Meson Production Calculations

1st Princeton/Oxford High-Power Targets Workshop

Oxford

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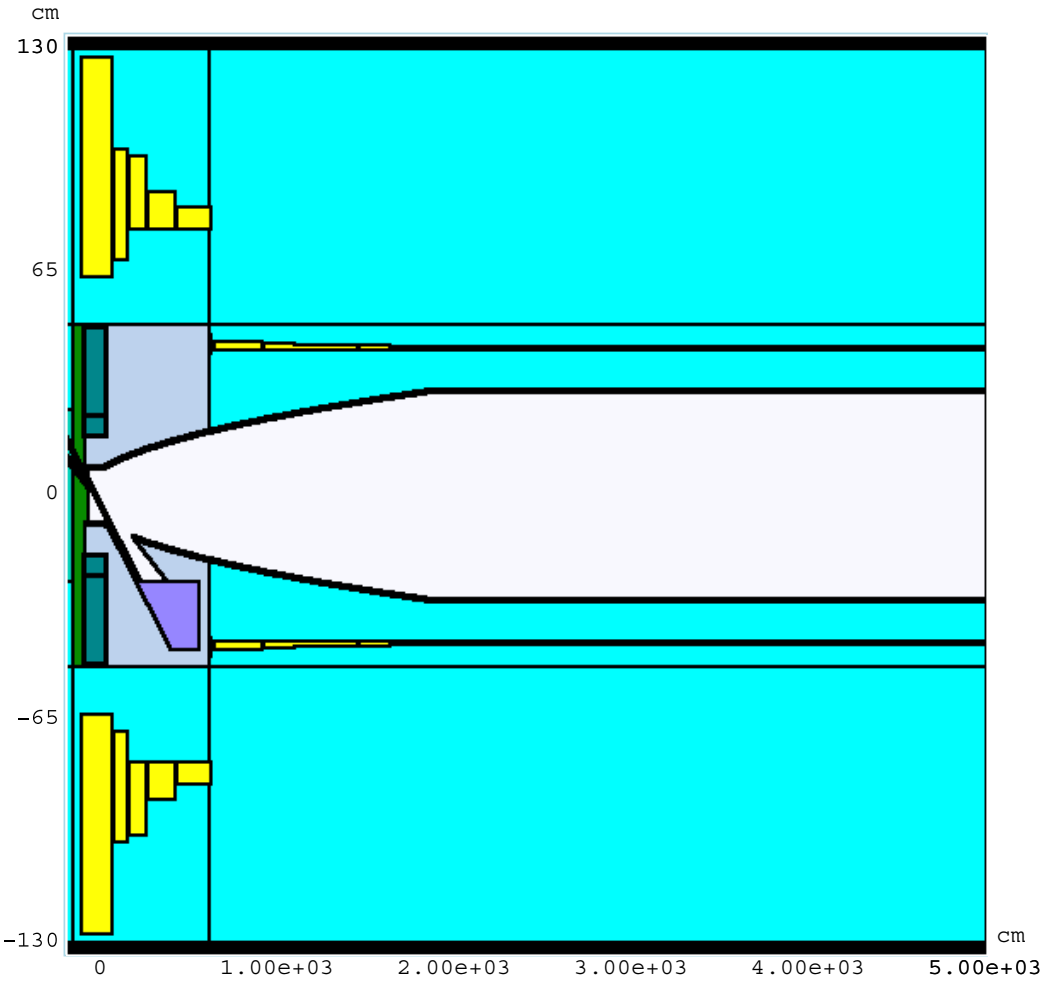
The Study2 Target System



Count all the pions and muons that cross the transverse plane at z=50m.

For this analysis we select all pions and muons with KE< 0.35 GeV.

