# Test Beam results for Timepix3 assembly W43_I3 (ACF)

Adriana Simancas, May 20th, 2021

HELMHOLTZ RESEARCH FOR GRAND CHALLENGES

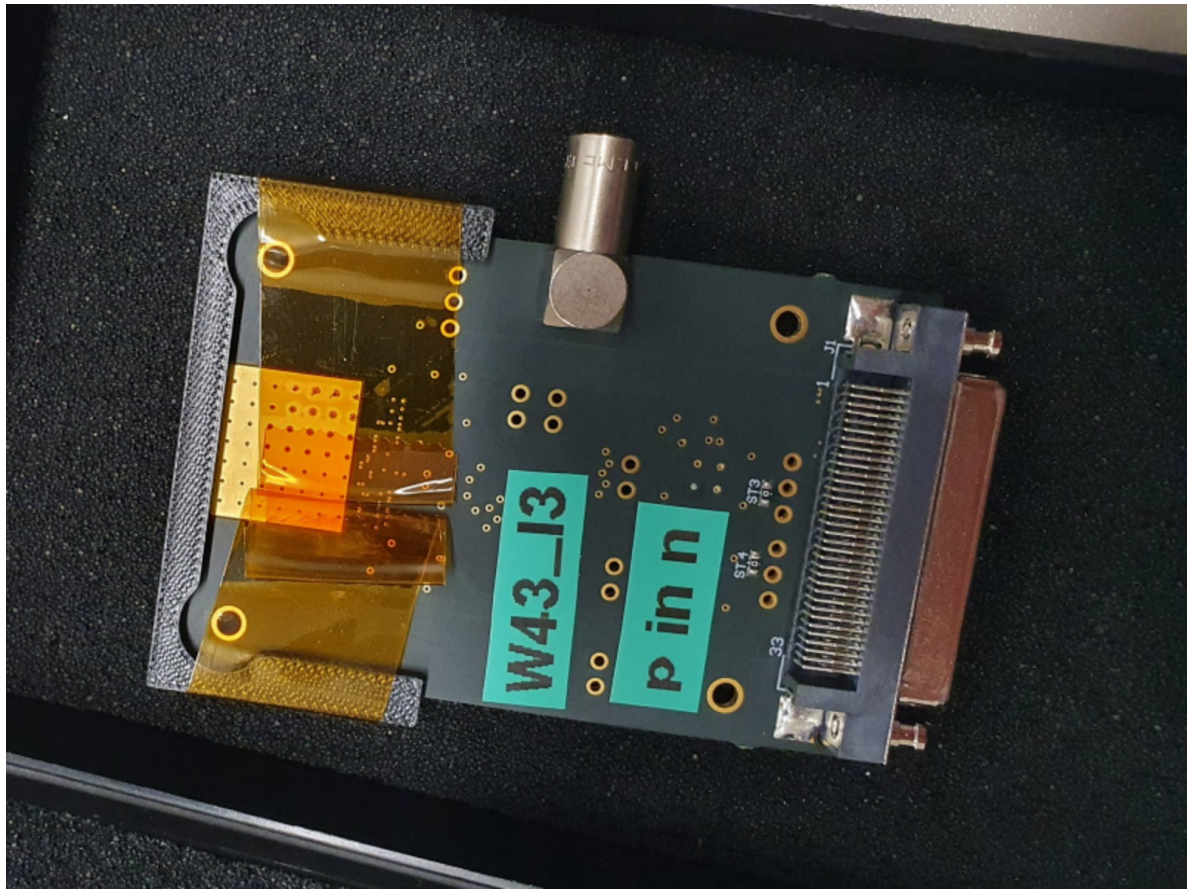
DESY.

