Analysis Status

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Reminder – Publication plan

Title	Contact	Target date		Comments
		Preliminary	Final	Jan-19
Phase-space density/emittance evolution; rapid communication	C. Rogers	Apr18 w/s	Apr19	4th referees meeting before around CM53 (21, 22Feb19, RAL)
Measurement of multiple Coulomb scattering of muons in lithium hydride	J. Nugent	Jun18; CM51	Apr19	Unfolding issues; perhaps resolved; CM53, 21,22Feb19, RAL
Performance of the MICE diagnostic systems	P. Franchini	Feb19; CM53		Almost complete draft
Phase-space density/emittance evolution review paper	C. Hunt	TBD		Analysis now advancing
Phase-space density/KDE/6D-emittance evolution	C. Brown	TBD		Thesis published on initial analysis; taken over by C.Brown
Measurement of multiple Coulomb scattering of muons in LH2	J. Nugent	TBD		Awaits completion of LiH paper
Field-on measurement of multiple Coulomb scattering	A. Young	TBD		Analysis underway
First particle-by-particle measurement of emittance in the Muon Ionization Cooling Experiment	V. Blackmore		Jun18, CM51	Accepted by EU Phys. J C; awaiting referees
The MICE Analysis and User Software framework	D. Rajaram	May18 w/s	Jun18, CM51	RAL-P-2018-007; 1812.02674; submitted to JINST; referees comments received

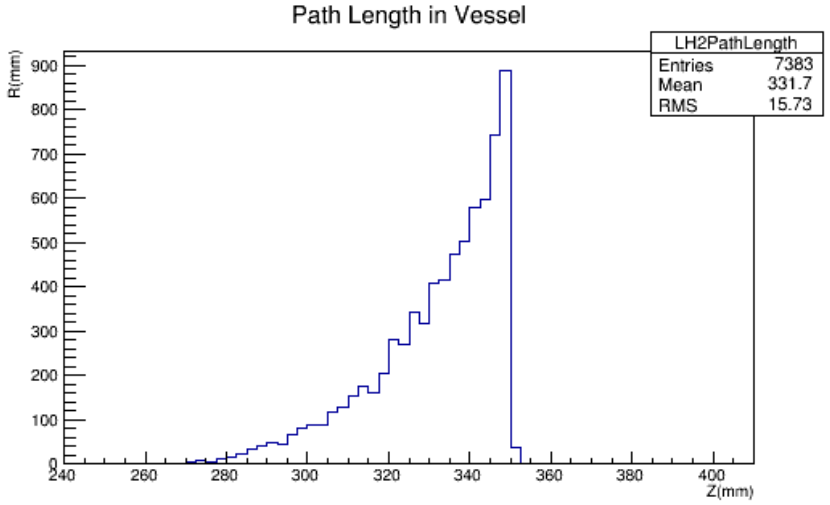
- Status as of CM53
- Few words about each analysis
- More details on the “First observation of cooling” paper

Scattering Analysis

LiH scattering (Nugent)

- Referee's meeting following CM53
- Considering using TOF12 for momentum reconstruction; efficiency issues look too hard to resolve
- Space angle deconvolution looks tricky
  - Does it add to the paper?
- Comments by John N later

IH2 scattering (Gavriil)



- Detailed analysis on path length estimation looks nice
  - Few % “bias” for some tracks
  - Need to understand how this can be treated in the analysis
- Identified possible issue in alignment of detectors
  - Can this be resolved in detail – did we screw up the alignment procedure?
- Need to tackle Particle Identification
  - This will be “new physics” at high momentum – cannot use tracker vs TOF

Field-on scattering

- Should allow larger angles to be measured
- Moving to a full analysis

System/Techiques Papers

System performance

- Too many plots to summarise!
  - 50 pages?
  - Will need some hard-nosed editing
- Getting ready to move to another version

Energy loss

- Good analysis
- Demonstrate good agreement between data, theory and MC
- But missing details of the analysis
- Missing some MC

Optics

- Optical aberrations study is proving interesting
  - Should be valuable to the community
  - But need to understand what conclusions can be drawn
- Still do not have basic optical alignment in place

Emittance Evolution Papers

Detailed emittance evolution

- Scope of the paper is huge
- Still working through MC and data basics
- Some discussion about splitting the paper into smaller chunks?

