Meson Production Calculations

ISS Meeting

RAL

April 22, 2006

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International Scoping Study

Question: Given a "Green Field" what are the most favorable parameters for a proton driver to a Neutrino Factory?

A related question: Liquid or Solid Target

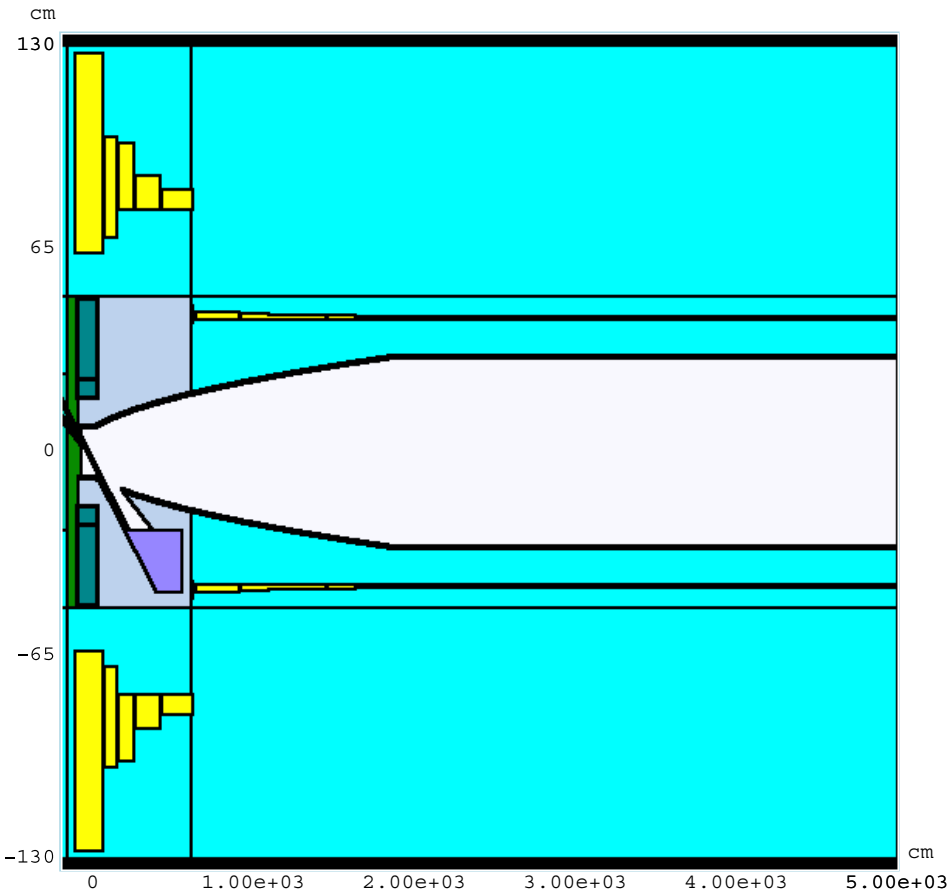
Can a solid target survive a >1MW proton driver beam?

Is a liquid target for a >1MW proton driver technically feasible?

(MERIT target experiment at CERN)

What is the "preferred" proton driver energy?

