Pion Production with MARS14

Neutrino Factory Muon Collider
Collaboration Meeting
Illinois Institute of Technology
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Count all the pions and muons that cross the transverse plane at \( z=50 \text{m} \).

For this analysis we select all pions and muons with \( KE < 0.35 \text{ GeV} \).
Consider mesons within acceptance of $\varepsilon_L = 30\pi \text{ mm}$ and $\varepsilon_L = 150\pi \text{ mm}$ after cooling.
Meson Post-cooling Survival

- All
- Survive

Mesons vs. Meson Kinetic Energy

350 MeV
Meson KE < 350 MeV at 50m

![Graph of Pion-Muons/Incoming Protons vs Proton Kinetic Energy]

- **Positives**
- **Negatives**

Harold G. Kirk
Normalized Meson count at 50m

MARS14

Normalized Meson count at 50m
Process mesons through Cooling

Count mesons within acceptance of $30\pi$ mm
Post-cooling 30π Acceptance

MARS14

Proton Kinetic Energy

Pion-Muons/Protons*GeV

Positives

Negatives

Harold G. Kirk
Summary for Hg

For Negatives the peak occurs for
6 Gev < Proton KE < 11 GeV

For Positives the peak occurs for
9 Gev < Proton KE < 19 GeV
Carbon Target Parameters Search
Carbon Target Optimization

Set R at 1.25cm

Set tilt angle at 50 mrad
Harold G. Kirk

Carbon Target Optimization (cont)

Set Length at 60cm

Set Zcent at -40 cm

MARS14

Carbon
1.25cm radius
5 GeV Proton Beam
50mrad angle

Positives
Negatives

MARS14

Carbon
1.25cm radius
5 GeV Proton Beam
50mrad angle

Positives
Negatives

Harold G. Kirk
Proton KE Scan with Carbon

MARS14

Pion-Muons/Protons*GeV vs. Proton Kinetic Energy

Positives

Negatives
Summary of Results

Compare Meson production for Hg at 24 GeV and 10 GeV

\[
\frac{N^+_{24 GeV}}{N^+_{10 GeV}} = 1.07 \quad \frac{N^-_{24 GeV}}{N^-_{10 GeV}} = 1.10
\]

Compare Meson production for C at 24 GeV and 5 GeV

\[
\frac{N^+_{24 GeV}}{N^+_{5 GeV}} = 1.90 \quad \frac{N^-_{24 GeV}}{N^-_{5 GeV}} = 1.77
\]

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

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