Meson Production Efficiencies

IDS Target Meeting

CERN

December 17, 2008

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Proton Driver Parameters

Proton driver power: 4 MW

Proton driver repetition rate: 50 Hz

Proton energy: around 10 GeV

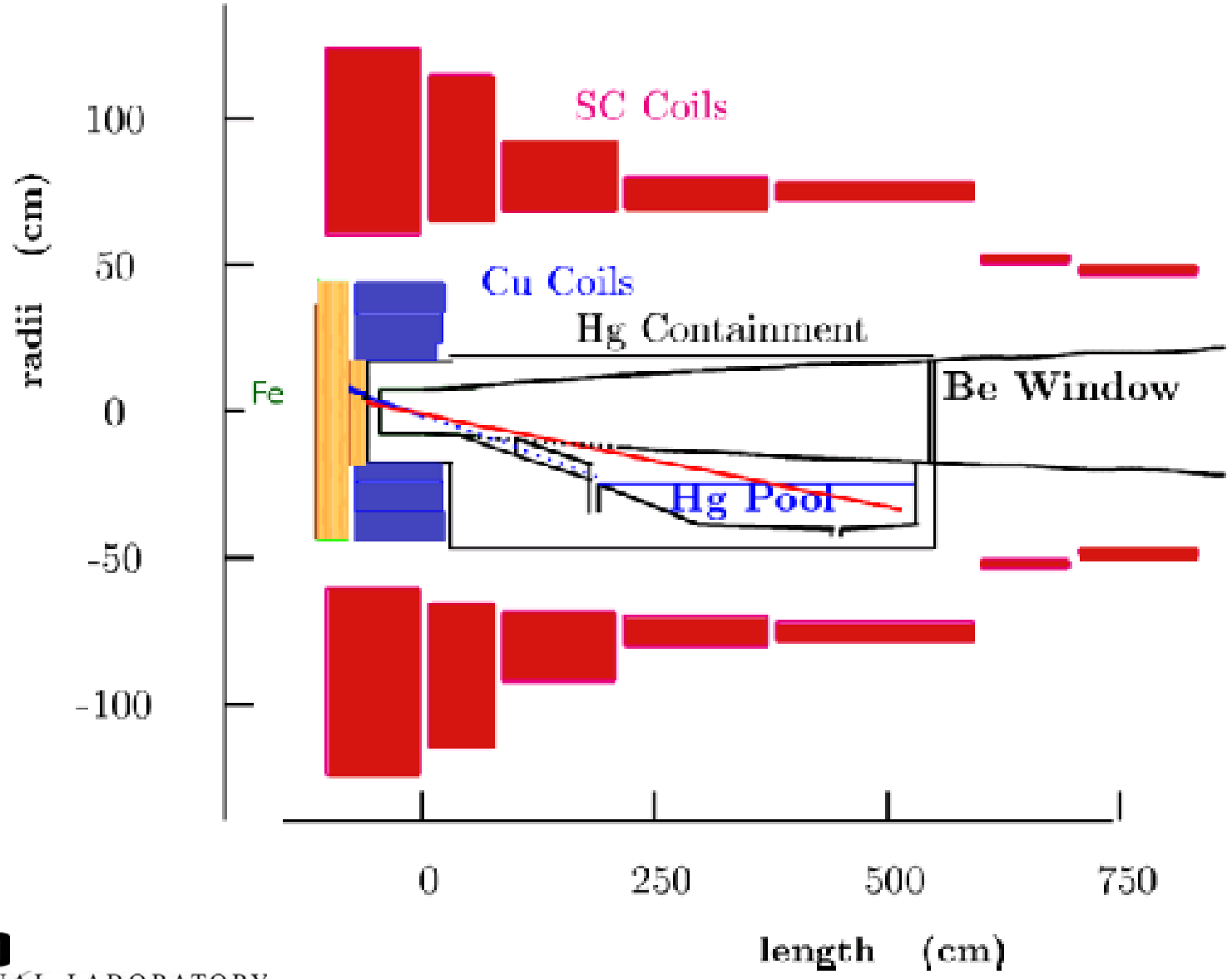
3 proton bunches in train

