Hit Triplet Finding in the PANDA-STT

Darmstadt, 11.12. 2012

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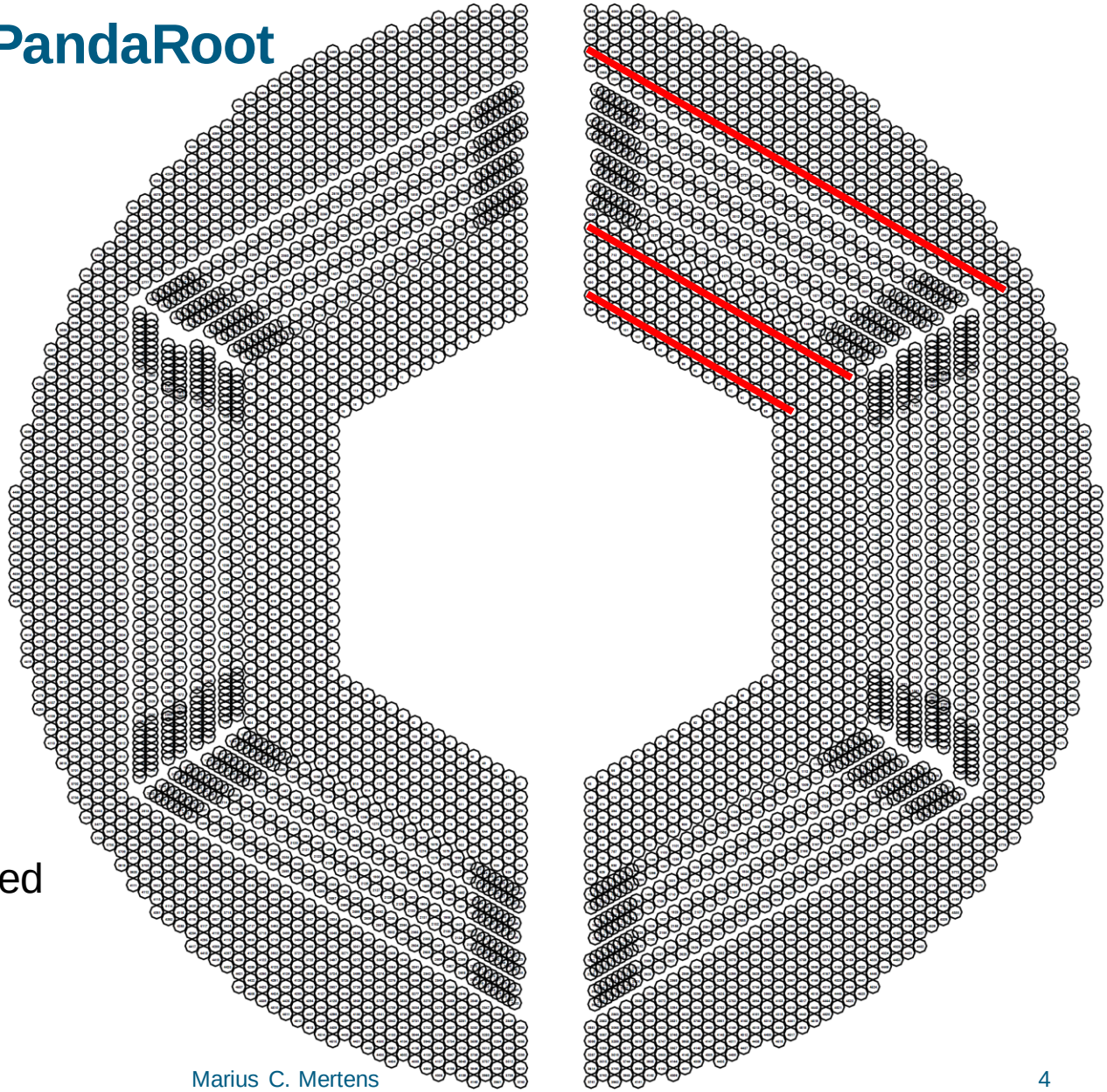
Outline

- **Part I → Focus on Tracking**
  - *Triplet Finding and Tracking in Axial Straws*
  - *STT Geometry in PandaRoot*
  - *Track Verification*
  - *Hitstream Display*
  - *Triplet Finding in Skewed straws: Skewlets*
  - *Summary/Outlook I*
- **Part II → Focus on OnlineManager/Implementation**
  - *Triplet / Skewlet Finding Overview*
  - *Implementation in OnlineManager*
  - *Track/Hit Quality Criteria*
  - *Output to Hitstream Display*
  - *Summary/Outlook II*