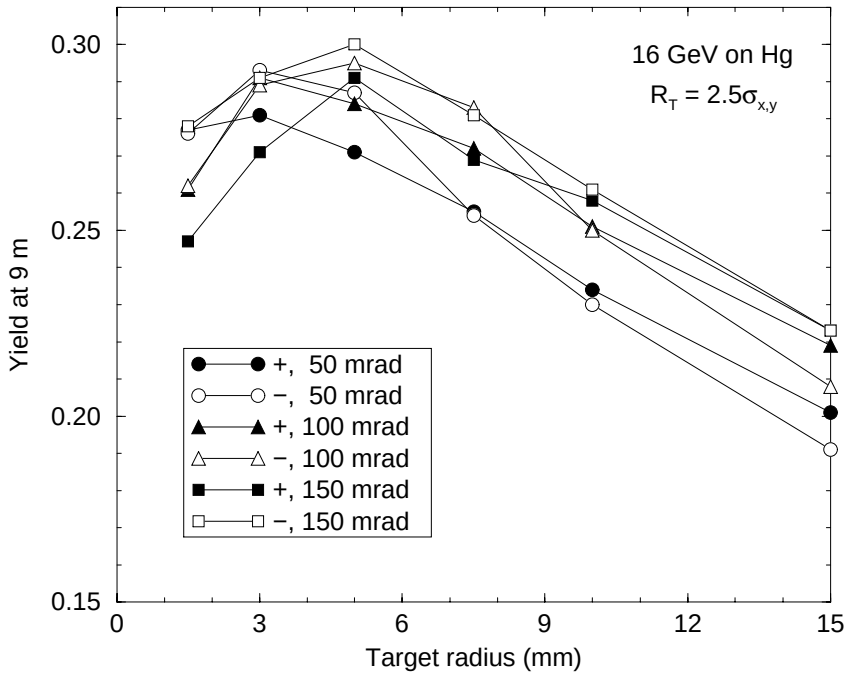
The Study2 Target System

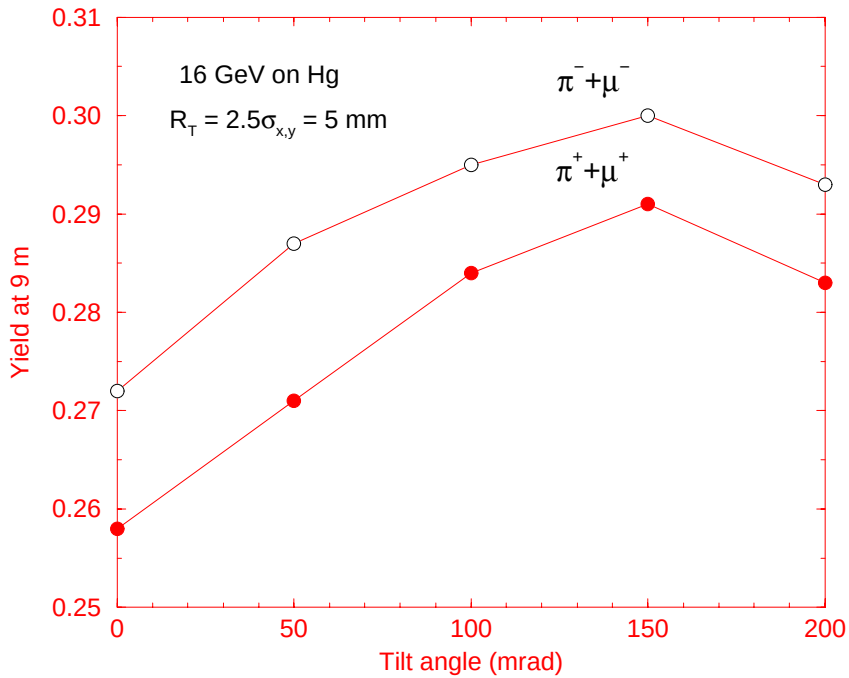


Count all the pions and muons that cross the transverse plane at z=50m.

