Follow-Up Report

11.10.14

Josiah D. Kunz

Follow-up for the meeting on 11.06.14

My Notes

- X-histogram is Gaussian, with $\sigma = \sigma_{PDG} + \sigma_{correction}$.
  - For $\sigma_c = 1 - \cos(\theta)$, make 1 mm, 30 mm, 50 mm phase-space portraits and see what they look like. Also, look at the 100 mm histograms.
- Energy losses can follow Vavilov theory, Blunck-Liesegang theory, or use the compound Poisson method. The 12 mm histograms match, but the 100 mm histograms do not.
  - Look at 1 vs 2 iterations for a 24 mm absorber for B-L and Vavilov theory. Compare to energy loss histograms from various ICOOL models (1)-(5).

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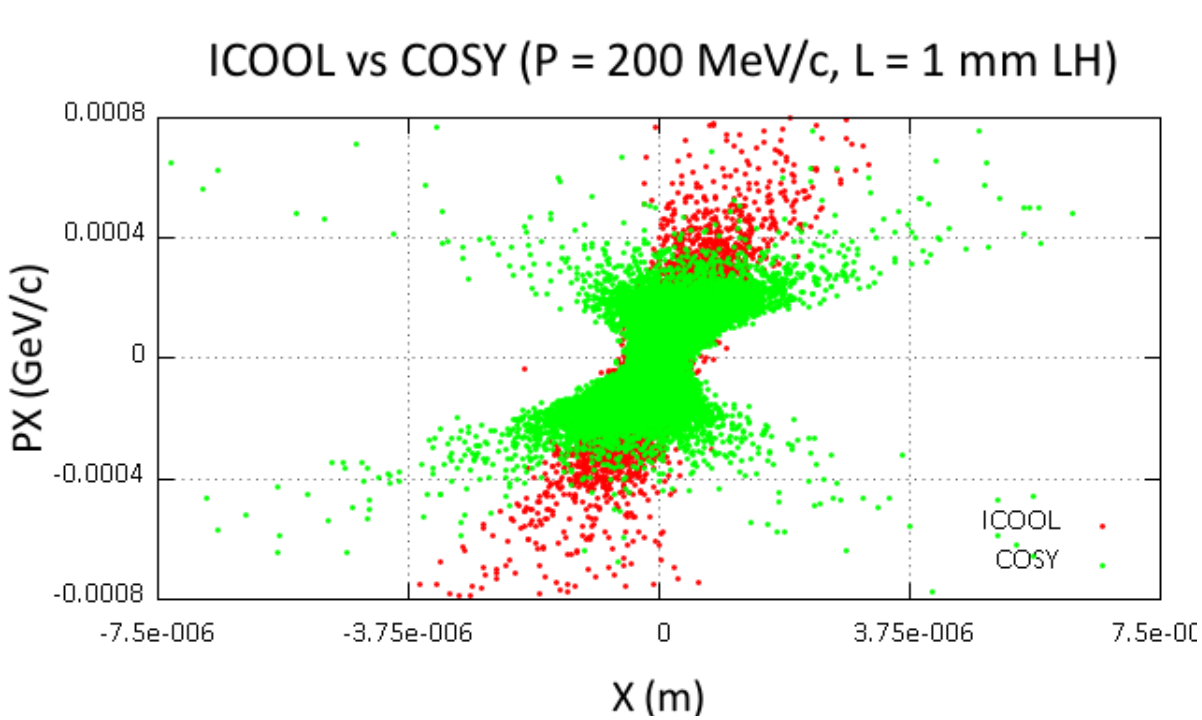
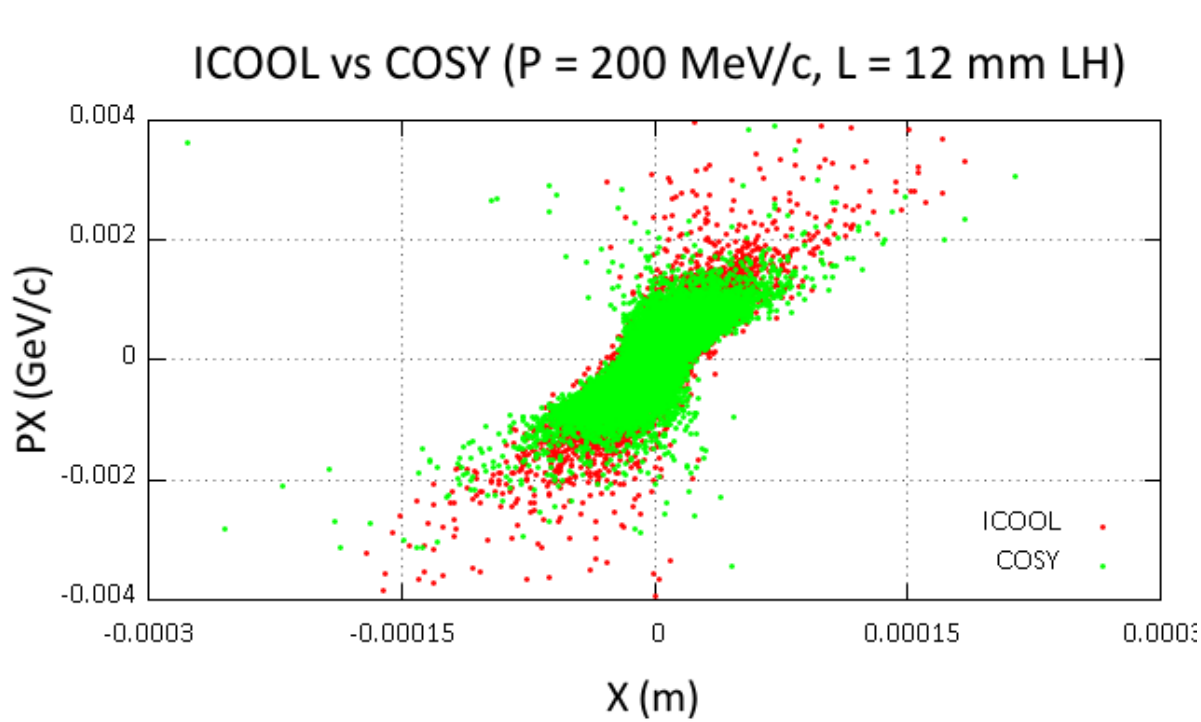
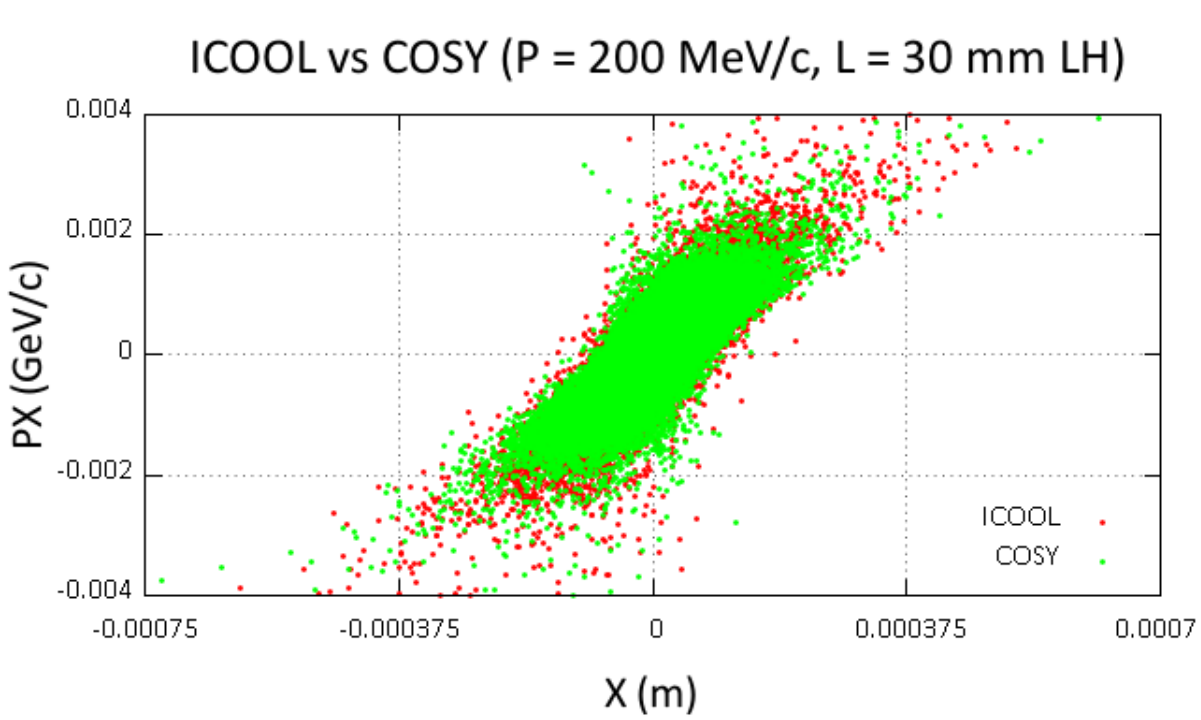
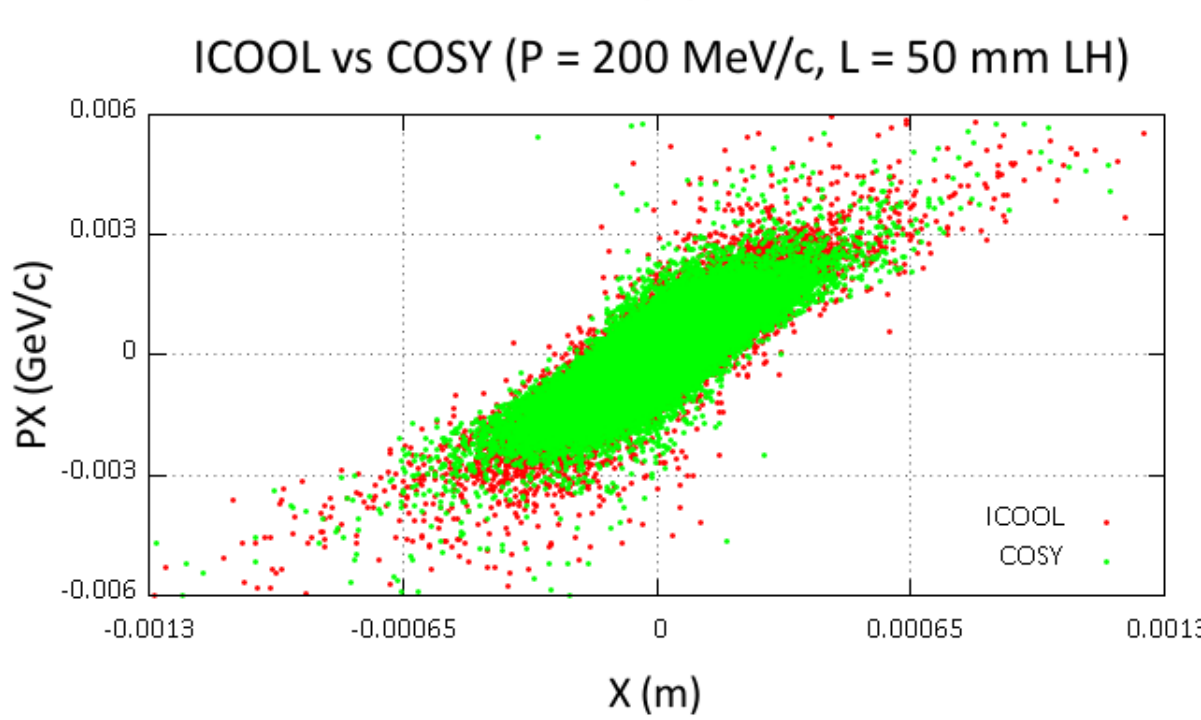

