



Emittance Evolution



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Overview

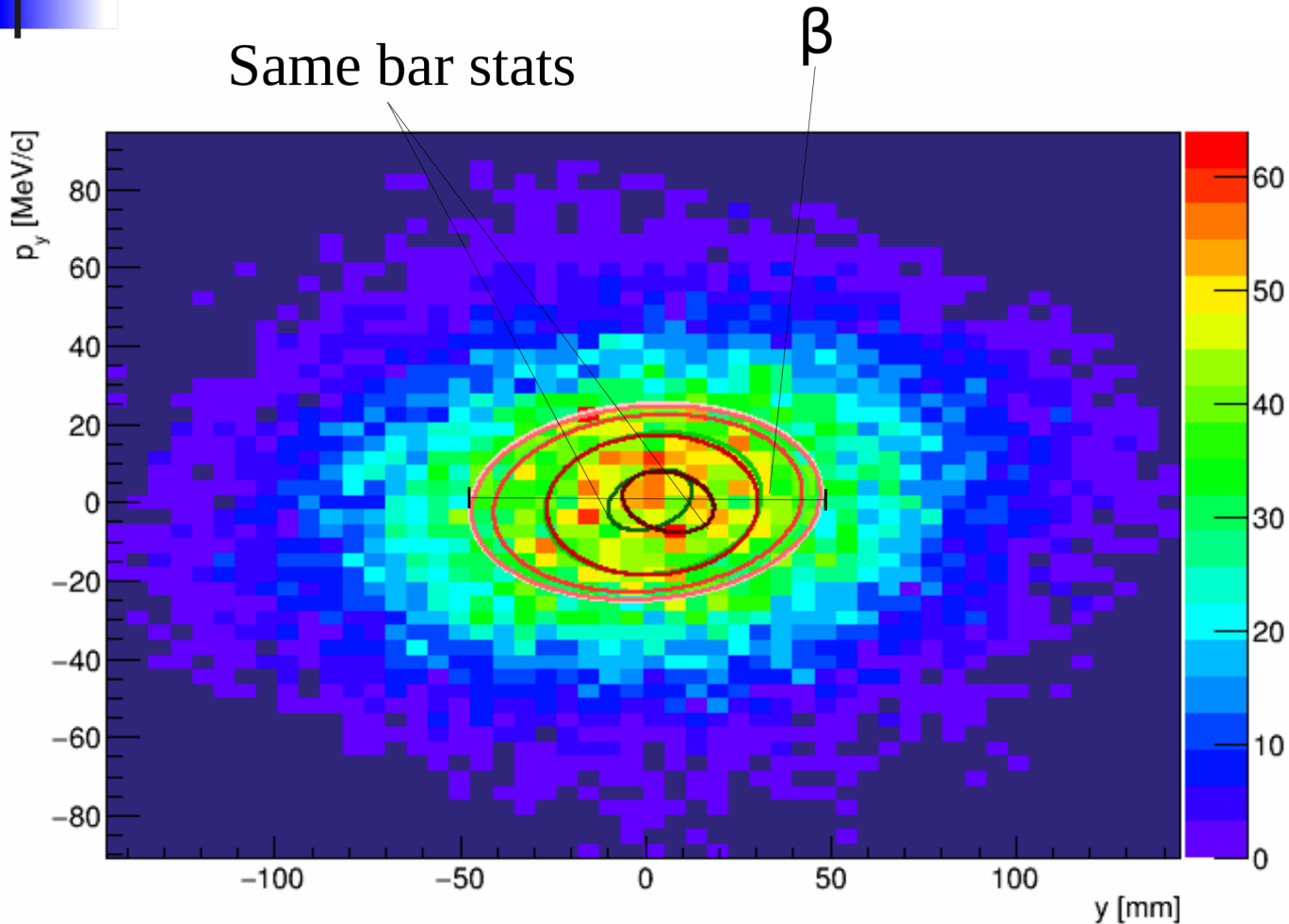


- Updates since CM53
 - Slight change to amplitude calculation
 - Modified systematic uncertainty
 - Add a plot showing uncorrected amplitudes
- First reading of paper by MICE referees
 - Consider replacing amplitude “CDF ratio” plot with “density ratio” plot
 - Various discussion on words and emphasis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

Reminder: amplitude routine

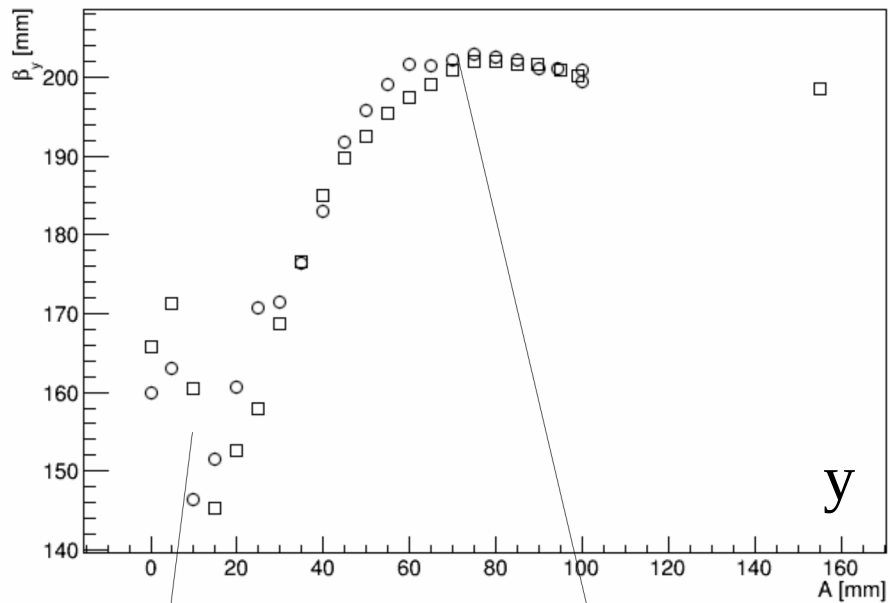
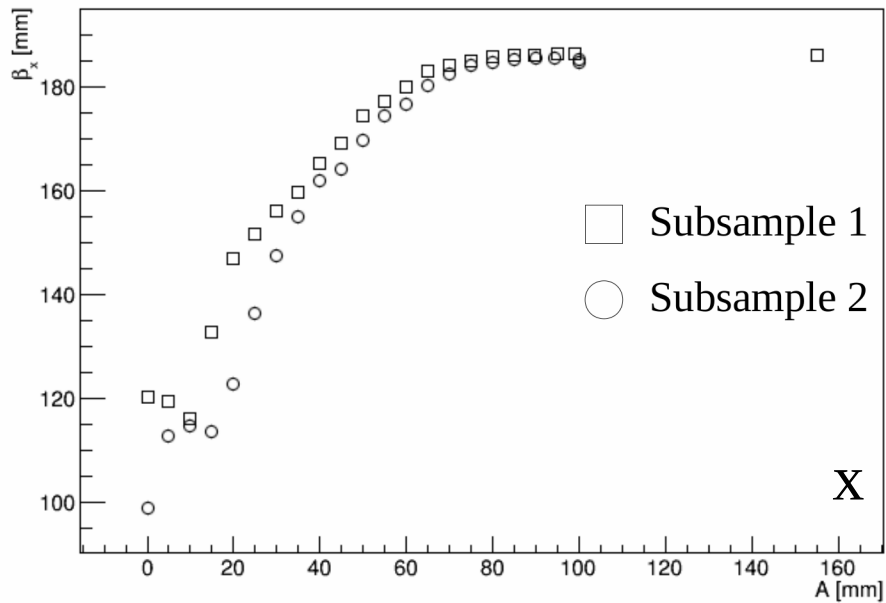
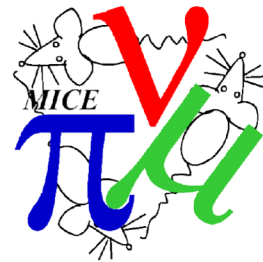


- Amplitude is calculated via
 - $A = \epsilon_n \underline{u}^T \underline{V}^{-1} \underline{u}$
- V is covariance matrix; susceptible to tails of distribution
- Introduce modified calculation uses V only for events in the same A bin and lower
 - Iterate over all events in the A bin until there are no more migrations to higher A
- At low A fewer events are included in the calculation
 - V becomes dominated by statistical effects
 - Stop recalculating V for low bins?