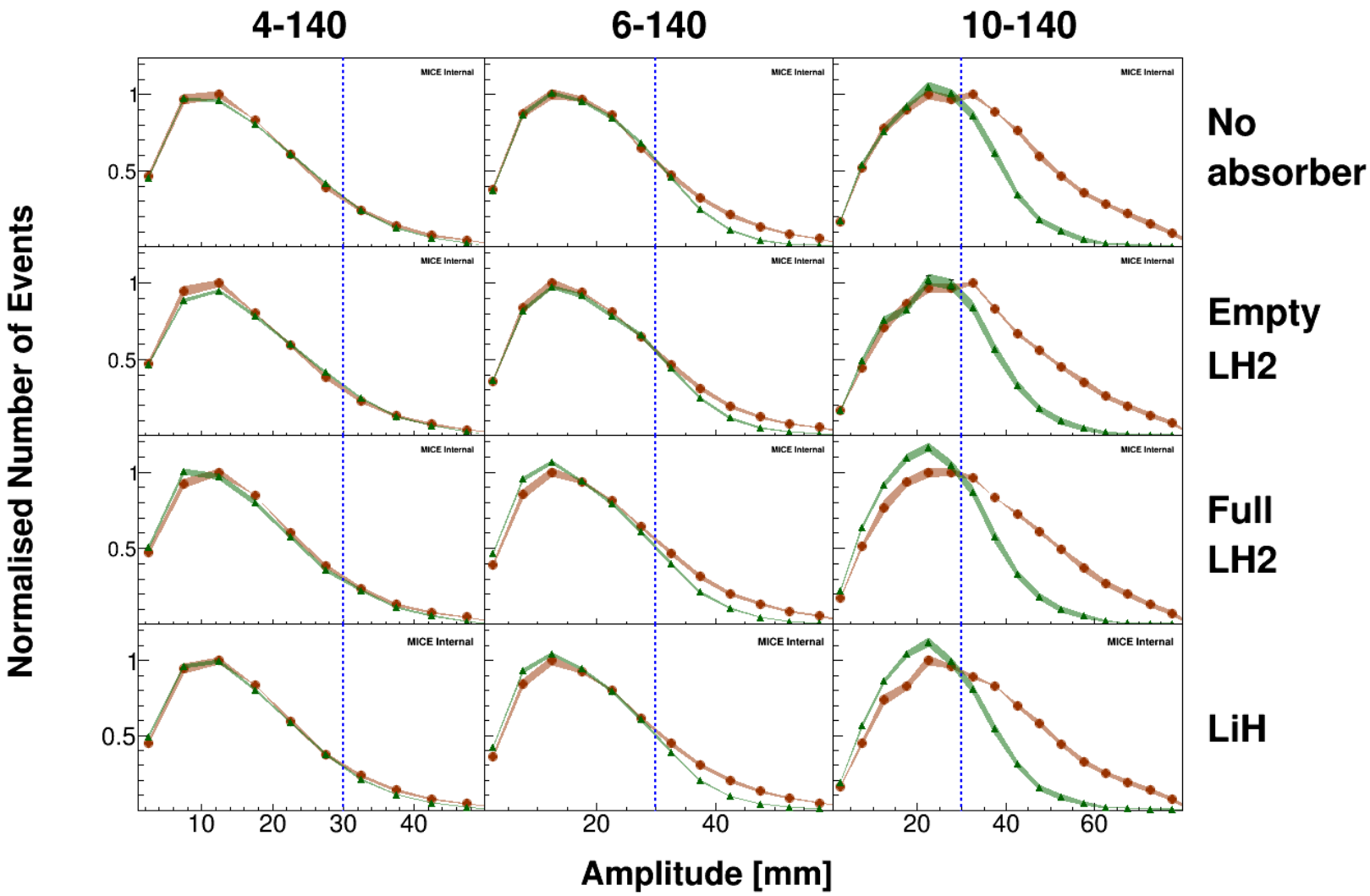
Wedge analysis

- Getting to grips with the analysis
  - Beam weighting/sampling
  - Phase space density or equivalent analysis
- Need to crystallise this into a full analysis loop
  - Sample selection
  - Detector resolution and efficiency
  - Systematic and Statistical uncertainties
  - Result

