$\Xi^{(*)}$ Production Estimates

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Estimate of Ξ Yields

- Recently I estimated

  - Acceptance of 4.2%, 1.6% for exclusive reconstruction of Ξ^- and $\Xi^-(1820)$ (not including BR($\Lambda \rightarrow p\pi^-$) = 0.639)

  - Estimated σ_{tot} of 15 nb, 1 nb $\rightarrow$ <u>production</u> of 9M and 600k events in Phase IV running

  - With current acceptances, expect 240k, 6k events to be <u>reconstructed</u>

PAC40 Ξ Estimates

- Estimates done by Nathan, BDT studies by Justin

- Assumed 15 nb, 2nb σ_{tot} for Ξ, Ξ(1530)

- Assumed acceptance (from both exclusive and inclusive) of 10% each, based on Ξ(1320) study only

- Leads to 800k, 100k <u>reconstructed</u>

- Exclusive reconstruction efficiencies are 1% and 3%

- For Ξ(1820), use pythia events of $K^+ K^+ K^- \Lambda$ events to estimate purity using BDT

- No estimates of Ξ(1820) σ_{tot}, yields

Comparison

- Assumed σ_{tot} is same

- Acceptance is 4.2%, 1.6% for me, 1%, 3% for Nathan

- Difference in acceptance: sim-recon versions, assumed production mechanisms

ground state Ξ

study	t-slope	M_{Y*}	Γ_{Y*}
PAC	1.4	1960	220
KM	3.0	1960	220

$\Xi(1820)$

study	t-slope	M_{Y*}	Γ_{Y*}
PAC	1.7	2700	1000
KM	3.0	2600	250

t-slopes are very different

Ξ⁻ Gen. Vertex Distributions

primary **secondary** **tertiary**
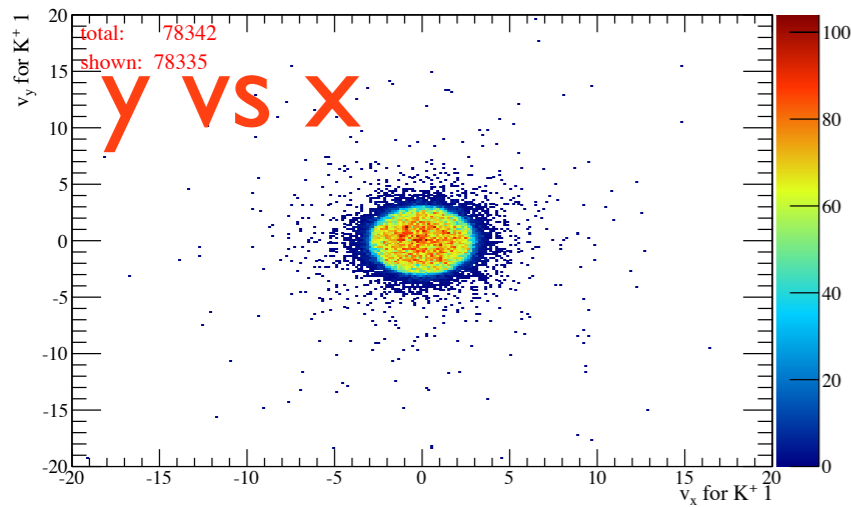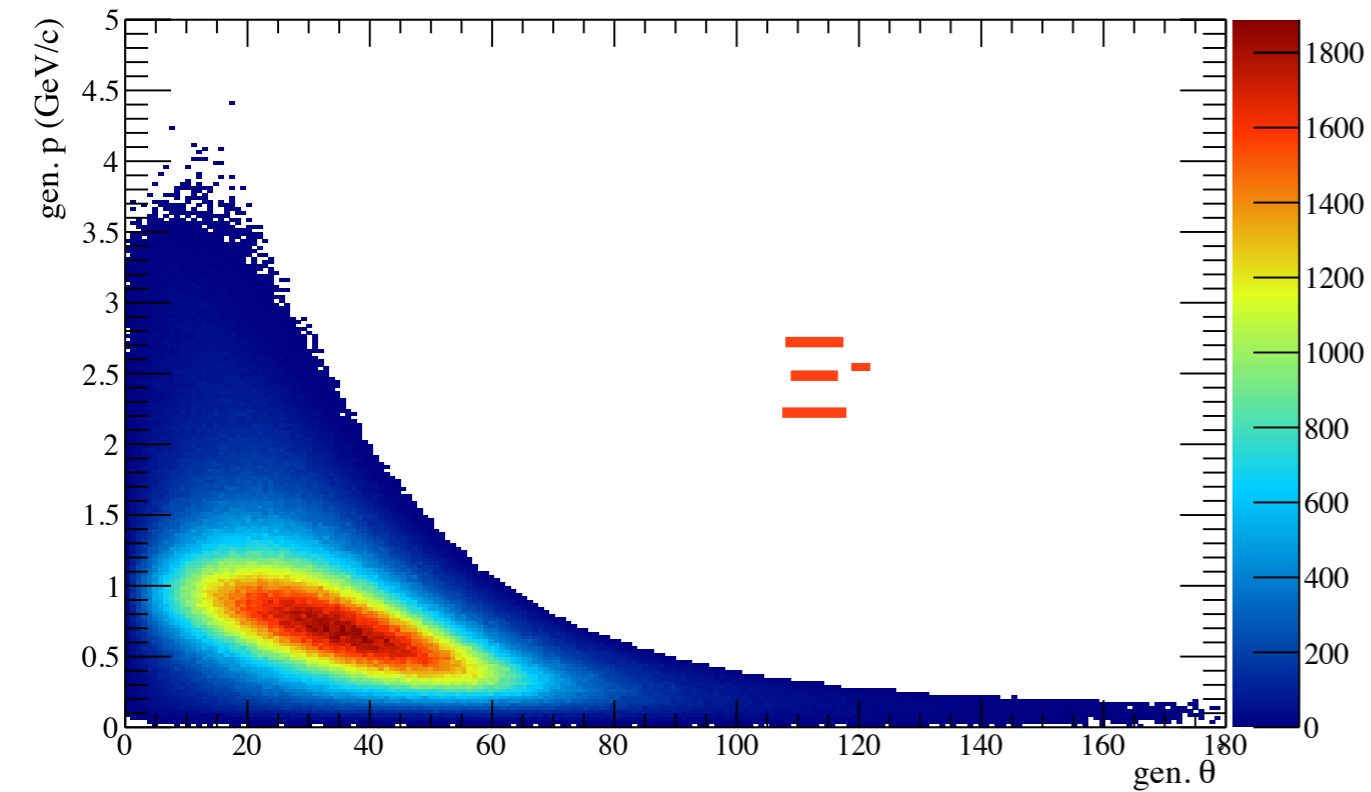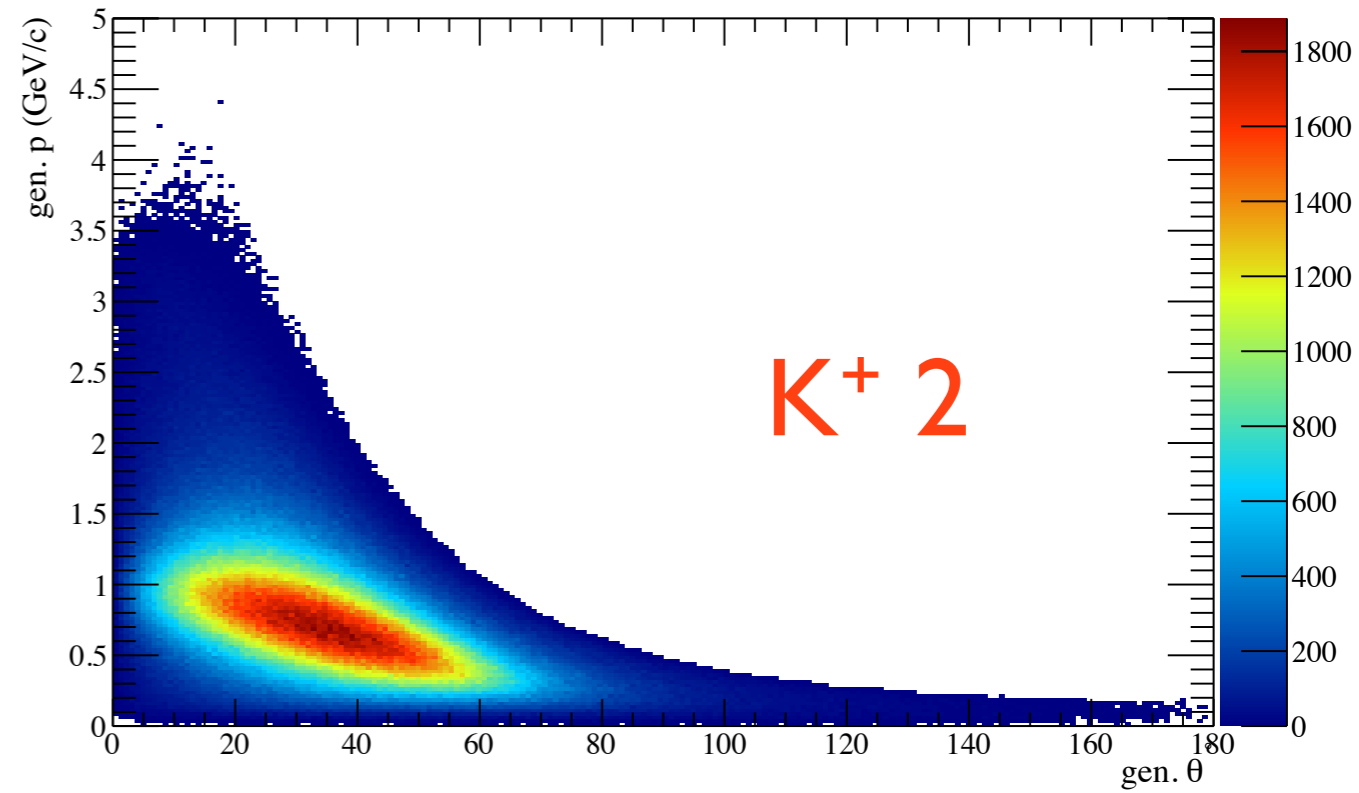

y vs x

ρ vs z

K⁺, K⁺, Ξ⁻ Λ, π⁻ p, π⁻

Primary vertices are uniform over target region

5

Ξ⁻ Recon. Vertex Distributions

Primary vertices are uniform over target region

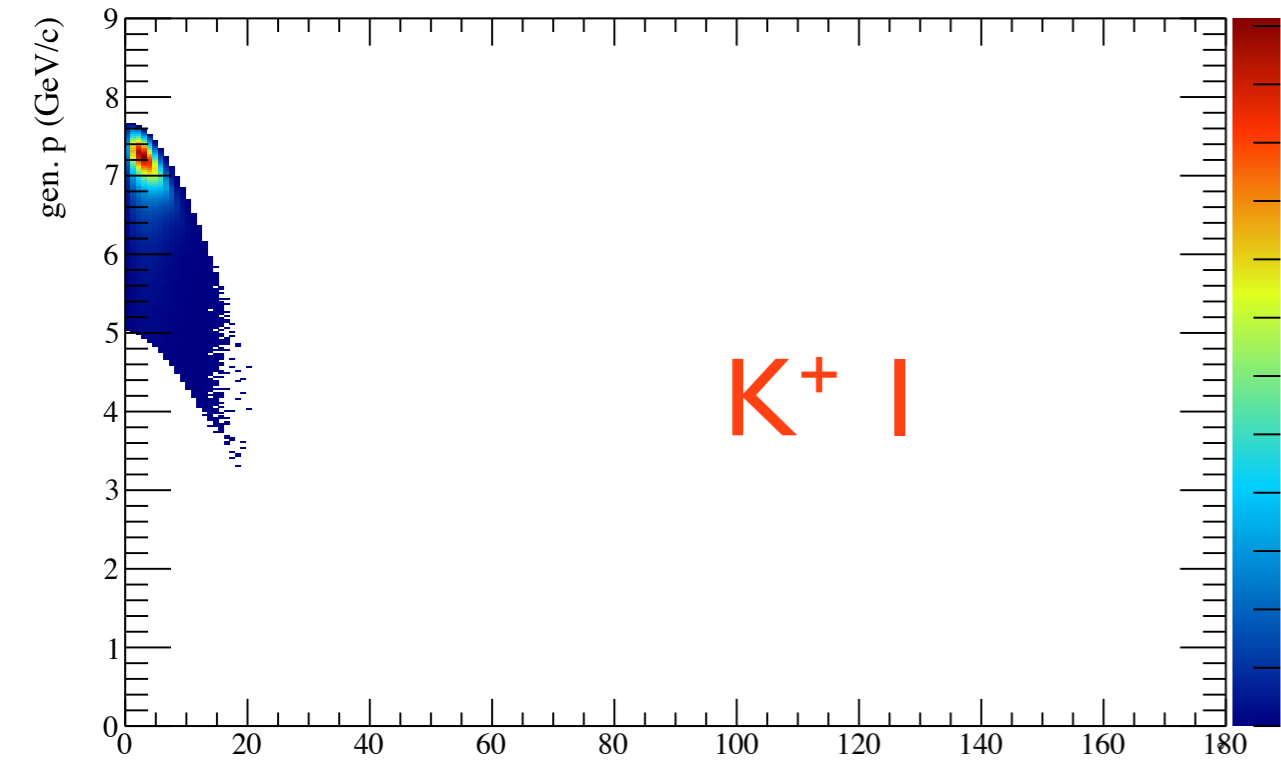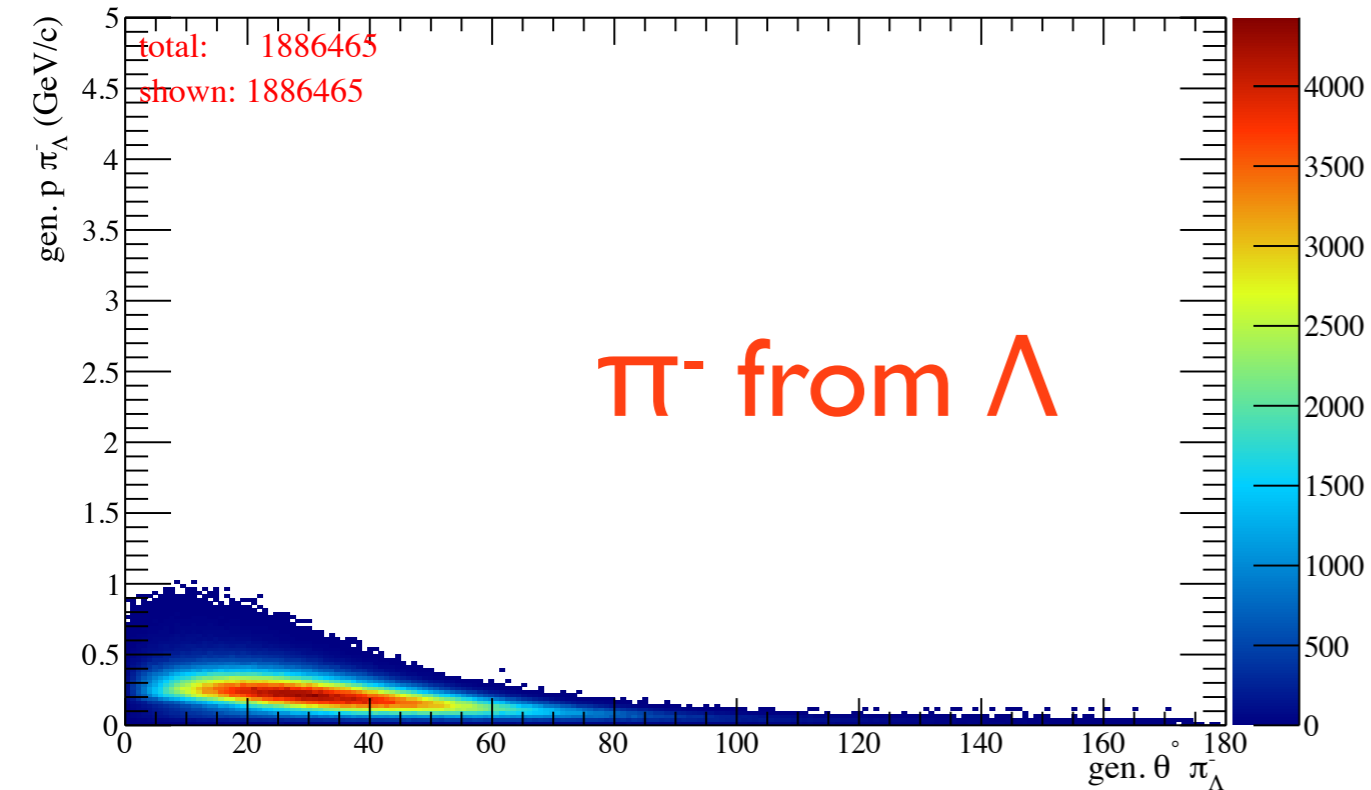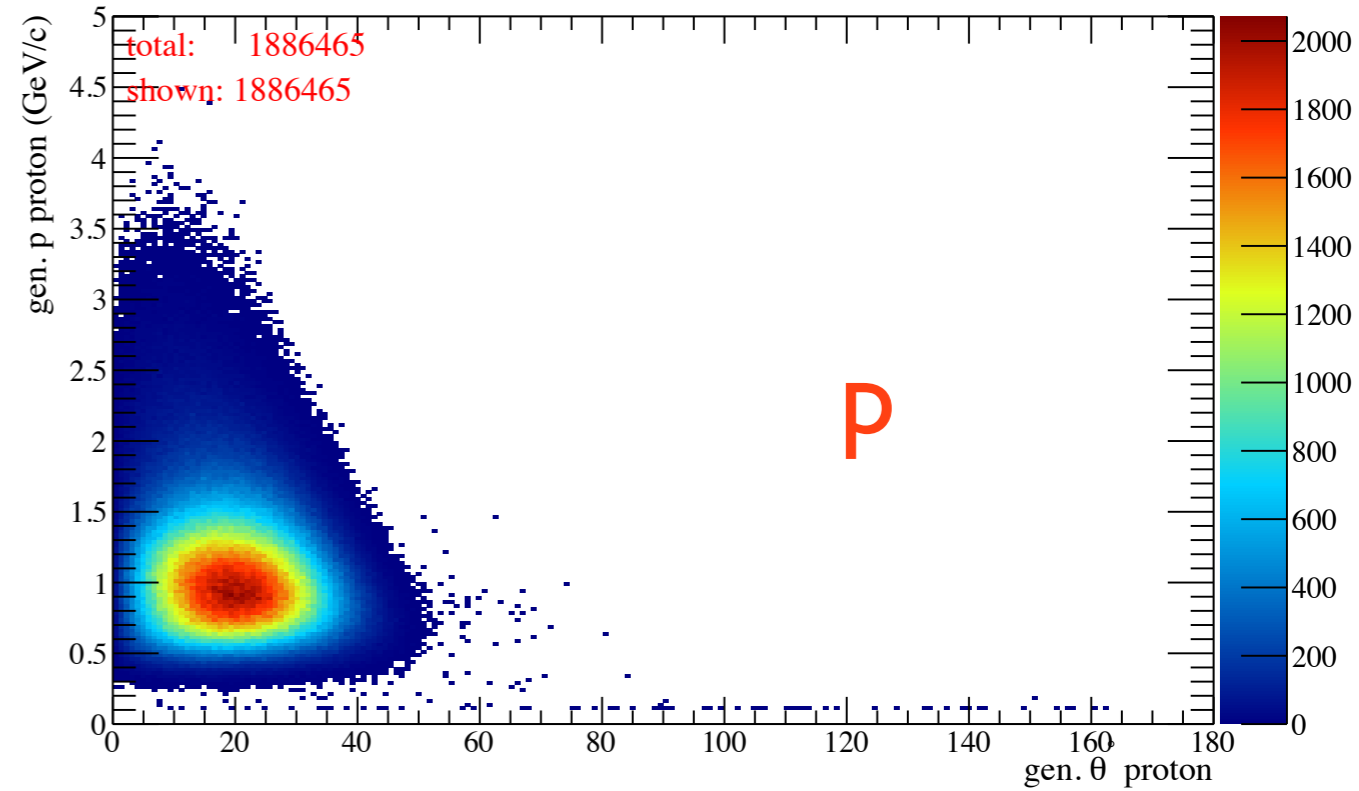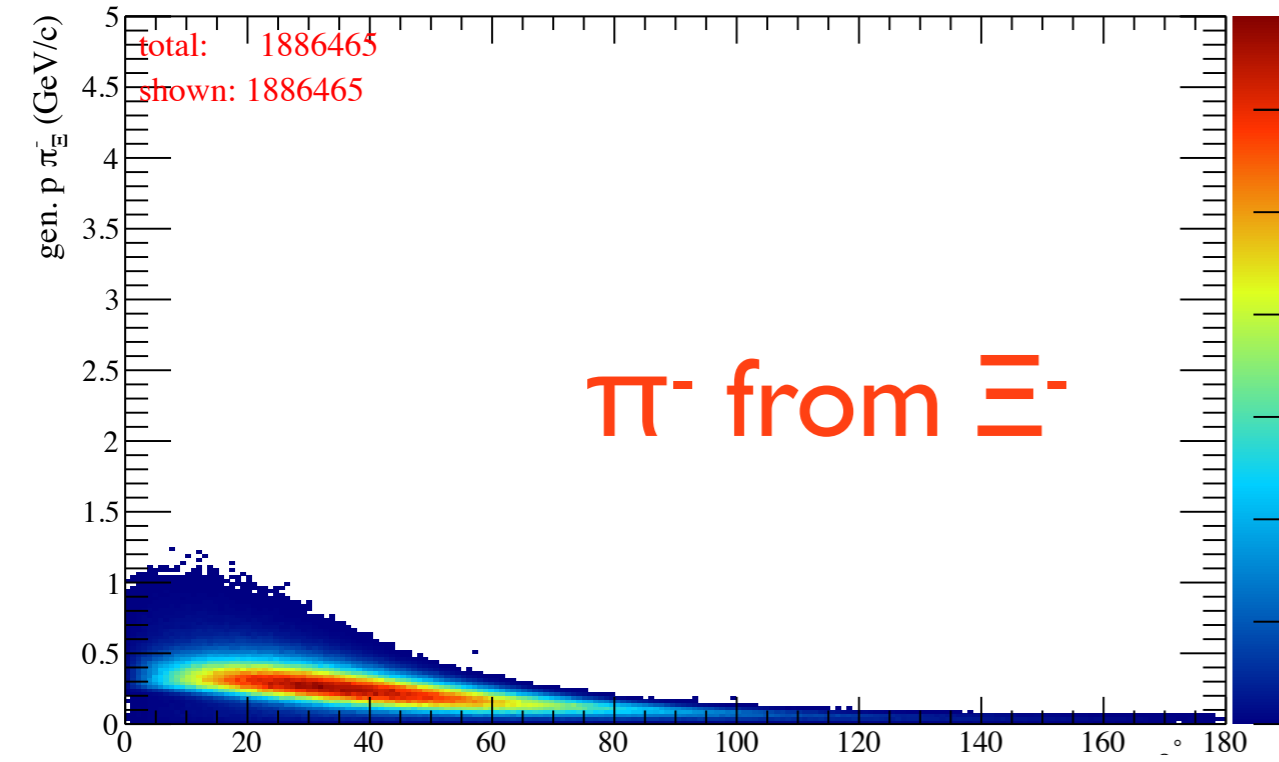# Ξ⁻ Gen. |p| vs θ - K⁺ K⁺Λ

