Pileup studies in run 8 data

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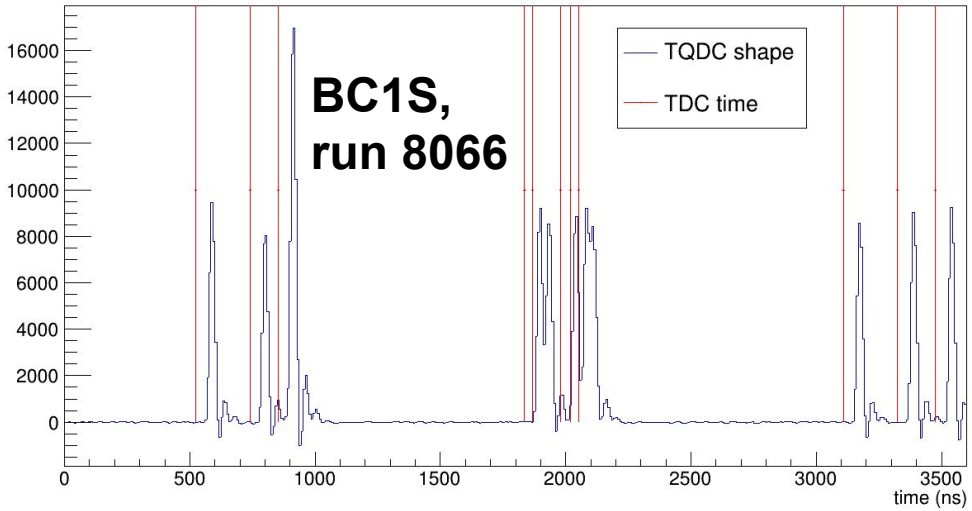
Aim

Study **frequency** and effect of

- **Close pileup (narrow window around mean trigger time)**
- Distant pileup



Data

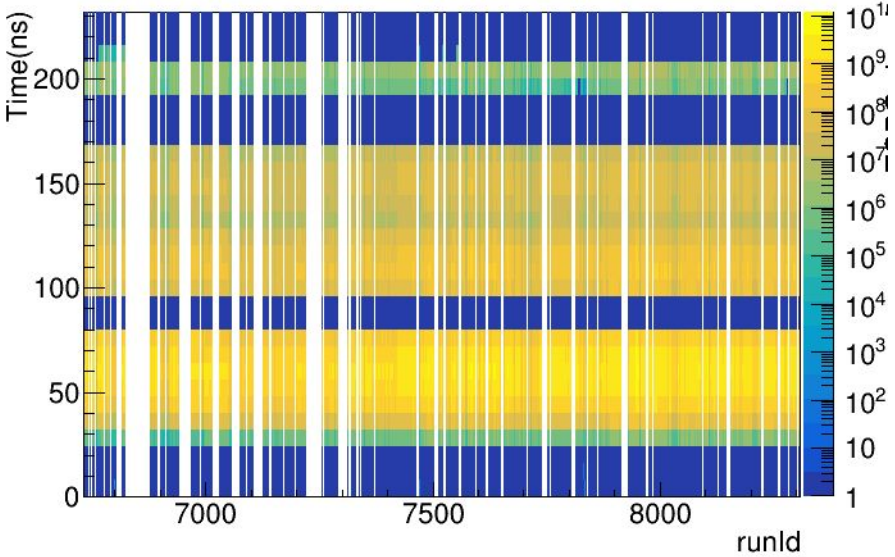
- Xe+CsI @ 3.8A GeV
- Physics runs
- Technical runs with BT trigger: 7426 and 8281

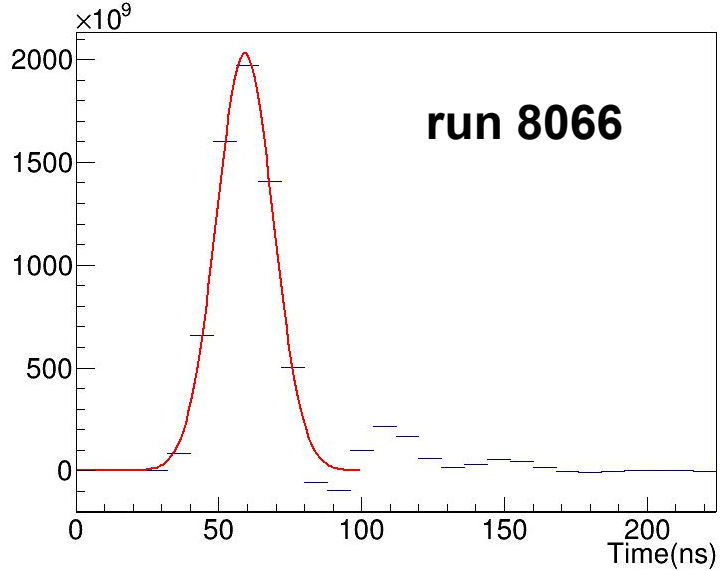
Analysis procedure

- Collect run-by-run distributions of integrals for single BC1 and FD hits
- Normalize BC1 and FD integrals with means of these distributions
- Plot distributions of normalized BC1 and FD integrals in varying time windows around mean trigger time
- Estimate frequency of multiple BC1 hits and interactions in these narrow windows (close pileup) for different triggers
- Estimate frequency of single interaction in case of close pileup for different triggers

