UNIVERSITY OF LIVERPOOL

ALIBAVA SYSTEMS

AIDA

A Portable Telescope Based on the Alibava System for Test Beam Studies

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Contents

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- Devices Under Test (DUT's)
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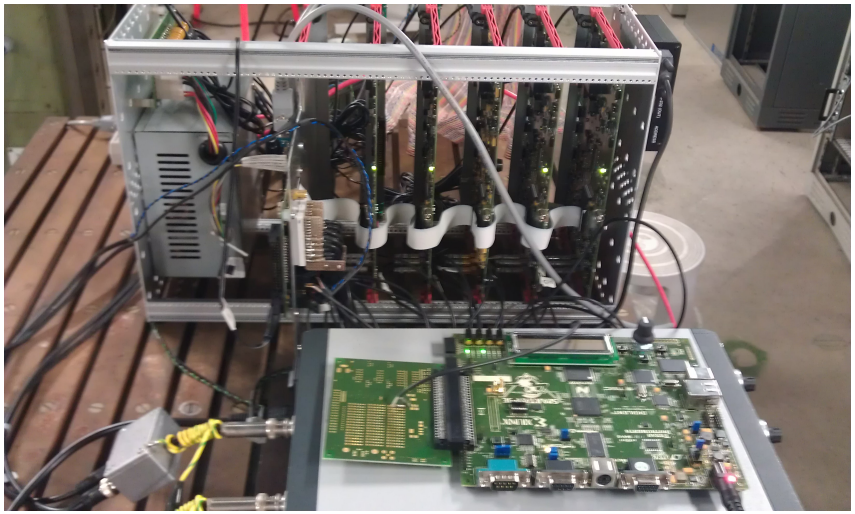
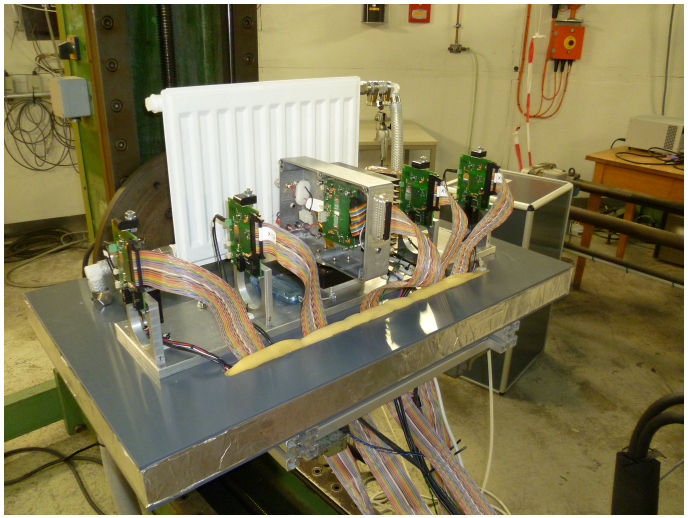
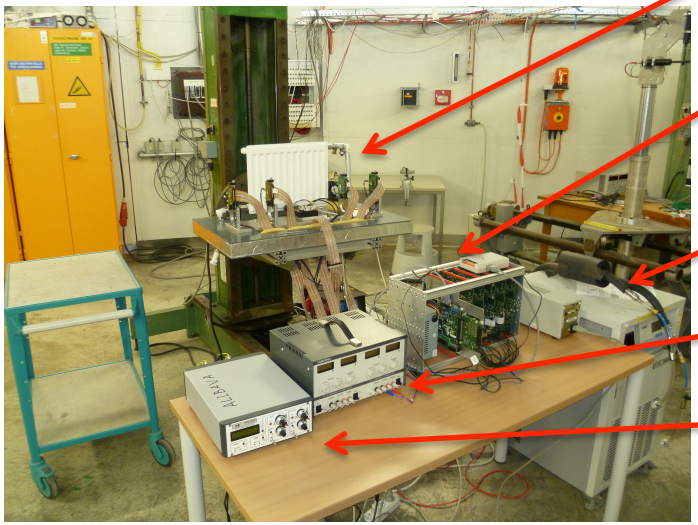
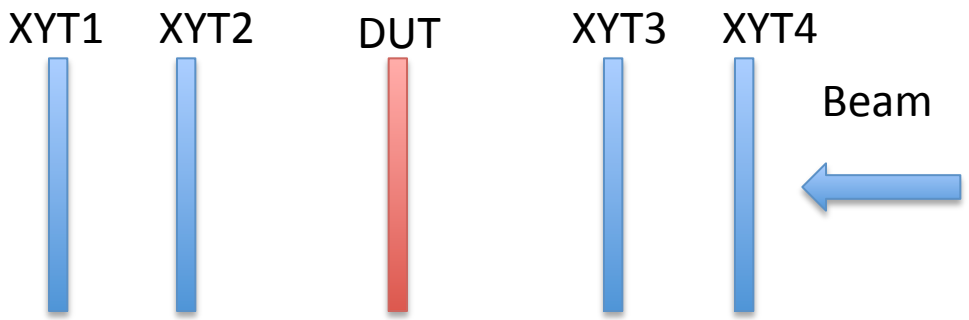


Alibava telescope setup







Telscope + mechanics

All electronics – Alibava boards (one for each XYT module) + Master controller FPGA baord

Chiller – cooling for peltier element + radiator

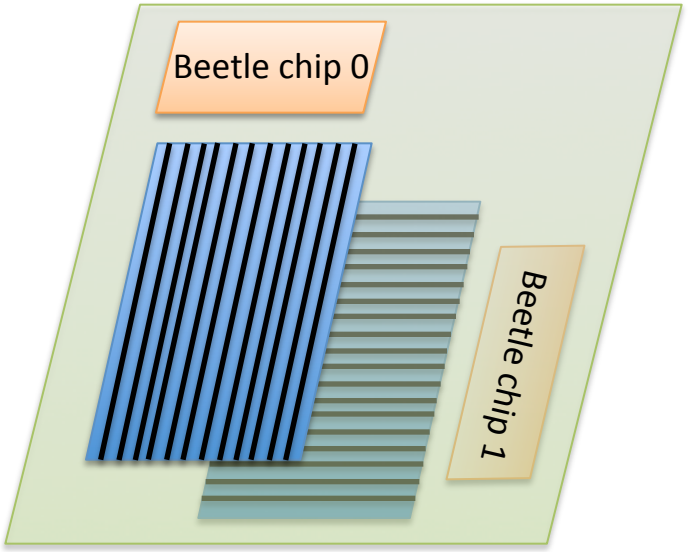
LV power supply for scintillators

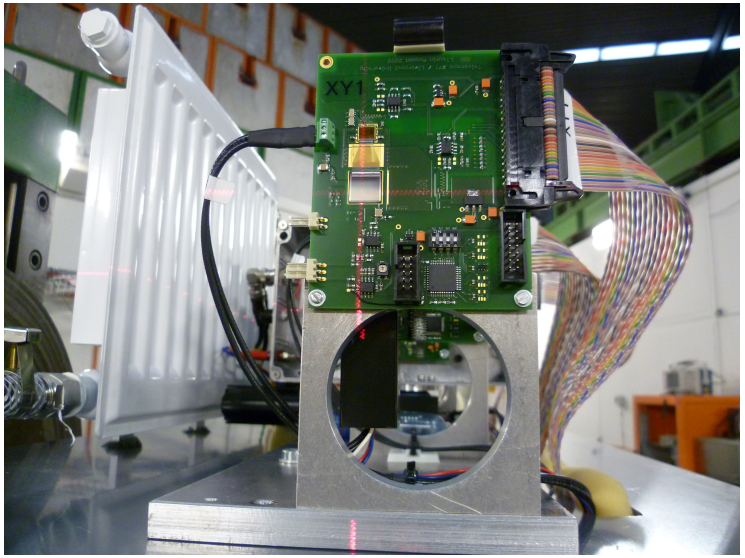
HV power supply for XYT modules + DUT

XYT module

XYT modules:

- 300um thick Micron strip sensors 1cm^2
- Sensors mounted back to back perpendicular to each other
- Current design uses only 2 beetle chips
- XYT upgrade will feature larger sensors utilizing more beetle chips
- Additional XYT stations are planned featuring micro-strip sensors





