Status of K+Σ- analysis from g13

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Previous work

- g2: Both inclusive and exclusive analysis.
  - Very low statistics!
- g10: Exclusive cross-section-measurement.
  - High statistics
  - Non-polarized beam!
- LEPS spring 8: Inclusive analysis.
  - Cross section and beam asymmetry
  - Very small angular coverage!

g13 Features

- Polarized photon beam: circular (g13a) and linear (g13b) polarization
- Photon energy range: 0.8-2.5 GeV
- Target: Liquid Deuterium (40-cm-length)
- Magnetic field negatively polarized
- About 52 billion triggers

Analysis: Goal

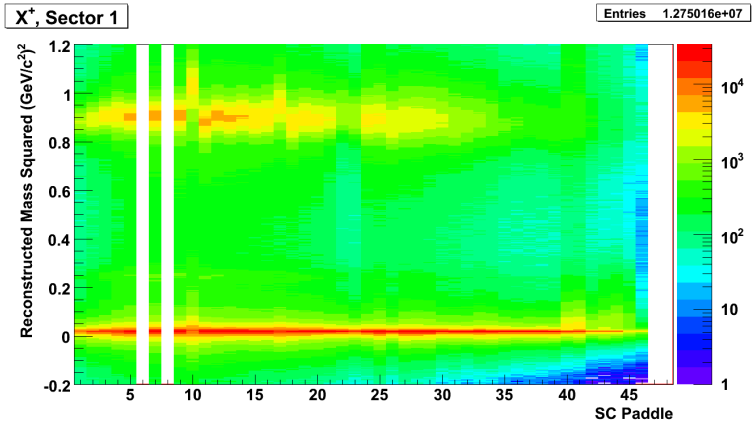
- Measurement of the cross section (g13a)
- Determination of the beam asymmetry (g13b)
- That's all what can be determined:
  - Experimental issue α = -0.068 (PDG)

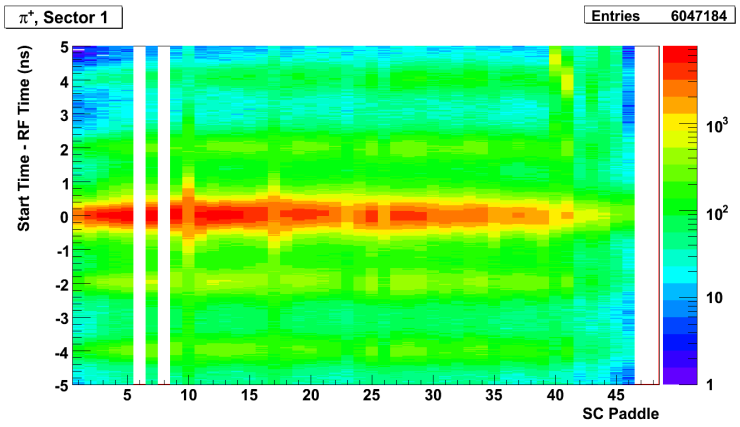
Analysis: $\gamma d \rightarrow K^+\Sigma^-(p) \rightarrow K^+ \pi^- n(p)$

- K+, π-, n are detected. (p) is reconstructed by MM
- Events with "at least" 1(+), 1(-), 1(0)
- All possible track combinations for $\gamma d \rightarrow K^+\Sigma^-(p)$
  - All (+) → kaons
  - All (-) → pions
  - All (0) → neutrons
  - 5σ cut around M(π-,n)
  - $|\Delta T(\gamma,K^+)| < 5.0$ ns
  - 5σ cut around MM(K+,π-,n)

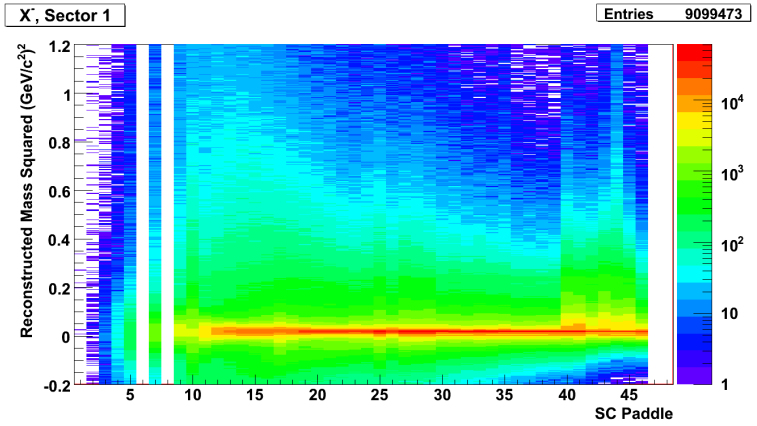
Analysis: Bad SC paddles (P. Mattione)