- **1.7×10^{13} protons per bunch at 10 GeV**

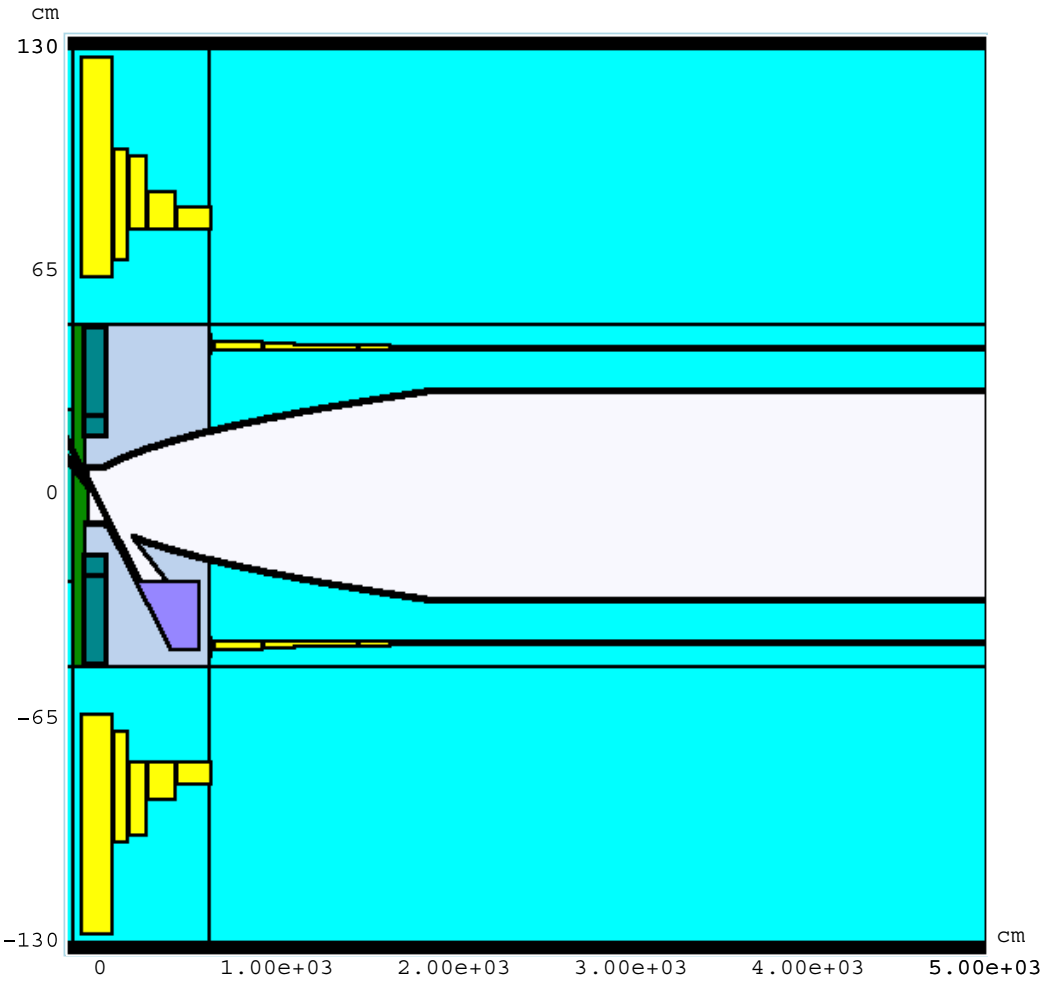
Bunch length 1–3 ns

Train length at least 200 μs

The Neutrino Factory Target Concept



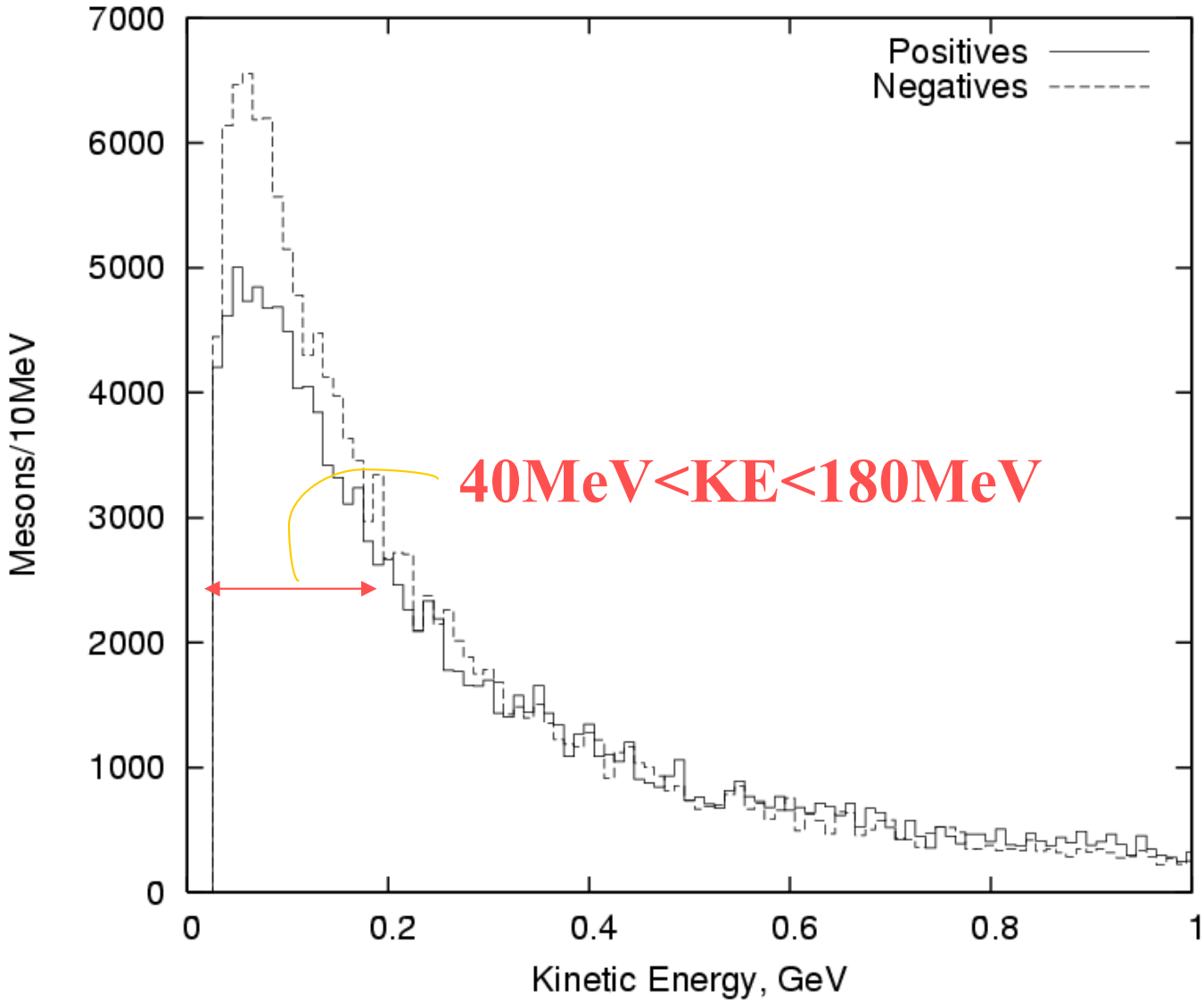
The Target/Collection System



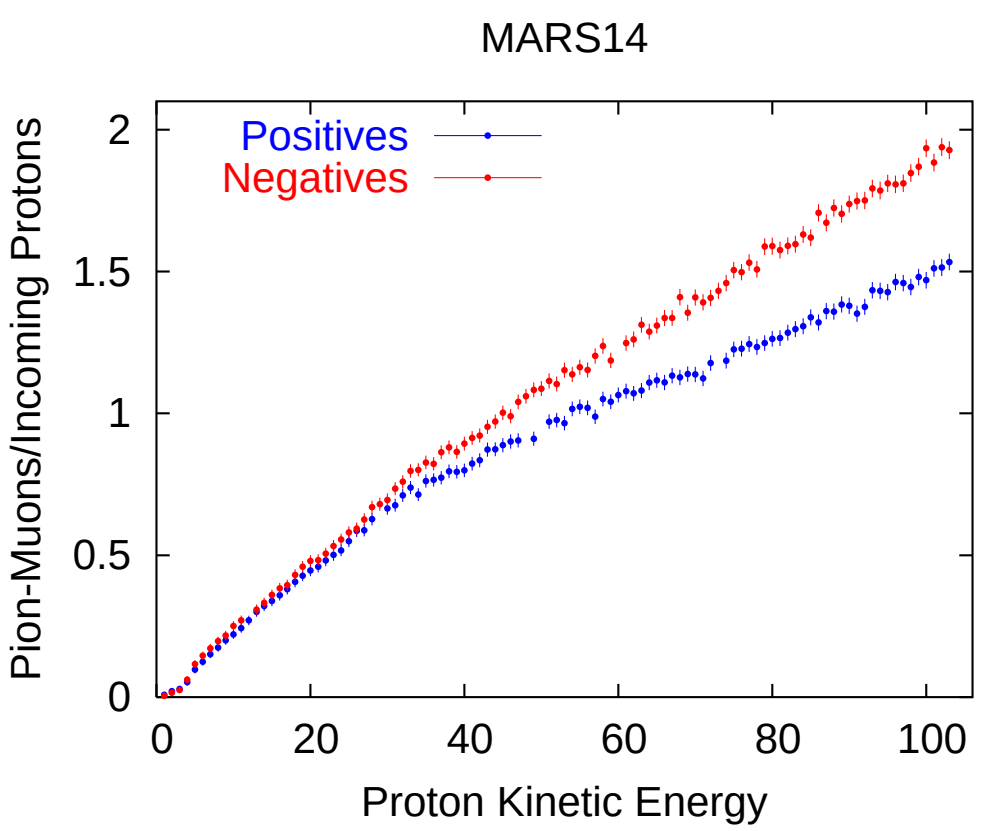
Count all the pions and muons that cross the transverse plane at z=50m.

