

# Basic Plotting with JAS3 and AIDA

## Getting the most out of your plots

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### Introduction

For plotting and fitting, `org.lcsim` provides an implementation of the Abstract Interfaces for Data Analysis [AIDA](#).

AIDA objects are organized in Trees, which can have a directory structure like a file system.

This tutorial will assume that you are working in JAS3 and have either loaded an existing AIDA file or created objects in AIDA with the [org.lcsim](#) plugin. For a first introduction how to create AIDA objects, you could execute one of the AIDA examples or one of the `org.lcsim` examples in JAS3 or follow [Explanation of Analysis101 Driver](#). If you have executed some of the `org.lcsim` examples in JAS3, you have already used AIDA in lines like these:




```
AIDA aida = AIDA.defaultInstance();
...
aida.cloud1D("nTracks").fill(tracks.size());
```


### Terminology

Class name of the AIDA object	Description
IHistogram1D, -2D, -3D	One-, two- and three-dimensional binned histograms <ul style="list-style-type: none"><li>• fixed and variable width binning</li><li>• support for simple arithmetic</li><li>• projections</li><li>• slices</li></ul>
ICloud1D, -2D, -3D	One, two and three-dimensional unbinned histograms <ul style="list-style-type: none"><li>• scatter plots</li><li>• can be (auto-)converted to histograms</li></ul>
IProfile1D, IProfile2D	One- and two-dimensional profile plots <ul style="list-style-type: none"><li>• access to bin and overall statistics</li><li>• scaling</li></ul>
IDataPointSet1D, -2D, -3D	Sets of one, two- and three-dimensional data points with errors <ul style="list-style-type: none"><li>• add, remove, get points</li><li>• scaling of values and errors</li><li>• simple arithmetic</li><li>• simple error propagation</li></ul>
ITuple	Tuple structure for persistence <ul style="list-style-type: none"><li>• data arranged in folders and sub-folders</li><li>• chaining</li><li>• projections to histograms, clouds and profiles</li></ul>


### Viewing and Loading Plots


Lets start with viewing AIDA objects. You can either create them with the AIDA examples, the org.lcsim examples or you can load an existing AIDA file with [File->Open File...](#) in the menu.


All AIDA objects are arranged in *trees*. You can have many trees open at the same time; they are represented as Folders, . Trees can contain, e.g. Clouds  and/or Histograms , with the name of the object appearing next to it. If a folder is closed, double-clicking will open it and display its contents. Similarly, double-clicking on an open folder will close it, so that the contents are hidden.

 Trees that are created by the org.lsim examples will have non-descriptive names like `aida5312aida`.

A double-click on a Cloud or a Histogram will cause JAS3 to plot the contents.

 Clouds are automatically displayed with 50 bins over the range of the data.

 If the active *page* shows source code or the examples, double clicking on an item in the tree will create a new plot page and display the item. If, however, the active page **is** already a plot page, double-clicking on an item will cause the displayed plot to be **overwritten**, and all your modifications (like changing the binning, the color or the text) to be lost !


 If you want to display more than one plot on a page, you have to use the context menu.  

1. *Right* click on the item you want to plot to open its context menu
2. Select [Show in New Plot](#)


In order to display an item **together** with an already displayed item, select `Overlay on Current Plot` from the context menu

## Saving your work

### Saving your plots as image files

 If you just want to include the plot in your presentation, you can copy it to the clipboard with [Copy Plot...](#) from the context menu. From there you can insert it into your presentation with the [Edit->Paste](#) menu entry of your presentation application.

JAS3 supports various graphics formats, for both bitmap and vector graphics.

 Bitmap graphics are **not scalable**. JAS3 saves all Plots in their current size. Please make sure to draw the window to the desired width before saving in a bitmap format.

The following list gives a brief description of the most often used formats

Graphics Formats		
PNG	Portable Network Graphics	We recommend this format as the default bitmap format. PNG files are compressed and can be used for inclusion in presentations.
EPS	Encapsulated PostScript	For inclusion in printed documents, the EPS format is preferred. This is an uncompressed format, so EPS files are usually much larger than their compressed counterparts. (Up to a factor of 10 or more)
PS	PostScript	Select this format if you want a document-quality printout of your plot. Uncompressed. This option should be used with care, because the PS format contains information about the page layout. The JAS3 PS format is letter-height and A4-width.
SVG	Scalable Vector Graphics	Like the EPS format, SVG is a vector graphics format. Unlike EPS, however, it is compressed. You can use this format for high-quality graphics output.

