Measuring the age of planetary surfaces using crater statistics: Guide to the *Craterstats* software

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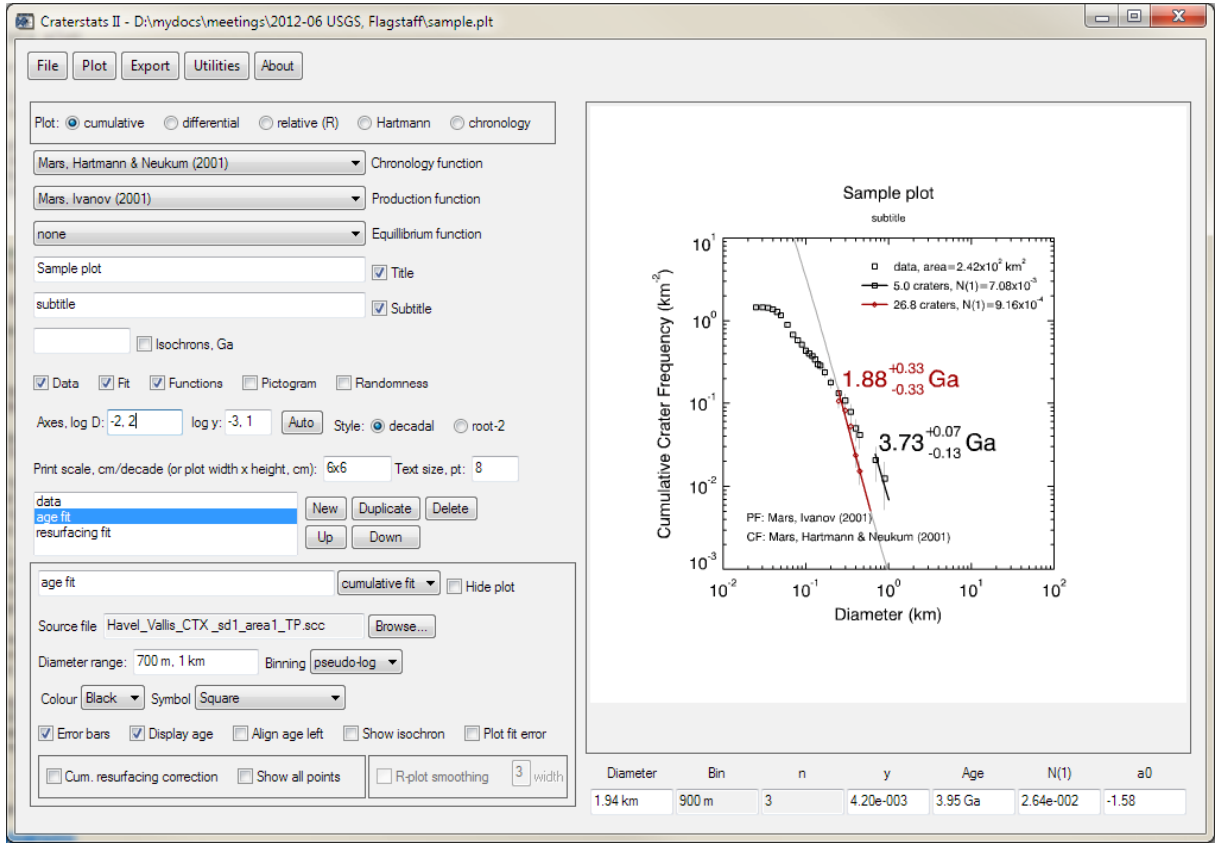
Program layout