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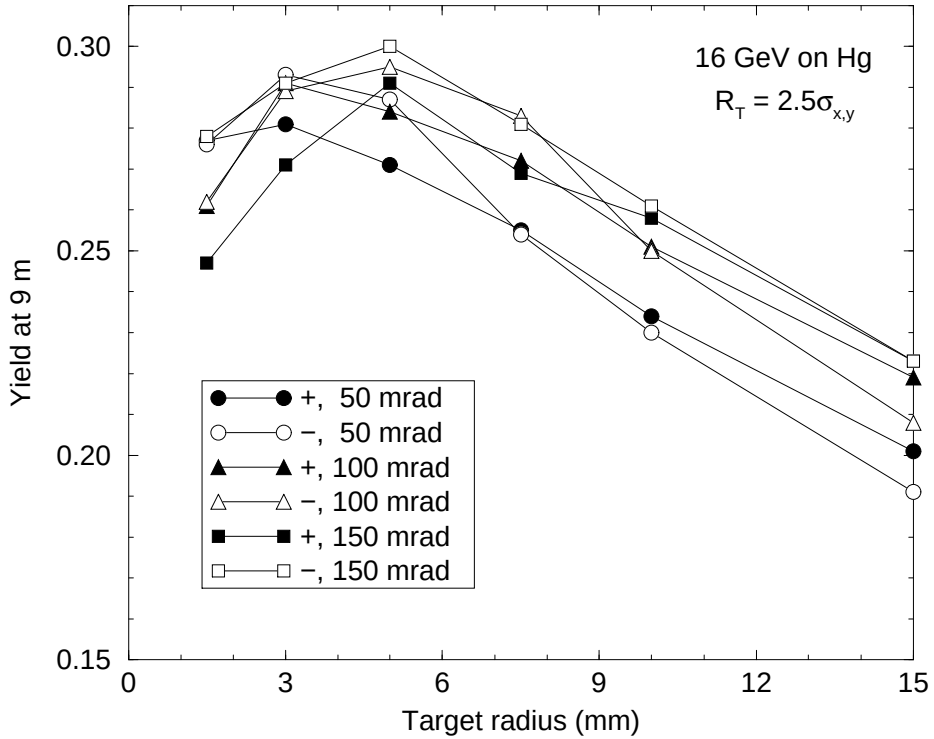
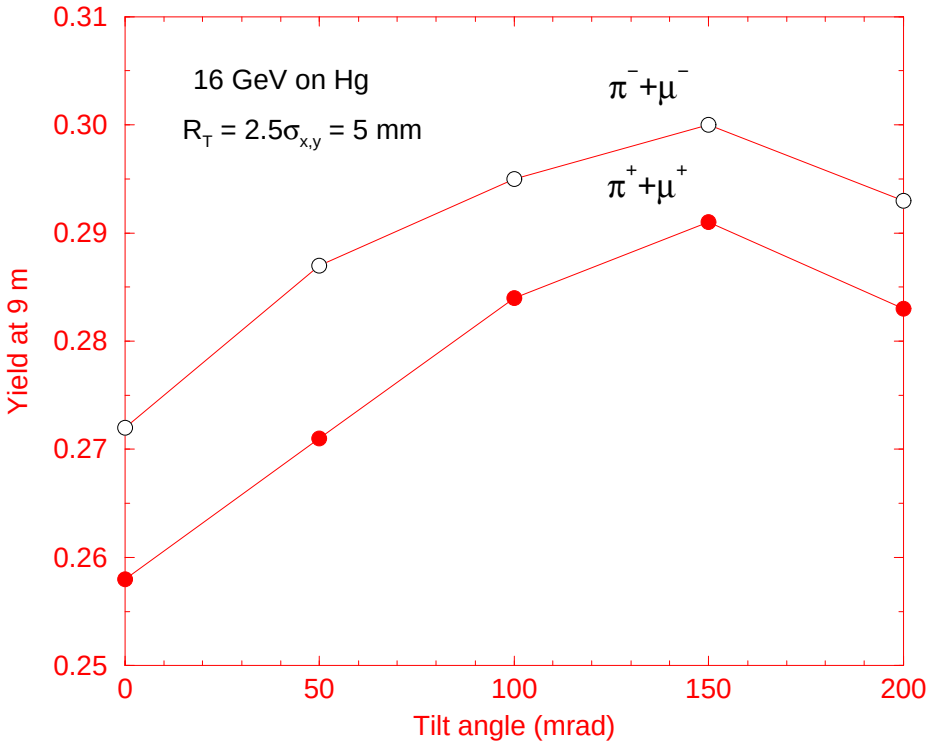
Optimizing Soft-pion Production