ICOOL vs COSY (P = 200 MeV/c, L = 1 mm LH)
PX (GeV/c)
0.0008
0.0004
0
-0.0004
-0.0008
-7.5e-006
-3.75e-006
0
3.75e-006
7.5e-00
X (m)
ICOOL
COSY


ICOOL vs COSY (P = 200 MeV/c, L = 12 mm LH)
PX (GeV/c)
0.004
0.002
0
-0.002
-0.004
-0.0003
-0.00015
0
0.00015
0.0003
X (m)
ICOOL
COSY


ICOOL vs COSY (P = 200 MeV/c, L = 30 mm LH)
PX (GeV/c)
0.004
0.002
0
-0.002
-0.004
-0.00075
-0.000375
0
0.000375
0.0007
X (m)
ICOOL
COSY

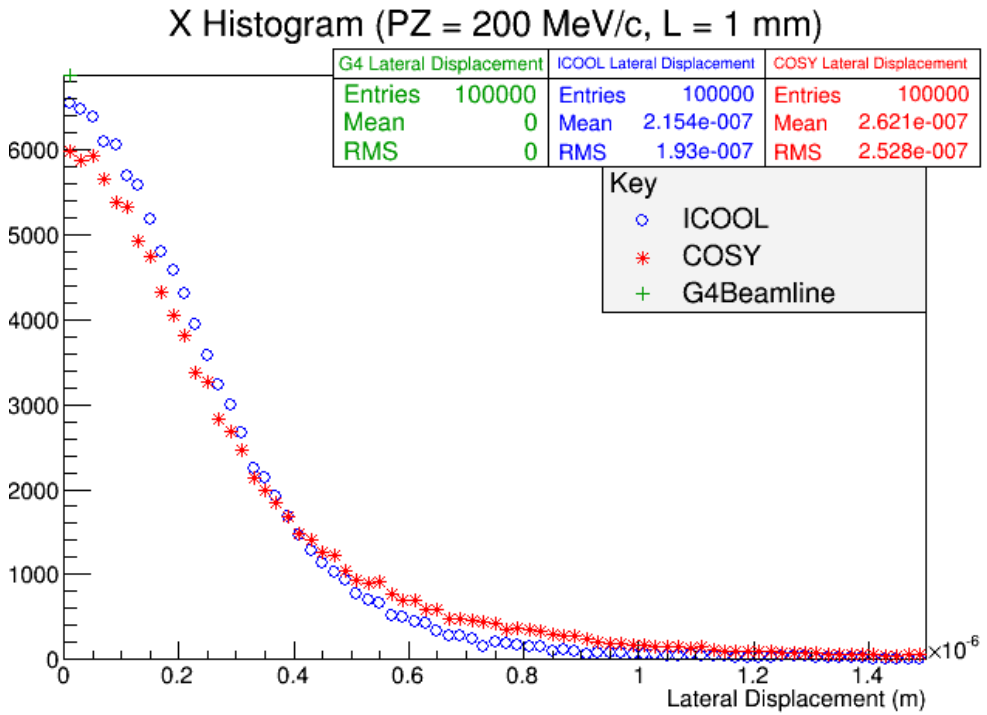

ICOOL vs COSY (P = 200 MeV/c, L = 50 mm LH)
PX (GeV/c)
0.006
0.003
0
-0.003
-0.006
-0.0013
-0.00065
0
0.00065
0.0013
X (m)
ICOOL
COSY