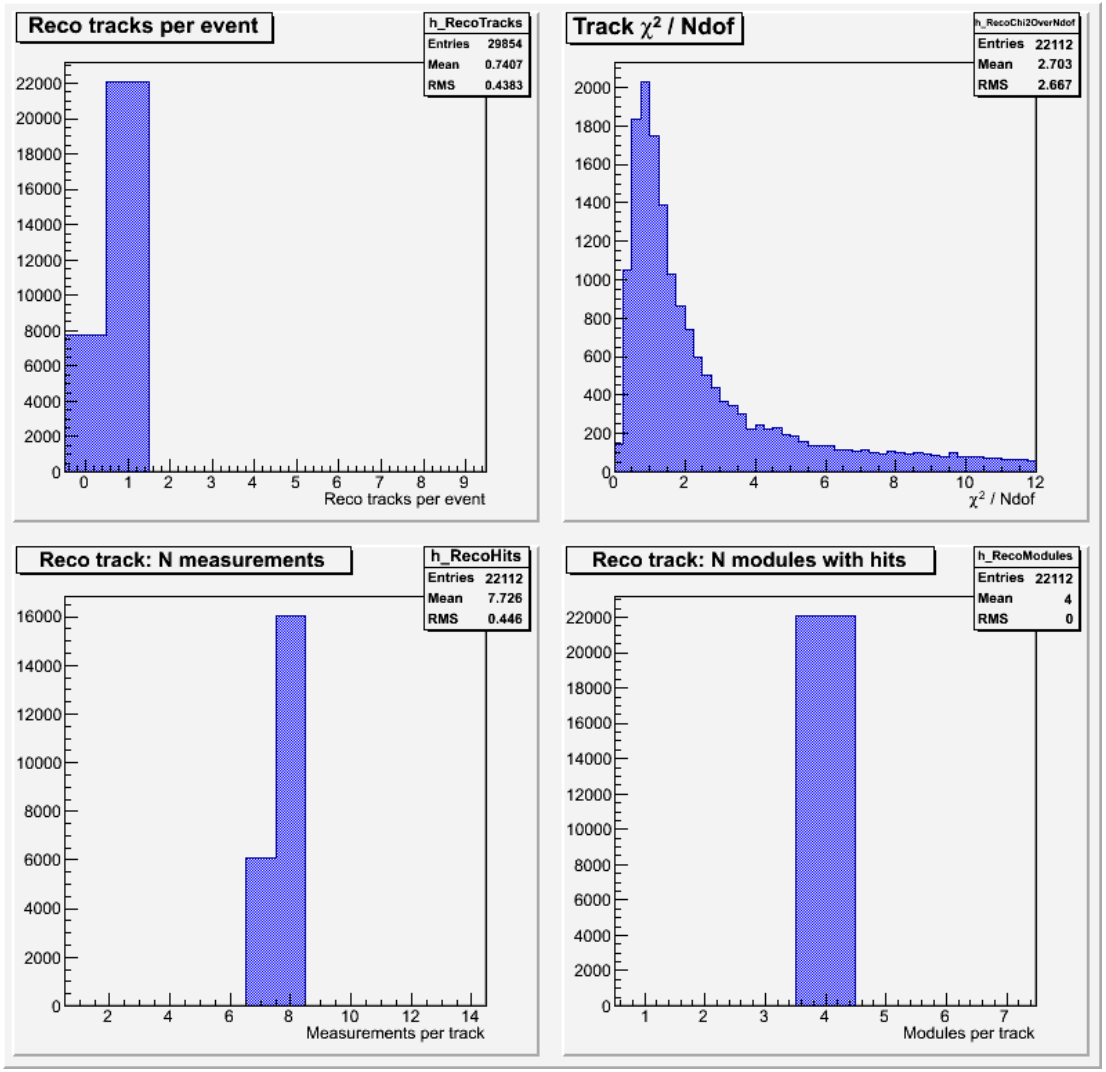
DUT's

Detector	Pitch/ width	Dose	notes	No.	Designation	Description	Thickness	Bulk resistivity
GLC06	P80 W60	1E15neq		#56	Liv-2935-7-1-13-L	Single-charged P+ junction implant, no diffusion	300µm	13kΩ/cm
GLC07	P80 W25	1E15neq		#57	Liv-2935-7-1-14-L	Single-charged P+ junction implant, no diffusion	300µm	13kΩ/cm
GLC08	P80 W60	5E15neq		#58	Liv-2488-7-1-13H	Single-charged P+, no diffusion	675µm	8kΩ/cm
GLC09	P80 W25	5E15neq		#62	Liv-2488-7-1-14H	Single-charged P+, no diffusion	675µm	8kΩ/cm
GLC10	P80 W25 I10	1E15neq	interstrip, biased	#48	Liv-2935-7-2-6-L	Single-charged P+ junction implant, no diffusion	300µm	13kΩ/cm

- DUT's are from Liverpool RD50 Charge Multiplication wafer
- Sensors have all been pre-tested in lab – see talk yesterday by Sven Wonsak
- Data taken at DESY 29TH April – 12th May, 5GeV electrons

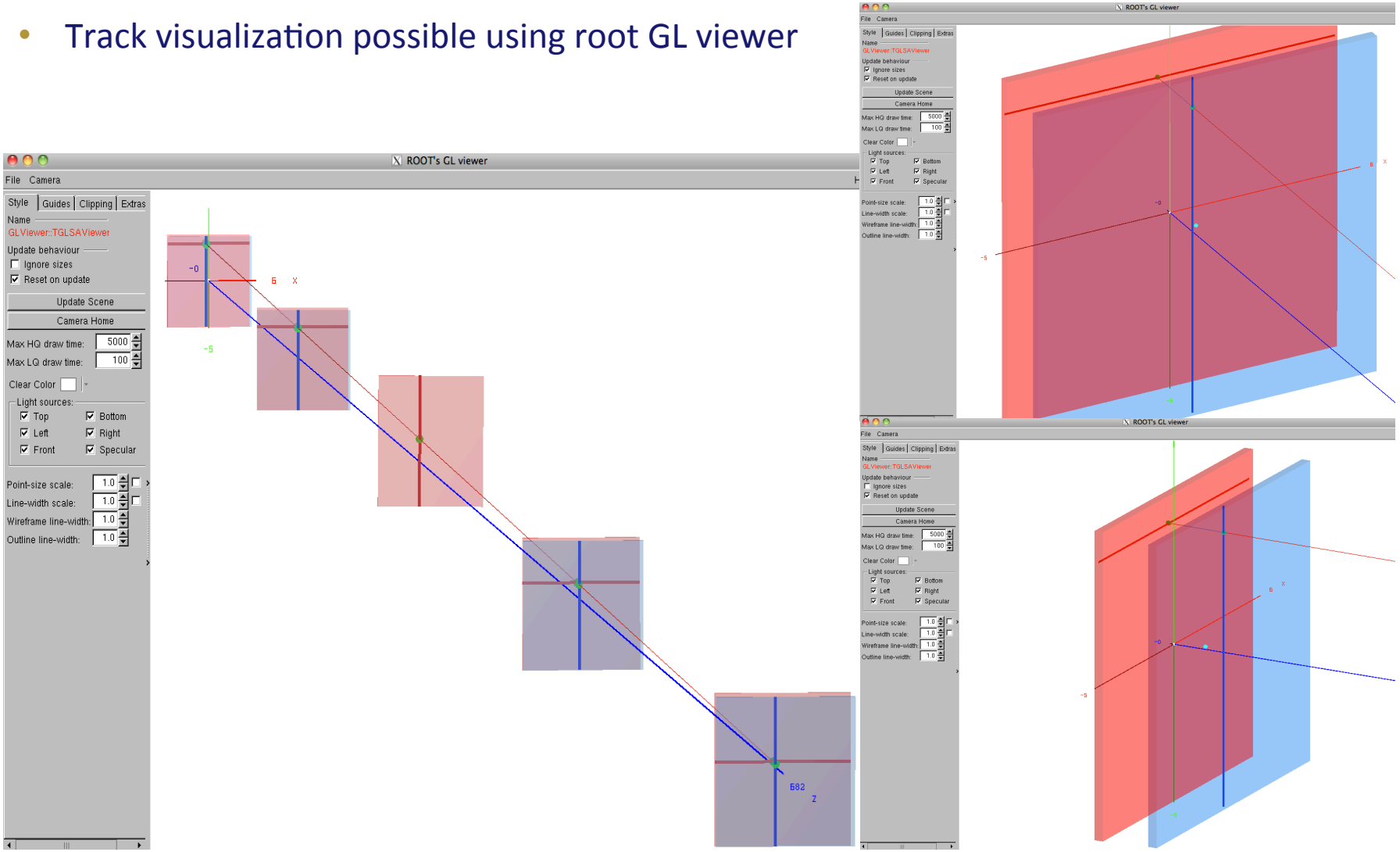
Track Characteristics

- Output from 100,000 evt sample
- DUT excluded
- Track candidates require 7 good plane hits
- Tracking and alignment software still under development
- Alignment has to be done by hand -> residual dependent auto alignment
- Material and dE/dx for tracking not fully implemented
- Straight tracks only