Signal shape relative to single BC1S hit time

BC1S

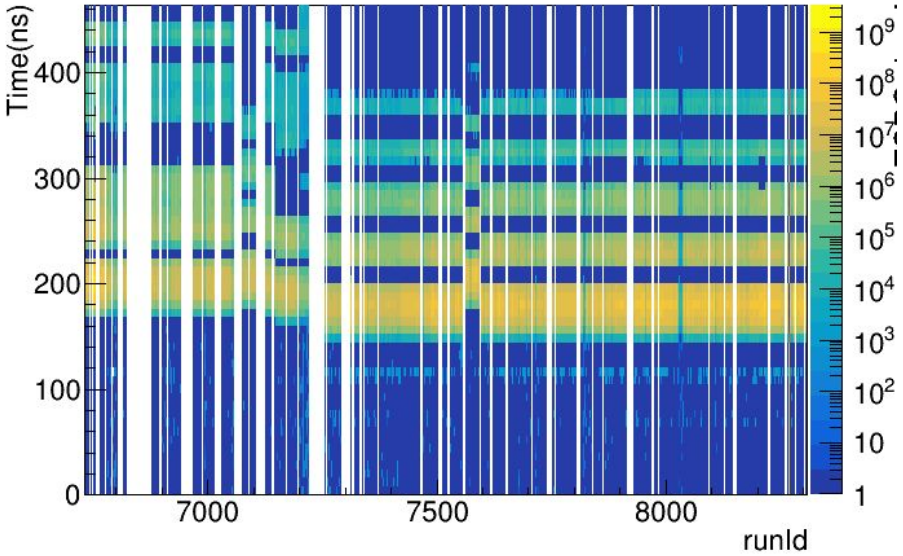


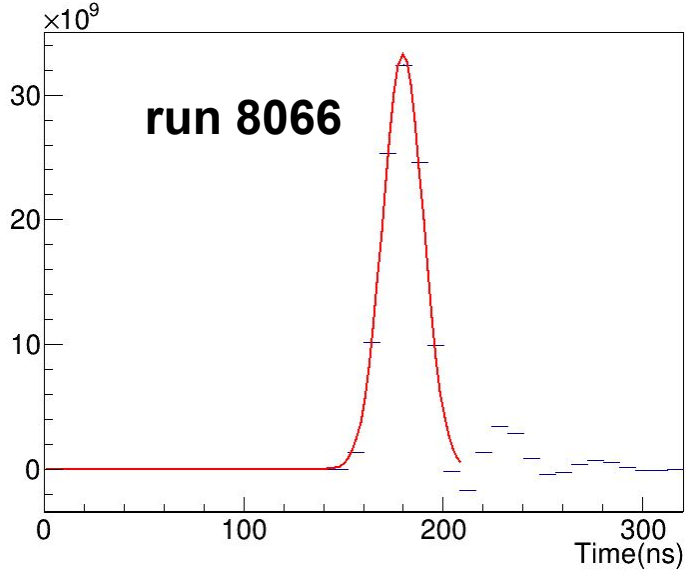


Integral is collected in mean +/- 3 sigma time from BC1S hit time

Signal shape relative to single BC1S hit time

FD

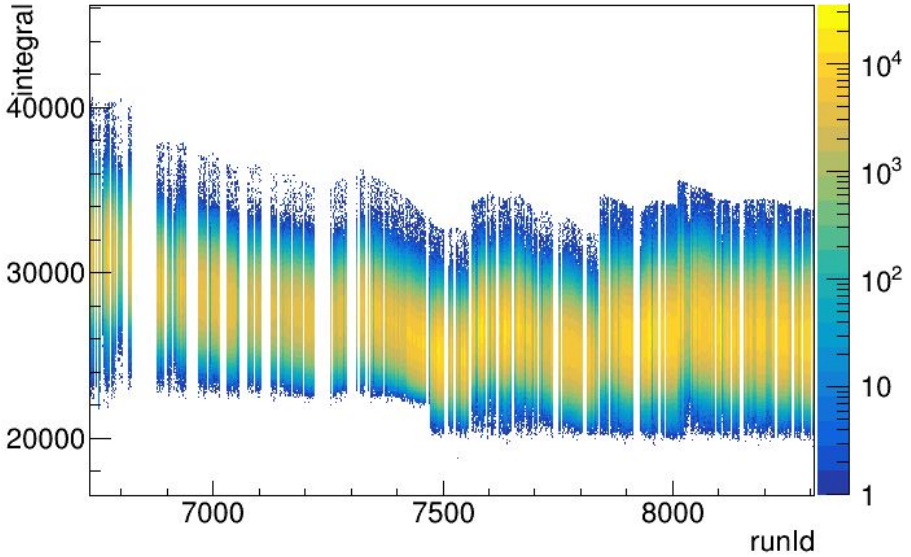


