Imperial College London

Science & Technology Facilities Council

Closing remarks

K. Long, 26 October, 2020

Papers

Title	Contact	Target date (03-Sep-20 v23)		Comments
		Preliminary	Final	
Measurement of multiple Coulomb scattering of muons in lithium hydride	J. Nugent	Jun18; CM51	Apr19	New MICE Note draft; working towards first draft of publciation
Performance of the MICE diagnostic systems	P. Franchini	Feb19; CM53		Wise-people recommended working towards draft of publication
Phase-space density/emittance evolution review paper				
Flip mode	P. Jurg	TBD		Preliminary results to conferences this summer
Solenoid mode	T. Lord	TBD		Preliminary results to conferences this summer
Phase-space density/KDE/6D-emittance evolution	C. Brown	TBD		Progress on applying analysis to data
Measurement of multiple Coulomb scattering of muons in LH2	G. Chatzitheodoridis/J. Nugent	TBD		Awaits completion of LiH paper
Field-on measurement of multiple Coulomb scattering	A. Young	TBD		Analysis underway
LH Scattering	G. Chatzitheodoridis	TBD		Analysis underway

Performance of the MICE diagnostic system

The MICE Collaboration

Abstract

Muon beams of low emittance provide the basis for the intense, well-characterised neutrino b
of a neutrino factory and for multi-TeV lepton-antilepton collisions at a muon collider. The int
tional Muon Ionization Cooling Experiment (MICE) has demonstrated the principle of ioniz
cooling, the technique by which it is proposed to reduce the phase-space volume occupied b
muon beam at such facilities. This paper documents the performance of the detectors us
MICE to measure the muon-beam parameters.

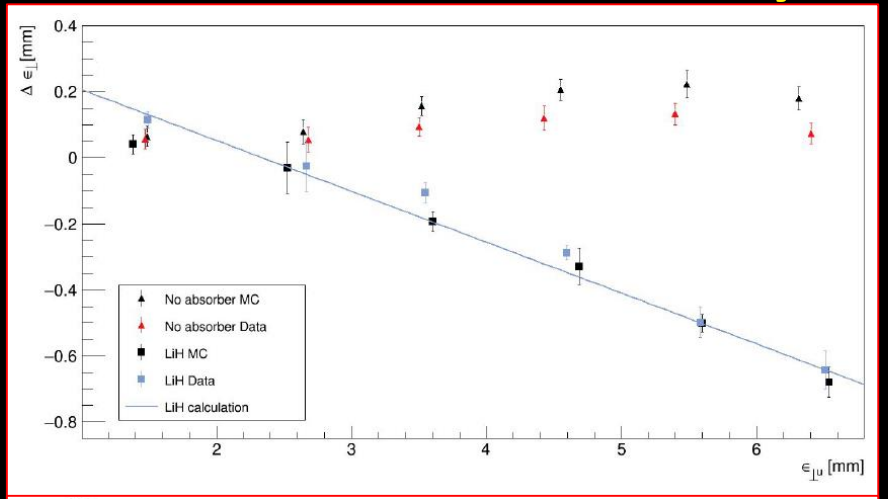
Field off Scattering Studies in Lithium Hydride

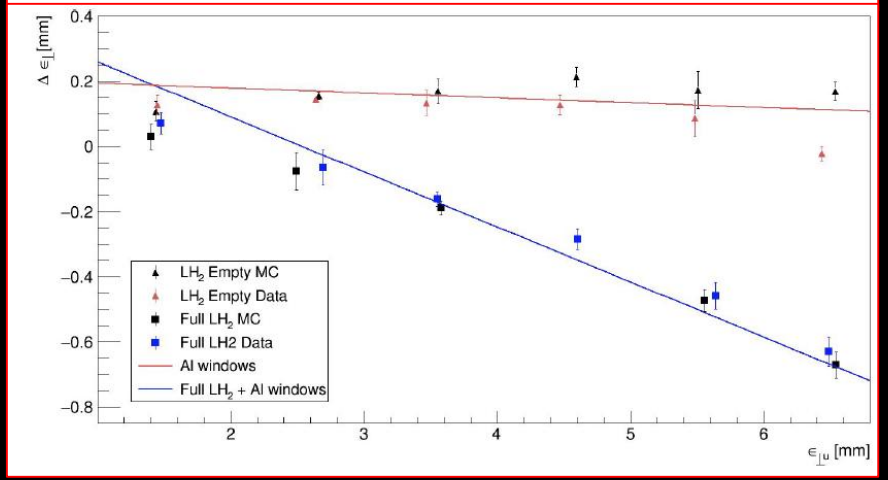
R. Bayes, J. C. Nugent & P. Soler
The MICE collaboration