Ξ⁻ Recon. |p| vs θ - K⁺ K⁺Λ

analysis code does not distinguish between two K⁺ in reconstruction - there are no duplicates due to interchanging the two detected K⁺
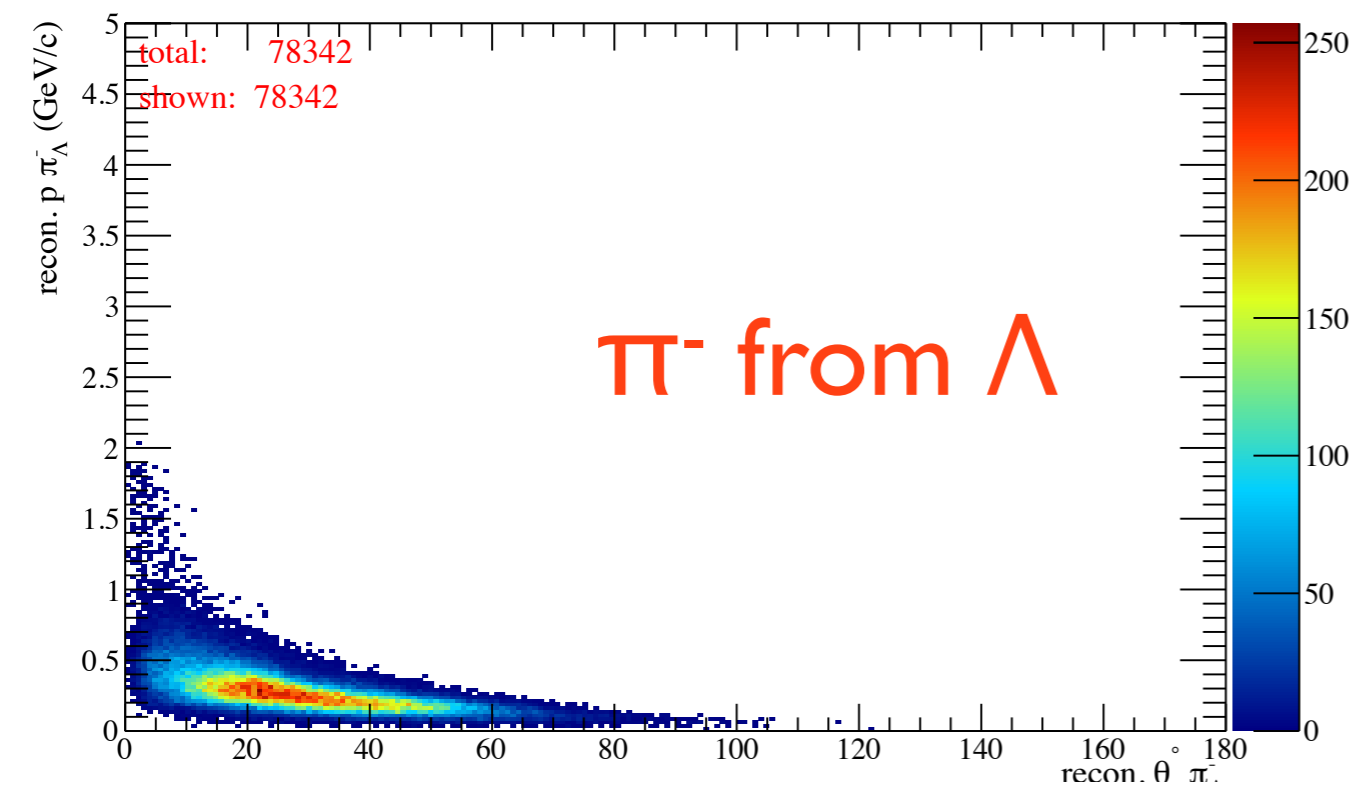
Ξ⁻ Comparison of two K⁺

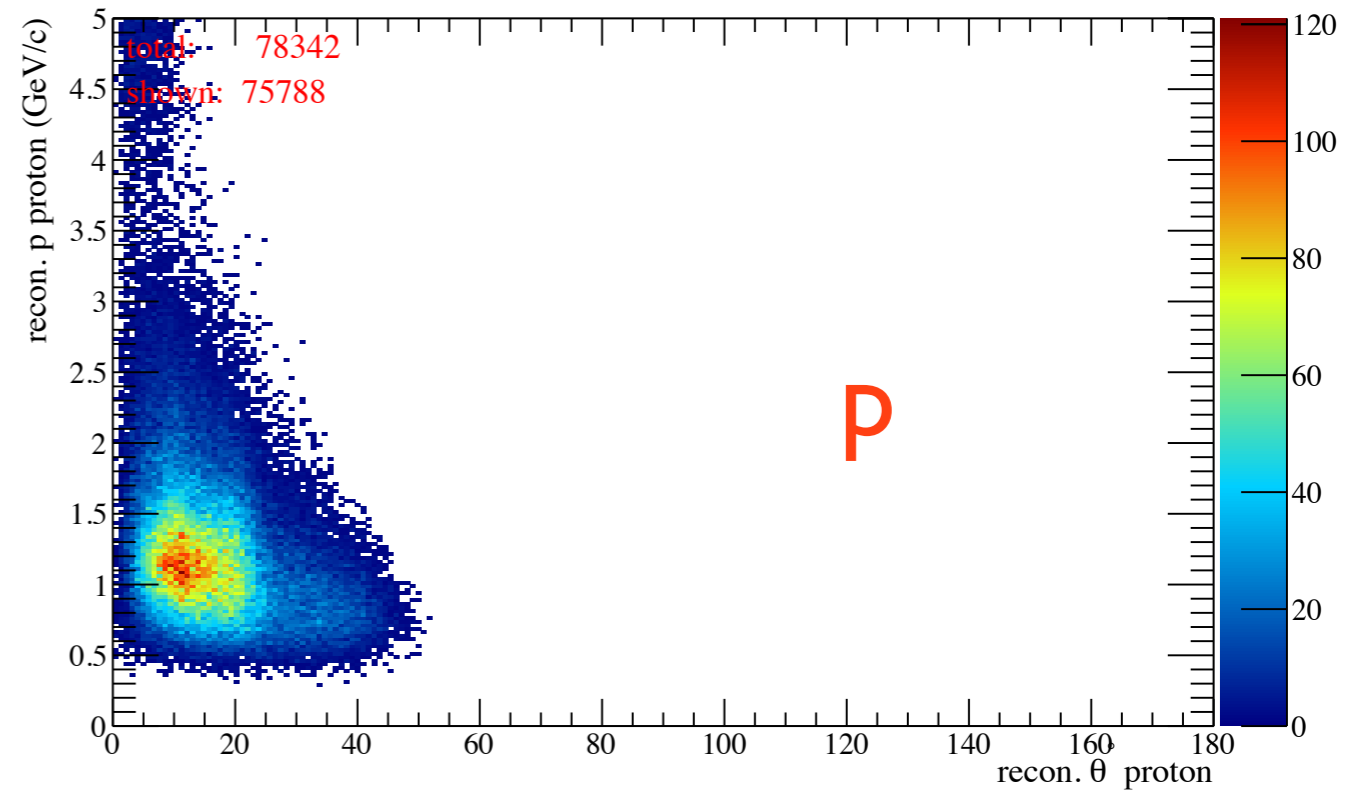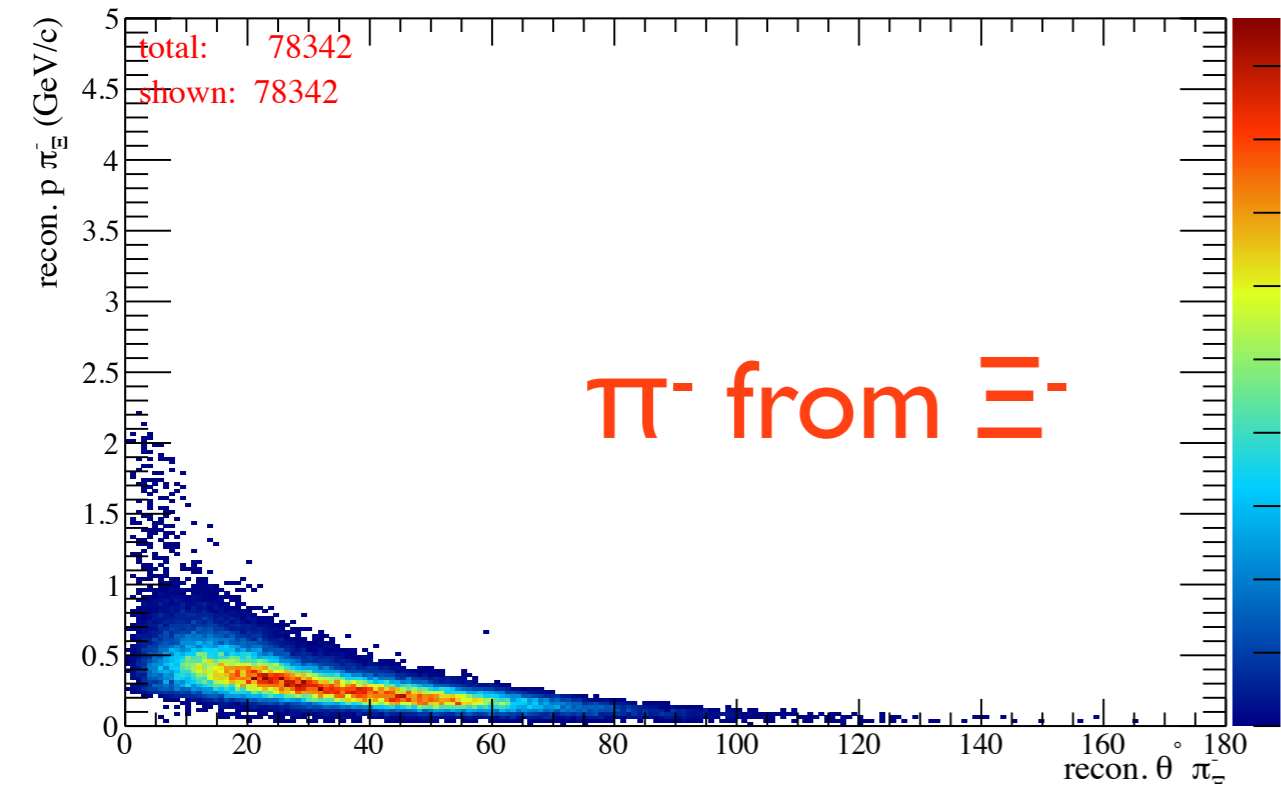
|p| of two K⁺ for each combo - no two combos are due to swapping the K⁺. We assign the K⁺ with higher |p| as "primary" K⁺
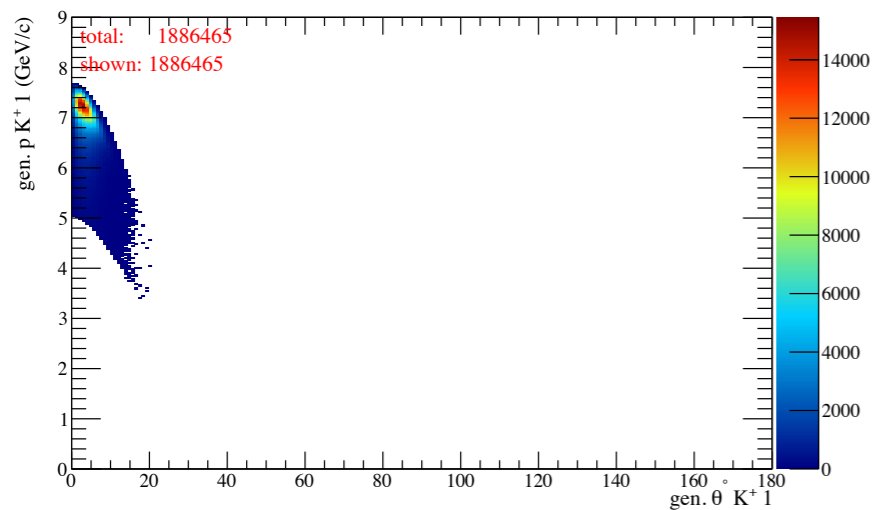
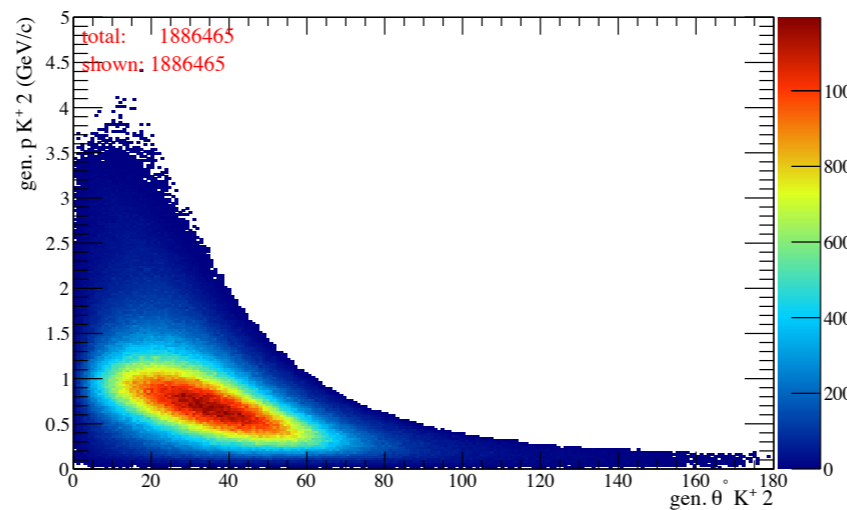# Ξ⁻ Gen. |p| vs θ - K⁻ pπ⁻