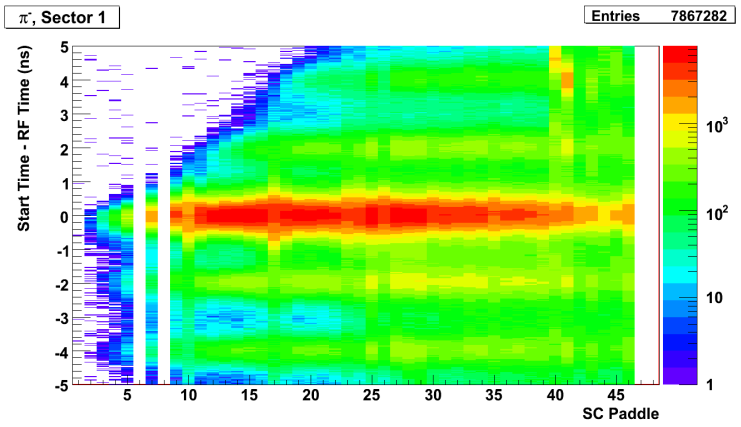
Positives





Negatives



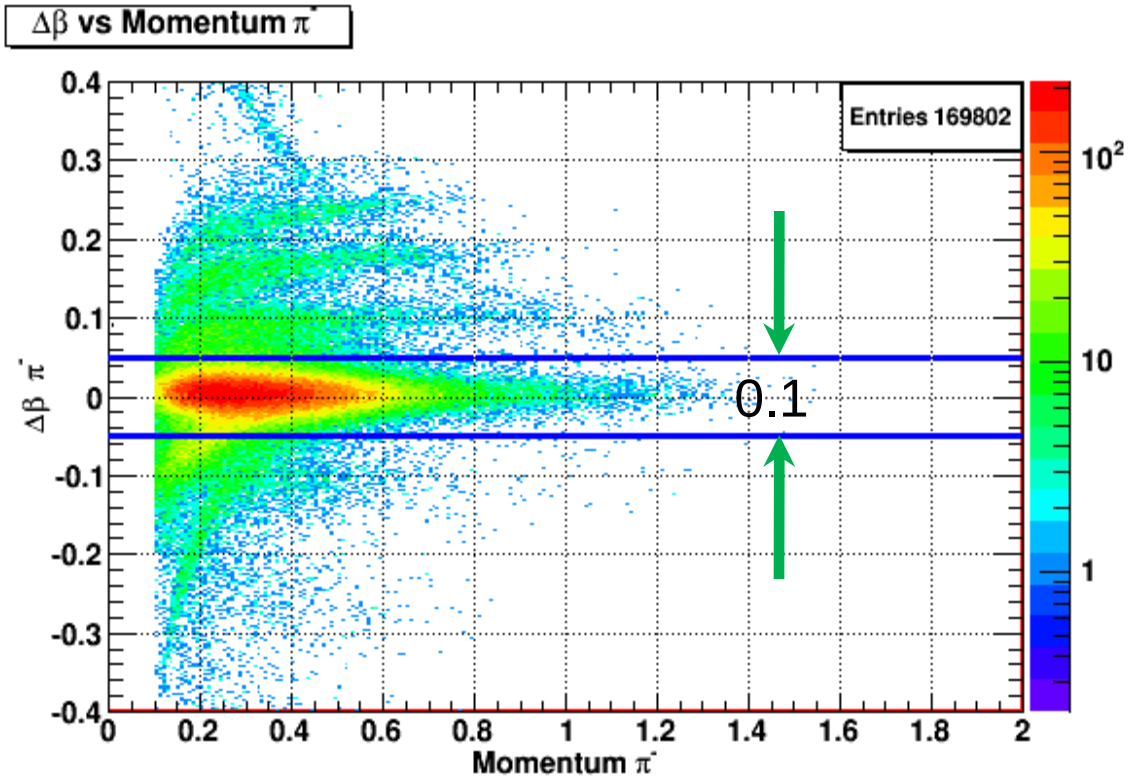


Analysis: Particle ID (pion)

Negative pions:

$\Delta\beta = \beta c - \beta m$

- βc from $|\mathbf{p}|$
- βm from **EVNT**

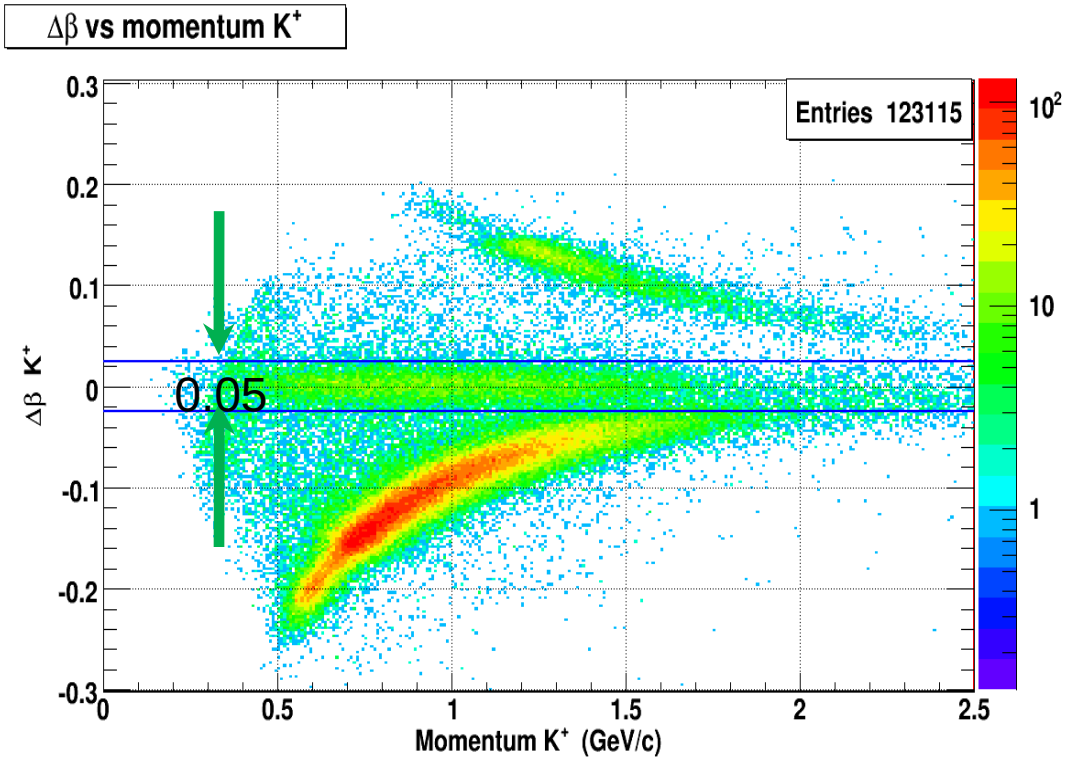


Analysis: Particle ID (kaon)