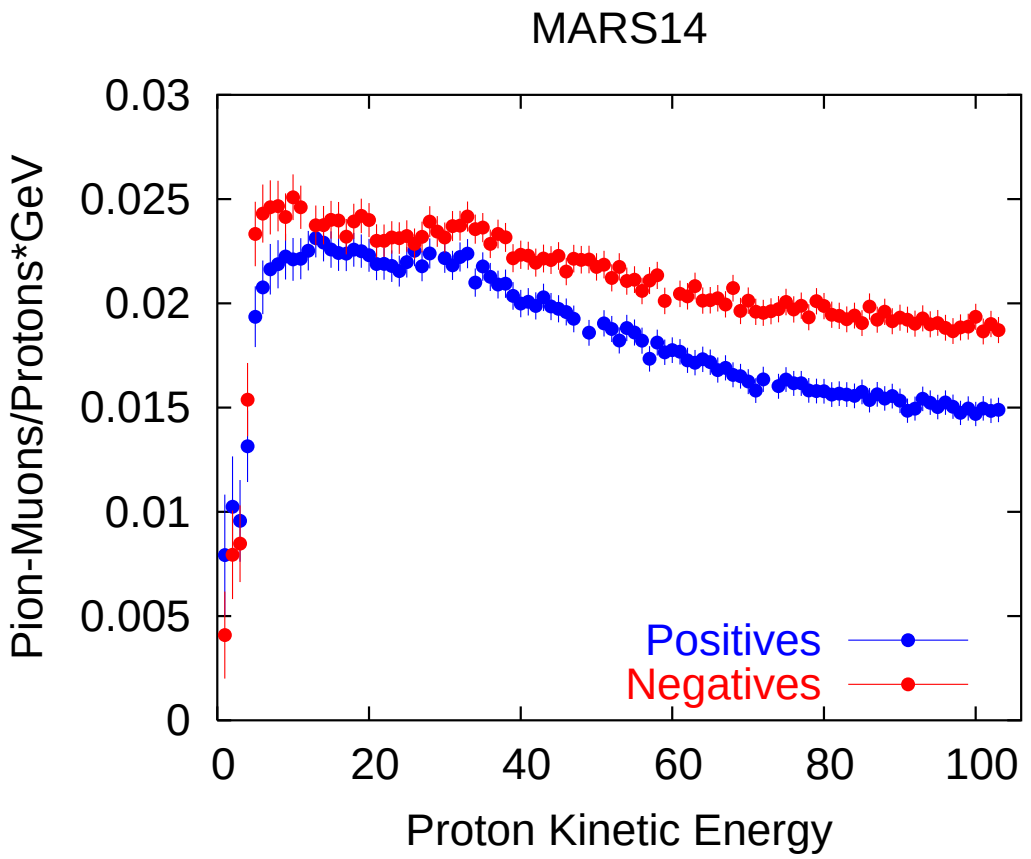
For this analysis we select all pions and muons with 40 < KE< 180 MeV.

50GeV Beam-Mesons at 50m



Mesons at 50m





Mesons/Proton

Mesons/Proton normalized to beam power

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ISS Results reported April, 2006

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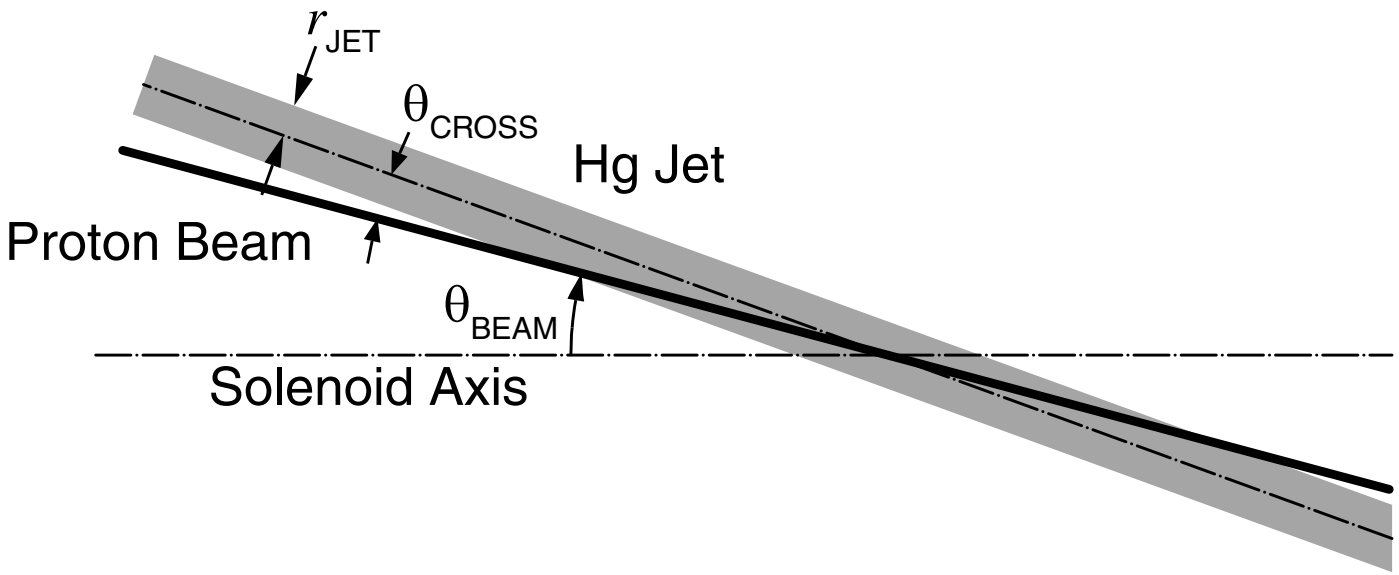
Hg Jet Target Geometry



Previous results: Radius 5mm, θ_{beam} =67mrad
$\Theta_{crossing}$ = 33mrad

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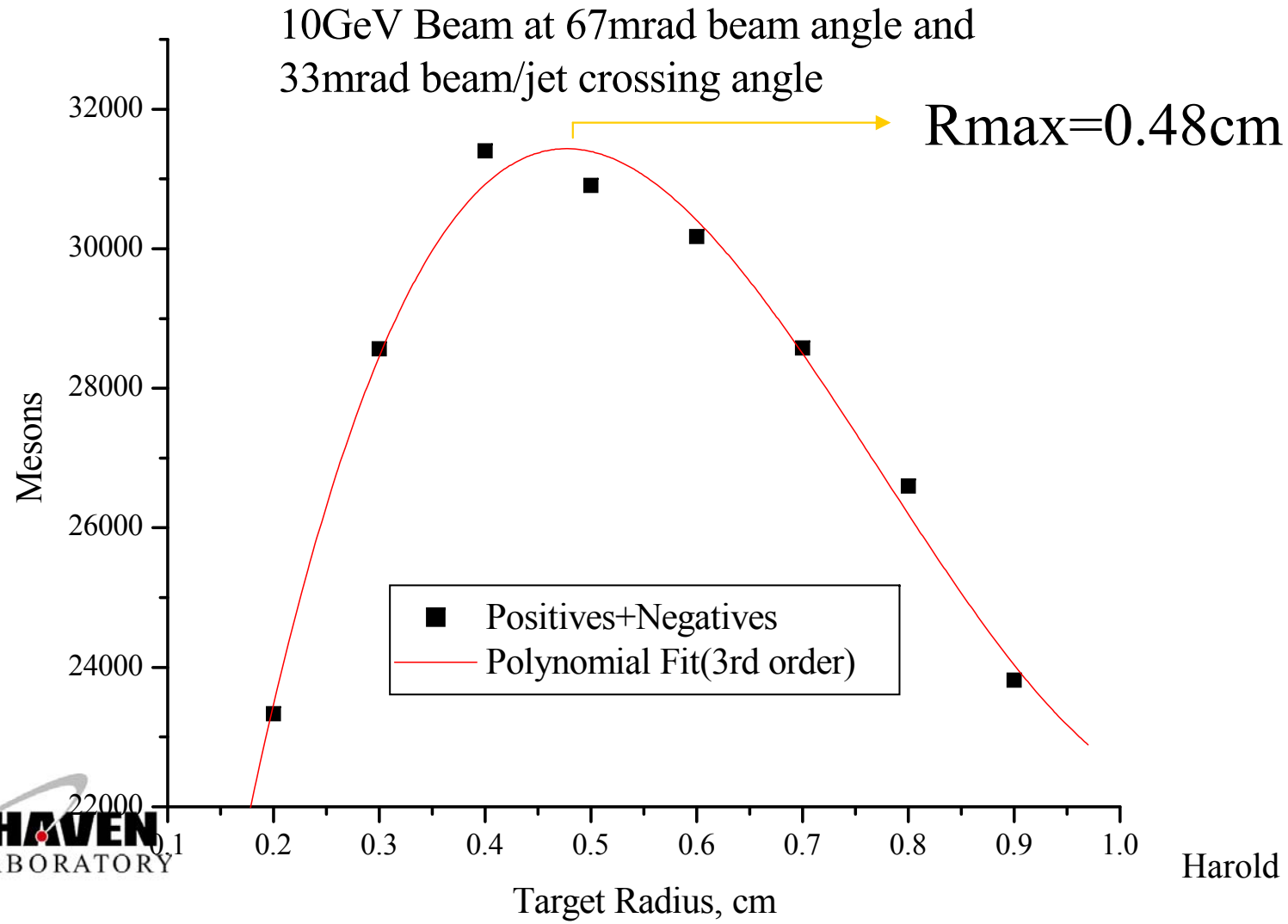
Step 1: Vary the Target Radius