Ξ⁻ Recon. |p| vs θ - K⁻ pπ⁻
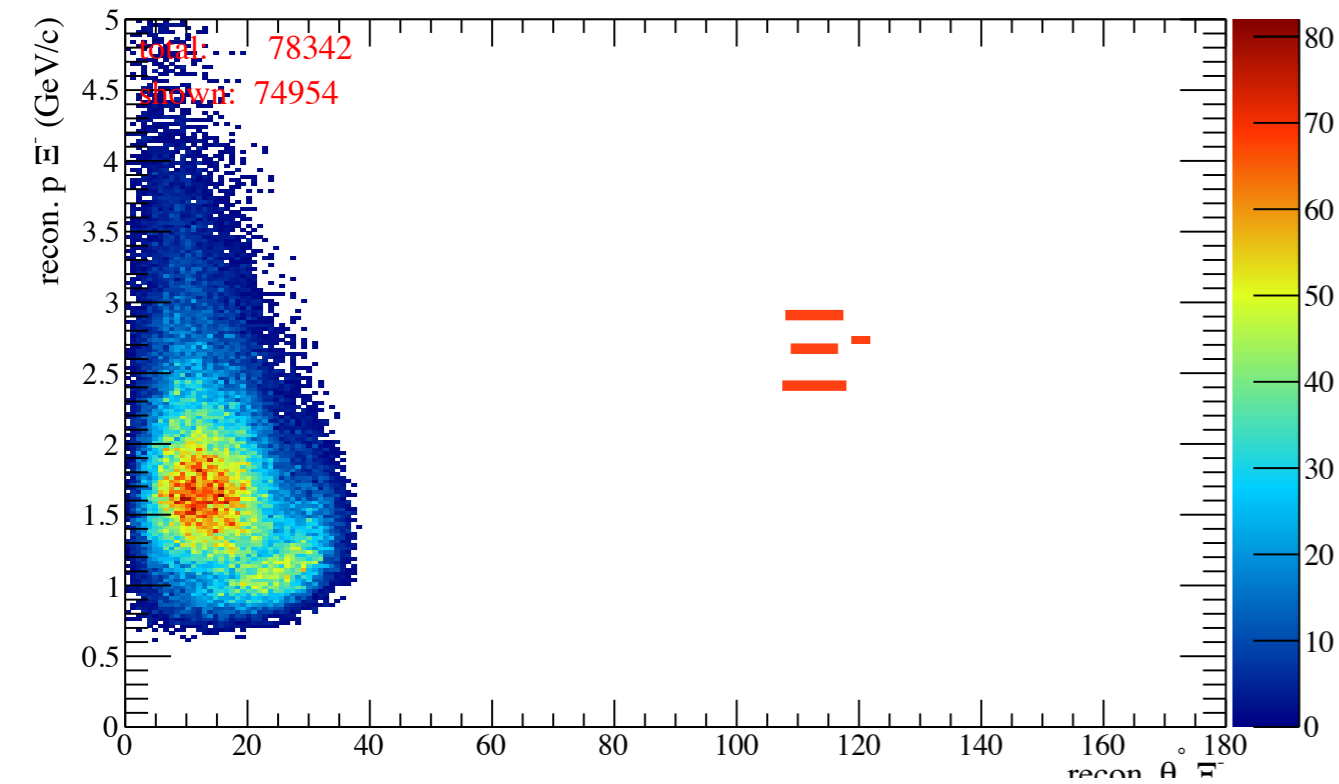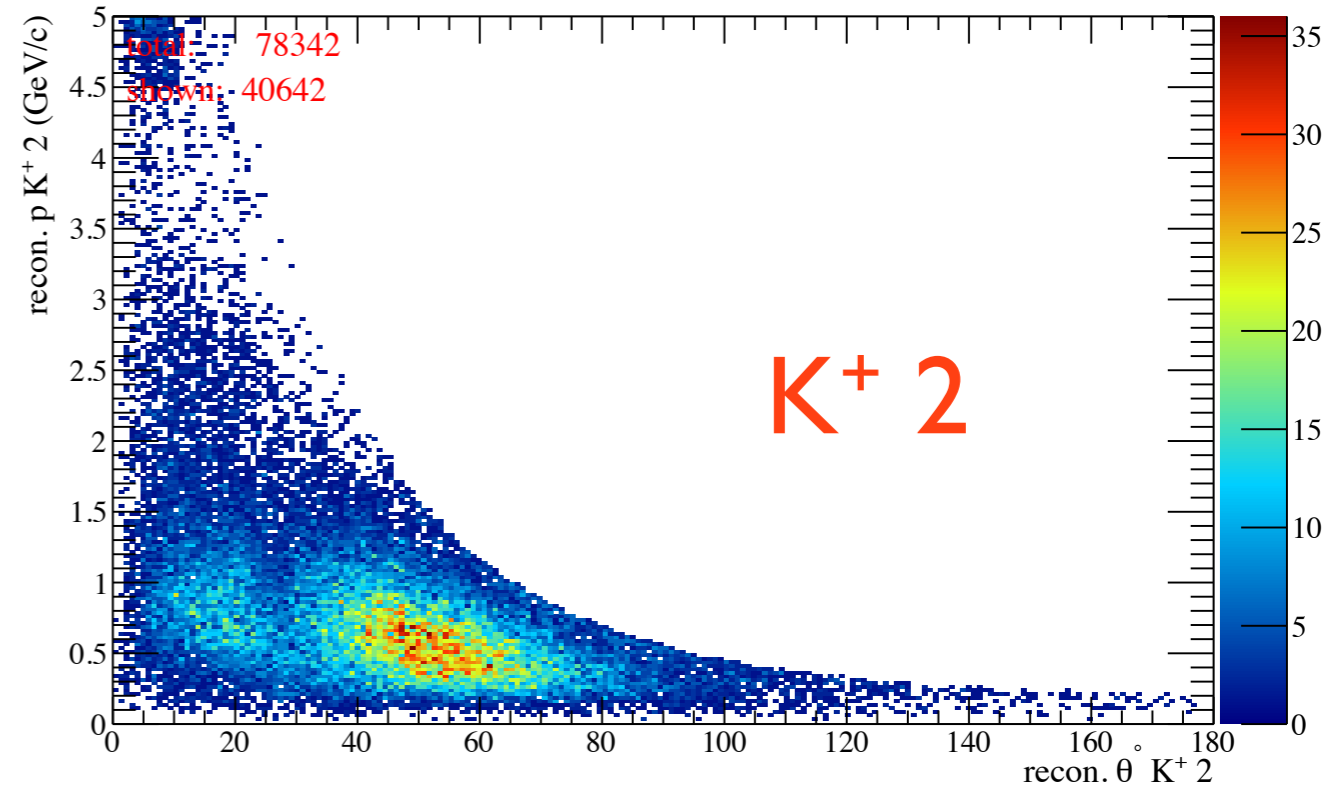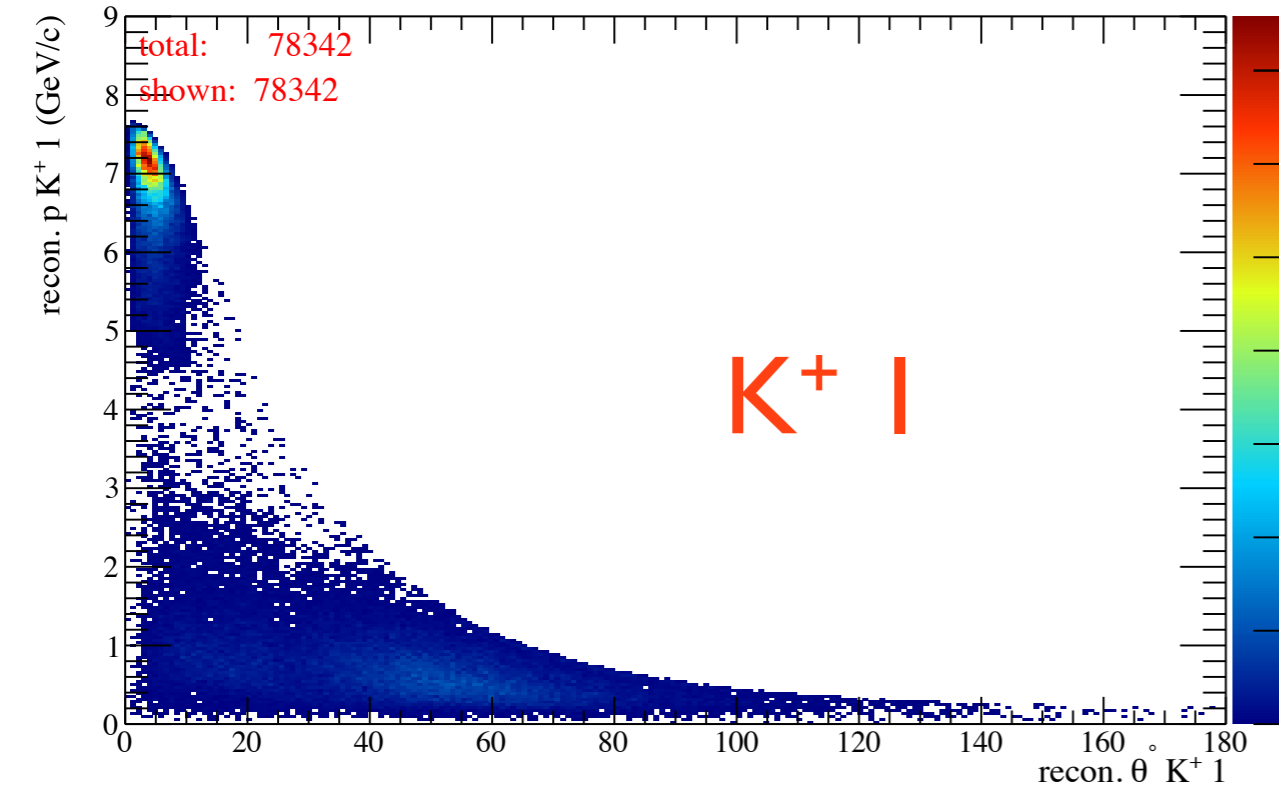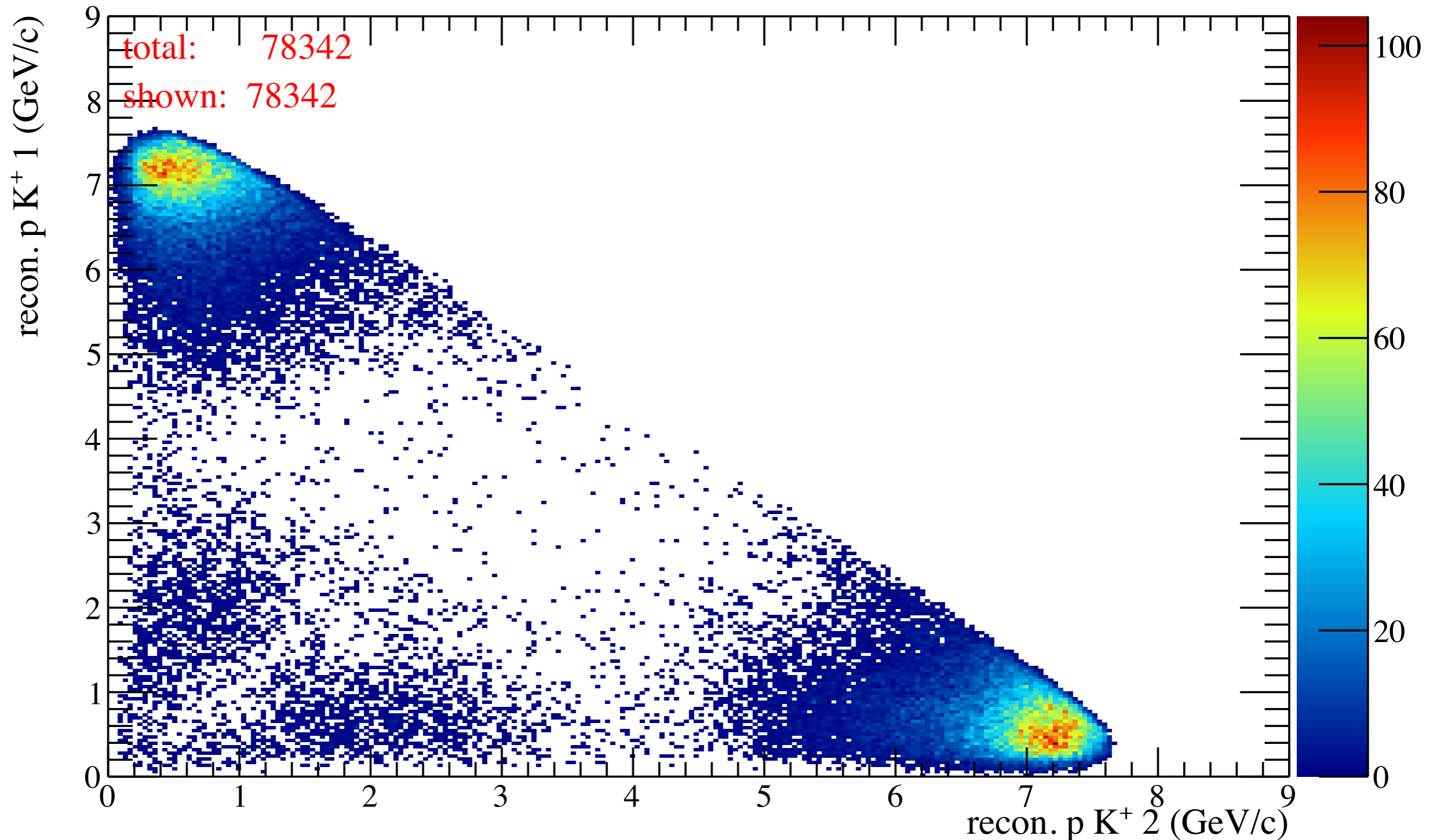
Ξ⁻ Comparison with Nathan

- t-slopes are 3.0 (mine) and 1.4 (Nathan)

