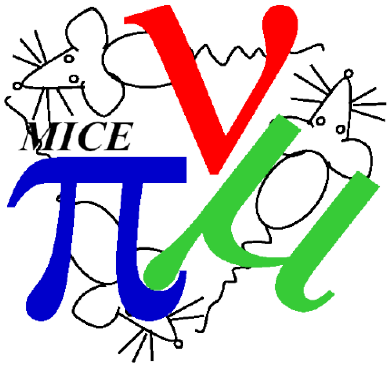
Emittance Evolution Update



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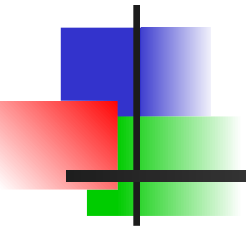
Emittance Evolution

- Referee's meeting on Wed 26th September
  - Reviewed the MICE Note
  - Summarise the meeting and major actions/reactions
- MICE Note describes:
  - Selection of data
  - Validation of detector reconstruction and model
  - Validation of cooling channel and model
  - Amplitude calculation
    - Estimation and correction of systematic effects
    - Uncertainties



Selection of Data

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Upstream Selection Criteria

- Upstream Selection Criteria are:
  - One space point in TOF1 and TOF0
  - One track in TKU
  - TKU chi^2/dof < 4
  - TKU fiducial volume cut
  - TOF01 cut
  - 135 < Momentum in TKU < 145 MeV/c
  - Successful extrapolation to TOF0
  - Diffuser aperture cut < 100 mm

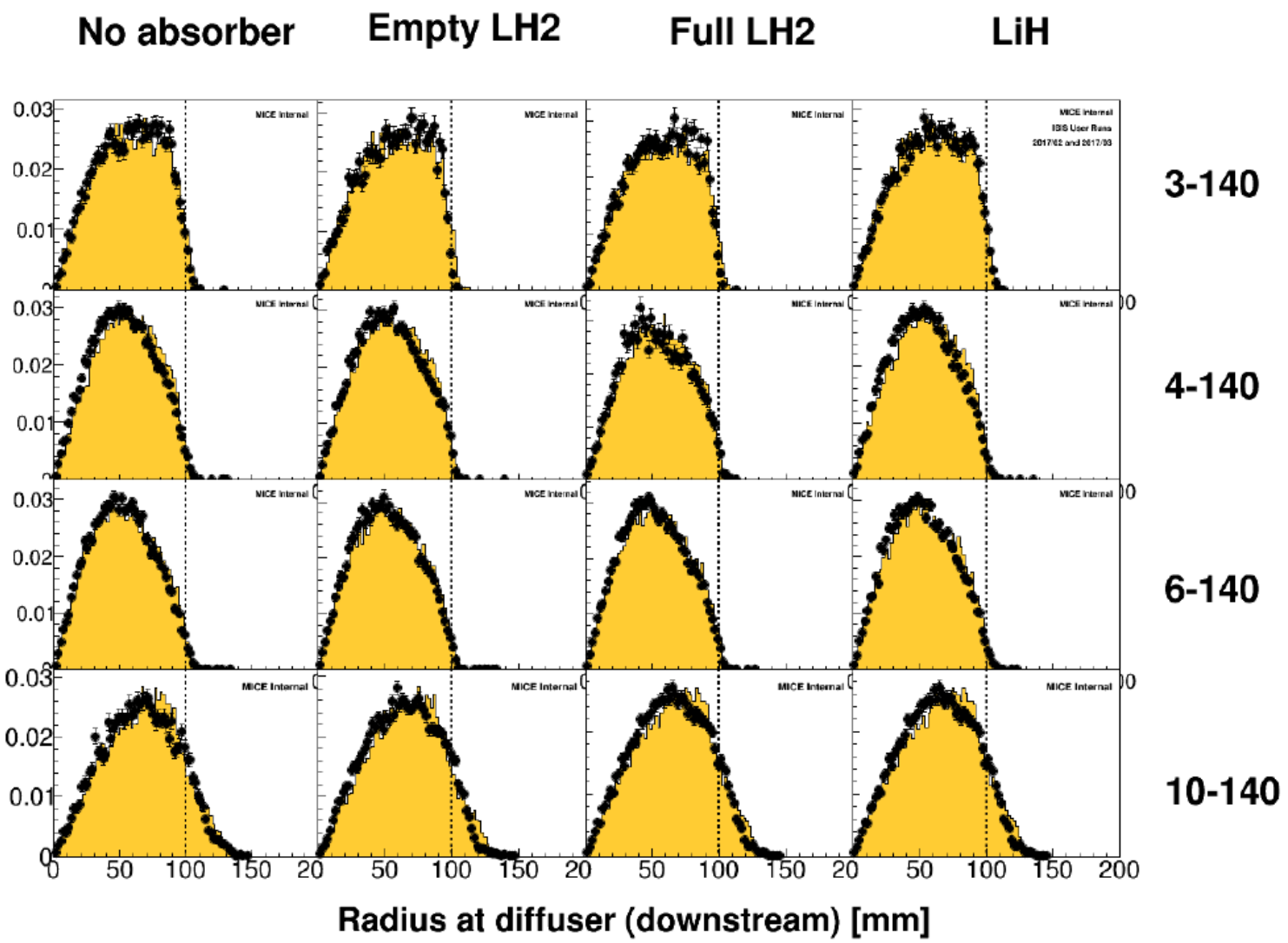
Downstream Selection Criteria

- Downstream Selection Criteria are:
  - In upstream sample
  - One TKD track
  - TKD chi2/dof < 4
  - TKD fiducial volume
  - TKD momentum
- Overall:-
  - Between about 3 % and 10 % of events make it into the upstream sample
  - Between about 65 % and 90 % of upstream sample events make it into the downstream sample
  - MC sample is somewhat limited; need to rerun a “final” MC with higher stats

Actions

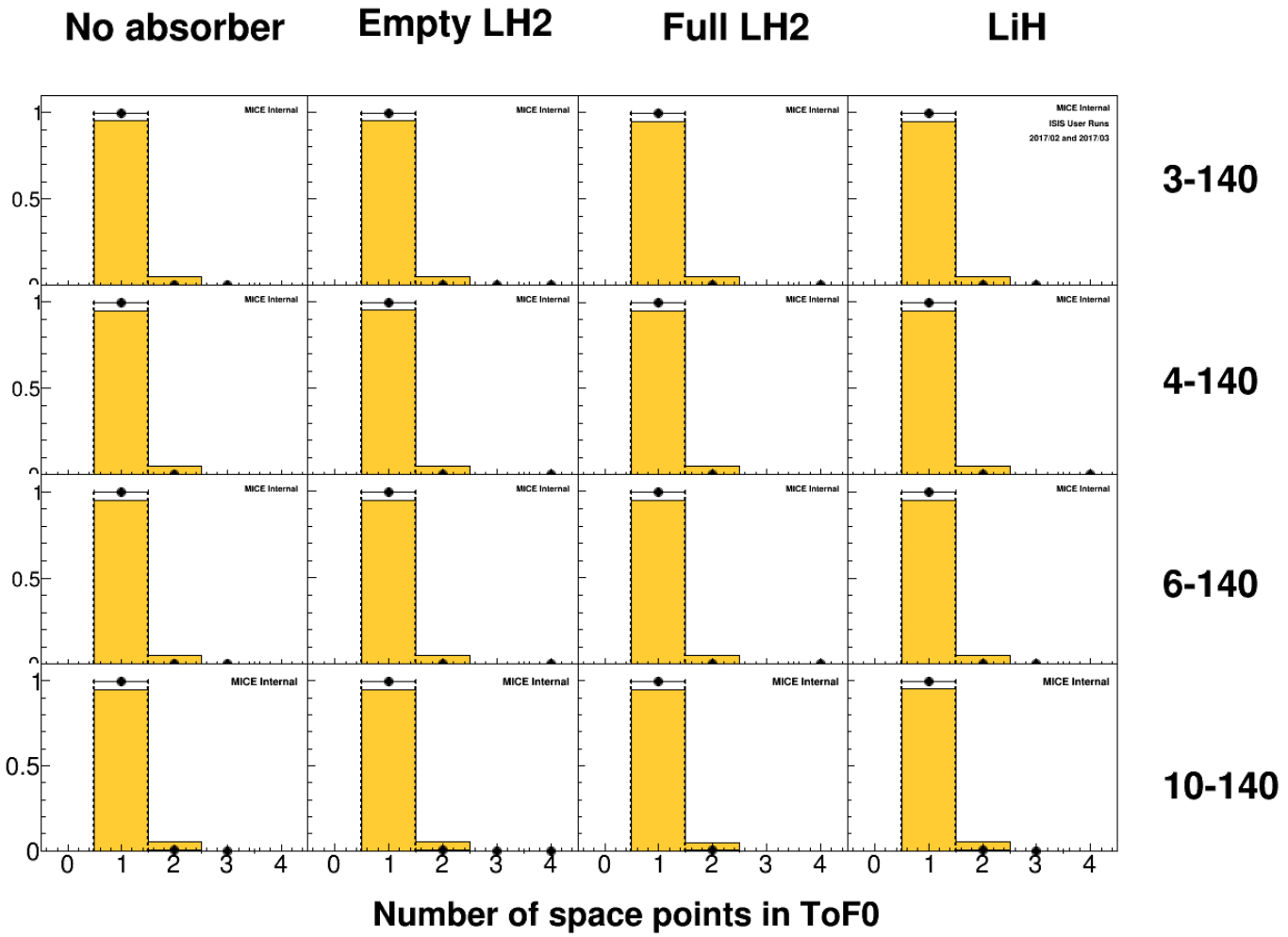
- Improve agreement between diffuser MC and simulation
- Understand excess in TOF2 space point events in MC
- Change diffuser aperture cut from 100 mm to 90 mm
- Chase tracker glue density measurement (for chi2 tuning)
- Tune momentum distribution better
- Remove requirement that we successfully extrapolate to TOF0
- Concern over level of disagreement between TOF01 MC vs data

