

ToF-700 π^\pm and K^\pm analysis

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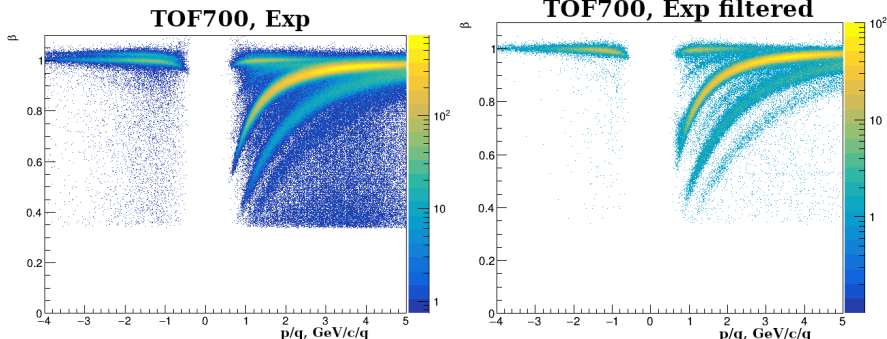


- Identifying π^\pm, K^\pm
- Estimation of the π, K meson production cross section

- Previous results
- Changes in track selection algorithm
- Efficiency corrections for TOF700 and DCH
- Evaluation of trigger performance
- Background subtraction by the linear fit
- Summary

- Algorithms for filtering experimental data have been implemented

Statistics were collected for the argon beam on **all targets and triggers.**



- **Realistic effects** have been added to the modeling process
 - Angle of beam
 - Gaussian smearing vertex
 - Lorentz shifts
 - Dead strips, hits
- Accounting for **dynamic** matching ranges and hit corrections

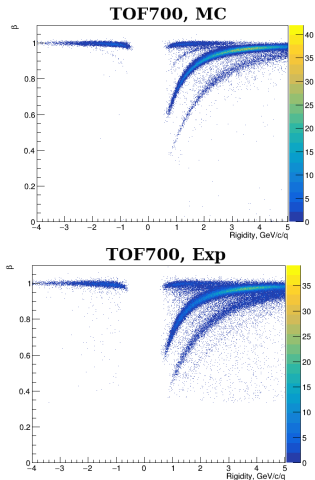
Run: 7 and Tracking: CellAuto

Monte Carlo

- Generator: DCM-SMM
- System: Ar + Cu, C, Al, Pb, Sn
- Energy: 3.2 AGeV
- Lorentz Shifts
- Dead strips, hits

Exp data

- System: Ar + Cu, C, Al, Pb, Sn
- Energy: 3.2 AGeV



Selection criteria for reliable experimental tracks:

- Vertex in range

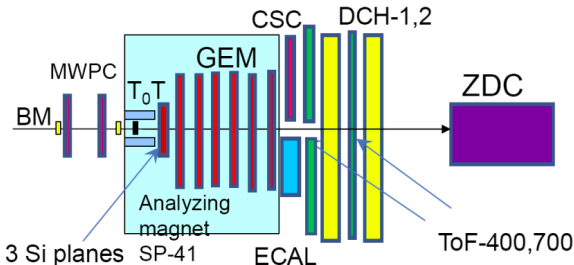
$$V_x \in (-2, 4)\text{cm}; V_y \in (-6, -1)\text{cm}; V_z \in (-5, 5)\text{cm}.$$

- Minimum **4 hits in GEM**.

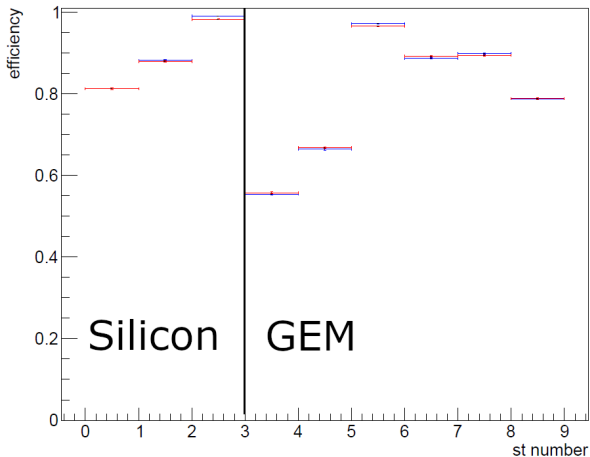
No longer required to have at least 2 hits of Si.

