



UNIVERSITÄT
HEIDELBERG
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SEIT 1386



GEFÖRDERT VOM
Bundesministerium
für Bildung
und Forschung



Status Report

on the DESY Testbeam Campaign 2019

WG vertex and tracking detector technology meeting

Jens Kröger

Heidelberg University & CERN

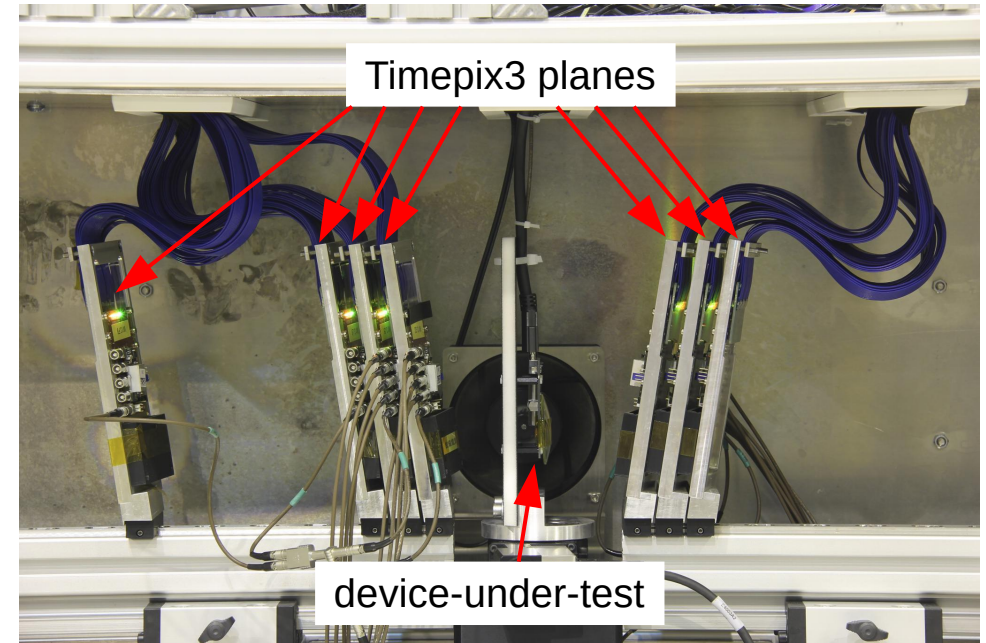
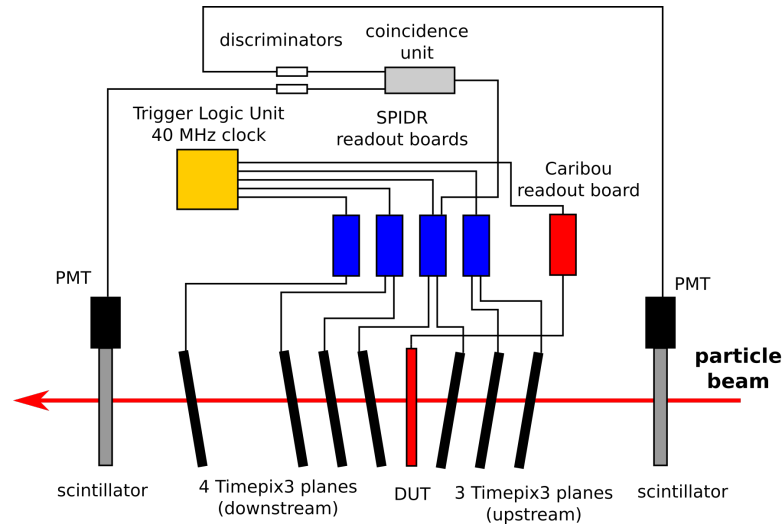
Overview

- What's different between SPS and DESY
- What did we do at DESY?
- What data has been taken?
- Status of the Analysis
 - focus on ATLASpix
 - more on CLICpix2 by Morag (next talk)

SPS vs. DESY – what's different?

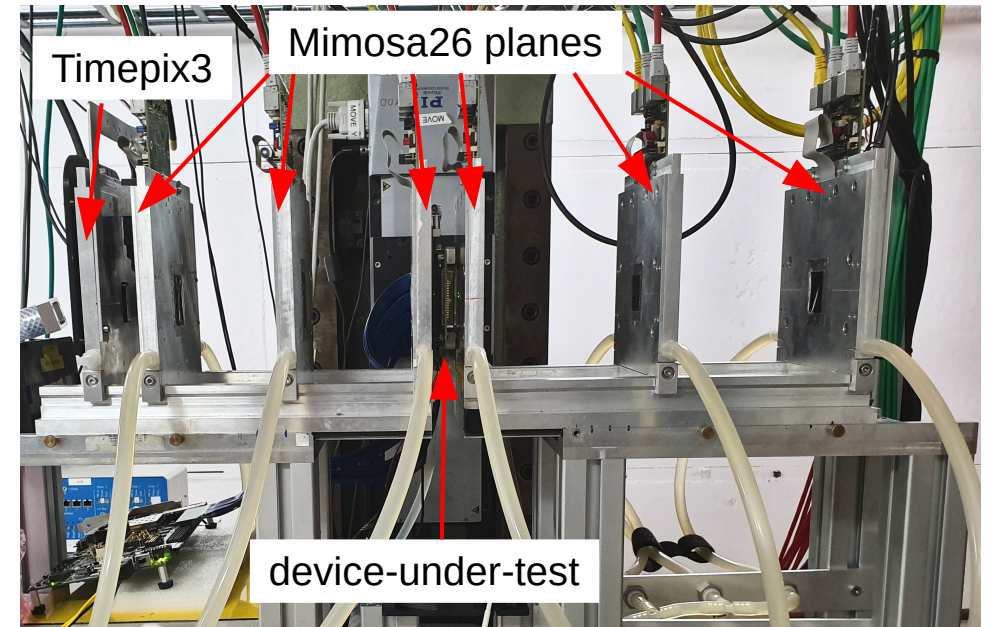
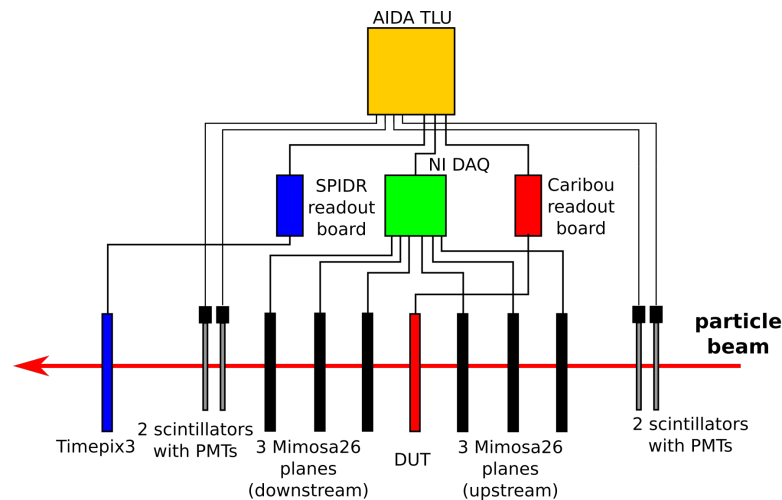
SPS:

typical beam condition:
120 GeV pions @ few 100 kHz



DESY:

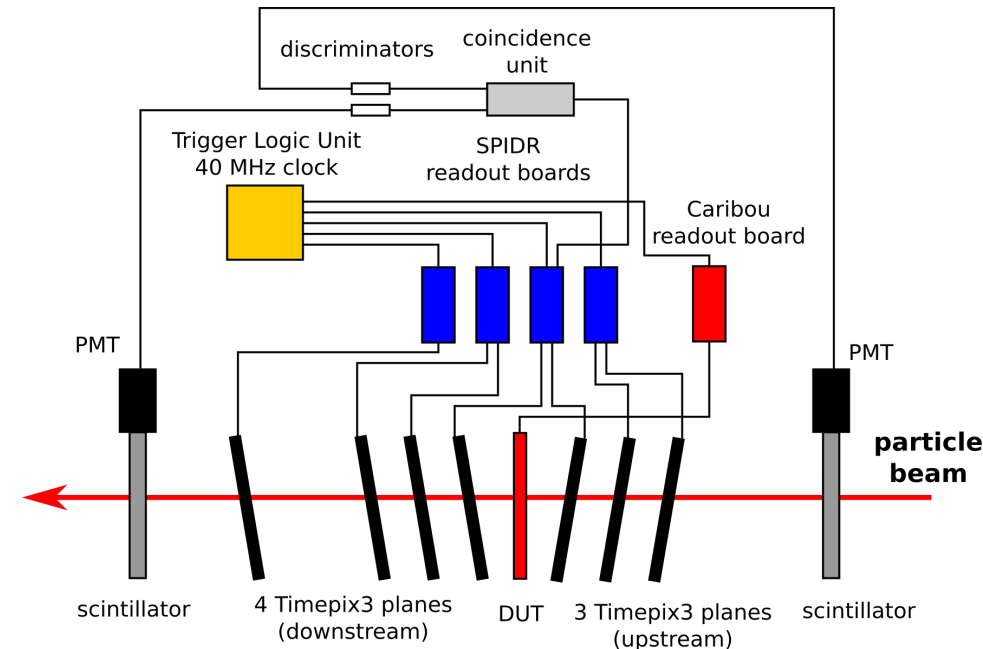
typical beam condition:
5.4 GeV electrons @ few kHz



SPS vs. DESY – what's different?

Timepix3 Telescope @ SPS:

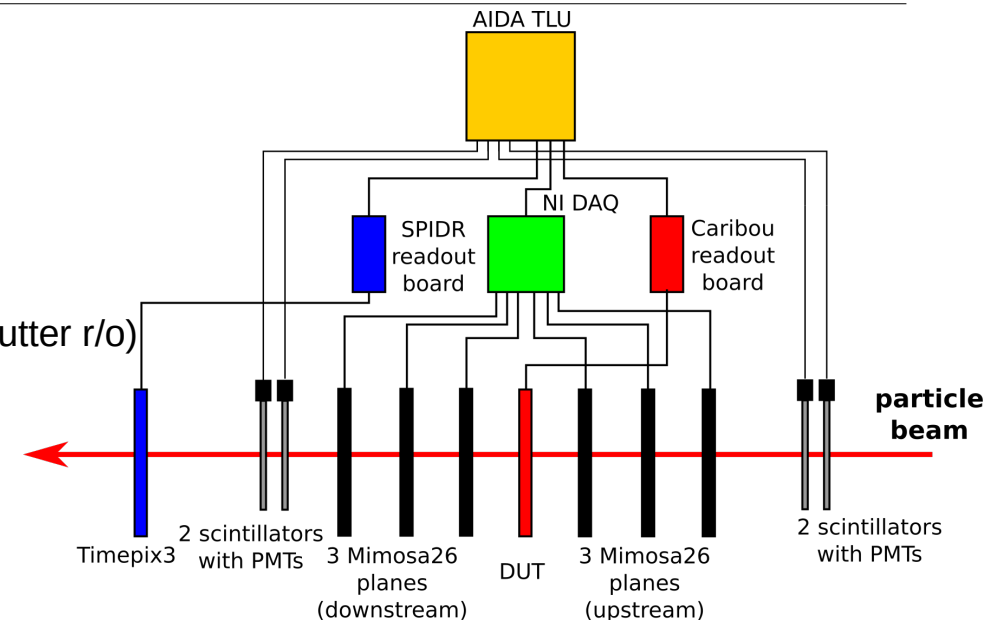
- Trigger Logic Unit (TLU) → developed for LHCb telescope
- 3 scintillators → additional trigger timestamp
- 7 Timepix3 planes → excellent spatial + time res.
- DUT → Investigator, Cracow SOI, CLICpix CLICpix2, ATLASpix



Mimosa Telescope @ DESY:

- Trigger Logic Unit (TLU) → latest AIDA TLU
- 4 scintillators → trigger Mimosa readout
- 6 Mimosa26 planes → good spatial res., $\sim 325\mu\text{s}$ bins (rolling shutter r/o)
- Timepix3 → additional precise time info
- DUT → CLICpix2 or ATLASpix

