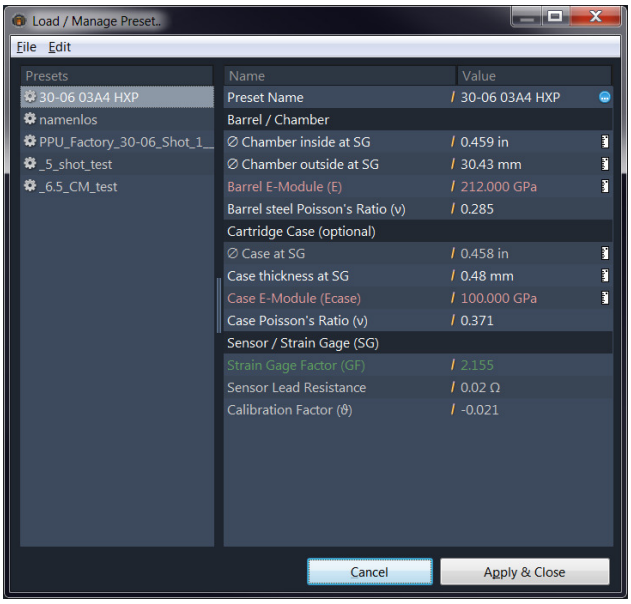
A SINGLE TRACE

You can move area cursors in your trace to determine the area under the curve. The area under the curve is useful to compare the delivered energy of multiple trace records.



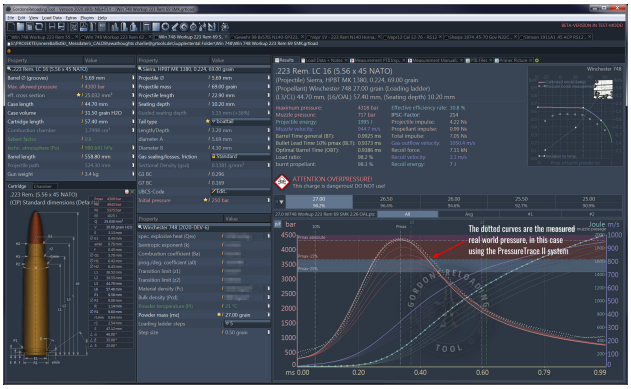
BARREL PRESETS

You can store several barrel presets of different rifles or barrels.



GRT CURVE OVERLAY

After import of a grtrace file, you can overlay the pressure curves onto the simulation for analysis.



How to use: GRTrace Basics

One of the major advances of GRTrace is the ability to load and edit the output files (xxxxxxxx.grtrace) at any time without having the device connected. There is also a simulator option where the user can familiarize himself with the plugin operations. Additionally, the output file can be reloaded into GRTrace and the user can add additional shot test (append) as desired , and there is no shot number limit. There is a practical limit set by the Users ability to keep track of how many Result Tabs he can keep track of. Overall the GRTrace software is much easier to use, and has a more pleasant GUI. GRTrace will duplicate (pass on) certain Shot parameters to the next shot so the User does not have to repeat entries. Additionally, there is a "debuglog" kept during every session with an option to save the log for troubleshooting problems.

GRTrace can be launched from within the GRT program, or launched by invoking GRTrace.exe from the Plugin folders. A shortcut, pin to start, or pin to taskbar option is available to make launching easier, and the program is portable similar to GRT, so it can be loaded to a thumb drive and run from any PC desired.

Upon opening GRTrace, the User should familiarizes himself with the Menu Options. An important one for first time users will be the Options menu Device Simulator. This will allow the User to experience the programs functions without actually expending ammunition and range time, or hooking up the PT2 device.

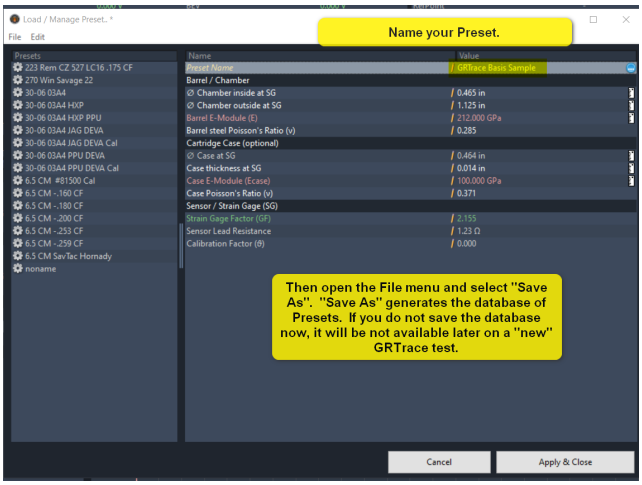
GRTrace, when first opened, may display a preloaded file, or may start with a blank "noname" start up. The preloaded file is usually available in the Plugin folder for GRTrace, and is useful in seeing what fields represent what.

First time User: Start GRTrace and once it is running, open the Options menu and select the Device Simulator. Please read the disclaimer. The user should now enter in his first Barrel Preset under the shown "No preset selected" data fields below the "All Traces" tab.

- 1. First is the "Chamber diameter" adjacent to the gage location. For mid case mounted gages measure with Plastigage on a sized casing and chambered in the rifle, and extract. Just measure the casing and read the Plastigage and add the two together.
- 2. Then enter the barrel diameter at the gage location, and enter in the into the "Chamber outside at SG" field. If your gage is set ahead of the mouth of the case, skip to step 5.
- 3. For mid case gages the "Case at SG" field is the same as the above "Chamber diameter" minus the Plastigage value.
- 4. For mid case gages the User usually has to section a case and measure the wall thickness, and enter that value in "Case thickness at SG".
- 5. "Strain Gage Factor" should be printed in your gage documentation.
- 6. Measure the lead wire internal resistance with a good Ohm meter, with one end shorted together into "Sensor Lead Resistance". This value will be low, but normally above the .02 default. This is not the combined lead and gage resistance. GRTrace assumes the gage is a standard 350 ohm one as required by the Wheatstone Bridge within the yellow box.
- 7. Leave the "Calibration Factor" empty until you have determined the true value by test and evaluation.

Note: Mid case gage locations result if finer reading of pressure steps, but there is often a initial delay in the start of pressure readings due the brass having to expand until it touches the chamber walls. End of mouth gages do not suffer this delay in pressure reading, but the steps in pressure is often coarser, up to twice the mid case gage depending on barrel thickness at the measurement points. Now that the basic Preset parameters are entered we need to save the data into a file that can be accessed at a later date. Either click the "load/manage" button at the top of the list of parameters, or select the File menu option that is the same. Make sure you rename the file from "noname" to something you can relate to later.

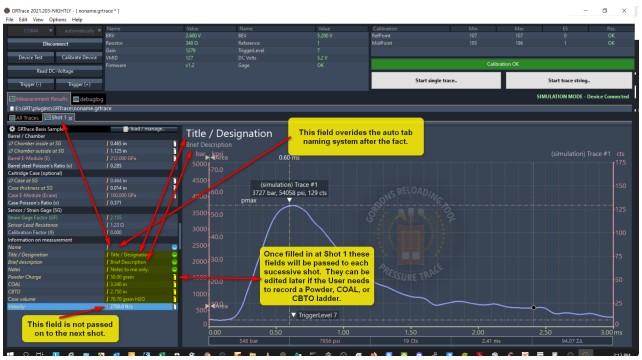
Once you have named the file, you will need to open the File menu being displayed and do a "Save As" to also save the file into a Preset database. If you do not do a "Save As" now, the Preset you have constructed will exist only in the .grtrace file you hopefully will generate when you save your project.



Now that the User has a Barrel Preset, he can start to measure relative pressures in his rifle. There is only the matter of finding out what the other imput fields are for, and where do they appear. First, place GRTrace in Simulator mode as mentioned above. Then fill in the "General File Information's" as required. Take note of where (if they do) appear on the Results screen for "All Traces". Not all show up in the Results screen, some are for User reference while viewing the graphs only.

Now click on the "Connect" button. The program will simulate the normal calibration routine seen in the field, but hidden by the RSI software. The User can now look in the "debuglog" tab and view the list of commands and device outputs. This debug screen can be useful if the User has trouble with the PT2 box, cables, or noise generated in the environment as he uses his PT2. All of the limited commands that are used to control the device are simulated through the various buttons under the "Connect" / "Disconnect" buttons at the upper left of the main screen. The simulator will at times even generate errors so the User can get used to seeing them.

Now we are ready to do a simulated shot. From the "All Traces" tab view, click the "Start single trace" button. You should hear Gordon's audio prompt unless you have turned those off in the Options menu. A new Shot tab should appear, and will be auto numbered as Shot 1, Shot 2, etc. unless the User over types this auto numbering using the "Name" field in the "Information on measurement". I suggest this "Name" field not be used until the shot series is finished. Most of these fields are passed on to the next Shot except the "Name" and the "Velocity".



