Resolution Study for First Experiment
$K^+\Lambda$ channel, low Q^2, $E_{beam} = 6.4$ GeV

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Outline

1. Trigger and Run Conditions
2. Kinematics
3. Run Conditions
   - Negative Outbending Torus Current
   - Negative Inbending Torus Current
4. Acceptance Table
5. Distinguish Σ from Λ

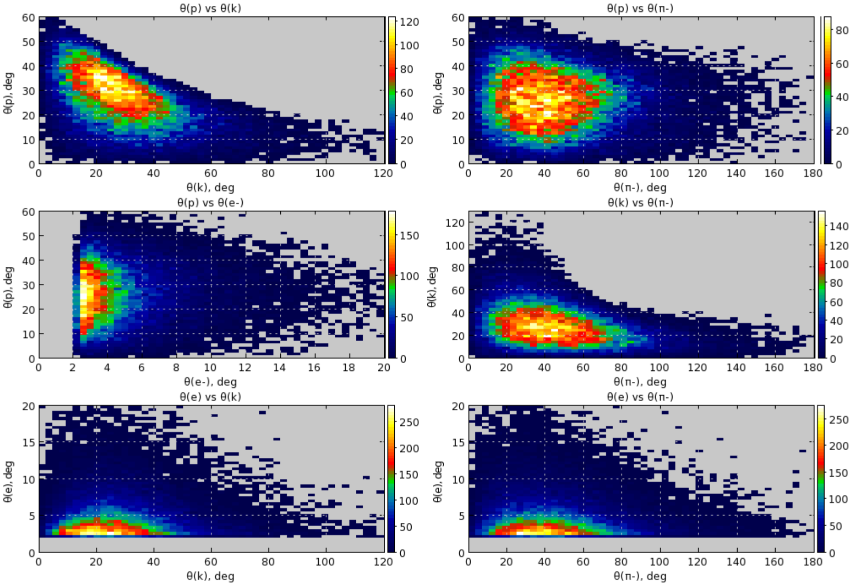
Trigger and Run Conditions

- Process studied

$$e^- p \to e^- K^+ \Lambda$$

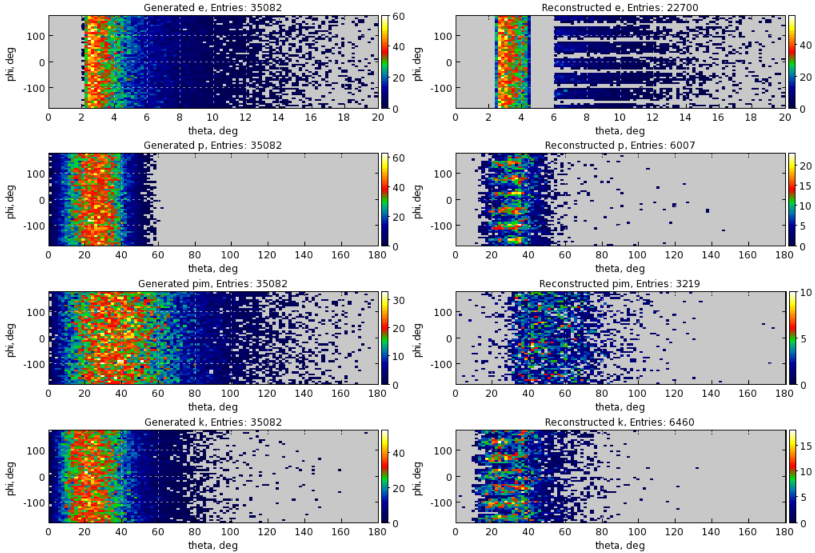
- Trigger Selection:
  - 1 e^- anywhere (maximum acceptance but not realistic)
  - 1 e^- in FT (excessive high rate)
  - 1 e^- in CLAS (Outbending: $Q^2 > \sim 1$ GeV^2)
  - 1 e^- in CLAS or 1 e^- in FT + 1 fwd ($\theta_{had} < 30°$) hadron (p or K^+)
  - 1 e^- in CLAS or 1 e^- in FT + 2 fwd hadrons (p and K^+)
  - 1 e^- in CLAS or 1 e^- in FT + 1 had (p/K^+/π^-) anywhere (fwd + ctl)
- Run Conditions:
  - E_{beam} = 6.4 GeV, Torus Current = 100 % (Outbending, -3375 A), Solenoid = 60 %.
  - E_{beam} = 6.4 GeV, Torus Current = -100 % (Inbending, 3375 A), Solenoid = 60 %.