→ **additional subsystem**

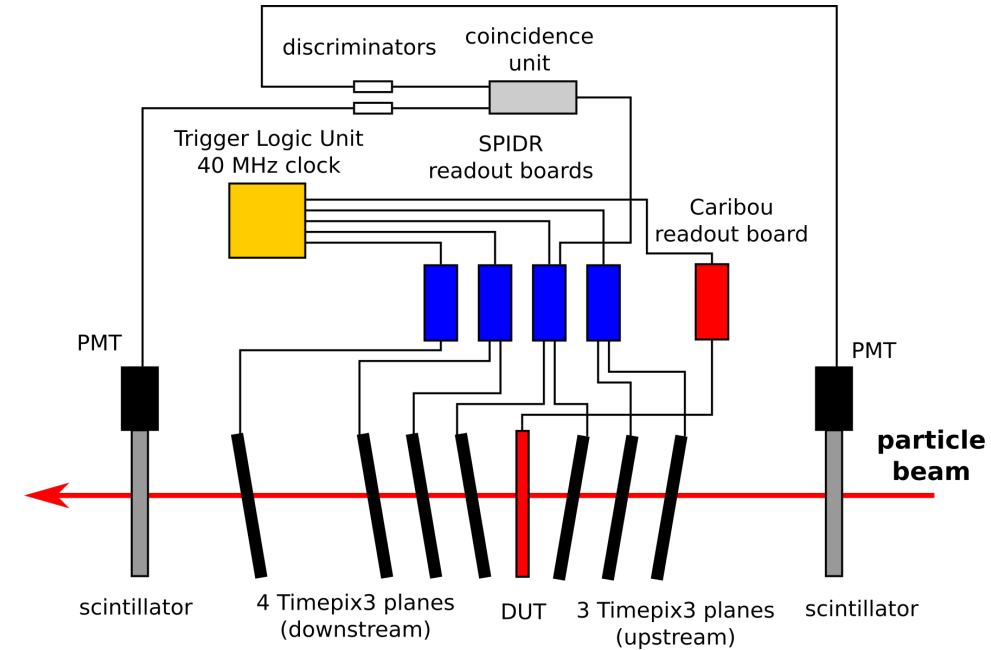


SPS vs. DESY – Readout

continuous readout, timestamps synchronous with global clock

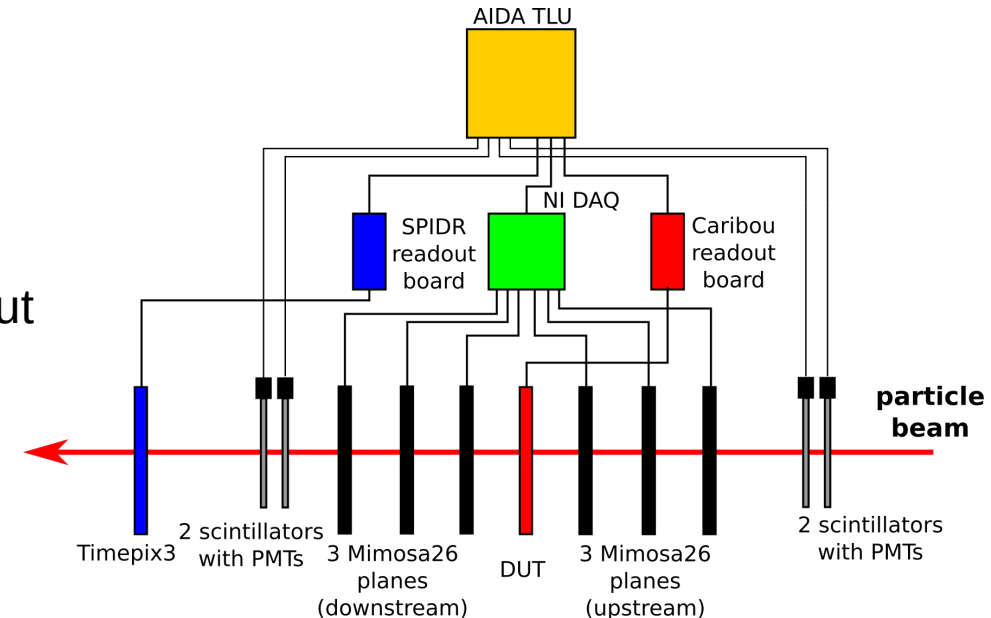
SPS:

- Trigger Logic Unit (TLU) → provides global clock + T0
- 3 scintillators → additional trigger timestamps
- 7 Timepix3 planes → continuous readout
- DUT → depends on device



DESY:

- 4 scintillators → input to TLU
- Trigger Logic Unit (TLU) → provides global clock + T0 + triggers Mimosa Readout
- 6 Mimosa26 planes → readout on trigger from TLU
- Timepix3 → continuous readout
- DUT → depends on device



SPS vs. DESY – Run Control

SPS:

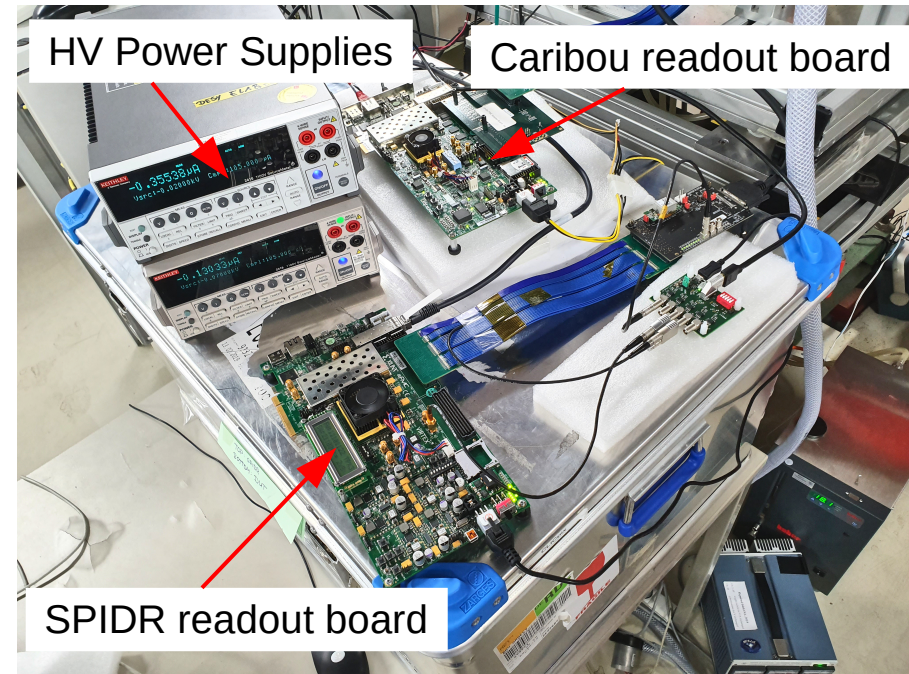
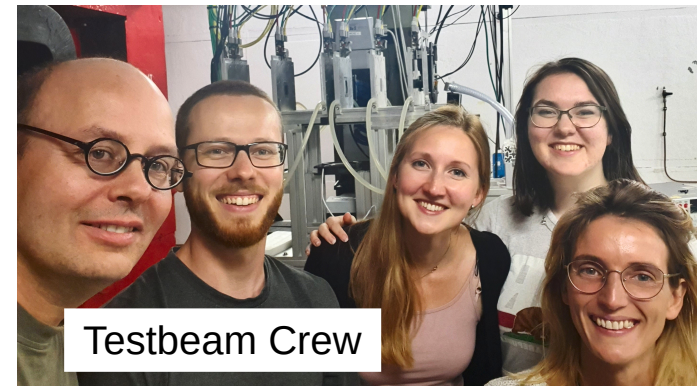
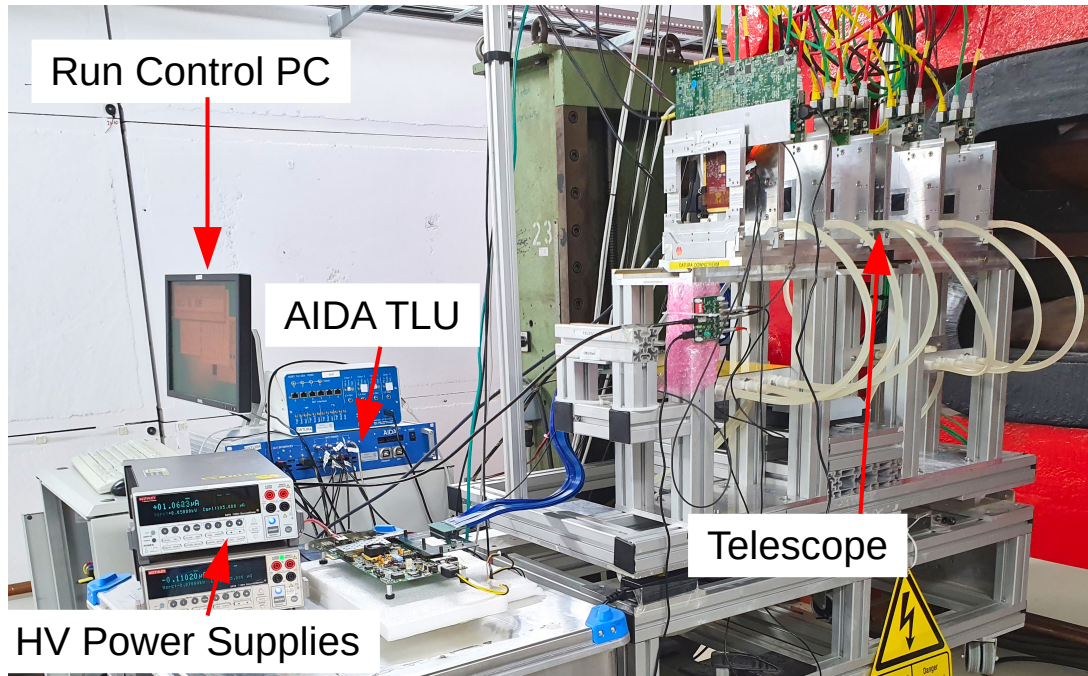
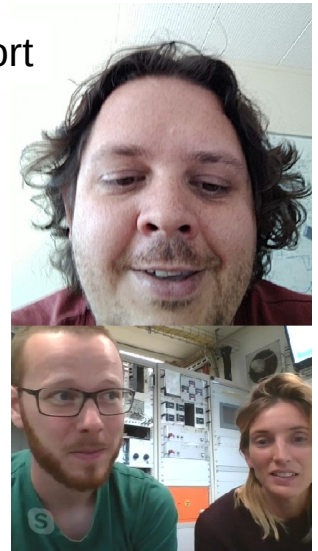
- based on LHCb telescope
- fully automated scans of all parameters (including HV, motion stage)

