

Trieste – Status and plans

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Università di Trieste & INFN Sezione di Trieste

Meeting on *ITS3 ER1 & ER2 Characterisation @INFN*
27 March 2025



ALICE



**UNIVERSITÀ
DEGLI STUDI
DI TRIESTE**



Dipartimento di

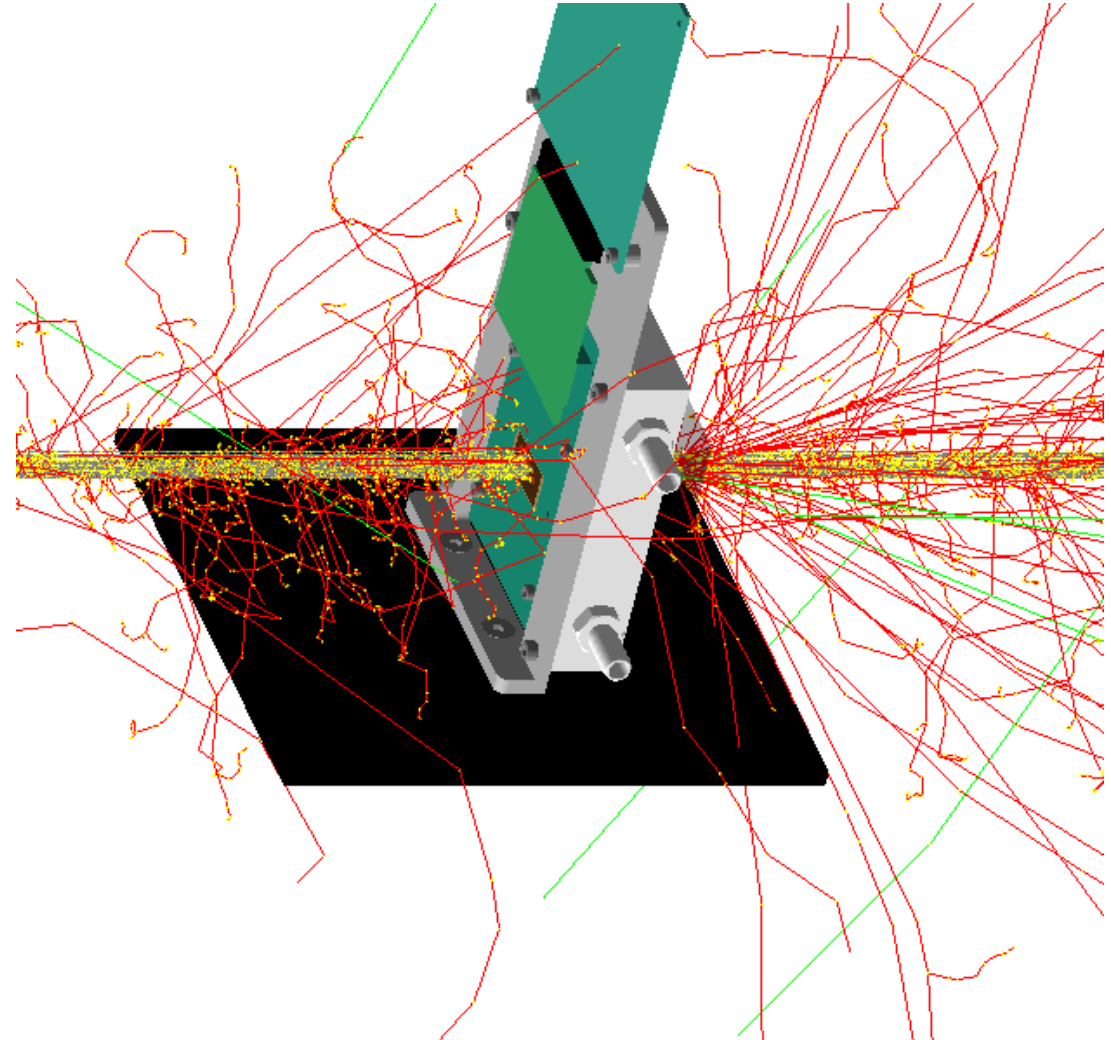
Fisica

Dipartimento d'Eccellenza 2023-2027



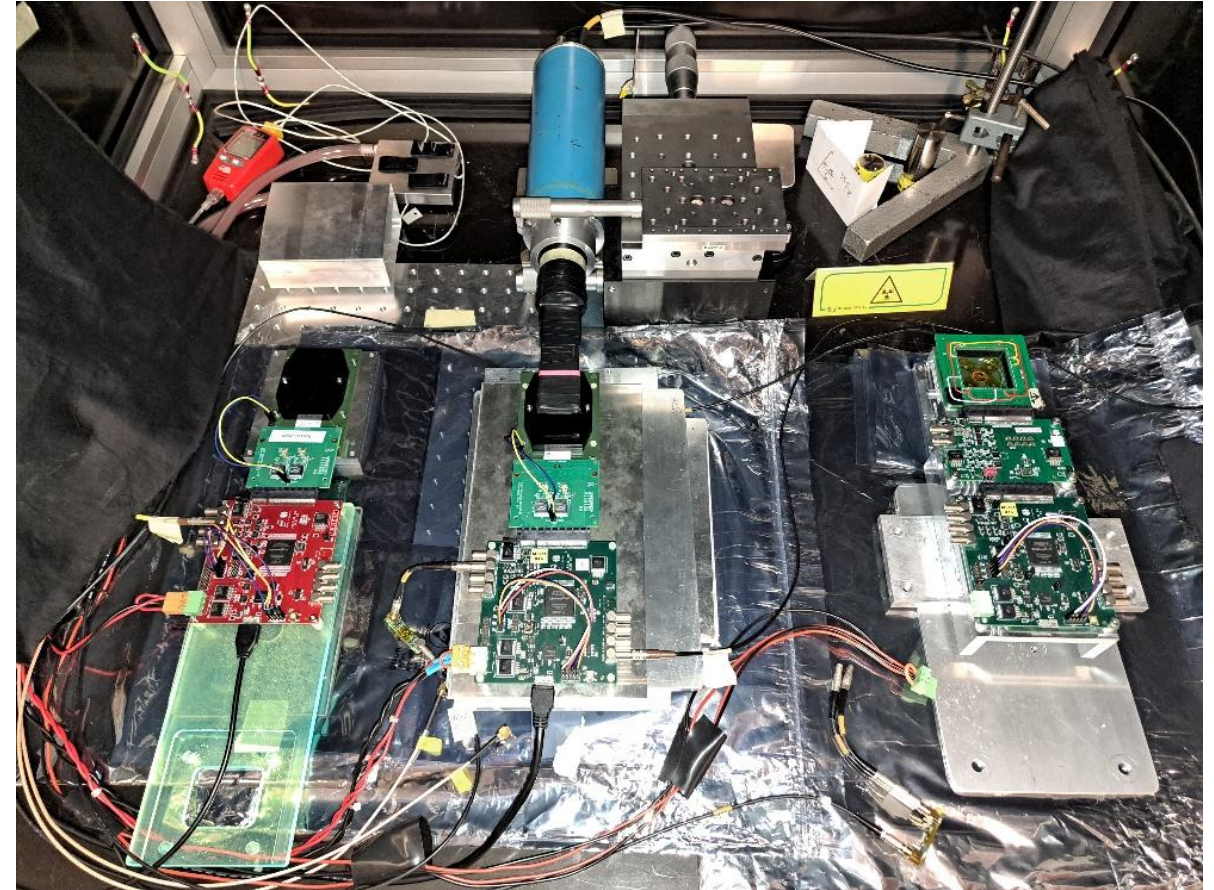
Outline - Status and plans in Trieste

- Available systems and infrastructure
- **MLR1** – completed activities
 - Full characterisation of DPTS
 - Characterisation of bent APTS
- **ER1** – ongoing activities
 - babyMOSS energy response with radioactive sources
 - Testbeam data analysis
