Activities in Padova on ITS3 prototypes

Serena Mattiazzo, Caterina Pantouvakis, Michele Rignanese,
Luz Elena Tiscareno Montoya, Alessandra Zingaretti

ITS3 ER1/ER2 Characterisation@INFN

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Istituto Nazionale di Fisica Nucleare
Sezione di Padova

Outline

- babyMOSS
  - Test beam at CERN PS
  - Laboratory characterization

- APTS-SF: laboratory characterization of irradiated chips
- Facilities in Padova
- Interests/possible tests for ER2

babyMOSS

Test beam activity at CERN PS (September 2024)

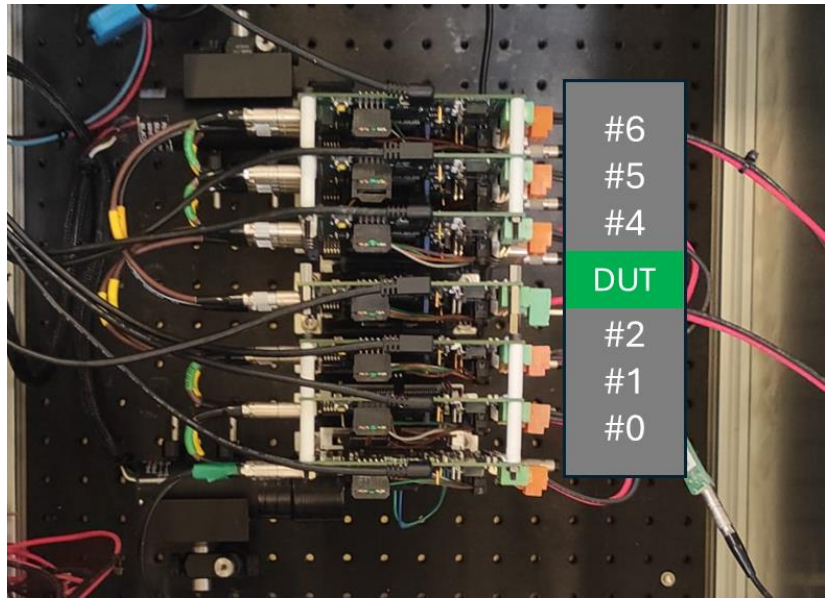
- MOSS-RAISER telescope constituted of 6 babyMOSS tracking planes
- Tested 3 babyMOSS DUTs: 1 non irradiated, 2 irradiated to 10^{13} 1 MeV n_{eq} /cm^2

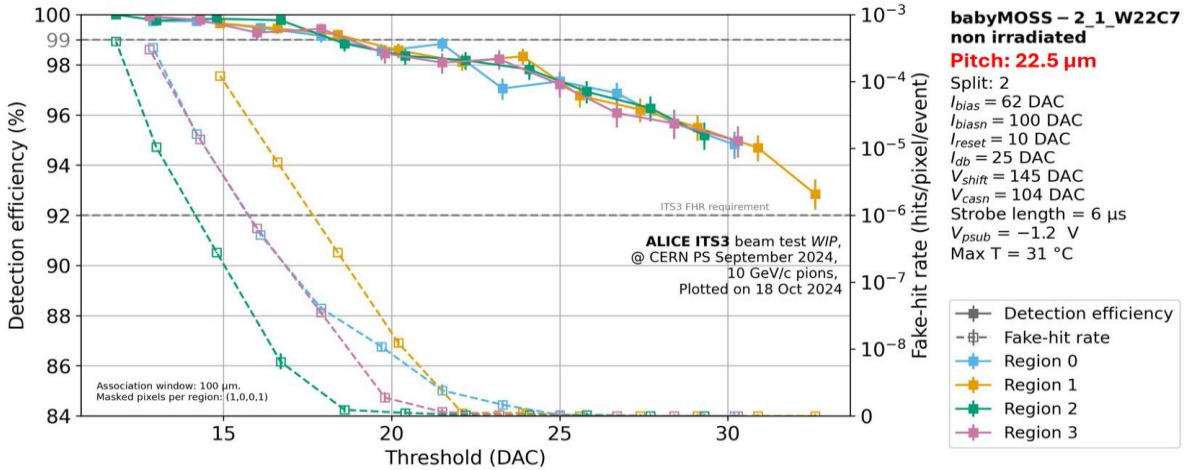
Measurements for efficiency and spatial resolution studies:

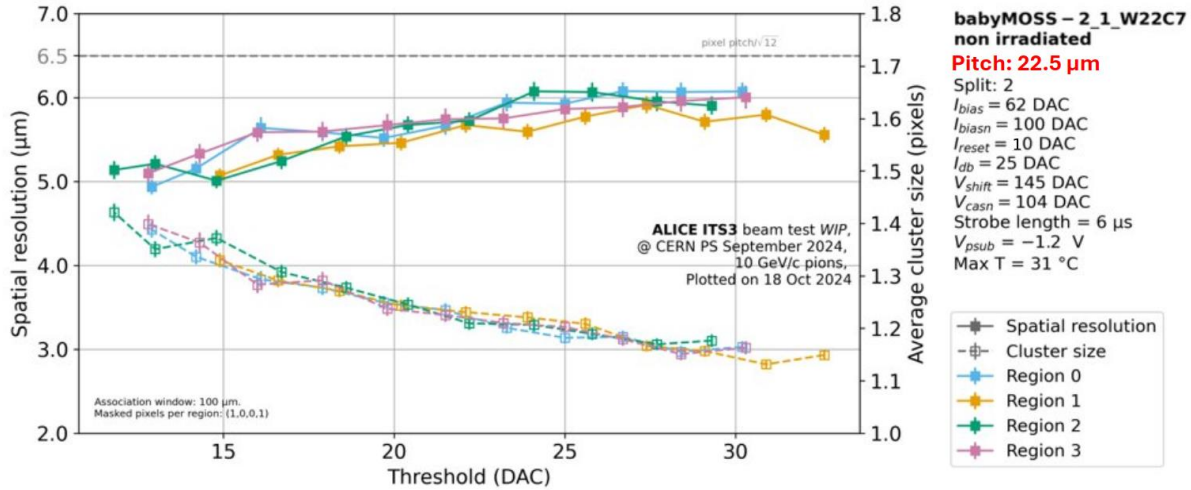
- Threshold scan
- Common threshold scan (only for non irradiated DUT)

