

PANDA EMC Software Development

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Universität Bonn, Bonn, Germany

9 -12 December 2014

Computing Session

PANDA Collaboration Meeting (Forschungszentrum Jülich)



BMBF application to develop EMC software

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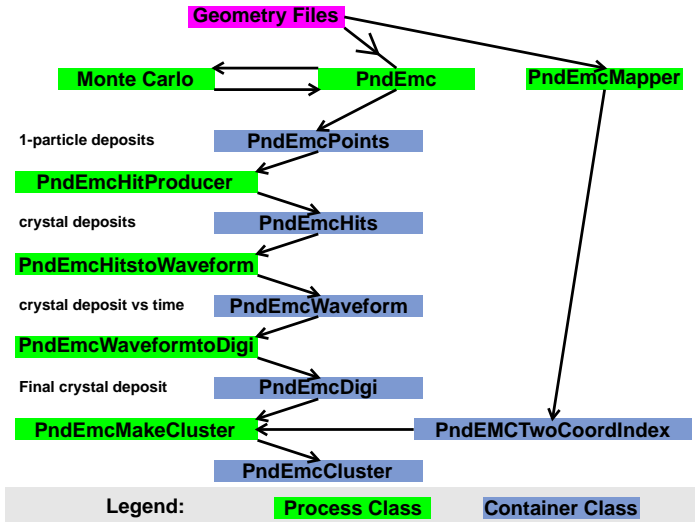
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Organizing Principles

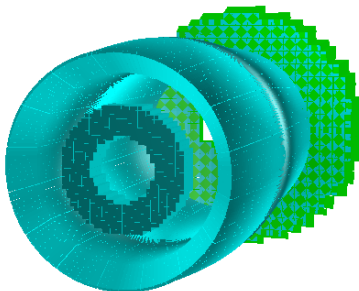
- Software is the link between Hardware and Analysis
 - Serve both communities.
- Externally, easy to use and transparent
 - hardware users: not using pandaroot, too daunting
 - Simplify to include/analyze Proto setups.
 - analysis users: need transparency
- Optimize for speed
 - Full Simulation of 5 γ 's: < 1 event/second
 - Software could become too slow to use.

EMC Software



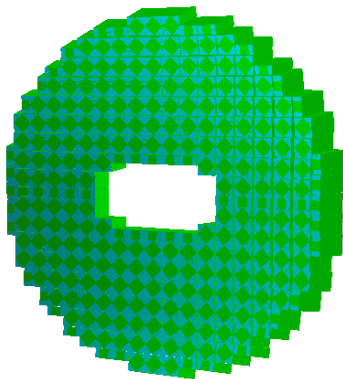
Basic Ingredient for all studies! Status

- Mostly Crystals in space
 - Forward End Cap has carbon alveoles, (with errors)
 - Backward End Cap has carbon alveoles, but outside pandaroot.
- Not Standardized: Mixture of Ascii files, Root Geometry, and pandaroot code



Next Steps

- 1 Standardize: transparency and efficiency
 - Move all geometry to ROOT geometry
 - Standardize root geometry filenames
- 2 Include Passive Structures
 - Between and in front of crystals
 - All other structures



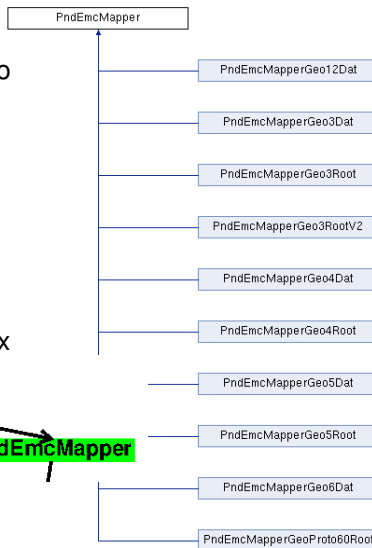
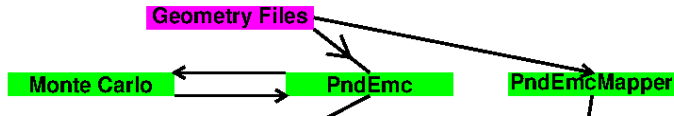
Forward End Cap

EMC Software: Geometry Handling

- Loads geometry information into simulation
- Extracts information from Virtual Monte Carlo
- Handles information on the positions of detectors

Status

- Inflexible loading of geometry and crystal information
- Inefficient methods for deducing crystal index

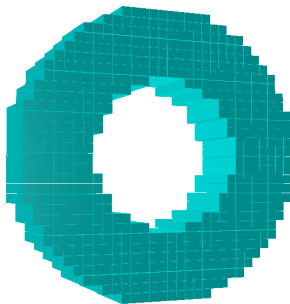


EMC Software: Geometry Handling

Create an easy way to include/exclude aspects of geometry

- analysis users: facilitate future analyses.
- Do not restrict the number of geometry root files to be loaded.
- Enable regular expressions for including or excluding geometry within files.