Multiple coulomb scattering is a well known electromagnetic phenomenon experienced by charged particles traversing materials. However, from recent measurements by the MuScat experiment it is known that the available simulation codes, specifically GEANT4, overestimate the scattering of muons in low Z materials. This is of particular interest to the Muon Ionization Cooling Experiment (MICE) which has the goal of measuring the reduction of a muon beam emittance induced by energy loss in low Z absorbers. Multiple scattering induces positive changes in the emittance in contrast to the reduction due to ionization energy loss. It therefore is essential that MICE measures multiple scattering for its absorber materials; lithium hydride and liquid hydrogen; and validate the multiple scattering against known simulations. MICE took data with magnetic fields off suitable for multiple scattering measurements in the spring of 2016 using the lithium hydride absorber. The data was compared to a convolution between data collected with no absorber and specific models of scattering in lithium hydride, including the default GEANT4 model. A deconvolution procedure was also applied to the data to extract the scattering distribution within the absorber material. The results for the comparisons and the deconvolved scattering widths are reported for the three nominal beam momenta; 172 MeV/c, 200 MeV/c, and 240 MeV/c. A momentum dependent measurement of multiple scattering in lithium hydride was also conducted and the result was compared to muon beams used to collect the lithium hydride data allow momentum dependent measurements of the scattering to be conducted and compared with the accepted scattering model.

Flip-mode emittance evolution; PJ

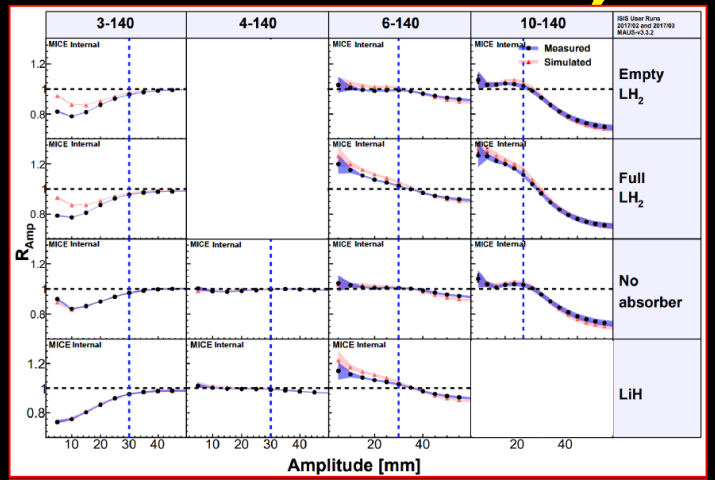
- **Good progress:**
  - **Convincing data/MC comparison**
- **Issues:**
  - **Systematic studies to accommodate data/MC differences**