Switch view

Global settings

Plot list

Plot settings

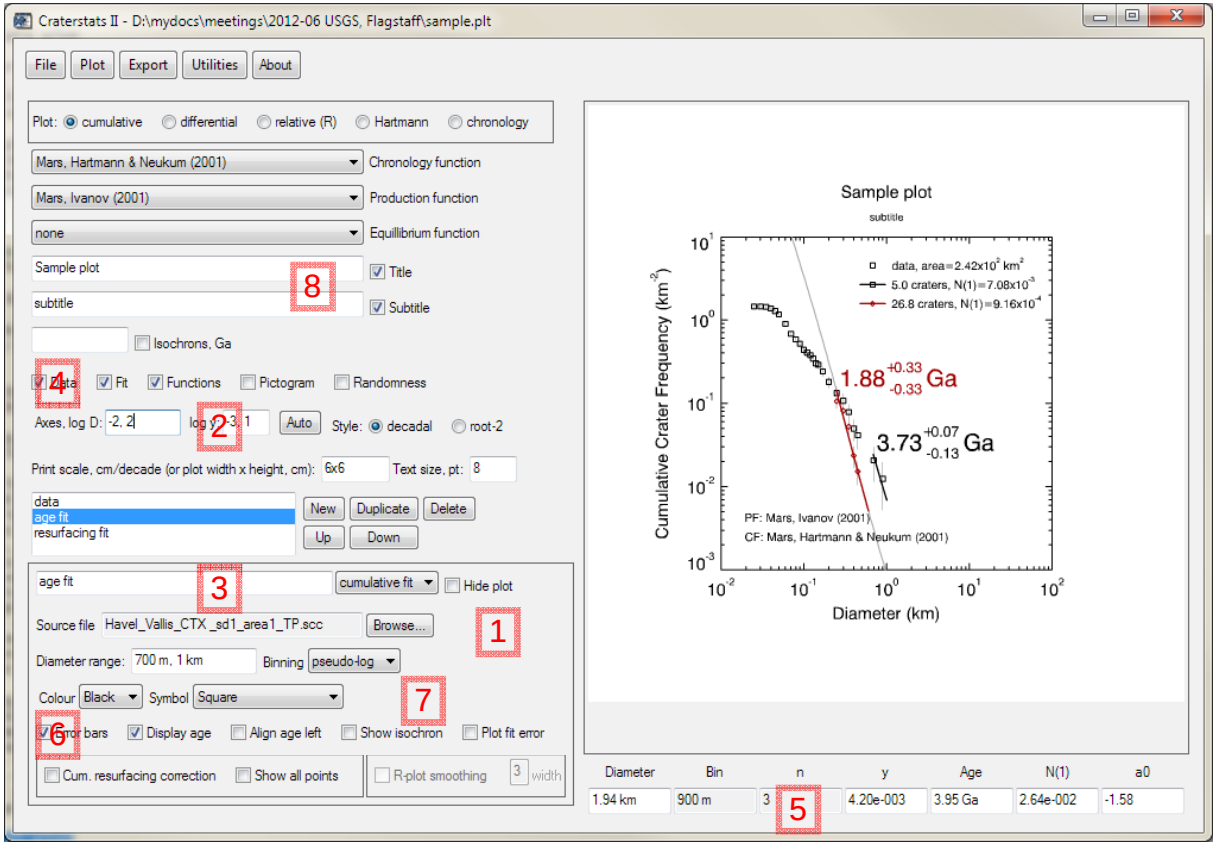


Plot window

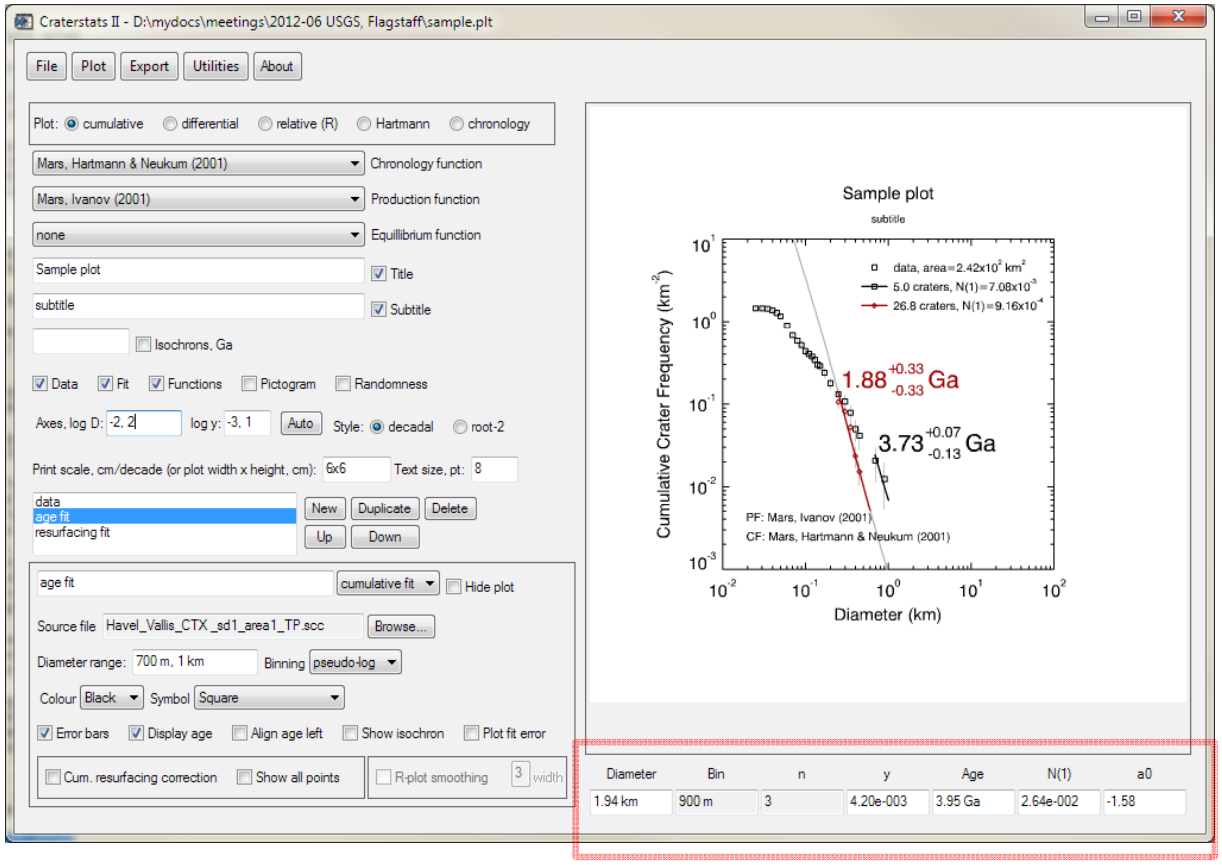
Info bar

Create a data plot

1. open source data (e.g. sample.diam)
2. set axes (manual/auto)
3. change plot name
4. display data legend
5. note displayed values in info bar on moving cursor
6. note error bars (on/off)
7. plot symbols/colours
8. title/subtitle



Calculator



y – crater density in no./km2 in cumulative view

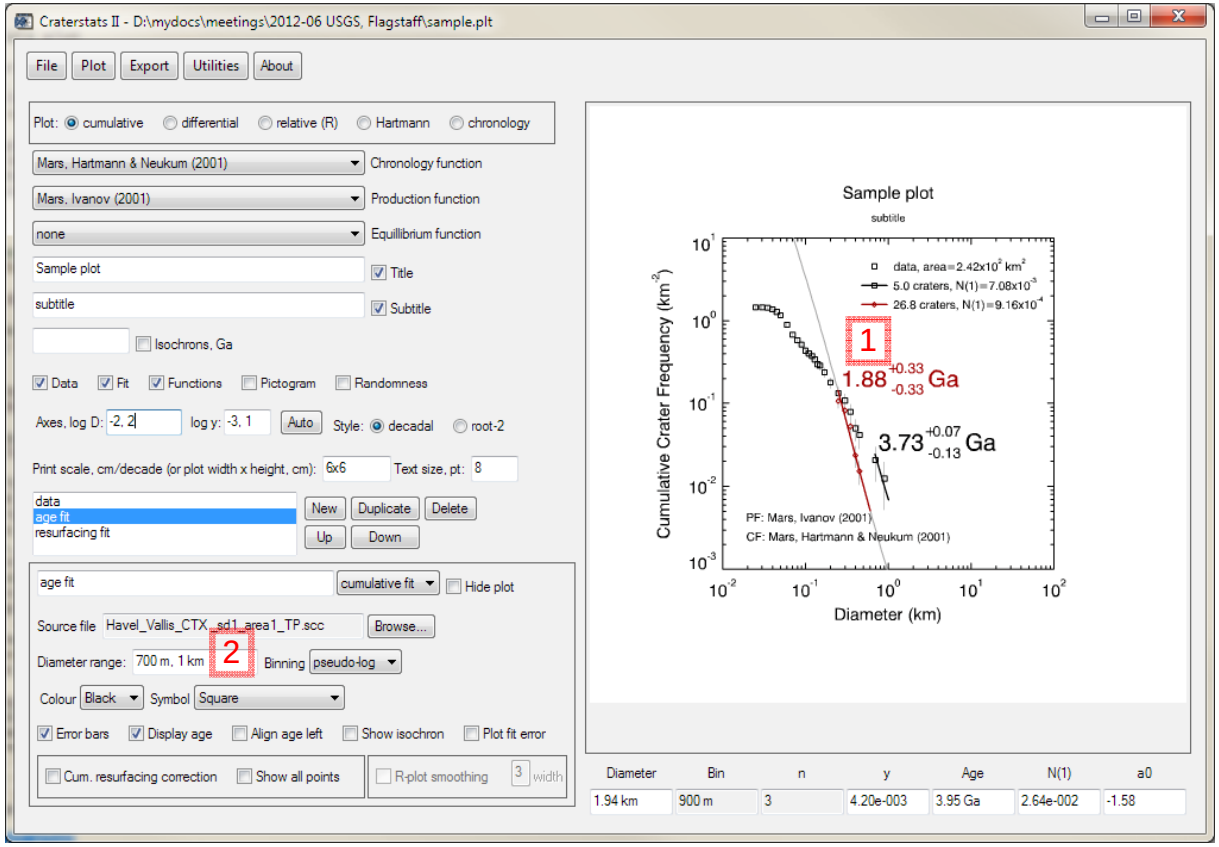
How old is a surface with 96 >5 km craters per million sq. km?