Diffuser



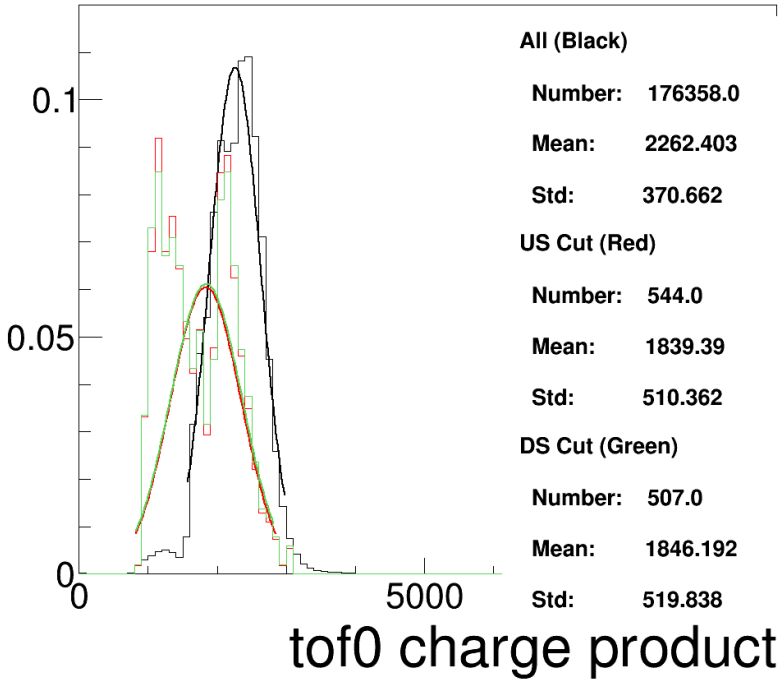
Fixed!