- **ER1 & ER2** – planned activities
 - babyMOSS energy response with X-rays and highly-ionizing particles
 - Noise studies
 - Bent babyMOSS characterisation
 - Irradiated chips qualification



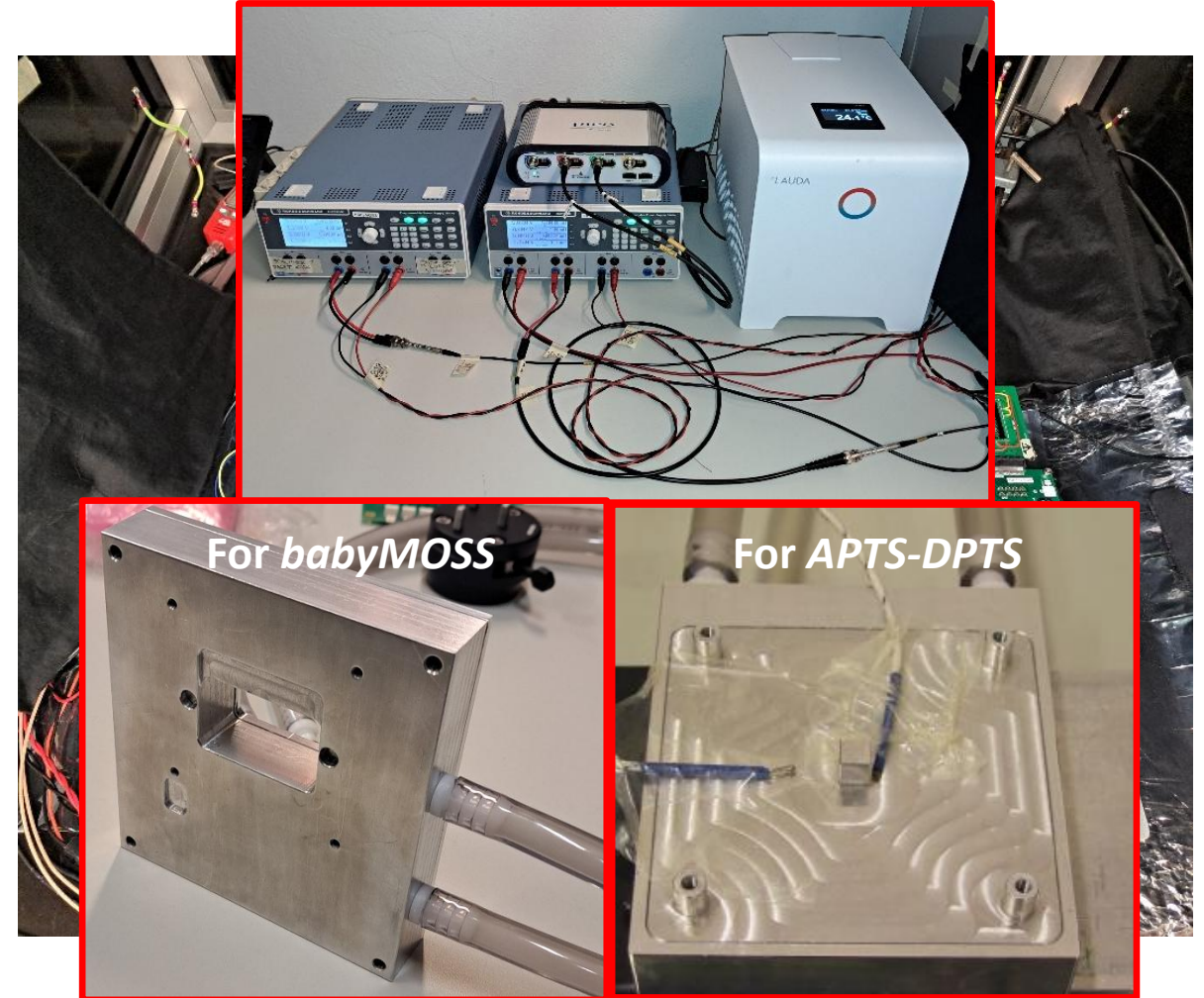
Available systems and infrastructure

- 2 babyMOSS sensors
 - **babyMOSS W20E1-2-5** → only at $V_{bb} = 0V$
 - **babyMOSS W20E1-3-6** → fully operative
- Multiple APTS and DPTS sensors:
 - **Bent and flat APTS**
 - **Bent and flat DPTS**
- Radioactive sources:
 - 2 **Fe-55** X-ray sources (3.7 - 37 MBq)
 - **Sr-90** β -source
 - **Am-241** α -source
- Chiller Lauda L250 (4 - 80°C):
 - **Cooling jig for MLR1 chips**
 - **Cooling jig for babyMOSS**