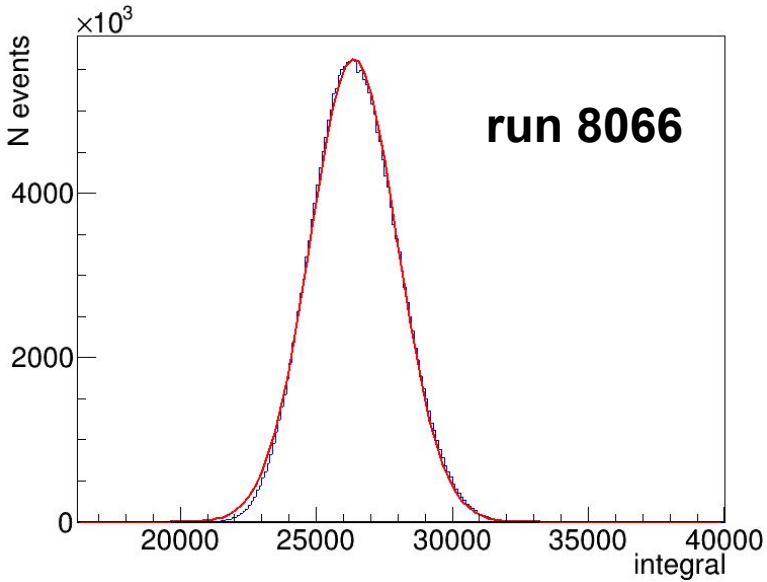


Integral is collected in mean +/- 3 sigma time from BC1S hit time

Single hit integral

BC1S

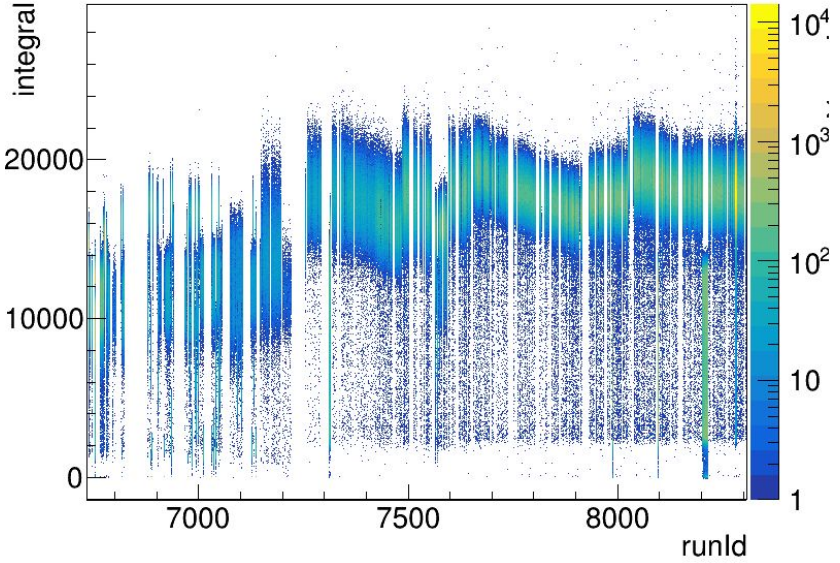


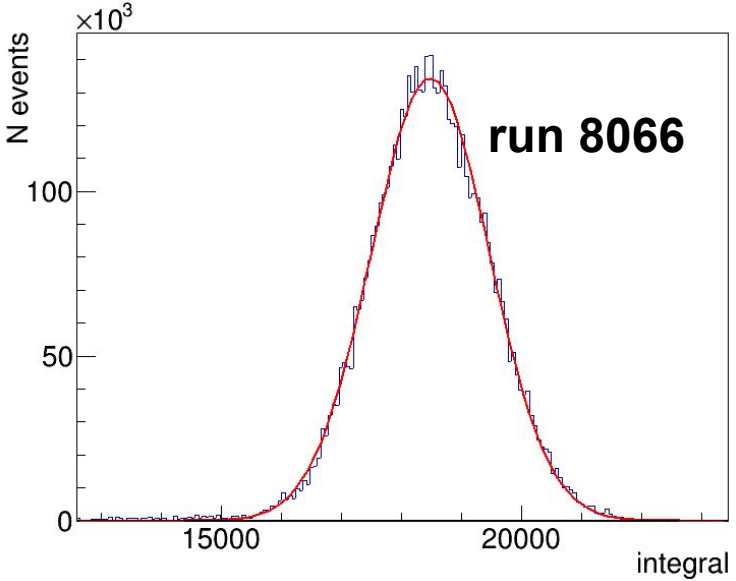


Single integral mean is used to normalize integral distribution

Single hit integral

FD (BT after reduction)