- The track is confirmed in the first **drift chamber**

For the **TOF700** detector, we associate the track with the **hit**,
and for the **DCH1** with the **track segment**

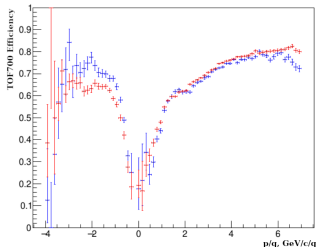
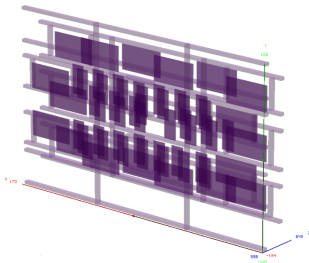


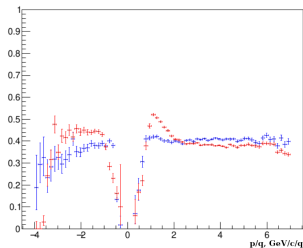
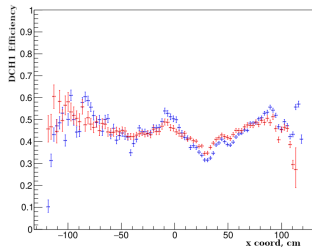
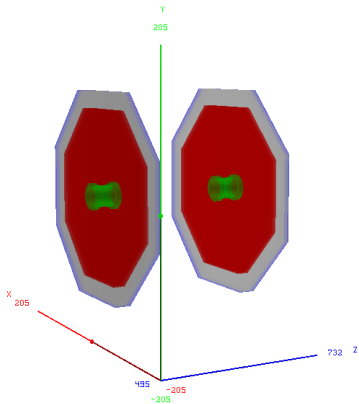
Station skip + hits disable + station acceptance



TOF700 eff constants: by modules

- From the **exp data** get the efficiency of **each module**: Mod_{eff}
- At the **stage of creating hits**, choose a random uniformly distributed number (Mod_{rnd})
- If $\text{Mod}_{\text{rnd}} > \text{Mod}_{\text{eff}}$, then the hit for the given module **is not recorded**



Alignment by **x** coordinate

$$\sigma_{\pi^\pm}(y, \rho_t) = \frac{N_{\text{rec}}^{\pi^\pm}(y, \rho_t)}{\varepsilon_{\text{rec}}(y, \rho_t)\varepsilon_{\text{trig}}L}$$

where

- y is the **rapidity**
- ρ_t is the **transverse momentum**
- N^{π^\pm} is the **number of reconstructed π^\pm**
- ε_{rec} is the **efficiency of the π^\pm reconstruction**
- $\varepsilon_{\text{trig}}$ is the **trigger efficiency**
- L is the **luminosity**

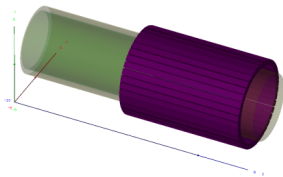
$$\varepsilon(\text{BD} > k) = \frac{N_{\pi}(\text{BD} > k, \text{FD} > N, N_{\text{tr}})}{N_{\pi}(\text{FD} > N, N_{\text{tr}})},$$

where

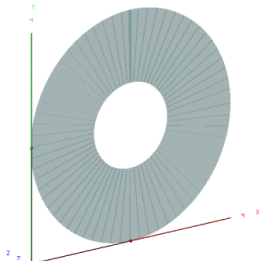
- $k = 1, 2, 3$ **reading from digits**
- N_{tr} is the **number of tracks in primary vertex**
- $\text{FD} > N$ is the trigger condition **for writing data**
- N_{π} is the **number of pions**

- Momentum:
 $-2.6 < p/q < 2.4$
- Parameters for π :
 - $-0.1 < m^2 < 0.15$
 - $0.10 < p_t < 0.80$
 - $1.5 < y < 3.2$
- Parameters for K :
 - $0.15 < m^2 < 0.35$
 - $0.10 < p_t < 0.70$
 - $1.0 < y < 2.0$