At any time during the gathering of data the User can save the work to a .grtrace file. The User is not restricted to end of test for saving, and editing. The whole test can be interrupted and restarted again at the Users whim. If the User

loads a file from storage, he can append new Shots to the end of his file. The User can also load a file than has multiple Shots, edit out Shots and save the file under a new name, thus preserving the original data, and generating different looks into existing data. It is up to the Users imagination how far this can go. Personally, I use keyboard CTRL + S for every shot, and sometimes more often. It is so easy to maintain data integrity.

Once the User is familiar with the system, he can start to use the "Start trace string" button option. Remember in simulator mode the system will generate errors so the User can get recognize these in the field.

WORDS OF CAUTION

If you have problems connecting the PT2 device, either using the original RSI software, or GRTrace, the problem is often traced to Windows (10) losing track of which COM port it is suppose to use. It seems the Plug and Play system is a bit senile, and gets lost at times especially if the PC has detected Blue Tooth devices nearby during the PC startup. What I have found to work well is, after you are certain which COM port is being used at home, open Device Manager, and disable all COM ports except the one that worked at home. That seems to disable the Plug and Play, and allow the system to communicate. There may be a better explanation, but that is what seems to be happening to me.

SAMPLE OUTPUT FILE

Users may download this file to be able to see what a nearly complete fill out looks like. Once downloaded, a double click on the file should load and launch GRTrace.

- :en:plugin:grtrace:media:deva-14981-clone-x5-avg-vel-2590-e-212.grtrace

Plugin-API

The GRT has a dynamic plug-in interface for add-on functions.

WHAT ARE GRT PLUGINS?

GRT plugins are standalone, executable programs or scripts. At startup, all activated plugins from the plugin folder are integrated into the main program.

For this purpose a communication channel between the GRT and each plugin is established via IPC (Inter Process Communication). IPC is a common type of connection between different programs on a system. It does not require an Internet connection for plug-ins or the GRT. With IPC, the connection is limited to the local computer.

The plug-ins are therefore only loosely connected to the GRT via a communication channel. If a plugin author so wishes, he can also design his plugin so that it can be used independently of the GRT.

WHERE ARE THE PLUGINS STORED/INSTALLED?

The *subdirectory* in which the GRT plugins must be located to be recognized: ***"plugins"*** . So the plugins are located e.g. in

- *C:/Applications/GordonsReloadingTool/plugins* /

WHAT REQUIREMENTS DOES A PLUGIN NEED?

- The plugin must be executable. I.e. it must be able to run independently as a program or script.
- The plugin must be able to recognize and process the **command line parameters** specified at startup.
- The plugin must be able to establish a **Socket connection** for the communication with the GRT.
  - **under Linux:** a Unix domain socket
  - **under Windows:** TCP-Socket
    Because there are no Unix domain sockets under Windows, a normal TCP socket is used. The GRT opens a specially configured TCP socket, which does not allow Internet connections and therefore does not provoke a firewall warning.

DIRECTORY STRUCTURE OF A PLUGIN

Each plugin is located in a separate folder. The name of the folder should be unique to avoid conflicts with other plugins, but it has no other meaning.

A plugin directory usually has the following files and folders:

- ***/media***
  Subdirectory for media files like icons or images (optional, name is a recommendation)

- ***com.grt.plugin.xml***
  This file is the so called ***Manifest*** of the plugin. **The name of this file is a default and always the same.** The plugin manifest contains the specification of the plugin. It also contains the definition of e.g. menus and toolbar icons which should be provided automatically in the GRT for the plugin.

- ***plugin.exe***
  The plugin itself as an executable file (any name), here for Windows. A plugin can also support multiple platforms and the location of the executable files is defined in the plugin manifest. Where the executable plugin files are stored within the plugin folder is therefore freely selectable.

Integration of plugins into the GRT

When a plugin is stored in the GRT plugin folder, the *Plugin Manifest* of all plugins is read by the GRT at startup. Depending on the configuration in the plugin manifest, all defined and desired behaviors, menu items and toolbar icons will be created or configured by the GRT for the plugin.

Menus defined by the plugin appear in the GRT in the menu "Plugins" with the name of the plugin and as submenus all menu items defined by the plugin. The menus defined by the plugin can be nested as deep as desired.

Then, depending on the operating system, the executable file defined in the plugin manifest is launched with a command line parameter. With the connection parameters specified in the command line, the plugin must then connect to the GRT with a ***Socket-Connect*** . A **Timeout** can be specified in the plugin manifest, which cancels the connection attempt on the part of the GRT in the event of an error.

See: The plugin manifest

COMMAND LINE PARAMETER FOR PLUGIN START

GRT starts the plugin with command line parameters as follows:

Windows

```
plugin.exe --ipcport <port number>
```

Under Windows the port for the TCP socket. If, for example, the port number **49771** is specified, the connection address to the GRT is: ***localhost:49771*** or ***127.0.0.1:49771*** .

Linux

```
plugin --ipcfile <filepath>
```

Under Linux the path of the connection file for the Unix domain socket.

CONNECTION TYPES

A plugin can be configured so that it either remains **continuously** connected to the GRT, or is only started during **user interaction** . For plugins that are permanently connected to the GRT, toolbar icons **will be disabled** (gray) if a plugin terminates the connection and menu items of the plugin are functionless.

As long as the GRT is running, the plugin can reconnect to the GRT automatically after a connection loss with the last specified connection information. Toolbar icons and menus are then automatically reactivated.

Communication (API)

The communication between the plugins and the GRT takes place via data packets which are exchanged via a socket connection. The data encapsulation is done in plain text via JSON-Notation with corresponding specifications to the structure.

- **Number values** are specified **decimal** .
- **Strings** are specified in plain text in UTF8-Format]. They may also be URL-encoded if necessary.

Important

It may happen that a package is lost due to technical circumstances. This means that the plugin must ensure that the **response packets** are **evaluated** by the GRT for a command sent by the plugin. If no response is received,

the plugin can recognize this and execute the command again.

Failed packets

The GRT reports back to the plugin packets detected as faulty with an error message and description.

Events & Functions

The GRT sends all **events activated in the plugin manifest** to the plugin. I.e. if the plugin has activated the event for tab change (tab clicked/changed by the user), an event message is automatically sent to the plugin as soon as the user has clicked a tab in the GRT.

LIST OF EVENTS

The events do **not** expect any confirmation from the plugin. No response message is necessary for events. When an event occurs, it is sent to all plugins that have activated the event in their manifest.

Note: "Tab" denotes the tab or the corresponding load file in the GRT.

- Event_Attached - Plugin integrated
- Event_ColorPresetChange - color scheme changed
- Event_MenuAction - Menu item clicked
- Event_ToolbarAction - Toolbar icon clicked on
- Event_TabClosed - Tab was closed by user
- Event_TabComputed - Simulation recalculated
- Event_TabDataChange - Data of a tab changed
- Event_TabSwitch - the user has clicked on a (different) tab
- Event_TabUnitChange - a unit of measurement has been changed
- Event_WindowActivate - a GRT main window (the one with tabs) has been activated/put in the foreground
- Event_WindowClosed - a GRT main window was closed
- Event_WindowDeactivate - a GRT main window was placed in the background
- Event_WindowMaximize - a GRT main window was maximized
- Event_WindowMinimize - a GRT main window was minimized
- Event_WindowMoved - a GRT main window was moved
- Event_WindowResized - a GRT main window has been resized
- Event_WindowRestore - a GRT main window was restored after maximizing/minimizing

LIST OF FUNCTIONS (COMMANDS)

CLOSE

- Close_ChunkStream - close data stream

GET

- Get_Chunk - read part of a data stream
- Get_ColorPresets - list of all color schemes
- Get_ColorPreset - read color scheme
- Get_Tab - read properties of a specific tab
- Get_TabList - read list with properties of all tabs
- Get_TabOnTop - read properties of the active (focus) tab
- Get_TabResults - read simulation results of a specific tab