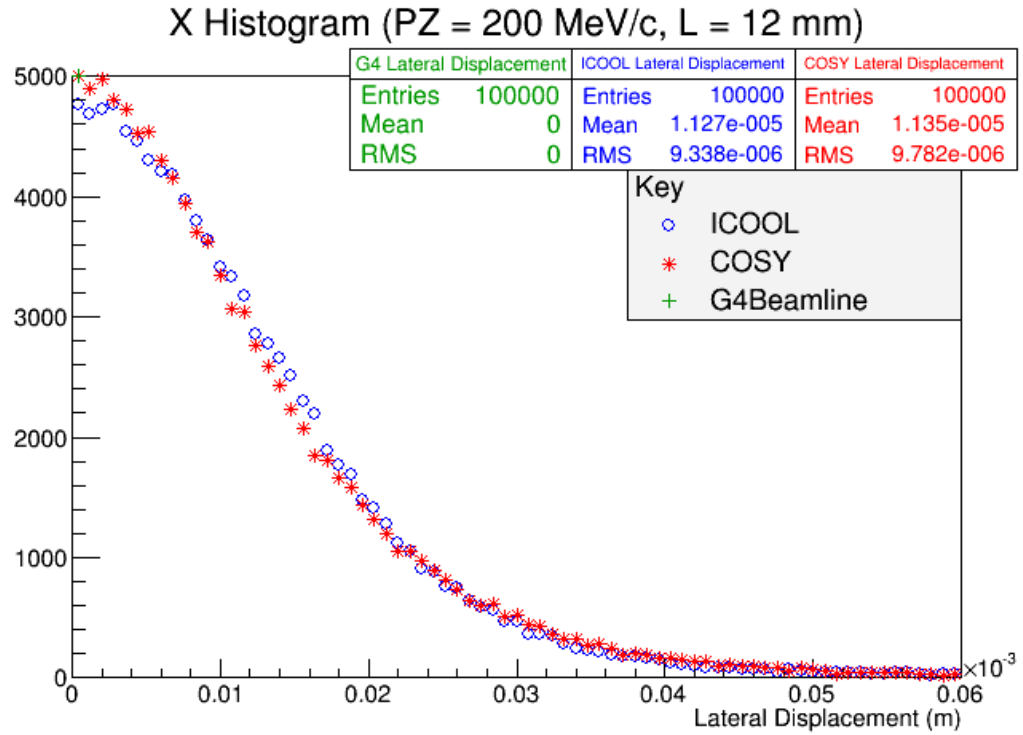
Special Note [New]

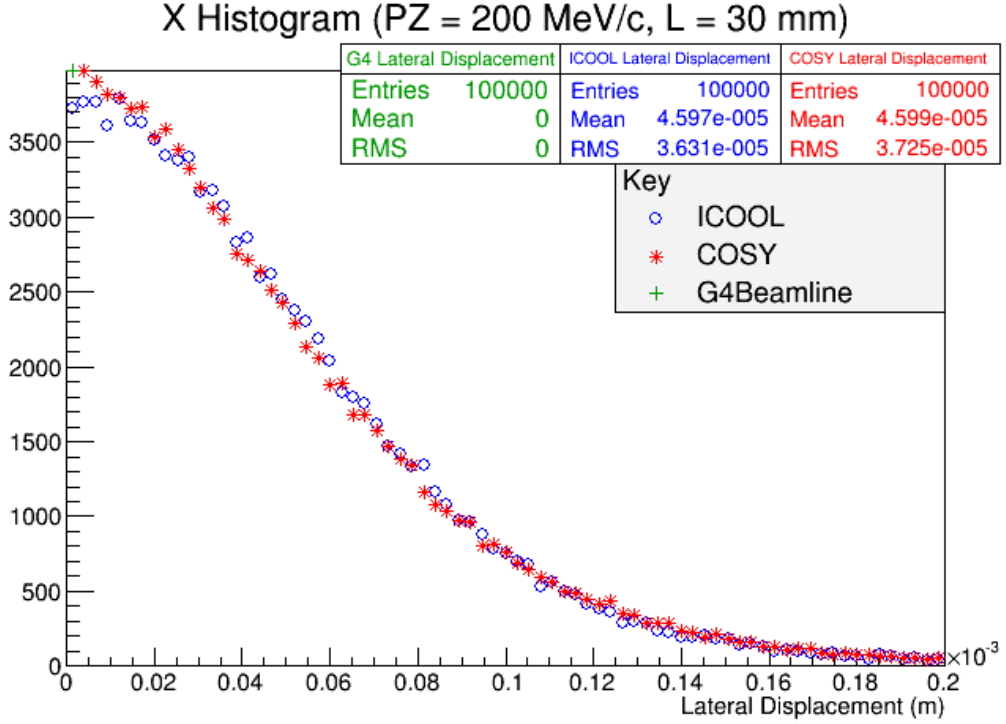
- X histograms for L = 30, 50 mm follow the ICOOL histograms quite closely. This is not true for L = 1, 12 mm (see next slide).
- This may mean that thin absorbers require a special treatment, with the limits of thin and thick methods converging at 20 mm or so.
- The point where we draw the line may depend on the straggling parameter κ, which separates Landau ($\kappa < 0.01$), Vavilov, and Gaussian ($10 < \kappa$).
- If this is the case, observe that $\kappa(12.0\ mm) = 0.006$ [barely Landau]

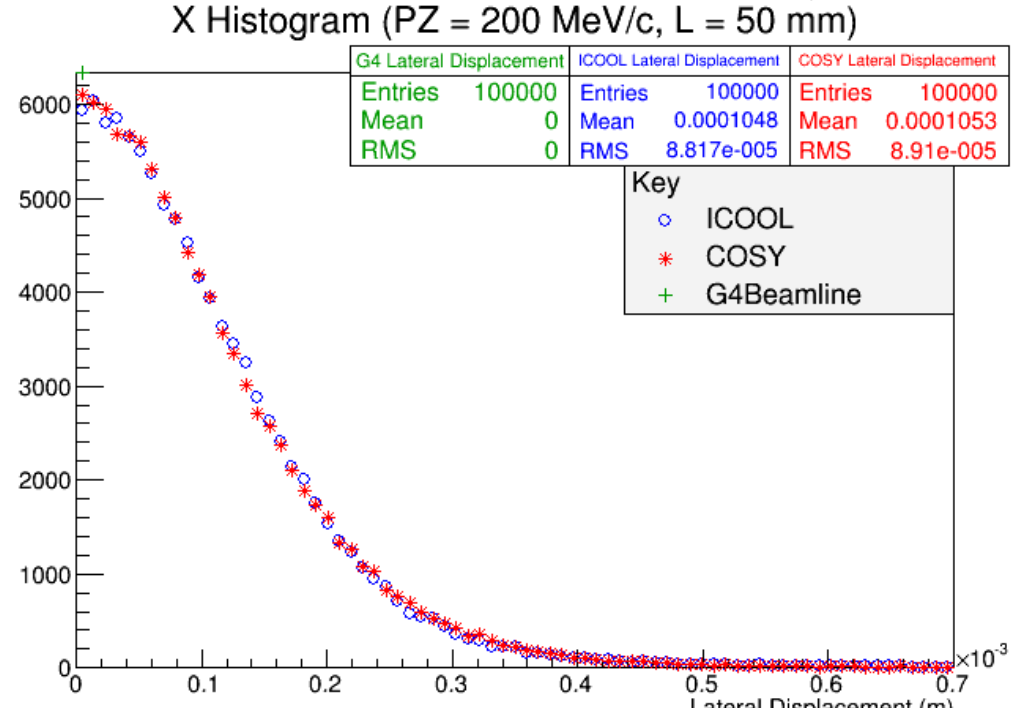
$$\kappa(30.0\ mm) = 0.017 \text{ [barely Vavilov]}$$