Positive kaons:

$\Delta\beta = \beta c - \beta m$

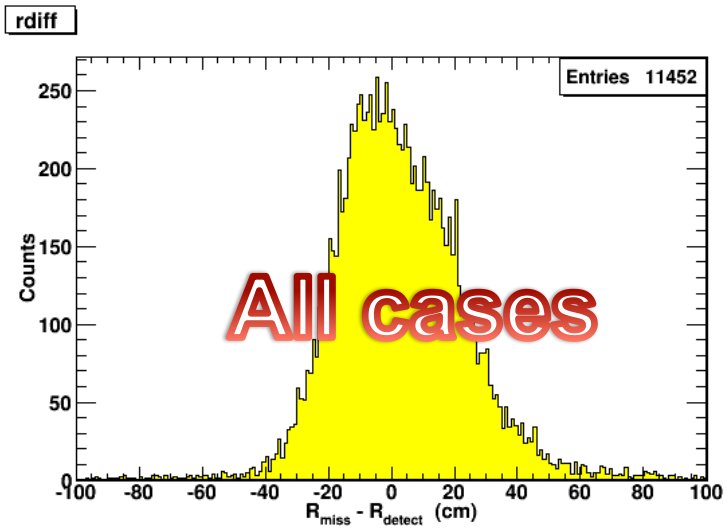
- βc from $|\mathbf{p}|$
- βm from **EVNT**

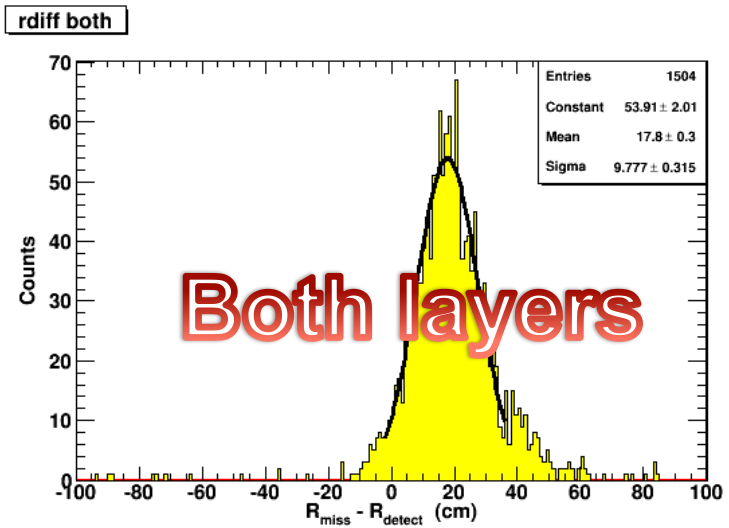


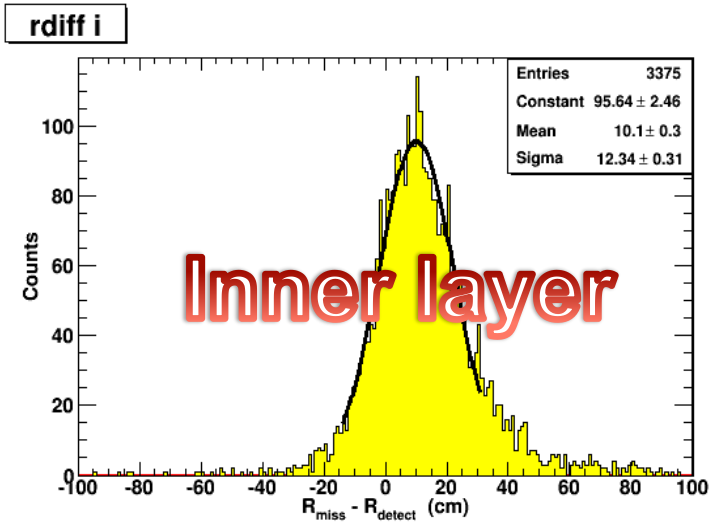
Analysis: Particle ID (neutron)

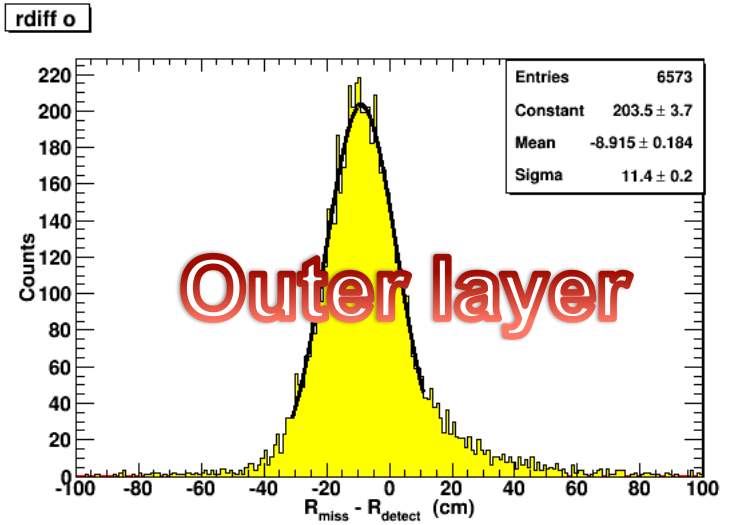
- Neutron path has to be corrected on both edges:
  - Vertex (detached vertex from Σ-):
    - VT(neutron) = VT(Kaon)
    - Vertex(neutron) = Vertex(Kaon)
  - EC hit coordinates (z-axis):
    - γd→π+π-pn is studied to find a global EC hit coord. corrections
- With the above corrections, β and p are re-calculated for the neutron

