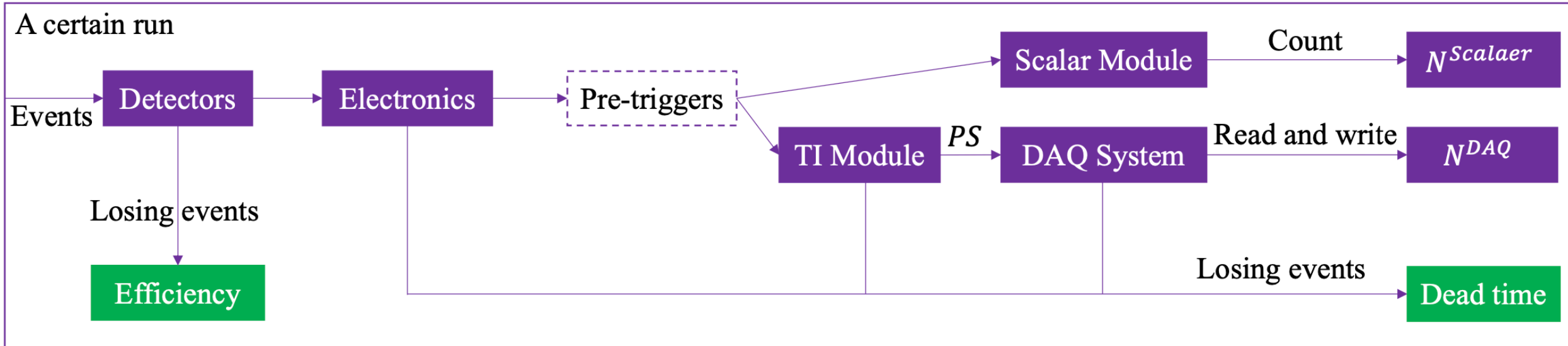


Deadtime Analysis

Yaopeng Zhang and Po-Ju Lin

NPS Collaboration Meeting
2025.05.06

Efficiency and Deadtime

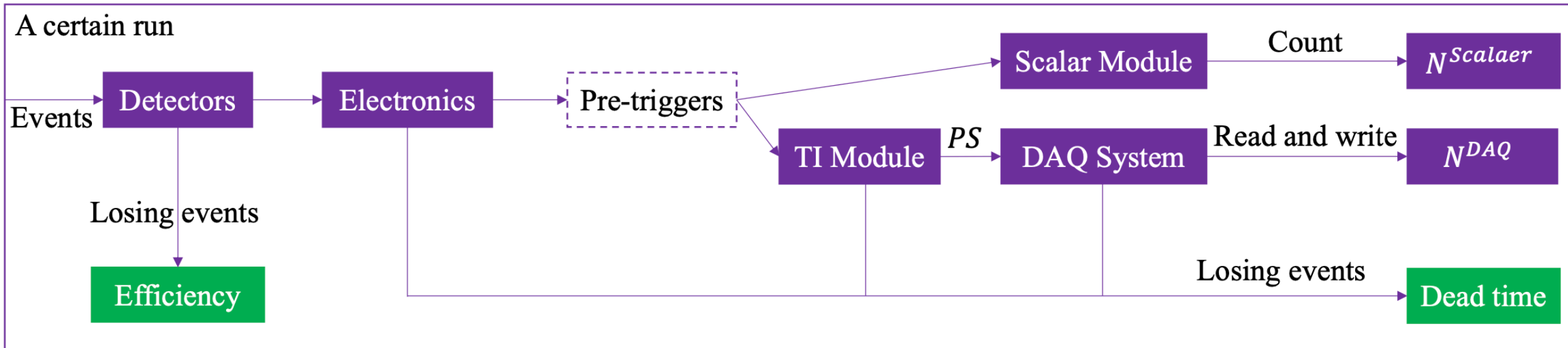


➔ For a certain run, the average dead time DT_i for the i_{th} trigger can be evaluated as:

$$DT_i = 1 - \frac{PS_i \cdot N_i^{DAQ}}{N_i^{Scaler}}$$

- PS_i - Pre-scale factors
- N_i^{DAQ} & N_i^{Scaler} - DAQ & Scaler Counts

Efficiency and Deadtime



➔ For a certain run, the average dead time DT_i for the i_{th} trigger can be evaluated as:

$$DT_i = 1 - \frac{PS_i \cdot N_i^{DAQ}}{N_i^{Scaler}}$$

Live time

- PS_i - Pre-scale factors
- N_i^{DAQ} & N_i^{Scaler} - DAQ & Scaler Counts

Deadtime Evaluations

1. EDTM deadtime

- TI / Computer deadtime
- Electronics (discriminator) deadtime



Calculated by:

N^{DAQ} with EDTM flag and N^{Scaler} of EDTM

2. TI live time

- TI / Computer deadtime
- Exists in the report files

3. NPS deadtime

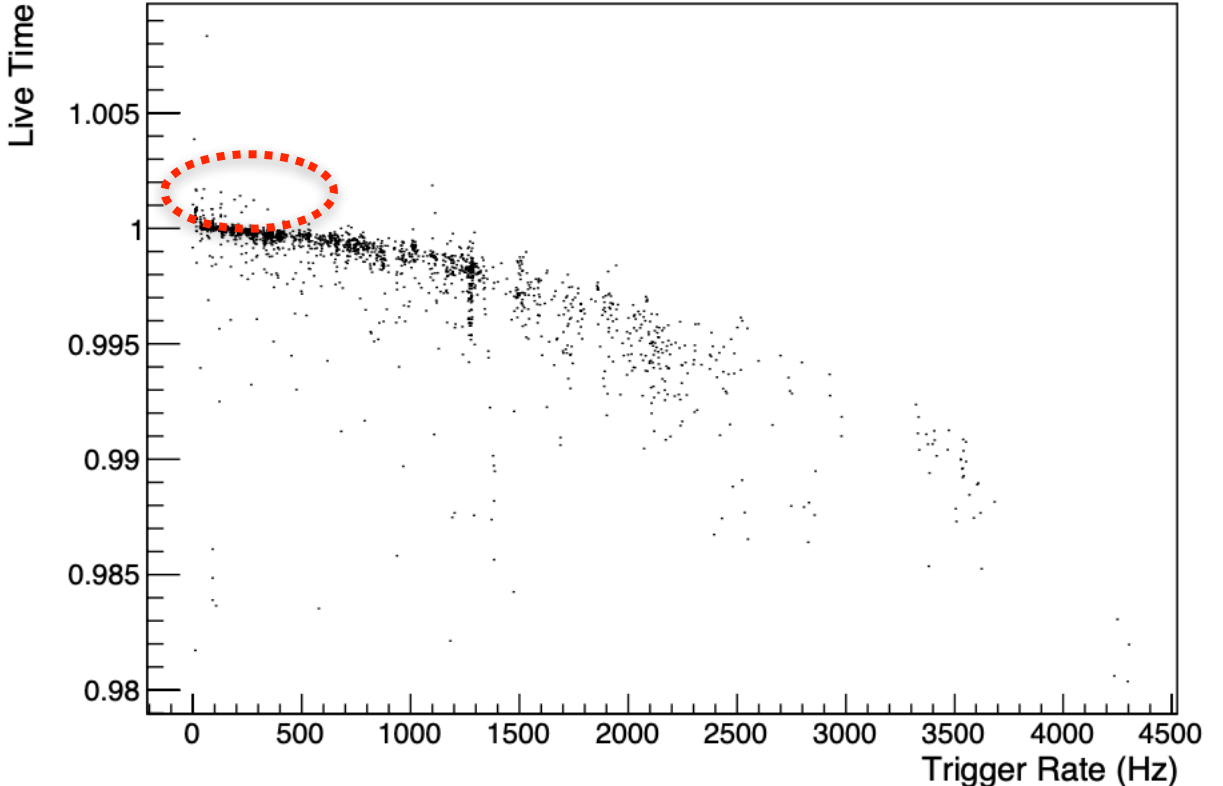
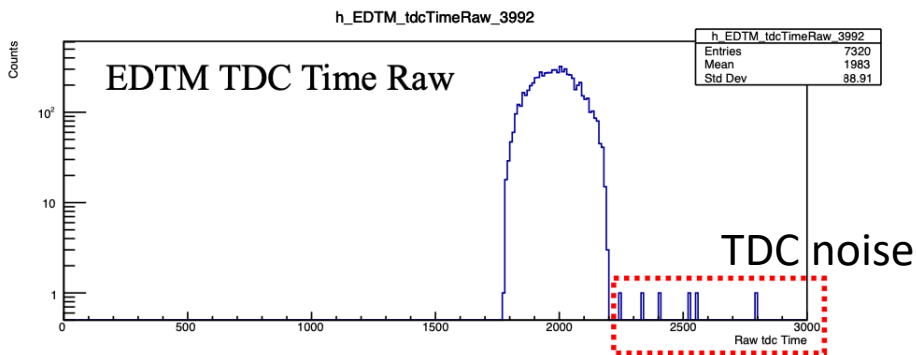
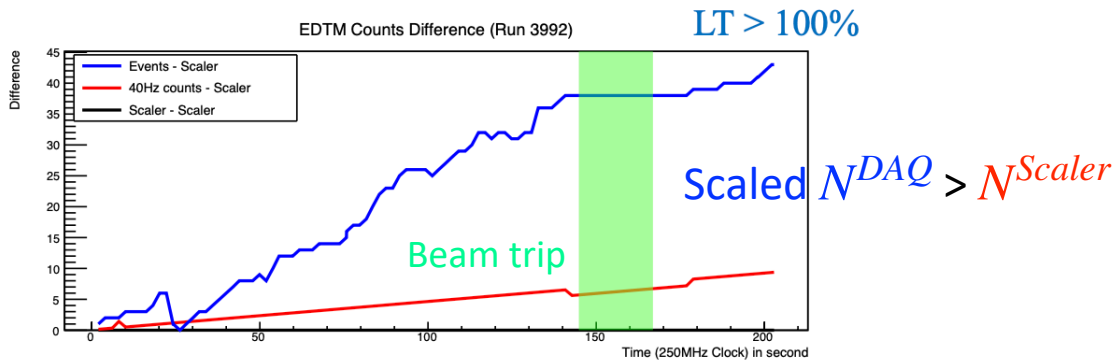
- Deadtime of the NPS part has no estimations yet