$$\kappa(17.8\ mm) = 0.010 \text{ [cutoff]}$$


X Histogram (PZ = 200 MeV/c, L = 1 mm)
G4 Lateral Displacement
Entries 100000
Mean 0
RMS 0
ICOOL Lateral Displacement
Entries 100000
Mean 2.154e-007
RMS 1.93e-007
COSY Lateral Displacement
Entries 100000
Mean 2.621e-007
RMS 2.528e-007
Key
ICOOL
COSY
G4Beamline
Lateral Displacement (m)


X Histogram (PZ = 200 MeV/c, L = 12 mm)
G4 Lateral Displacement
Entries 100000
Mean 0
RMS 0
ICOOL Lateral Displacement
Entries 100000
Mean 1.127e-005
RMS 9.338e-006
COSY Lateral Displacement
Entries 100000
Mean 1.135e-005
RMS 9.782e-006
Key
ICOOL
COSY
G4Beamline
Lateral Displacement (m)


X Histogram (PZ = 200 MeV/c, L = 30 mm)
G4 Lateral Displacement
Entries 100000
Mean 0
RMS 0
ICOOL Lateral Displacement
Entries 100000
Mean 4.597e-005
RMS 3.631e-005
COSY Lateral Displacement
Entries 100000
Mean 4.599e-005
RMS 3.725e-005
Key
ICOOL
COSY
G4Beamline
Lateral Displacement (m)


X Histogram (PZ = 200 MeV/c, L = 50 mm)
G4 Lateral Displacement
Entries 100000
Mean 0
RMS 0
ICOOL Lateral Displacement
Entries 100000
Mean 0.0001048
RMS 8.817e-005
COSY Lateral Displacement
Entries 100000
Mean 0.0001053
RMS 8.91e-005
Key
ICOOL
COSY
G4Beamline

My Notes

- X-histogram is Gaussian, with $\sigma = \sigma_{PDG} + \sigma_{correction}$.
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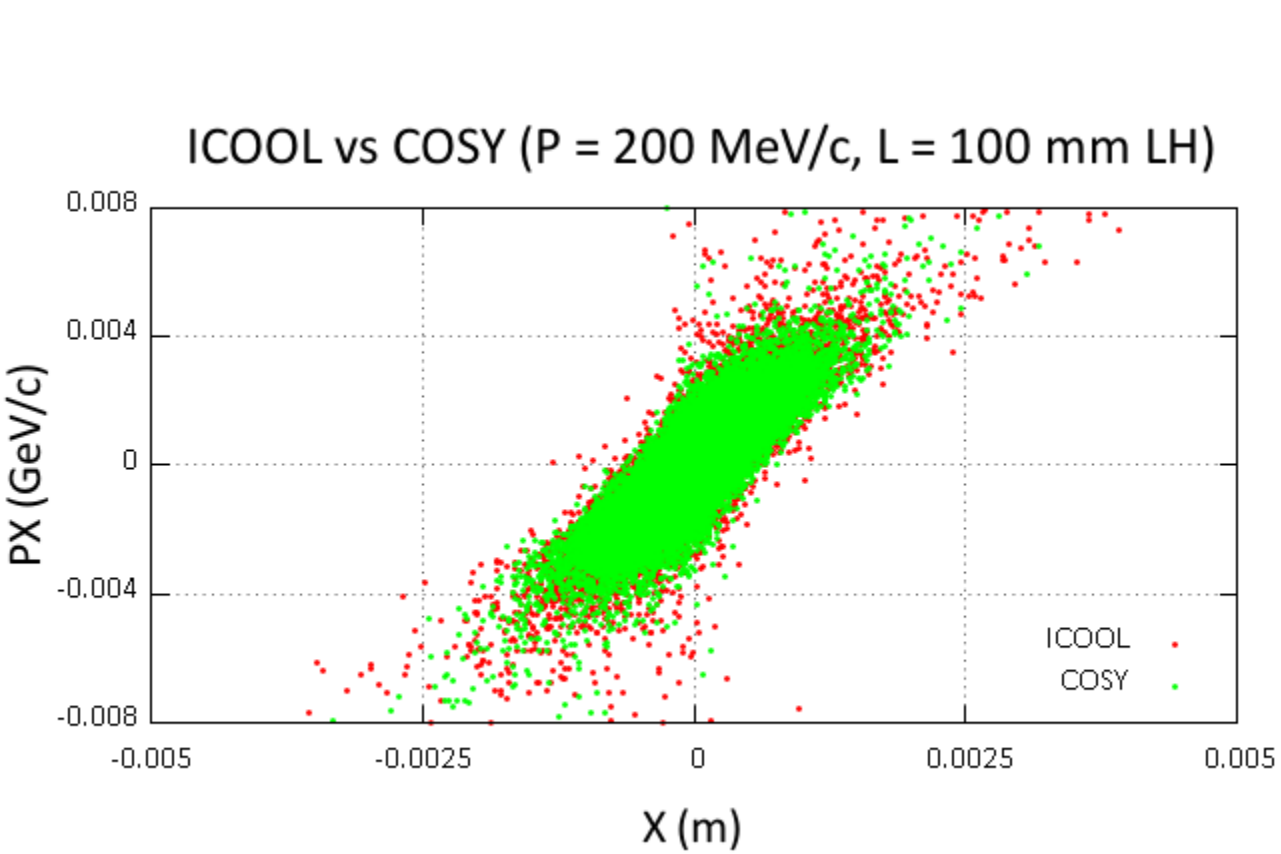
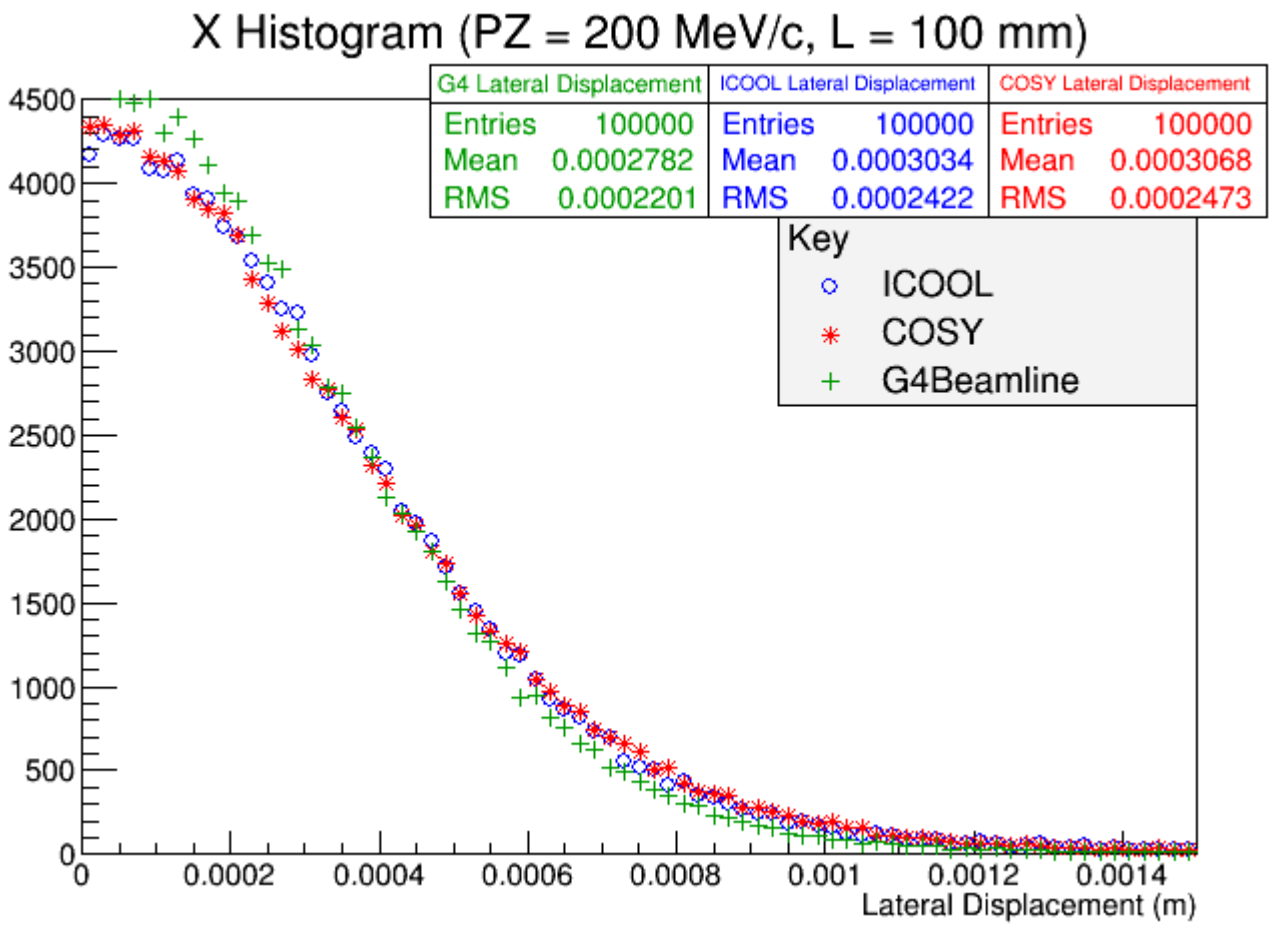

