

Solenoid Mode Emittance Analysis

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21/05/2020 / Analysis Workshop

Status

Amplitude analysis for 2017-02-6 with systematics (low systematics MC statistics) exists, with plots

Running more MC for systematics currently

Systematics used:

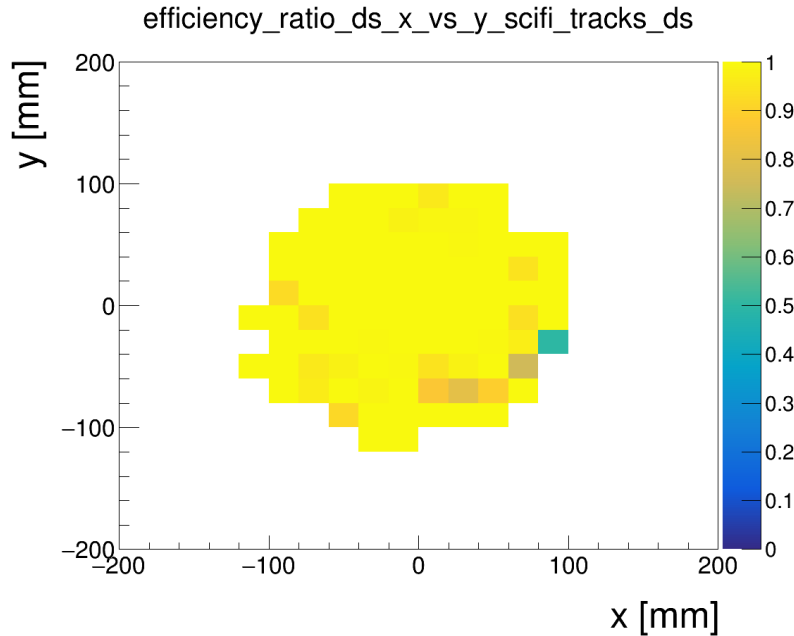
- +3mrad tku/tkd rotation in x
- +3mm tku/tkd position in x
- +3% in SSU/SSD Centre
- +5% in SSU/SSD E1/E2
- +50% (2- \rightarrow 3g/cm³) tracker glue density

Running own MC for 2017-02-5 for MC tunes

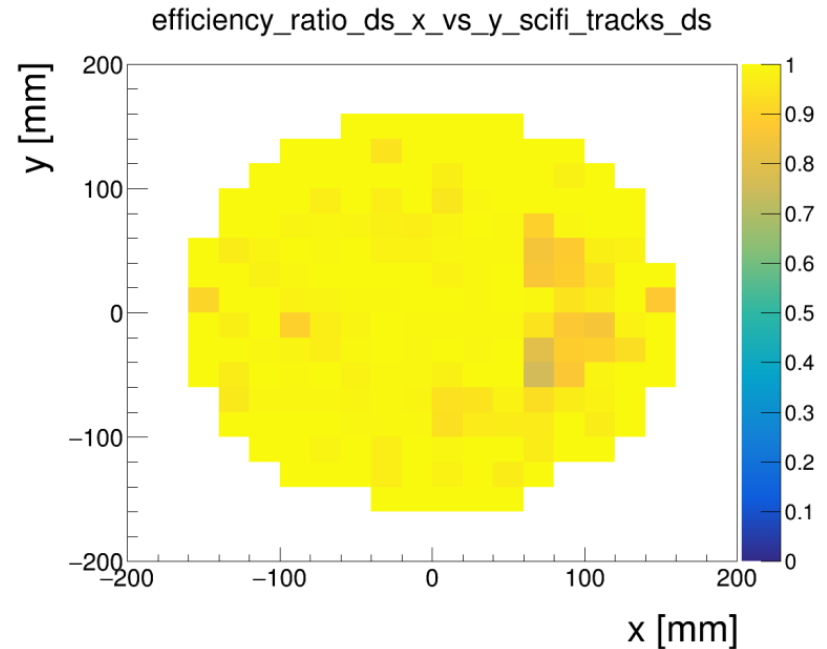
Inefficiency in Scifi Track DS cut

- Larger inefficiencies in PxPy / x-y

3-140 Empty

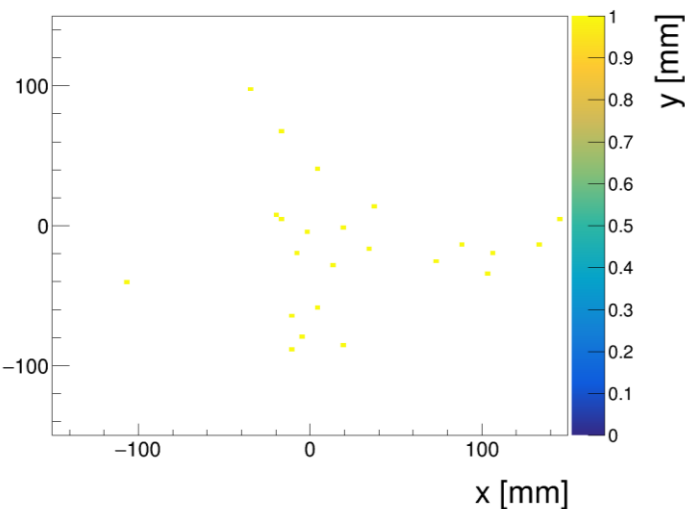


3-240 LH2

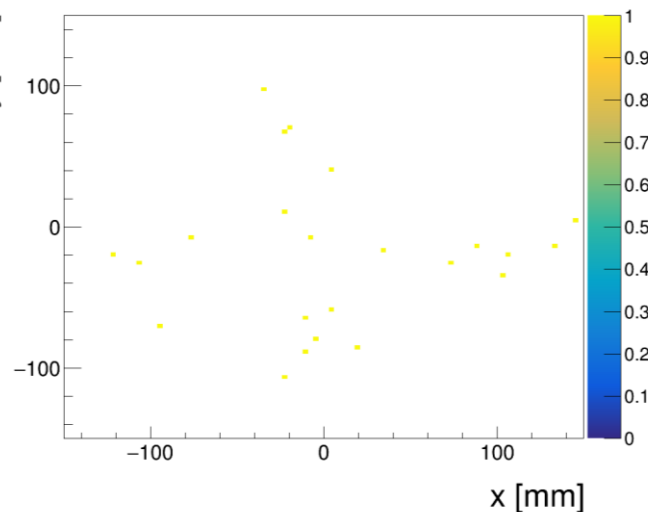


Tkd station 1 trackpoints – LH2 3-240 MC

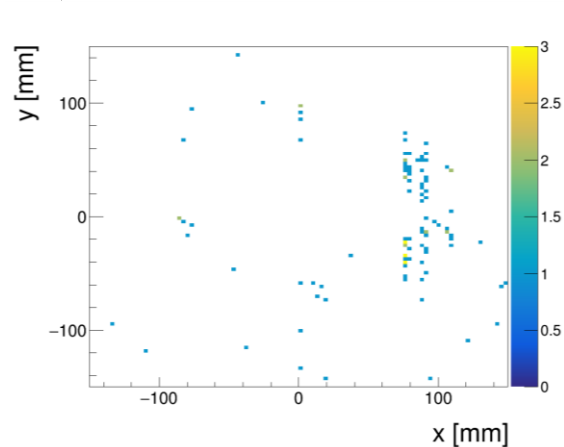
Reconstructed X-Y



X-Y Truth of reconstructed

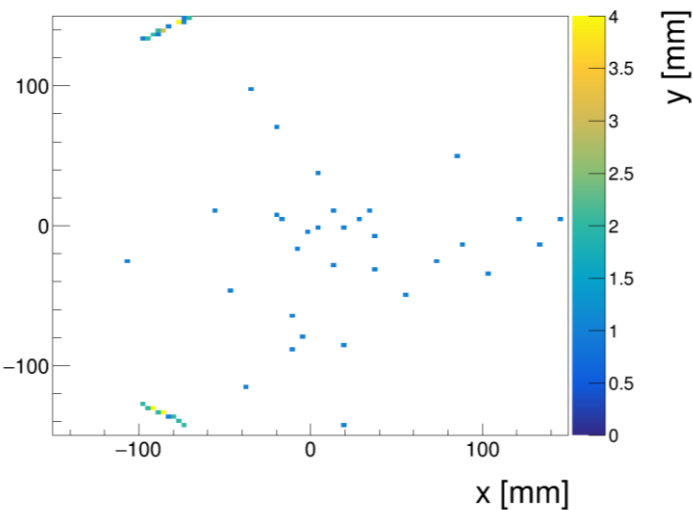


Truth of not reconstructed

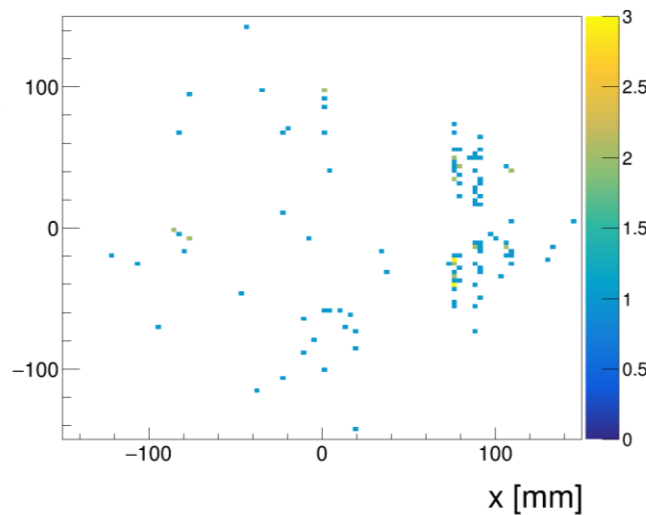


Tkd station 1 spacepoints – LH2 3-240 MC

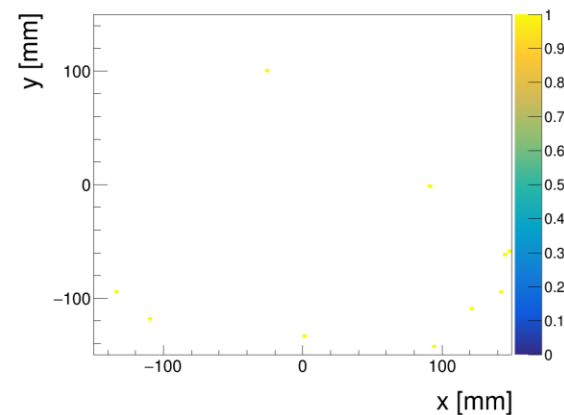
Reconstructed X-Y



X-Y Truth of reconstructed

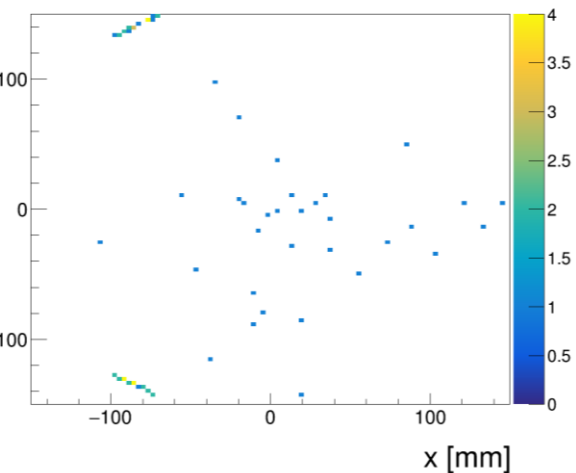


Truth of not reconstructed

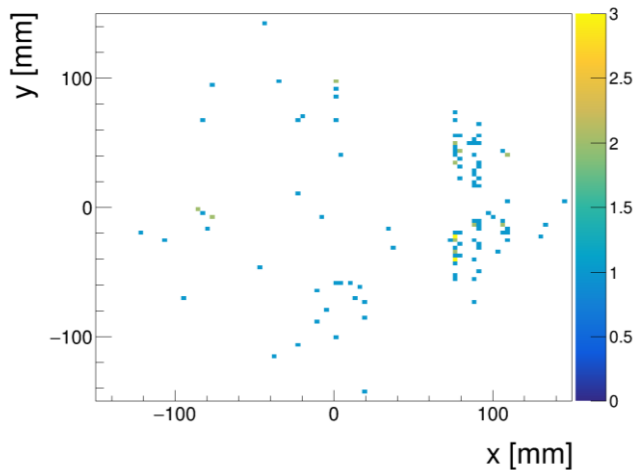


Tkd station 1 spacepoints – LH2 3-240 MC

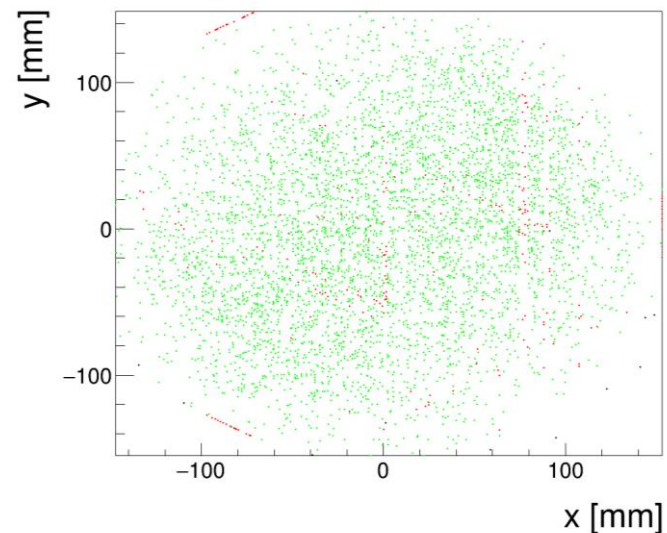
Reconstructed
X-Y



X-Y Truth of
reconstructed



3 plane Spacepoints
2 plane Spacepoints



Particle loss &/or track rejection between US and DS samples

3-170 runs

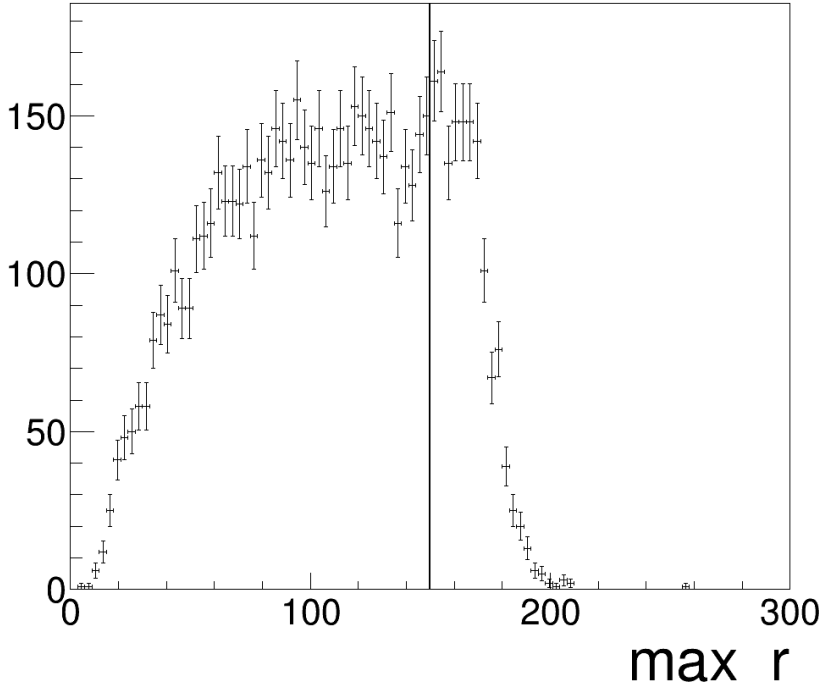
Low transmission issues seen in 3-170 solenoid beams