UNIVERSITÄT BONN

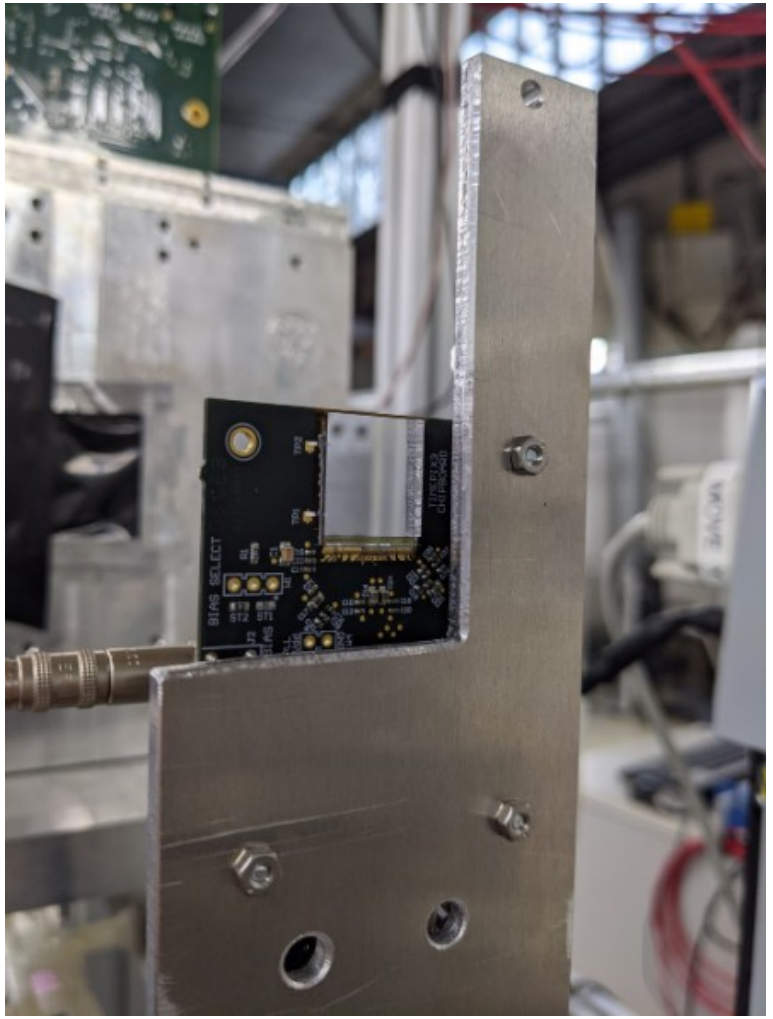
DESY.