TKU Momentum

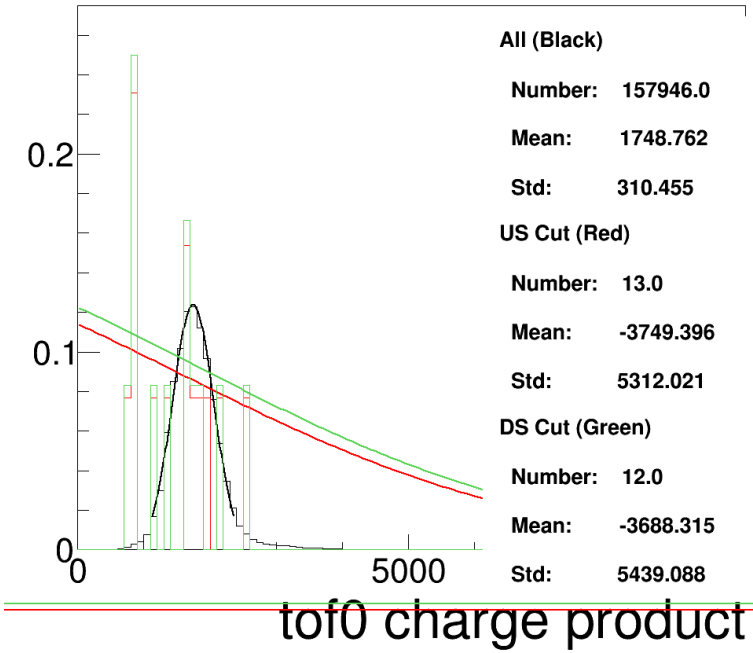


TKU Momentum

Simulated 2017-2.7 3-140 lH2 empty

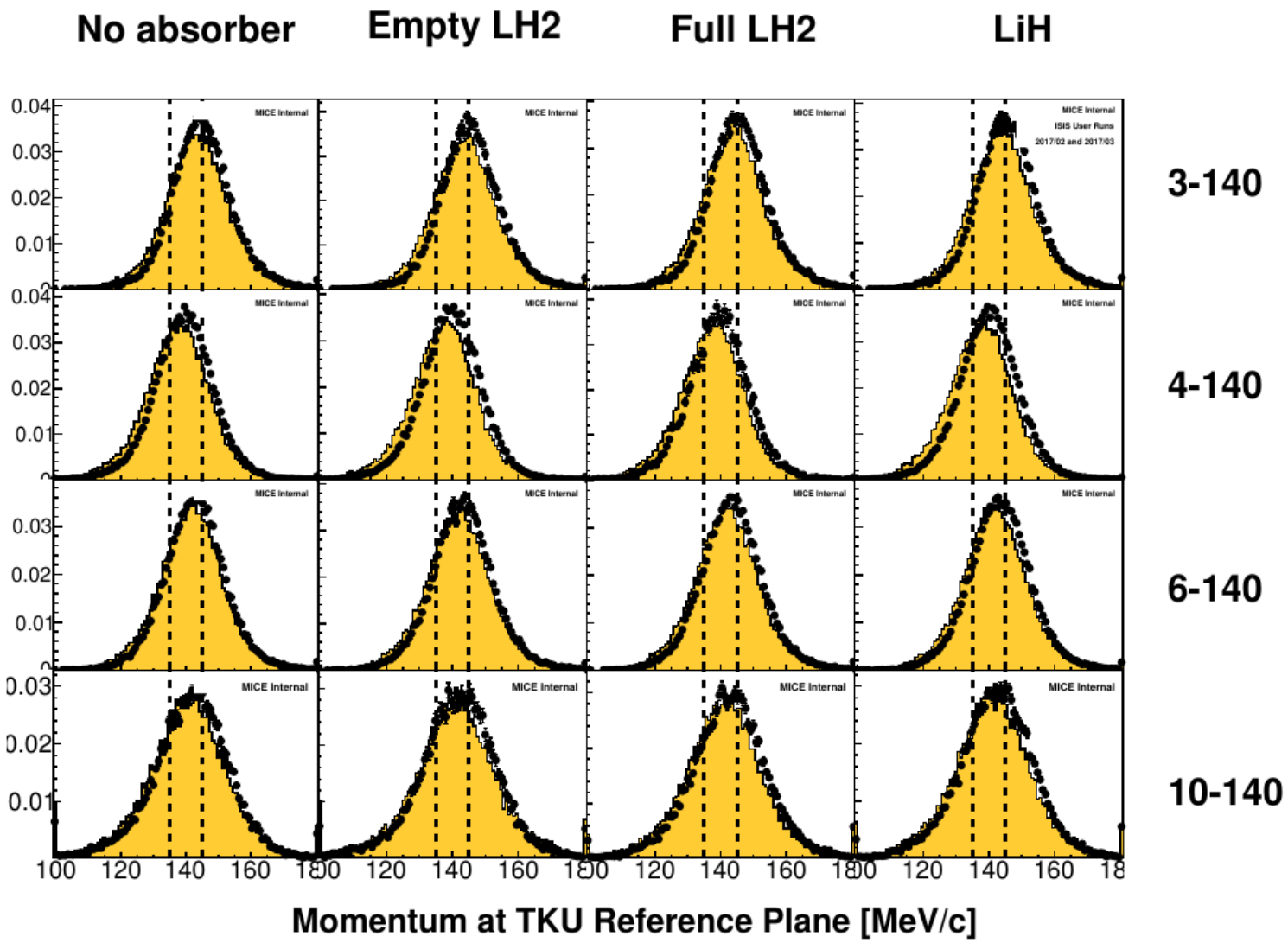


2017-2.7 3-140 lH2 empty

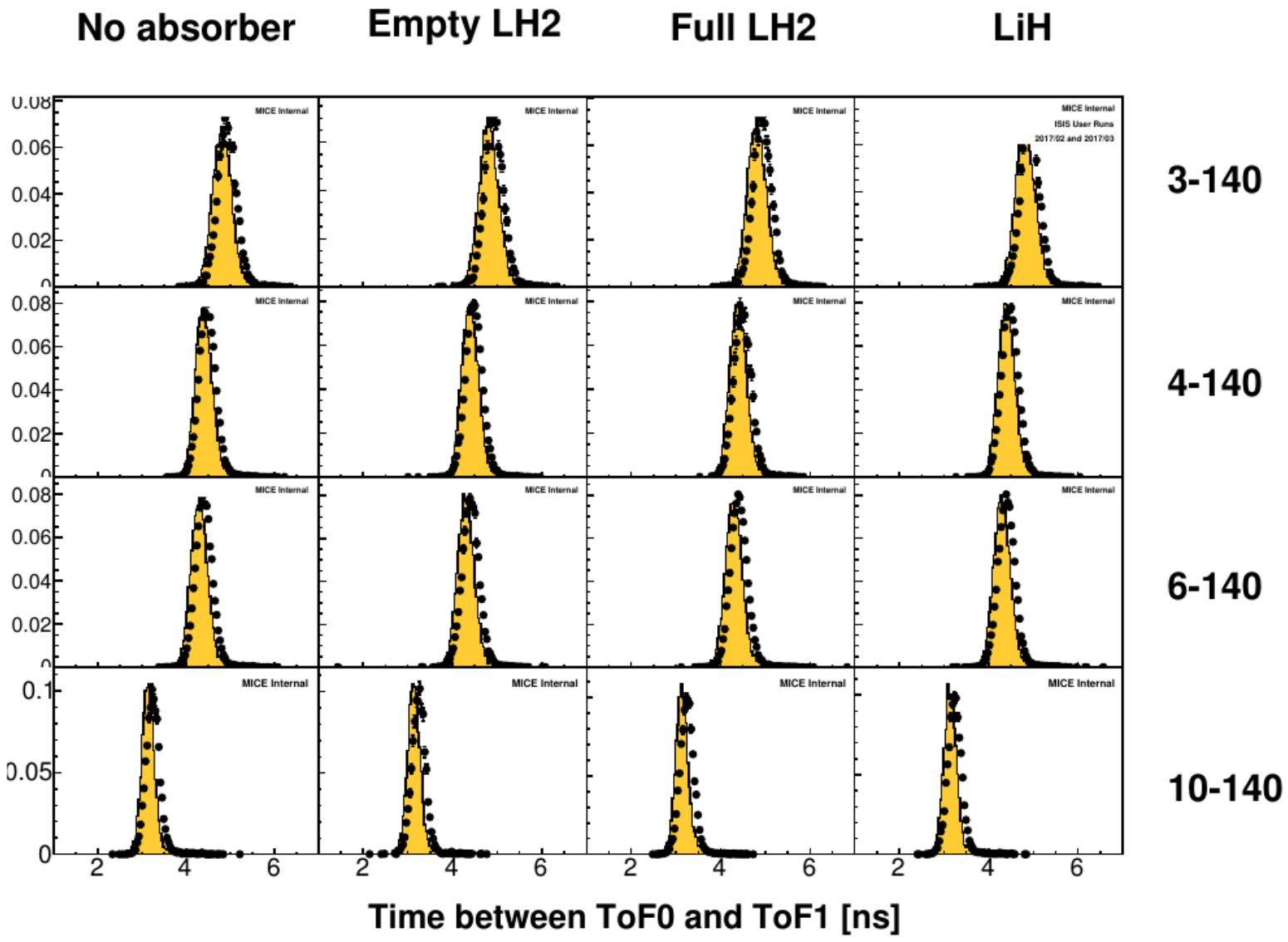


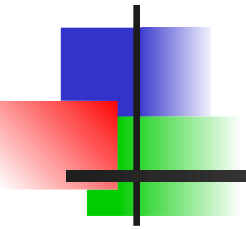
Green/red are TOF0
2 space point events

TKU Momentum



TOF01


No absorber
Empty LH2
Full LH2
LiH
3-140
4-140
6-140
10-140
MICE Internal
ISIS User Runs
2017/02 and 2017/03
Time between ToF0 and ToF1 [ns]



Detector Performance

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Detector Comparison

- Tracker reconstruction:
  - Cluster-finding efficiency is not well reproduced in MC, especially in TKD (which is where it counts!)
  - Concern about tracker efficiency particularly at low pt