Track Visualization

- Track visualization possible using root GL viewer



All Hits - XYT stations

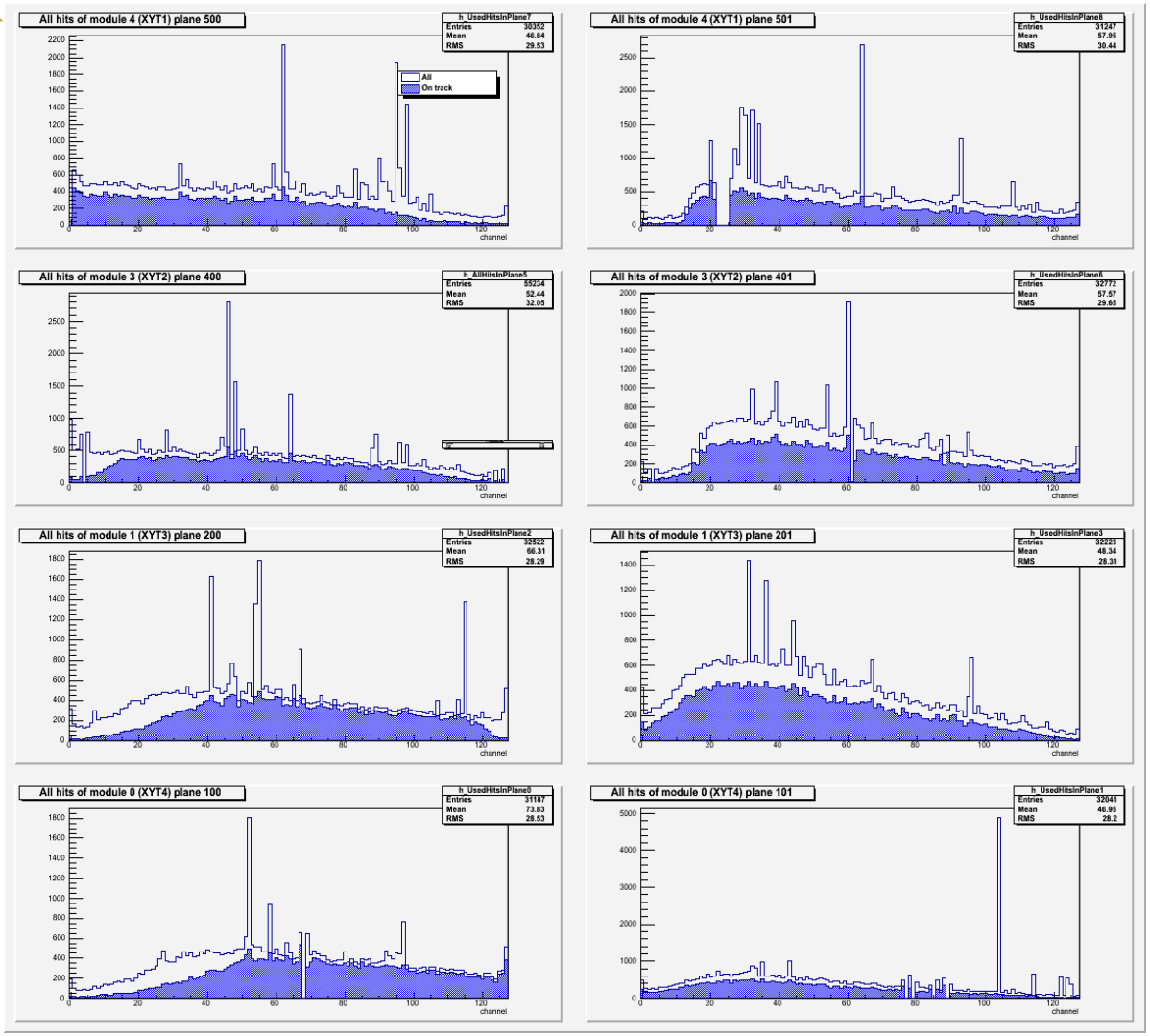
- Station refers to each silicon sensor
- White is all hits seen by XTY stations
- Blue shows ‘on track’ hits
- On Track refers to hits associated with tracks
- Usual Alibava/Beetle noise seen – noise suppression working well

BEAM EXITS

BEAM ENTERS

X station

Y station



All Hit Clusters - XYT stations

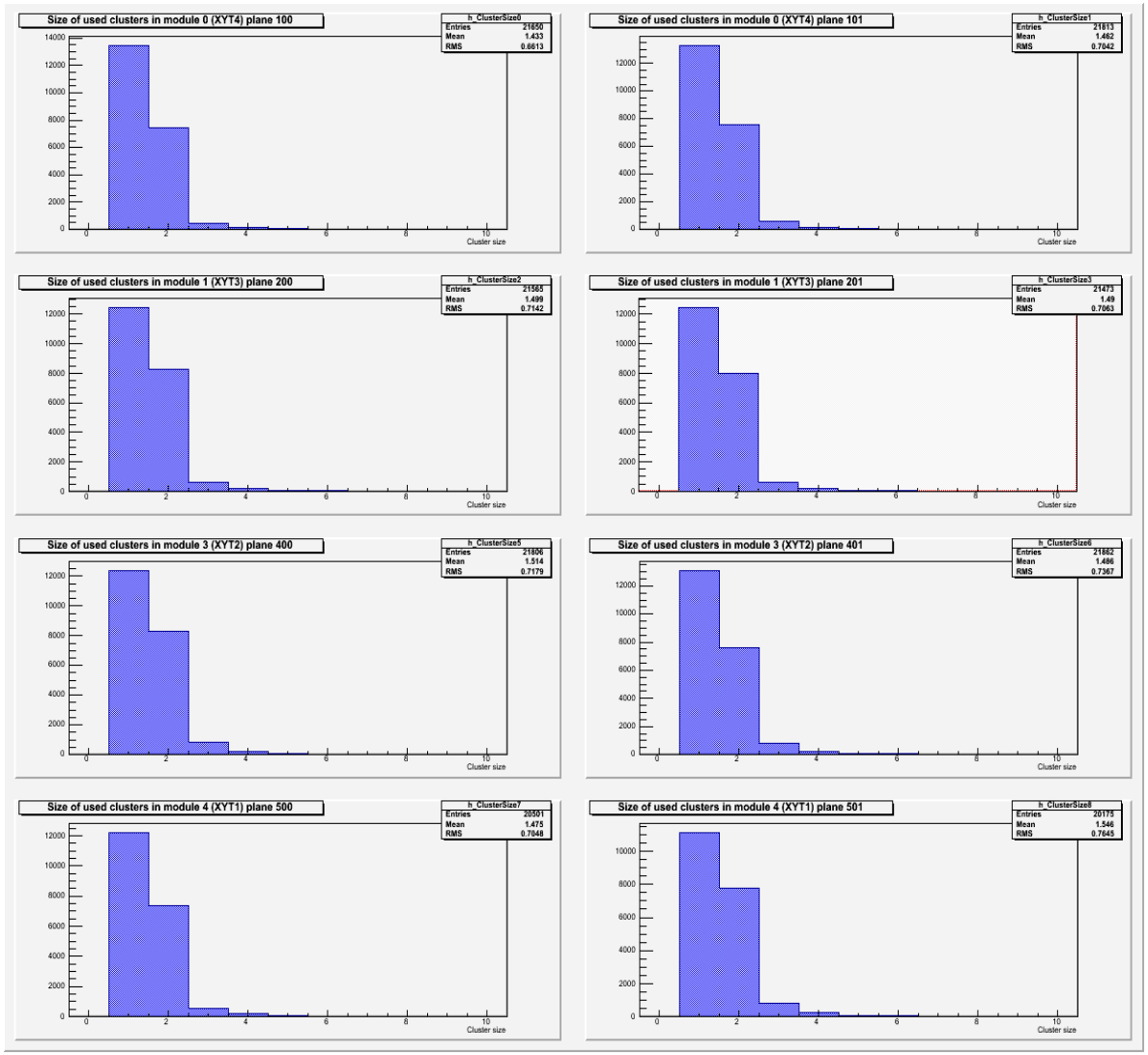
- Each station shows nearly identical cluster sizes

