



Triplet-Based Online Track Finding in the \bar{P} ANDA-STT

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Outline

- Introduction

- *PANDA Detector*

→ Daniela Calvo's talk

- *Straw Tube Tracker (STT)*

→ Peter Wintz' talk

- *Operating Conditions*

- *Online Tracking Scheme*

- Triplet Finder

- *Concept*

- *Monte Carlo Benchmarking*

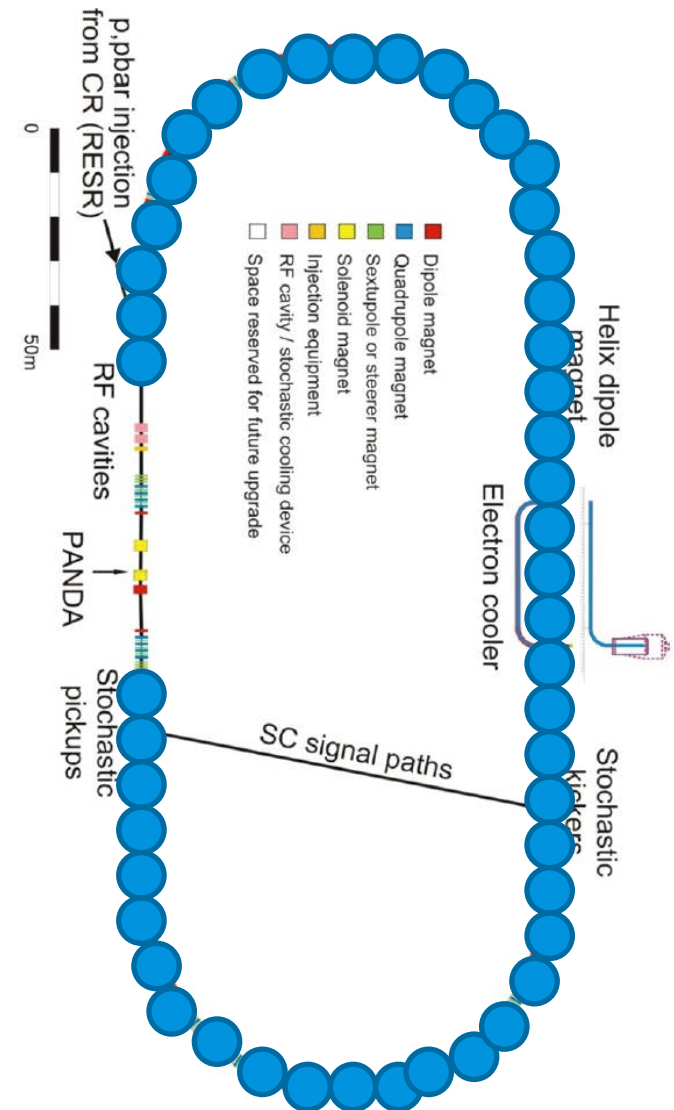
- *Results*

- Summary

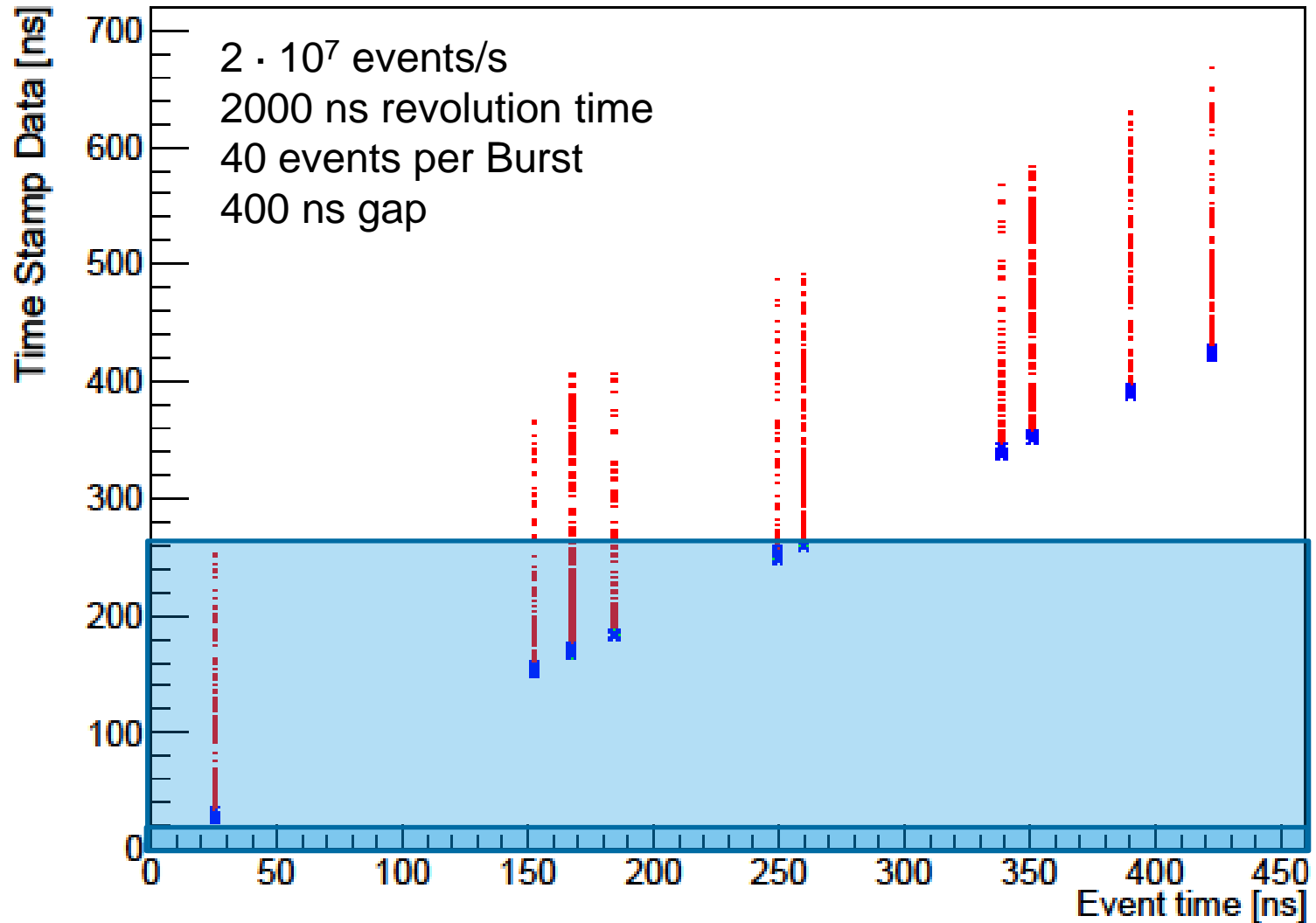
Online track reconstruction
for continuous data stream
without external timing

PANDA Operating Conditions

- Gap estimate:
 - *Barrier Bucket: 80% Filling*
 - *HESR length: 575 m*
 - *Antiproton velocity: c*
 - *Revolution time: 2000 ns*
 - *Gap: 400 ns*
 - *Fill/Gap ratio may vary*
- Events per revolution → Burst:
 - $2 \cdot 10^7 / s \cdot 2 \mu s = 40$



Event Structure



Triplet Finder Concept

- Focus on **mathematical simplicity** → Fast and robust
- **No isochrone information** used → Does not require t_0 or radius-drifttime calibration
- **Can provide t_0 seed** for selected tracks (hit timestamp constraints, matching with other detectors)
- Three step operation:
 - *Identification of hit Triplets (or n-lets) around pivot straws*
 - *3 point circle calculation: Origin + 2 Triplets*
 - *Hit association via circle proximity*