# The Sensor

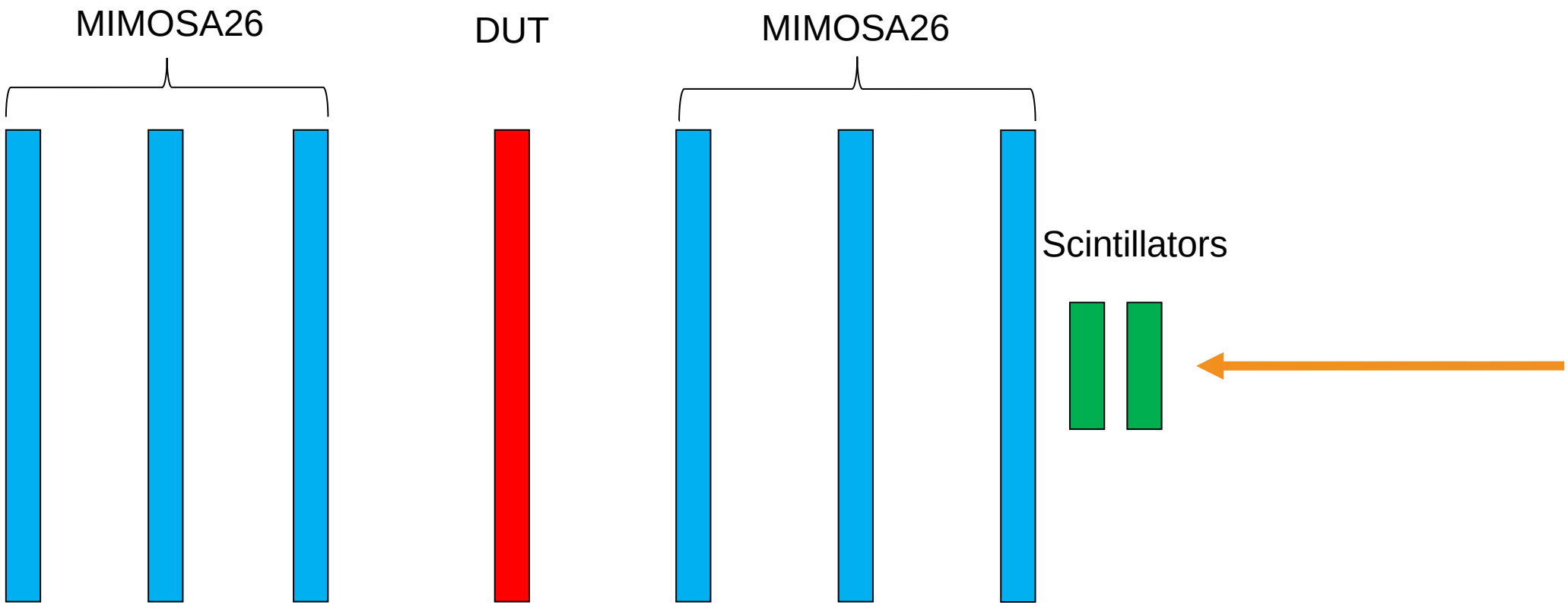
## Timepix3 assembly W43_I3




- P-in-N sensor
- 300 µm thick
- ACF bonding

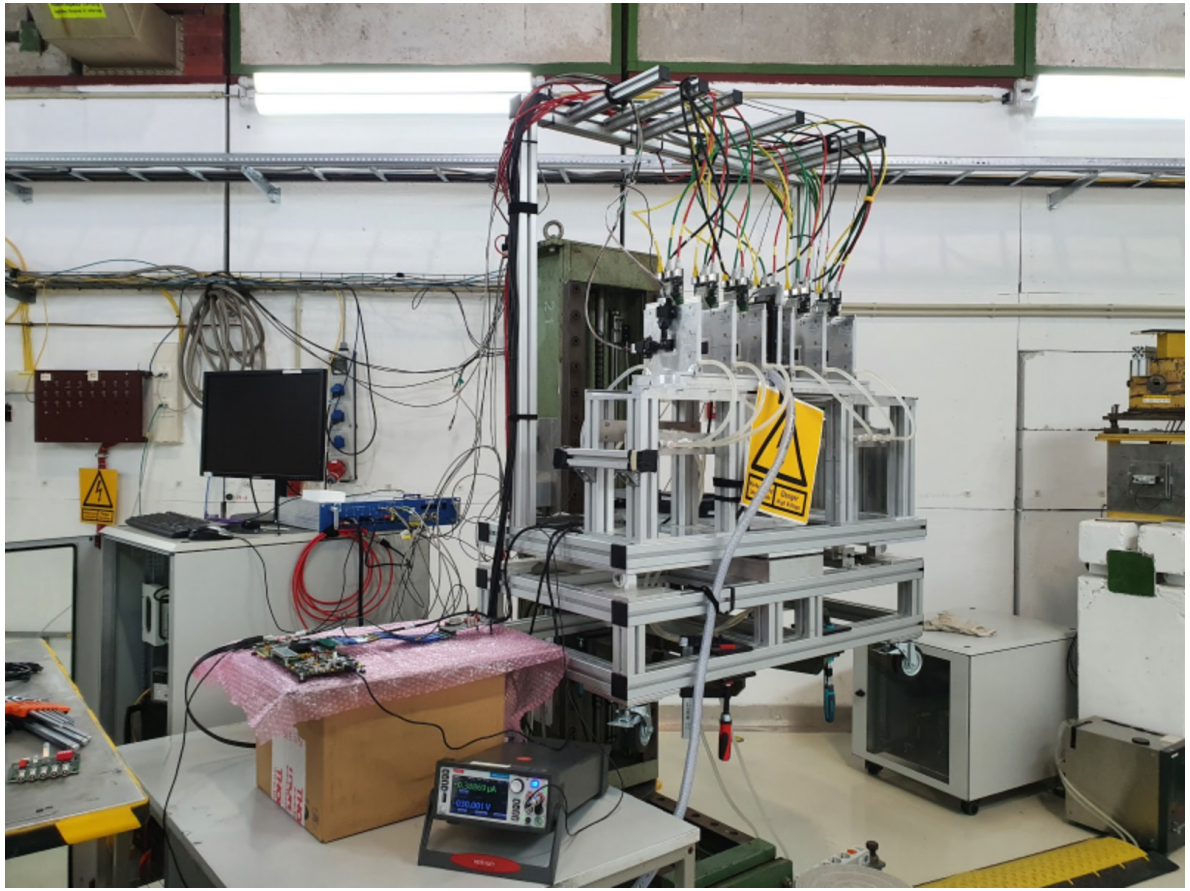


