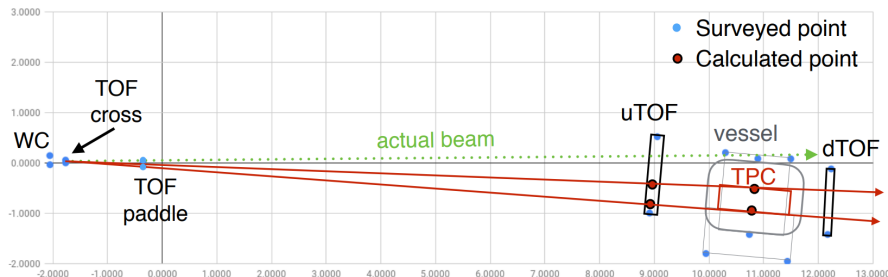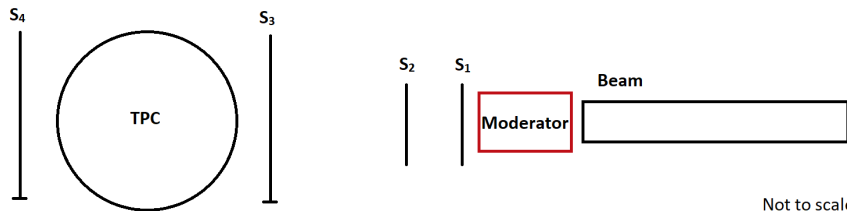# Beam flux update

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Beam area layout reminder

Paper Plan: Figures of Merit

- ToF measurement (including momentum measurement)

- Flux measurement (including proton:pion ratio measurement)

- In each case
  - S3/S4
  - Varying moderator blocks
  - (And varying particle type for the flux measurement)

Runs used for analysis

- For different numbers of moderator blocks wanted to have same beam conditions
- Beam being bent away from TPC
- No electron target
- 0.8 GeV/c beam momentum
    - 0 blocks: `Data_2018_8_31_b2_800MeV_0block.root` – 273 spills
    - 1 block: `Data_2018_9_1_b4_800MeV_1block_bend4cm.root` – 253 spills
    - 2 blocks: `Data_2018_9_1_b2_800MeV_2block_bend4cm.root` – 266 spills
    - 3 blocks: `Data_2018_9_1_b3_800MeV_3block_bend4cm.root` – 212 spills
    - 4 blocks: `Data_2018_9_1_b8_800MeV_4block_bend4cm.root` – 3822 spills
- These should be runs should have most visible proton peak
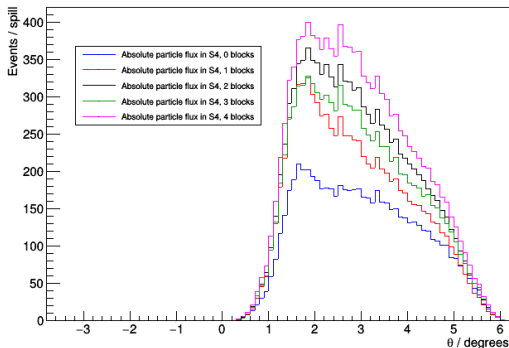- Corresponding DsToF runs used

Angle definitions
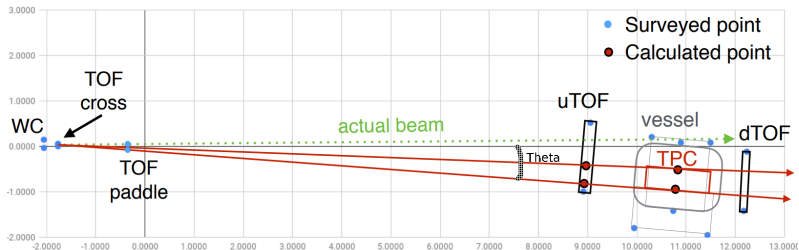
- Measure 'off-axis' angles as angle from $S1$ and nominal beam axis ($y = z = 0$)
- x is beam direction, z is vertical
- θ is angle in $x - y$ plane
- ϕ is angle in $x - z$ plane

# $S4$ flux measurement

Absolute particle flux in S4

- In $S4$, data-taking was continuous – no trigger
- Available timing point combinations: $S4$, $S1 \times S2$ and $S1 \times S2 \times S4$
- Drop-off at ~ 1 is due to inefficiency of bars at the ends – attempting to use cosmic ray flux to quantify this

$S1 \times S2$ flux

- This is as measured in the DsToF files
- No spatial or particle type information for this measurement