Analysis: Particle ID (neutron)



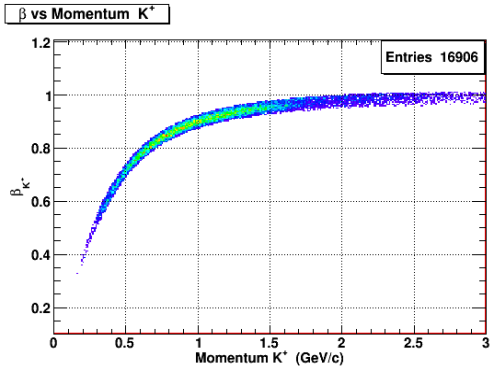




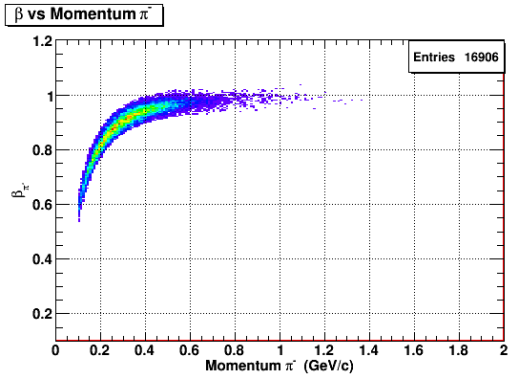


Analysis: After particle ID

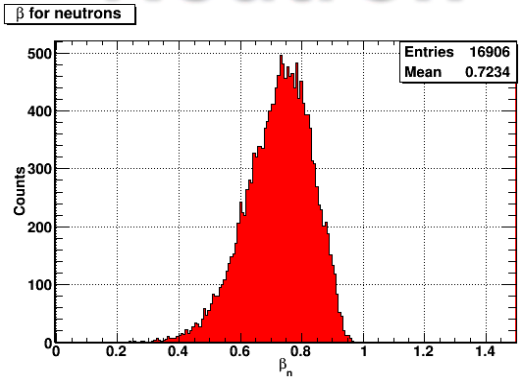
Kaon

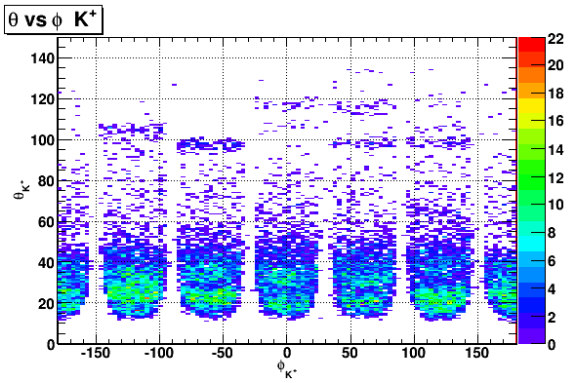


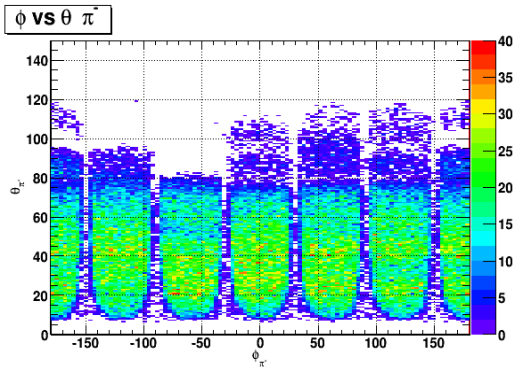
Pion

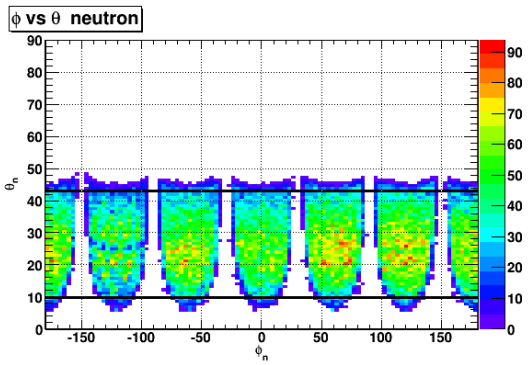