Triplet Finding in Axial Straws

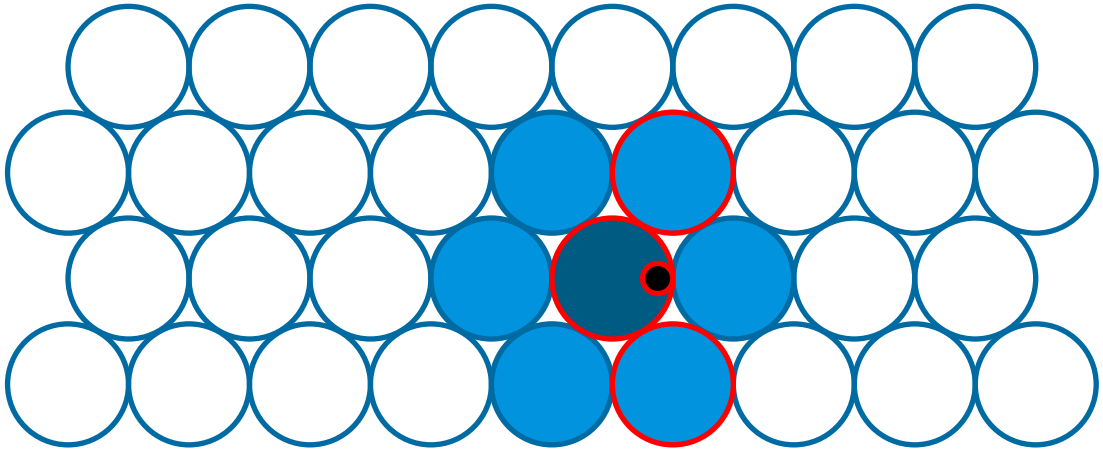
- Basic properties:
  - *Finds tracks originating from the interaction point*
  - *Works in xy projection*
  - *No isochrone information used → Does not require t_0 or isochrone-drifttime calibration*
- Results:
  - *Track candidates*
  - *Associated hits*
  - *t_0 seed for selected tracks (hit timestamp constraints, matching with other detectors)*
- Carried out in three steps:
  - *Identification of hit triplets (or n-lets) around pivot cells*
  - *3 point circle calculation: Origin + 2 Triplets*
  - *Hit association via circle proximity*

STT Geometry in PandaRoot



Axial pivot cells indicated in one sector

Triplet Finding in Axial Straws



- Pivot cell is checked for hit
- Surrounding straws are checked for hits
- Center of mass of fired straws is calculated
  (small number of combinations → suitable for lookup table)

Triplet Finding in Axial Straws

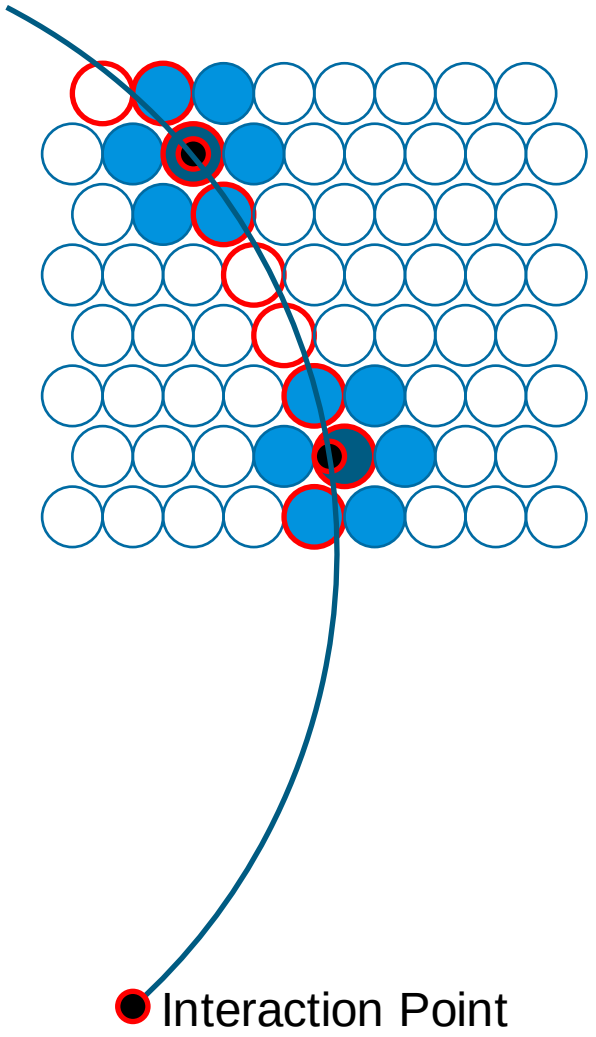
- Once two triplets are found, calculate circle through origin
- Associate nearby hits with track candidate