ICOOL vs COSY (P = 200 MeV/c, L = 100 mm LH)
PX (GeV/c)
X (m)
0.008
0.004
0
-0.004
-0.008
-0.005
-0.0025
0
0.0025
0.005
ICOOL
COSY


X Histogram (PZ = 200 MeV/c, L = 100 mm)
G4 Lateral Displacement
Entries 100000
Mean 0.0002782
RMS 0.0002201
ICOOL Lateral Displacement
Entries 100000
Mean 0.0003034
RMS 0.0002422
COSY Lateral Displacement
Entries 100000
Mean 0.0003068
RMS 0.0002473
Key
ICOOL
COSY
G4Beamline
4500
4000
3500
3000
2500
2000
1500
1000
500
0
0
0.0002
0.0004
0.0006
0.0008
0.001
0.0012
0.0014
Lateral Displacement (m)

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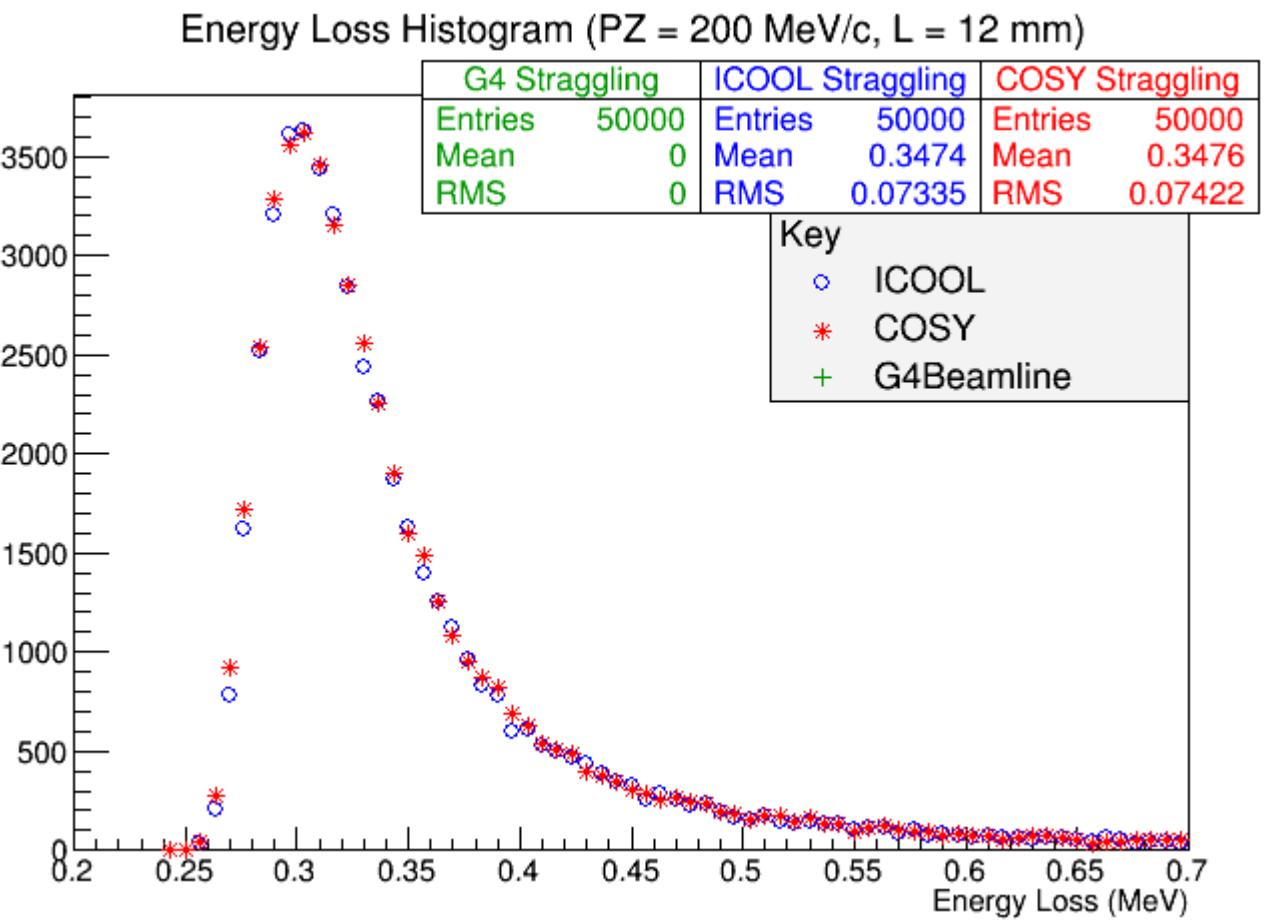
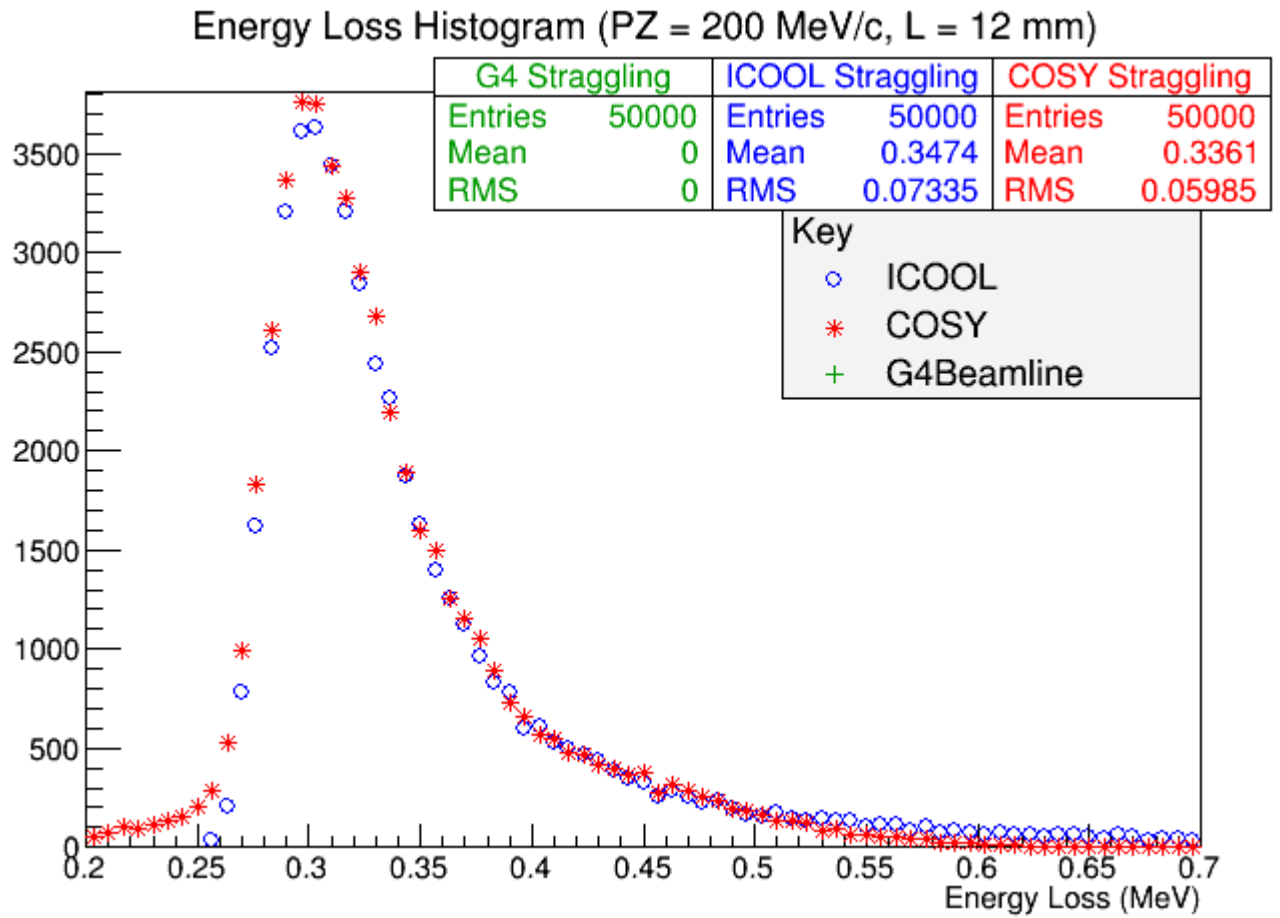
COSY Single Step Histograms