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

Optimizing Soft-pion Production





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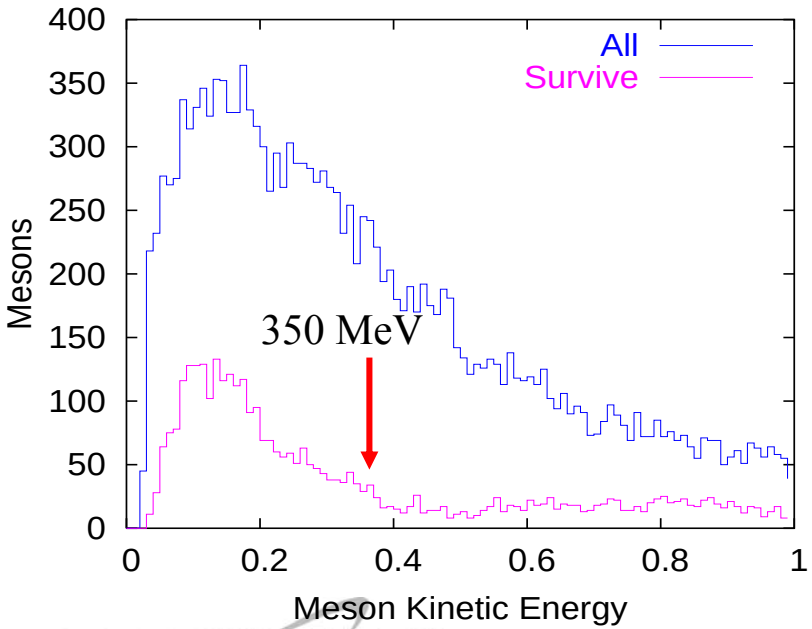
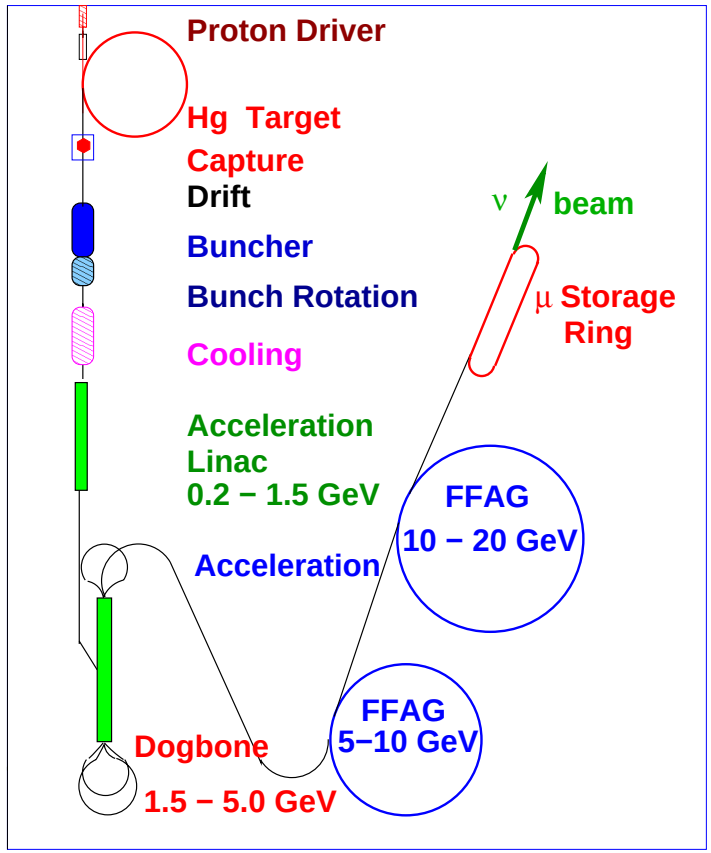
Process mesons through Cooling