BEAM EXITS

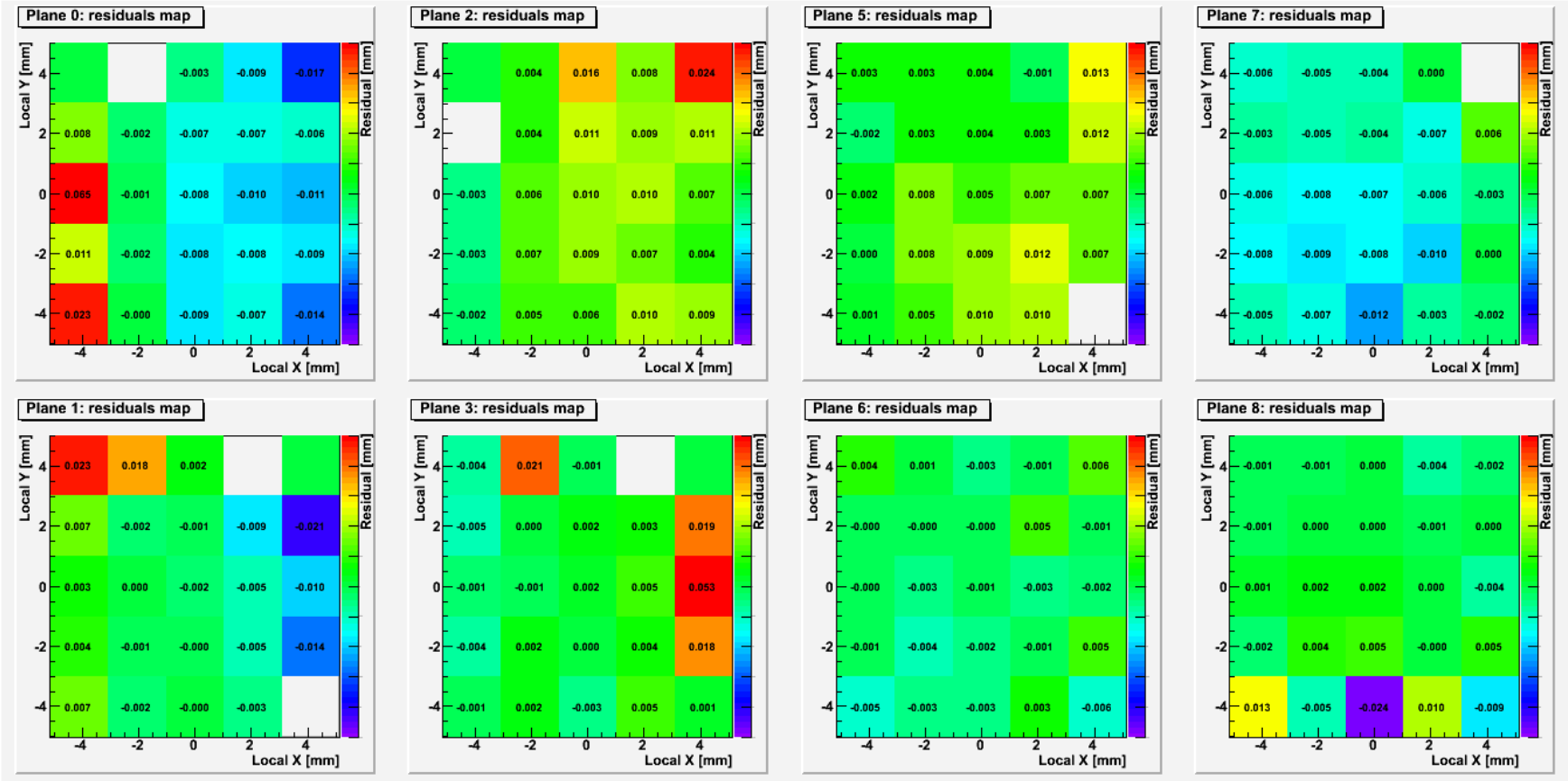
BEAM ENTERS

X station

Y station



Residual map – XYT stations

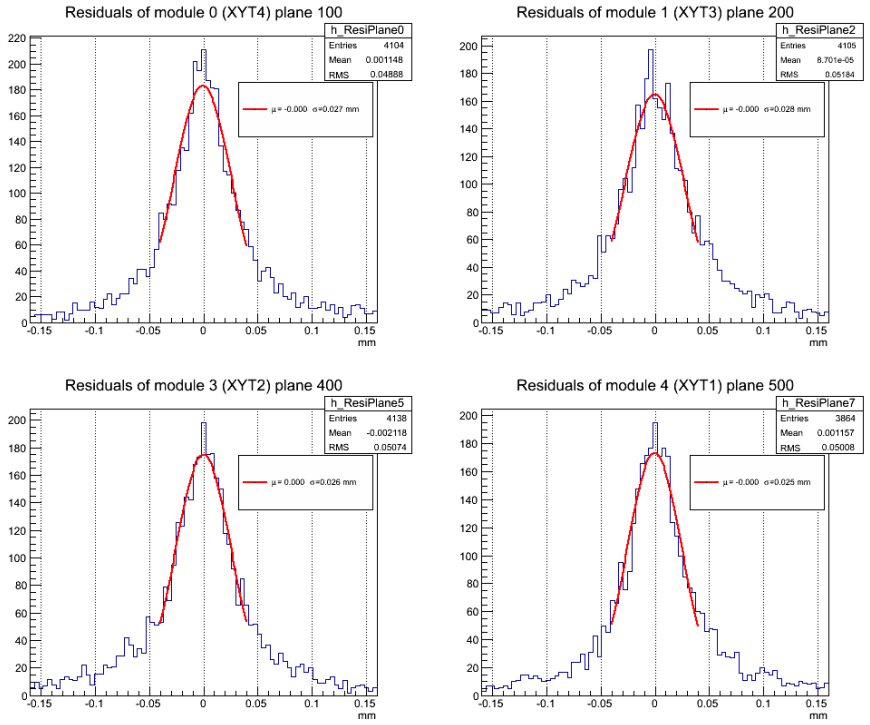


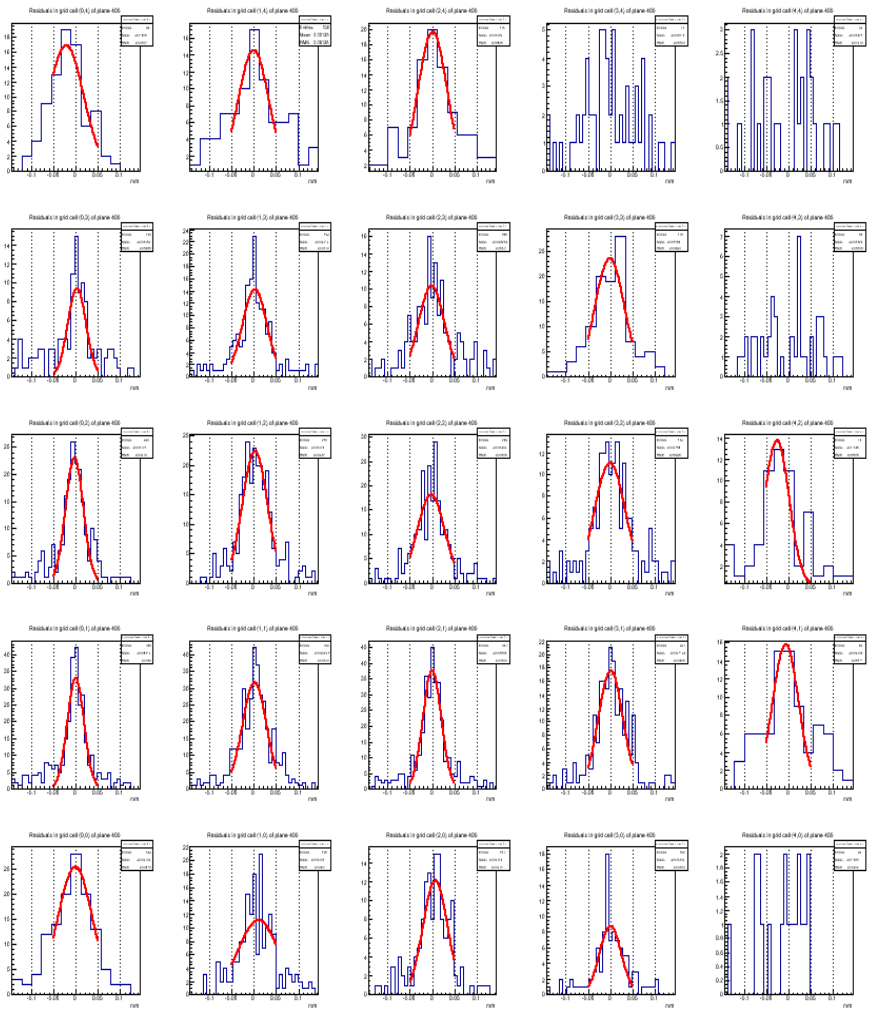
Residuals are calculated for each XTY module and each X/Y station

