Experiment Frameworks

GSI

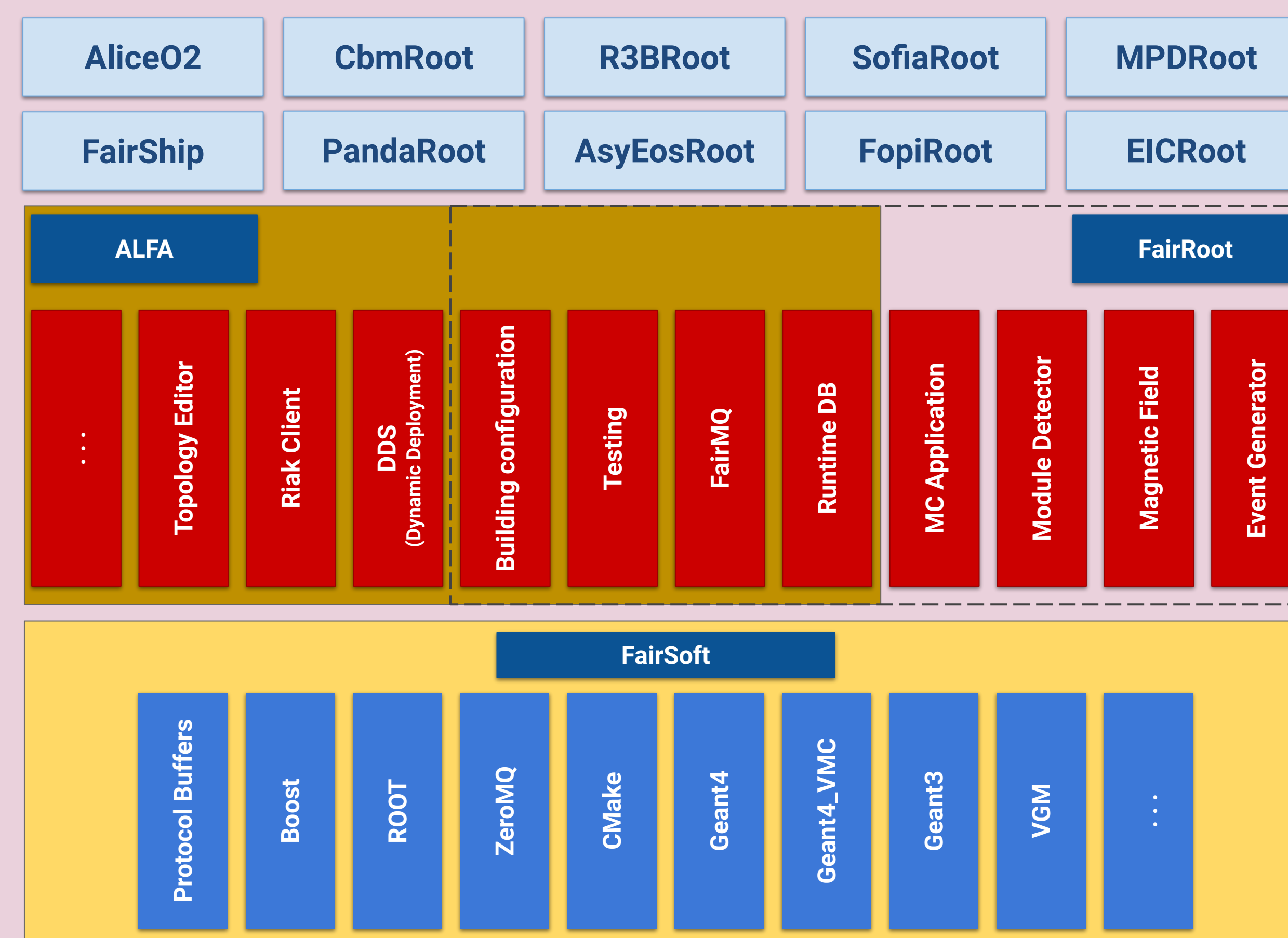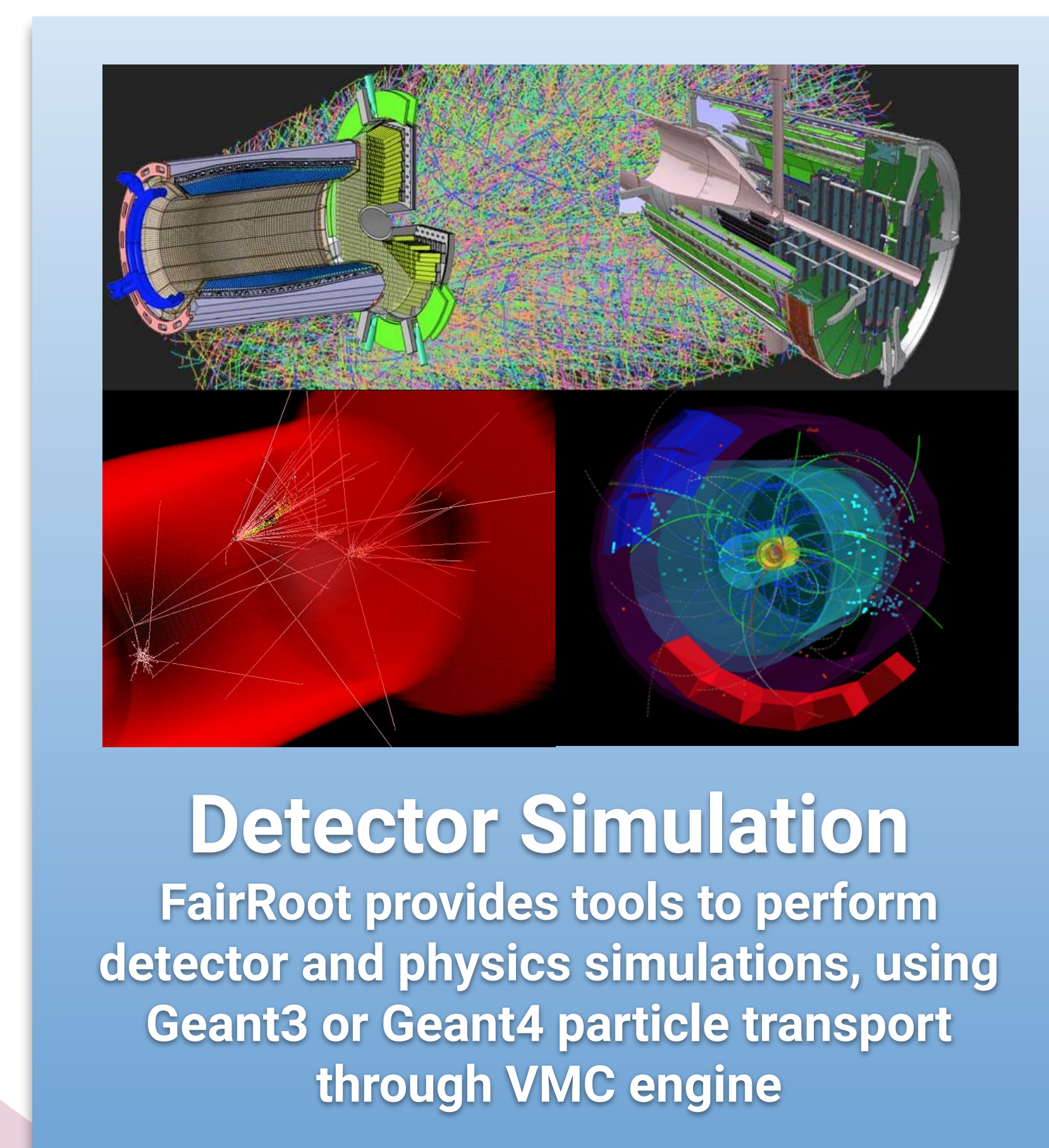