

slicPandora:
slic + pandoraPFANew

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(SLAC)

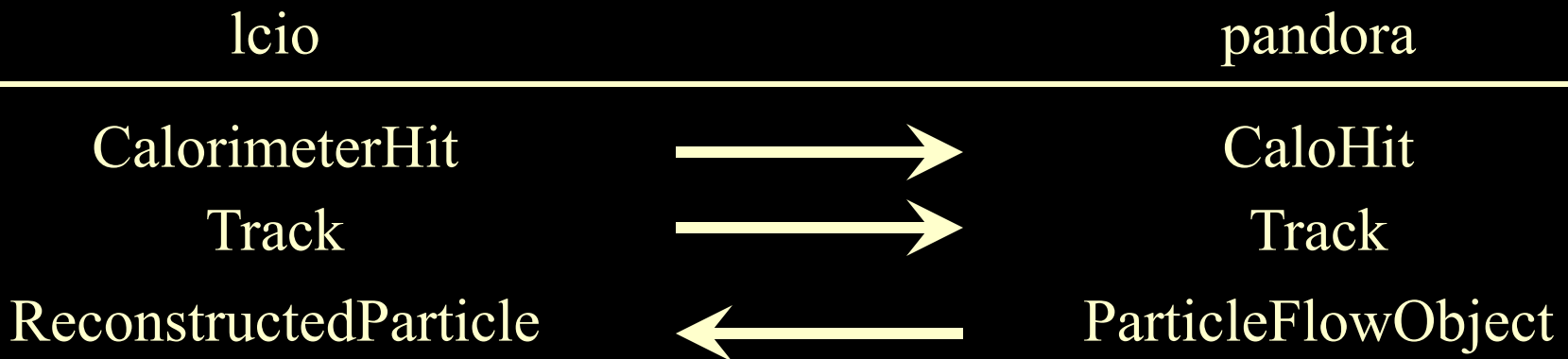
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slic + PandoraPFANew

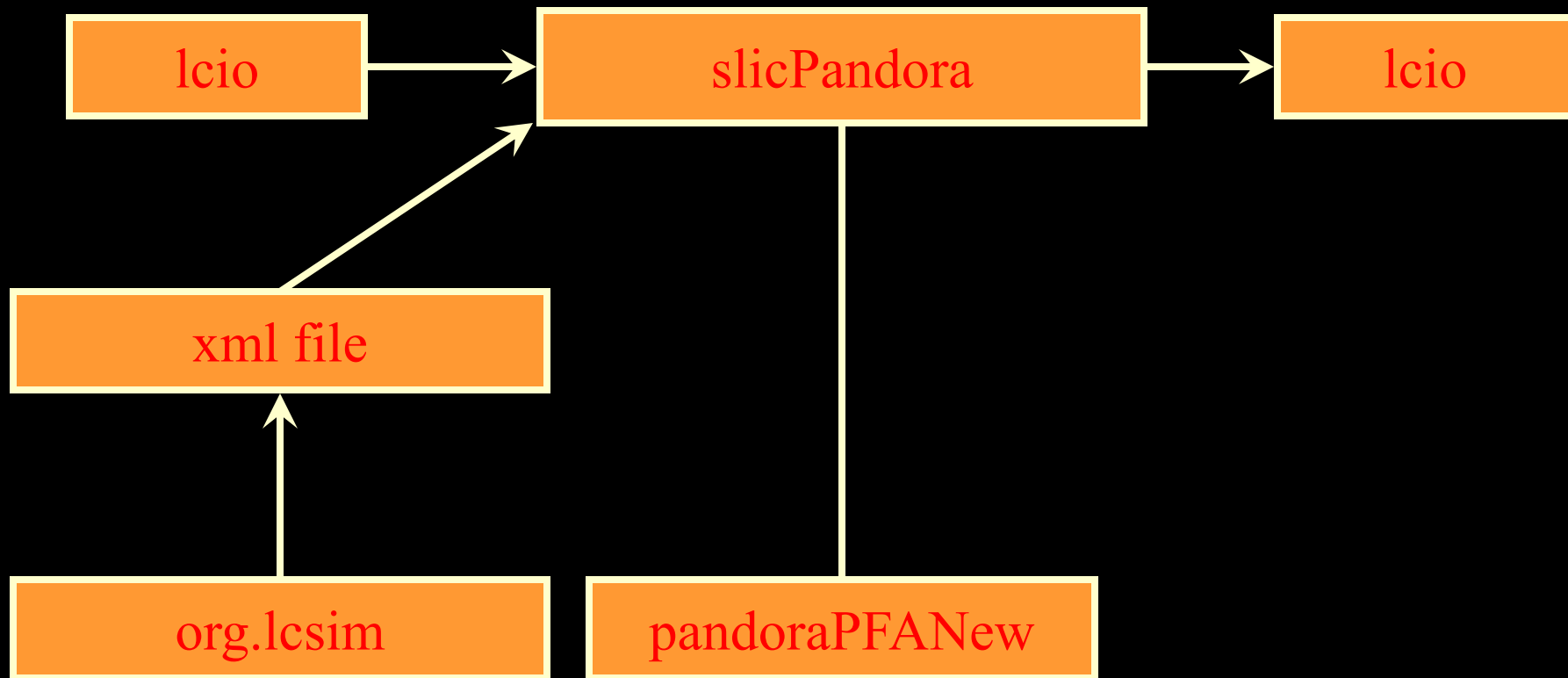
- PandoraPFA was rewritten to make it modular and framework & detector independent.
- We present a binding between the slic LCIO output and the compact.xml geometry description and this new package.
- Developed and implemented an xml format for geometrical information needed by pandoraPFA.
- Developed C++ front end to read lcio files + geometry.xml + pandoraPFA.xml and process events.