Data analysis carried out using Corryvreckan software

Results for top HU of non irradiated DUT



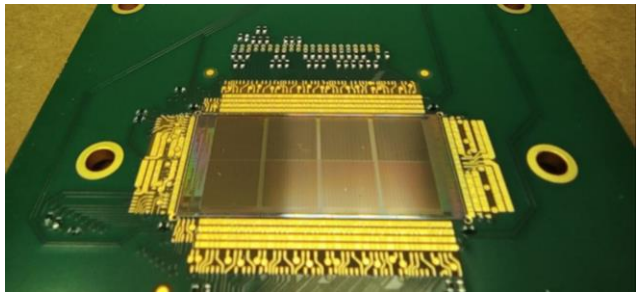




babyMOSS

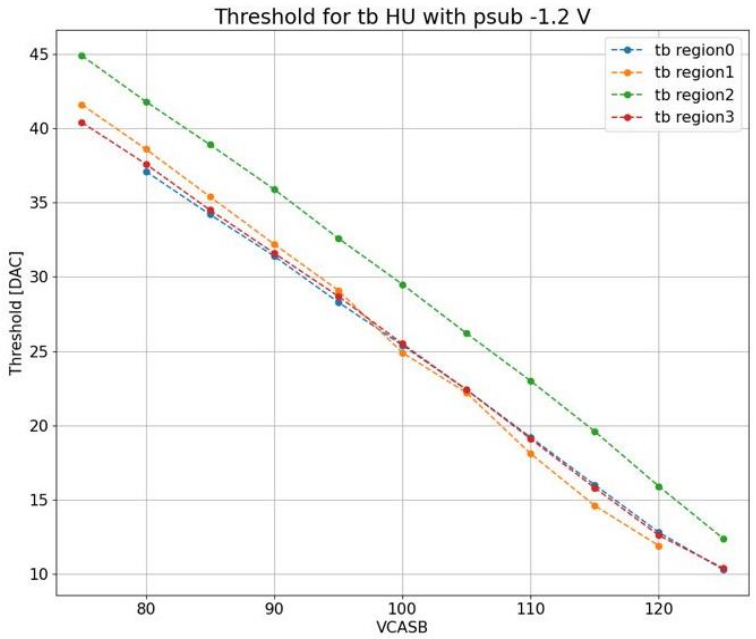
Lab characterization

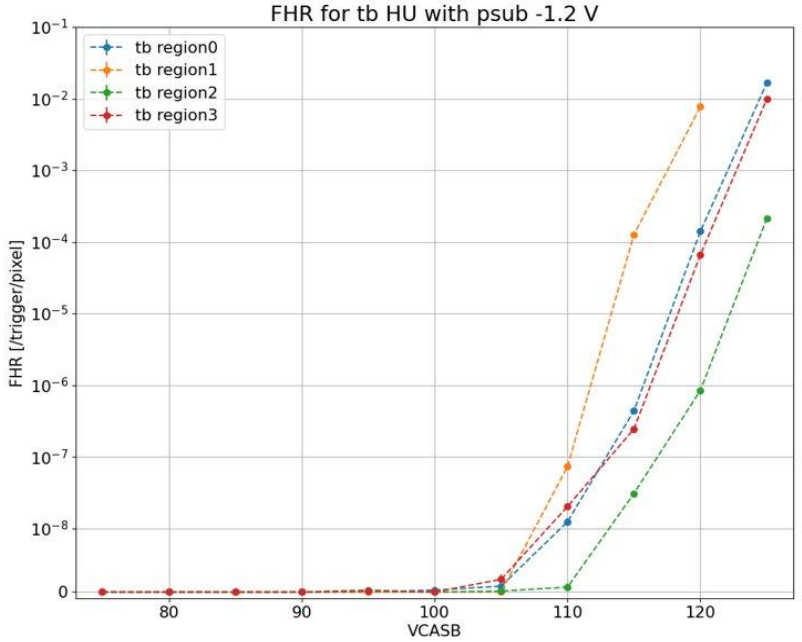
1 babyMOSS chip in Padova: **babyMOSS-1_1_W06D0**

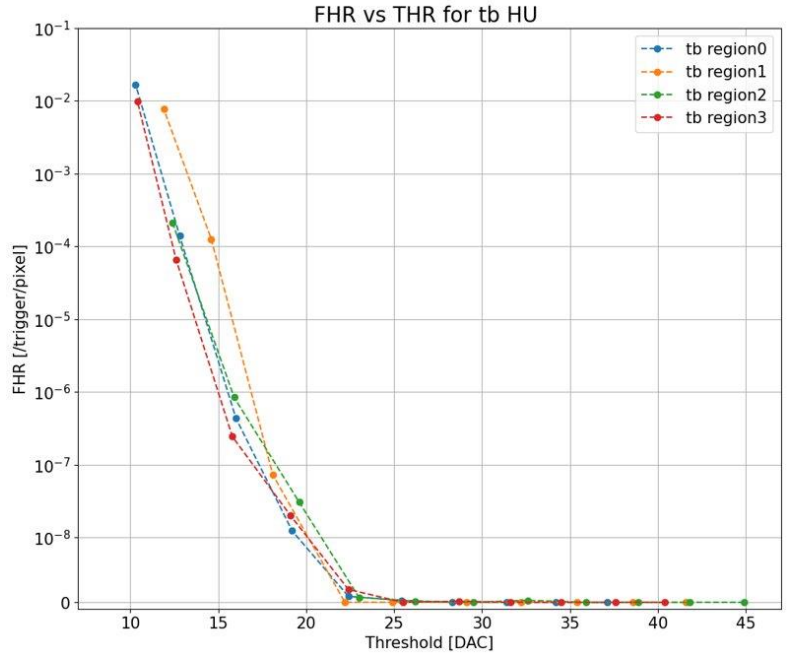


- ✓ Functional tests ➡ bb region 0 not working for SA fault of column 94 in digital scan
- ✓ Threshold scan
- ✓ Fake Hit Rate scan