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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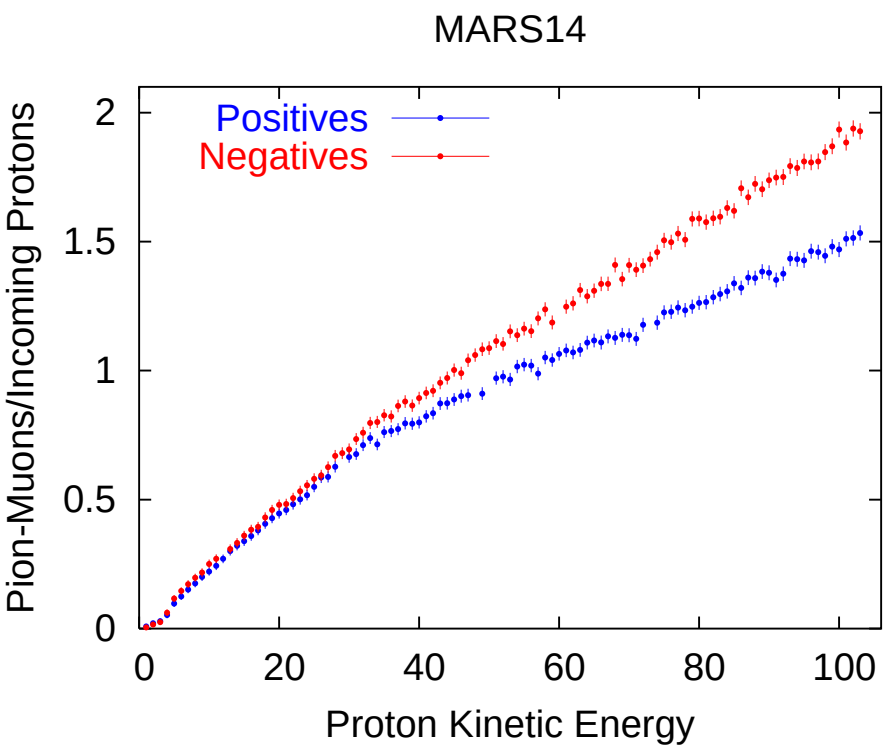
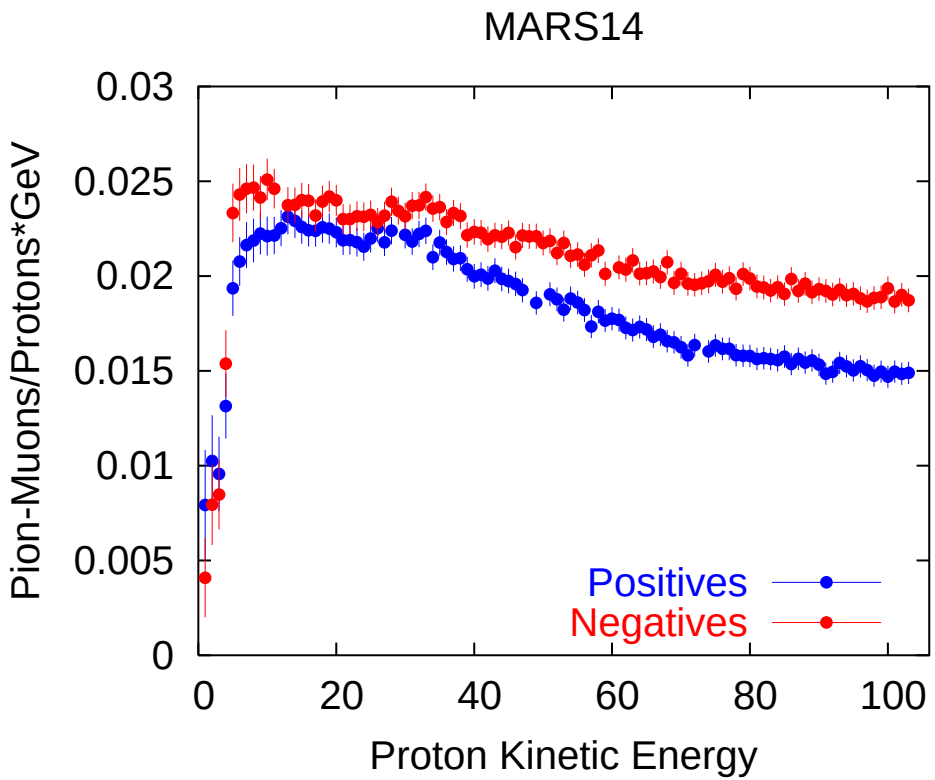
Meson KE < 350 MeV at 50m