Generated Angular Correlations

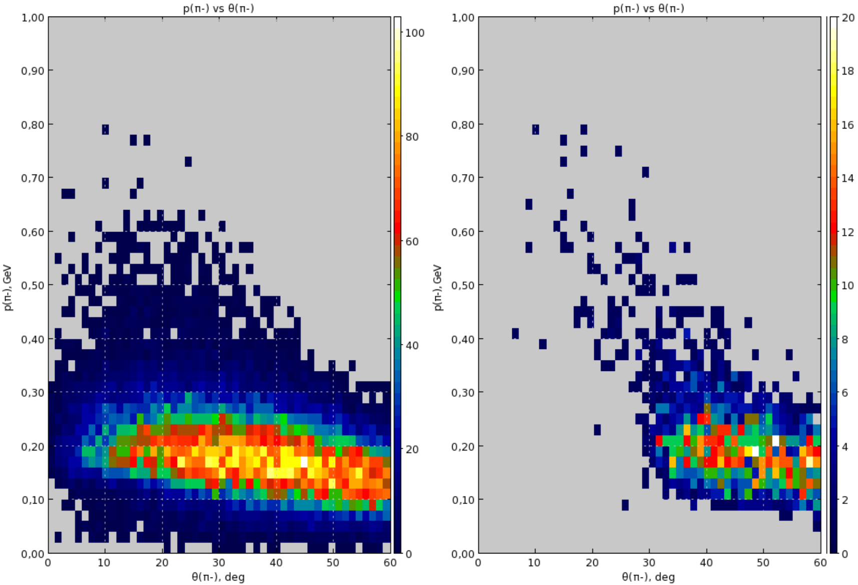


Generated and Reconstructed Particles

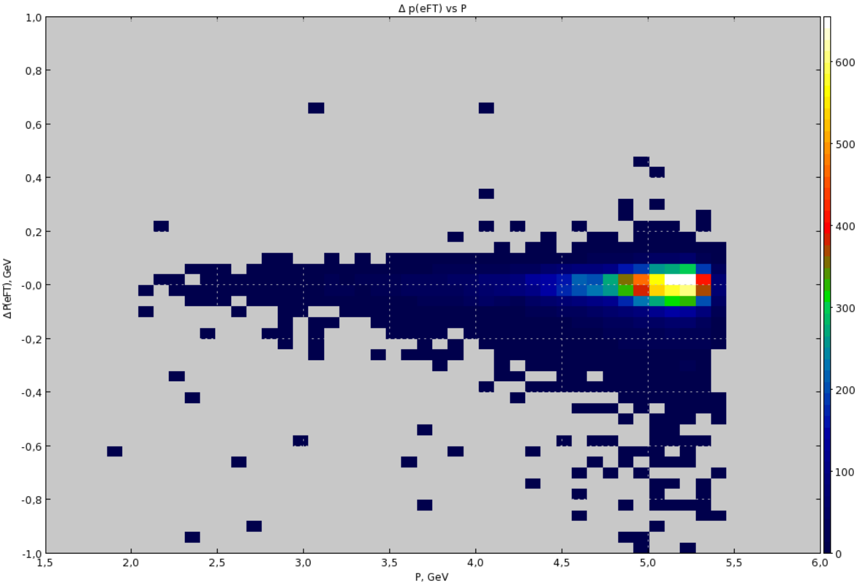
Trigger: 1 e^- anywhere, Fiducial Cuts applied