Mask settings for analysis:
tb region 0: column 109 masked
tb region 1: masked pixel (19,175)
bb region 3: masked (141,108) , (191, 124) and (141, 206)



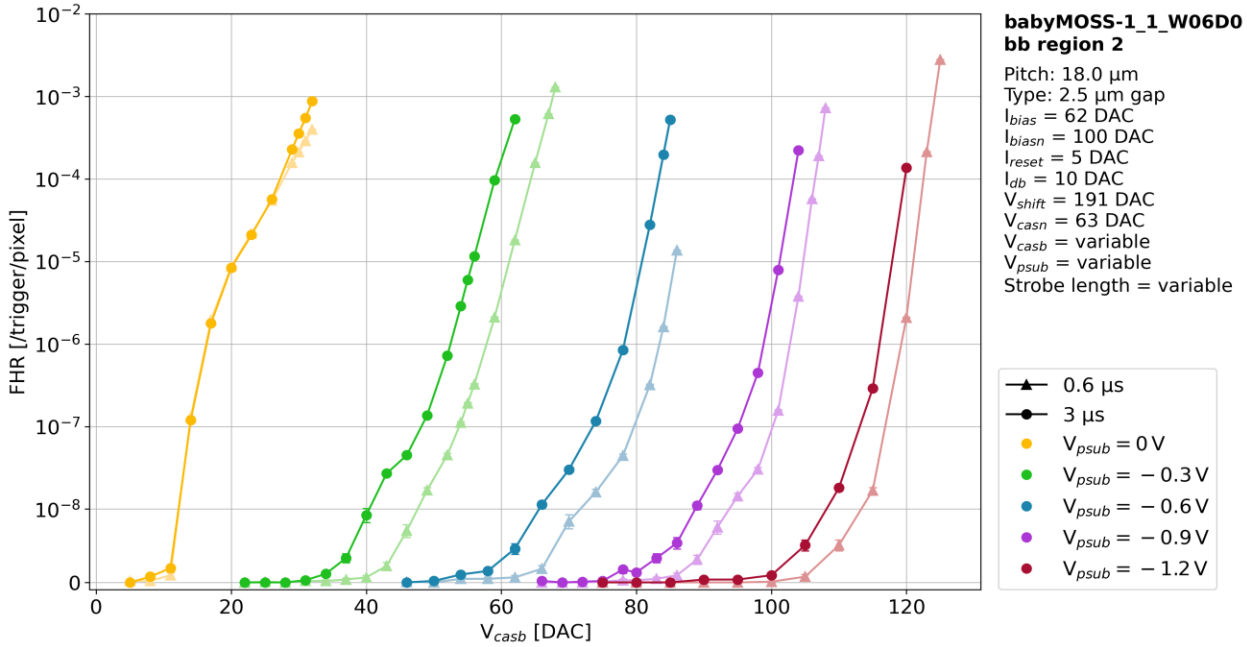


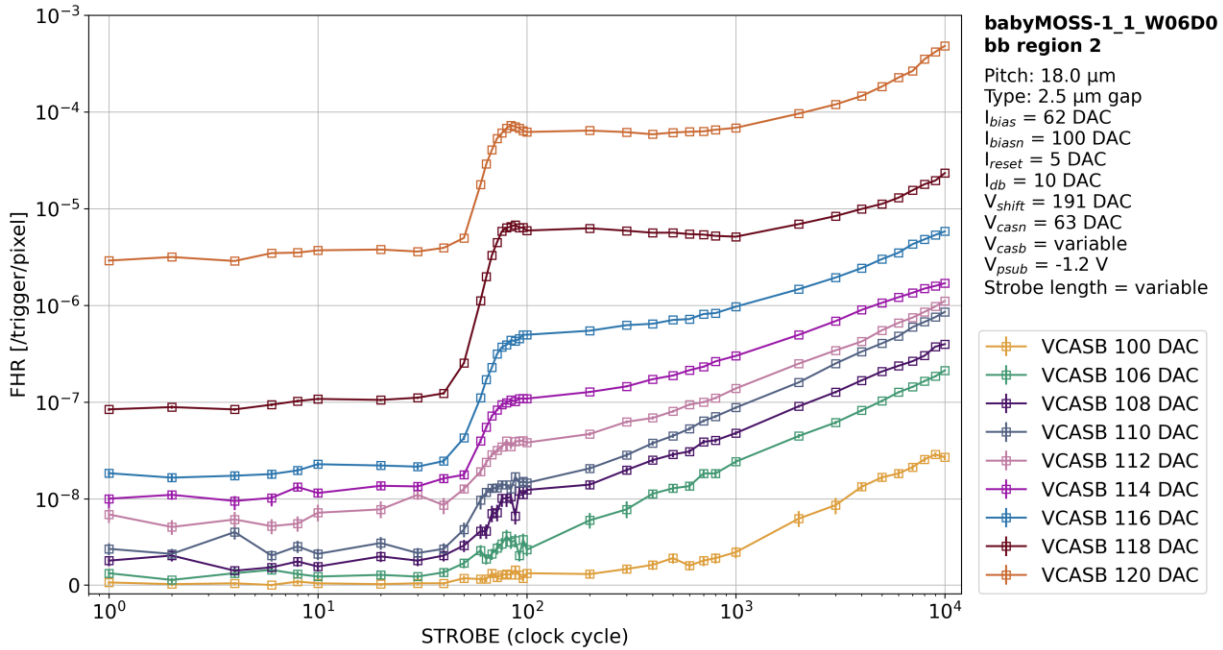


babyMOSS

Lab characterization

More detailed studies on Fake Hit Rate
Studies of FHR as a function of psub voltage and strobe length





