

CBMROOT

29.01.13

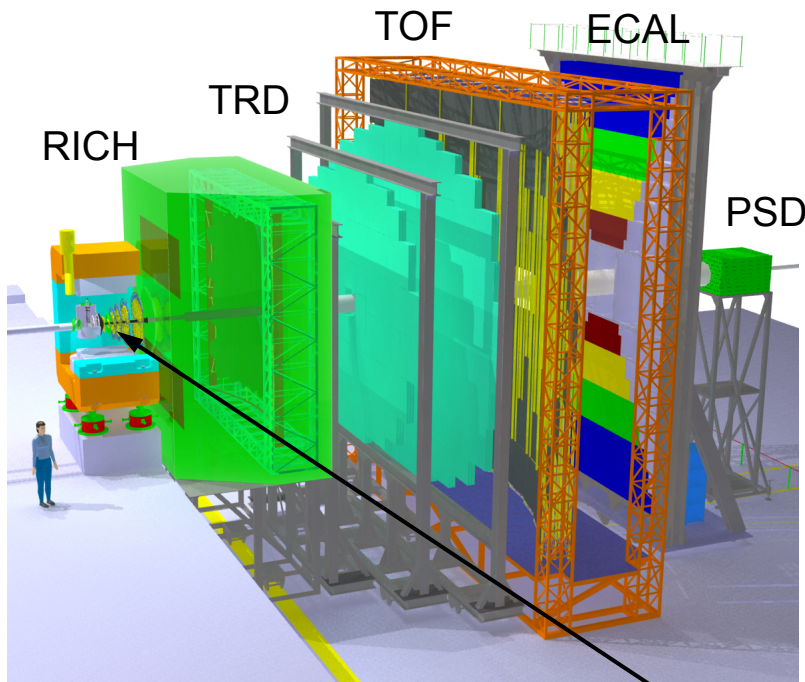
Alice-Fair-Meeting

Experiment without Hardware Trigger

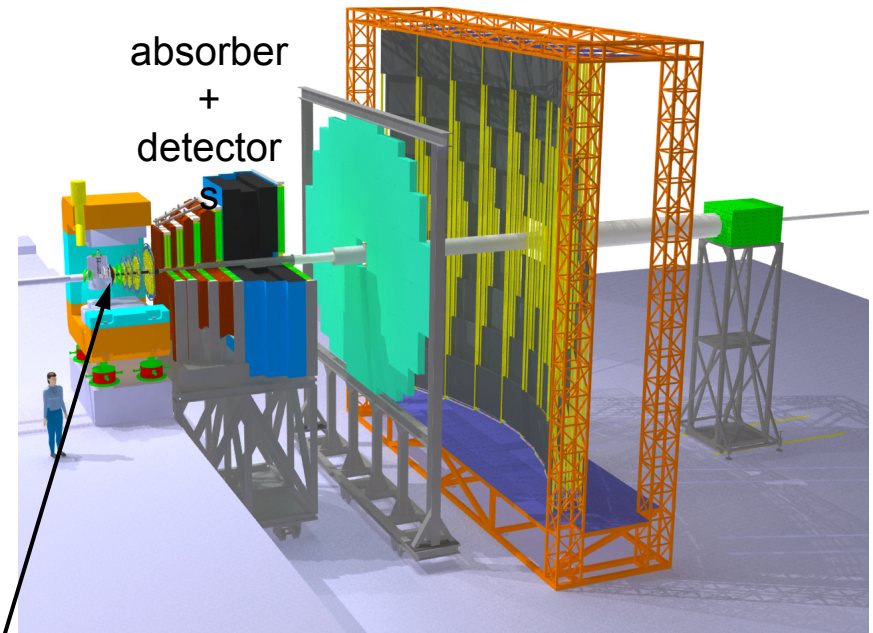
CBM

2

Electron + Hadron setup



Muon setup



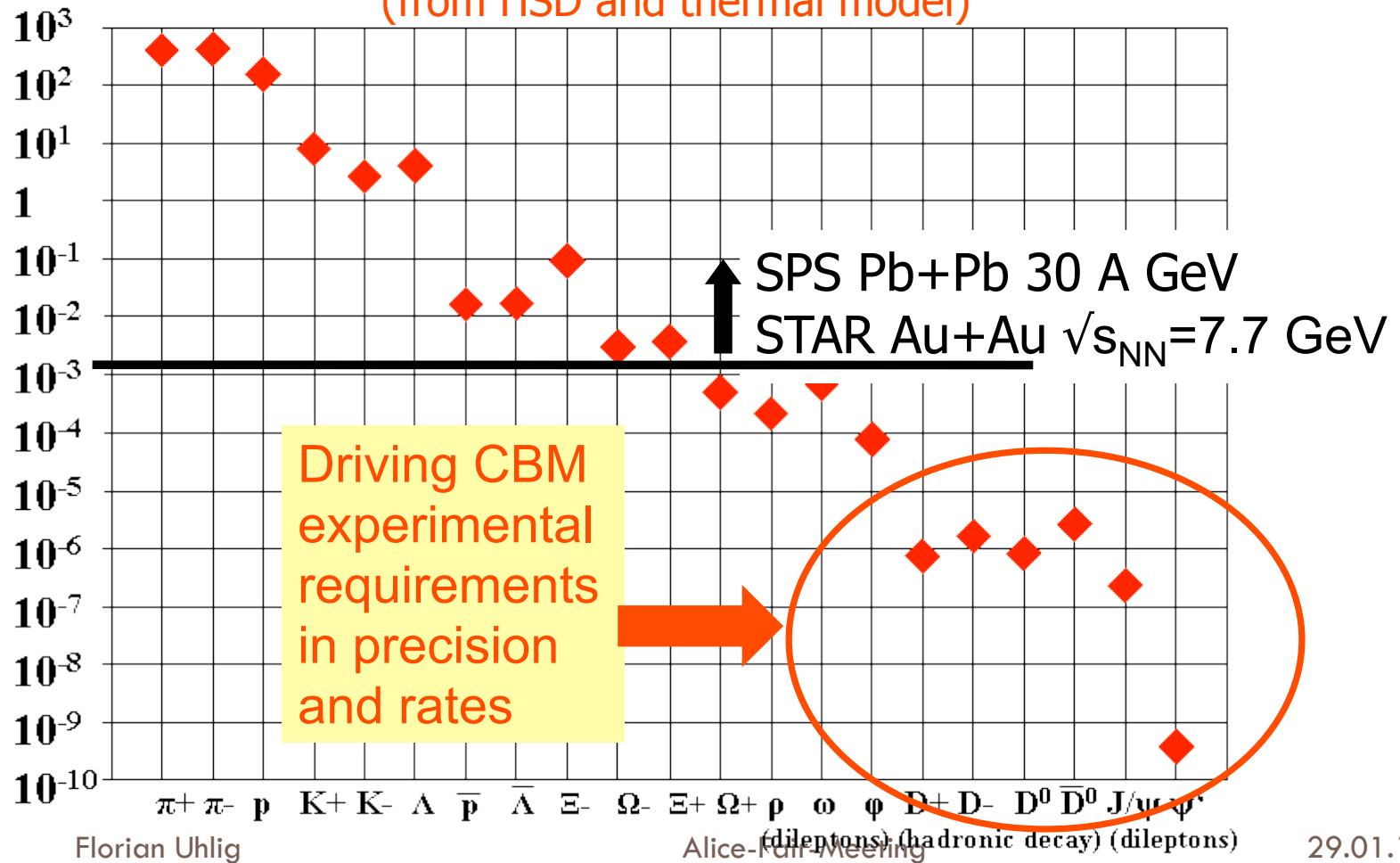