N blocks	Hits per spill
0	683
1	1913
2	2949
3	3415
4	5630

$S1 \times S2 \times S4$ flux

Background subtracted and efficiency corrected S4 ToF spectrum
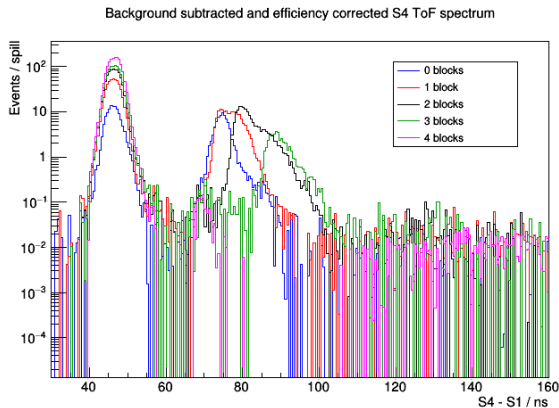
- Define a hit as being when $30 < t_{S4} - t_{S1} < 160$ ns
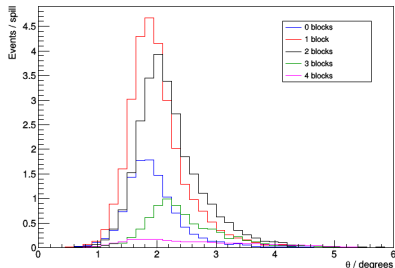
$S1 \times S2 \times S4$ flux – absolute rates

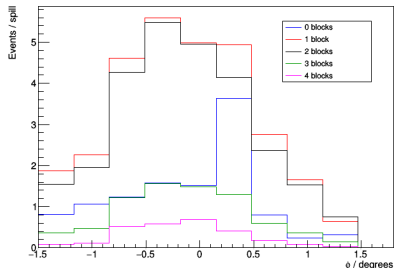- Using the cut defined on the previous slide, the rates for various numbers of moderator blocks are as follows

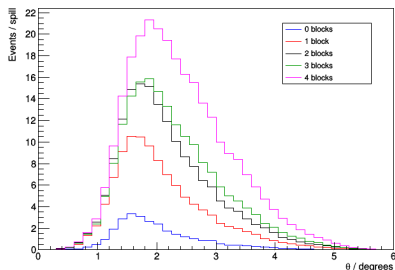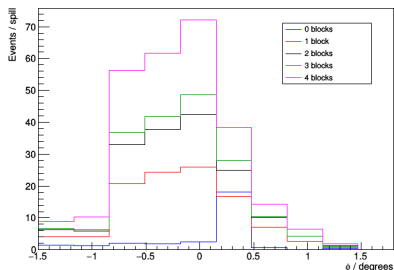| N blocks	Hits per spill
0	208
1	665
2	990
3	1010
4	1460

$S1 \times S2 \times S4$ flux – protons

- Angles are as defined previously
- Proton peak not visible for 4 block case on previous slide

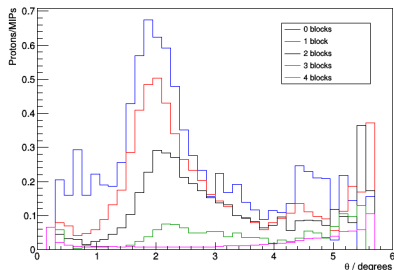# $S1 \times S2 \times S4$ flux – MIPs

- Angles are as defined previously

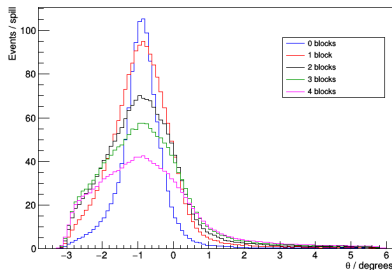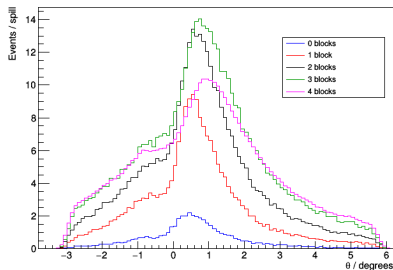# $S1 \times S2 \times S4$ flux – Proton/MIP ratio
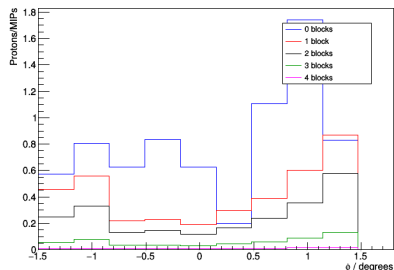
- Angles are as defined previously

$S1 \times S3$ and $S1 \times S2 \times S3$ flux

Angular distribution of S3 hits with S1 trigger only

Angular distribution of S3 hits with S1 & S2

- For $S3$, data taken when there is a hit in $S1$ and $S3$
- Available timing point combinations: $S1 \times S3$ and $S1 \times S2 \times S3$
- In general, fluxes a lot lower than those seen in $S4$, probably due to constraint of requiring $S1$ hit

$^{\triangle}$UCL

Next steps

- Similar to $S4$ data need to do angular distributions of protons and MIPs using both timing and amplitude cuts
- Have done this for the $S1 \times S2 \times S3$ case but not for $S1 \times S3$