

# JAIDA, JAS3, WIRED4 and the AIDA tag library – experience and new developments

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**Abstract.** This software is currently used by several experiments and collaborations, BaBar, GLAST, and Geant4. Experience of using AIDATLD, JAIDA, and JAS3 in experiments, as well as description of new developments will be presented in the paper.

## 1. FreeHEP library

Items discussed in this paper are all part of the FreeHEP Java Library<sup>1</sup>, which is mostly written in Java and groups together open-source utilities for High Energy, Astrophysics, and beyond.

To avoid common pitfall of lock-in to monolithic frameworks, FreeHEP follows the philosophy of utilizing small modular projects that can be used together or separately. Defining module interfaces and using open-standards where possible allow open communication between modules and make it easy to extend or replace components.

Good example of such modular approach is AIDA<sup>2</sup> - Abstract Interfaces for Data Analysis. Data can be in different formats and representations, but if it is adapted to “look like” the standard AIDA object, then a set of standard interfaces can be used to work with it. Tools built using AIDA can work with analysis objects from Root, PAW, Fits, SQL transparently.

New in FreeHEP:

- Re-factor dependences and move code from CVS to SVN repository
- Use Maven2<sup>3</sup> to build, test, and deploy projects

## 2. JAIDA

Java implementation of AIDA (JAIDA<sup>4</sup>) is part of the FreeHEP library. JAIDA allows Java programmers to quickly and easily create histograms, scatter plots and tuples, perform fits, view plots, store and retrieve analysis objects from files. JAIDA can be used either in a non-graphical environment (for batch processing) or with a GUI to be used just to display plots. In addition, files written with JAIDA adhere to the AIDA IO standards and can be read by any AIDA compliant analysis system.

### 2.1. JAIDA Features

JAIDA includes (but is not limited to) the following set of features:

- Data analysis and fitting with **JMinuit** (Java port of Minuit) and **FMinuit** (original, Fortran Minuit library)
- Creating high quality plots in variety of formats (pdf, ps, gif, png, swf, etc.)

*Presented at International Conference on Computing in High Energy and Nuclear Physics,  
9/2/2007-9/7/2007, Victoria BC Canada*

- Read/Write support for AIDA XML format (with *zip* and *gzip* options)
- Read support for **Hbook**, **Root** and plain Text files

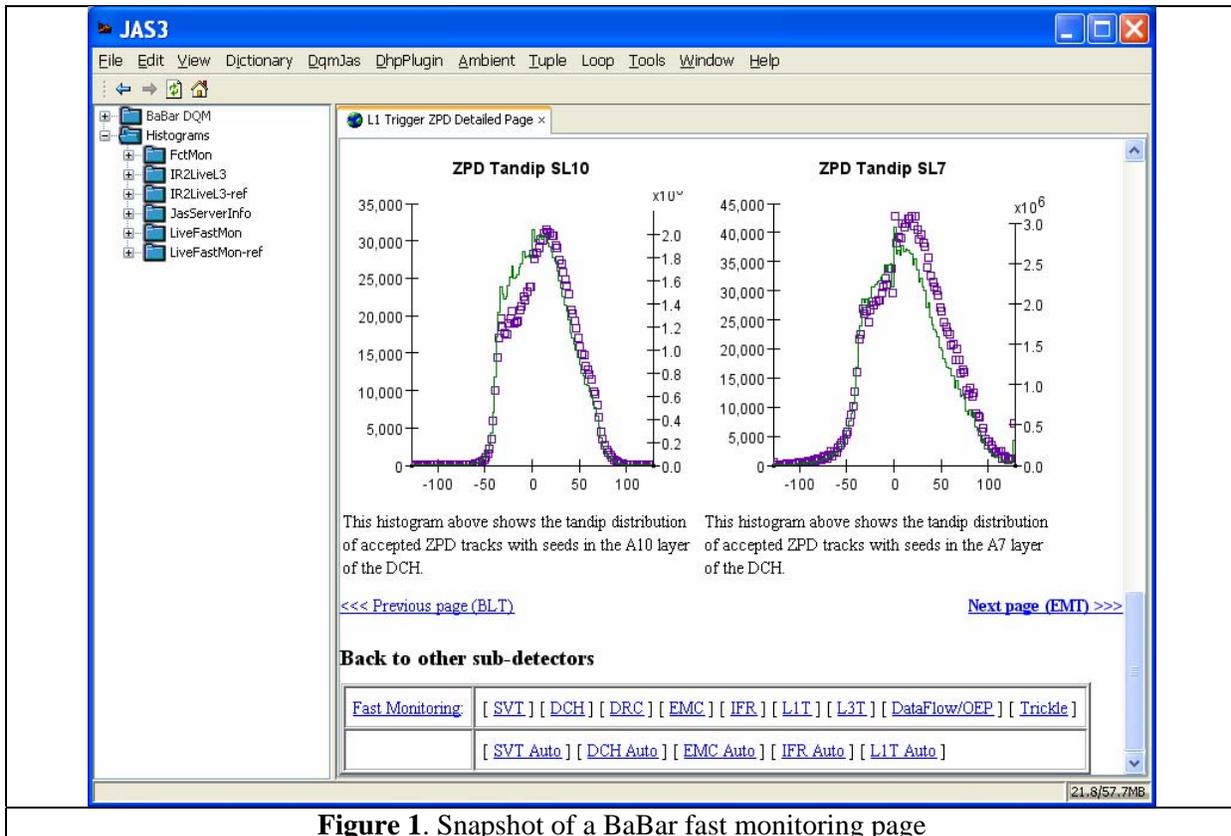
Current version of JAIDA is 3.3.0-5; it implements AIDA 3.3.0 and needs Java 1.4 or higher.