STS+MVD

Experimental Challenge

3

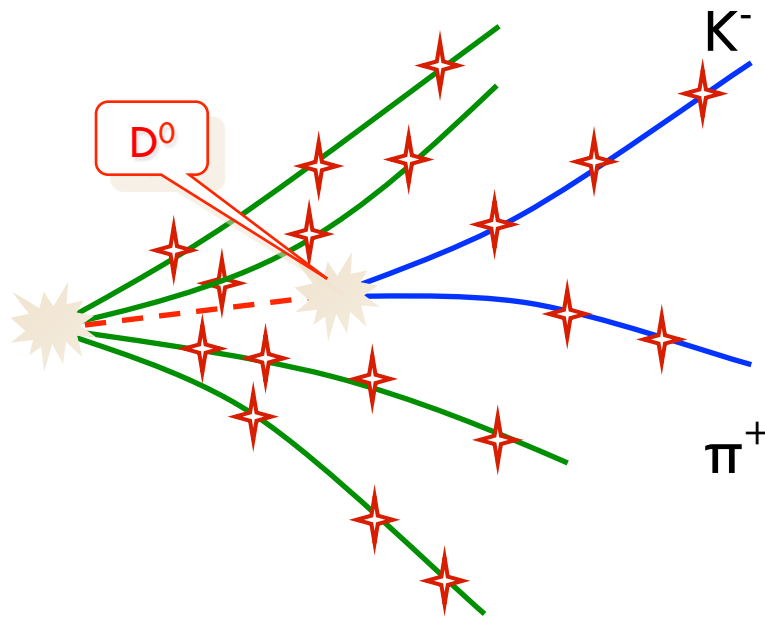
Particle multiplicity x branching ratio
for min. bias Au+Au collisions at 25 A GeV
(from HSD and thermal model)

$M \times BR$



Experimental Challenge