DESY:

- EUDAQ2
- automated scan of chip settings
 - threshold etc.
 - motion stage
 - under development: HV (Keithley software integration)

Some more Impressions from July

Skype Support



Data Sets – a short testbeam history

February

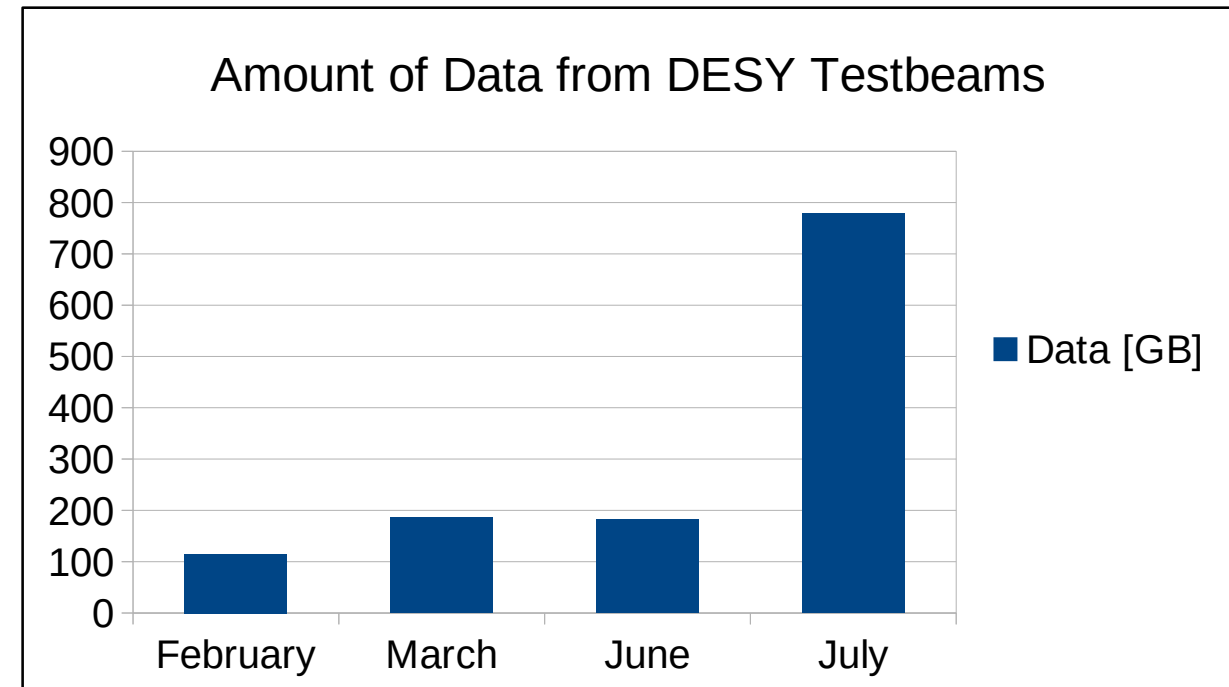
- integration of Caribou and SPIDR (Timepix3)
 - hardware: mechanical integration
 - software: readout, run control

March

- commissioning of combined data taking
- interface to reconstruction (Corryvreckan)
- online monitoring
- debugging “slow time drift” issues (DUT)

