

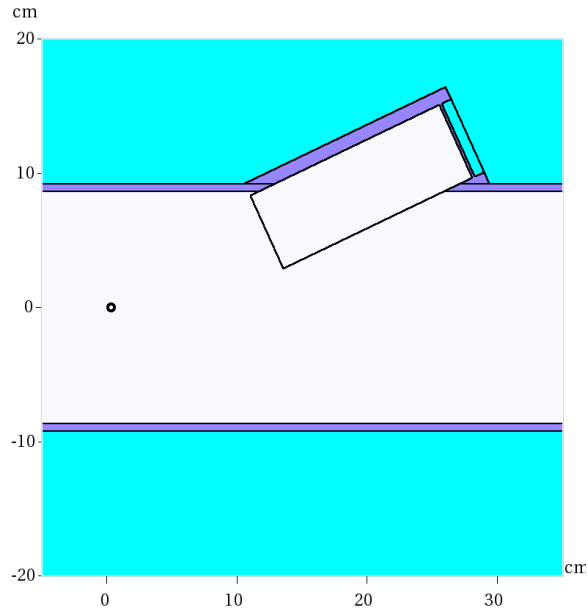
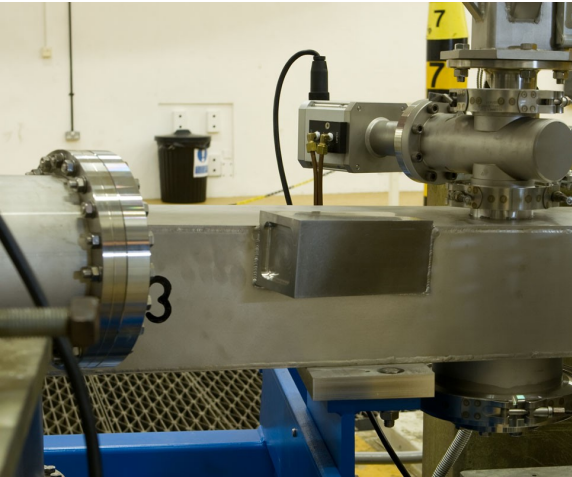


Pion Production at Target

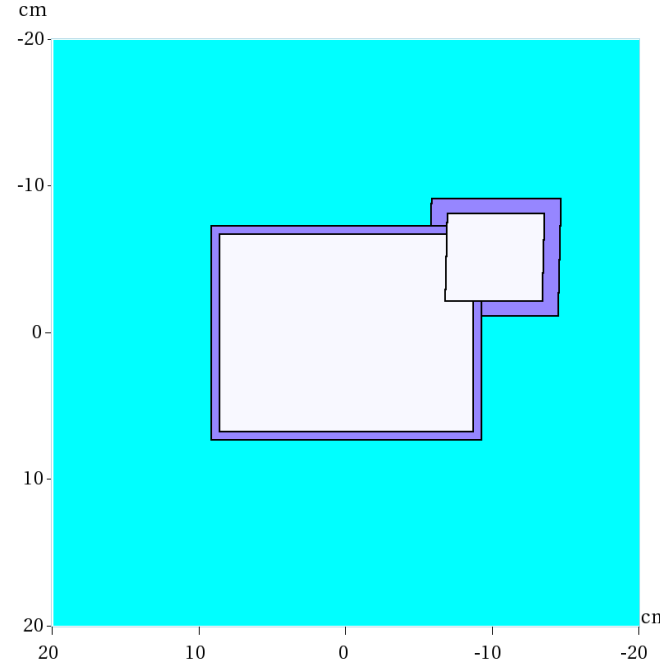
T. Lord, P. Franchini



MARS GUI Geometry



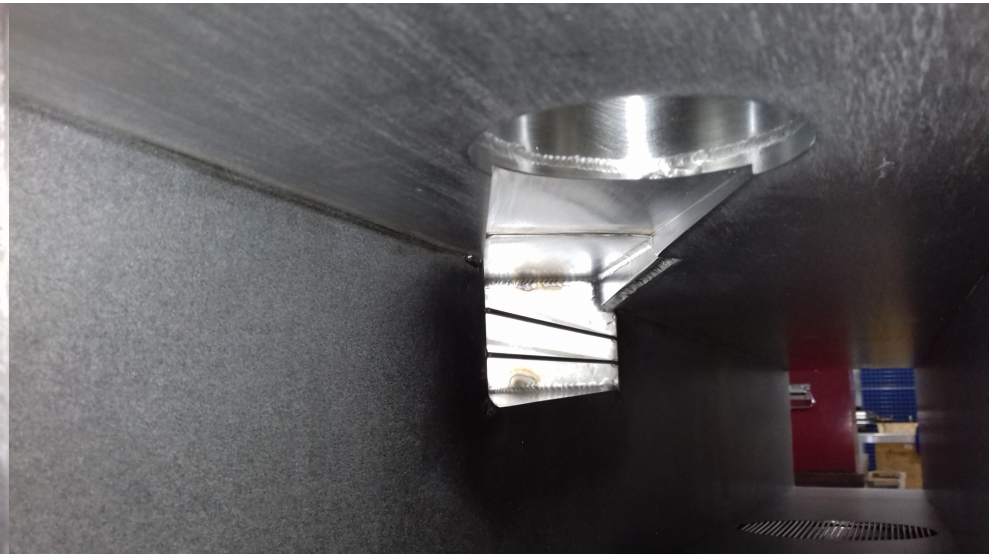
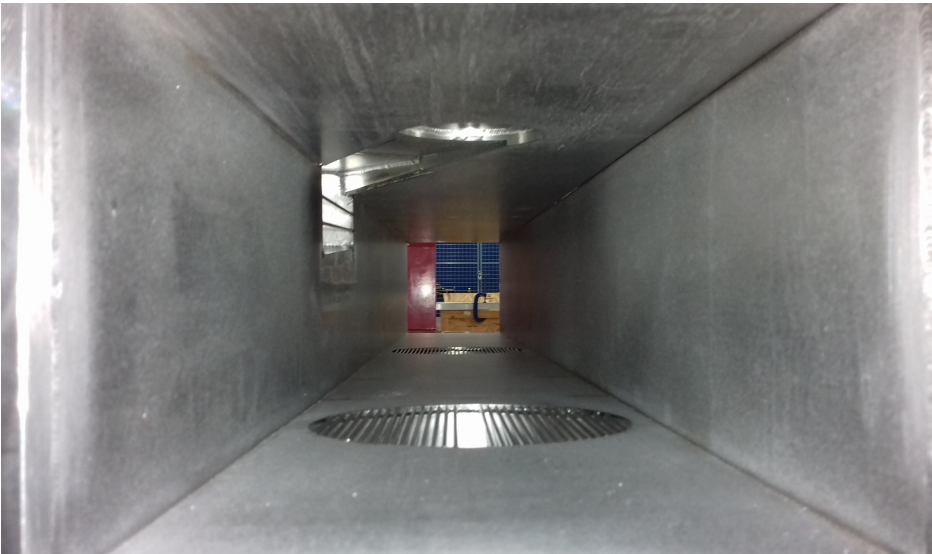
x
z
x:z = 1:1.000e+00

