BRIEF UPDATE ON MODULE FLIPPING TEST

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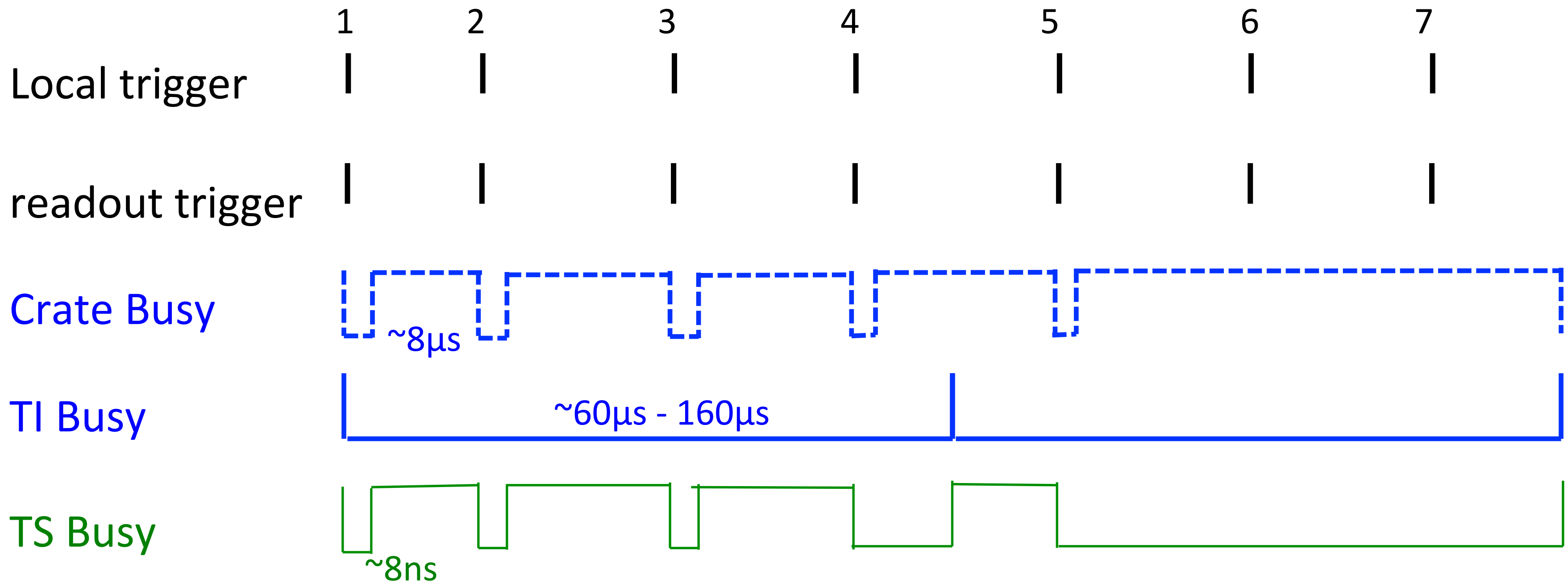
Module flipping test

- Reduce the dead time by switching the trigger between 3 crates.
- Local trigger (level 1) trigger ~ 100 – 200 kHz
- Readout trigger (level 2) trigger ~ 5 kHz
- SBS trigger supervisor (TS)
  - Receive TI busy and frond-end busy from Fastbus crates
  - Send the local trigger to the next non-busy crate
  - Send readout trigger to all crates.
  - Send fast clear signal when there is no readout.
- Current test setup
  - 3 crates (8ADCs on each)
  - Distribute triggers via TD and SD modules