What's the density of >100m craters on a 1 Ma surface?

Enter known values: corresponding ones are computed for current production/chronology functions

Selecting data range

1. Click and drag in plot window, or...
2. Enter range manually

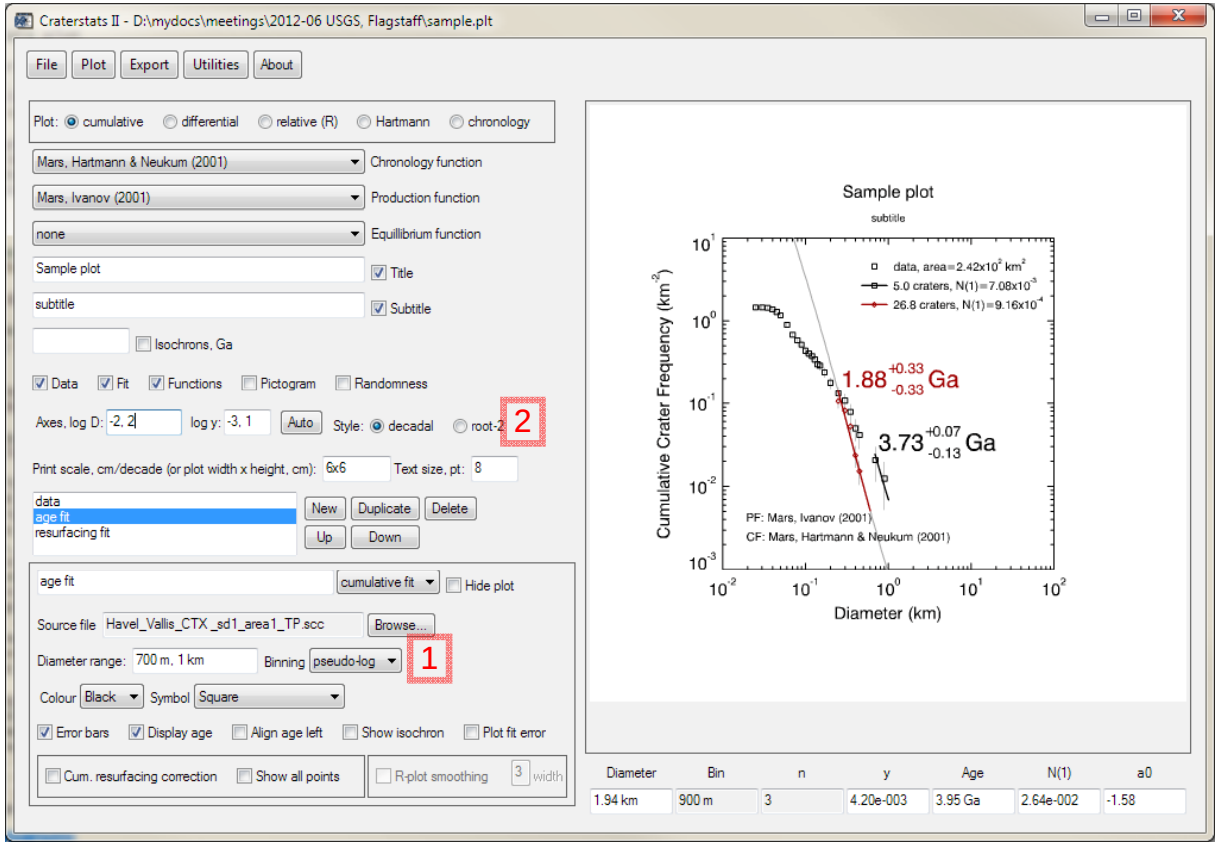


Binning

1. Binning

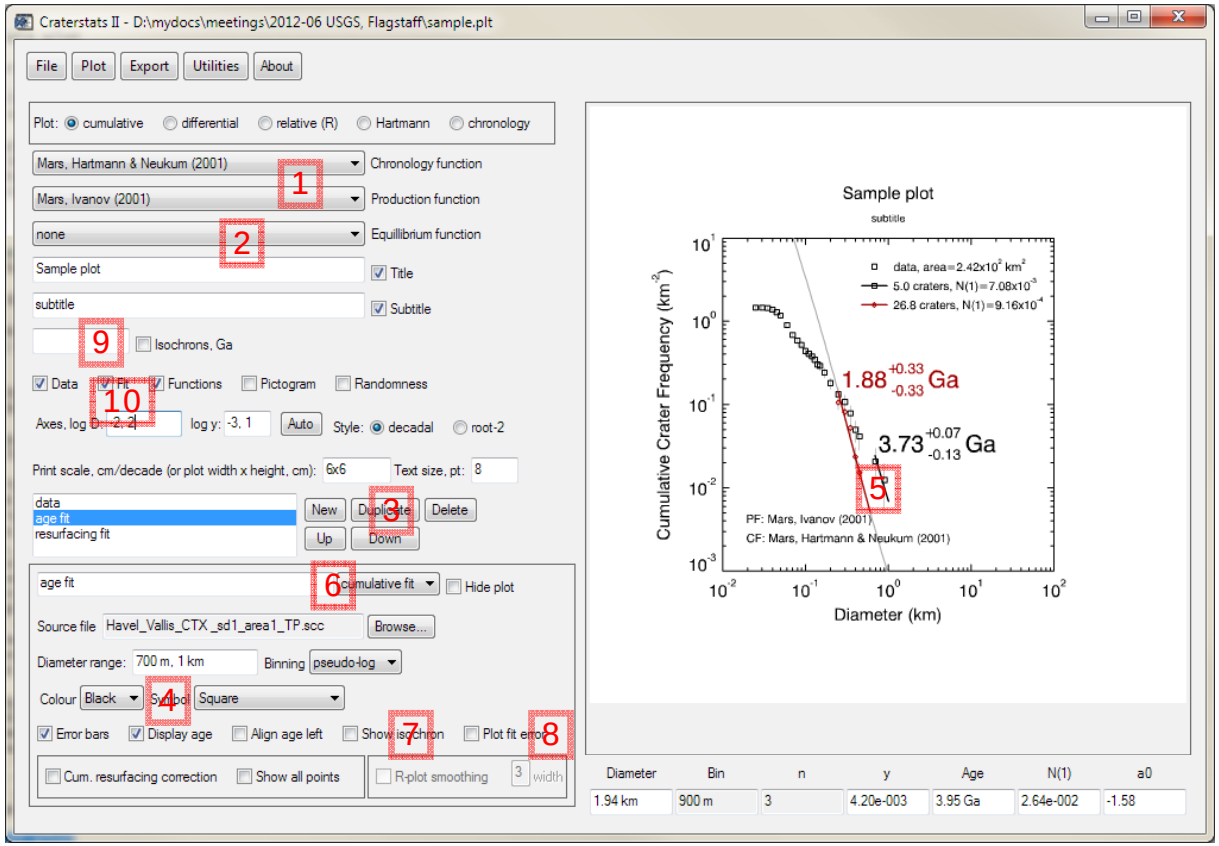
- Pseudo-log - Neukum's technique, 18 bins/decade at rounded intervals, roughly evenly spaced
- Root-2 (Hartmann and others' technique: boundaries at 1, 1.4, 2, 2.8, 4...)
- None – cumulative plot can be made without any data binning