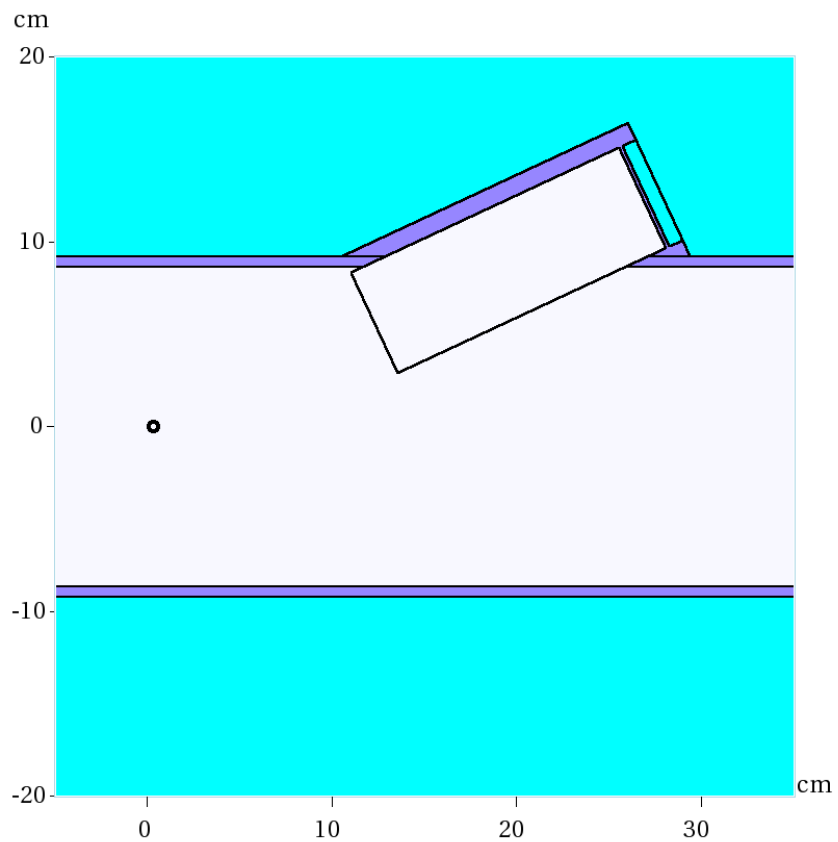


y
x
x:y = 1:1.000e+00

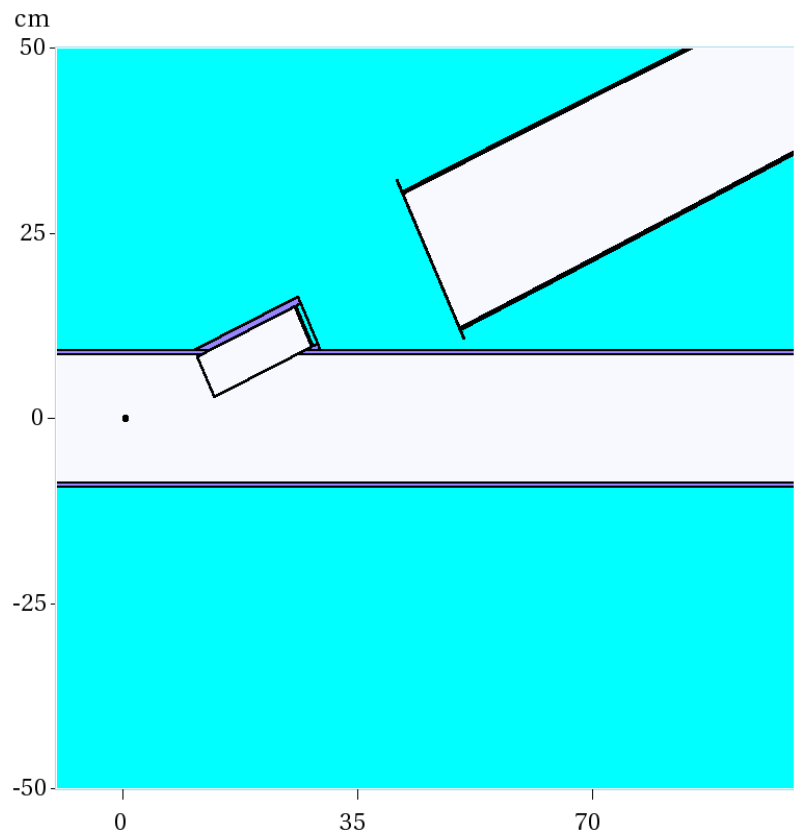
R78 Target Survey

- R78 Target Replica depressurized, end flanges removed
- Internal structure photographed, unofficial survey by paolo to confirm measurements against other surveys





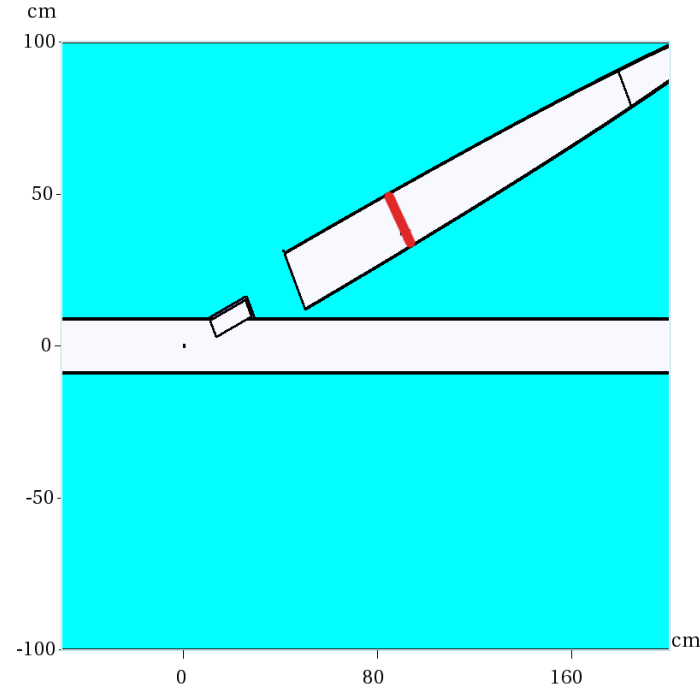
x
z
x:z = 1:1.000e+00



x
z
x:z = 1:1.100e+00

Updated Geometry

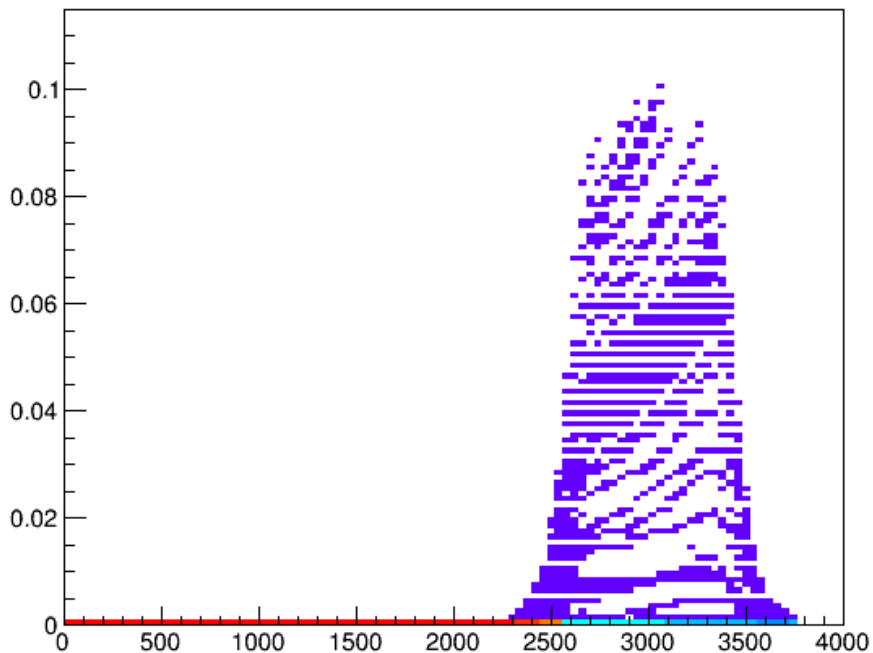
- MICE Beampipe included in model up to Q1 aperture
- Beampipe geometry based off G4BL geometry definitions for the MICE beampipe & checked against some beampipe measurements made during D1 survey
- Q1 survey height used to define angle between IP and Q1 aperture for beampipe angle
- Red and black line along MICE BP define cuts at $z=1\text{m}$ and $z=2\text{m}$ in the MICE beamline coordinate frame, resp.