    - Incorporate combined TOF-tracker fit and TKU-TKD fit
  - Concern about bias in tracker residuals O(1 MeV/c)
    - Rogers to chase tracker folks
- TOF reconstruction:
  - Referees propose reweighting to improve TOF data vs MC
- Comparison of detectors:
  - Some concern at level of disagreement between detectors
    - Await revised tracker recon
  - Add “banana plot”

Selection Criteria

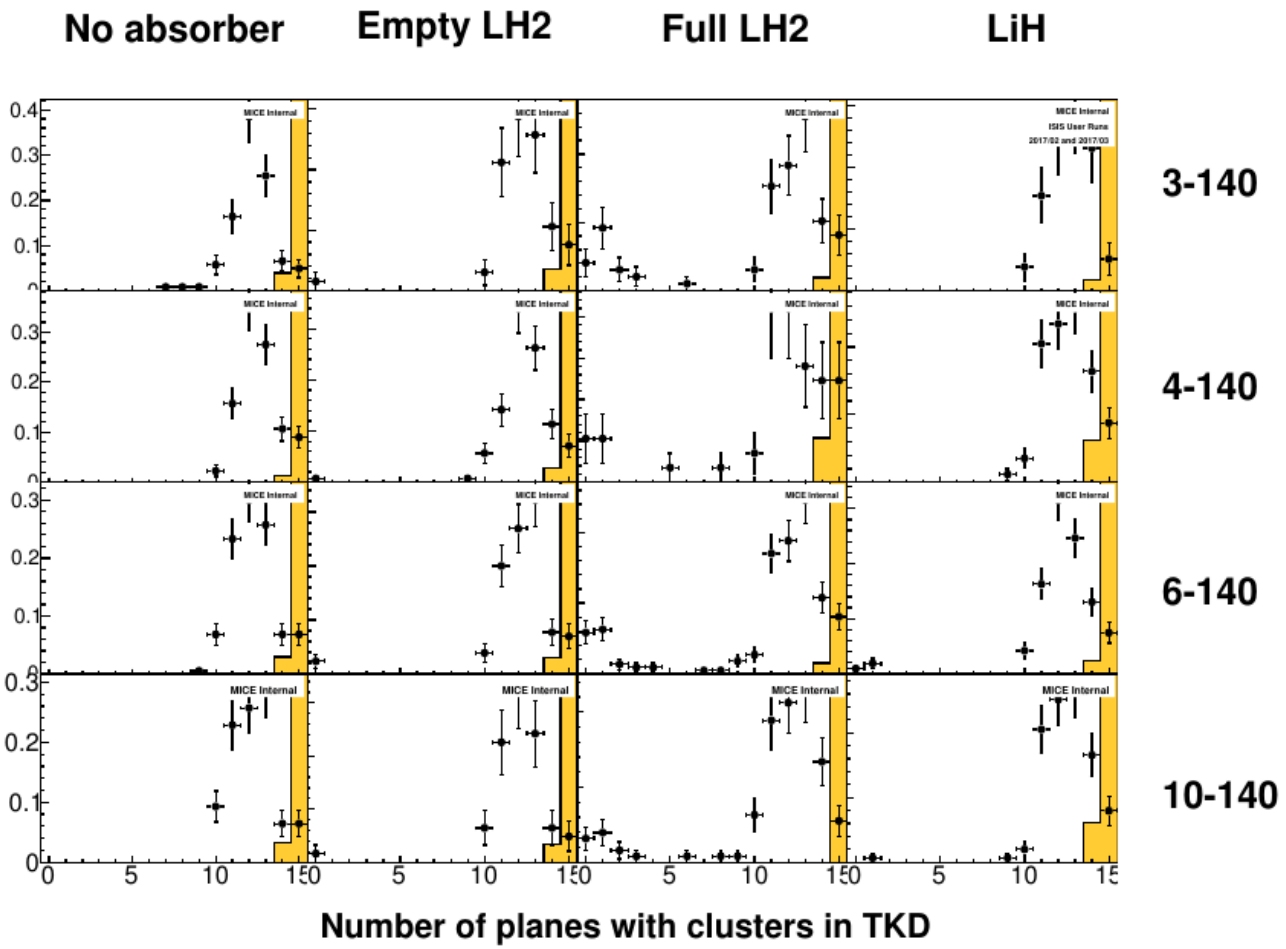
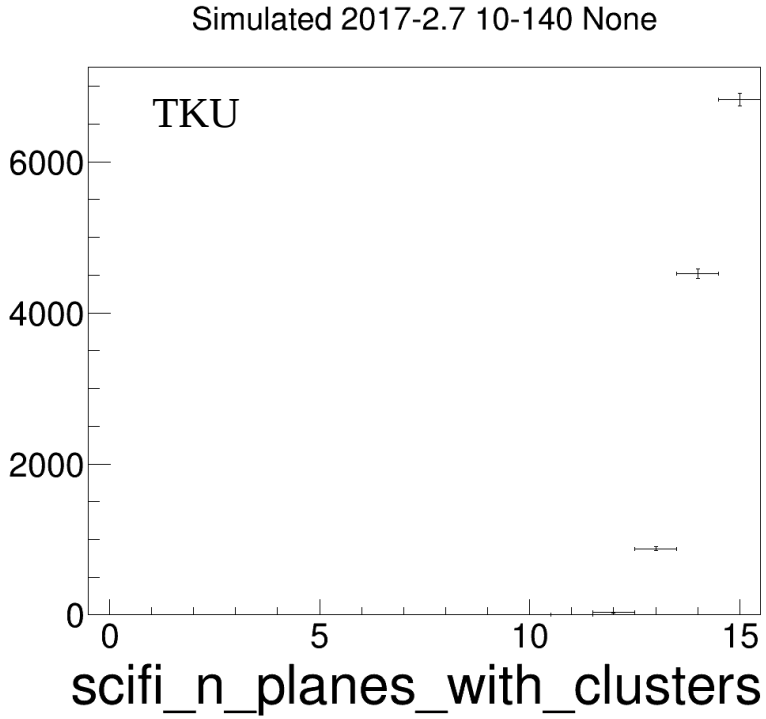
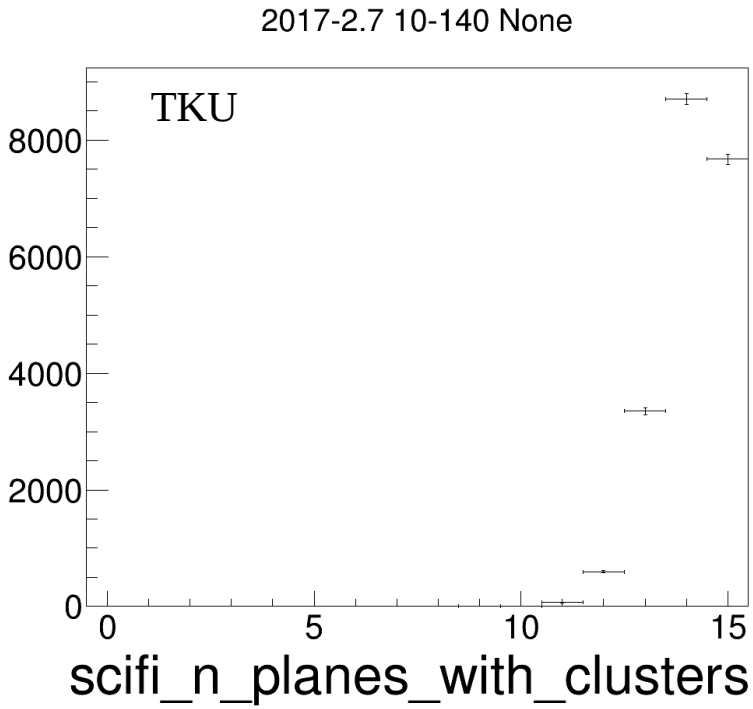


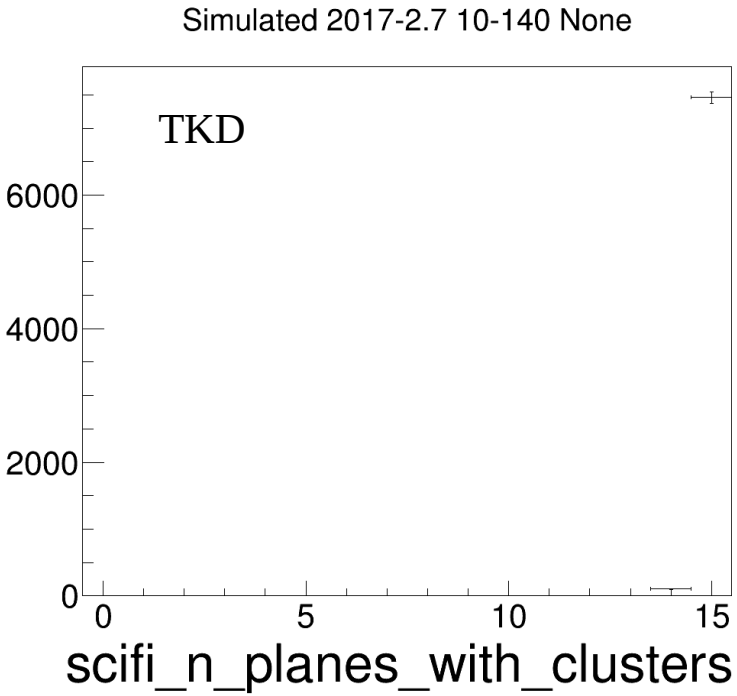
Figure 20: Number of planes in TKD that contain at least one cluster. Here we take all events in the upstream sample, and add the requirement that exactly one space point was reconstructed in ToF2 and no track was reconstructed in TKD.