COSY: Vavilov Theory



COSY: Blunck-Liesegang Theory



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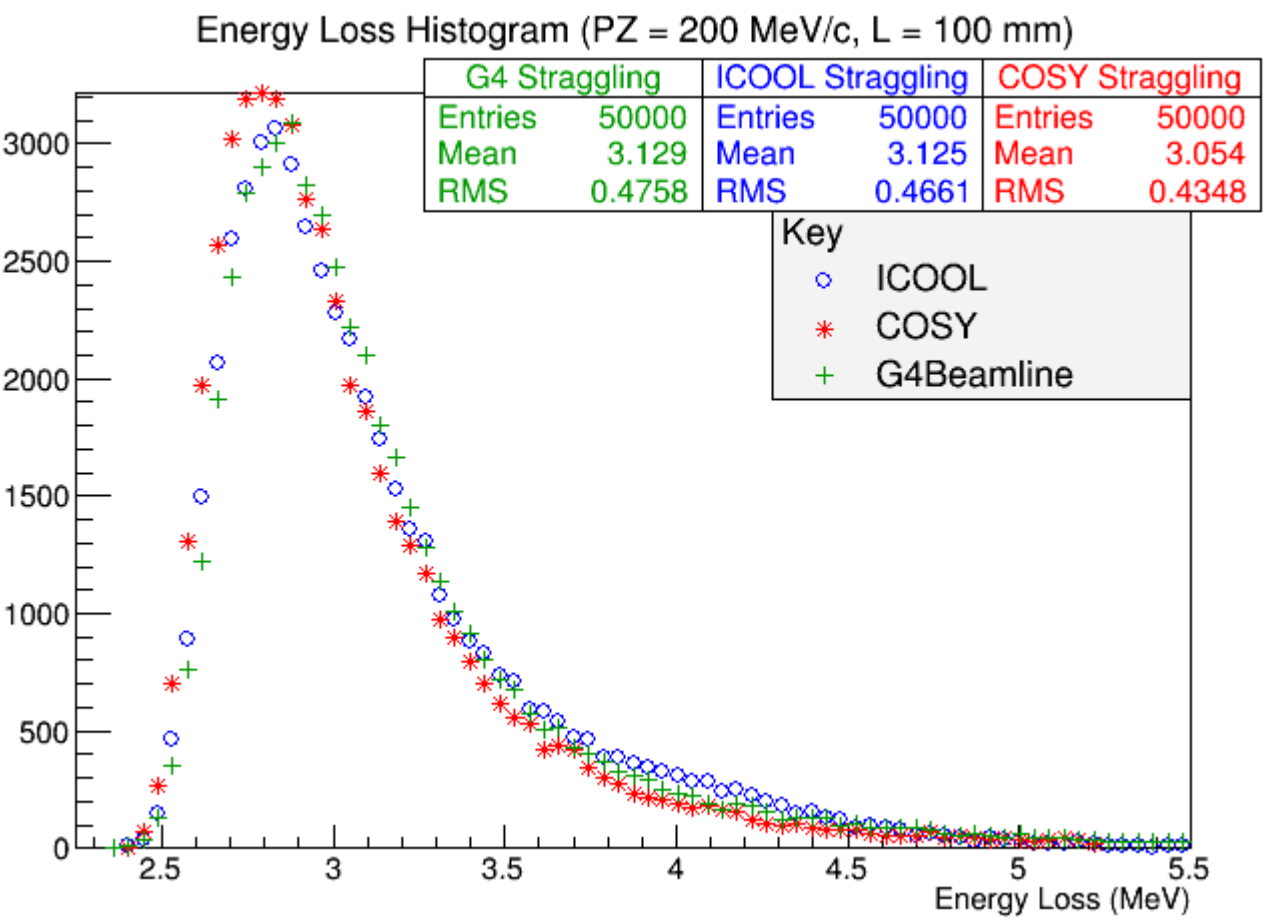
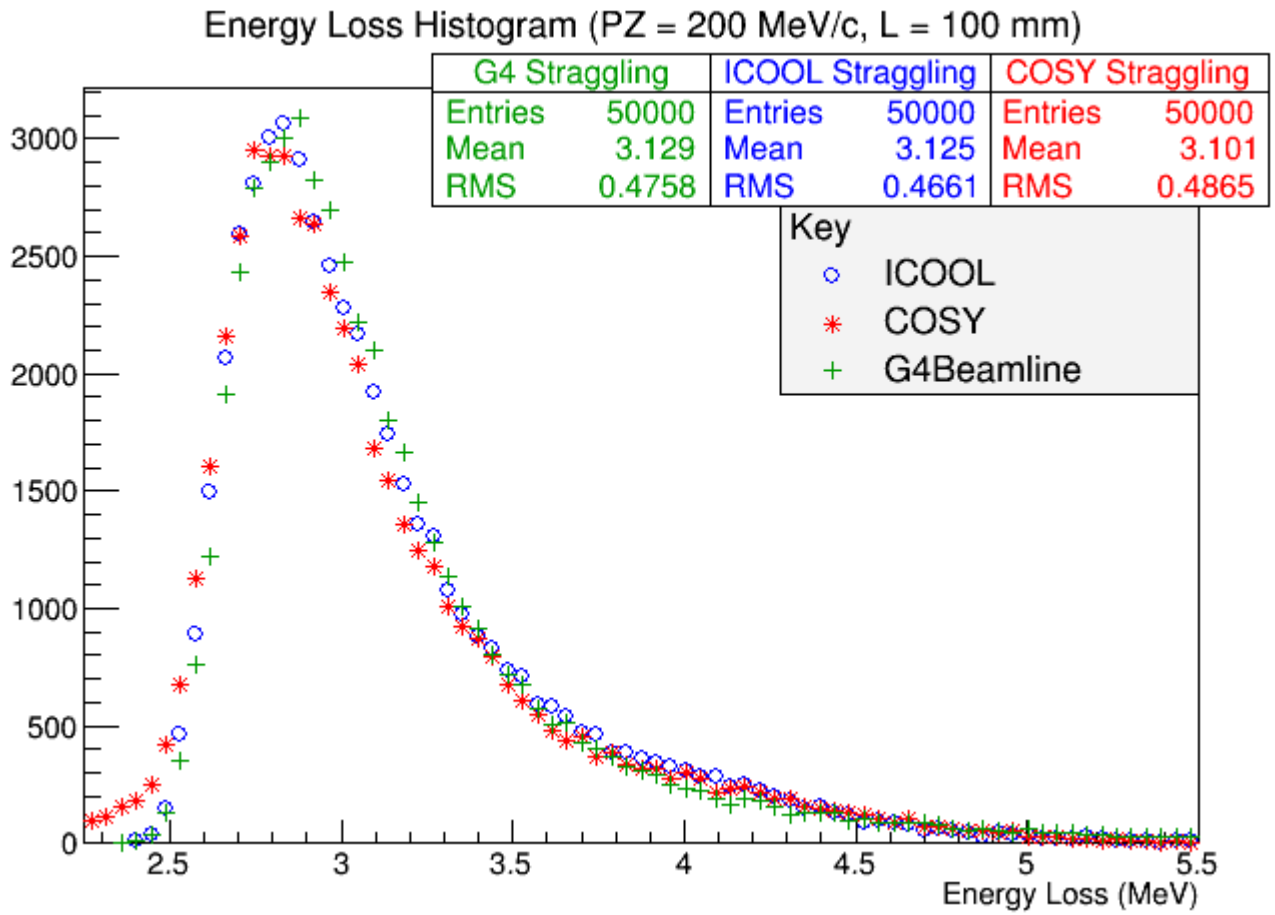
COSY: Vavilov Theory



