Introduction to Flair
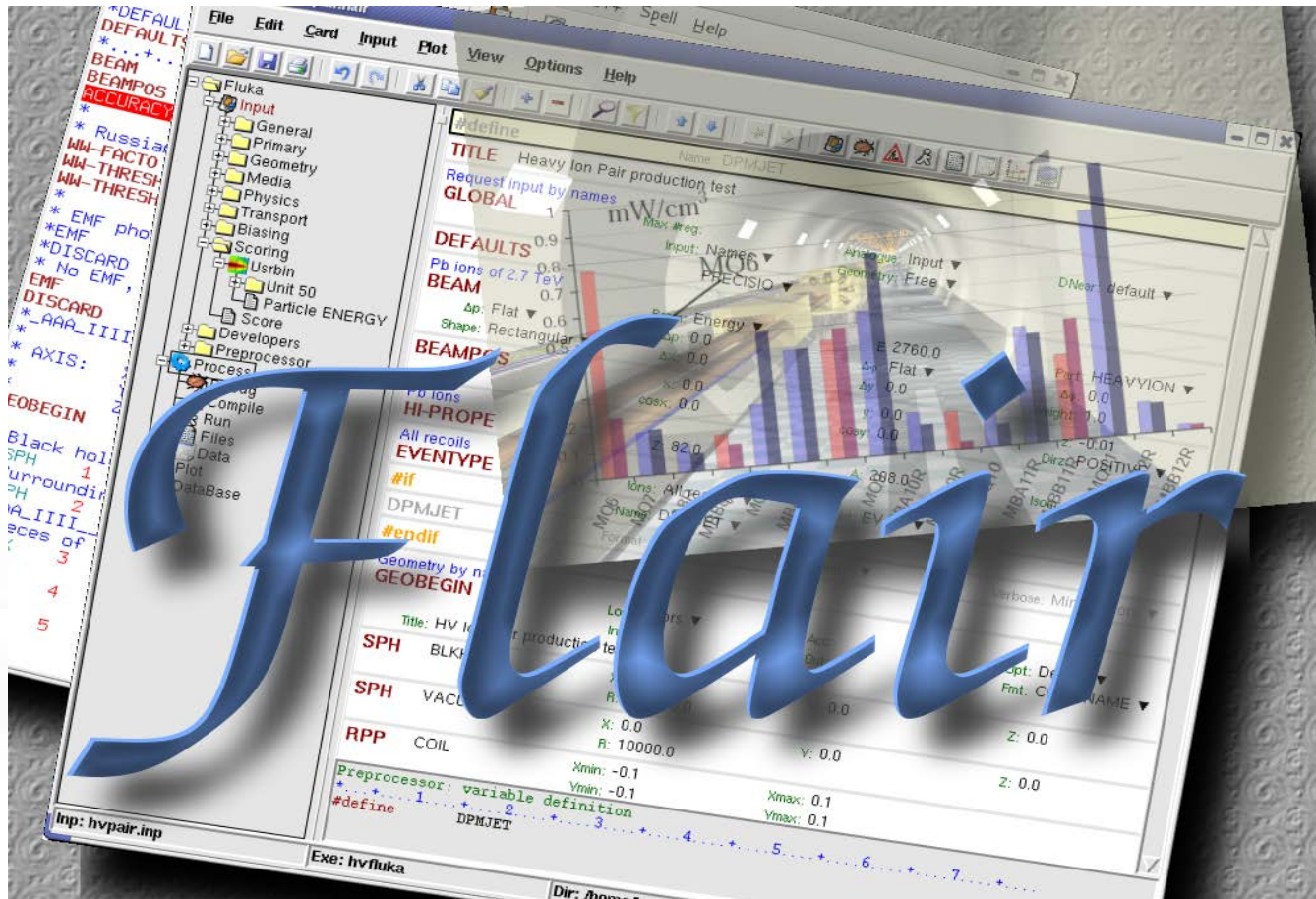
About

/fleə(r)/   n [U,C] natural or instinctive ability (to do something well,
to select or recognize what is best, more useful, etc.
[*Oxford Advanced Dictionary of Current English*]