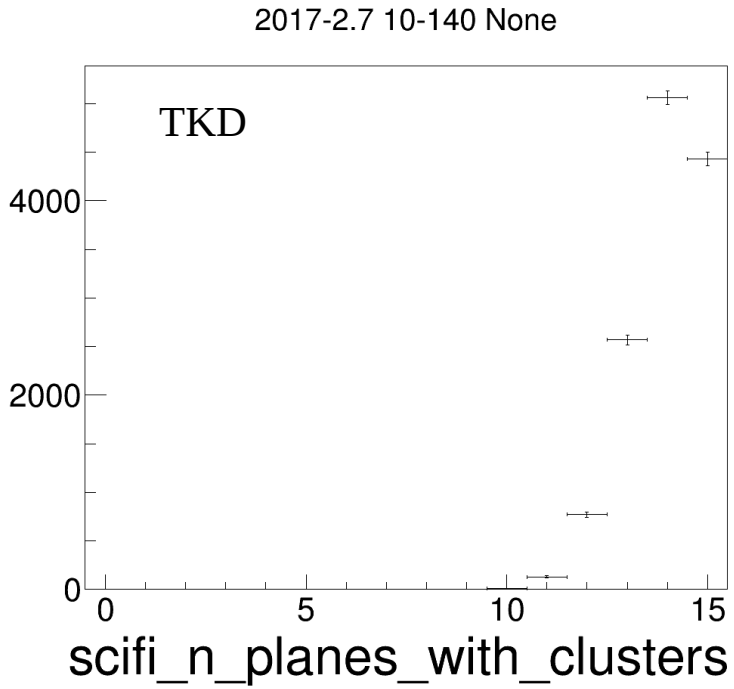
Tracker Clusters



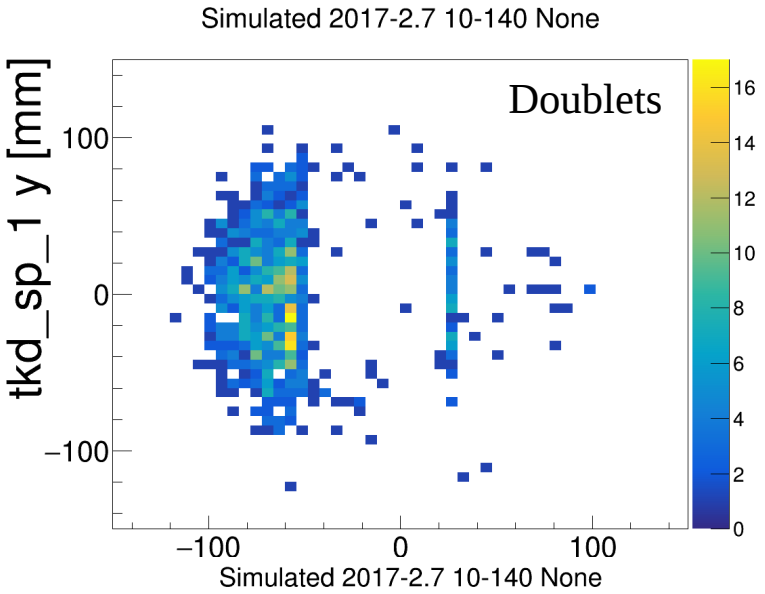


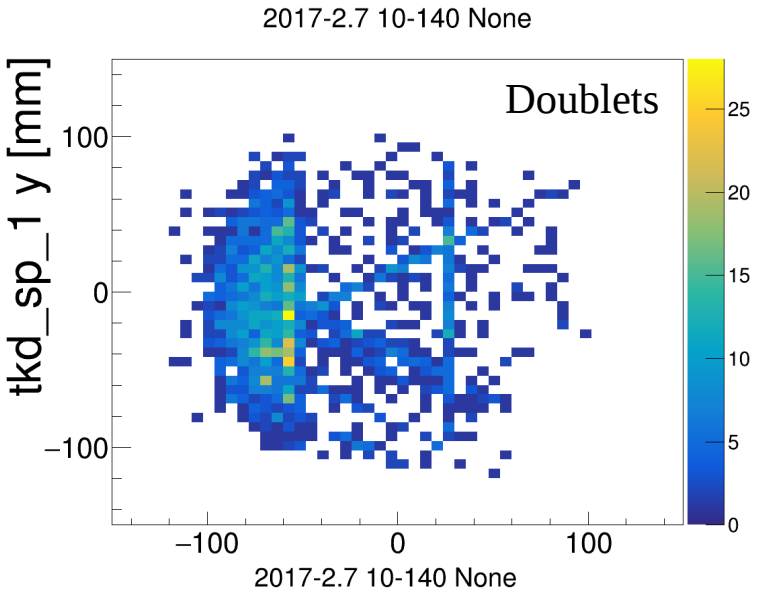
Tracker Clusters

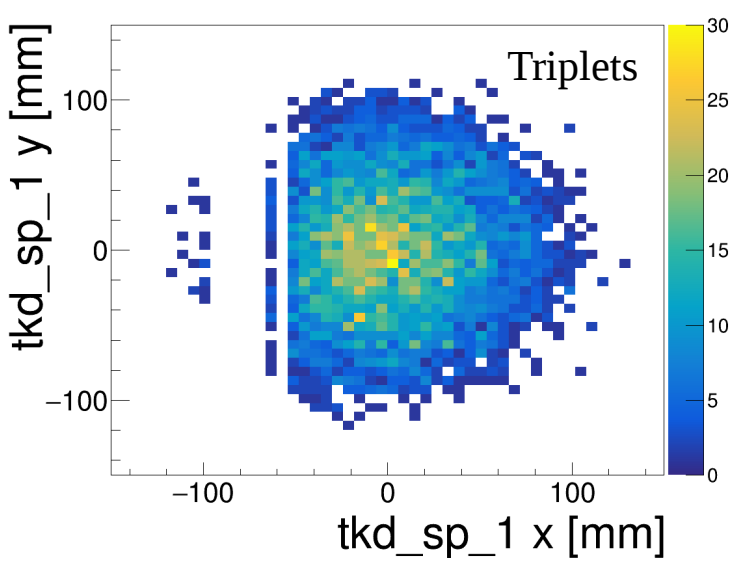


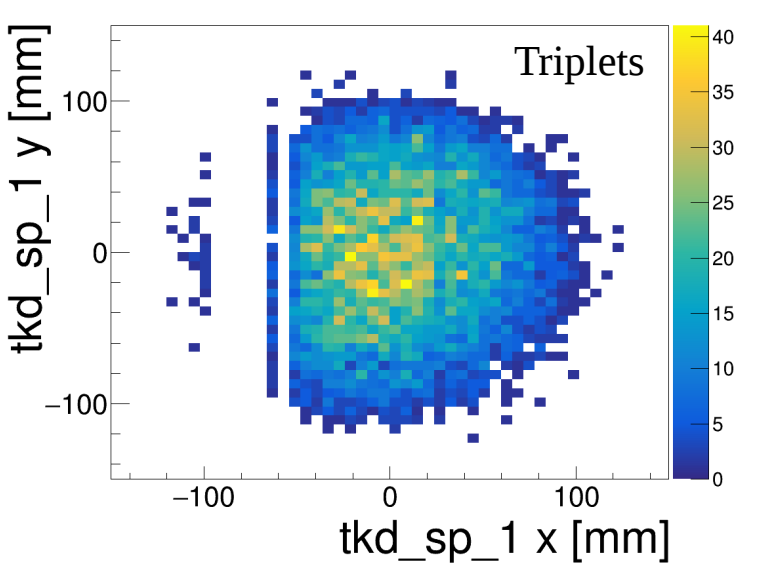


Tracker **Used** Space Points

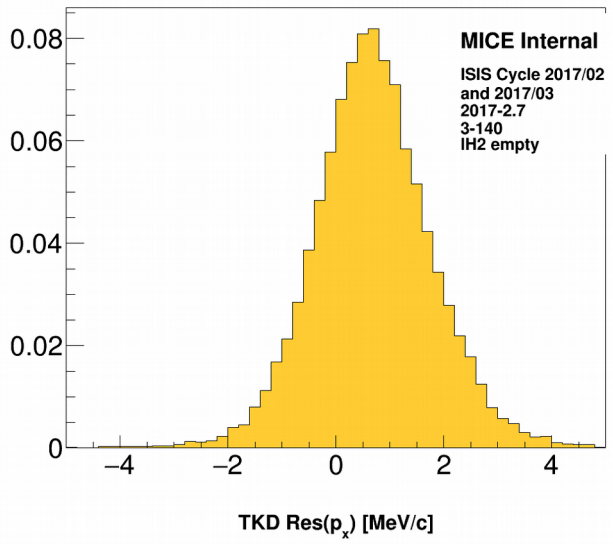


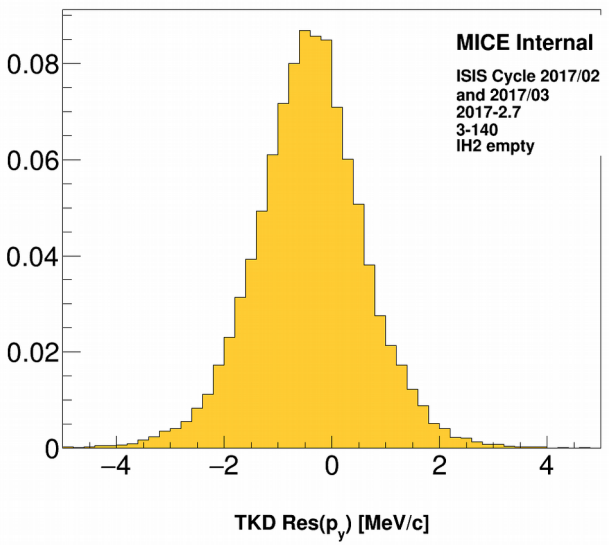


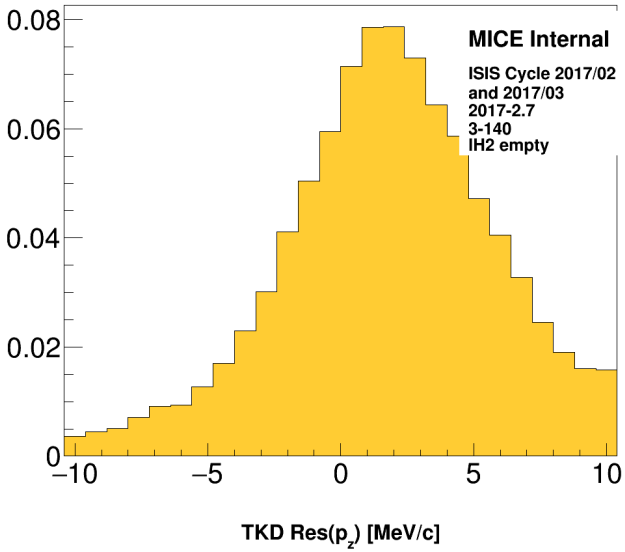




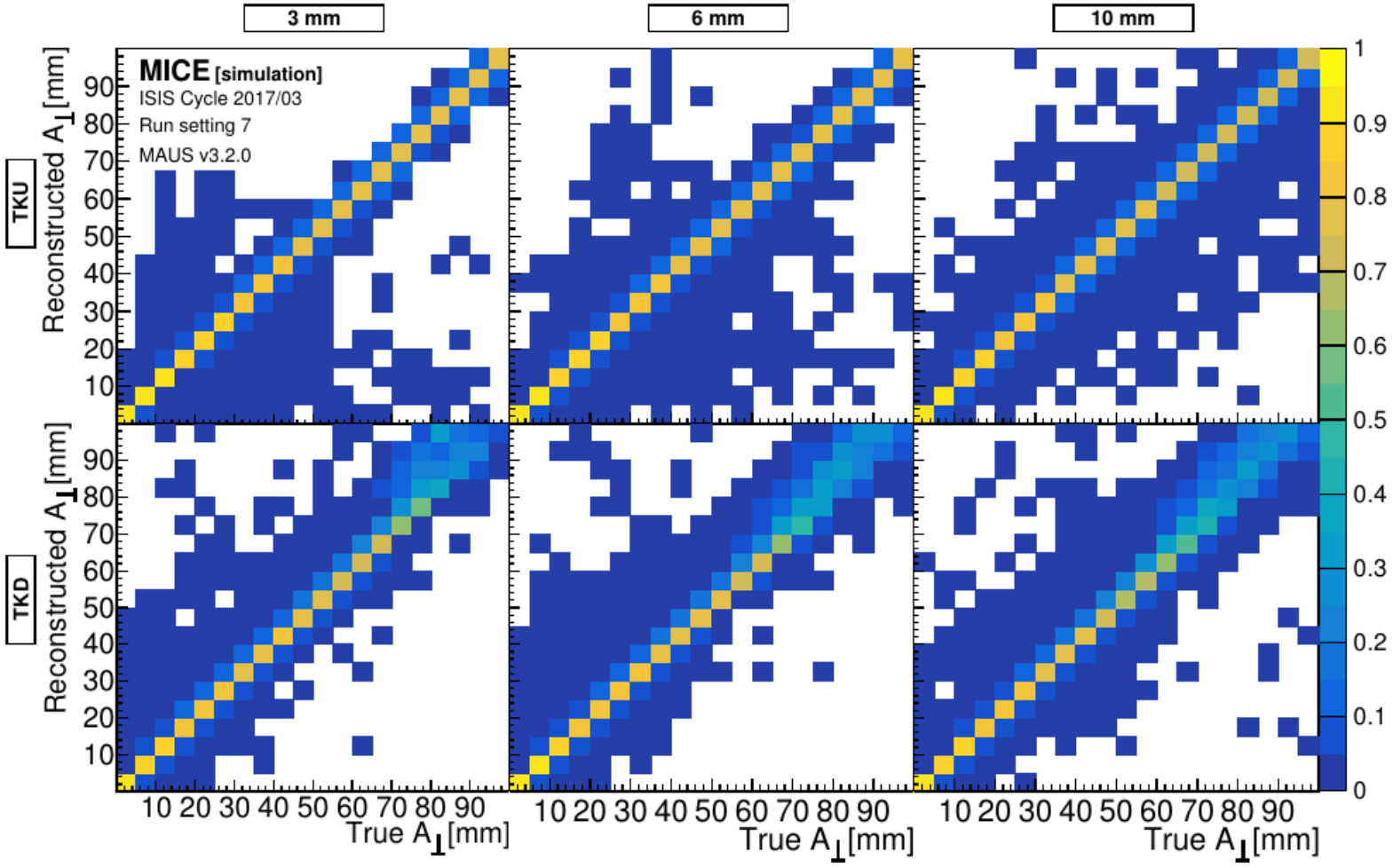
TOF01


MICE Internal
ISIS Cycle 2017/02
and 2017/03
2017-2.7
3-140
IH2 empty
0.08
0.06
0.04
0.02
0
−4
−2
0
2
4
TKD Res(p_x) [MeV/c]

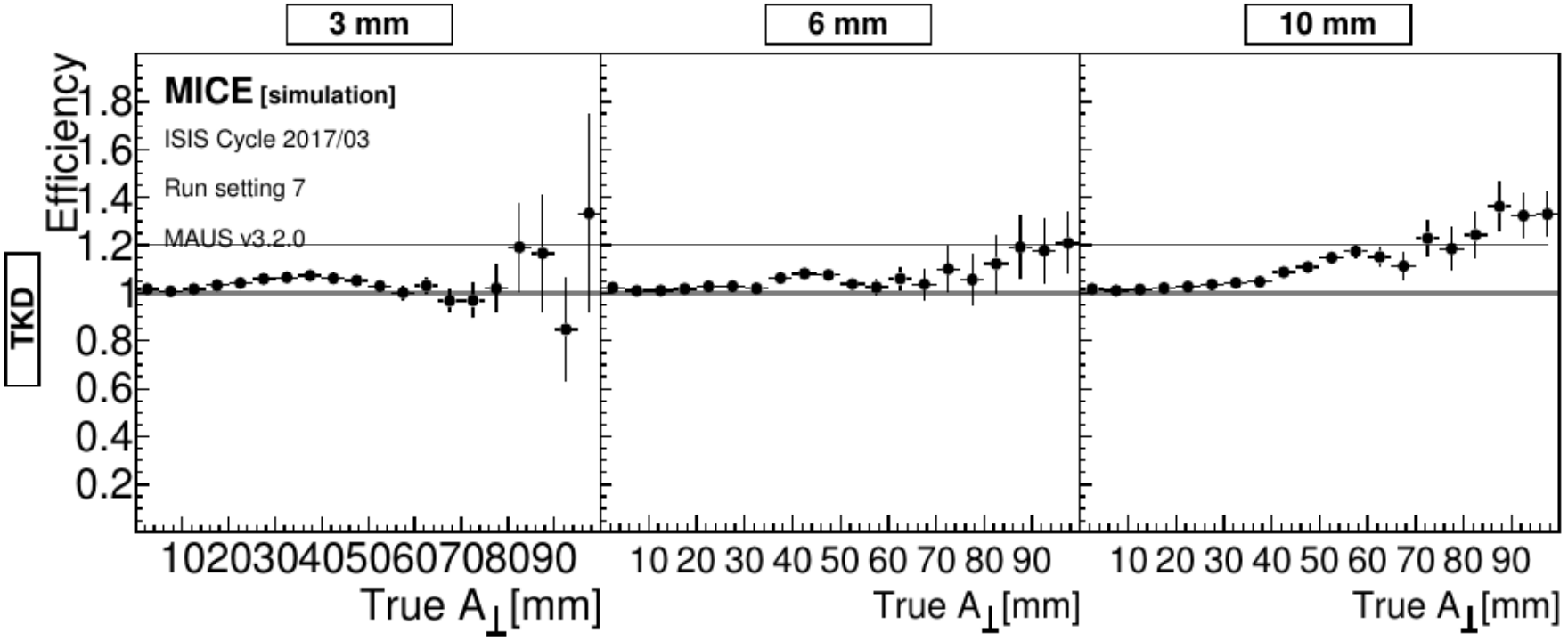

MICE Internal
ISIS Cycle 2017/02
and 2017/03
2017-2.7
3-140
IH2 empty
0.08
0.06
0.04
0.02
0
−4
−2
0
2
4
TKD Res(p_y) [MeV/c]