x
↑
z
x:z = 1:1.250e+00

Magnetic Field from Q1

B_z (T) vs z

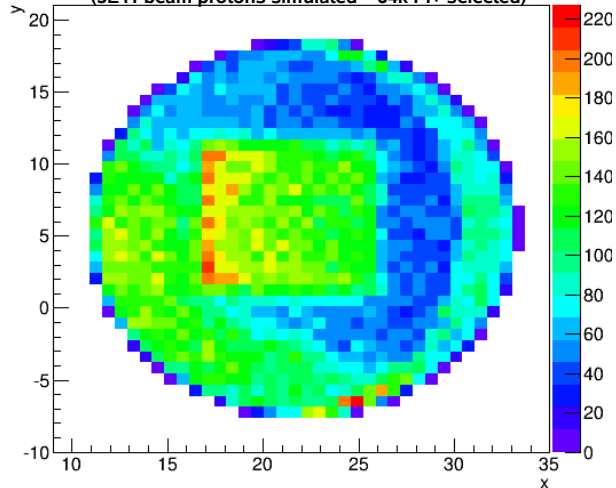


- Not modelling Q1 field in MARS
- G4BL model shows little B field up to $\sim 2.25\text{m}$

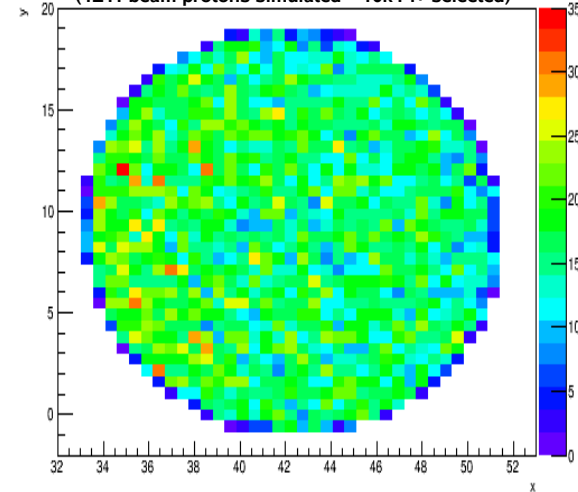
Run-Time Optimisation

- Ran MC with new geometry at cut 1m downstream (in MICE BL frame)
- 2m downstream has $\sim 2x$ runtime compared with 1m, $\sim 1/4x$ pions selected at 2m
- Plan to run more significant 2m cut MARS model following CM to contrast with 1m

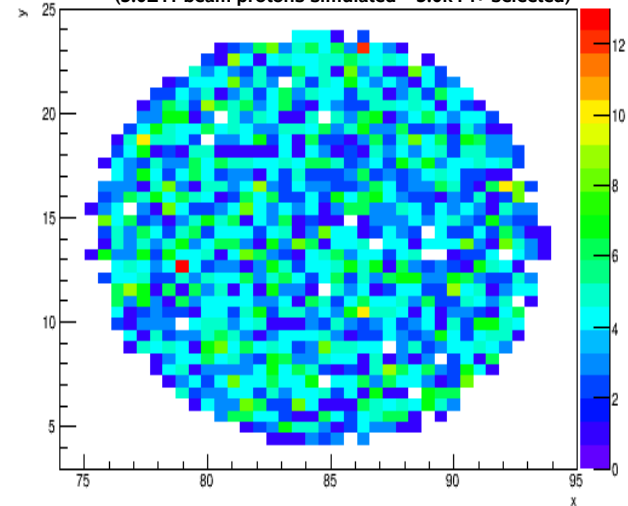
Pi+ XY distribution $\sim 50\text{cm}$ downstream of target (in MICE BL frame)
(5E11 beam protons simulated – 84k Pi+ selected)



Pi+ XY distribution 1m downstream of target (in MICE BL frame)
(4E11 beam protons simulated – 16k Pi+ selected)



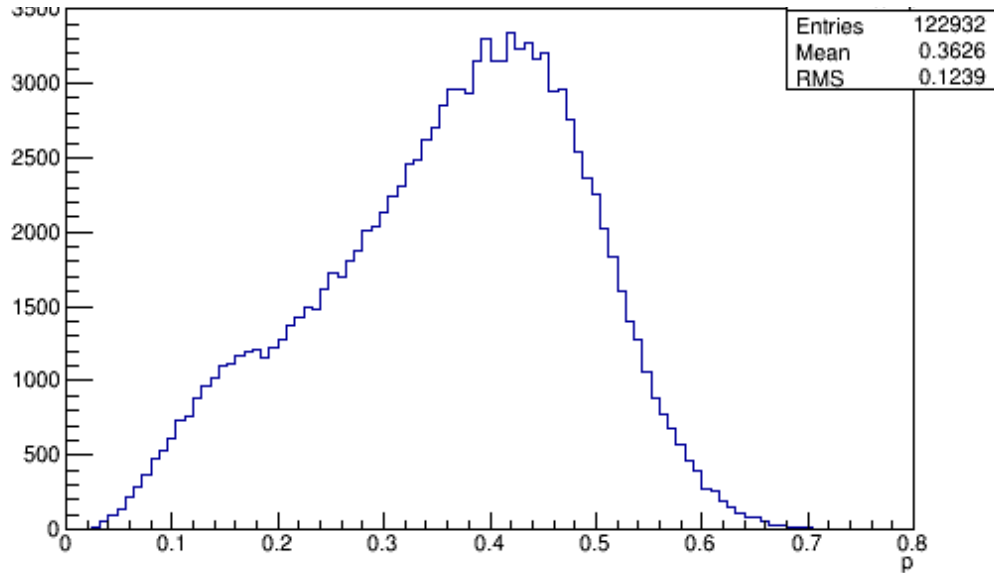
Pi+ XY distribution 2m downstream of target (in MICE BL frame)
(3.6E11 beam protons simulated – 3.6k Pi+ selected)



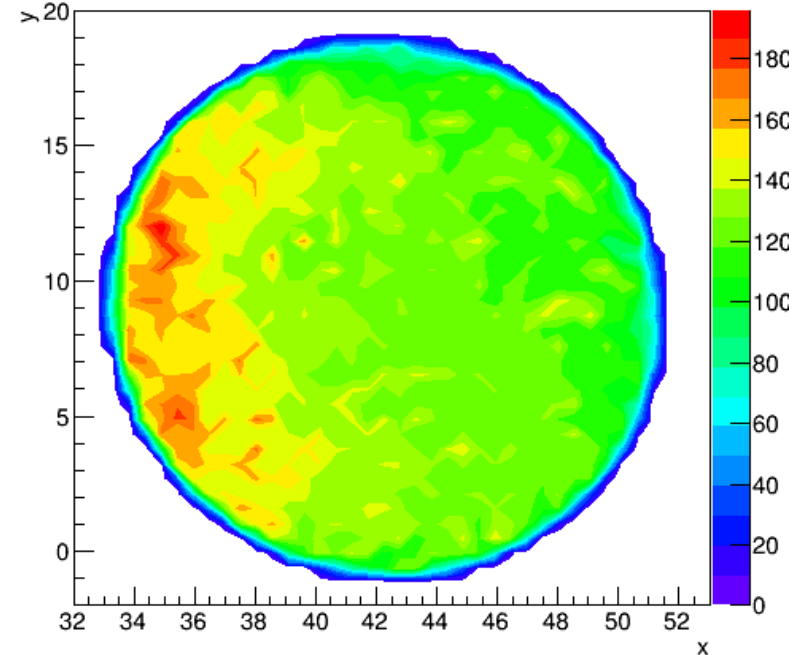
MARS Output

- 800MeV ISIS Protons simulated in MARS
- Particles selected 1m downstream of target IP, inside MICE Beampipe

Pi+ Momentum distribution 1m downstream of target (in MICE BL frame)
3.5404E12 beam protons simulated