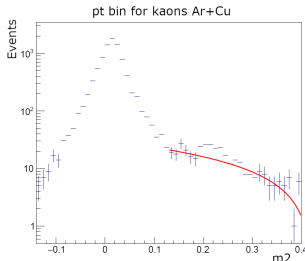
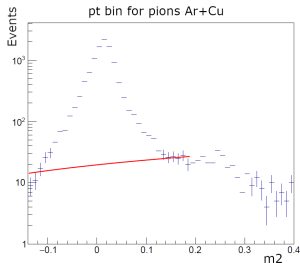
BD (barrel detector)

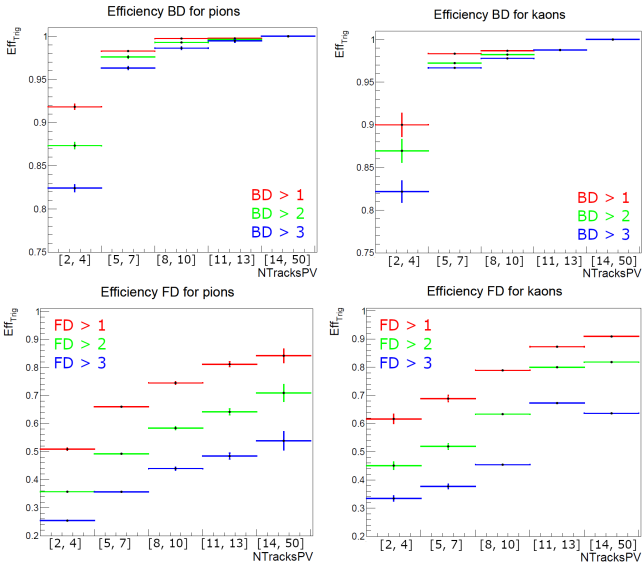


FD (forward silicon detector)



- Select **reliable** tracks
- **Restrict** by p_t and y
- For each p_t bin save all m^2
- Select a some range to the left of m_{\min}^2 and to the right of m_{\max}^2
- If there are **more than 10 events** in the mass range and **at least 2 events on the left and right**, perform a linear fit
- **Subtract background** from the signal



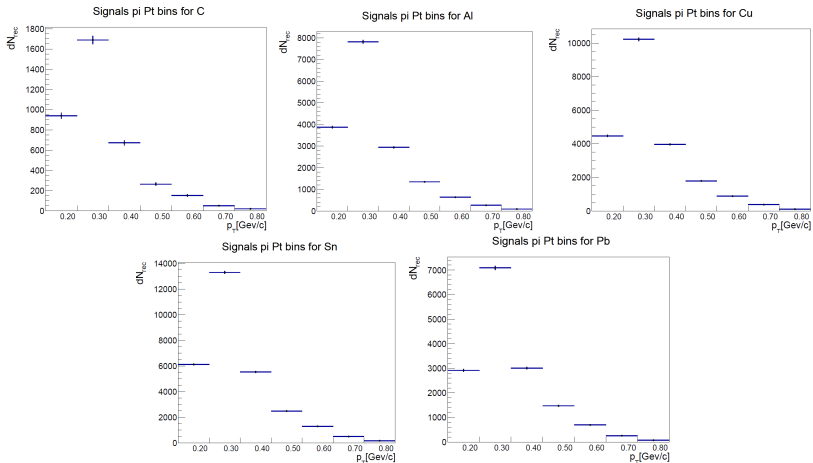


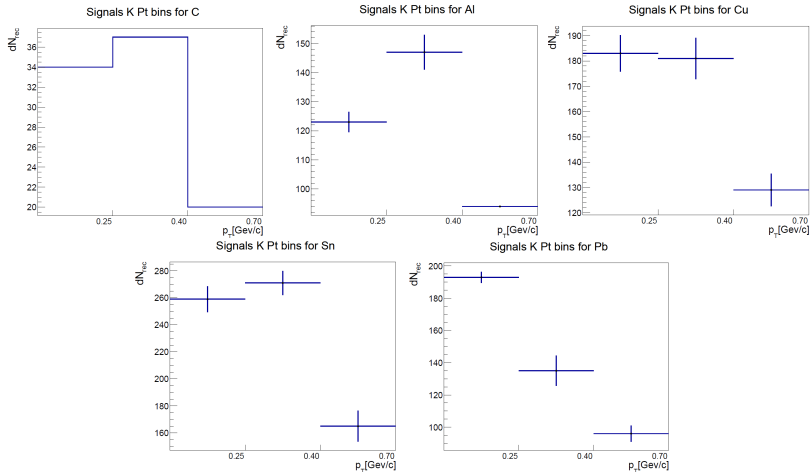
π	C	Al	Cu	Sn	Pb
BD >1	0.72	0.94	0.97	0.99	0.99
BD >2	0.57	0.90	0.96	0.99	0.99
BD >3	0.44	0.85	0.94	0.98	0.98
K	C	Al	Cu	Sn	Pb
BD >1	0.50	0.90	0.95	0.99	0.99
BD >2	0.50	0.92	0.96	0.99	0.99
BD >3	0.40	0.95	0.94	0.98	0.98