MICE Internal
ISIS Cycle 2017/02
and 2017/03
2017-2.7
3-140
IH2 empty
0.08
0.06
0.04
0.02
0
−10
−5
0
5
10
TKD Res(p_z) [MeV/c]

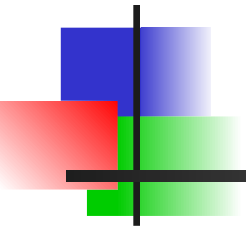
Modified Reco (Drielsma)



Modified Reco (Drielsma)



Plan to adopt Francois's reconstruction when it is migrated into MAUS



Cooling Channel

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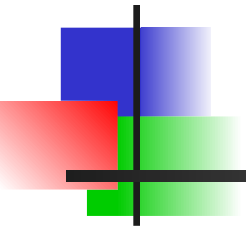
Cooling Channel Validation

- Request MC for comparison in beam optics plots
- Request MC for comparison in energy loss vs position in absorber



Amplitude Calculation

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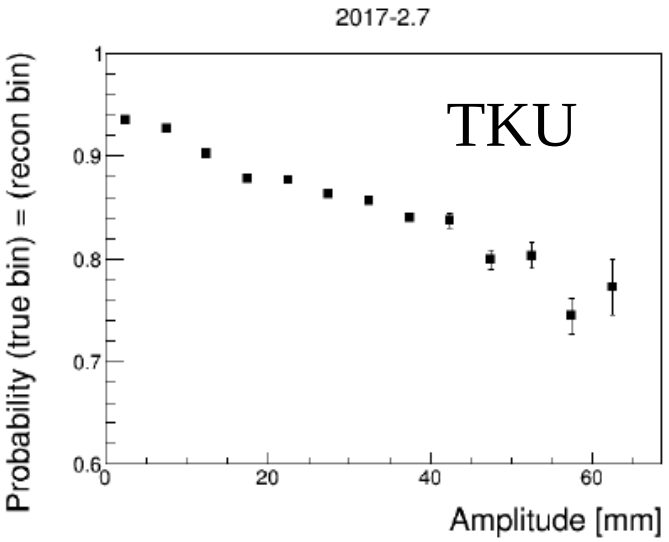
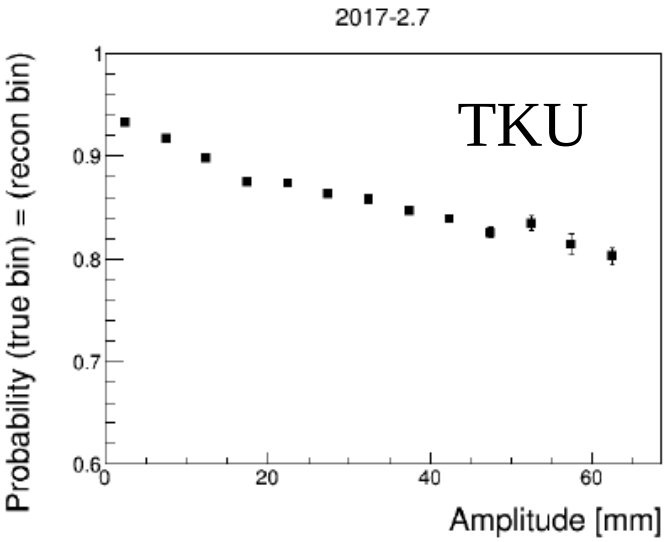
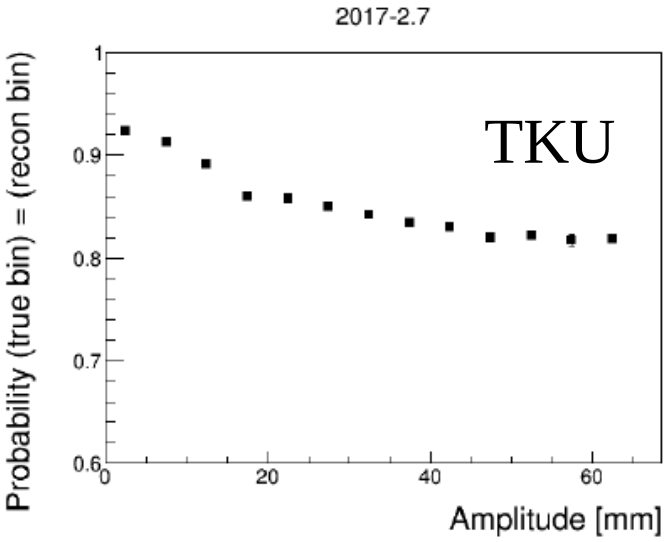
Amplitude Calculation

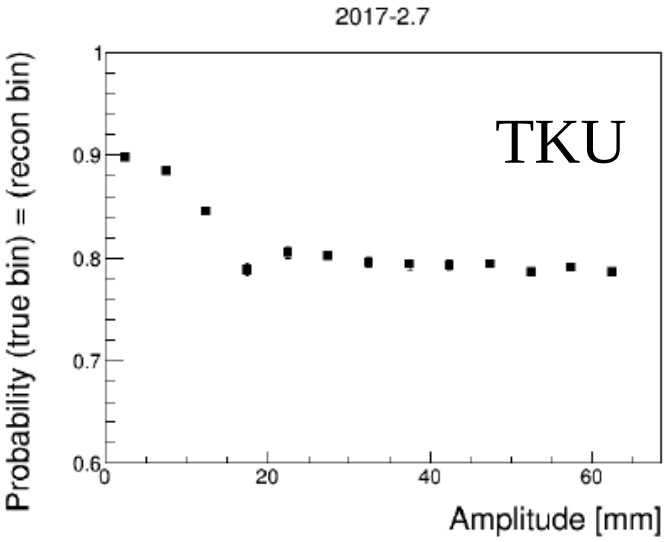
- Amplitude is calculated in “the usual way”
  - Note addition of tail rejection, split statistics
- Resolution correction (upstream and downstream)
- Efficiency correction (downstream)
- Uncertainties – systematic and statistical
  - Mostly benign

TKU Migration (diagonal terms)

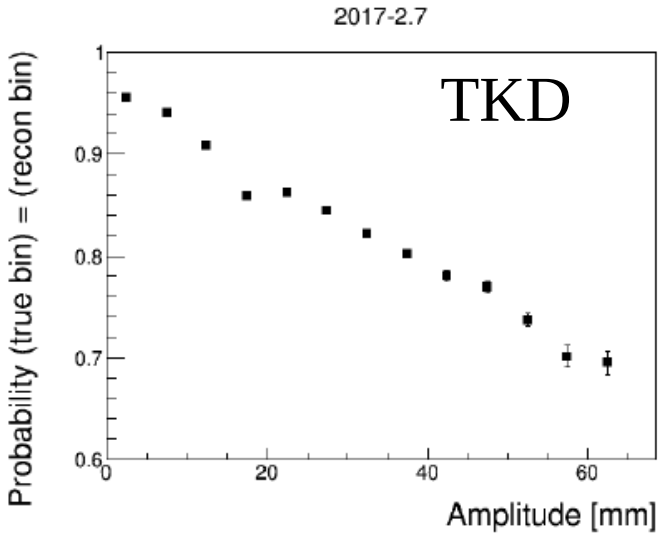


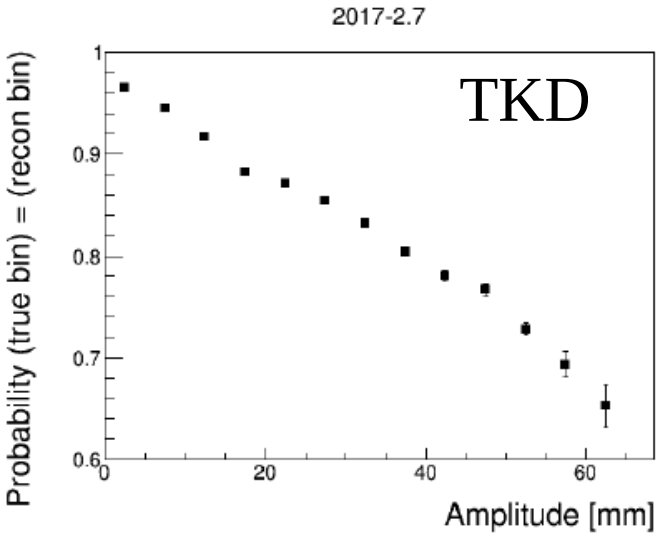


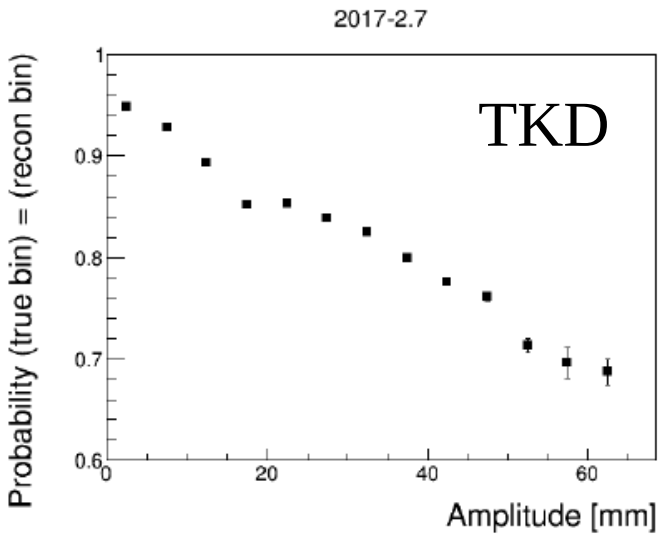


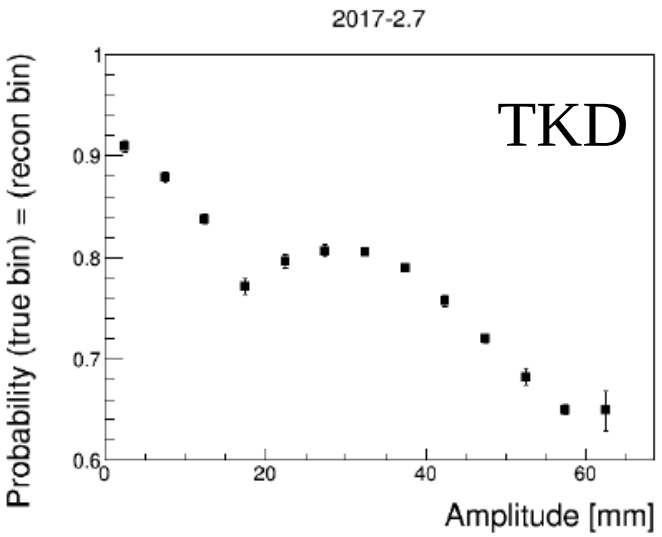


TKD Migration (diagonal terms)