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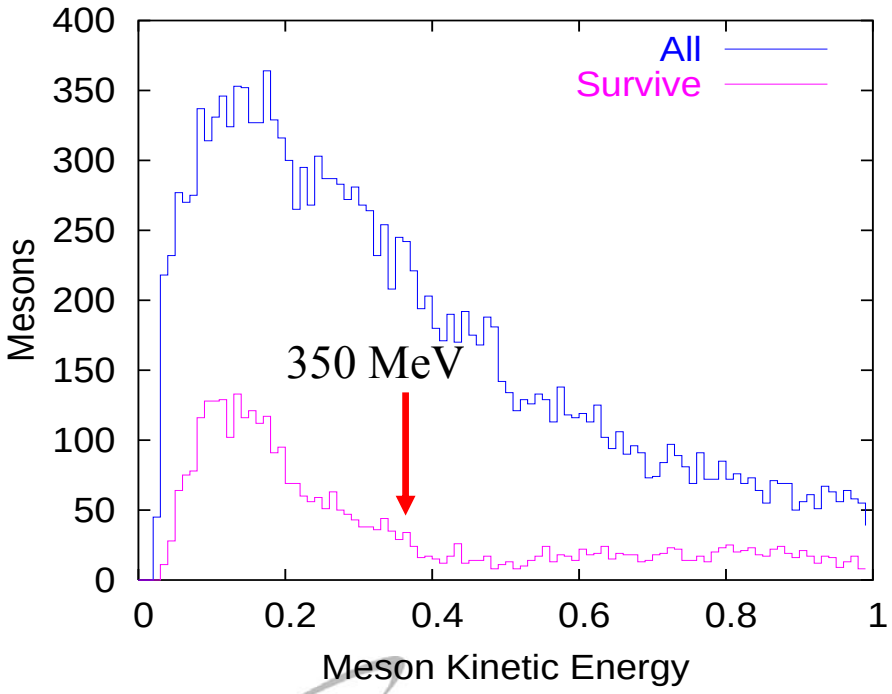
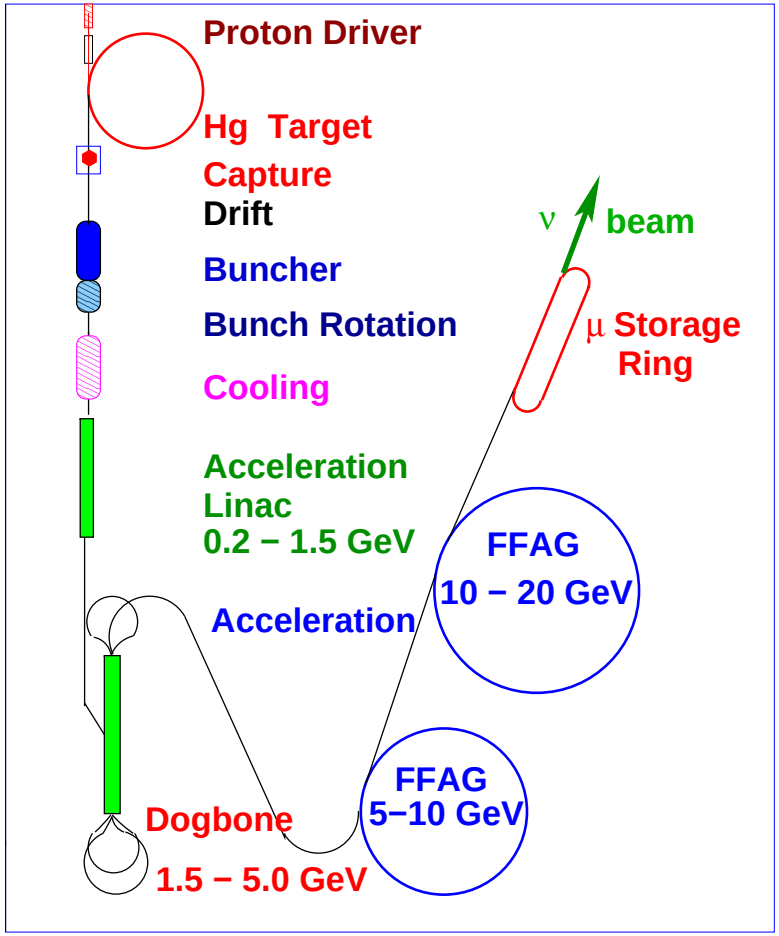
Process mesons through Cooling

Consider mesons within acceptance of
$\varepsilon_\perp = 30\pi$ mm and $\varepsilon_L = 150\pi$ mm
after cooling





Use meson count with KE < 350 MeV as a figure of merit.