What is flair

FLUKA Advanced Interface   [http://www.fluka.org/flair]

- **All-in-one** User friendly graphical Interface
- Minimum requirements on additional software
- Working in an intermediate level
  Not hiding the inner functionality of FLUKA

Front-End interface:

- Fully featured **Input file Editor**
  - Mini-dialogs for each card, allows easy and almost error free editing
  - Uniform treatment of all FLUKA cards
  - Card grouping in categories and card filtering
  - Error checking and validation of the input file during editing
- **Geometry:** interactive visualization editing, transformation, optimizations and debugging (see Geometry Editor talk)
- **Compilation** of the FLUKA Executable
- **Running** and **monitoring** of the status of a/many run(s)

What is flair

Back-End interface:

- Inspection of the output files (core dumps and directories)
- Output file(s) viewer divided in sections
- Post processing (merging) the output data files
- Plot generation through an interface with gnuplot

Other Goodies:

- Access to FLUKA manual as hyper text
- Checking for release updates of FLUKA and flair
- Nuclear wallet cards
- Library of materials
- Database of geometrical objects (Not yet completed)
- Programming python **API**
- Everything is accessible with keyboard shortcuts

Concepts: Flair Project

- Store in a **single file** all relevant information:
    - Project notes
    - Links to needed files: **input** file, **source** routines, **output** files ...
    - **Multiple runs** from the same input file, as well as running status
    - Procedures on how to **run the code**
    - **Rules** on how to perform **data merging**
    - Information on how to post process and **create plots** of the results
- You can consider Flair as an **editor** for the project files.
- Can handle any FLUKA input format (reading & writing), but internally it works using the **names format** for the input, free format with **names** for the geometry (Recommended way of working)
- The format is plain **ASCII** file with extension: **.flair**

Note: If you want to copy a project you need to copy also all linked files especially the input and source routines!

Installation

- Flair web site to download code and documentation

  ## http://www.fluka.org/flair

- Installation procedures:

  - RPM/DEB method (Linux): strongly recommended! on systems that support the RPM/DEB. The package will create all file association, menu items and keep track of updates and files installed.
    The package will install the program to: /usr/local/flair
    and will create the following launcher programs:

    - /usr/local/bin/flair   flair program
    - /usr/local/bin/fm   FLUKA manual
    - /usr/local/bin/pt   Periodic Table
    - /usr/local/bin/fless   FLUKA output viewer

  - tar.gz method (MacOS, MS-Windows). Please follow the instructions on:
    http://www.fluka.org/flair/download.html
    and for special instruction on the FAQ:
    http://www.fluka.org/flair/faq.html

Starting flair

Programs Menu (Linux)

- Click the icon of Flair from the programs menu;
- Flair is registered under the **Science/Physics** category but depending your Linux distribution and window manager it might appear in different sub-menus (i.e. Applications, Education, Science or Others).

Window Manager (Linux, only via RPM or DEB installation)

- Flair makes an association of the following extensions:

  *.flair   ***.fluka *.inp**

Console

- Type the command flair. Remember to add to your **$PATH** the directory where flair is installed!

Startup

Unless you specify any option during startup flair will perform the following operation:

- Open an "xterm" to be used as the Output window;

- Display the **About Dialog**;

- Check for the existence of a FLUKA installation (**FLUPRO** environment variable), and if not found will open the Preferences dialog to set explicitly the FLUKA path;
WARNING: Window managers (GNOME, KDE...), as well command shells (bash, tcsh, ash...) have a different configuration file where they expect the environment variable.

- Display the "**Tip of the Day**" dialog;

- Open the "**Check for Updates**" dialog (every 30 days interval).