Architecture

- Package provides access to events processed with slic (not necessarily SiD).
- Access to the detector geometry is via xml.
 - Parse compact.xml natively to produce the information required by pandoraPFA.
 - Use existing tinyxml parser bundled with pandoraPFA.
- Access to the event is through lcio.



Architecture

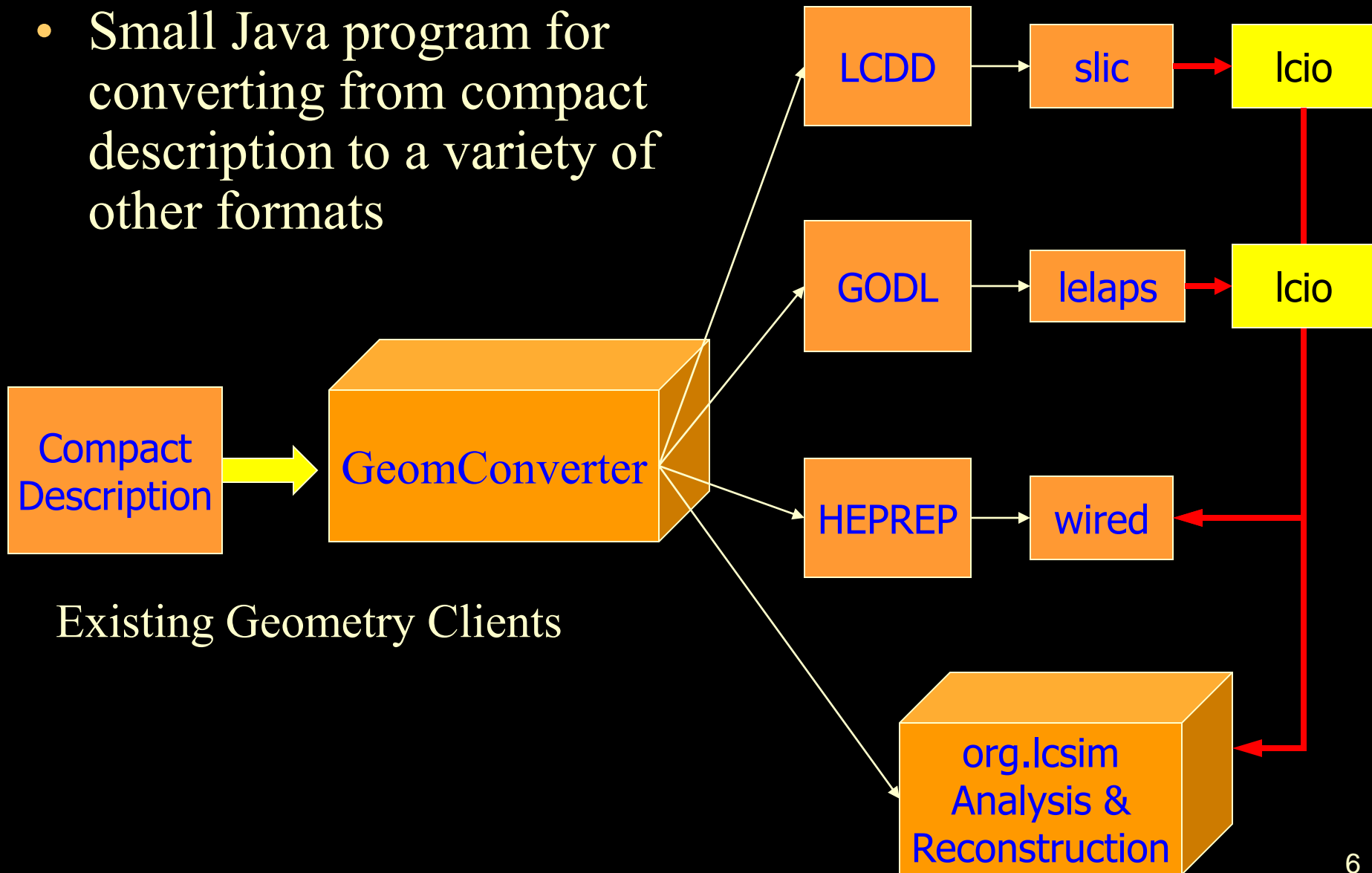


Pandora Geometry Format

- Generated by GeomConverter from compact.xml
 - ~500 Java lines of code
- Adds additional extension classes/objects to basic Pandora geometry API
- Calorimeters
 - type
 - envelope parameters
 - cell sizes
 - hit collection
 - ID description (layer, etc.)
 - layer
 - radiation/interaction lengths
 - cell thickness
 - sampling fractions (basic, EM, HAD)
- Coil / B-field
- Tracking envelope