# Test Beam Setup

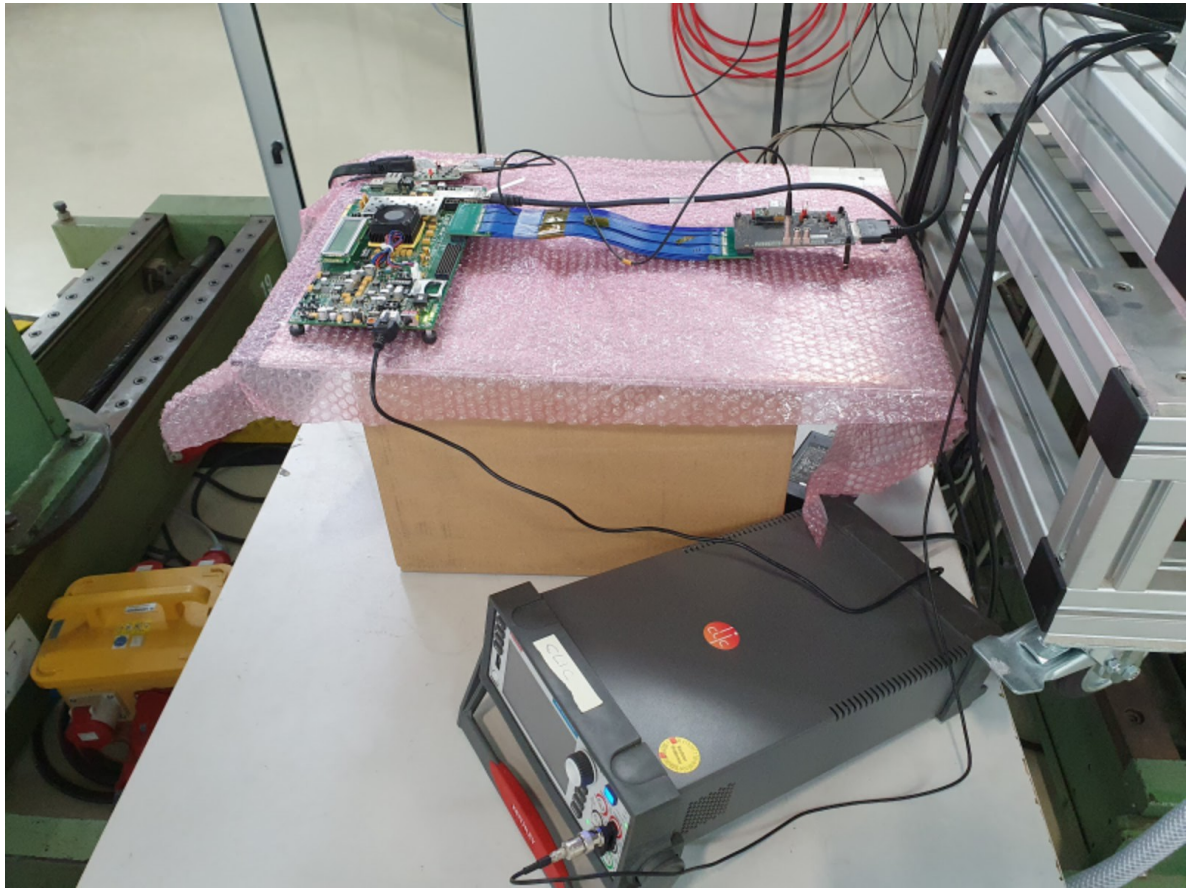


# Test Beam Setup

DESY II Test Beam Facility, beam line 24 @4.6 GeV.



Power supply for sensor, control and readout electronics.