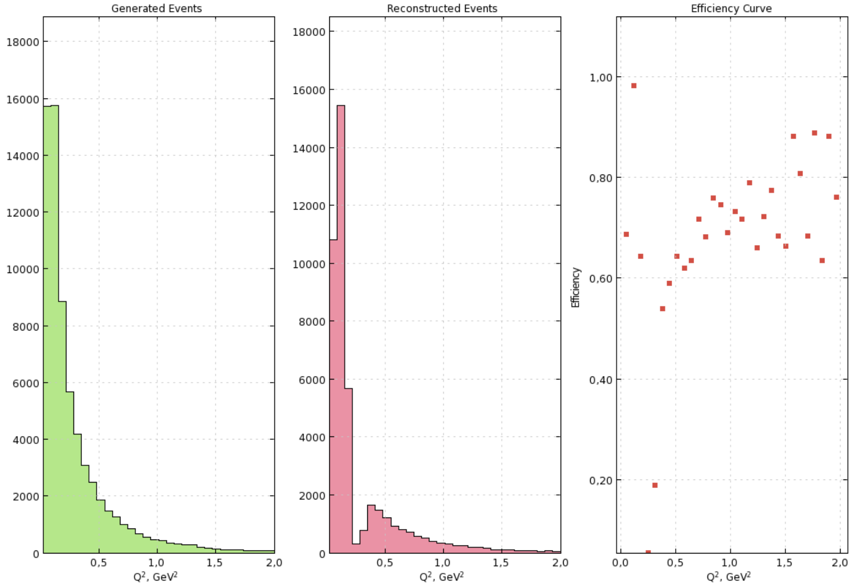
Generated and Reconstructed π^-



Reconstructed Electron Energy in FT



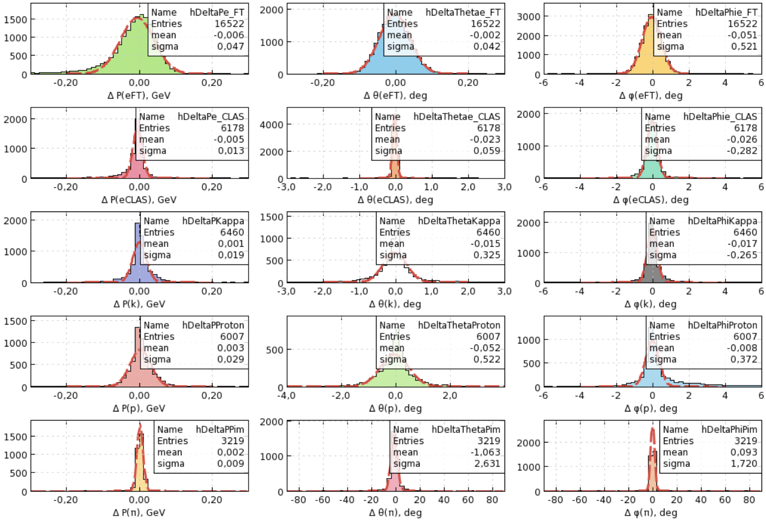
Efficiency Curve



Resolution

Trigger: 1 e^- anywhere, Fiducial Cuts applied

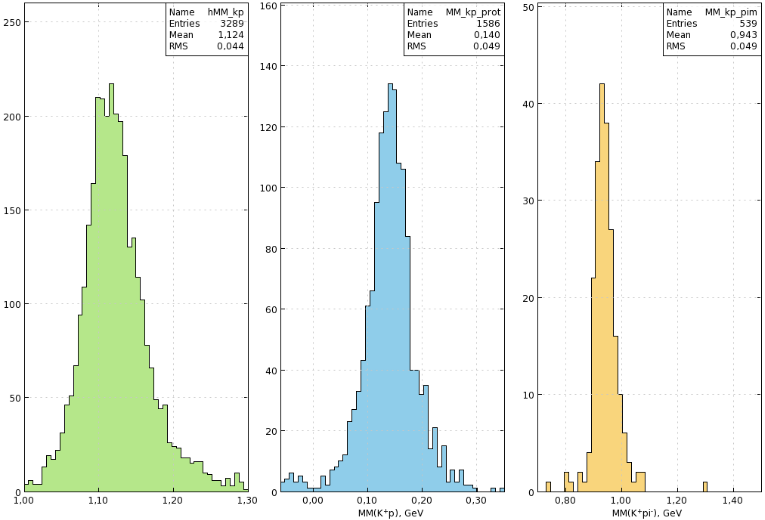