Track Verification:

- Currently mix of curvature and associated hits
- Lots of room for improvement

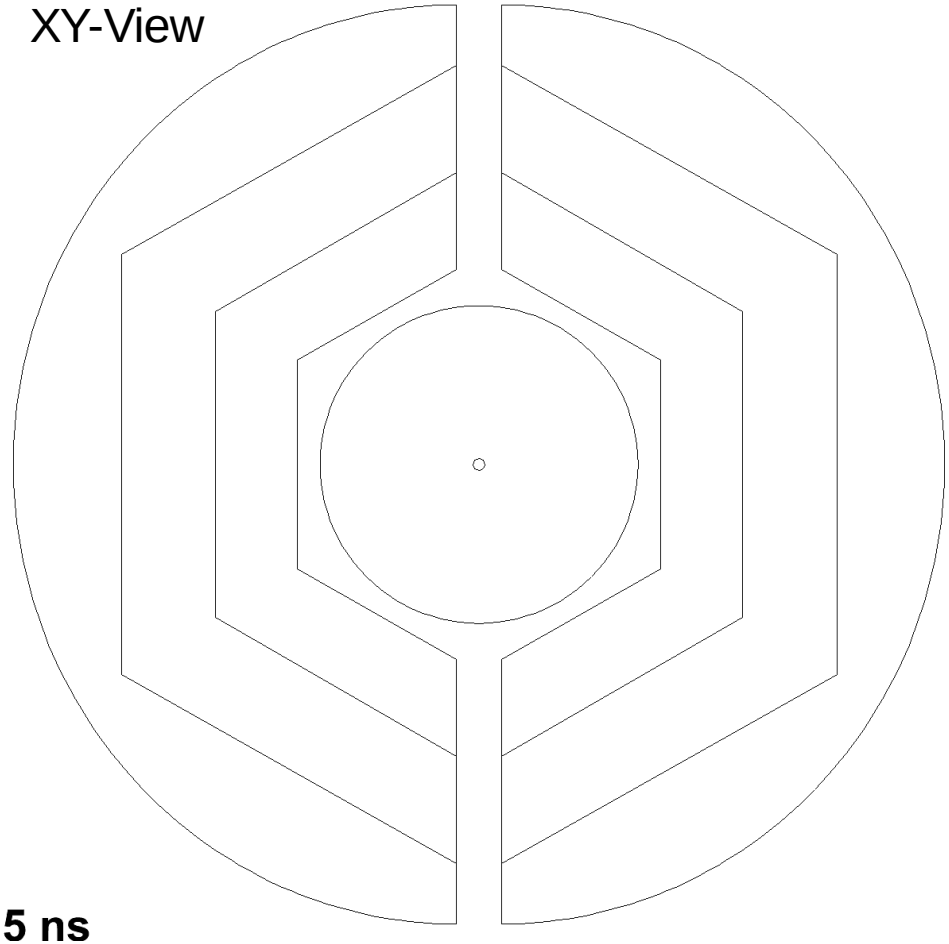
Further possibilites:

- Distance sorting, Concurrent associations, Clutter veto, …
- Missing straw compensation: Pivot Straw triggered by neighbor straws
- Weight hits according to timestamp
- Improved Triplet merging



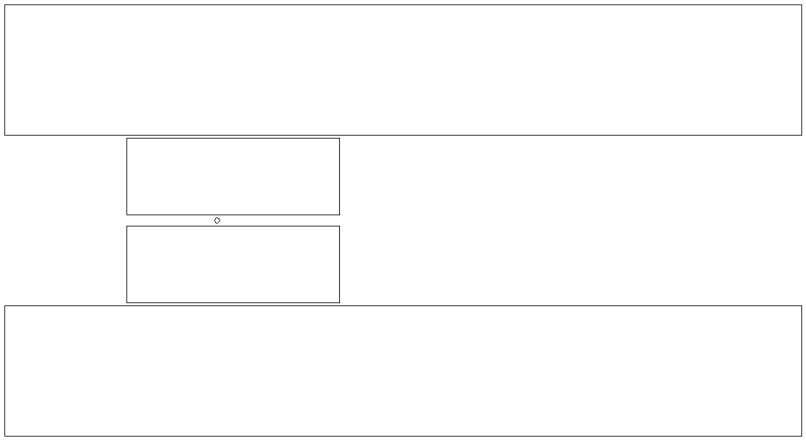
Hitstream Display: 15 GeV/c DPM, 50 ns mean time

