Unpolarized Muons and
$\mathcal{TWIST}$ Angular Response

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- Reasons for unpolarized beam
- Ability to achieve zero polarization
- Measuring $\mathcal{TWIST}$ Angular Response

Reasons for unpolarized beam

- Measuring $\mathcal{TWIST}$ angular response
- Second measurement of ρ
- Energy calibrations

Method to make unpolarized beam

Choose momentum to balance cloud and surface muons.

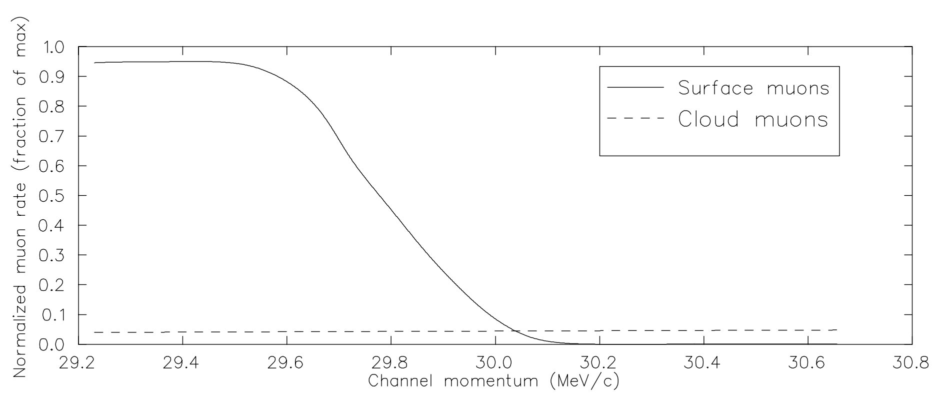
- Polarization is sensitive to momentum selection error due to steepness of surface muon edge.

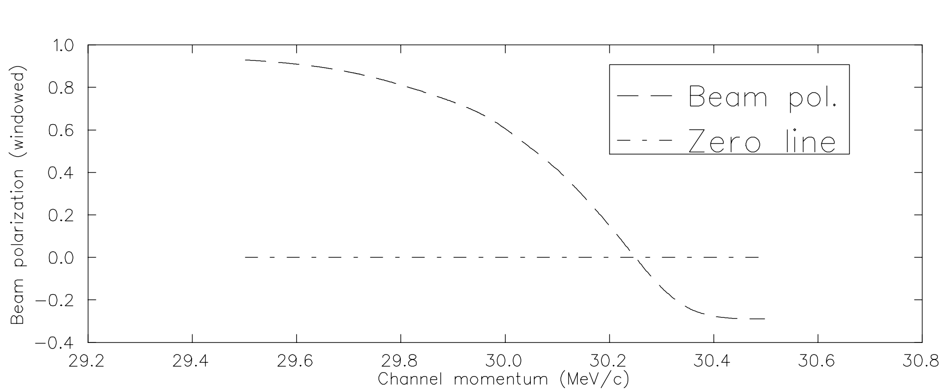
- Using wider momentum bite reduces sensitivity.

Study of $P(p)$

- A study was done to check feasibility of making unpolarized beam.
  - Found rates of cloud and surface muons from momentum scan data.
  - Determined polarization vs. momentum.

With a 2% momentum bite:





Sensitivity to momentum

Let $p_0 = 30.16$ MeV/c.
Then $(p_0 - 0.1\%) = 30.13$ MeV/c,
and $(p_0 + 0.1\%) = 30.19$ MeV/c.

Using a 3% momentum bite (± 0.9 MeV/c):

- $P(p_0) = 0.0009$ (artifact of grid spacing)
- $P(p_0 - 0.1\%) = +0.065$
- $P(p_0 + 0.1\%) = -0.082$

0.1% is roughly the level of control attainable. Therefore, we can expect to get a beam polarization of 0.0 ± 0.1. (The above study could have errors as high as 10%.)

Not good enough for angular response measurement.

Measuring angular response

- Could use unpolarized muon beam, but we can't guarantee the polarization to be low enough.

- "Wire efficiency" as a function of track angle should work.

  - Take data at any polarization (eg. surface muons).

  - Count missing wires as a function of track angle, divide by number of tracks with that angle.

  - Resulting ratio should be constant for all track angles.

Software

- Current GEANT handles efficiencies as plane-by-plane.
  - Modifications for wire-by-wire and angular should be simple.
- Better would be to handle efficiencies as a "pre-processor" to Mofia—allows for changing efficiency without rerunning GEANT.
  - This should also be simple to include (and is already there to some extent).

Short term plans

- Look for “magic angles” in existing GEANT data. (Straight tracks.)
  - Do some angles look less efficient than others, despite no angular dependence in GEANT inefficiencies?

- Make necessary modifications to Mofia (GEANT?) for angular efficiencies. (Already there?) (Probably the same code for both straight and helical tracks.)