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MLR1 – completed activities

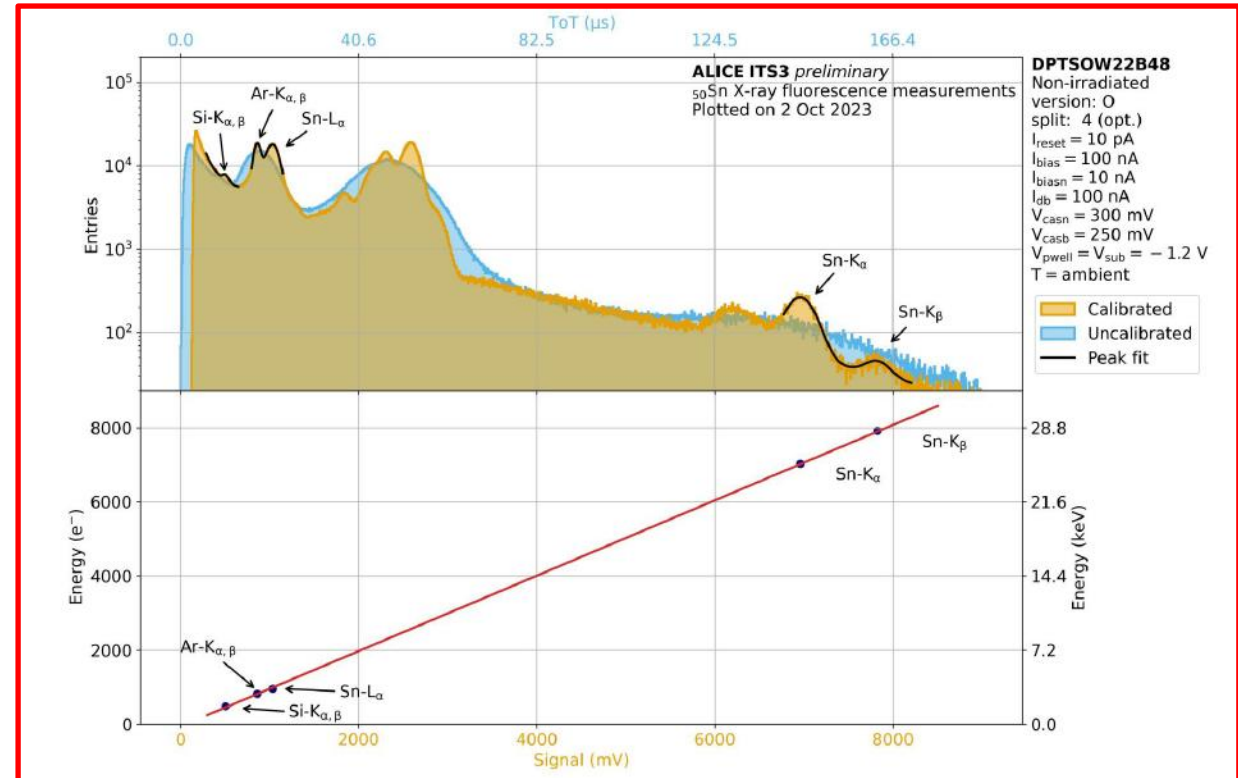
- DPTS
 - Parameter space exploration → **full characterisation**
 - **Energy scan** with fluorescence X-rays up to 28.5 keV¹
 - **Noise contribution study**²
 - **Split 4 vs split 2** charge collection comparison
- APTS
 - Charge collection comparison in **bent vs flat geometry**³

References:

- ¹https://indico.cern.ch/event/1403670/contributions/5900963/attachments/2833458/4951048/DPTS_Fake-Hit_Rate_study.pdf
- ²https://indico.cern.ch/event/1332379/contributions/5608697/attachments/2725960/4737746/WP3_03102023_DPTS_XRF_measurements.pdf
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 - Charge collection comparison in **bent vs flat geometry³**

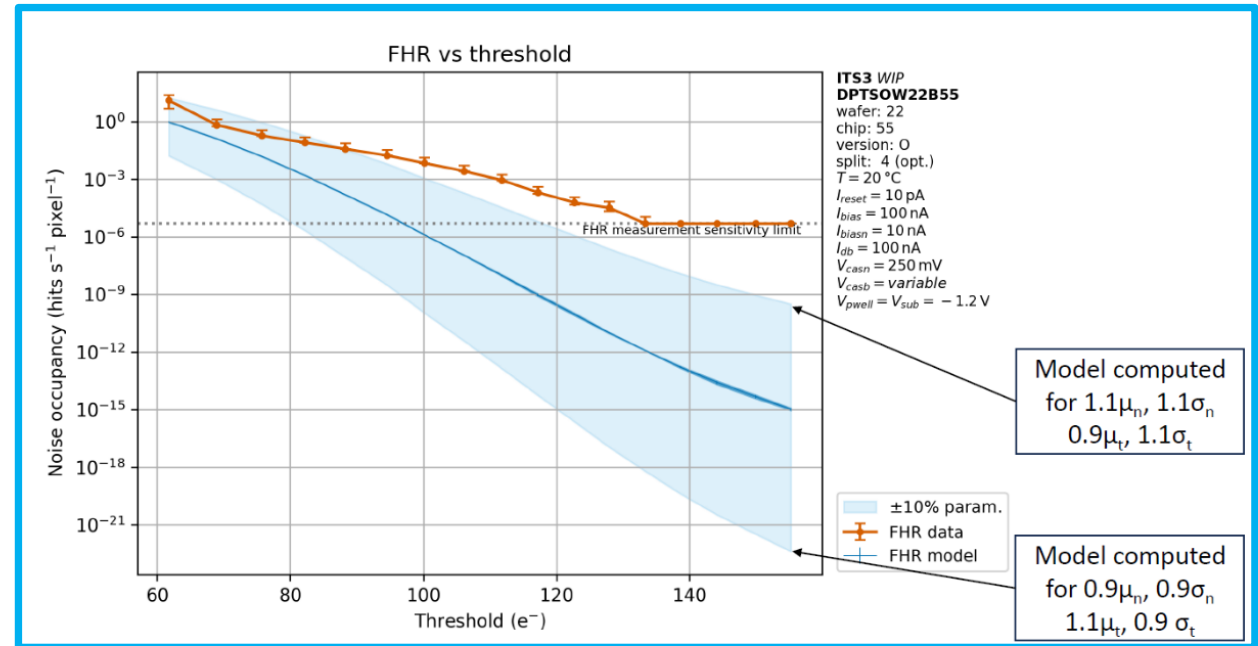


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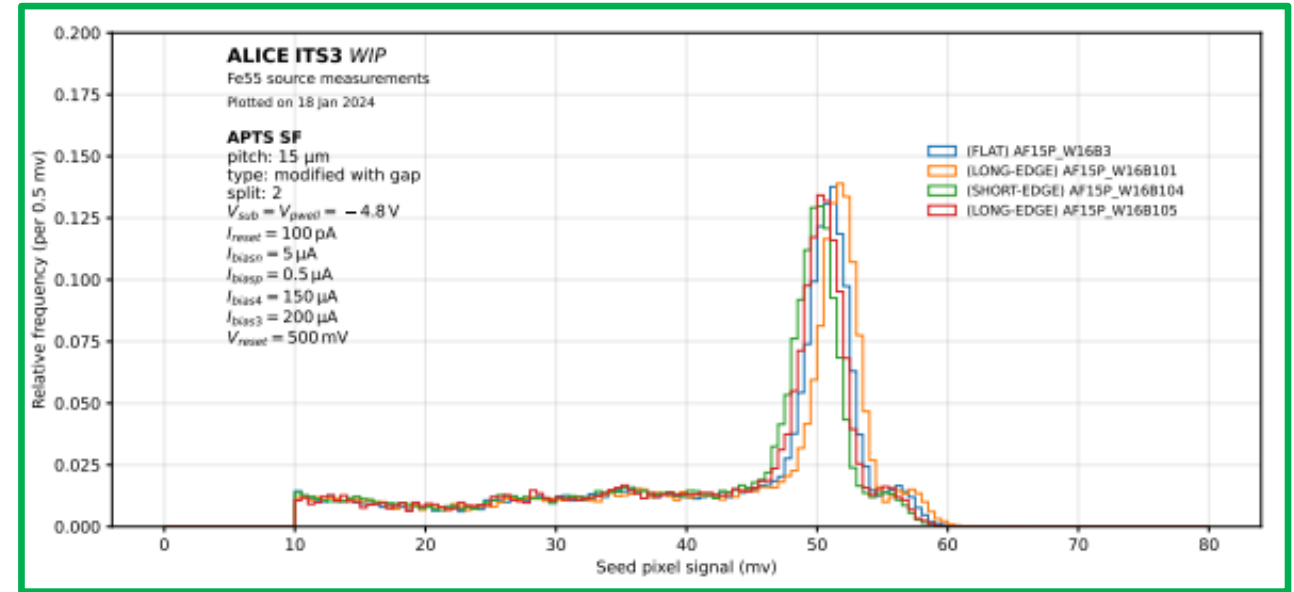