- E.g. y - p_y space
 - Difference between subsamples is worse
- Characterise by β , the width of the ellipse normalised by the area

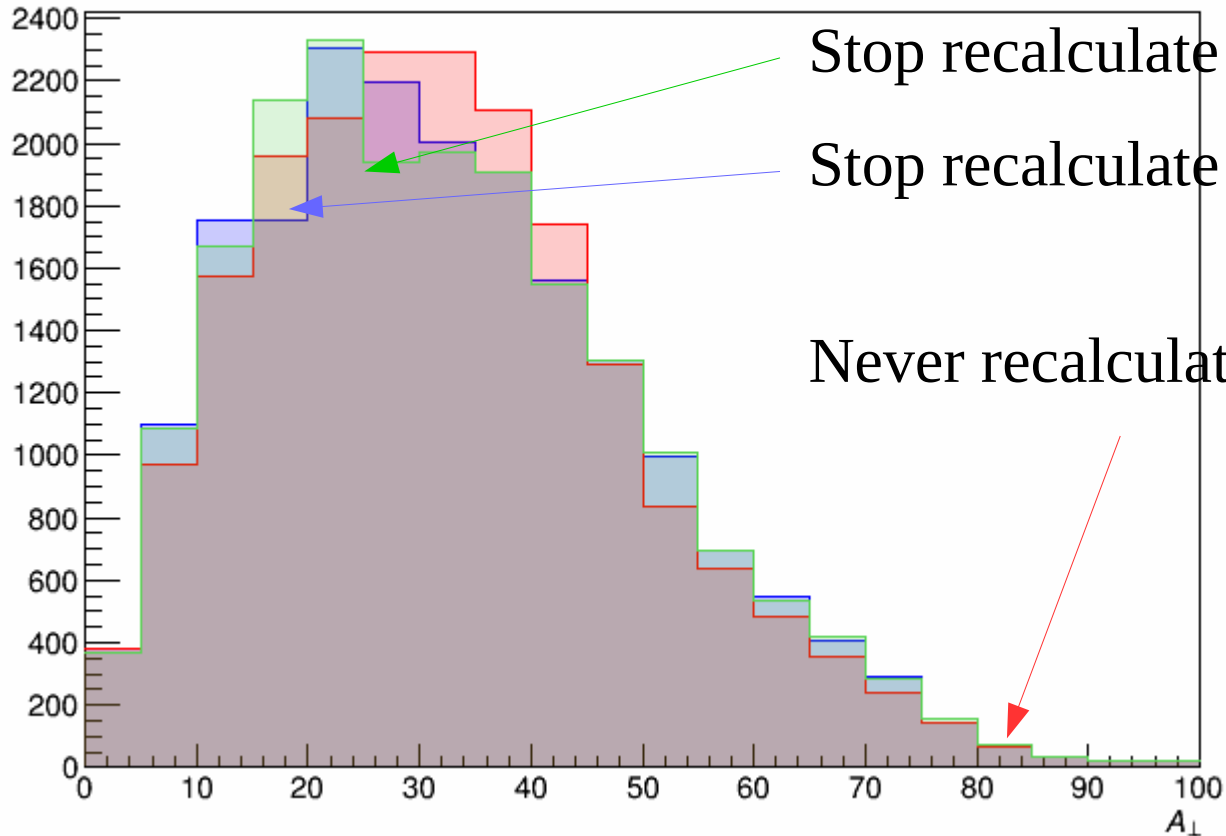
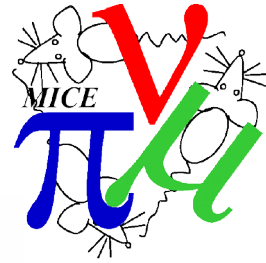
Beta x/y vs bin



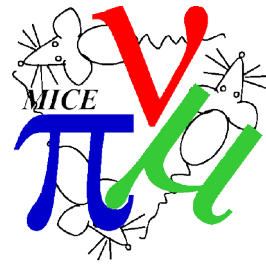
Statistical
variation

Well
conditioned

Effect of V recalculation

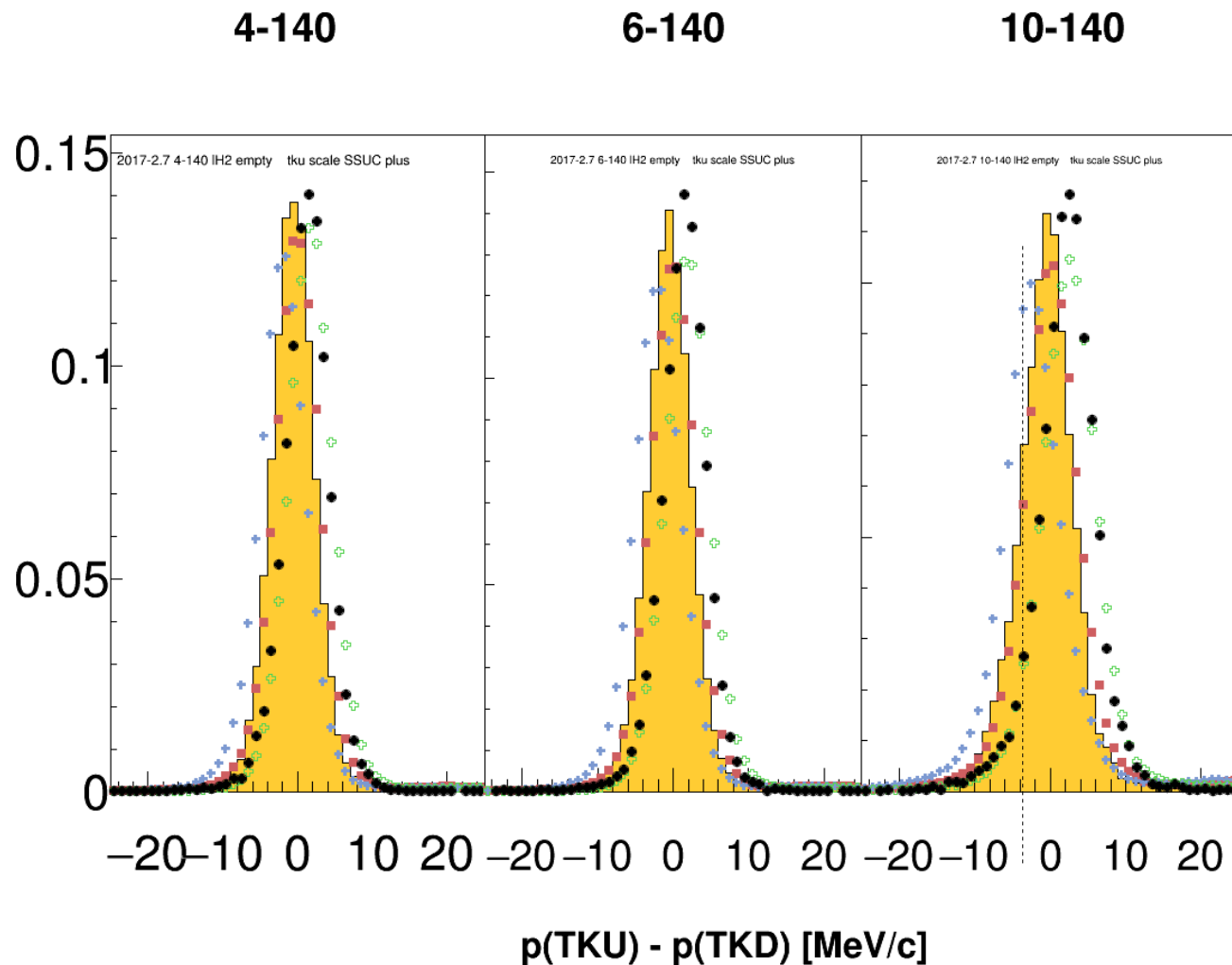
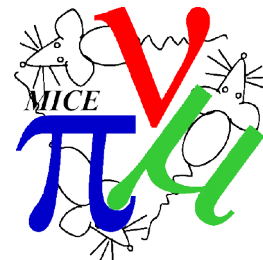


Reminder: systematics



- Momentum discrepancy between TOF01, TKU, TKD
- Included a big field uncertainty for TKU and TKD in systematics
 - 3 % TKU
 - 3 % TKD
- Now uncertainty in field is
 - 3 % TKU
 - 0.3 % TKD