Either no track recorded or particles excluded from radial cut

Applies both in data, MC, and MC truth

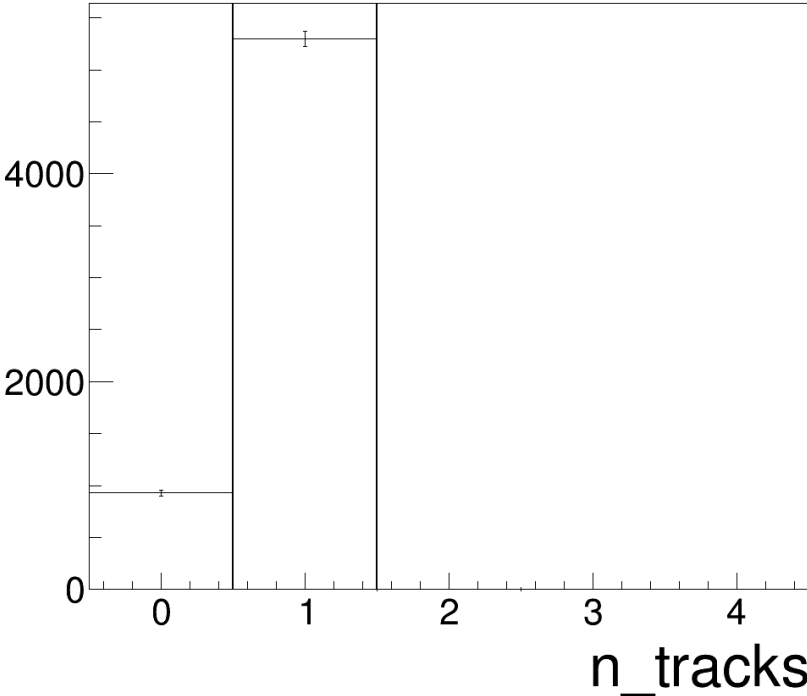
TKD Max Radius Cut - MC

Simulated 2017-02-6 3-170 ABS-LH2

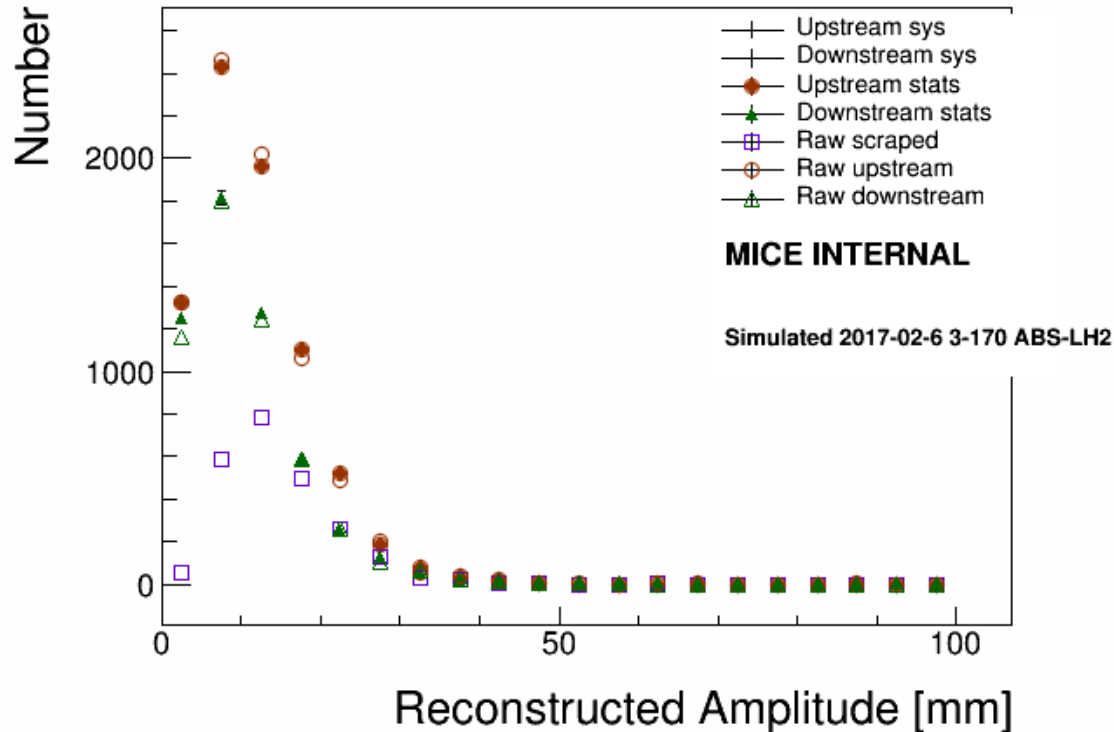


TKD N Tracks cut - MC

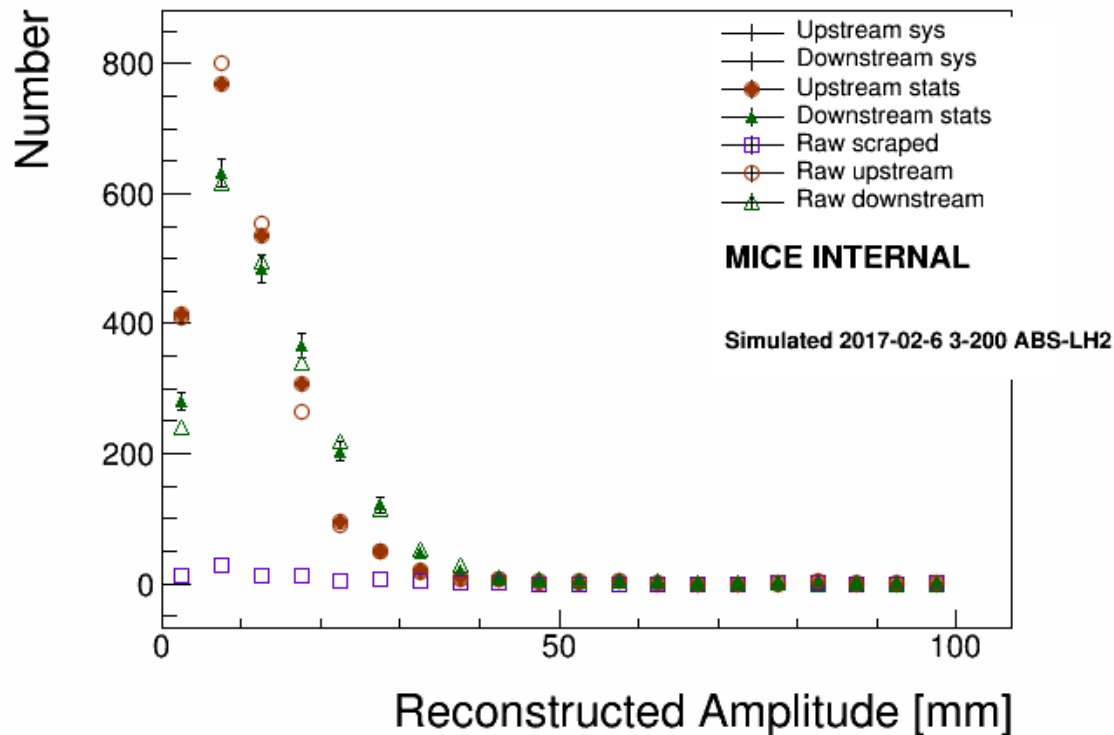
Simulated 2017-02-6 3-170 ABS-LH2



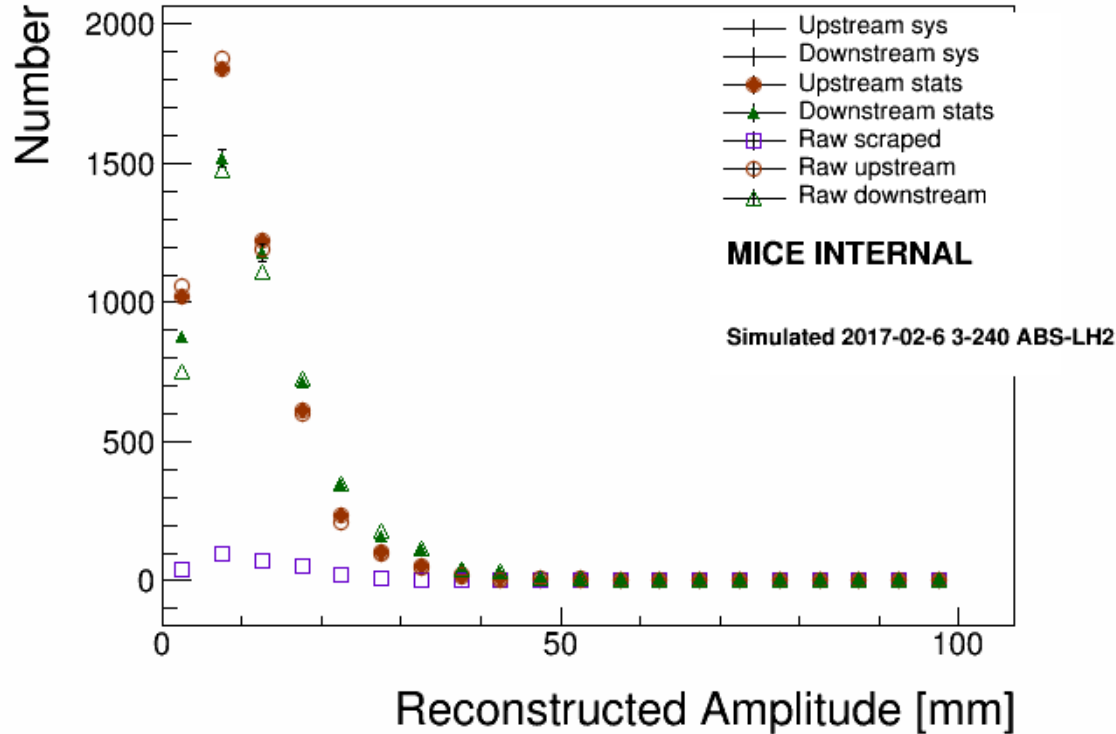
Amplitude PDF – LH2 3-170 MC



Amplitude PDF – LH2 3-200 MC

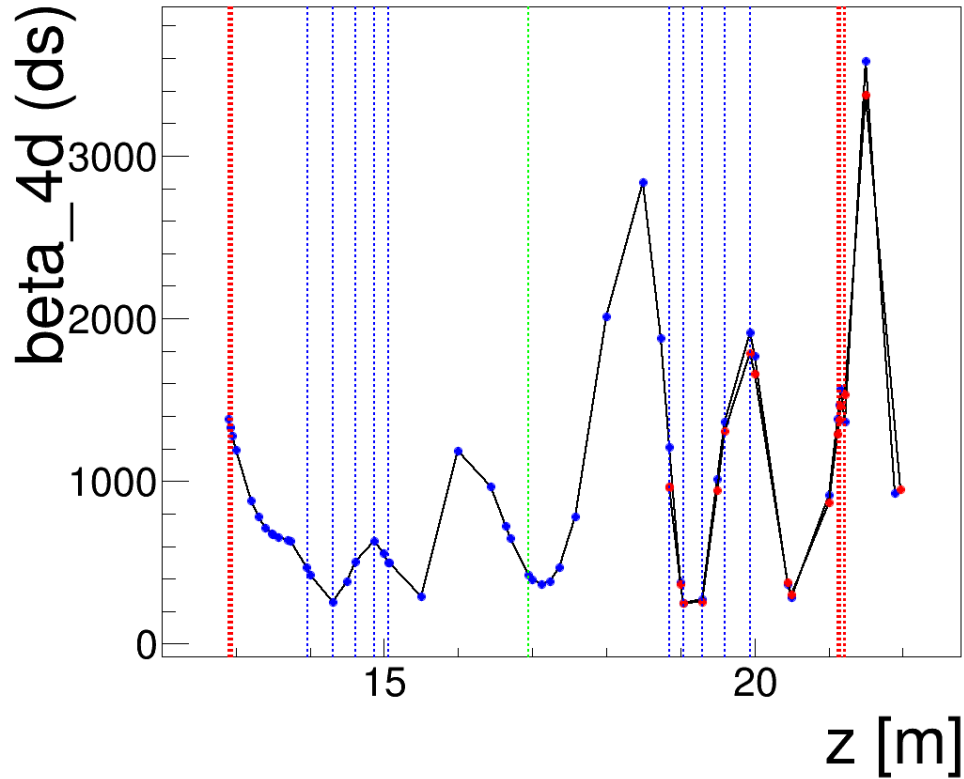


Amplitude PDF – LH2 3-240 MC



Beta - MC

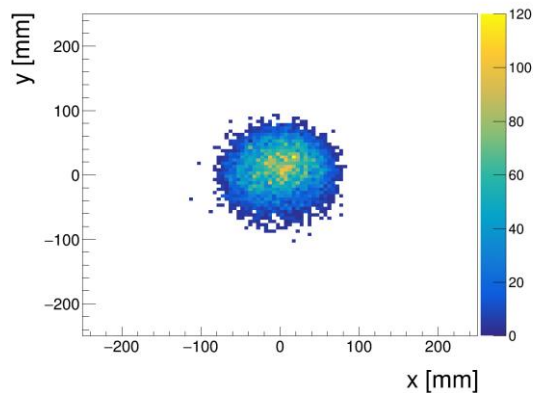
Simulated 2017-02-6 3-170 ABS-LH2



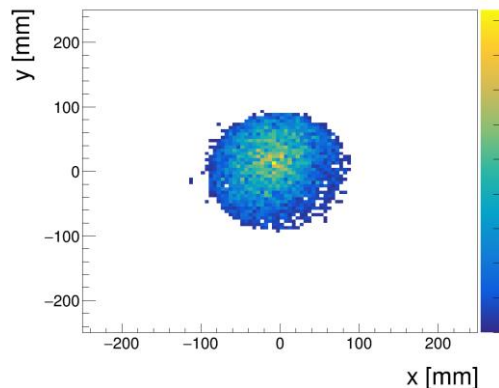
Blue - US sample
Red - DS sample

TKU X-Y US vs DS cut

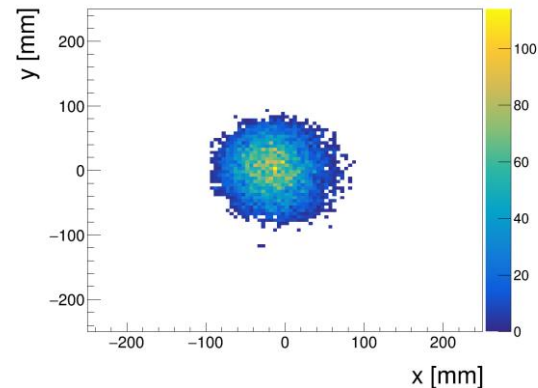
tku 1



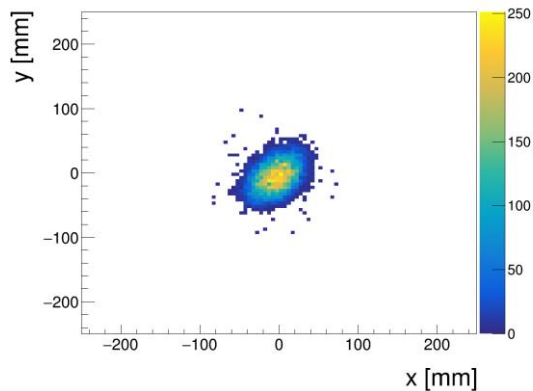
tku 2



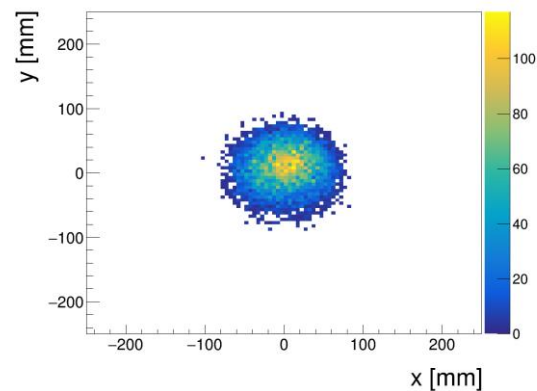
tku 3



tku 4

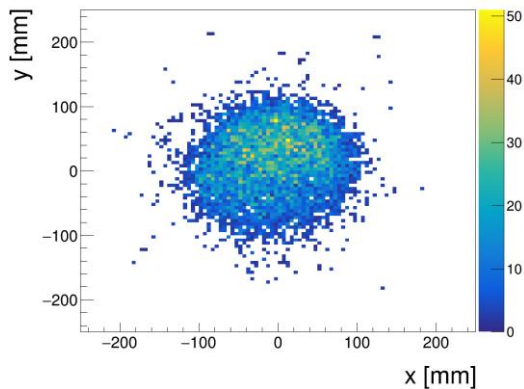


tku 5

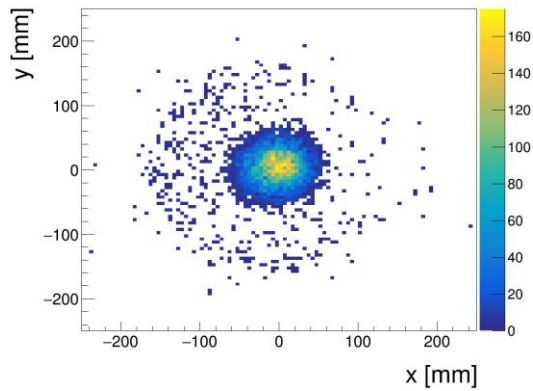


TKD X-Y US vs DS cut

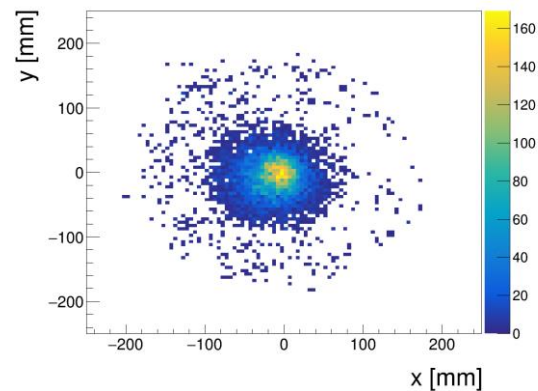
tku 1



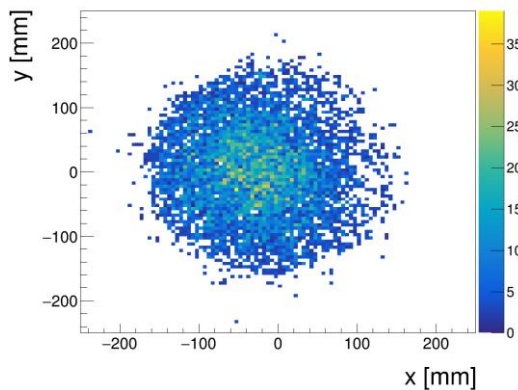
tku 2



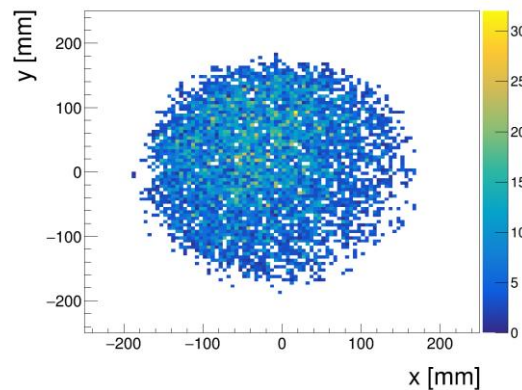
tku 3



tku 4



tku 5



TKU Sample Selection (MC)

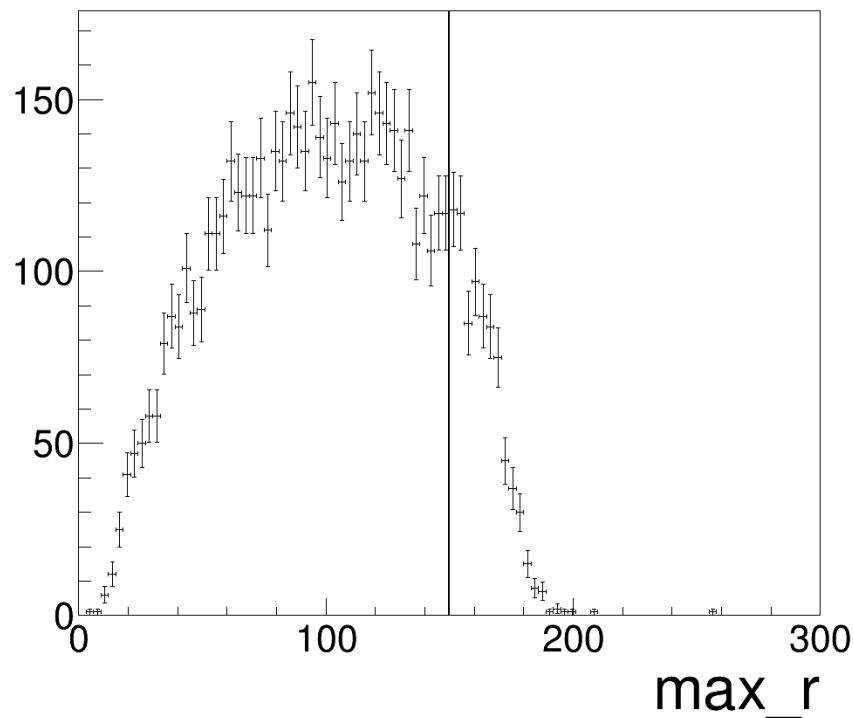
Can select the core of the beam in TKU to try and improve transmission

TKU x-y radius nominally ~100mm

TKU radius < 75mm

TKD max r cut

Simulated 2017-02-6 3-170 ABS-LH2



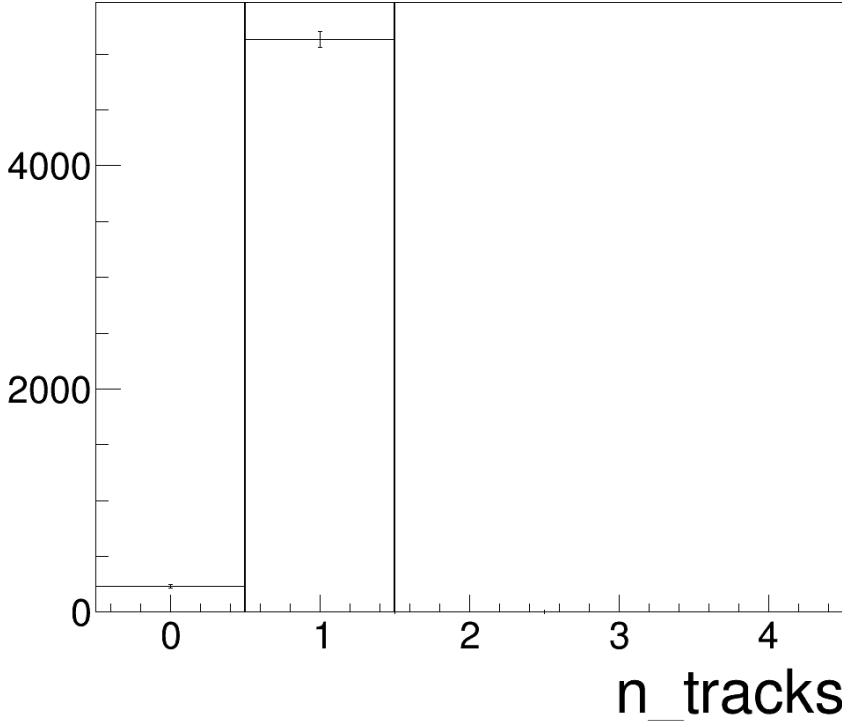
Transmission ~82%

DS sample size ~97%

TKU radius < 75mm

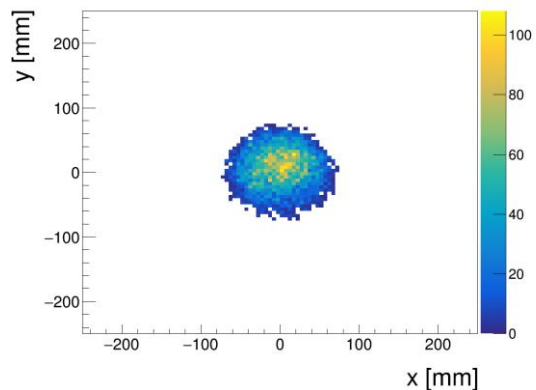
TKD N Tracks cut

Simulated 2017-02-6 3-170 ABS-LH2

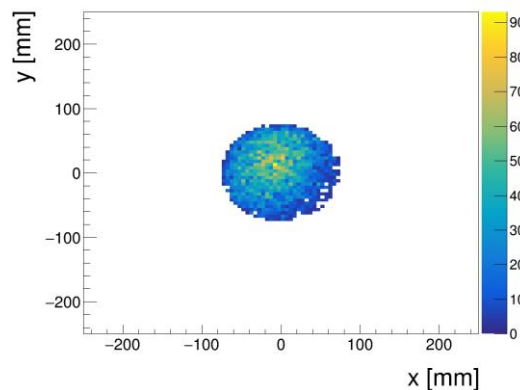


TKU X-Y US vs DS cut - TKU radius < 75mm

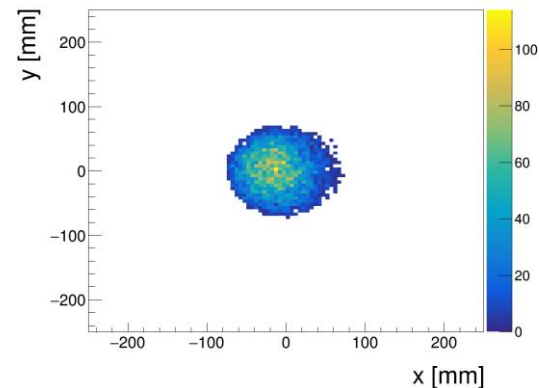
tku 1



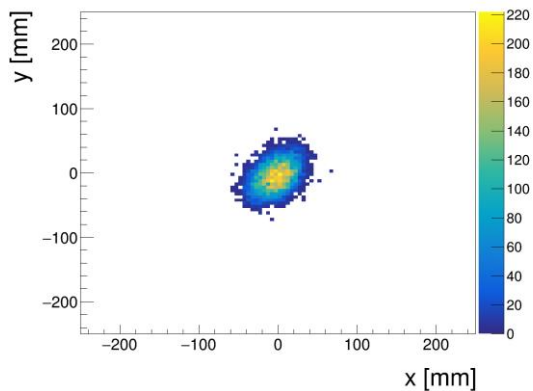
tku 2



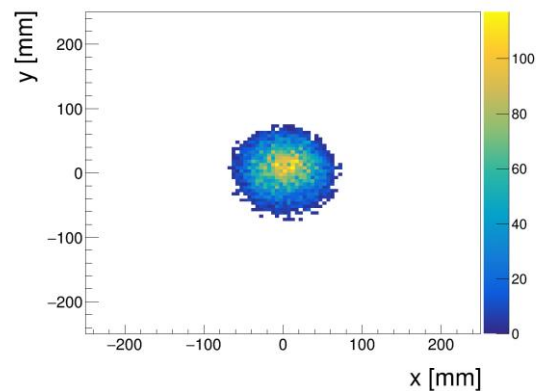
tku 3



tku 4

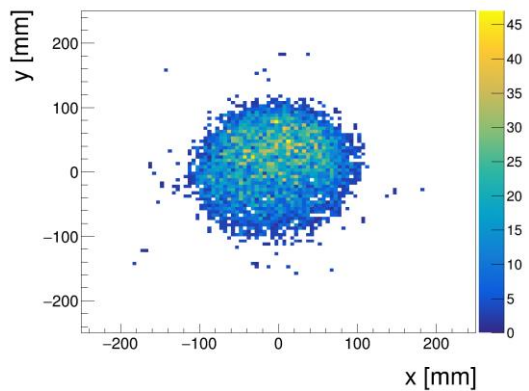


tku 5

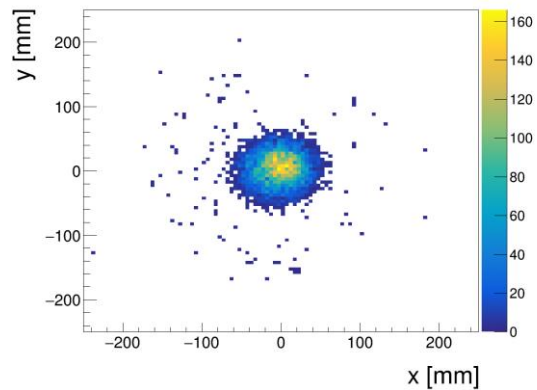


TKD X-Y US vs DS cut - TKU radius < 75mm

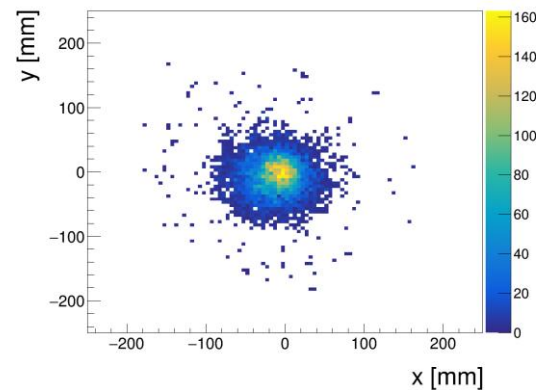
tkd 1



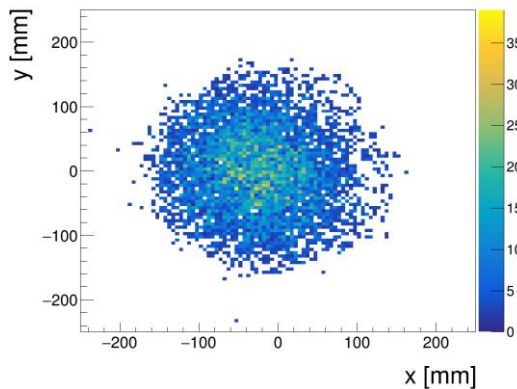
tkd 2



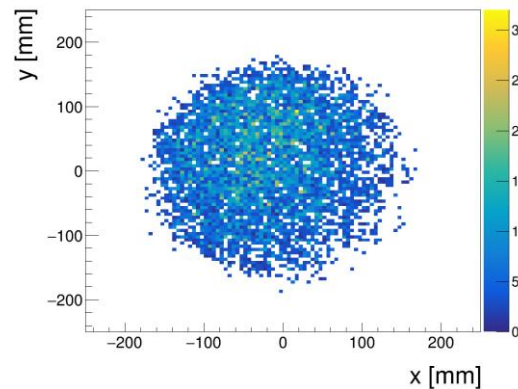
tkd 3



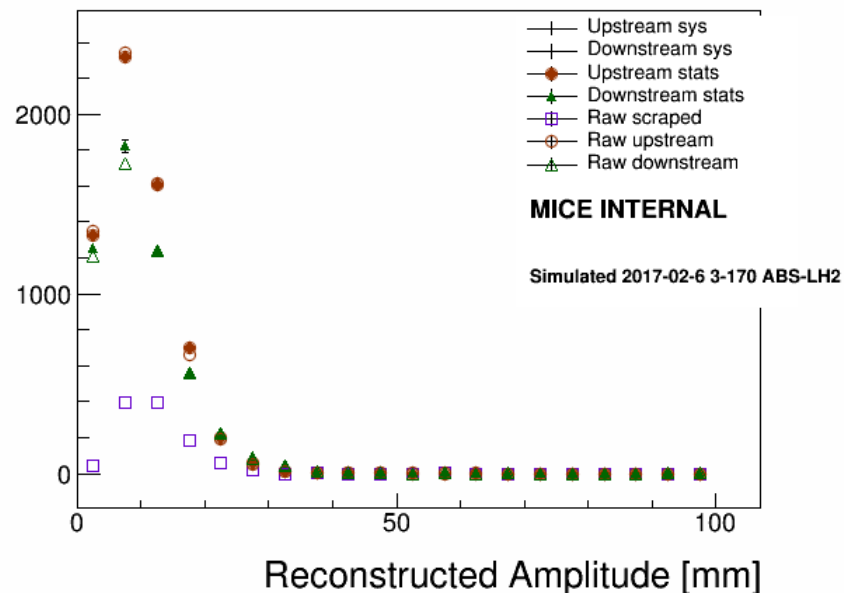
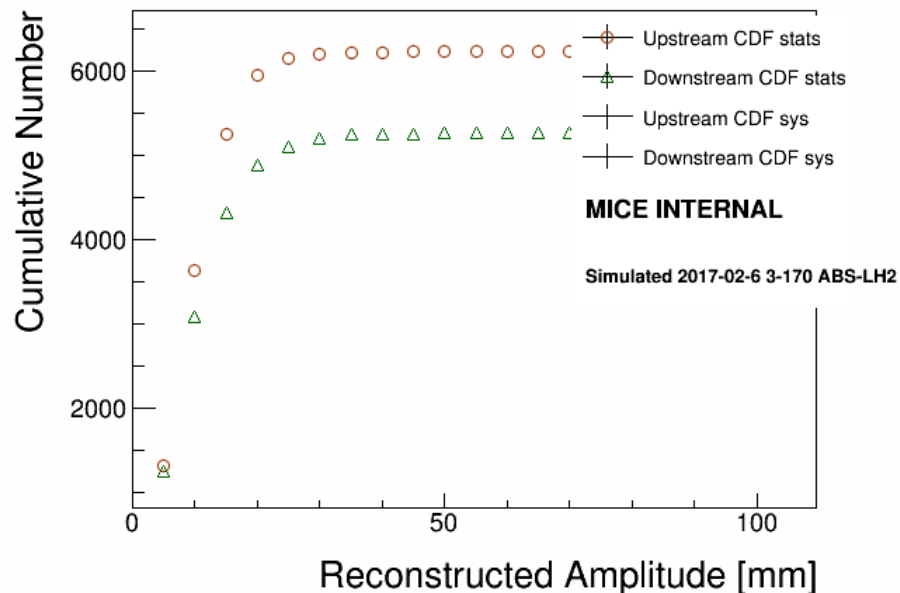
tkd 4