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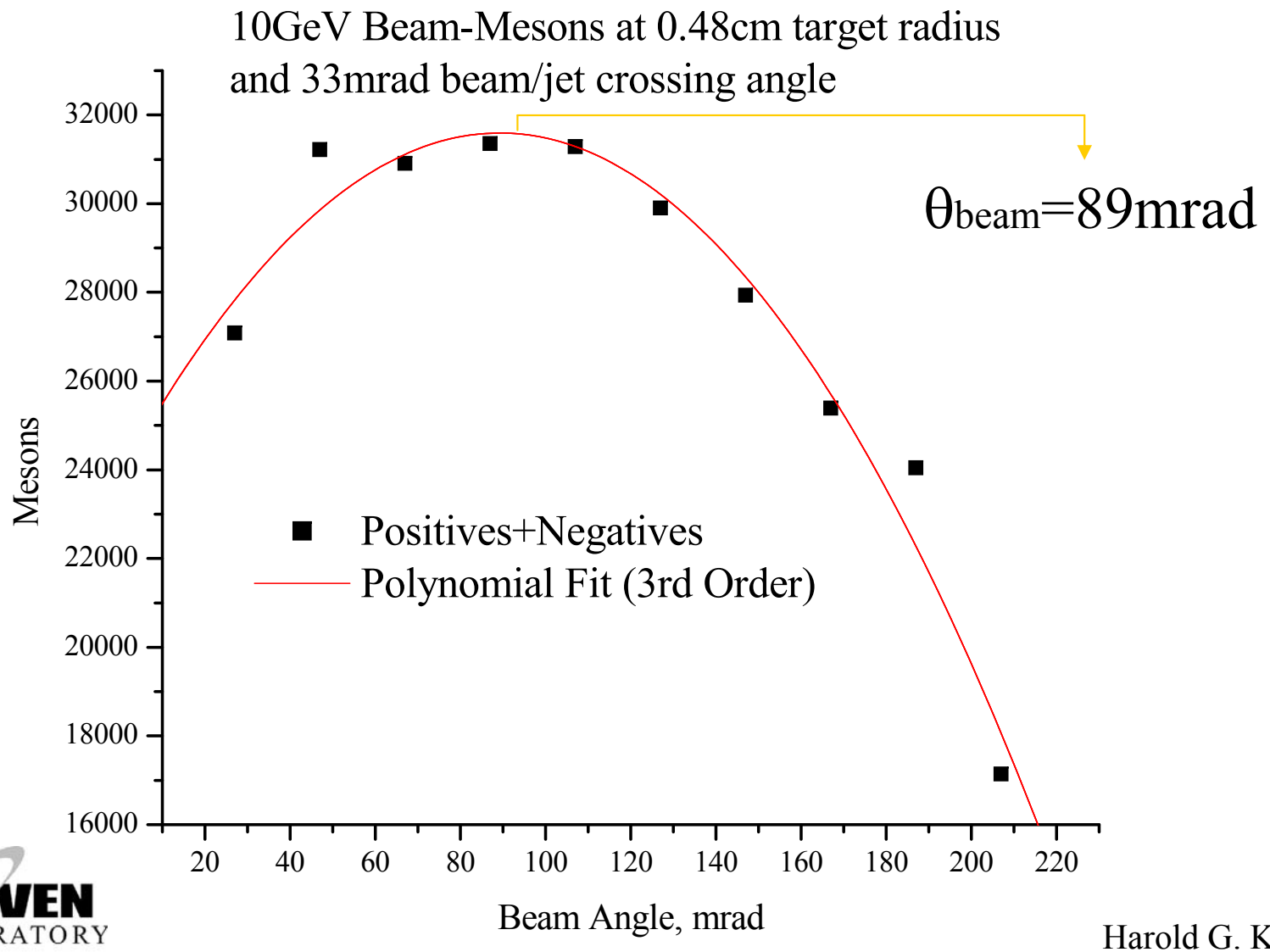
Step 2: Vary the Beam Angle