- Others - e.g. 20/decade - like Neukum's, but regularly spaced; 4th root-2 - twice as finely spaced as root-2

2. Axis style: decadal vs root-2 - no influence on data handling: just display



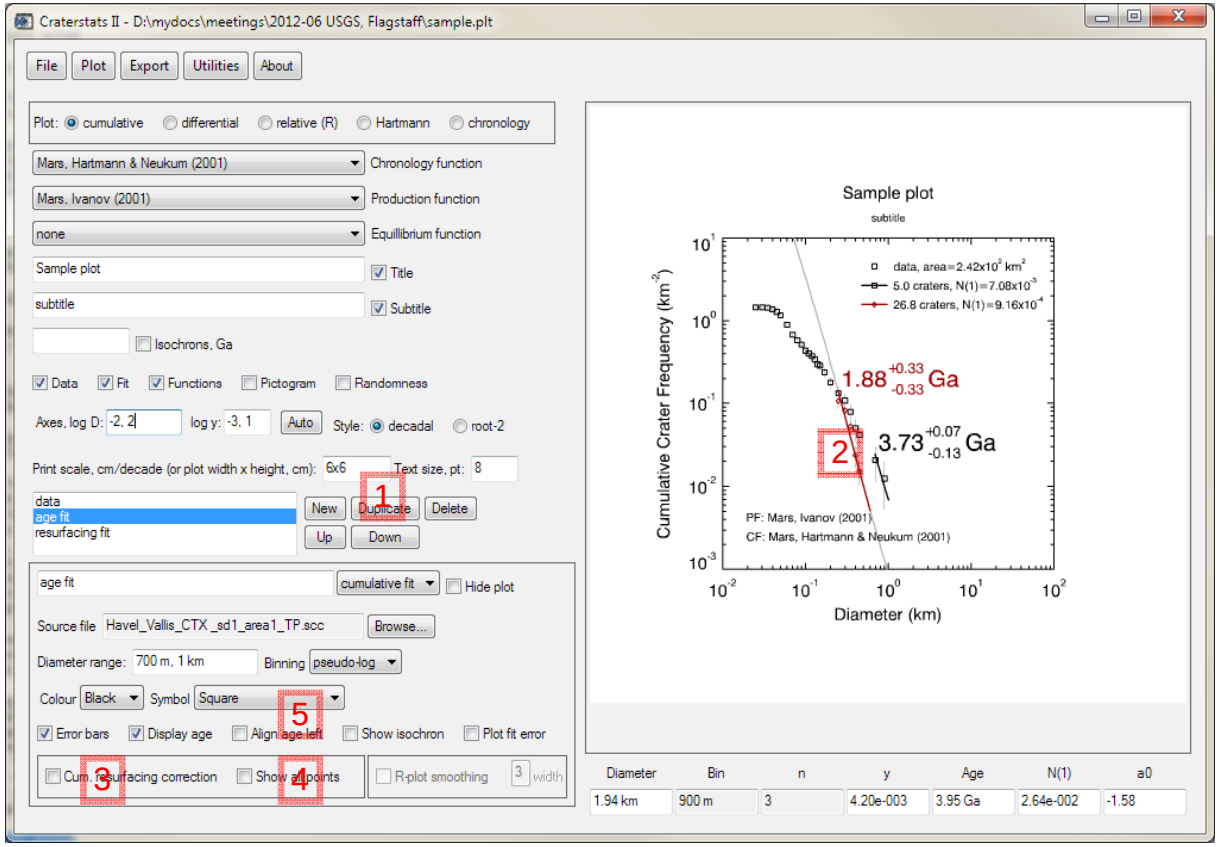
Isochron fitting

1. Select production and chronology functions
2. Show equilibrium function
3. Duplicate existing data plot
4. Change to red triangles
5. Select diameter range (click-drag in plot)
6. Switch plot type to cumulative fit
7. Show complete isochron
8. Plot fit error (on/off)
9. Add user-selected isochron
10. Show fit legend (on/off)