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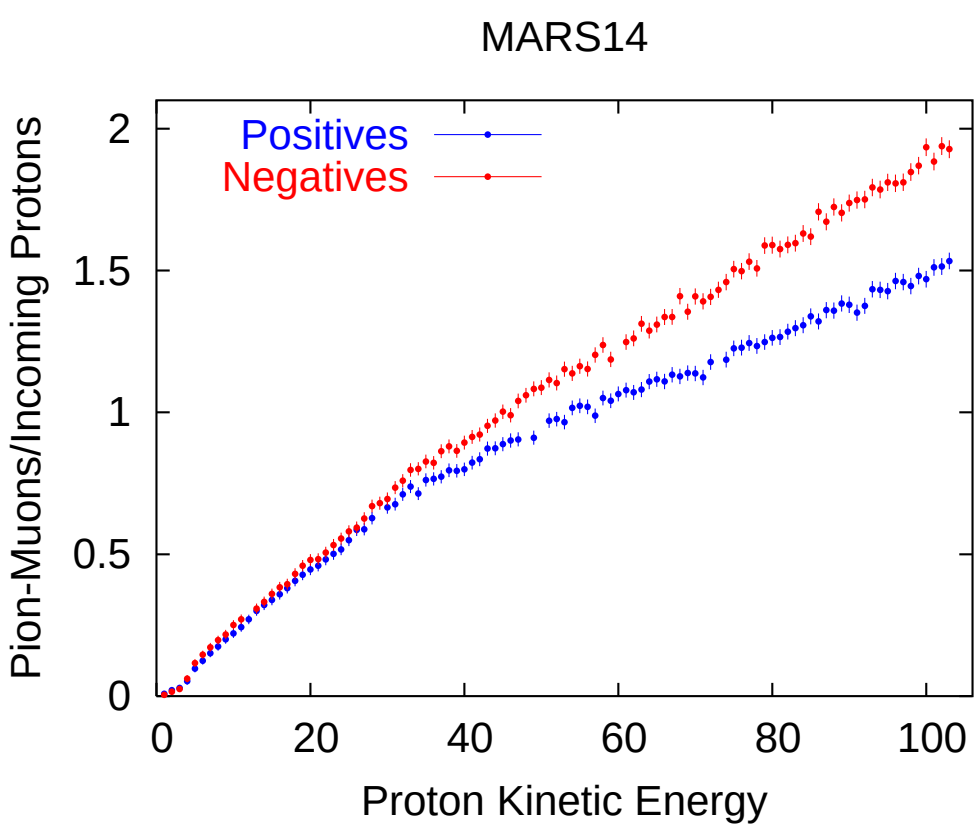
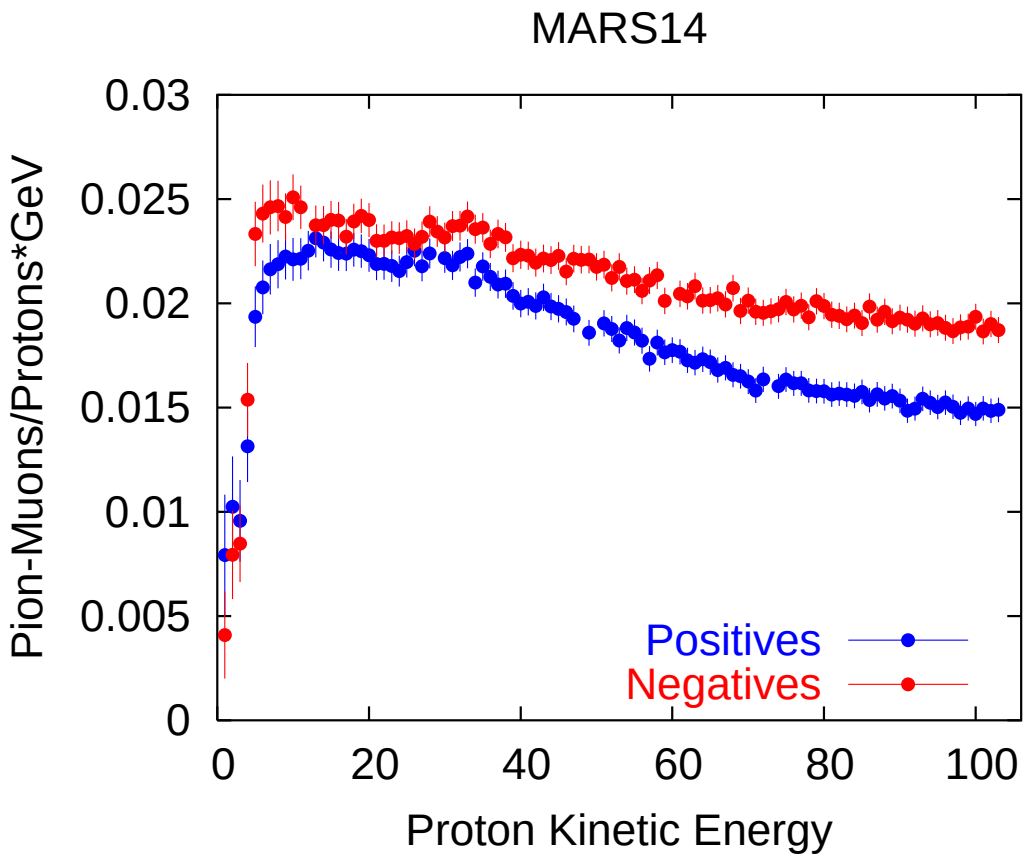
Meson KE < 350 MeV at 50m





