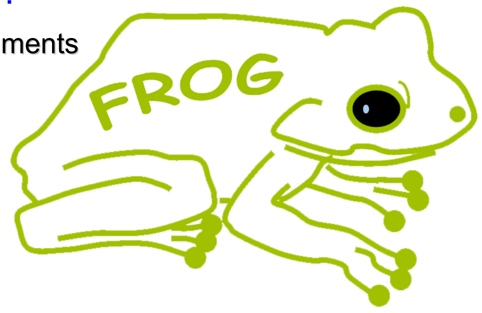
Loïc Quertenmont

November 2008

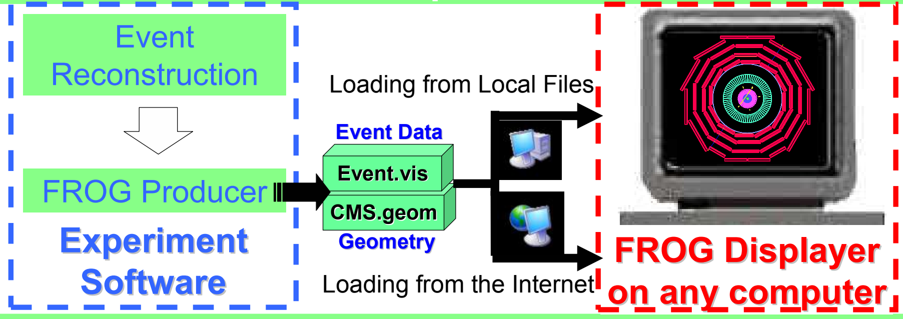
FROG
The Fast & Realistic OpenGL Event Displayer

1. FROG in a nutshell

- FROG decouples display and physics computations
- FROG is a Free Toolkit based on OpenGL and a few other common libraries
- FROG can be used easily in any experiment :
  - From very small experiments up to large LHC experiments
- FROG is written in C++
- FROG uses files in a compact binary format
- FROG is really Fast and Intuitive
- FROG has two main components :
  - **The Displayer : Used to display the experiment's geometry and event data**
  - **The Producer : The Interface between The Displayer and the experiment software!**
- FROG Displayer is compatible with **Linux** and **Windows**.
  - In principle also with **MacOS** but nobody tried yet
- FROG doesn't require HEP specific libraries like ROOT! (Good for Outreach)
  - **This allows 100% of flexibility and portability**
- FROG can also work **online** with a constant data flow !



2. The 2 Steps of FROG


Event Reconstruction

FROG Producer

Experiment Software

Loading from Local Files

Event Data

Event.vis

CMS.geom

Geometry

Loading from the Internet

FROG Displayer on any computer

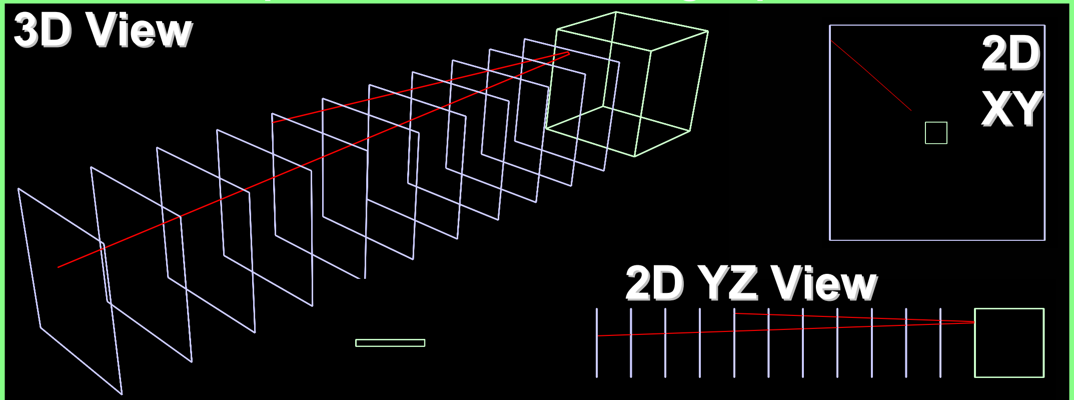
3. The Producer

- It is in general a small piece of code
- It stores on a file the information needed to draw the desired parts of the detector and/or the reconstructed objects. Only the information needed to display the object or to give additional information to the user is stored.
  - **The Files are very light !** (~100Ko / CMS Cosmic Event)
- The output files have a tree structure. A stored object can have one mother and some daughters. The display of a mother causes all the daughters to be displayed.
- The producer has to be written once and for all for a given experiment.