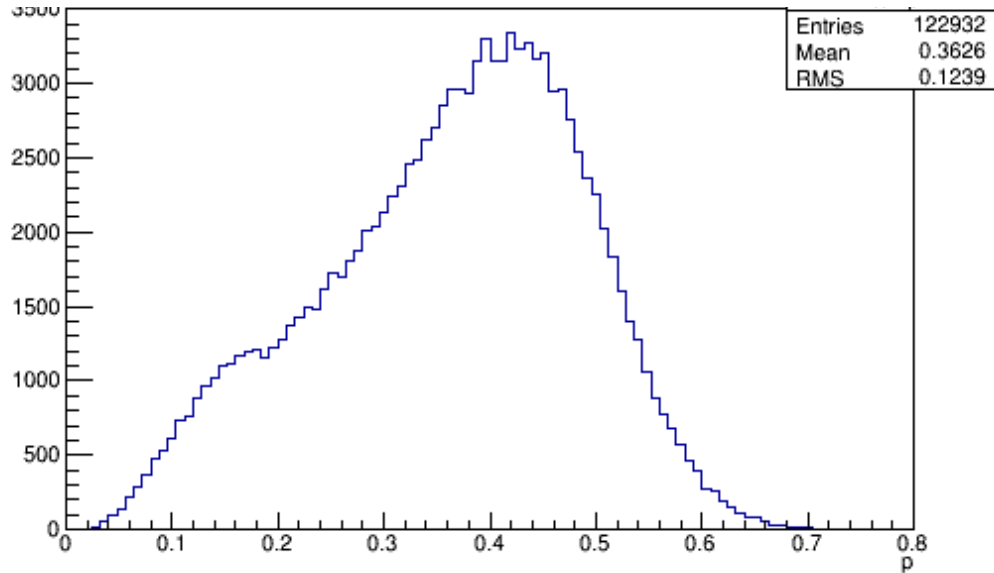
Pi+ XY distribution 1m downstream of target (in MICE BL frame)
3.5404E12 beam protons simulated



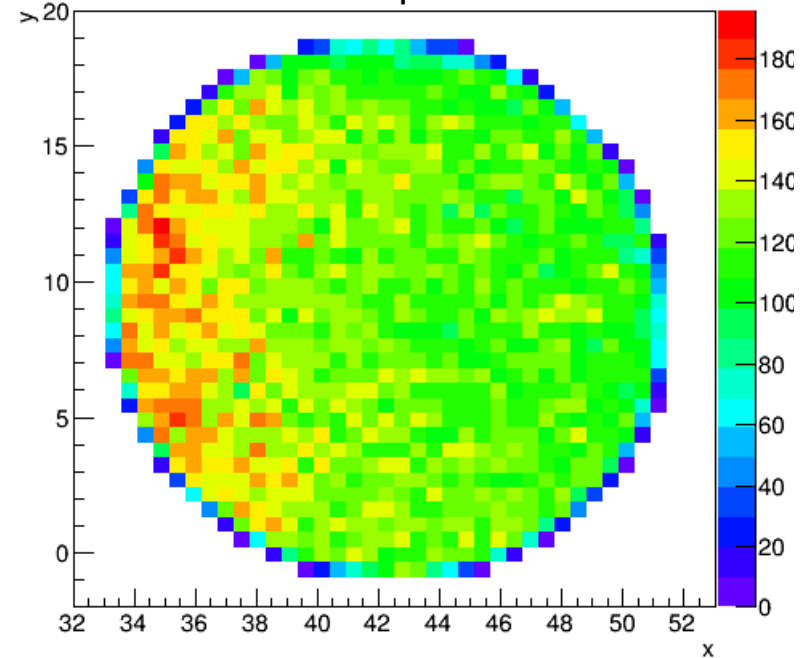
MARS Output

- 800MeV ISIS Protons simulated in MARS
- Particles selected 1m downstream of target IP, inside MICE Beampipe

Pi+ Momentum distribution 1m downstream of target (in MICE BL frame)
3.5404E12 beam protons simulated

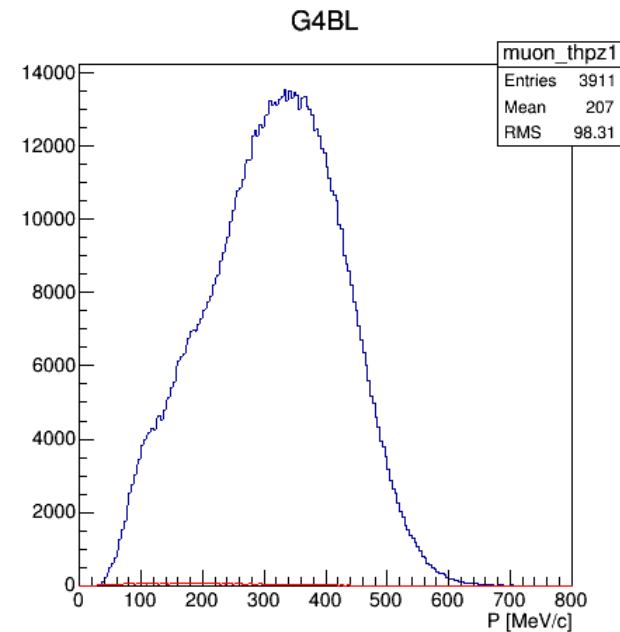
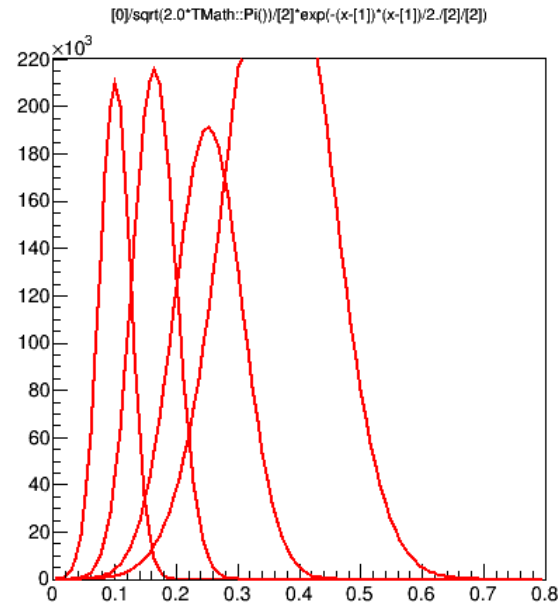
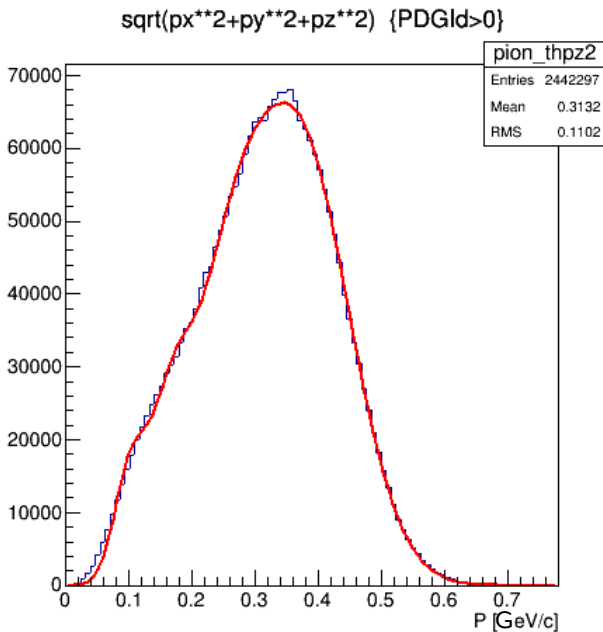


Pi+ XY distribution 1m downstream of target (in MICE BL frame)
3.5404E12 beam protons simulated