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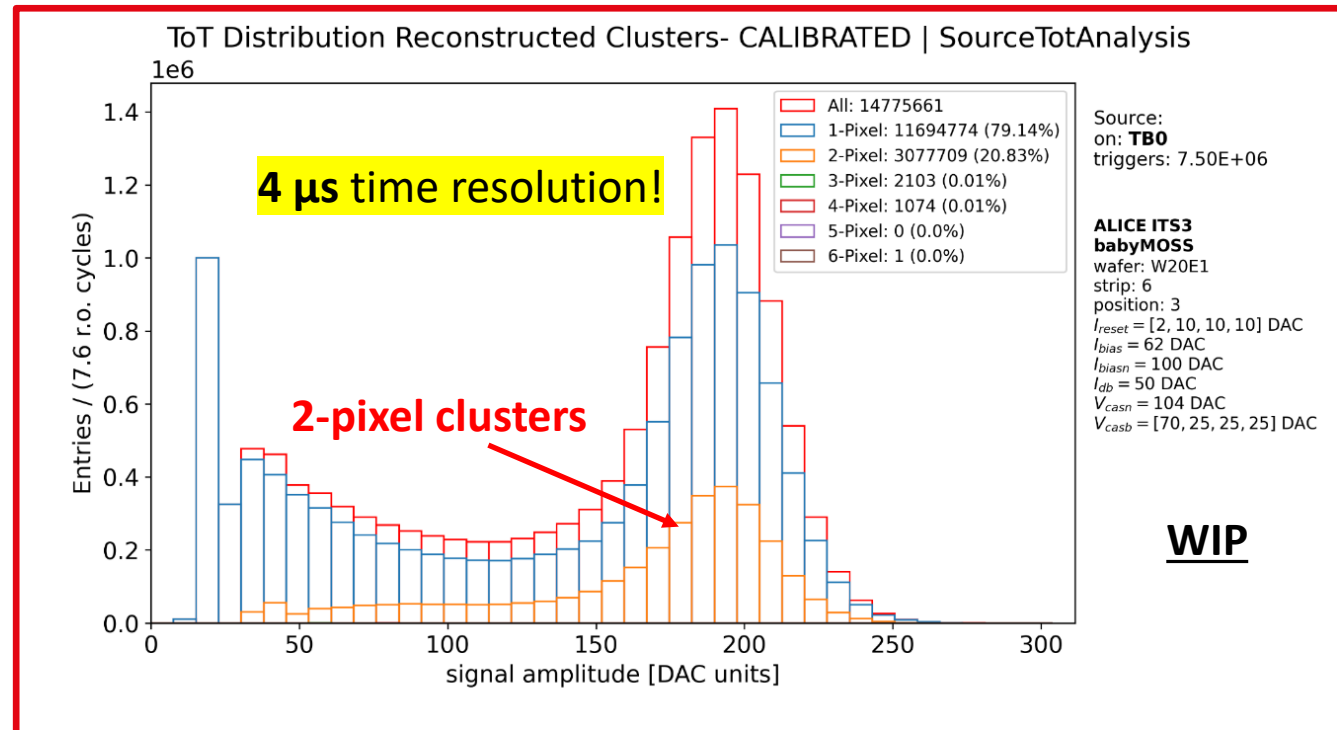
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ER1 – ongoing activities

- babyMOSS
 - Parameter space exploration
 - Sensor performance @ low IRESET
 - **Energy response** with Fe-55
 - ***Standard ToT method***
 - Calibrated spectrum
 - Total cluster charge reconstruction
 - ***Stuck readout ToT method***
 - 1-pixel cluster spectrum
 - WIP: development of calibration procedure
 - Development of total cluster charge reconstruction