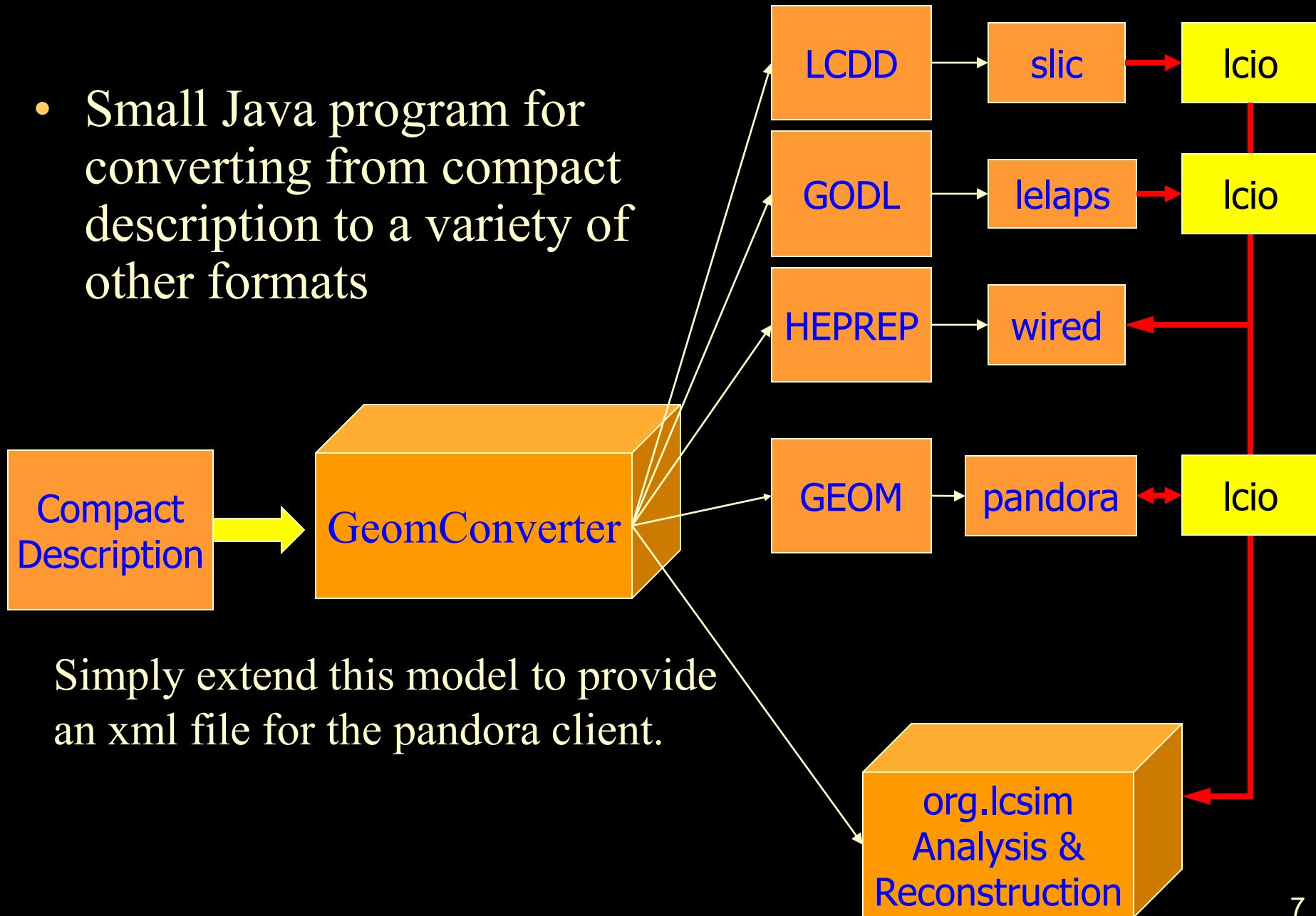
GeomConverter

- Small Java program for converting from compact description to a variety of other formats



GeomConverter

- Small Java program for converting from compact description to a variety of other formats



Simply extend this model to provide an xml file for the pandora client.

slicPandora

- Provides interface between slic output and lcsim geometry and PandoraPFA reconstruction.
 - ~2500 lines of C++ code
 - xml format defines geometry and additional required information, e.g. sampling fractions
- Input Tracks and TrackStates provided by org.lcsim track reconstruction.
- Tracks + CalorimeterHits fed to pandoraPFA.
- Pandora ParticleFlowObjects (PFO) converted to LCIO ReconstructedParticle.

slicPandora Testing

- Developed a number of detectors using analog scintillator readout in the hadron calorimeters
 - will investigate digital readout when the code binding has been fully debugged and understood.
- Focusing on analysis of single particle response.
- Using tagged, stable version of pandoraPFA
 - will move to head version before production.
- Using pandoraPFA as a “black box”
 - will investigate tuning parameters once binding verified

Optimization Tools

- Code being written to automate standard procedures needed for new detectors:
 - Sampling Fraction determination
 - MIP most-probable-value determination
 - EM shower sampling fractions for Ecal, Hcal, Barrel, Endcap
 - Had shower sampling fractions for Ecal, Hcal, Barrel, Endcap
 - EM shower covariance matrices for particle ID
 - Standard energy and position resolution plot generation.

Optimization Data Sets

- Single μ^\pm , γ , K^0_L , at fixed angles and energies for sampling fraction determination.
- Single particles (as above, plus e^\pm , π^\pm , K^\pm , p^\pm , ...) at variable angles and energies to study clustering and tracking efficiency and resolution.
- Simple resonances (π^0 , η , ρ^\pm) to study efficiency and resolution of two-particle states.
- Single quarks at fixed energies to study jet energy resolution (u,d,s).
- Single Z^0 at fixed energies to study dijet mass resolution.