Neutron

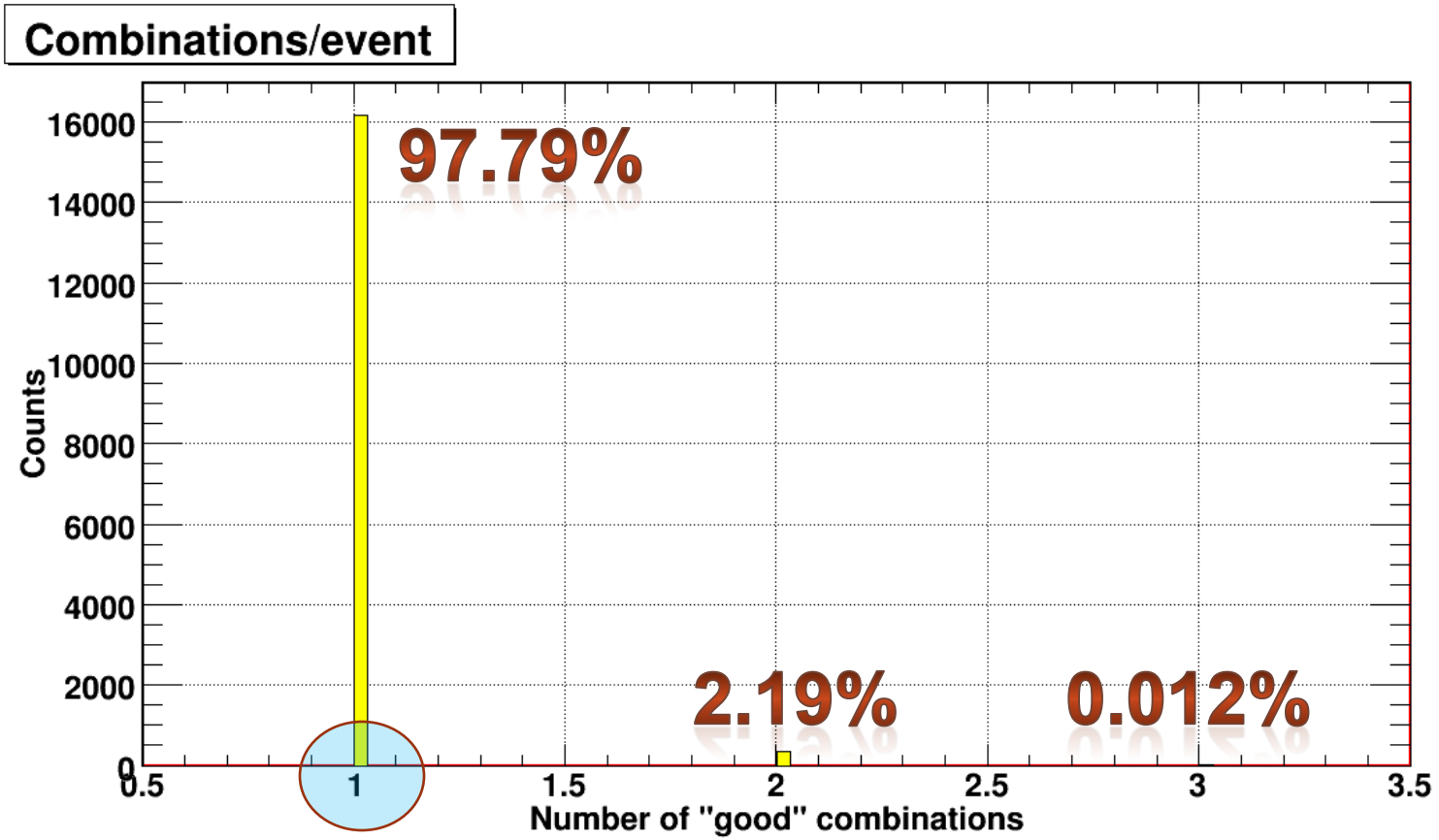






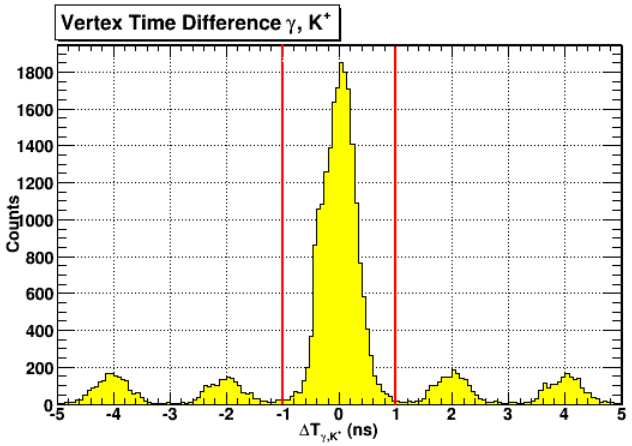


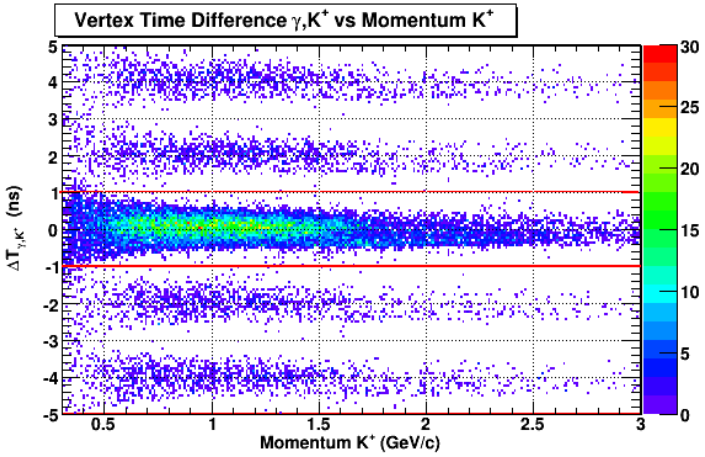
Analysis: ONE combination

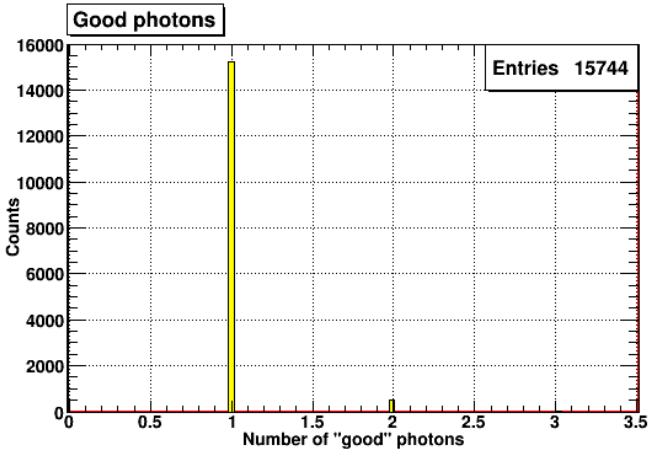


Analysis: Photon selection

- The best photon is selected within ± 1.0ns.







