

# Software Status for KLF

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KLF Collaboration Meeting

May 6th, 2026

# Organization

- Software / analysis group meets every other week
  - Tuesdays, 10 am JLab time
  - Meetings announced on mailing list  
[halld-klf-physics@jlab.org](mailto:halld-klf-physics@jlab.org) [[sign up here](#)]

- More information on [KLF Wiki](#)

[KLF Collaboration Meetings](#) [edit]

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[Service Statements](#) [edit]

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[KLF Beamline](#) [edit]

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[KLF Software](#) [edit]

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[KLF Flux Monitor](#) [edit]

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# Organization

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## KLF Software

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- 1 [Useful Links](#)
- 2 [Meetings \(bi-weekly\): Tuesday, 8 to 9 AM EDT \(Eastern or JLab time\)](#)
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## Useful Links [\[edit\]](#)

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- [How-to's for KLF simulations](#) (updated for 2026)

## Meetings (bi-weekly): Tuesday, 8 to 9 AM EDT (Eastern or JLab time) [\[edit\]](#)

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This meeting is to discuss the development of KLF reconstruction and analysis software, and the analysis of simulated data.

## Remote Participation [\[edit\]](#)

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Join ZoomGov Meeting <https://jlab-org.zoomgov.com/j/1615438135> [🔗](#) (Click "Expand" to the right for more details -->):

## KL Software Meeting Minutes [\[edit\]](#)

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# KLF Software

- KLF software stack based on well-tested GlueX software
- Early 2026: updated stack to latest JANA2-based software
  - Updated detailed how-to on configuring and running software
  - Run software at JLab or on local machine
  - Detailed analysis example upcoming



The screenshot shows a page titled "KLF Software" with a navigation bar at the top containing "Read", "Edit", "View history", a star icon, and "More". Below the title is a "Contents" section with a "[hide]" link, listing four items: "1 Useful Links", "2 Meetings (bi-weekly): Tuesday, 8 to 9 AM EDT (Eastern or JLab time)", "3 Remote Participation", and "4 KL Software Meeting Minutes". Below the contents is a section titled "Useful Links" with an "[edit]" link, containing a single bullet point: "• How-to's for KLF simulations (updated for 2026)". An orange oval highlights the "Useful Links" section and its content.

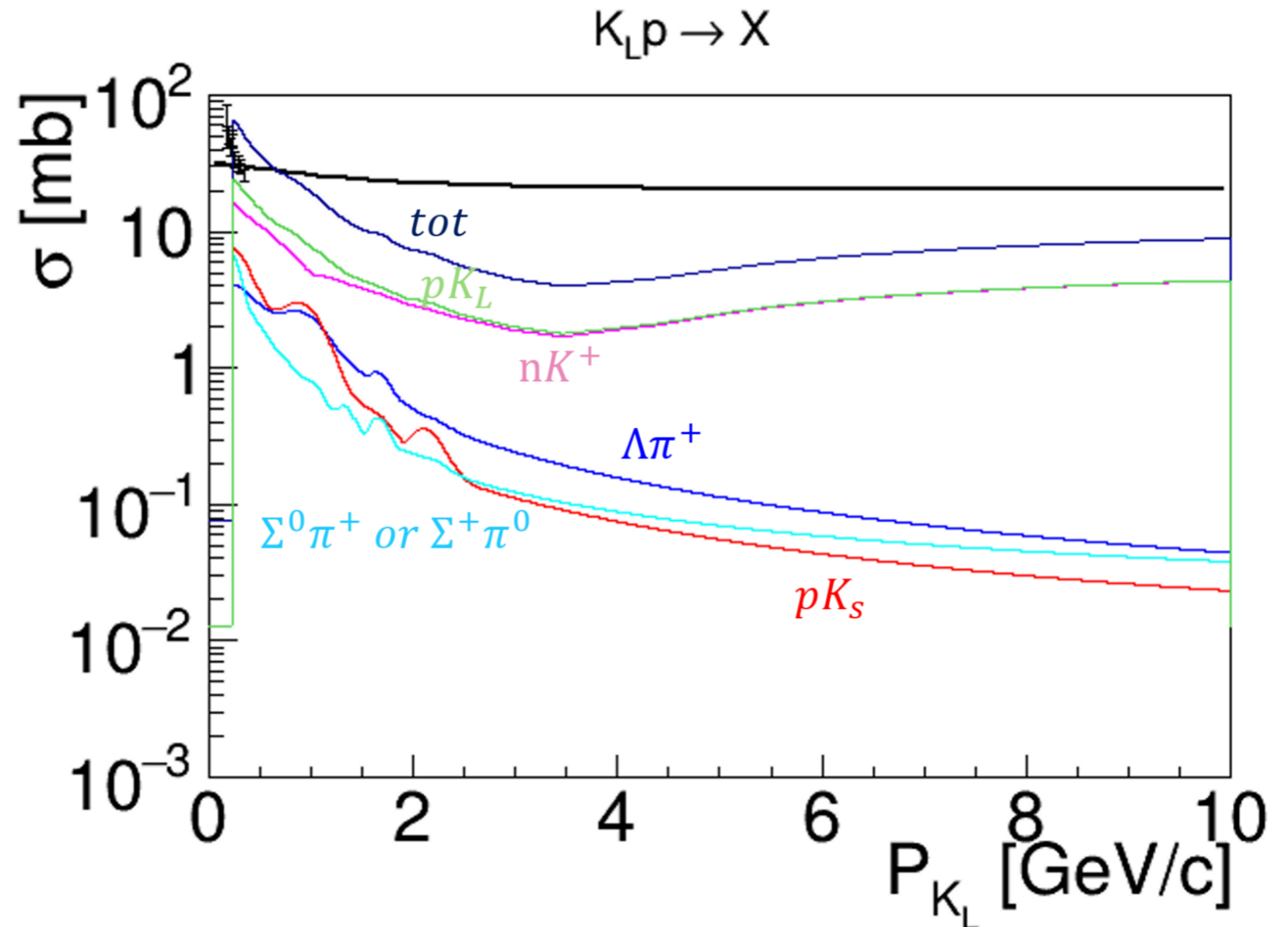
# Major Recent Activities

- KLF Software refresh
- New KL+p event generator
- Magnetic field studies
- New Start Counter Concept simulations

# KL “Cocktail” Generator

- New model for KLGenerator includes realistic parameterization of several reactions based on previous measurements

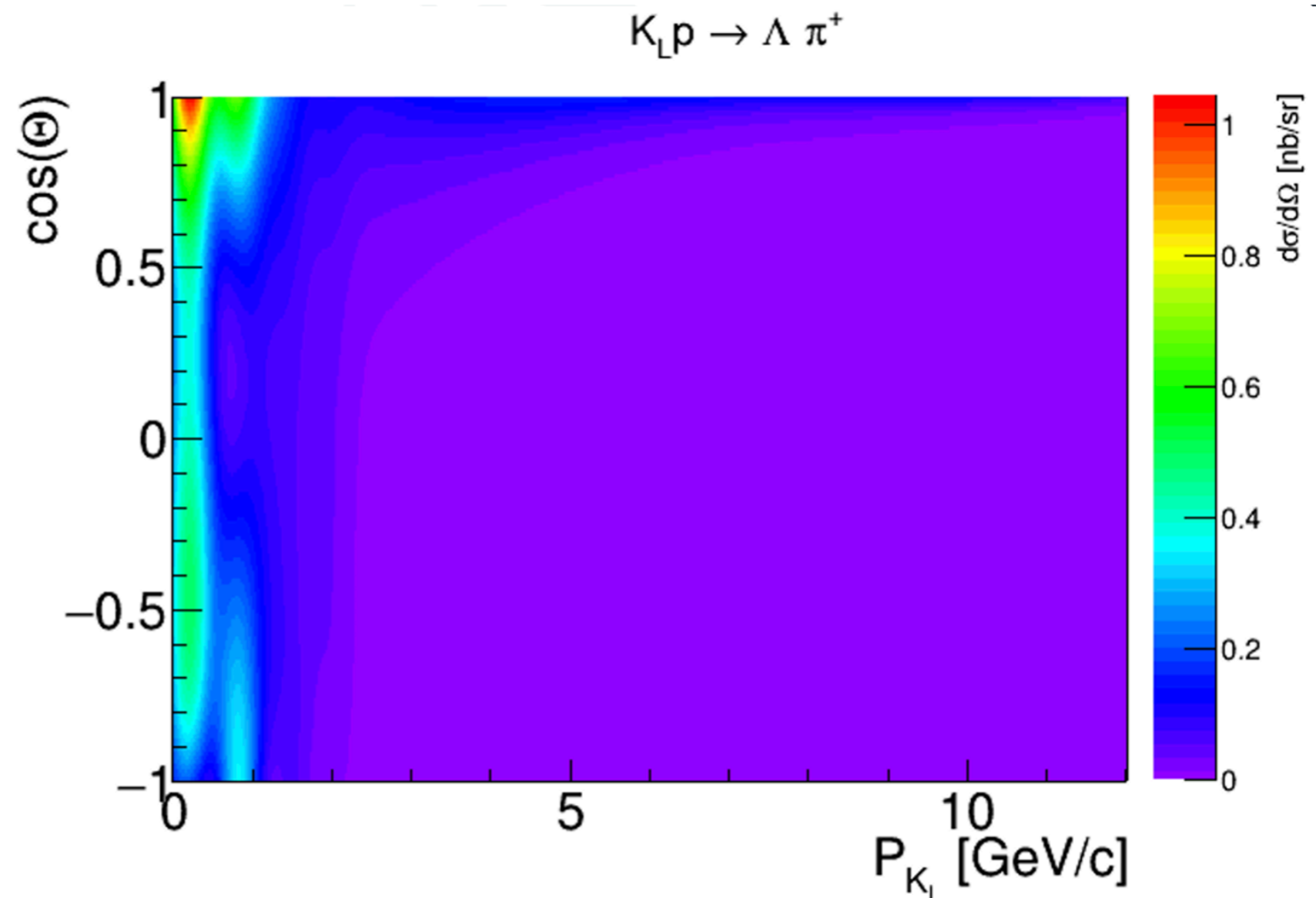
- $K_L p \rightarrow K^+ n$
- $K_L p \rightarrow K_S p$
- $K_L p \rightarrow K_L p$
- $K_L p \rightarrow K^+ \Xi^0$
- $K_L p \rightarrow \pi^+ \Lambda$
- $K_L p \rightarrow \pi^+ \Sigma^0$
- $K_L p \rightarrow \pi^0 \Sigma^+$