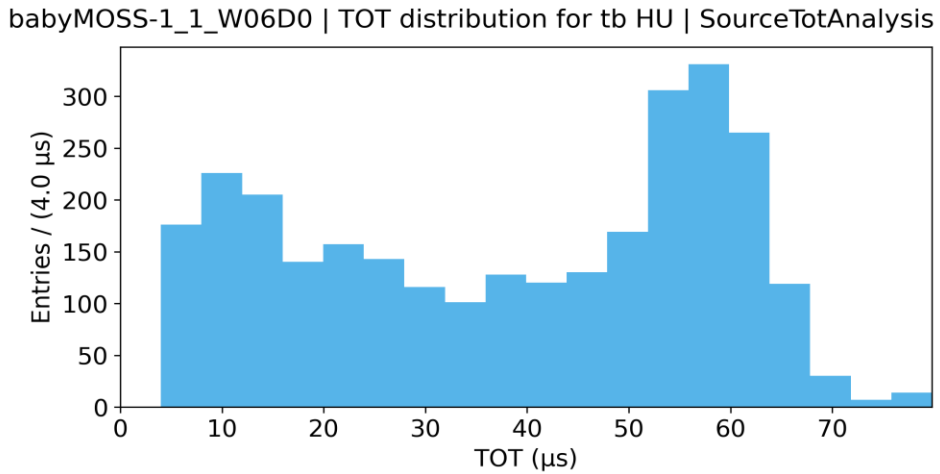
babyMOSS

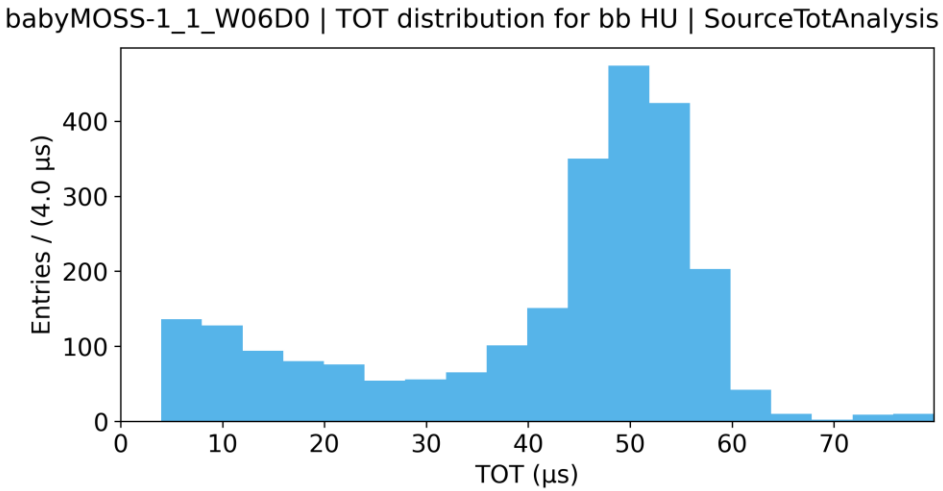
Lab characterization

TOT scan with ^{55}Fe (with source_tot_scan.py)

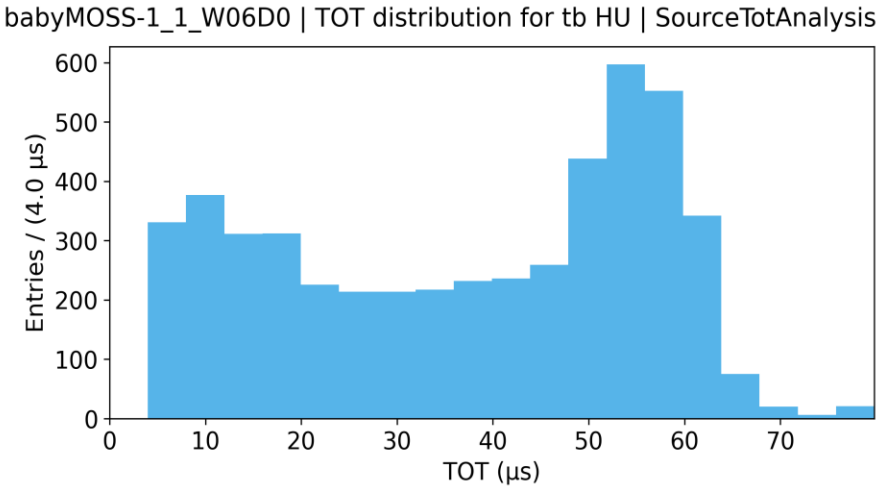