XY-View



5 ns

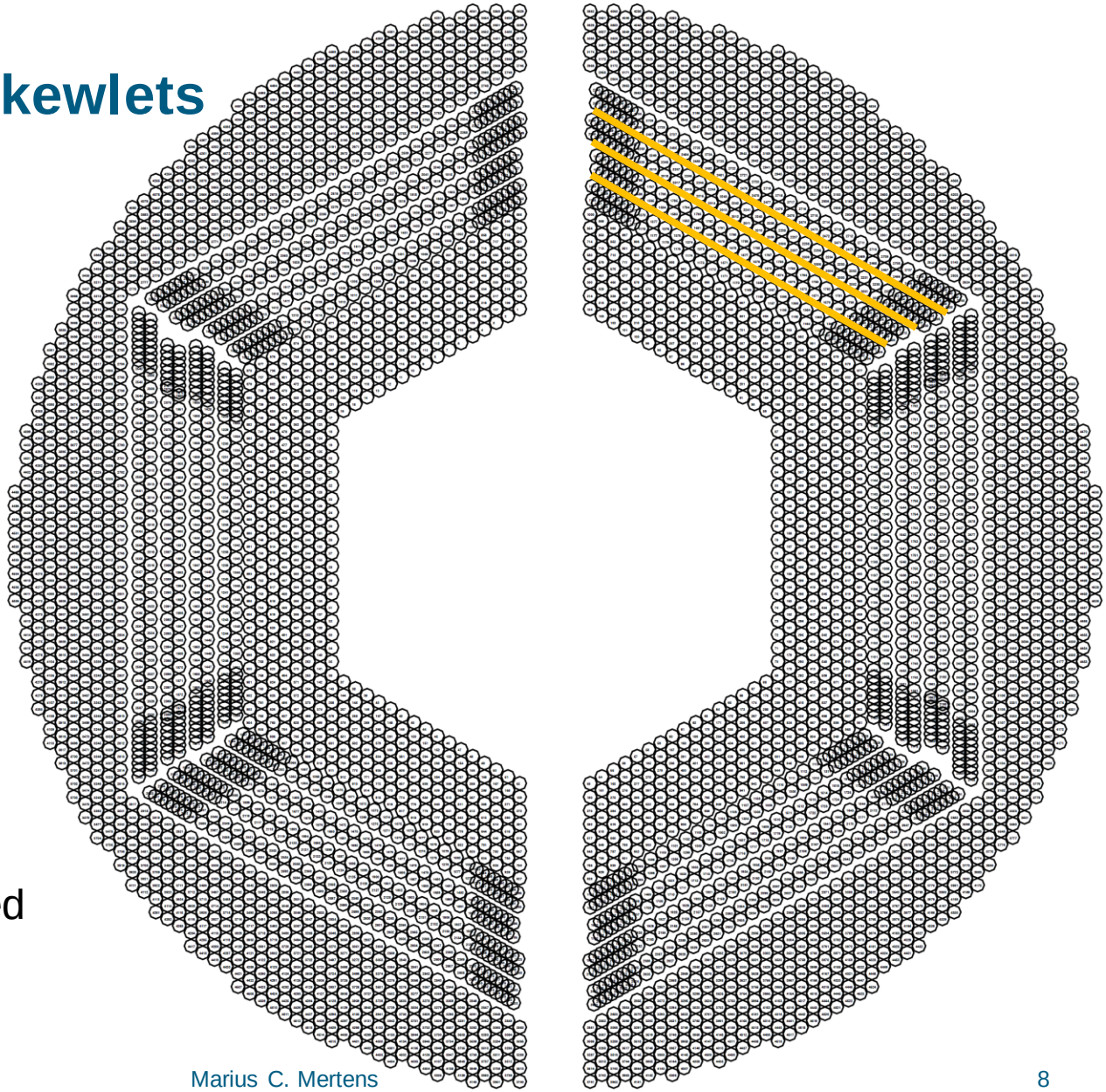
RZ-View



5 ns

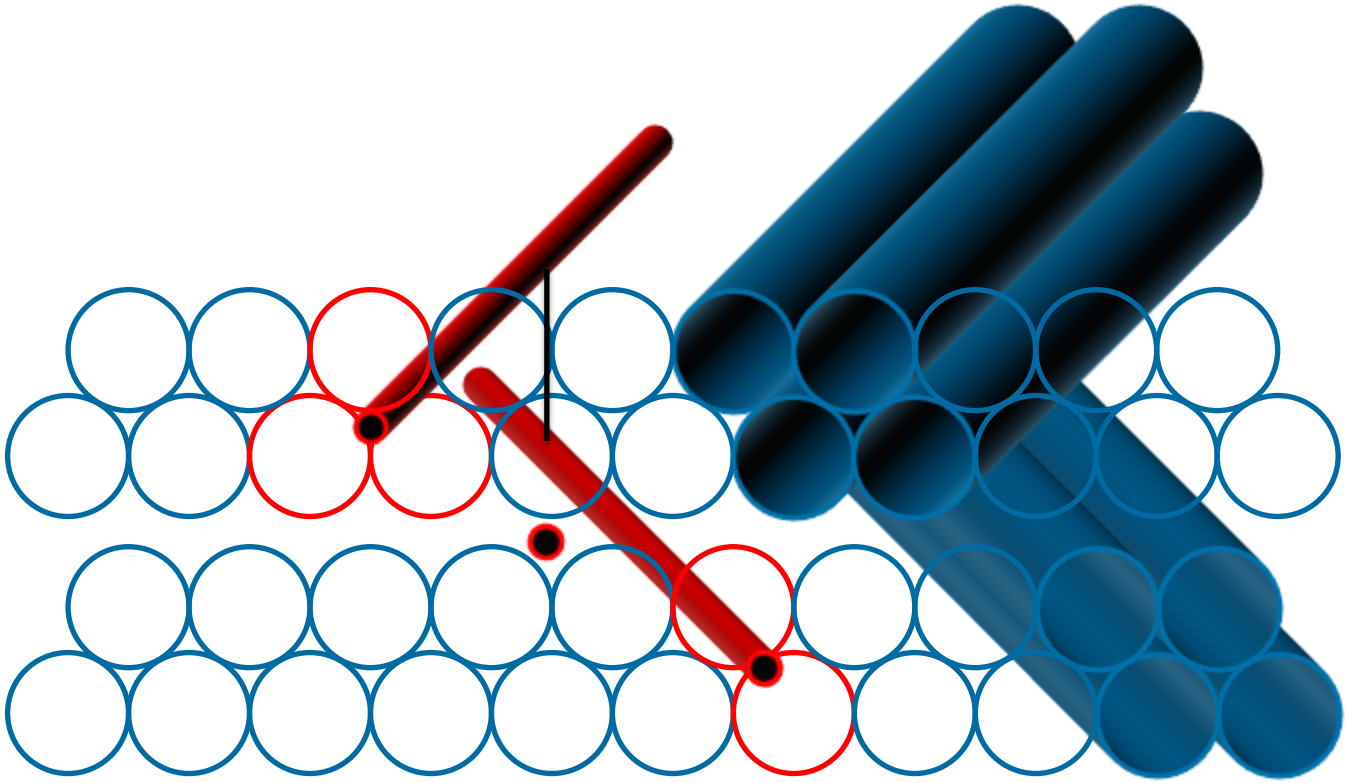
- **Black** circles: Early isochrone
- **Blue** circles: Early skewed isochrone
- **Green** circles: Close isochrone
- **Red** circles: Late isochrone
- **Black** dots: MVD hits
- **Green** dots: MVD hits r/z > 0.3
- **Black+Red** dots: Triplets/Skewlets
- **Yellow** tracks: Vetoed
- **Blue** tracks: Accepted

Triplet Finding in Skewed Straws: Skewlets



Skewlet layers indicated in one sector

Triplet Finding in Skewed Straws: Skewlets



- Triplet search in individual skewed double layers
- Combination of adjacent double layers‘ Triplets to Skewlets
- Track matching in xy-projection
- Extraction of z-information

Interlude Summary/Outlook

Part I

- Proof of concept Triplet Finder tested with DPM input
- Robust first-line algorithm independent of isochrone (t_0) information and drifttime calibration
- Visual inspection yields promising results
- Many (straightforward) tuning possibilites affecting efficiency, purity and robustness

Part II

- Implementation within OnlineManager → Sean's talk
- Triplet Finder runs as compiled code and uses OnlineManager's data flow
- Animated visualization in HitstreamDisplay

Outlook:

- Implementation of hit association quality property
- Merge with canonical PandaRoot tools
- Long term goal: Track-to-event association

Part II

Darmstadt, 11.12. 2012 Marius C. Mertens

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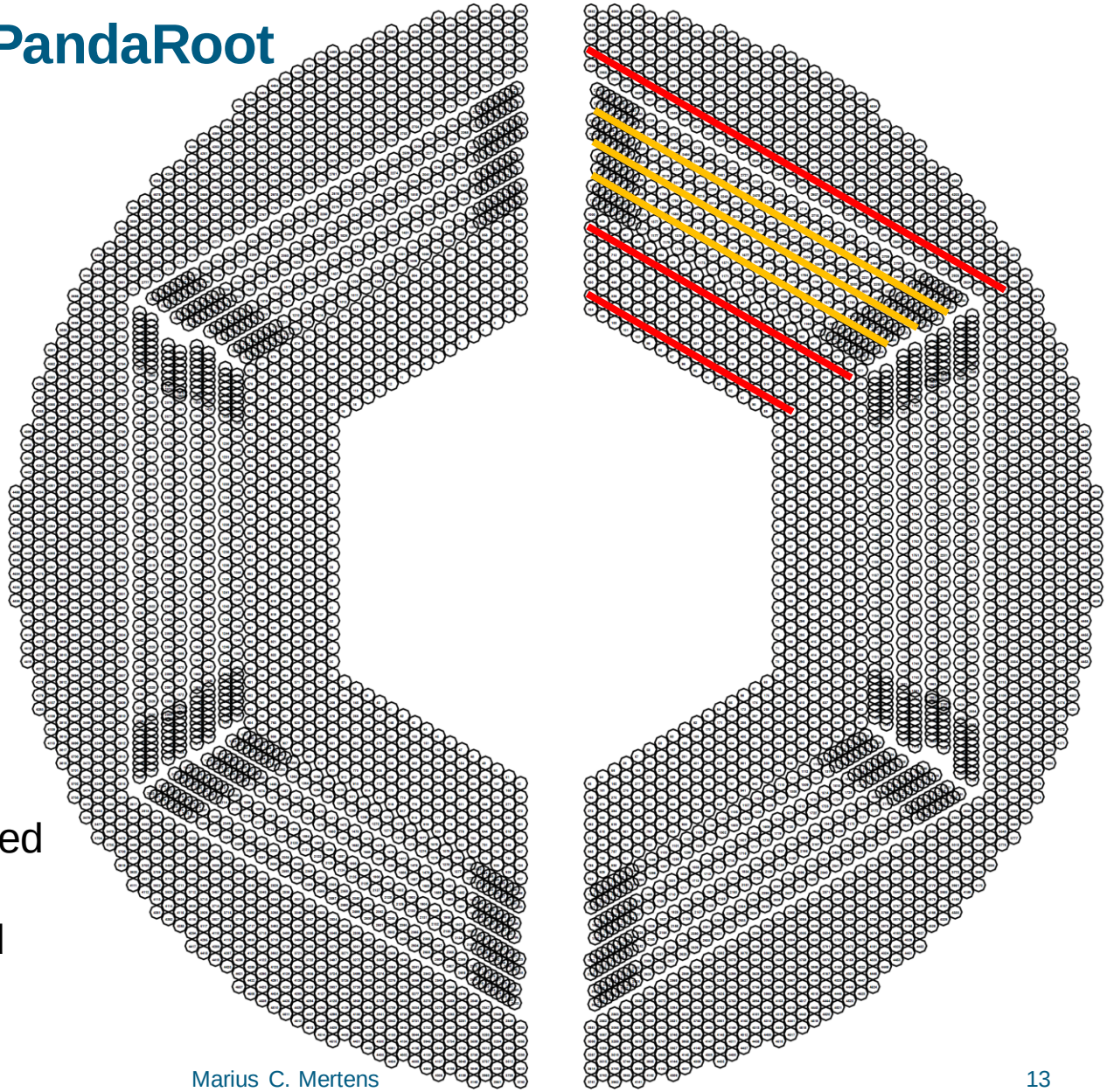
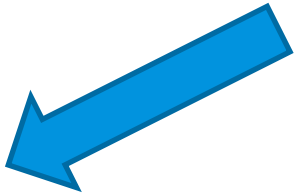
STT Geometry in PandaRoot



