



# FLUKA: Flair Plots

7<sup>th</sup> FLUKA Course  
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# Plot List

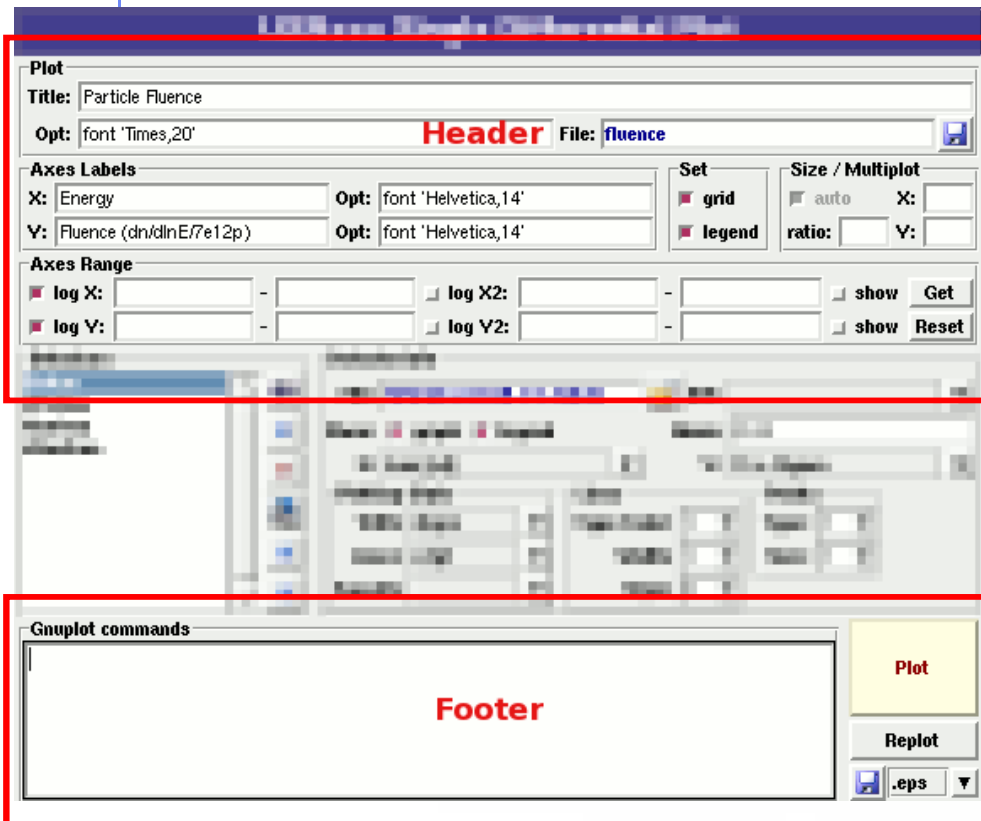
| Plot List |                      |          |
|-----------|----------------------|----------|
| File      | Title                | Type     |
| geometry  | nTOF Target Geometry | Geometry |
| enedep    | Deposited Energy     | USRBIN   |
| Fluence   | Particle Fluence     | USR-1D   |
| resnuc    | Residual Nuclei      | RESNUCLE |

- Plots can be created in the “Plot” list frame. Either Add new plots or Clone from existing ones.
- It is important to set a unique filename for each plot. This filename will be used for every auxiliary file that the plot needs (the extension will change)
- The Filter button creates automatically one plot for each processed unit
- Hit Enter or click the Edit icon to display the plotting dialog

## Plot Types

- Geometry For geometry plots
- USRBIN For plotting the output of USRBIN
- USR-1D To plot single differential quantities from cards  
USRBDX, USRTRACK, USRCOLL, USRYIELD
- USR-2D To plot double differential from USRBDX
- RESNUCLE To plot 1d or 2d distributions of RESNUCLEi
- USERDUMP To plot the output of USERDUMP. Useful for visualizing the source distribution (ToDo)