Pion Generation in G4BL

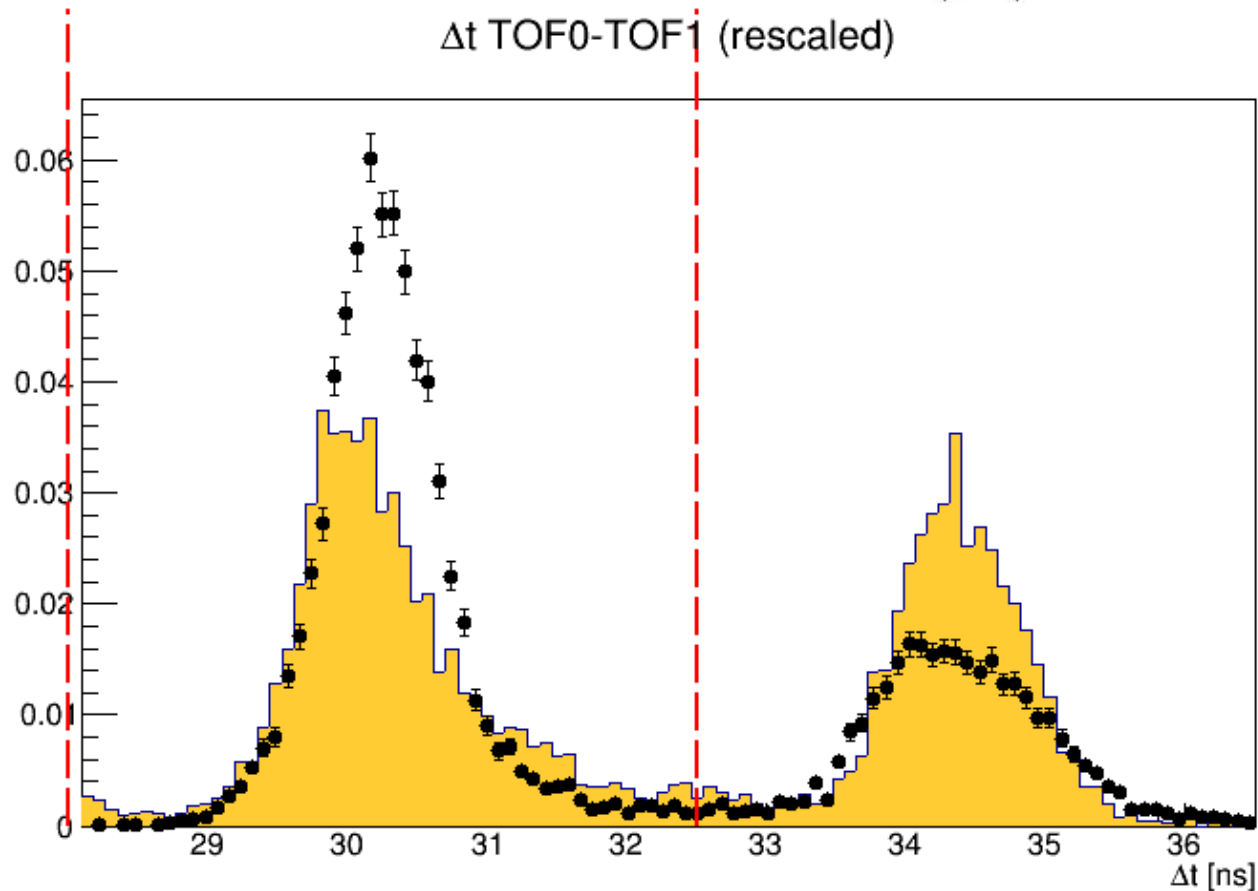
- Fit P distribution with 4 Gaussian
- Define the new beam input in G4BL



- 3-140+M3-Test4
- Full G4BL+MAUS simulation chain
- Comparison of
 - $Dt(\text{tof}0 \rightarrow 1)$
 - Muons & Pions P at TKU Station5
 - pions/muons yields

Data/MC Comparison

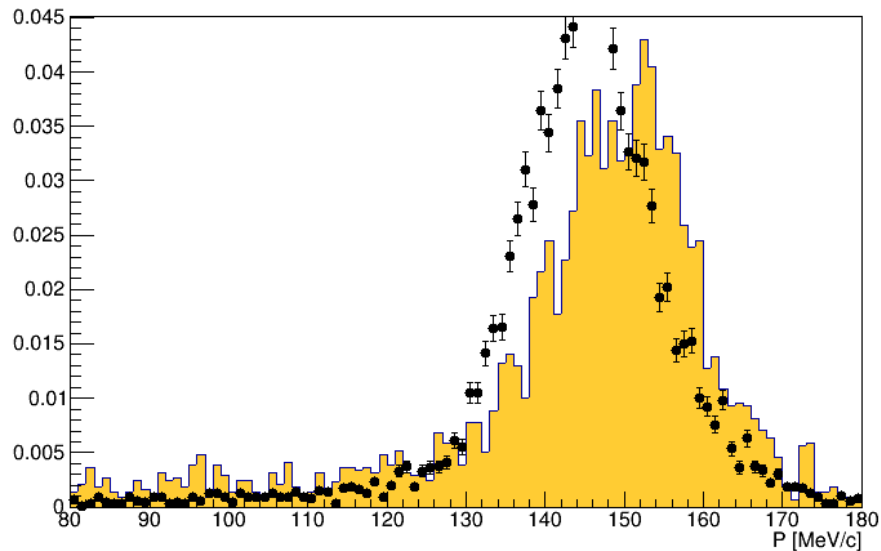
- Delta-T distribution rescaled wrt the positron MC-data time shift
- Positron MC-Data timeshift of 0.16ns, data is “faster” than MC
- 800 MeV/c produced so far
- Plan for 700+750MeV



