

Dead time correction

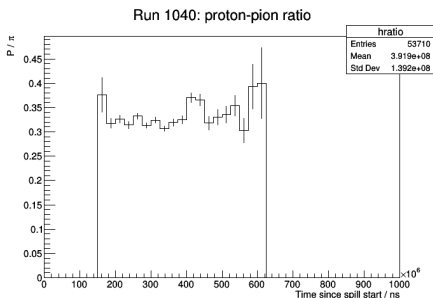
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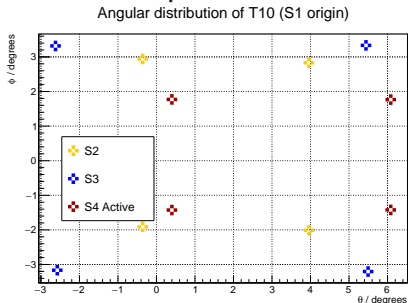
April 12, 2019

S3 dead time correction – recap

- Currently, we are not sure of UToF ($S1$, $S2$, $S3$) deadtime – measurements of proton & MIP flux are incorrect
- Proton/MIP ratio is fairly constant across spill (see right) – ratio plots should be ok
- Would like to find a way to correct the absolute $S3$ flux plots



A possible solution – recap



- Given previous slide, *S3* fluxes should be correct up to a factor
- Need a signal present in UToF & DToF (negligible deadtime) data
- Use *S1* + *S2* coincidences
 - Were fed directly into DToF TDC – no *S4* hit required and no UToF deadtime
 - Also have these in UToF data, in coincidence with *S3* hits
 - *S2* completely shadowed by *S3* – no geometric effects (see above)

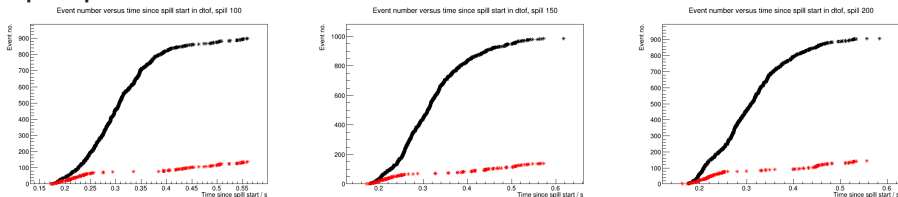
Results – recap

- Here are number of $S1 + S2$ coincidences recorded in each filesystem for each number of blocks

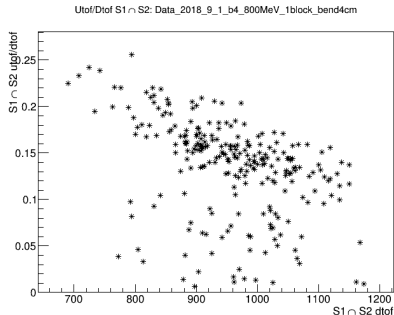
N. blocks	DToF	UToF	Ratio
0	97,722	9,268	0.0948
1	259,579	36,707	0.1414
2	417,054	63,495	0.1522
3	396,519	64,264	0.1621
4	11,461,429	1,037,454	0.0905

- People were concerned about ratio for 4 block data, doesn't fit pattern.

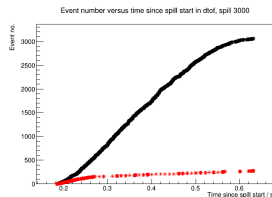
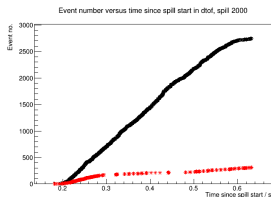
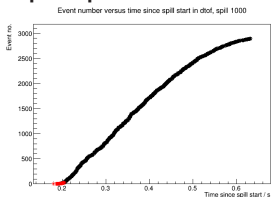
Spill profiles – 1 block data



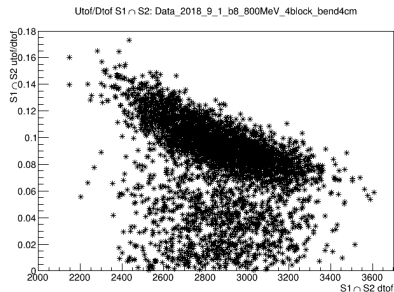
- Above are spills from 1 block data used in table previously
- Red is utof data, Black is dtof data
- Utof appears to cut out about 0.25s after spill start
- Right is utof/dtof against dtof – apparent negative correlation