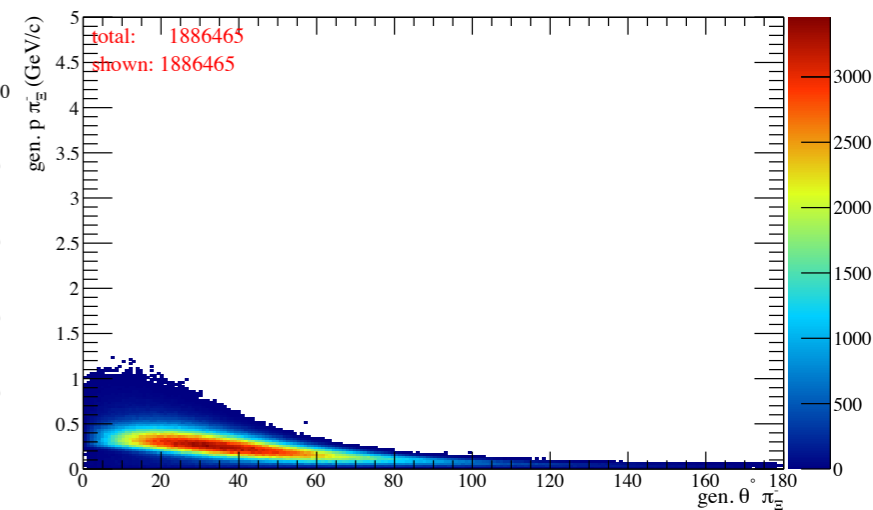- Acceptances are 4.09%, 4.11%
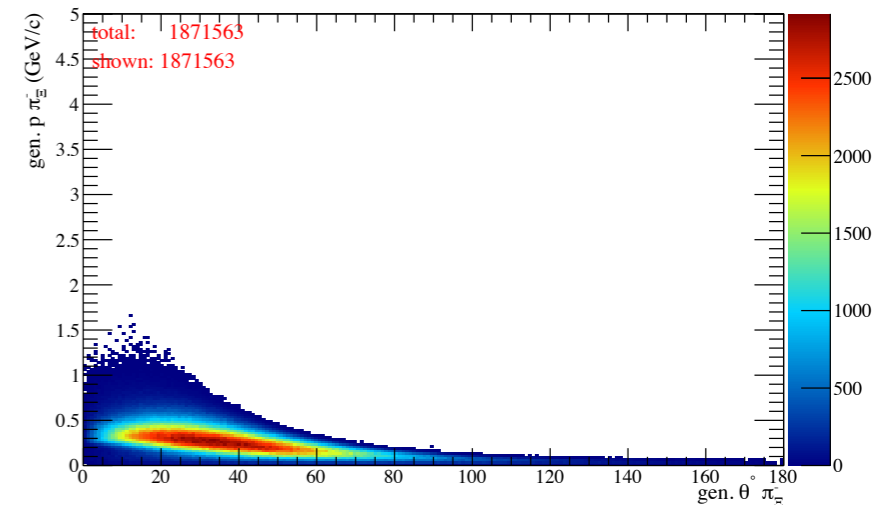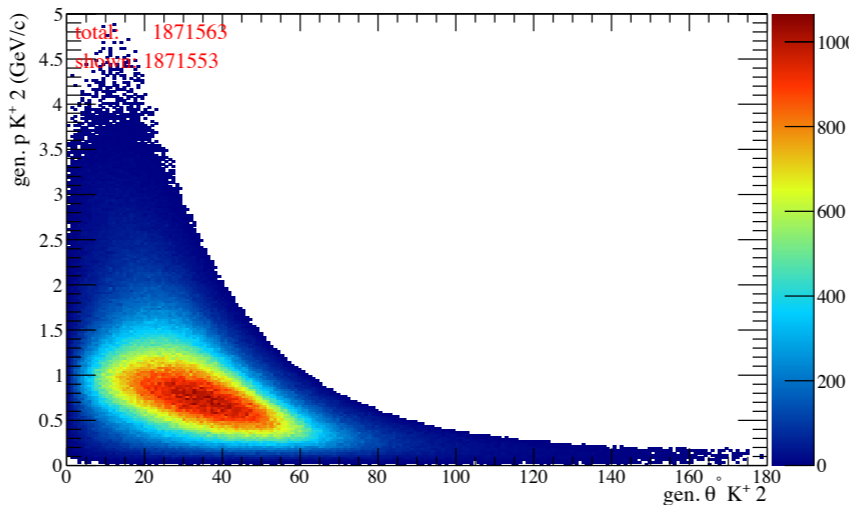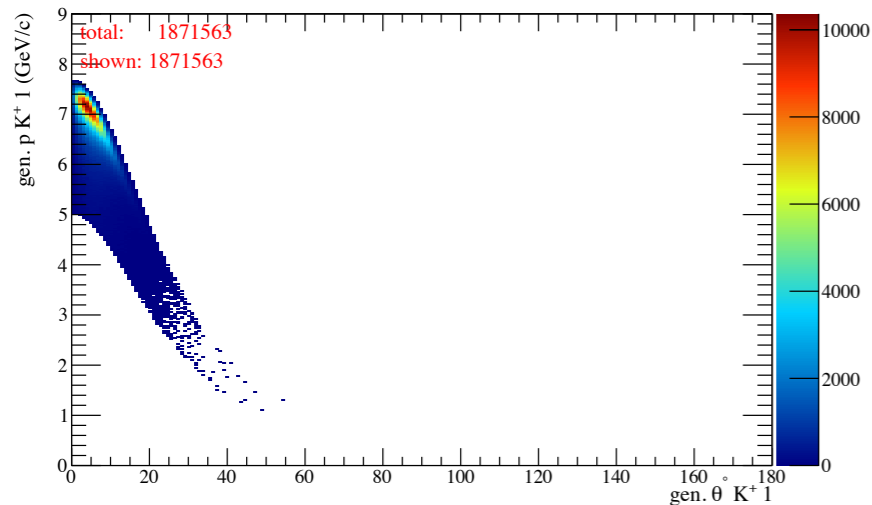
- Nathan reported ~1% for this channel

generated

K⁺ 1   K⁺ 2   π⁻ 1

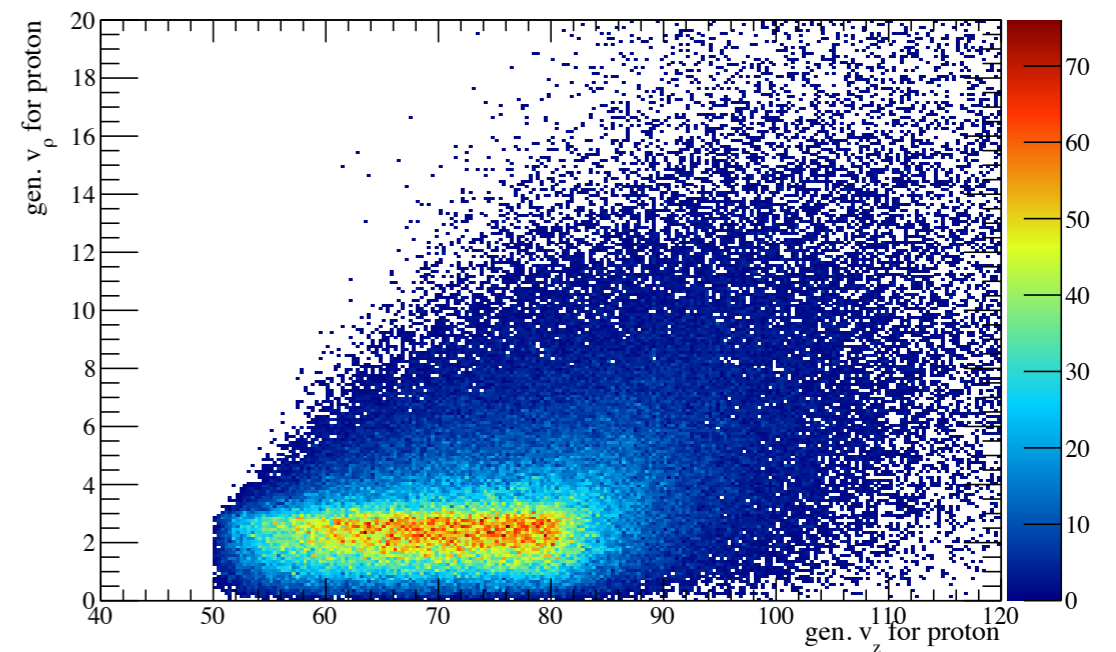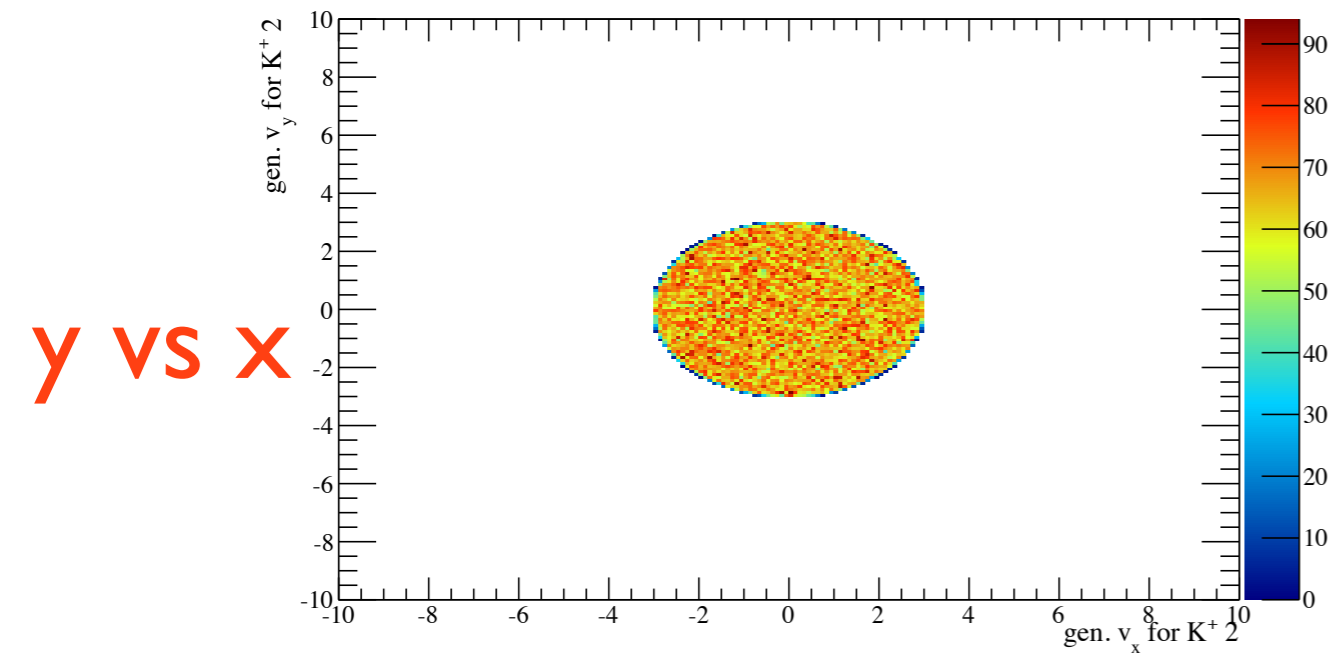# Ξ(1820) Gen. Vertex Distributions
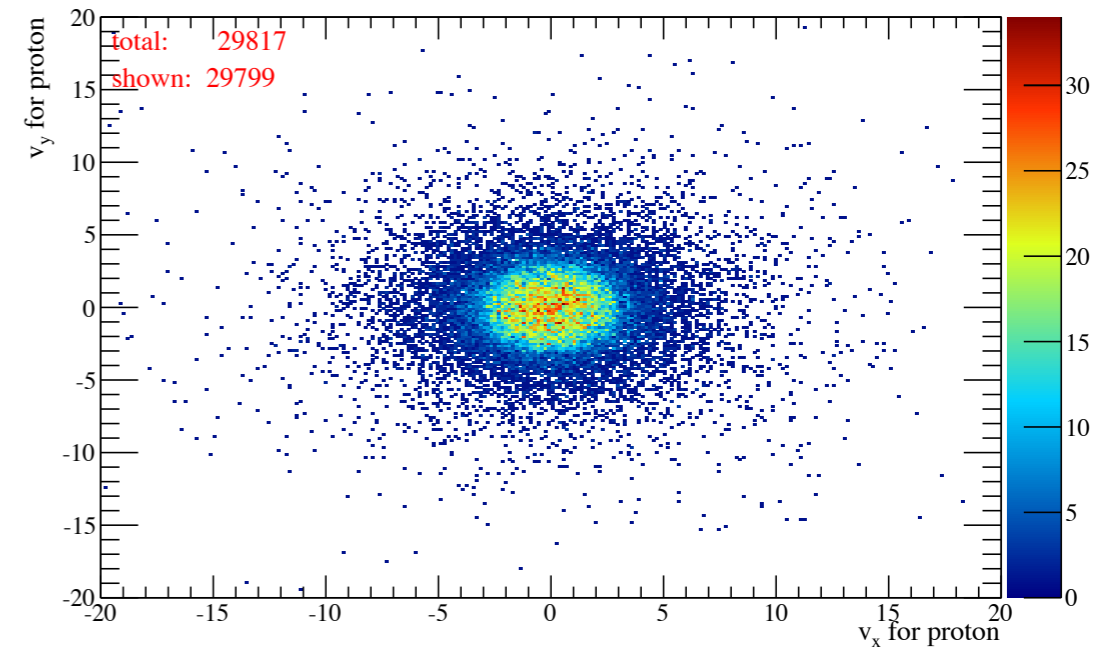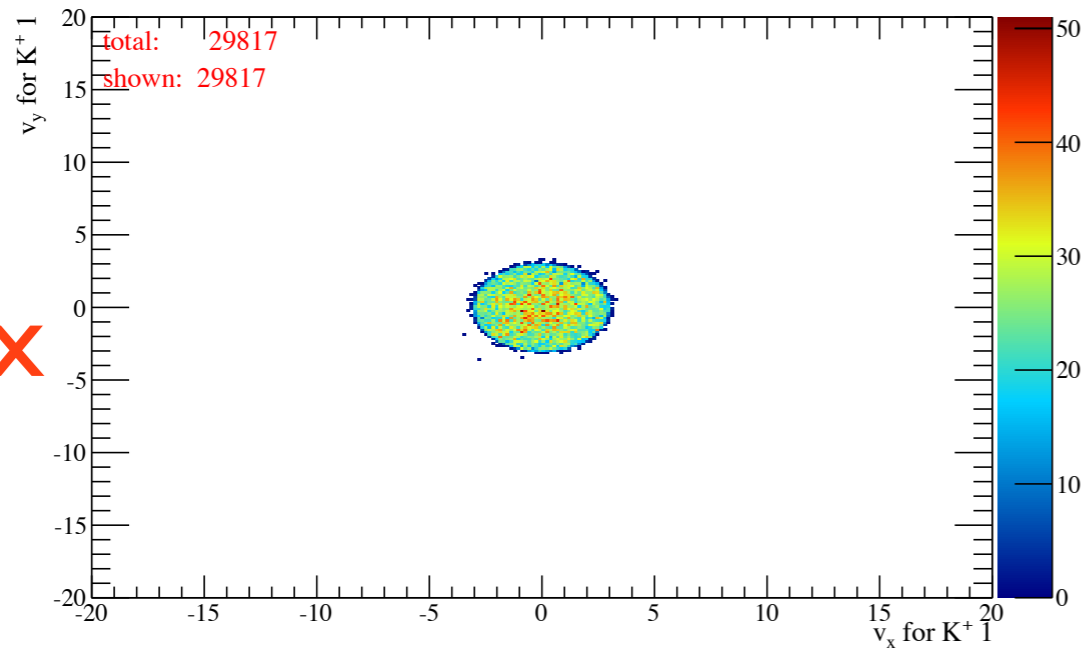