Interface
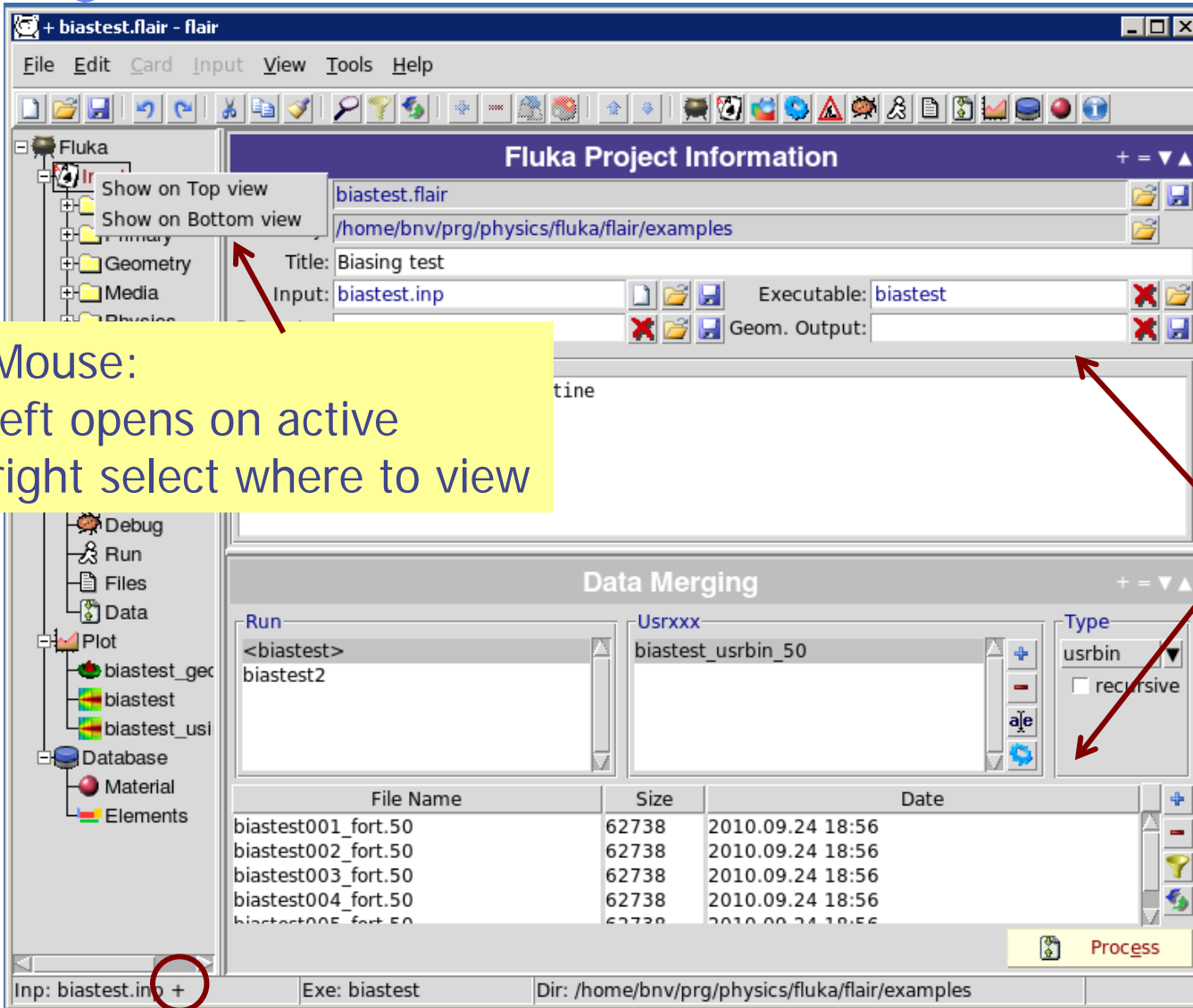
active

+ vertical/horizontal
= equalize
▼ minimize
▲ maximize

2 working frames

inactive
click to activate

Mouse:
left opens on active
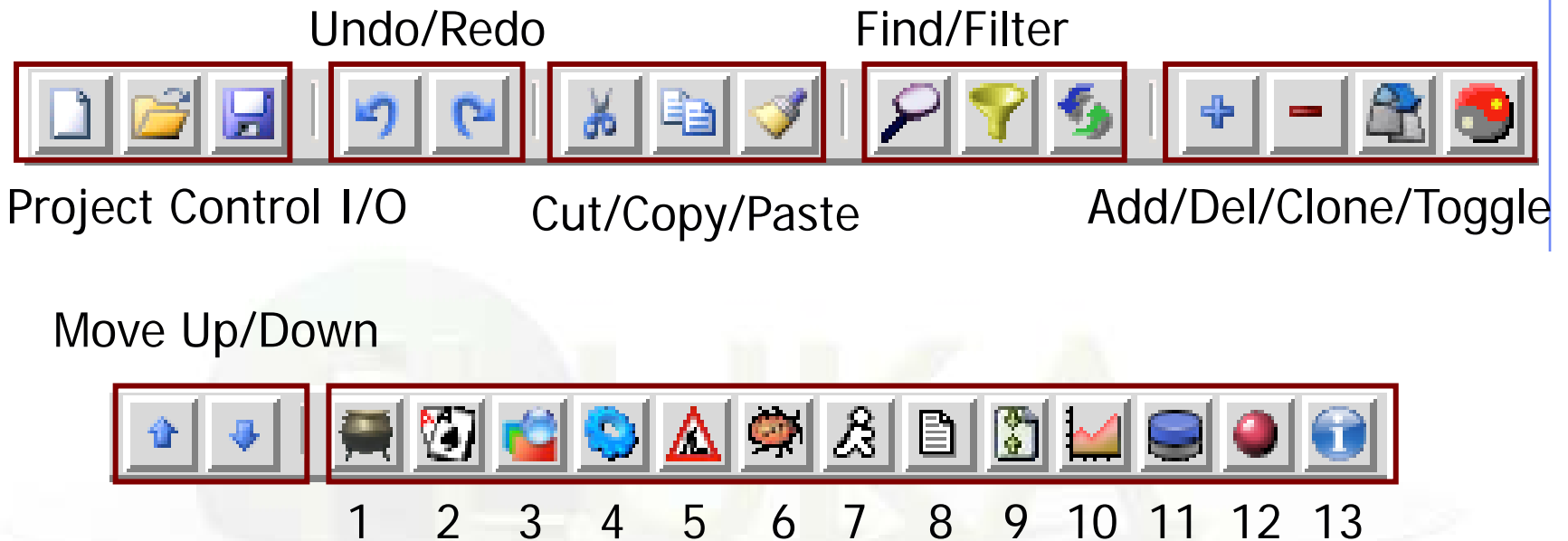right select where to view

input modified and not saved

Menus

File	Edit	Card	Input	View	Tools	Help

File   I/O, export to other formats, printing, recent projects

Edit   Common editing features: Cut, Paste, Add, Del, Clone, Filter

Card   Add or change cards in input; grouped by Categories

Input   Commands to manipulate input cards

View   Accessing various views of flair

Tools   General purpose commands: Terminal, Browser, Preferences

Help   Access to help, check for updates, web page, about dialog

Keyboard Short cuts (Linux/Windows): F10 or Alt+*F, E, C, I, V, T, H*

Toolbar

Undo/Redo

Find/Filter

Project Control I/O

Cut/Copy/Paste

Add/Del/Clone/Toggle

Move Up/Down

1 2 3 4 5 6 7 8 9 10 11 12 13

Quick Access to:
1. Project Frame
2. Input Editor
3. Geometry Editor (if installed)
4. Process Summary
5. Compile executables/Add user routines
6. Debug Geometry
7. Run/monitor simulations
8. View output files
9. Data merging
10. Plots
11. Databases (not yet functional)
12. Material Database
13. Help