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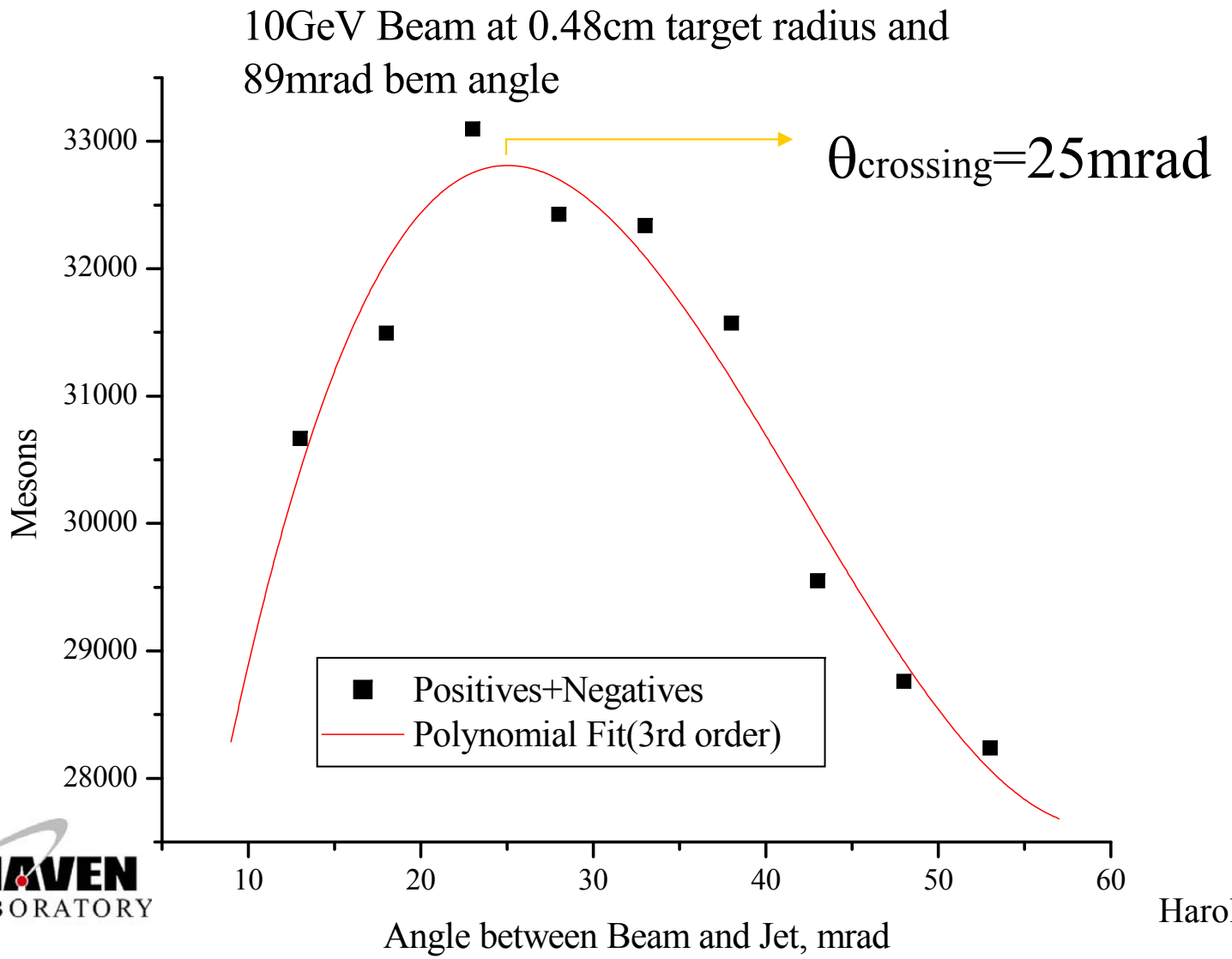
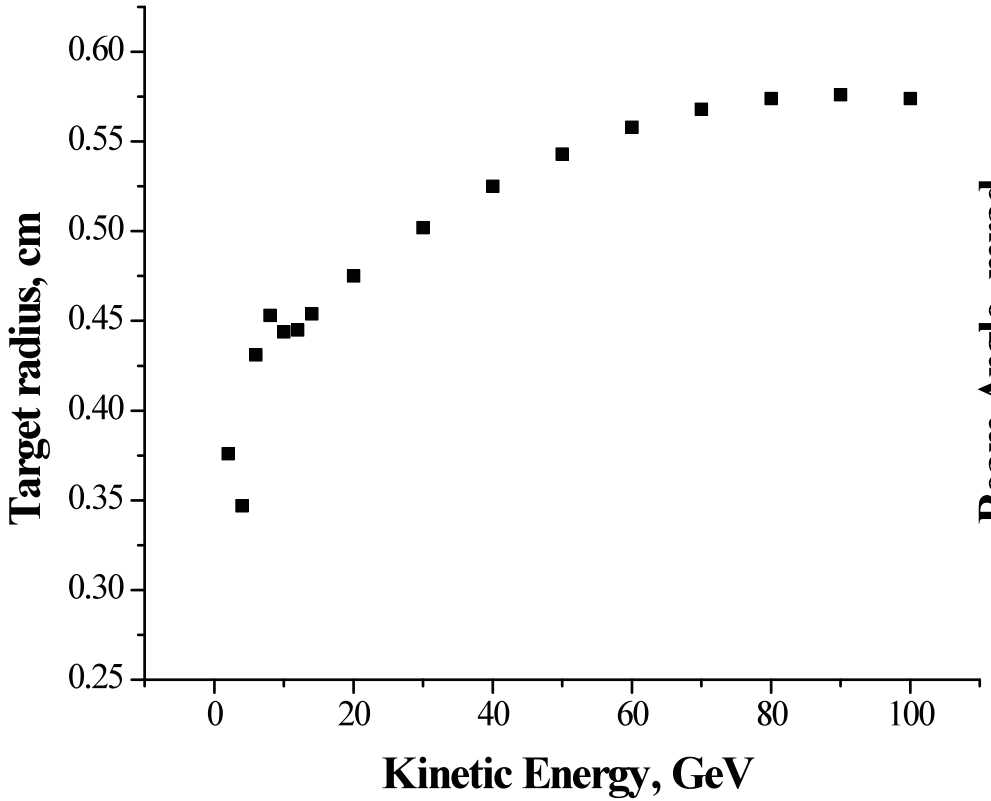
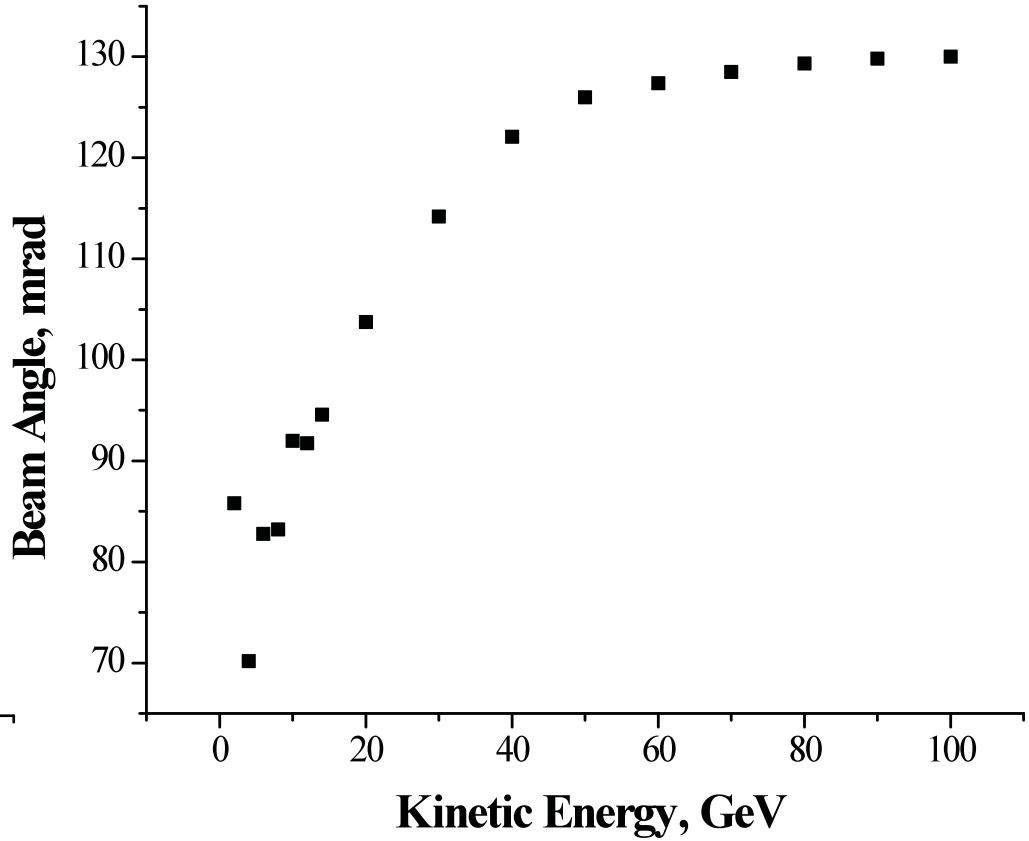
Step 3: Vary the Beam/Jet Crossing Angle



