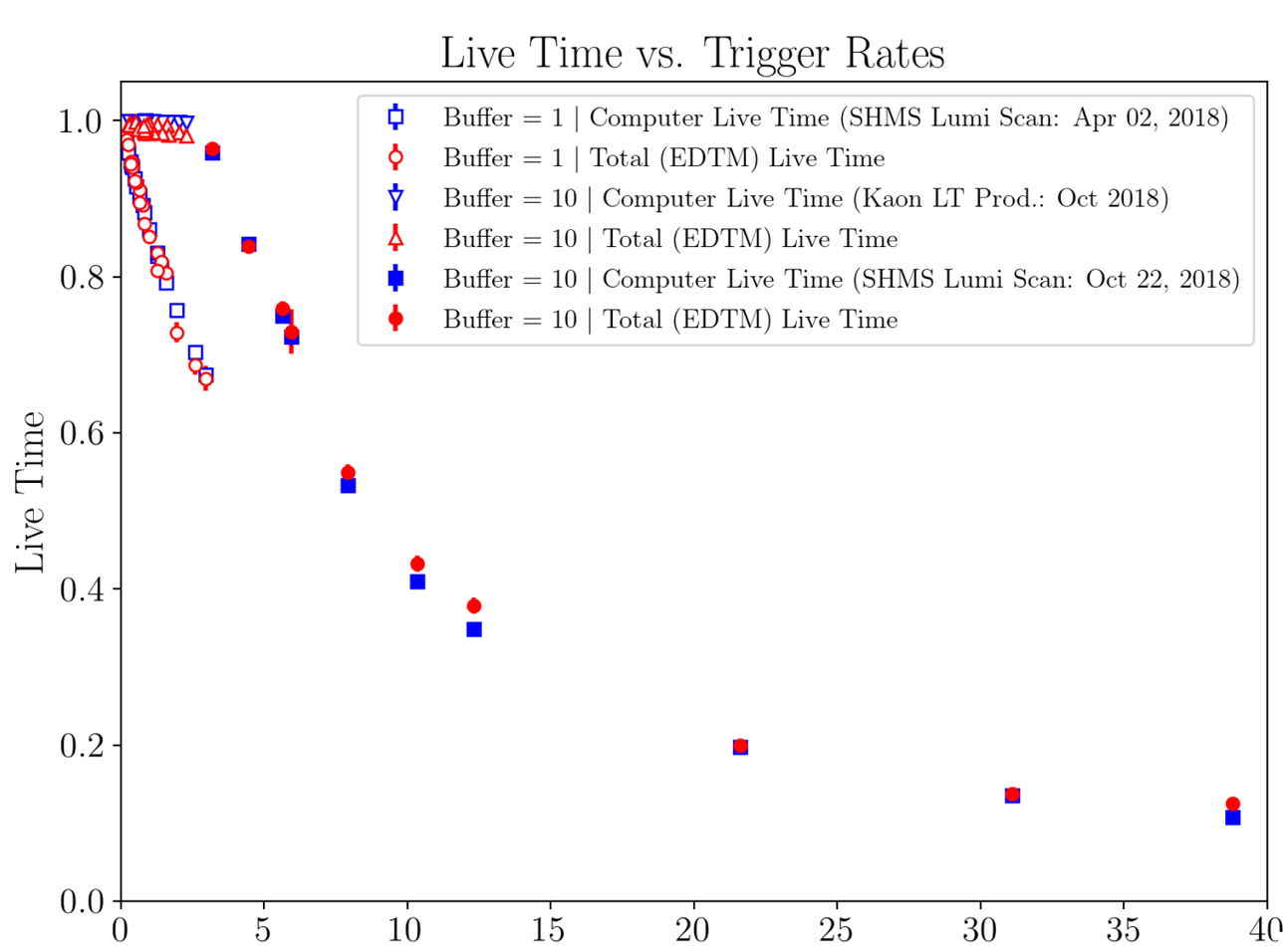


Live Time Study

- Errors calculated using Binomial Statistics
- Triggers were NOT pre-scaled
- Buffer 1 was taken with DAQ in single-arm mode
  Buffer 10 was taken with DAQ in coin. mode
- Electronic Live Time > 1 : indicates total live time is greater than computer live time. A correction to the TOTAL (EDTM) live time for buffer level 10 may be needed, similar to what D. Mack did for buffer 1.