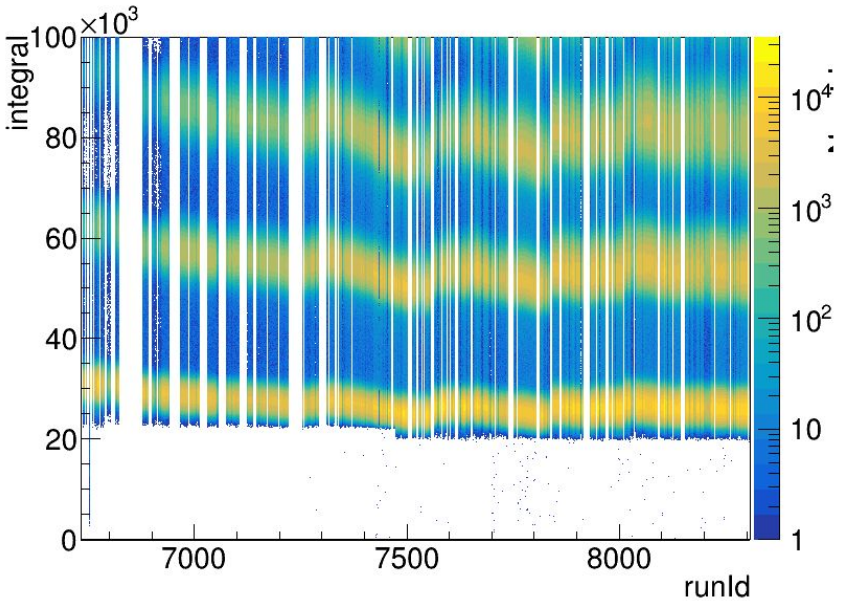




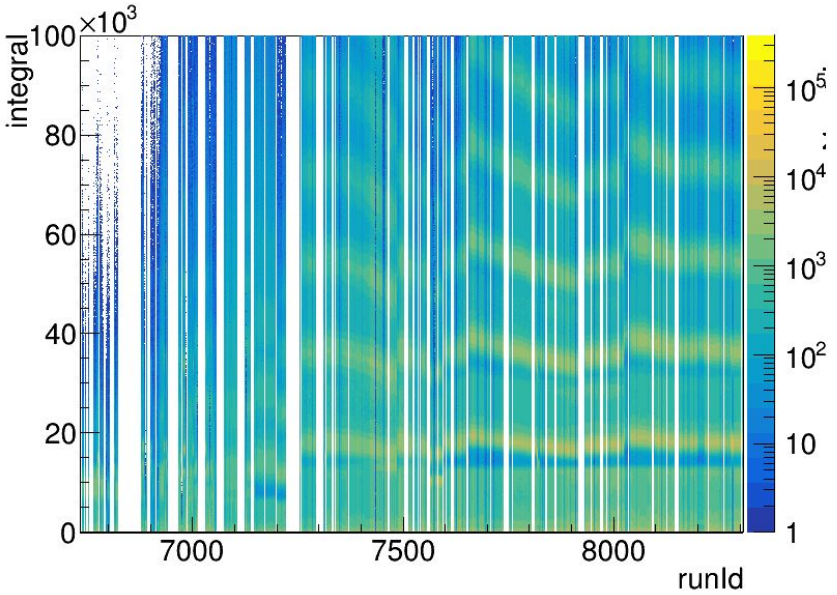
Single integral mean is used to normalize integral distribution