## 2.2. New in JAIDA

There is a set of new features that have been recently added to JADA:

- Full implementation of AIDA 3.3 interfaces
- Add *zip* format option for AIDA XML files that creates file with directory structure which maps the AIDA tree. That allows reading and creating AIDA objects on-demand, which makes opening XML files with many objects much faster
- Add Binary XML option for AIDA XML files, which saves space and makes reading XML files faster – don't have to convert numbers from String to double
- New module for reading and writing **Fits** files
- Add support for plotting 1D and 2D histograms with variable bins
- Add utility class to fill AIDA object with data distributed according to a given function
- Add utility class to convert individual AIDA objects to XML and back
- Support for native i386-MacOSX (**Hbook**, **FMinuit**)

Current version of JAIDA is 3.3.0-5; it implements AIDA 3.3.0 and needs Java 1.4 or higher.



**Figure 1.** Snapshot of a BaBar fast monitoring page

### 3. JAS3

JAS3 pulls together many FreeHEP modules, event display (Wired 4), etc. into single GUI application. Its design is based on Application Shell, into which many (optional) modules can be plugged. JAS3 functionality and features have been described in details elsewhere<sup>5</sup>.

JAS3 comes with a simple integrated web browser that allows including static pictures, live plots, and text on the same page. For example, a page with a combination of live monitoring plot, static reference plot, and text instructions with links to more in-depth explanations for shifters can be a powerful tool for data quality monitoring.

#### 3.1. JAS3 usage in BaBar

BaBar<sup>6</sup> detector at SLAC<sup>7</sup> is using JAS3 for two ways. For data quality control during the data taking (fast monitoring) and to access time histories of voltages, currents, temperatures, etc. (ambient, or slow monitoring). In both cases data is retrieved by JAS3 client from the central server.

Figure 1 shows a snapshot of a fast monitoring page with the live plots (purple squares), reference data (green histogram), and text. Also on the left there is a navigation tree that allows user to access plots directly.

Time history of a temperature outside the BaBar detector hall is shown on figure 2. User can set time limits directly, or by specifying the start and end run number.