tkd 5



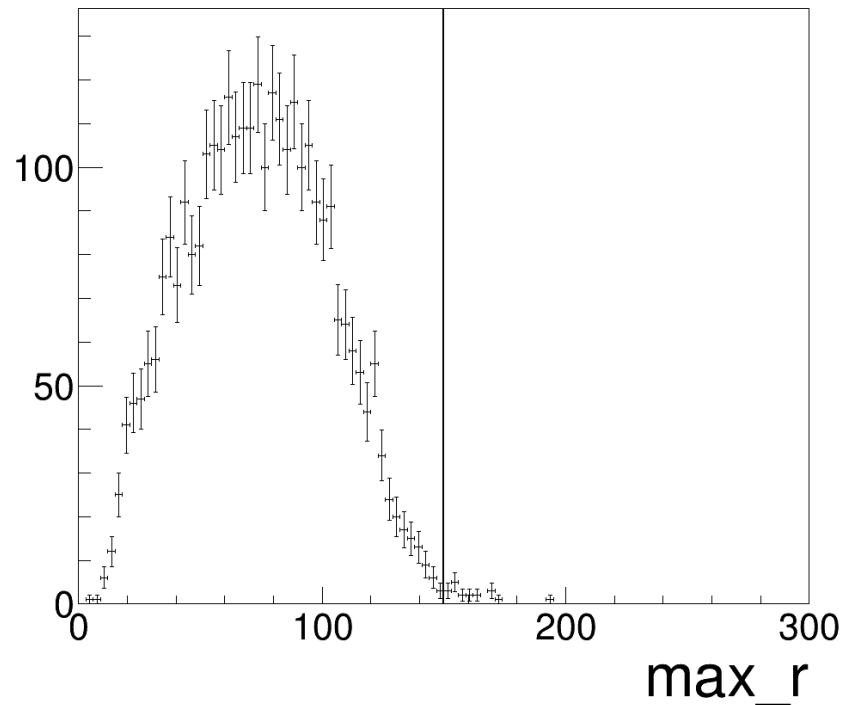
Amplitude CDF & PDF - TKU radius < 75mm



TKU radius < 50mm

TKD max r cut

Simulated 2017-02-6 3-170 ABS-LH2



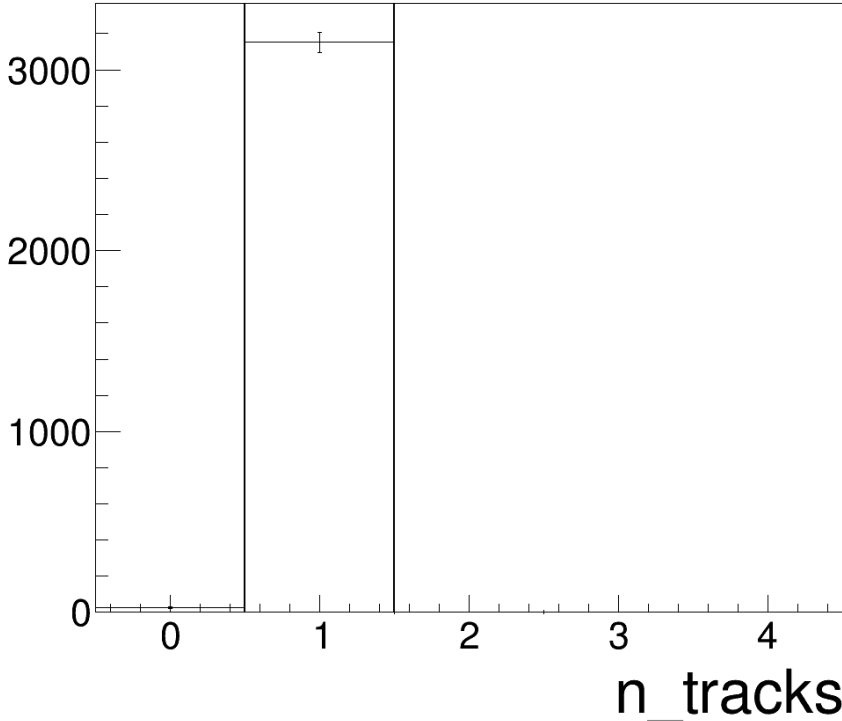
Transmission ~98%

DS sample size ~60%

TKU radius < 50mm

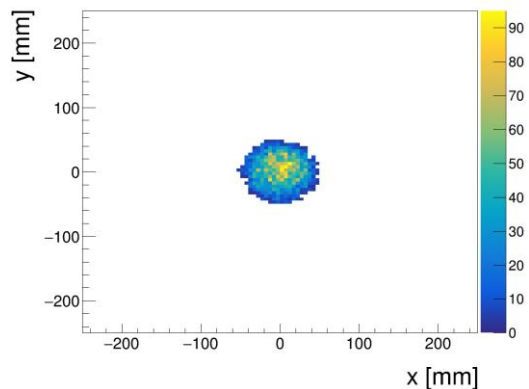
TKD N Tracks cut

Simulated 2017-02-6 3-170 ABS-LH2

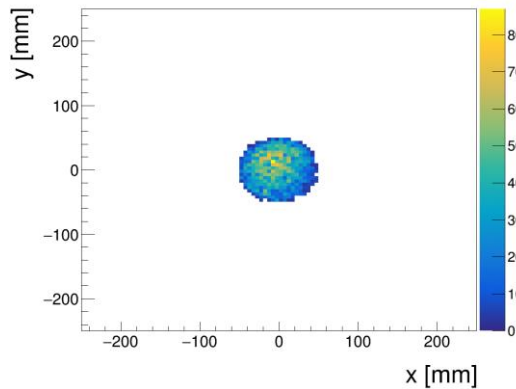


TKU X-Y US vs DS cut - TKU radius < 50mm

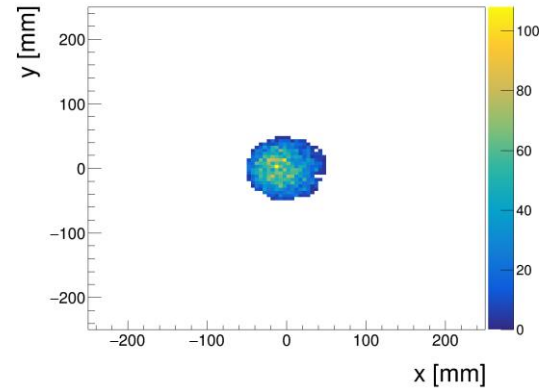
tku 1



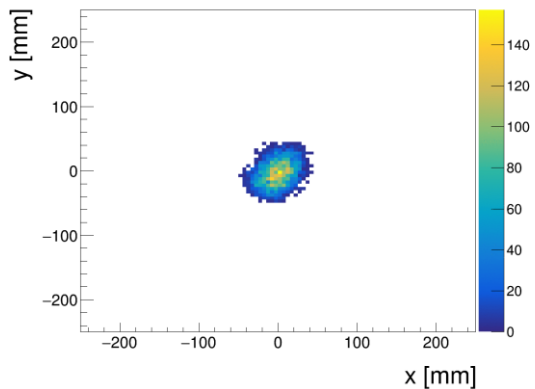
tku 2



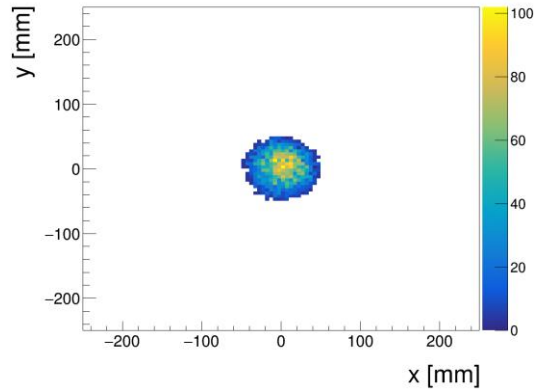
tku 3



tku 4

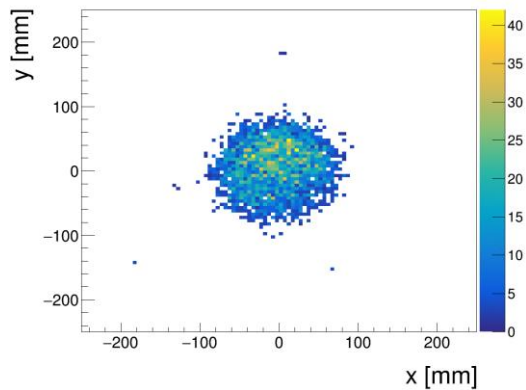


tku 5

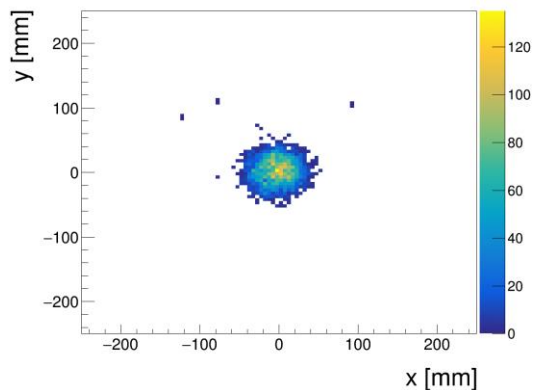


TKD X-Y US vs DS cut - TKU radius < 50mm

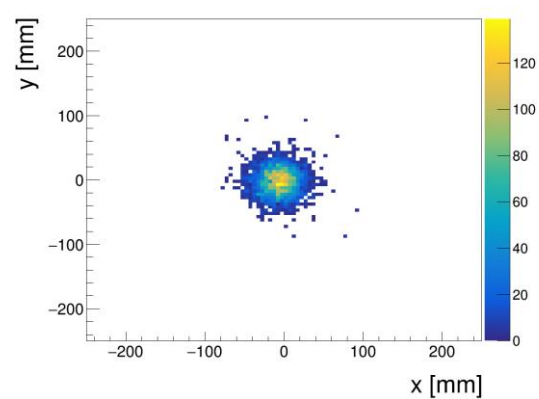
tkd 1



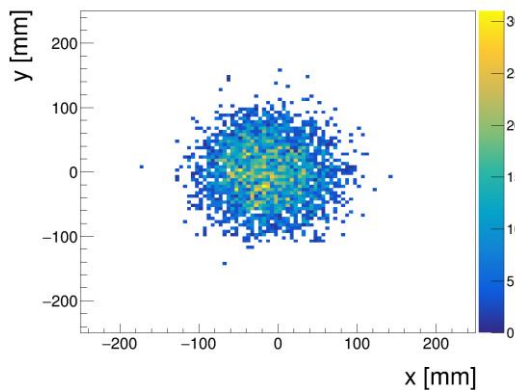
tkd 2



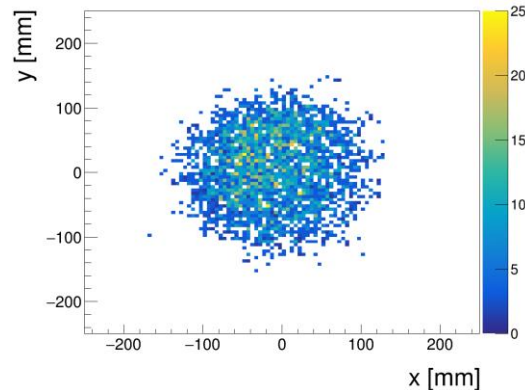
tkd 3



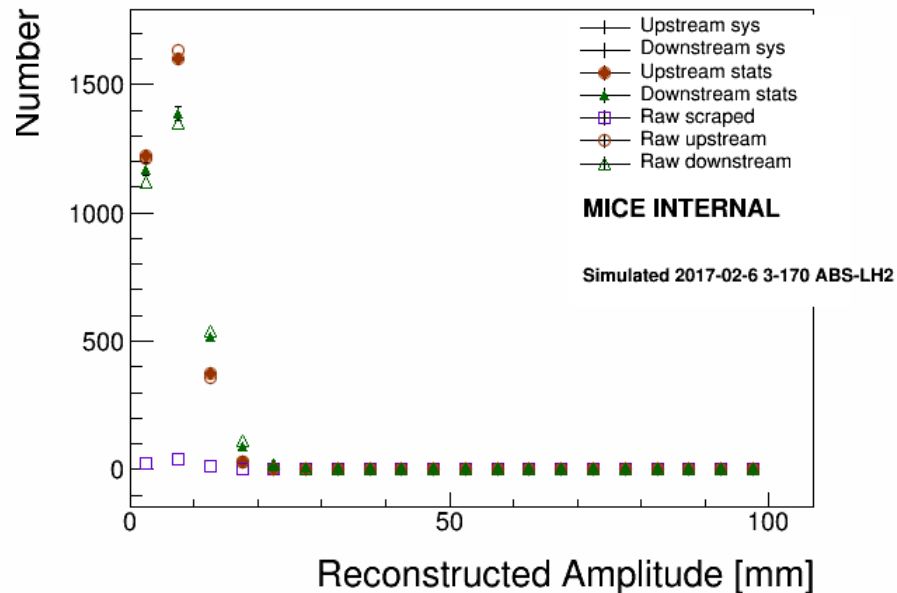
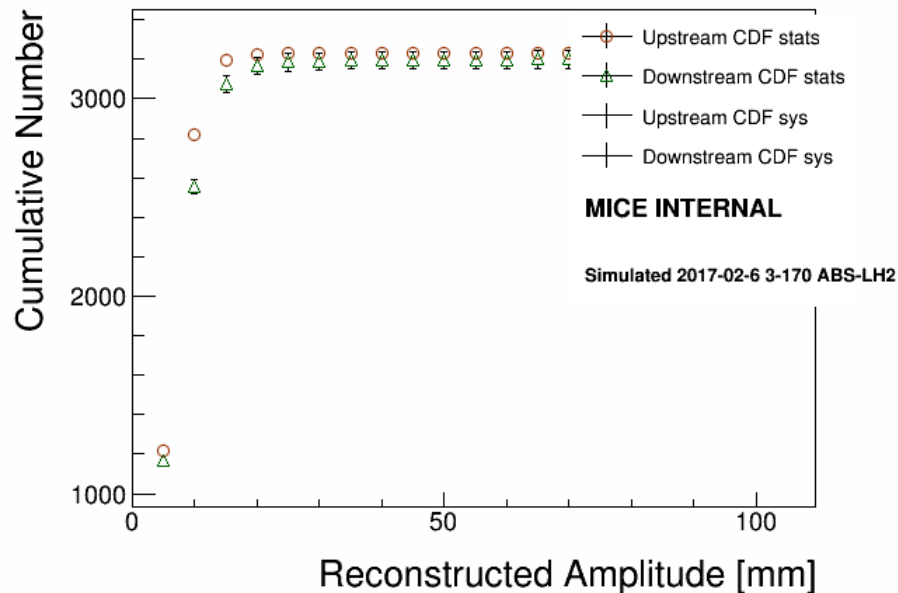
tkd 4



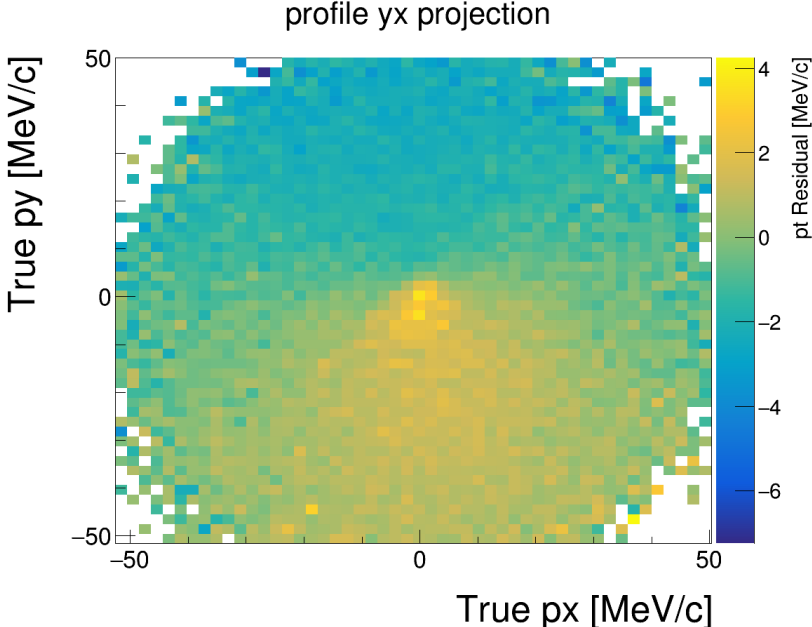
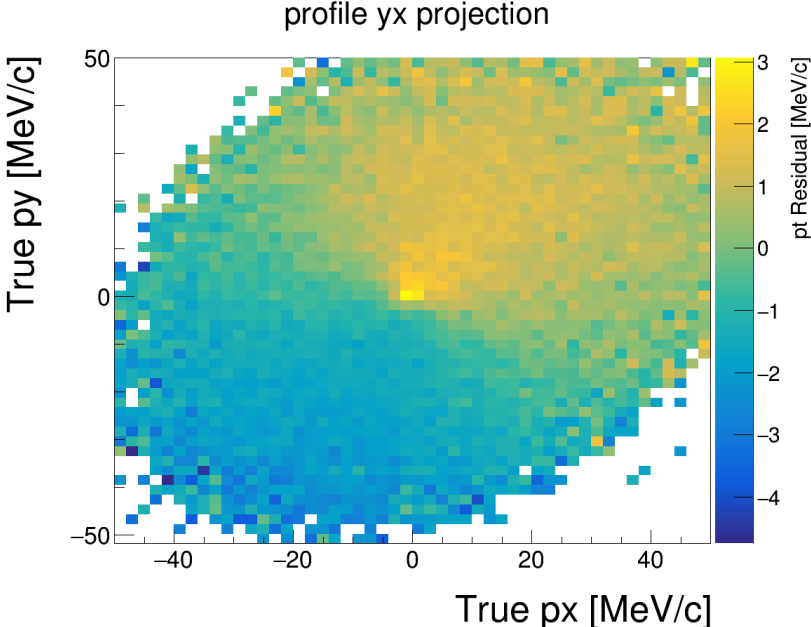
tkd 5



Amplitude CDF & PDF - TKU radius < 50mm



Low Pt – Pt residual



Amplitude Analysis Plots

Run Selection

Cooling Channel tag : 2017-02-6

3,4,6,10-140 LH2-full, LH2-empty, empty + LiH

MC + Data

3-140 LH2

9883, 9888, 9893, 9897,
9903, 9906

3-140 LH2-EMPTY

10243, 10248, 10253,
10254, 10255, 10256

3-140 No Absorber

10313, 10314, 10323, 10327,
10333

3-140 LiH

10508, 10511

4-140 LH2

4-140 LH2-EMPTY

4-140 No Absorber

4-140 LiH

10315, 10317, 10322, 10328,
10334

10504, 10505, 10506, 10507

6-140 LH2

9884, 9885, 9889, 9894,
9898, 9904, 9905

6-140 LH2-EMPTY

10245, 10247, 10249

6-140 No Absorber

10318, 10324, 10329, 10335

6-140 LiH

10509, 10510

10-140 LH2

9886, 9887, 9890, 9891,
9892, 9895, 9896, 9899,
9900, 9901, 9902

10-140 LH2-EMPTY

10246, 10250, 10251,
10252, 10257, 10258,
10259, 10260

10-140 No Absorber

10319, 10321, 10325, 10326,
10330, 10331, 10332

10-140 LiH

Cuts

US :

1 TOF0 & TOF1 SP

TOF01 (rescaled wrt electron peak)

1 Scifi track US

Scifi fiducial US ; $r < 150\text{mm}$

Chi2 US < 8

TOF01 vs P – banana cut

P tot US +/- 5

US aperture ; $r < 90\text{mm}$

DS :