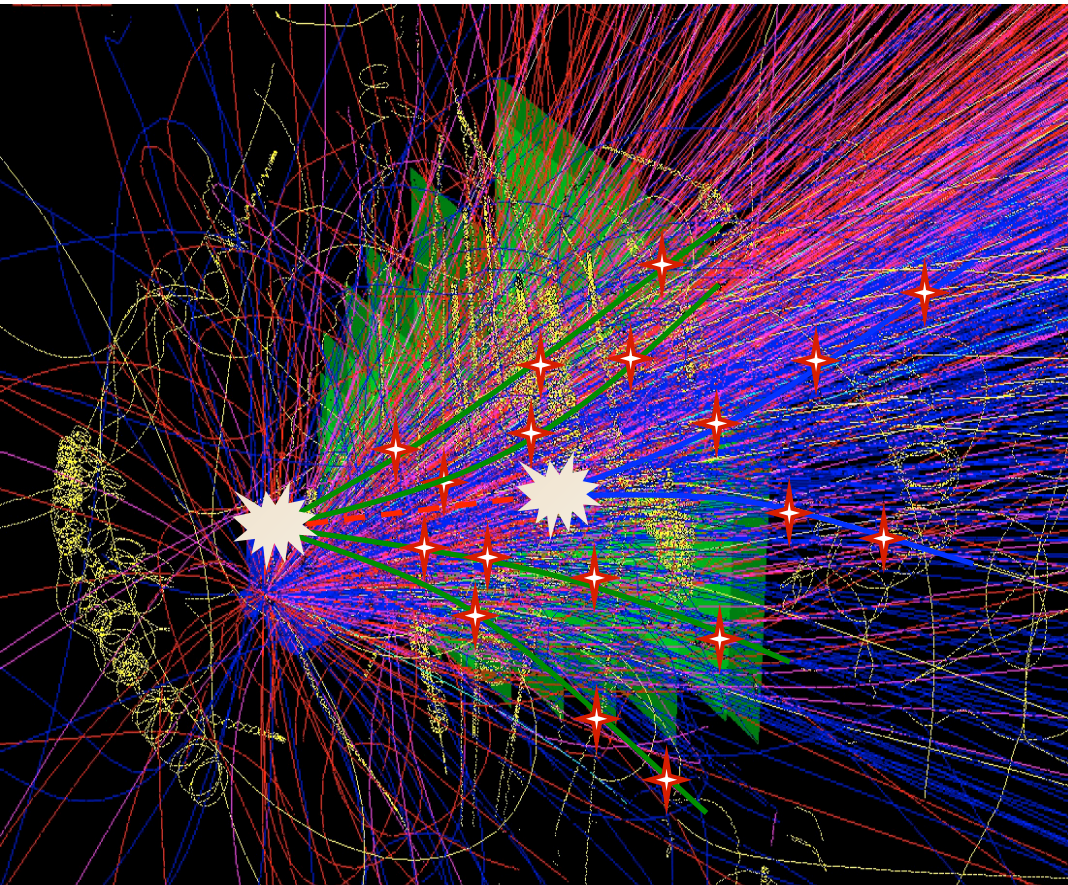
4



- Looking for rare probes require events rates up to 10^7 per second
- Complicated trigger signature
- Searching for secondary vertex requires reconstruction of a large part of the event