# KL “Cocktail” Generator

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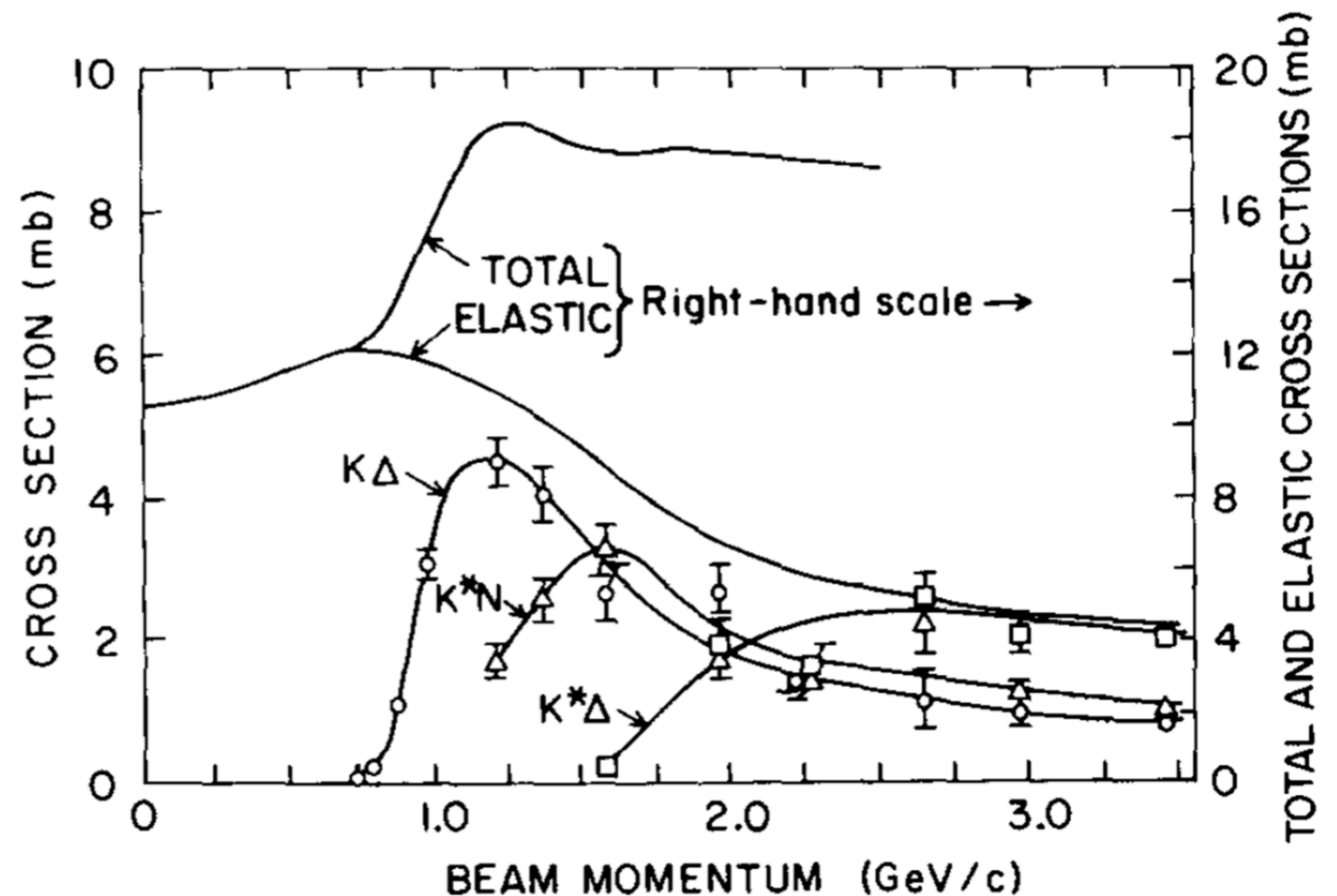
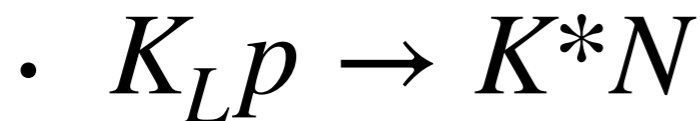
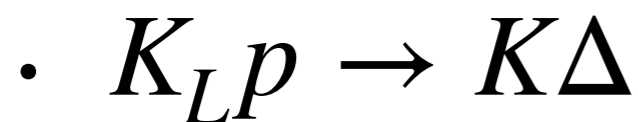


# KL “Cocktail” Generator

- New model for KLGenerator includes realistic parameterization of several reactions based on previous measurements

- At  $p(K_K) \approx 1 - 4$  GeV

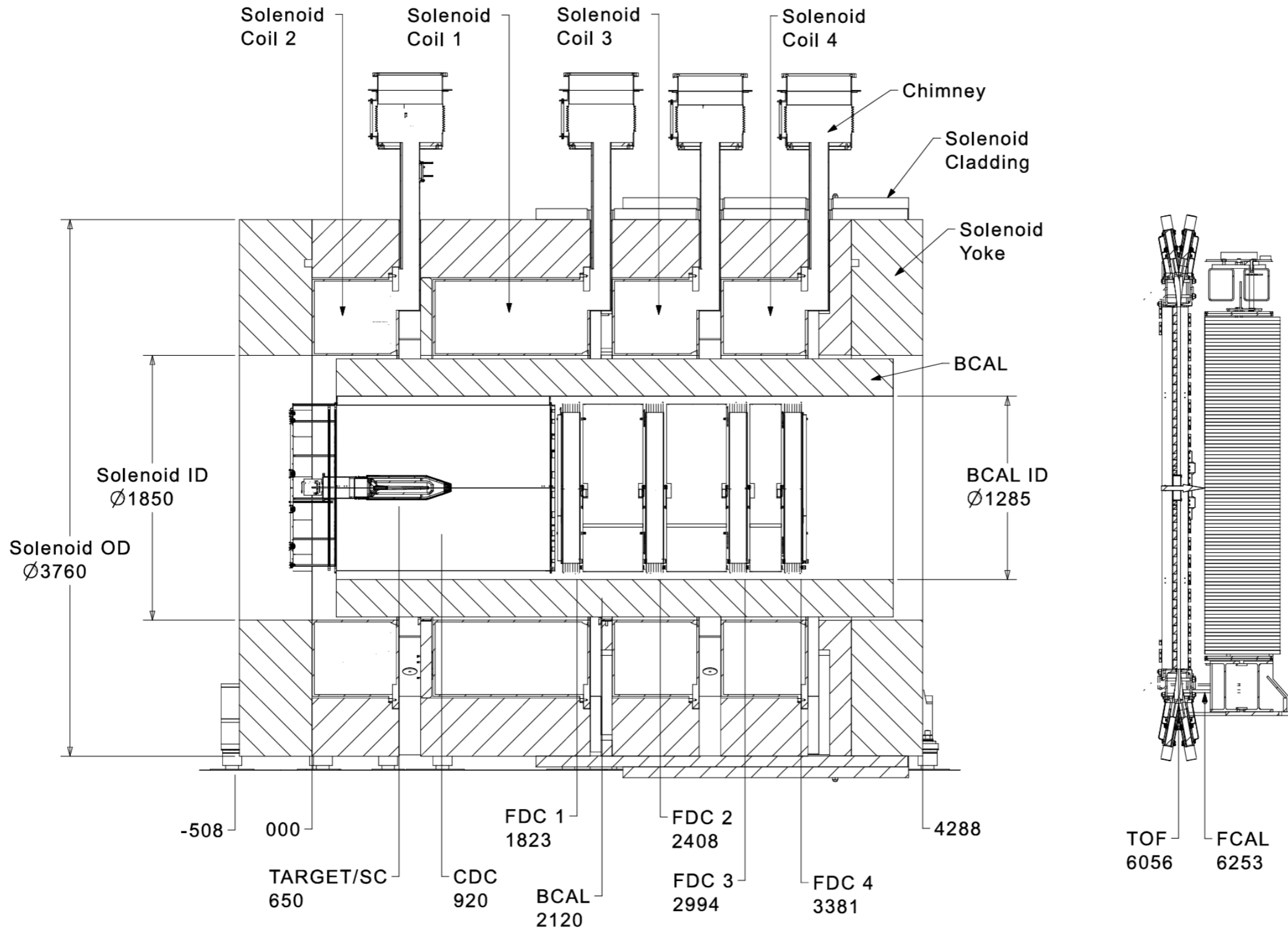
sizable contributions from quasi-two-body decays