π	C	Al	Cu	Sn	Pb
FD >1	0.37	0.49	0.63	0.73	0.80
FD >2	0.23	0.31	0.46	0.58	0.69
FD >3	0.15	0.19	0.33	0.44	0.58
K	C	Al	Cu	Sn	Pb
FD >1	0.51	0.66	0.86	0.76	0.86
FD >2	0.29	0.44	0.87	0.63	0.73
FD >3	0.16	0.30	0.63	0.43	0.60







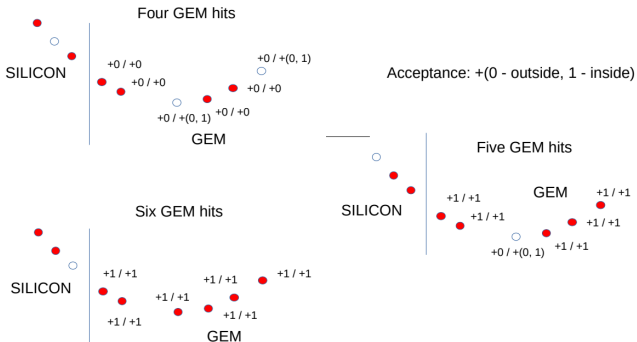
- The efficiency **inside** and **after** the magnet are **in good agreement**.
- The **efficiency of triggers** was evaluated.
- The distributions of the experimental signals were **cleared from the background**

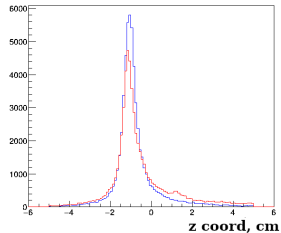
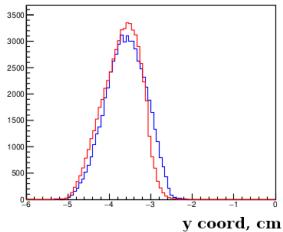
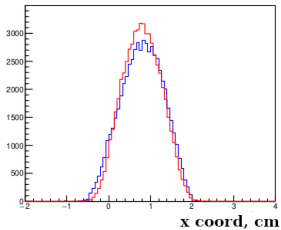
Thank you for the attention!

Silicon Tracks (Min 0 hits)

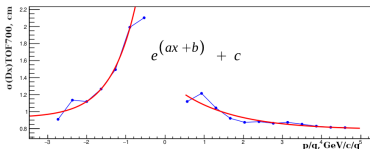
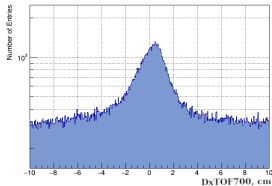
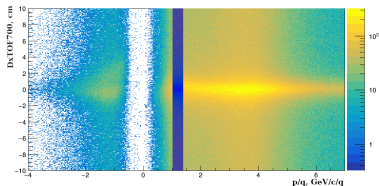
GEM Tracks (Min 4 hits)