Basic Preferences
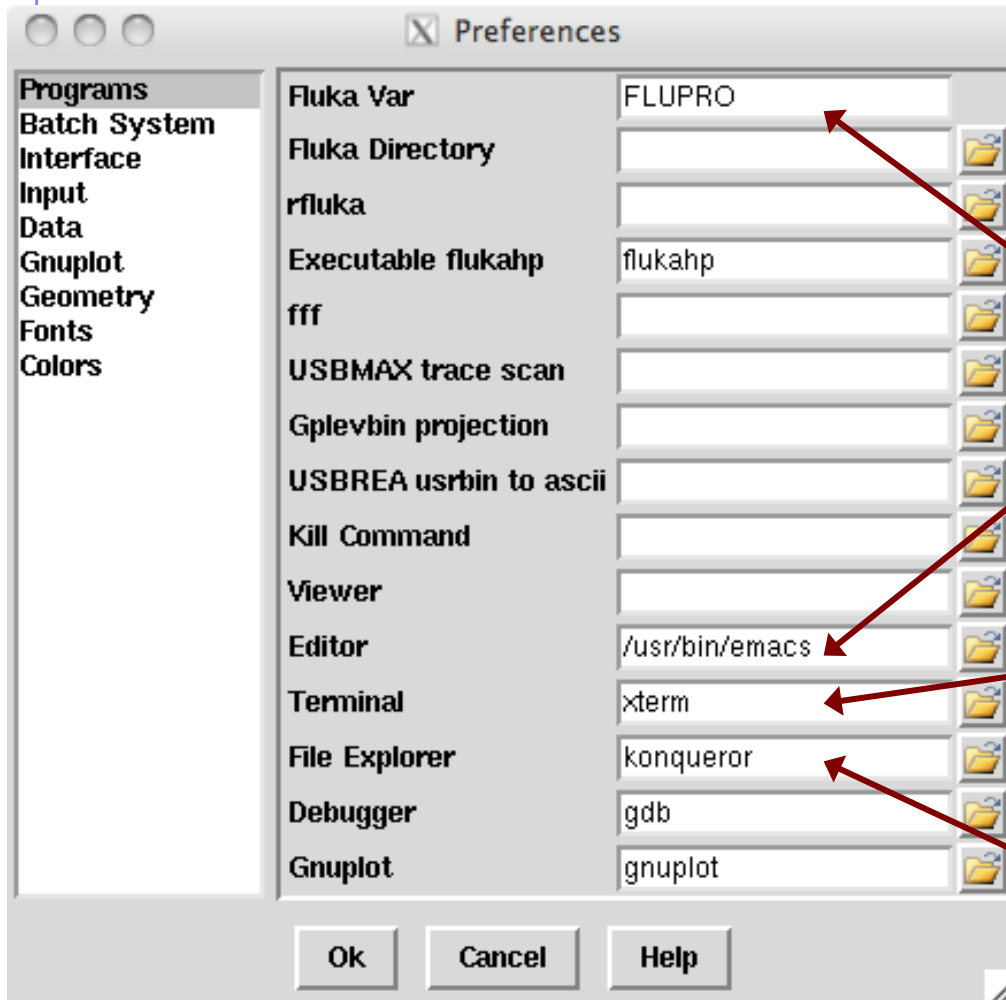
The program tab of preferences allows the user to set the default programs and directories

Set your FLUKA directory, to override $FLUPRO

Set your favorite editor

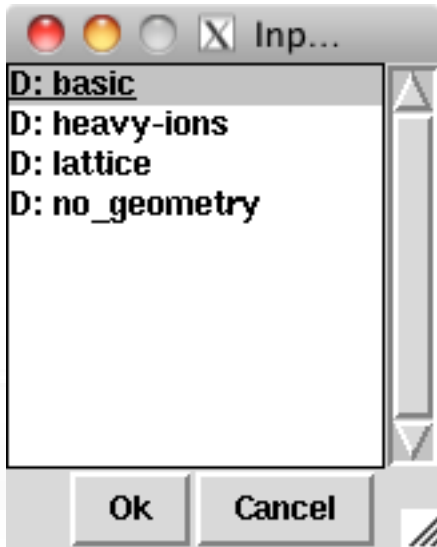Set your favorite console program (xterm, nxterm, kconsole...)

Set your favorite file browser for example:
• "konqueror" for Linux with KDE
• "open" for the finder in MacOS

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Input Templates

- When requesting a new input or a new project flair will prompt to select an input template:

```
TITLE

GLOBAL                                              1.0        1.0
DEFAULTS                                                              NEW-DEFA
BEAM
BEAMPOS
GEOBEGIN                                                              COMBNAME
     0    0
* Black body
SPH blkbody      0.0 0.0 0.0 10000000.0
* Void sphere
SPH void         0.0 0.0 0.0 1000000.0
* Cylindrical target
RCC target       0.0 0.0 0.0 0.0 0.0 10.0 5.0
END
* Black hole
BLKBODY          5   +blkbody -void
* Void around
VOID             5   +void -target
* Target
TARGET           5   +target
END
GEOEND
* ..+....1....+....2....+....3....+....4....+....5....+....6....+....7..
ASSIGNMA      BLCKHOLE     BLKBODY
ASSIGNMA        VACUUM        VOID
ASSIGNMA        COPPER      TARGET
RANDOMIZ          1.0
START
STOP
```

Inp...