June

- solved “slow time drift” issues (DUT)
 - PLL setting
- first physics data



Data Sets – a short testbeam history

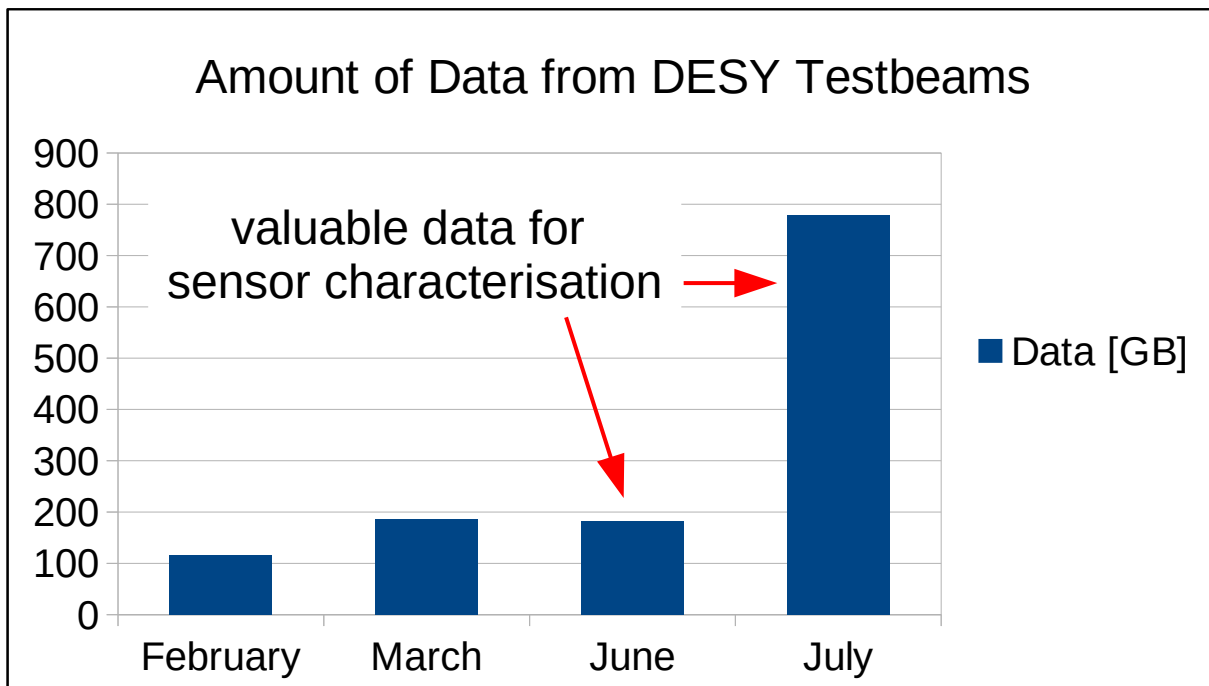
July

- Data from all subsystems:
 - TLU + Mimosa + Timepix3 + DUT
- stable run control
- automated threshold scans



ATLASpix:

- coherent data set for 3 samples with different resistivities:
 - w06s12: 20 Ω cm
 - w10s30: 80 Ω cm
 - w23s11: 200 Ω cm (same as SPS data)
- bias scan + threshold scan



CLICpix2:

- 3 assemblies: AS19, AS20, AS22
 - long runs – including extended ToA+ToT data
 - bias & threshold scans
 - power pulsing measurements
- more by Morag (next talk)

Changes in the Analysis Framework

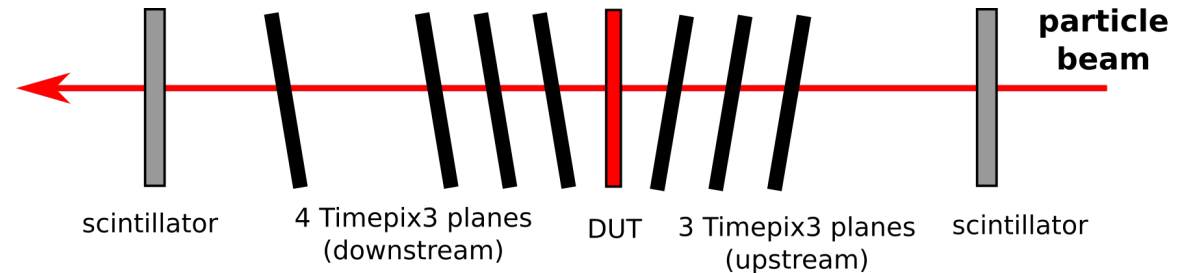
Event Building:

- Corryvreckan expects time-sorted hits
 - data locally non-chronological for Timepix3 and ATLASpix
- now:
 - buffer of configurable length to sort hits “on-the-fly”

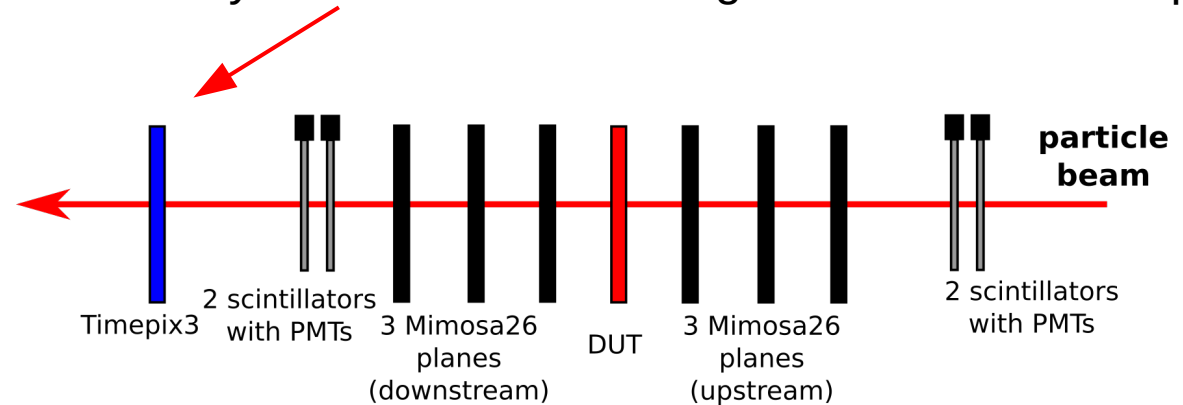
Tracking:

- **SPS:**
 - 7 Timepix3 hits with precise timestamp
 - track timestamp = average TPX3 timestamp
- **DESY:**
 - Mimosa26 hits (325 μ s bins) with multiple trigger timestamps
 - require Timepix3 for unambiguous track time
 - track timestamp = TPX3 timestamp

SPS: all sensors provide hit timestamps for tracking



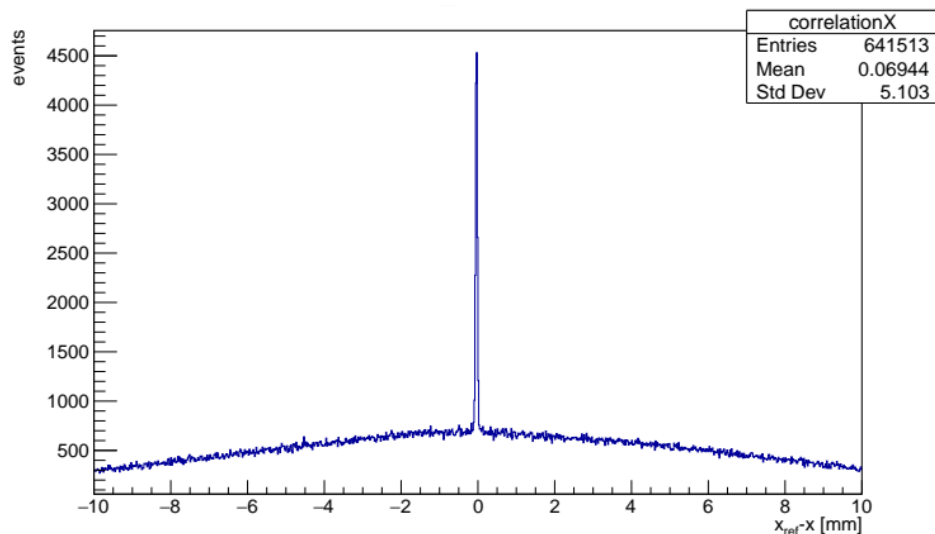
DESY: only with TPX3 → unambiguous track timestamp