The Plugin-Manifest

The plugin manifest is a file in XML format with a fixed filename (all lowercase letters):

com.grt.plugin.xml

A common plugin manifest has the following structure:

```
<?xml version="1.0" encoding="UTF-8" standalone="yes" ?>
<GordonsReloadingTool>
<!--
GRT plugin manifest

Plugin configuration <plugin>
The attribute "id" must be begin with the domain "com.grt.plugin" and is
usually extended by a unique, alphanumeric name without spaces for your plugin.

The attribute "enabled" activates or deactivates the plugin. If "false" the
plugin is ignored at startup.

The attributes "launch-windows" and "launch-linux" defines the executable of
the plugin. The executables can be placed in a sub-folder also. In this case
just add the local directory path like "bin\plugin.exe" for windows or
"bin/plugin" for linux. At least ONE of both attributes must contain a valid
executable file. The Plugin fails to load if no file for the specific OS is
specified.

The attribute "launch-type" configures the launch method for the plugin.
With value "permanent" the plugin is executed at startup and permanent attached
to the GRT (default). With Value "onDemand", the plugin is launched if a
user-action take place and it is not yet running. The plugin can terminate
itself after finish a process and will be then launched again on next
user-action.

If you are using a script language that runs on windows and linux e.g. python,
then just enter in BOTH attributes the same file.

The attribute "launch-args" are the custom commandline for the plugin where
the placeholder "{PLUGIN_COMMANDLINE}" can be used ti implement the original
commandline from the GRT (holds the specific connection infos).
"launch_args" replaces the original commandline that are passed at plugin start.

-->

  <plugin
   name           = "GRT Example Plugin"
   id             = "com.grt.plugin.example"
   version        = "1.0.0"
   provider       = "Test Provider"
    description    = "This is a plugin example"
    launch-windows = "plugin.exe"
    launch-linux   = "plugin"
    launch-type    = "permanent"
    launch-args    = ""
    start-timeout  = "2.0"
    enabled        = "false"
  >
<!--
Registering to GRT events
each event you turn on with value "true" will be sent to your plugin when the
the event occours.

NOTE: ONLY TURN EVENTS ON THAT YOU ARE REALY NEED, OTHERWISE IT CAN AFFECT
THE PERFORMANCE OF THE GRT IN CASE OF MANY PLUGINS ACTIVE.

The events here are only for example purpose all activated.
-->
    <registerevent>
      <event name="ColorPresetChange" enabled="true" />
```

```
      <event name="TabSwitch" enabled="true" />
      <event name="TabDataChange" enabled="true" />
      <event name="TabUnitChange" enabled="true" />
      <event name="TabClosed" enabled="true" />
      <event name="WindowActivate" enabled="true" />
      <event name="WindowDeactivate" enabled="true" />
      <event name="WindowMaximize" enabled="true" />
      <event name="WindowMinimize" enabled="true" />
      <event name="WindowRestore" enabled="true" />
      <event name="WindowMoved" enabled="true" />
      <event name="WindowResized" enabled="true" />
      <event name="WindowClosed" enabled="true" />
    </registerevent>

<!--
Menu integration
You can as many menuitems and submenus define as you want.
The main tag <menu> is the main menuitem only that are created with the name
of your plugin defined above. <menu> has the attributes "autoenable" and "icon"
only. If autoenable="true" the GRT auto-enables the menu items in
the GRT menu integration for you. Otherwise you have to alter each
menuitem yourself to enable/disable it (using the menuitem command).

Each <menuitem> can be a submenu by inserting more <menuitem>-tags.
Each <menuitem> must have the attributes "id" and "label".
The attribute "id" is appended to the plugin-id defined above and will be
sent to the plugin if a menuaction event occours.
(same for toolbar-icons/buttons down below)

-->
    <menu autoenable="true" icon="media/icons/icn_about_16x16.png">
      <menuitem id="menu1" label="Menu 1">
      <menuitem id="entry1" label="Entry 1" icon="media/icons/icn_plugin_16x16.png" en
      <separator />
      <menuitem id="entry2" label="Entry 2" icon="media/icons/icn_plugin_go_16x16.png"
      <menuitem id="entry3" label="Entry 3" icon="media/icons/icn_plugin_edit_16x16.pn
     </menuitem>
      <menuitem id="menu2" label="Menu 2">
      <menuitem id="entry1" label="Entry 1" icon="media/icons/icn_plugin_16x16.png" en
      <menuitem id="entry2" label="Entry 2" enabled="true" checked="true"/>
     </menuitem>
    <menuitem id="about" label="About" icon="media/icons/icn_about_16x16.png" enabled=
    <menuitem id="version" label="Version" enabled="true" checked="false"/>
    </menu>
<!--
Toolbar integration
You can as many toolbar-icons/buttons define as you want.
Also separators can be added with <separator />.
Each Toolbar-Icon have to be 32 x 32 pixels and the GRT overlays a small plugin-icon i
right bottom corner to indicate the toolbar-icon/button as plugin.
-->
    <toolbar>
      <toolbaritem
        id           = "toolbar_button1"
        label        = "Plugin example"
        tooltip      = "press to show this plugin"
        icon         = "media/icons/icn_about_32x32.png"
        enabled      = "true"
      />
    </toolbar>

  </plugin>
</GordonsReloadingTool>
```

Event_Attached

This event is sent to the plugin after each implementation/start of the plugin.

The event cannot be disabled.

VALUES

- ***(integer) windowhandle*** - Window handle of the current GRT main window
- ***(string) languagecode*** - language code of the language that GRT is running in

JSON-SOURCE (EXAMPLE)

```
{
  "Event_Attached":{
    "windowhandle":"531876"
    "languagecode":"en"
  }
}
```

Event_ColorPresetChange

This event is sent after each change of the color scheme.

The event can be activated/deactivated in the plugin manifest.

VALUES

- ***(integer) ColorPresetId*** - ID of the new/changed color scheme

JSON-SOURCE (EXAMPLE)

```
{
  "Event_Attached":{
    "ColorPresetId":133424
  }
}
```

Event_MenuAction

This event is sent to the plugin when clicking on a menu entry of the plugin.

The event cannot be switched off.

VALUES

- ***(integer) windowhandle*** - Windowhandle of the current GRT main window
- ***(string) id*** - ID of the clicked menu item
- ***(string) label*** - Menu text of the clicked menu item
- ***(boolean) checked*** - Menu entry with check mark (true) or without (false)

JSON-SOURCE (EXAMPLE)

```
{
  "Event_MenuAction":{
    "windowhandle":531876,
    "id":"com.grt.plugin.tester.menu.version",
    "label":"Version",
    "checked":false
  }
}
```

Event_ToolbarAction

This event is sent to the plugin when clicking on a toolbar button of the plugin.

The event cannot be switched off.

VALUES

- ***(integer) windowhandle*** - Windowhandle of the current GRT main window
- ***(string) id*** - ID of the clicked button
- ***(string) label*** - text of the clicked button

JSON SOURCE (EXAMPLE)

```
{
  "Event_ToolbarAction":{
    "windowhandle":531876,
    "id":"com.grt.plugin.tester.toolbar_button1",
    "label":"Example Plugin"
  }
}
```

Event_TabClosed

This event is sent to the plugin after closing a tab.

The event can be activated/deactivated in the plugin manifest.

VALUES

- ***(integer) windowhandle*** - Windowhandle of the current GRT main window
- ***(integer) tabhandle*** - Tabhandle of the closed tab (load file)

JSON SOURCE (EXAMPLE)

```
{
  "Event_TabClosed":{
    "windowhandle":531876,
    "tabhandle":4922491
  }
}
```

Event_TabComputed

This event is sent to the plugin after a recalculation of the simulation.

The event can be activated/deactivated in the plugin manifest.

VALUES

- ***(integer) windowhandle*** - Windowhandle of the current GRT main window
- ***(integer) tabhandle*** - Tabhandle of the currently activated tab (load file)

JSON SOURCE (EXAMPLE)

```
{
  "Event_TabComputed":{
    "windowhandle":531876,
    "tabhandle":130662912
  }
}
```

Event_TabDataChange

This event is sent to the plugin after a change of an input value in the tab.

The event can be activated/deactivated in the plugin manifest.

VALUES

- ***(integer) windowhandle*** - Windowhandle of the current GRT main window
- ***(integer) tabhandle*** - Tabhandle of the currently activated tab (load file)
- ***(string) varname*** - the name of the value changed

JSON SOURCE (EXAMPLE)

```
{
  "Event_TabDataChange":{
    "windowhandle":531876,
    "tabhandle":120858727,
    "varname":"gdepth"
  }
}
```

Event_TabSwitch

This event is sent to the plugin after a click on a (different) tab.

The event can be activated/deactivated in the plugin manifest.

VALUES

- ***(integer) windowhandle*** - Windowhandle of the current GRT main window
- ***(integer) tabhandle*** - Tabhandle of the currently activated tab (load file)

JSON SOURCE (EXAMPLE)

```
{
  "Event_TabSwitch":{
    "windowhandle":531876,
    "tabhandle":120858727,
  }
}
```

Event_TabUnitChange

This event is sent to the plugin after a change of a unit of measurement in the tab.

The event can be activated/deactivated in the plugin manifest.

VALUES

- ***(integer) windowhandle*** - Windowhandle of the current GRT main window
- ***(integer) tabhandle*** - Tabhandle of the currently activated tab (load file)
- ***(string) varname*** - the name of the value changed

JSON SOURCE (EXAMPLE)

```
{
  "Event_TabUnitChange":{
    "windowhandle":531876,
    "tabhandle":120858727,
    "varname":"glen"
  }
}
```

Event_WindowActivate

This event is sent to the plugin when a GRT main window is activated.