Optimized Target Parameters



Target Radius



Proton Beam Angle

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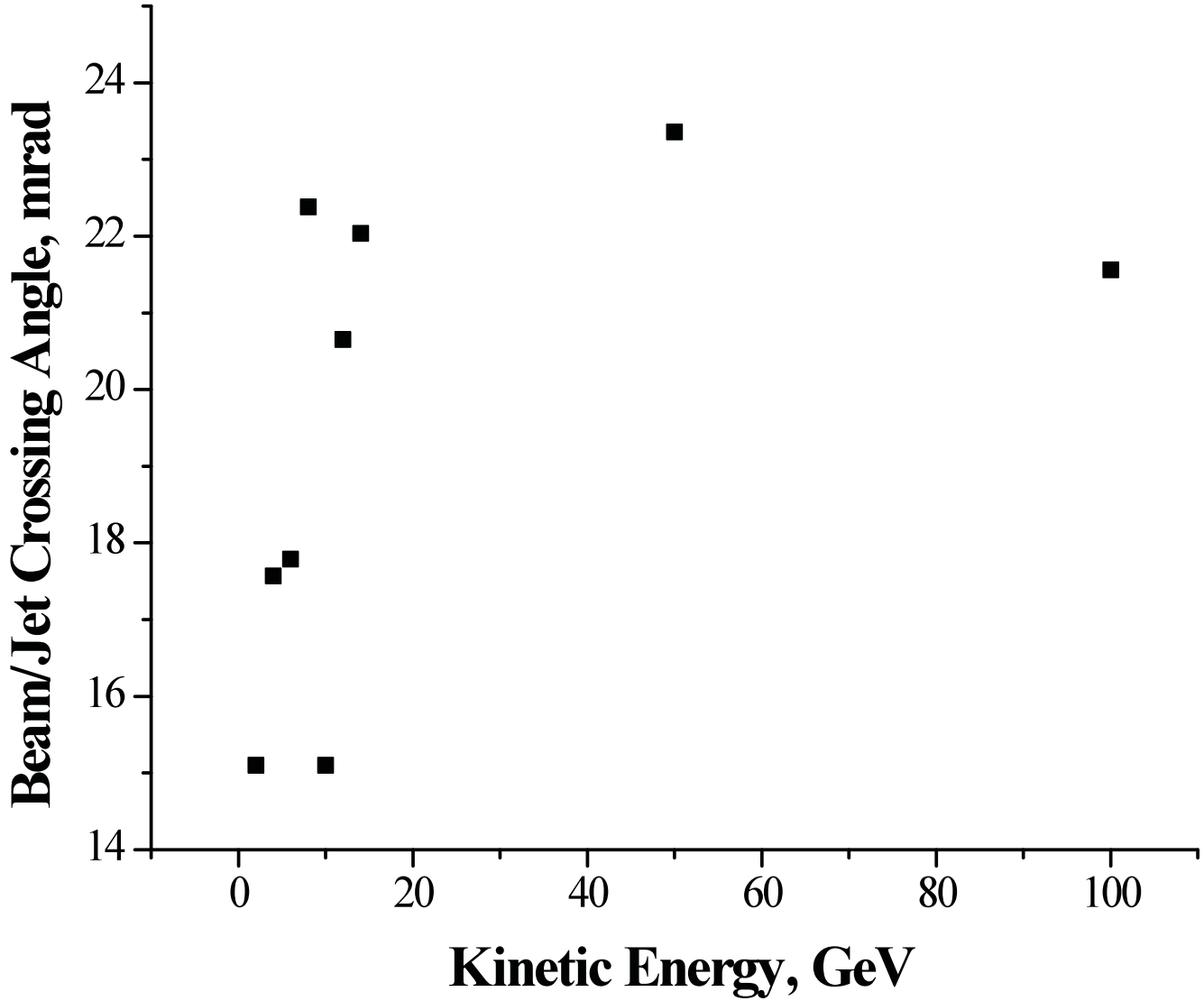
Beam/Jet Crossing Angle



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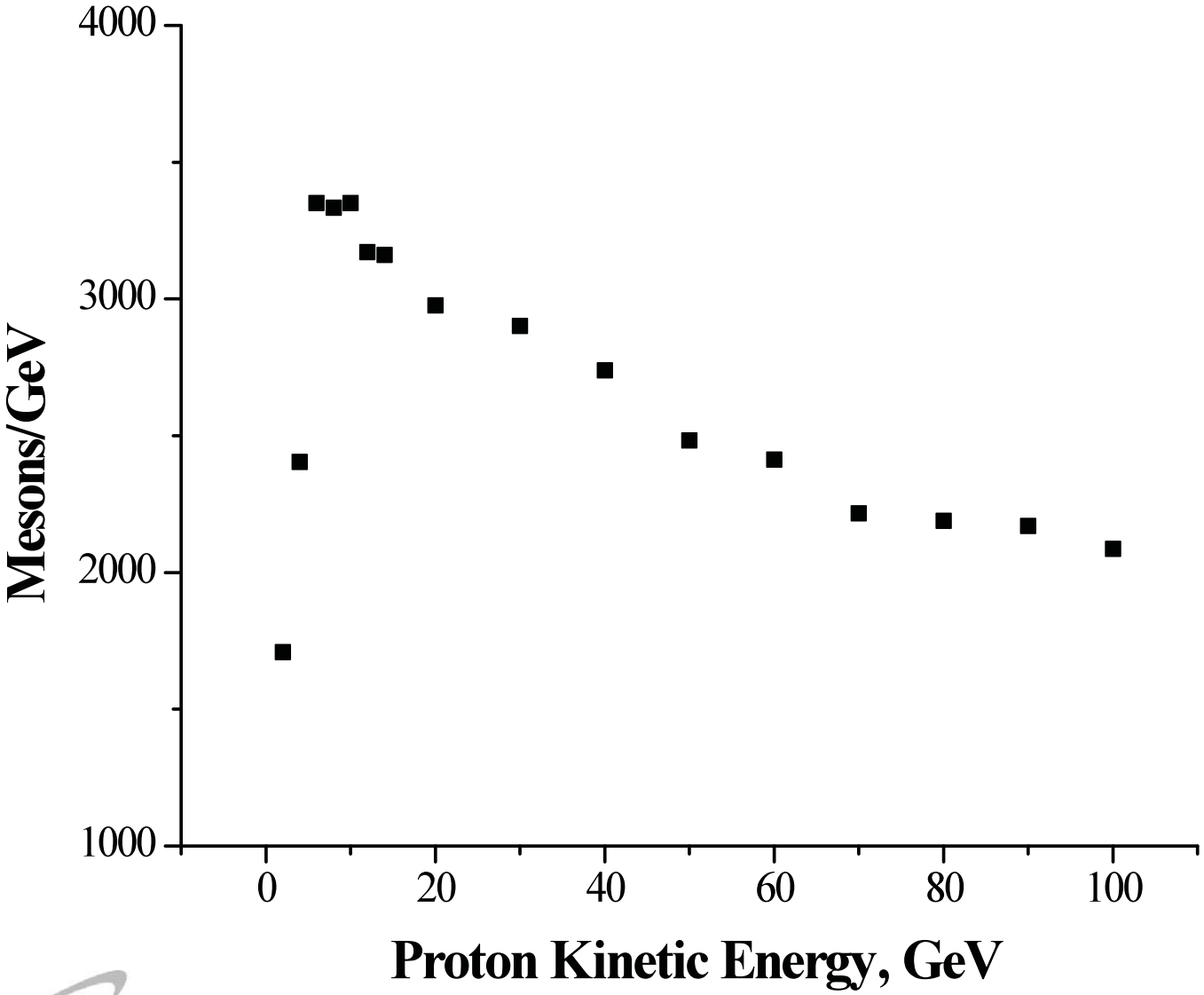
Meson Production Normalized to Beam Power