# Test Beam Setup

## Geometry 2

- Fixed plane

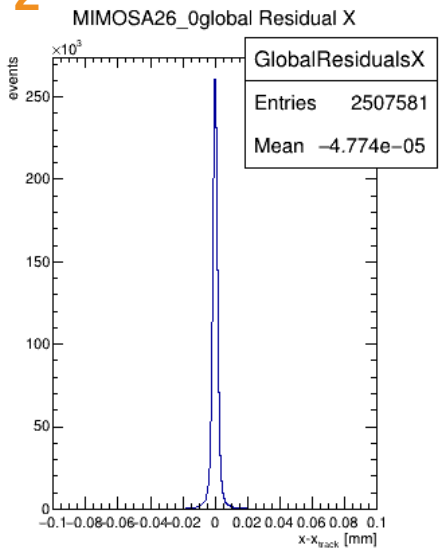
## Geometry 4

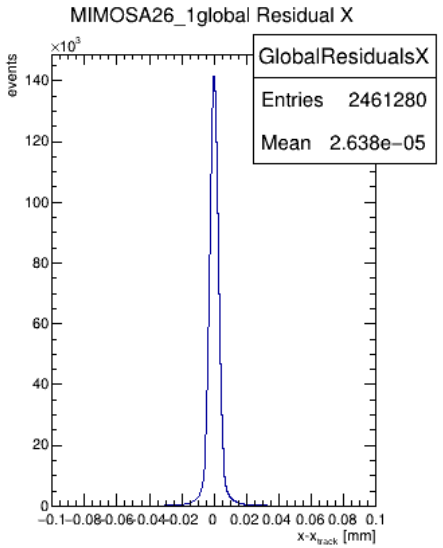
- Rotational stage, but without rotations