# Plotting Frames



- All plot types share some common fields: Title + options, Filename, Axis Labels, Legends (Keys) and Gnuplot Commands.
- **Plot** button (Ctrl-Enter) will generate all the necessary files to display the plot, **ONLY** if they do not exist.
- **Re-Plot** will force the creation of all files regardless their state
- Check the gnuplot manual to provide additional customization commands: e.g. To change the title font to Times size=20, add in the Opt: field the command: font 'Times,20'

# General Tips

- To set some default parameters for gnuplot create a file called `~/.gnuplot`
- The **output window** displays all the commands that are sent to gnuplot. As well as the errors. In case of problem always consult the output window!
- In the **Gnuplot commands** you can fully customize the plot by adding manually commands. Please consult the gnuplot manual for available commands
- All buttons and fields have tool tips. Move the cursor on top of a field to get a short description

# Geometry Plotting

The screenshot shows a software interface for geometry plotting with the following sections:

- Center:** Fields for x, y, z (all 0.0) and  $\Delta x$ ,  $\Delta y$ ,  $\Delta z$  (all 0.0). Buttons: Move, Move [u,v], Reset.
- Basis:** Fields for u, v components. Buttons: x-y, y-z, -u, x-z, swap, -v, Rotate, Polar, Reset.
- Extends:** Fields for  $\Delta u$ ,  $\Delta v$  (both 50.0) and f (2.0). Buttons: x f, Get, x 1/f, Reset.
- Grid:** Fields for Nu, Nv (both 200).
- Options:** Checkboxes for boundaries, labels. Vector Scale: 0.1.
- Style:** Palette, Font field.
- Type:** Material, Z-Y dropdown.

- For geometry plotting the following information is needed (Fields with white background):
  - Center (x,y,z) point defining the center of your plot
  - Basis (U,V): Two perpendicular axis vectors defining the new system
  - Extends (DU, DV) of the plot. The total width/height will be **twice** the extends
  - Scanning grid (NU, NV): how many points to scan
  - Plotting type (Only borders, Regions, Materials, ...)

# Geometry plotting

- All input fields with **light-yellow** background are used to perform operations on the previous fields. e.g. to rotate the basis-vectors
- When the “**Plot**” button is pressed, flair will create a temporary input file containing only the geometry and the related information together with the appropriate **PLOTGEOM** card. It will start a FLUKA run, and on exit it will convert the PLOTGEOM file in a format that gnuplot understands

# USRBIN

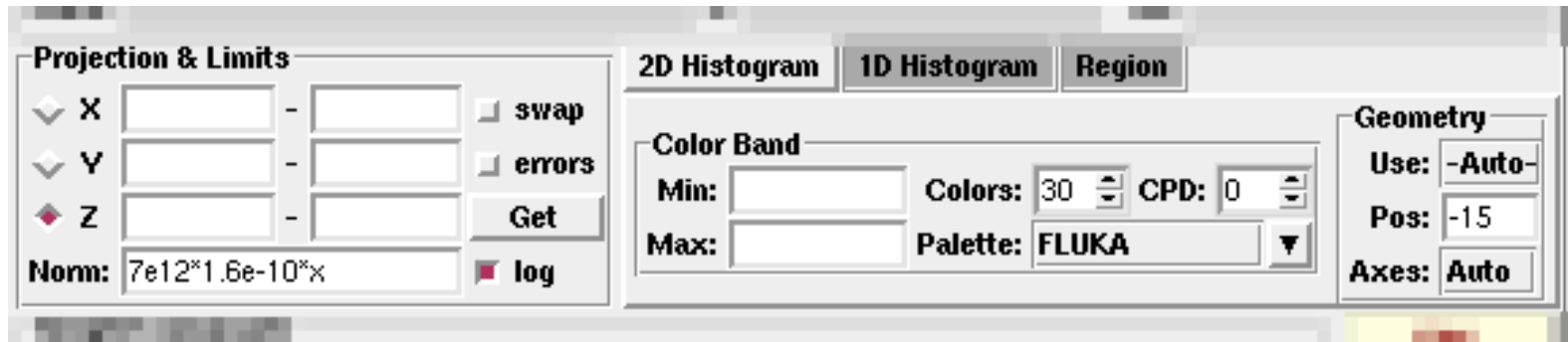
- With the USRBIN plotting frame you can perform 2D or 1D projections of the data or errors from USRBIN data.
- For the moment the special binning and region binning is not supported