Mesons/Proton

Mesons/Proton normalized to beam power

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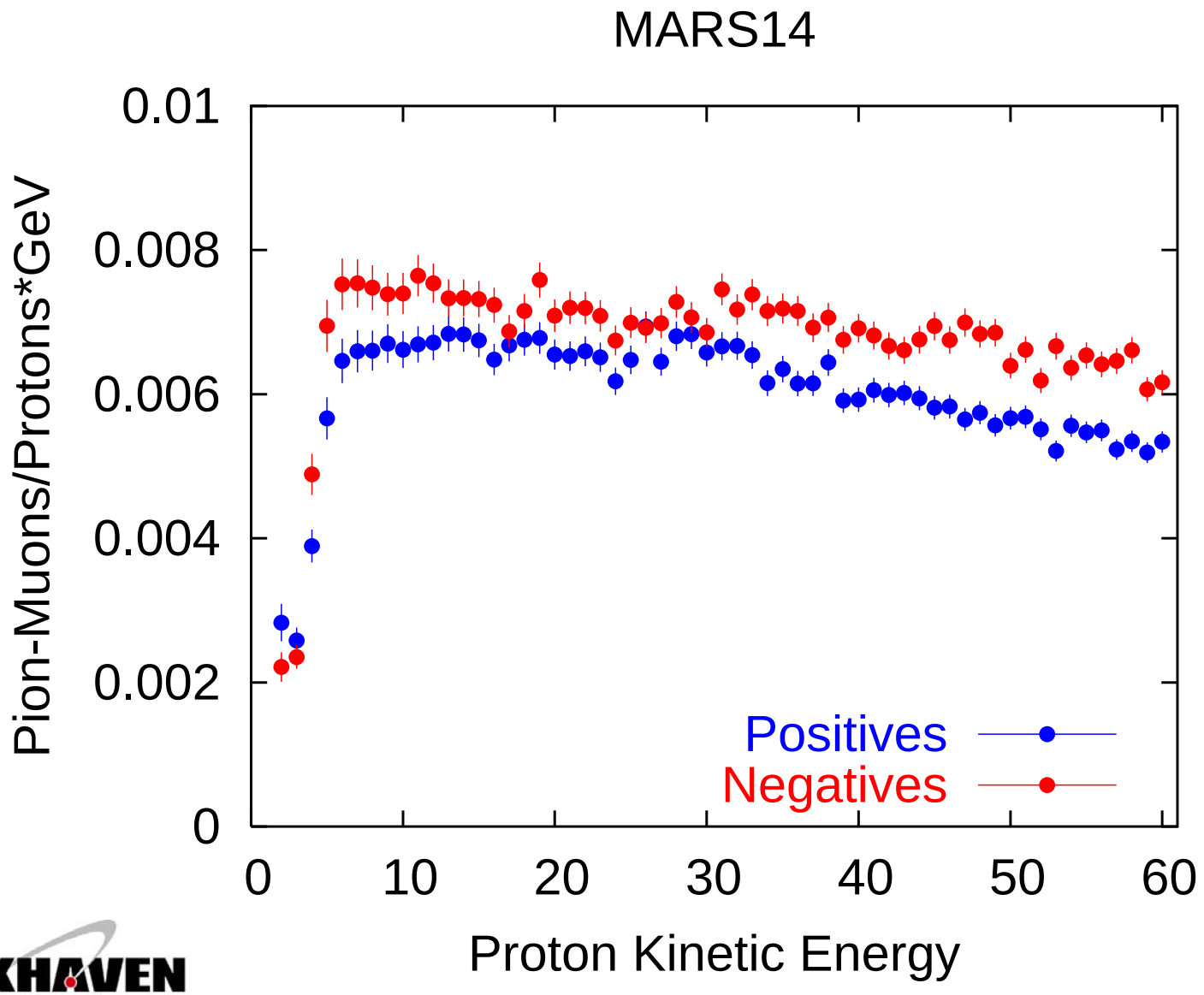
Post-cooling 30π Acceptance