Inner module/station residuals calculated – 2mm^2 blocks

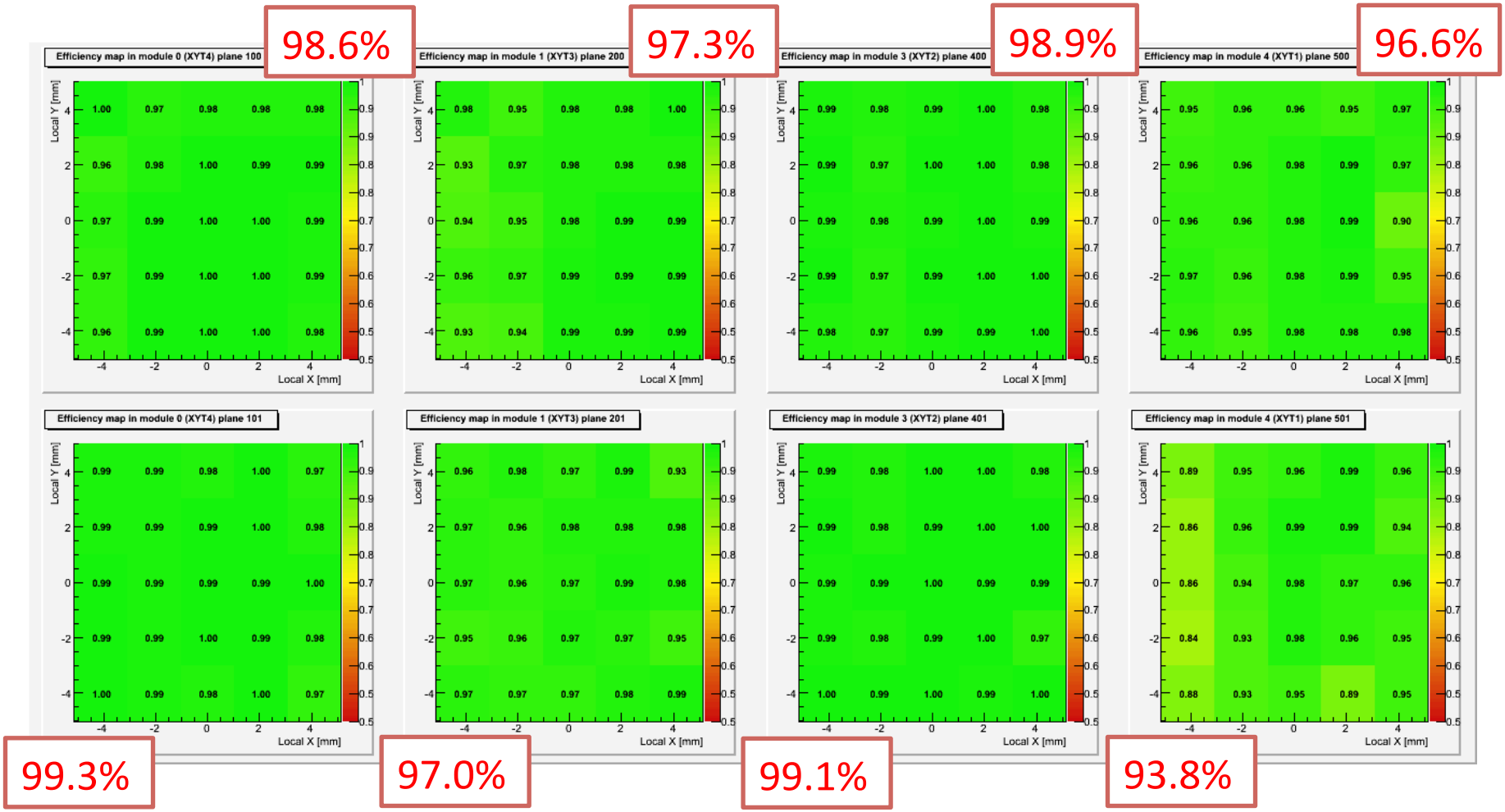
Residuals – XYT stations

- Left shows XYT module averaged residuals
- Right shows inner station residuals

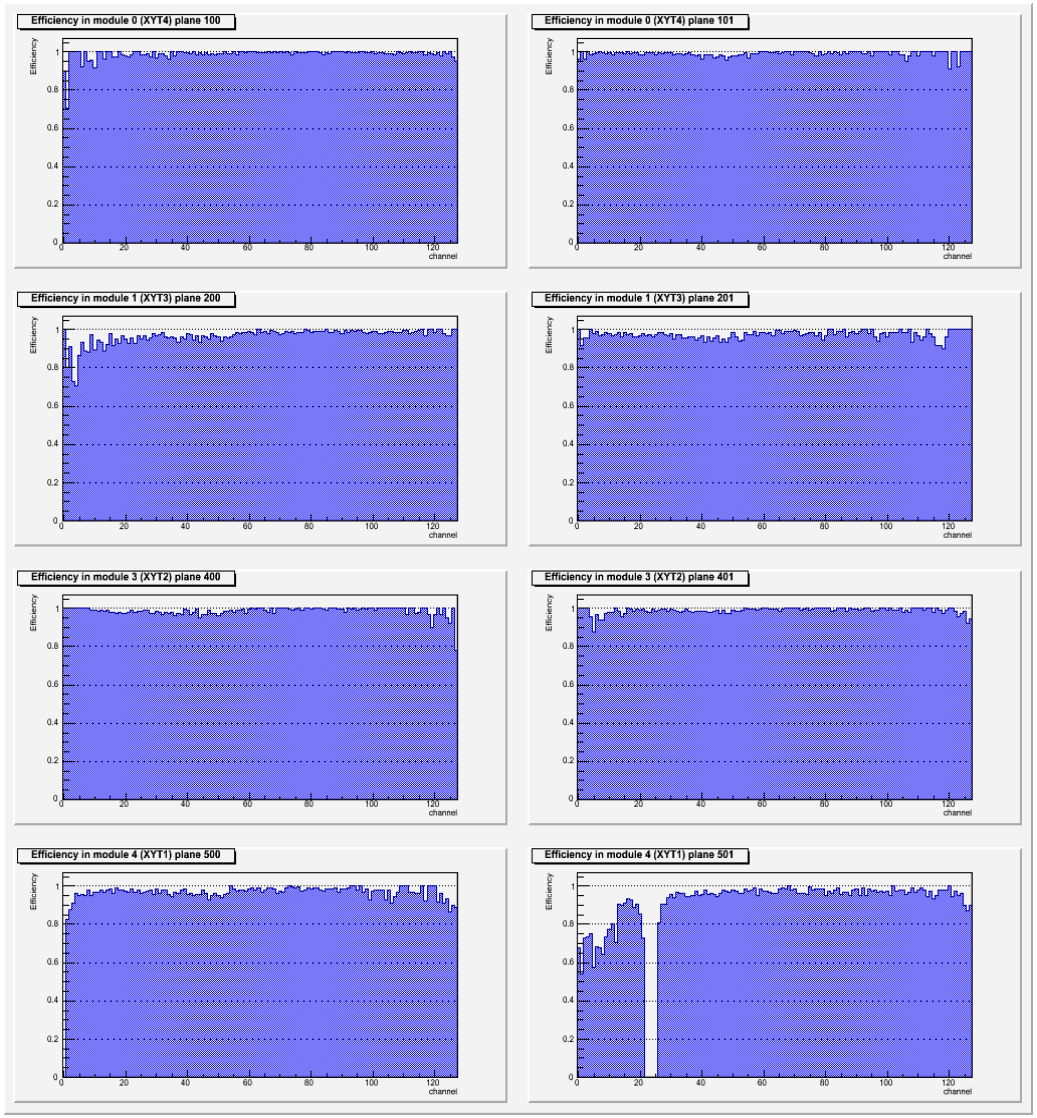




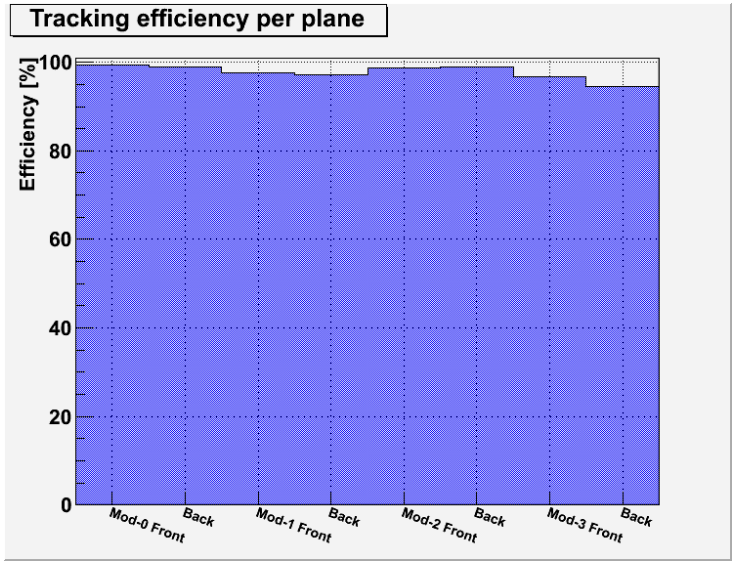
XYT Station Efficiency



XYT Station Efficiency



- Each X/Y station shows excellent efficiency
- Some inefficiency's seen at edges
  – beetle generally have more noise at ends channels
  – non perfect alignment with respect to beam



Cluster Charge – XYT stations

- All X/Y stations show similar charge collection with respect to each other
- Calibration from adc to electrons is ~150