D: basic
D: heavy-ions
D: lattice
D: no_geometry

Ok   Cancel

- Flair default templates are prefixed with "D:"
- User templates will be prefixed with "U:"

The user can create his own set of input templates. They are normal FLUKA input files and they have to be placed in the directory `~/.flair/templates` (create the directory if not existing)

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Input Editor

- With the input editor the user can manipulate the input cards:
  - Add card to input
  - Edit & modify existing ones
  - Copy & Paste
  - Clone (Duplicate)
  - Import from other input files
  - Validate the correctness of the cards
  - Error filtering
  - Rearrange order

- The editor will try to rearrange the input cards (if needed) to create a valid FLUKA input file
  e.g. body cards outside the GEOBEGIN/GEOEND parts will be moved inside

Note: Automatic rearranging of cards cannot work if "**#include**" cards are present. The user have to do it manually

Card Categories

For easier access, cards are groups in the following categories:

- **General**   General purpose (TITLE, DEFAULTS, GLOBAL...)
- **Primary**   Definition of the primary starting particles
- **Geometry**   Cards related to the definition of the geometry bodies/regions/lattices plotting and rotations/translations

  - **Bodies**   Subcategory containing only the bodies definition
  - **Transformations** Subcategory containing only the geometrical directives

- **Media**   Definition and assignment of materials
- **Physics**   Setting physics properties of the simulation
- **Transport**   Modify the way particles are transported in FLUKA
- **Biasing**   Cards for importance biasing definition
- **Scoring**   Cards related to scoring
- **Flair**   flair special cards
- **Preprocessor** Definitions for creating conditional input files

Concepts: Extended Cards

- Flair is treating the input file as a list of extended cards;
- Each extended card contains:
  - Comment: All commented lines preceding the card(s) as well the inline comments
  - Tag: The 8 character word identifying the card. All tags not recognized by flair will be converted to #error
  - WHATs: Multiple number of WHATs (0=sdum, 1-6 first line, 7-12 continuation line...)
  - Extra: multi line string of extra information for special cards like REGION, TITLE, PLOTGEOM etc.
  - State (Enable/Disable)
- Flair recognize automatically (and separates them from the comments) all the disabled valid FLUKA cards

Concepts: Extended Cards

- The region definition in the in geometry is emphasized by the presence of a card named "REGION"

- All COMPOUND cards related to one material are joined in one card

- Cards are edited with the flair editor through the use of the mini-dialogs, forcing the user to enter a *proper* information

- The user gets full control of the card using the Edit dialog (*Ctrl-E*)

- Flair will try to find the best floating point representation of each number, to ensure the maximum accuracy; number of digits that fits in the specific width (10 for the fixed format, 22 for the free format)