primary

secondary

y vs x

ρ vs z
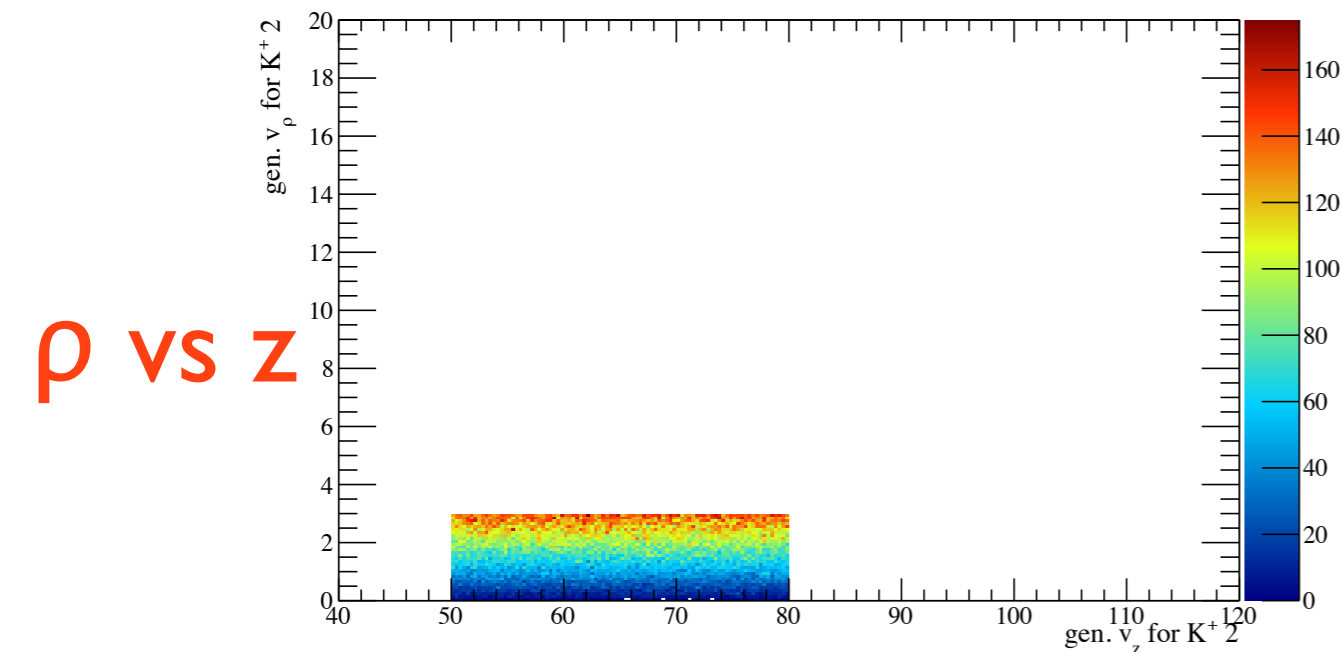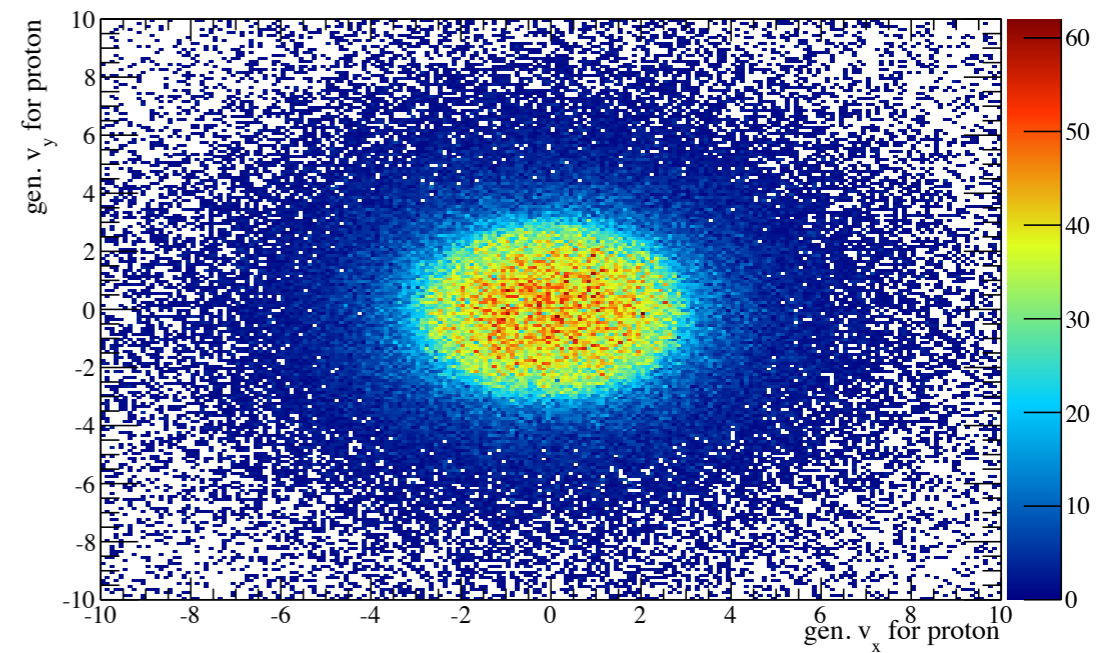
Primary vertices are uniform over target region
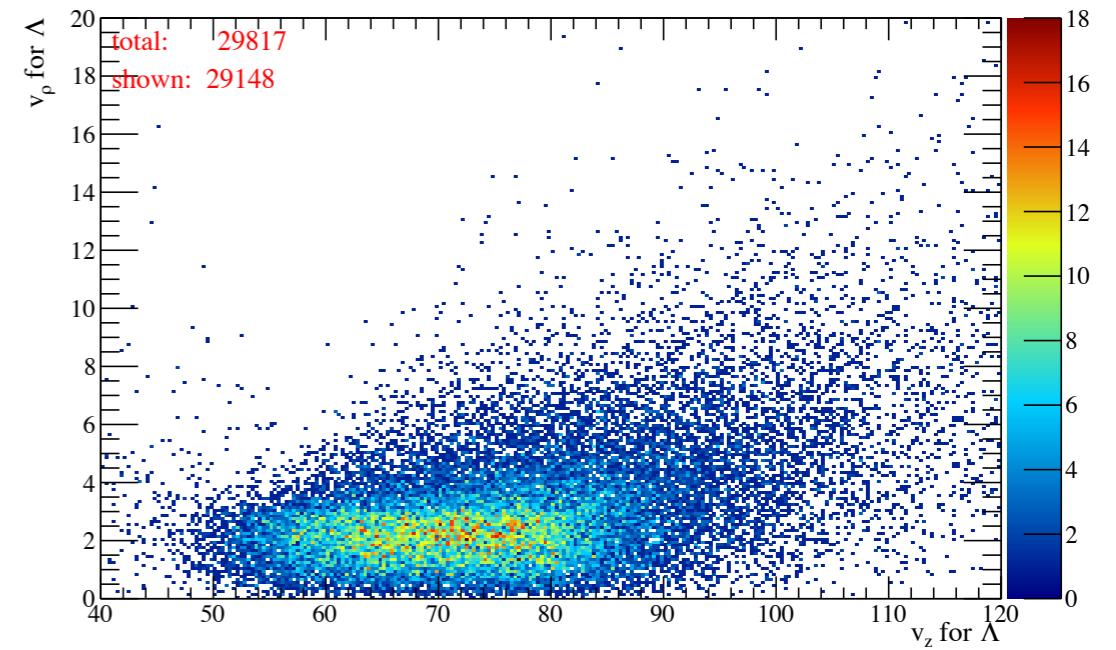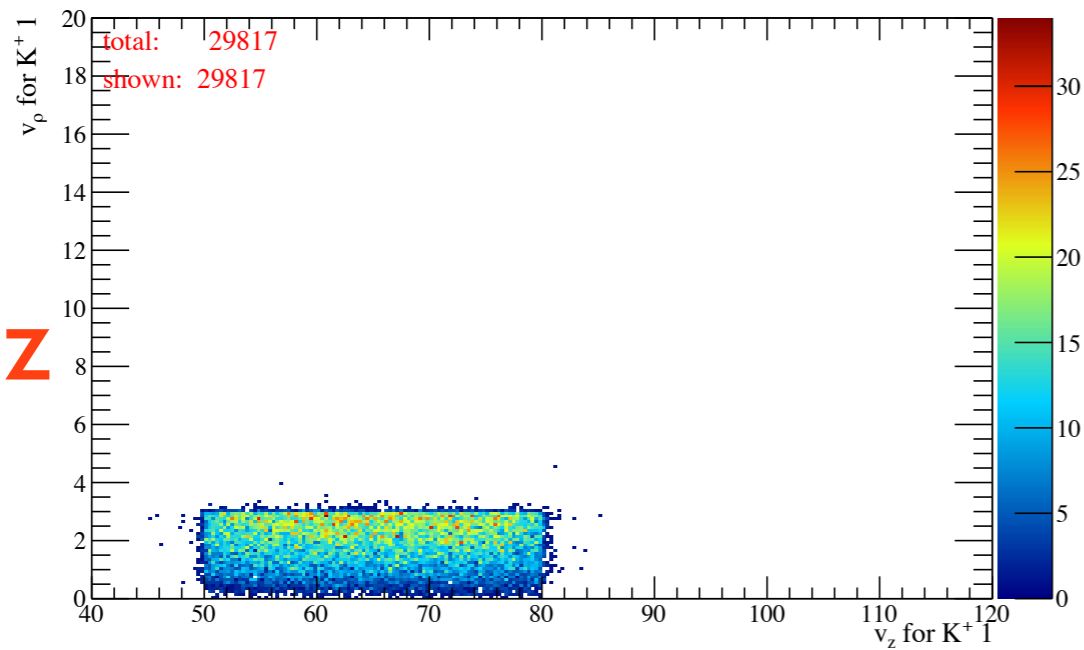
13
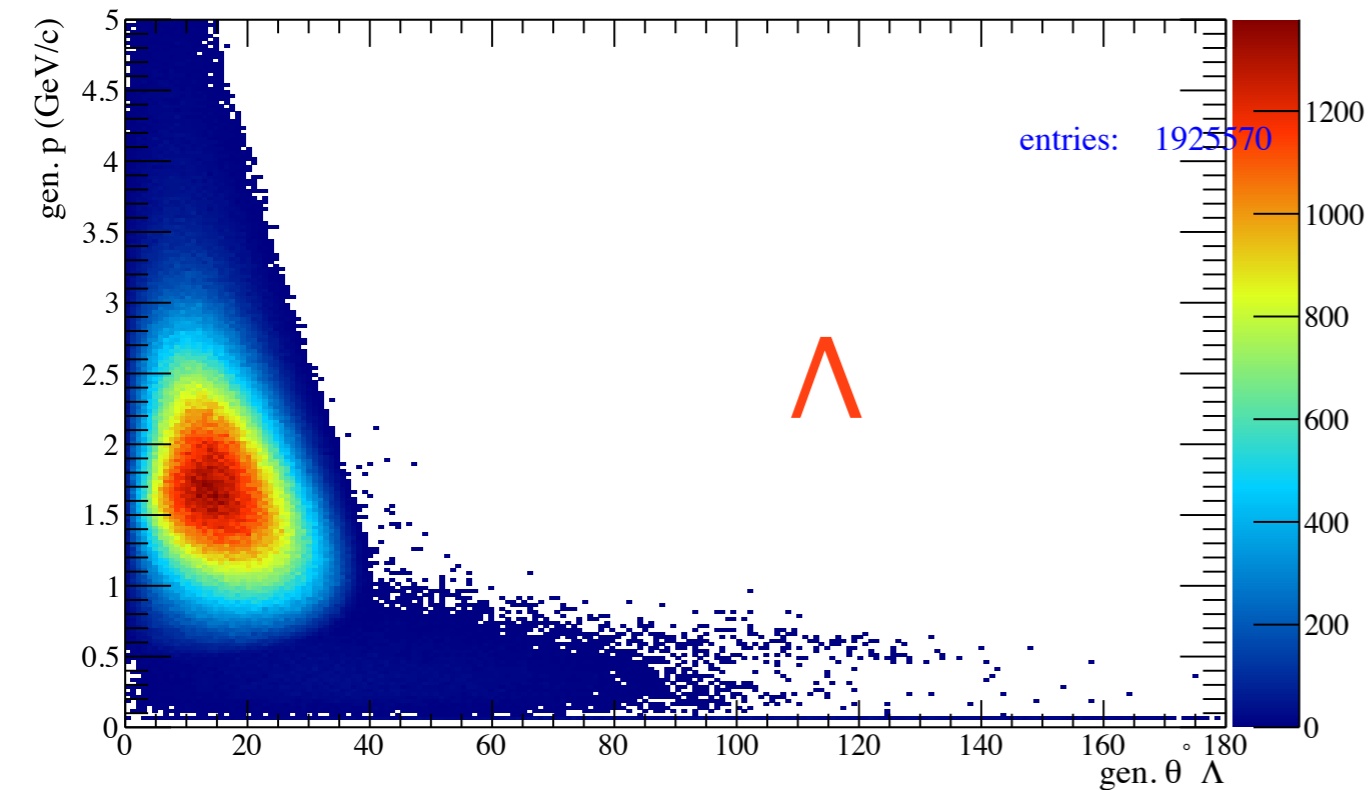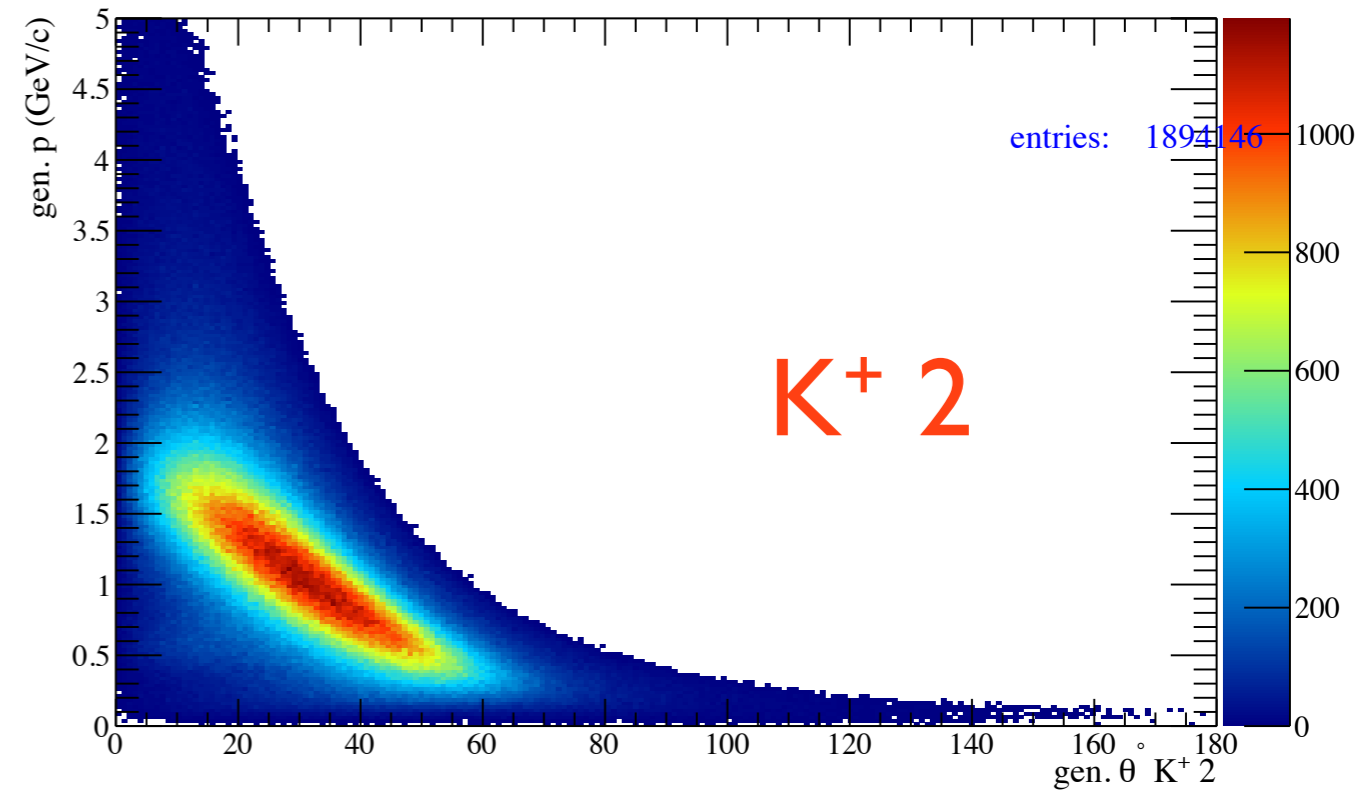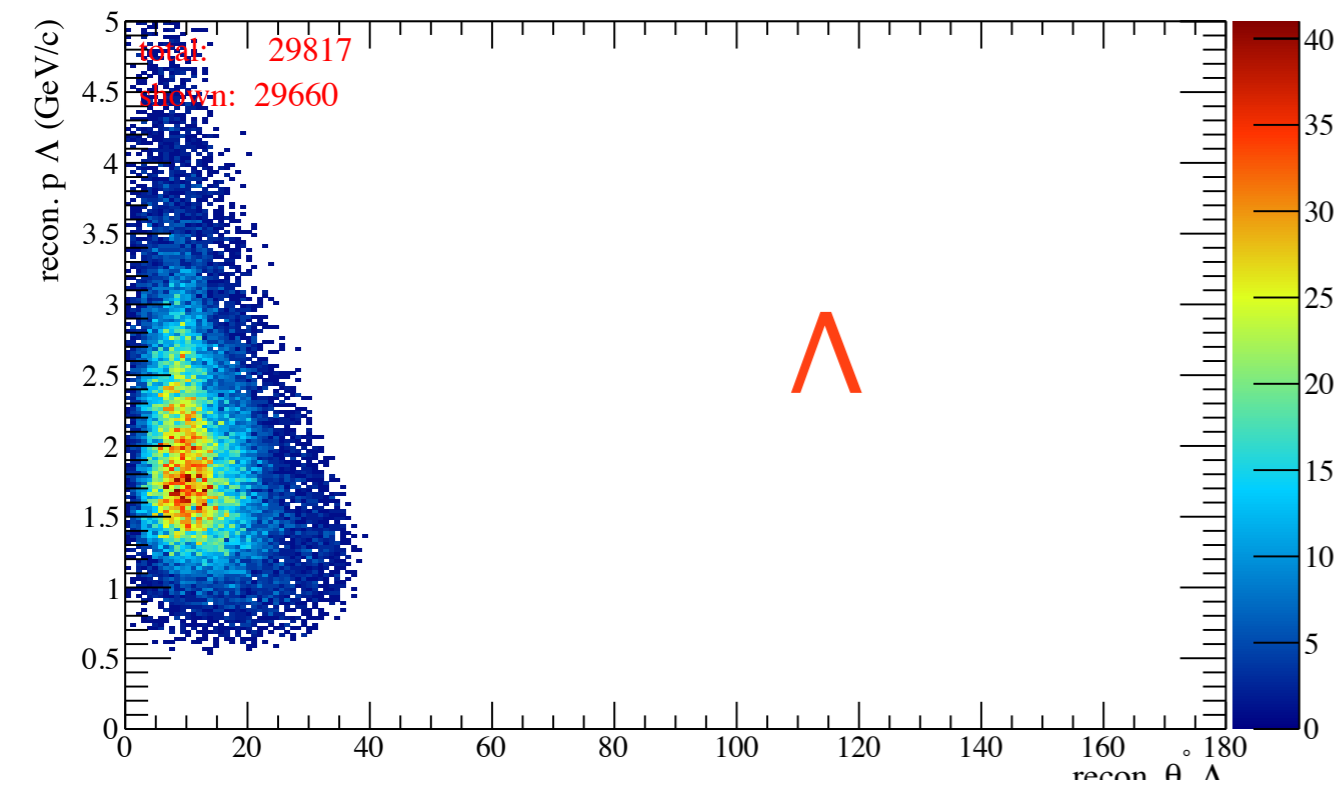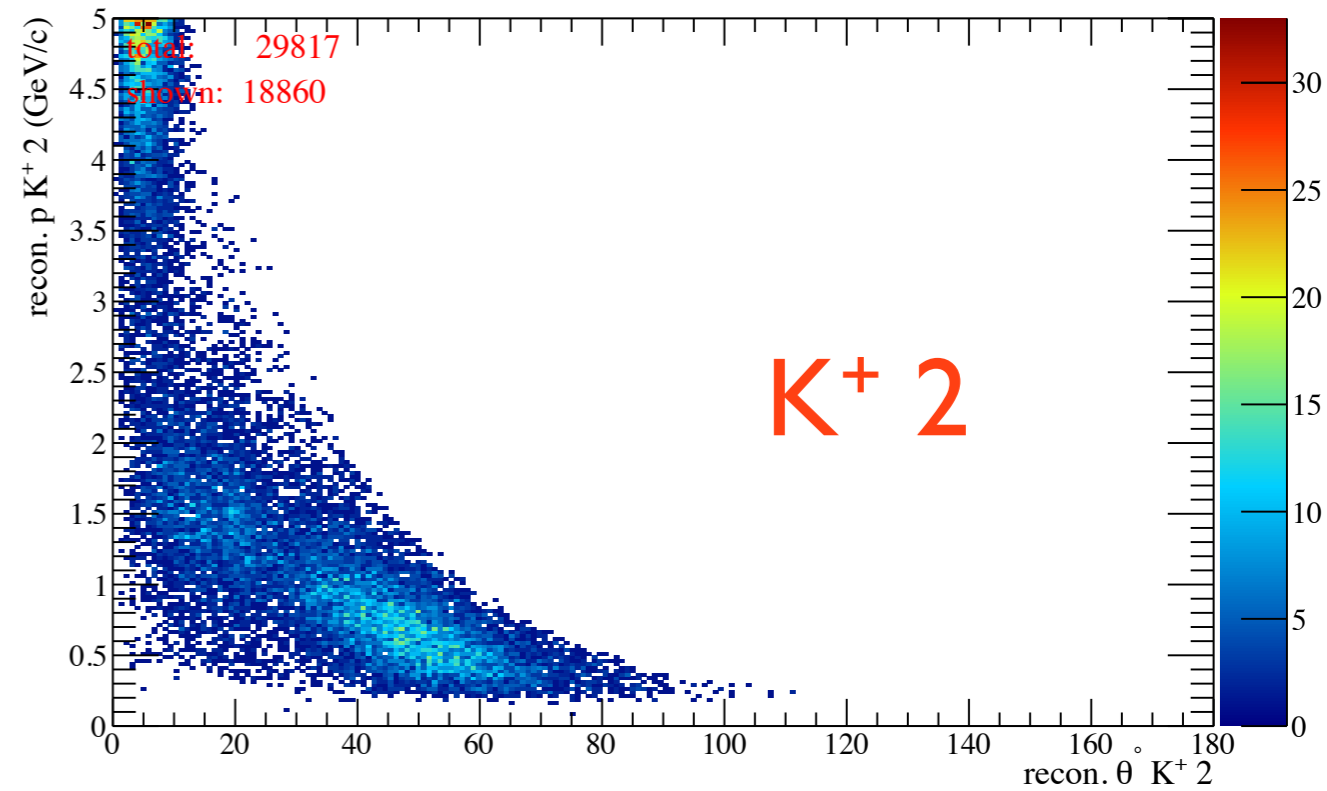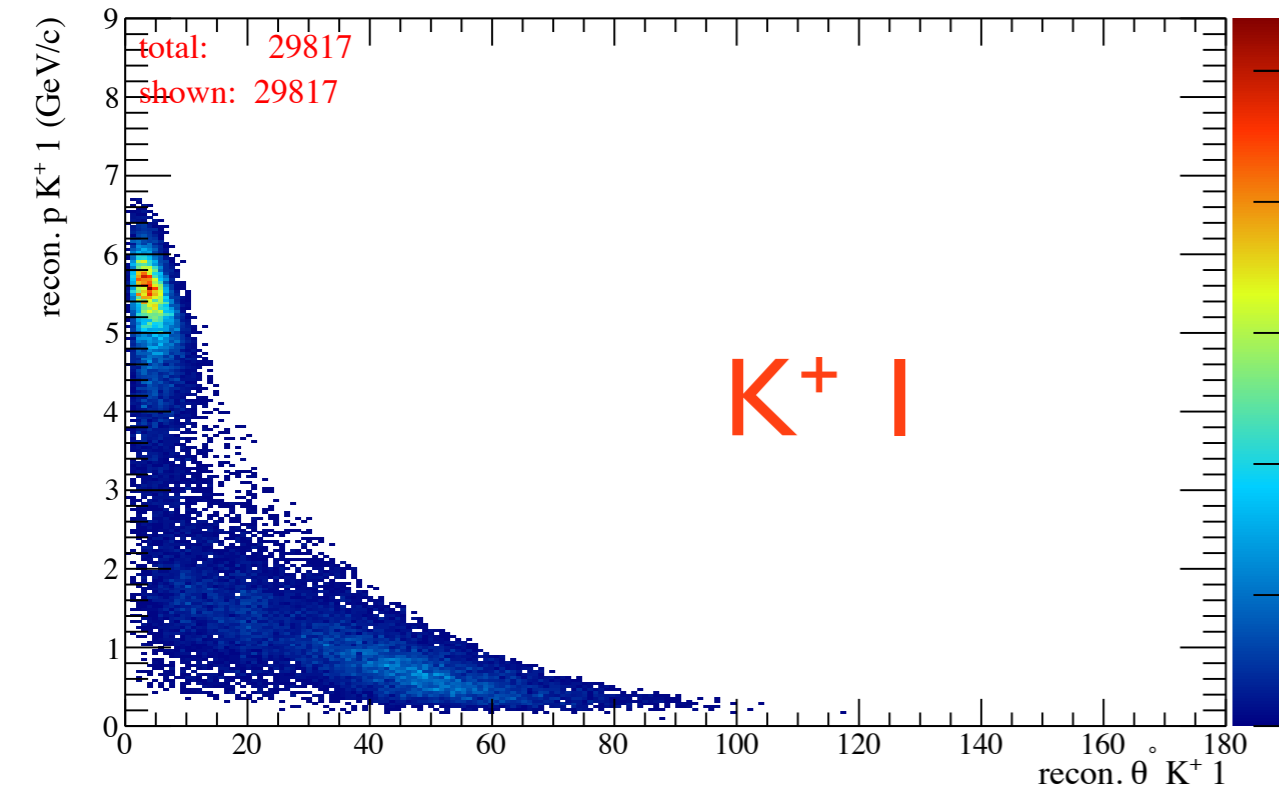
Ξ(1820) Recon. Vertex Distributions