Making a resurfacing fit

1. duplicate existing fit (over largest craters)
2. select new range
3. **apply resurfacing correction**: accounts for the excess large craters present in the cumulative function (Michael & Neukum, 2010). Normally reduces the model age with respect to an uncorrected fit
4. show all corrected points (on/off): we normally show only the corrected points of the fit range, which lie below those of the uncorrected data
5. align age left (on/off)

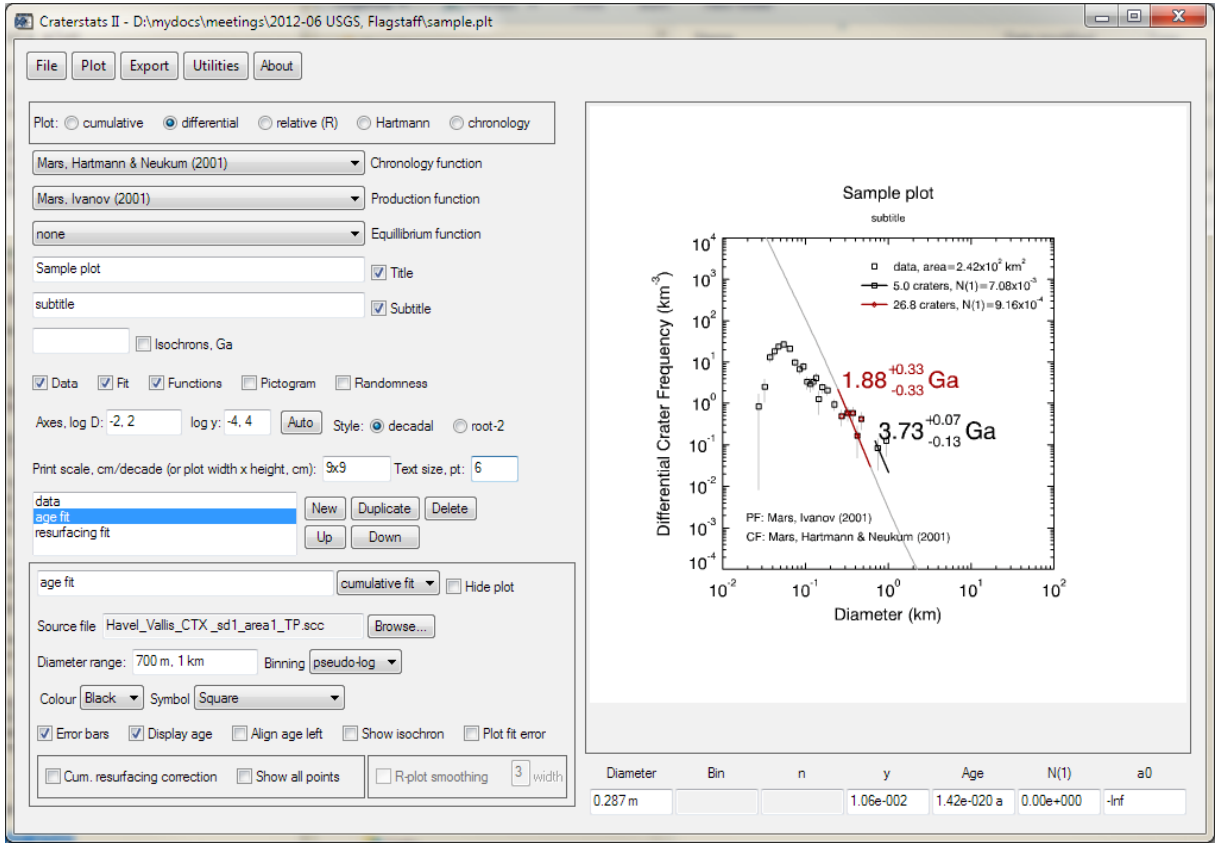


Differential plot

Plots $\frac{\text{craters per bin}}{\text{bin width}}$

the bin width term makes the plot essentially independent of the type of binning used. Similar to a Hartmann plot, which plots specifically the number of craters per root-2 bin