4. The Displayer

- It is completely experiment independent
- It reads a configuration file containing : (non exhaustive list)
  - The path of the input files (.vis and .geom)
  - Which objects should be displayed
  - Styles and colour of objects (or groups of objects)
  - Viewing parameters, like the type (2D, 3D), the size, …
  - The (physics) thresholds to be used.
  - The screenshot format (png, ps, eps, pdf, tex, …)
- It contains a menu useful to toggle on/off object display and also to list available objects (with their properties)
- It can download input files from the internet (http, ftp)
- It is so fast that it can be used live in a meeting and also as a screensaver !
- No particular hardware requirements
  - Any recent (<5 years) VGA card is enough
- Displayer Package Size < 4Mo! (it is enough to display events!)
- Performance on a AMD3800+ RAM=2Ghz Geforce7600GT
  - CMS Cosmic events :
    - **Initialisation time ~3s | Next event time << 1s**
    - **FramesPerSecond > 500FPS | Memory used < 80Mo**

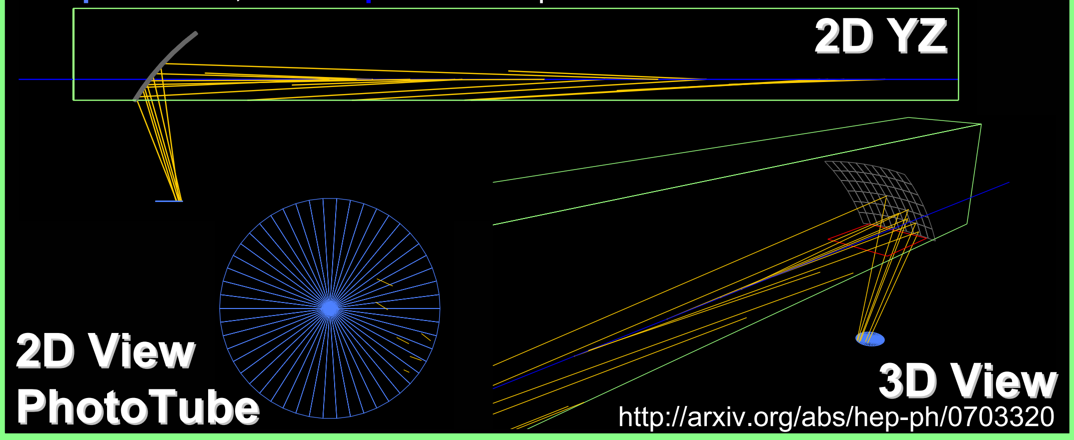
5. Example : a fictitious tracking experiment



- This fictitious experiment contained in the FROG package is used as a tutorial to learn how to create a FROG Producer for a specific experiment
- It is composed of 10 tracking layers + a block that reflects the beam