EDTM Deadtime

- Issues found:

1. Sudden EDTM scaler rate drop -> scaling correction applied, investigation may be needed
2. Beam trips —> should be removed in EDTM deadtime calculation, correction applied
3. In the first study by Yaopeng, livetime > 1 (deadtime < 0) observed, persists after TDC noise removal.
 - Possible correlation with problematic jobs submitted on ifarm

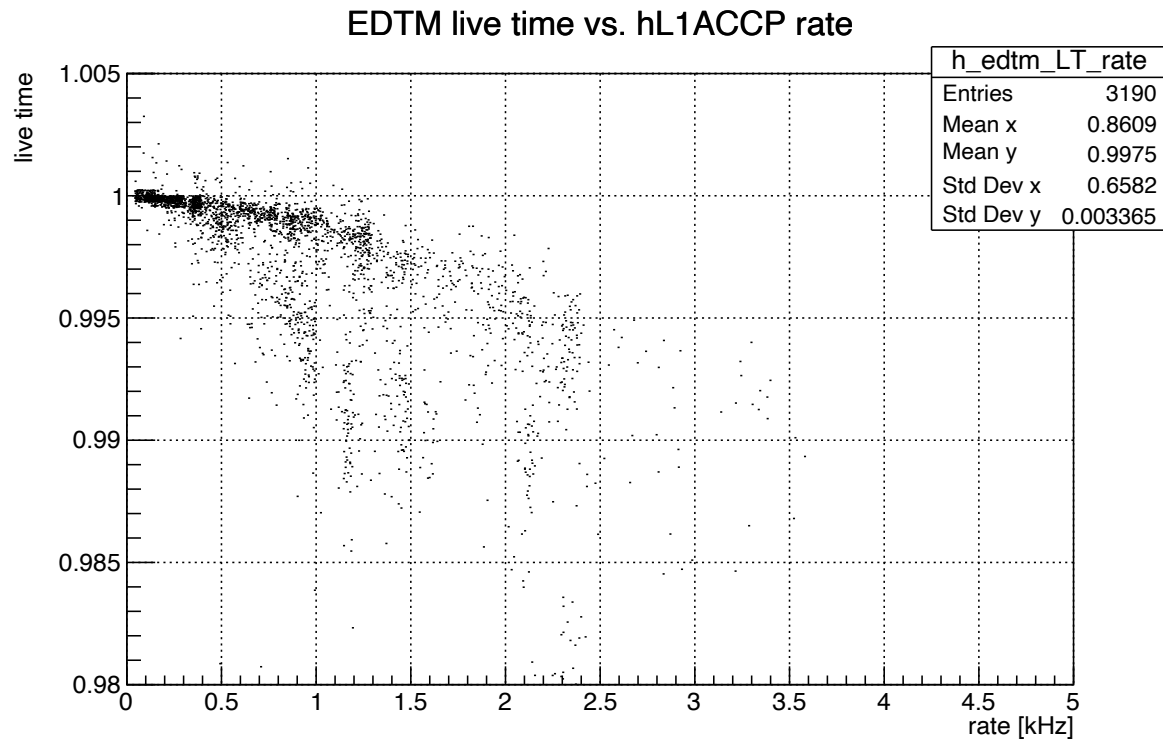
EDTM Live Time vs. Trigger Rate



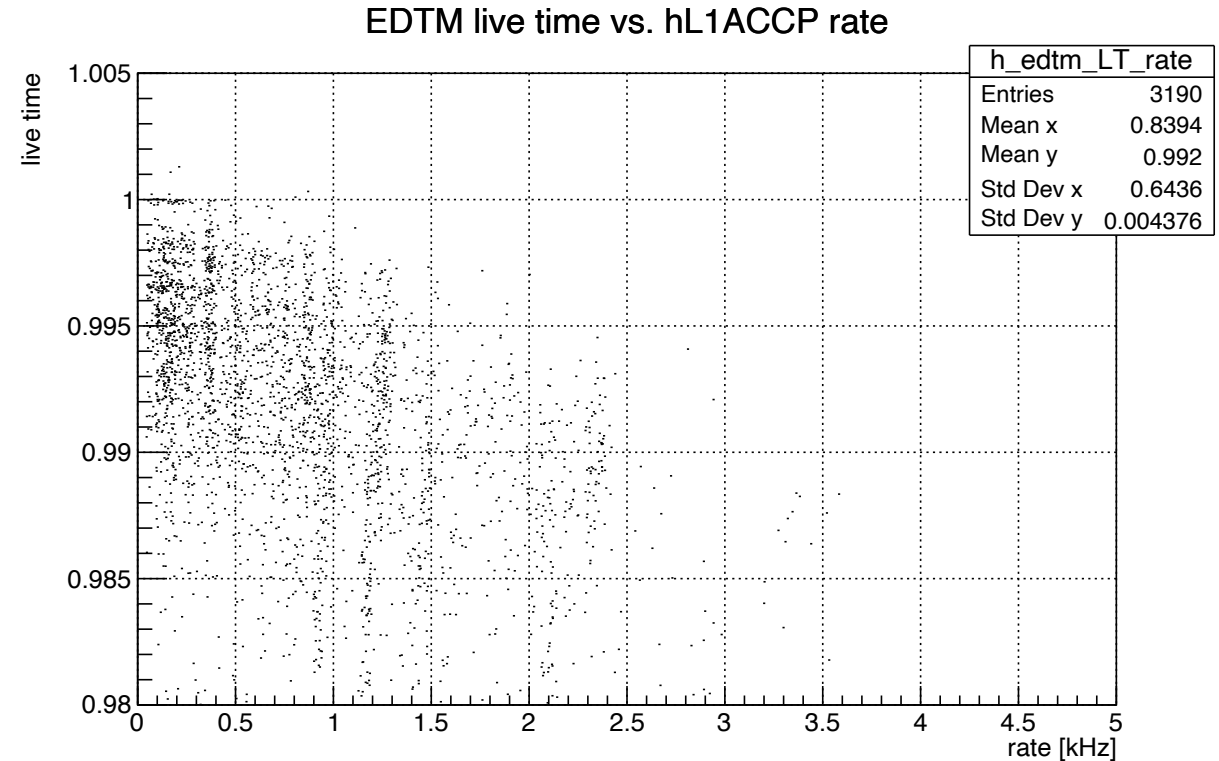
EDTM Deadtime

- EDTM livetime > 1 issue
 - ➔ Suppressed with the application of $2 \mu A$ cut on beam current?