psub = -1.2 V, default DAC values, IRESET = 5, n_events = 1 M

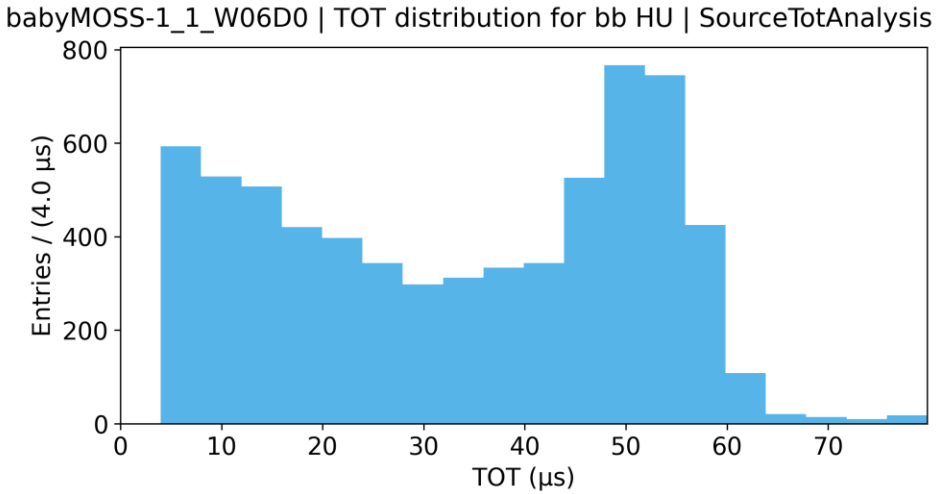
region 1





region 2





bb region 2: masked 1 additional pixel (84,248)