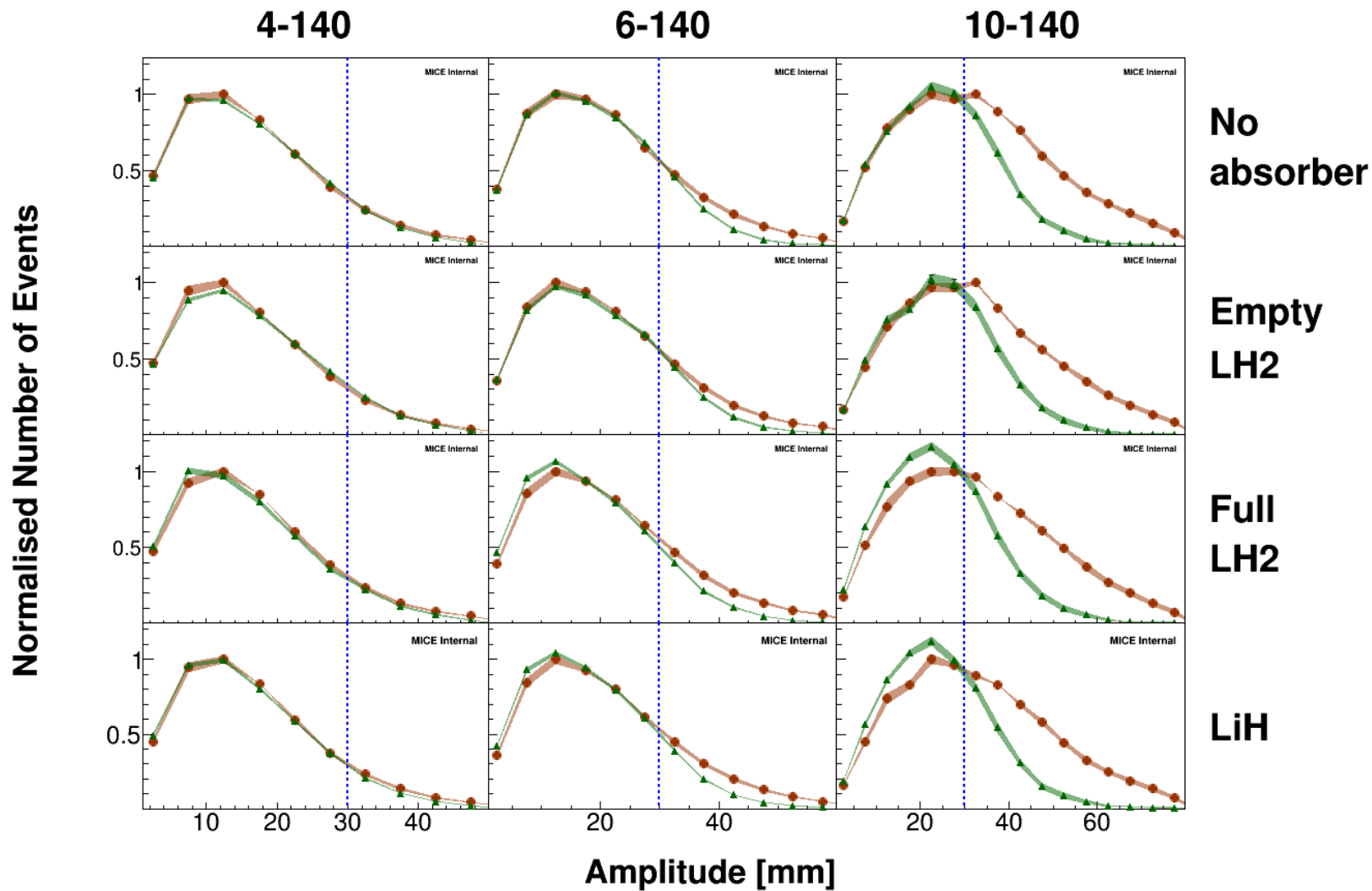
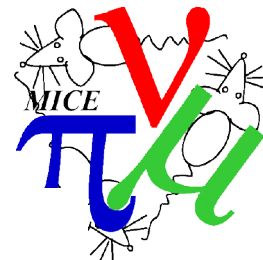
Why 3 % CC offset? - delta p



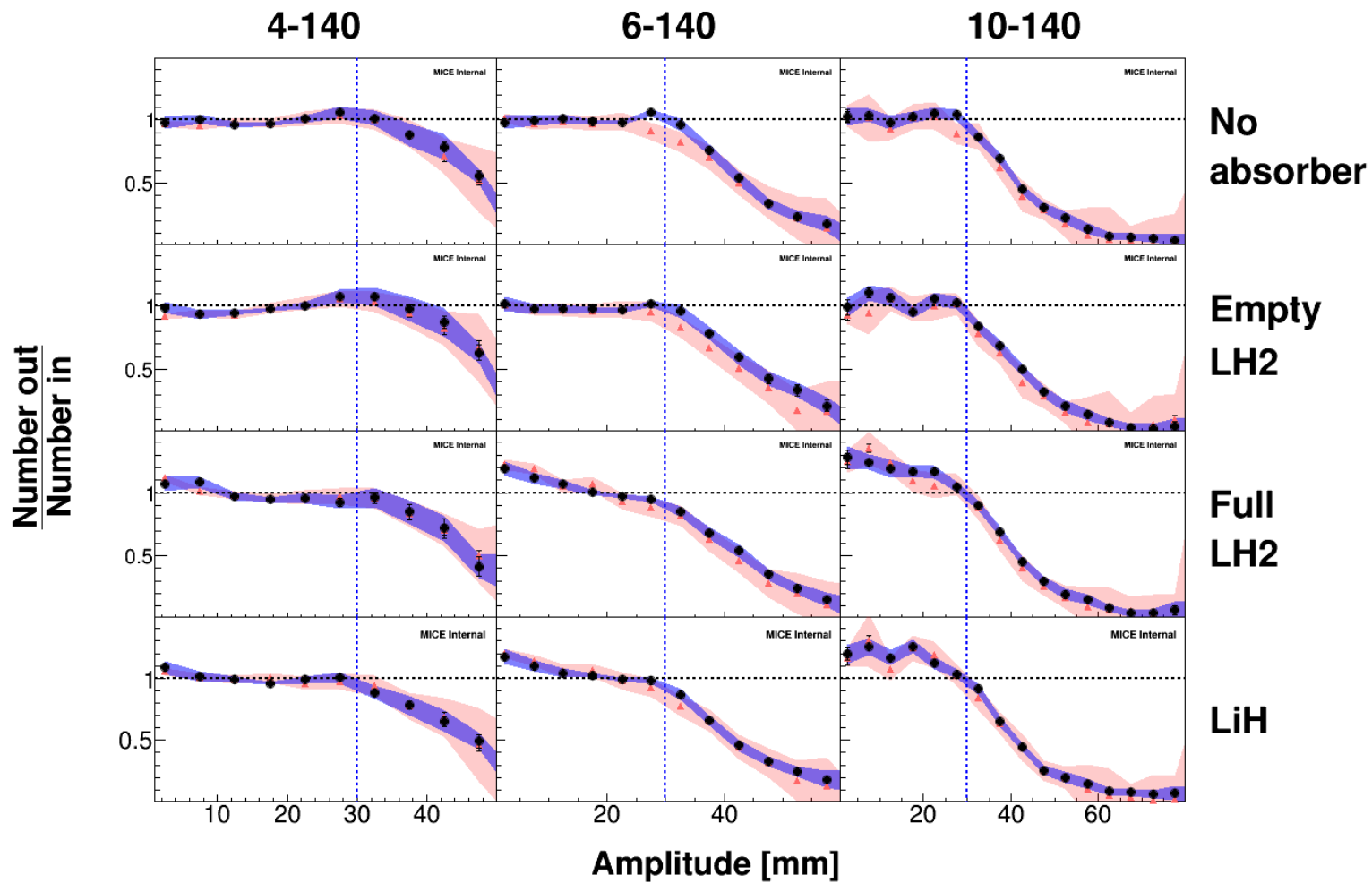
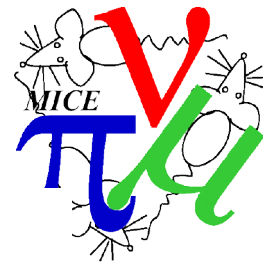
SSU CC

- Recon
- Full MC
- Default hybrid MC
- + Positive shift hybrid MC
- + Negative shift hybrid MC