Without $2 \mu A$ cut



With $2 \mu A$ cut



EDTM Deadtime

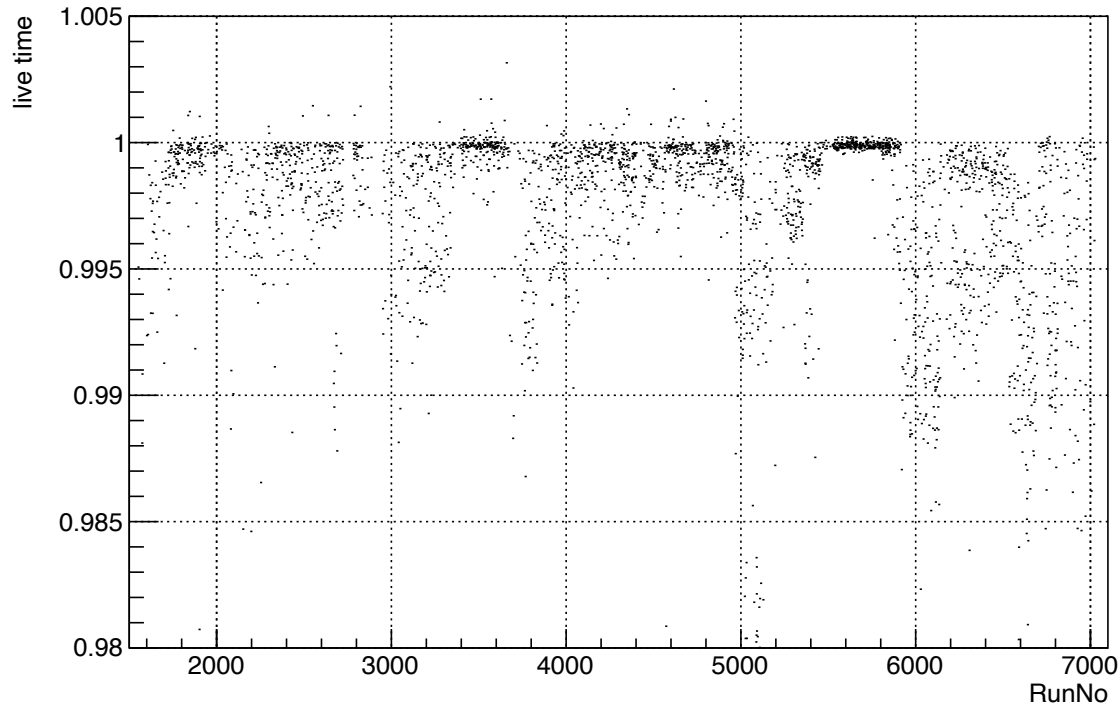
- EDTM livetime > 1 issue

- ➔ Suppressed with the application of $2 \mu A$ cut on beam current?
- ➔ Run-dependence observed