very useful for considering diameter range attributable to a resurfacing event

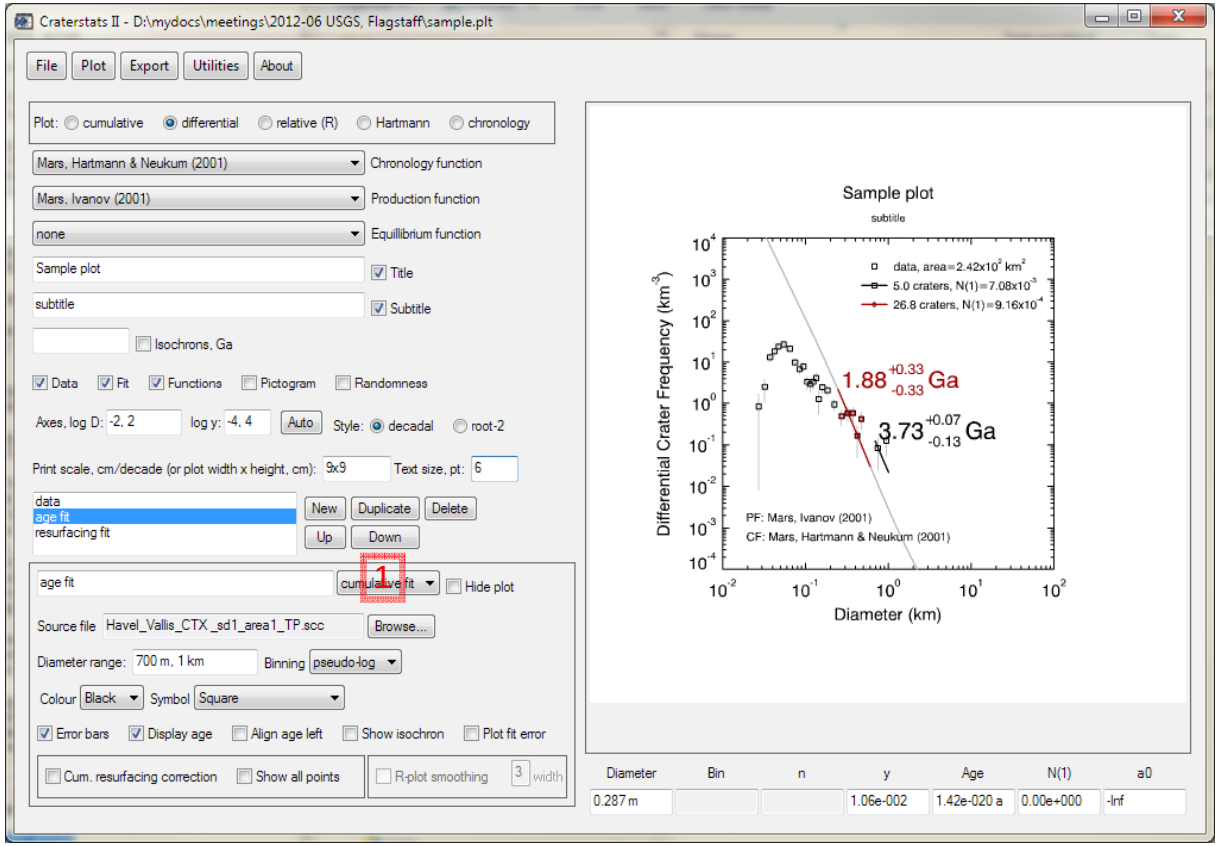


Differential fit

1. may use differential form of production function (Michael & Neukum, 2010) to fit the data

for "ideal" dataset, should obtain same result as cumulative fit

practically, there are small differences, due to different weighting of data points (in a cumulative plot, each crater is represented in more than one data point)

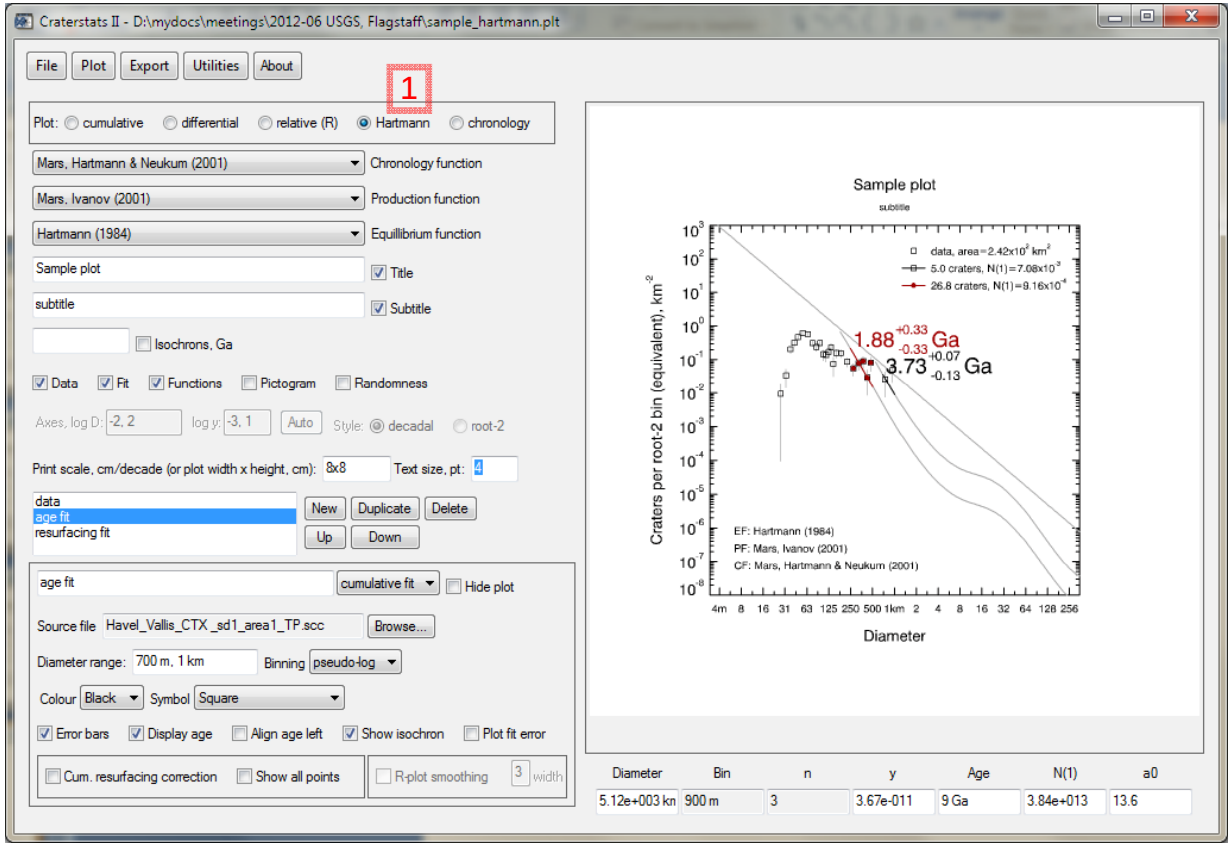


Hartmann plot

1. Hartmann plot is a special case of the differential:
   here, craterstats plots craters per root-2 bin "equivalent": non-root-2 binnings are normalised to be directly comparable with a Hartmann plot (Michael & Neukum, 2010)

Software handles Hartmann piecewise (and tabular) production functions, but no chronology function at present for Hartmann system (to be added shortly)