The event can be activated/deactivated in the plugin manifest.

VALUES

- ***(integer) windowhandle*** - Windowhandle of the current GRT main window
- ***(integer) tabhandle*** - Tabhandle of the currently activated tab (load file)

JSON SOURCE (EXAMPLE)

```
{
  "Event_WindowActivate":{
    "windowhandle":531876,
    "tabhandle":130662912
  }
}
```

Event_WindowClosed

This event is sent to the plugin when a GRT main window is closed.

The event can be activated/deactivated in the plugin manifest.

VALUES

- ***(integer) windowhandle*** - Windowhandle of the current GRT main window

JSON SOURCE (EXAMPLE)

```
{
  "Event_WindowClosed":{
    "windowhandle":531876
  }
}
```

Event_WindowDeactivate

This event is sent to the plugin when a GRT main window is deactivated (window goes into the background).

The event can be activated/deactivated in the plugin manifest.

VALUES

- ***(integer) windowhandle*** - Windowhandle of the current GRT main window

JSON SOURCE (EXAMPLE)

```
{
  "Event_WindowDeactivate":{
    "windowhandle":531876
  }
}
```

Event_WindowMaximize

This event is sent to the plugin after maximizing a GRT main window.

The event can be activated/deactivated in the plugin manifest.

VALUES

- ***(integer) windowhandle*** - Windowhandle of the current GRT main window
- ***(integer) left*** - window position left on the screen
- ***(integer) top*** - window position at the top of the screen
- ***(integer) width*** - Window width
- ***(integer) height*** - Height of the window

JSON SOURCE (EXAMPLE)

```
{
  "Event_WindowMaximize":{
    "windowhandle":531876,
    "left":944,
    "top":108,
    "width":1871,
    "height":1118
  }
}
```

Event_WindowMinimize

This event is sent to the plugin after minimizing a main GRT window.

The event can be activated/deactivated in the plugin manifest.

VALUES

- ***(integer) windowhandle*** - Windowhandle of the current GRT main window

JSON SOURCE (EXAMPLE)

```
{
  "Event_WindowMinimize":{
    "windowhandle":531876,
  }
}
```

Event_WindowMoved

This event is sent to the plugin after moving a GRT main window.

The event can be activated/deactivated in the plugin manifest.

VALUES

- ***(integer) windowhandle*** - Windowhandle of the current GRT main window
- ***(integer) left*** - window position left on the screen
- ***(integer) top*** - window position at the top of the screen
- ***(integer) width*** - Window width
- ***(integer) height*** - Height of the window

JSON SOURCE (EXAMPLE)

```
{
  "Event_WindowMoved":{
    "windowhandle":531876,
    "left":944,
    "top":108,
    "width":1871,
    "height":1118
  }
}
```

Event_WindowResized

This event is sent to the plugin after resizing a GRT main window.

The event can be activated/deactivated in the plugin manifest.

VALUES

- ***(integer) windowhandle*** - Windowhandle of the current GRT main window
- ***(integer) left*** - window position left on the screen
- ***(integer) top*** - window position at the top of the screen
- ***(integer) width*** - Window width
- ***(integer) height*** - Height of the window

JSON SOURCE (EXAMPLE)

```
{
  "Event_WindowResized":{
    "windowhandle":531876,
    "left":944,
    "top":108,
    "width":1871,
    "height":1118
  }
}
```

Event_WindowRestore

This event is sent to the plugin after restoring from the maximized or minimized position of a GRT main window.

The event can be activated/deactivated in the plugin manifest.

VALUES

- ***(integer) windowhandle*** - Windowhandle of the current GRT main window
- ***(integer) left*** - window position left on the screen
- ***(integer) top*** - window position at the top of the screen
- ***(integer) width*** - Window width
- ***(integer) height*** - Height of the window

JSON SOURCE (EXAMPLE)

```
{
  "Event_WindowRestore":{
    "windowhandle":531876,
    "left":944,
    "top":108,
    "width":1871,
    "height":1118
  }
}
```

Close_ChunkStream

Close data stream.

PARAMETER

- *chunkStreamHandle* - The handle of the ChunkStream.

JSON-SOURCE

COMMAND

```
{
  "Close_ChunkStream":{
    "chunkStreamHandle":"7835152"
  }
}
```

RESULT (EXAMPLE)

```
{
  "Result":{
    "command":"Close_ChunkStream",
    "status":"success",
    "values":null
  }
}
```

Get_Chunk

Read part of a data stream.

Some functions provide a ChunkStream for the transmission of large amounts of data. With this function the data packets can be read in any order. You get the number of data packets *n* with the handle of the ChunkStream.

PARAMETER

- *chunkStreamHandle* - The handle of the ChunkStream.
- *chunkIndex* - The index of the data packet from *0* to *n-1* .

JSON-SOURCE

COMMAND


```
{
  "Get_Chunk":{
    "chunkStreamHandle":"7835152",
    "chunkIndex":"0"
  }
}
```


RESULT (EXAMPLE)


```
{
  "Result":{
    "command":"Get_Chunk",
    "status":"success",
    "values":{
      "chunkStreamHandle":7835152,
      "chunkIndex":0,
      "EOF":false,
      "data":[
        {
          "x":0.0,
          "xp":0.0,
          "z":0.0,
          "p":250.13109753758943,
          "v":0.0,
          "e":0.0,
          "t":0.0
        },
        {
          "x":0.162446184754769,
          "xp":0.0,
          "z":0.002736369921903,
          "p":261.52630474905732,
          "v":5.885113598146926,
          "e":0.190763958950622,
          "t":0.0
        },
        {
          "x":0.324892369509538,
          "xp":0.0,
          "z":0.005477313637181,
          "p":281.13137939145037,
          "v":8.470504316329208,
          "e":0.39518928651079,
          "t":0.019601002114133
        },
        {
```

```
            "x":0.487338554264307,
            "xp":0.0,
            "z":0.008204408906824,
            "p":306.54680252355814,
            "v":10.591005129049949,
            "e":0.617818605660446,
            "t":0.039202004228266
          },
          {
            "x":0.649784739019076,
            "xp":0.0,
            "z":0.010919632660886,
            "p":336.03192467685858,
            "v":12.507579884155321,
            "e":0.861654572380366,
            "t":0.051476042284432
          },
          {
            "x":0.812230923773845,
            "xp":0.0,
            "z":0.013624546458675,
            "p":368.32514181234359,
            "v":14.315448684653926,
            "e":1.128746860343957,
            "t":0.063750080340598
          },
          {
            "x":0.974677108528614,
            "xp":0.0,
            "z":0.016319751125968,
            "p":402.51046725094392,
            "v":16.059145256276761,
            "e":1.420468080079626,
            "t":0.073333569606384
          },
          {
            "x":1.137123293283383,
            "xp":0.0,
            "z":0.019005481727411,
            "p":437.92263703522144,
            "v":17.762107873150207,
            "e":1.737703327960109,
            "t":0.082917058872169
          },
          {
            "x":1.299569478038152,
            "xp":0.0,
            "z":0.02168186418882,
            "p":474.0789076206388,
            "v":19.437536854905574,
            "e":2.080985652303175,
            "t":0.090823334215323
          },
          {
            "x":1.462015662792921,
            "xp":0.0,
            "z":0.024348993949104,
            "p":510.62959515843909,
            "v":21.093194920810046,
            "e":2.450593956682427,
            "t":0.098729609558478
          },
          {
            "x":1.62446184754769,
            "xp":0.0,
            "z":0.02700695734543,
            "p":547.32205864876335,
            "v":22.733784747213154,
            "e":2.846624045036704,
            "t":0.10547967207317
          },
          {
            "x":1.786908032302459,
            "xp":0.0,
```

```
            "z":0.029655837202642,
            "p":583.97443198630651,
            "v":24.362217803491948,
            "e":3.269040261503466,
            "t":0.112229734587863
          },
          {
            "x":1.949354217057228,
            "xp":0.0,
            "z":0.032295714345411,
            "p":620.45645593687527,
            "v":25.980327404500983,
            "e":3.717713048872881,
            "t":0.118129184551665
          },
          {
            "x":2.111800401811997,
            "xp":0.0,
            "z":0.034926668071723,
            "p":656.67548877476918,
            "v":27.589284617897487,
            "e":4.192446268217186,
            "t":0.124028634515466
          },
          {
            "x":2.274246586566766,
            "xp":0.0,
            "z":0.037548776347226,
            "p":692.56629615866632,
            "v":29.189847645166331,
            "e":4.692997065967103,
            "t":0.129274266960623
          },
          {
            "x":2.436692771321535,
            "xp":0.0,
            "z":0.040162115912015,
            "p":728.0835994504605,
            "v":30.782514515982069,
            "e":5.219090313445689,
            "t":0.134519899405781
          },
          {
            "x":2.599138956076304,
            "xp":0.0,
            "z":0.042766762352042,
            "p":763.19663751129349,
            "v":32.367618096452766,
            "e":5.770429092446725,
            "t":0.139246705750728
          },
          {
            "x":2.761585140831073,
            "xp":0.0,
            "z":0.045362790152253,
            "p":797.88519822178239,
            "v":33.945385938368595,
            "e":6.346702299967474,
            "t":0.143973512095675
          },
          {
            "x":2.924031325585842,
            "xp":0.0,
            "z":0.047950272738615,
            "p":832.13672281804338,
            "v":35.515978333720831,
            "e":6.947590153922914,
            "t":0.148278397696113
          },
          {
            "x":3.086477510340612,
            "xp":0.0,
            "z":0.050529282512784,
            "p":865.94419331747304,
```

```
          "v":37.079512674904613,
          "e":7.572768169616585,
          "t":0.152583283296552
        },
        {
          "x":3.24892369509538,
          "xp":0.0,
          "z":0.053099890881713,
          "p":899.30459154518871,
          "v":38.636079116924385,
          "e":8.221910022282481,
          "t":0.156538263828233
        },
        {
          "x":3.41136987985015,
          "xp":0.0,
          "z":0.055662168283615,
          "p":932.21777538126139,
          "v":40.185750667751563,
          "e":8.894689598458232,
          "t":0.160493244359914
        },
        {
          "x":3.573816064604919,
          "xp":0.0,
          "z":0.058216184211277,
          "p":964.68565953673635,
          "v":41.728589686027817,
          "e":9.59078245691083,
          "t":0.164153331277882
        },
        {
          "x":3.736262249359688,
          "xp":0.0,
          "z":0.060762007233356,
          "p":996.71161859706206,
          "v":43.264652051364912,
          "e":10.309866860028734,
          "t":0.16781341819585
        }
      ]
    }
  }
```