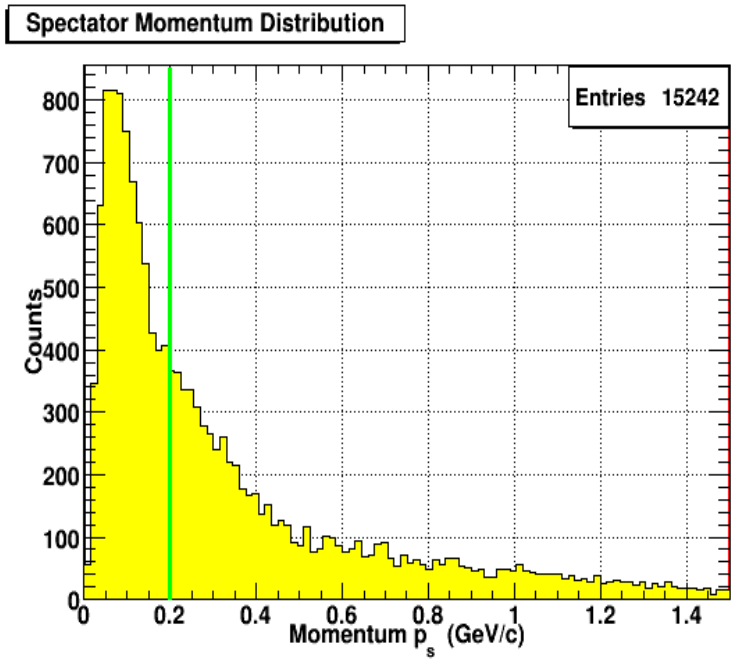
One photon = 96.81%

Two photons = 3.14%

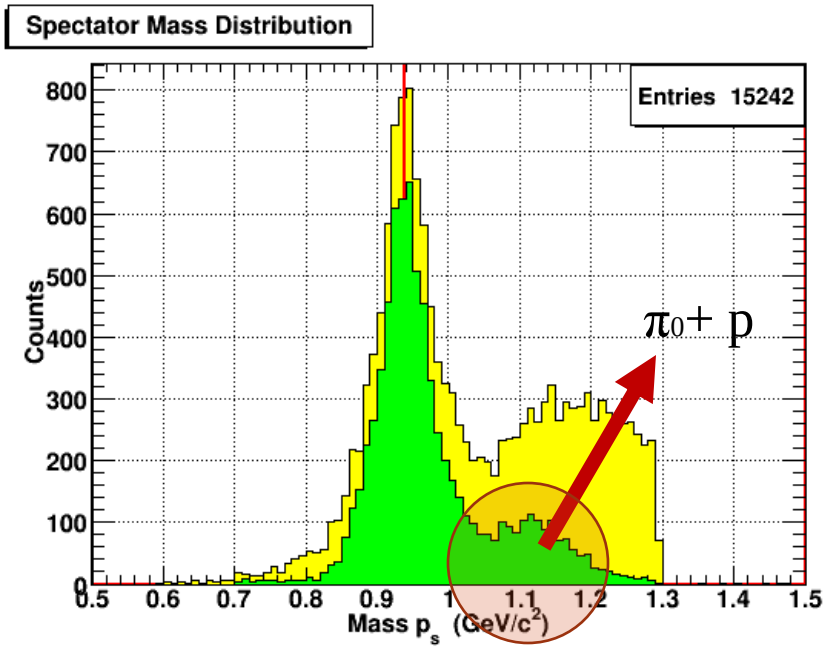
Three photons = 0.044%

Spectator Proton

Momentum

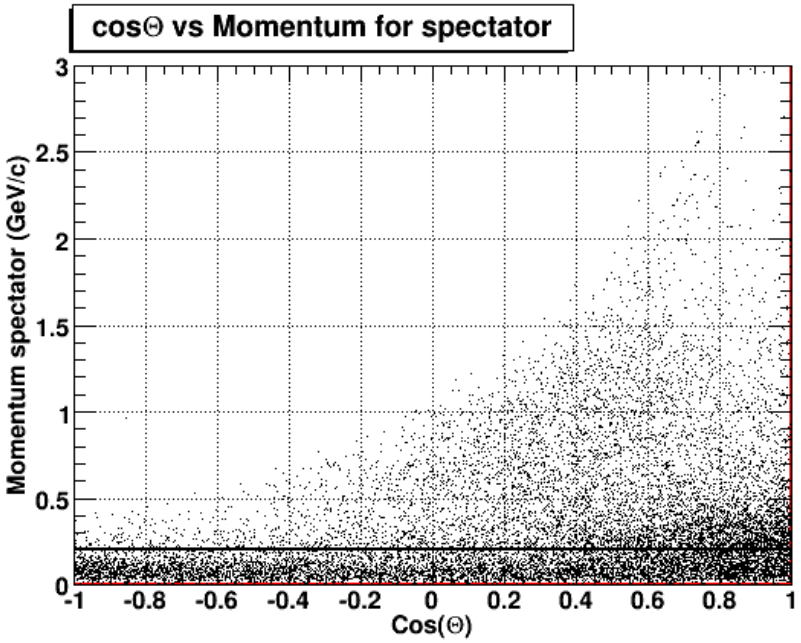