Mesons/Proton



Mesons/Proton normalized to beam power

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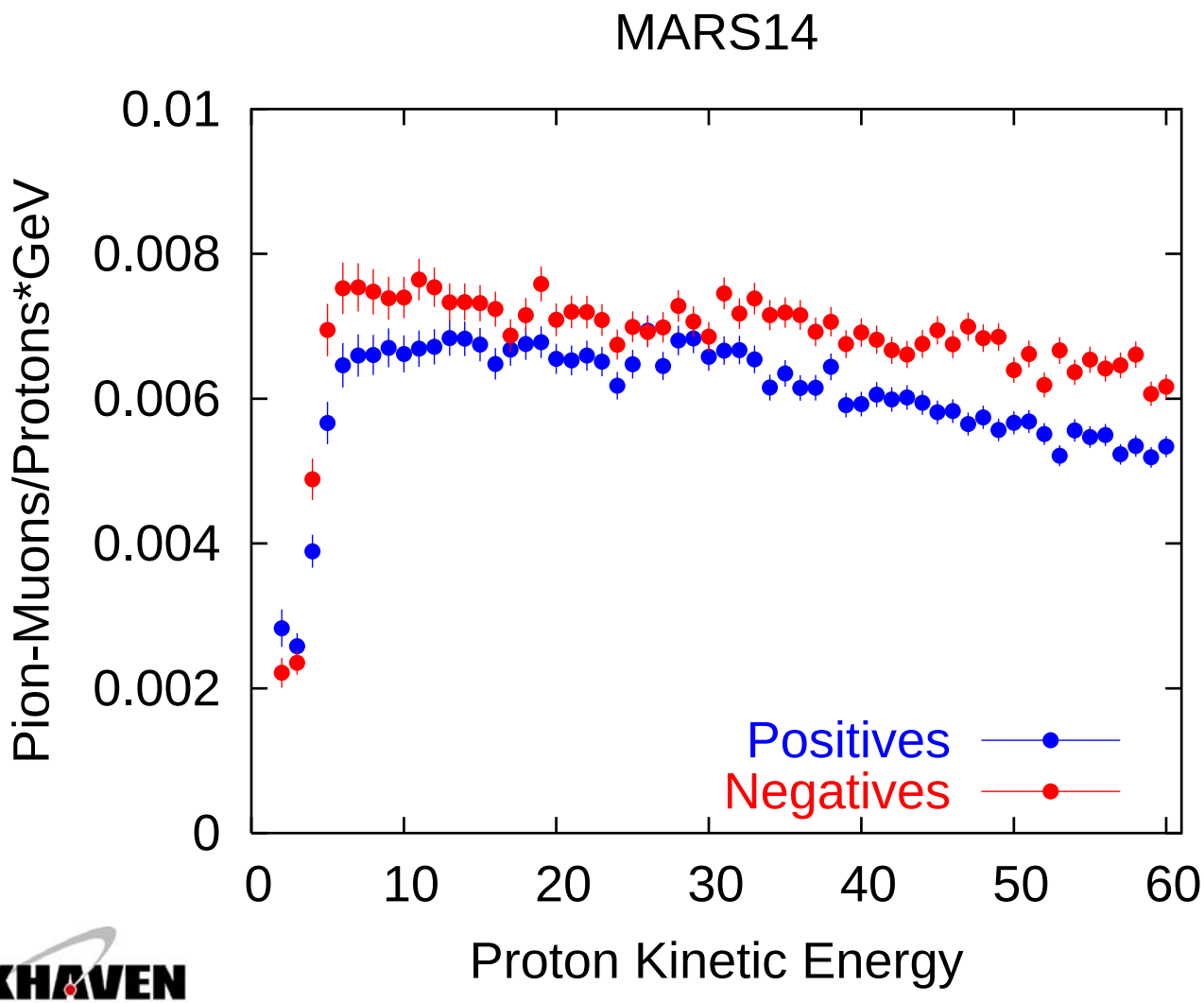
Post-cooling 30π Acceptance