Single Muon Test

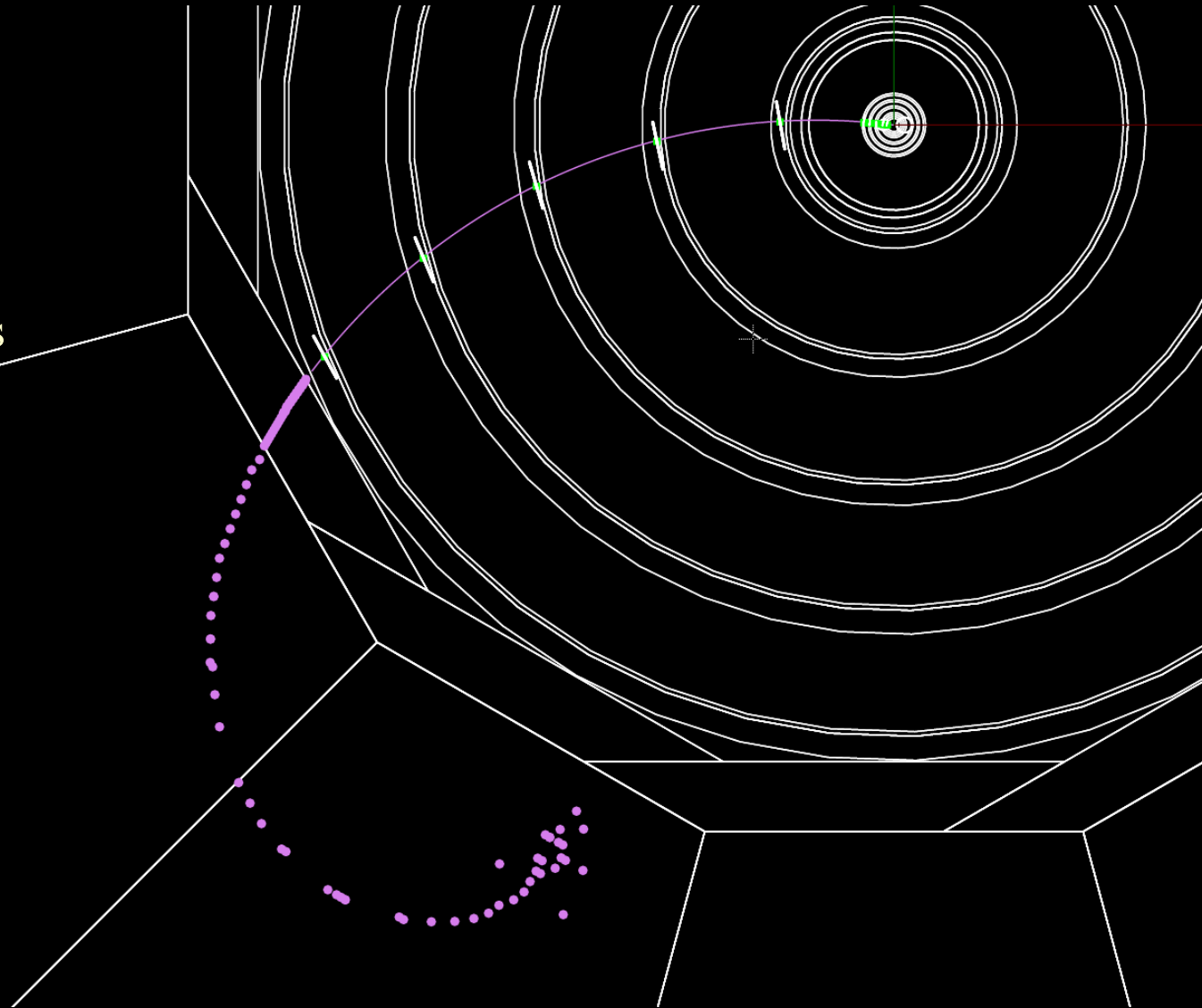
Single PFO tests:

Track and TrackState
definition

Cluster association
across calorimeter types
(EM & Had) and across
module boundaries.

Track Cluster
association.

MIP sampling fraction
and hit isolation
calculation.



Clustering across modules

Efficiency of cross module clustering.