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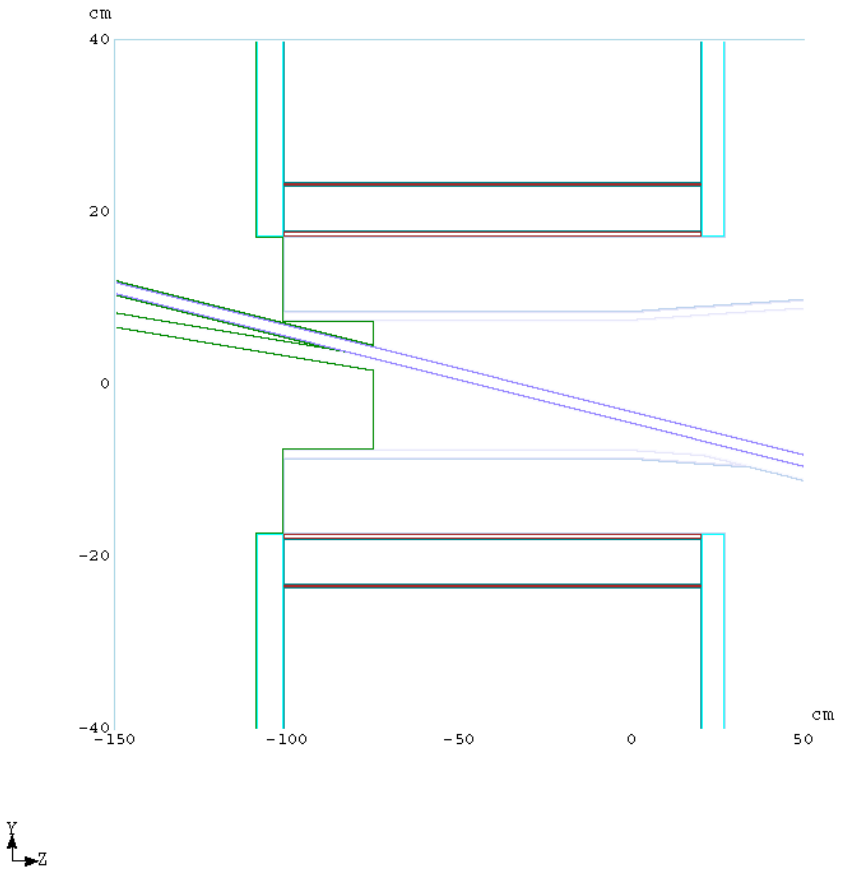
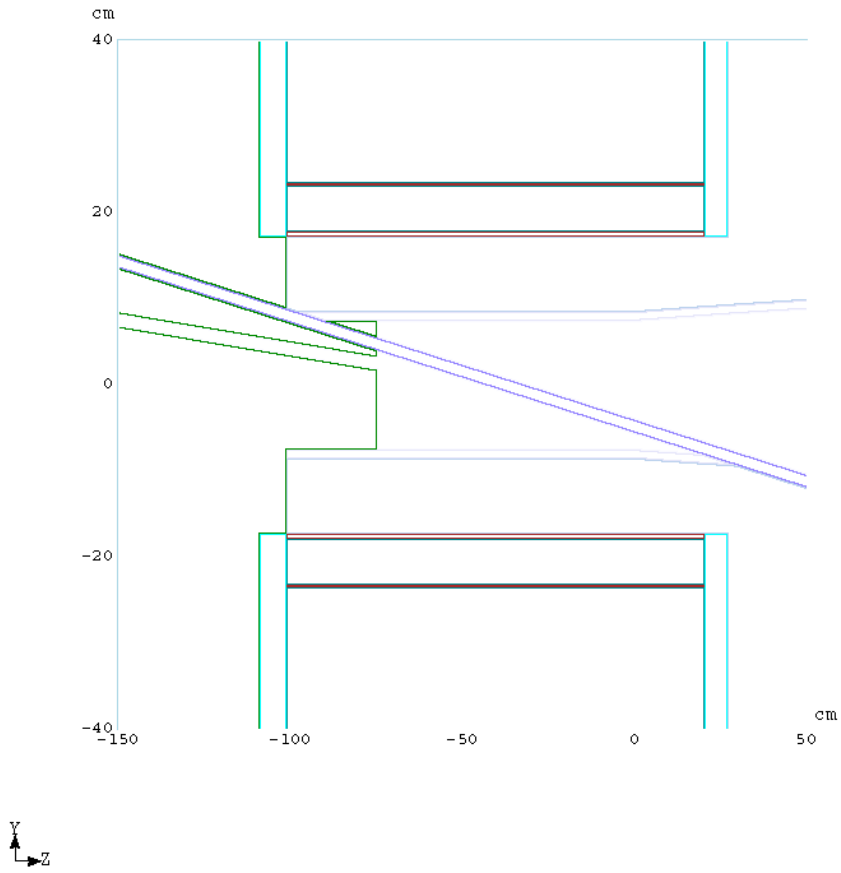
The Target Interaction Length