The screenshot shows a software interface for USRBIN plotting. It is divided into three main sections:

- Binning Detector:** Contains a 'File:' field with the text 'tutorial\_usrbin\_50' and a folder icon, a 'Title:' field, and four input fields for 'Cycles:', 'Primaries:', 'Weight:', and 'Time:'.
- Binning Info:** Contains a 'Det:' dropdown menu, and three rows of input fields for 'X:', 'Y:', and 'Z:' coordinates, each with corresponding 'Min:' and 'Max:' or 'Int:' fields.
- Projection & Limits:** Contains three buttons: '2D Histogram', '1D Histogram', and 'Region'.

- Set the usrbins summary file in the File: field
- Select from Det: the detector to use.
- All the available detector information will be displayed
- The information **Minimum**, **Maximum** and **Integral** will be filled after displaying the plot!

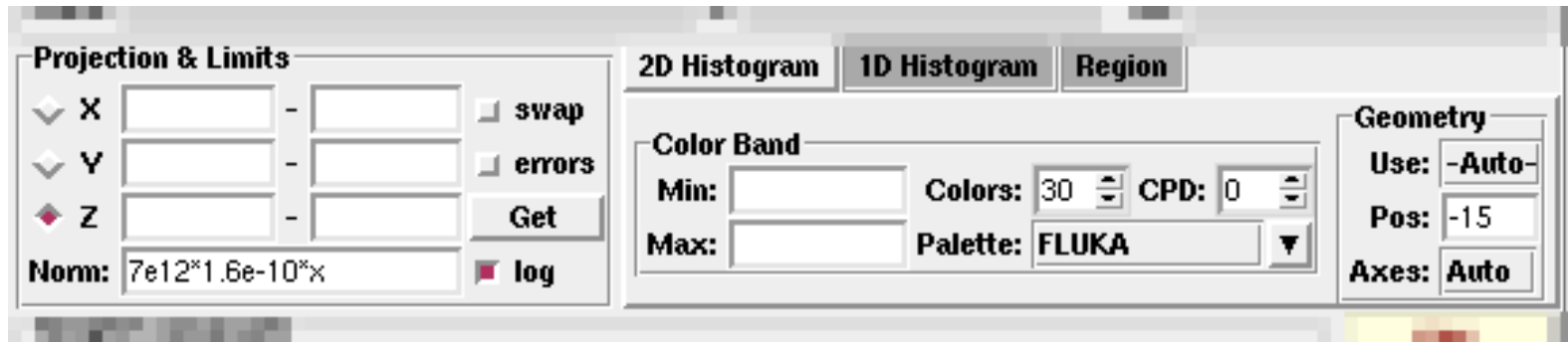
# USRBIN (2D Plot)



- Select the "2D Histogram" tab
- Select the projection axis and limits
- swap: will exchange the plotting X and Y axis
- errors: will plot the error values as color plot
- Get: will get the projection limits from the gnuplot window
- Norm: is the **normalization value or expression**. You can even define a function to use as normalization using as argument x:  
e.g.  $5*x**2+4*x$
- log: select linear or log in the color bar axis



# USRBIN (2D Plot) cont.



- The Minimum, Maximum, Colors and CPD (Colors per decade) are interconnected.

$$\log_{10}(\text{Max}) = \log_{10}(\text{Min}) + \text{Colors}/\text{CPD}$$

- Once the value is changed in one field, the other will be calculated accordingly
- Palette: offers a possibility to the user to choose from various predefined palettes. The user can define his own palette using the "set palette" command from the "Gnuplot commands" text box

## USRBIN (2D plot) cont..

Superimpose the geometry can be done either automatically or manually.