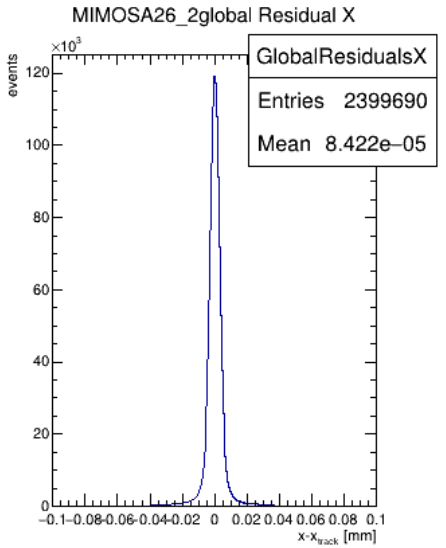
# Telescope Alignment Results

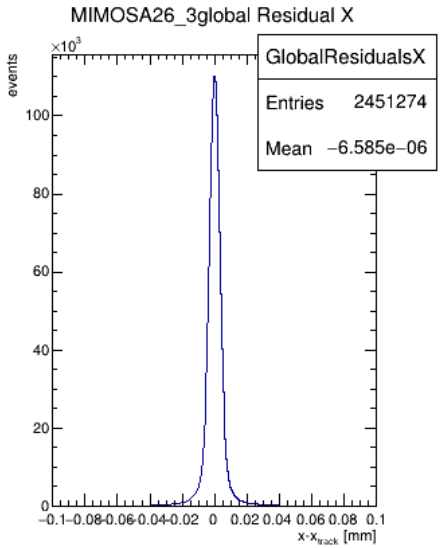
## Geometry 2

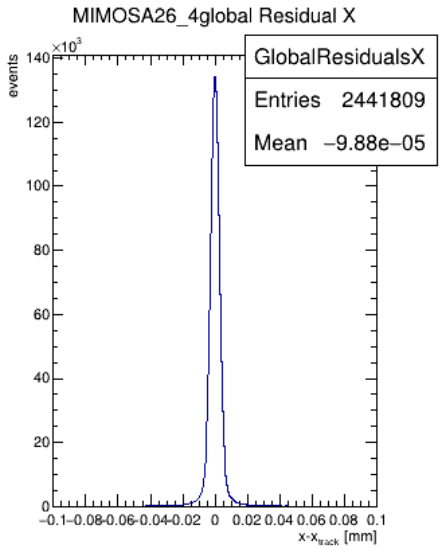
Reference Plane

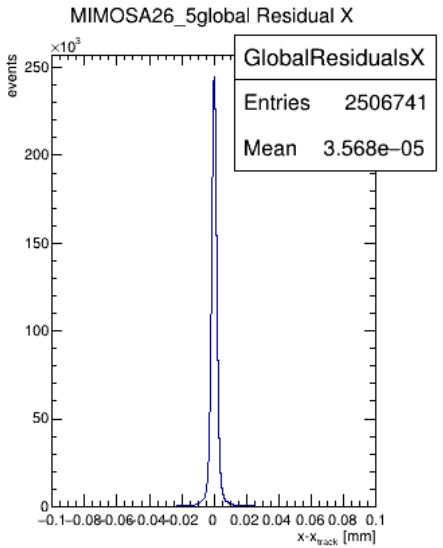


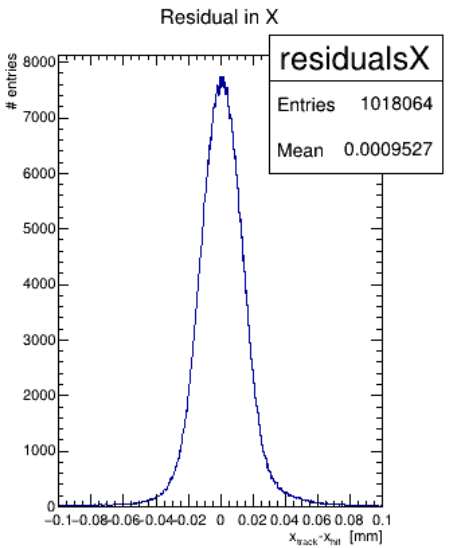