Experimental Challenge

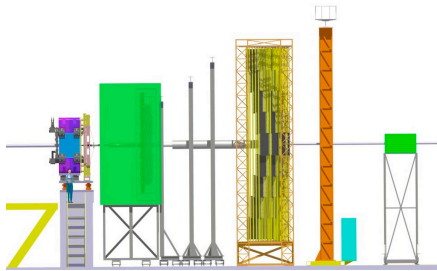
5



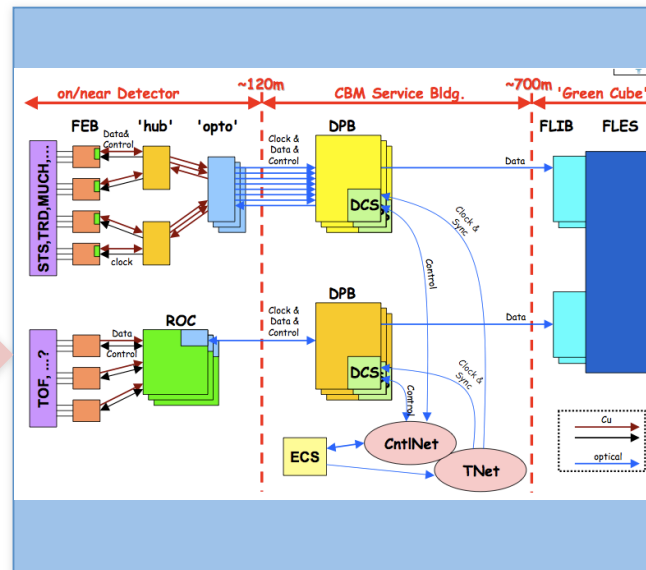
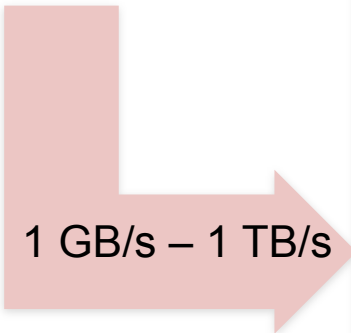
- Looking for rare probes require events rates up to 10^7 per second
- Complicated trigger signature
- Searching for secondary vertex requires reconstruction of a large part of the event
- Central events have up to 1000 charged particles inside acceptance
- Conventional hardware trigger not feasible: no dead time allowed
- Self-triggered autonomous front-ends pushing time-stamped data forwards to DAQ