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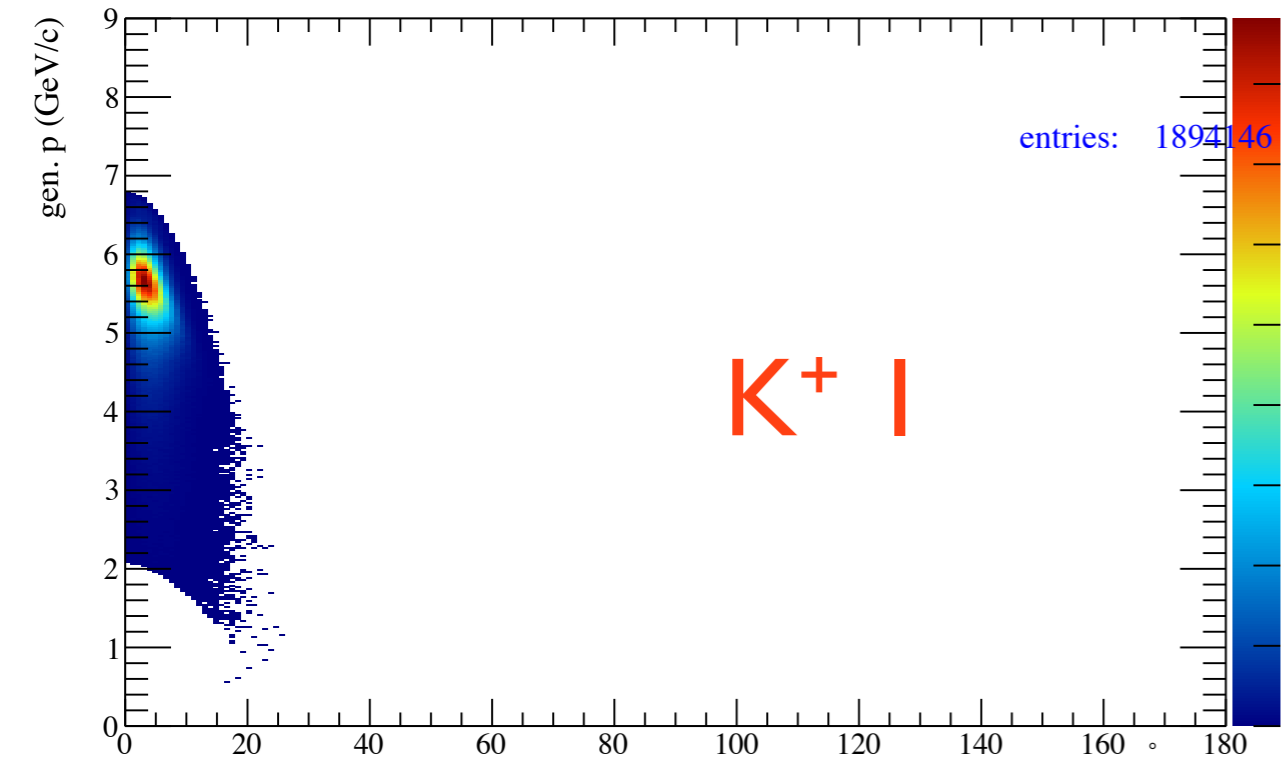# Ξ(1820) Gen. |p| vs θ - K⁺ K⁺Λ

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Ξ(1820) Comparison of two K⁺
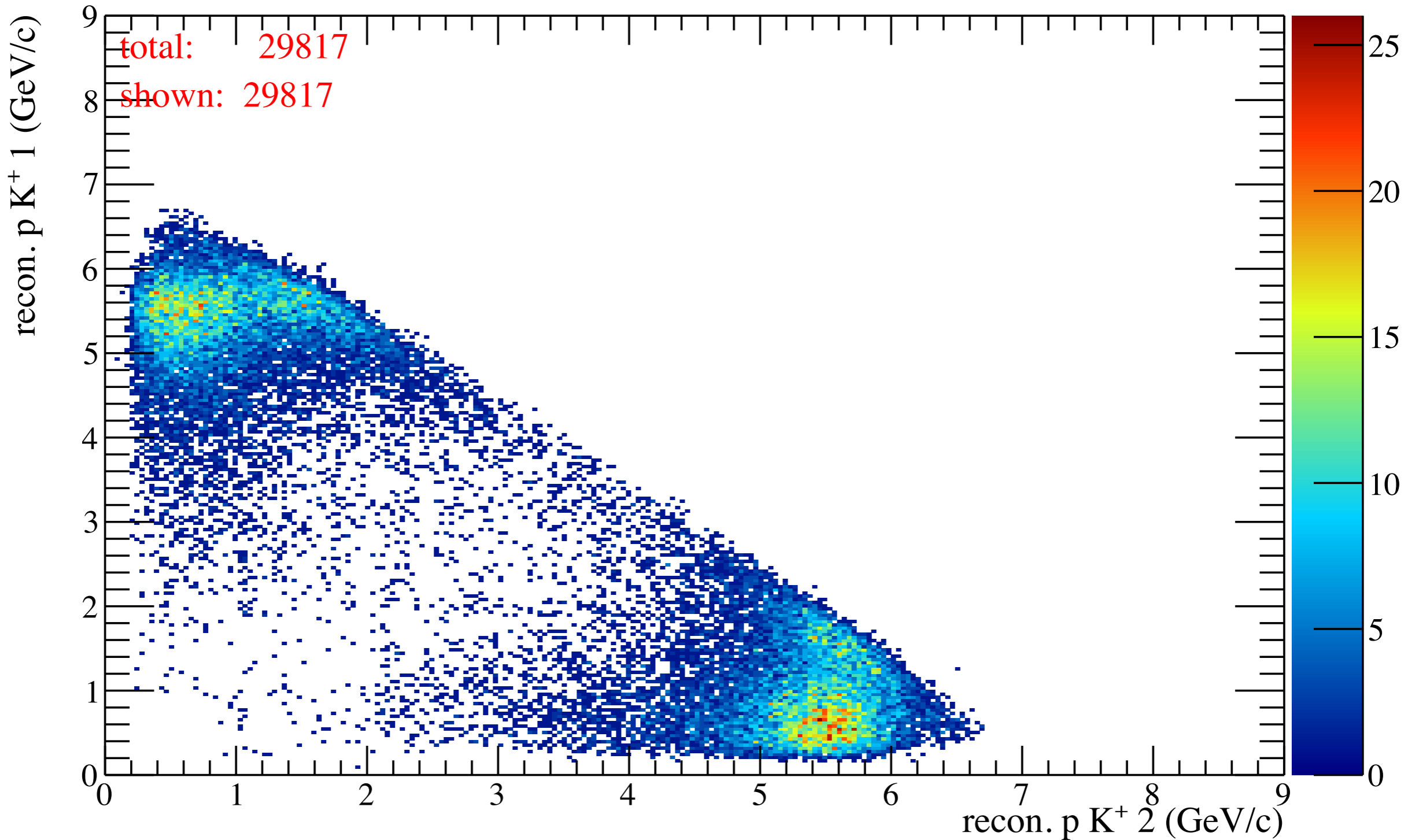
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Ξ(1820) Gen. |p| vs θ - K⁻ pπ⁻