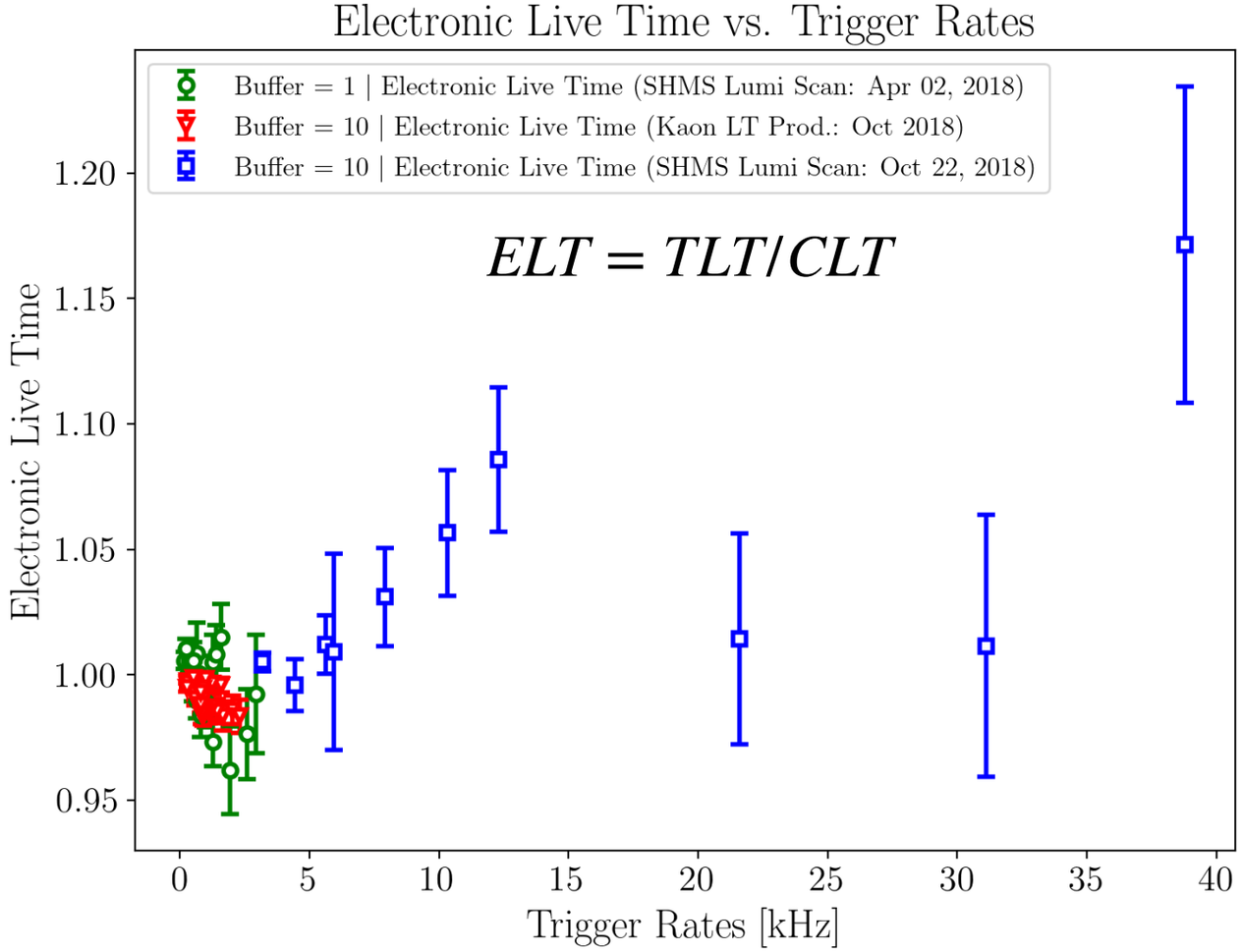
ELT : **electronic live time**

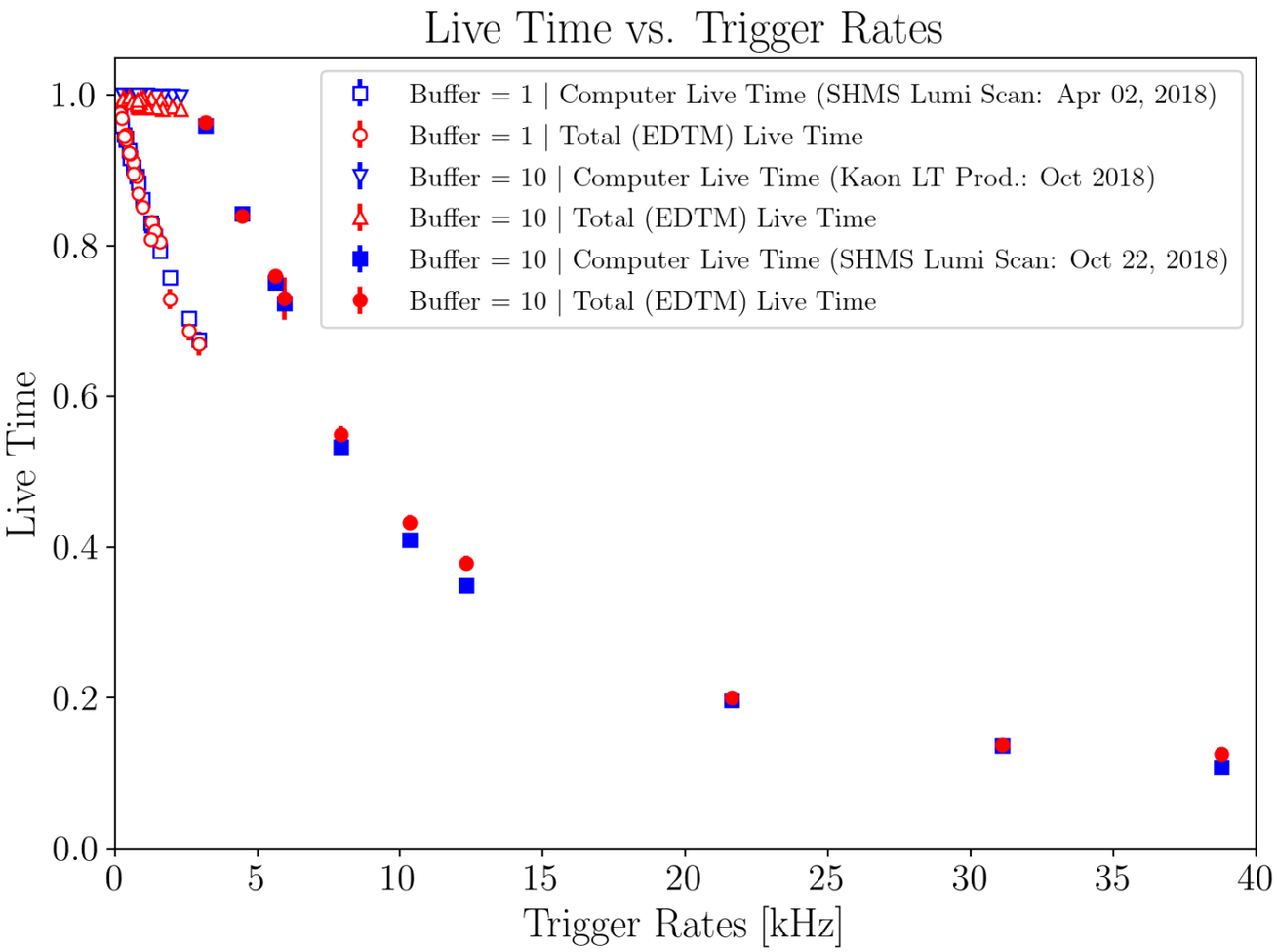
TLT : **total live time**

CLT : **computer live time**

Binomial Statistics Error Formula:

https://arxiv.org/pdf/physics/0701199v1.pdf



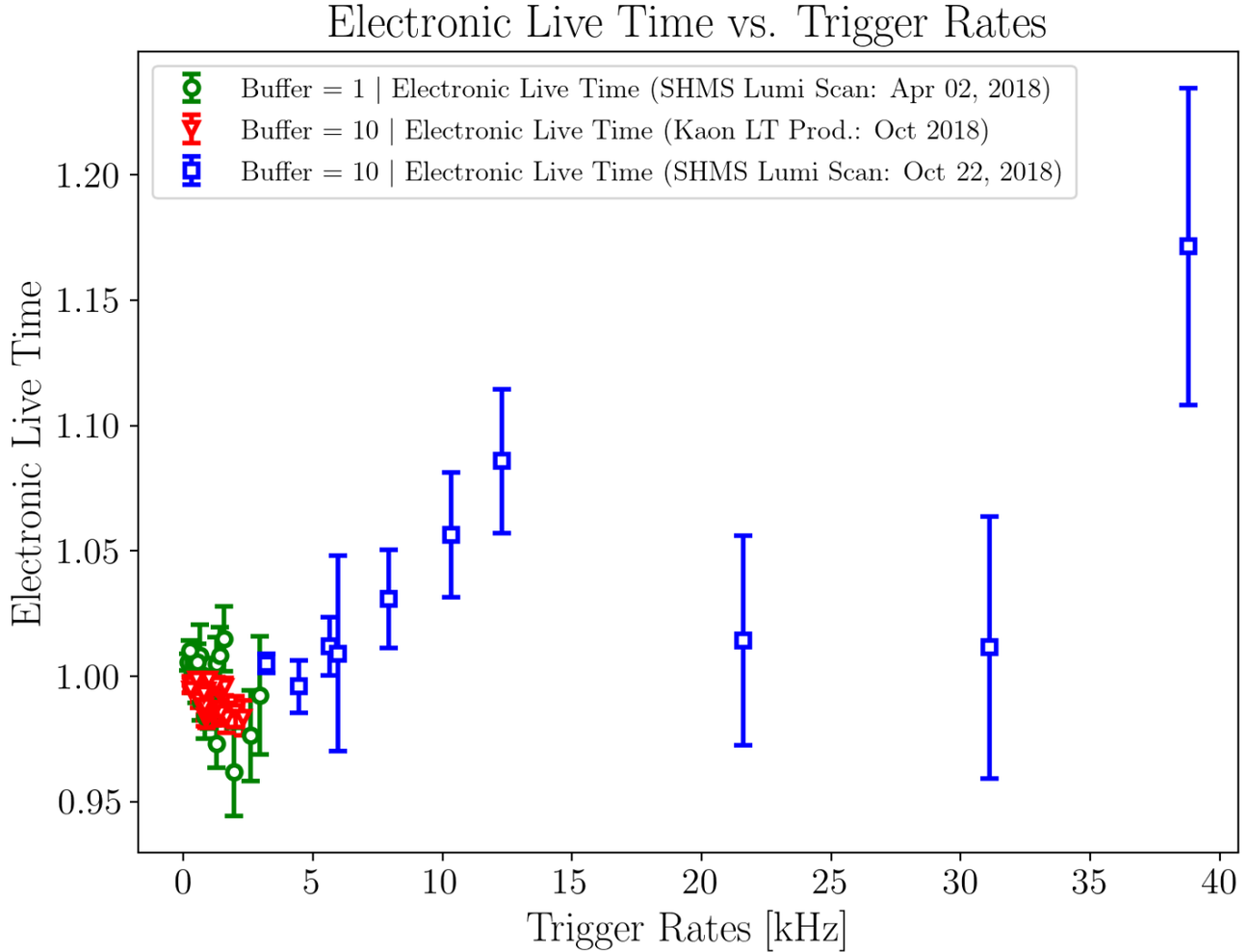


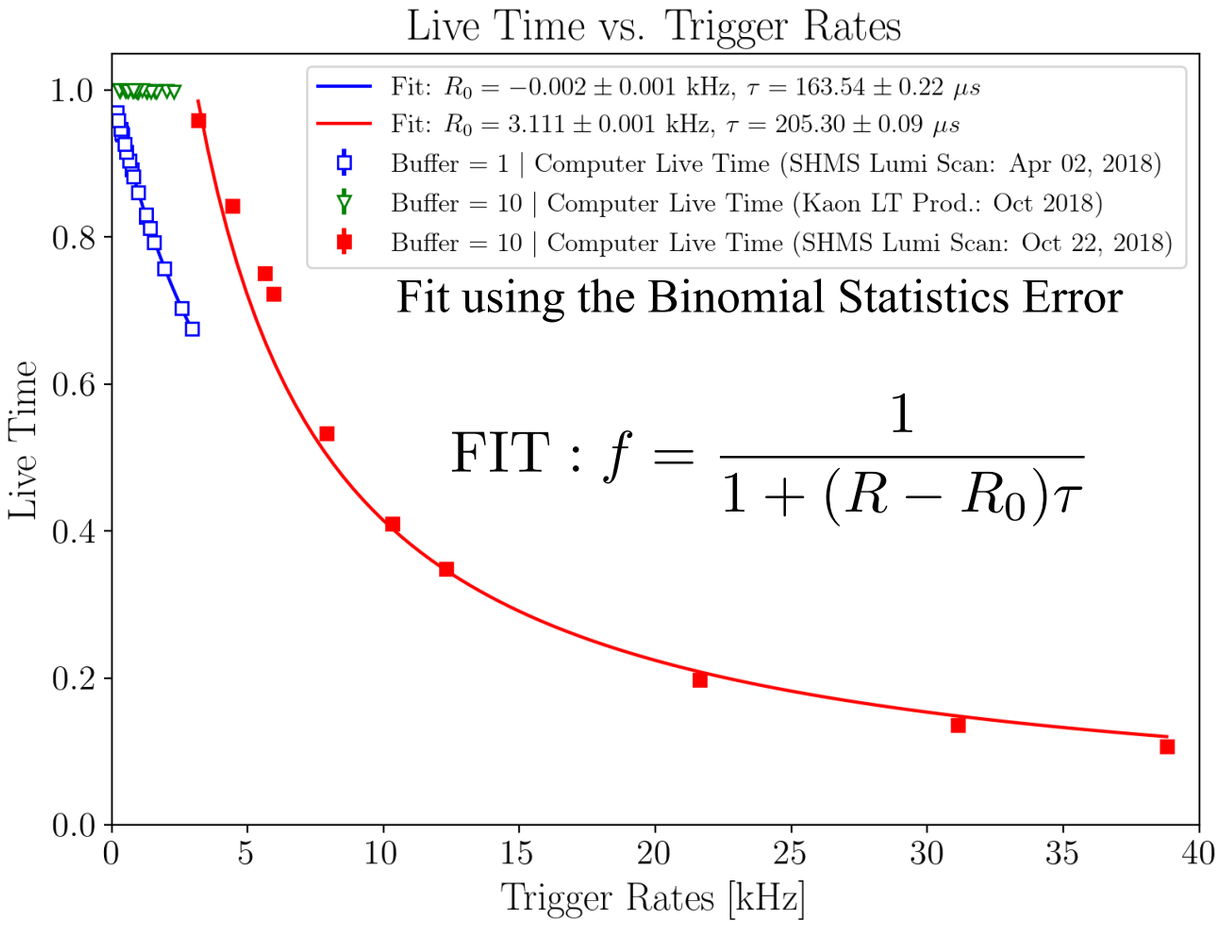
Live Time Study

- Same as previous slide, but using Bayesian statistical errors, which did NOT make much difference

Bayesian Statistics Error Formula:

https://arxiv.org/pdf/physics/0701199v1.pdf





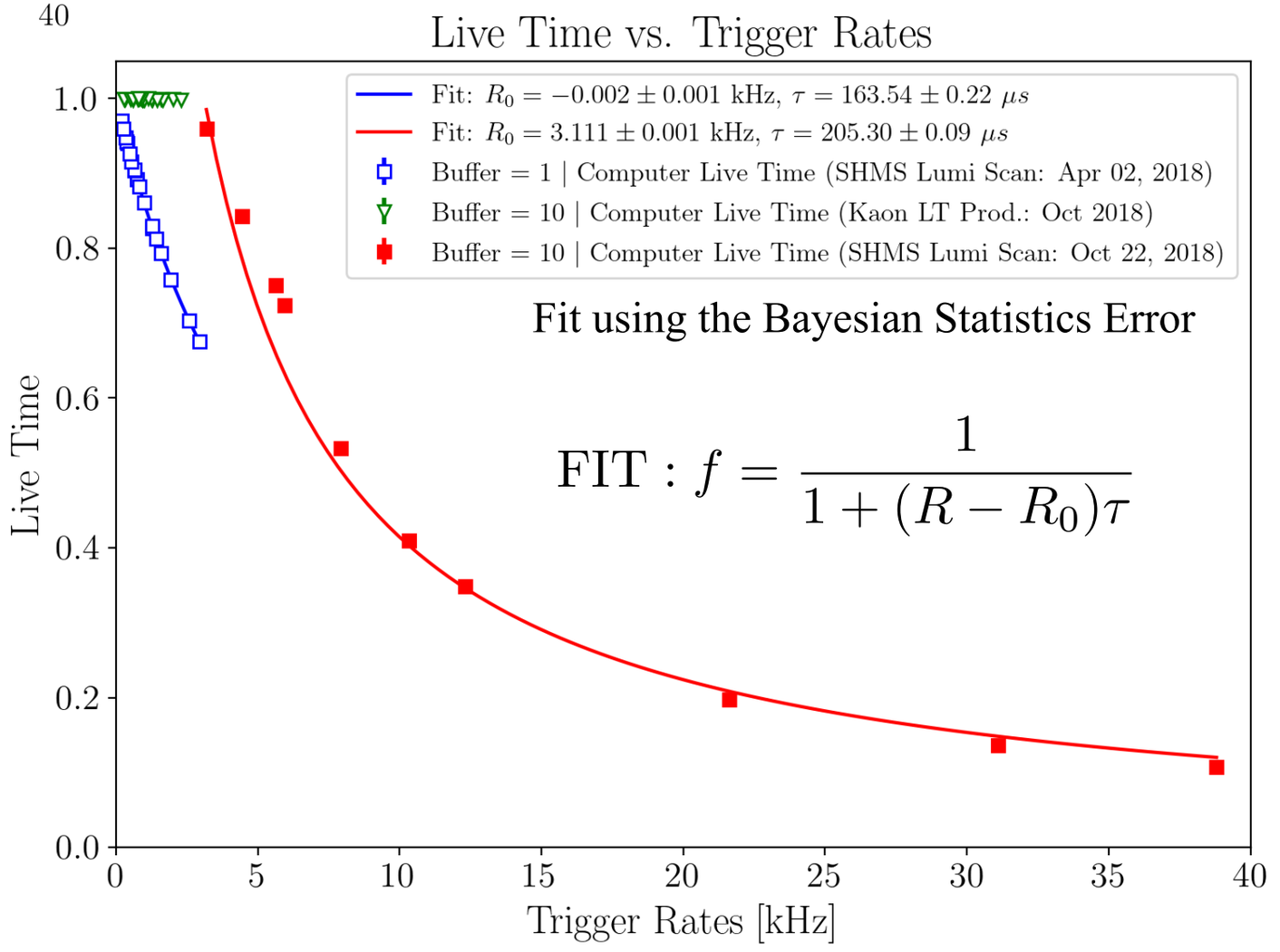
Live Time Study

- For now, since EDTM is NOT well understood, we assume that for these trigger rates (<40 kHz) There is virtually NO electronic dead-time, and the computer and total (EDTM) live time are assumed to be the same. A fit to the fall-off part of the computer live time was done.

- No difference between the fit results using the Binomial or Bayesian statistics error was found

- The fit function models the fall-off observed in both buffer levels 1 and 10. The "flat" region at buffer level 10 has not been modeled yet.
- The two buffer level curves are offset by the fit parameter, R0. The parameter tau is representative of the DAQ dead-time BUSY logic signal width generated by the Trigger Interface (TI) module