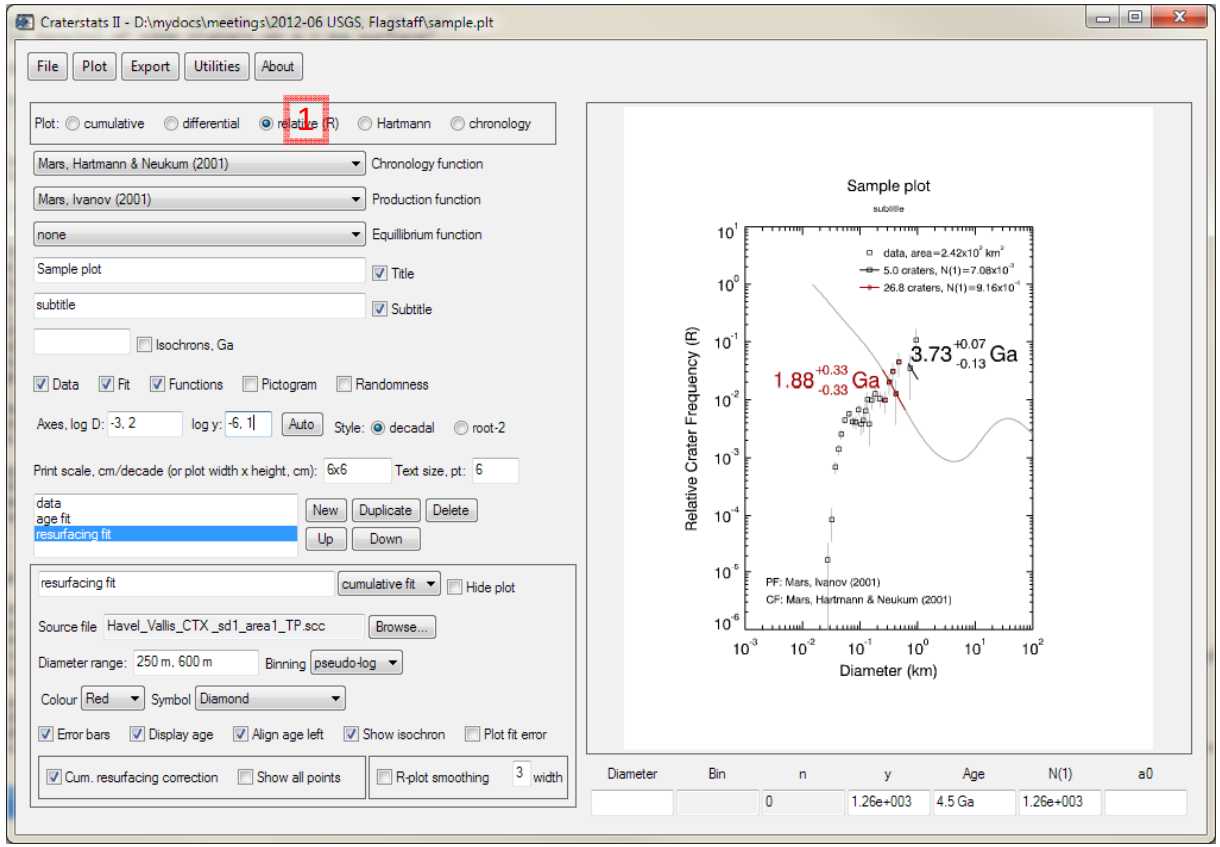
Can plot Neukum-style PF/CF results on a Hartmann plot and v.v.



R-plot

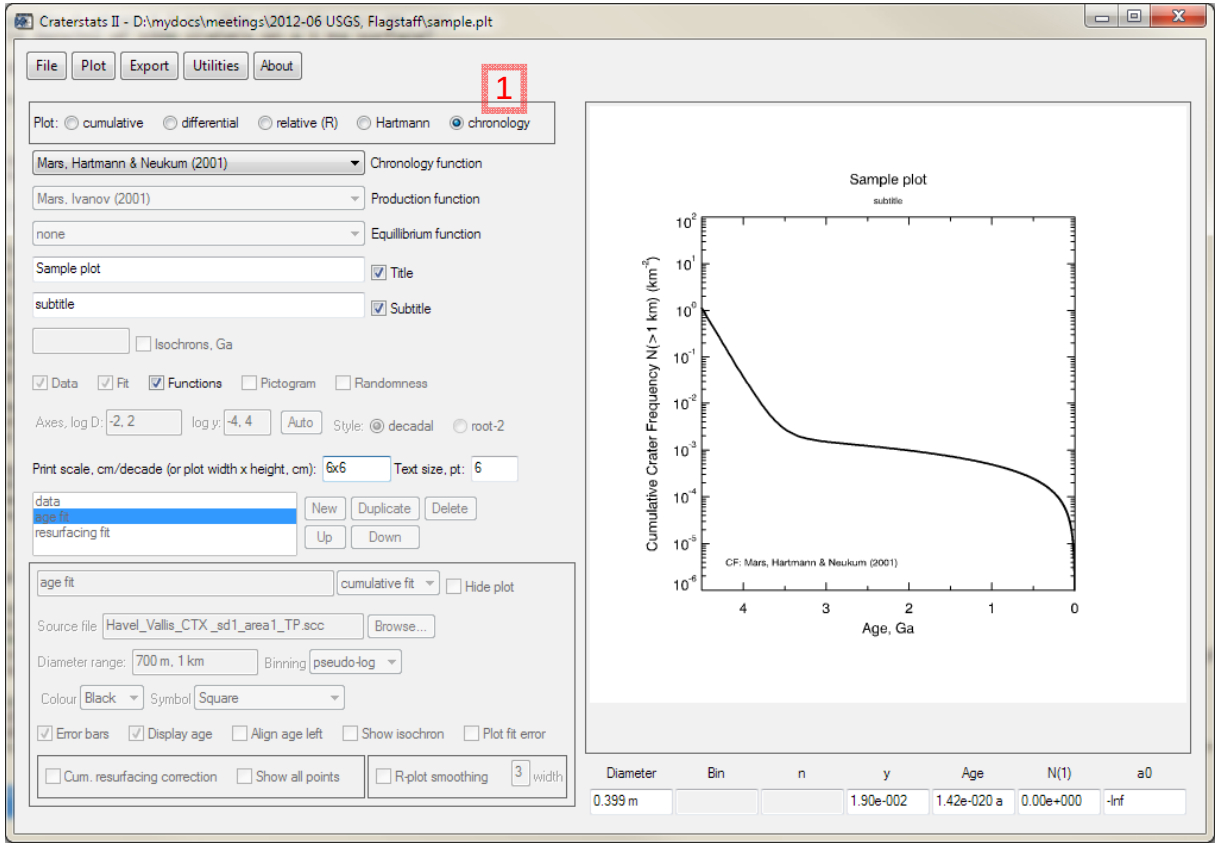
1. Plots the slope relative to a differential -3 slope

Favoured for comparing size-frequency characteristics of crater or impactor populations



Chronology plot

1. not a data view like the others, but just a plot of the current chronology function