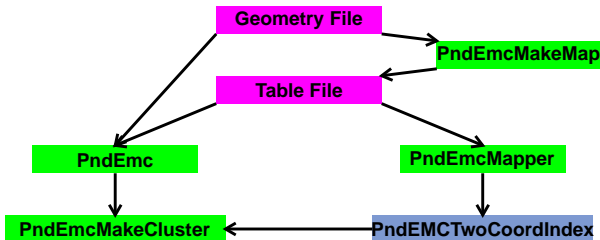
Backward End Cap



EMC Software: Geometry Handling

Optimize geometrical information retrieval

- Speed: Create pre-defined lookup tables for crystal information
 - lookup table(hash of volume names, crystal index)
 - array: (crystal index, position in space)



Legend:

Process Class

Container Class

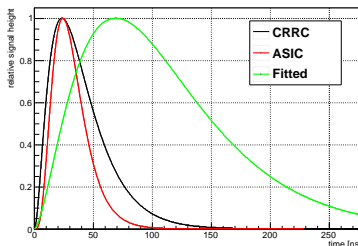
File

hardware users: Guide choices for DAQ

Status

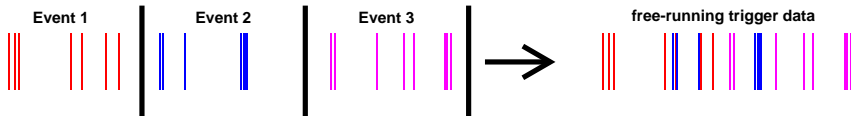
- Methods for Time-dependent simulation, Non-uniform light deposition, Waveform simulation have been implemented.
- Not much hardware specific processing.
- event-based simulation to free-running trigger data is not fully implemented.

Waveform Shapes



Next Steps

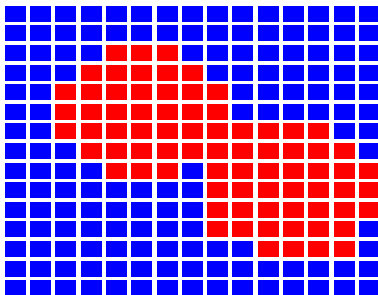
- 1 Provide tools which help hardware developers.
 - Guide data acquisition choices
 - Thresholds, Analog to Digital conversion,
- 2 Implement event-based data to free-running trigger data



Need a good relationship with hardware users.

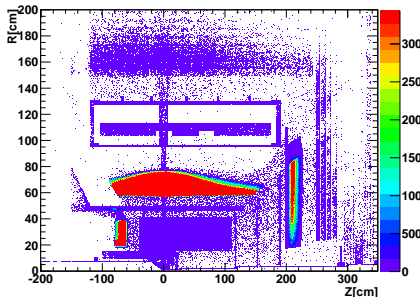
Status

- Primitive methods for clustering and bump-splitting are present
- Developing: Time-based reconstruction (Marcel Tiemens KVI, Philip Mahlberg Uni-Bonn)
- Only able to analyze event-based data so far.
- Produces results but are far from optimized.



Next Steps

- 1 Develop simulation geometry.
- 2 Optimize Clustering Algorithms
 - Include timing considerations (time-based reconstruction)
 - Improve splitoff handling
 - Improve Bump splitting
- 3 Matching clusters to charged tracks
- 4 Pre-shower detections
 - $\approx 10\%$ photon conversion rate
 - Recover original photon
 - Avoid contaminating events.



Vertex points (γ simulation)

EMC Software Current Status

- Simulation Geometry: crystals only (some exceptions)
- Geometry Handling: useable but needs optimization
- Digitization and Reconstruction is in useable condition, but require significant upgrades and optimization

Important First Steps

- 1 Optimize Geometry Handling
- 2 Complete Crystal and (in front/between crystals) Passive Structure definition in ROOT Geometry files.
- 3 Upgrade reconstruction using new geometry
- 4 Incorporate hardware specific digitization characteristics
- 5 ...

- Currently, Evaluation and Planning Stage.
 - Evaluating the current software.
 - Looking for collaborators and ideas.
 - Gathering information from hardware developers.
 - Spending time planning for the optimal methods
- Not interested in quick-fixes
Start building a solid foundation.
 - 1 Solve Simulation Geometry Issues FIRST
 - 2 THEN Reconstruction, kinematic fitting, ...

Ideas? Comments?