# Magnetic Field Studies

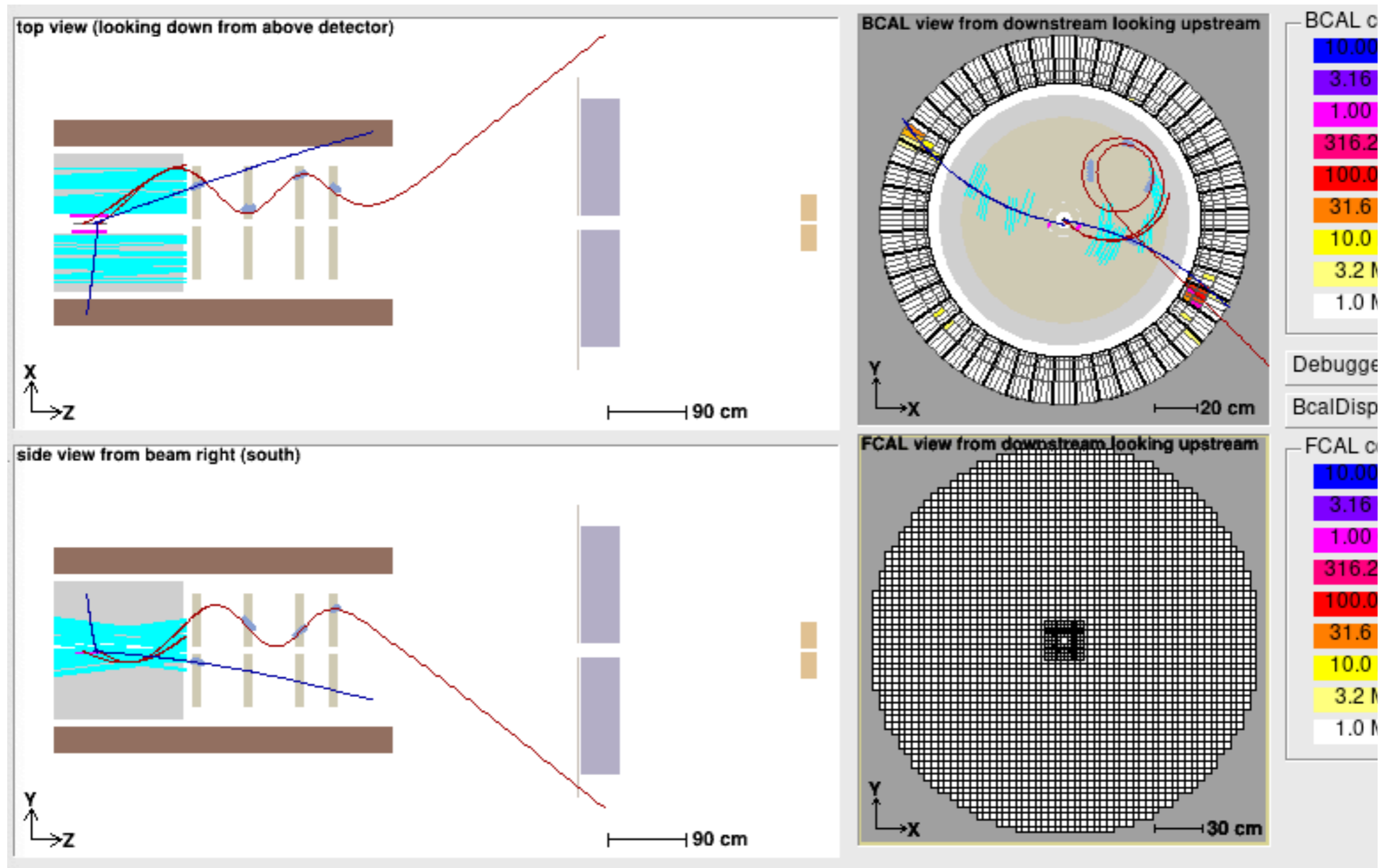
- GlueX detector uses a 4m long superconducting solenoidal magnet with maximum field of 2T
- Nominal solenoid current of 1350A optimized for  $\gamma + p$  interactions with  $E_\gamma > 8$  GeV
- Can improve acceptance by lowering magnetic field strength at the cost of momentum resolution
- Start by studying effect on physics channels
  - Detailed studies in progress: [wiki page](#) [private]
- Follow up: effect on beam backgrounds

# GlueX Detector



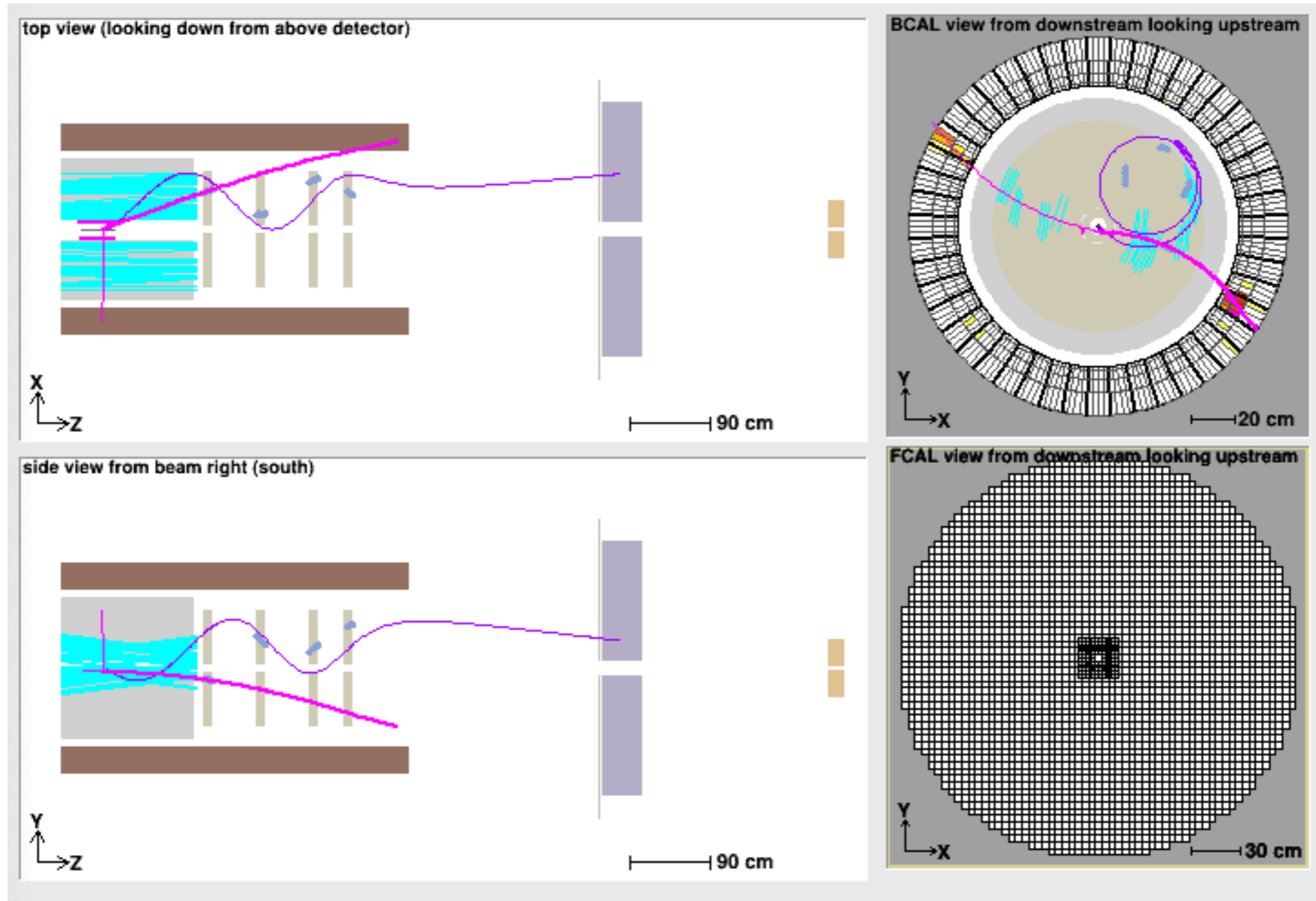
# Event display for $K_L p \rightarrow \Lambda \pi^+, \Lambda \rightarrow p \pi^-$