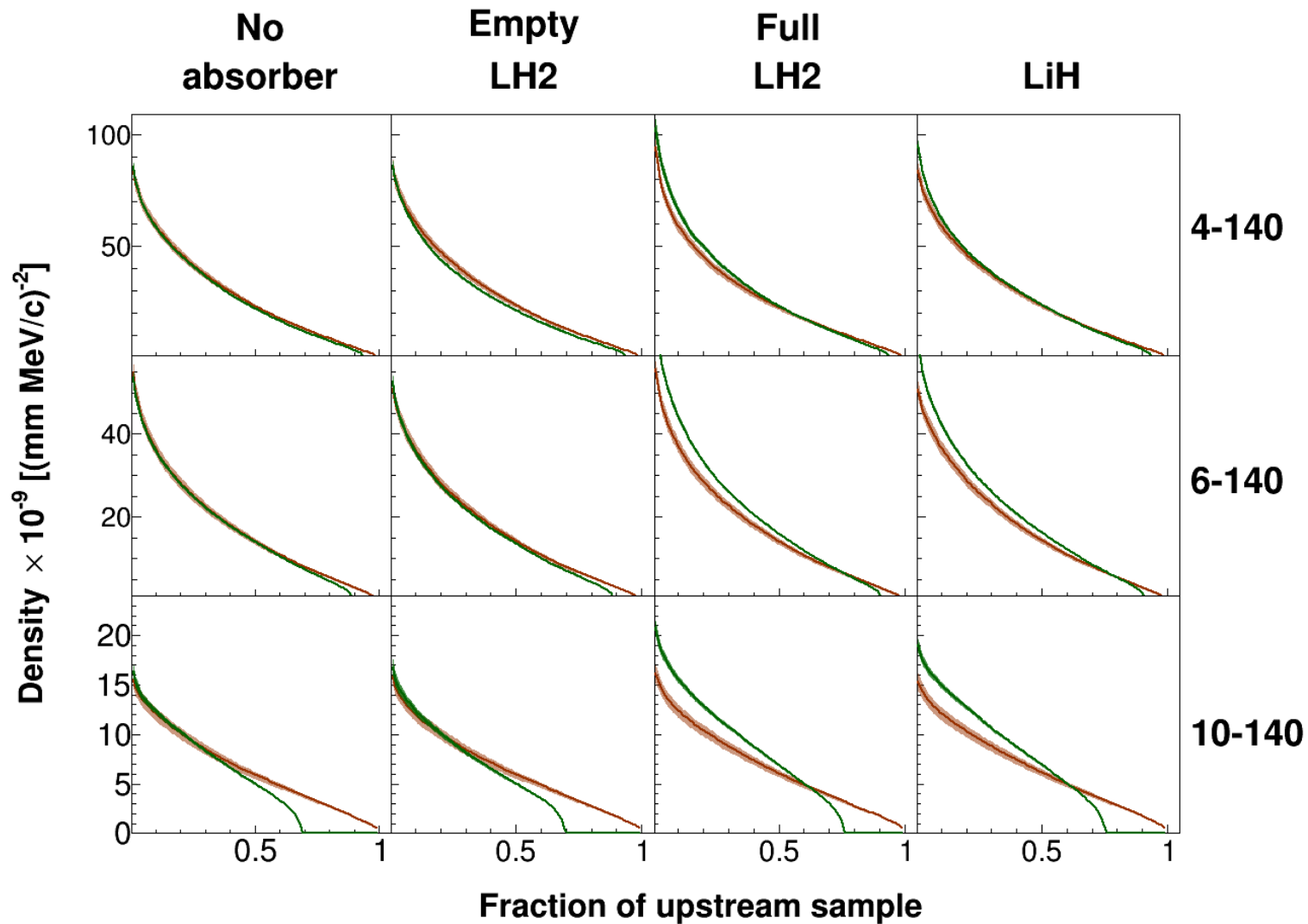
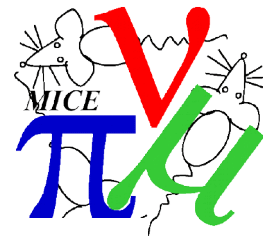
Empty
LH2



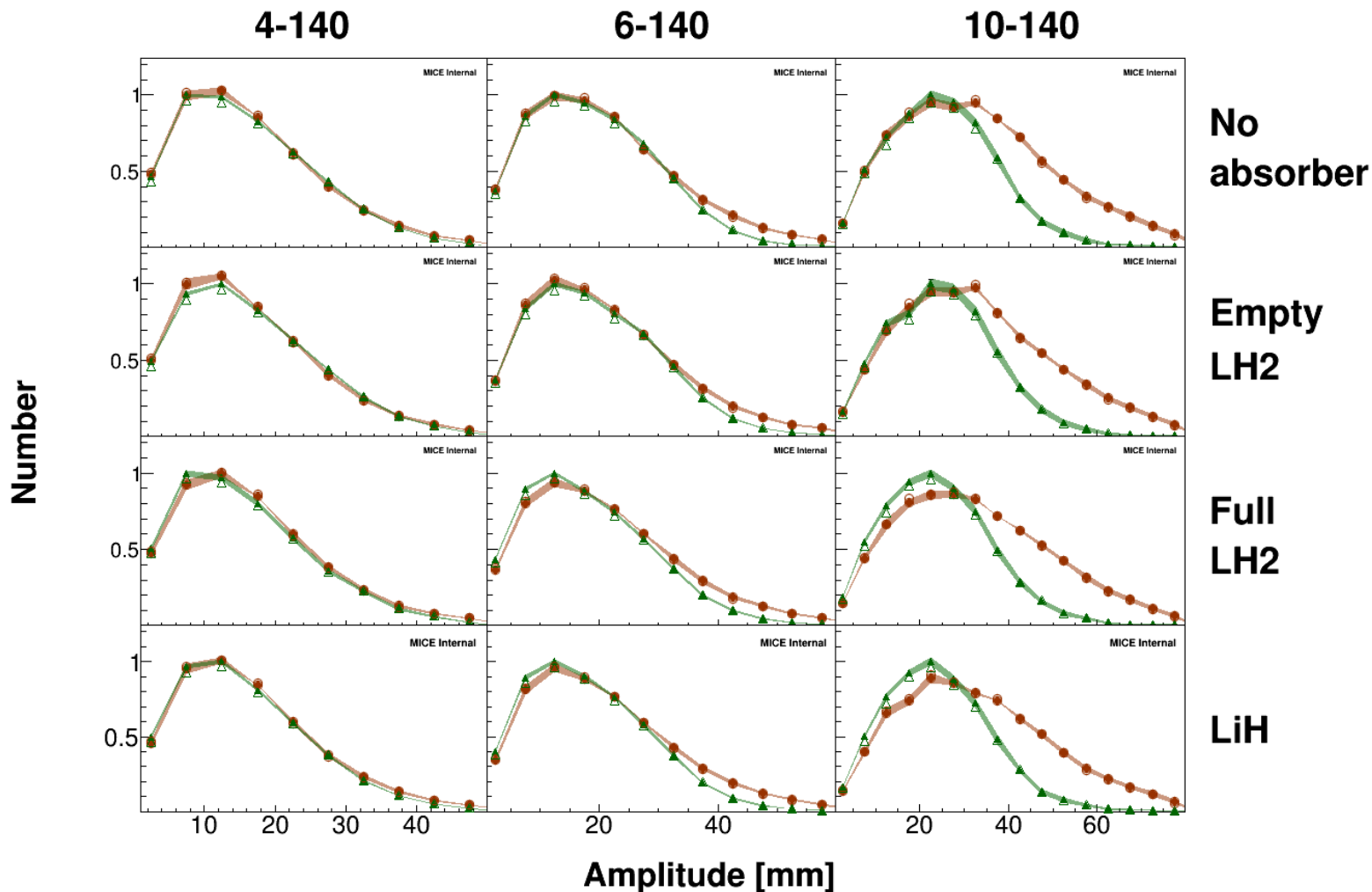
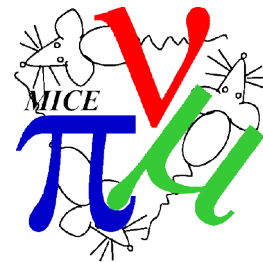
Updated pdf ratio



