Detector Signature Studies

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Ideal Track Finder

- Uses different *functors* for reconstructibility, *e.g.*
  - StandardTrackFunctor: ≥ 4 MVD hits OR ≥ 6 MVD+STT+GEM hits (DEFAULT)
  - OnlySttFunctor: ≥ 6 STT hits
  - FtsTrackFunctor: ≥ 6 FTS hits (NOT ACTIVATED BY DEFAULT)
- Possible functors:
  - tracking/PndIdealTrackFinder/PndTrackFunctor.h
- Get one output branch per functor
- To use both target and forward spectrometer, activate functor for both regions!

Detector Signature/Hit Multiplicity Analysis

- Hits per track in certain detector
  - Independently for each particle in reaction
- Number of tracks in detector
- Number of tracks in detector per event (to know how many tracks can be reconstructed ideally)
- Illumination plots (where in the detector are the hits)
- Kinematics:
  - Momentum distributions
  - Decay vertices

Detector Signature/Hit Multiplicity Analysis

- Jenny Regina
  - IN-STU-2019-001
  - MVD, STT, GEM
  - $\Lambda \rightarrow p\pi^-$, $\Xi^- \rightarrow \Lambda\pi^- \rightarrow p\pi^-\pi^-$, $\Omega^- \rightarrow \Lambda K^- \rightarrow p\pi^- K^-$
- Gabriela Pérez Andrade
  - http://urn.kb.se/resolve?urn=urn:nbn:se:uu:diva-349678
  - $\Xi^- \rightarrow \Lambda\pi^- \rightarrow p\pi^-\pi^-$
  - FTS, different setups
- Andreas Herten
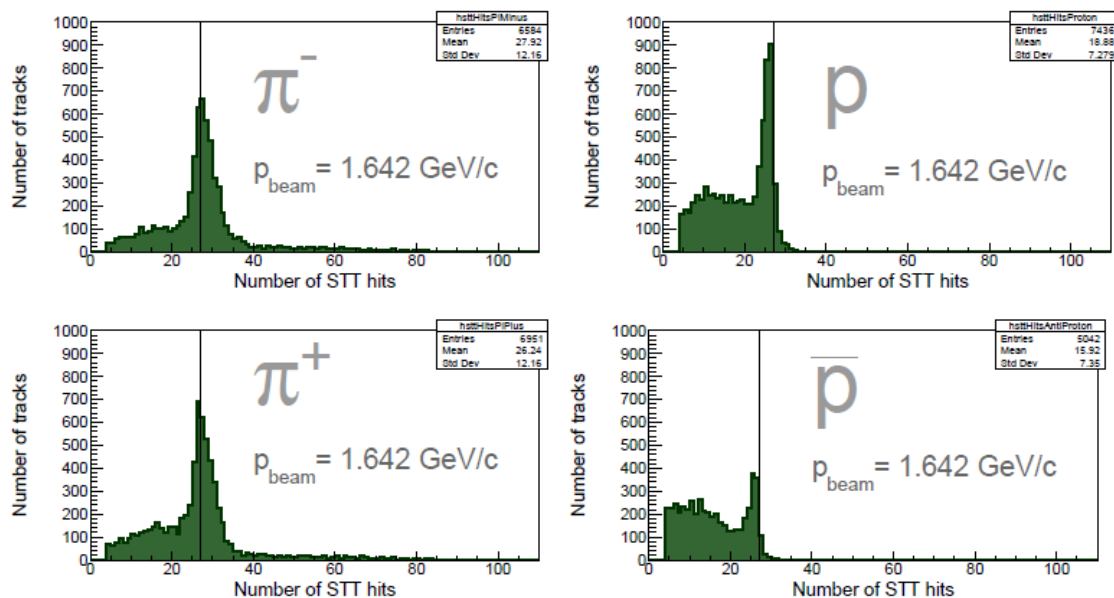 - TH-PHD-2015-002
  - $D \rightarrow K\pi\pi$
  - MVD, STT, GEM, FTS

