Target Apertures and Beam Distributions

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Review of Previous Talks

- Neuffer found significantly worse performance with C compared to Hg
  - Found larger emittance for C
- I looked at emittances at 3 m
  - Various Hg distributions had very different emittances
  - Neuffer used the one with the smallest emittance
    - Emittance with current configuration, current MARS similar to this one
  - C emittances were larger than Hg
  - C emittances worst with dump no tilt; with dump better with tilt

Review of Previous Talks

- New default for MARS event generator has significant impact on performance
  - Largest impact is total count reduction, less so on spectrum
  - Transverse emittances virtually unchanged
- C energy spectrum peaked at much higher energy than Hg
  - Overall production may be comparable to Hg
  - NBPR design likely very different for Hg and C
  - But Bob argued correctly that capturing flux at higher energies is likely more costly and less efficient
  - C with dump no tilt has signficantly worse production

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Propagation in MARS vs. ICOOL

- With current Hg target configuration, examine emittances at 3 m in two ways
  - Receive from MARS at 0.375 m, propagate in ICOOL to 3 m
  - Receive from MARS at 2.0 m, propagate in ICOOL to 3 m

	μ^-+	μ^--	μ^++	μ^+-	π^-+	π^--	π^++	π^+-
0.375	45.4	16.8	51.1	19.7	35.5	21.5	36.4	22.8
2.000	30.7	13.4	35.2	15.1	21.0	14.4	21.9	15.1

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Propagation in MARS vs. ICOOL

- Next, do ICOOL propagations without pion decays, and look at pion emittances of pions common to both runs

	π^-+	π^--	π^++	π^+-
0.375	19.3	14.4	19.4	15.0
2.000	18.9	13.4	19.1	14.4

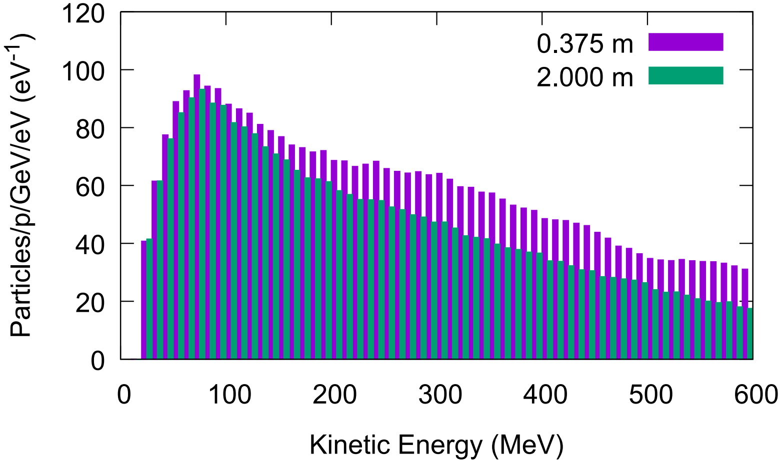
- Results similar to propagation from 2 m
- Conclusion: particles lost on object in MARS
- Further analysis: square root taper aperture, starting at a radius of 7.5 cm at $z = 0.375$ m, growing to 30 cm at $z \approx 19$ m

Distributions vs. Handoff Point

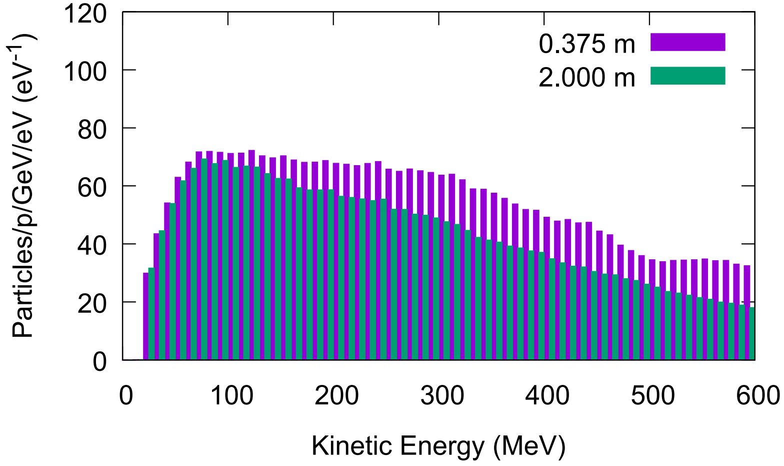
- Energy spectra have differences as well
- Pions weighted to higher energies
    - Still not to the degree that carbon is
- More low energy muons, presumably from low energy pions that have already decayed