Integral distributions

BC1S

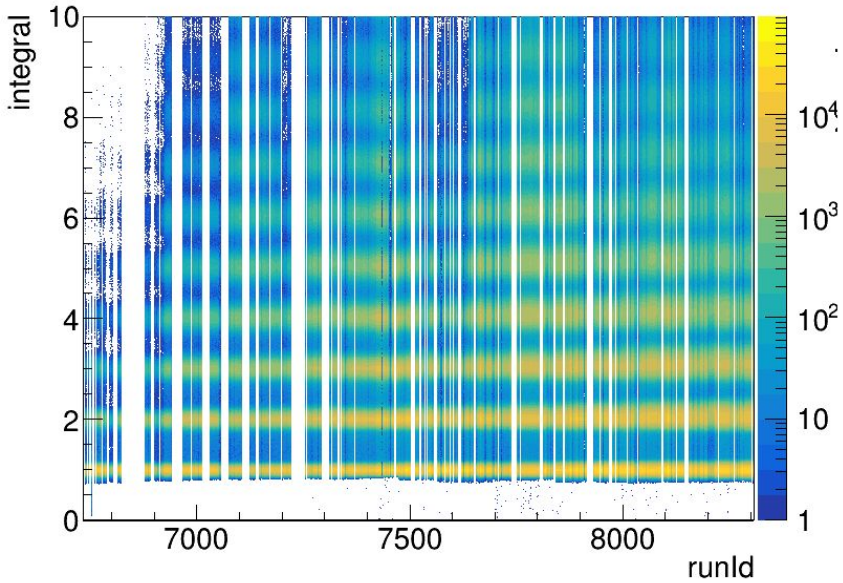


FD

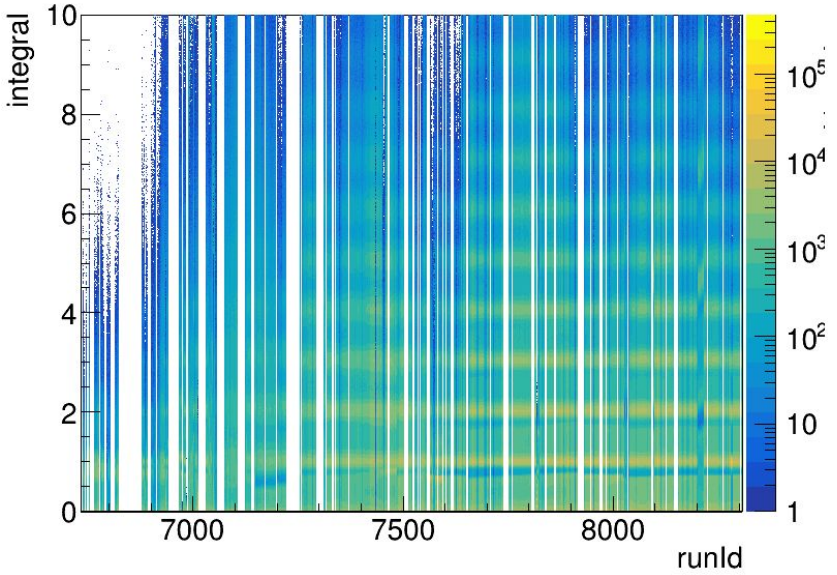


Normalized integral distributions

BC1S

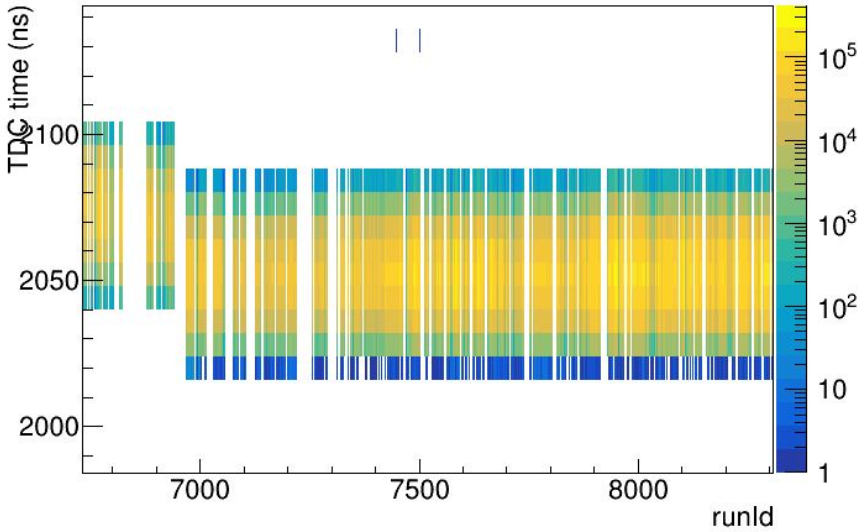


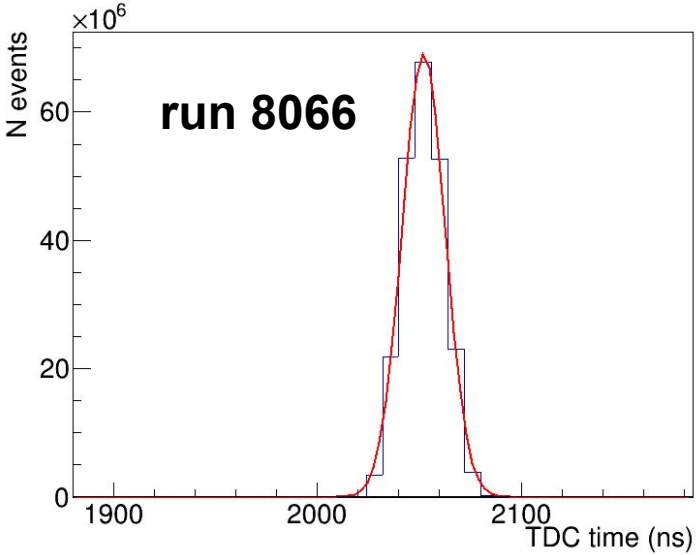
FD



BC1S normalization deteriorates with time.
Reducing resolution due to scintillator radiation damage?