1 Scifi track DS

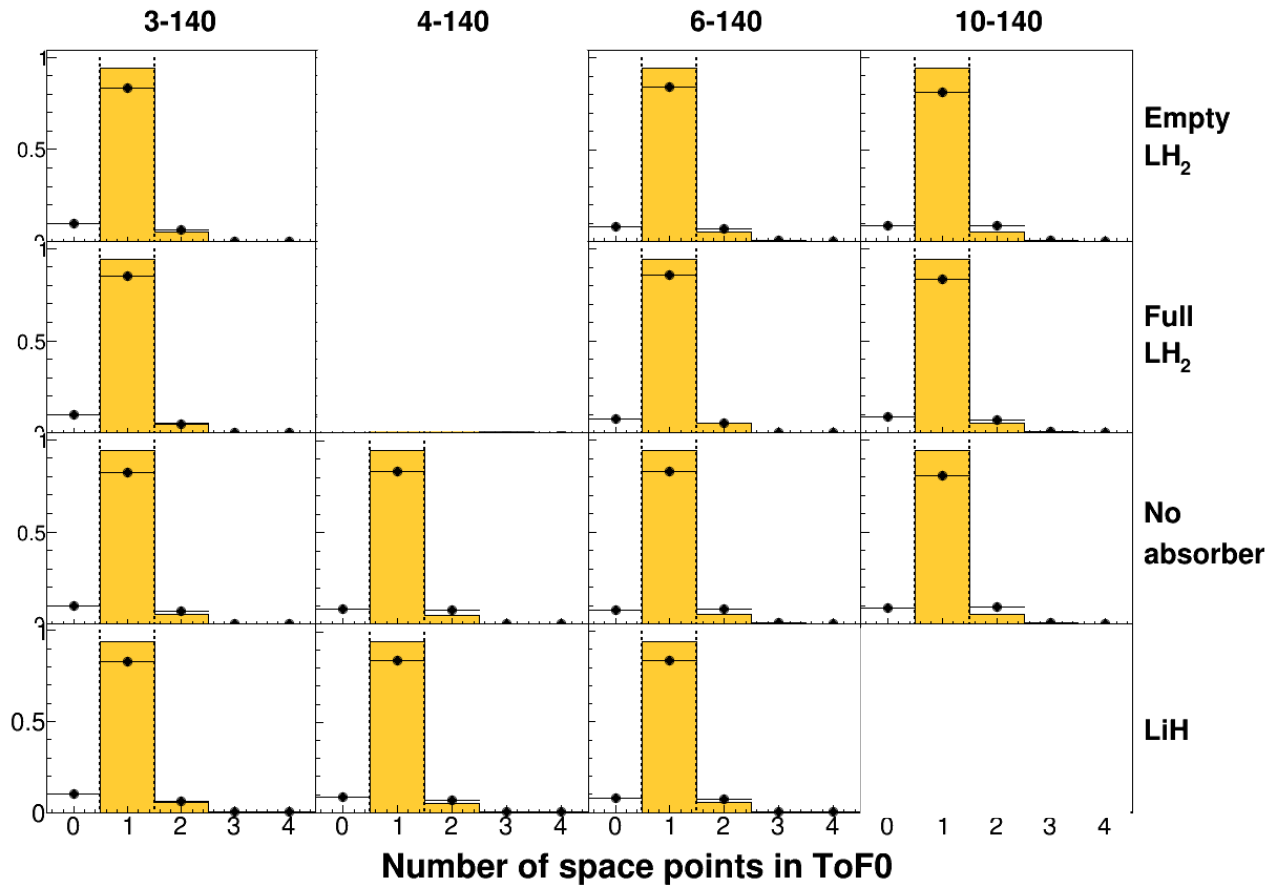
Chi2 DS < 8

Scifi fiducial DS ; $r < 150\text{mm}$

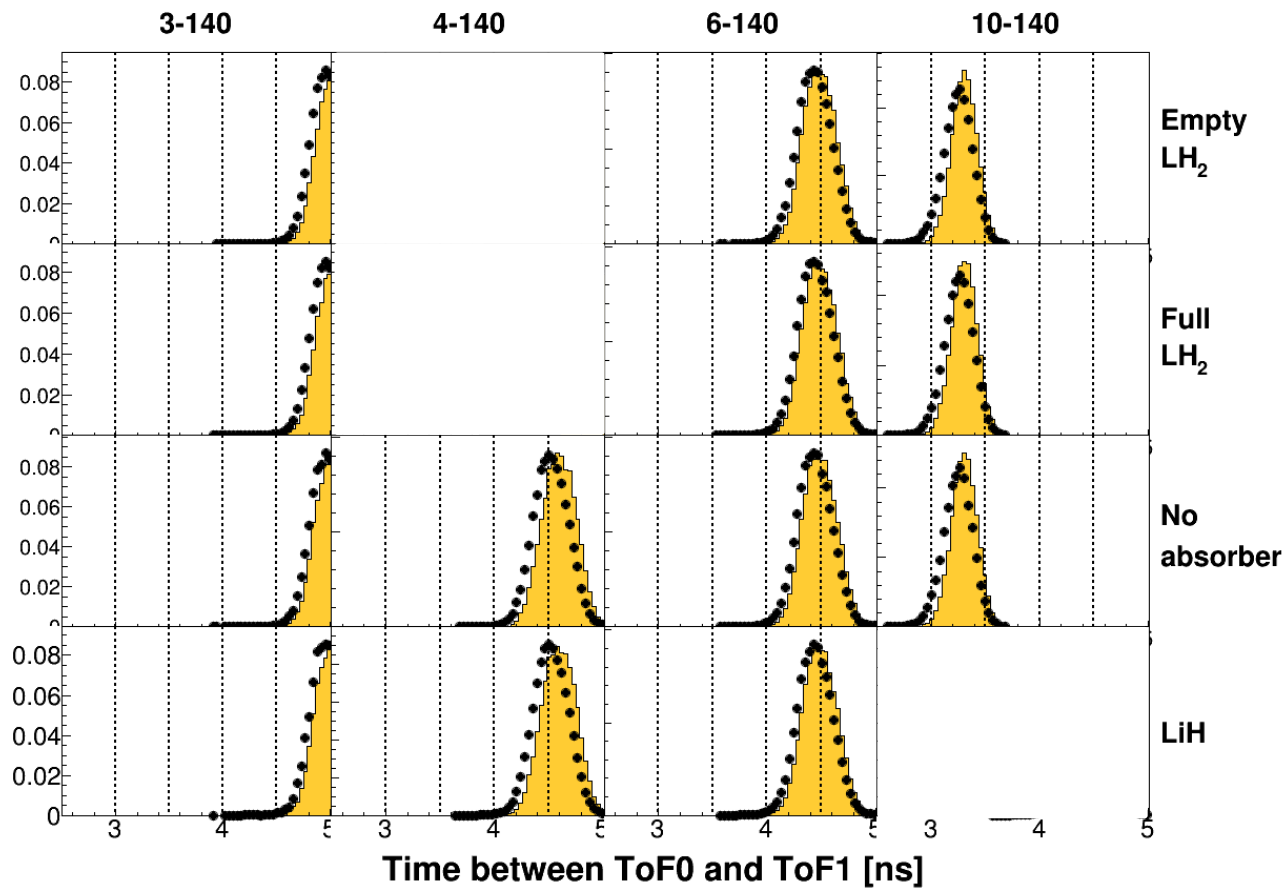
90 $< P \text{ tot DS} < 170$

DS aperture ; $r < 100\text{mm}$

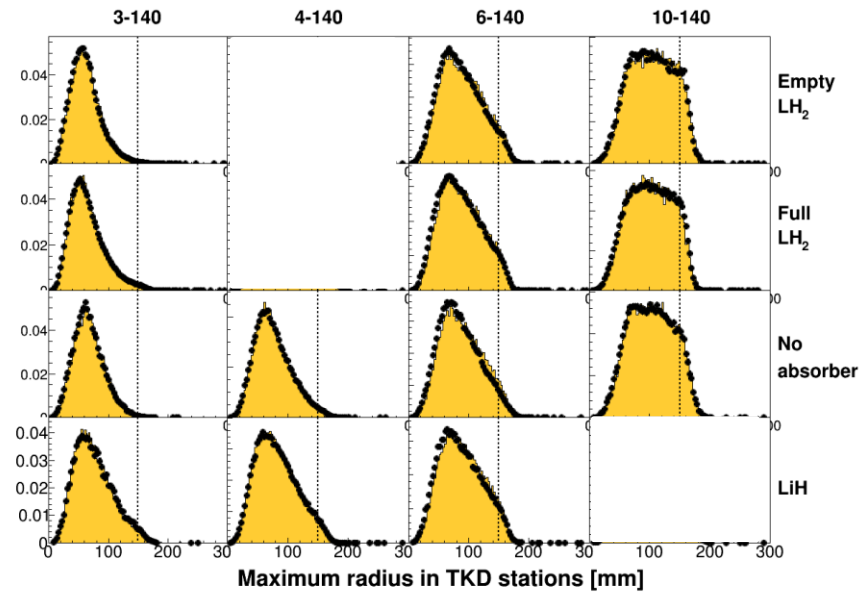
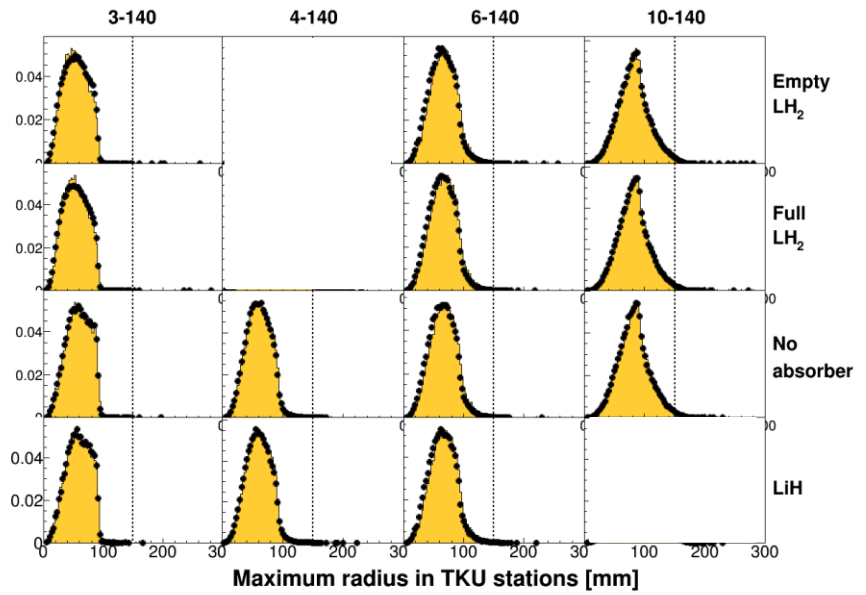
Sample Selection