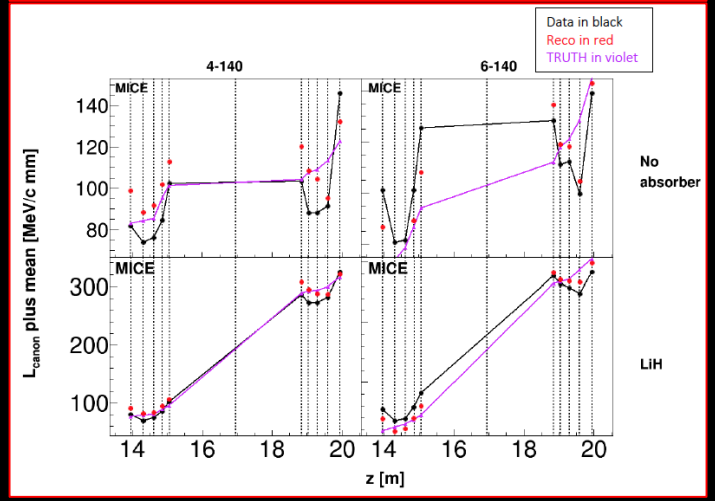




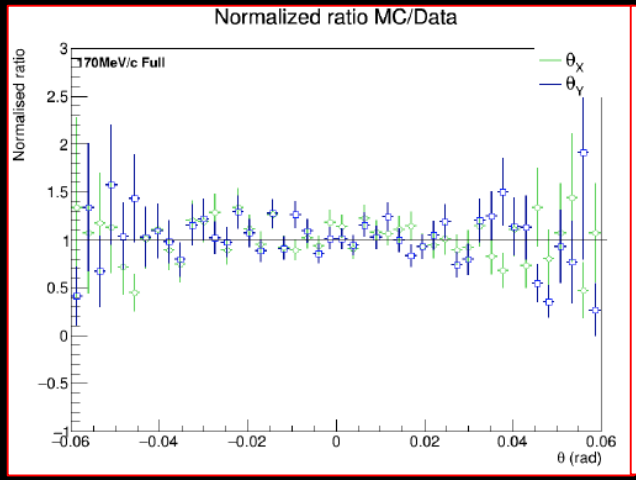
Emittance evolution, solenoid mode; TL

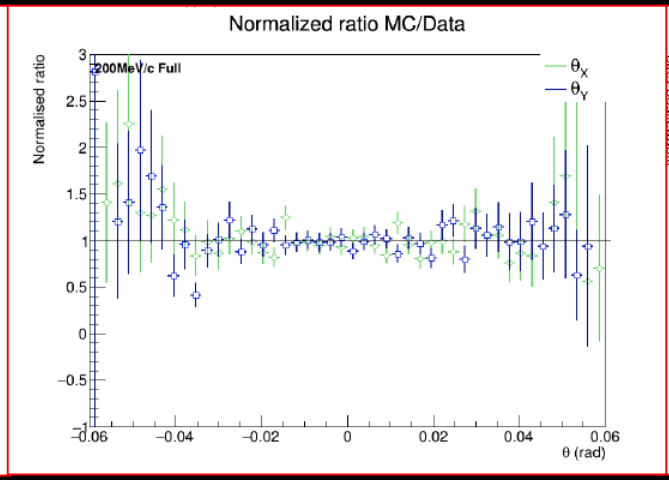
- Good progress:
  - Convincing data/MC comparison
  - Canonical angular mmtm:
    - Difficult analysis:
      - Detail of field, reconstruction …
    - But demonstration of gain of L_{canon}
- Issues:
  - Systematics:
    - Probably both for full amplitude analysis and L_{canon}