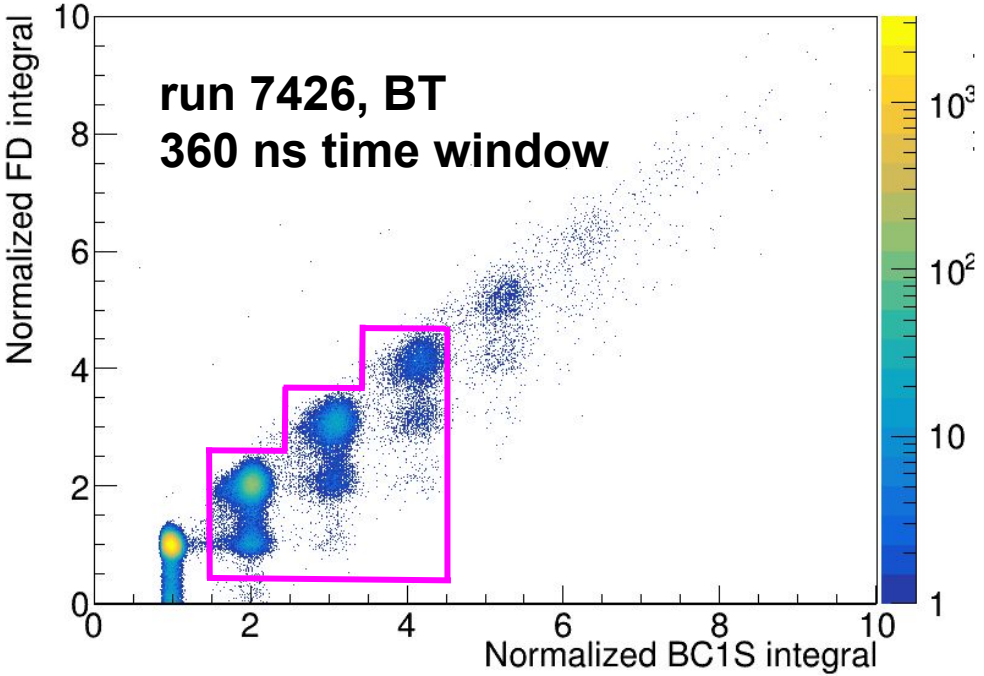
Single BC1S hit time





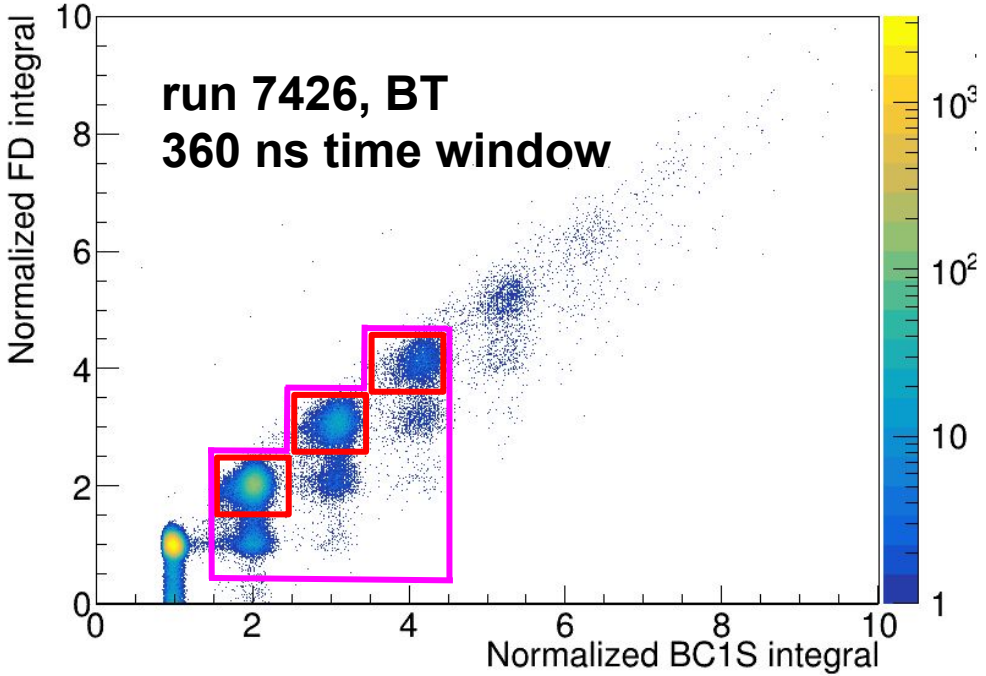
Close pileup is estimated in a narrow time window around mean