Triplet Finding in Axial Straws

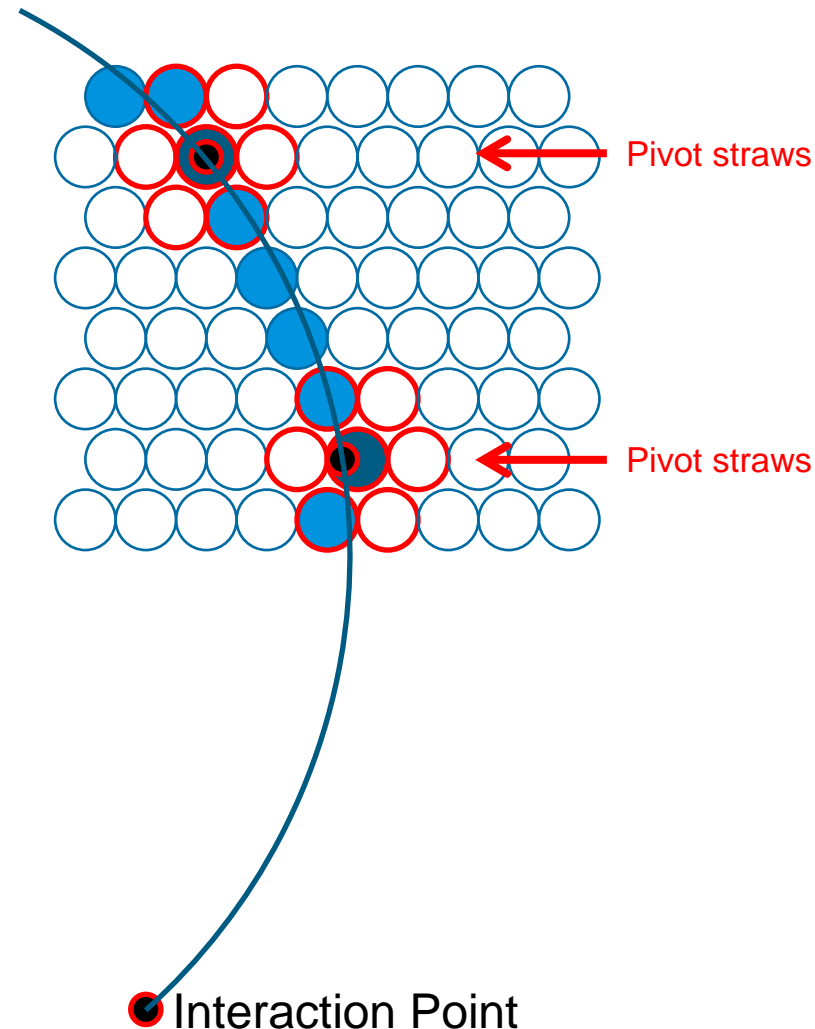
- Once two triplets are found, calculate circle through origin
- Associate nearby hits with track candidate

Track Verification:

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

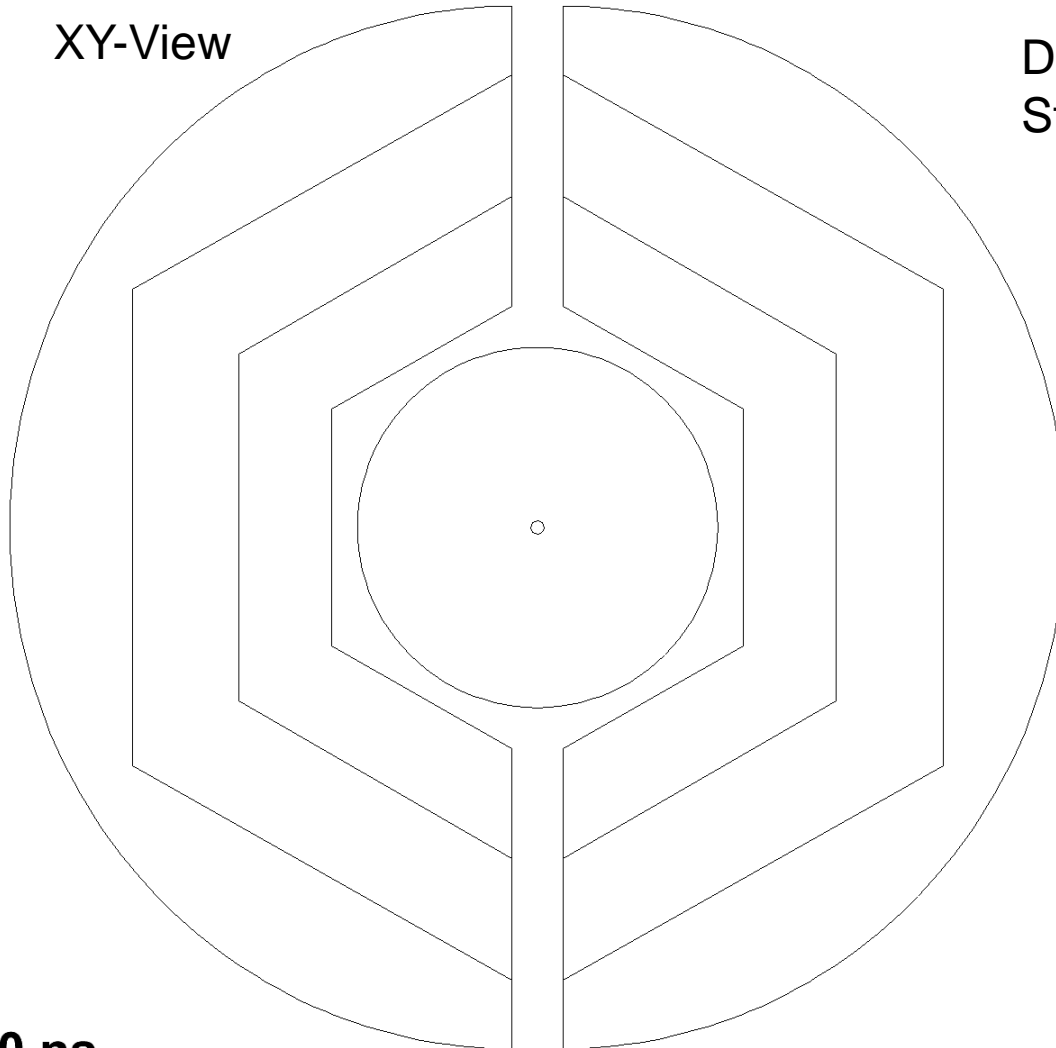
Further possibilities:

- Distance sorting, Concurrent associations, Clutter veto, ...
- Missing straw compensation: Pivot straw triggered by neighbor straws
- Weight hits within triplet according to timestamp