Inclusive electron acceptance: FT: 47 % CLAS: 18 %



MM Reconstruction

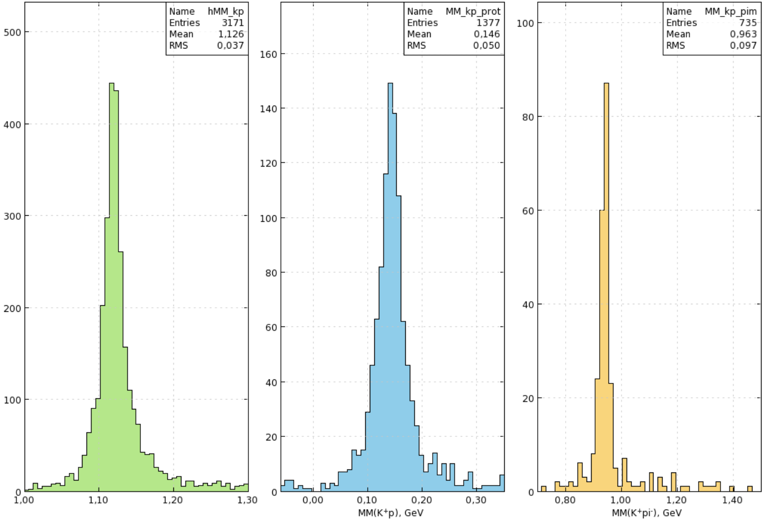
Trigger: 1 e^- in FT $(2.5^\circ < \theta_{e^-} < 4.5^\circ)$

Inclusive electron acceptance: 47 %



Trigger: 1 e^- in CLAS ($\theta_{e^-} > 6.0°$)