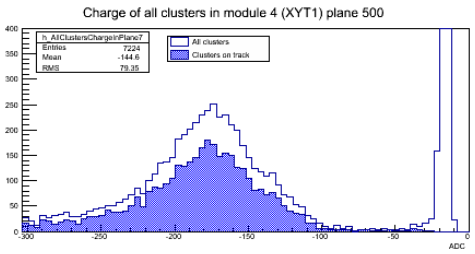
*each board has a slightly different calibration

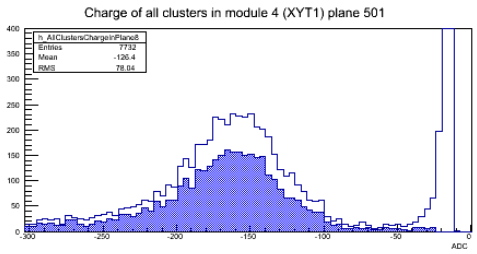
BEAM EXITS

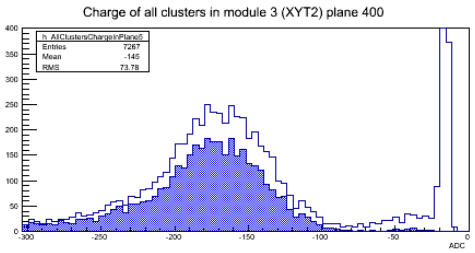
BEAM ENTERS

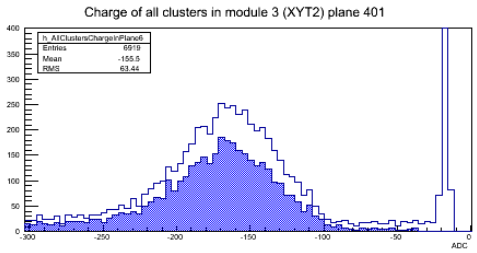
X station

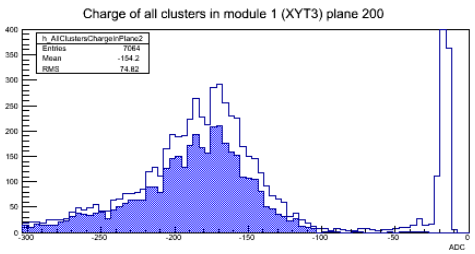
Y station

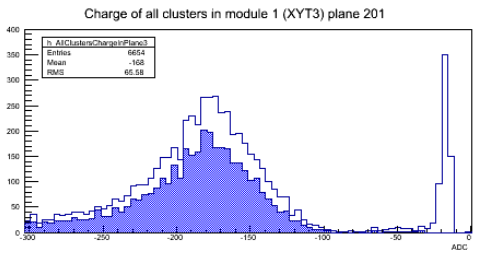


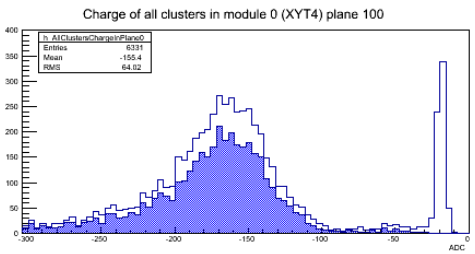


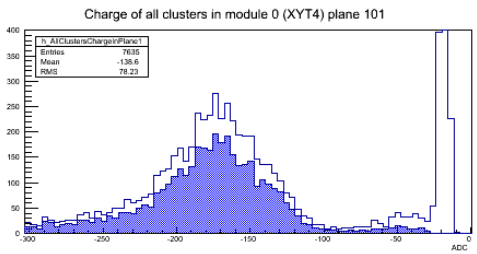












Cluster Charge – XYT stations

BEAM EXITS

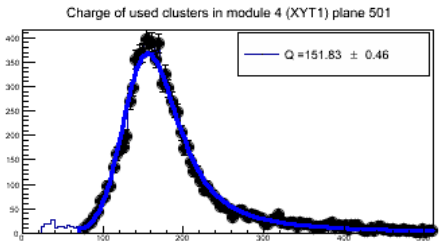
- All X/Y stations show similar charge collection with respect to each other
- Calibration from adc to electrons is ~150

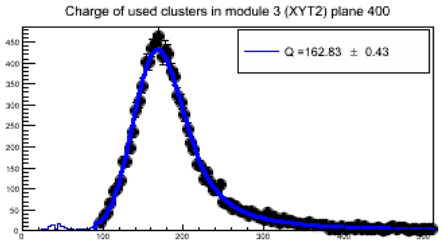
*each board has a slightly different calibration