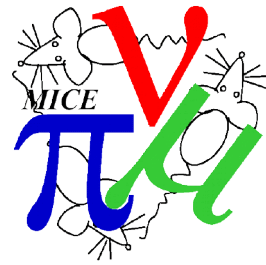
Updated density profile



Uncorrected vs corrected amplitude pdf



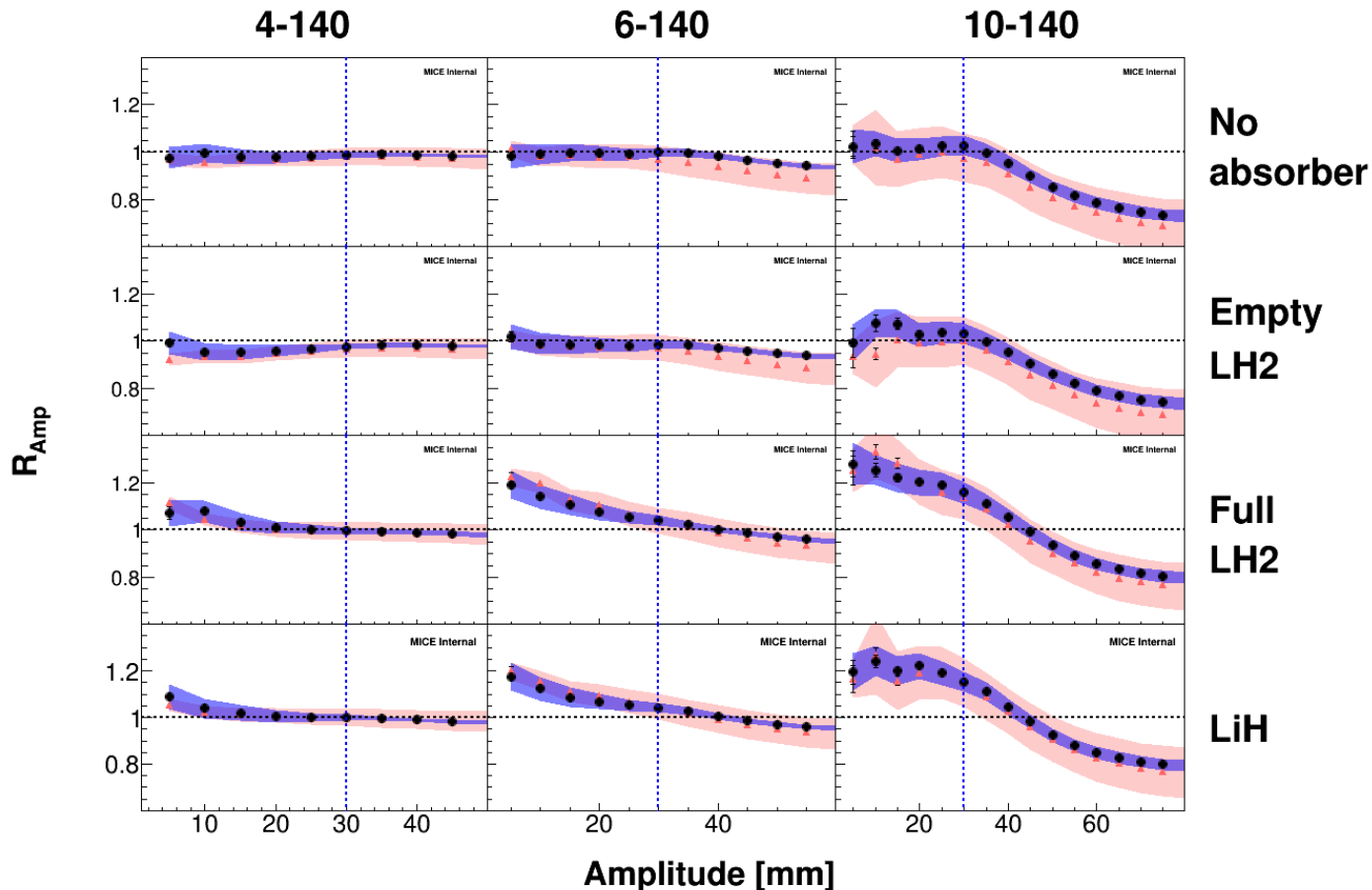
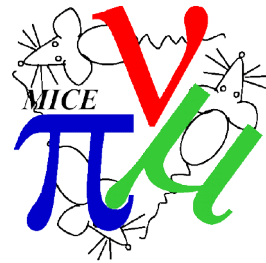
Discuss – “6th figure”



- 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

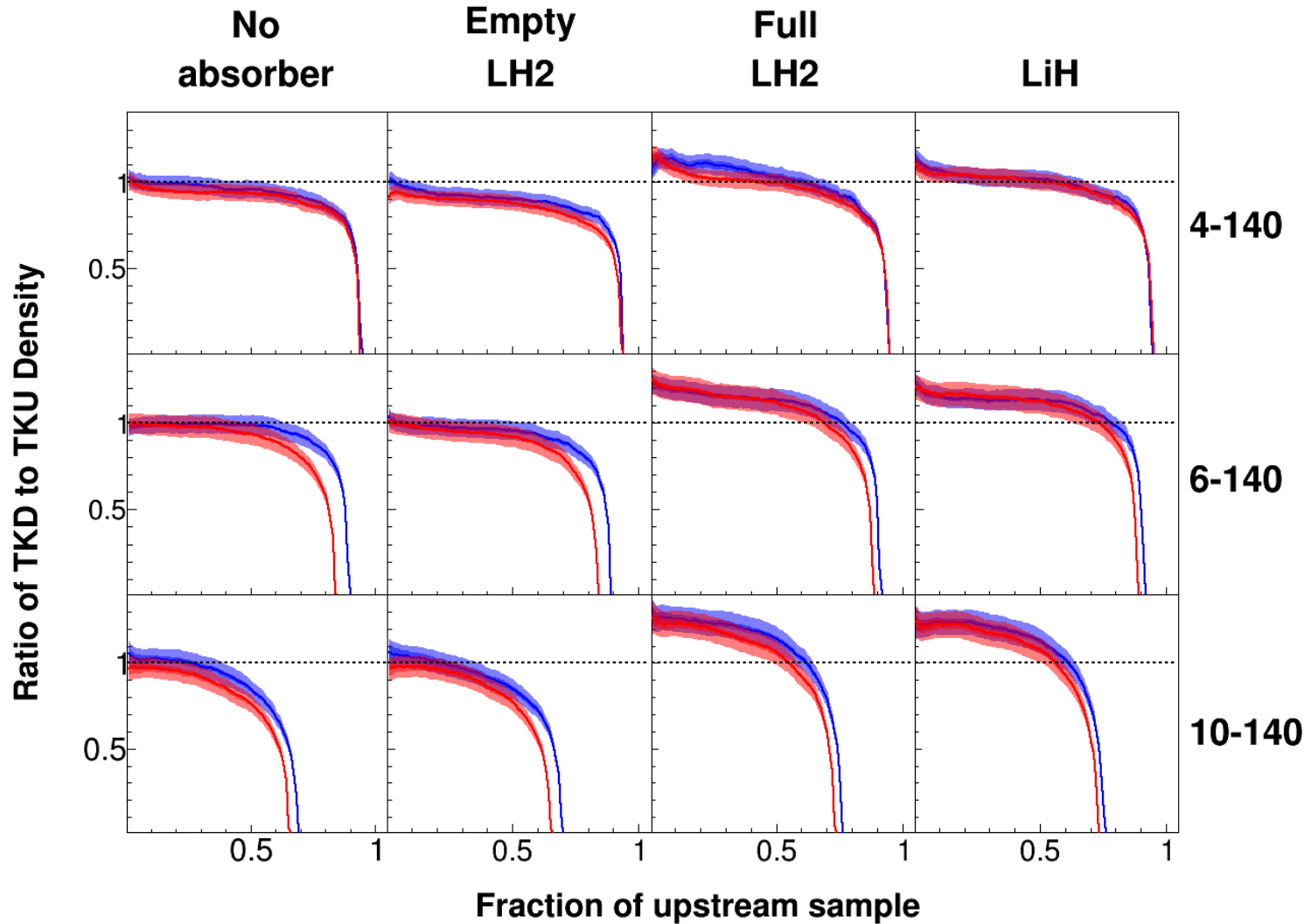
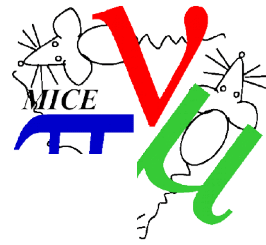
- Propose
 - 1 Schematic
 - 2 Phase space distributions
 - 3 Amplitude PDF
 - 4 Ratio of amplitude PDFs
 - 5 Phase space density vs fraction of beam
 - 6 **Ratio of phase space densities**

CDF Ratios



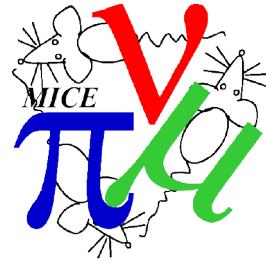
- Ratio of amplitude CDFs
 - Consider Cumulative Density Function – the number of particles enclosed by a given amplitude ellipse
 - Take ratio of downstream to upstream CDF