Saving Plots is a trivial task in JAS3:

- You want to save the whole page:
  - Select [File->Save As...](#)
- You want to save only one plot in the current page
  - Right click on the plot and select [Save Plot As...](#)



### The Blue Frame Bug

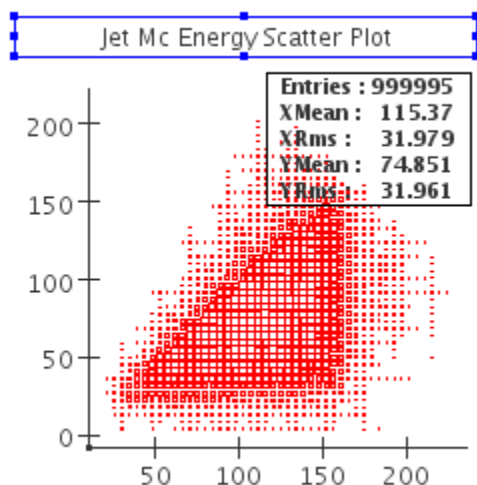
Sometimes one of the plots shows an undesired (blue) frame. **This blue frame will appear in the image.** You need to make sure that none of the plots has this frame before saving the image. You can do that by clicking on an area outside of the frame.

Please note that if you try to save the plot by selecting the entry `Save Plot As...` from the context menu, it will **always** have the blue frame !




Don't try to remove the frame by hitting the `delete` key !

Hitting `delete` on a selected plot can result in **data loss** !



## Saving your data in the AIDA format

In order to save your whole tree with all Cloud and Histogram objects, right-click on the folder icon , and select `Save As...` from the context menu. Please select a filename with the extension `.aida` so that you will be able to recognize the file later.

## Changing the layout

Thanks to the close integration of JAS3 and AIDA, a plethora of manipulations is available via menus and dialogs. This tutorial can merely give an overview over the most commonly used ones.

### Changing the title and the axis labels

- Right-click on the plot and select `Plot Properties...` from the menu. You will see tabs that represent different regions of the plot.
- The **Title** of the plot can be found under the **General** tab. Change it to something descriptive and click on the **Apply** button to see it change.
- The axis labels can be changed under the **Y Axis** and **X Axis** tabs, respectively. After entering the label in the text field, click the **Apply** button to see it change.

### Changing the axis range / log scale

The axis properties can be found in the `Plot Properties...` entry in the context menu, which you can bring up with a right-click. The **Y Axis** and **X Axis** tabs let you specify a range for the respective axis, as well as change the scale to logarithmic. Click the **Apply** button to make the change visible immediately.

### Changing the appearance of the plot

#### Changing the font

You can change the font of the title or the axis labels. Open the context menu of the label you want to change by right-clicking on the text. The first item in the context menu is either `Title Font...` or `Axis Font...` depending on where you click.

## Changing the color, line and filling options

When overlaying two or more histograms, oftentimes important information is hidden behind the opaque histogram bars. In this case it is convenient to access the context menu with a right click and selecting [Fill Histogram Bars](#). More sophisticated changes can be made by accessing the [Plot Properties...](#) dialog from the context menu. The [Data](#) tab shows all data sets contained in the current plot. Click each data set to access its options. After changing an option, click the [Apply](#) button to see the changes.

You can select for each data set whether you want to display it. JAS3 has also the option to plot a secondary Y Axis. You can select which of the two possible axes to associate your data with.

[1D Plot Style/2D Plot Style](#): This is where you change the color, line width and other display properties of each plot. Click apply after your changes to confirm that this is what you wanted.

## Changing the statistics box

You can select what information should be displayed in the statistics box by right-clicking on the statistics box and selecting [Statistics Properties...](#) If you want the statistics box to disappear completely, right-click on the main plot and select [Show Statistics](#). This entry is also used to make the box re-appear.



### Label Box

There is currently no option in JAS3 to make the label box disappear. If, for some reason, you do not want to have it displayed, you can select it and resize it to a size of 0.

## Basic Fitting

JAS3 provides some predefined functions.

- A Gaussian (3 parameters)
  - An exponential (2 parameters)
  - 0th, 1st and 2nd order polynomials (1, 2 and 3 parameters, respectively)
- You can fit your data to one of these functions as well as to a sum of any combination of these. Select [Add function](#) from the context menu by right-clicking on the histogram. Select [Fit](#) from the context menu and select the function you want to fit to the data.

The fit parameters will be displayed in the statistics box.

If, for some reason the fit has failed, you can access the parameters by accessing the [Functions](#) tab in the [Plot Properties...](#) dialog, which you can access from the context menu.

The [Functions](#) tab lets you choose:

- The display properties of the function curve
- The fit parameters with their error and an indicator whether they are included in the fit
- A box that lets you select the fitter and the dataset which to fit, as well as an indicator whether the fit was successful and the chi-Squared value of the fit.

Before re-fitting the function, make sure the indicators of all parameters that you want included in the fit are checked. You can modify the Values of each Parameters, which will then be used as the new starting point for the fit. Click the checkbox labelled [Fit](#) to uncheck it, then click it again to start the new fit.

For further information on fitting, please visit [Fitting Through The GUI](#) and [Fitting Tutorial](#)

## Advanced Tutorials

- The [second part of this Tutorial](#) has more examples on fitting and scripting as well as Tuples
- The Documentation on the [AIDA homepage](#) contains many advanced examples together with code samples that demonstrate the features
- The Documentation on the [PAIDA homepage](#) contains many small examples of Python scripts together with images that demonstrate advanced AIDA capabilities. At the point of this writing, PAIDA contains some functionality that cannot be found in the JAIDA implementation, such as 3D plotting.