Hg/Beam angle=33mrad
➔ 30.3cm Hg/Beam overlap

Hg/Beam angle=60mrad
➔ 16.6cm Hg/Beam overlap

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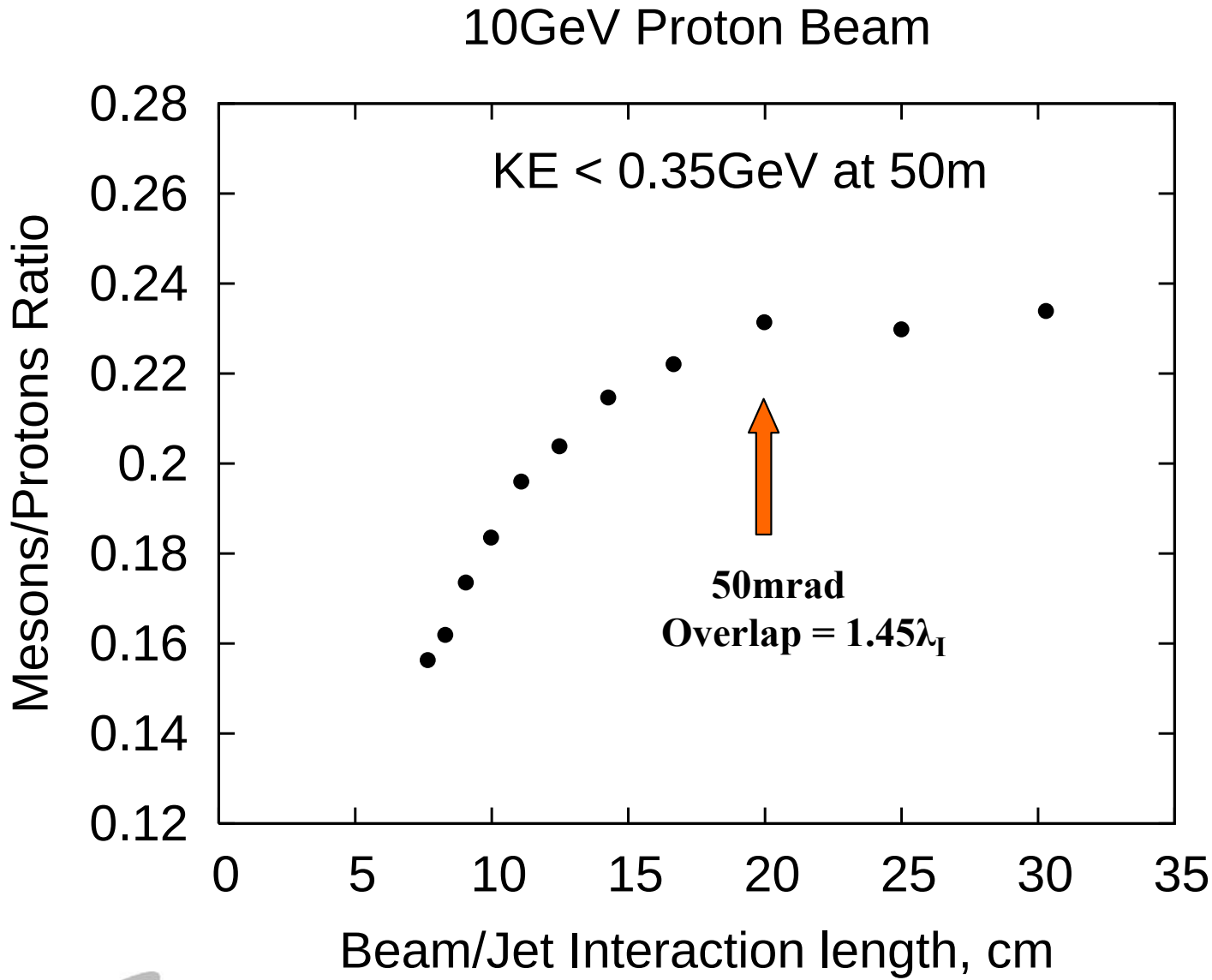
Meson Production Efficiency