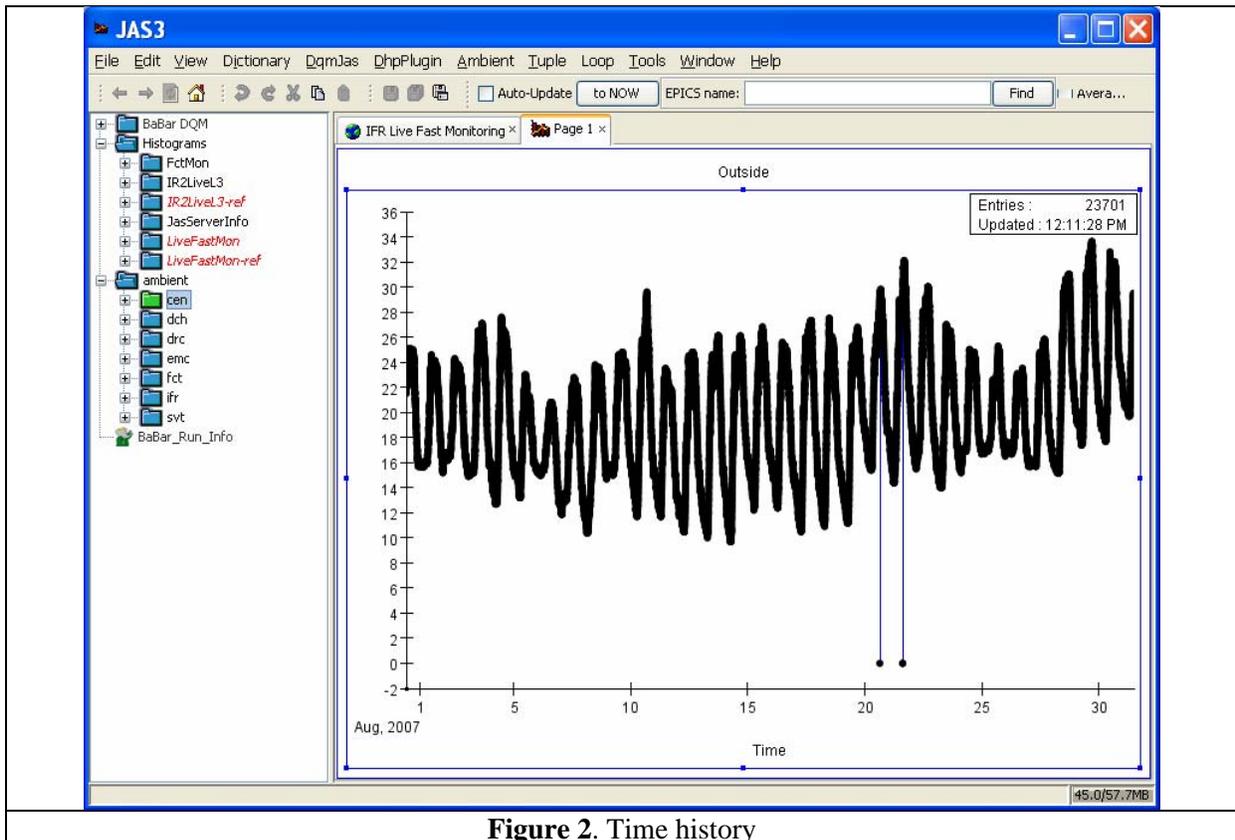


Figure 2. Time history

#### 4. AIDA tag library

The AIDA tag library (AIDATLD<sup>8</sup>) is an open source suite of custom tags that provide access to JAIDA from J2EE applications and JSP pages. It provides the ability to dynamically create high quality physics and astronomy plots, as well as access to histograms and Ntuples stored in any AIDA store (which includes ROOT files via rootd or xrootd<sup>9</sup>) from web applications.

Using AIDATLD has several advantages over the “traditional” ways of accessing the data:

- Users don't need to install any special software, just need a web browser
- Can make data and plots accessible to distributed collaboration quickly
- Can insert live plots into the web pages (using Java Server Pages technology)

AIDATLD home page also provides examples<sup>10</sup> that include sample source code and resulting plots.

##### 4.1. AIDATLD in GLAST

Several collaborations and experiments have adopted AIDATLD and GLAST<sup>11</sup> is one of them. Many web applications that were developed for GLAST make use of AIDATLD:

- Software releases validation<sup>12</sup>
- Telemetry trending
- Data quality monitoring
- Calibrations trending
- Pipeline processing overview

GLAST data can be stored in different formats: Oracle, MySQL, XML, Fits, Root, so specialized adapters are used to present data as AIDA objects. These objects are then displayed using AIDATLD and underlying JAIDA, so users do not have to care where is the data coming from and in what format was it stored.

#### 5. Wired 4

Wired 4 is an experiment independent event display and it has been described in details elsewhere<sup>13</sup>. Current stable release is 4.0 and it can be downloaded from the Wired 4 web site<sup>14</sup>.

Most recent development is concentrated on interfacing Wired 4 with 3D navigation devices, like SpaceNavigator<sup>15</sup>.

#### 6. Status and plans

We continue support and development of AIDA, FreeHEP library, JAS3, and Wired 4. Two most pressing issues here are: development of a new, more functional plotter, and ability to work with big data volumes. While the second issue is partially addressed by introduction of a new AIDA XML *zip* format, the first one is still in the development stage.

AIDATLD is currently undergoing another development cycle, while we are utilizing the feedback from experiments (like GLAST) and our own experience to improve it and make it more transparent for users.

As before, we continue to provide user support, mainly through our forum<sup>16</sup> and bug-reporting<sup>17</sup> web sites.

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