Get_ColorPreset

Read the list of all available color schemes.

PARAMETER

- *none*

JSON-SOURCE

COMMAND

```
{
  "Get_ColorPresets":{}
}
```

RESULT (EXAMPLE)

```
{
  "Result":{
    "command":"Get_ColorPresets",
    "status":"success",
    "values":[
      {
        "ColorPresetId":121187463,
        "ColorPresetName":"Default"
      },
      {
        "ColorPresetId":118969621,
        "ColorPresetName":"DefaultDark"
      }
    ]
  }
}
```

Get_ColorPreset

Read color scheme.

PARAMETER

- *ColorPresetId* - The ID of the color scheme, enter -1 to request the currently set color scheme.

JSON-SOURCE

COMMAND

```
{
  "Get_ColorPreset":{
    "ColorPresetId":-1
  }
}
```

RESULT (EXAMPLE)


```
{
  "Result":{
    "command":"Get_ColorPreset",
    "status":"success",
    "values":{
      "Name":"DefaultDark",
      "ColoredTabPanel":true,
      "ColoredScrollbars":true,
      "ColoredWindowBg":true,
      "ColorValues":{
        "color_bar_bg":"#272f3a",
        "color_bar_border":"#000000",
        "color_bar_title_bg":"#4e5e73",
        "color_bar_title_border":"#000000",
        "color_bar_title_stripes":"#3f4c5e",
        "color_bar_title_stripes_dark":"#132838",
        "color_bar_title_stripes_light":"#e2edf5",
        "color_bar_title_symbol":"#8ba5c8",
        "color_bar_title_symbol_focus":"#ffffff",
        "color_burnchart_fast":"#683434",
        "color_burnchart_line":"#c0c0c0",
        "color_burnchart_mid":"#767636",
        "color_burnchart_slow":"#387238",
        "color_burnchart_text":"#eeeeee",
        "color_burnchart_text_highlight":"#ffffff",
        "color_button_bg_dark":"#28323c",
        "color_button_bg_dark_focus":"#516279",
        "color_button_bg_light":"#4e5e73",
        "color_button_bg_light_focus":"#7387a2",
        "color_button_border":"#000000",
        "color_button_border_focus":"#ffffff",
        "color_button_text":"#e8edf4",
        "color_button_text_disabled":"#5e738f",
        "color_button_text_focus":"#ffffff",
        "color_button_update_bg":"#8e3399",
        "color_button_update_text":"#ffffff",
        "color_diagram_area_pmax":"#50364f",
        "color_diagram_area_pmax15":"#503636",
        "color_diagram_area_pmax25":"#4b5b70",
        "color_diagram_bg":"#394454",
        "color_diagram_bg_diagram":"#2e3744",
        "color_diagram_bg_graph":"#2d3643",
        "color_diagram_border_dark":"#475261",
        "color_diagram_border_light":"#59677a",
```

```
        "color_diagram_burn_info":"#60a060",
        "color_diagram_cursor_bg":"#000000",
        "color_diagram_cursor_border":"#ffffff",
        "color_diagram_cursor_line":"#c0c0c0",
        "color_diagram_default_div":"#4f5f75",
        "color_diagram_energy":"#8bbebe",
        "color_diagram_energy_alt":"#4c6666",
        "color_diagram_factor":"#bad8e4",
        "color_diagram_force":"#d3b7a7",
        "color_diagram_graph_highlight":"#ffffbd",
        "color_diagram_graph_legend_text":"#748394",
        "color_diagram_graph_part1":"#ff8080",
        "color_diagram_graph_part2":"#8c8cd2",
        "color_diagram_graph_part3":"#60a060",
        "color_diagram_graph_phys":"#898989",
        "color_diagram_graph_point":"#e0e0e0",
        "color_diagram_graph_point_line":"#657a98",
        "color_diagram_graph_real":"#ffb5ff",
        "color_diagram_graph_tcc":"#83d0fa",
        "color_diagram_graph_tch":"#f786ad",
        "color_diagram_highlight":"#ff8000",
        "color_diagram_ladder_bg":"#2d3643",
        "color_diagram_ladder_border":"#59677a",
        "color_diagram_ladder_sel_bg":"#637690",
        "color_diagram_ladder_sel_text":"#ffffff",
        "color_diagram_ladder_text":"#c0c0c0",
        "color_diagram_mousetip_bg":"#212732",
        "color_diagram_mousetip_border":"#c0c0c0",
        "color_diagram_mousetip_text":"#c0c0c0",
        "color_diagram_pressure":"#e49e9e",
        "color_diagram_pressure_alt":"#985552",
        "color_diagram_pressure_div":"#808080",
        "color_diagram_pressure_info":"#c0c0c0",
        "color_diagram_range":"#d3cea7",
        "color_diagram_range_div":"#707070",
        "color_diagram_text":"#c0c0c0",
        "color_diagram_text_bg":"#000000",
        "color_diagram_text_error":"#ff8080",
        "color_diagram_text_highlight":"#ffffff",
        "color_diagram_text_inactive":"#808080",
        "color_diagram_text_warning":"#000080",
        "color_diagram_velocity":"#8c8cd2",
        "color_diagram_velocity_alt":"#48486b",
        "color_doku_bg":"#2e3744",
        "color_doku_block_bg":"#394454",
        "color_doku_block_border":"#546072",
        "color_doku_block_text":"#c0c0c0",
        "color_doku_border":"#14181f",
        "color_doku_code_comment":"#808080",
        "color_doku_code_directive":"#e195ea",
        "color_doku_code_heading":"#ffffff",
        "color_doku_code_number":"#74baba",
        "color_doku_code_parenthesis":"#ffb871",
        "color_doku_code_string":"#fff27b",
        "color_doku_code_symbol":"#ff7b7b",
        "color_doku_code_text":"#c0c0c0",
        "color_doku_code_url":"#6ab5ff",
        "color_doku_linkextern":"#a7c2f5",
        "color_doku_linkinvalid":"#ffb5b5",
        "color_doku_linkpage":"#b7cdf7",
        "color_doku_listindex":"#ffffff",
        "color_doku_notetext":"#113f94",
        "color_doku_search_highlight":"#ffffd5",
        "color_doku_selection_bg":"#1c78c4",
        "color_doku_selection_text":"#ffffff",
        "color_doku_separator":"#3f4856",
        "color_doku_table_border":"#3f4856",
        "color_doku_table_heading_bg":"#2b3139",
        "color_doku_table_heading_text":"#c0c0c0",
        "color_doku_table_text":"#c0c0c0",
        "color_doku_text":"#c0c0c0",
        "color_drawing_bg":"#2d3643",
        "color_drawing_border":"#59677a",
        "color_drawing_case":"#a77730",
```

```
        "color_drawing_case_shot":"#2944ad",
        "color_drawing_centerline":"#272f3a",
        "color_drawing_dimensions":"#8a8a8a",
        "color_drawing_line":"#7b8699",
        "color_drawing_projectile":"#924625",
        "color_drawing_shape_area":"#666c77",
        "color_drawing_table_bg":"#1f252e",
        "color_drawing_table_border":"#7b8699",
        "color_drawing_text":"#d8d8d8",
        "color_drawing_text_highlight":"#c5dafa",
        "color_drawing_text_label":"#bebebe",
        "color_drawing_text_value":"#bebebe",
        "color_editor_ac_bg":"#fcffc5",
        "color_editor_ac_prev":"#999999",
        "color_editor_ac_prev_highlight":"#0000ff",
        "color_editor_ac_text":"#808080",
        "color_editor_bg":"#313a48",
        "color_editor_border":"#161b21",
        "color_editor_dark":"#48576c",
        "color_editor_folding":"#516279",
        "color_editor_folding_bg":"#2d3542",
        "color_editor_folding_highlight":"#aab6c6",
        "color_editor_folding_sel":"#eac29b",
        "color_editor_info_bg":"#fcffc5",
        "color_editor_info_border":"#ecefb5",
        "color_editor_info_text":"#303030",
        "color_editor_light":"#cccccc",
        "color_editor_parenthesis_match_bg":"#364150",
        "color_editor_parenthesis_match_text":"#00ff80",