Λ→pπ⁻

Fig. 6.9. The number of STT hits per track for all final state particles in the Λ events at 1.642 GeV/c.
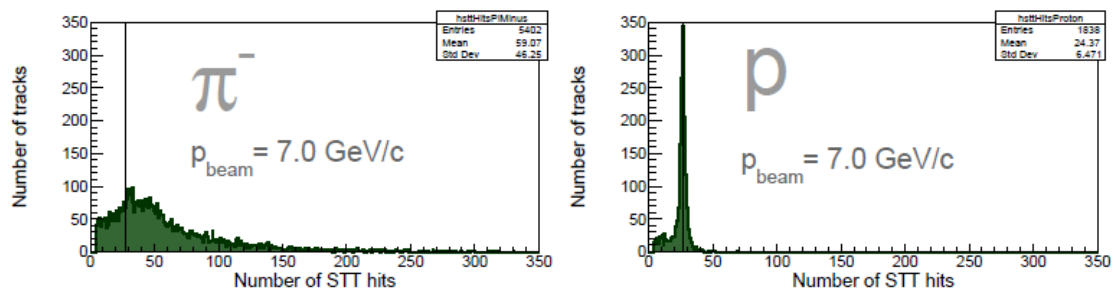

Fig. 6.10. The number of STT hits per track for all final state particles in the Λ events at 7.0 GeV/c.

Ω⁻→ΛK⁻→pπ⁻K⁻

Tab. 8.3. The total number, and percentage in parenthesis, of final state particle tracks with hits in the specified detectors. In total, 60,000 final state particle tracks were generated and the first line indicates the percentage of these satisfying each condition. There is no restriction on the number of STT hits for the tracks.

| Detector	5.0 GeV/c	15.0 GeV/c
% of all generated tracks	51 %	71 %
Total number of tracks	30,302 (100 %)	42,779 (100 %)
MVD	25,728 (85 %)	24,460 (57 %)
GEM	27,119 (89 %)	25,461 (60 %)
Barrel TOF	7 (0.02 %)	63 (0.1 %)
Barrel TOF and MVD	5 (0.02 %)	47 (0.1 %)
Barrel TOF or MVD	25,730 (85 %)	24,476 (57 %)

- Spiraling behavior of pions
- Difficulty obtaining timing reference from Barrel TOF
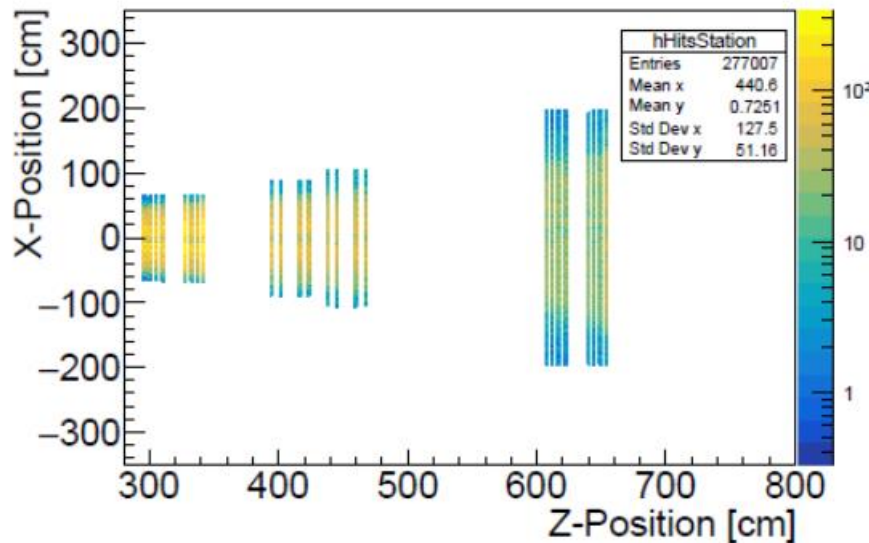
From: IN-STU-2019-001