- Function evaluation: a field value starting with = will force flair to evaluate its content as a function e.g.
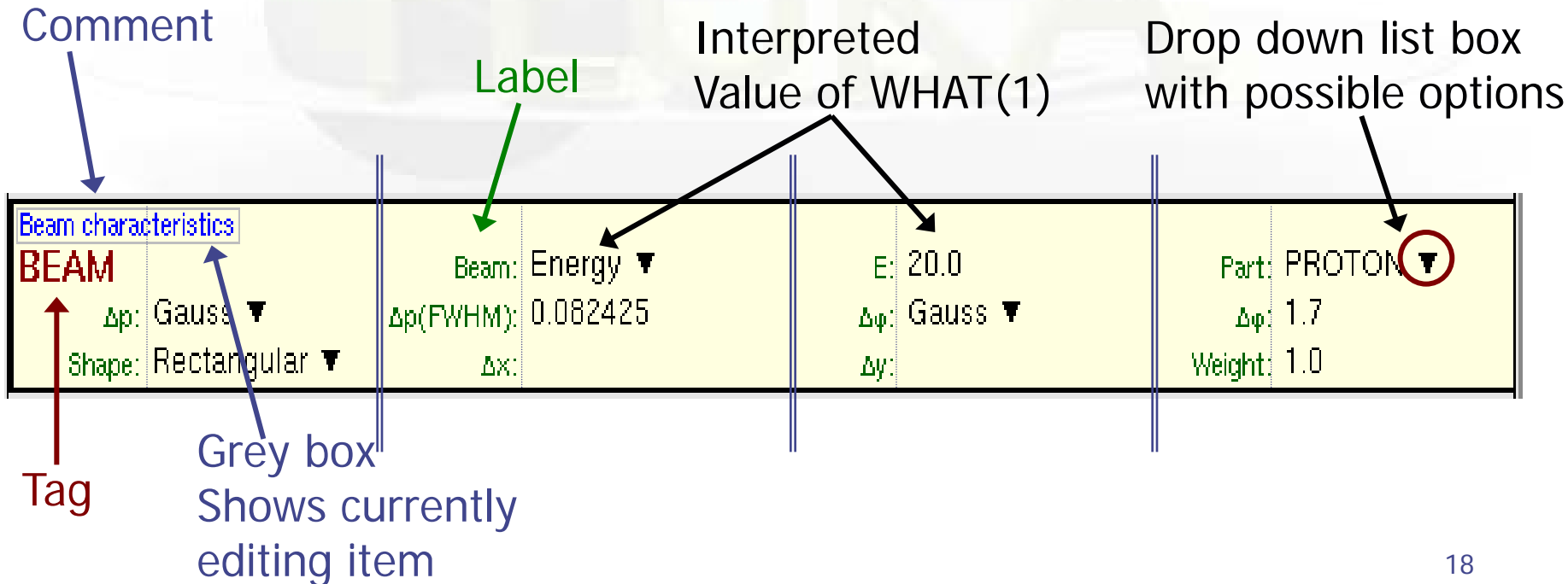
  BEAMPOS   x: =2*10+length

  Flair will create a valid fluka input containing the evaluation of the formula and keep the formula inside the comments as

  *@what.1 =2*10+length

Anatomy of a card mini-dialog

- For each extended card flair has a mini dialog (currently in 4 columns), interpreting all information stored in the card

```
* Beam characteristics
BEAM              -20.0 -0.082425              -1.7                              1.0PROTON
```

Comment

Label

Interpreted
Value of WHAT(1)

Drop down list box
with possible options

Beam characteristics			
BEAM	Beam: Energy ▼	E: 20.0	Part: PROTON ▼
Δp: Gauss ▼	Δp(FWHM): 0.082425	Δφ: Gauss ▼	Δφ: 1.7
Shape: Rectangular ▼	Δx:	Δy:	Weight: 1.0

Grey box
Shows currently
editing item

Tag

Anatomy of a card mini-dialog

```
*  Energy deposition in 3D binning
USRBIN            10.0      ENERGY      -50.0        45.0        54.0        36.0EneDep
USRBIN           -45.0      -54.0       -33.0       100.0       100.0       100.0&
```

USRBIN			Unit: 50 BIN ▼	Name: EneDep
Type: X-Y-Z ▼	Xmin: -45.0	Xmax: 45.0		NX: 100.0
Part: ENERGY ▼	Ymin: -54.0	Ymax: 54.0		NY: 100.0
	Zmin: -33.0	Zmax: 36.0		NZ: 100.0