COSY: Blunck-Liesegang Theory



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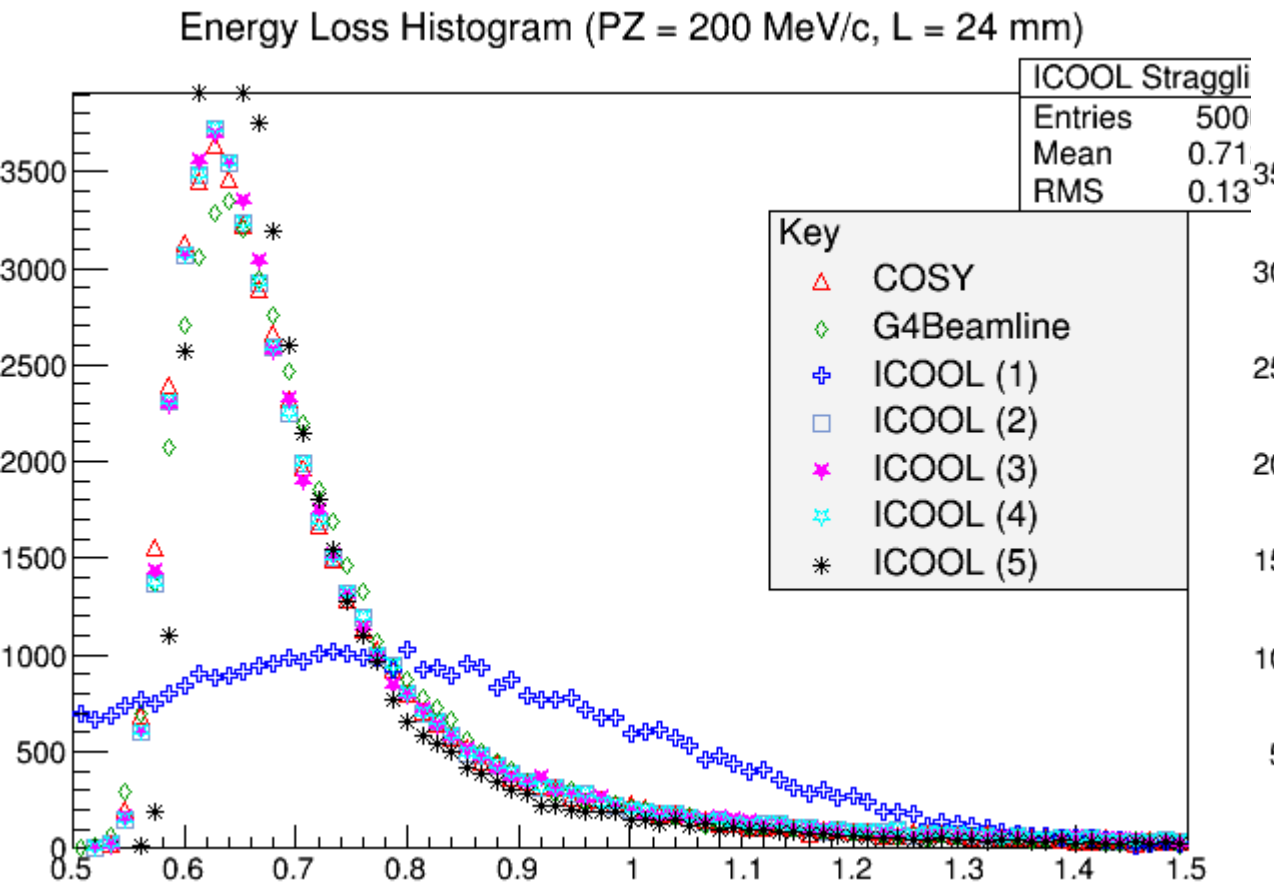
ICOOL Models:

1) Gaussian (Bohr)
2) Landau
3) (not used) [probably default]
4) Vavilov [default]
5) Restricted Energy Loss