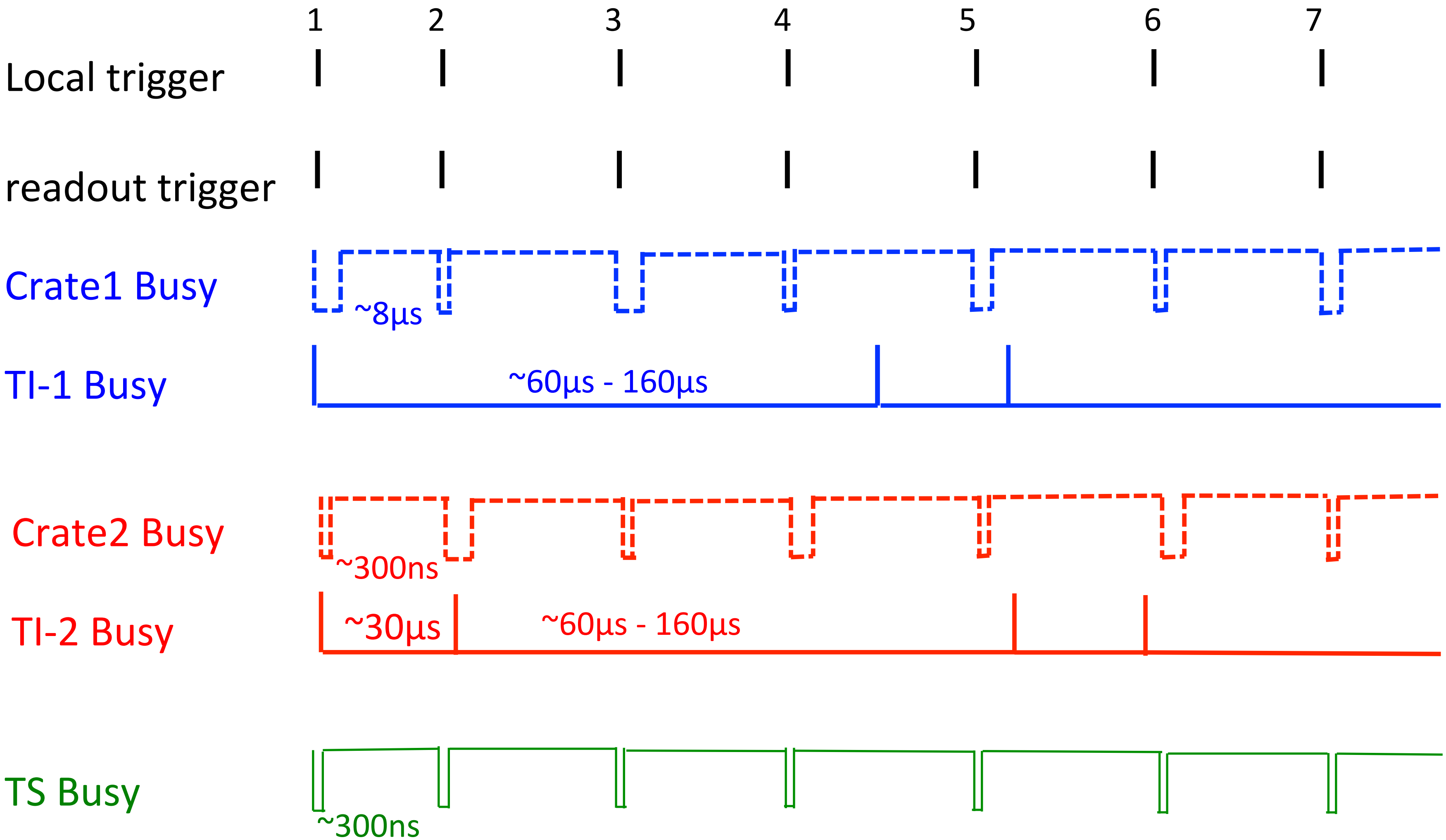
Single Crate, Buffer Level = 4



TI busy (readout) ~ 60µs when we read no data from ADC (pedestal suppressed)