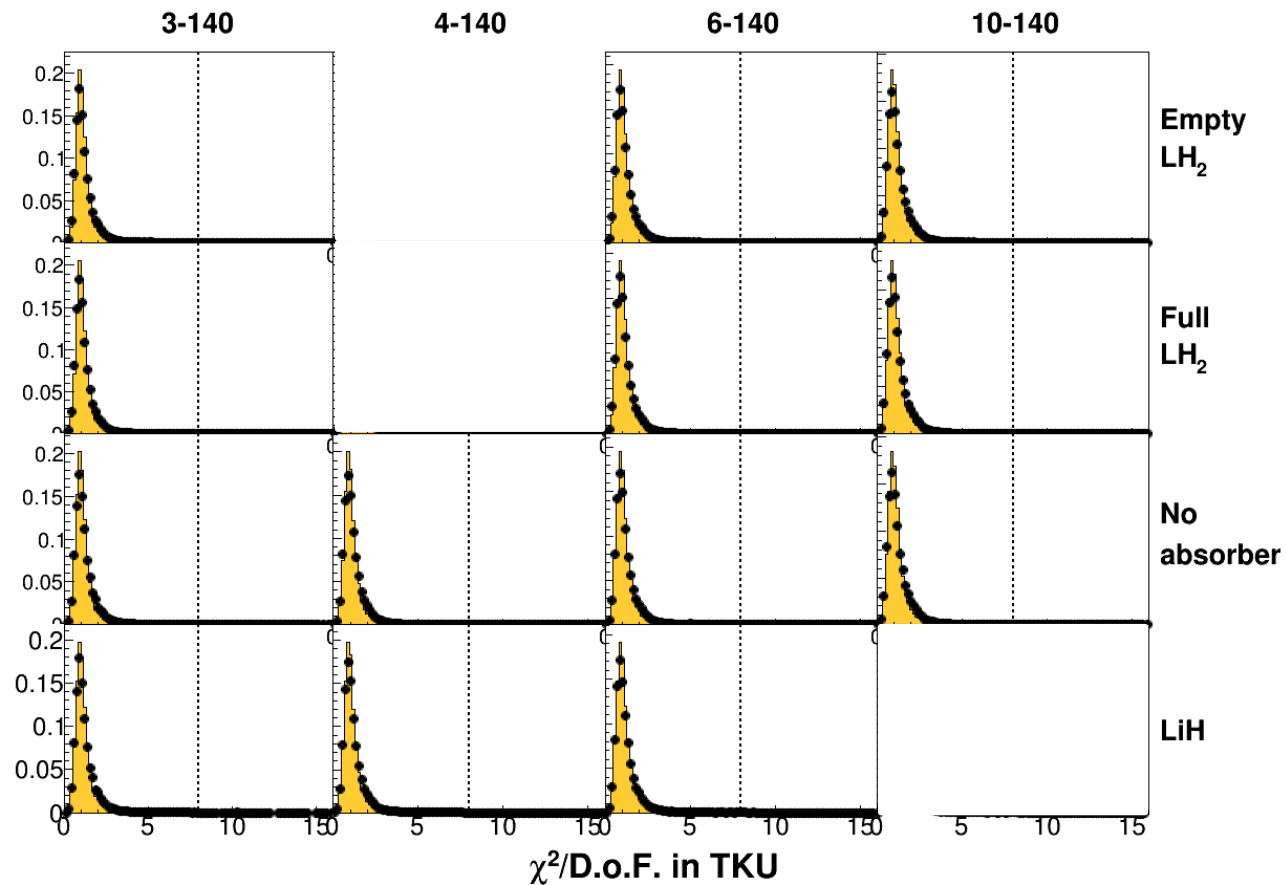


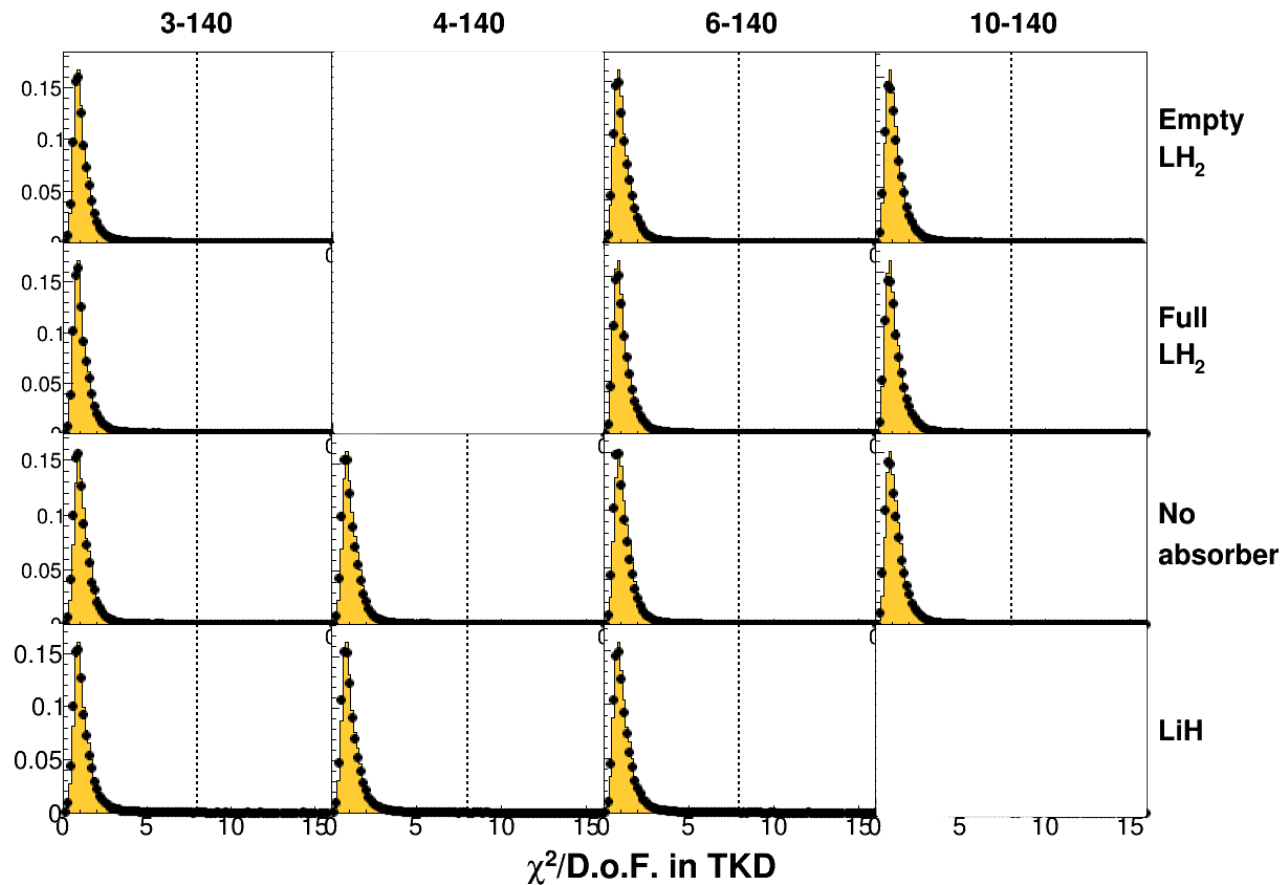
Sample Selection



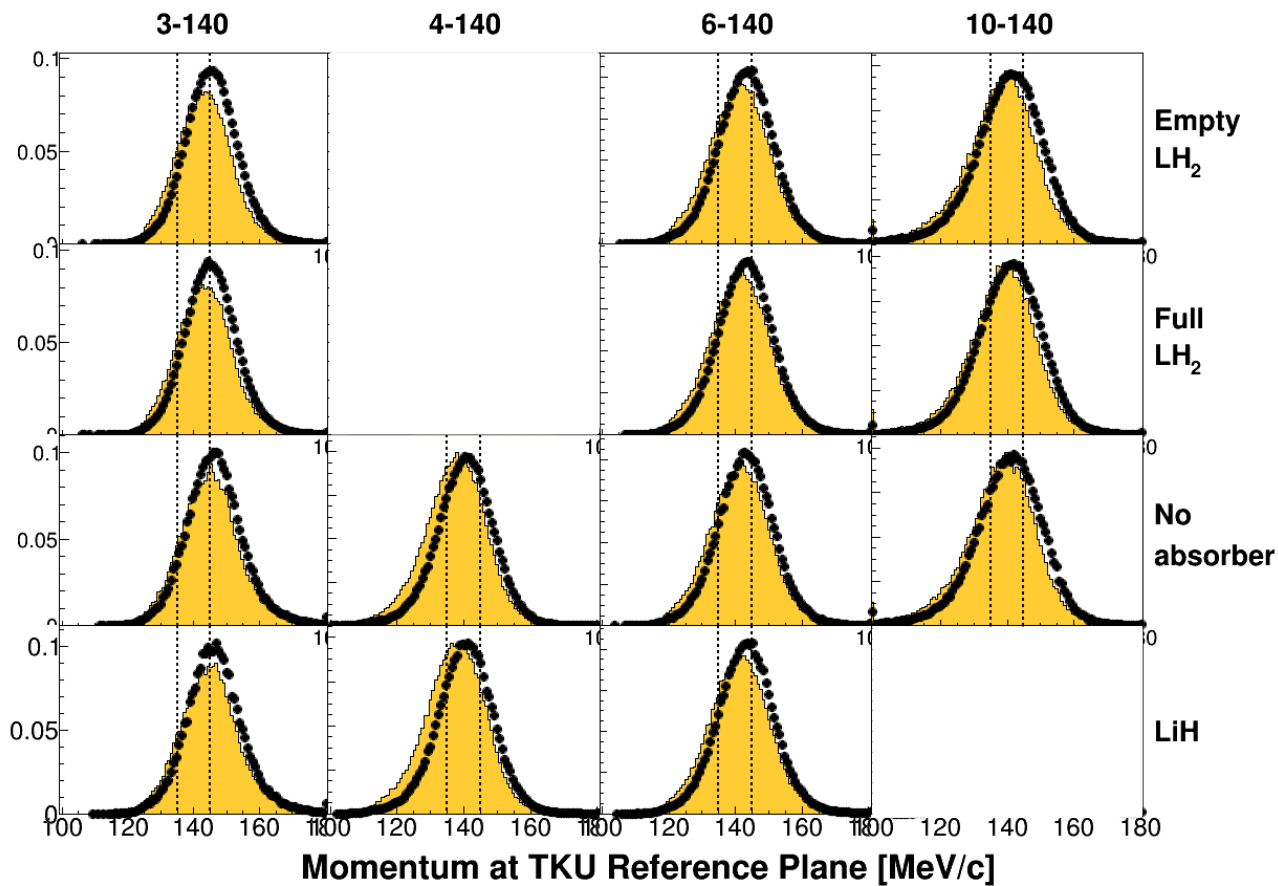
Sample Selection

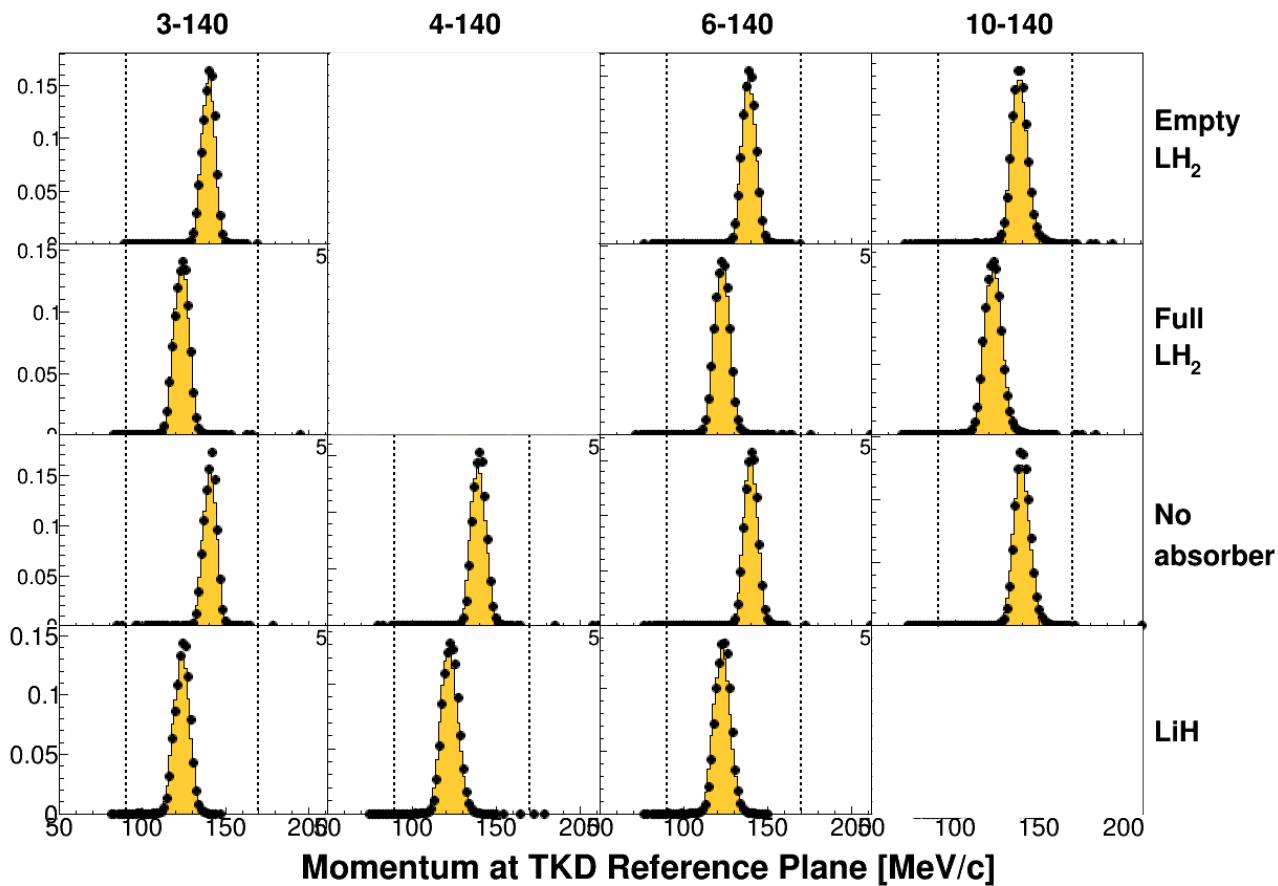




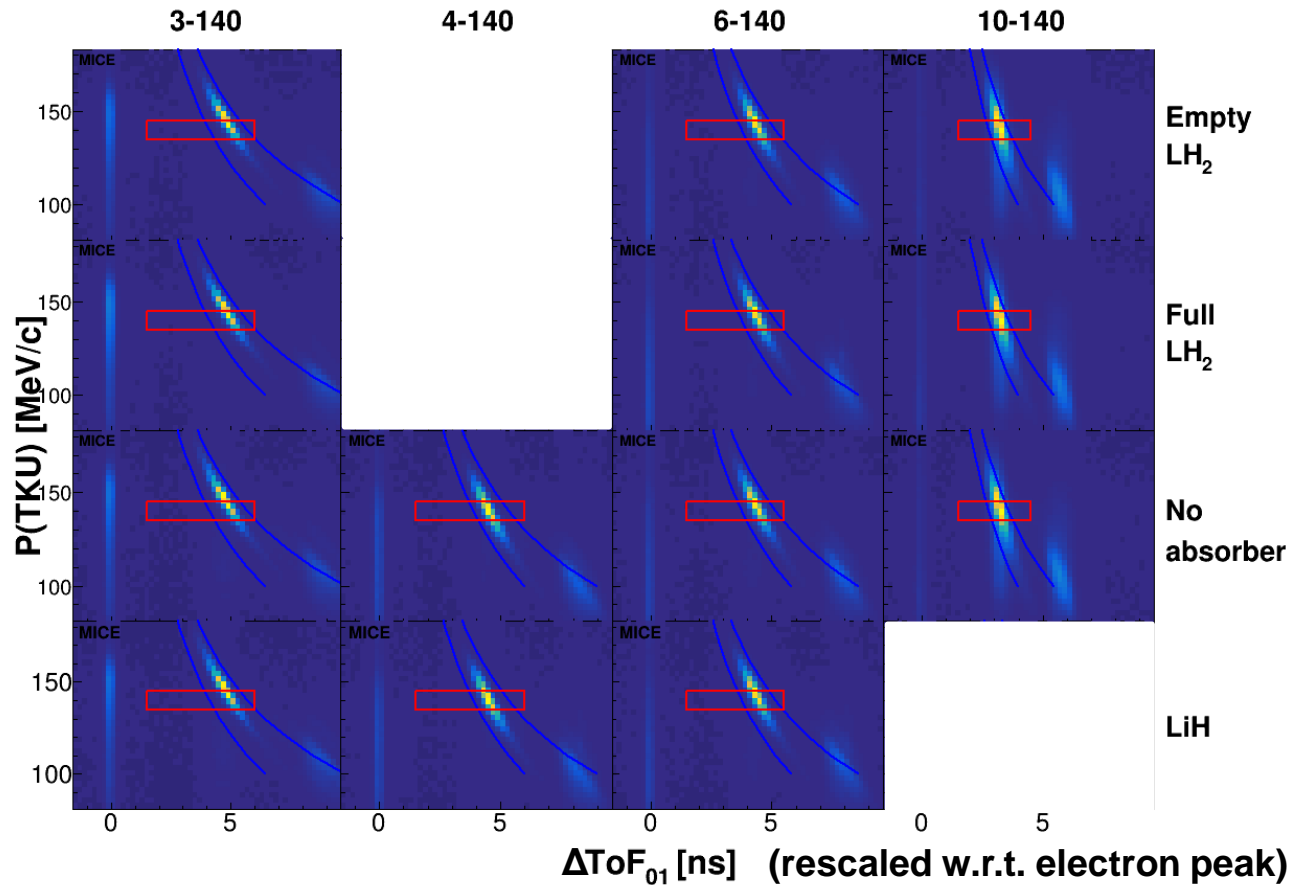


Further MC tuning
needed for tku
momentum
agreement for 4-140

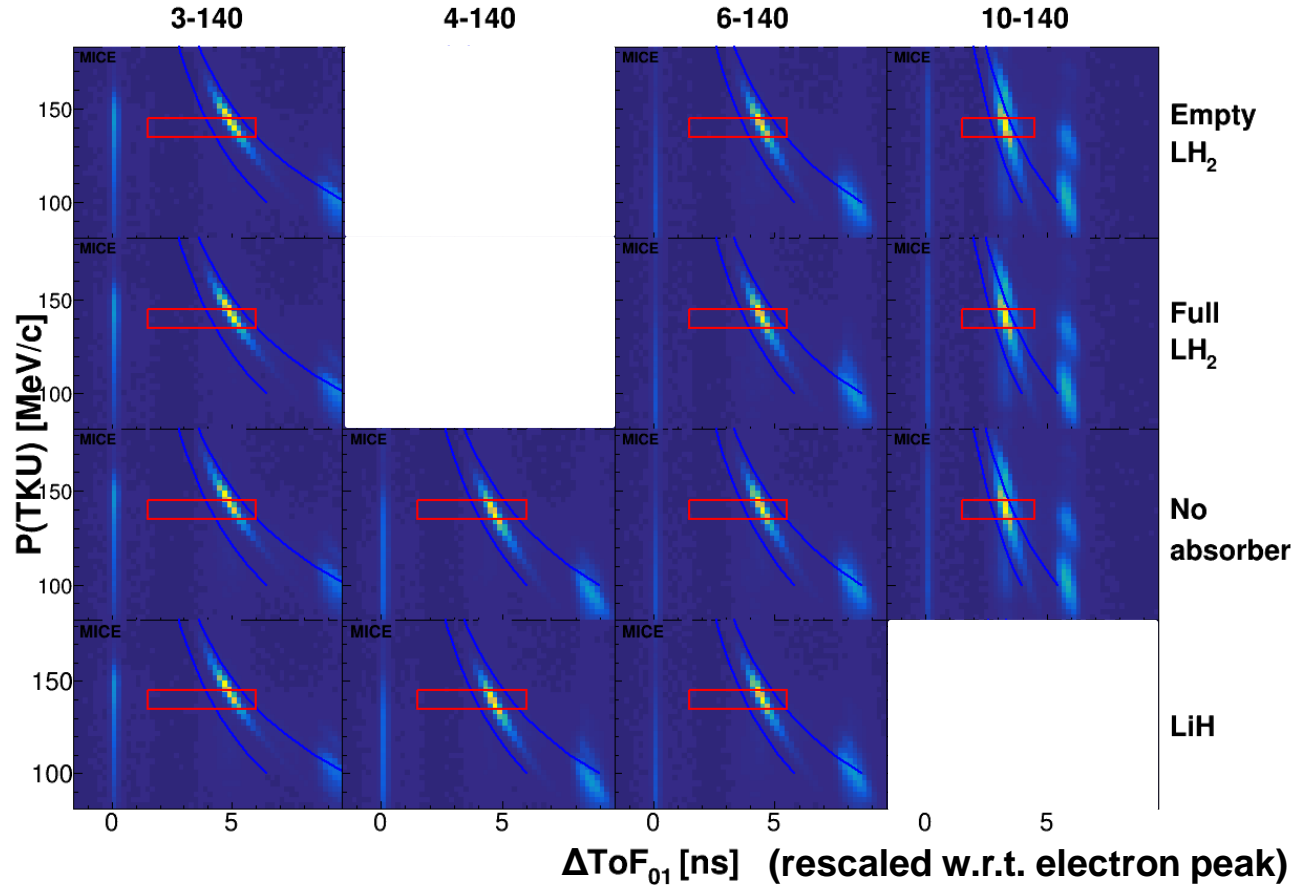




Sample Selection



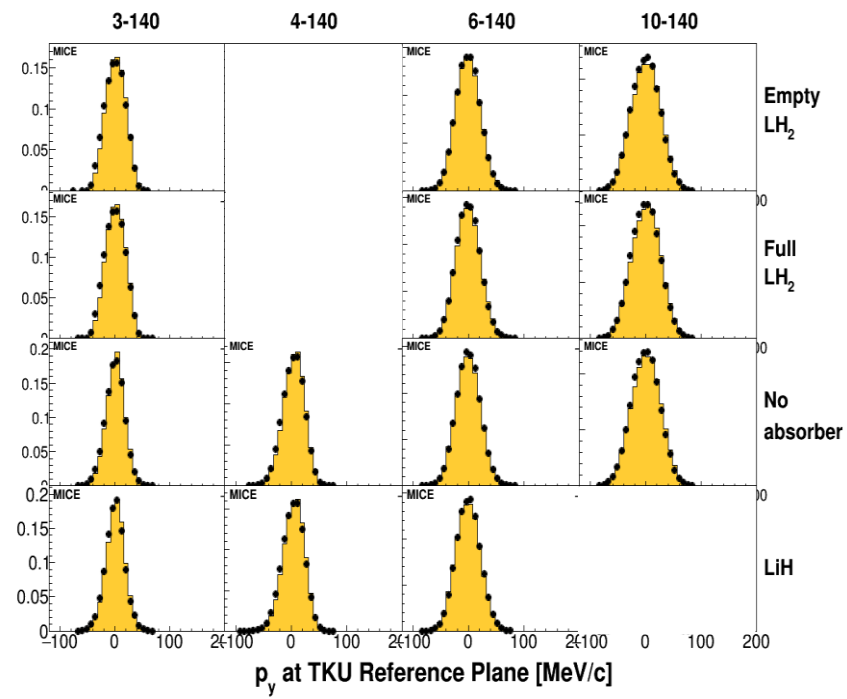
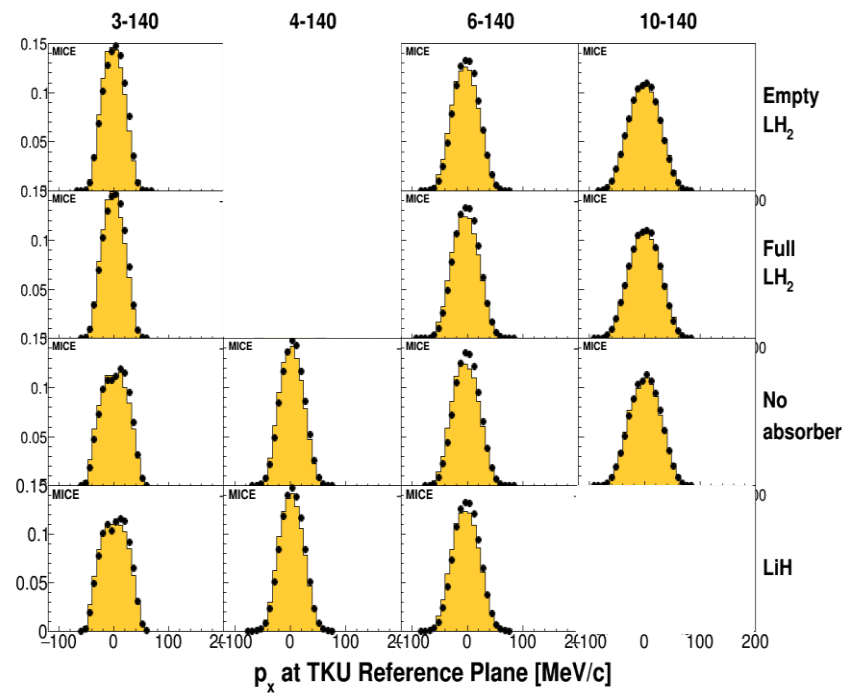
Sample Selection



MC
No cuts

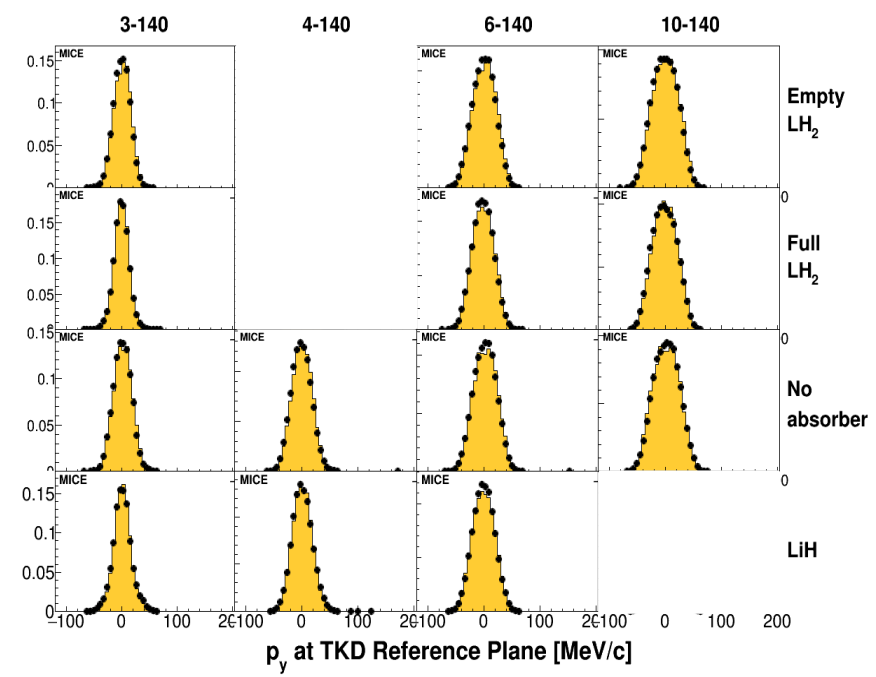
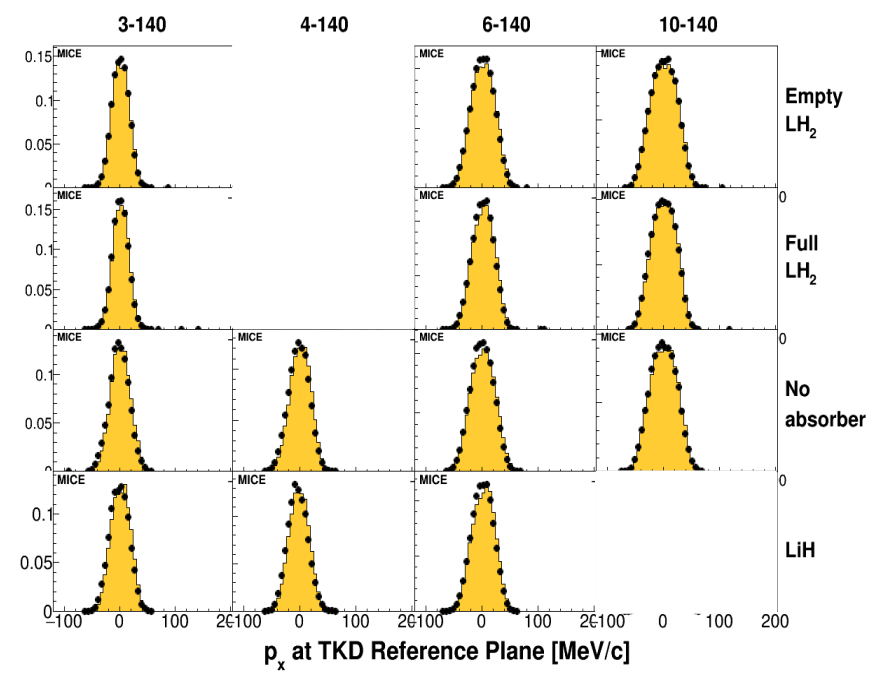
Px