Density Ratios

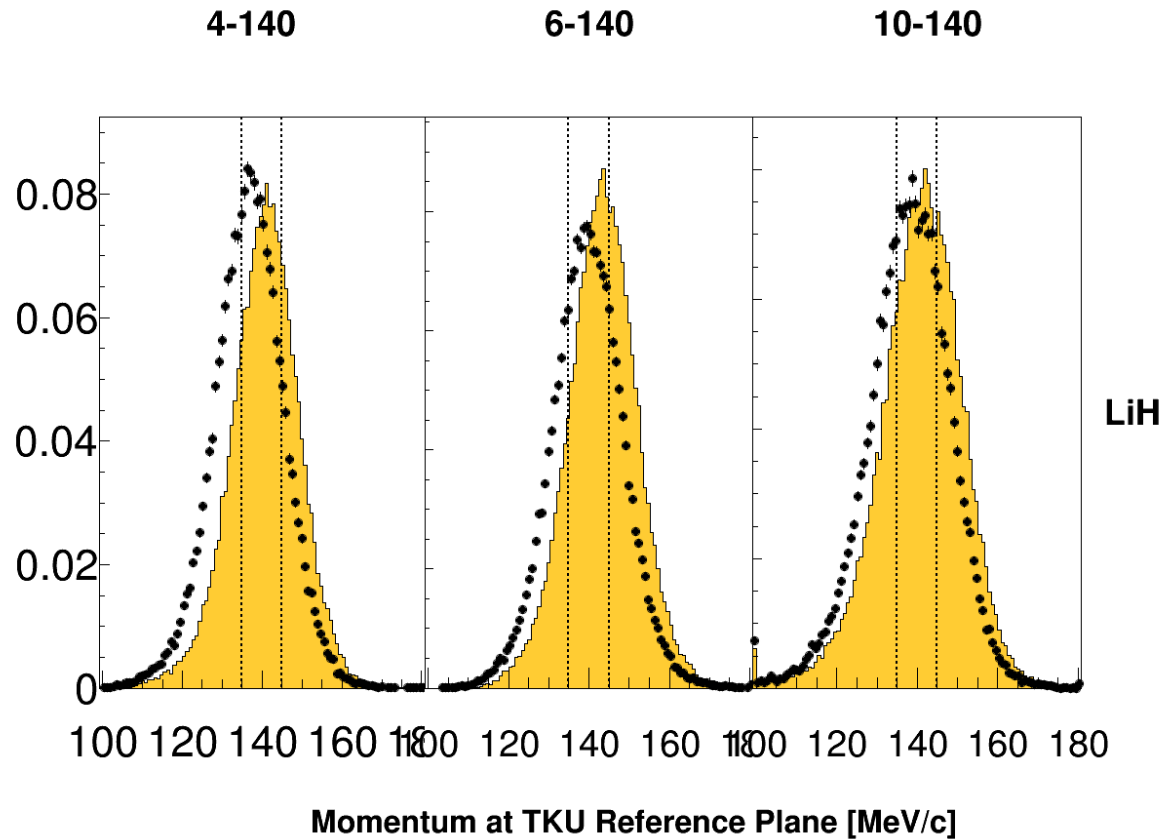


- Error on transmission is underestimated

Move to Production

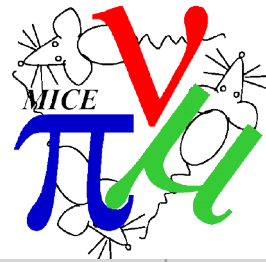


- Plan to move to production reconstruction
 - More statistics
 - Better audit trail (MAUS version, etc)
- Paolo and Dimitrije have provided recon of some 2017-02-7 LiH data
 - Rogers reconstruction is shown in yellow
 - Production reconstruction is shown in black
 - Reconstruction is of exactly the same data files
 - Same analysis scripts
- Looks like very nice agreement except momentum scale