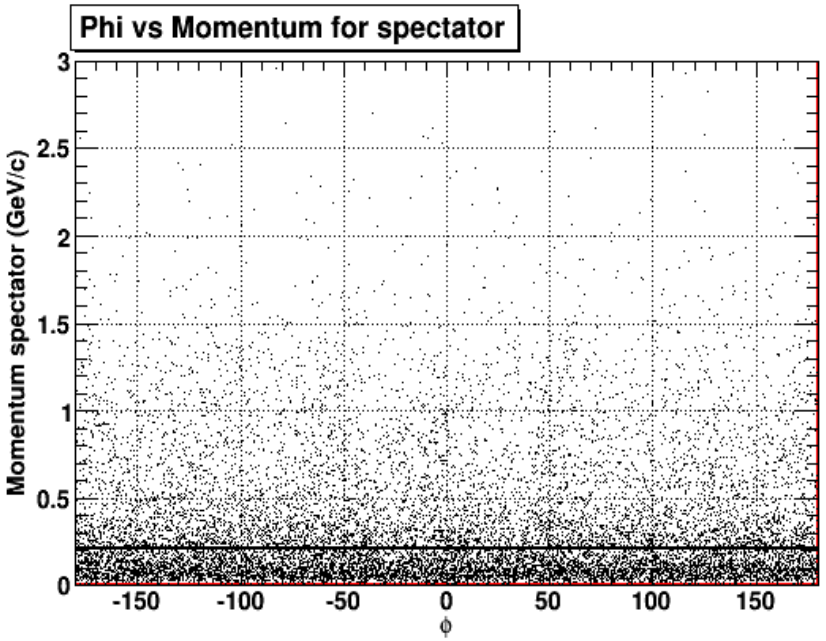
Mass



Spectator Proton

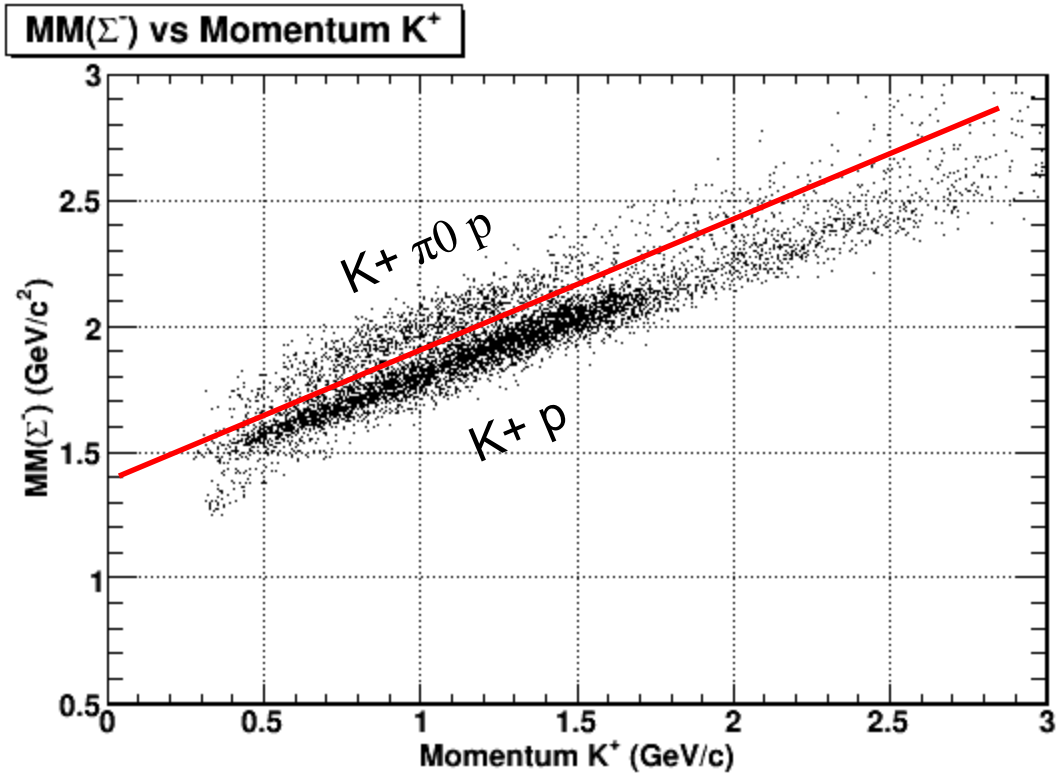
- Proton momentum cut (0.2 GeV/c)
  - Quasi-free vs re-scattering