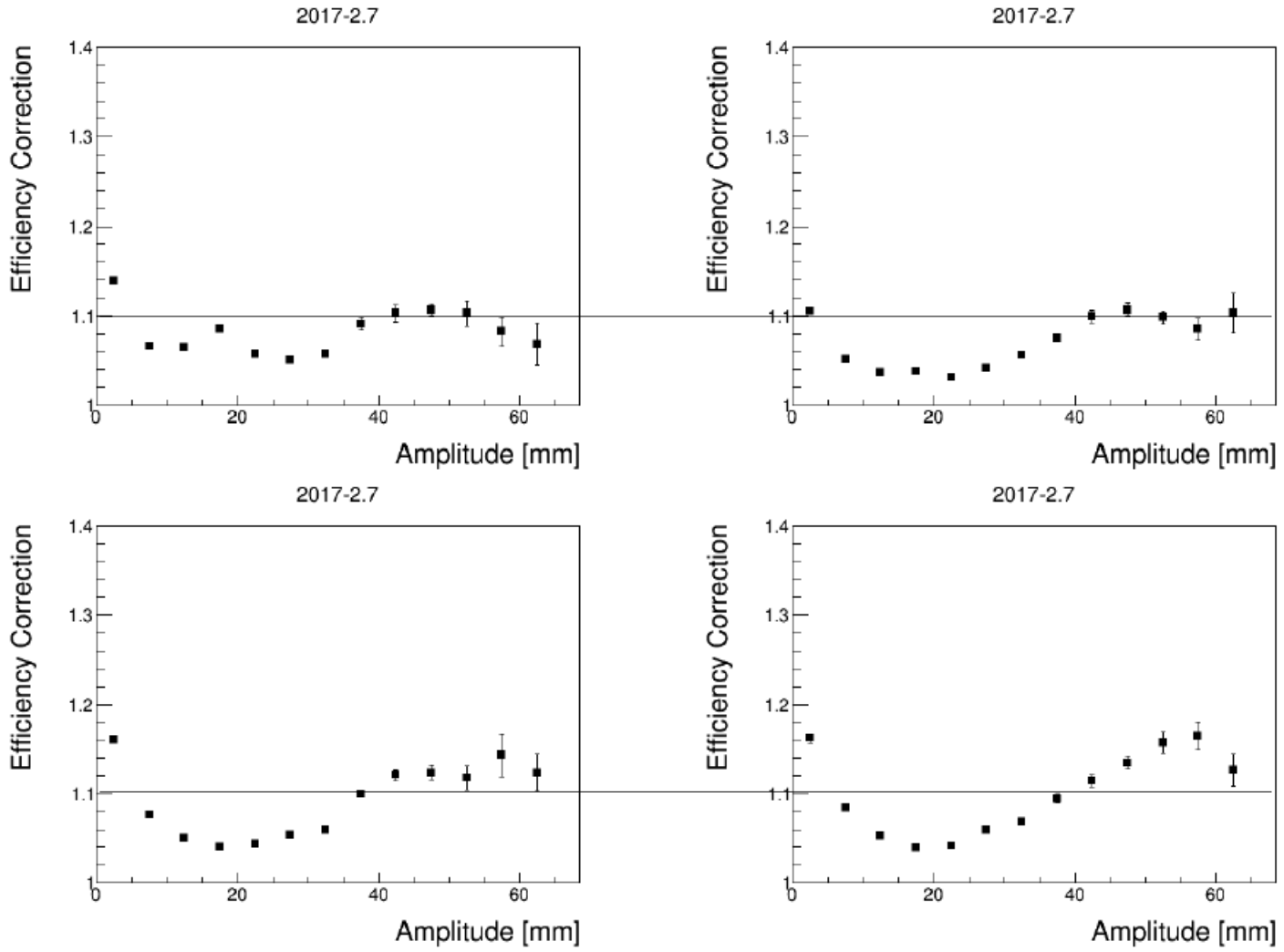




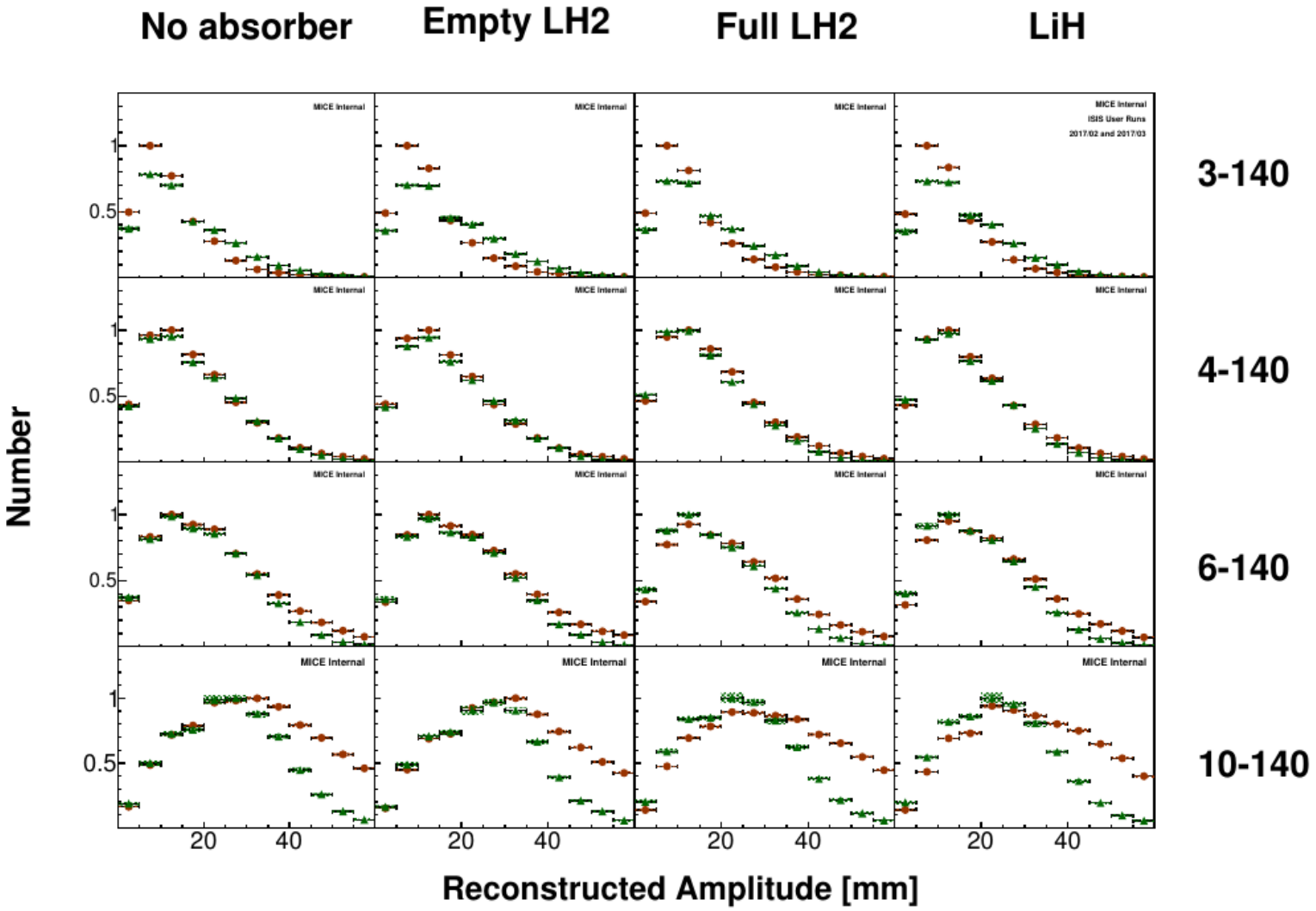




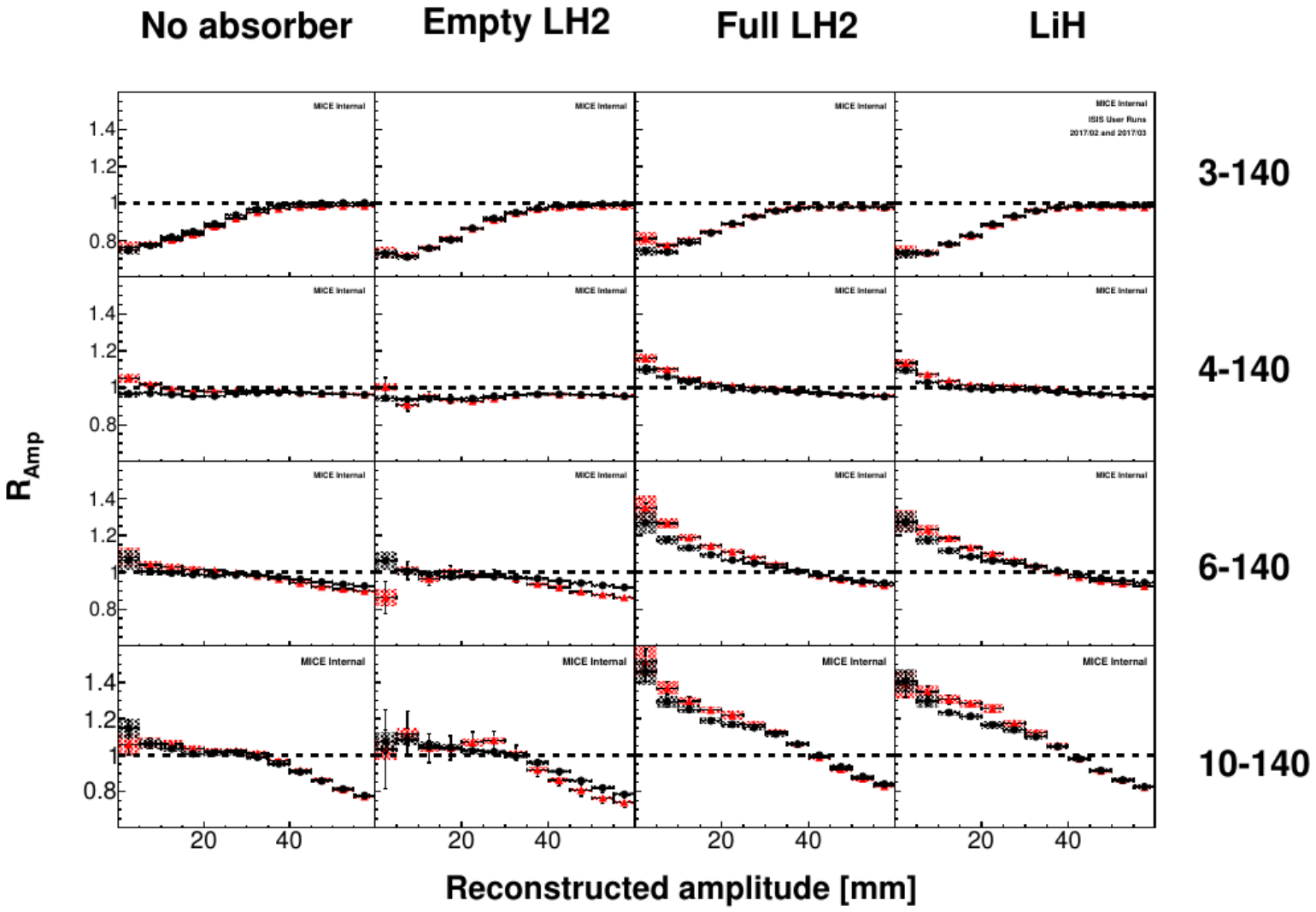
Efficiency correction



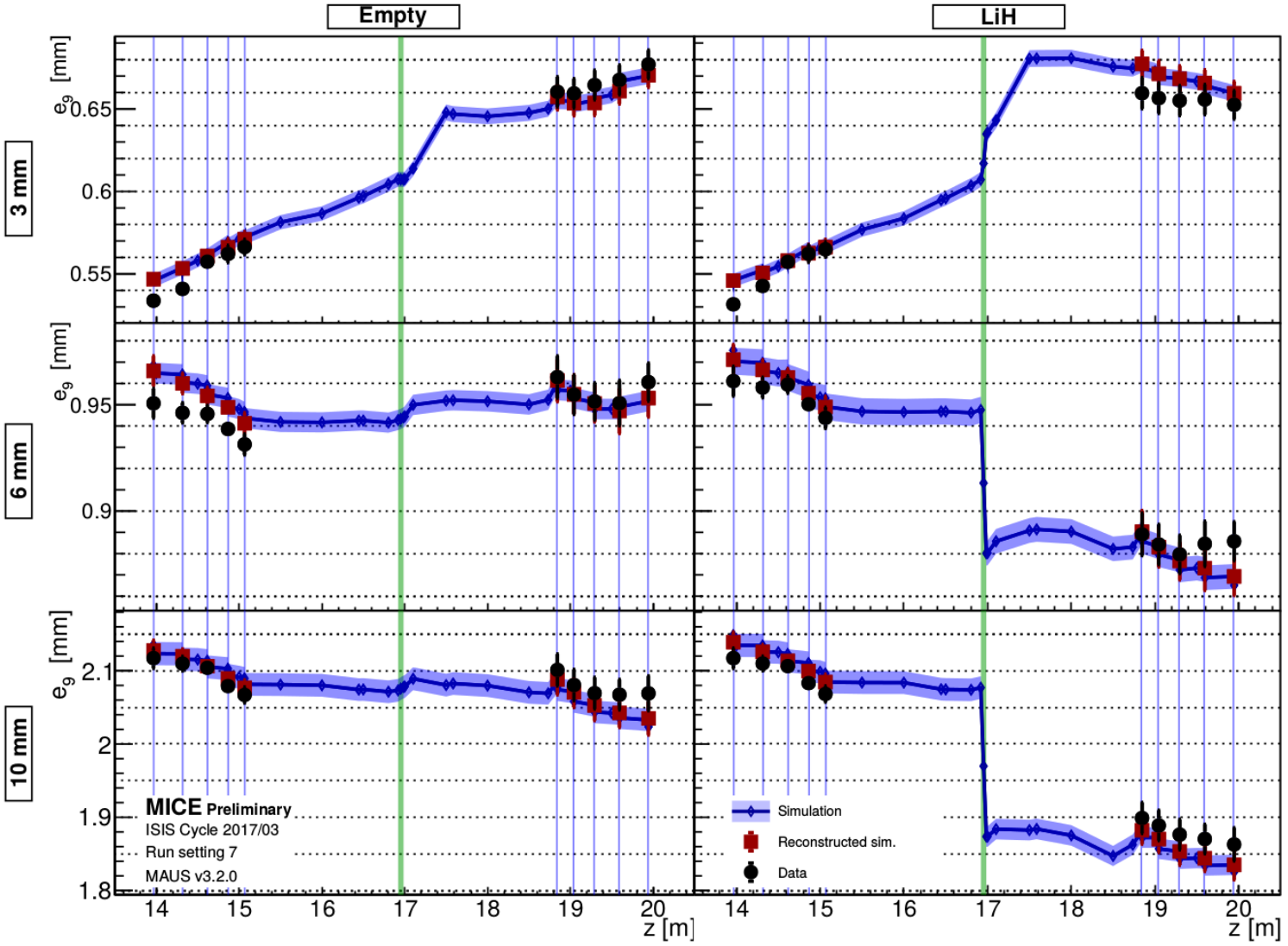
Amplitude pdf