Ξ(1820) Recon. |p| vs θ - K⁻ pπ⁻

Ξ(1820) Mass Resolution

total: 29817
shown: 29734   reconstructed
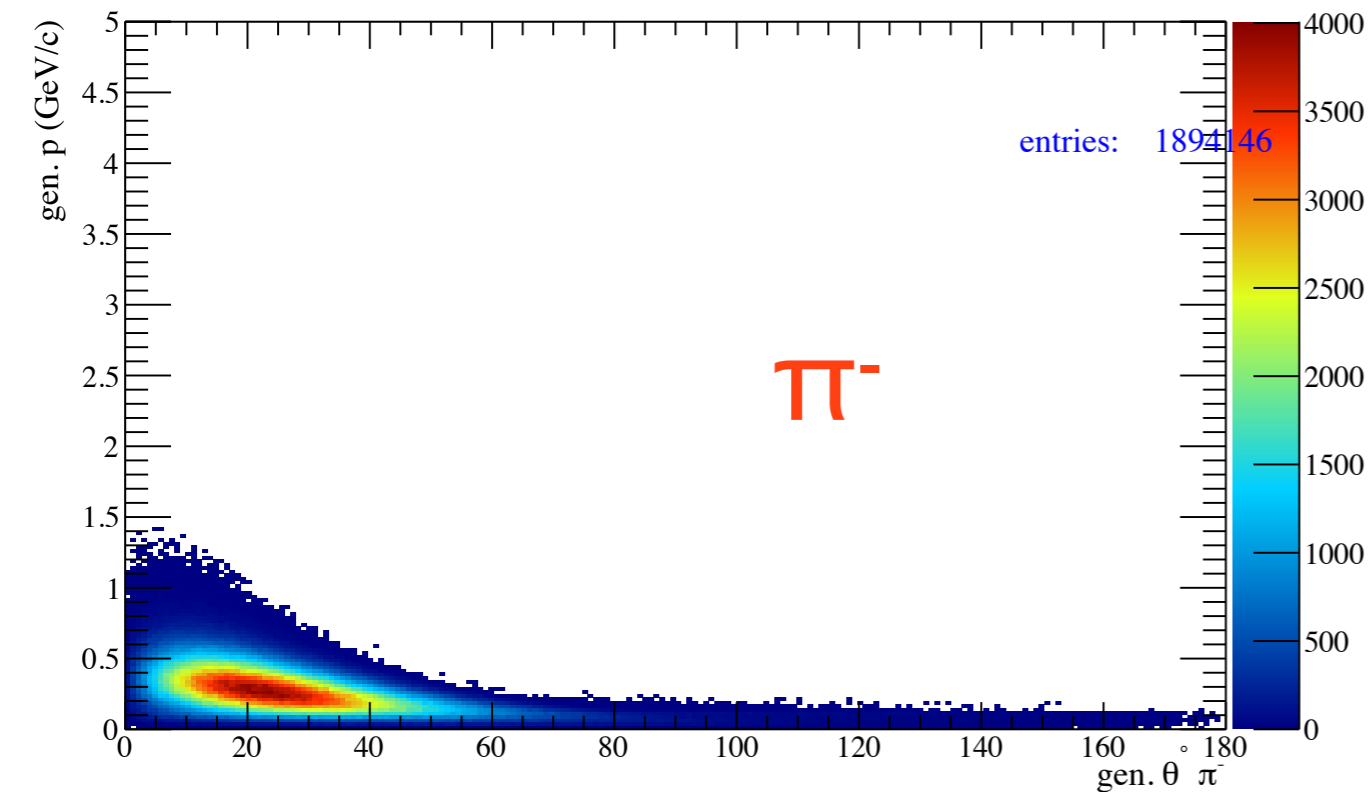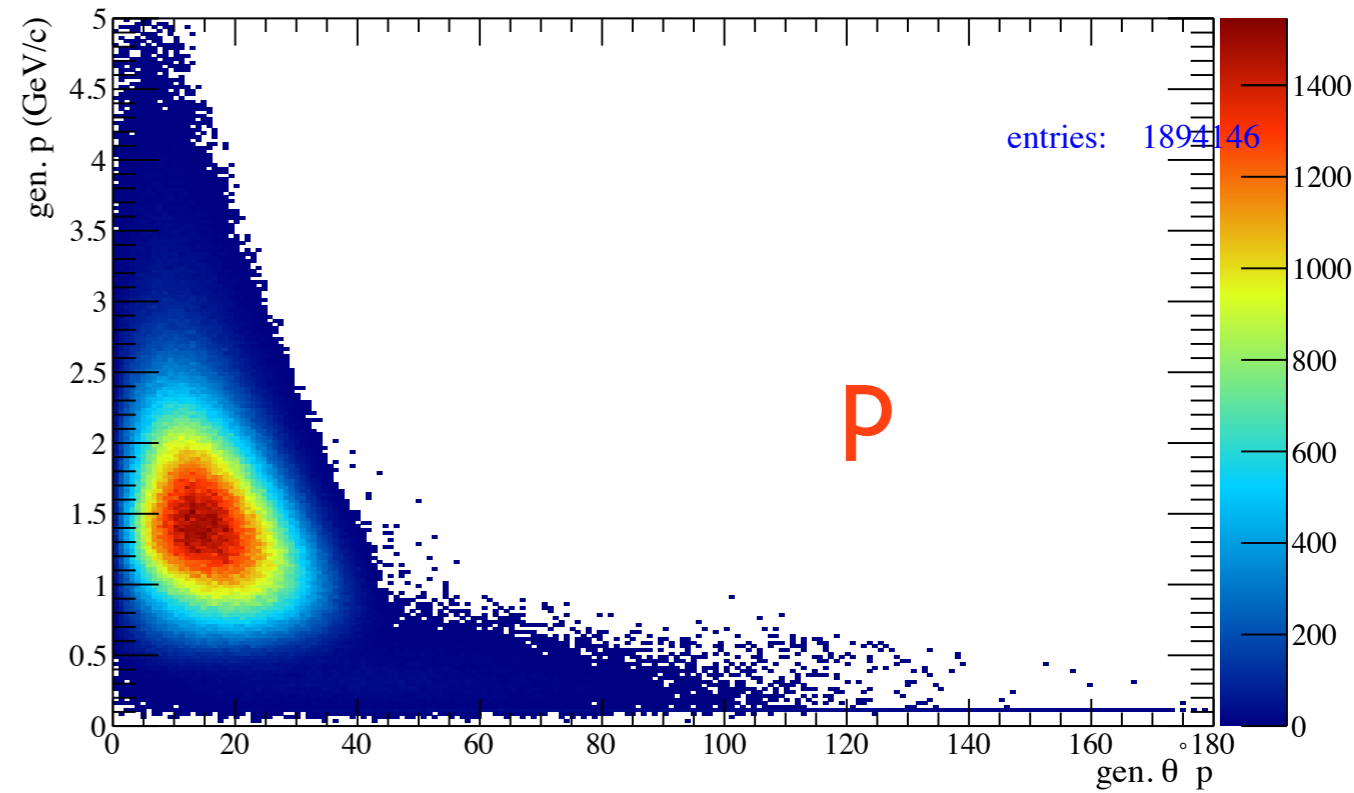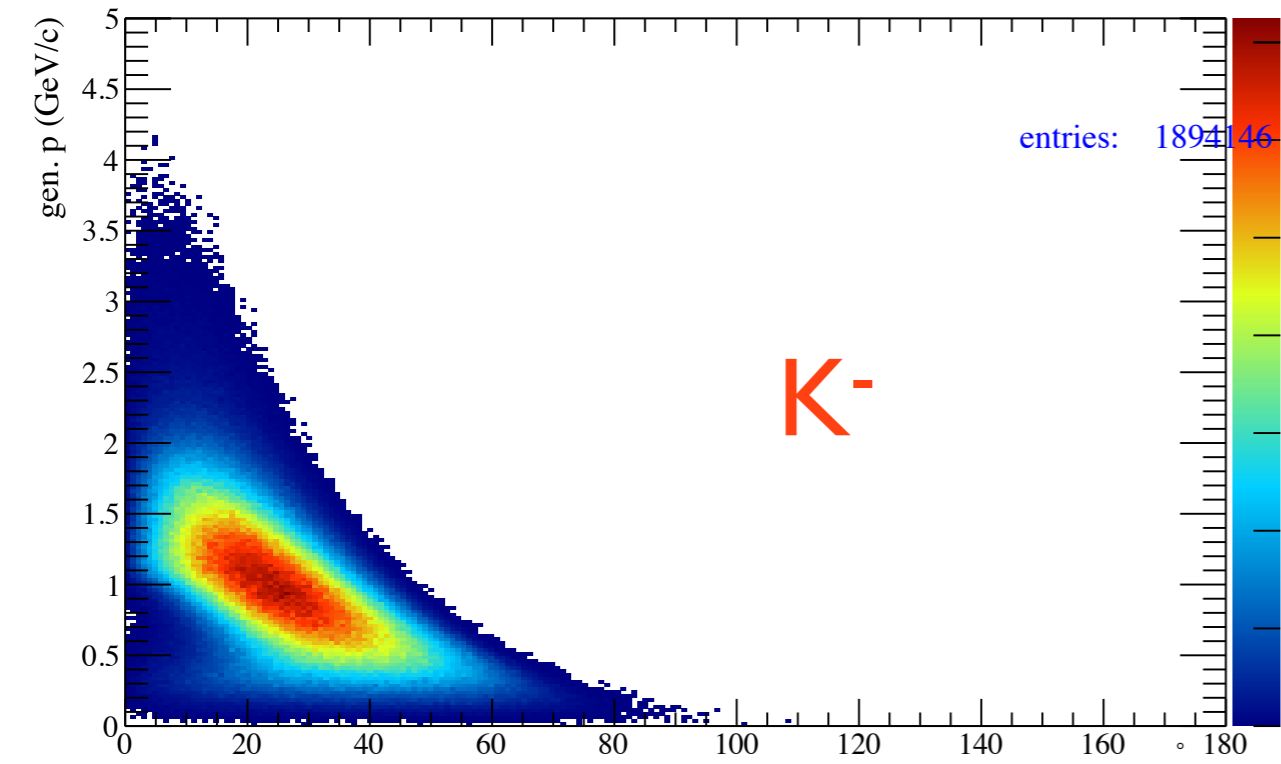
total: 29817
shown: 29046

3M events generated,
of which 1.89M had
correct Λ decay

Gaussian σ: 20.7 MeV
BW Γ: 68.3 MeV
Voigt Γ: 19.3 ± 0.4 MeV
Voigt σ: 10.6 ± 0.3 MeV
width:106.3 MeV

input was Γ = 24 MeV

$MM(\gamma, K^+ K^+)$ (GeV/c^2)

IM(K⁻ Λ)
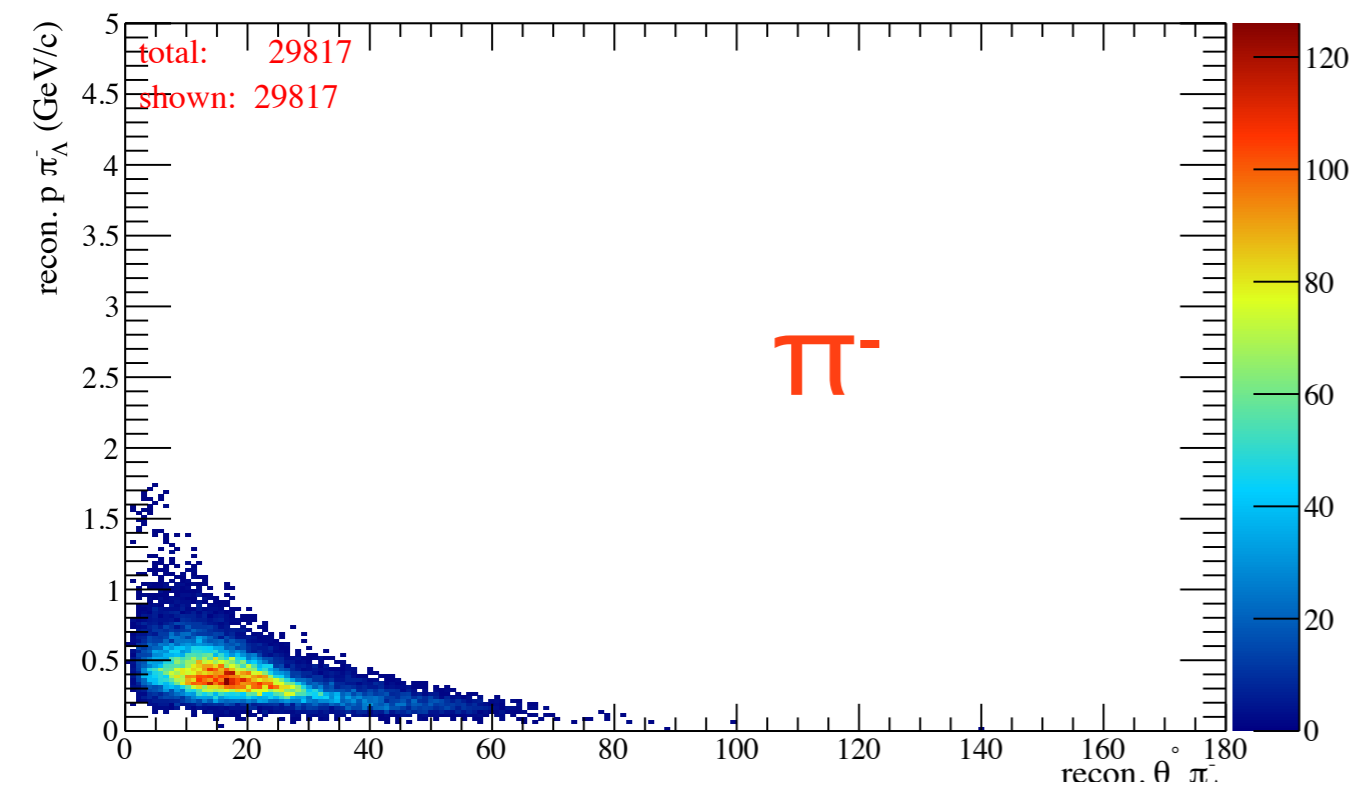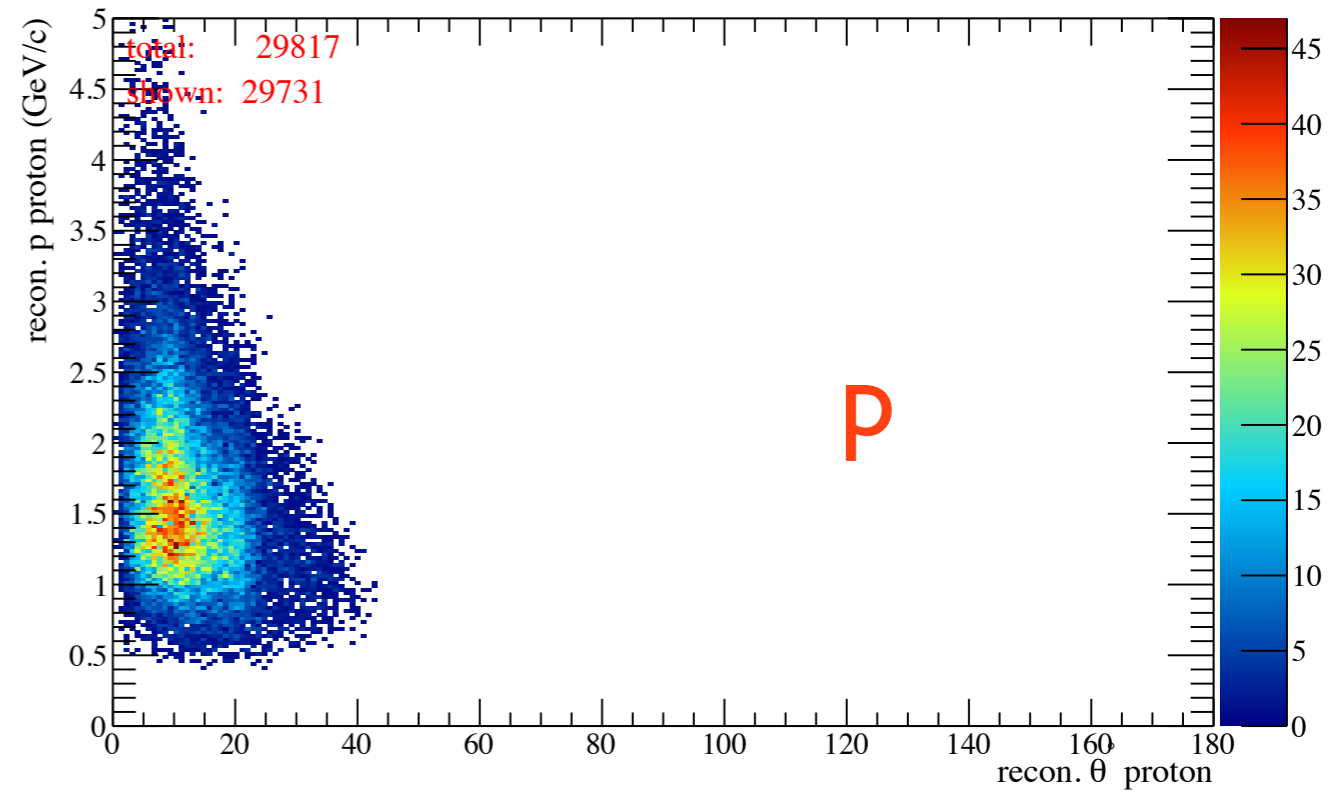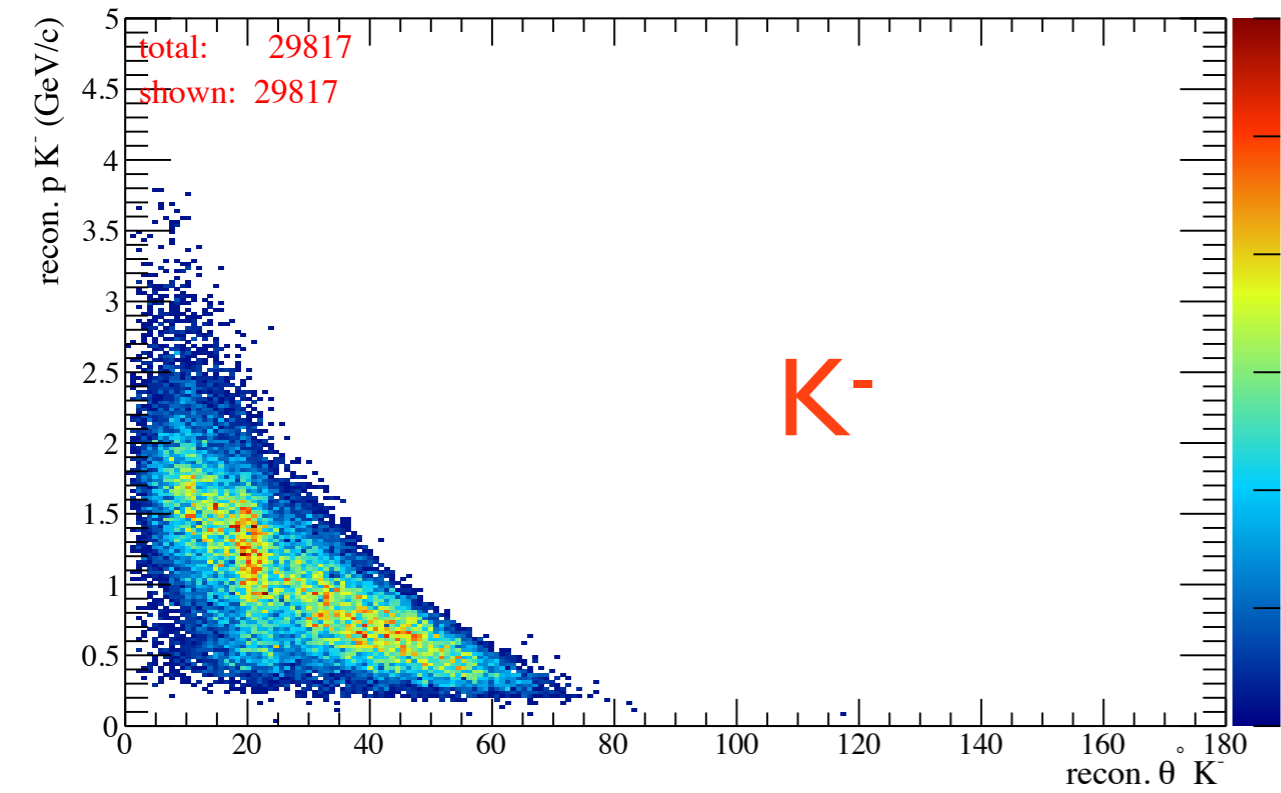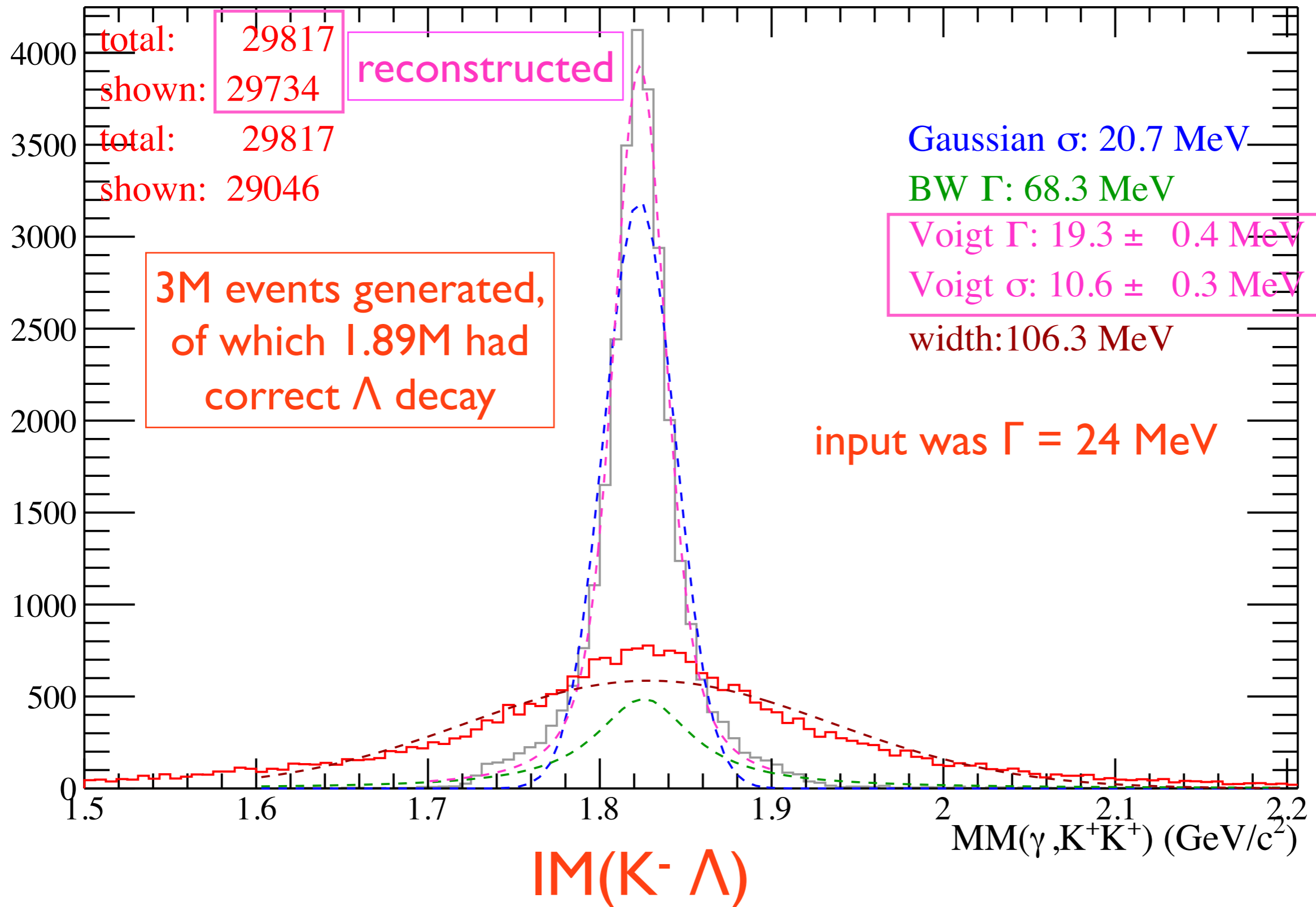
acceptance of ~1% (1.6% if accounting for BR$_\Lambda$)

