

GammaLib

A versatile toolbox for high-level analysis of astronomical gamma-ray data

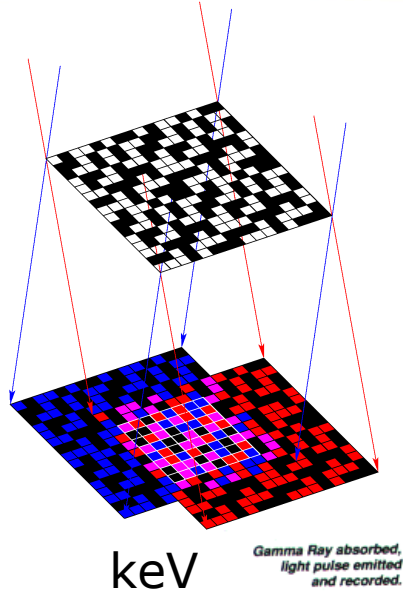
... or: stop reinventing the wheel



...AND I HAVE FOUND THIS ONE WORKS A LOT BETTER.

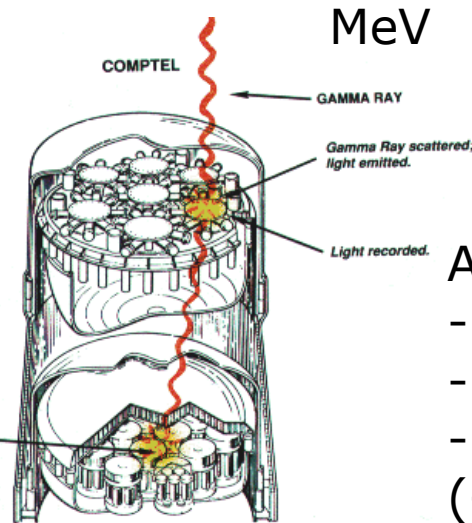
Jürgen Knödseder (Toulouse, France)

Observing gamma rays



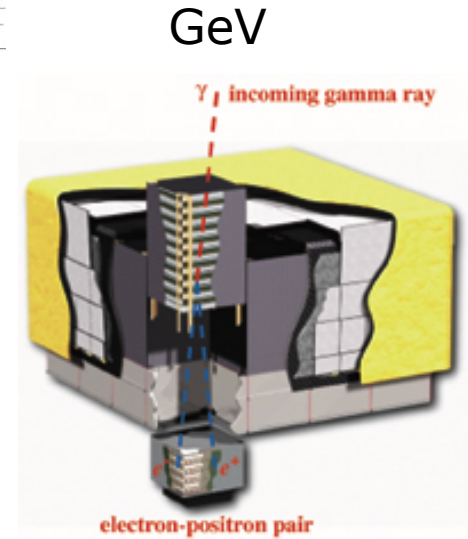
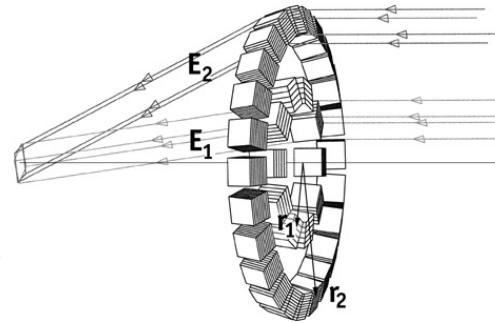
keV

Gamma Ray absorbed, light pulse emitted and recorded.



MeV

- All measure photons !
- localization
 - time
 - energy
 - (- polarization)