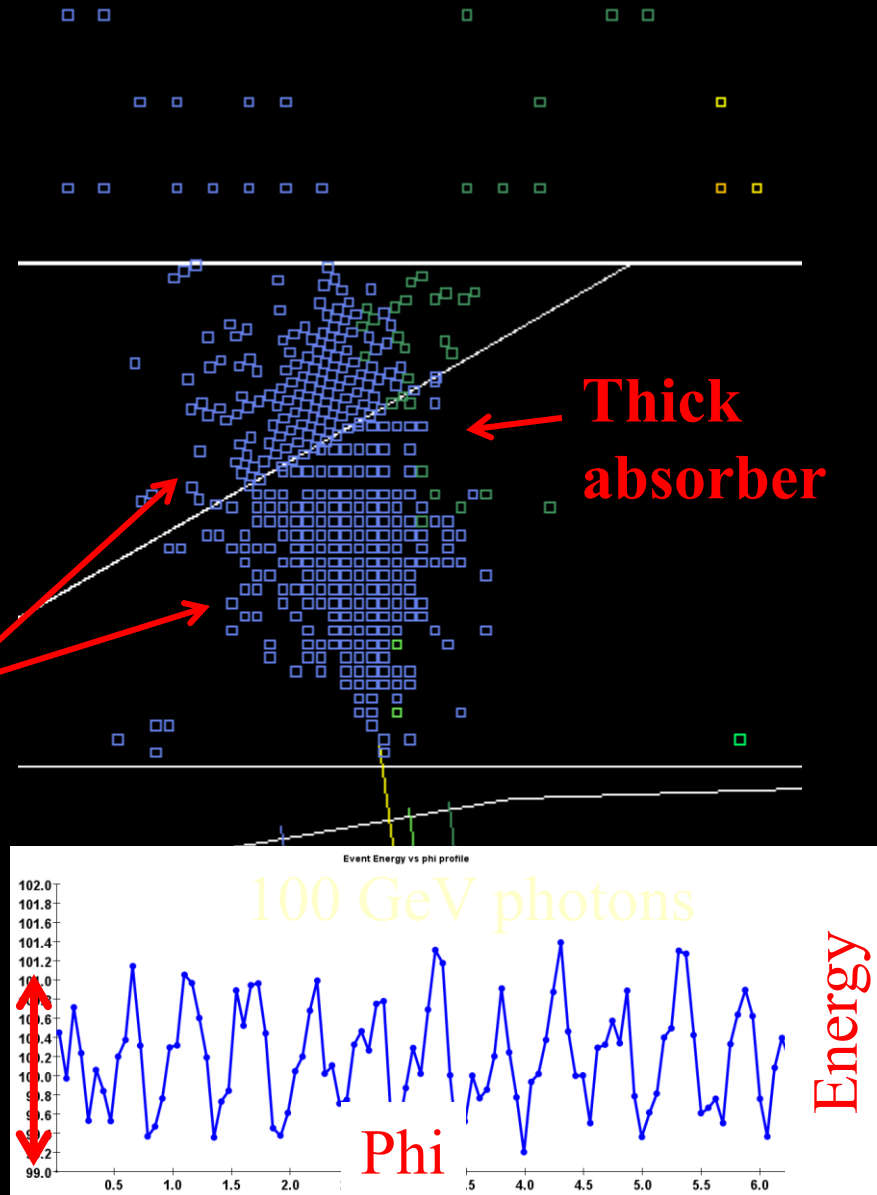
- geometry

Particle ID efficiency as a function of phi.

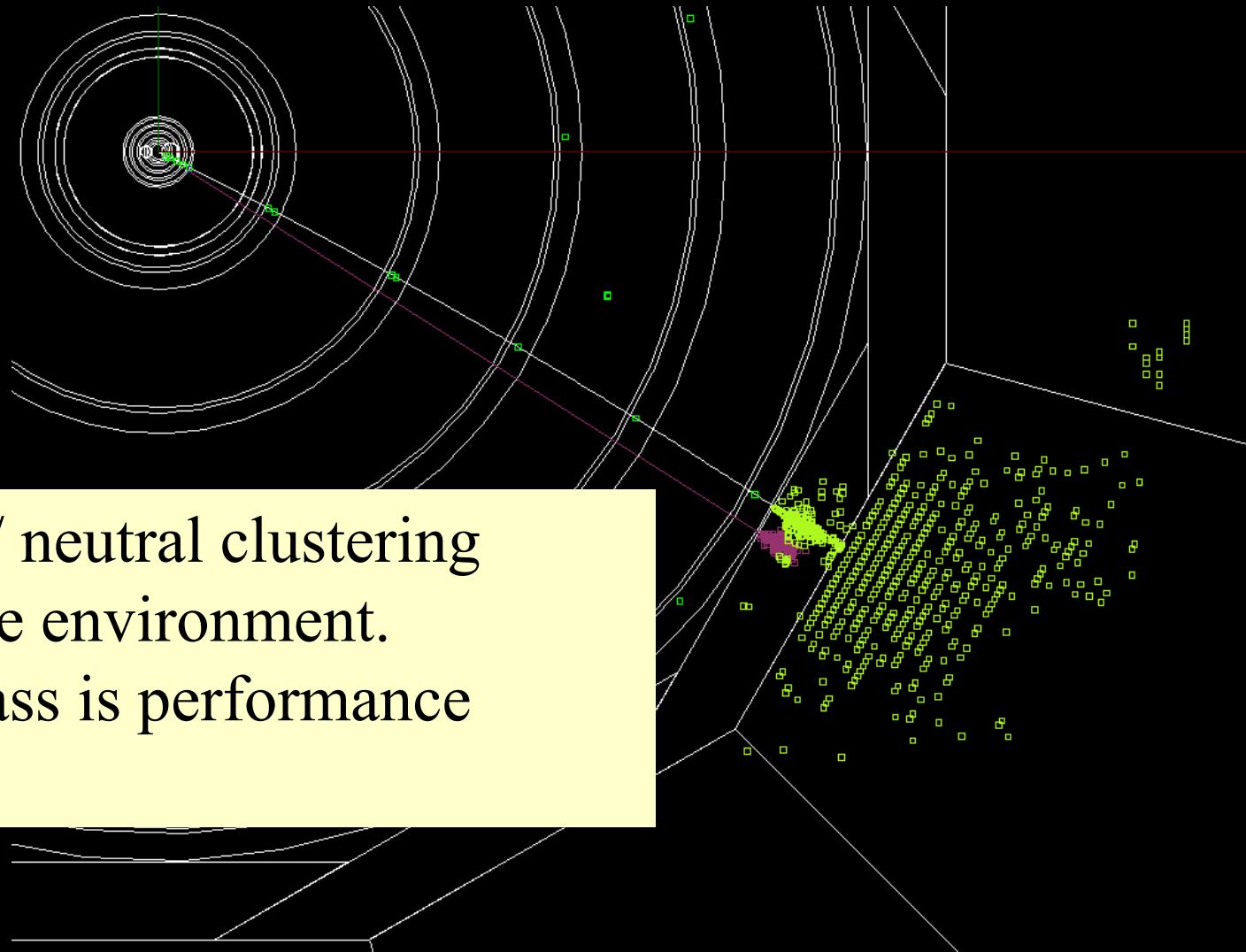
- shower shape

Energy resolution as a function of phi.