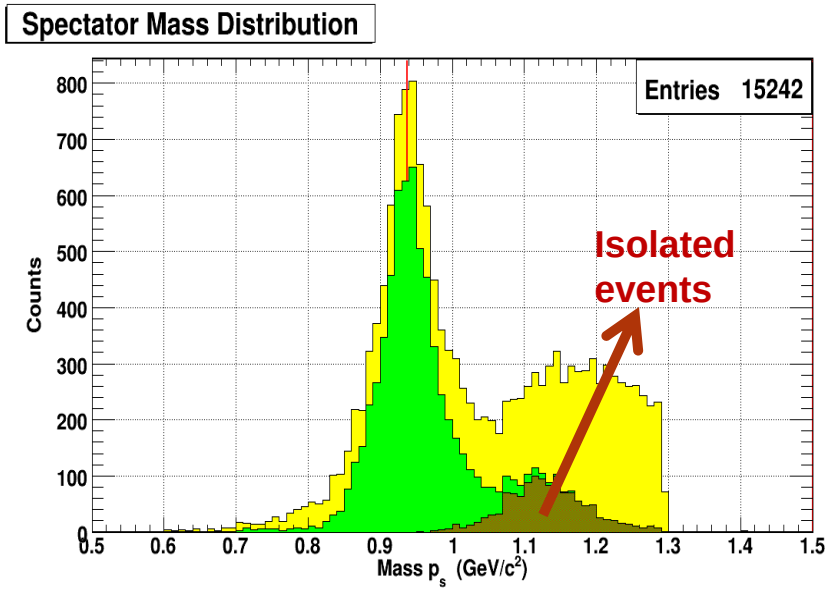


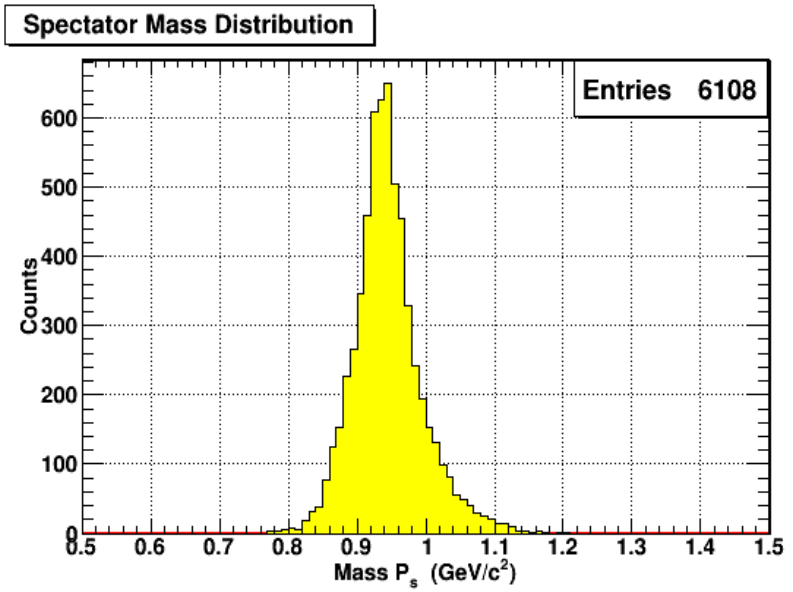
Spectator Proton

- MM(Σ-) vs Momentum K+ helps getting rid of most of the background from π_0+p

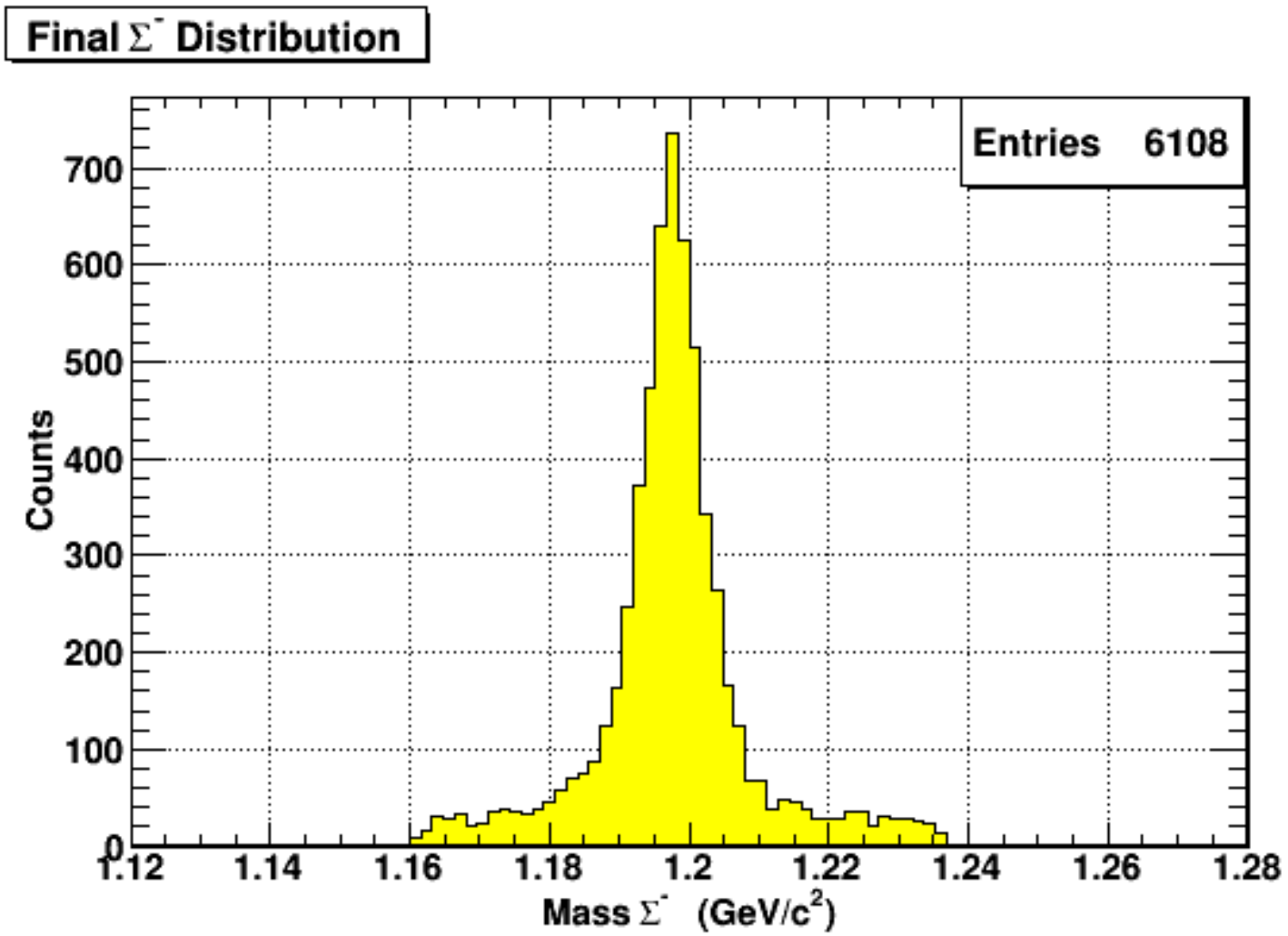


Spectator Proton Mass





Final Σ- Mass


Final Σ⁻ Distribution
Entries 6108
Counts
0
100
200
300
400
500
600
700
1.12
1.14
1.16
1.18
1.2
1.22
1.24
1.26
1.28
Mass Σ⁻ (GeV/c²)

Conclusions

- Analysis of the $K^+\Sigma^-$ is in progress, focused on the determination of beam asymmetry and cross section.

- The current data look very promising. Based on this analysis (22 runs with 2.3 GeV in photon energy), it is predicted to end up having about 400.000 Σ^- events in total.