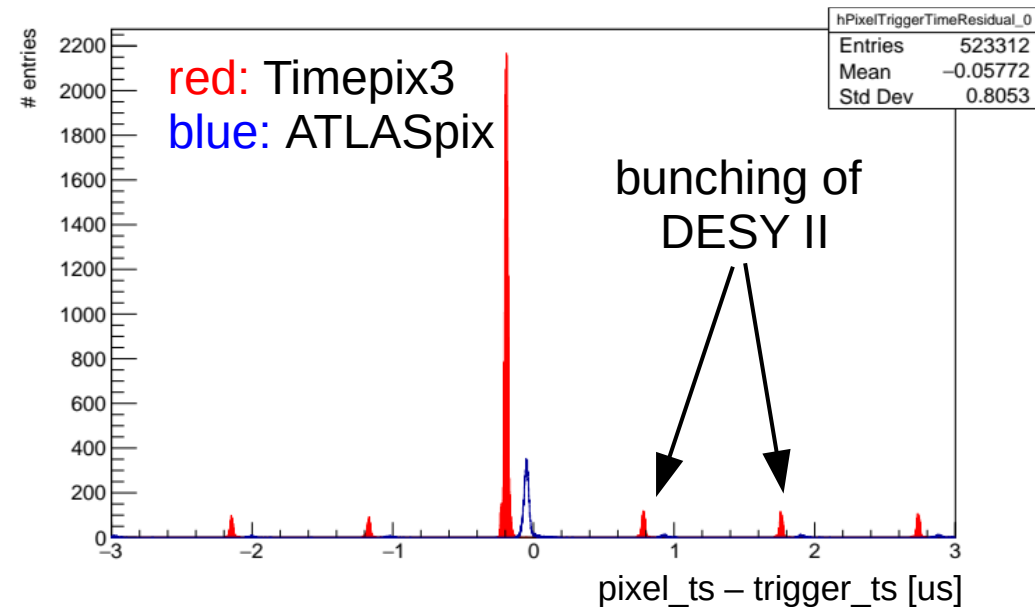
Status of the Analysis

- Data Quality Monitoring:
 - for all bias & threshold scan runs
 - hit timestamps
 - ToT spectrum
 - spatial correlations
 - time correlations

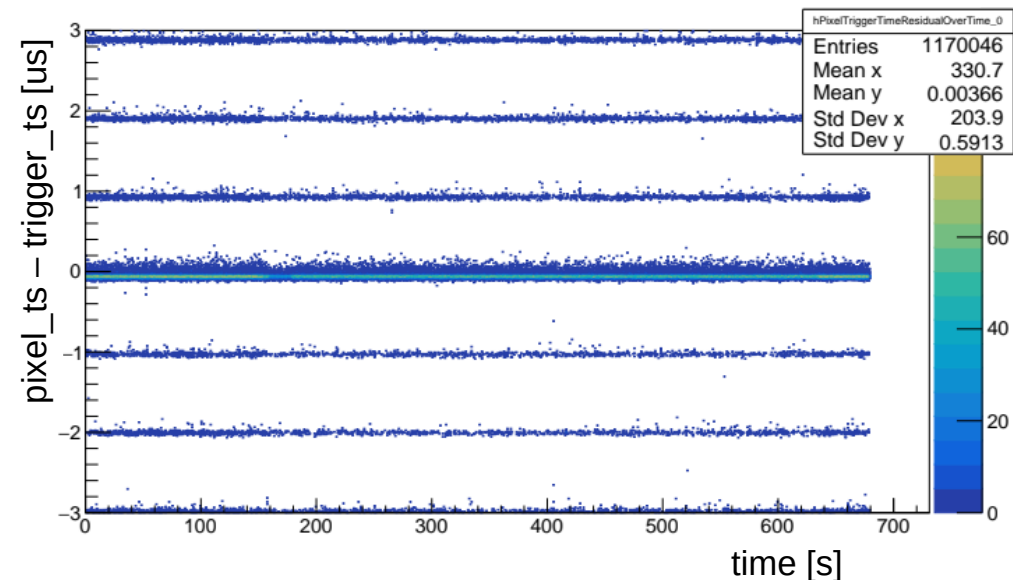
X correlation between ATLASpixon and Mimosa_2