- Tracks from wire-based tracking

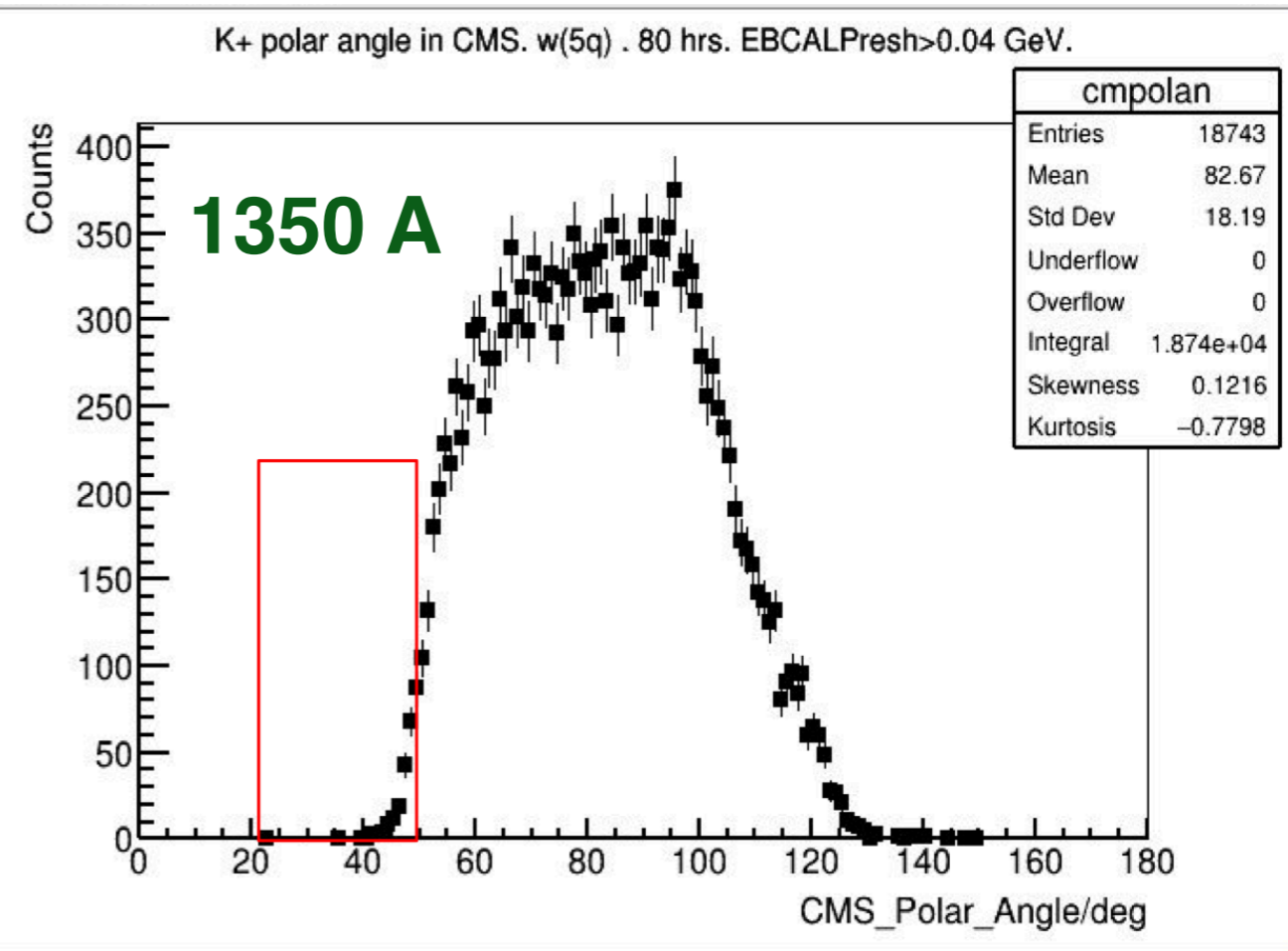
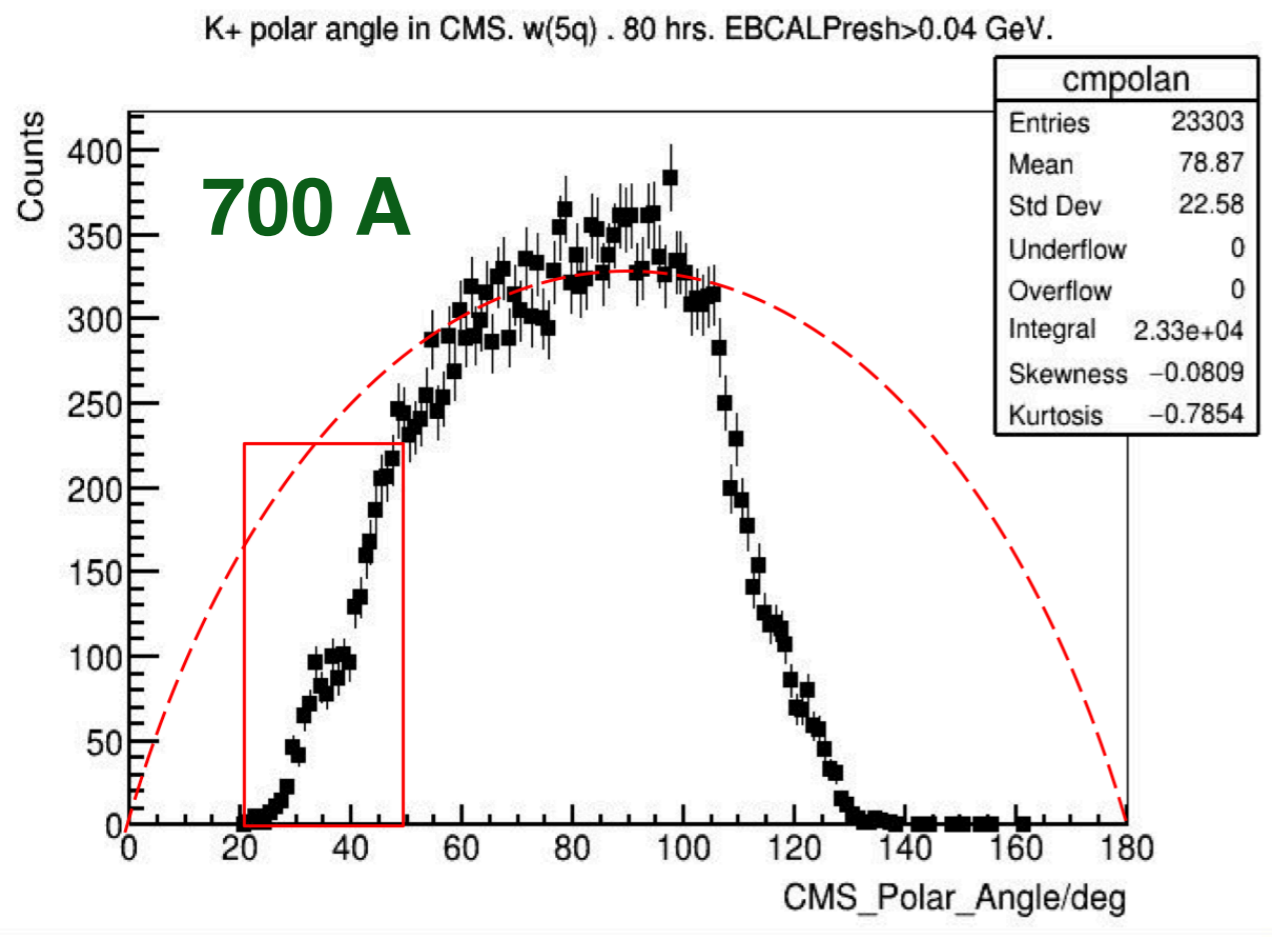