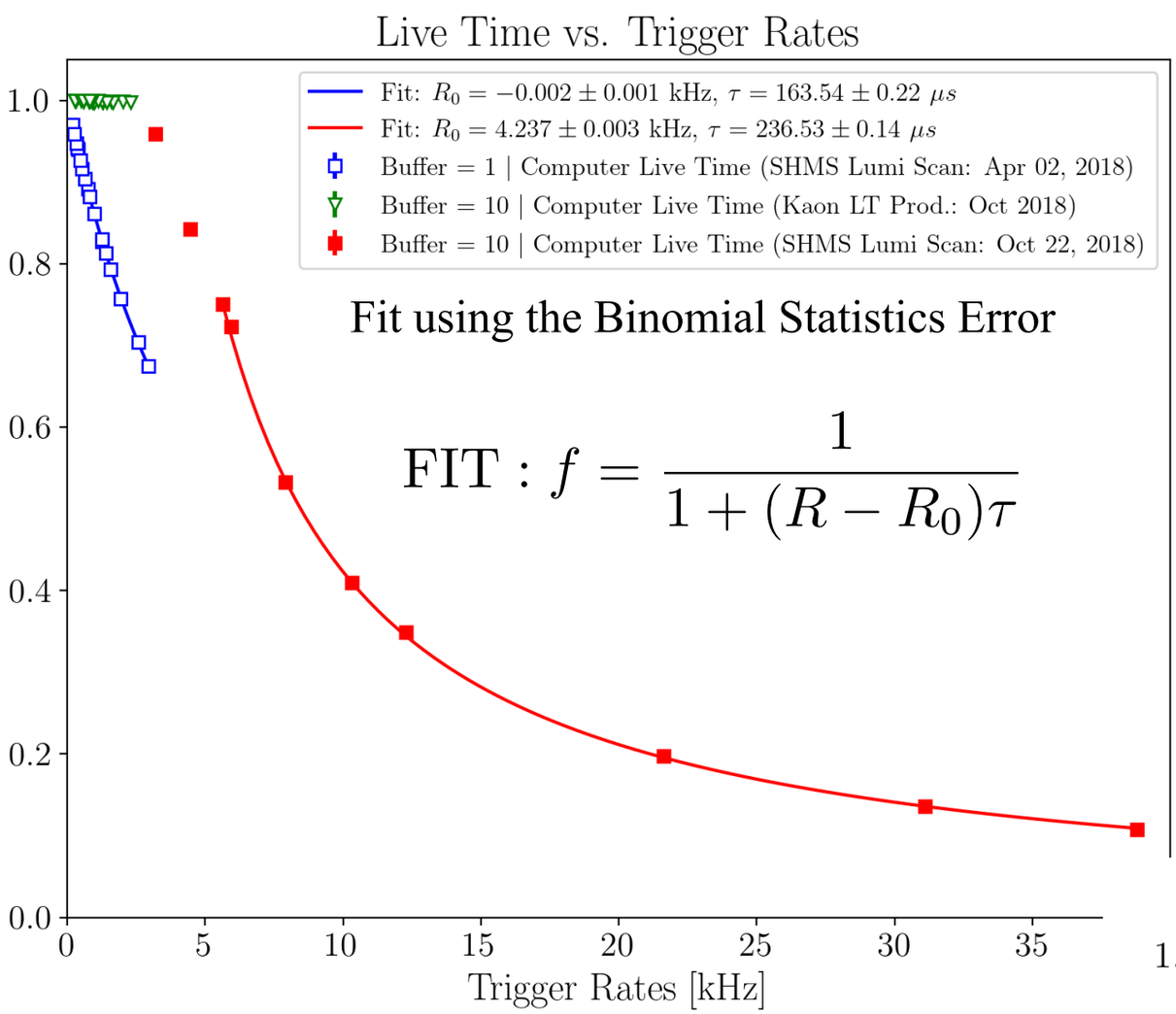
- The fit function was determined by Mark K. Jones, and it models the fall-off behavior observed.



Live Time Study

- Same as previous slide, but for buffer level 10 fit range starting at ~5 kHz

- A better fit is done in this range, for buffer 10.
  The "flat" region of buffer 10 reflects the fact that that the DAQ is capable of accepting higher trigger rates without compromising the computer live time. At $\sim 1/\tau$, a fall-off is observed at buffer 10,
  Which is similar to the fall-off of buffer 1. The fit function therefore is only capable of describing the buffer 1 fall-off behavior
  But modeling the "flat" part still needs some work.



The buffer level 10, on average, has a DAQ BUSY dead-time of 236 micro-seconds

The buffer level 1, on average, has a DAQ BUSY dead-time of 163 micro-seconds

NOTE: Buffer 10 was taken with DAQ on Coin Mode, whereas Buffer 1 was taken on Single Arm Mode, which may explain the BUSY widths being larger in Coin Mode, as all crates are readout, whereas in Single-Arm mode, ONLY the crates of the corresponding Spectrometer are readout.