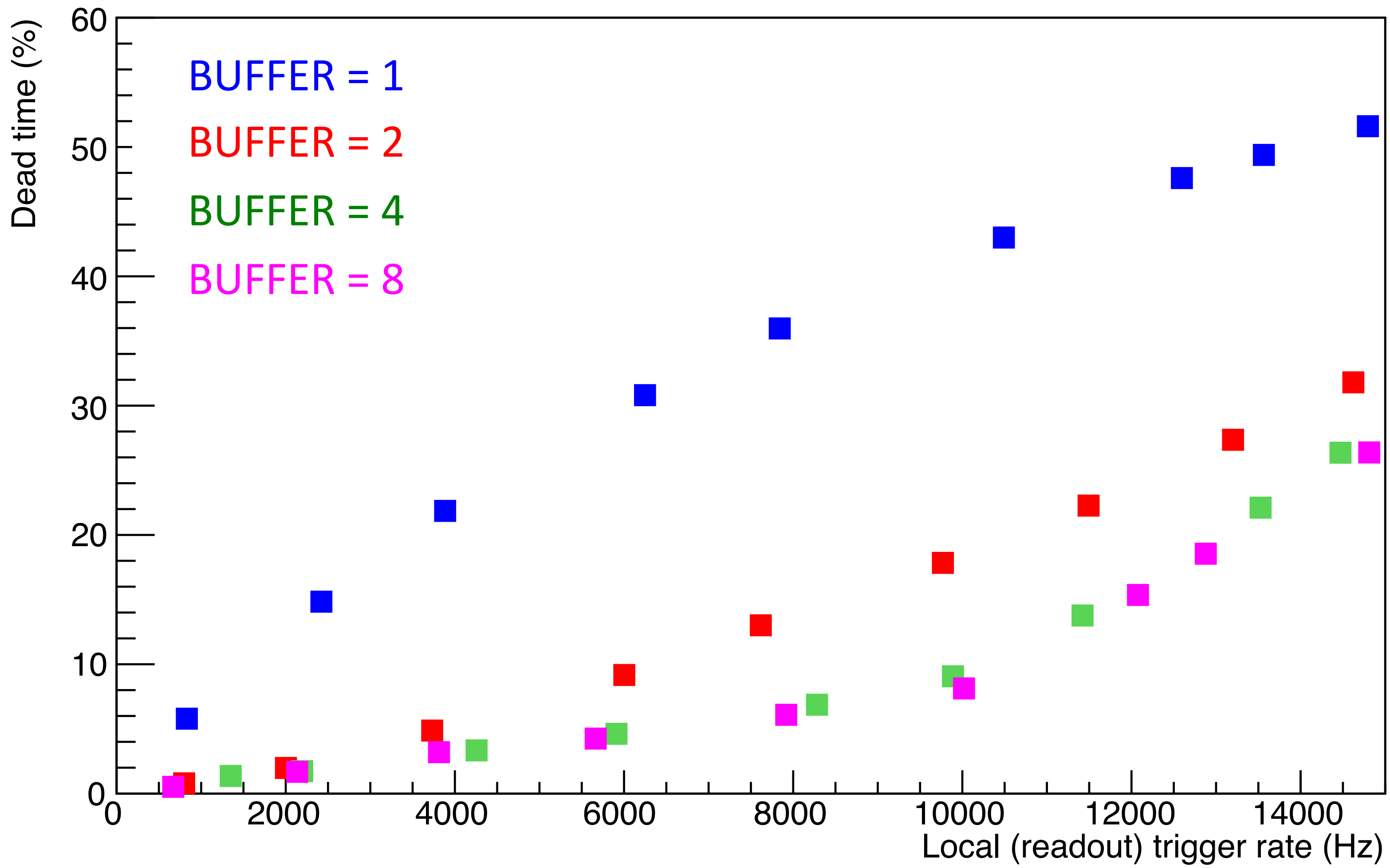
TI busy (readout) ~ 160µs when we read 8ADC (No pedestal suppression)