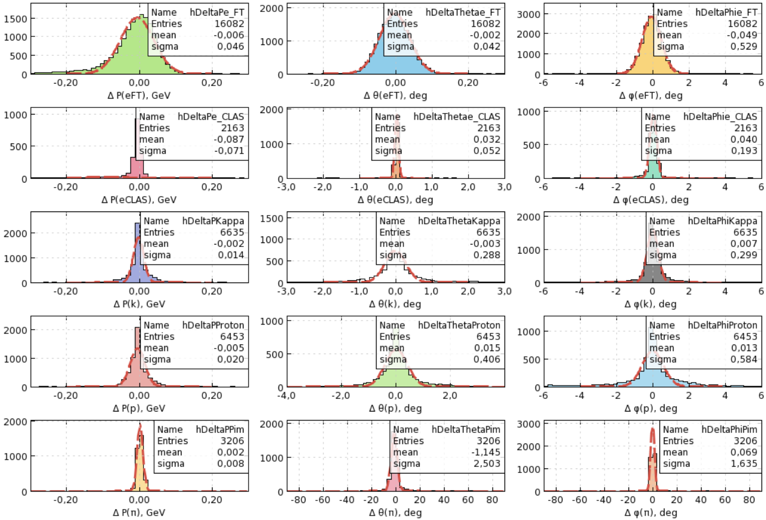
Inclusive electron acceptance: 18 %



Resolution

Trigger: 1 e^- anywhere, Fiducial Cuts applied

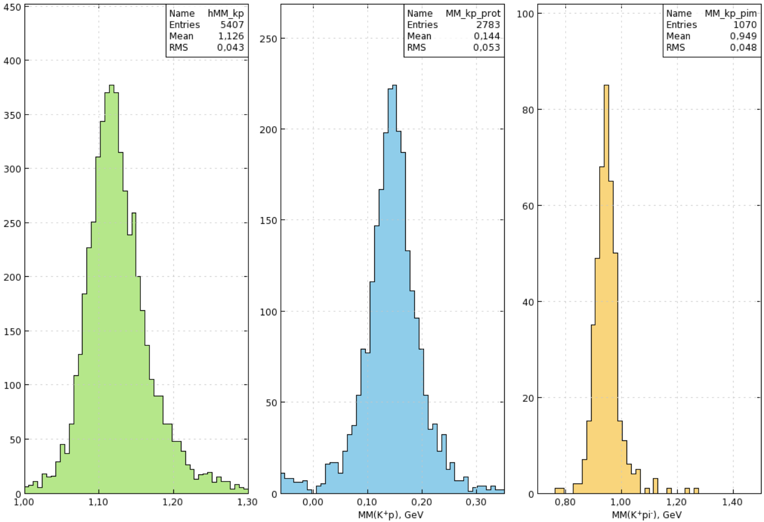
Inclusive electron acceptance: FT: 47% CLAS: 6%



MM Reconstruction

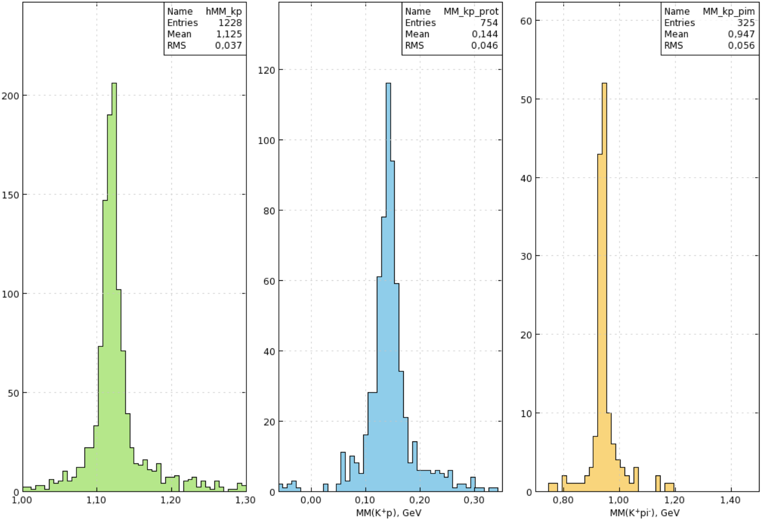
Trigger: 1 e^- in FT $(2.5^\circ < \theta_{e^-} < 4.5^\circ)$

Inclusive electron acceptance: 47%



Trigger: 1 e^- in CLAS ($\theta_{e^-} > 6.0^\circ$)

Inclusive electron acceptance: 6%



Acceptance Table

Trigger	Negative Outbending	Negative Inbending
1 e^- FT	47%	47%
1 e^- CLAS	18%	6%
1 e^- anywhere	65%	54%
1 e^- FT + 1 fwd had	7%	16%
1 e^- FT + 1 ctl had	12%	19%
1 e^- FT + 2 fwd had	0	1%
1 e^- CLAS /1 e^- FT + 1 forward had	25%	22%
1 e^- CLAS /1 e^- FT + 1 had (ctl or fwd)	32%	31%

Where:

1 fwd had= 1 forward hadron (p / K^+ / π^-)

1 ctl had= 1 central hadron (p / K^+ / π^-)

