



EasyBC - GPConway

A brief help file ...

The EasyBC interface can be viewed as three separate elements:

- 1.0 **A menu system**
- 2.0 **A data-entry interface**
- 3.0 **A Table, Plot and Confidence Panel**

Overview ...

EasyBC calculates the Ballistic Coefficient using either one or two chronographs. The methods have their advantages and disadvantages:

One chronograph ... (aka 'The Δ POI Method')

Given the ambient temperature, pressure, relative humidity, muzzle velocity, far zero range, sight-height ... the **Δ POI** method calculates the Ballistic Coefficient from the measured vertical distance between the Point-of-Impact and the Point-of-Aim at a measured target range.

Advantage - Requires only one chronograph

Disadvantage - there are many things to measure - and all of these measurements need to be accurate for an accurate result.

One chronograph + Timer ... (aka 'The Δ T Method')

Given the ambient temperature, pressure, relative humidity and muzzle velocity ... the **Δ T** method calculates the Ballistic Coefficient from the measured elapsed time between muzzle and a measured target range.

Advantages - Requires only one chronograph, only one distance measurement to make.

Disadvantage - requires a timing setup preferably capable of one millisecond resolution or better.

Two chronographs ... (aka 'The ΔV Method')

Given the ambient temperature, pressure, relative humidity and muzzle velocity ... the ΔV method calculates the Ballistic Coefficient from the measured velocity at a measured target range.

Advantage - only one distance measurement to make, invariably more accurate than the ΔPOI Method method.

Disadvantage - requires two matched and calibrated chronographs (or a single Doppler Radar device).

One chronograph + Bore Sighter ... (aka 'The ΔD Method')

Given the ambient temperature, pressure, relative humidity and muzzle velocity ... the ΔD method calculates the Ballistic Coefficient from the distance between projected Line-of-departure and the point-of-impact at a measured target range.

The projection is achieved by marking a tall target at the required target range and aligning both the projected bore-sighter image and the scope's cross-hair.

Advantages - Requires one chronograph, only one long distance measurement and one short measurement to make.

Disadvantage - requires a bore-sighter.

In any case, measure all values as accurately as possible, enter said values into the appropriate textboxes and the Ballistic Coefficient will be calculated when the appropriate 'POI @ Target' (ΔPOI), 'Time to Target' (ΔT), 'Velocity @ Target' (ΔV) or 'Drop from LoD' (ΔD) value is entered.

1.0 Menu System

System

About:

A brief descriptive About panel (in MacOS)

Preferences: (MacOS)

Opens an applet having options:

- a) Enable/disable check for updates on startup
- b) Enable/disable the EasyBC logo on start and close
- c) Enable/disable tooltips

Utility

Table:

Display both the data input and table panels

Plot:

Display both the data input and plot panels

Confidence:

Display both the data input and confidence panels

Close Panel:

Display the data input panel only - same as clicking the '<<' button

Preferences: (Windows/Linux)

as per the MacOS Preferences menu above.

Help

Help Topics:

This help file

GPC Website:

Display the GPC website in the default browser

About:

A brief descriptive About panel (Windows/Linux only)

2.0 Data-entry interface

Mode Selection

One Chronograph

prepares the interface for the **ΔPOI** method

One Chronograph + Timer

prepares the interface for the **ΔT** method

One Chronograph + Bore-sighter

prepares the interface for the **ΔD** method

Two Chronographs

prepares the interface for the **ΔV** method

Some combination of textboxes will be disabled depending on the calculation method chosen (**ΔPOI** , **ΔT** , **ΔV** or **ΔD**) but others will always be available since they have an influence on the calculations regardless of the selected method. Specifically, these are:

Muzzle Velocity

Selectable units: Ft/s, m/s and Mach

Limits: 200 - 4000 Ft/s

A tool-tip displays the limits in the chosen units.

Target Range

Selectable units: Foot, Yard and Metre

A tool-tip displays the limits in the chosen units.

In **ΔT** , **ΔV** and **ΔD** modes, the target range extends from 5 Yards to a maximum range depending on the trajectory defined by the muzzle velocity and nominal Ballistic Coefficient.

If the **ΔPOI** has been used then the minimum target range is set at 1.25 x far Zero Range to that muzzle velocity and nominal Ballistic Coefficient. In practice, it is suggested that the target range should be at least 2 x far Zero Range to minimise errors.

Note that the Target Range can be different (or the same) for all four calculation methods. The shorter the test (Target) range, the higher resolution requirement.