Estimation of close pileup



close pileup

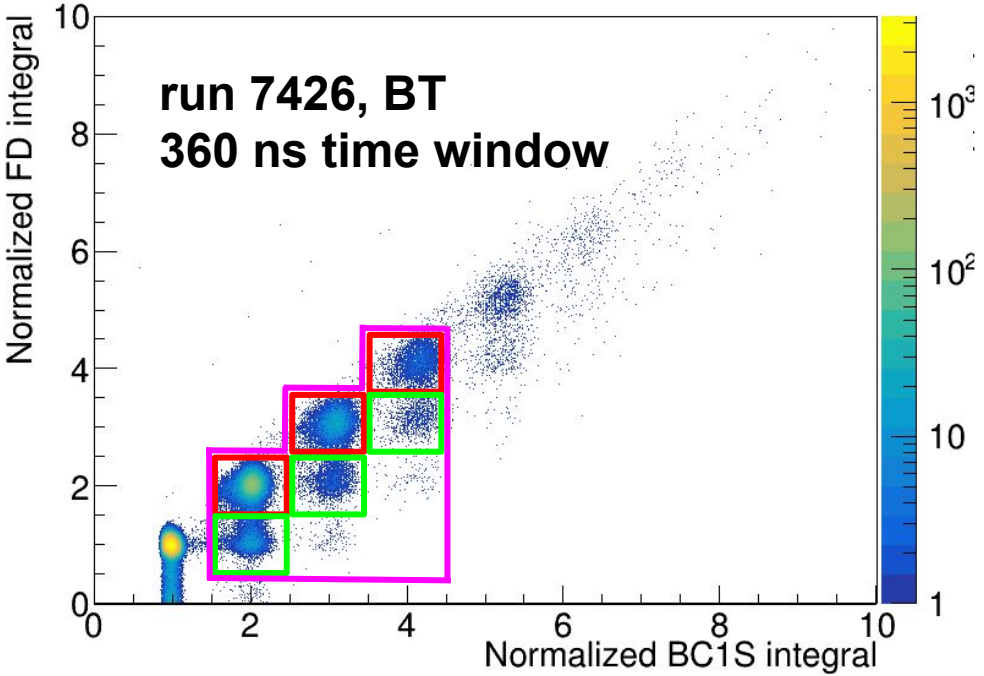
Estimation of close pileup



close pileup

no interaction

Estimation of close pileup



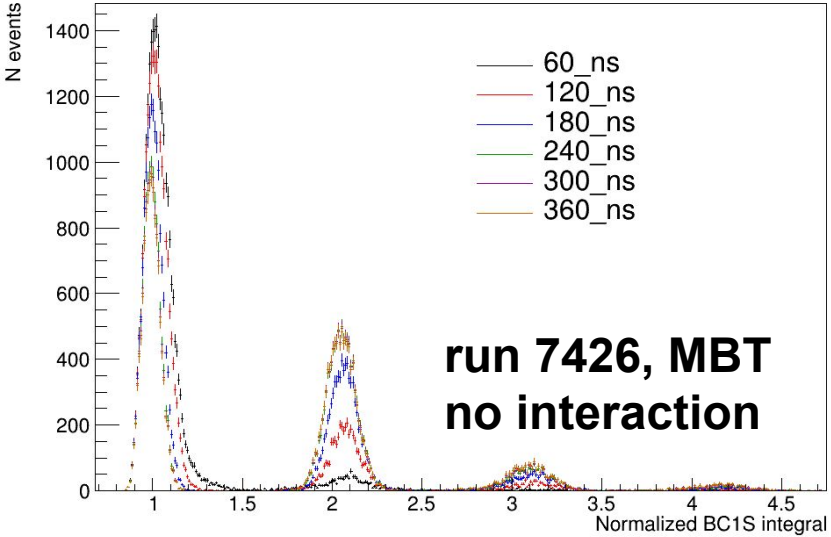
close pileup

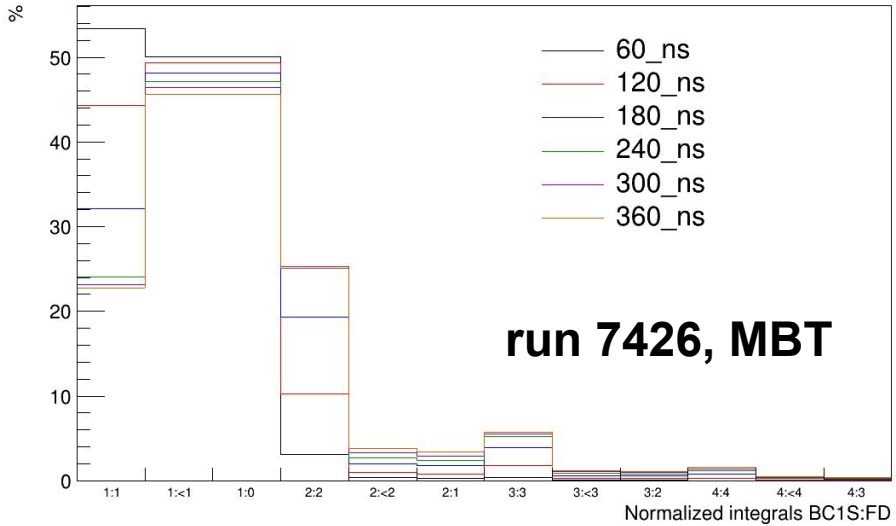
no interaction

one interaction

Aim: to find the share of each type of events for different triggers

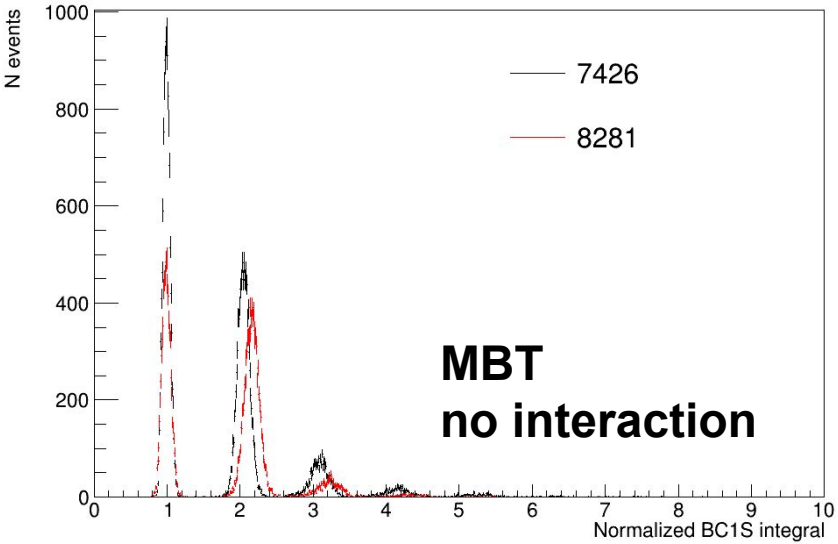
Choosing the width of time window around trigger

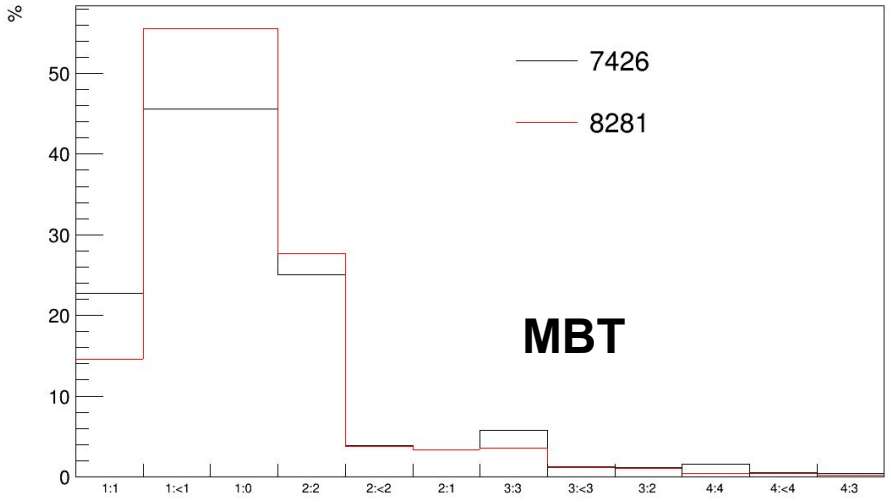




Curves converge after 240 ns. Choosing 360 ns window for now.

360 ns time window, runs 7426 and 8281





More close pileup for the later run.

Results for 360 ns time window, %

Run 7426

	close_pileup	no_interaction	one_interaction
MBT	37.8306	32.3103	4.95517
CCT2	24.4608	16.383	7.09652
CCT1	22.0325	18.9096	2.99391
BT	14.9322	13.3102	1.57772

Run 8281

	close_pileup	no_interaction	one_interaction
MBT	36.939	31.6038	4.69779
CCT2	18.3705	11.9393	5.63197
CCT1	15.9568	13.5857	2.25856
BT	9.31639	8.13084	1.14172

More or less consistent for earlier and later runs.

Summary

- Rate of close pileup (in 360 ns time window around trigger) is ~37% for MBT and ~21% for CCT2.
- Rate of close pileup with one interaction is ~5% for MBT and ~6% for CCT2.
- Distant pileup will be considered further.