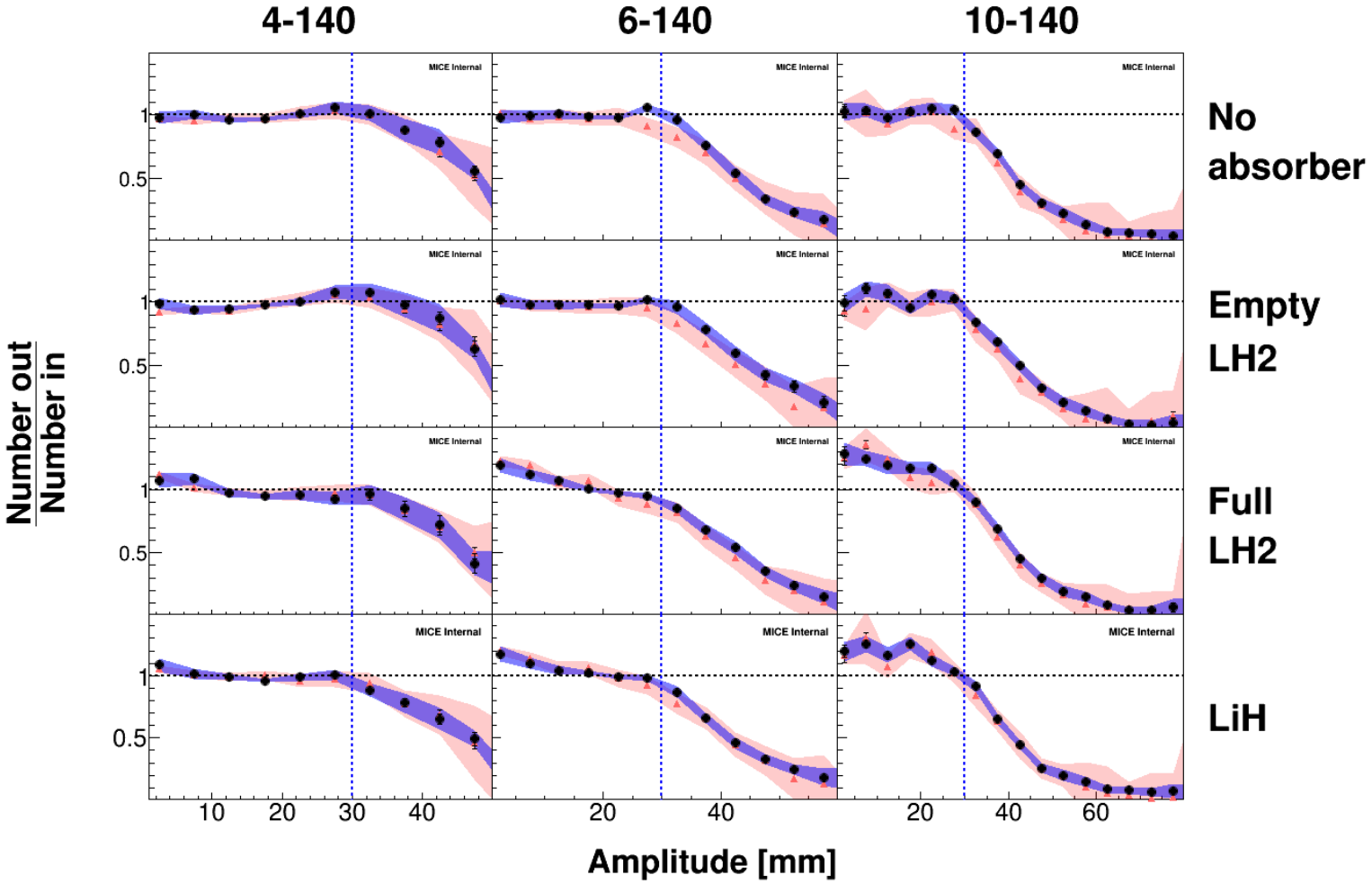
First observation paper

- Updates since CM53
  - Slight change to amplitude calculation
  - Modified systematic uncertainty
  - Add a plot showing uncorrected amplitudes
- First reading of paper by MICE referees
  - Consider replacing amplitude “CDF ratio” plot with “density ratio” plot
  - Various discussion on words and emphasis
- Work in progress
  - Move to production reco