Spill profiles – 4 block data

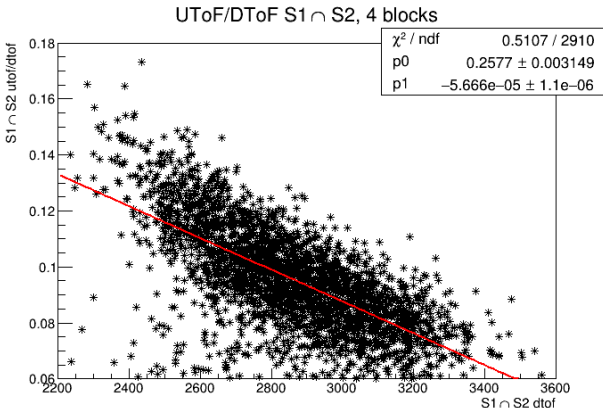


- Above are spills from 4 block data used in table
- Red is utof, Black is dtof
- Utof appears to cut out ~ 0.25 s after spill start
- Right is utof/dtof against dtof
- Think situations like LH plot produce spills with low utof/dtof values

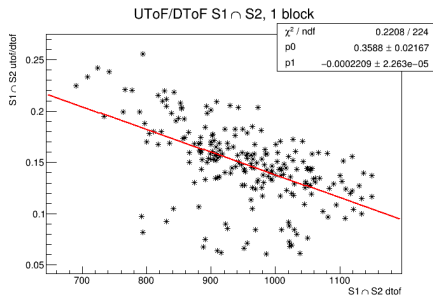
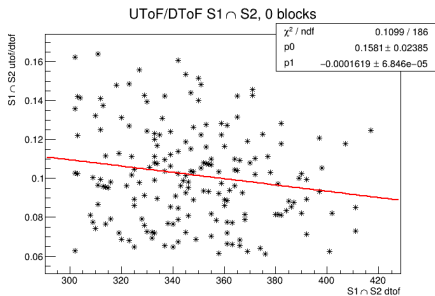


Relation between number of DToF & UToF $S1 \cap S2$ hits

- For each run, make a cut at $y = \frac{UToF}{DToF} = 0.06$ and plot straight line through points

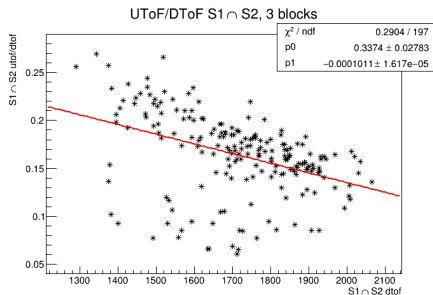
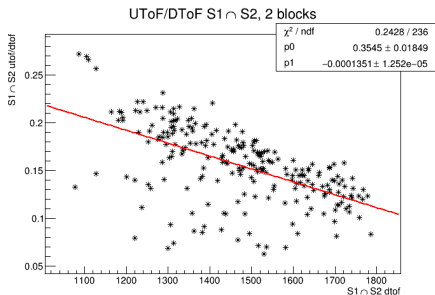


Relation between number of DToF & UToF $S1 \cap S2$ hits



Little discernible correlation for 0 block case (above left) – use average ratio over run to perform scaling

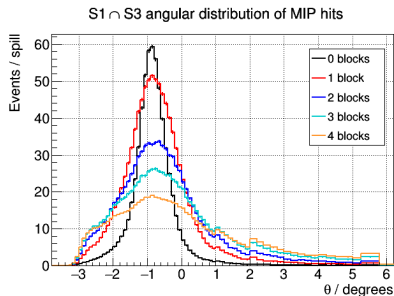
Relation between number of DToF & UToF $S1 \cap S2$ hits