COSY: Vavilov Theory



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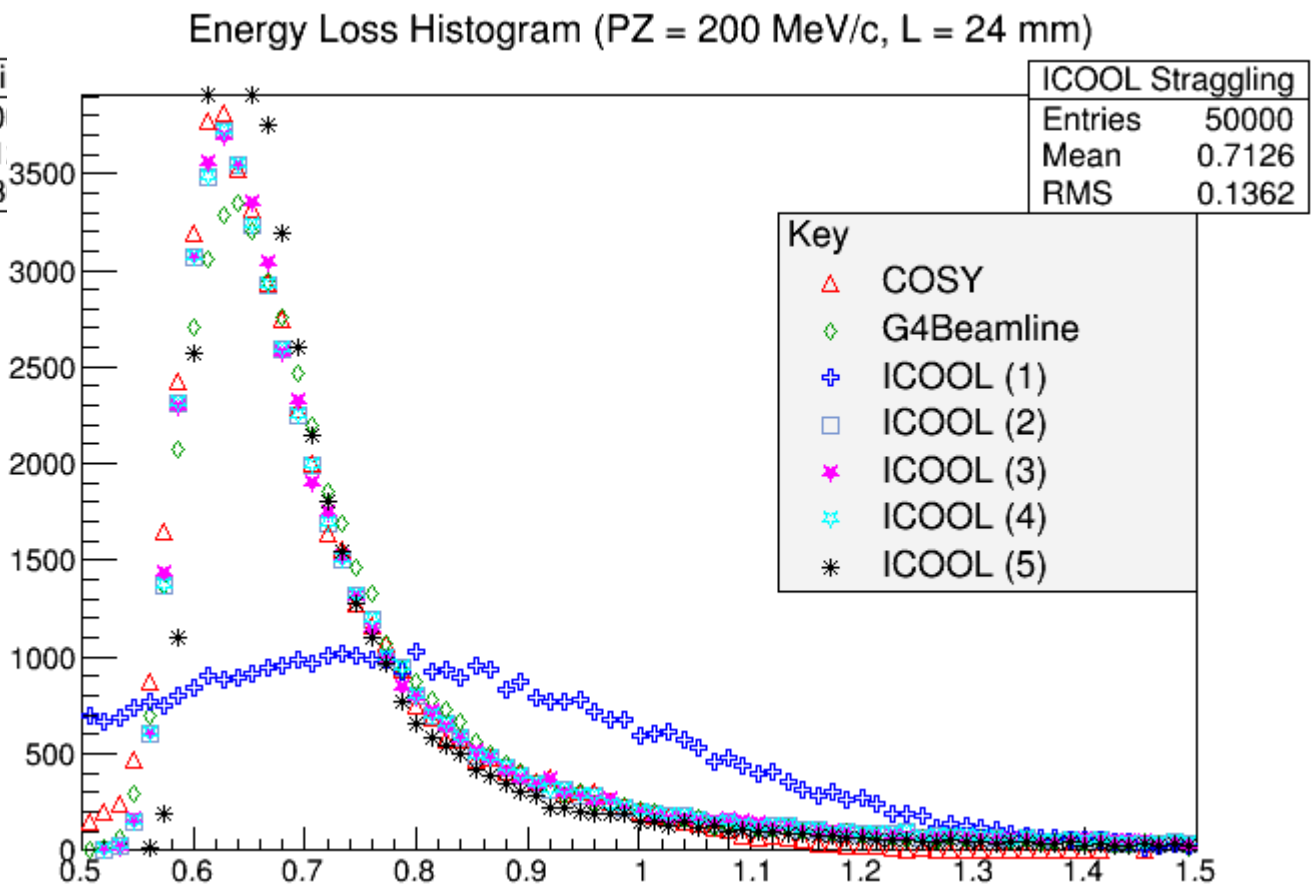

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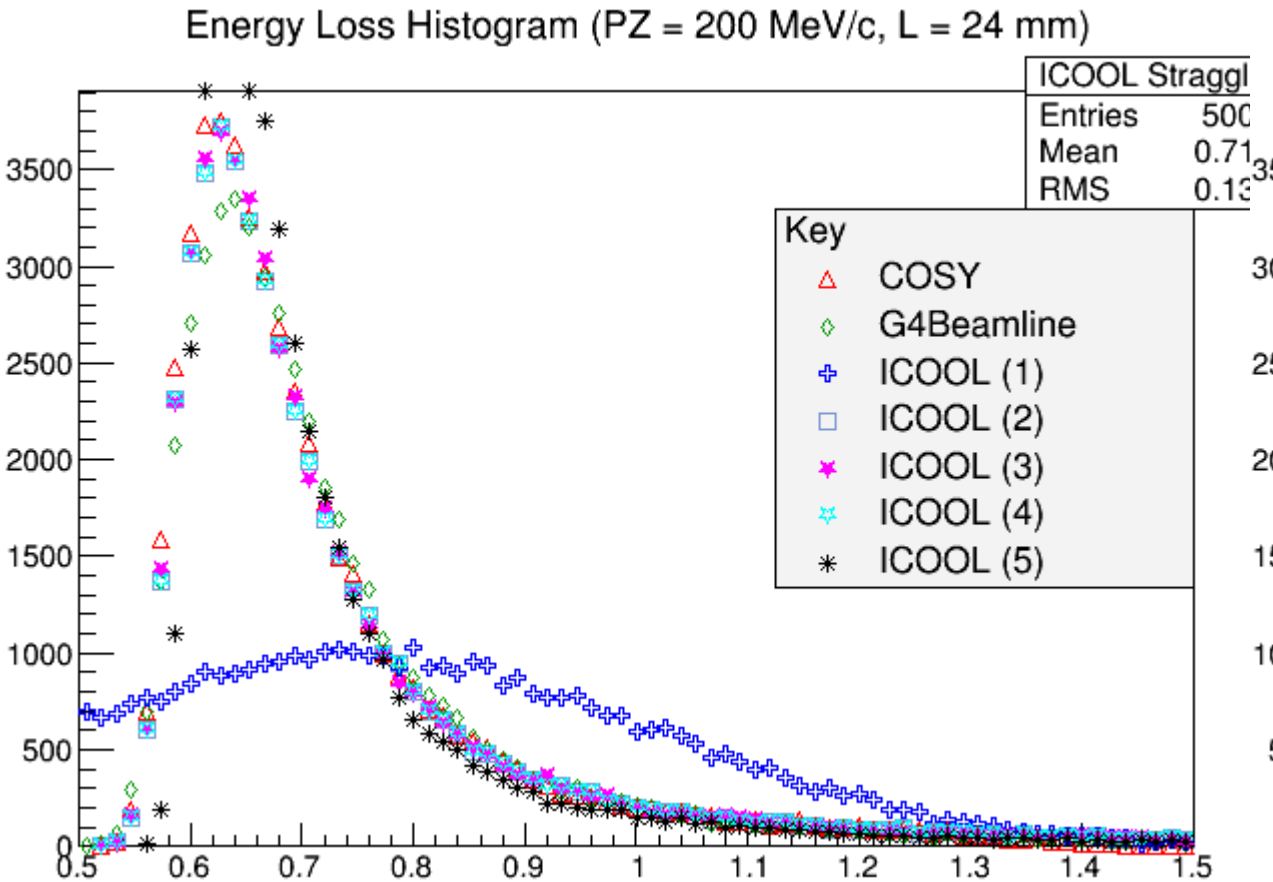

COSY: Blunck-Liesegang Theory