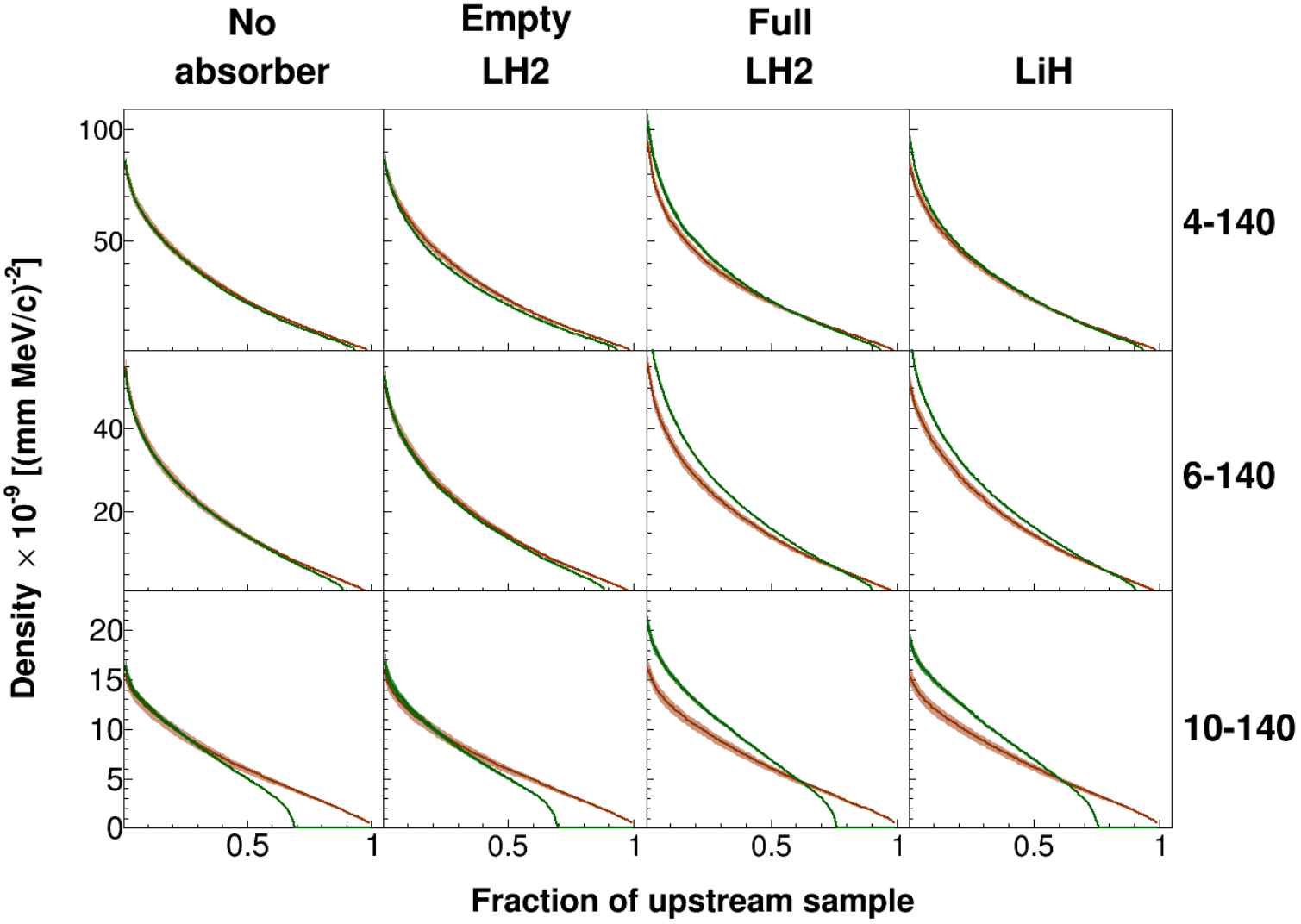
Updated pdf


4-140
6-140
10-140
MICE Internal
Normalised Number of Events
Amplitude [mm]
No absorber
Empty LH2
Full LH2
LiH