Ballistic Coefficient

Limits: 0.004 to 1.200

Selectable Drag Laws: G1, GA, GA₂, GS, RA4, G7, SLG0 and SLG1

Entering a suitable value computes the trajectory using the the pertinent deterministic inputs and the 'Velocity @ Target', 'POI @ Target', 'Time @ Target' or 'Drop from LoD' textboxes are updated according to the Target Range set.

Changing the Drag Law re-computes the effective Ballistic Coefficient with reference to the new selection.

Ambient Temperature

Selectable Units: °C or °F

Limits: -20°C to 60°C

Ambient Pressure

Selectable Units: "Hg, mmHg or mBar

Limits: 19"Hg to 35"Hg

Ambient air density is displayed in **Lbm/Ft³** when "Hg units are selected otherwise the density is displayed in **Kg/m³**

Ambient Relative Humidity

Range: 0% to 100%

Each of the four remaining textboxes are made editable depending on the calculation mode chosen ... although all are updated programmatically when ever a trajectory is computed.

Near/far Zero ... editable (and relevant) in **ΔPOI** mode only

Selectable Units: Foot, Yard or Metre

Limits: dependent on Muzzle Velocity and Sight Height parameters.

Near/far inputs can be toggle by clicking on the button above the textbox.

Sight Height ... editable (and relevant) in **ΔPOI** mode only

Selectable Units: Inch, centimetre or millimetre

Limits: 0.1" to 6.0"

The Sight Height is defined as the distance between the Line-of-Sight and the Line-of-Departure **measured at the muzzle**.

POI @ Target ... editable (and relevant) in **ΔPOI** mode only

Selectable Units: Inch, centimetre or millimetre

Limit: less than -0.10"

Time @ Target ... editable in **ΔT** mode only

Selectable Units: Second and millisecond

Limit: greater than zero

Drop from LoD ... editable in **ΔD** mode only

Selectable Units: Inch, centimetre or millimetre

Limit: less than -0.20"

Velocity @ Target ... editable in **ΔV** mode only

Selectable Units: Ft/s, m/s or Mach

Limit: between 200 Ft/s and Muzzle Velocity

3.0 Table, Plot and Confidence

The Table/Plot/Confidence panel is displayed in the 'Wide' display mode and can be selected by clicking on the Table, Plot or Confidence tabs or by selecting the required panel from the main menu.

Table

The table displays a list of Velocity, POI and Elapsed time for every range as specified by Target Range.

Range units are as per the Target Range units, Velocity units as per the Muzzle Velocity units, POI as per the POI @ Target textbox, Elapsed Time as per the Time @ Target textbox and Drop from LoD as per the Drop from LoD textbox. A '•' alongside a drop-down menu indicates that the units of the relevant table column can be changed.

A right-click popup menu gives options:

Table Step

Set the table increment to 1, 5, 10 or 25

Show Table Gaps

Set gaps every 5 steps or display no gaps

Print Table

Print the current table to an attached printer

Save Table as .CSV

Save the current table in .CSV format for spreadsheet use

Plot

Displays an appropriate plot for the current calculation mode selected.

i.e., POI v. Range for **ΔPOI** mode - units as per POI @ Target,

Time v. Range for **ΔT** mode - units as per Time @ Target ,

Velocity v. Range for **ΔV** mode with units as per Muzzle Velocity.

Drop from LoD v. Range for **ΔD** mode with units as per Drop from LoD.

The horizontal unit is as the Target Range unit.

A '•' alongside a drop-down menu indicates that the units of the current plot or table can be changed.

A right-click popup menu has options:

Show/Hide Target Marker

Displays or hides a marker on the plot corresponding to the parameter at the Target Range.

Print Image

Print the current plot to an attached printer

Save Image

Save the current plot as a .png image

Confidence

Displays the calculated (Naïve) BC value together with the maximum, mean and minimum values associated with the assessed error values of the various non-deterministic input parameters.

The non-deterministic parameters being:

a) Muzzle chronograph error (all modes)

limit: up to $\pm 5\%$

b) Muzzle chronograph error (**ΔV** mode only)

limit: up to $\pm 5\%$

Note that, given some combinations of values, the maximum and/or minimum BC will lie outside of the application's limits (BC = 0.004 to 1.200). Such values are denoted by "?????" meaning that the value is undefined/incalculable. The mean BC is calculated as (maximum + minimum)/2 and so, if either are undefined, the mean BC value will appear as "?????" too.