# Event display for $K_L p \rightarrow \Lambda \pi^+, \Lambda \rightarrow p \pi^-$

- Tracks from time-based tracking

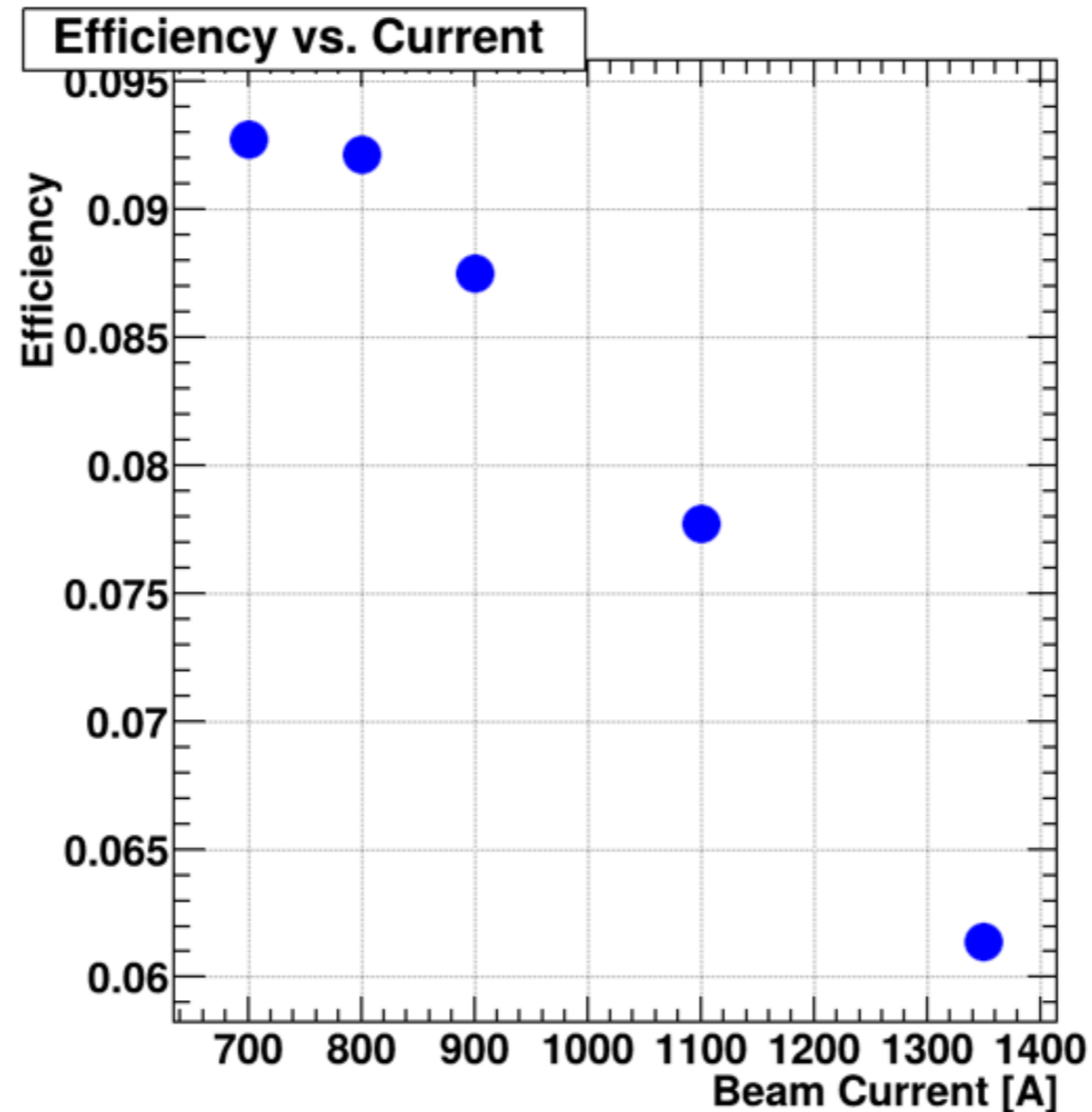


# Magnetic Field Studies: $K_L p \rightarrow K^+ n$



- Reducing magnetic field provides mild increase in acceptance at smaller polar angles

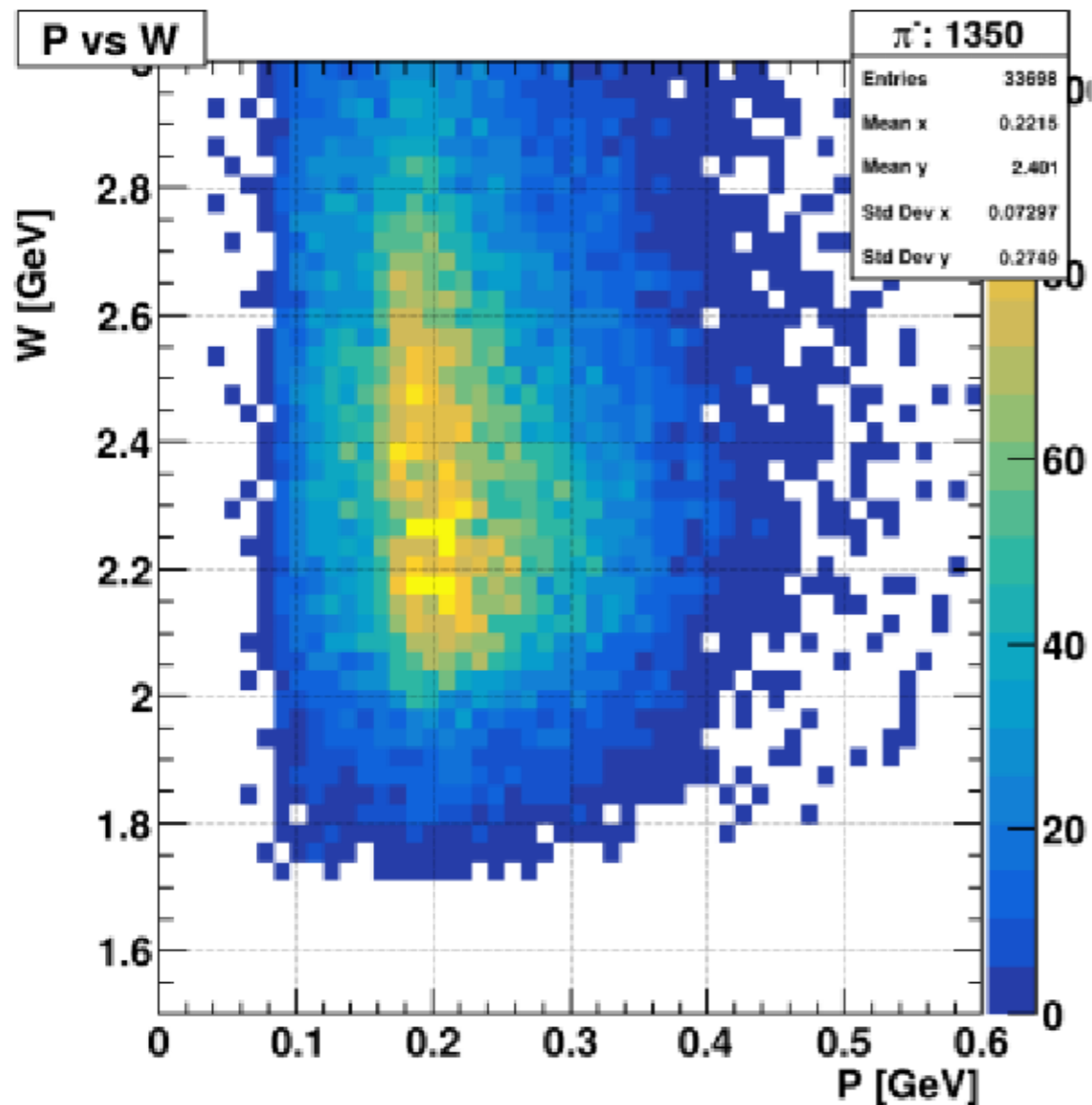
# Magnetic Field Studies: $K_L p \rightarrow \Lambda \pi^+$