$$\text{Efficiency}_i = \frac{\text{Numerator}_i}{\text{Denominator}_i}$$

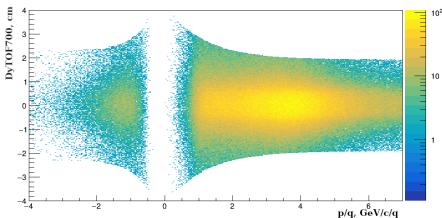
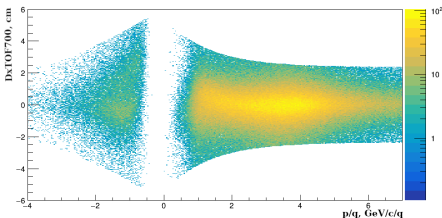
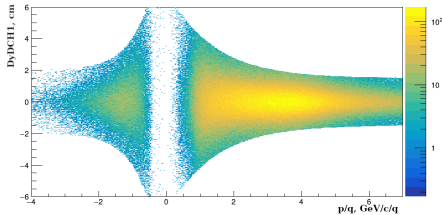
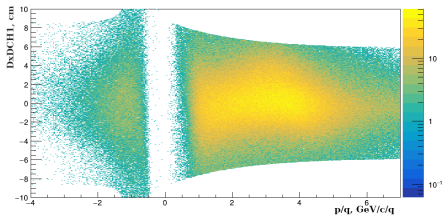


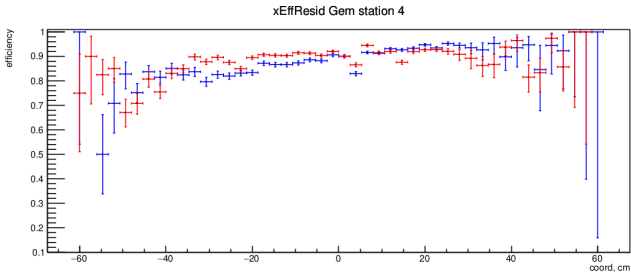
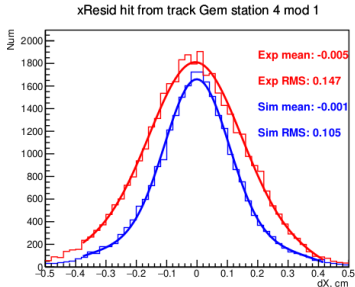
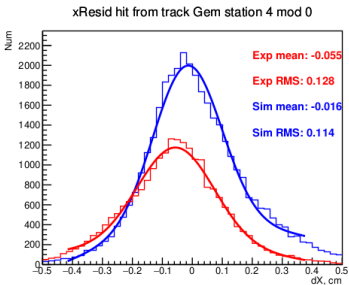


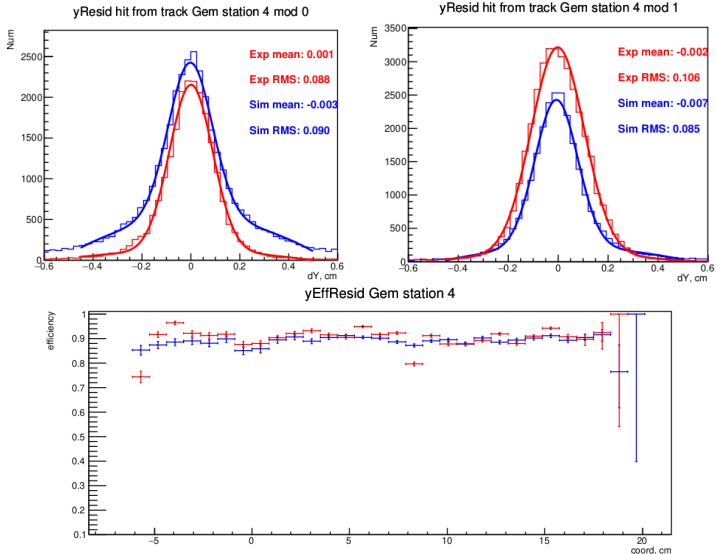
- Propagate each track to the detector plane
- Create histograms with all track-to-hit(track) connections from momentum
- Every 350 MeV, project the residuals onto the Y plane
- Fit distributions by gaus + pol2 to get $\mu_{D_x}(\rho/q)$ and $\sigma_{D_x}(\rho/q)$
- Fit all μ_{D_x} and σ_{D_x} by exponential function



Matching criteria: $\pm 3\sigma_{D_x}(\rho)$, $\pm 3\sigma_{D_y}(\rho)$







- Let station i is station where we want to calculate efficiency
- Propagate $SIL \rightarrow GEM \rightarrow DCH1 \rightarrow TOF700 \rightarrow DCH1 \rightarrow GEM \rightarrow SIL \rightarrow Vertex$ by KF with parameters update (skip station i)
- Propagate $Vertex \rightarrow SIL \rightarrow GEM$ by KF with getting residuals and calculating efficiencies