        "color_editor_sb_bg":"#29323d",
        "color_editor_sb_highlight":"#3399ff",
        "color_editor_sb_text":"#707070",
        "color_editor_sel":"#465568",
        "color_editor_struct":"#59677a",
        "color_editor_struct_bg":"#404b5e",
        "color_editor_struct_highlight":"#ffffff",
        "color_editor_struct_sel":"#800000",
        "color_editor_text":"#c0c0c0",
        "color_gallery_bg":"#2e3744",
        "color_gallery_border":"#59677a",
        "color_gallery_highlight":"#ffaa55",
        "color_gallery_selected":"#0080ff",
        "color_gallery_text":"#c0c0c0",
        "color_gallery_thumbnail_bg":"#222831",
        "color_gallery_thumbnail_border":"#000000",
        "color_gallery_thumbnail_text":"#ffffff",
        "color_icon_disabled":"#718197",
        "color_icon_focus":"#eeb795",
        "color_icon_hover":"#ffffff",
        "color_icon_hover_fade":"#ff8102",
        "color_icon_normal":"#ffffff",
        "color_icon_normal_fade":"#284f82",
        "color_inspector_bg":"#181e25",
        "color_inspector_border_light":"#414b5a",
        "color_inspector_progress_bg":"#6894ca",
        "color_inspector_progress_text":"#ffffff",
        "color_inspector_text":"#ffffff",
        "color_listbox_bg":"#3d495c",
        "color_listbox_bg_alt":"#394454",
        "color_listbox_bg_disabled":"#394454",
        "color_listbox_border":"#59677a",
        "color_listbox_border_dark":"#202020",
        "color_listbox_disclosure":"#a0a0a0",
        "color_listbox_disclosure_active":"#ffffff",
        "color_listbox_folder1_bg":"#2c3441",
        "color_listbox_folder1_bg_alt":"#2e3541",
        "color_listbox_folder1_text":"#ffffff",
        "color_listbox_folder_bg":"#242b35",
        "color_listbox_folder_bg_alt":"#282f39",
        "color_listbox_folder_text":"#ffffff",
        "color_listbox_gridlines":"#22282f",
        "color_listbox_highlight_bg":"#51617b",
        "color_listbox_highlight_border":"#51617b",
        "color_listbox_highlight_text":"#ffffff",
```

```
        "color_listbox_selected_bg":"#8c98a6",
        "color_listbox_selected_border":"#4f5f75",
        "color_listbox_selected_focus":"#51a0e1",
        "color_listbox_selected_text":"#ffffff",
        "color_listbox_text":"#d0d0d0",
        "color_listbox_text_changed":"#ffe9a6",
        "color_listbox_text_disabled":"#8193ab",
        "color_listbox_text_error":"#ff9b9b",
        "color_listbox_text_important":"#ff8040",
        "color_listbox_title_bg":"#212831",
        "color_listbox_title_border":"#4f5f75",
        "color_listbox_title_text":"#ffffff",
        "color_listbox_type_a0":"#c0c0c0",
        "color_listbox_type_aeff":"#c0c0c0",
        "color_listbox_type_b":"#c0c0c0",
        "color_listbox_type_ba":"#c0c0c0",
        "color_listbox_type_caselen":"#ffffff",
        "color_listbox_type_casevol":"#ffffff",
        "color_listbox_type_dbul":"#ffffff",
        "color_listbox_type_dz":"#ffffff",
        "color_listbox_type_gdepth":"#ffffff",
        "color_listbox_type_gdepthc":"#c0c0c0",
        "color_listbox_type_glen":"#ffffff",
        "color_listbox_type_gmaterial":"#ffffff",
        "color_listbox_type_gtaildiaa":"#c0c0c0",
        "color_listbox_type_gtaildiab":"#c0c0c0",
        "color_listbox_type_gtailh":"#c0c0c0",
        "color_listbox_type_gtailtype":"#ffffff",
        "color_listbox_type_k":"#c0c0c0",
        "color_listbox_type_laddercnt":"#c0c0c0",
        "color_listbox_type_laddermc":"#c0c0c0",
        "color_listbox_type_mc":"#ffffff",
        "color_listbox_type_mp":"#ffffff",
        "color_listbox_type_oal":"#ffffff",
        "color_listbox_type_pc":"#c0c0c0",
        "color_listbox_type_pcd":"#c0c0c0",
        "color_listbox_type_pmaxzul":"#e49e9e",
        "color_listbox_type_pmethod":"#c0c0c0",
        "color_listbox_type_po":"#60a060",
        "color_listbox_type_ps":"#e49e9e",
        "color_listbox_type_pt":"#60a060",
        "color_listbox_type_qex":"#c0c0c0",
        "color_listbox_type_sebert":"#60a060",
        "color_listbox_type_vb":"#c0c0c0",
        "color_listbox_type_xe":"#ffffff",
        "color_listbox_type_xeeff":"#c0c0c0",
        "color_listbox_type_xeeff1":"#c0c0c0",
        "color_listbox_type_z1":"#c0c0c0",
        "color_listbox_type_z2":"#c0c0c0",
        "color_progress_bar_bg":"#ee7d00",
        "color_progress_bar_border":"#272f3a",
        "color_progress_bg":"#272f3a",
        "color_progress_border_lefttop":"#59677a",
        "color_progress_border_rightbottom":"#59677a",
        "color_progress_textcolor":"#ffffff",
        "color_rating_border":"#2c343d",
        "color_rating_high":"#288a20",
        "color_rating_low":"#7b2220",
        "color_rating_mid":"#9da00c",
        "color_scroll_active":"#808080",
        "color_scroll_bg":"#272f3a",
        "color_scroll_border":"#14181f",
        "color_scroll_button":"#2d3643",
        "color_scroll_selected":"#212731",
        "color_scroll_symbol":"#b1bccb",
        "color_scroll_symbol_selected":"#ffffff",
        "color_separator_dark":"#53667d",
        "color_separator_light":"#617692",
        "color_shotgroup_bg":"#2e3744",
        "color_shotgroup_border":"#59677a",
        "color_shotgroup_darkenimage":"#000000",
        "color_shotgroup_es":"#ffff00",
        "color_shotgroup_flyer":"#ff0000",
        "color_shotgroup_group":"#00ff00",
```

```
        "color_shotgroup_group_default":"#00ff00",
        "color_shotgroup_group_flyer":"#ff6868",
        "color_shotgroup_group_inactive":"#c0c0c0",
        "color_shotgroup_group_size":"#ffff00",
        "color_shotgroup_group_size_border":"#ffffff",
        "color_shotgroup_group_text":"#ffffff",
        "color_shotgroup_highlight":"#ffaa55",
        "color_shotgroup_linecolor":"#f2f2f2",
        "color_shotgroup_oscillation":"#80e2ff",
        "color_shotgroup_sd1":"#d7d7d7",
        "color_shotgroup_sd2":"#d7d7d7",
        "color_shotgroup_sd3":"#d7d7d7",
        "color_shotgroup_selected":"#ffff80",
        "color_shotgroup_text":"#d7d7d7",
        "color_shotgroup_text_bg":"#000000",
        "color_shotgroup_text_border":"#555555",
        "color_shotgroup_title":"#ffffff",
        "color_tabpanel_bg":"#2d3643",
        "color_tabpanel_bg_inactive":"#181e25",
        "color_tabpanel_border":"#59677a",
        "color_tabpanel_btn":"#616161",
        "color_tabpanel_btn_inactive":"#616161",
        "color_tabpanel_btn_mousedown":"#ff8080",
        "color_tabpanel_btn_mouseover":"#ffffff",
        "color_tabpanel_text":"#ffffff",
        "color_tabpanel_text_chg":"#ff8080",
        "color_tabpanel_text_chg_inactive":"#974242",
        "color_tabpanel_text_inactive":"#939393",
        "color_window_bg":"#1f252e",
        "color_window_border":"#59677a",
        "color_window_border_alt":"#728298",
        "color_window_border_light":"#303947",
        "color_window_border_notify":"#ffbc80",
        "color_window_edit_bg":"#3d485a",
        "color_window_infotext":"#ff8080",
        "color_window_text":"#eeeeee"
      }
    }
  }
}
```

Get_Tab

Read properties of a tab.