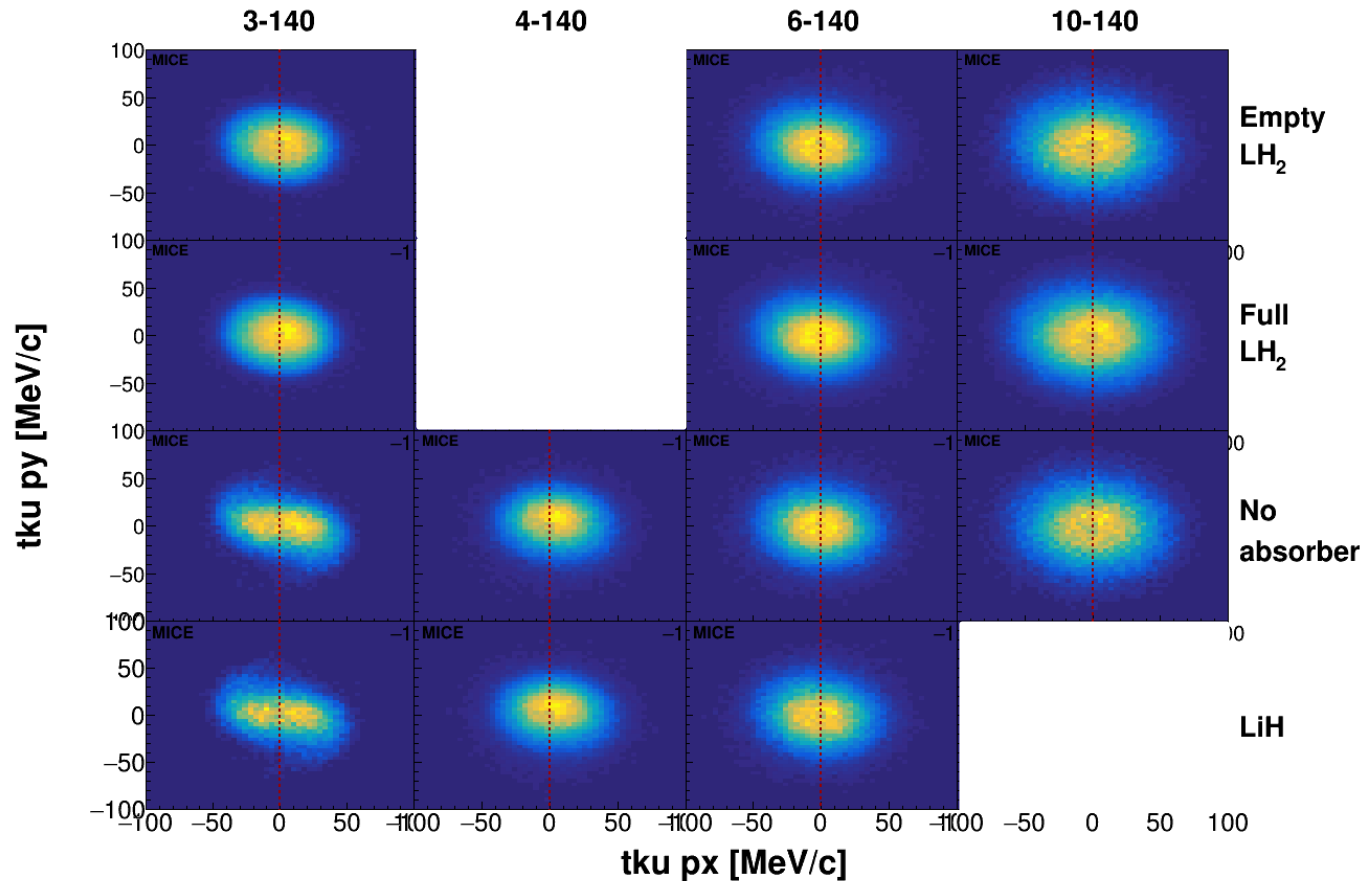
Py

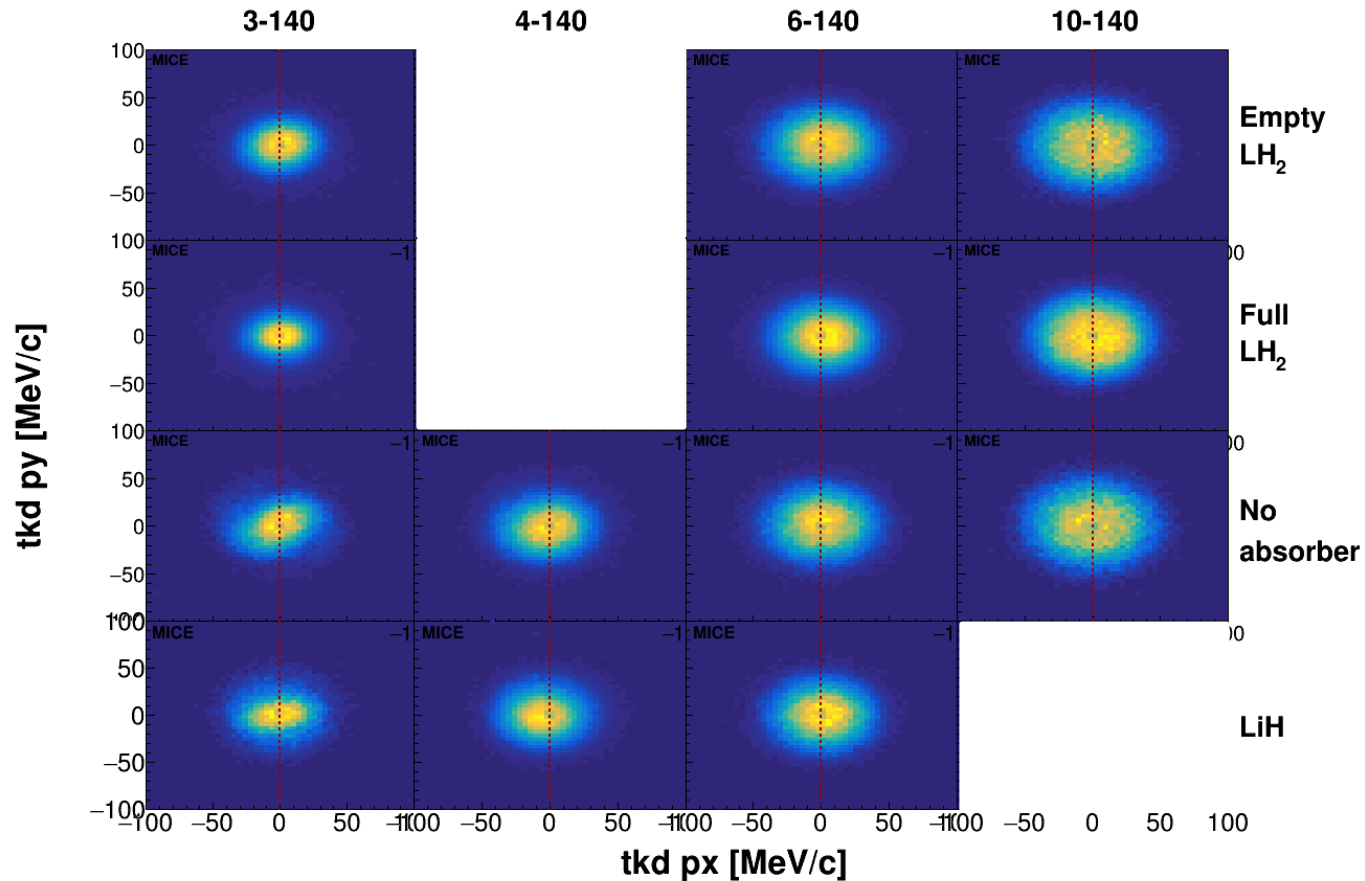


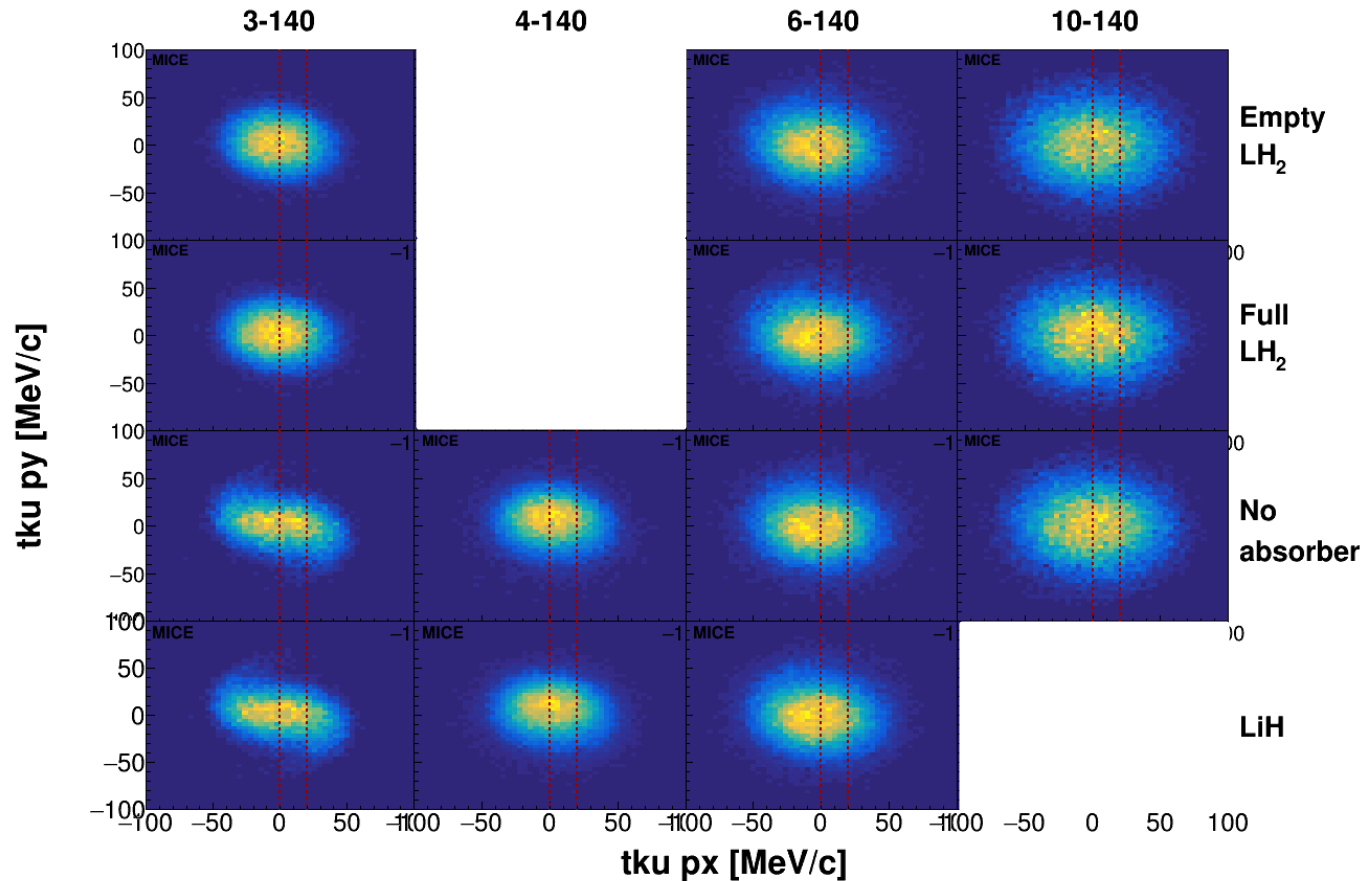
Px

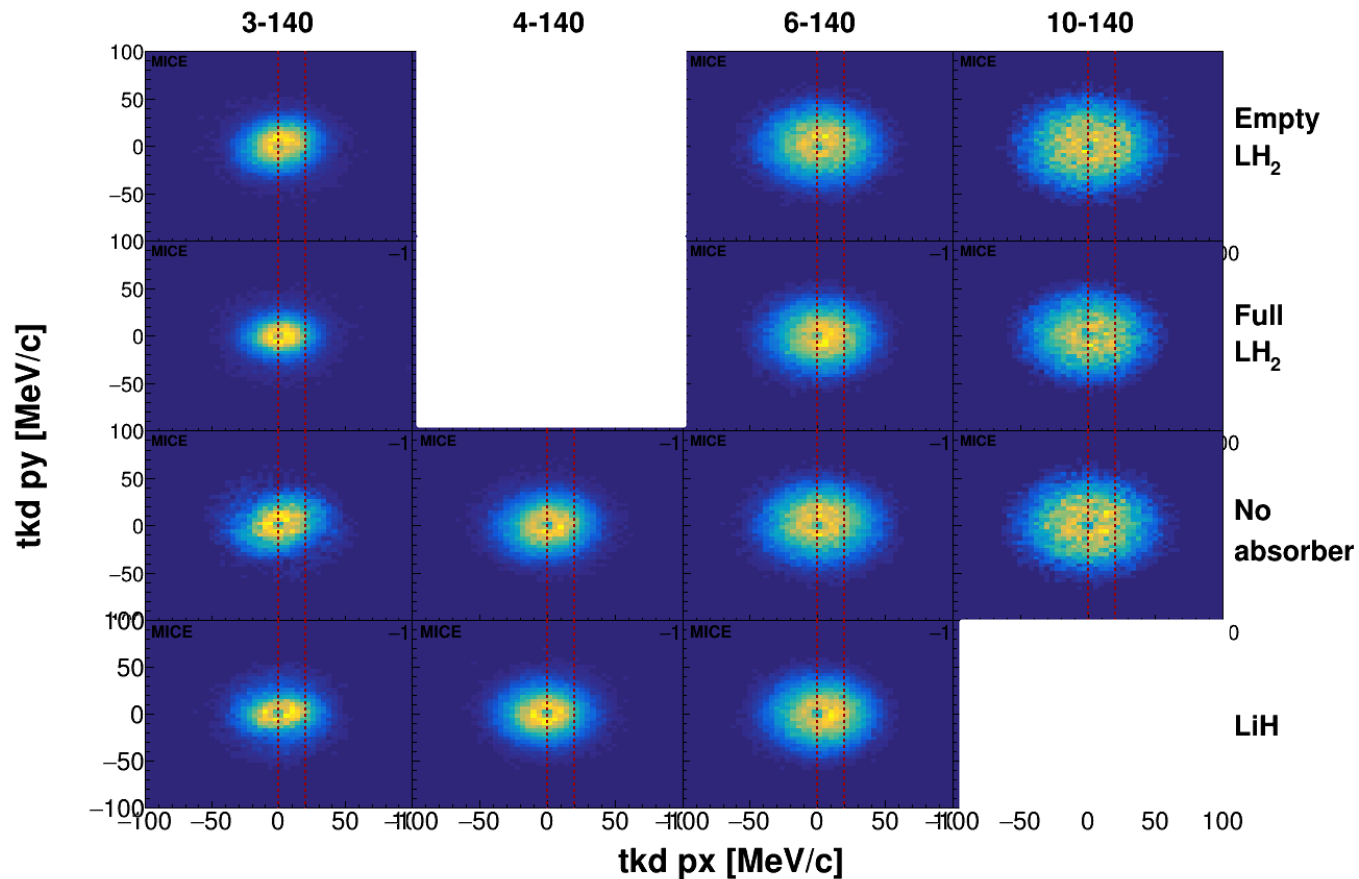
Py



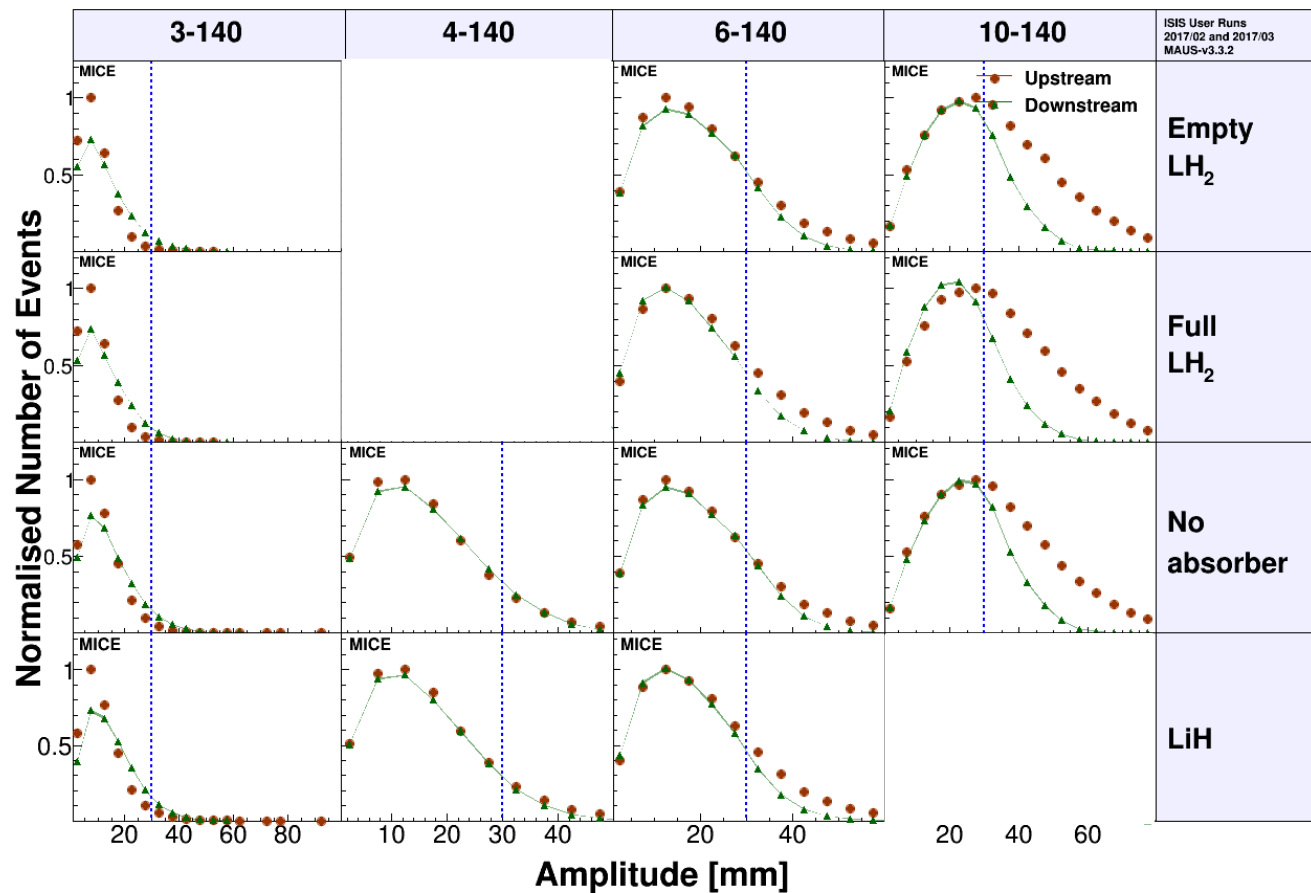




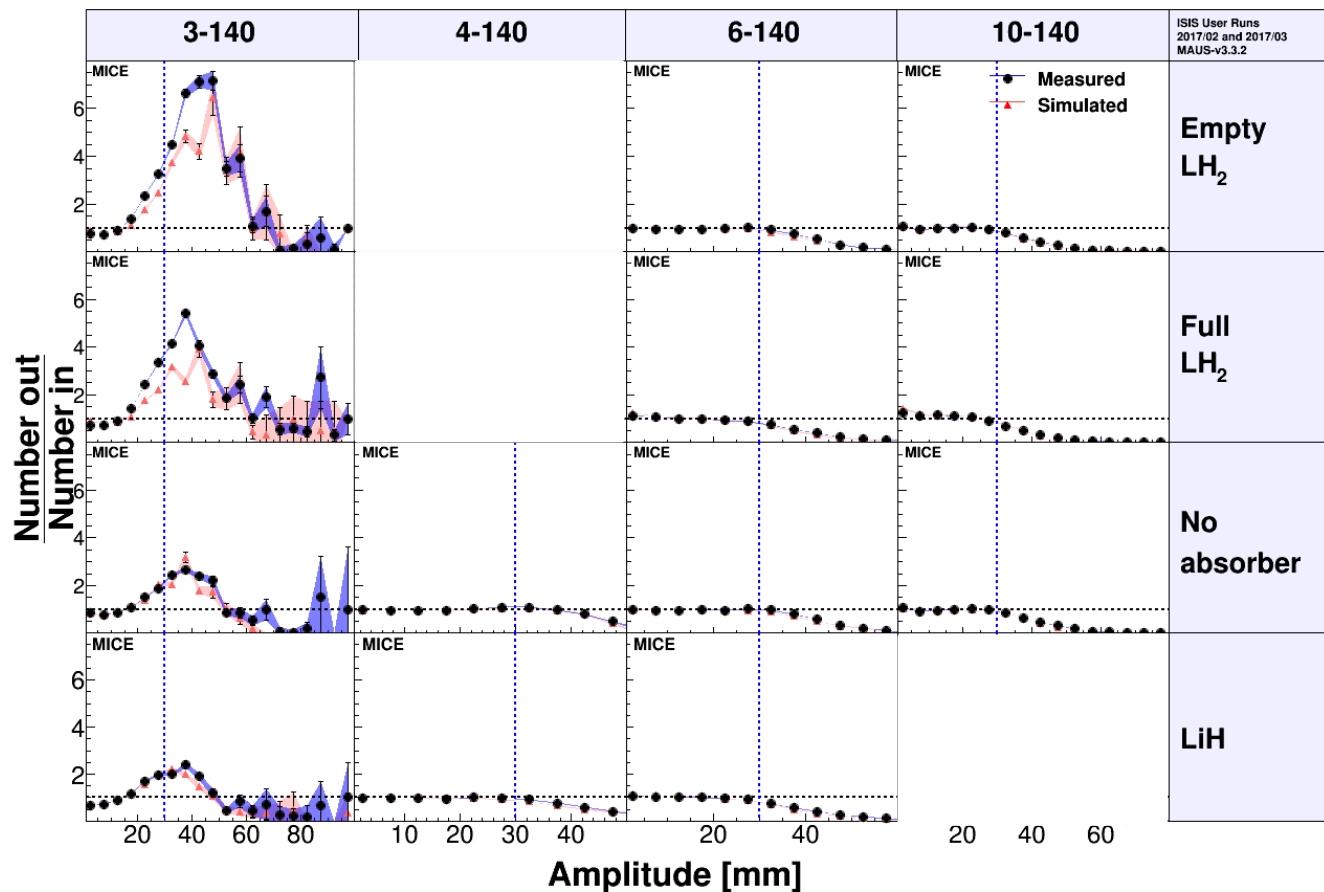




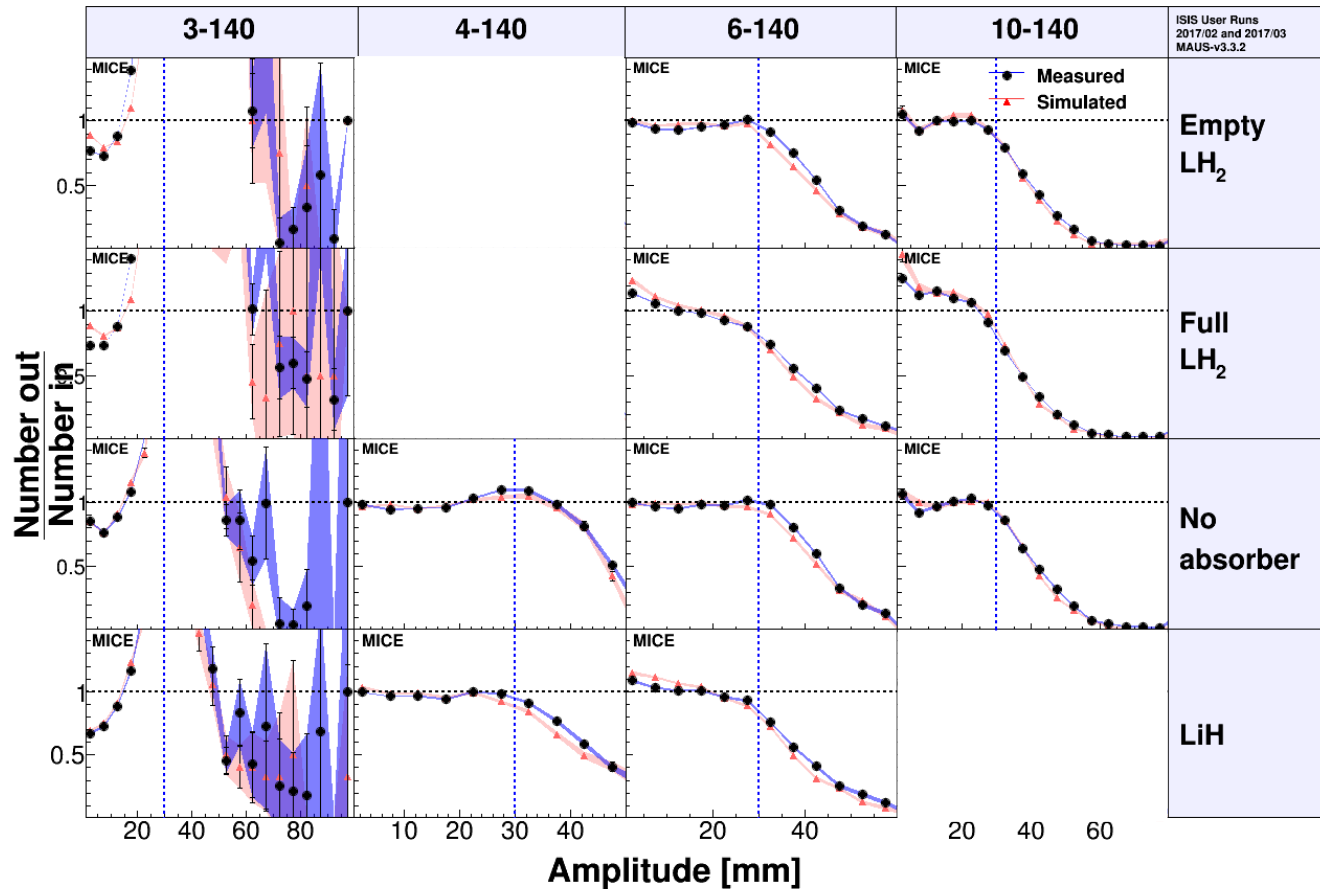
No Systematics
Errors only statistical

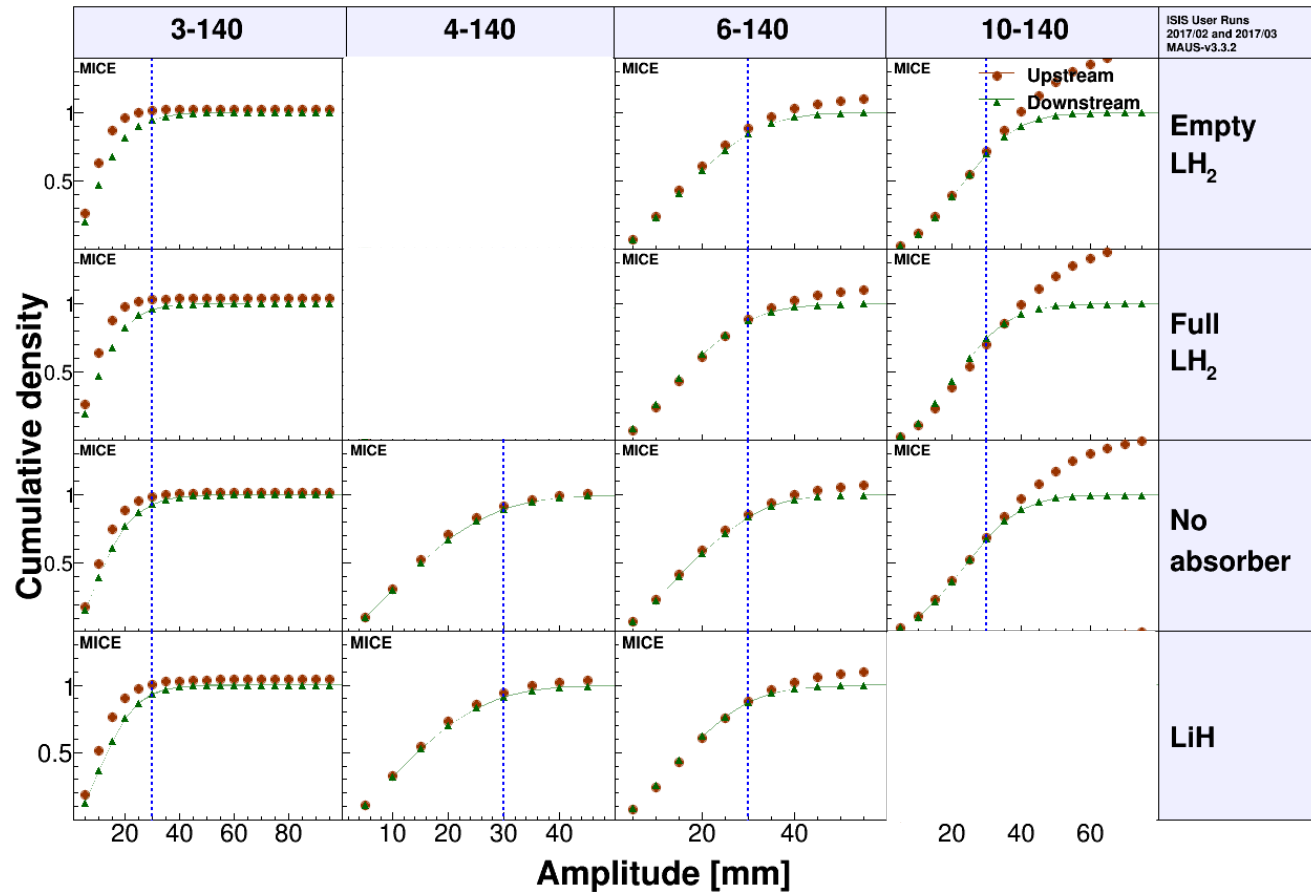


Amplitude PDF Ratios – Data vs MC

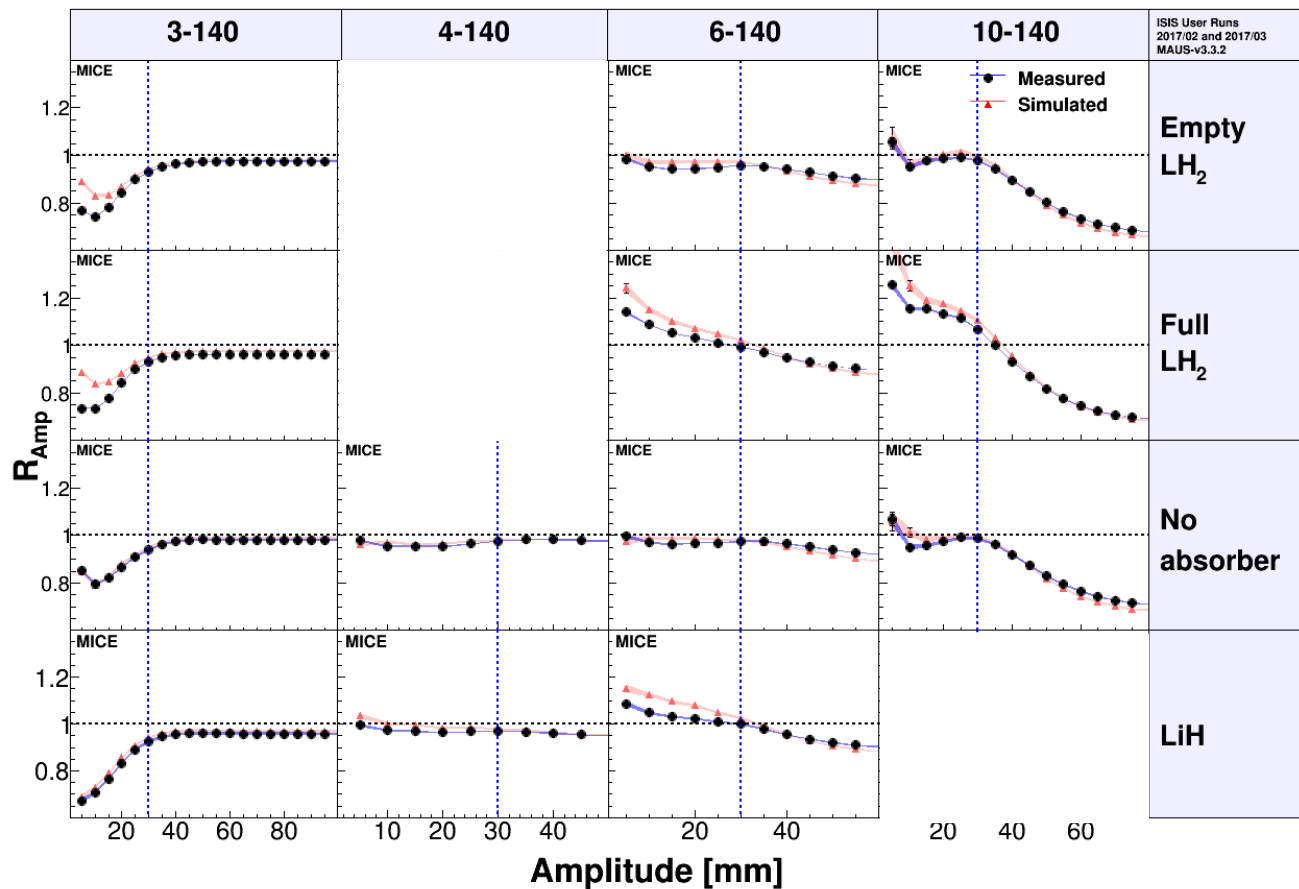


Amplitude PDF Ratios – Data vs MC





Amplitude CDF Ratios – Data vs MC



ISIS User Runs
2017/02 and 2017/03
MAUS-v3.3.2

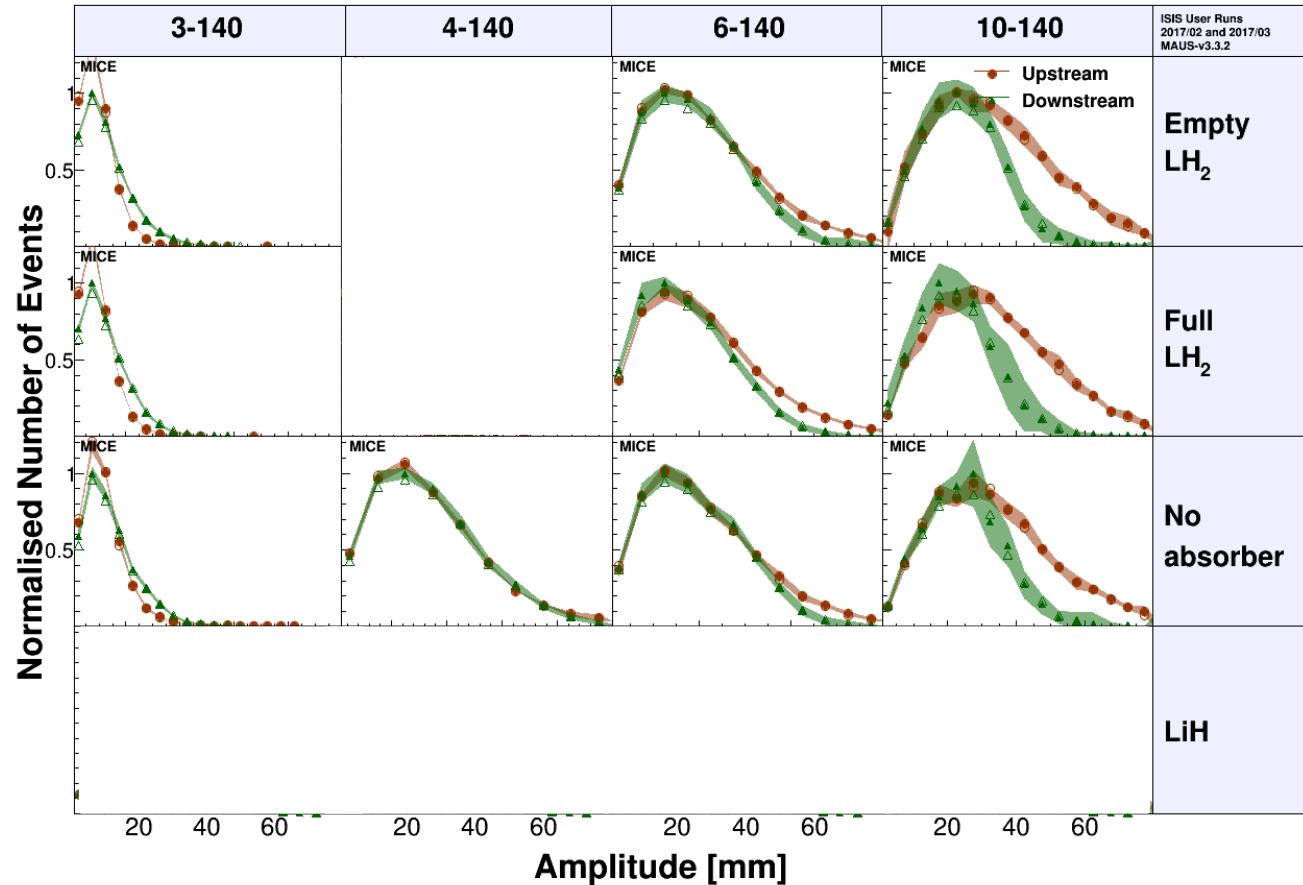