Challenge

6



CBM FEE

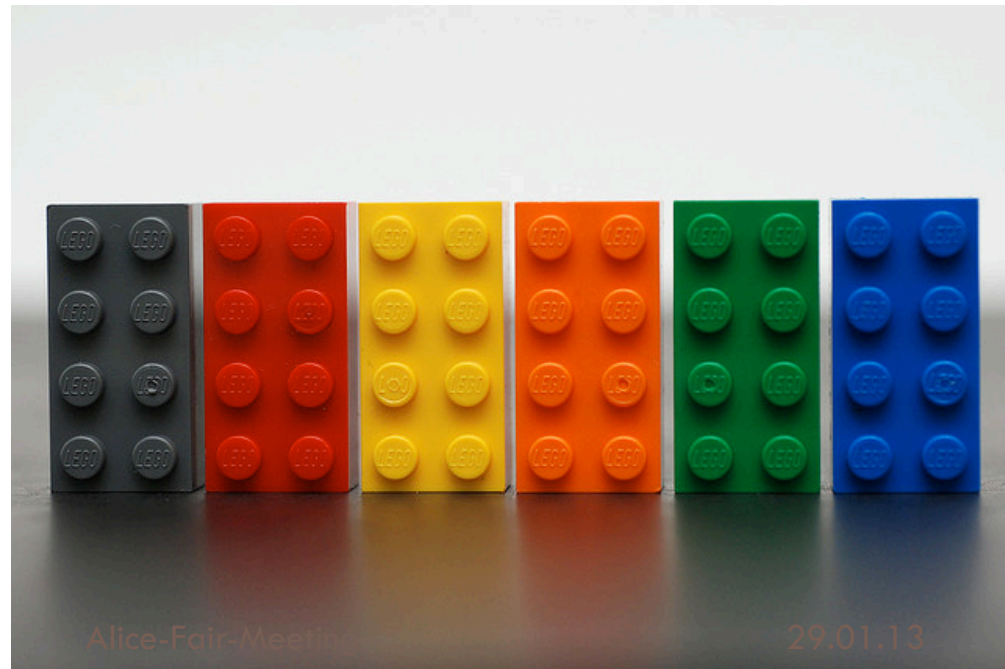


Mass Storage



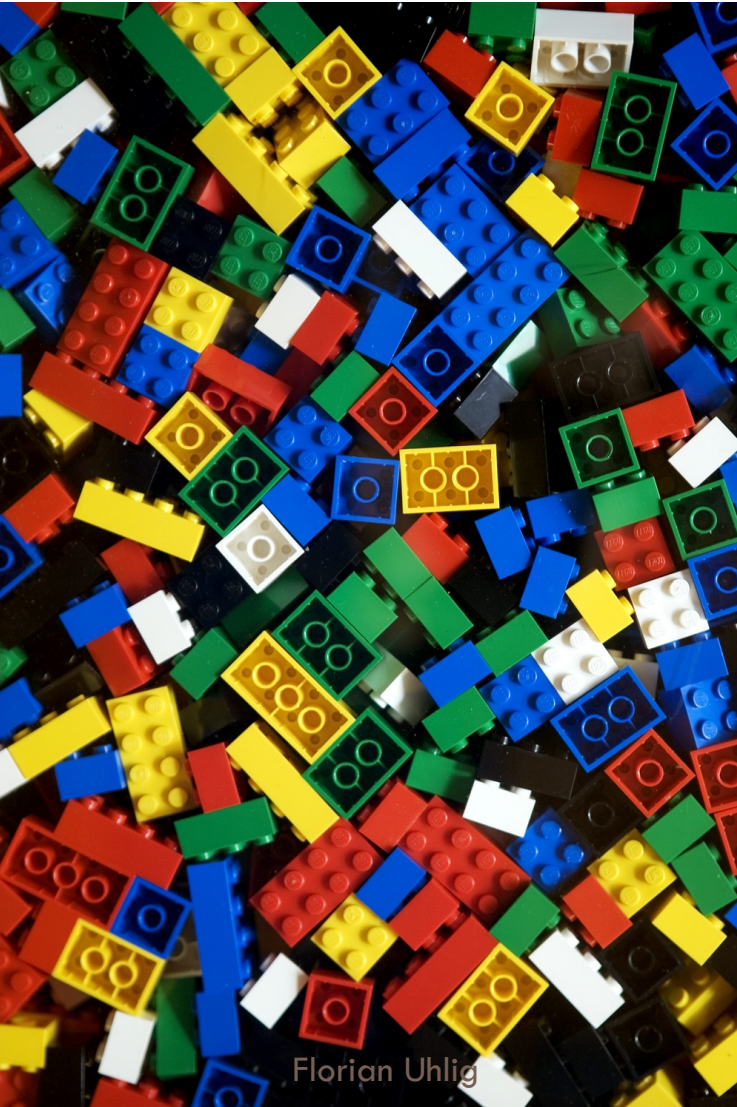
Triggered Experiment

7



Experimental Task Event Builder

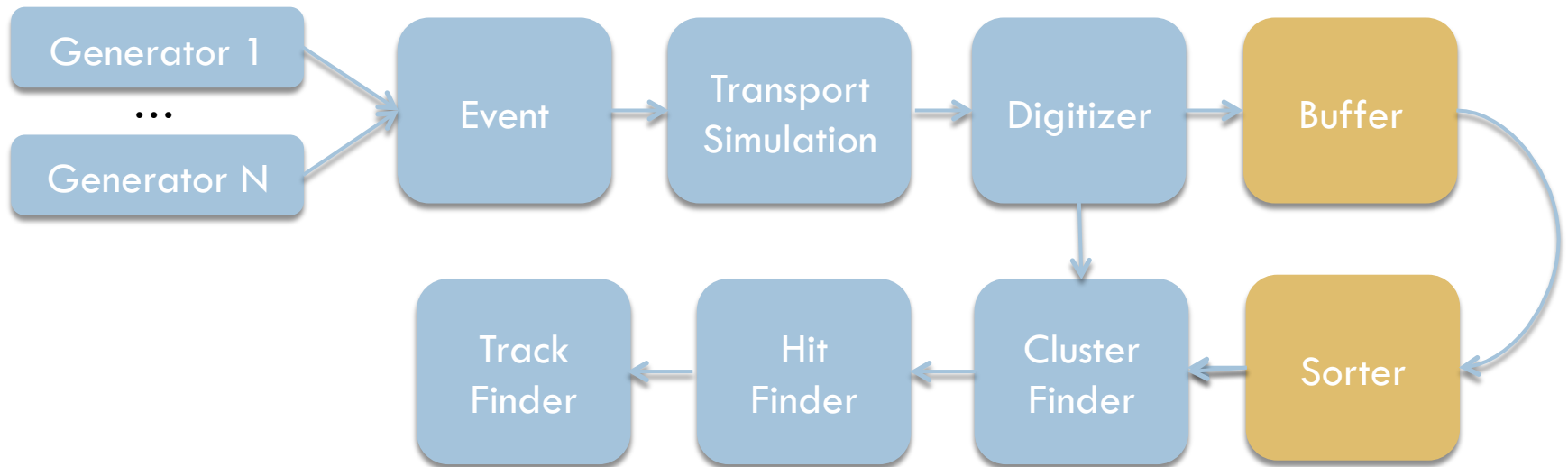
8



Time based simulation

9

- Part of the FairRoot framework
- Provide functionality for the tasks “event mixing” in the digitization stage and “time sorting” in the reconstruction stage



Hottest Topics in CbmRoot

10

- Manpower
 - ▣ Only 10 people commit more then 90% of the code.
- Code Quality
 - ▣ How to test the code base?
 - ▣ How to guarantee a good code quality?
- Online \neq Offline ?
- C++11
 - ▣ Which functionality to use?
 - ▣ When to move?

Backup Slides

11

FairRoot

12

- Framework for simulation, reconstruction and data analysis
- Very flexible
 - ▣ No executable
 - Use plug-in mechanism from Root to load libraries only when needed
 - Use Root macros to define the experimental setup or the tasks for reconstruction/analysis
 - Use Root macros to set the configuration (Geant3, Geant4, ...)
 - ▣ No fixed simulation model
 - Use different simulation models (Geant3, Geant4, ...) with the same user code (VMC)

FairRoot cont.

13

- Very flexible
 - ▣ No fixed navigation engine / geometry management
 - Use Root TGeoManager for geometry management
 - Geometry can be defined using different input formats
 - ASCII files in format inherited from HADES
 - Root files
 - Defined directly in the source code
 - Use TEvent as base for general event display
 - Geometry is described once. Then it can be converted (VGM) to choose between different MC's and different navigations
 - G4 native geometry and navigation
 - G4 native geometry and Root
 - ...

FairRoot cont.

14

- Very flexible
 - ▣ No fixed output structure
 - Use a dynamic event structure based on Root TFolder and TTree which is created automatically
 - Depend on registered data classes
 - Data output possible after each step
 - Simulation and reconstruction can be done in one go or in several steps
 - ▣ Use runtime data base
 - Developed for the HADES experiment
 - Decouple parameter handling in FairRoot from parameter storage
 - runtime data base IO to/from
 - ASCII files
 - Root files
 - Data base