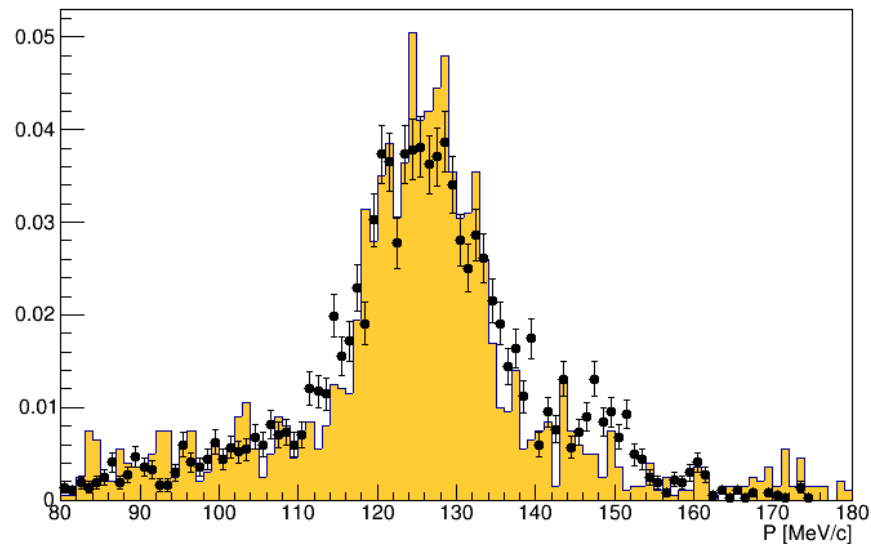
Data/MC Comparison

- Good fit for Pions at TKU-5
- Some offset for muons at TKU-5

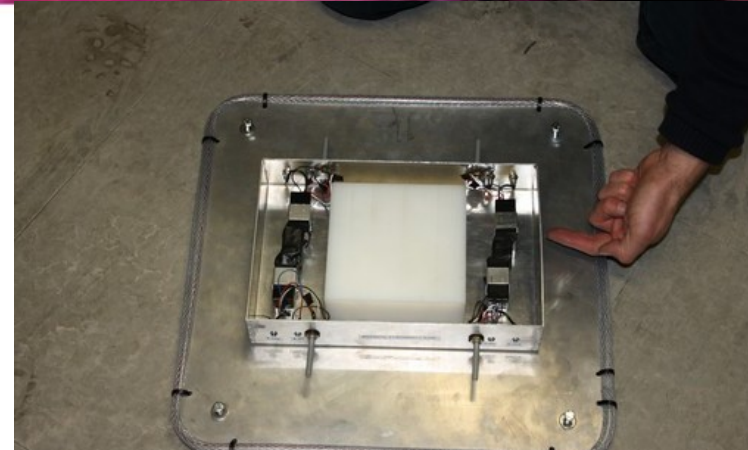
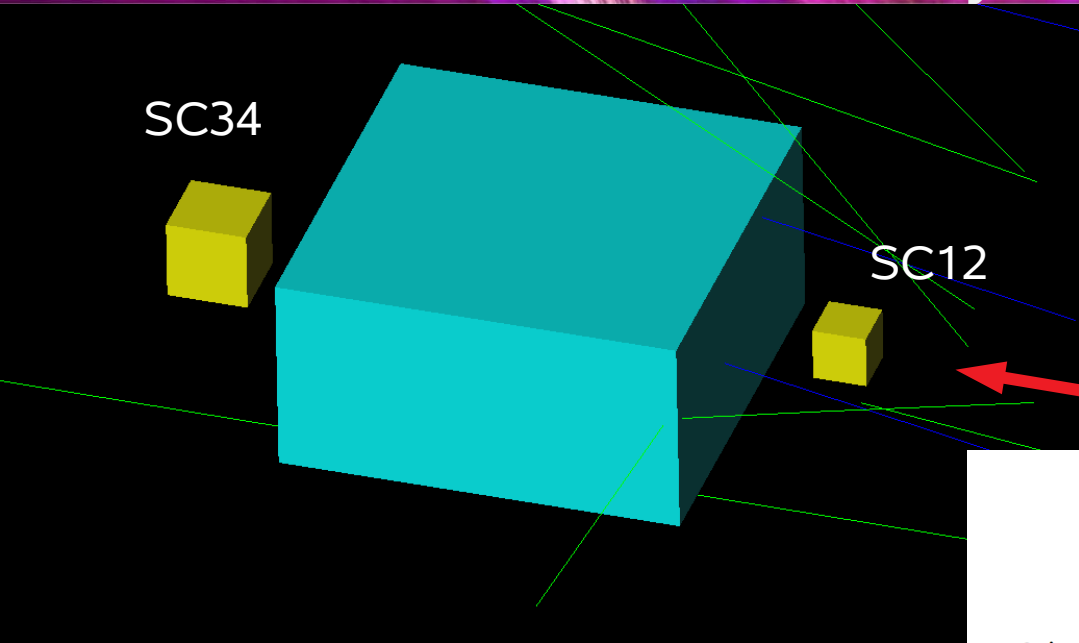
Muons at TKU-Station 5 - P



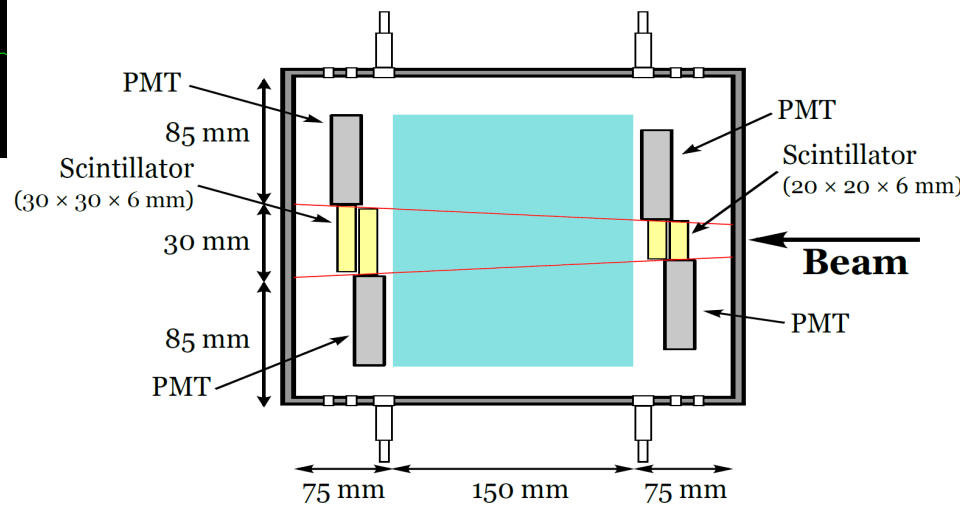
Pions at TKU-Station 5 - P



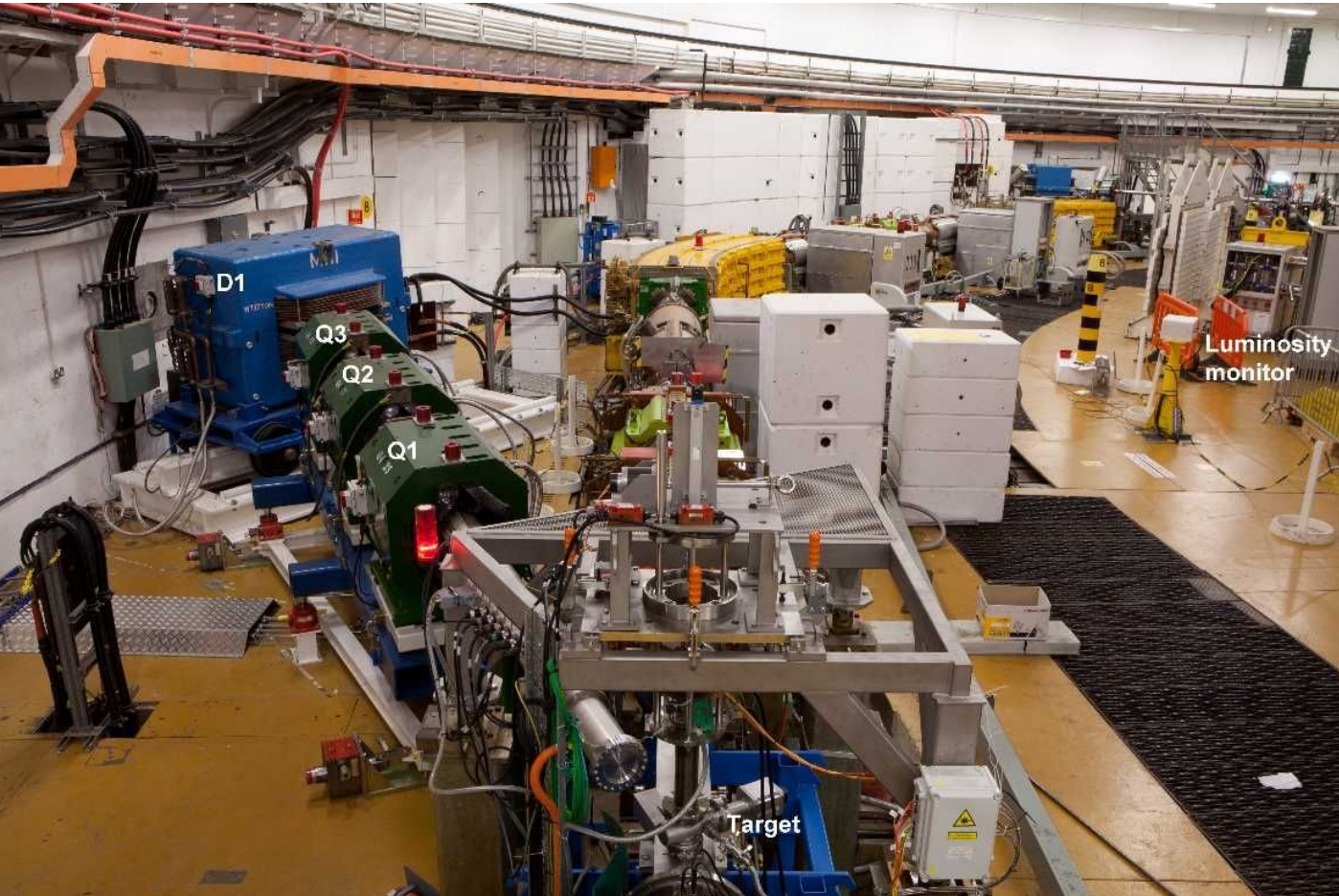
Luminosity monitor



Luminosity monitor box (200 × 300 mm)