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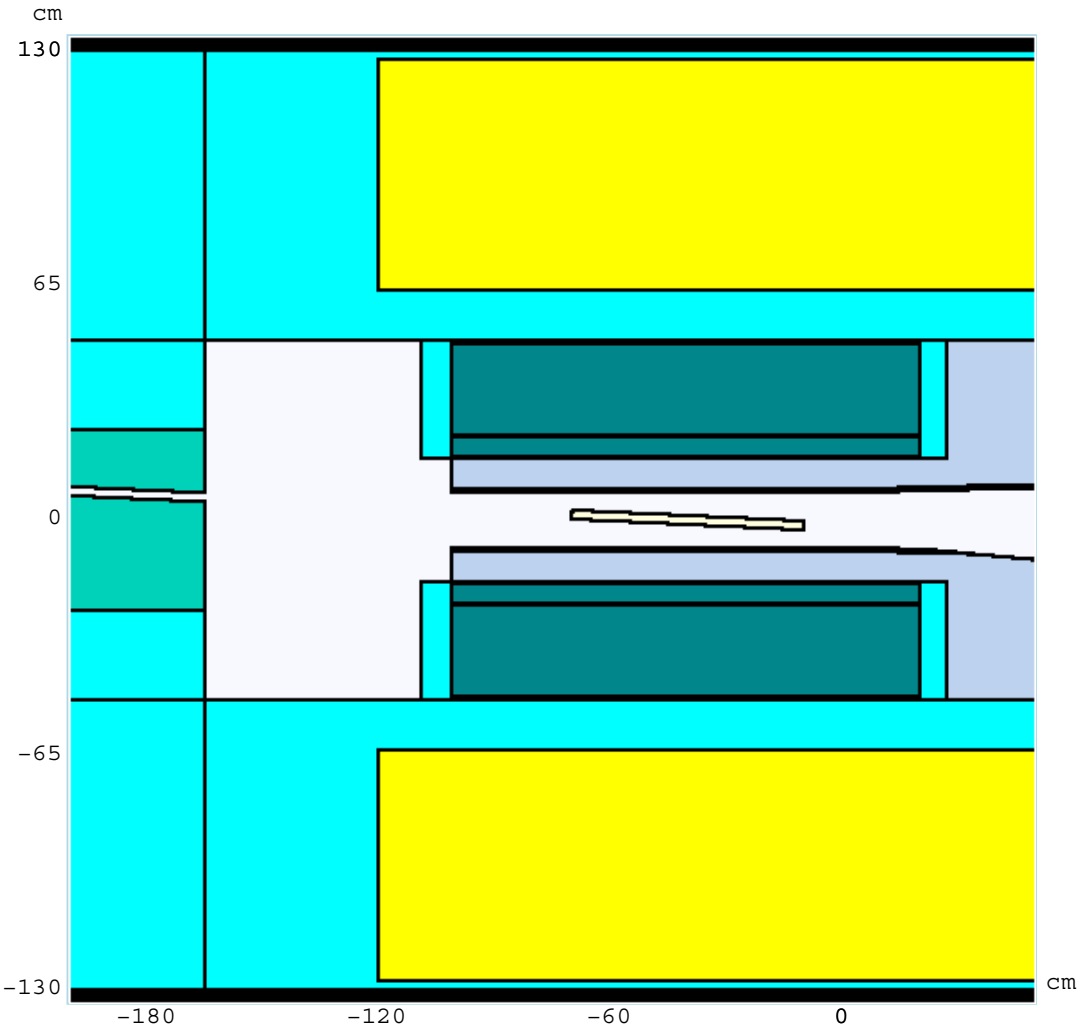
Carbon Target Parameters Search



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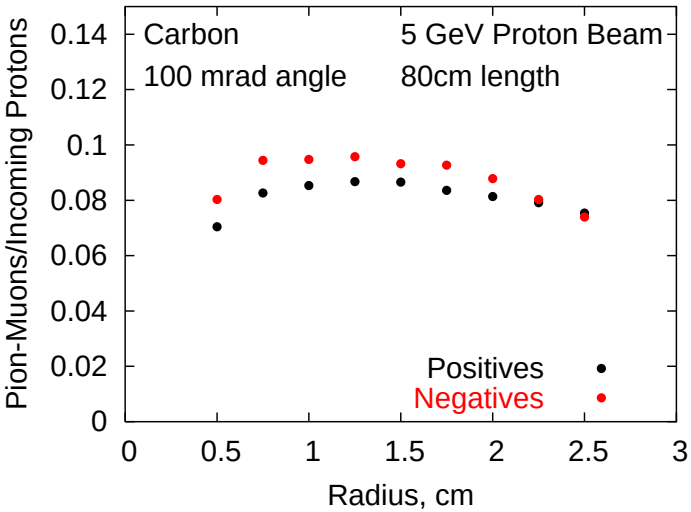
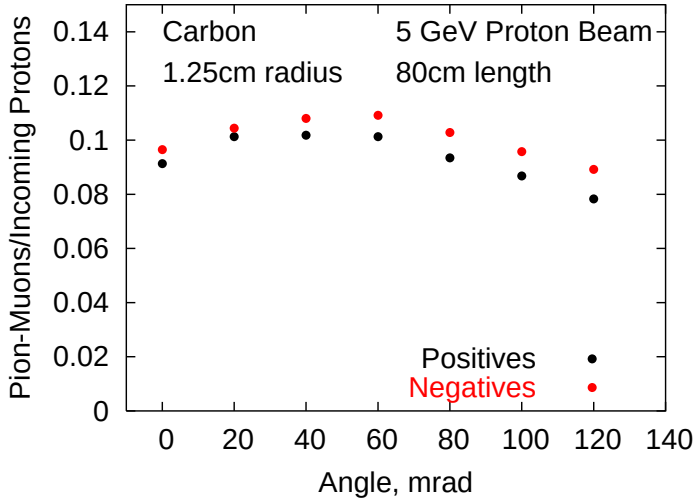
Carbon Target Optimization