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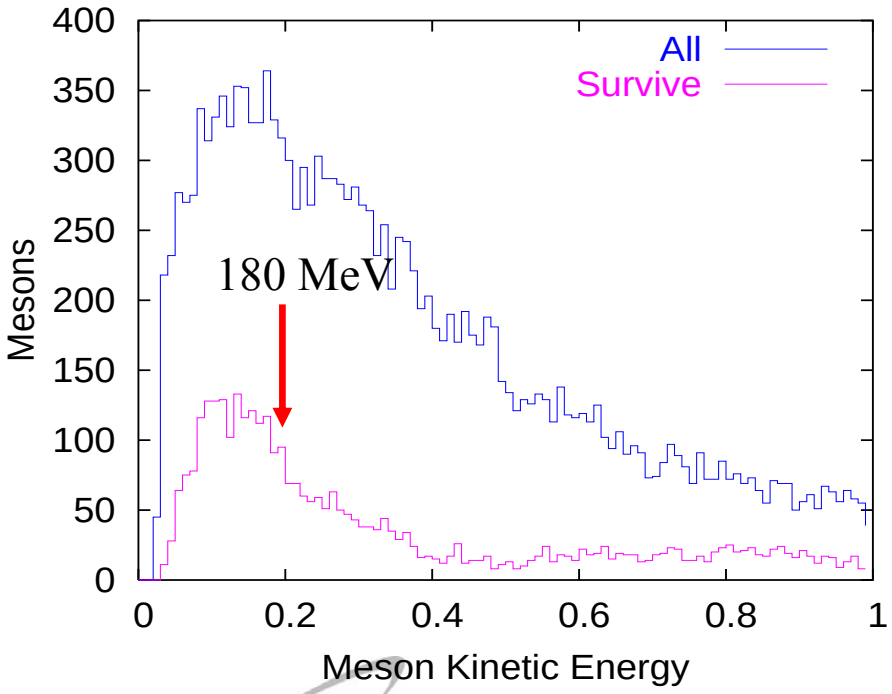
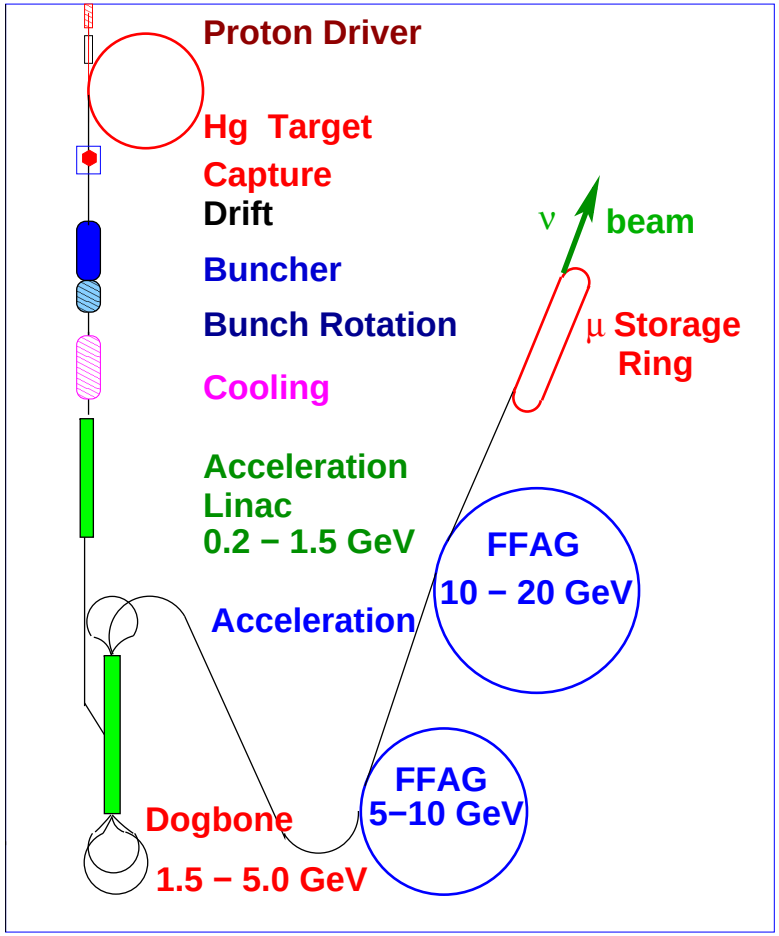
Process mesons through Cooling

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





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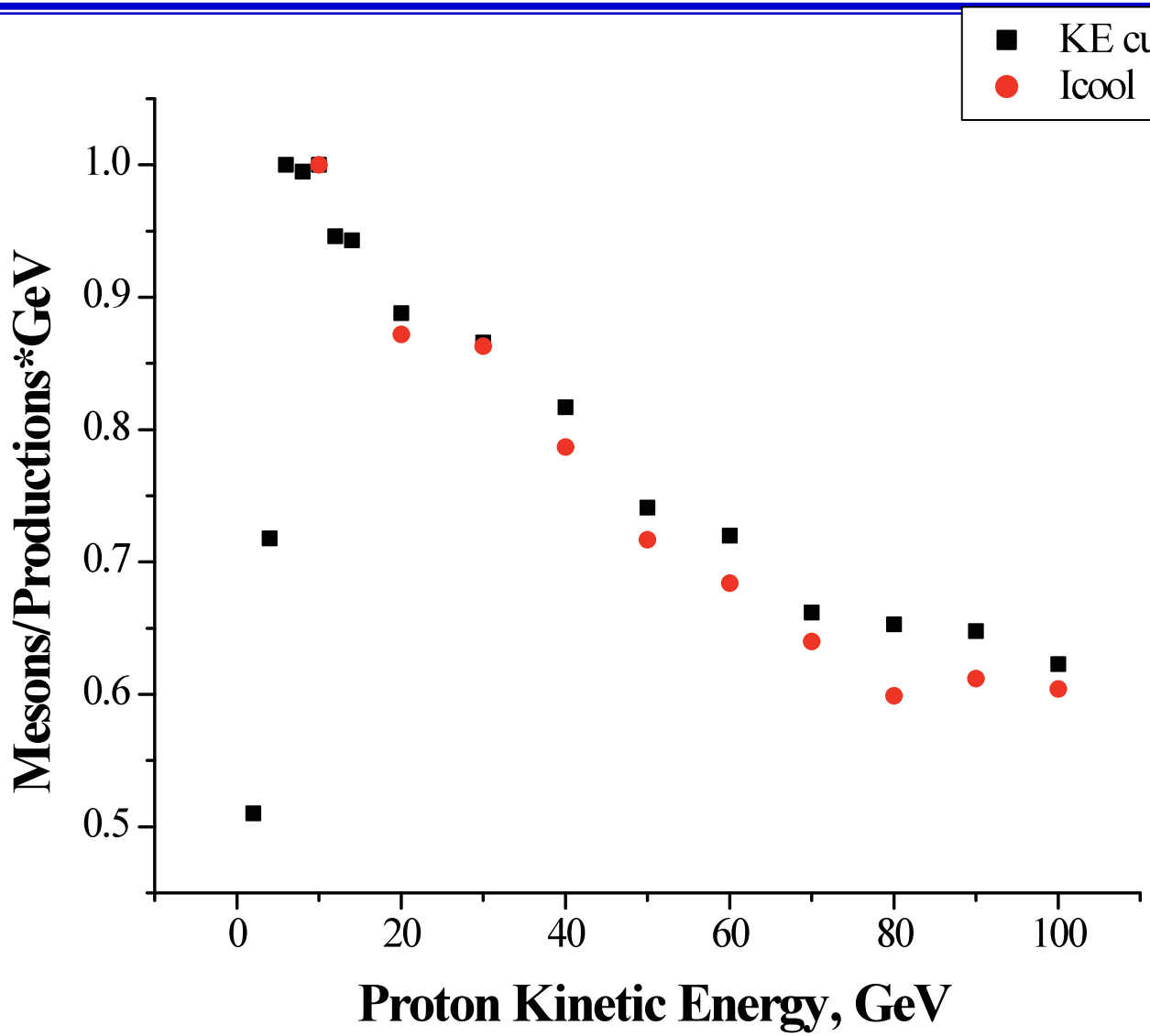
Compare 50m to Post-Cooling



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Summary

- Peak meson production efficiency for a Neutrino Factory Hg Target system occurs in the region of 6 to 10 GeV
- At 20 GeV we have a 10% loss in efficiency
- At 40 GeV we have a 20% loss in efficiency
- At 80 GeV we have a40% loss in efficiency