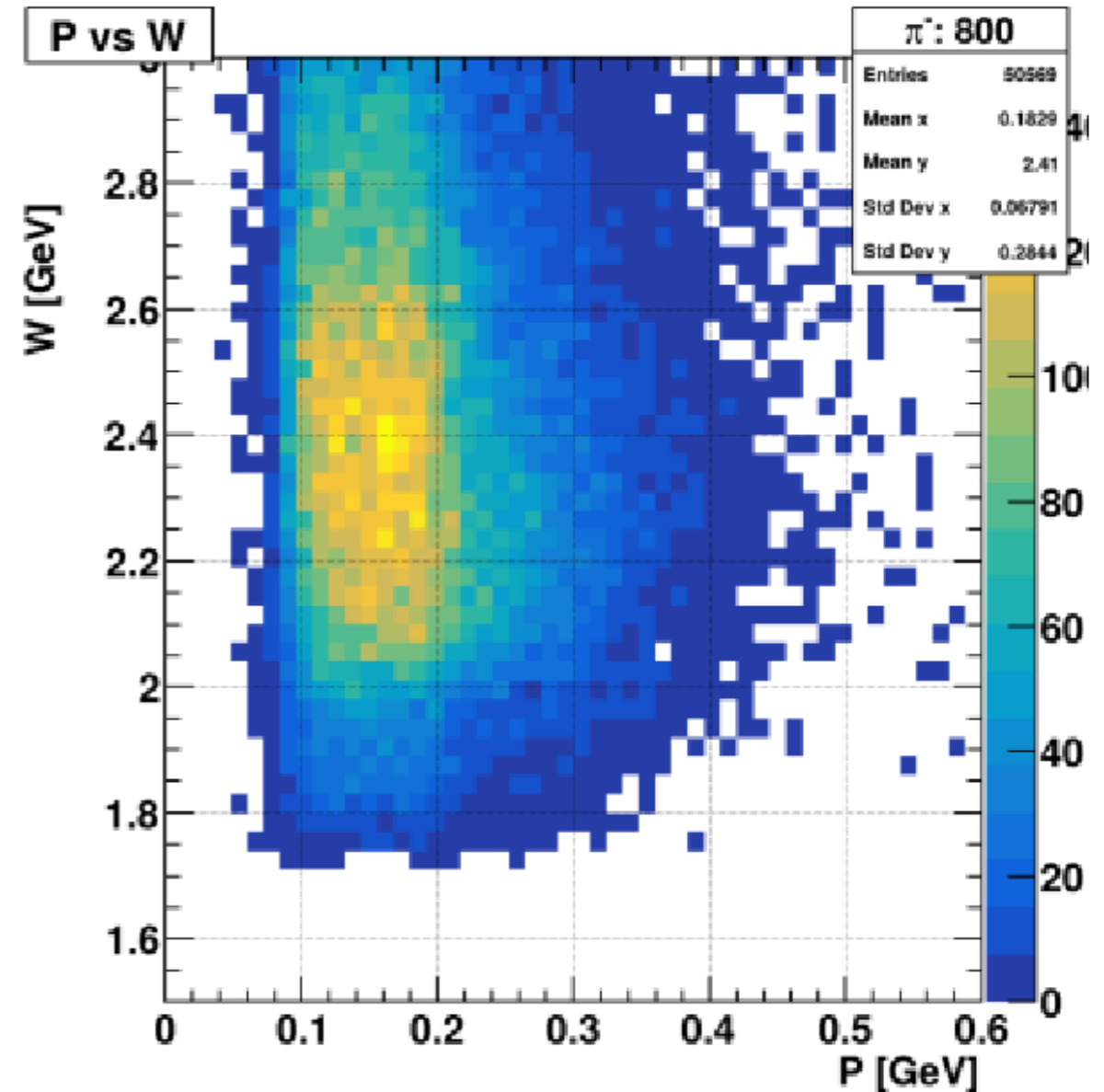
- $\Lambda \pi^+$  channel prefers solenoid current of  $\approx 800\text{A}$ 
  - Little effect on resolution
- Effect on background separation under investigation