Module Flipping (2 crates), Buffer Level = 4



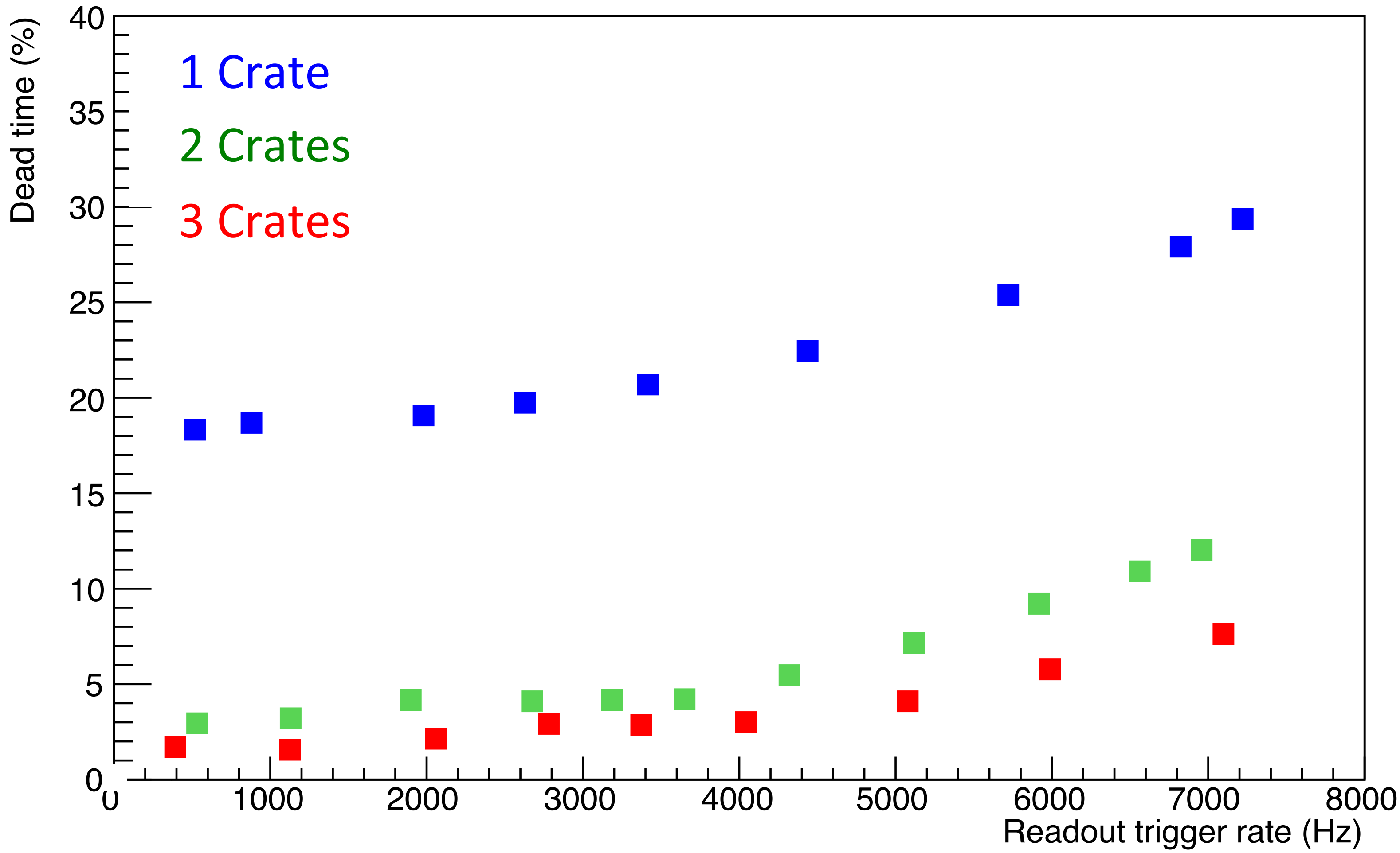
Buffering

Single Crate, 8ADCs (reading pedestals on 6 channels on each ADC)
Local trigger rate = Readout trigger rate