- sampling fractions $\pm 1\%$



$$\pi^0 \rightarrow \gamma\gamma, \rho^\pm \rightarrow \pi^\pm \gamma / \pi^\pm \pi^0$$

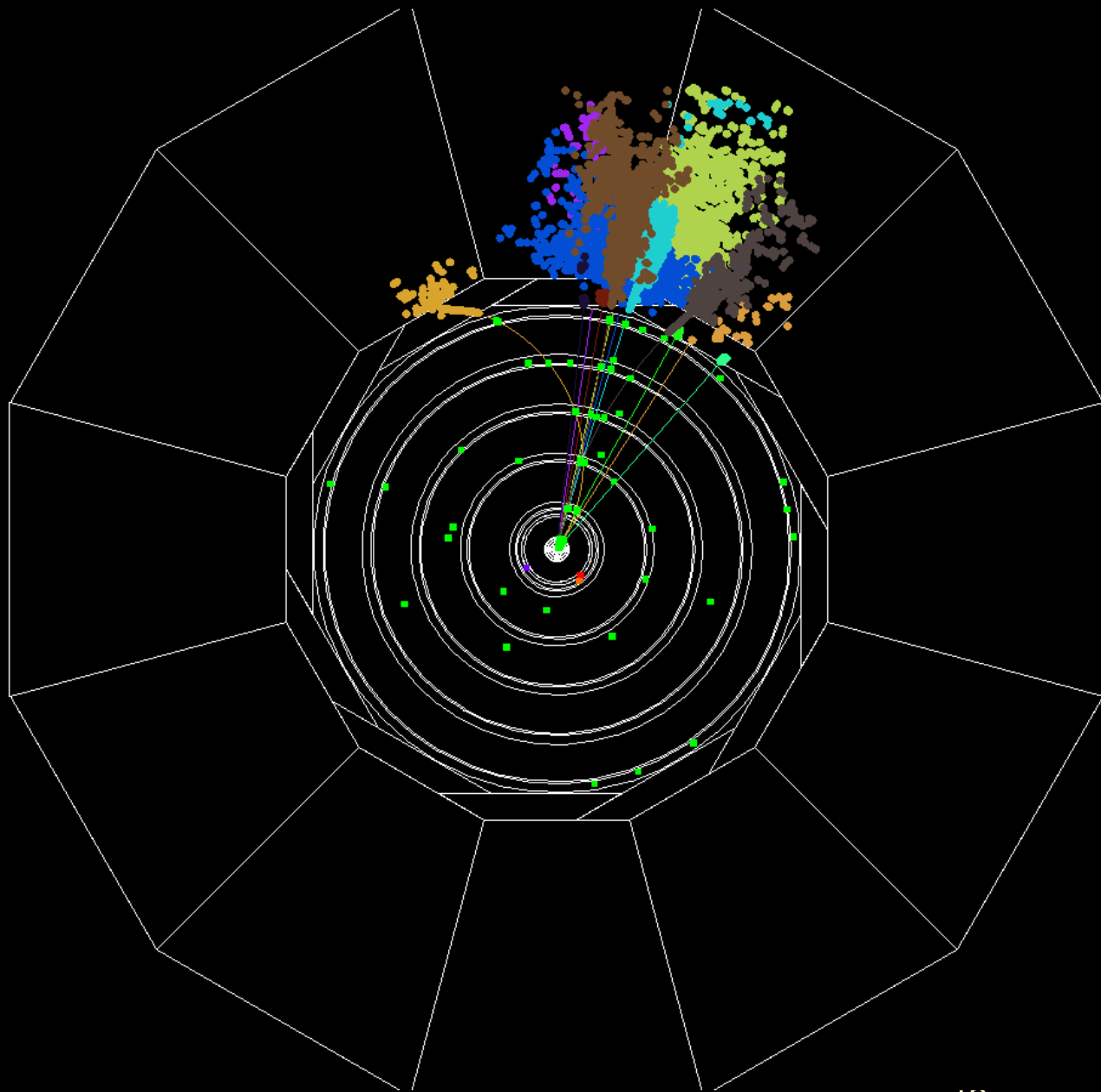


Tests charged / neutral clustering
in locally dense environment.
Resonance mass is performance
metric.