FTS1234 Stations illumination, 4.6 GeV
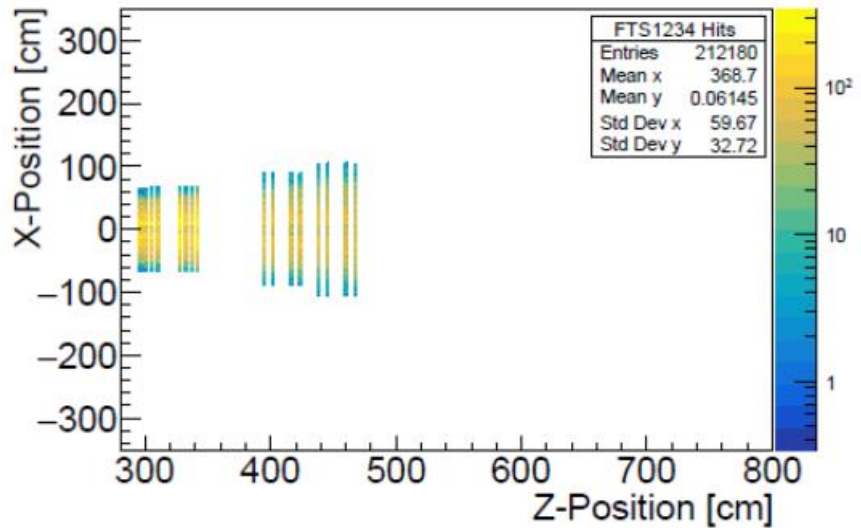
FTS1256 Stations illumination, 4.6 GeV
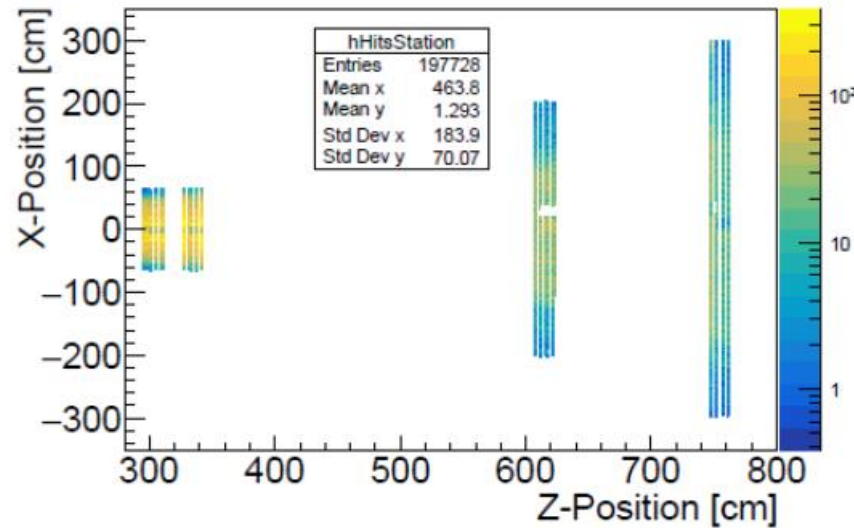
FTSFULL Stations illumination, 4.6 GeV

- Difference in **position** of station **6** between **FTS1256** and **FTSFull**

- Number of hits **decrease** with **distance** from the interaction point.

From: Computing Session CM18/1, Gabriela Pérez Andrade
https://indico.gsi.de/event/6944/contribution/5/material/slides/0.pdf

- Wrong geometry

Take Home Messages

1. Studying hit patterns in detectors, hits per track, illumination plots give a deep understanding of the behavior of reactions in detectors

2. Important to use correct settings in IdealTrackFinder

3. Mistakes in underlying code (both your own analysis code and PandaRoot) can be detected this way

Thank You!