# Magnetic Field Studies: $K_L p \rightarrow \Lambda \pi^+$

current = 1350 A

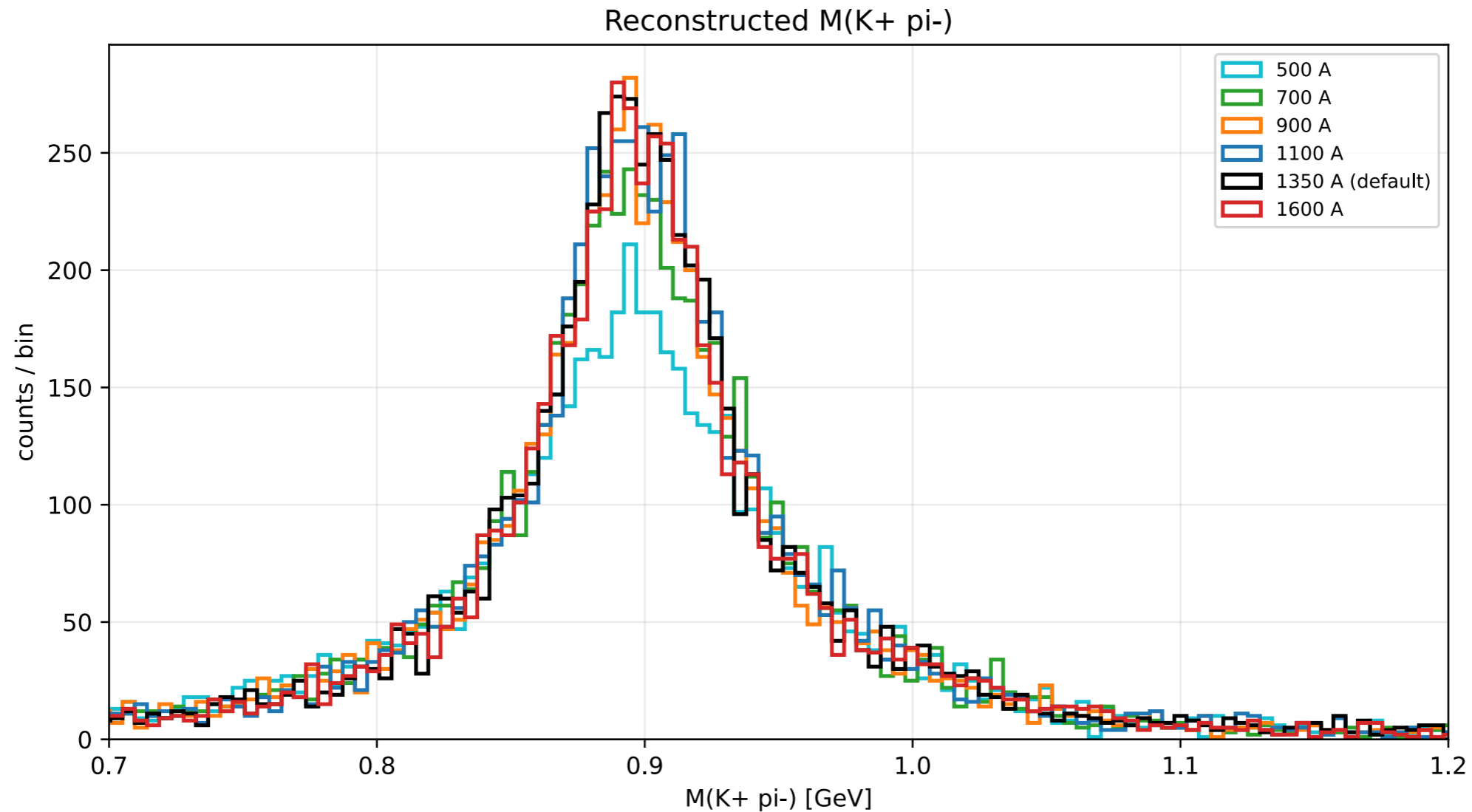


current = 900 A



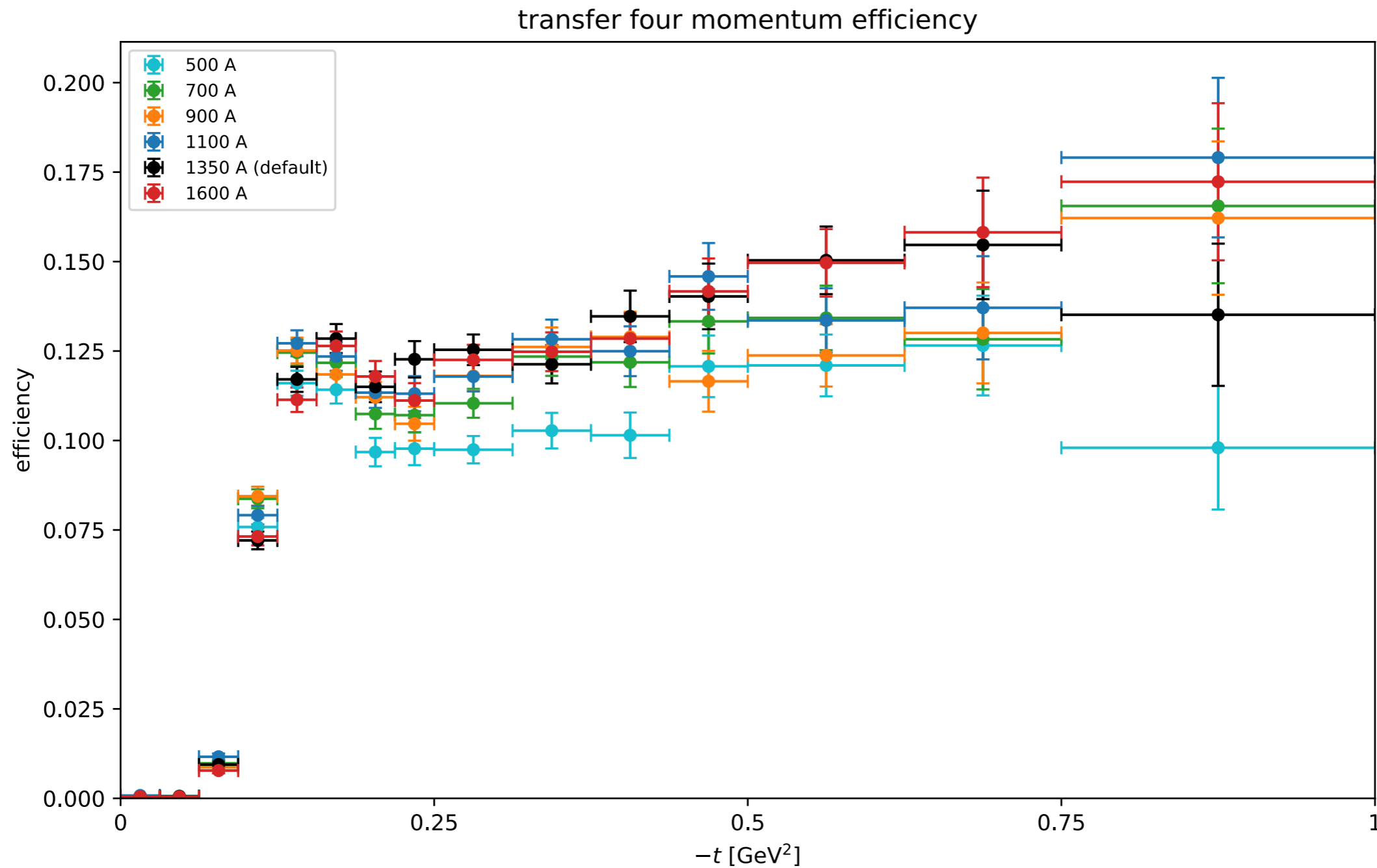
- Clear increase in reconstruction efficiency of  $\pi^-$  with momentum  $< 150$  MeV at lower magnetic field

# Magnetic Field Studies: $K_L p \rightarrow K^*(892)p \rightarrow K^+ \pi^- p$



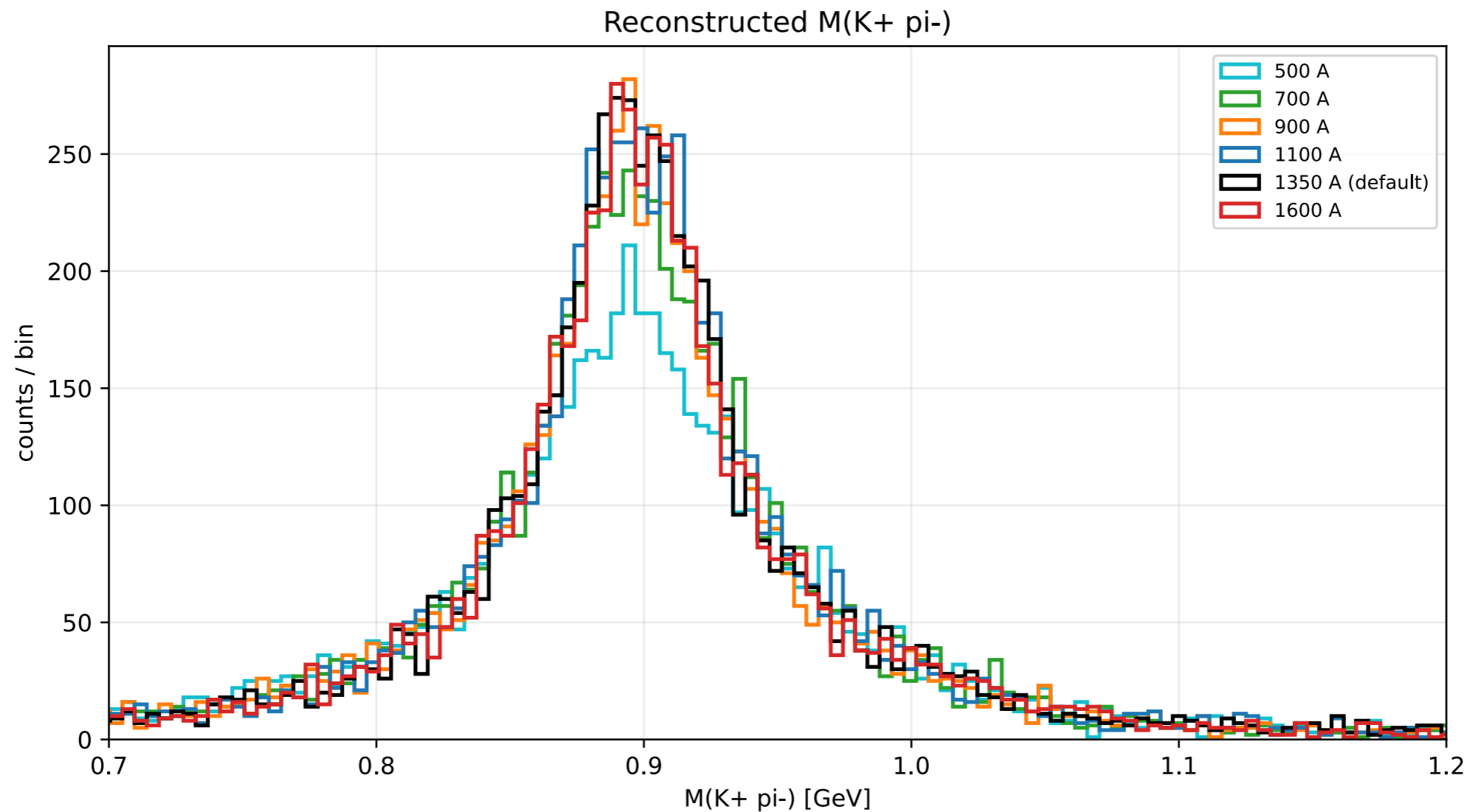
- $K^+ \pi^-$  channel reconstructed well with solenoid current of  $\approx 700\text{--}900\text{A}$

# Magnetic Field Studies: $K_L p \rightarrow K^*(892)p \rightarrow K^+ \pi^- p$



- $K^+ \pi^-$  channel reconstructed well with solenoid current of  $\approx 700\text{--}900\text{A}$