PARAMETER

- *tabhandle* - The handle of the tab.

JSON-SOURCE

COMMAND

```
{
  "Get_Tab":{
    "tabhandle":159930475
  }
}
```

RESULT (EXAMPLE)

```
{
  "Result":{
    "command":"Get_Tab",
    "status":"success",
    "values":{
      "tabhandle":159930475,
      "ontop":true,
      "changed":false,
      "locked":false,
      "caption":"357 Mag 3N37 JSP 4217",
      "file":"C:/loads/357 Mag 3N37 JSP 4217.grtload"
    }
  }
}
```

Get_TabList

Read the list of all available tabs.

PARAMETER

- *none*

JSON-SOURCE

COMMAND

```
{
  "Get_ColorPresets":{}
}
```

RESULT (EXAMPLE)

```
{
  "Result":{
    "command":"Get_ColorPresets",
    "status":"success",
    "values":[
      {
        "ColorPresetId":121187463,
        "ColorPresetName":"Default"
      },
      {
        "ColorPresetId":118969621,
        "ColorPresetName":"DefaultDark"
      }
    ]
  }
}
```

Get_TabOnTop

Read properties of the current tab.

PARAMETER

- *none*

JSON-SOURCE

COMMAND

```
{
  "Get_TabOnTop":{}
}
```

RESULT (EXAMPLE)

```
{
  "Result":{
    "command":"Get_TabOnTop",
    "status":"success",
    "values":{
      "tabhandle":245977421,
      "ontop":true,
      "changed":false,
      "locked":false,
      "caption":"357 Magnum",
      "file":"C:/files/357 Magnum.grtload"
    }
  }
```

Get_TabResults

Read simulation results of a tab.

The function provides a ChunkStream for transmission, from which the data is read.

Siehe: Get_Chunk - Read part of a data stream

PARAMETER

- *tabhandle* - The handle of the tab from which the simulation results are requested.

JSON-SOURCE

COMMAND

```
{
  "Get_TabResults":{
    "tabhandle":132273211
  }
}
```

RESULT (EXAMPLE)

```
{
  "Result":{
    "command":"Get_TabResults",
    "status":"success",
    "values":{
      "tabhandle":132273211,
      "chunked":true,
      "chunkStreamHandle":7835152,
      "chunkCount":190,
      "data":{
        "BurnoutInBarrel":"true",
        "MaxPressure":"3347.4831159072783 bar",
        "PointIdxBurnedEnergy95":"1425",
        "PointIdxBurnout":"3922",
        "PointIdxPmax":"268",
        "PointIdxZ1":"234",
        "z":"1",
        "EndEnergy":"3984.2004144201014 joule",
        "EndPressure":"455.89276608605616 bar",
        "EndVelocity":"850.50579100633934 m/s",
        "EndTime":"1.39346279789998 ms",
        "Ekin":"4336 joule",
        "Eprop":"0 joule",
        "UnitInfo":{
          "x":"mm",
          "xp":"mm",
          "z":"",
          "p":"bar",
          "v":"m/s",
          "t":"ms"
        }
      }
    }
  }
}
```

File Formats

File format: Caliber (*.xml, *.caliber)

The caliber file is a file formatted in the universal exchange format XML.

The regular structure is as follows:

```
<?xml version="1.0" encoding="UTF-8" standalone="yes" ?>
<GordonsReloadingTool>
  <caliberfile>
    <var name="Name of the property" value="Value of the property" />
    [...]
  </caliberfile>
</GordonsReloadingTool>
```

- **Strings** are entered in plain text or URL encoded.
- **Number values** are indicated with the dot "." as decimal separator.
- **Multiple caliber entries** are possible by multiple presence of the block .

EXAMPLE: .45 AUTO

```
<?xml version="1.0" encoding="UTF-8" standalone="yes" ?>
<GordonsReloadingTool>
  <caliberfile>
    <var name="cipname" value=".45%20Auto" />
    <var name="altname" value=".45%20ACP" />
    <var name="standard" value="CIP" />
    <var name="ciporigin" value="US" />
    <var name="ciptype" value="4%20pistol%2Frevolver" />
    <var name="cipdate" value="1984-06-14" />
    <var name="ciprevdate" value="2000-06-07" />
    <var name="cippdf" value="tabivcal-de-page76.pdf" />
    <var name="L1" value="0.00" />
    <var name="L2" value="0.00" />
    <var name="L3" value="22.81" />
    <var name="L4" value="0.00" />
    <var name="L5" value="0.00" />
    <var name="L6" value="32.39" />
    <var name="R" value="1.24" />
    <var name="R1" value="12.19" />
    <var name="R3" value="0.00" />
    <var name="E" value="4.11" />
    <var name="E1" value="10.16" />
    <var name="Emin" value="0.89" />
    <var name="Delta" value="26.00" />
    <var name="FG" value="0.00" />
    <var name="Beta" value="35.00" />
    <var name="P1" value="12.09" />
    <var name="P2" value="0.00" />
    <var name="Alpha" value="0.00" />
    <var name="S" value="0.00" />
    <var name="r1min" value="0.00" />
    <var name="R2" value="0.00" />
    <var name="H1" value="0.00" />
    <var name="H2" value="12.01" />
    <var name="G1" value="11.48" />
    <var name="G2" value="0.00" />
    <var name="f" value="0.38" />
    <var name="L3G" value="25.58" />
    <var name="Pmax" value="1300.00" />
    <var name="PK" value="1495.00" />
    <var name="PE" value="1690.00" />
    <var name="M" value="12.50" />
```

```
    <var name="EE" value="0.00" />
    <var name="FLauf" value="11.23" />
    <var name="ZLauf" value="11.43" />
    <var name="b" value="3.73" />
    <var name="N" value="6.00" />
    <var name="u" value="406.00" />
    <var name="Q" value="101.33" />
    <var name="V" value="26.00" />
    <var name="L0" value="0.00" />
    <var name="R0" value="0.00" />
    <var name="P0" value="0.00" />
    <var name="shot_alpha1" value="0.00" />
    <var name="shot_B" value="0.00" />
    <var name="shot_D" value="0.00" />
    <var name="shot_G" value="0.00" />
    <var name="shot_H" value="0.00" />
    <var name="shot_L" value="0.00" />
    <var name="shot_M" value="0" />
    <var name="shot_T" value="0.00" />
    <var name="sebert" value="0.75" />
    <var name="cdate" value="2019-05-03" />
    <var name="cby" value="GRT" />
    <var name="mdate" value="" />
    <var name="mby" value="" />
    <var name="type" value="" />
    <var name="mode" value="" />
    <var name="status" value="" />
    <var name="origin" value="cip-bobp.org" />
    <var name="descr" value="" />
  </caliberfile>
</GordonsReloadingTool>
```

File format: Bullet (*.xml, *.projectile)

The bullet file is a file formatted in the universal exchange format XML.

The regular structure is as follows:

```
<?xml version="1.0" encoding="UTF-8" standalone="yes" ?>
<GordonsReloadingTool>
  <projectilefile>
    <var name="Name of the property" value="Value of the property" />
    [...]
  </projectilefile>
</GordonsReloadingTool>
```

- **Character strings** are entered in plain text or URL encoded.
- **Number values** are indicated with the dot "." as decimal separator.
- **Multiple projectile entries** are possible by multiple presence of the block .

EXAMPLE: HORNADY RN 3235

```
<?xml version="1.0" encoding="UTF-8" standalone="yes" ?>
<GordonsReloadingTool>
  <projectilefile>
    <var name="mname" value="Hornady" />
    <var name="pname" value="RN 3235" />
    <var name="lotid" value="" />
    <var name="caliber" value="0.323" />
    <var name="gBC0" value="0.217" />
    <var name="gBC1" value="0" />
    <var name="gBC2" value="0" />
    <var name="gBC3" value="0" />
    <var name="gBC4" value="0" />
    <var name="gdia" value="8.20" />
    <var name="glen" value="21.8" />
    <var name="gmass" value="170.0" />
    <var name="gmaterial" value="" />
    <var name="gpressure" value="0" />
    <var name="gtailDiaA" value="0.0" />
    <var name="gtailDiaB" value="0.0" />
    <var name="gtailh" value="0.0" />
    <var name="gtailType" value="0" />
    <var name="gUBCS" value="H0S2F2S4N3" />
    <var name="gV0" value="0" />
    <var name="gV1" value="0" />
    <var name="gV2" value="0" />
    <var name="gV3" value="0" />
    <var name="gV4" value="0" />
    <var name="cdate" value="2019-05-03" />
    <var name="cby" value="GRT" />
    <var name="mdate" value="" />
    <var name="mby" value="" />
    <var name="type" value="" />
    <var name="mode" value="" />
    <var name="status" value="import" />
    <var name="origin" value="" />
    <var name="descr" value="" />
  </projectilefile>
</GordonsReloadingTool>
```

File format: Propellant (*.xml, *.projectile)

The propellant file is a file formatted in the universal exchange format XML.