Target Frame Pillars

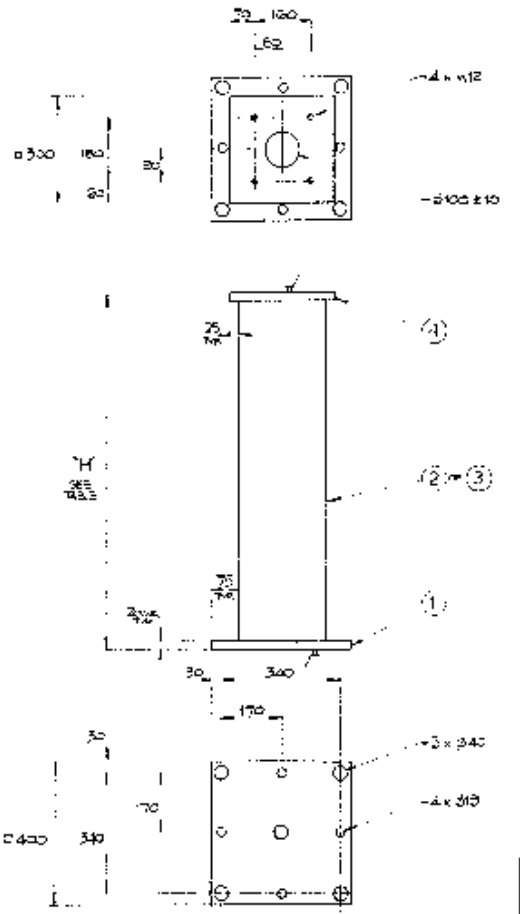


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THE UNIVERSITY OF WARWICK

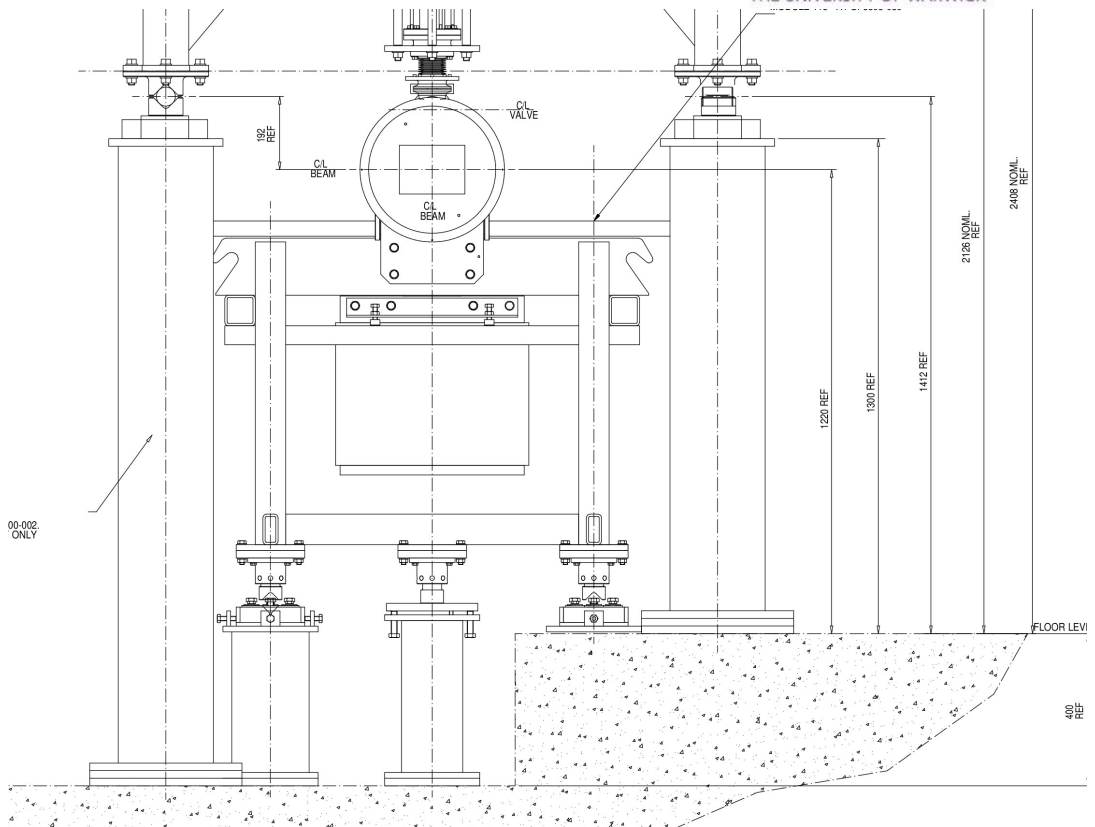
- Back-Right Target Frame Pillar is obscuring the path from Target IP to LM

Target Frame Pillars

IR 5900-117
PROJECTION

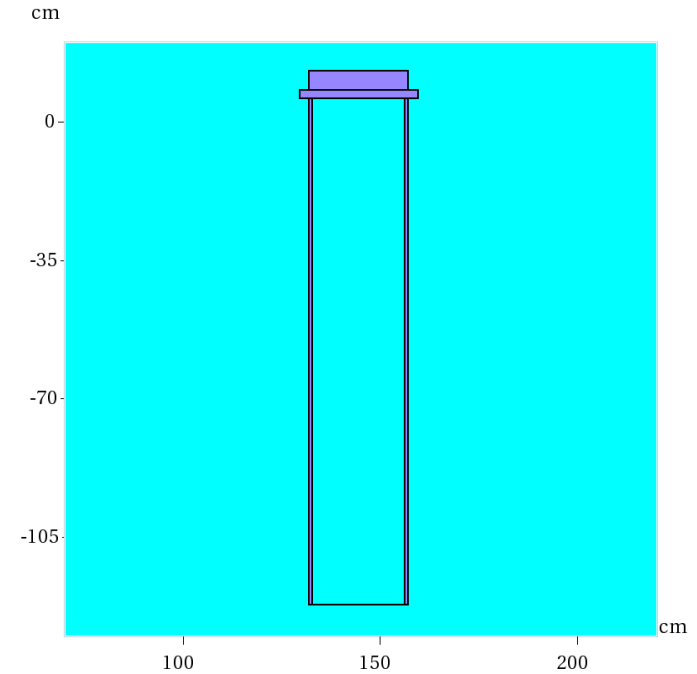


- Included pillar structure in LM simulation from old drawings/surveys



Target Frame Pillars

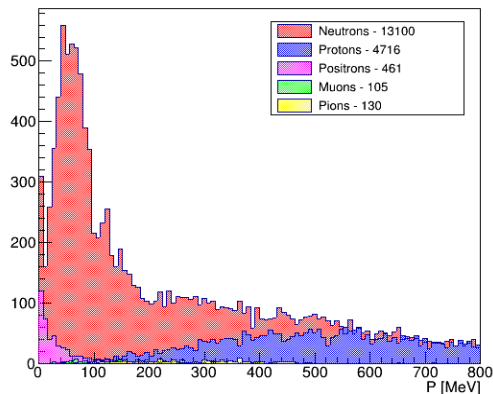
- Currently missing survey details on LM – MARS model assumes it sits at projected beamline height for MICE beamline at 10m horizontal displacement = ~52cm above target IP



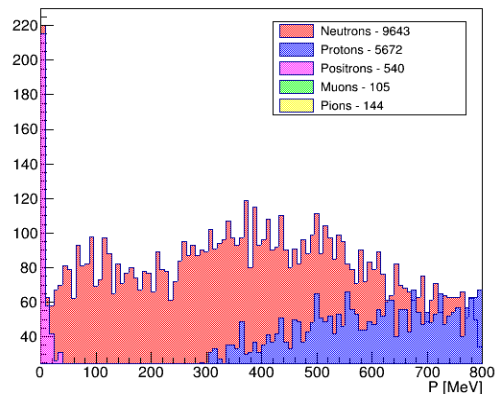
y
↑
z
yz = 1:1.000e+00

LM G4BL Model Output

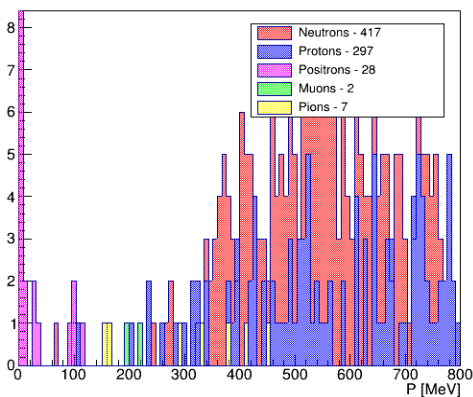
LM12



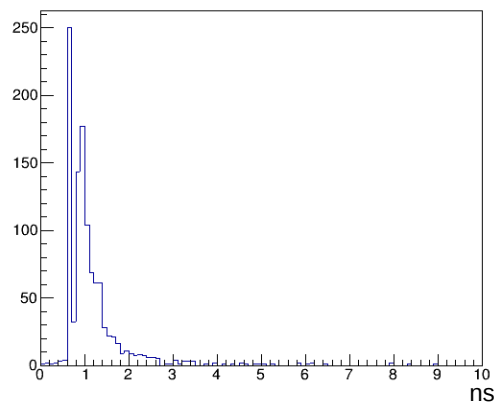
LM34



LM34 (if LM1234)