Menu operations

File
- Save: save the current collection of plots in a form which can be opened and edited (.plt file)
- Open: open such a file
- Close
- Exit

Plot
- New/duplicate/delete - repetition of the plot list buttons

Export
- Image (either .png or .eps of current view)
- Summary file - text file with key data from current plots and fits. Can be read, e.g. into Excel table
- .stat table (binned data table)

Utilities
- sum .stat files (merge pre-binned data)
- merge .diam files (merge crater lists - preferred)
- randomness analysis - run randomness analysis program

About - program info

Program settings

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In the program folder are several text files which may be modified to alter the default settings:

craterstats2.ini

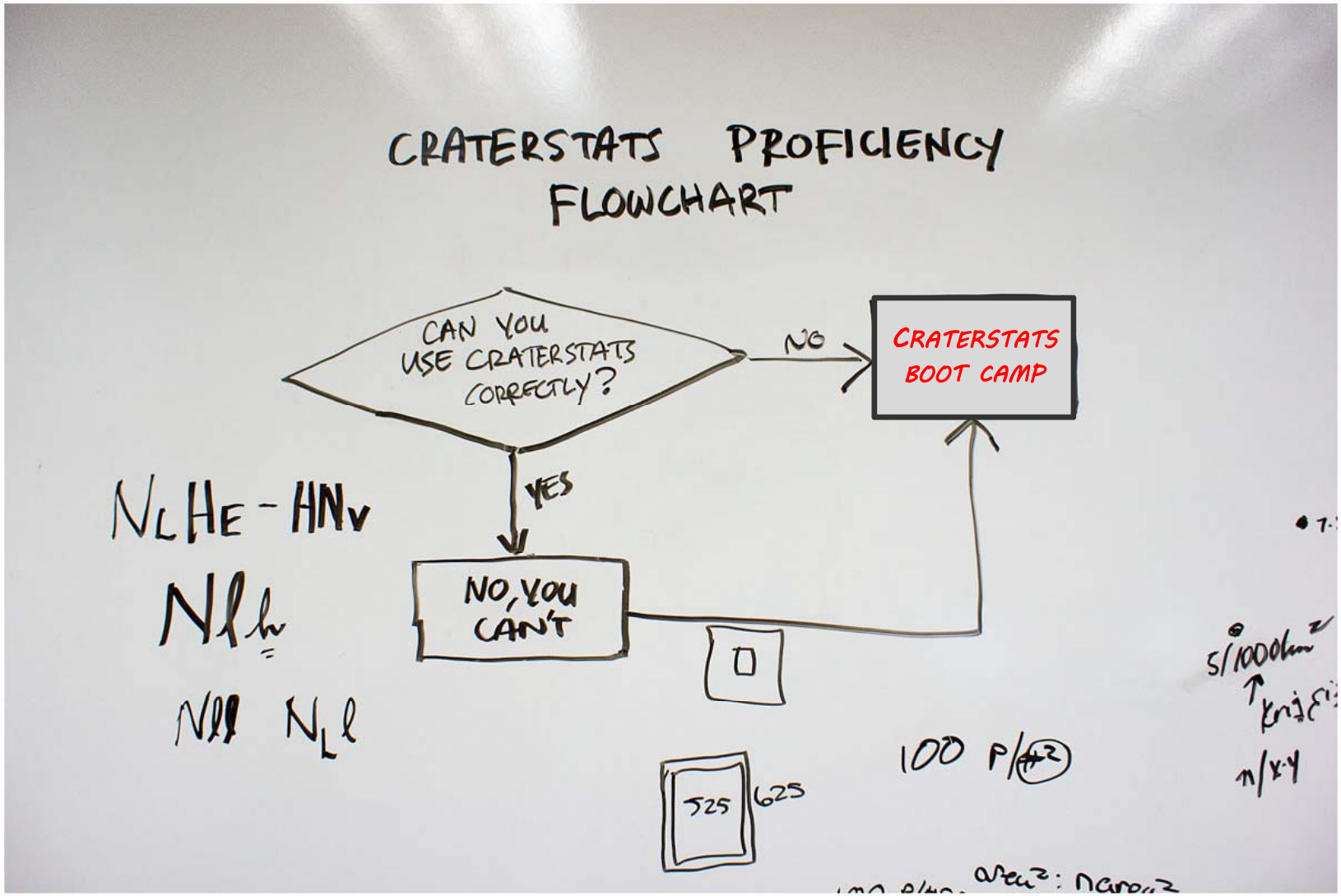
a few control settings for the program, e.g. window size, starting folder for file dialogs

default.plt

plot settings: edit this to change the default axis range, view, production and chronology functions, isochrons etc.

functions_user.txt

here you can define new production functions (polynomial or piecewise), chronology functions or equilibrium functions. The format should be modelled after those present in functions.txt


CRATERSTATS PROFICIENCY FLOWCHART
CAN YOU USE CRATERSTATS CORRECTLY?
NO
CRATERSTATS BOOT CAMP
YES
NO, YOU CAN'T
0
525
625
100 P/(#2)

Craterstats software – task guide

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- Start
  - Download from:
    - http://hrscview.fu-berlin.de/software.html
  - Install IDL virtual machine
  - On Windows, double-click craterstats.sav; on linux: type idl -vm=craterstats.sav
- Make cumulative histogram plot
  - Use pre-binned count (Echus Chasma, Mary Chapman):
    - sample/ECHUS_CHAP_AR1_A.stat
  - Select the source file for the count using the 'Browse…' button
  - Set the axis ranges
- Make first fit
  - Duplicate first plot (File-duplicate), and change plot-type to 'fit'
  - Choose production function
  - Select fit range
  - Options: age, error bars, isochron
- Make 2nd fit (younger part)
  - Duplicate previous plot
  - Modify fit range
  - Hide plot
- Make resurfacing correction
  - Duplicate first plot
  - Change colour/symbol
  - Modify diameter range
  - Enter minimum fitting diameter for correction
  - Check 'resurfacing correction' box
- Make fit to corrected points
  - Duplicate previous plot
  - Change plot type to 'fit'
  - Set minimum diameter equal to the 'minimum fitting diameter'
  - Display age/isochron
  - Option: align left
- Export graphic
  - Export image as .png file, or as postscript
  - Save composite plot (File-Save…)
  - Examine .plt and .txt output files (both ASCII)
- Now try with your own crater count