Anatomy of a card mini-dialog

```
* Polypyromellitimide Polyimide, Kapton
* Chemical          O = C    H-C    C = 0
* Formula            / \   // \ / \         H-C - C-H          H-C - C-H
*                   /    \C    C   \      //       \\        //        \\
*         ---- N        |    ||    N - C        C - 0 - C         C ----
*                  \    /C    C   /      \        /         \       /
*   C  H  N O        \ /   \\ / \ /       H-C = C-H          H-C = C-H
*    22 10 2 5      O = C    H-C      C = 0
```
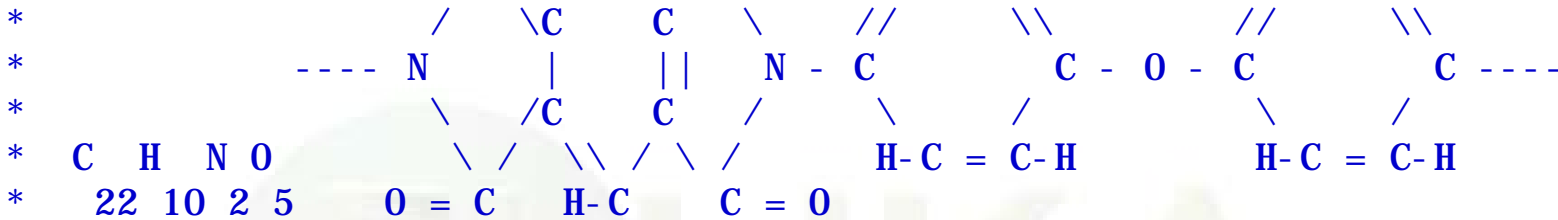
MATERIAL			1.43			Polyimid
COMPOUND	10.0	HYDROGEN	22.0	CARBON	2.0	NITROGENPolyimid
COMPOUND	5.0	OXYGEN				Polyimid

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Editing Cards

While in input editor you can work in two modes:

1. Card mode: manipulate the cards as a unit (e.g. to copy, paste, delete, change order of cards)

2. Edit mode: manipulate the contents of the card

Edit mode is activated immediately after **adding** a new Card, by hitting **Enter** or with the **mouse click**

To leave edit mode click the **Esc** or with the mouse click somewhere else

The active item (what) is highlighted with a **grey rectangle** and highlighted also in the card viewer below the editor

A range of cards can be selected with:

● Shift + Mouse

● Shift + Up/Down arrows

Validating input and Error correction

- Flair validates the input file while loading and each card during editing

- Errors are highlighted in **red**

- For the moment only syntactical errors are checked, and a few logical errors

- Popup-menu option "Show errors" displays a short message on what is expected as correct value

- Menu item "Input / Filter Invalid" shows only the invalid cards from the last filtered view

Material Database

- Flair contains an **internal database** of ~500 predefined materials and/or compounds
- Some (~300) with the Sternheimer parameters

Please use these data as Reference only!

- Validate **always** the correctness of the data
- If errors found please contact the author

- The database can be edited, and populated with your own materials. In this case a local copy of the database will be made in ~/.flair directory

Starting a Run

- Flair can starts a simulation (single run) based on the input file

- Multiple runs can started be by overriding some options, like #defines, title, random number seed and number of starting particles (primaries)

- Flair will try to "attach" to a run. Using only the information from the output files generated by FLUKA, flair will try to identify the directory where the run takes place and monitor the progress of the selected run

- During the execution of the run the user can view the output files in the "Files Frame"

Tips & Tricks

- **Mouse**
  - right-click — opens the popup-menu with the most important actions

- **Keyboard** — Check the accelerators on the menus
  - Ctlr-Enter — Performs the default action in every frame.

    e.g. Add a card in the Input Editor

      start a run in the Run Frame
  - Ctrl-Space — Access popup-menu (like right-clicking)
  - Listboxes — All listboxes in flair are searchable and case insensitive. Type the first characters of the string you are searching and the closest match will be highlighted
    Ctrl-G repeats the search. Space selects/deselect item
  - +, -, Ins — While editing the REGION expression shows a list of all available bodies

Known Bugs / Limitations

- **Unicode / International** characters do not work well and should be avoided

- Gnuplot:
    - <4.2 has a bug in the number of palette colors, and on the cblabel for the wxt terminal
    - 4.4.3 has a non linear behavior on the palette colors for the xterm terminal

- **Inline comments**, and comments inside REGION definition are treated as one comment preceding the input card

- **REMEMBER** always that the .flair and .inp are different thing
  Do not save the project as .inp or the input file as .flair

Other goodies

Flair has a lot of functionalities that are not shown in this tutorial

Most of these will be shown during the exercises of the course

We would advice the users to go through the various menus and help page and try it out

Flair Geometry Editor
Part I: The Editor as a viewer

FLUKA Beginner's Course