time difference



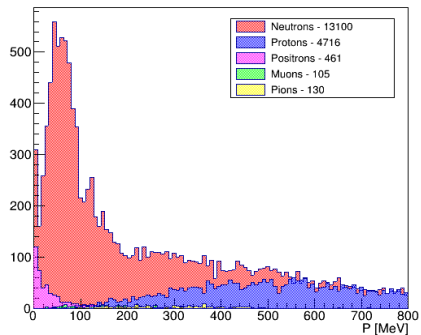
- LM Output at 800MeV
- 5E10 ISIS protons simulated

- SC12 = 18512
- SC34 = 16104
- SC1234 = 751

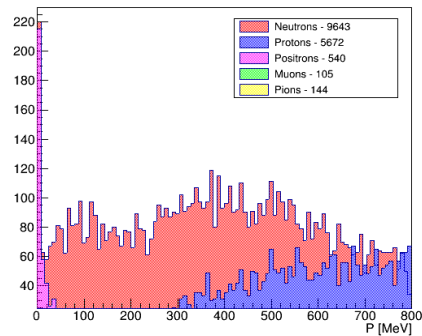
- c.f. Previous slides on agreement between SC12 & SC34 coincidence events

New G4BL propagated LM Model

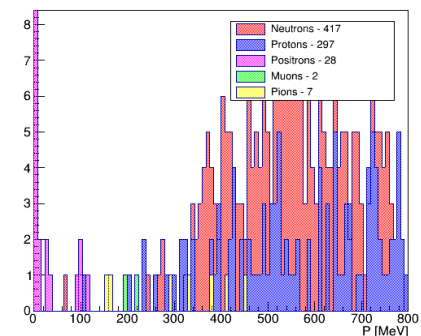
LM12



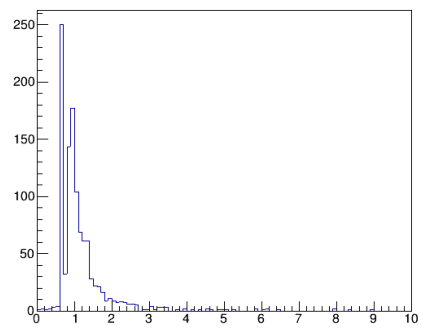
LM34



LM34 (if LM1234)

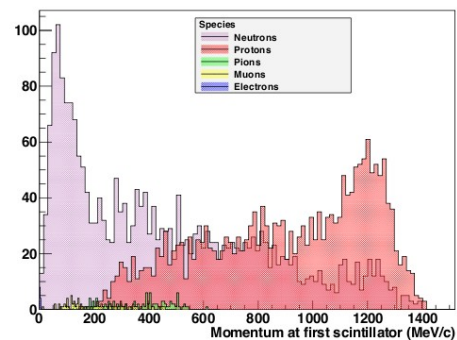


time difference

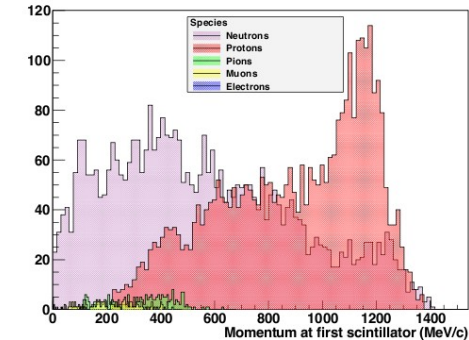


Old LM Model – LM MICEnote 367

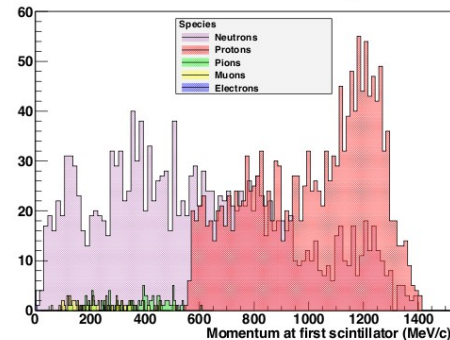
Momentum Distribution: QGSP_BIC Channel: C12



Momentum Distribution: QGSP_BIC Channel: C34



Momentum Distribution: QGSP_BIC Channel: C1234



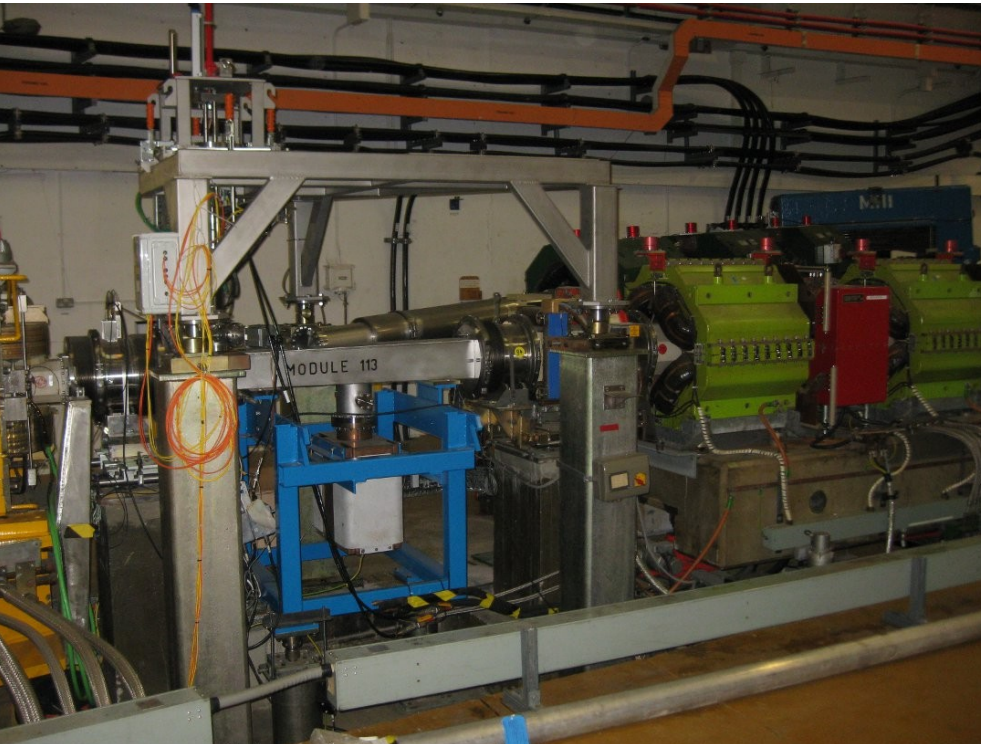
- Geometry in place so:
 - Simulate different ISIS beam energies
 - Normalize using the LM
- MICE Note in progress
- Section for the System performance paper
- Implement target model in G4BL together with few other corrections coming from surveys
- Some apparent scattering from beyond-target ISIS beampipe as we do not model ISIS quads – investigate running with this downstream scattering removed



Bonus Slide

MARS Output

- G4BL propagation for LM has suggested some high P_T scattering from ISIS beampipe further downstream
- Have implemented a fix to remove particles in beampipe past 2.25m i.e. ~ distance of ISIS quads



Pi+ XY distribution 1m downstream of target (in MICE BL frame)
3.5404E12 beam protons simulated