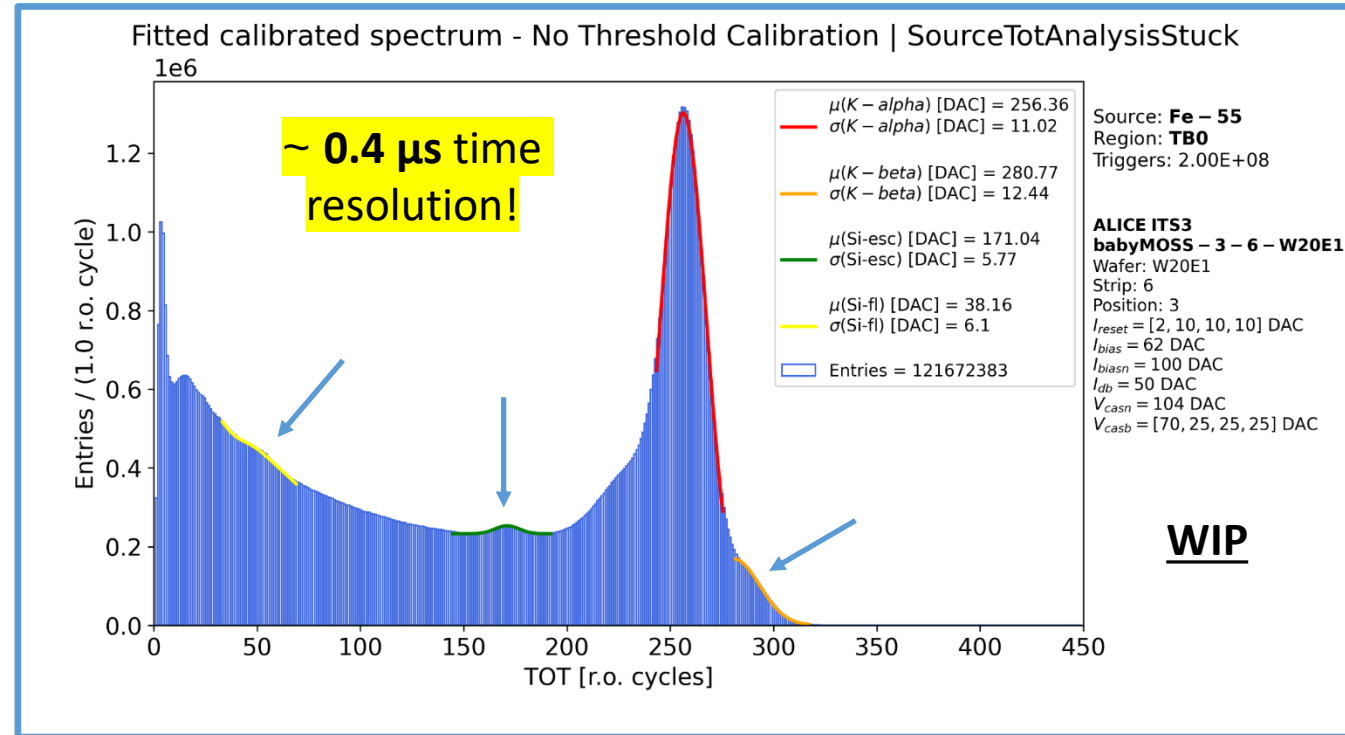
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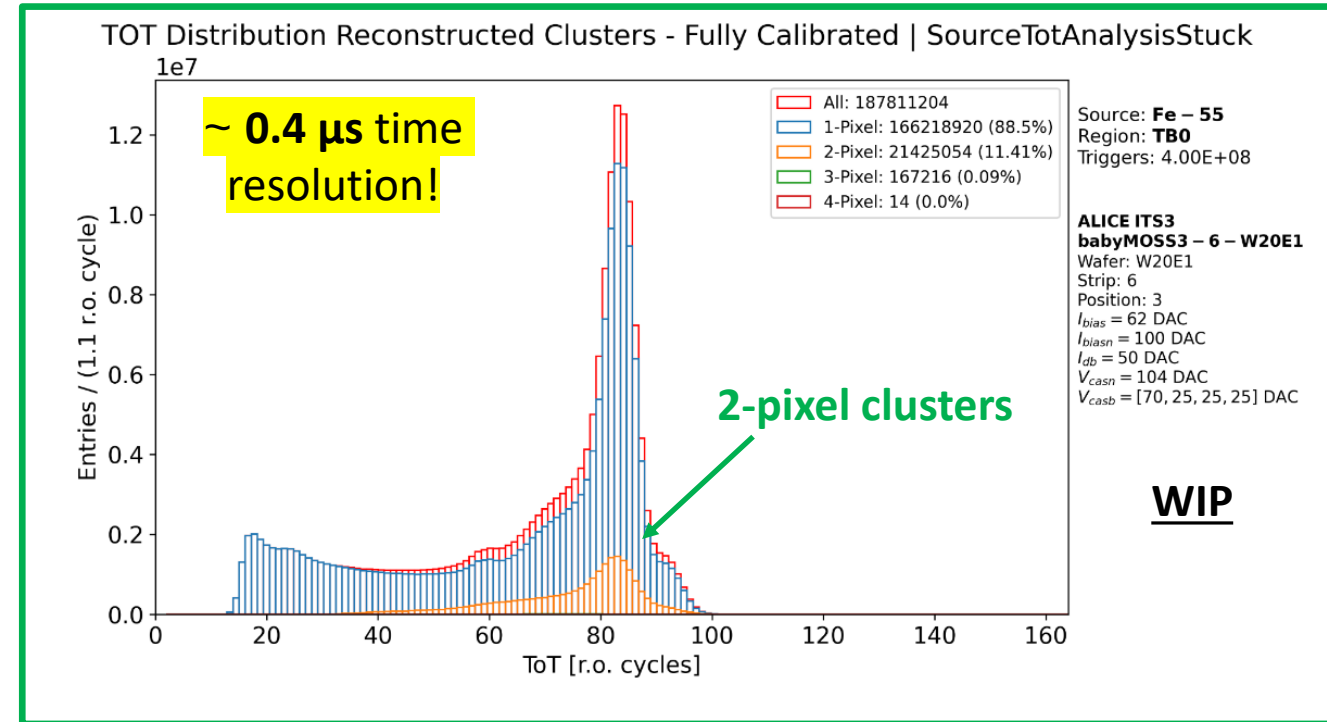
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- babyMOSS
 - Energy response with Sr-90
 - Stuck readout ToT with **external trigger**
 - WIP: exploring *Stuck ToT method* performance with **large clusters**
 - ToT measurement implementation in EUDAQ
 - Tesbeam data analysis
 - Tracking resolution @ varying cluster size
 - Efficiency uniformity

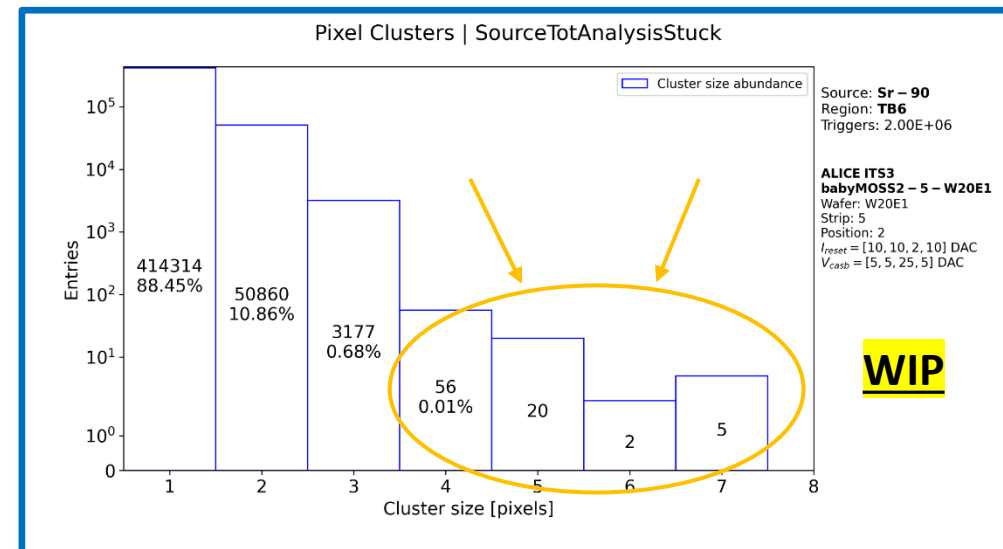
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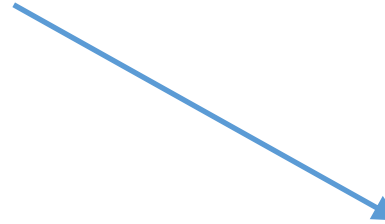


ER1 & ER2 - planned activities

- babyMOSS
 - Complete **noise contribution** study
 - Continue energy response study (ToT + cluster size/shape)
 - with **Am-241**
 - with **fluorescence X-rays** up to 28.5 keV
 - with **highly-ionizing particles**
 - **Bent chip** performance
- babyMOSAIX
 - Exploration of parameter space
 - Extend **noise contribution and energy response** studies
- **Irradiated chips** (APTS, babyMOSS, babyMOSAIX...)
 - Qualification tests @ low temperature (-25 °C) for *ALICE 3 Inner Tracker*