Empty LH_2

Full LH_2

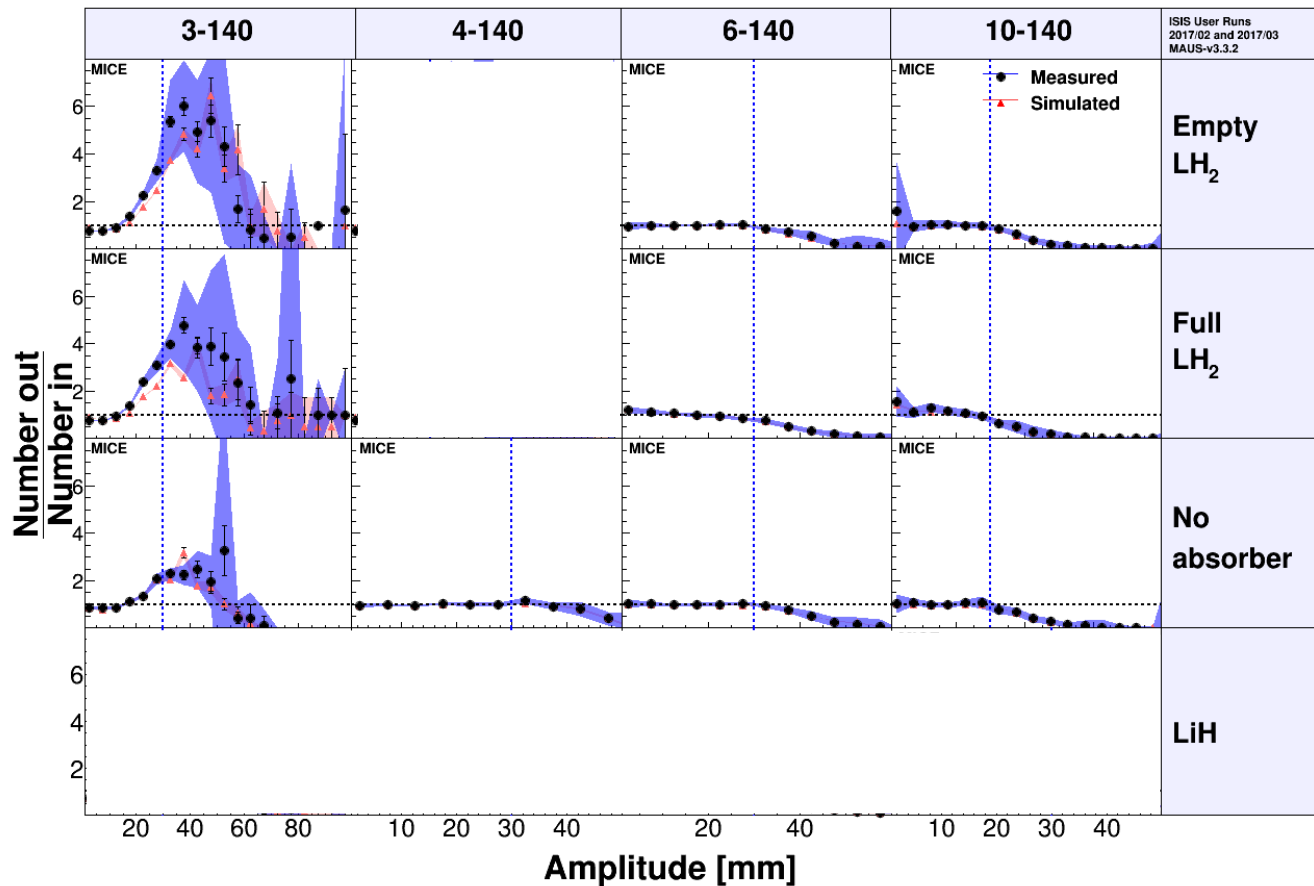
No absorber

LiH

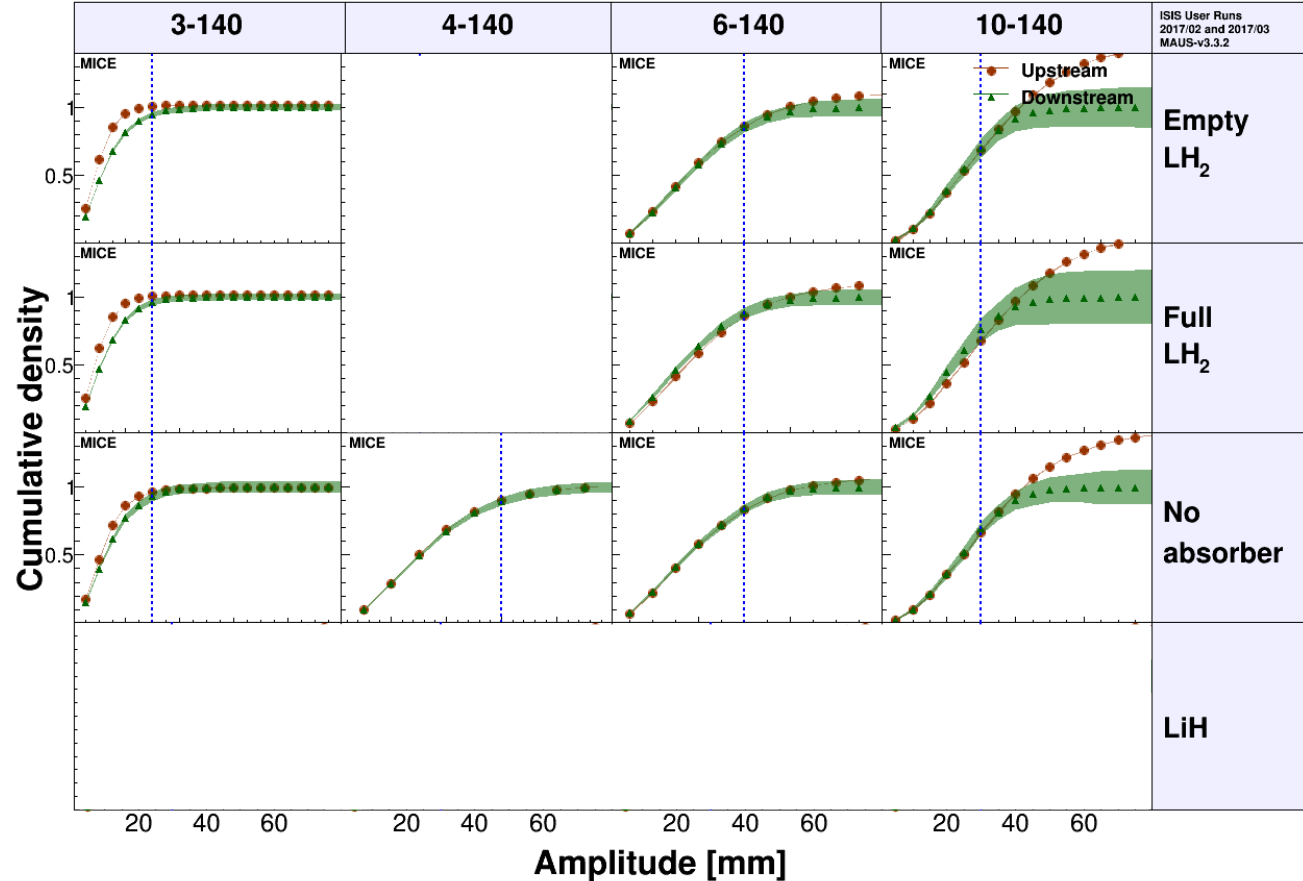
With Systematics
LiH systematics currently
buggy - fixing



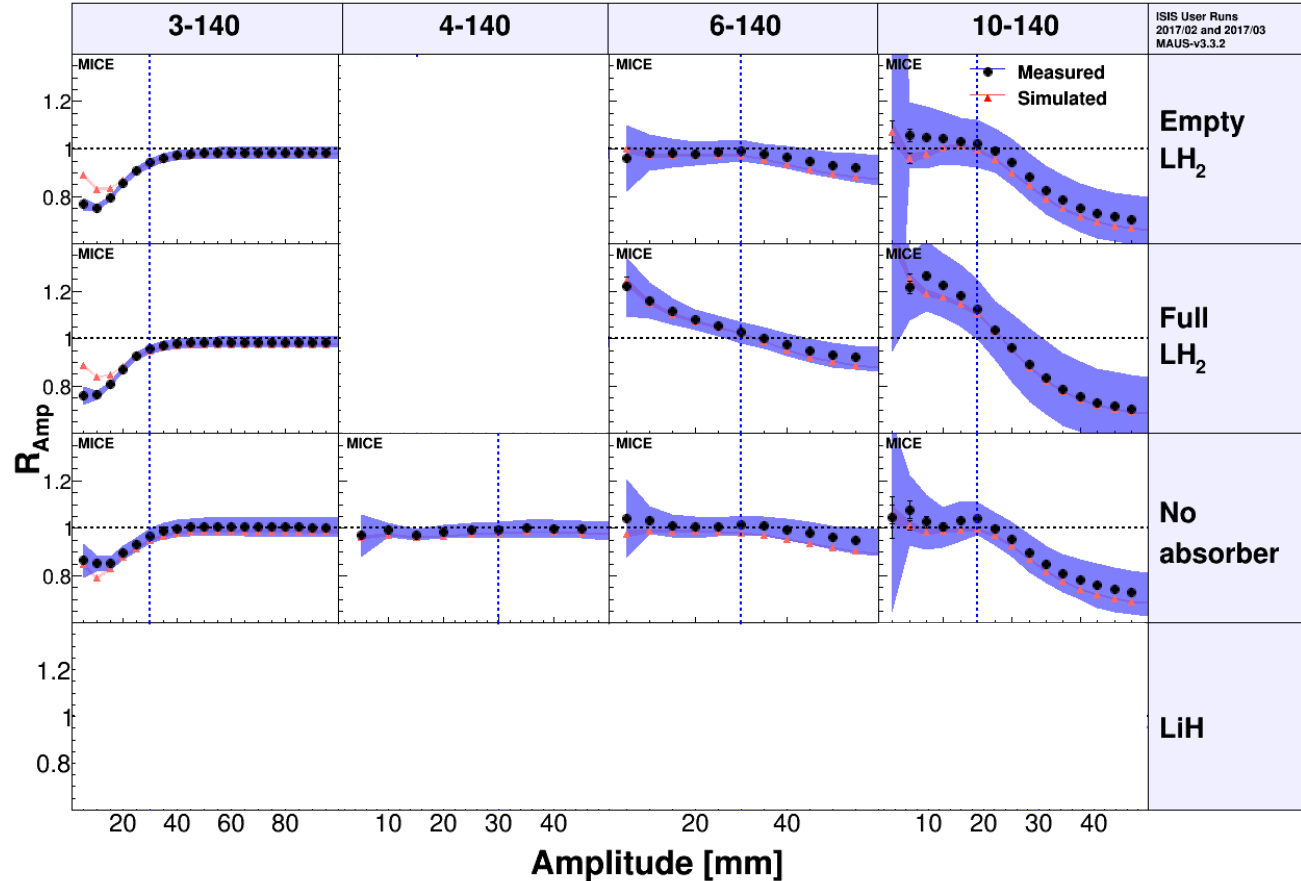
Amplitude PDF Ratios – Data vs MC



Amplitude CDFs



Amplitude CDF Ratios – Data vs MC



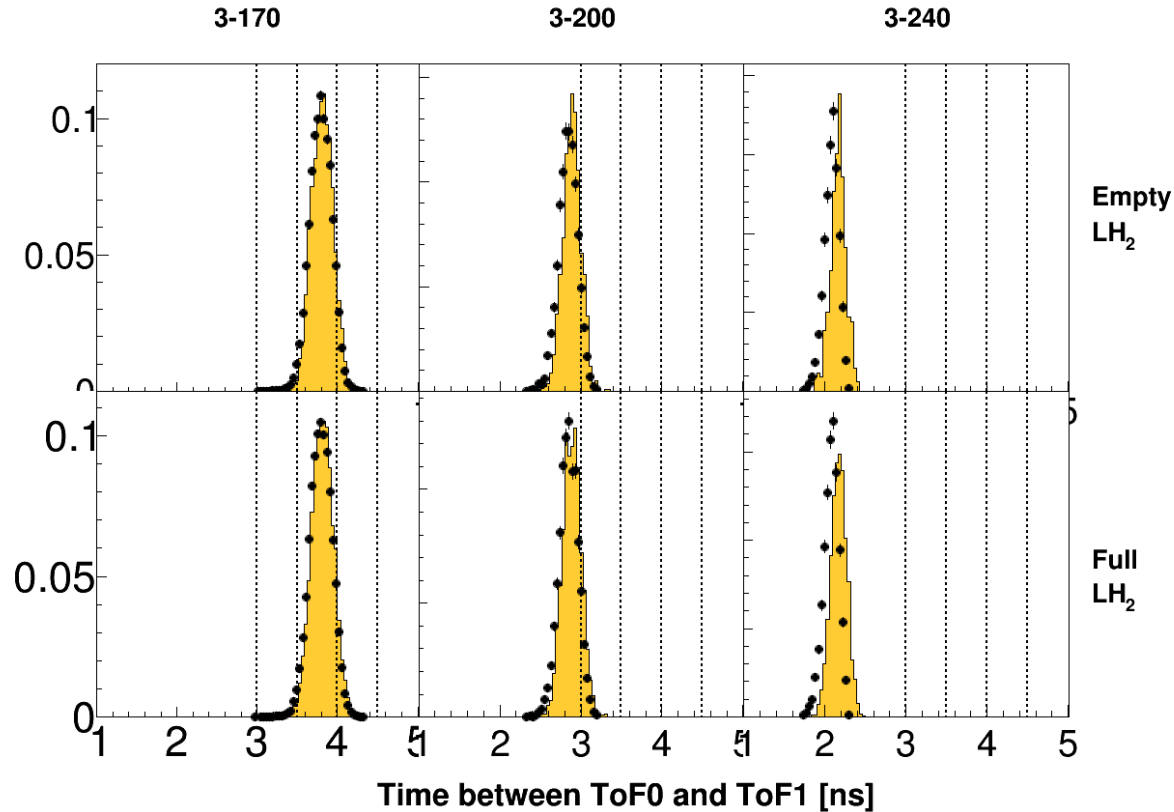
Shown :

Cooling Channel tag : 2017-02-6

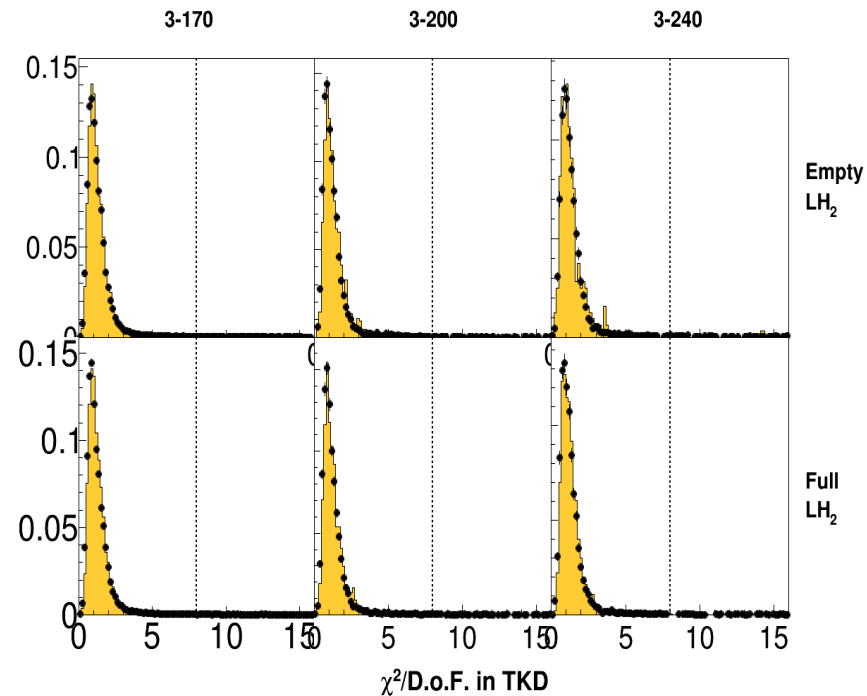
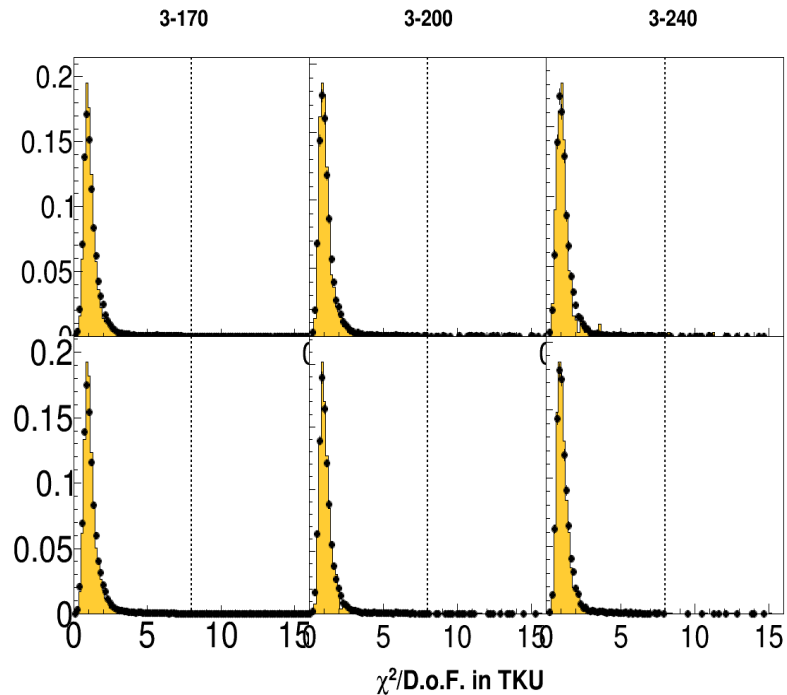
3 – 170, 200, 240

LH2, LH2-empty

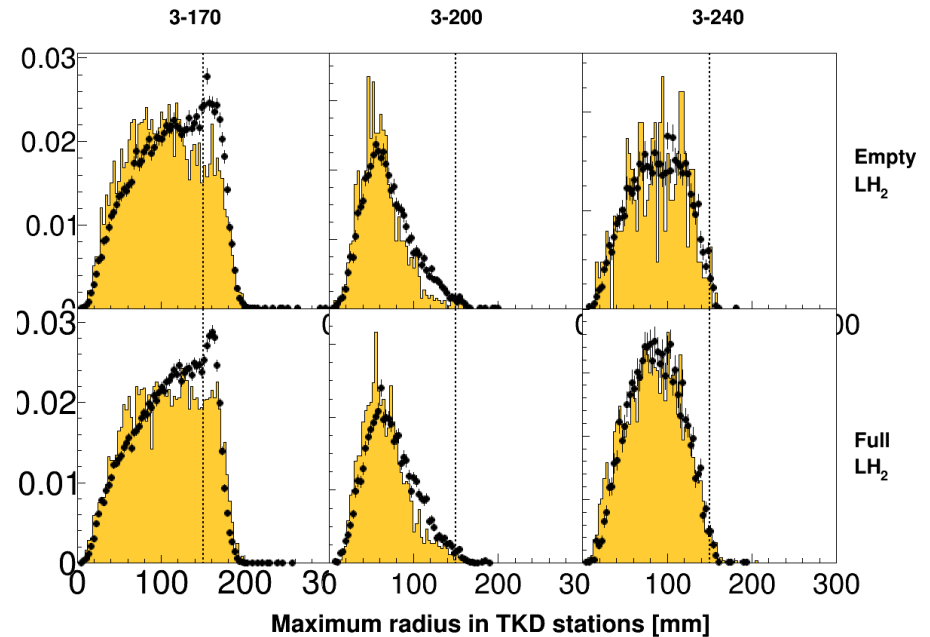
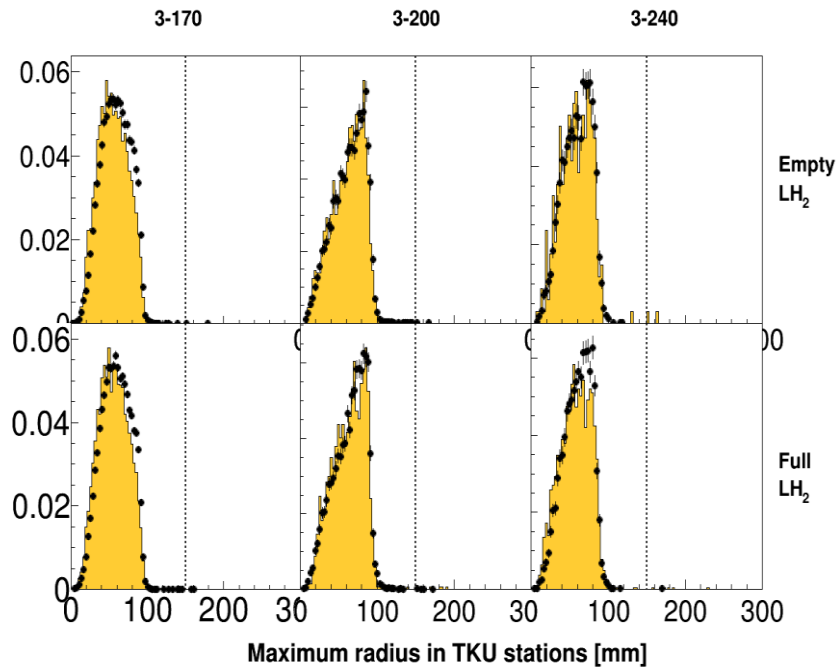
Higher momentum runs, solenoid mode