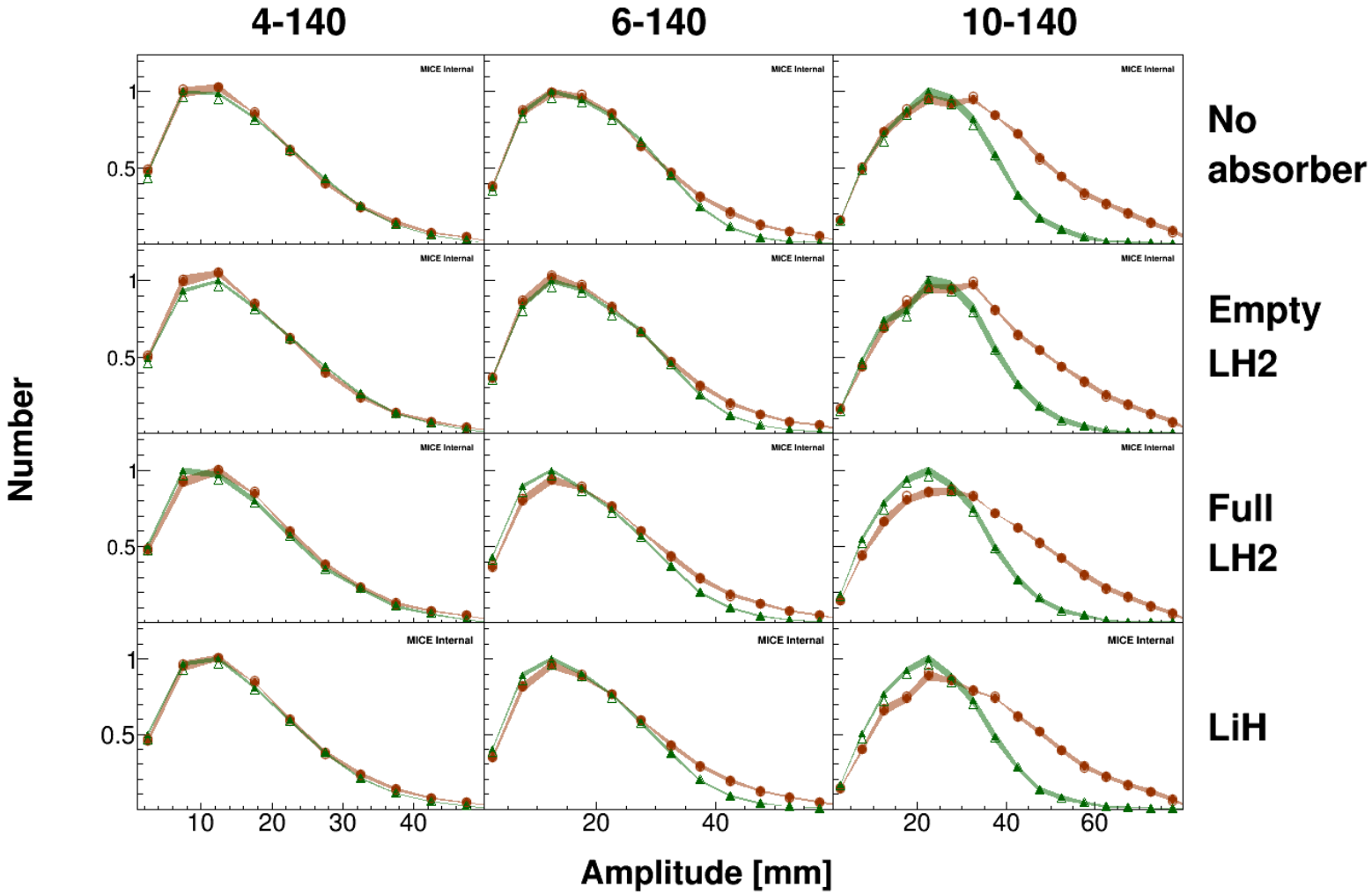
Updated pdf ratio



Updated density profile