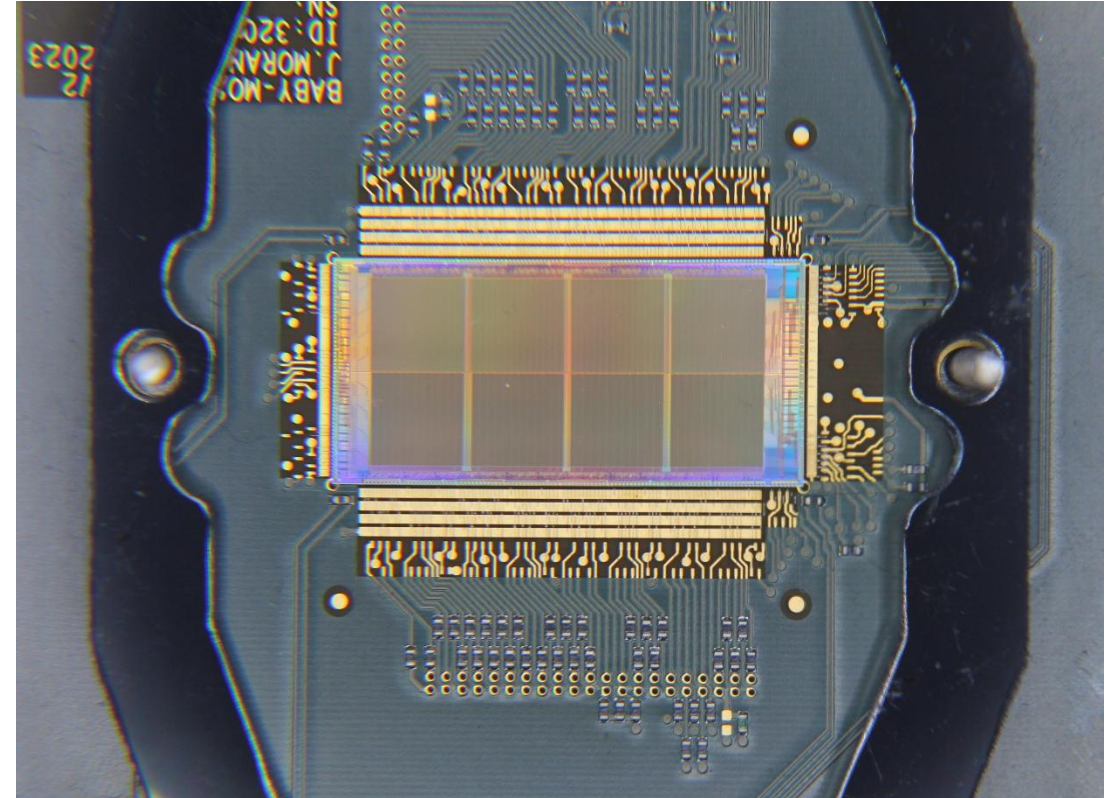
Future additional infrastructure

- **Climate chamber (ESPEC SH-662)**
 - From -60 to 150°C, 400 x 400 x 400 mm
 - Immediately available
 - Adding nitrogen flushing system
- In-house irradiation facility
 - Possibly **X-ray tube, e⁻ gun**
 - Available from beginning 2026



Conclusions

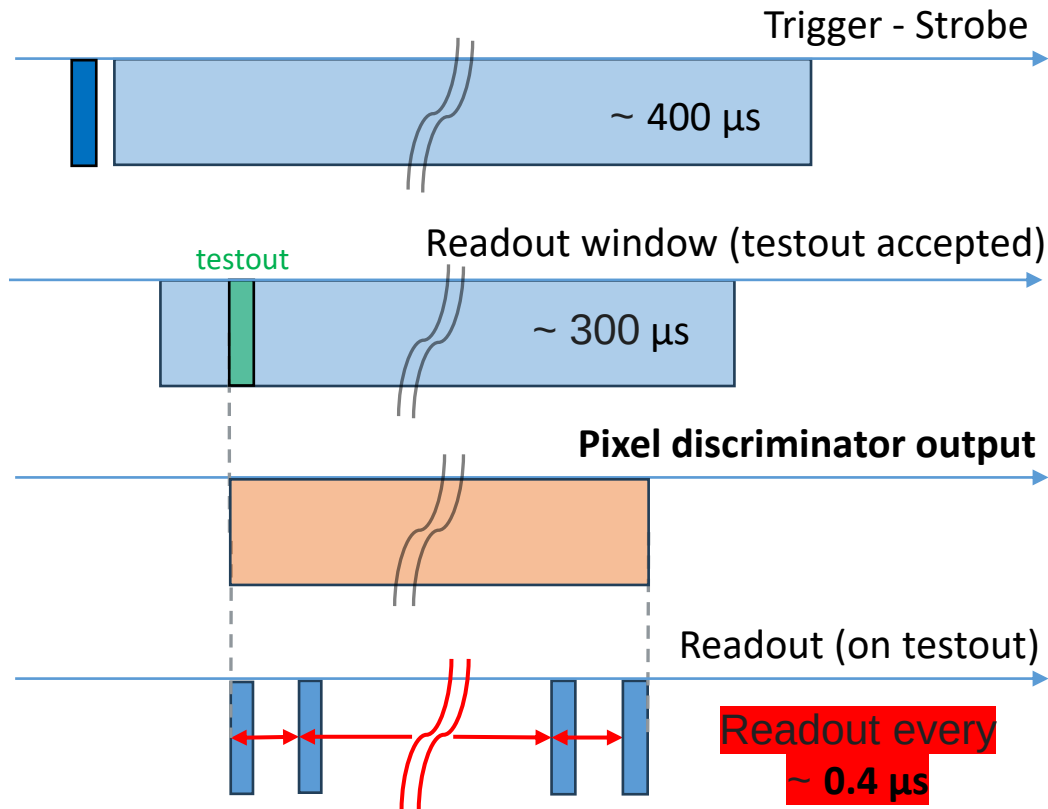
- Currently in Trieste
 - 1 PhD + 2 scholarships + bachelor students
 - 2x test systems, chiller, sources
- **Plans:** extend to ER2 the studies started for MLR1/ER1
 - Energy response, noise contributions, bending effects
 - Maintain similar effort level
 - New climate chamber available
 - Working on local irradiation facility