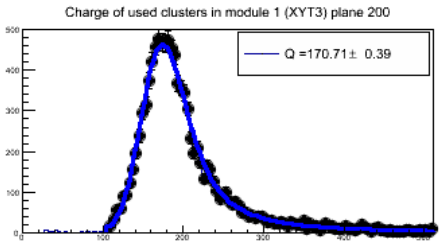
Yields ~23,000e

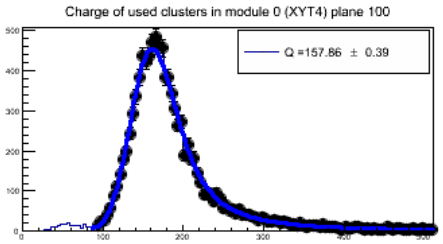
BEAM ENTERS

X station

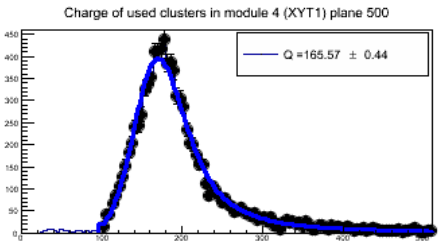


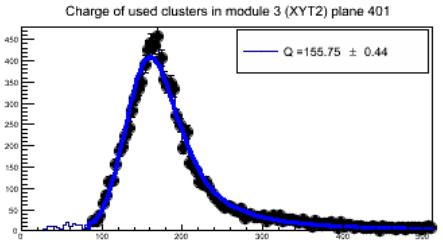


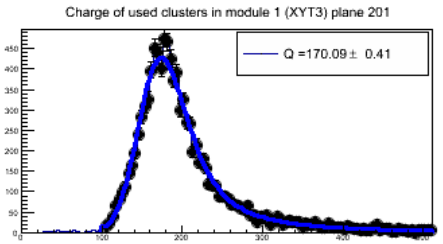


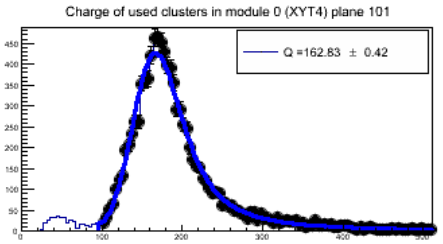


Y station

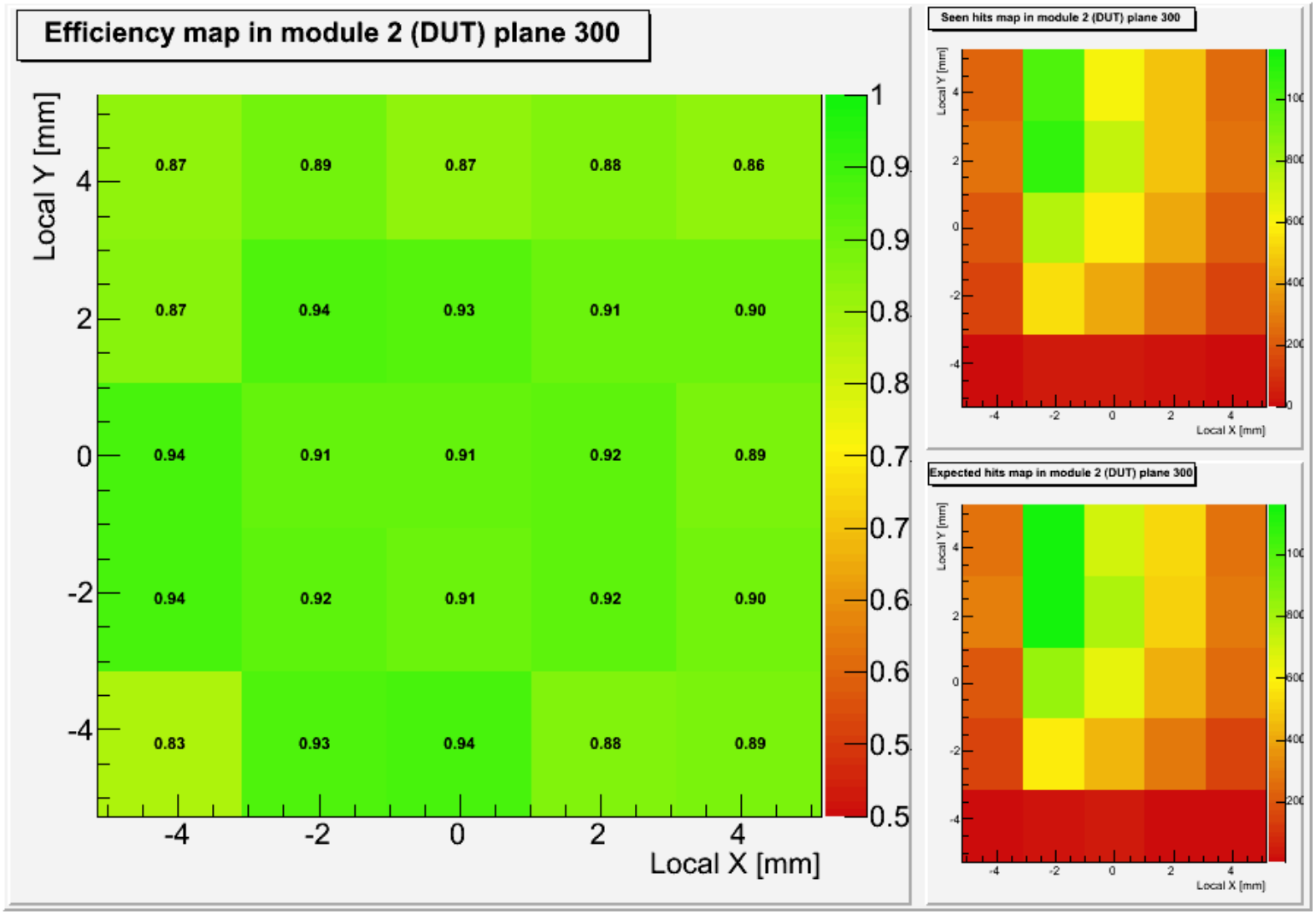






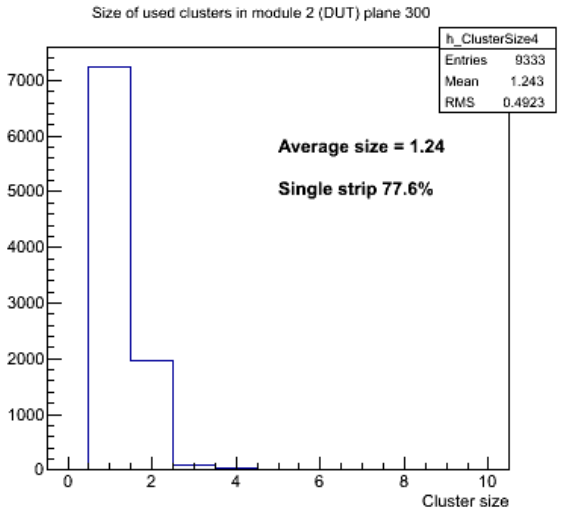


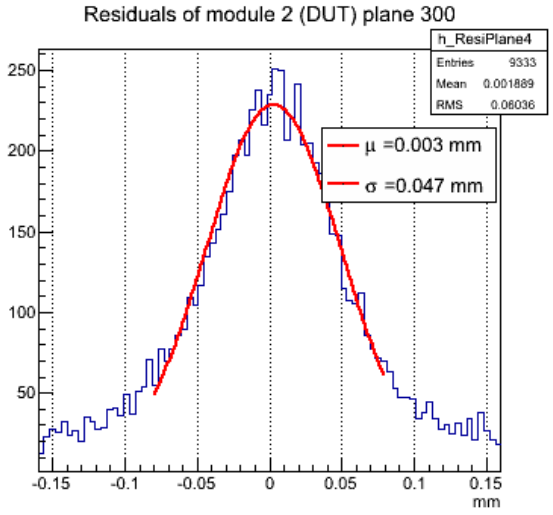
DUT Efficiency Map

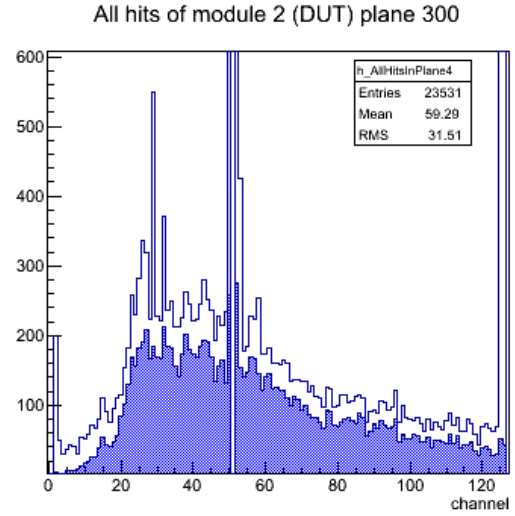


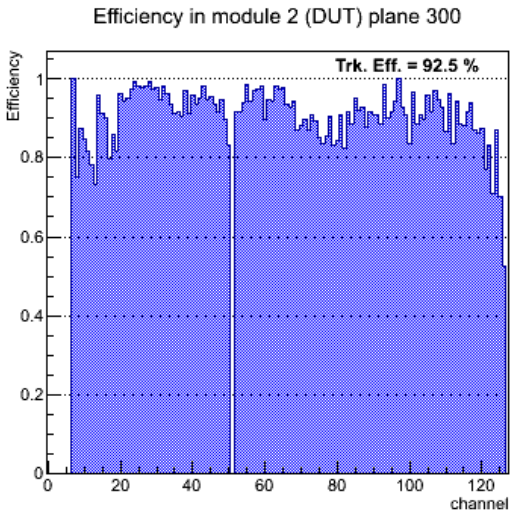
DUT - Overview

- Cluster size increased away from 1
- Don't expect very big cluster due to strip pitch/ width and low track multiplicity
- Noisy channels are removed and don't influence DUT results
- Average DUT hit efficiency – 92.5% - for the whole sensor