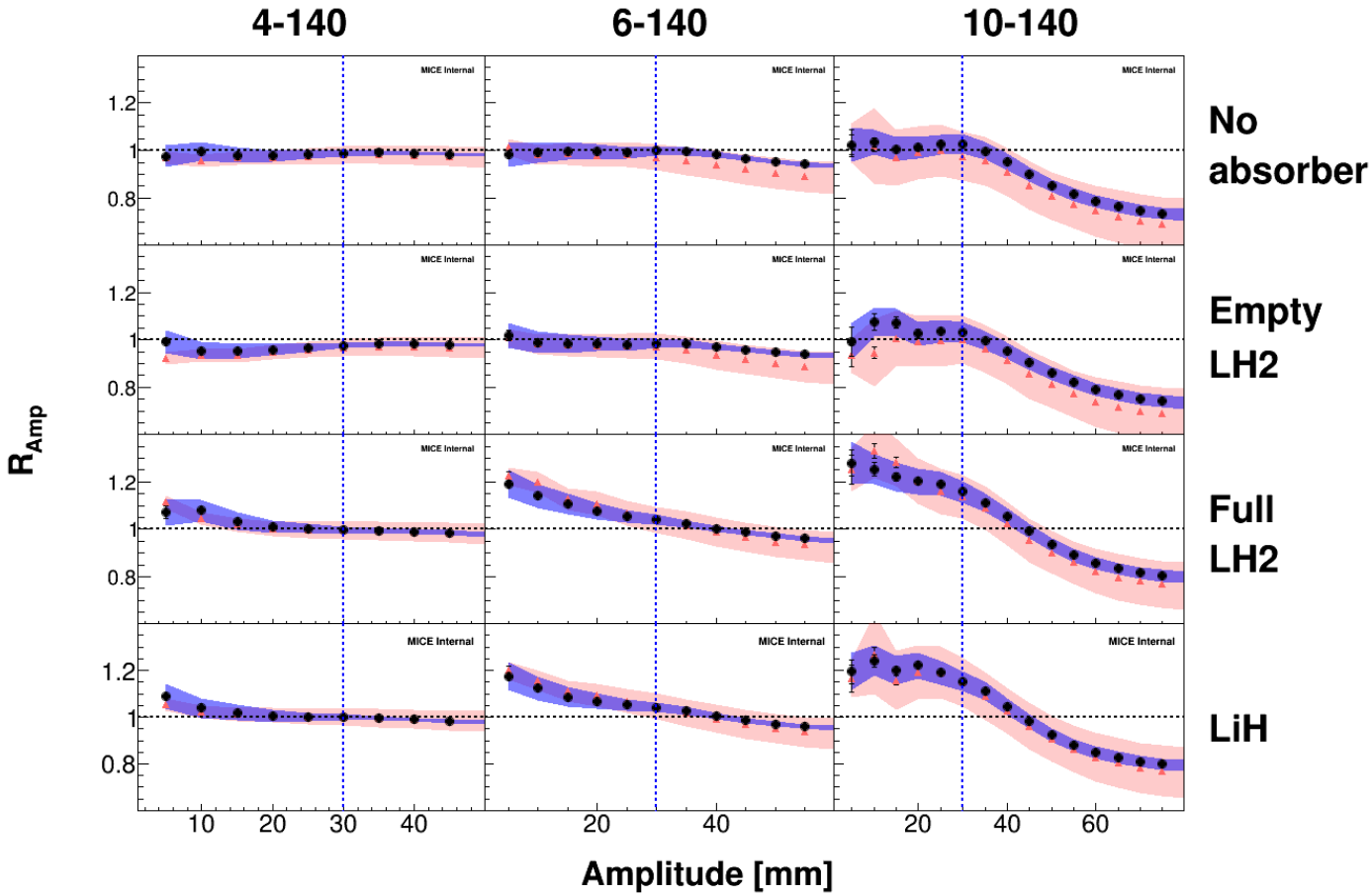
Uncorrected vs corrected amplitude pdf



Discuss – "6th figure"