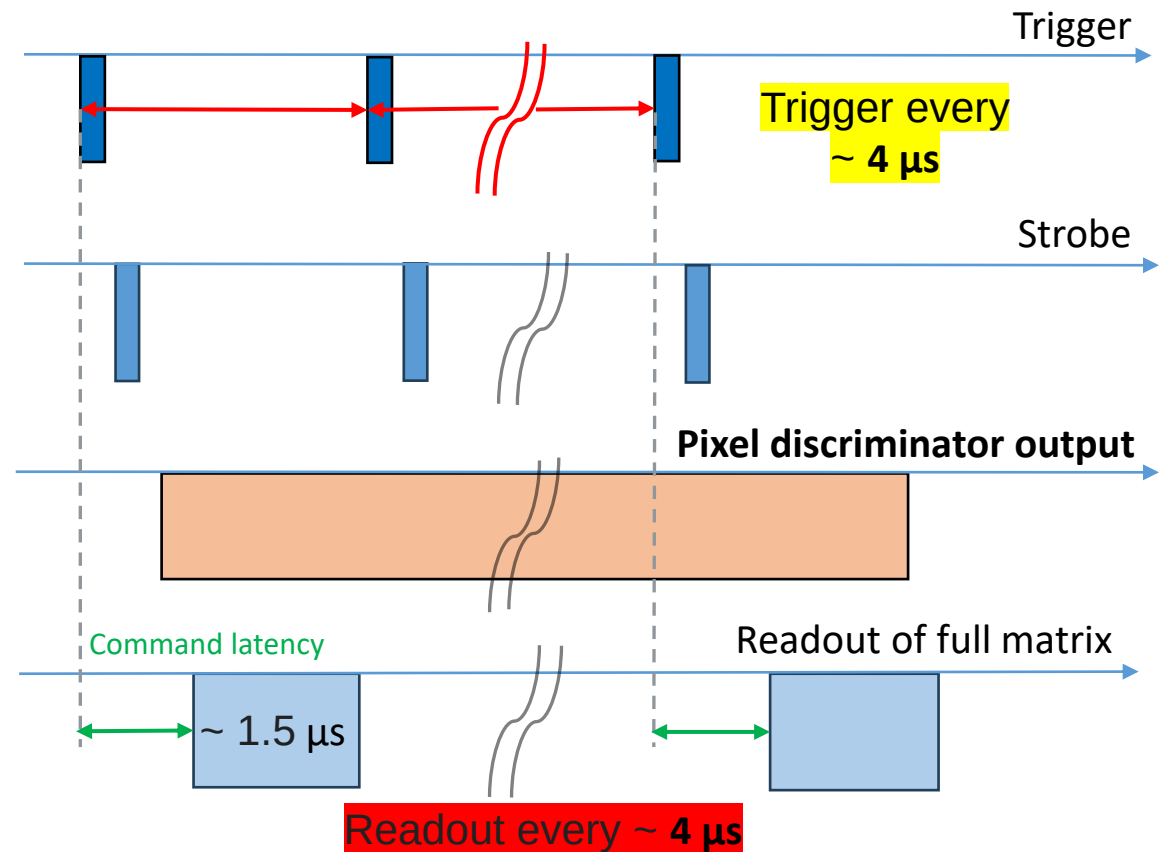
Backup

babyMOSS – Standard ToT vs Stuck ToT

- *Stuck readout ToT method*
 - Readout gets stuck on a single active pixel

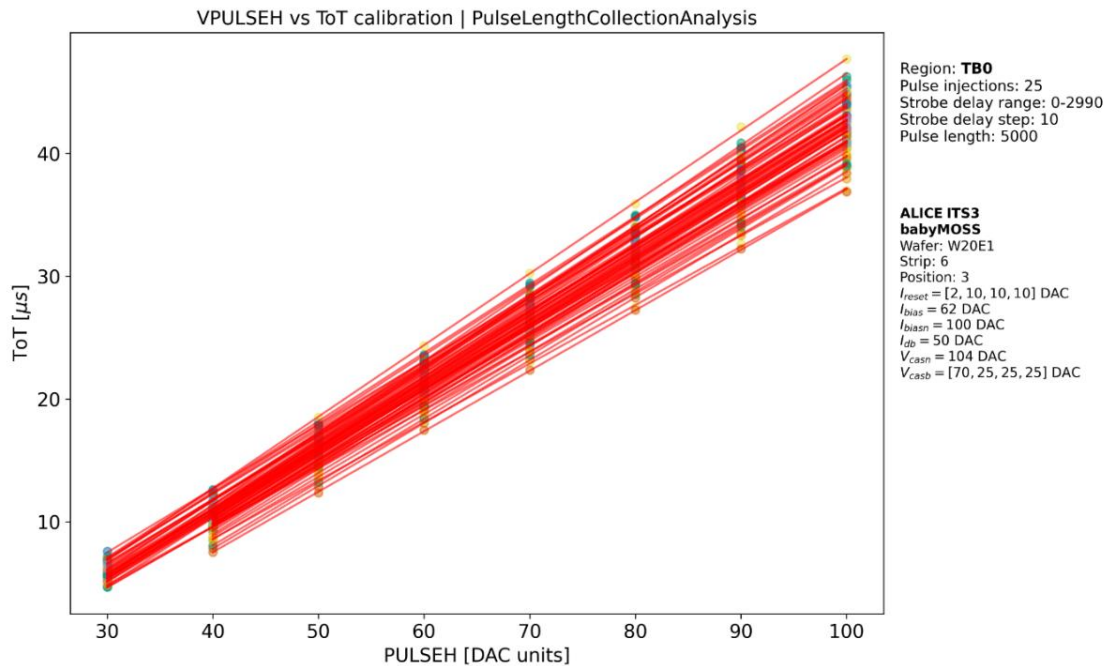


- *Standard ToT method*
 - Simultaneous readout of multiple pixels

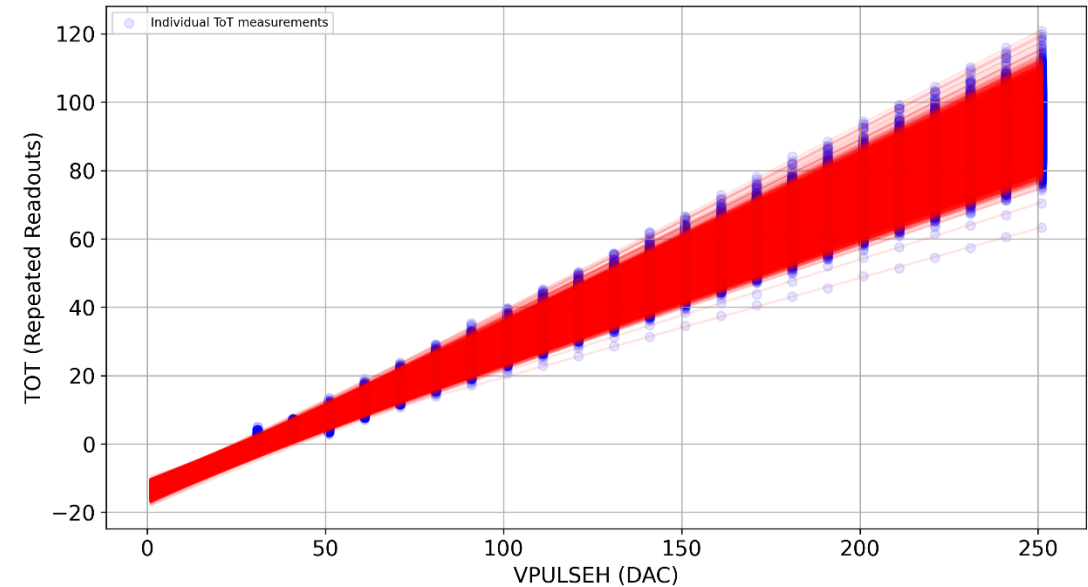


babyMOSS - VPULSEH-ToT calibration

- *Standard* method for Pulse Length Scan

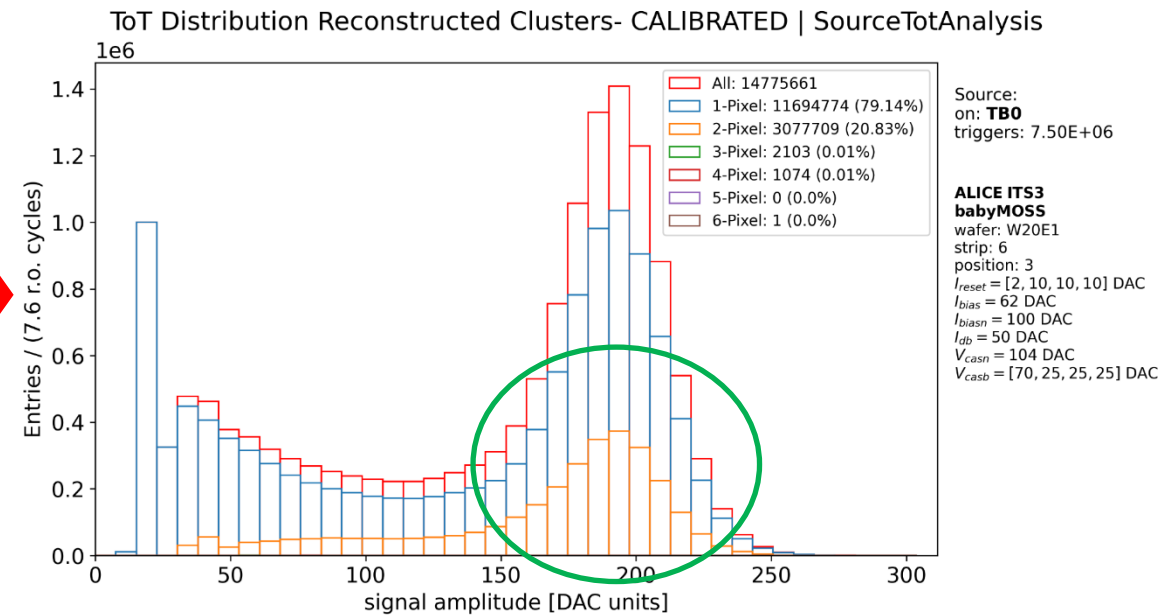