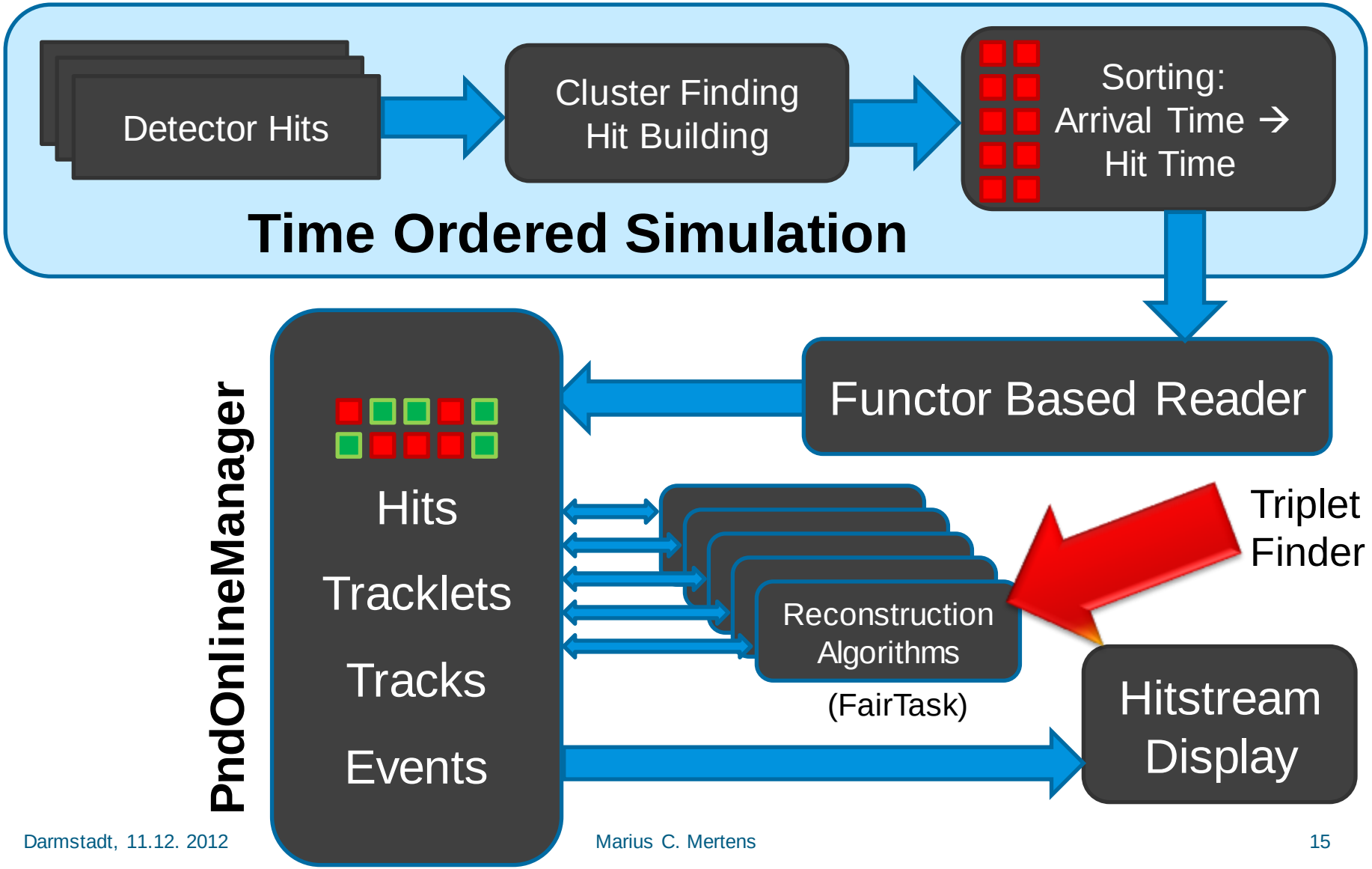
Axial pivot cells indicated in one sector (**red**)
Skewlet layer indicated in one sector (**orange**)

Continuous Online Tracking: Status Sep. 2012



Hitstream Display

Continuous Online Tracking in OnlineManager



Track/Hit Quality Criteria

Possible Extensions in Track Quality Measurement

- Hit distance to track order should correspond to hit timestamp
- Add extrapolations to other detectors
- Concurrent hit association / clutter criterion
- …

Implementation Sketch

- Hits are assigned to tracks with their quality measure
- Algorithms access and update the quality measure (may also reject processing if quality is already marked as very good)
- Same principle: Association of tracks to events