Jets

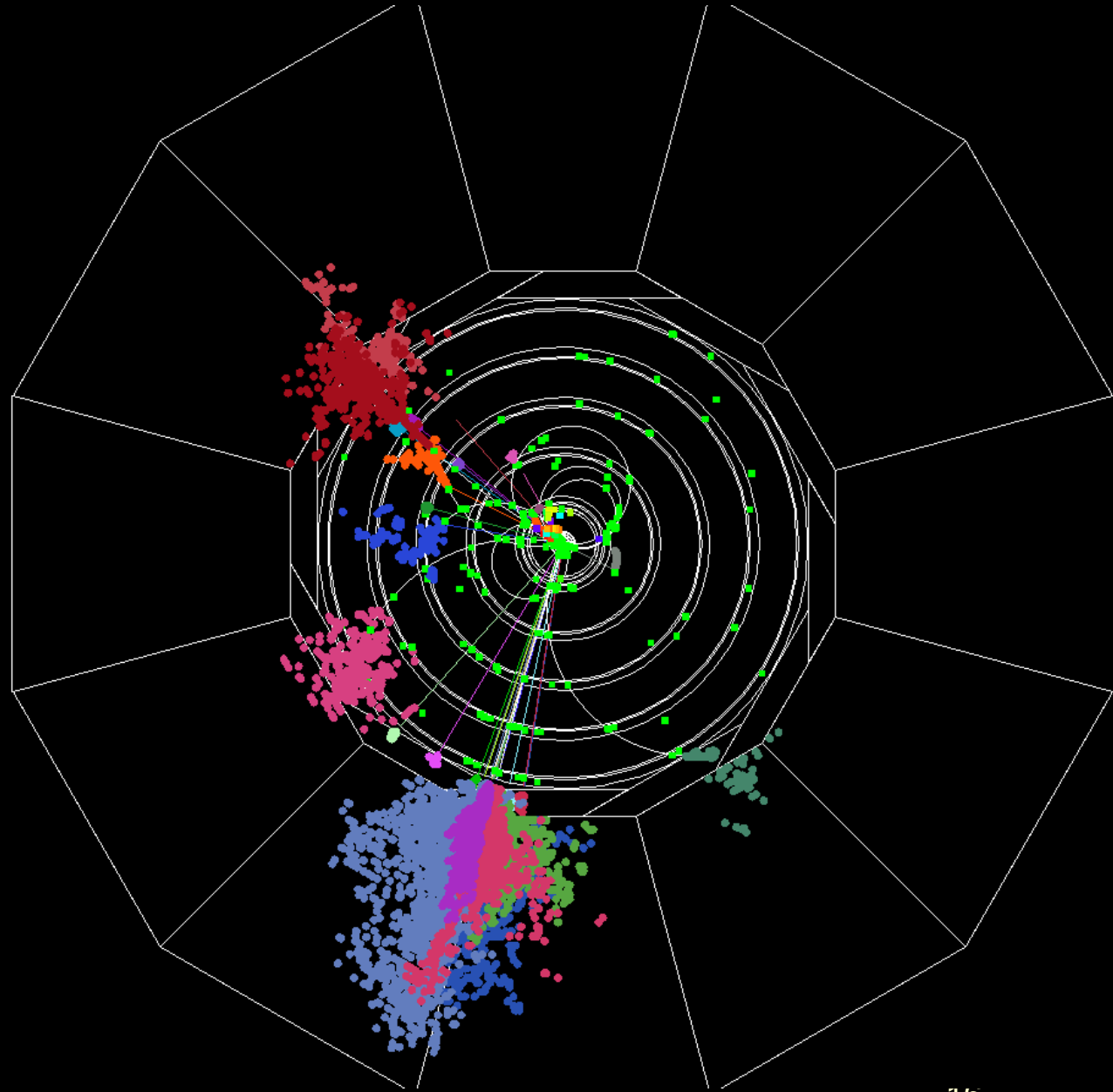
Single quarks
(u,d,s) at fixed
energies and
angles.

Tests energy
resolution in
controlled
environment.