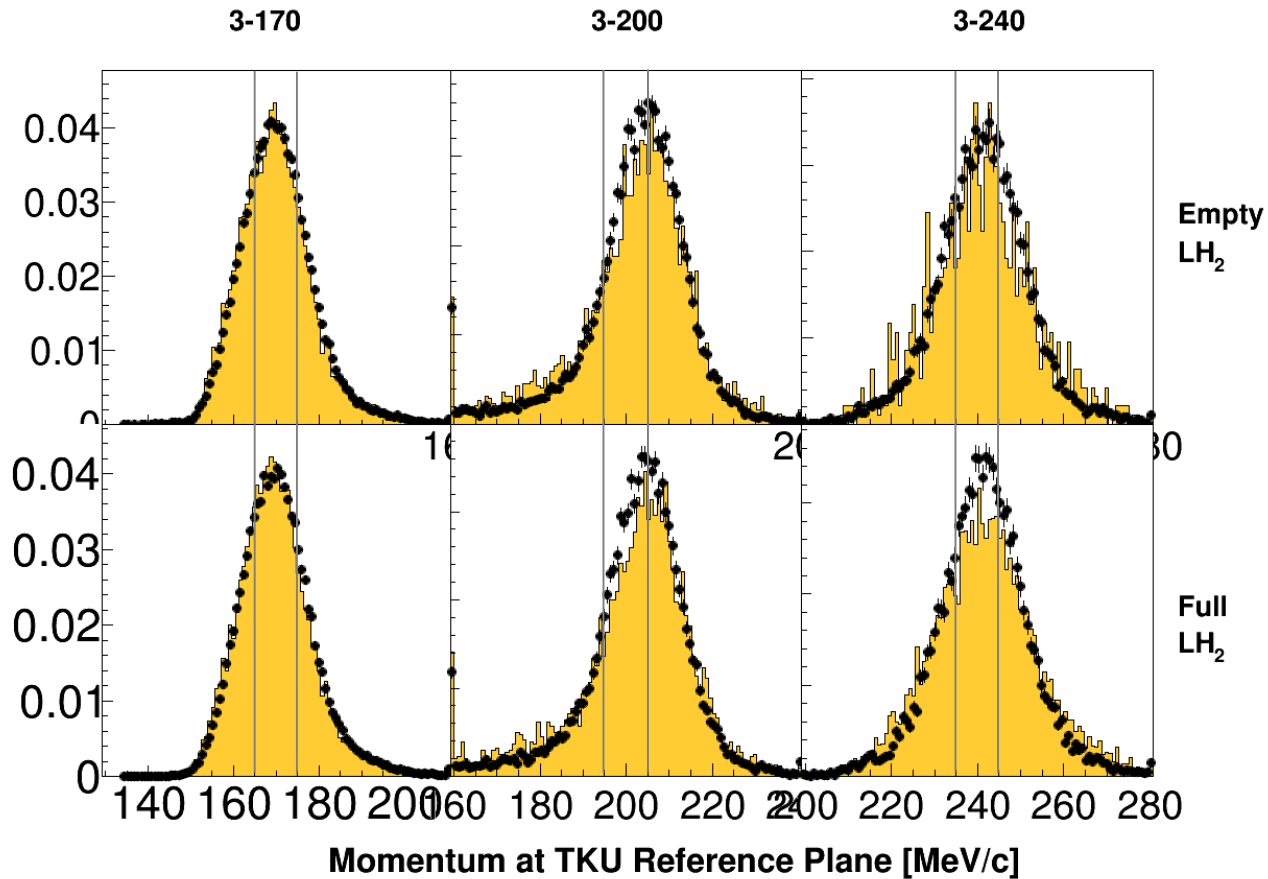
Higher momentum runs, solenoid mode



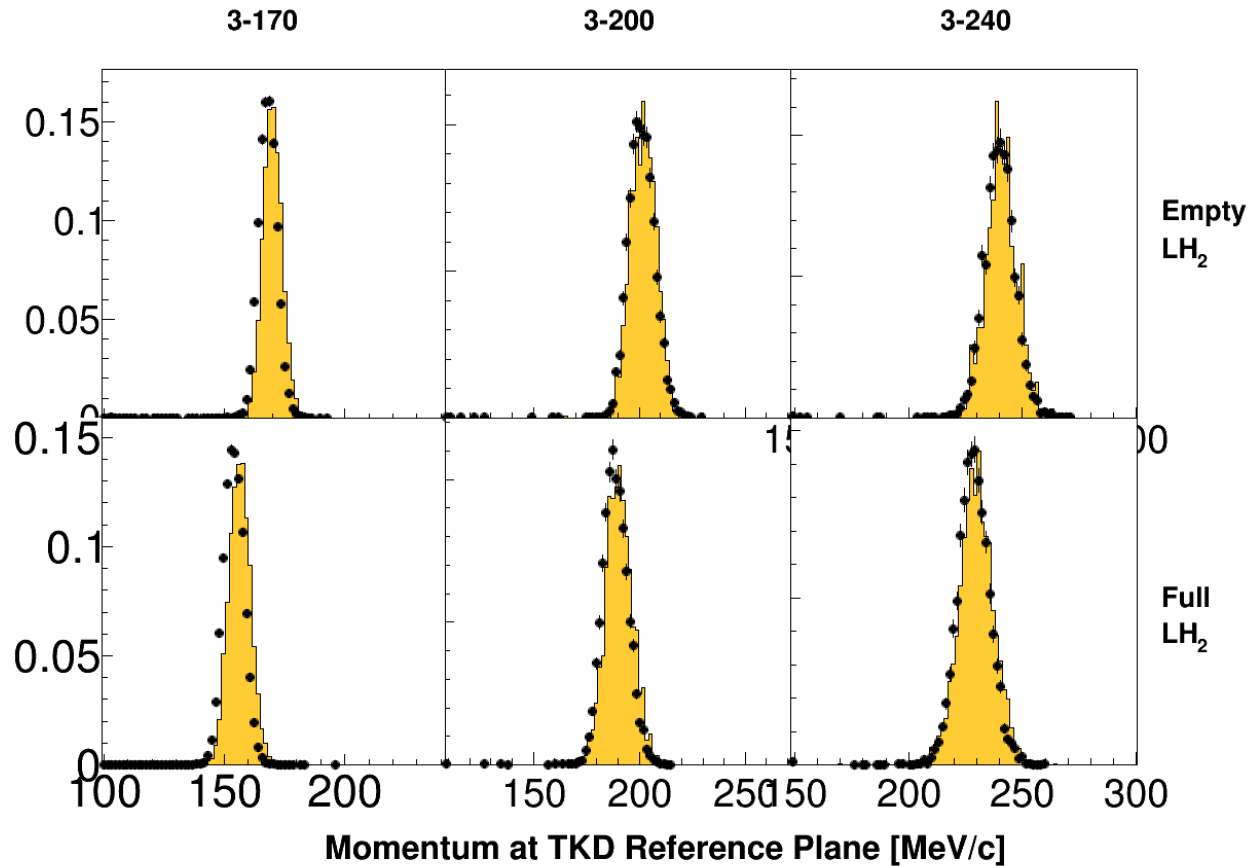
Higher momentum runs, solenoid mode



Higher momentum runs, solenoid mode



Higher momentum runs, solenoid mode

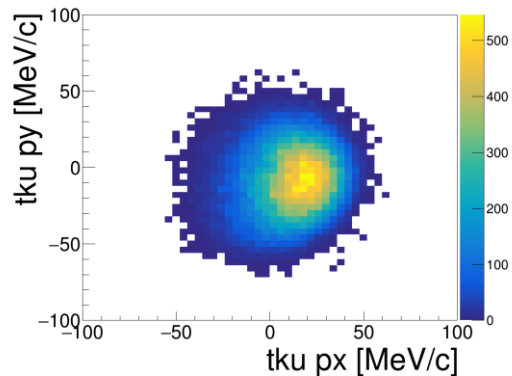


Higher momentum runs, solenoid mode

Strong bias in p_xp_y plots for higher mom beamline. Suggestion is this could be from refitting of momentum based on TOF01 + TRACKER combined refit – Testing without TrackerTOFCombinedFit to see if this changes

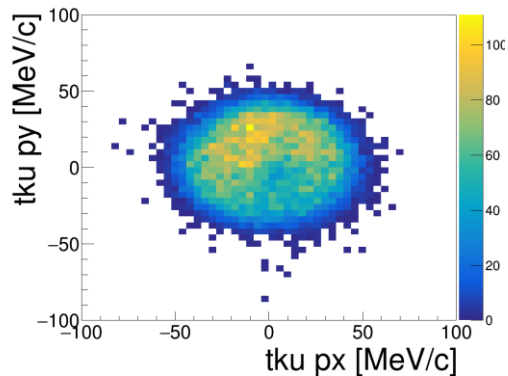
3-170

10268, 10269 2017-02-6 3-170 ABS-LH2-EMPTY



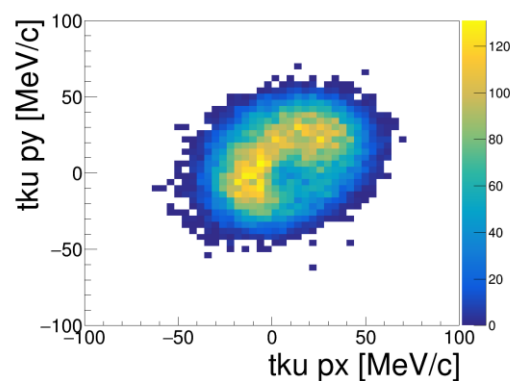
3-200

10262, 10266, 10267, 10275 2017-02-6 3-200 ABS-LH2-EMPTY



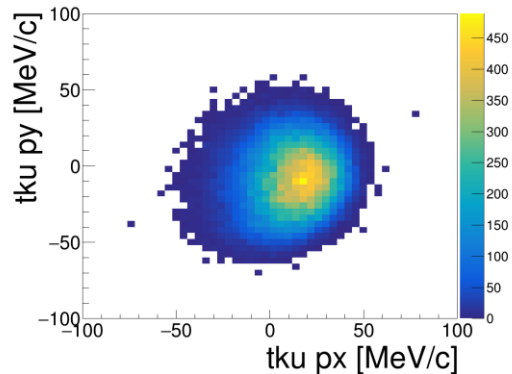
3-240

10261, 10264, 10265, 10270, 10271, 10272, 10273, 10274 2017-02-6 3-240 ABS-LH2-EMPTY

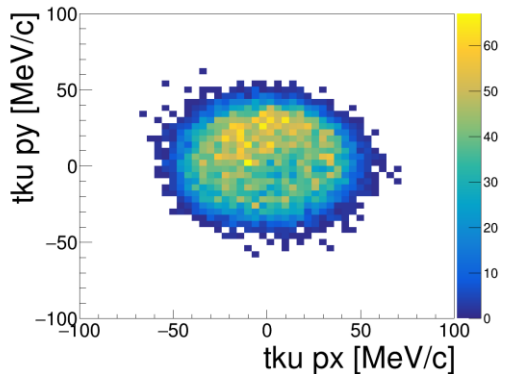


LH2-Empty

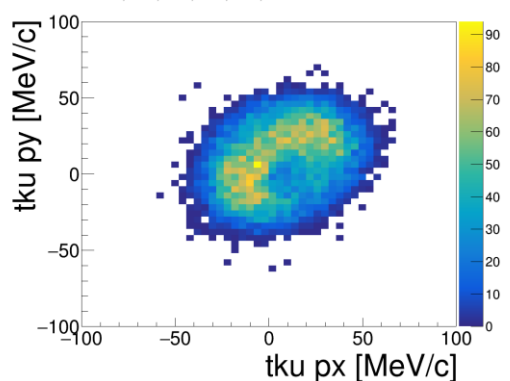
9911 2017-02-6 3-170 ABS-LH2



9910, 9915 2017-02-6 3-200 ABS-LH2



9907, 9908, 9909, 9912, 9913, 9914 2017-02-6 3-240 ABS-LH2



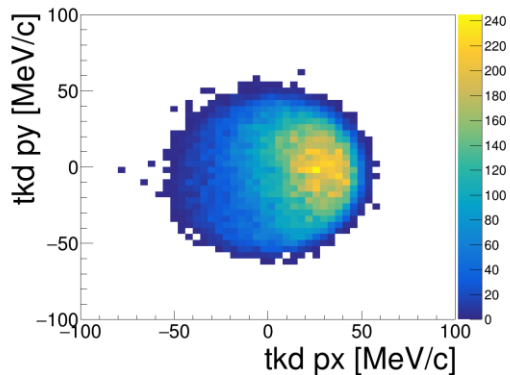
LH2

Higher momentum runs, solenoid mode

Strong bias in p_xp_y plots for higher mom beamline. Suggestion is this could be from refitting of momentum based on TOF01 + TRACKER combined refit – Testing without TrackerTOFCombinedFit to see if this changes

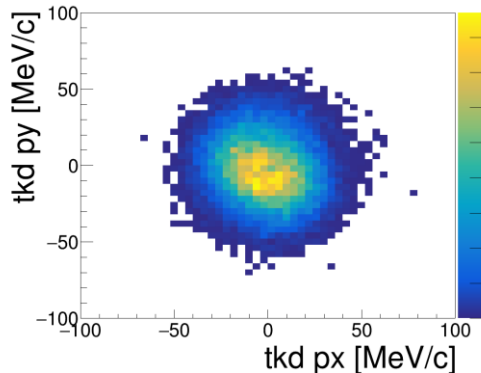
3-170

10268, 10269 2017-02-6 3-170 ABS-LH2-EMPTY



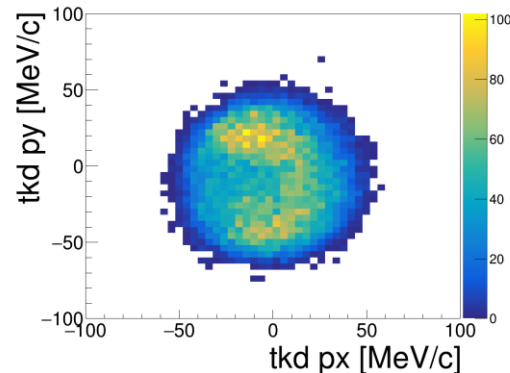
3-200

10262, 10266, 10267, 10275 2017-02-6 3-200 ABS-LH2-EMPTY



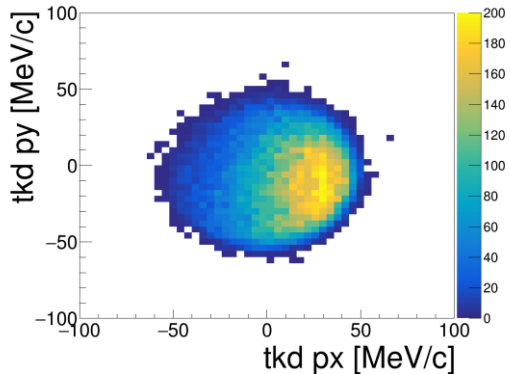
3-240

10261, 10264, 10265, 10270, 10271, 10272, 10273, 10274 2017-02-6 3-240 ABS-LH2-EMPTY

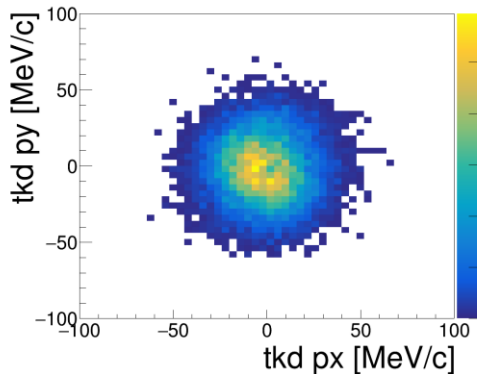


LH2-Empty

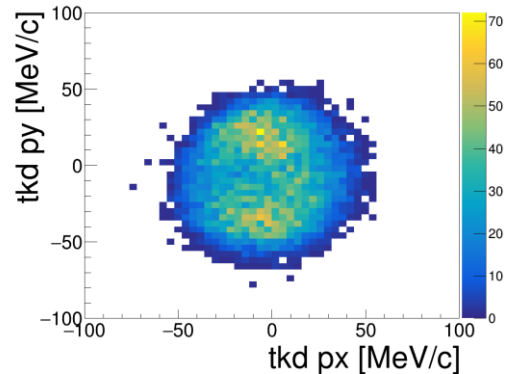
9911 2017-02-6 3-170 ABS-LH2



9910, 9915 2017-02-6 3-200 ABS-LH2



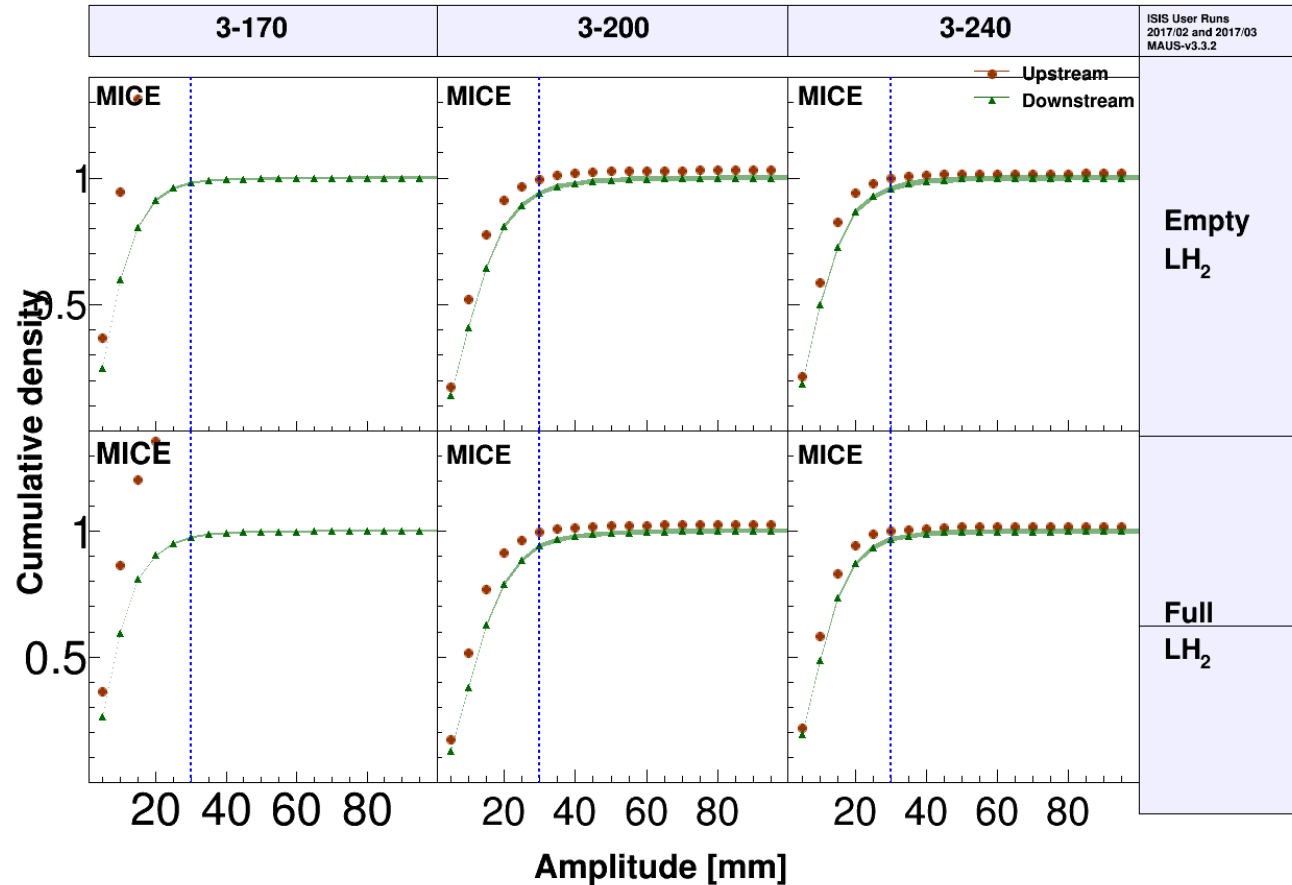
9907, 9908, 9909, 9912, 9913, 9914 2017-02-6 3-240 ABS-LH2



LH2

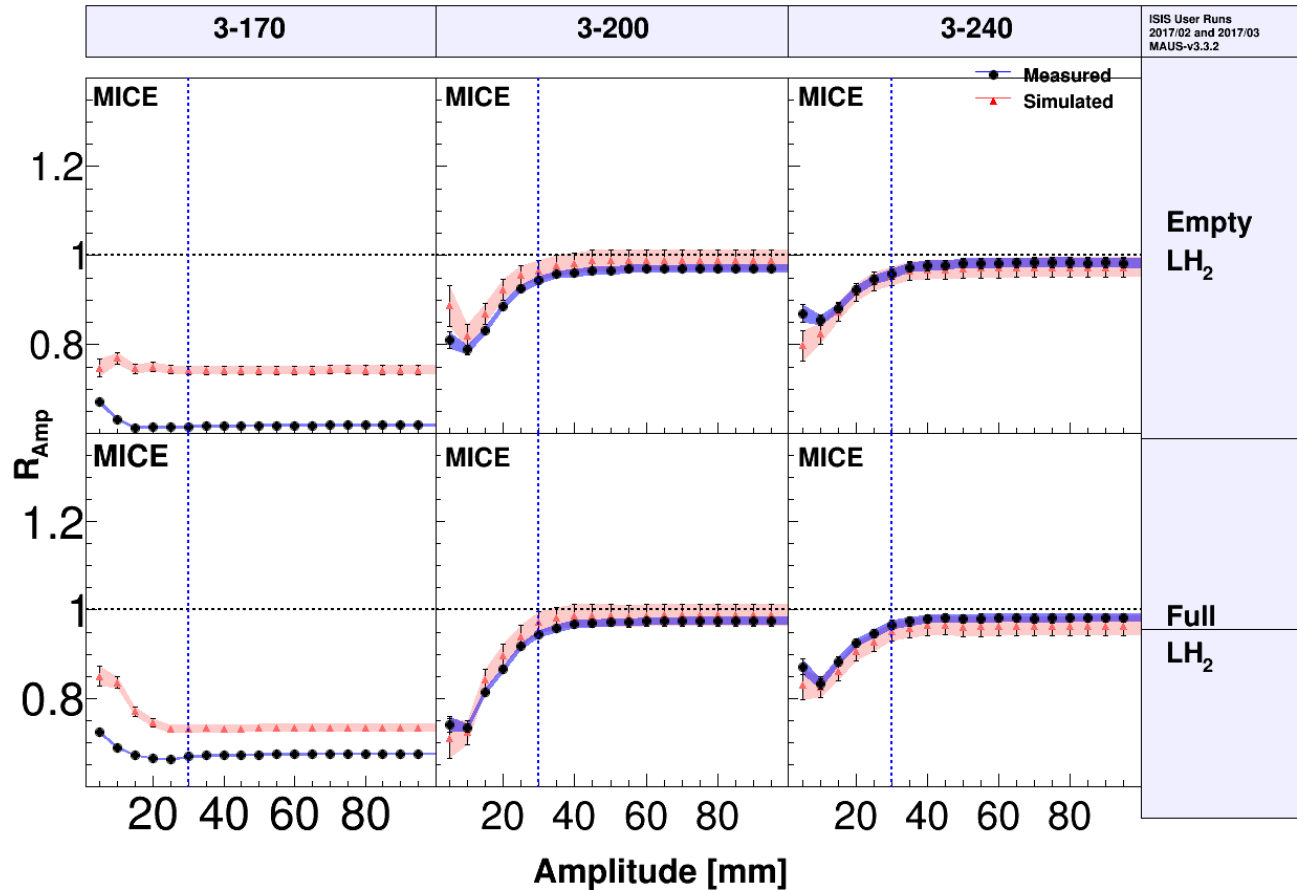
Higher momentum runs, solenoid mode

CDF



Higher momentum runs, solenoid mode

CDF ratios



Higher momentum runs, solenoid mode

PDF