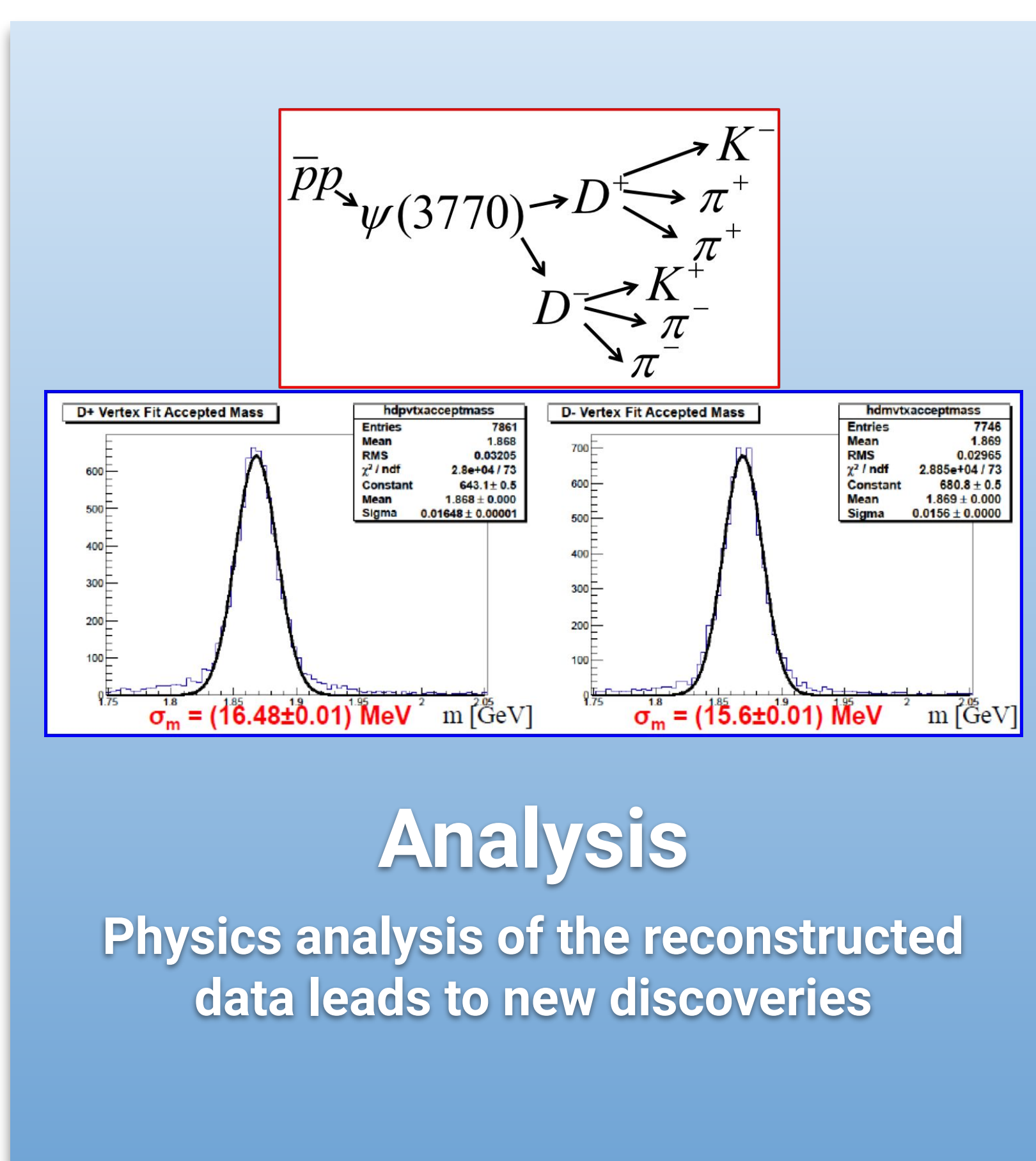## ALFA / FairRoot framework