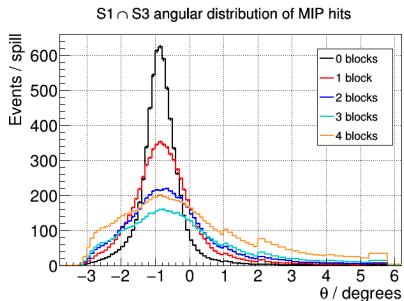
Correction process

- For each spill:
 - Count number of $S1 \cap S2$ hits as recorded in DToF
 - Calculate weight from the fitted line on previous slides
 - Weight events recorded in UToF data by 1 over this factor

Comparisons with old plots – MIP distribution

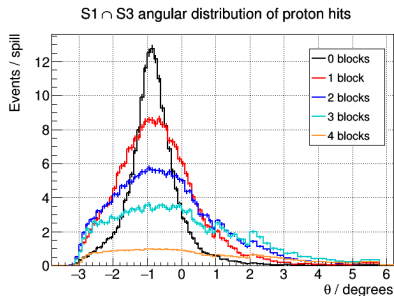


Without dead time correction

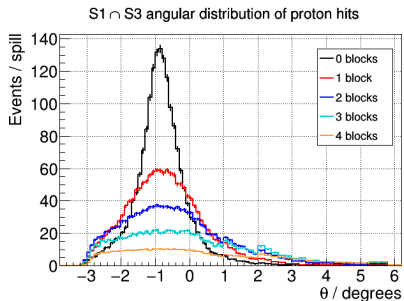


With dead time correction

Comparisons with old plots – Proton distribution

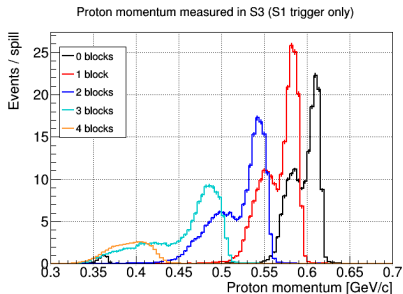


Without dead time correction

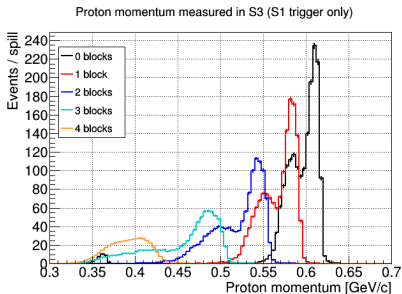


With dead time correction

Comparisons with old plots – Proton momentum

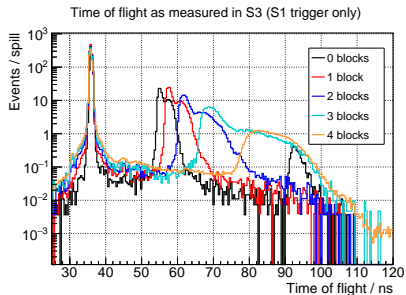


Without dead time correction

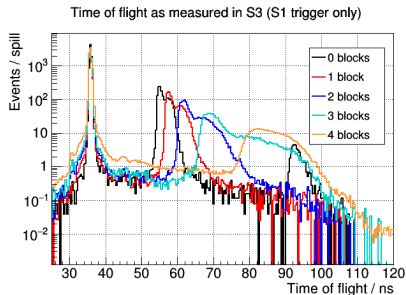


With dead time correction

Comparisons with old plots – Proton momentum

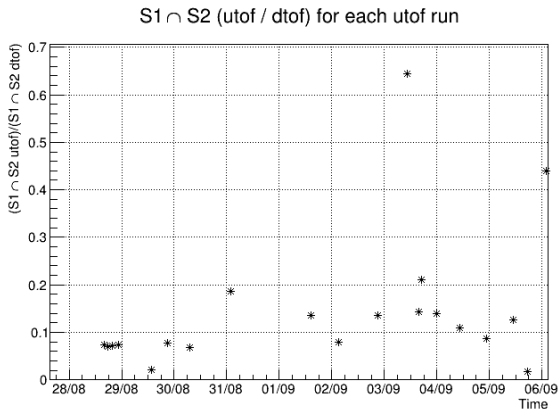


Without dead time correction



With dead time correction

$S1 \cap S2$ utof/ $S1 \cap S2$ dtof over run



- Most runs around what was seen previously (0.09 – 0.16)