

# Muon Cooling Experiment?

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# First and foremost...

- Can we do a beam experiment (as opposed to a single particle experiment)?
  - Complementary to MICE!
  - Cooling of a beam would be a more tangible result than "cooling" single particles.
  - Could potentially be done with simpler instruments (beam profiles vs tracking spectrometer).
  - Good case for doing it at Fermilab.

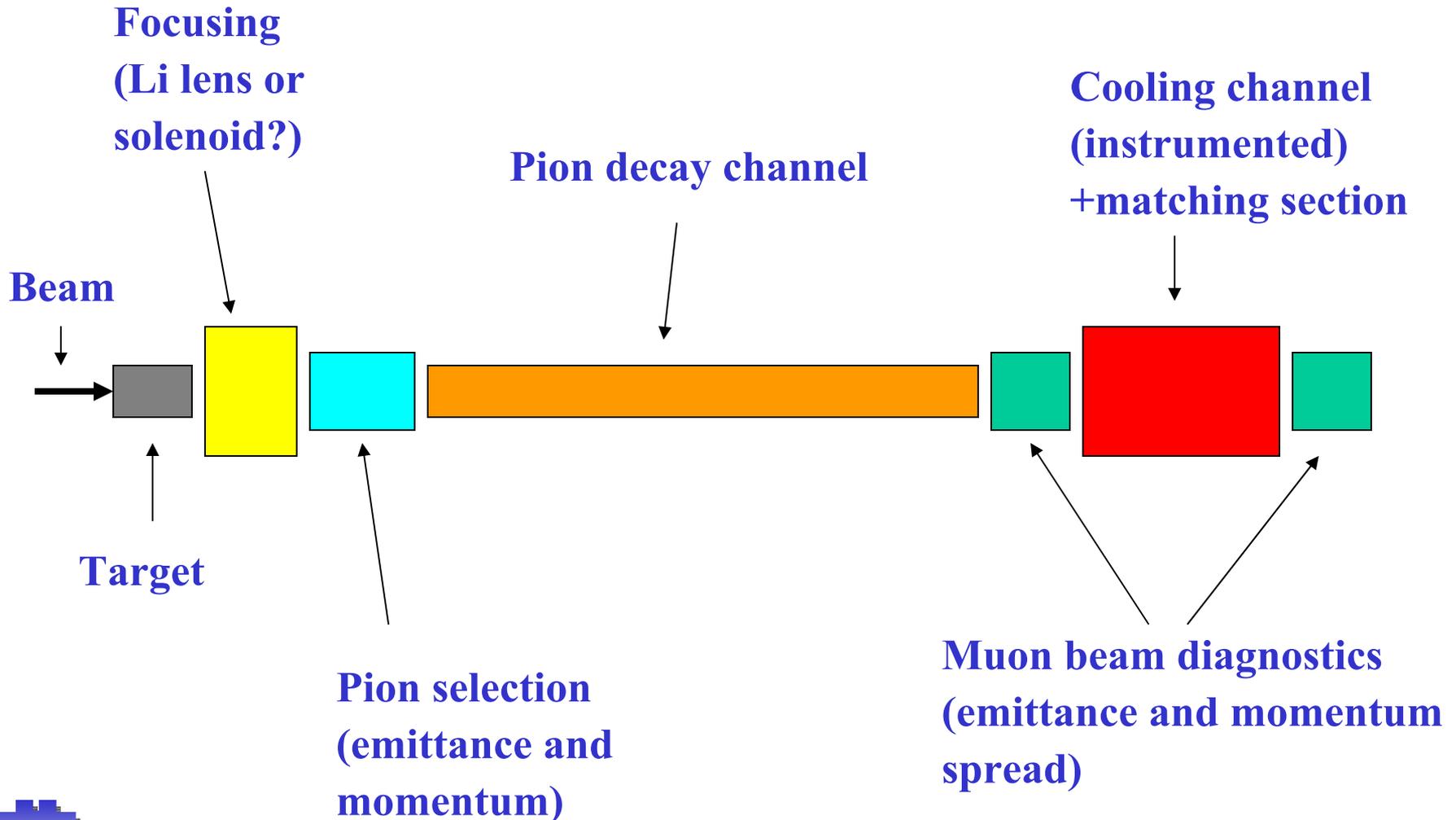


# Open questions for beam experiment

- Can we get "sufficient" muon beam intensity in a "small enough" emittance?
  - What is "sufficient" and "small enough"?
  - MTA? MiniBoone? Pbar target?
- Can we measure the beam properties accurately enough to detect cooling?
  - Expected cooling, instrument accuracy, beam line design...



# Conceptual setup



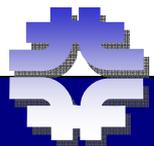
# Target, focussing, selection and decay

- Stopping target?
  - Radiation protection...
- Solenoid or Li lens for focusing?
  - Implications for angular momentum of beam
  - Can we use pbar lens?
- Muons are hard to collimate
  - Need to collimate and momentum select the pions
  - Reduces intensity
- Decay section length?
  - $c\tau$  of pions is 7.8 m



# What muon beam diagnostics?

- For a beam, can only measure profiles
  - Need multiple profiles.
  - Need suitable optics between monitors to disentangle phase space parameters and emittance.
  - Need high dispersion region to get momentum spread.
  - Compatible with solenoid optics?
  - Is there enough space?



# Acceptance of HCC?

- Need close to 100% transmission for a beam experiment!
  - Need to verify by current measurement!
  - What is the largest emittance we can use (and what are the matched phase space parameters)?
  - Is the cooling as efficient for a beam that does not fill the acceptance?



# What do we really want to measure?

- Critical thing is to show longitudinal cooling in HCC (?)
  - Can the HCC be re-optimized to cool more longitudinally (at the expense of transverse cooling)?
  - How big is the cooling effect in this case?
  - Do we need a momentum-spread dominated beam to get good measurement accuracy?
  - Do we care about the time coordinate?



# Possible locations and issues

- MTA
  - Probably enough muons (?)
  - Space, shielding
- MiniBoone line
  - Ample # of muons
  - No facilities (CRYO etc)
  - Availability?
- Pbar?



# Primary action Items

- Find out the useful emittance and matching parameters into HCC
  - Agree on emittance definition (remember that  $mv=p-qA$ )
- Find out how much muon intensity we can get within this emittance
  - Proton energy (location), target and capture
- Can we measure this beam?