time correlation between ATLASpixon/Timepix3 and 1st trigger



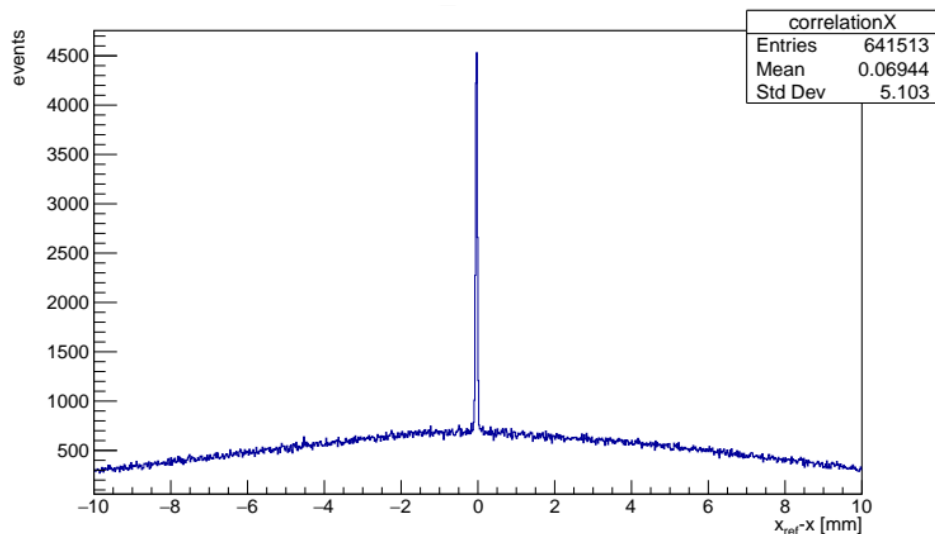
same as above over time for ATLASpixon



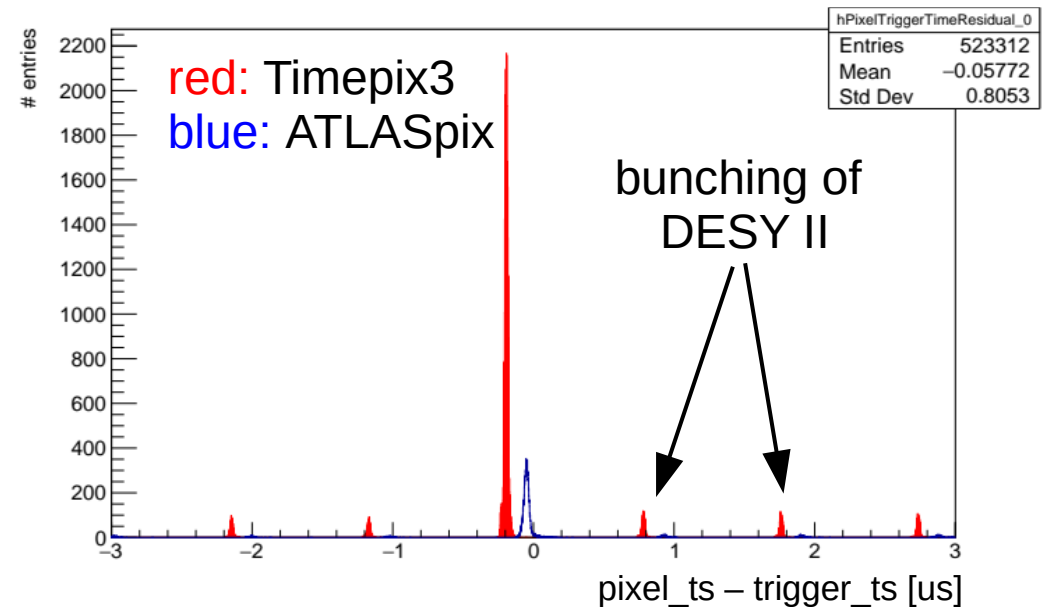
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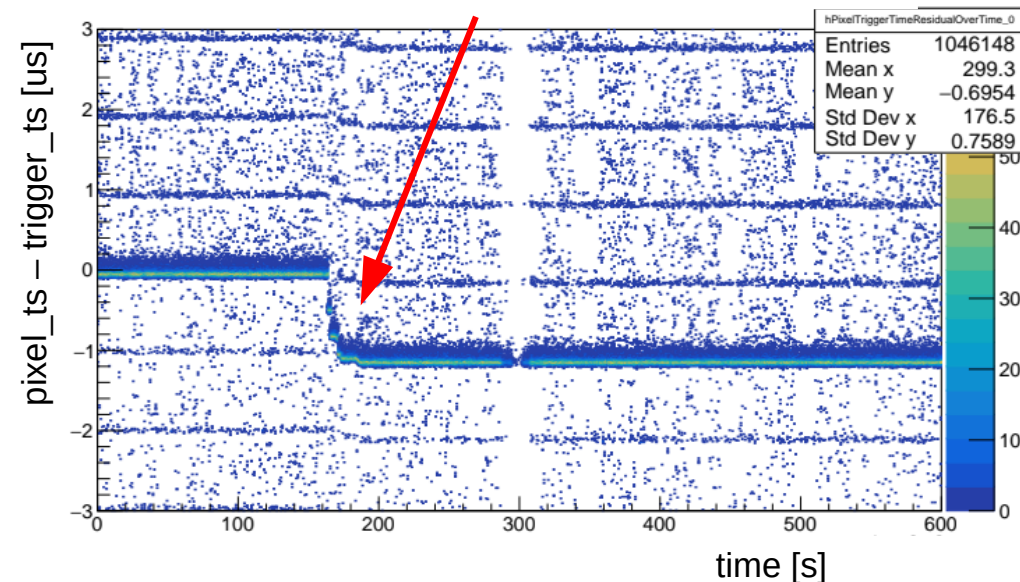
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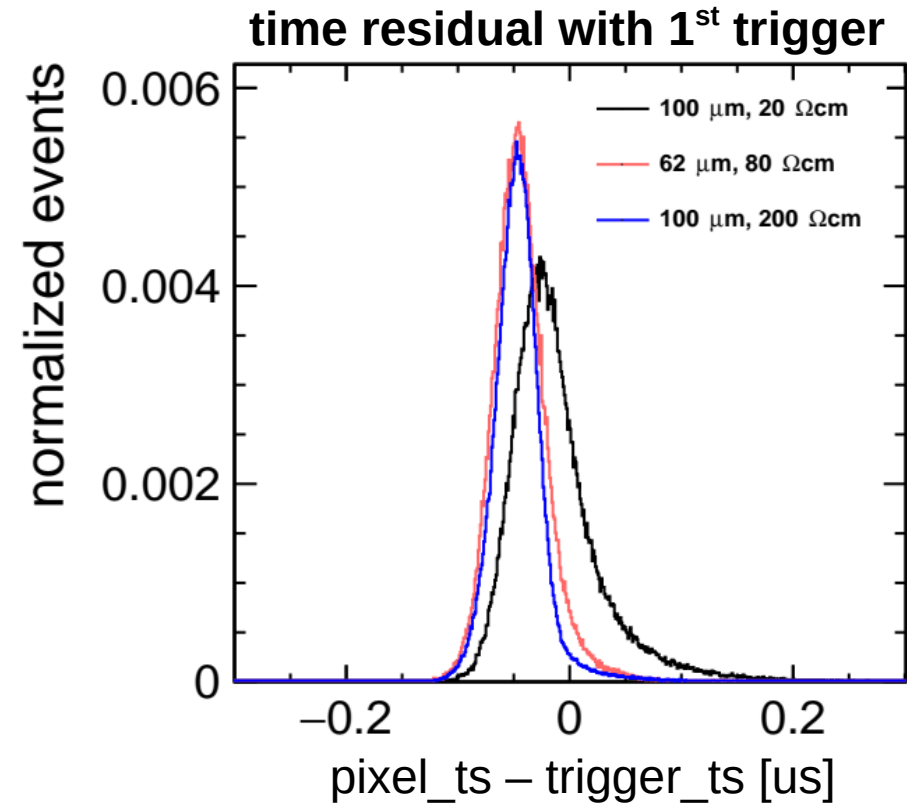
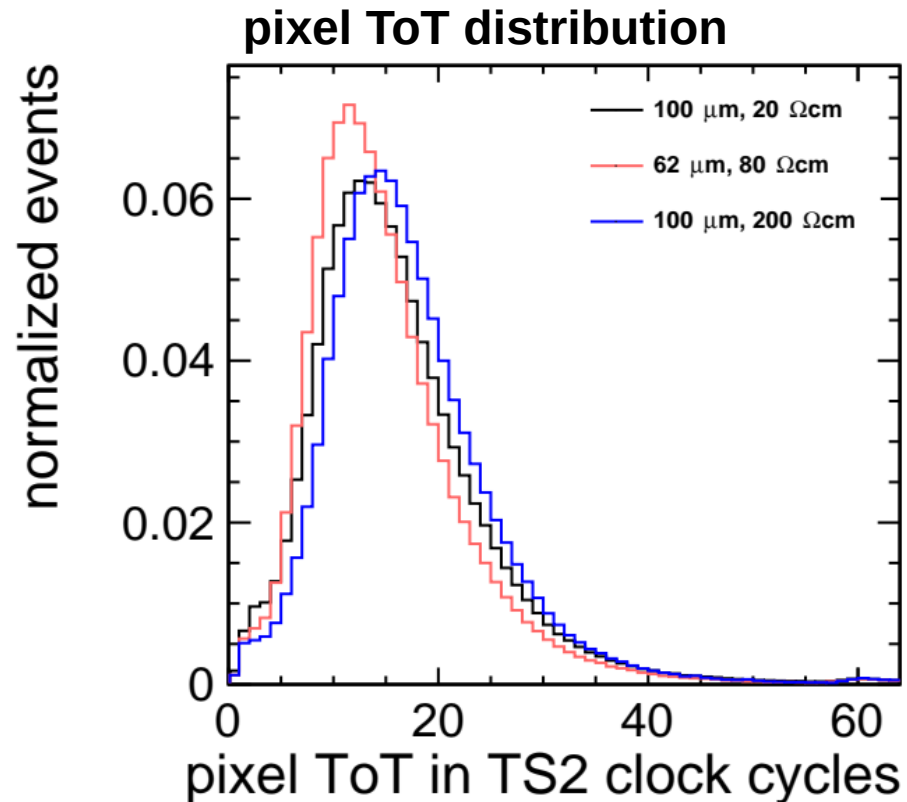