- Not sure if correction for Hall probes has been implemented in production

Geometry files



```
File Edit View Search Terminal Tabs Help
scarf148@scarf:~/data x scarf148@scarf:~/data
Substitution $$SUE2Current 205.7003 Substitution $$SUE2Current 20
Substitution $$SUE2Scale 1.02 Substitution $$SUE2Scale 1.0
Substitution $$SUE2Polarity +1 Substitution $$SUE2Polarity +
Substitution $$SUE1Current 205.7003 Substitution $$SUE1Current 20
Substitution $$SUE1Scale 1.02 Substitution $$SUE1Scale 1.0
Substitution $$SUE1Polarity +1 Substitution $$SUE1Polarity +
Substitution $$SUM2Current 168.2496 Substitution $$SUM2Current 16
Substitution $$SUM2Scale 1.0 Substitution $$SUM2Scale 1.0
Substitution $$SUM2Polarity +1 Substitution $$SUM2Polarity +
Substitution $$SUM1Current 190.9981 Substitution $$SUM1Current 19
Substitution $$SUM1Scale 1.0 Substitution $$SUM1Scale 1.0
Substitution $$SUM1Polarity +1 Substitution $$SUM1Polarity +
Substitution $$SUCCurrent 205.70039 Substitution $$SUCCurrent 205