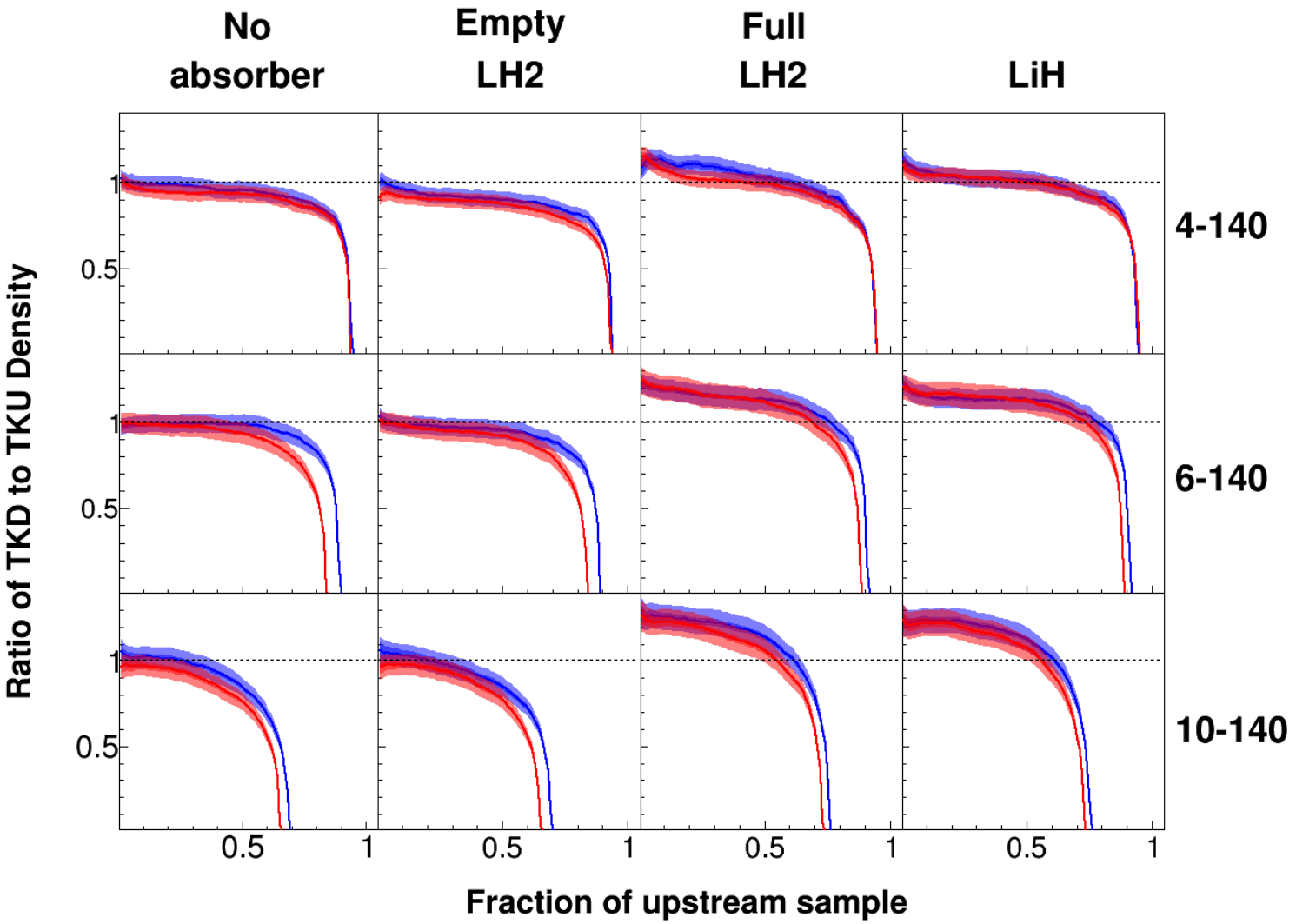
- We are allowed 6 figures
  1. Schematic
  2. Phase space distributions
  3. Amplitude PDF
  4. Ratio of amplitude PDFs
  5. **Ratio of amplitude CDFs**
  6. Phase space density vs fraction of beam
- Propose
  1. Schematic
  2. Phase space distributions
  3. Amplitude PDF
  4. Ratio of amplitude PDFs
  5. Phase space density vs fraction of beam
  6. **Ratio of phase space densities**

CDF Ratios



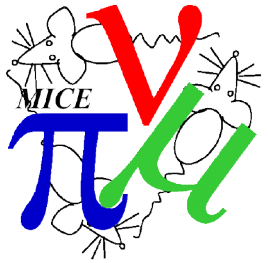
- Ratio of amplitude CDFs
  - Consider Cumulative Density Function – the number of particles enclosed by a given amplitude ellipse
  - Take ratio of downstream to upstream CDF

Density Ratios



- Error on transmission is underestimated

First observation of cooling paper



First demonstration of ionization cooling using the Muon Ionization Cooling Experiment

MICE collaboration

Muon beams of high brightness have the potential to carry the ... new phenomena in lepton-antilepton collisions to extremely high energy. Such beam... exploited to provide uniquely well-characterised neutrino beams. The muon beam ... through the decay of pions produced in the interaction of a proton beam with a targ... high-brightness beam then requires that the phase-space volume occupied by th... duced (cooled). Ionization cooling is the novel technique by which it is proposed ... m. The Muon Ionization Cooling Experiment (MICE) collaboration constructed a ... ization cooling cell and used it to provide the first observation of ionization cooling ... the pioneering measurements made by the MICE collaboration. These results have sig... mplications for the future development of high-brightness muon beams for particle physics.

- First reading of paper by referees
- Decision/revision of which plots should be included
- Discussion of wording and level of emphasis
- Aim for revised draft early May