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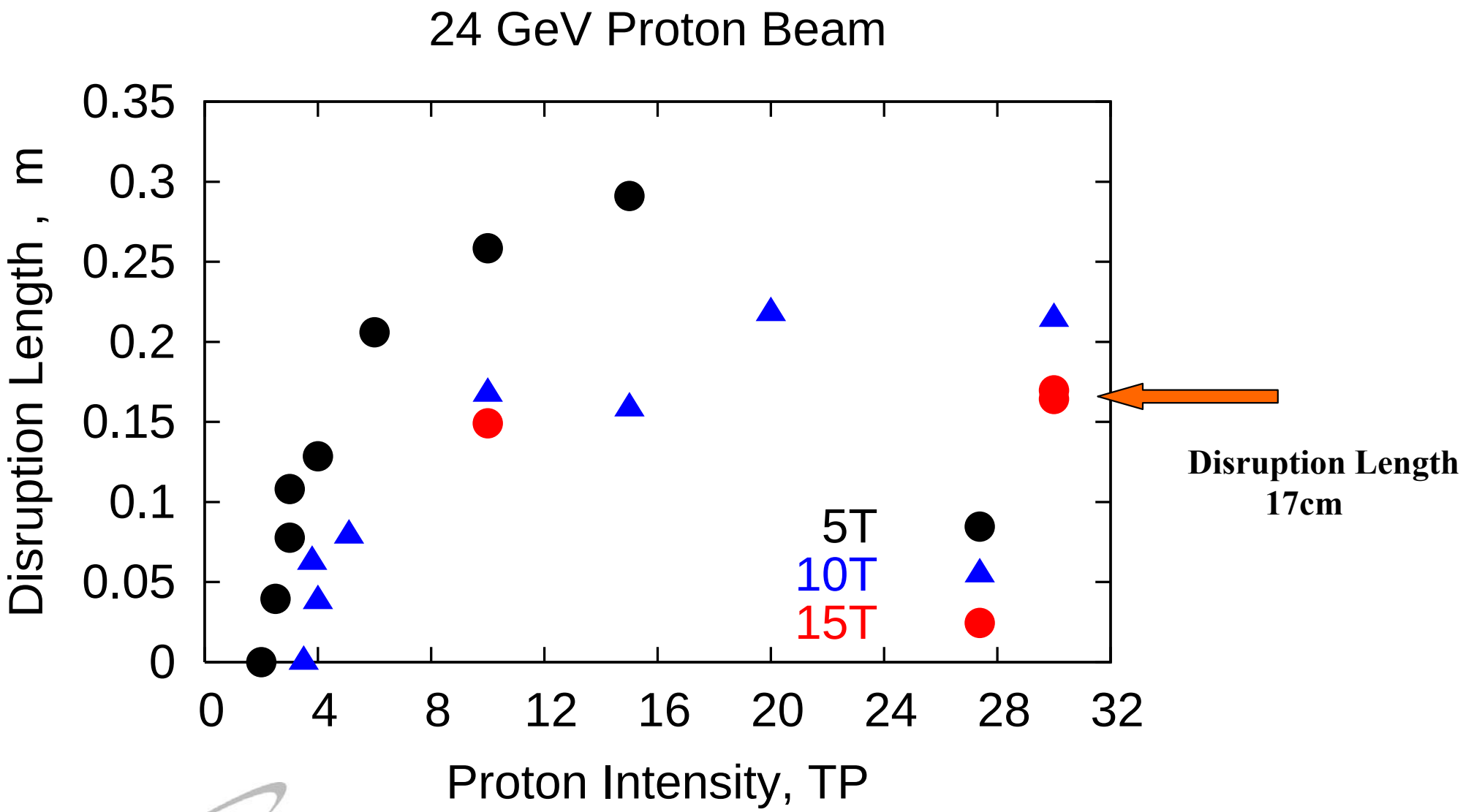
Key Merit Result



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The 24 GeV 30TP shot

Beam pulse energy = 115kJ

B-field = 15T

Jet Velocity = 20 m/s

Disruption Length = 17 cm

We will replace 1.45 interaction lengths (20cm)

Then the jet transport time is 20cm/20m/s = 10ms

➔Rep rate of 100Hz

➔Proton beam power at that rate is 115kJ *100Hz = 11.5MW

Demonstrated Beam Power at 24 GeV

B Field T	Rep. Rate Hz	Bunch Intensity TP	Beam Power MW
15	100	30	11.5
10	90	30	10.5
5	70	15	4
0	55	10	2

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Demonstrated Beam Power at 14 GeV

B Field	Rep. Rate	Bunch Intensity	Beam Power
T	Hz	TP	MW
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15	100	30	6.5
10	90	30	5.5
5	80	20	3.5

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