Acceptance for 1 e^- CLAS /1 e^- FT + 1 had anywhere, Negative Outbending

Acceptance for 1 e^- CLAS /1 e^- FT + 1 had:

Trigger	pK^+	$p\pi^-$	π^-K^+	$p\pi^-K^+$	1 had
1 e^- CLAS/1 e^- FT + 1 fwd had	7.7%	3.1%	3.6%	1.3%	23%
1 e^- CLAS/1 e^- FT + 1 ctl had	8.4%	3.6%	4.0%	1.4%	28%
1 e^- CLAS/1 e^- FT + 1 had (ctl/fwd)	8.5%	3.6%	4.0%	1.4%	30%

Where:

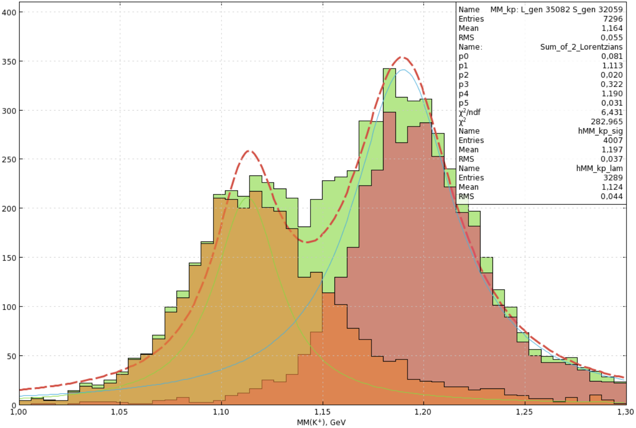
1 fwd had= 1 forward hadron (p / K^+ / π^-)

1 ctl had= 1 central hadron (p / K^+ / π^-)

Distinguish Σ from Λ: Negative Outbending

Trigger: 1 e^- FT

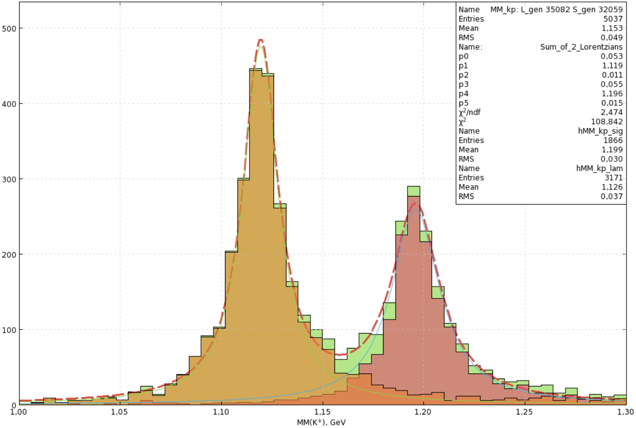
Λ^0_{mass}: 1115,683 $\pm$ 0.006 MeV Σ^0_{mass}: 1192.642 $\pm$ 0.024 MeV