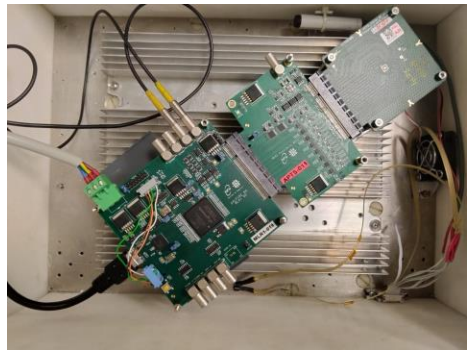
APTS-SF

Lab characterization of irradiated chips

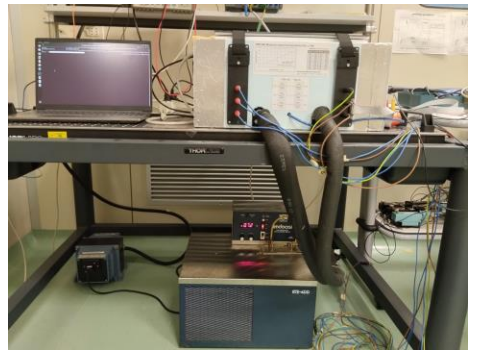
Tests of **irradiated** APTS-SF, repeated for different reverse bias voltages (DAQ+proximity+carrier inside cold box):

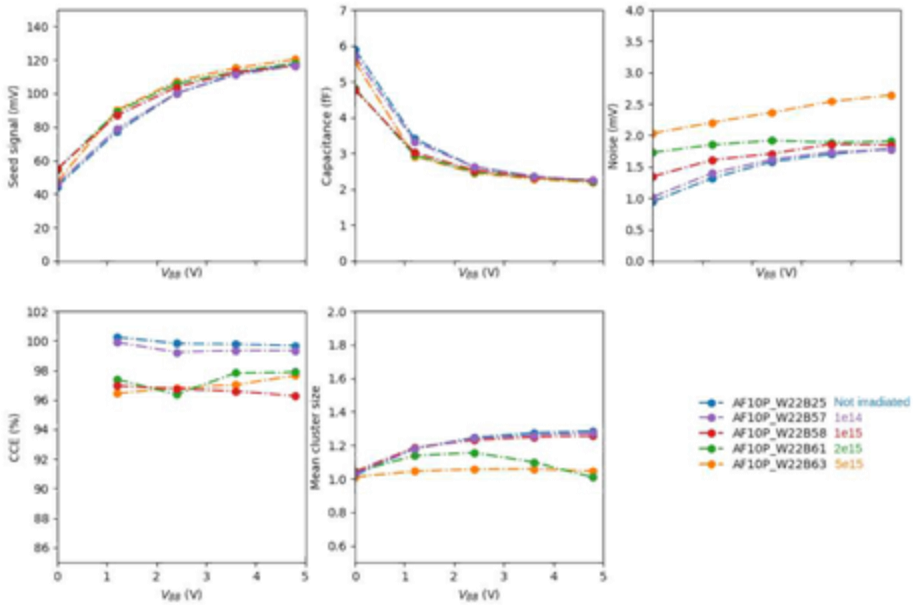
- Test pulse: check if all pixels are working;
- Threshold scan: set hardware threshold;
- Gain: check baseline and working point conditions;
- Source measurement: data acquisition with radioactive sources ^{55}Fe, ^{90}Sr;
- Leakage current tests: tests to measure leakage current.