GeV

electron-positron pair



TeV

Analysing gamma rays



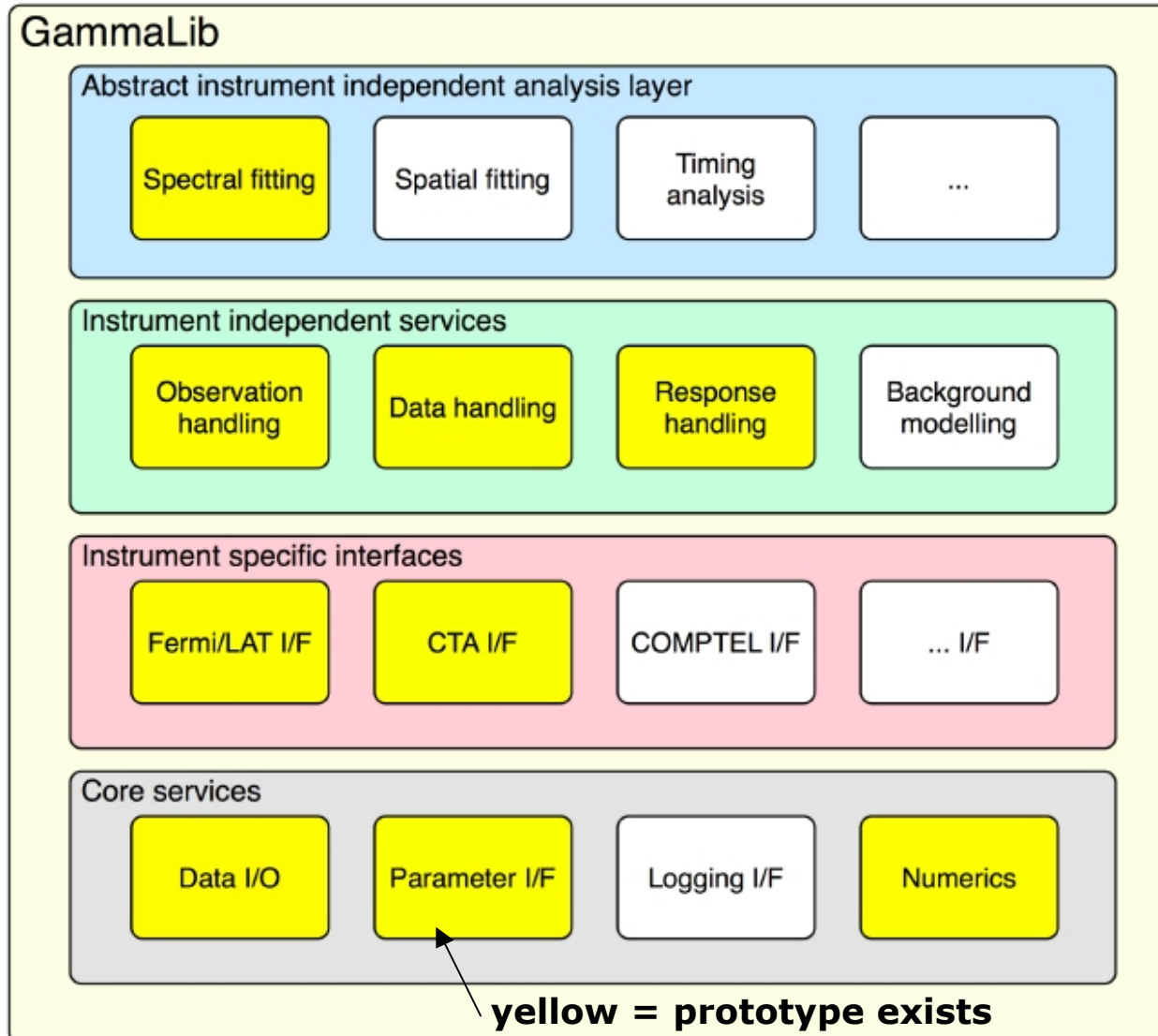
Common features

- Data are **photon based** (event lists or event histograms)
- **Background** is important or dominating (reduction techniques are crucial)
- Instruments are **complex** (time variable background and instrument properties, indirect imaging)
- Support **guest observers**

Common formats, methods and issues

- All community data are in **FITS format (OGIP)**
http://heasarc.gsfc.nasa.gov/docs/heasarc/ofwg/ofwg_recomm.html
(ftools, DS9, ...)
- Most analysis systems break down analysis tasks in **executables**
(bricks of science analysis)
(ftools like executables; analysis pipeline by chaining executables)
- Many missions use the **IRAF parameter interface**
(ftools, Chandra, INTEGRAL, SWIFT, Fermi, ...)
- Most systems rely on a **maximum likelihood optimizer** (Poisson statistics)
(INTEGRAL/SPI, Fermi, COMPTEL, ...)
- **Execution time** and **data volume** **is** an issue ...