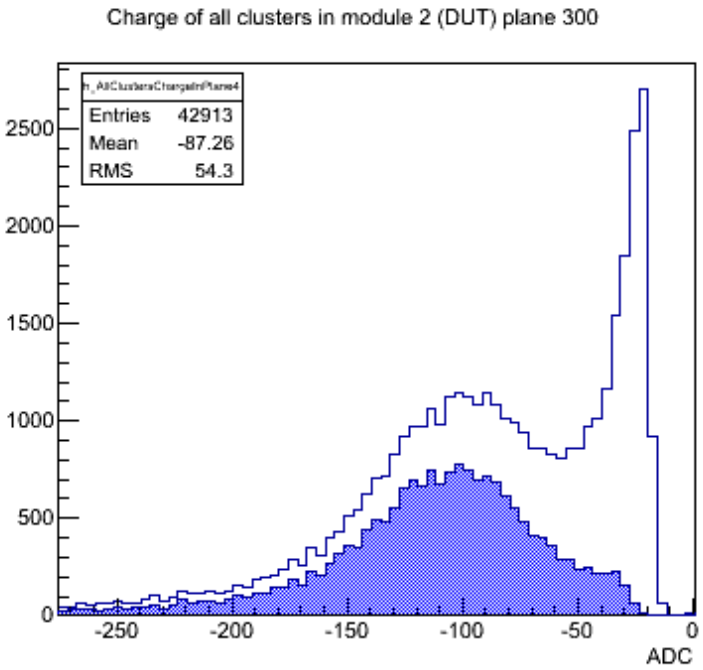


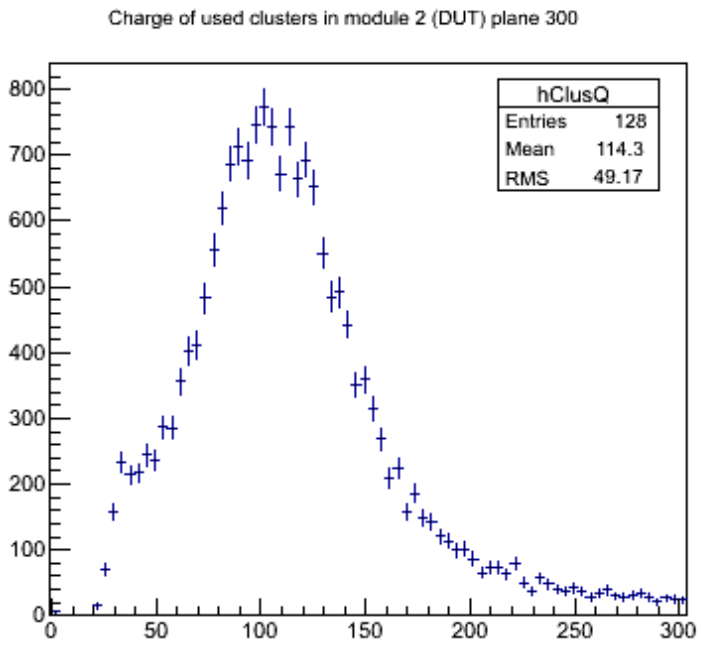






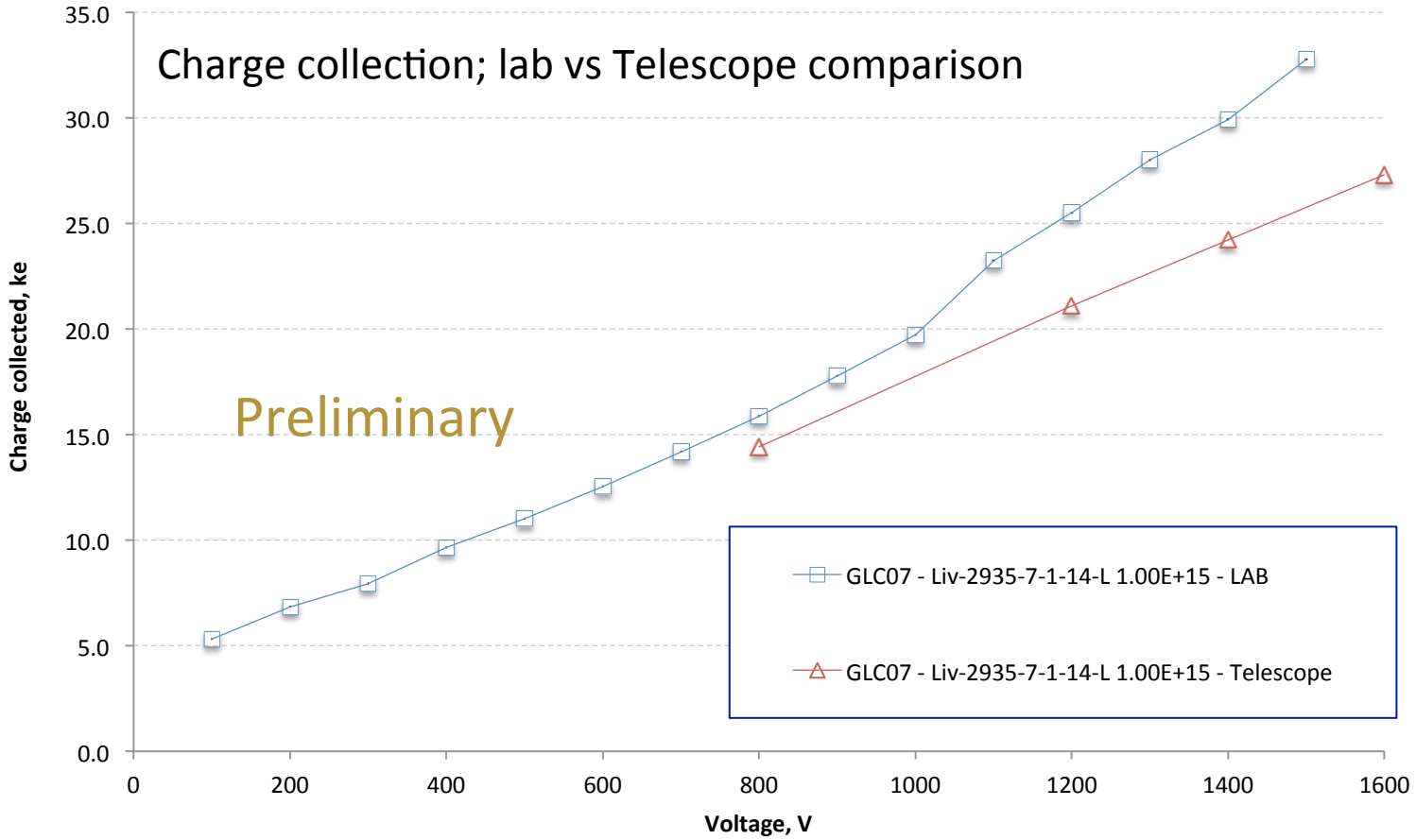
DUT - Overview





- Left shows full CC spectrum in white, and CC from used clusters in blue
- Right shows same spectrum but for used clusters only

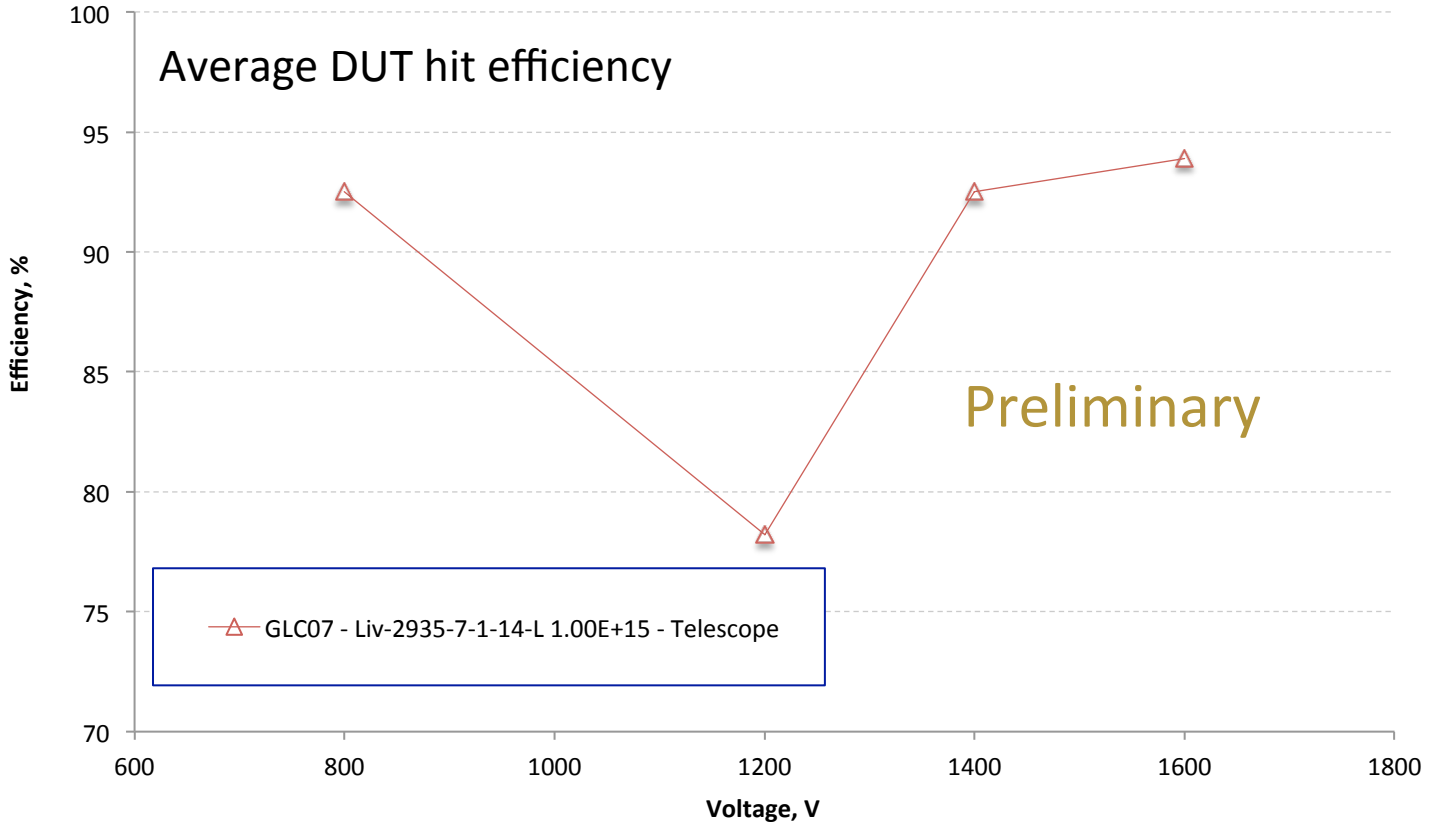
Charge Collection - Lab vs Telescope



- Discrepancy in telescope Charge collection due to change in exact adc -> e calibration
- Waiting for telescope to be shipped back to perform the calibration

DUT Efficiency vs Voltage

- Work still ongoing
- Alignment was done manually, poor efficiency at 1200V should increase with automatic alignment



Upgrade roadmap

- 6 module arms instead of 4 – each fully moveable
- Larger sensors 15-20mm^2 for standard XYT modules
- Micro-strip XYT modules planned
- Firmware changes – Allow greater than 2 beetles per Alibava board
  – Allow access to onboard 64mb per Alibava board for caching
- Allow multiple mounting points for DUT's

Summary

- Telescope performs well
- Upgrades to both sensors and mechanics to improve tracking and acceptance for DUT's
- Tracking and alignment software still being developed
- Next step is data analysis with inclined tracks (data exists)