- **Auto:** Select **-Auto-** in the Use: field of the Geometry and the program will try to draw the geometry at the middle of the limits on the projection axis. To change the position modify the Pos: value
- **Manual:** The dropdown listbox will display also a list of all geometry plots in the flair project. Select the one you prefer and the plotting axis. The manual mode can be used in special cases when the usrbn file do not contain the absolute coordinates
- The color palette is predefined in flair, but the user can modify it with the **"set palette"** gnuplot command. See gnuplot help page for more info.

# USRBIN (1D-plots)



- Select the "1D Histogram" tab
- Select the projection axis from "Projection & Limits" as before
- WARNING: When making projections the error is typically underestimated.

# USR-1D Single Differential Plot



- USR-1D is able to plot the 1D single differential information from the **USRBDX**, **USRCOLL**, **USRTRACK** and **USRYIELD** cards (The 2D information is not handled).
- The file type in use should have the extension **\_tab.lis** and are generated by the FLUKA data merging tools (See Data Frame)
- You can superimpose many scoring output in a single plot.

# USR-1D Single Differential Plot

The basic steps to create a plot are:

- Add or Clone a `_tab.lis` file, in the Detectors listbox.
- Select the detector to be used from the Det: dropdown listbox
- Set a name in the Name: field. Names starting with `#` will not be displayed as keys in the plot
- Select the X: and Y: information to plot as well the Style:  
X,Y,Style have different values.

**Note:** Different combination will be interpreted in different way from gnuplot, resulting to maybe unwanted results

- You have the possibility to select:
  - Plotting axes
  - Smoothing of the plot
  - Color, line type, width, point sizes etc.  
(Enter the command "test" in the gnuplot command and hit "Plot" you will get a plot of all possible types)
  - Predefined styles

# USR-1D Plots

- X: choices:  
[xl, xh refer to the limits of each individual bin of the histogram]
  - GeoMean [ $\sqrt{xl \cdot xh}$ ] Geometrical mean. Should be used if X is **scored** as a log-histogram
  - Mean  $[(xl+xh)/2]$  Normal mean. For **linear** scoring
  - Low [xl] Low value of the bin
  - High [xh] High value of the bin
- Y: choices:
  - Y **Y-bin** value as given by FLUKA
  - $Y \times \langle X \rangle$  Y-bin value multiplied by the **mean X value** of the bin (Isolethargic)
  - $Y \times \langle X_{geo} \rangle$  Y-bin value multiplied by the **geometrical X-mean** of the bin (Isolethargic)
  - $Y \times Xl$  -//- with the **X-low** value of the bin
  - $Y \times Xh$  -//- with the **X-high** value of the bin
  - $Y \times DX$  -//- with the **width** of the bin

# USR-1D Plots

- Style: has a huge list of choices as given by gnuplot. You can consult gnuplot manual for the description of the options. Some suggested settings are the following:
  - To make a line/scatter plot with or without errors
    - X: GeoMean (if scored in log), Mean (if scored in linear)
    - Y:  $Y \times \langle X_{\text{geo}} \text{ or } X \rangle$ , for isoethargic plotting
    - Style: lines, linespoints, dots, errorbars, yerrorbars, errorlines...
  - To make a histogram
    - X: Xlow [xl]
    - Y: what ever choice you want to plot
    - Style: steps
    - or
    - X: Xhigh [xh]
    - Style: **histeps**

# USR-1D Plots

- You have the possibility to superimpose plots. Useful if you want to show a histogram with the errorbars superimposed.
- You can selected angular slices from **USRBDX** data using the "**Block**" option
- You can superimpose experimental data or any other data file and override all options using the "**Using:**" input field



# USERDUMP

- Still under development
- Particle tracks (use with care)
- Visualize the source particles distribution, as well superimposed with the geometry.

The logo for the Fluka particle accelerator facility, featuring the word "FLUKA" in a stylized, 3D, metallic font. The letters are arranged in a slightly curved line, with the "F" being the largest and most prominent. The background is a light, circular glow.