The GammaLib concept



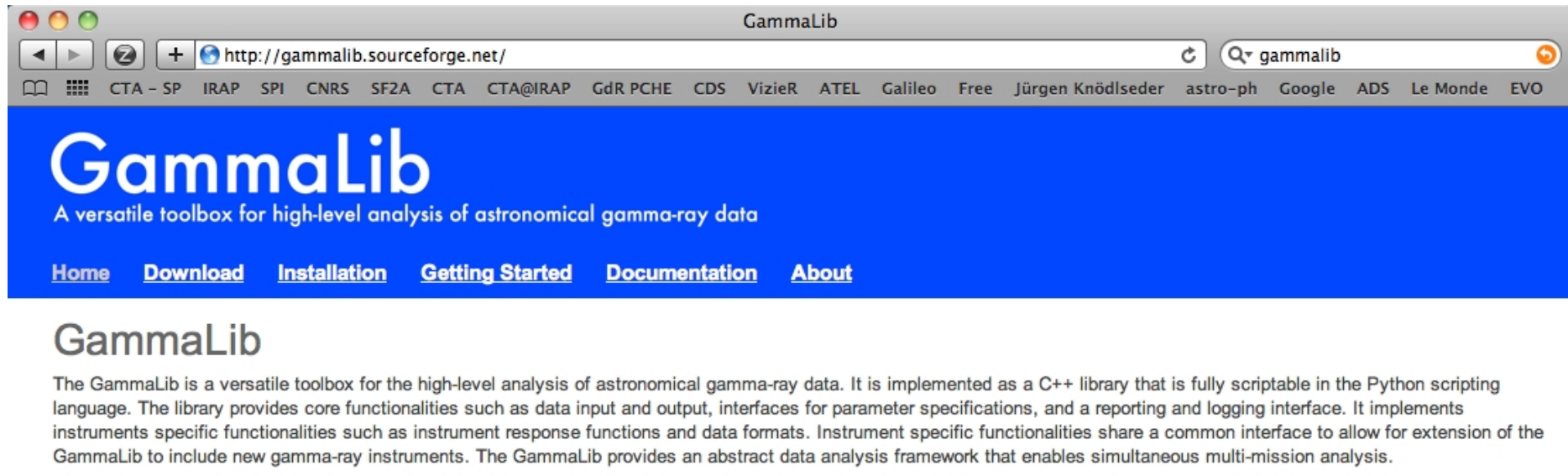
High-level analysis support (model fitting)

Generic analysis services (abstract combination of observations and events)

Instrument specific support (data content, response function, background handling)

Generic core services such as input/output in standard formats and numerical support (e.g. matrix handling/solving)

Summary

A screenshot of a web browser displaying the GammaLib website. The browser's address bar shows the URL 'http://gammalib.sourceforge.net/'. The website has a blue header with the 'GammaLib' logo and the tagline 'A versatile toolbox for high-level analysis of astronomical gamma-ray data'. Below the header is a navigation menu with links for 'Home', 'Download', 'Installation', 'Getting Started', 'Documentation', and 'About'. The main content area features a heading 'GammaLib' followed by a paragraph describing the library as a versatile toolbox for high-level analysis of astronomical gamma-ray data, implemented as a C++ library scriptable in Python. It lists core functionalities like data input/output and interfaces for parameter specifications, and instrument-specific functionalities like response functions and data formats. It also mentions an abstract data analysis framework for multi-mission analysis.

- **generic:** GammaLib core code does not depend on a specific instrument type or architecture
- **extandable:** new instrument interface implemented as derived classes
- **self-contained:** does not depend on any other library (considerable cost-reduction for maintenance; exception: cfitsio)
- **open source:** GNU licence (<http://sourceforge.net/projects/gammalib/>)
- **multi-platform C++:** should compile on any POSIX-compliant platform (32 and 64 bit)
- **API and Python scriptable** (SWIG based)