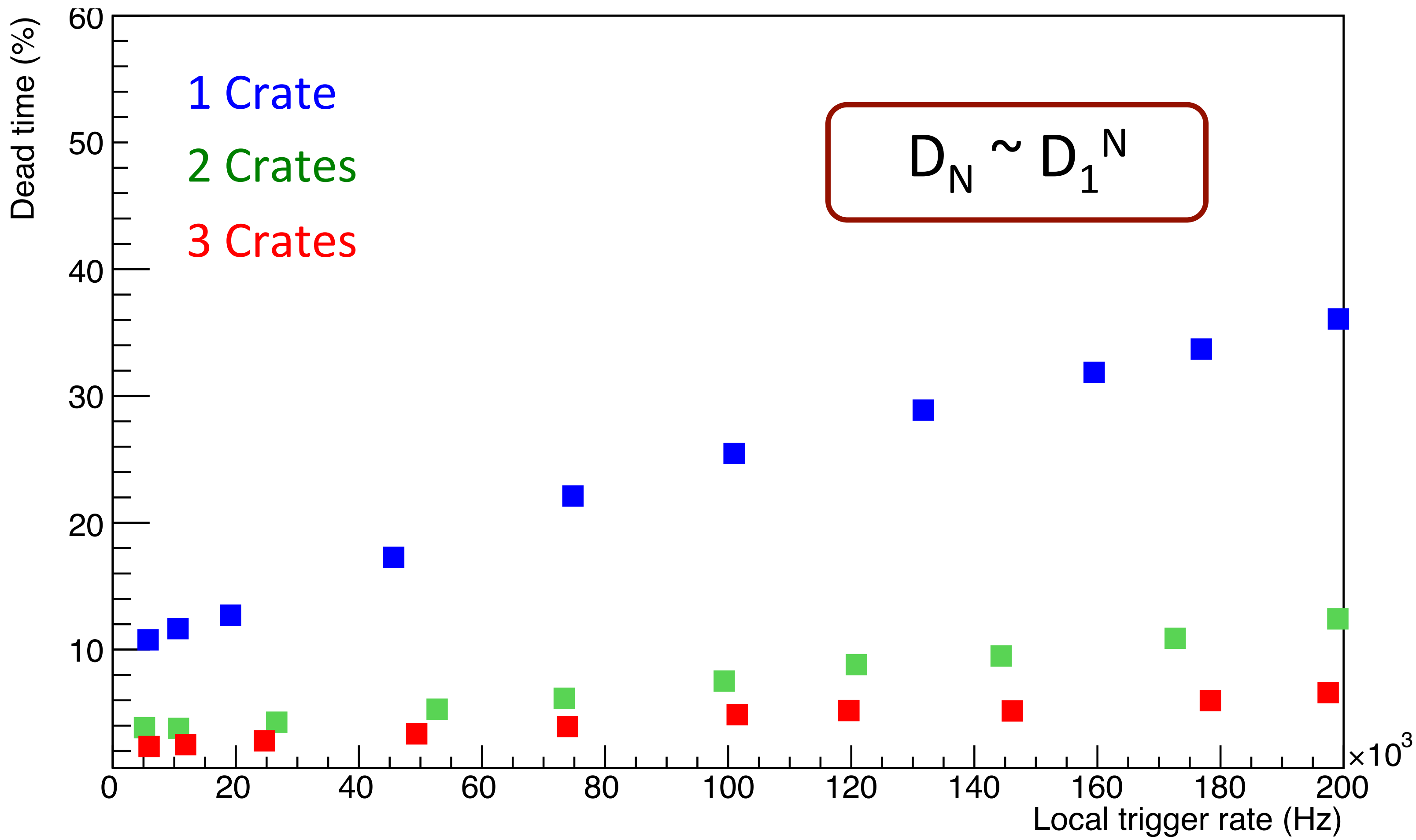
Single Crate vs. Module Flipping

8ADCs (reading pedestals on 6 channels on each ADC)
At fixed Local trigger ~100kHz



Single Crate vs. Module Flipping

8ADCs (reading pedestals on 6 channels on each ADC)
At fixed Readout trigger ~5kHz



FASTBUS Dead time Model

Poisson probability

If the expected number of occurrences in a given interval is λ, then the probability that there are exactly k occurrences (k = 0, 1, 2…) is

$$f(k;\lambda) = \frac{\lambda^k e^{-k}}{k!}$$

Assume that

- a trigger has been accepted and an event is being processed.
- time to process one event is τ
- triggers are being generated at the average random rate *f*

The total probability of *n* triggers occurring at time τ is, $$P_n = \frac{(f\tau)^n e^{-f\tau}}{n!}$$

And the dead time, $$DT = \sum_{n=1}^{\infty} \frac{(f\tau)^n e^{-f\tau}}{n!}$$

FASTBUS Dead time Model

- Dead time can be break down in to 3 infinite sums.