Hitstream Display: 15 GeV/c DPM, 50 ns Mean Time

XY-View



Dual Parton Model (DPM):
Standard $\bar{p}p$ background generator

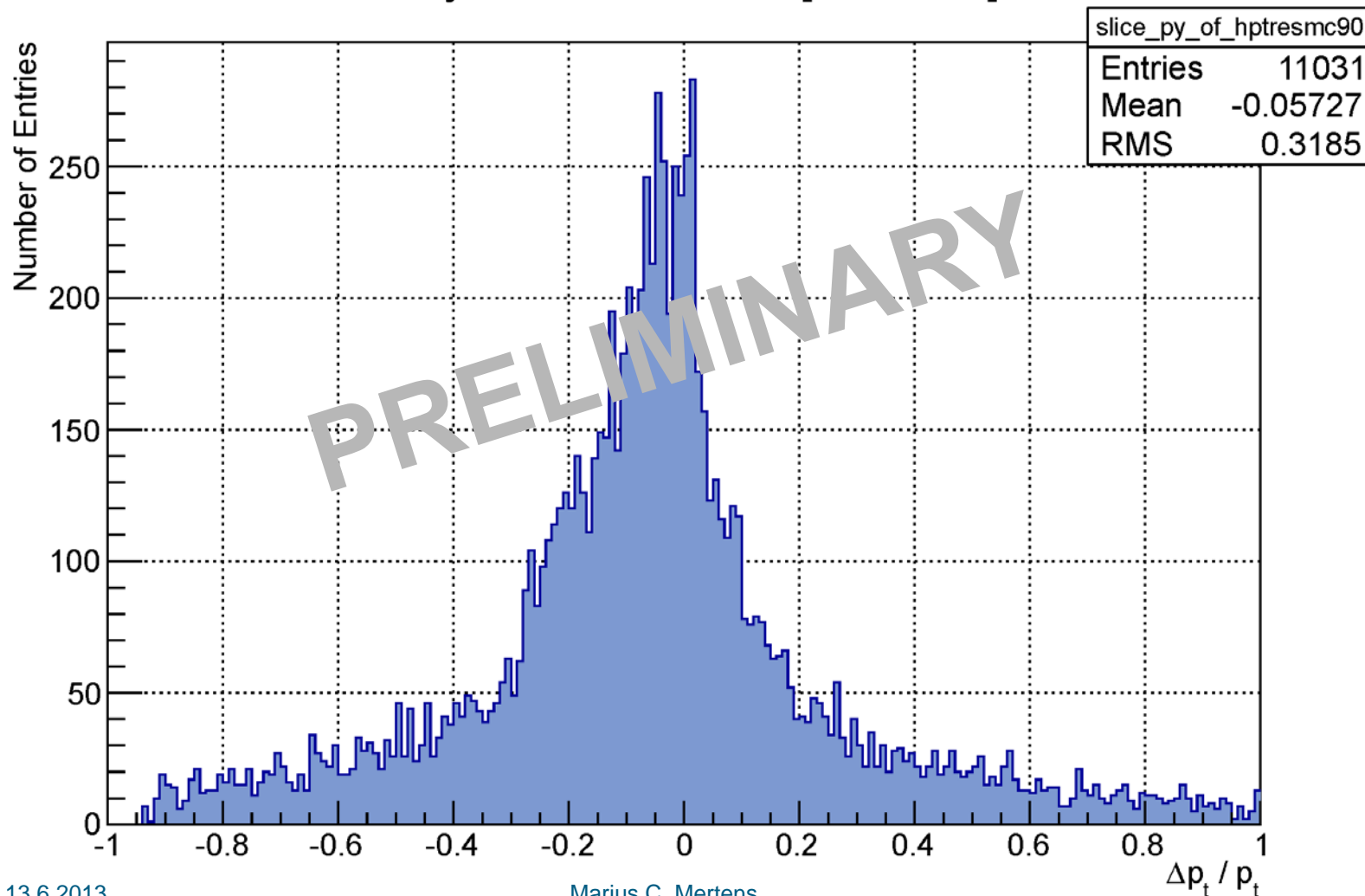
- Black** circles: Early isochrone
- Blue** circles: Early skewed isochrone
- Green** circles: Close isochrone
- Red** circles: Late isochrone
- Black** dots: MVD hits
- Green** dots: MVD hits $r/z > 0.3$
- Black+Red** dots: Triplets/Skewlets
- Yellow** tracks: Timed out track
- Blue** tracks: Current track