Substitution $$SUCScale 1.02 Substitution $$SUCScale 1.0
Substitution $$SUCPolarity +1 Substitution $$SUCPolarity +1
<try/geometry_10484/ParentGeometryFile.dat 90,25 16% <v1/10484/geo-10484/ParentGeometryFile.dat 99,25
"reco/Production-v1/10484/geo-10484/ParentGeometryFile.dat" [noeol] 568L, 26493C
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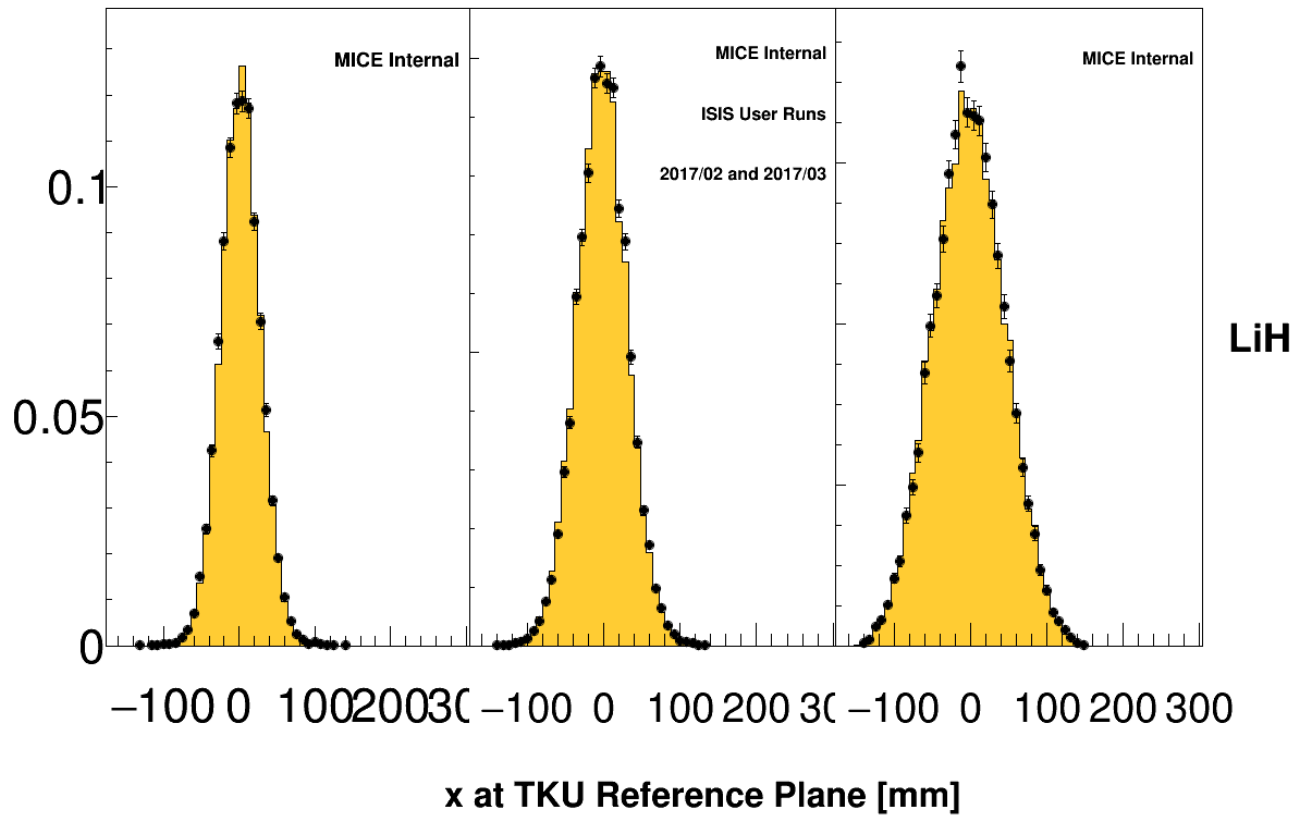
Rogers

Production

4-140

6-140

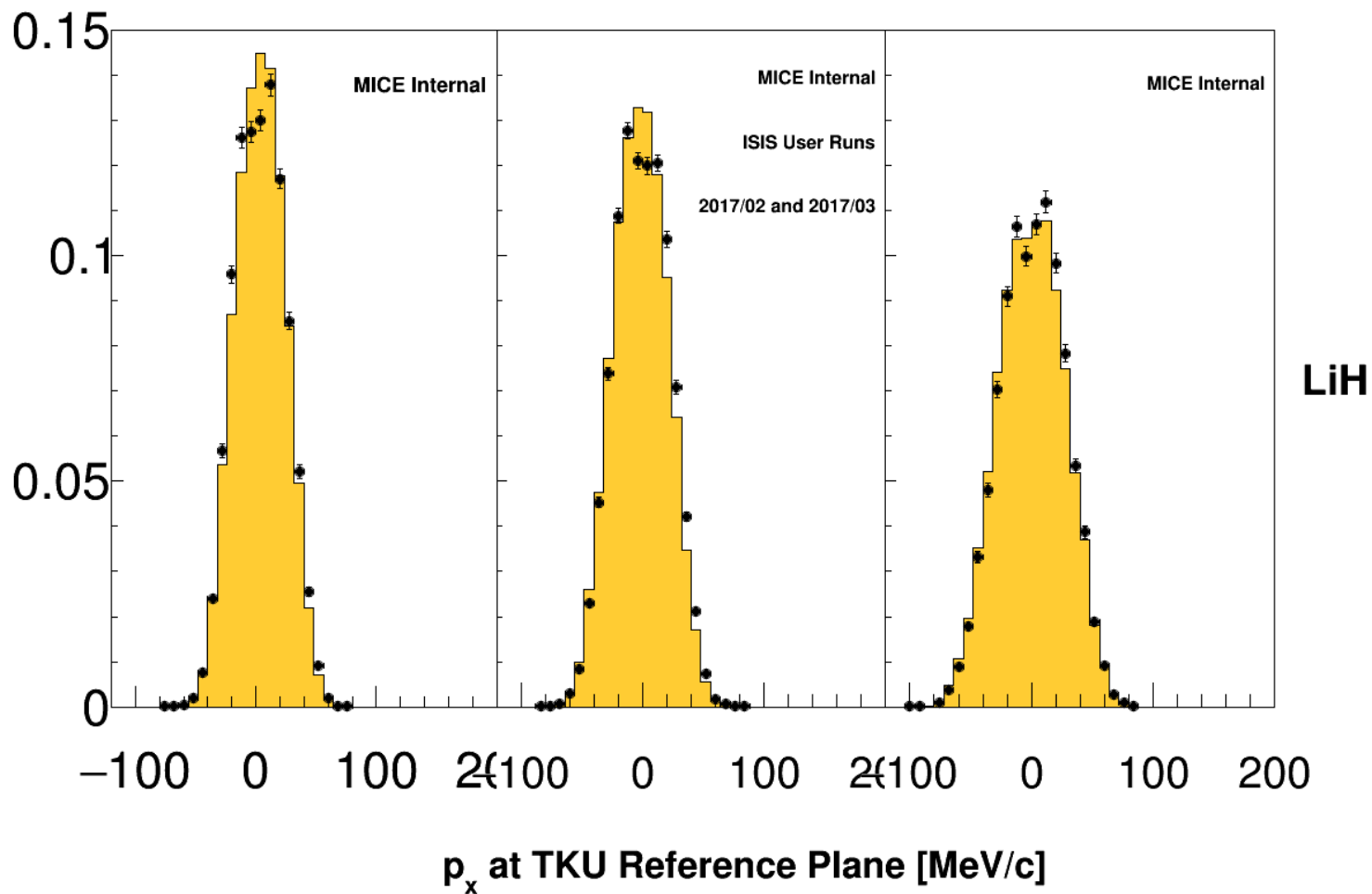
10-140

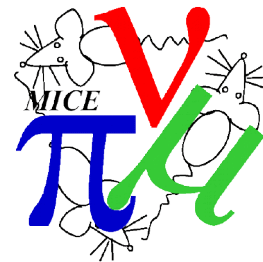


4-140

6-140

10-140

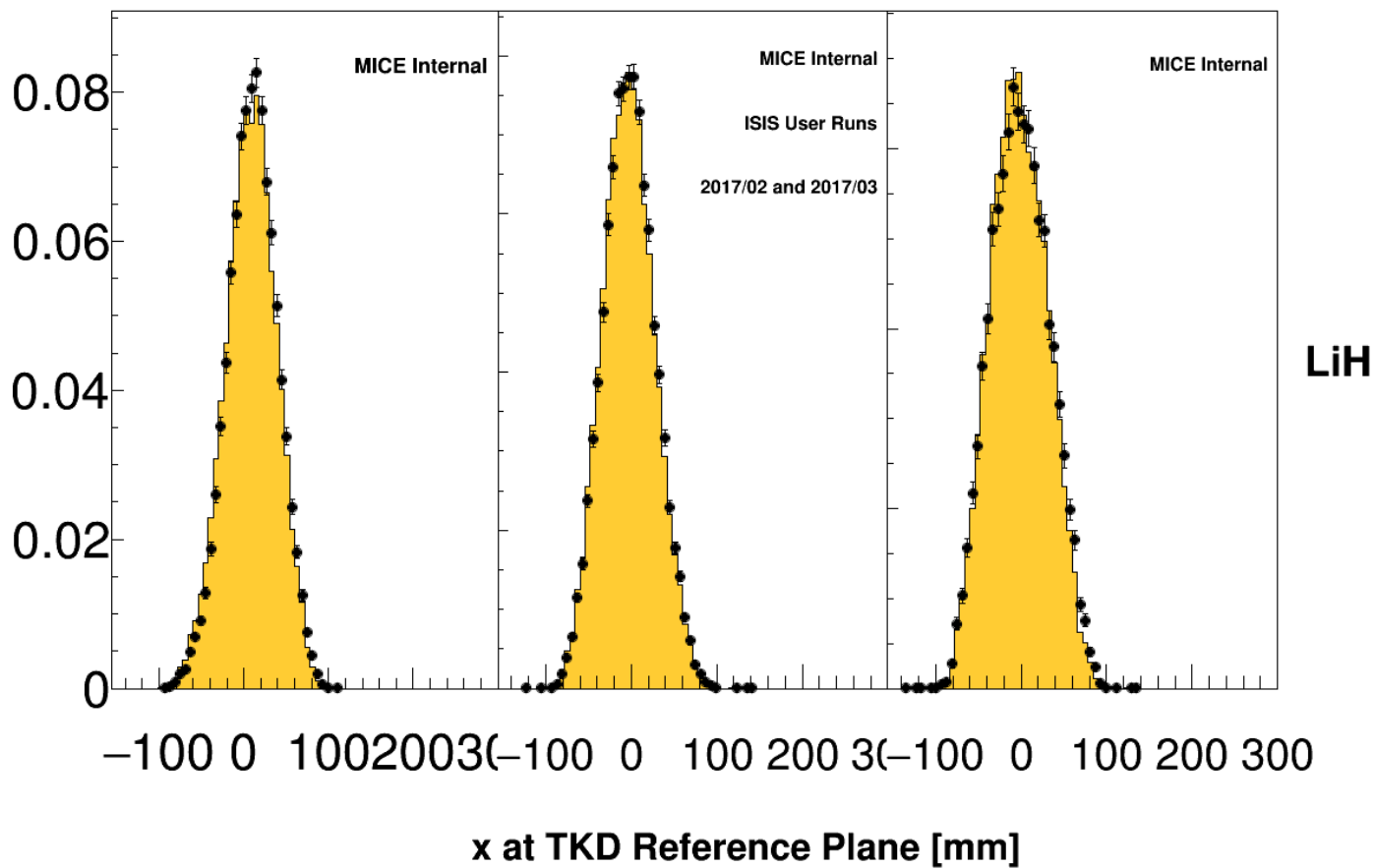


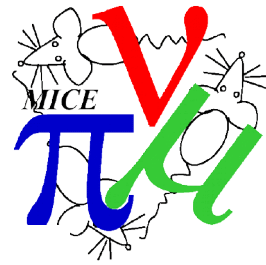


4-140

6-140

10-140

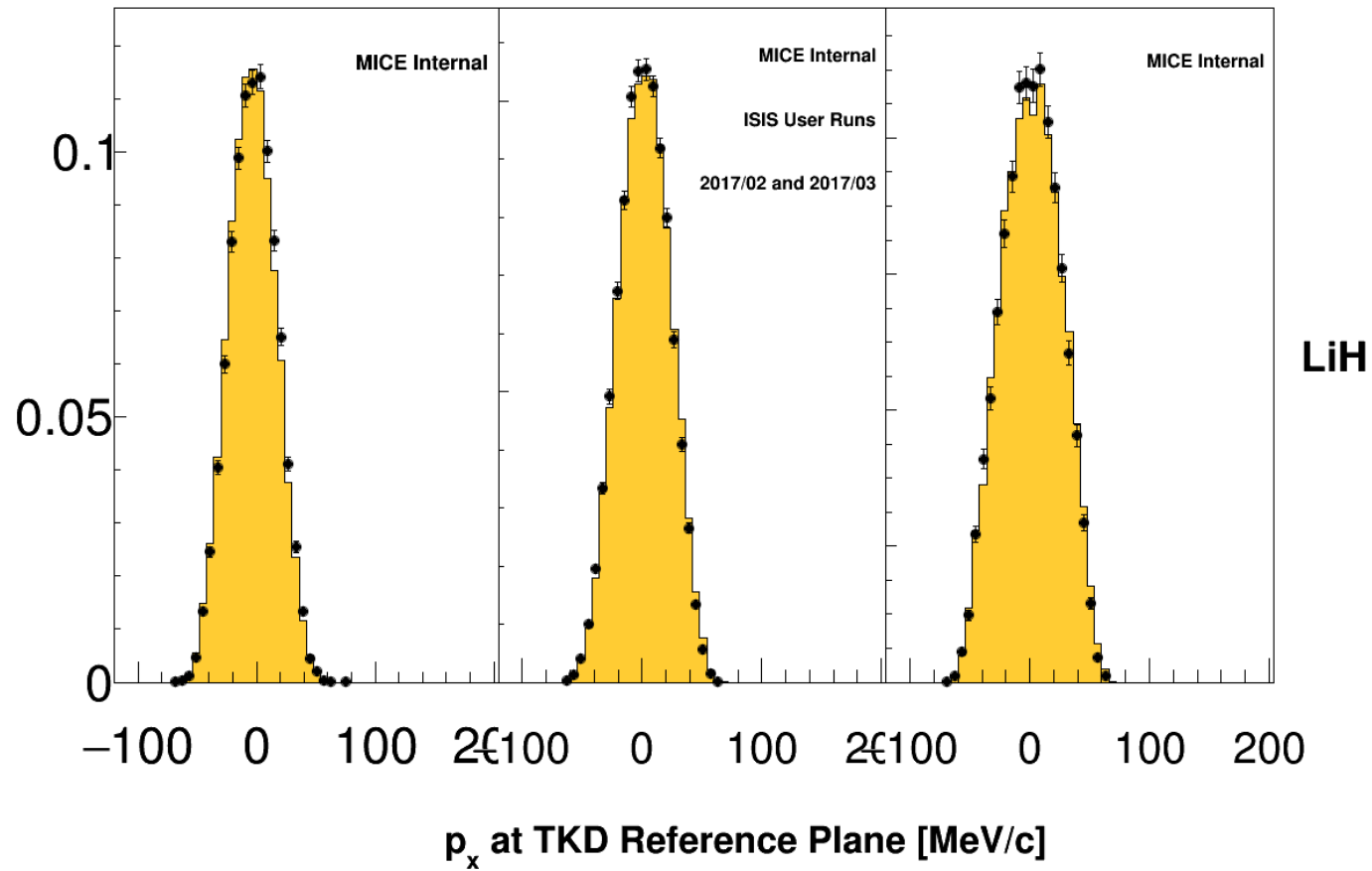




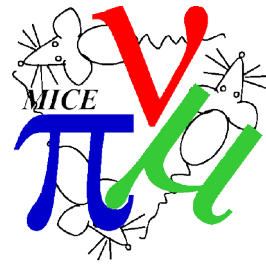
4-140

6-140

10-140



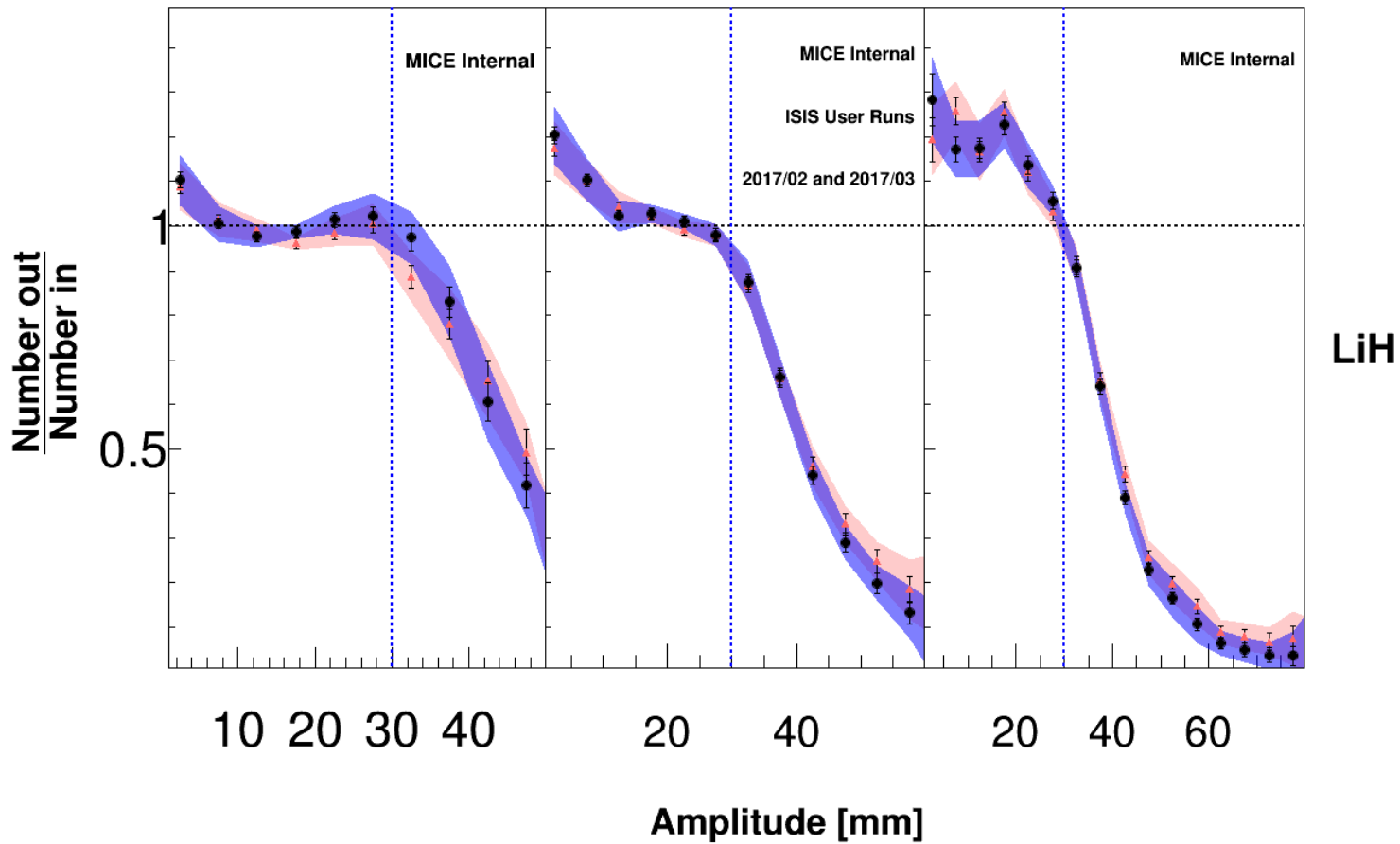
PDF ratio



4-140

6-140

10-140



Still to do

- Use production MC and recon
- Update MICE Note
 - Need to write detailed text on systematic error analysis
- Write methods section