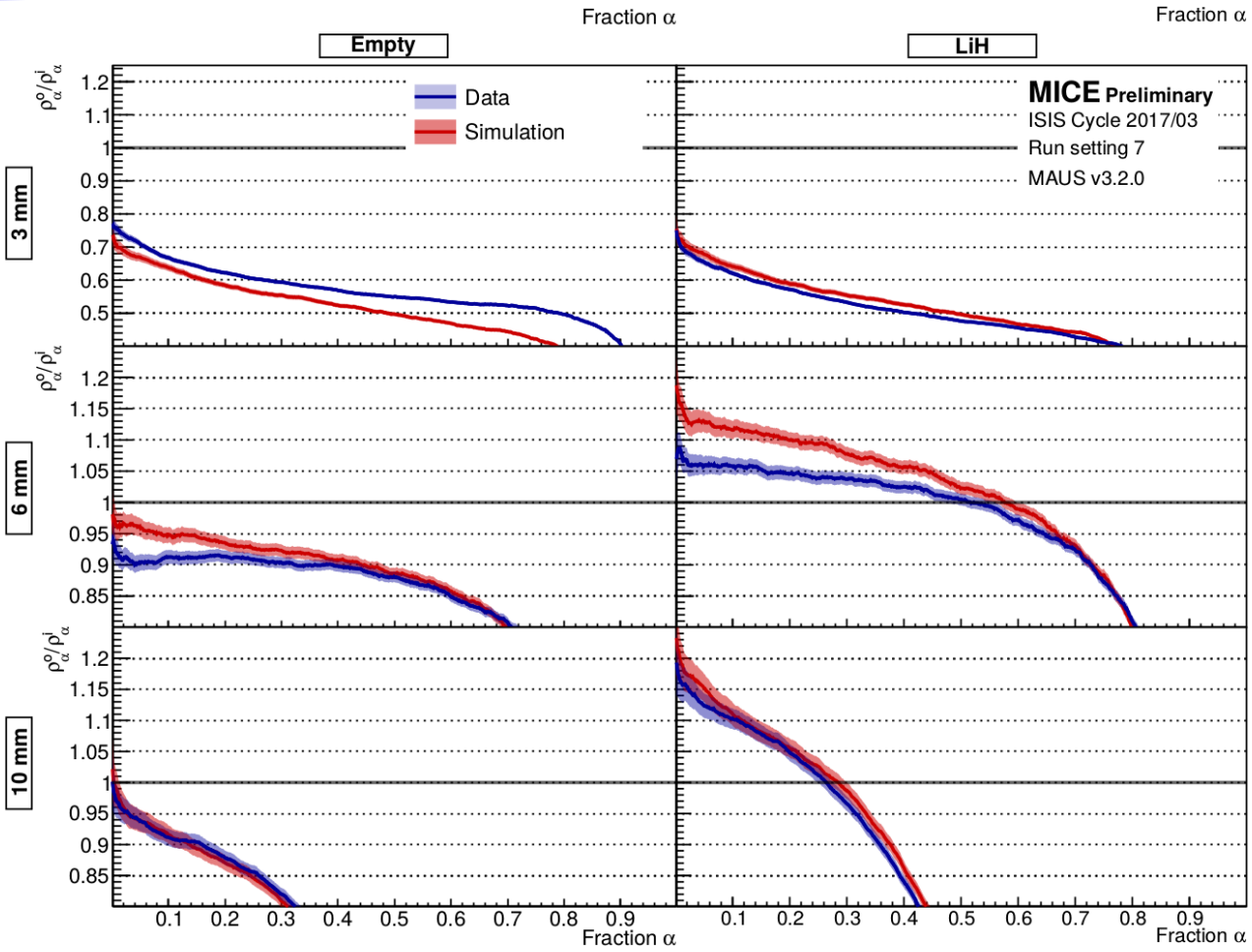
Amplitude cdf ratio



Fractional emittance evolution (Drielsma)



KNN Density Estimate (Drielsma)



Conclusions

- No major problems with the paper
- Some expected requests to improve MC
  - In progress