MARS14



MARS14



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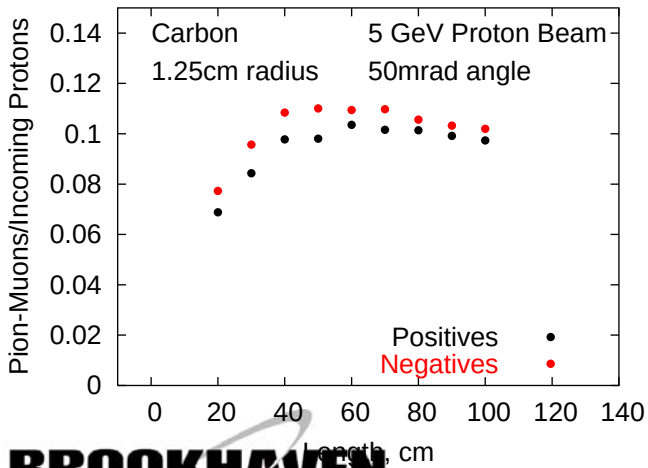
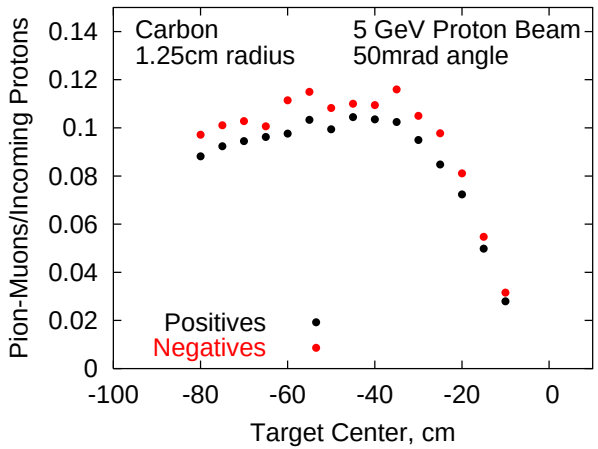


MARS14



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Set R=1.25cm; tilt angle = 50 mrad; Length=60cm; Z=-40cm