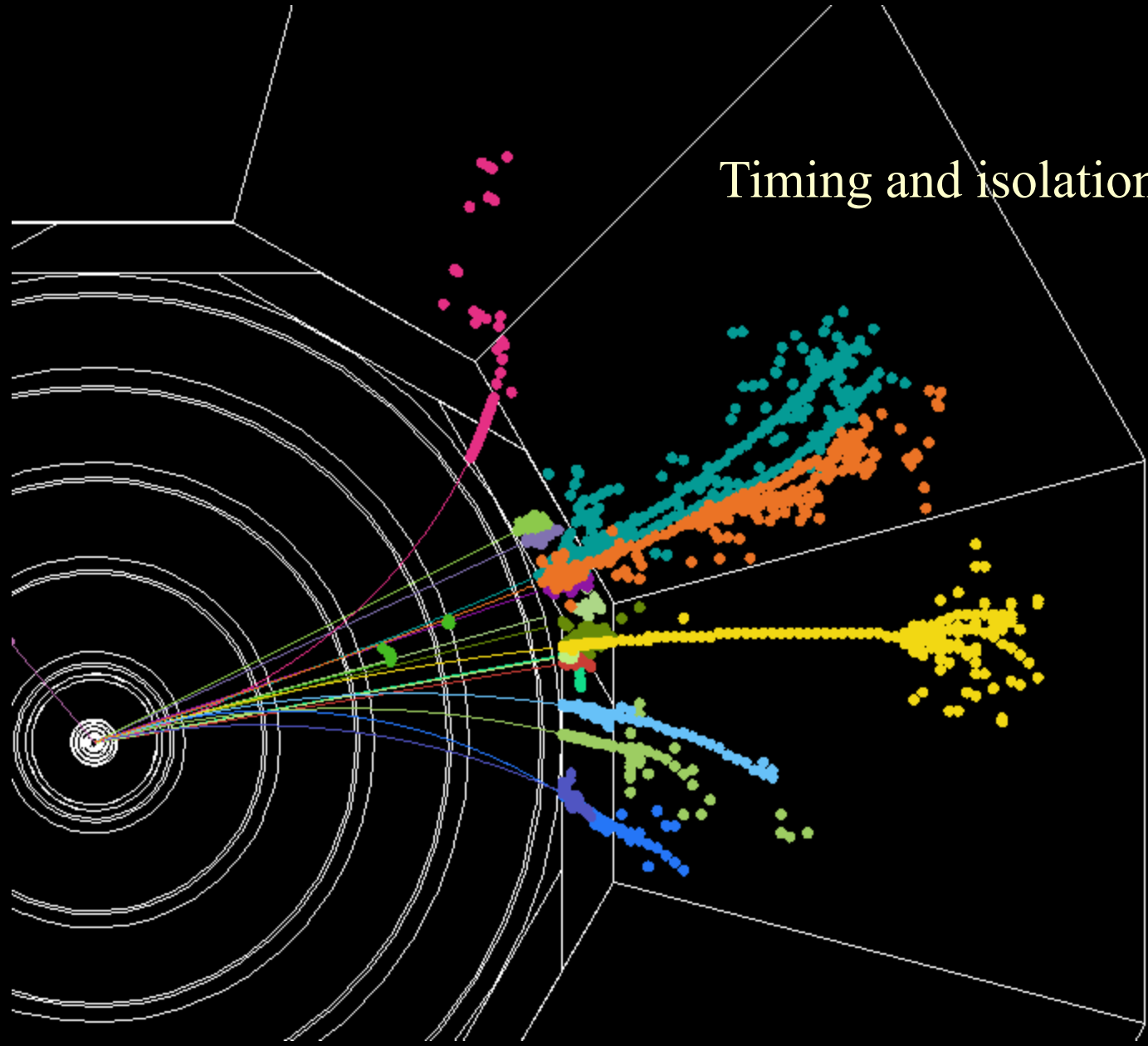


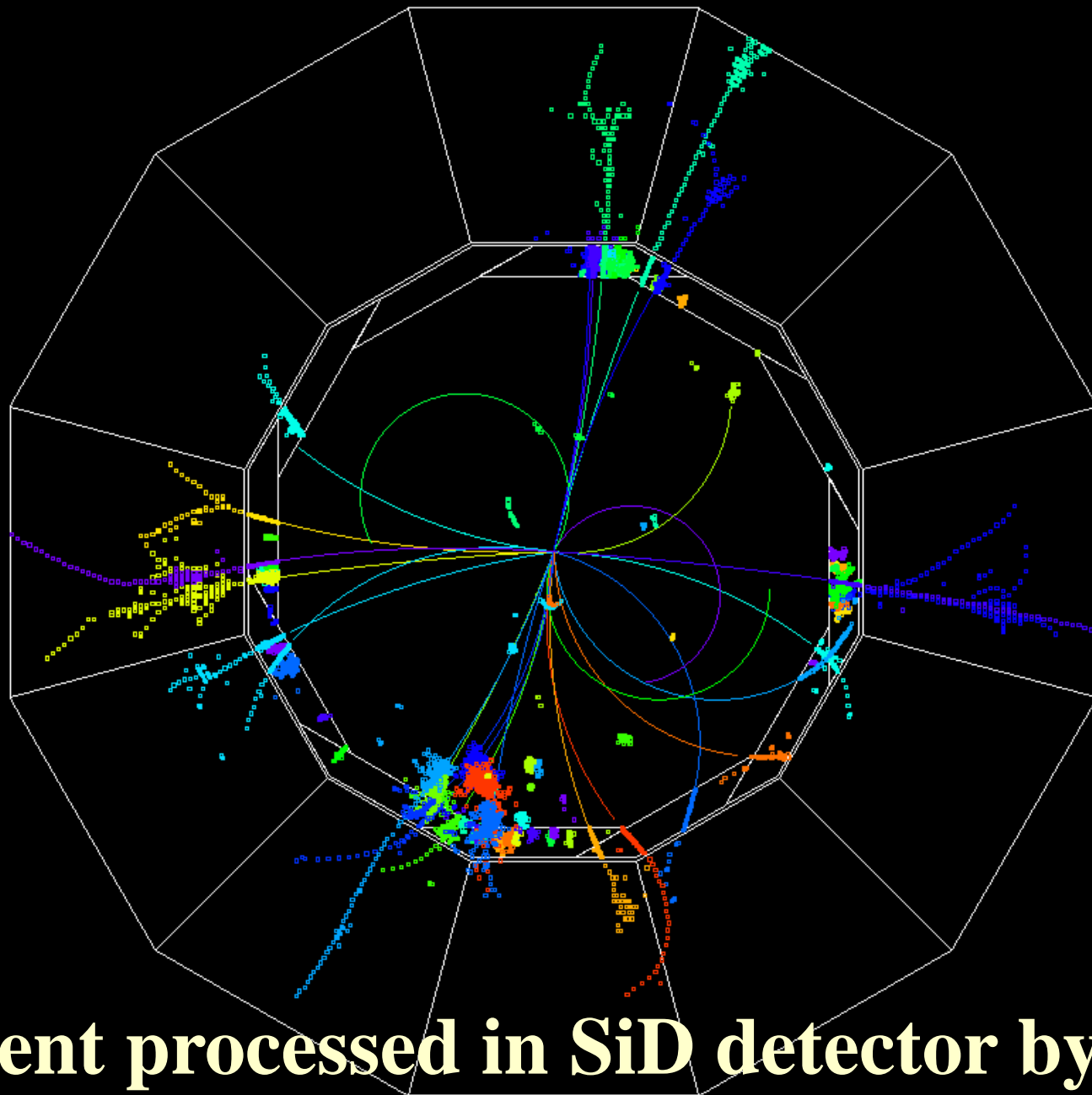
$$Z^0 \rightarrow q\bar{q}$$

Single boson
decaying to
light quarks at
fixed energies
and angles.
Tests invariant
mass resolution
as function of
boson energy.



Timing and isolation cuts





**$t\bar{t}$ event processed in SiD detector by slic,
reconstructed using pandoraPFANew.**

Current Status

- Connection between slic output and pandora library was established during recent visit to Cambridge (albeit by hardcoding geometry) and first simple events processed.
- Have since developed and implemented an xml format for all the geometrical information needed by pandora and automated procedure to create it.
- Developint automated QA procedures to ensure that all interfaces are understood and correctly implemented.
- Characterization and optimization next.