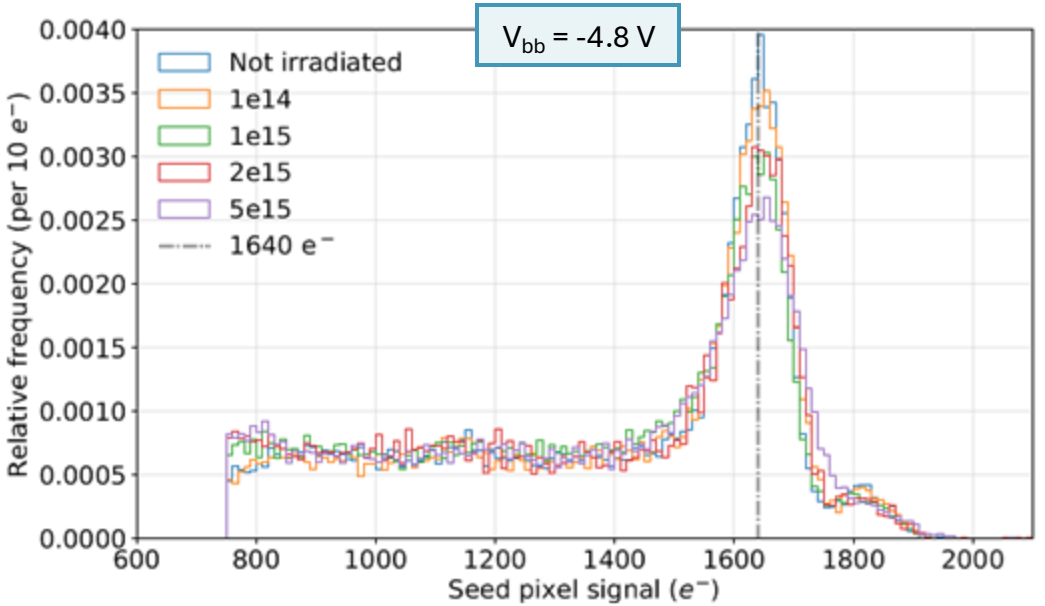
DAQ+proximity+carrier



Cold box







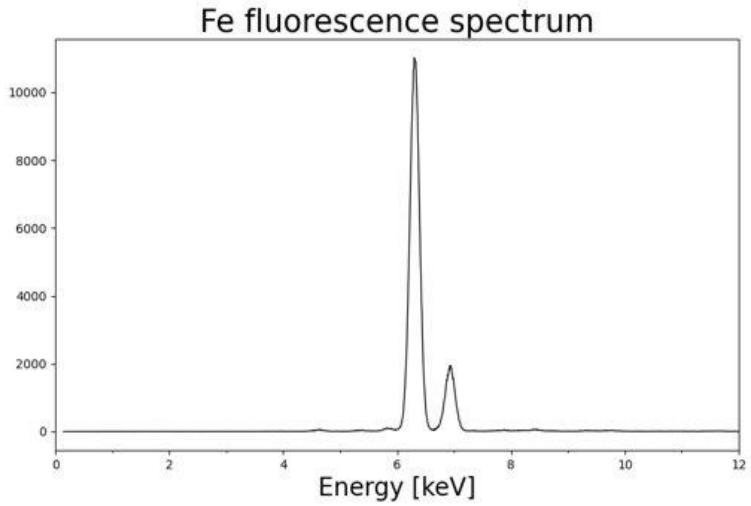
Facilities in Padova

- **Radioactive sources**: ^{55}Fe, ^{90}Sr

- NIR pulsed **laser**

- **Xray** tube (W) with setup for X-ray **fluorescence** already used for sensor characterization
  Available target materials:

Element	Energy $K\alpha_1$ [keV]	Energy [e^-]
Al	1.486	413
Ti	4.510	1253
Fe	6.404	1779
Cu	8.048	2236



- **Coldbox**: RTE-4DD Refrigerated Bath Circulator
  Temperature range from – 30 °C to 100 °C
  Drier for dry air flow
  Temperature and humidity probes for monitoring

Interest/possible tests for ER2

- Exploration of **parameter space**

- Study of the pixel **response linearity**

- Test of **irradiated** samples (ITS3, ALICE3)
  - This was done in Padova for MLR1 APTS chips up to a fluence of 2×10^{15} 1 MeV n_{eq}/cm^2 (not clear how to receive chips irradiated to higher doses)