- **Common system for simulation, reconstruction, and analysis**
- **Configuration tools**
- **Management and monitoring tools**

- **A data-flow based model**
- **Unified access to configuration parameters and databases**
- **Generic data transport layer**

Analysis
Physics analysis of the reconstructed data leads to new discoveries

$$\overline{p}p \xrightarrow{\psi(3770)} D \rightarrow \begin{array}{c} K^- \\ \pi^+ \\ \pi^+ \end{array}$$

Reconstruction
Data analysis includes clusters and hits finding, tracks finding and fitting, Cherenkov ring reconstruction, particle identification

Detector Simulation
FairRoot provides tools to perform detector and physics simulations, using Geant3 or Geant4 particle transport through VMC engine

| AliceO2 | CbmRoot | R3BRoot | SofiaRoot | MPDRoot |
| FairShip | PandaRoot | AsyEosRoot | FopiRoot | EICRoot |

ALFA / **FairRoot**

Topology Editor · Riak Client · DDS (Dynamic Deployment) · Building configuration · Testing · FairMQ · Runtime DB · MC Application · Module Detector · Magnetic Field · Event Generator

FairSoft

Protocol Buffers · Boost · ROOT · ZeroMQ · CMake · Geant4 · Geant4_VMC · Geant3 · VGM · ...

Dataflow-driven Architecture
User code is organized into task topologies defined by their data inputs and outputs. The framework takes care of inter-task communication, File I/O, and task execution.

Unified Online/Offline
Whether you run on a laptop, a batch farm or a online farm, the same framework building blocks are used.

Concurrency
Multi-process/-threaded architecture, where entities communicate via generalized high-performance message queue system (FairMQ).

FairMQ
FAIRMQ TOPOLOGY (example)

SAMPLER · PROCESSOR · SPLITTER · PROCESSOR · MERGER · SINK · SAMPLER · PROCESSOR

Communication patterns: PUB-SUB, PUSH-PULL, REQ-REP, …

Generic transport layer (ZeroMQ, RDMA, shared memory) through which multiple simultaneously running processes pass messages within a node and across node boundaries efficiently.

Dynamic Deployment System

Detectors · 250 FLPs · Switching Network · 1500 EPNs · Storage Network · 33 Storage Servers · Storage

1.2 TB/s · 500 GB/s · 90 GB/s
8100 Read-out Links · Input: 250 ports Output : 1500 ports · 1500 x 60MB/s

automates and significantly simplifies a deployment of user defined processes and their dependencies on any resource management system

our users: ALICE · CBM · panda · R3B · SHiP (Search for Hidden Particles) · FOPI

HELMHOLTZ