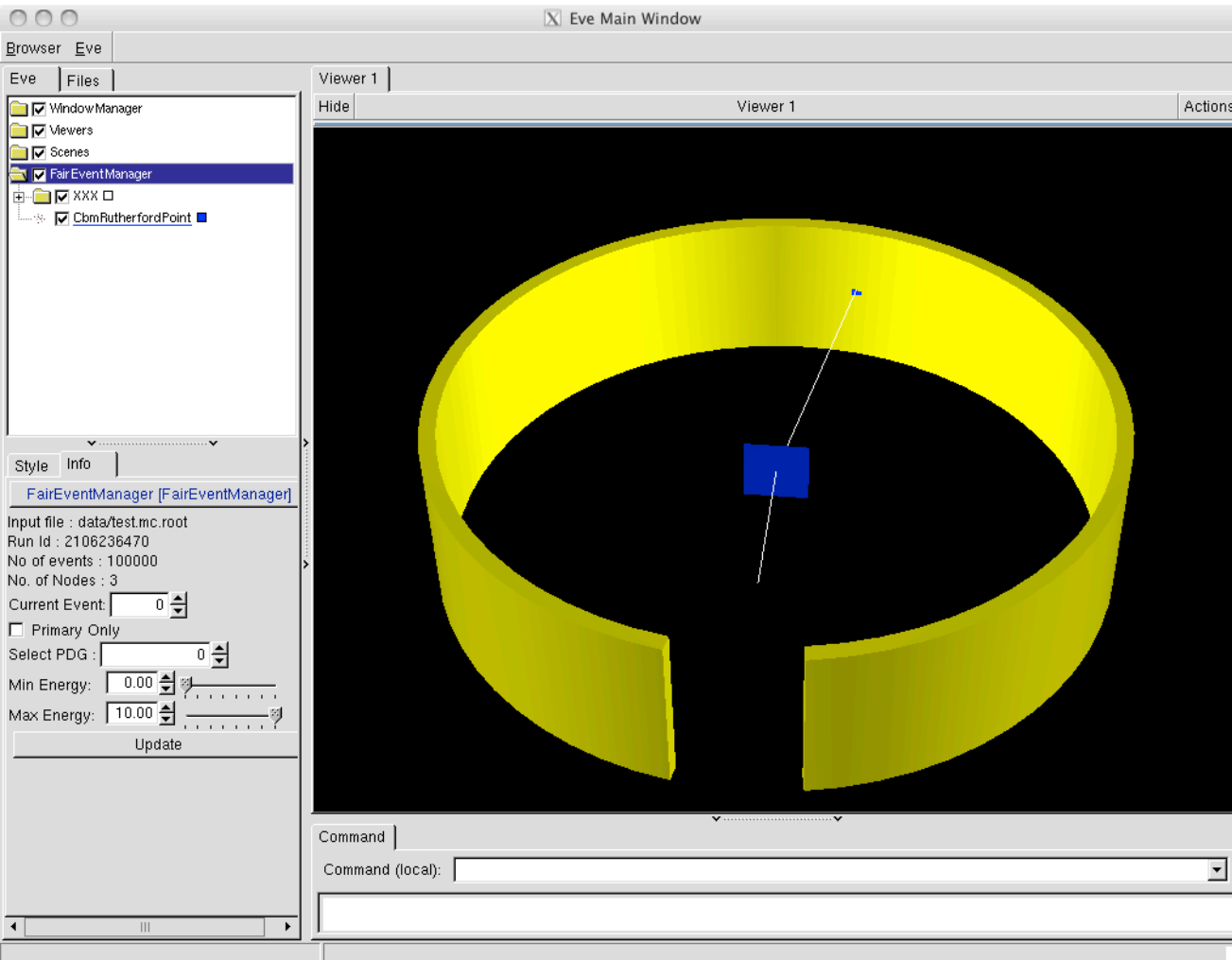
Example: Rutherford Experiment

15

- Scattering of 5MeV alpha particles at a $2 \mu\text{m}$ gold foil
- Unexpected large scattering angles observed
- Implementation using FairRoot needs
 - ▣ 600 lines of c++ source code created mostly automatically
 - ▣ 60 lines of code for the build system
 - ▣ 200 lines of code for the steering macros
 - ▣ 70 lines of code for the geometry and media definition

Rutherford Experiment

16



- Change experimental setup
- Change material properties
- Change simulation engine
- Change physical processes

- Usable in lectures or practical work??