Distributions vs. Handoff Point

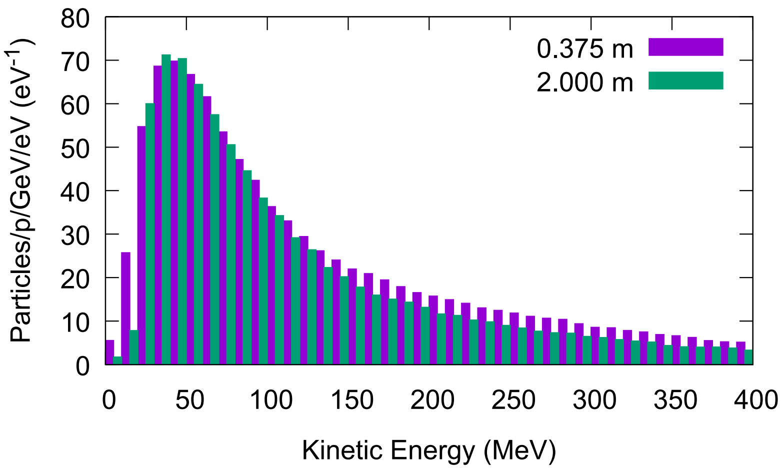
π^-



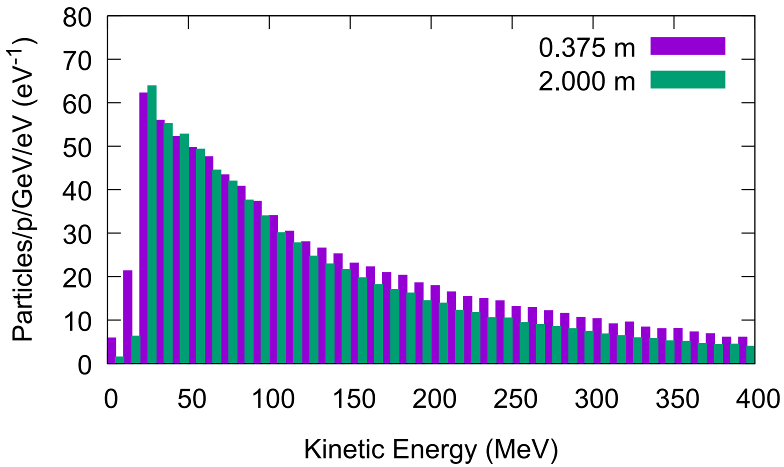
π^+



μ^-



μ^+



Carbon Target Apertures

- 13 cm aperture around target to 1.7 m, vs, 7.5 cm to 37.5 cm for Hg
- No apertures (other than solenoids and sheilding) beyond that for C
- Likely reason for (or at least contribution to) larger emittances from C
- May also be contributing cause to higher energy spectral peak
- Neuffer finds many of the high emittance particles are lost, but higher final field would hang onto more of them

Conclusions

- I think we understand reasons for
  - Differences between emittances for various Hg runs
  - Some of differences between C and Hg emittances and spectra
- Apertures in Hg case cutting off particles
  - Apertures were set for long taper
  - Apertures unnecessarily small for warm solenoids
  - Hisham's runs likely different because he removed apertures (?)

Next Steps

- Next: run both Hg and C (tilt no dump) with the following apertures (runs are complete, awaiting analysis)
  - 13 cm inner radius to 85 cm
  - 23 cm inner radius beyond that
- These apertures enclose all solenoids
- Use these as our reference distributions for now
- Comments from Kirk McDonald
  - I was probably not starting from standard input files
  - Could have had graphical output which would have helped