# Magnetic Field Studies: $K_L p \rightarrow K^*(892)p \rightarrow K^+ \pi^- p$

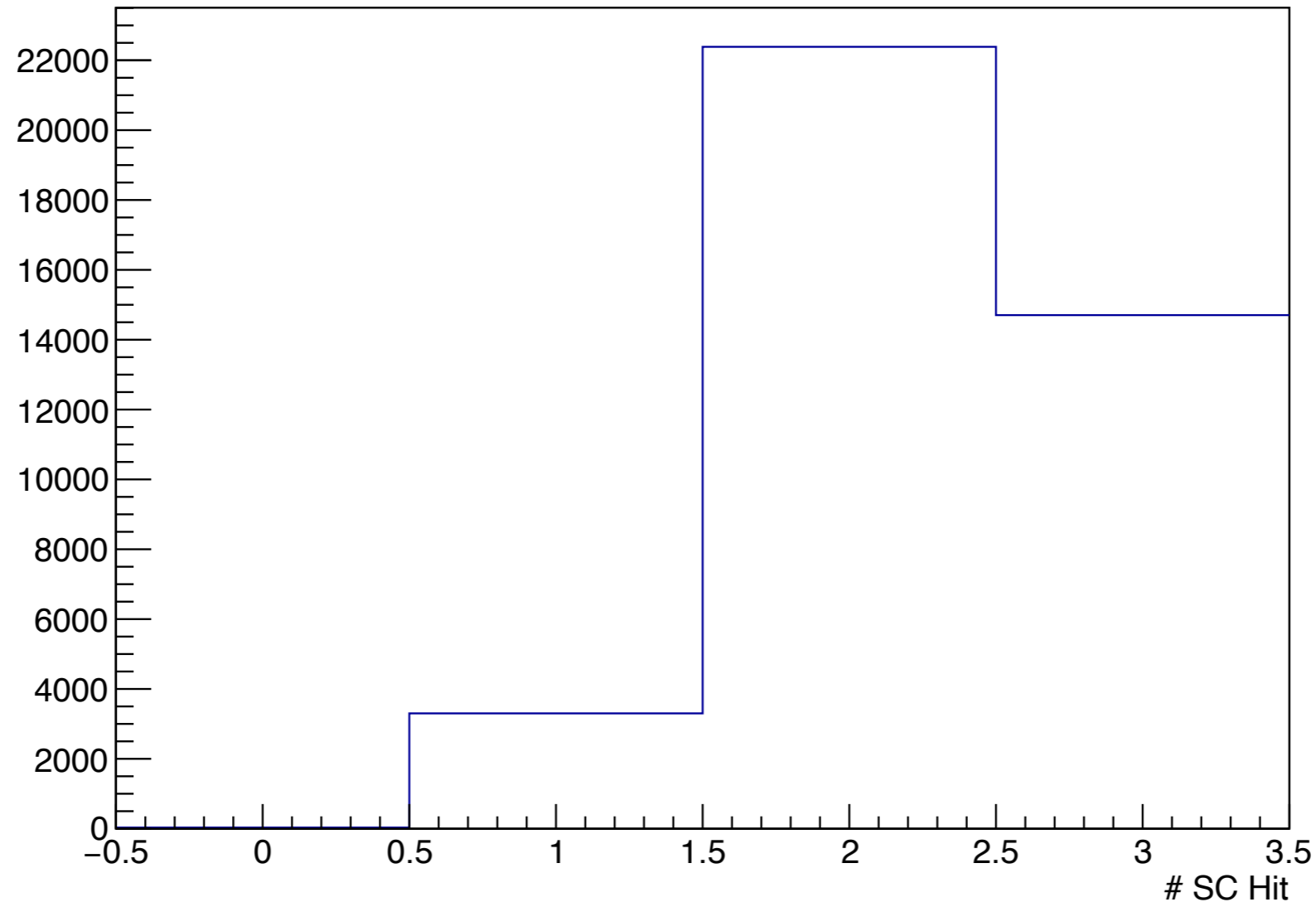


- $K^+ \pi^-$  channel reconstructed well with solenoid current of  $\approx 700\text{--}900\text{A}$

# New SC Concept Simulation

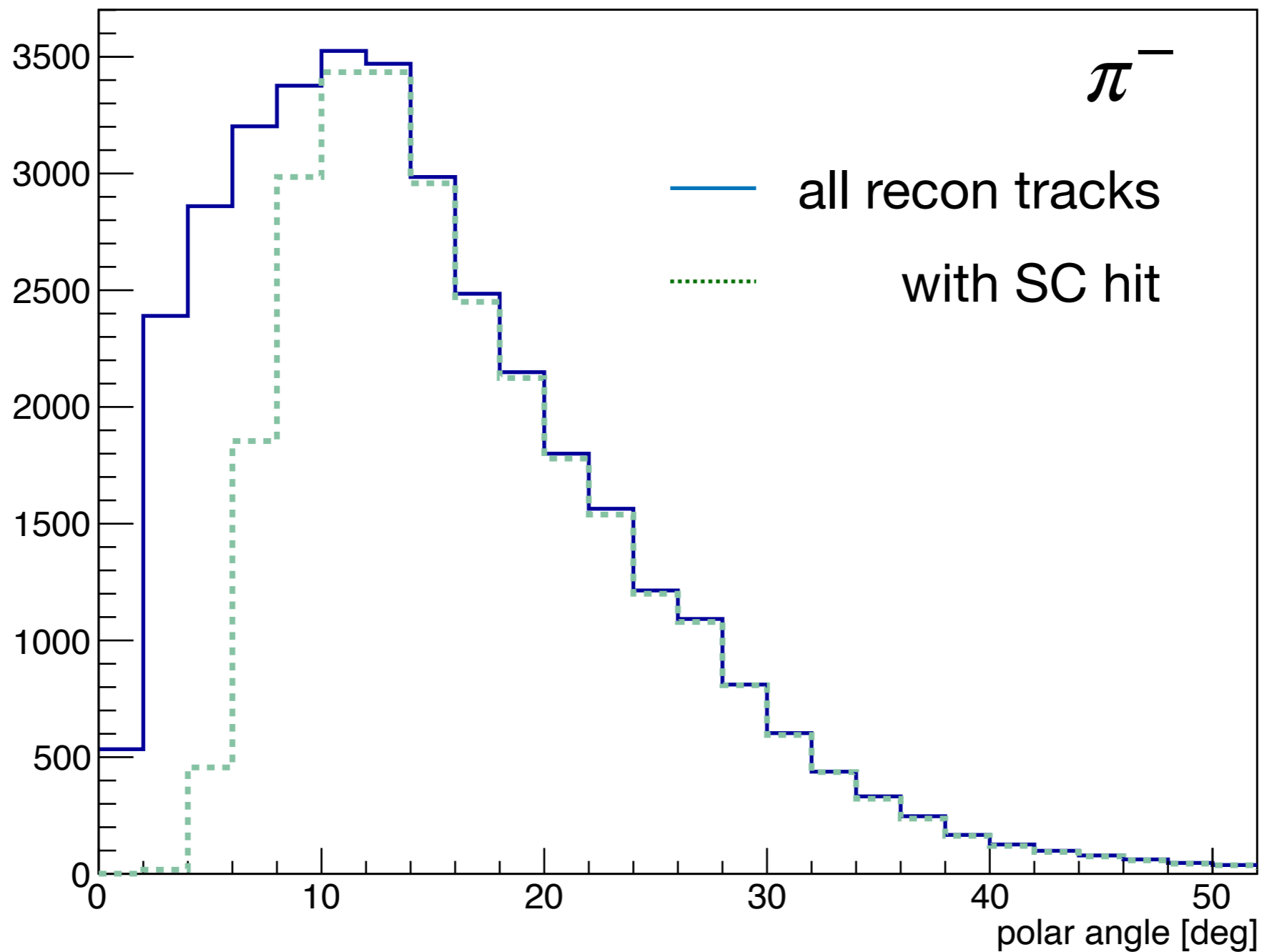
- Initial  $K_L$  beam simulations suggested a SC without nose required for reasonable beam intensity
- Started initial simulations for conceptual design to evaluate the effect of different configurations on physics channels
  - Straight paddles 80 — 90 cm long, 3 / 6 mm thick
  - Timing resolution  $\sigma = 100 - 300$  ps

# Simulations: $K_L p \rightarrow K^*(892) p \rightarrow K^+ \pi^- p$



- Events from Keigo's generator for  $K_L p \rightarrow K^*(892) p \rightarrow K^+ \pi^- p$  events with t-exchange model,  $p(K_L) > 4$  GeV
- Most events have at least 2 SC hits

# Simulations: $K_L p \rightarrow K^*(892) p \rightarrow K^+ \pi^- p$



- Momentum-dependent cutoff for SC acceptance  $\theta \approx 6 - 10^\circ$

# Upcoming Activities

- Learn from current GlueX  $E_\gamma = 1 - 4$  GeV run
  - Closer to KLF c.o.m. energies
  - Can benchmark detector performance, acceptance, trigger, etc.
- Benchmark physics analyses with simulated beam backgrounds
  - Requires SC and KLM conceptual designs
- Study  $\Lambda^*/\Sigma^*$  and  $\Xi^*$  resonance determination with realistic physics models
- KL flux studies
  - Can we use existing GlueX data to reduce uncertainties in  $\gamma + \text{Be} \rightarrow K_L + X$ ?

# Summary

- Progress being made on several important topics
  - Optimizing solenoidal magnetic field
    - Physics channels seem okay with  $\approx 800$  A
    - Need beam background studies
  - SC conceptual design simulations
  - Extracting cross sections with physics backgrounds
- To satisfy ERR, need to show determination of resonance properties / PWA including beam backgrounds
  - Hope to focus on these this summer
- Lots of software and analysis work still needed to run experiment
  - Benchmark acceptance & performance with new SC
  - Simulate channels for new physics ideas
  - Many projects for both experienced scientists and students
  - Happy to help collaborators get started!

# Summary

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