example of a **time jump** in ATLASpixon



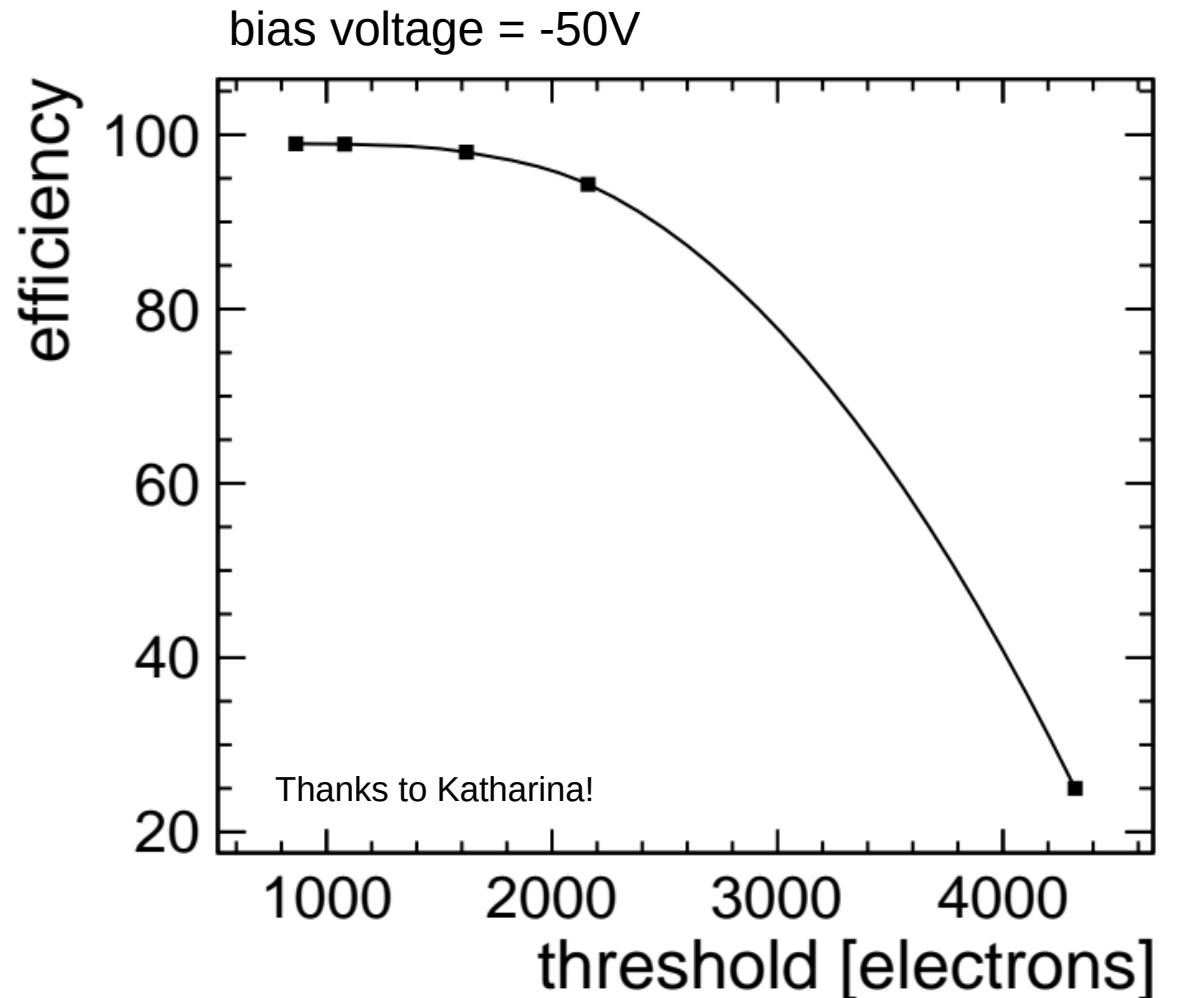
Status of the ATLASpix Analysis

- Comparison of different resistivities:
 - runs 715, 739, 877
 - bias = -50V, thres = 900 mV



Status of the ATLASpix Analysis

- threshold scan for 200 Ωcm :
 - tracking incl. Timepix3
 - shows expected behaviour
 - efficiency saturates at $\sim 98.98\%$
 - only first shot, no optimisation of cuts



Summary

Data Taking:

- successfully running with all subsystems
- stable run control
- automated threshold scans

Analysis:

- in full swing
- many improvements to Corryvreckan have been made + are in the pipeline
- first results show **good data quality** and expected device performance

Outlook

Data Taking:

- software integration: Keithley power supply
→ for automated bias scans
- **commissioning/data taking with CLICTD**

Analysis:

- jobsub on lxplus
→ faster systematic analysis of many runs
- compare different ATLASpix resistivities
→ interesting physics results expected
→ bias & threshold scan
→ timing performance