Distinguish Σ from Λ: Negative Outbending

Trigger: 1 e^- CLAS

Λ^0_{mass}: 1115,683 ± 0.006 MeV Σ^0_{mass}: 1192.642 ± 0.024 MeV



Distinguish Σ from Λ: Negative Outbending

Trigger: 1 e^- anywhere

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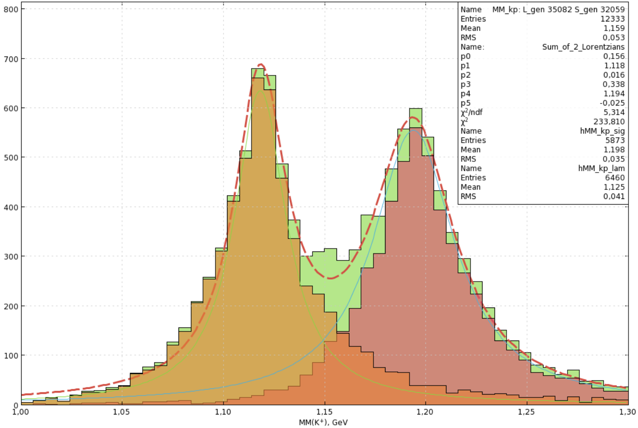
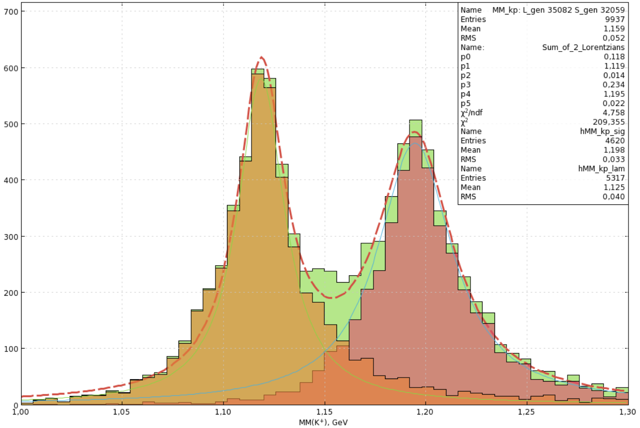


Trigger:
1 e^- in CLAS ($\theta_{e^-} > 6.0^\circ$) or 1 e^- in FT ($2.5^\circ < \theta_{e^-} < 4.5^\circ$) + 1 fwd hadron (p or K^+ or π^-)

Λ^0_{mass}: 1115,683 $\pm$ 0.006 MeV Σ^0_{mass}: 1192.642 $\pm$ 0.024 MeV



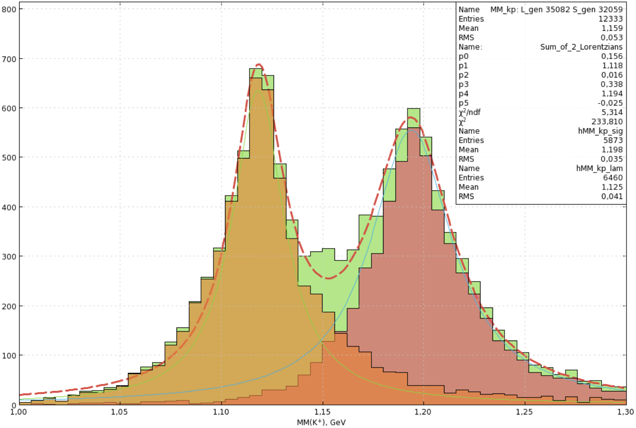
Fitting function: sum of 2 Lorentzians

$$f(x) = \frac{p_0}{(x - p_1)^2 + p_2^2} + \frac{p_3}{(x - p_4)^2 + p_5^2}$$

Trigger:

1 e^- in CLAS ($\theta_{e^-} > 6.0^\circ$) or 1 e^- in FT ($2.5^\circ < \theta_{e^-} < 4.5^\circ$) + 1 hadron (p or K^+ or π^-)

Λ^0_{mass}: 1115,683 $\pm$ 0.006 MeV Σ^0_{mass}: 1192.642 $\pm$ 0.024 MeV



Fitting function: sum of 2 Lorentzians

$$f(x) = \frac{p_0}{(x - p_1)^2 + p_2^2} + \frac{p_3}{(x - p_4)^2 + p_5^2}$$

Conclusions

Evidences from simulations:

- Electrons reconstructed from CLAS present a better resolution, but low acceptance.
- On the contrary, electrons from FT are reconstructed with worse energy resolution but with higher statistics.
- Using a trigger with 1 e^- in CLAS or 1 e^- in FT + 1 forward hadron (p/K^+) the global acceptance is lower than 25%.
- Adding the trigger from the central detector 1 e^- in CLAS or 1 e^- in FT + 1 central hadron (p/K^+/π^-) the statistics increases by a factor 1.3