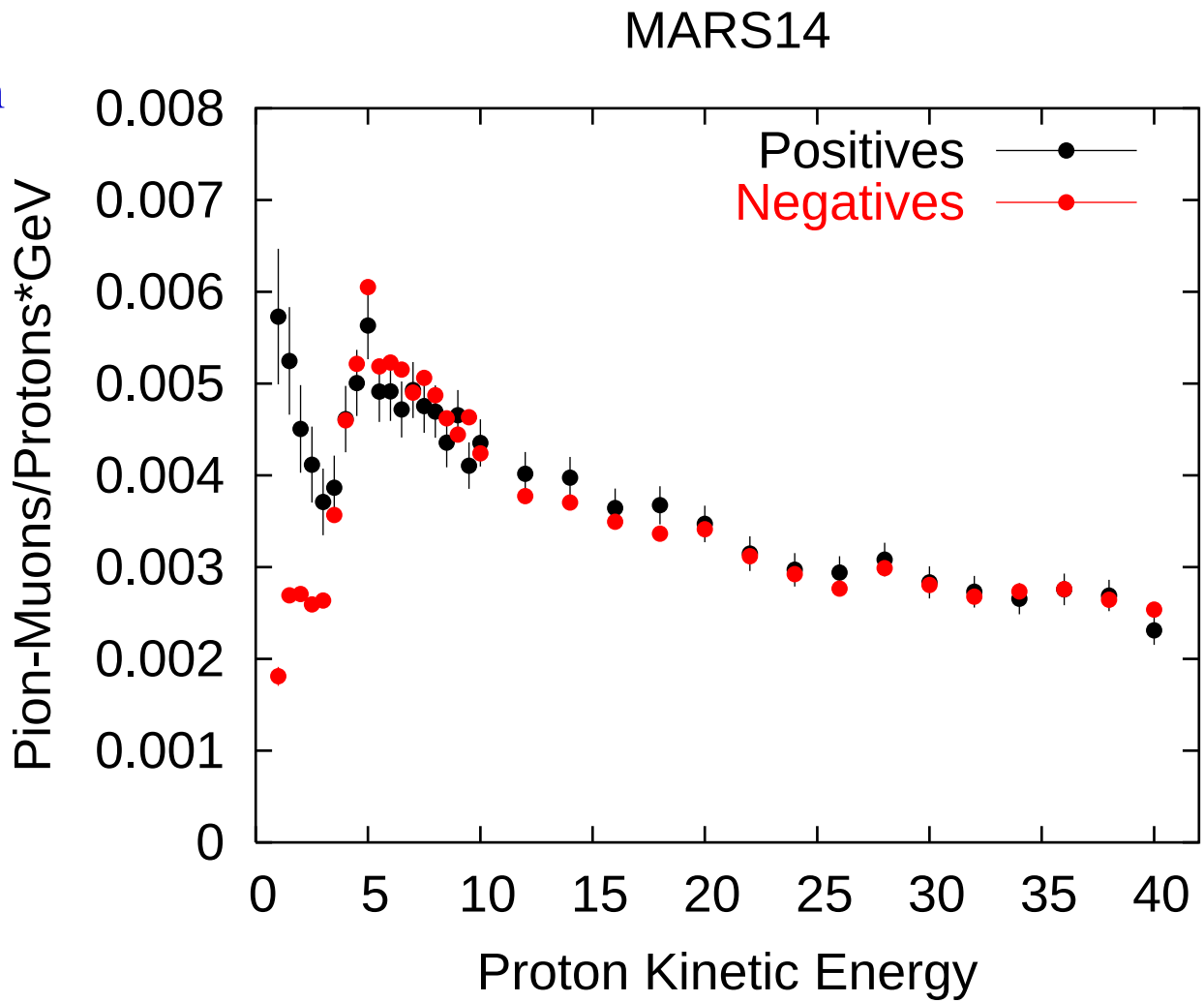
Proton KE Scan with Carbon

Count mesons within acceptance of

$\varepsilon_\perp = 30\pi$ mm and

$\varepsilon_L = 150\pi$ mm

after cooling



Summary of Results

Compare Meson production for Hg at 24 GeV and 10 GeV

$$\frac{N^{+}_{10GeV}}{N^{+}_{24GeV}} = 1.07 \qquad \frac{N^{-}_{10GeV}}{N^{-}_{24GeV}} = 1.10$$

Compare Meson production for C at 24 GeV and 5 GeV

$$\frac{N^{+}_{5GeV}}{N^{+}_{24GeV}} = 1.90 \qquad \frac{N^{-}_{5GeV}}{N^{-}_{24GeV}} = 1.77$$

Compare Meson production for Hg at 10 GeV and C at 5 GeV

$$\frac{N^{+}_{Hg-10GeV}}{N^{+}_{C-5GeV}} = 1.18 \qquad \frac{N^{-}_{Hg-10GeV}}{N^{-}_{C-5GeV}} = 1.22$$