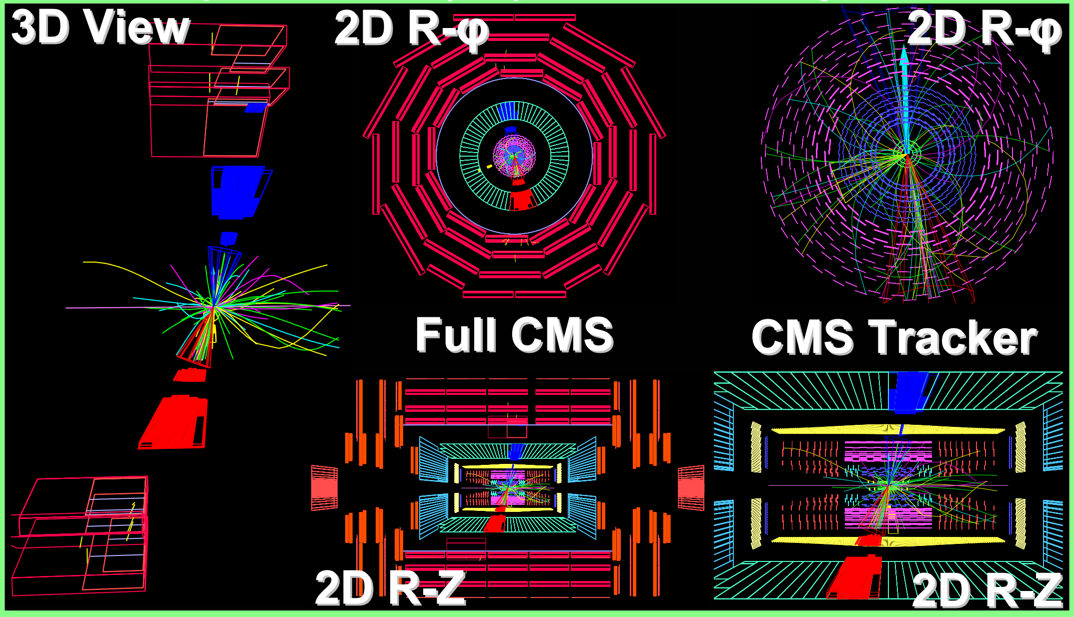
6. Example : Gastof : Ultra-fast ToF forward detector

- A proton enters a **gaseous detector** and creates **photons** by the cherenkov effect. The photons are reflected by a curved mirror and focused on a **phototube**, and the proton escapes!

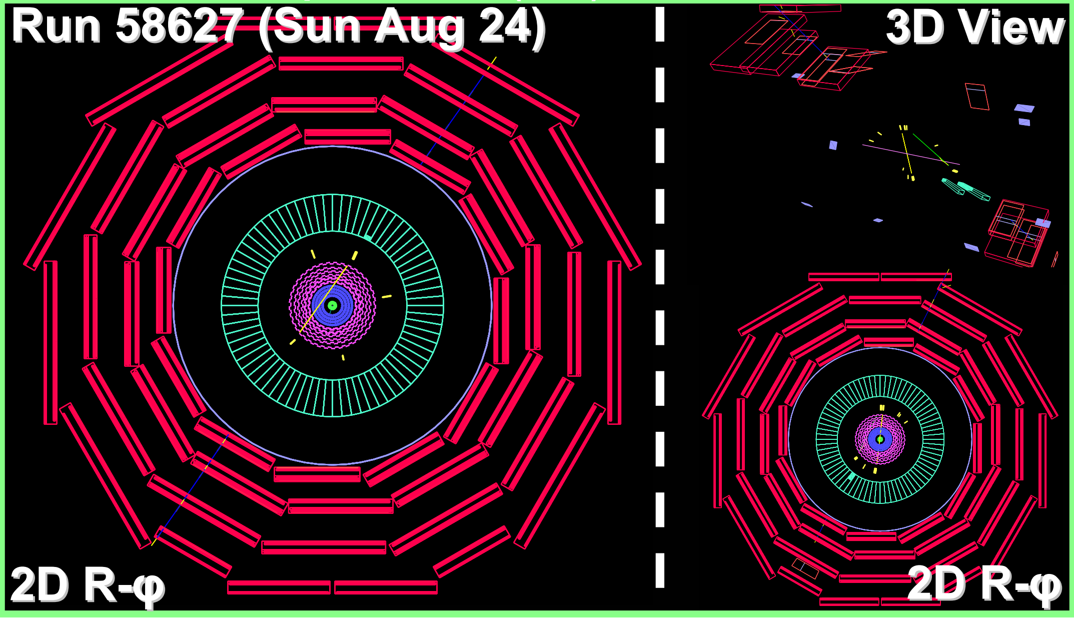


http://arxiv.org/abs/hep-ph/0703320

7. Example : CMS : a (MC) QCD 3.5 TeV di-jet event



8. Example : CMS : (real) cosmic events



http://projects.hepforge.org/frog/

or just Google for "FROG Displayer"