Due to frond-end conversion

$$D_{FE} = \sum_{n=1}^{\infty} \frac{\mu_{FE}^n e^{-\mu_{FE}}}{n!}$$

$\mu_{FE} = f_{L2} \times T_{FE}$, T_{FE} ~ 8µs

Due to readout

$$D_R = \sum_{n=1}^{\infty} \frac{\mu_R^{n+b} e^{-\mu_R}}{(n+b)!}$$

$\mu_R = f_{L2} \times (T_c - T_{FE})$, T_c ~ (60 – 160)µs

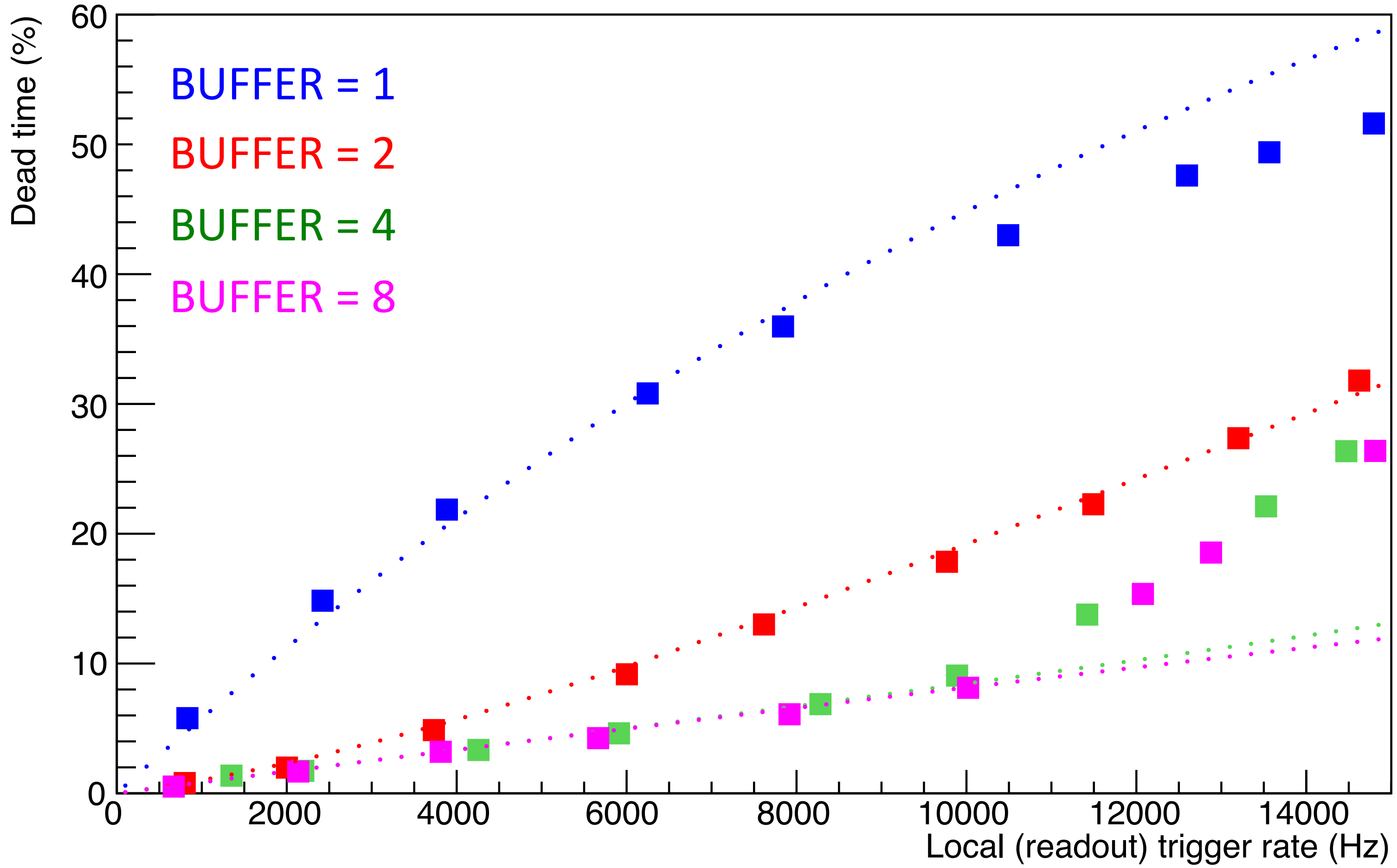
Due to Fast Clear

$$D_{FC} = \sum_{n=1}^{\infty} \frac{\mu_{FC}^n e^{-\mu_{FC}}}{n!}$$

$\mu_{FC} = (f_{L1} - f_{L2}) \times T_{FC}$, T_{FC} ~ 2µs

Data vs. Dead time model

Single Crate, 8ADCs (reading pedestals on 6 channels on each ADC)
Local trigger rate = Readout trigger rate



Future Work

- Improve the Dead time model to better understand the measurements.
- We still experience about ~3% Branch 0 events which needed to be studied and fixed.

Thanks Alexander Camsonne, Robert Michaels, William Gu, Bryan Moffit and Dave Abbott for support and guidance.