The regular structure is as follows:

```
<?xml version="1.0" encoding="UTF-8" standalone="yes" ?>
<GordonsReloadingTool>
  <propellantfile>
    <var name="Name of the property" value="Value of the property" />
    [...]
  </propellantfile>
</GordonsReloadingTool>
```

- **Character strings** are entered in plain text or URL encoded.
- **Number values** are indicated with the dot "." as decimal separator.
- **Multiple propellant entries** are possible by multiple presence of the block .

EXAMPLE: VIHTAVUORI N340

```
<?xml version="1.0" encoding="UTF-8" standalone="yes" ?>
<GordonsReloadingTool>
  <propellantfile>
    <var name="mname" value="Vihtavuori" unit="" type="string" descr="propellant manufac
    <var name="pname" value="N340" unit="" type="string" descr="propellant product name"
    <var name="lotid" value="2018-12" unit="" type="string" descr="lot-id/no." />
    <var name="Bp" value="0.8757" unit="" type="decimal" descr="progressivity factor" />
    <var name="Br" value="0.8023" unit="" type="decimal" descr="brisance factor" />
    <var name="Brp" value="0.8398" unit="" type="decimal" descr="combined brisance/progr
    <var name="Ba" value="2.9203" unit="" type="decimal" descr="burn coefficient" />
    <var name="Qex" value="4100" unit="kJ/kg" type="decimal" descr="specific explosive h
    <var name="k" value="1.2245" unit="" type="decimal" descr="ratio of the specific hea
    <var name="a0" value="0.9701" unit="" type="decimal" descr="burn coefficient" />
    <var name="z1" value="0.2863" unit="" type="decimal" descr="burn-up limit z1" />
    <var name="z2" value="0.8148" unit="" type="decimal" descr="burn-up limit z2" />
    <var name="pc" value="1390" unit="kg/m3" type="decimal" descr="material density" />
    <var name="pcd" value="620" unit="kg/m3" type="decimal" descr="bulk density" />
    <var name="pt" value="21" unit="Cel" type="decimal" descr="propellant temperature" /
    <var name="cdate" value="2019-01-20" unit="" type="string" descr="creation date" />
    <var name="cby" value="GRT" unit="" type="string" descr="created by" />
    <var name="mdate" value="2019-01-20" unit="" type="string" descr="last modification
    <var name="mby" value="2019-01-20" unit="" type="string" descr="last modified by" />
    <var name="origin" value="GRT" unit="" type="string" descr="data origin" />
    <var name="descr" value="" unit="" type="string" descr="note/description" />
  </propellantfile>
</GordonsReloadingTool>
```

File format: Simulation Results (*.xml)

The simulation result file is a file formatted in the universal exchange format XML.

Load the file into a text editor to see the value descriptions. Each value has the attribute "descr" in which a short description is stored.

- **Strings** are entered in plain text or URL encoded.
- **Number values** are indicated with the dot "." as decimal separator.
- **Multiple simulation result entries** are possible by multiple presence of the block .

EXAMPLE:

```
<?xml version="1.0" encoding="UTF-8" standalone="yes" ?>
<GordonsReloadingTool>
  <InnerBallistikResult>

    <BurnoutInBarrel value="true" unit="" type="boolean" descr="flag is true if burnout
    <MaxPressure value="3425.2889360089803" unit="bar" type="decimal" descr="maximum pea
    <PointIdxBurnedEnergy95 value="740" unit="index" type="integer" descr="point index o
    <PointIdxBurnout value="2077" unit="index" type="integer" descr="point index of burn
    <PointIdxPmax value="132" unit="index" type="integer" descr="point index max peak pr
    <PointIdxZ1 value="115" unit="index" type="integer" descr="point index Z1 position o
    <z value="1" unit="" type="decimal" descr="amount of burned propellant, 1=100%" />
    <EndEnergy value="3990.7852079488966" unit="joule" type="decimal" descr="projectile
    <EndPressure value="461.69285453629368" unit="bar" type="decimal" descr="pressure at
    <EndVelocity value="851.20832757070048" unit="m/s" type="decimal" descr="velocity at
    <EndTime value="1.464324275006306" unit="ms" type="decimal" descr="projectile travel
    <Ekin value="4543" unit="joule" type="integer" descr="theoretical kinetic energy of
    <Eprop value="0" unit="joule" type="integer" descr="theoretical energy content of th

    <InnerBallistikResultPointUnits>
      <def name="x" unit="mm" type="decimal" descr="pressure diagram position" />
      <def name="xp" unit="mm" type="decimal" descr="corrected projectile diagram positi
      <def name="z" unit="" type="decimal" descr="amount of burned propellant, 1=100%" /
      <def name="p" unit="bar" type="decimal" descr="combustion pressure" />
      <def name="v" unit="m/s" type="decimal" descr="projectile velocity" />
      <def name="t" unit="ms" type="decimal" descr="time" />
    </InnerBallistikResultPointUnits>

    <InnerBallistikResultPointGroup>
      <point idx="0" x="0" xp="0" z="0" p="299.02447646591941" v="0" e="0" t="0" />
      <point idx="1" x="0.322488388431654" xp="0" z="0.00552976188127" p="367.8449403467
      <point idx="2" x="0.644976776863308" xp="0" z="0.011044113531568" p="443.729901033

      [...]

      <point idx="2186" x="739.46587467379561" xp="0" z="1" p="461.69285453629368" v="85
   </InnerBallistikResultPointGroup>

  </InnerBallistikResult>
</GordonsReloadingTool>
```

Team

The Developer Team

Gordon	**Team leader/main developer** , Internal ballistic formalisms & algorithms, programming of the GUI & server applications, Website & programming, Project management, GUI-design, GRT-Laboratory (DE), Powder-Model development
Charlie Sears	GRT-Laboratory (US), Powder-Model development, GRT debugging, Website debugging, Ballistic measurements

DEVELOPMENT-SUPPORT, PROJECT RELATIONS

Alliwyn (Peregrine Bullets)	Bullet friction research
Barney,Andi	Concepts for user interface, development, management and support of the subproject *"Universal Bullet Classification Scheme" (UBCS)*
Casper Nienaber	project relations, ballistic measurements for powder model development
DerMozart (Johannes)	Head of distribution and Community Management
Hackstock (Stefan)	Database tools, data acquisition, software-based data evaluation
Hannes	Support in the development of mathematical models
Heiko	Java API Programming for Core Services
John Perry	GRT-Laboratory (US): Professional detailed propellant pictures
Johannes Rapprich	Vector graphic toolbar icons
Lukáš Souček (Explosia)	Lovex laboratory data

TRANSLATIONS

Afrikaans	Alliwyn (Peregrine Bullets)
Czech	Lukáš Souček (Explosia)
Dutch	John (mus)
French	Matthieu Gouey
Italian	Armando Fabbian
Polish	Wozzi
Russian	Boris Trubachev (rusniper), Yuriy (Numbat)

Ukrainian	Mykola Hryhoryan

DATA ACQUISITION, EVALUATION & TEST

- Ausbilder (Christian Kasparek) - https://www.ausbildung -bds.de/
- Berni84
- cox (Ralf)
- Darkness (Tassilo)
- Estragon78
- FiberMan
- Flojoe
- Fritz109
- Hunter19
- in Glock we trust
- JoHo (Joachim)
- Kustus
- MasterToSch
- Mfg
- M.Hopeman
- cox (Ralf)
- michi6383 (Michael)
- Nukular (Klaus)
- pgj (Peter)
- Raik
- ruiz124
- scorpac
- shkrauh
- SintoraZ (Dominik)
- SRM (Sirko)
- Stefan
- test85 (Constantin)
- torsi
- WiederladerTV (Markus)
- Wolverine
- Veerplant (Sören)
- zottelhase (Markus)
- ...

..and many helpers and supporters more!

Our thanks goes to Marc from https://youtube.com/eisenfell for supporting and making available the communication possibilities on his Discord server, as well as to Markus from WiederladerTV for promotion and support!

Creator/Contact

GORDONS RELOADING CHANNEL

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