Backup Slides

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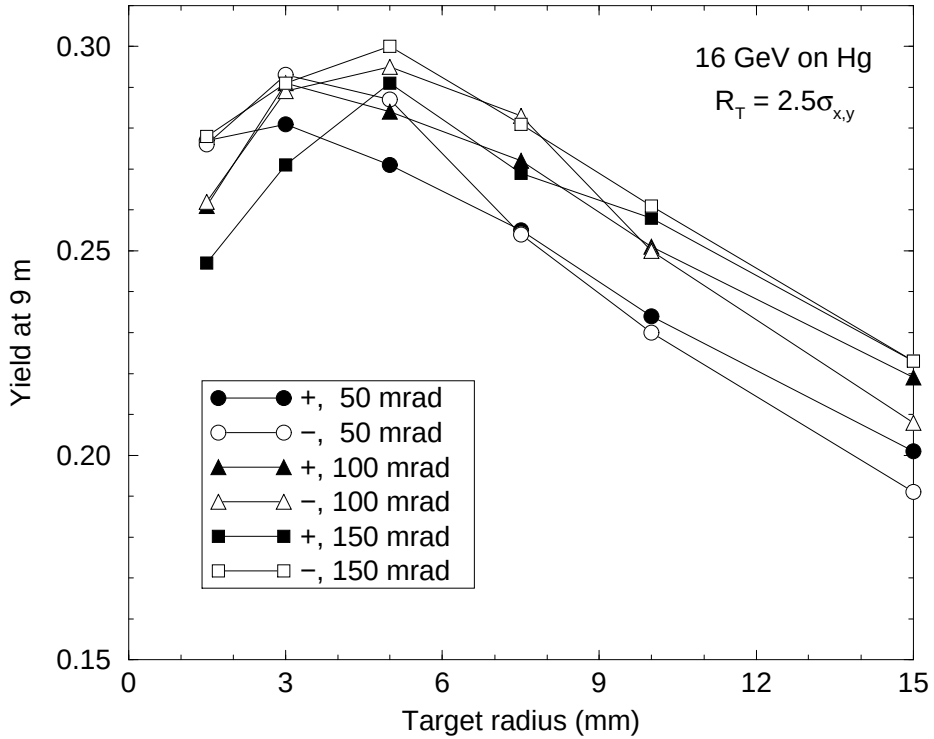
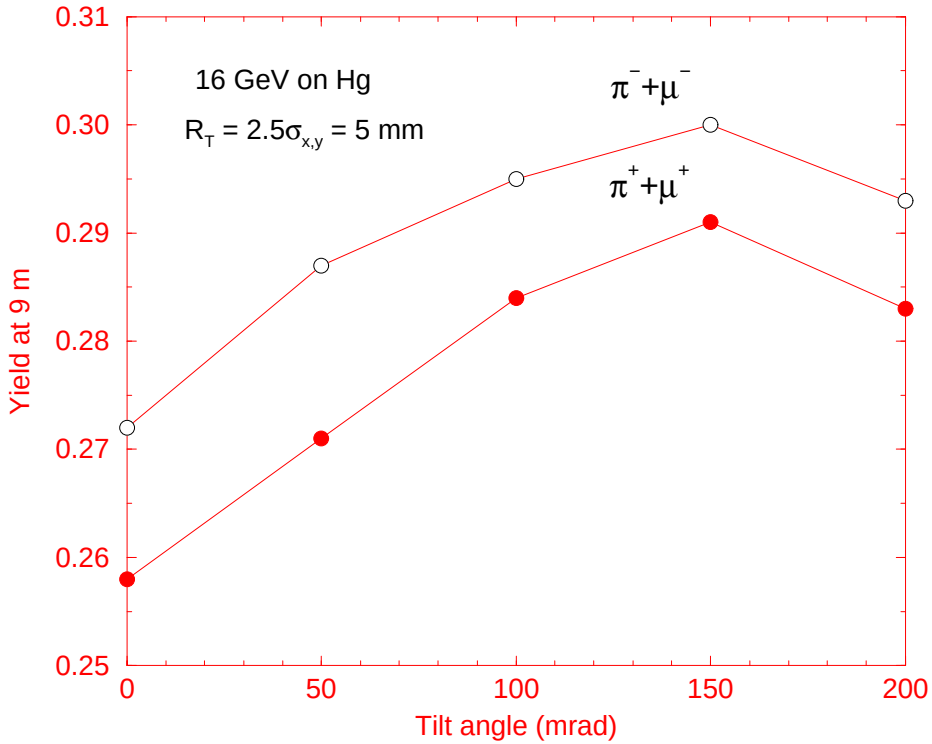
Optimizing Soft-pion Production





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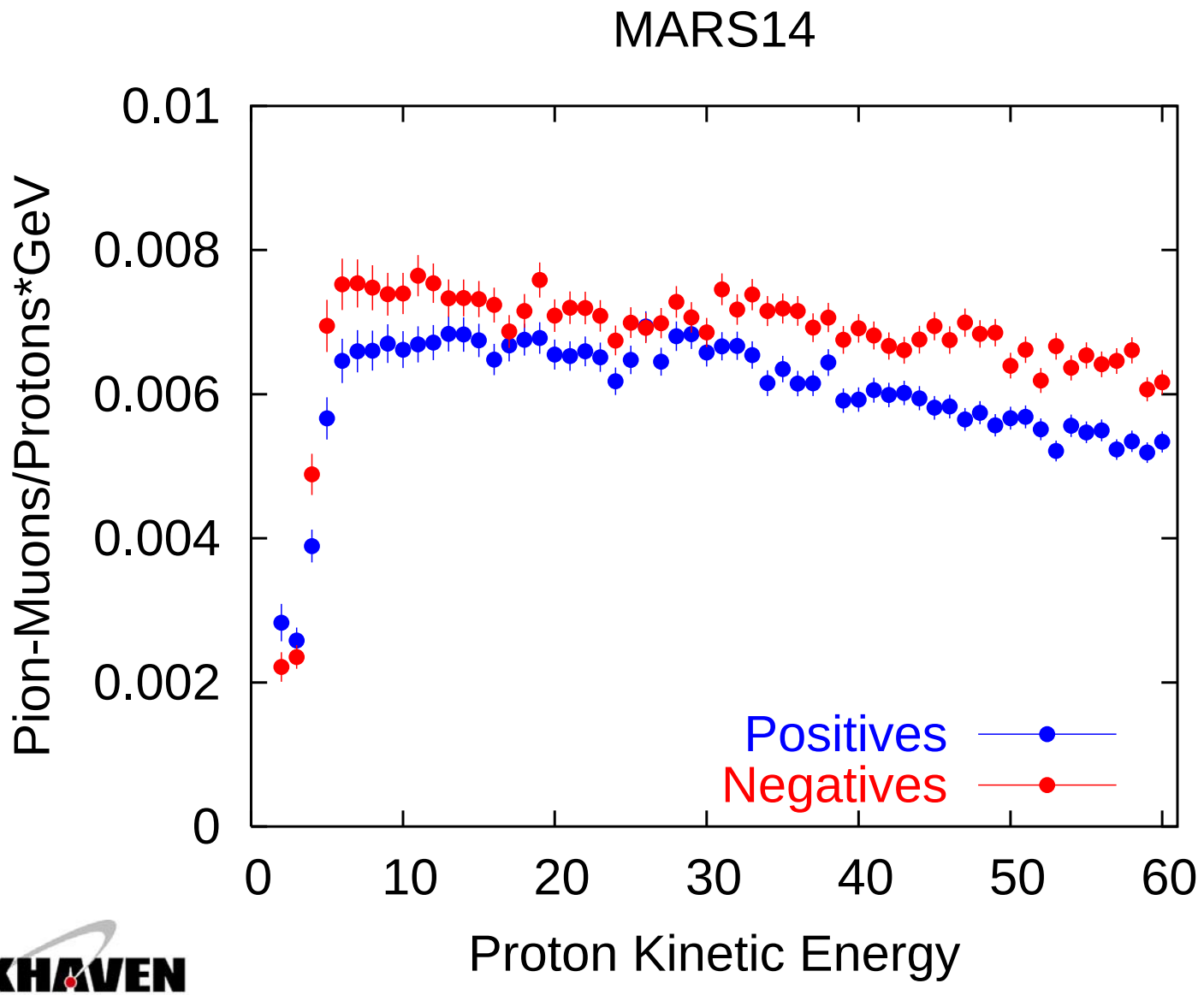
Post-cooling 30π Acceptance



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