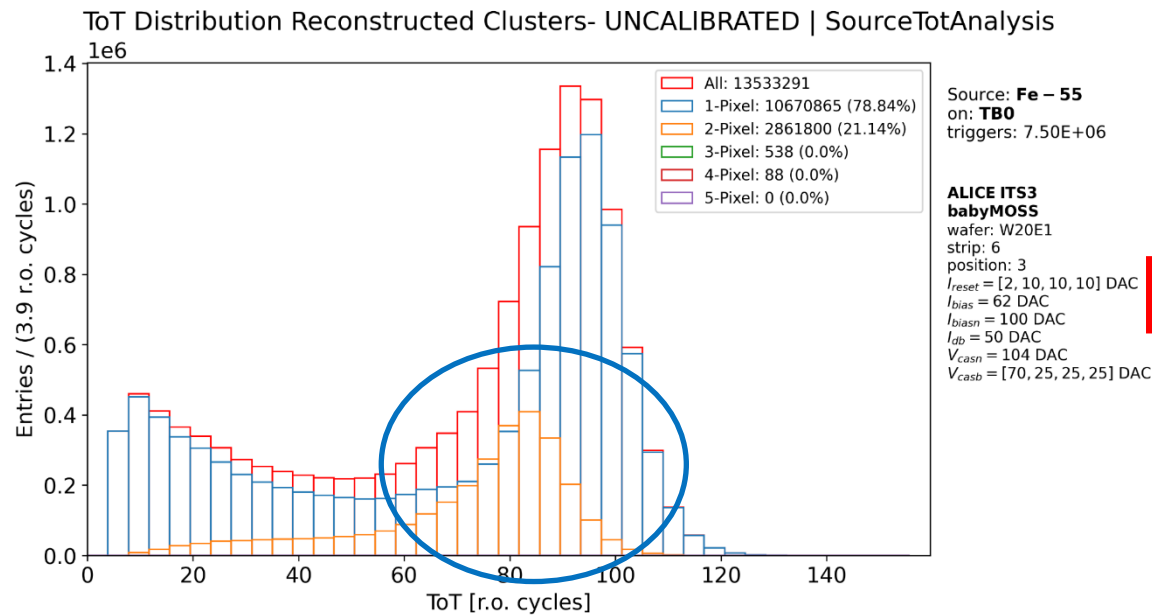


- Pulse Length Scan with *Stuck ToT* method
 - **Not working at IRESET < 10**



babyMOSS – Clusters with Fe-55 source

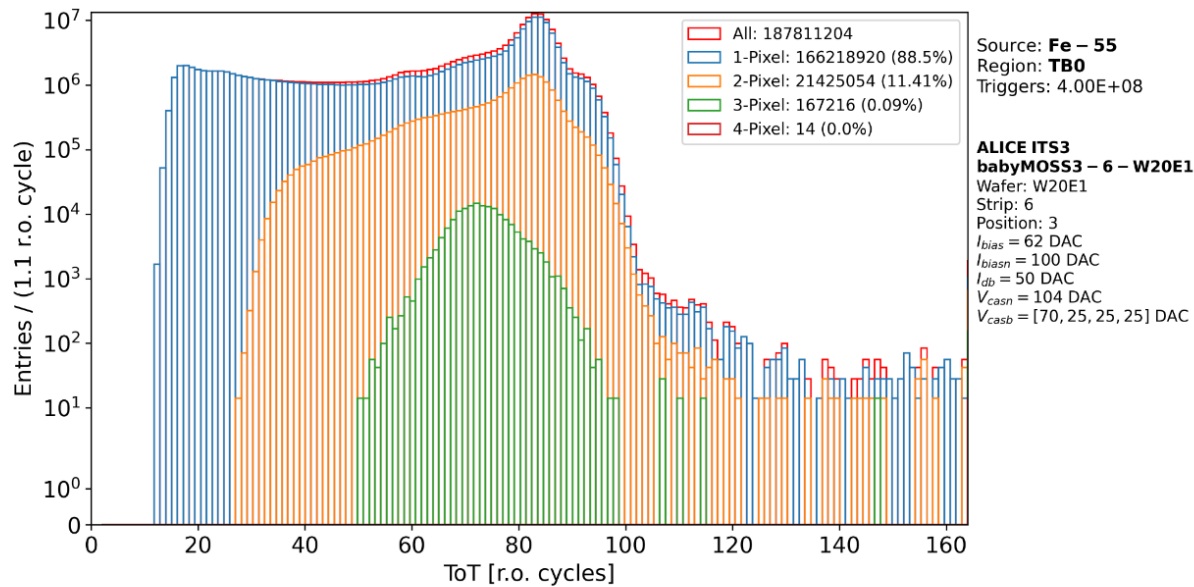
- Effect of calibration on cluster charge reconstruction



babyMOSS – Clusters with Fe-55 source

- WIP: clusters charge reconstruction for large clusters

TOT Distribution Reconstructed Clusters - Fully Calibrated | SourceTotAnalysisStuck



Cluster shapes