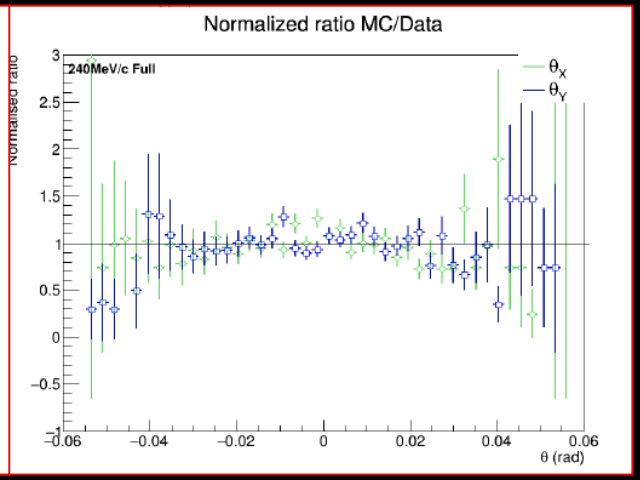




LH_2 scattering: GC

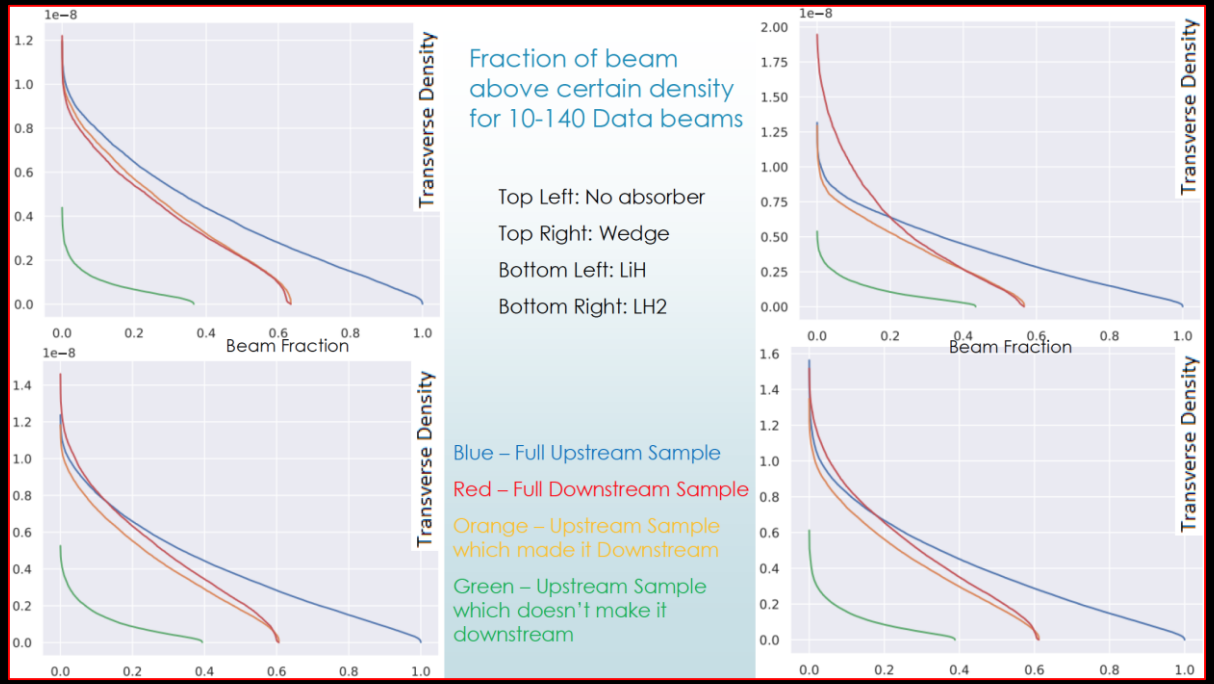






- **Good progress:**
  - **Full analysis chain; data is generally well described by MC**
- **Issues:**
  - **Some issues in selection and data/MC comparison**
  - **Unfolding and systematics**

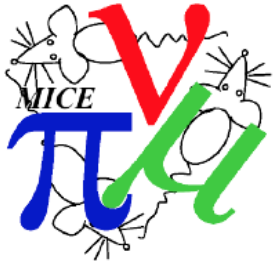
Emittance exchange: CB



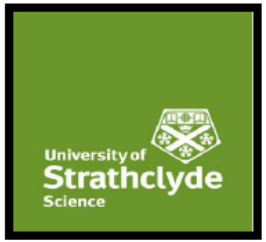
- **Full density analysis chain**
  - **Effects small, analysis subtle**
- **Personal feeling:**
  - **Need an accessible measure to demonstrate an effect exists**

Field-on scattering: AY

- Good progress on event selection and cut studies



Comparison of Fiducial cut with tracks in DST
LiH 170MeV/c



No Other Cuts

Measured

	Track in DST	No Track in DST
Pass Fiducial Cut	211192	87597
Fail Fiducial Cut	88282	465597

Monte Carlo

	Track in DST	No Track in DST
Pass Fiducial Cut	161333	60980
Fail Fiducial Cut	93270	214401

All Cuts

	Track in DST	No Track in DST
Pass Fiducial Cut	42384	6554
Fail Fiducial Cut	18797	98727

	Track in DST	No Track in DST
Pass Fiducial Cut	26006	1110
Fail Fiducial Cut	14806	33110

Future meetings

- 2020:
  - CM58 – offer to co-organise with iMC/nuSTORM
    - March 2021
  - CM59:
    - October 2021

- Analysis meetings:
  - 05Nov20
  - 19Nov29

- Analysis workshop:
  - 17Dec20

- Video conferences:
  - 03Dec20
  - 04Feb21

- Muon collider cooling:
  - 12Nov20
  - 26Nov29
  - 10Dec20

Thanks to:

- You all for joining, presenting and arguing!
- See you at CM58 on ZOOM in Mar21