DPM Benchmark:
Realistic event rate
and structure,
continuous operation

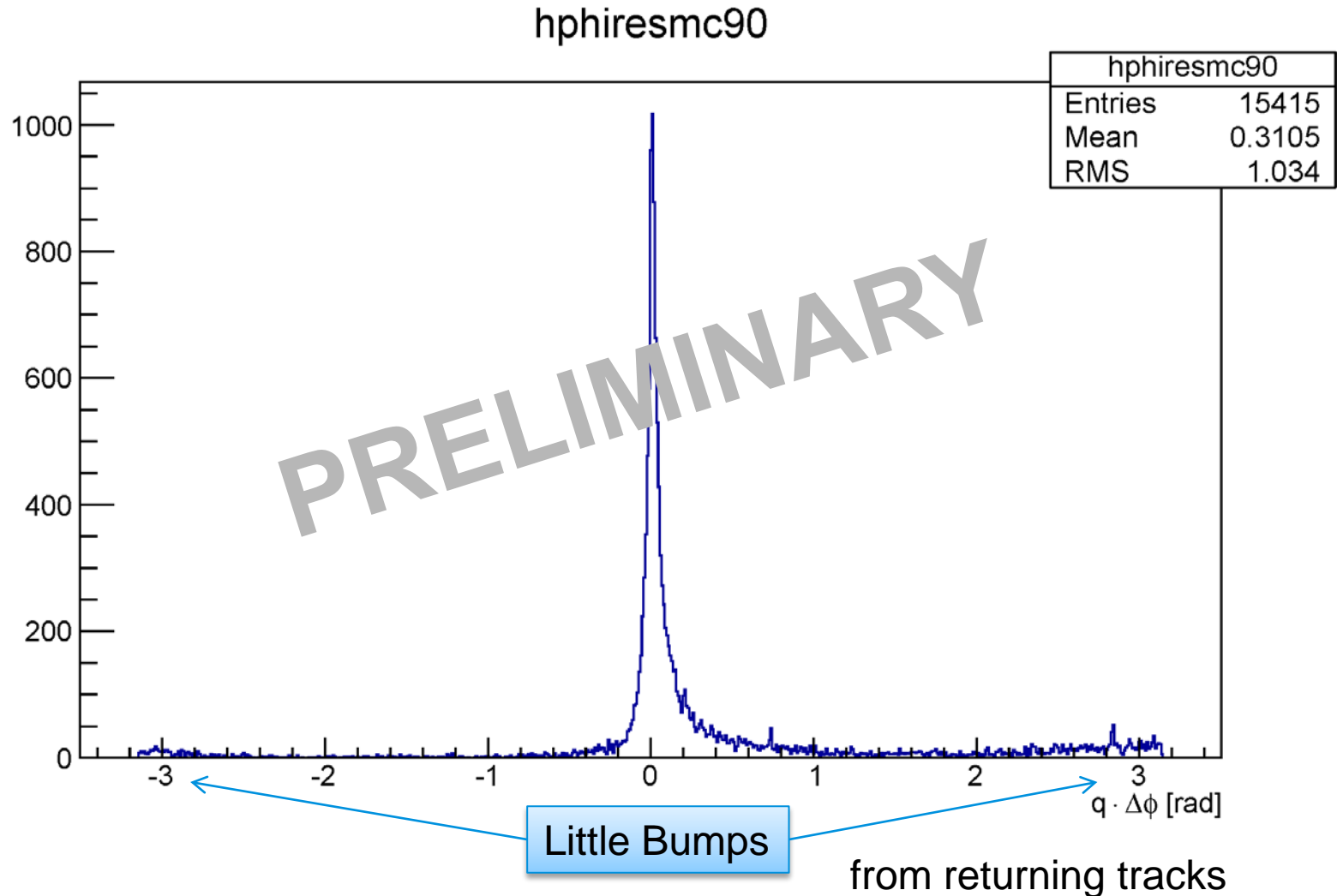
0 ns

Results: Positive Particles' p_t (90% Correct Hits)

ProjectionY of binx=[141,275]



Results: ϕ Resolution (90% Correct Hits)



Summary/Outlook

- Proof of concept **Triplet Finder** tested with DPM input in time based simulations at realistic event rates

Thank you for your attention

- First **quantitative test results** incoming
- Many (straightforward) **tuning possibilities** affecting efficiency, purity and robustness to be studied