Further investigations required

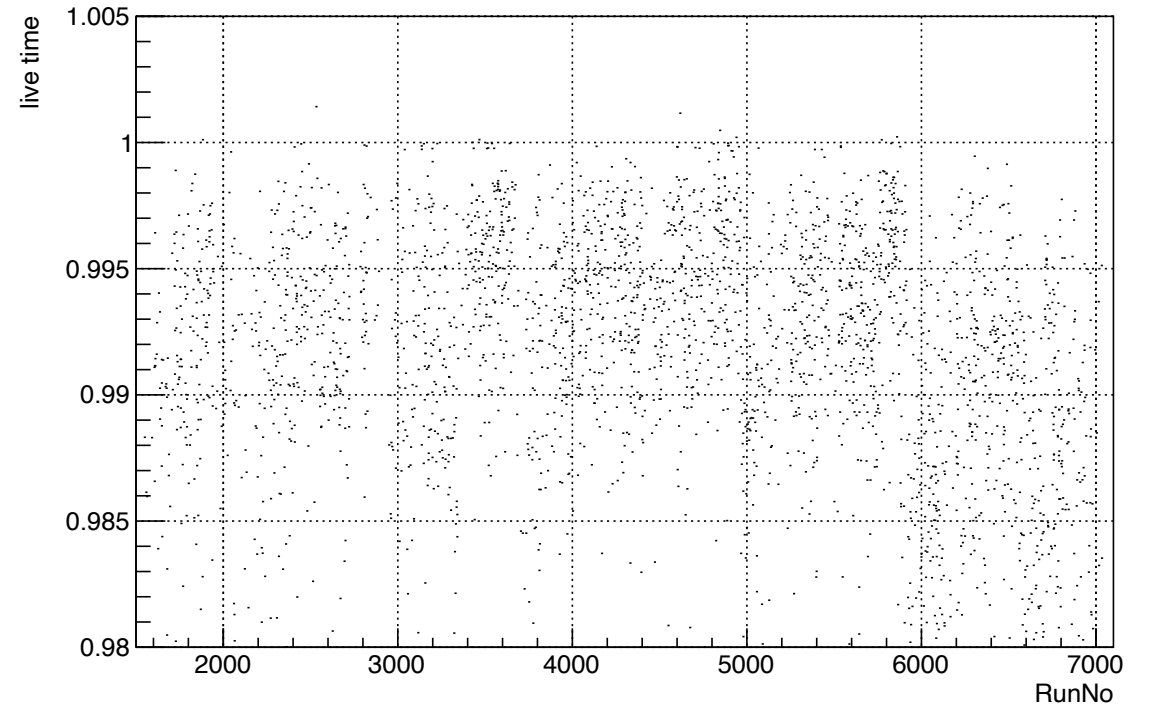
Without $2 \mu A$ cut

EDTM live time vs. RunNo



With $2 \mu A$ cut

EDTM live time vs. RunNo

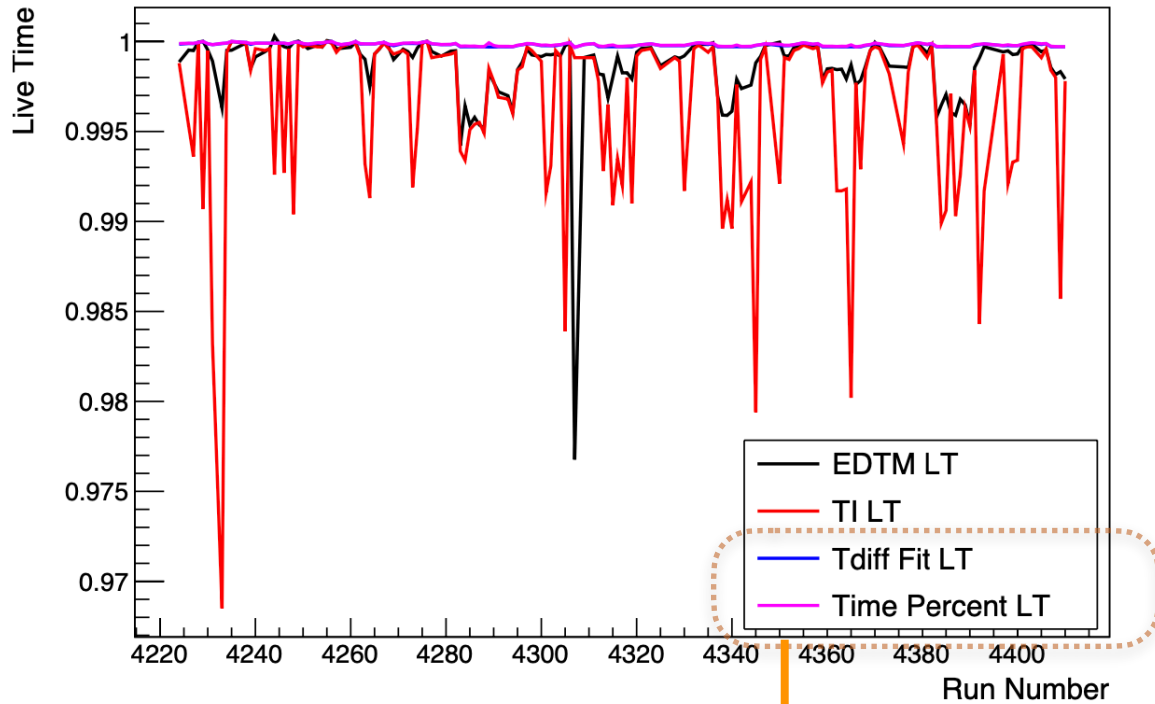


TI Livetime

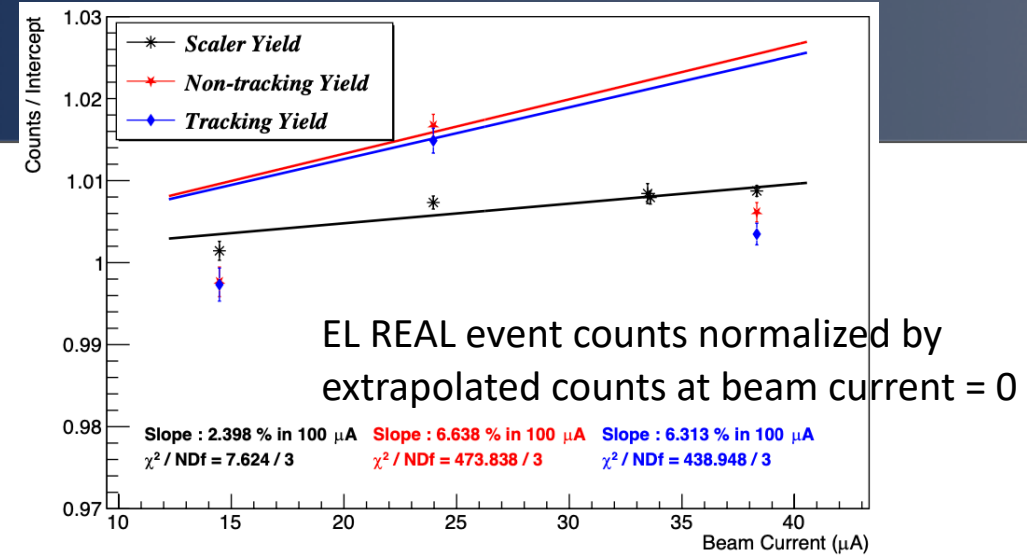
- Observations made by Yaopeng

- ➔ TI LT from report files noticeably smaller than the EDTM LT.

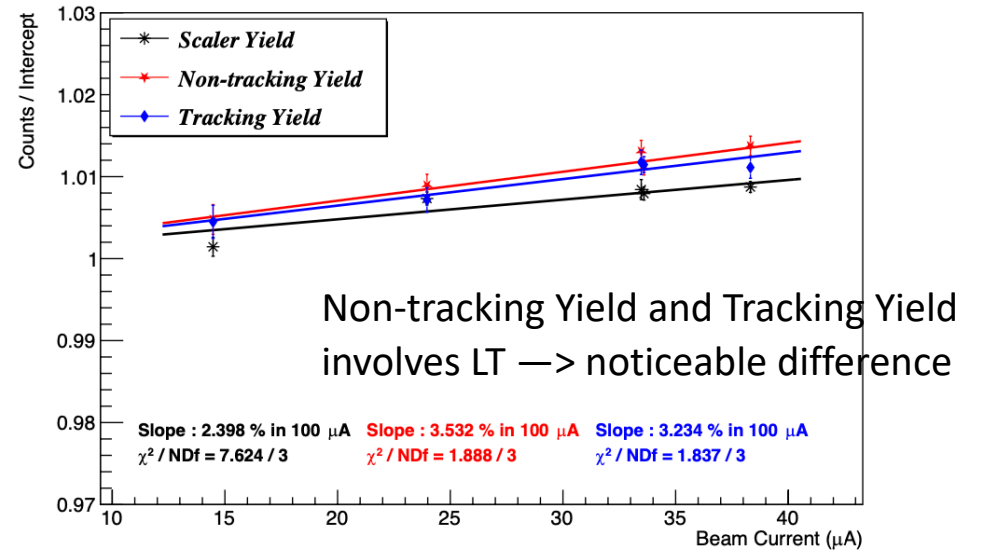
Comparison between different dead time calculation methods



Other methods by Yaopeng



LT from the report file
("HMS TRIG4 Computer Live Time")



$$\text{LT} = \frac{\text{\# of events}}{\text{scaler_htrig4} - \text{scaler_edtm}} \times \text{ps-factor}$$

Next Steps

1. EDTM deadtime

- Redo the evaluation in the pass-two replay
- Po-Ju will double check the result

2. TI live time

- Resolve the difference in LT from the report file

3. NPS deadtime

- Deadtime estimation using wave forms?
- Suggestions needed.

4. Root file

- Basic structure made by Yaopeng —> Will be produced