Output to Hitstream Display

Analysis / Track Finding Part

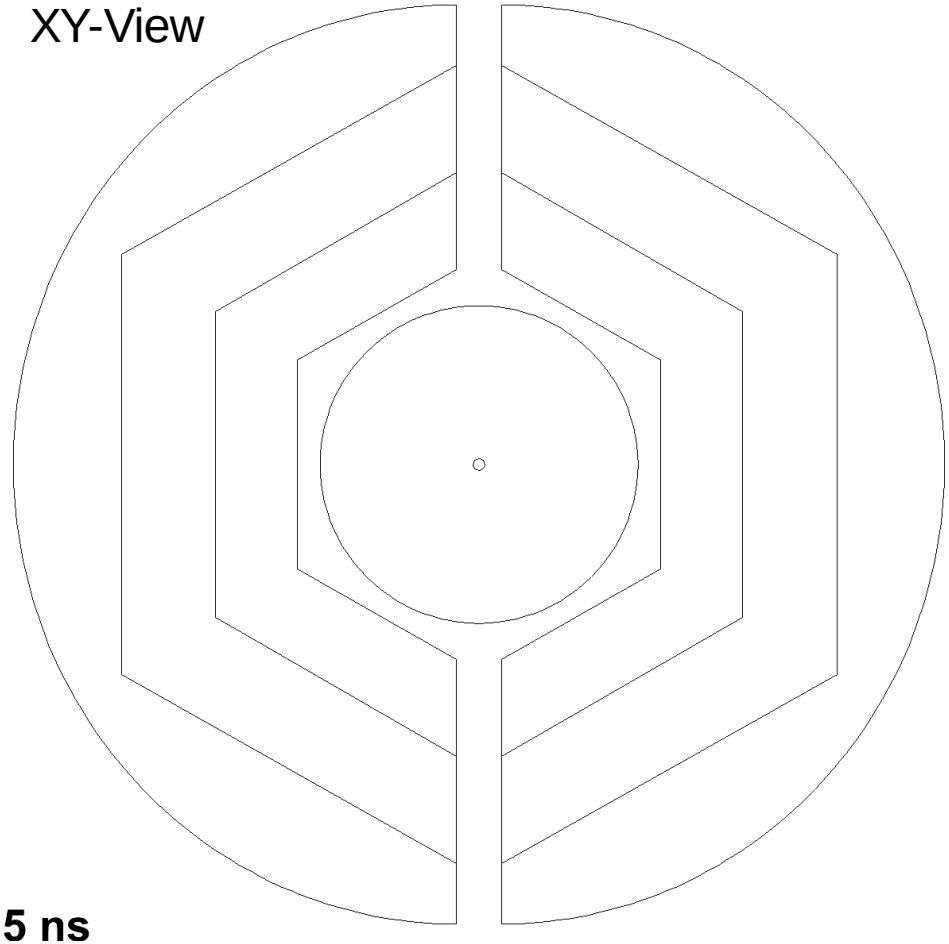
- OnlineManager provides hits
- Triplet Finder processes hits and generates Triplet lists
- Track candidates are sent to OnlineManager

Visualization Part

- OnlineManager provides OnlineTracks
- Display Macro has functions to draw the different objects stored in the lists for display

Hitstream Display: 15 GeV/c DPM, 50 ns mean time

XY-View



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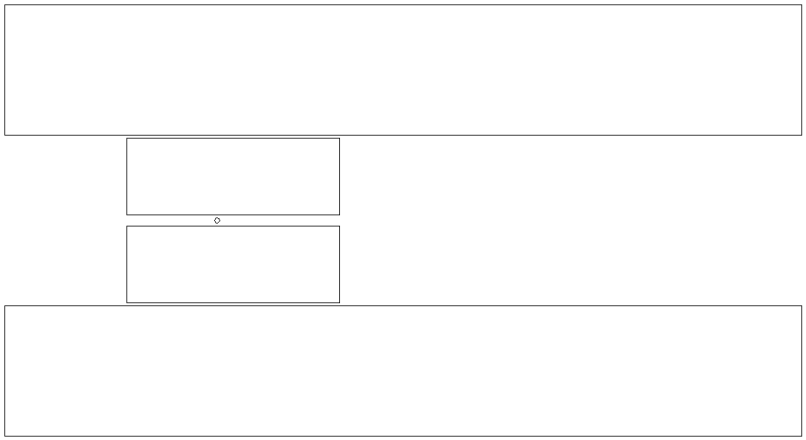

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Thank you for your attention

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- Long term goal: Track-to-event association