Ξ(1820) Comparison with Nathan
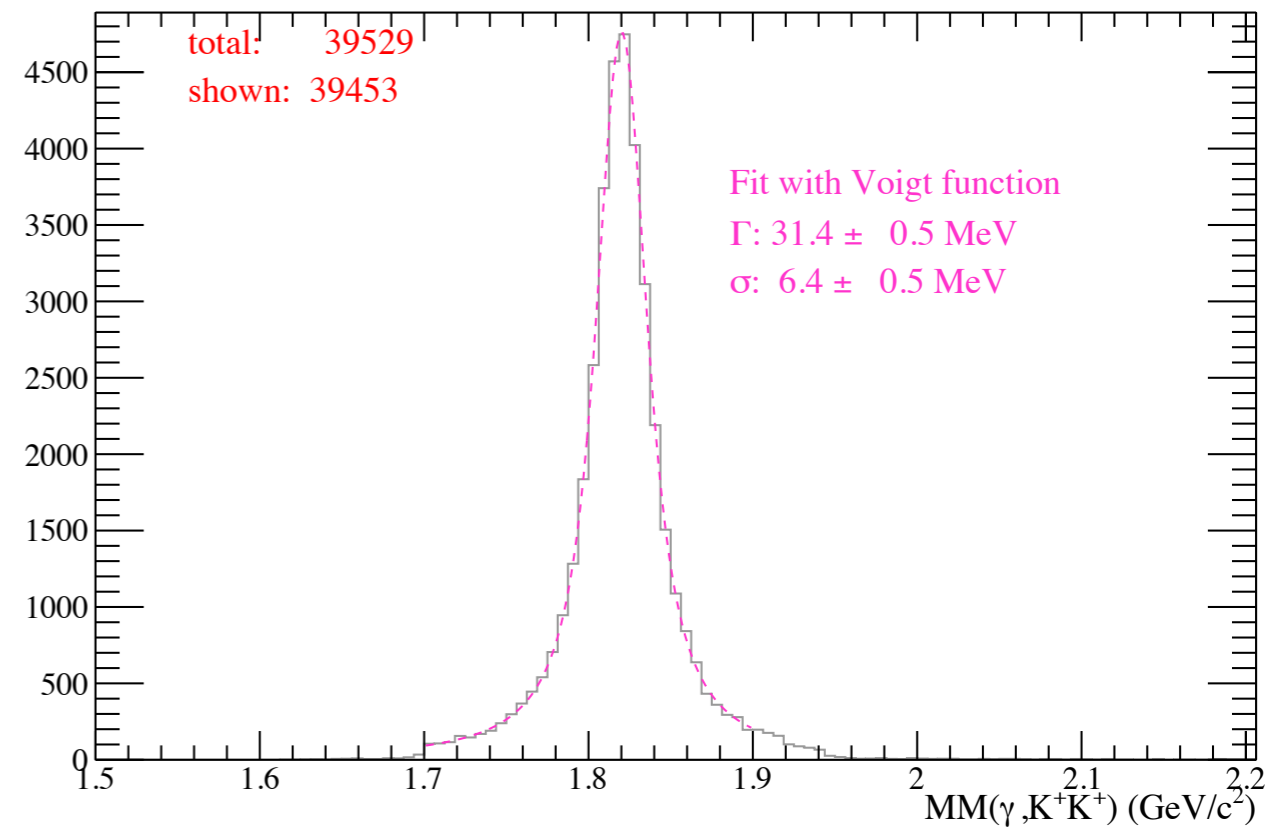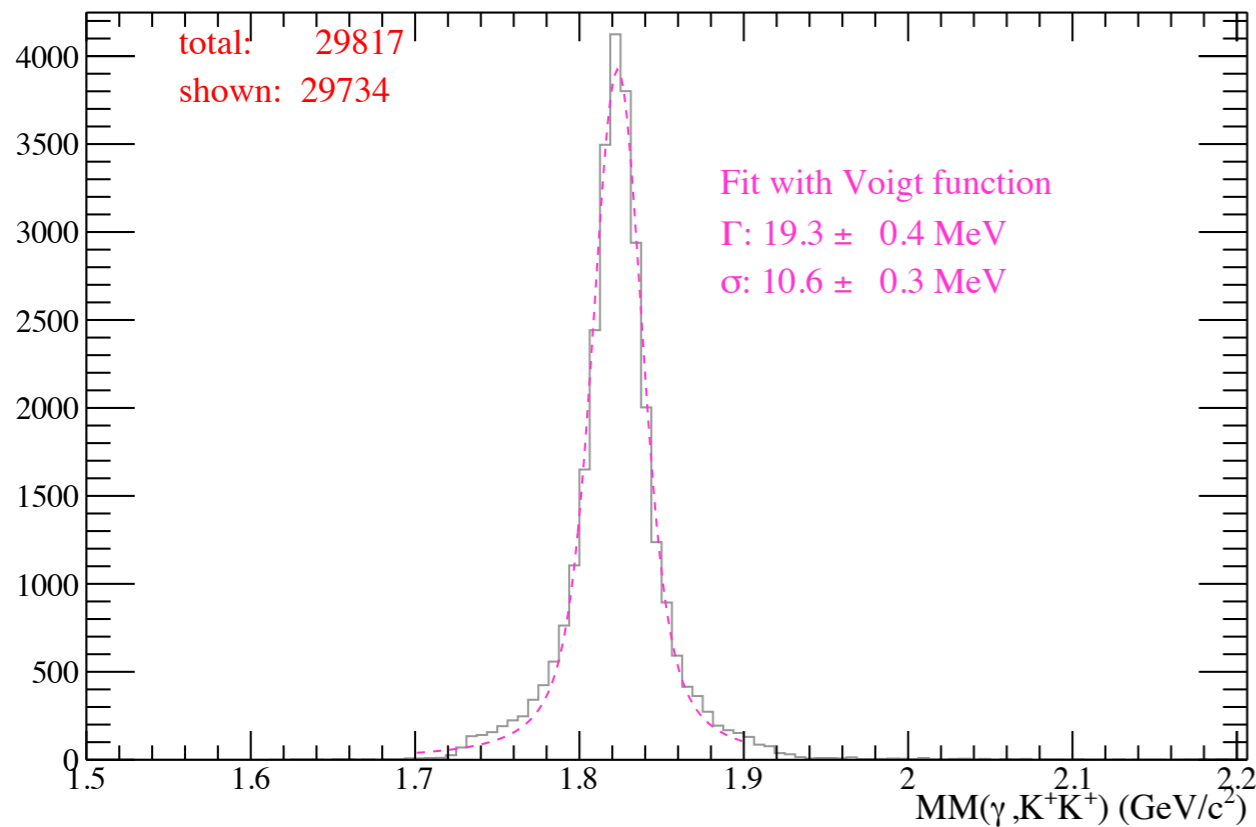
- t-slopes are 3.0 and 1.7

- acceptances are 1.56%, 2.06%

33% increase in acceptance due to different t-slope

- BW resolution: inputs are 24, 30 MeV; fit results with Voigtians are Γ = 19, 31 MeV and σ = 10.6, 6.4 MeV

- Nathan reported acceptance of ~3%

– upper limit of 1.1 nb for Ξ⁻(1820) σ_{tot}

Talk by John Goetz at HADRON 2013: http://hadron2013.kek.jp

Entries 42299

Xi-(1820)
upper limit
< 1.1 nb (90% CL)

MM(K^+K^+) (GeV)

g12
g11
g6

σ (nb)

E_{beam} (GeV)
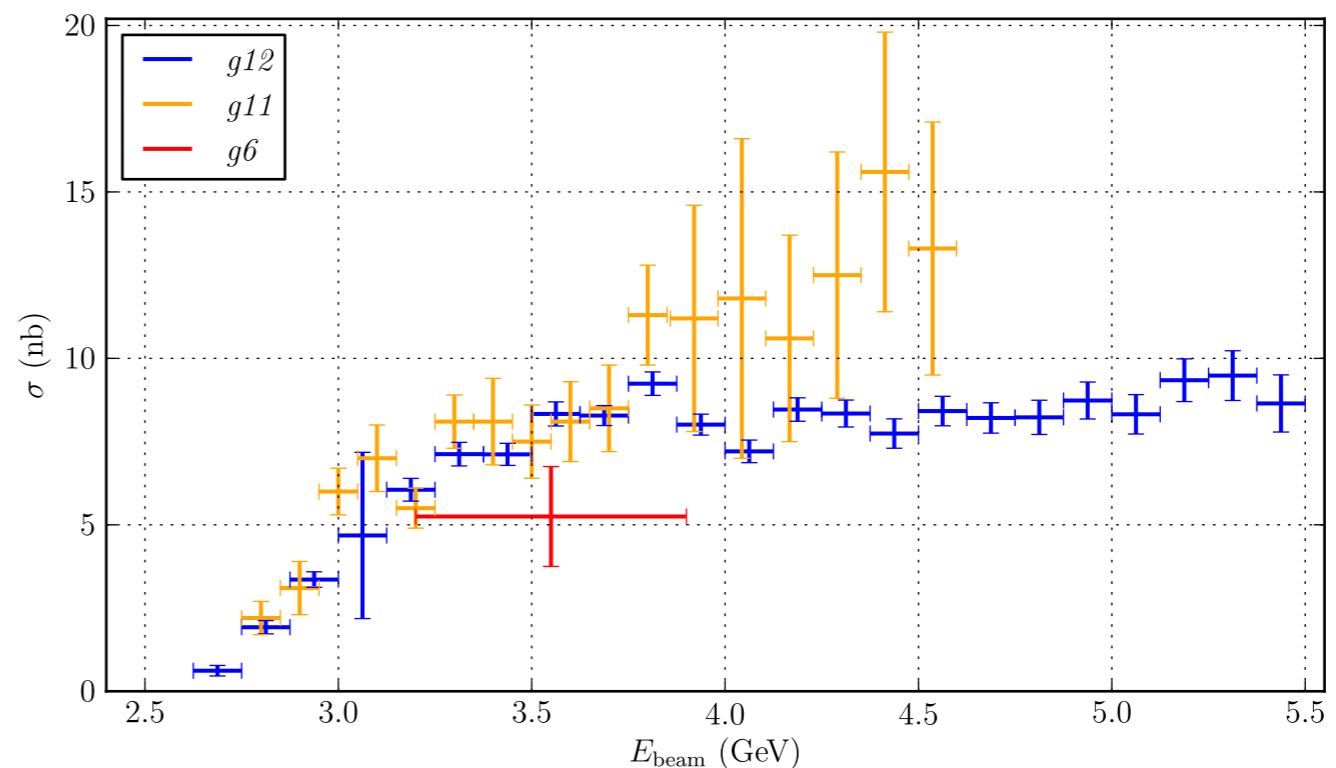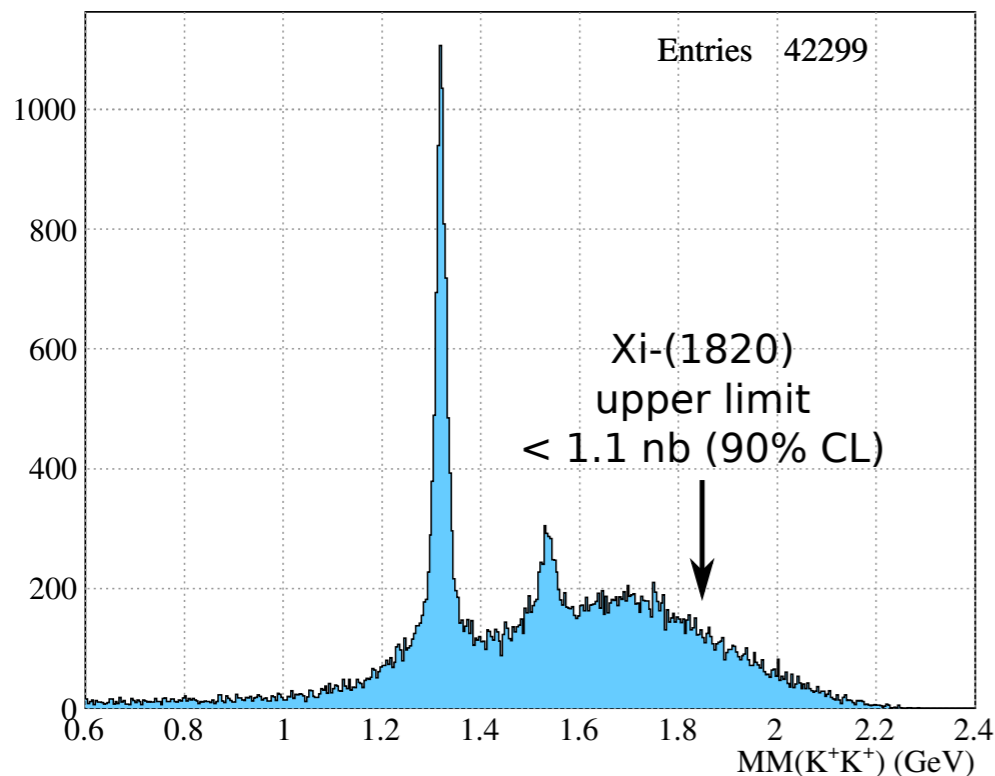
Conclusions

- Estimates of $\Xi^{(*)}$ yields has large uncertainties in

  - production mechanism (distribution of momenta)

  - σ_{tot} unresolvable until we have data

  - Continue studies of acceptance, reconstruction, physics observables for $\Xi^{(*)}$ production

  - Also do background studies