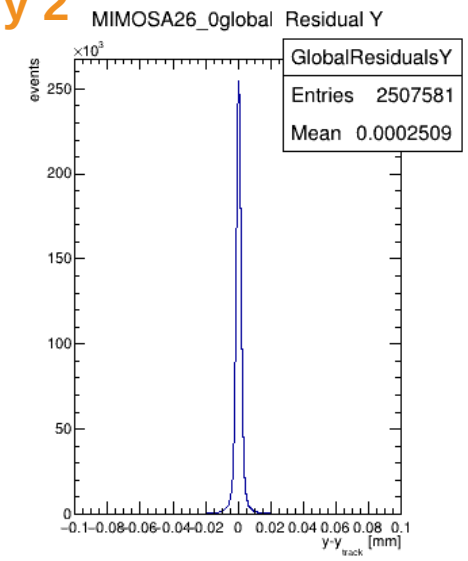



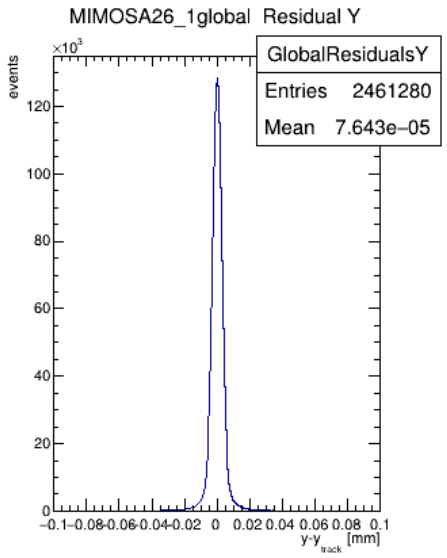



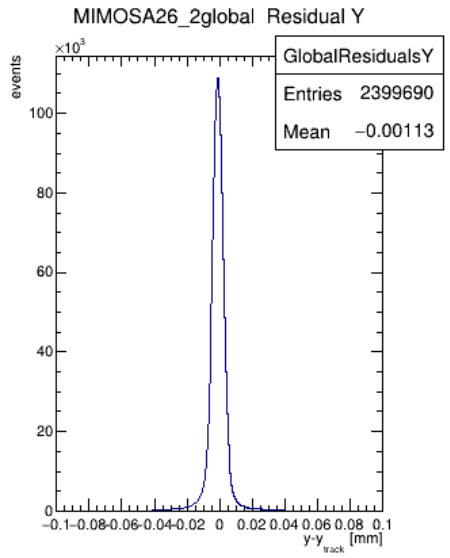
# Telescope Alignment Results

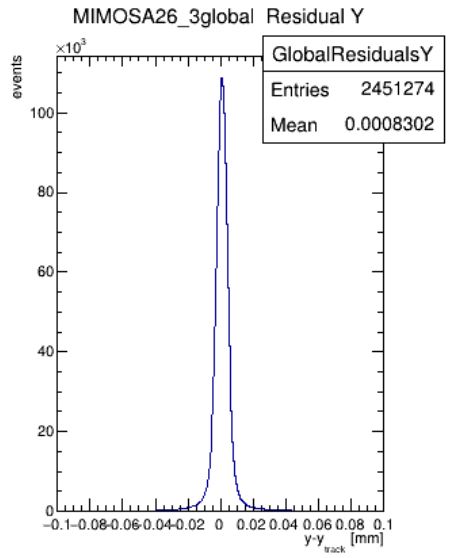
## Geometry 2

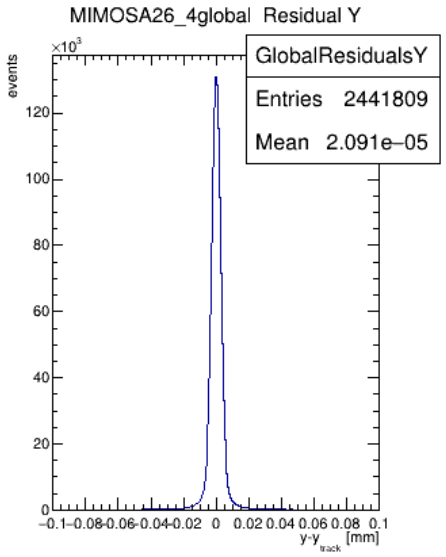
Reference Plane

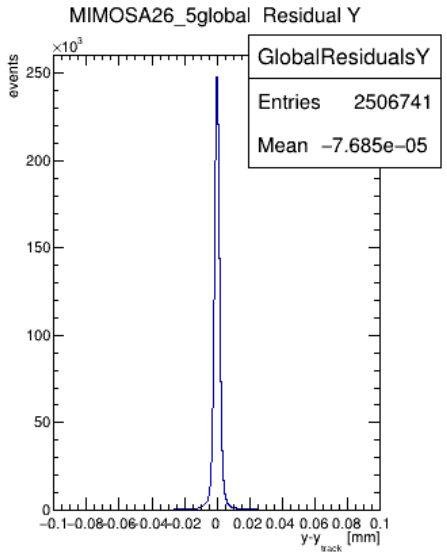


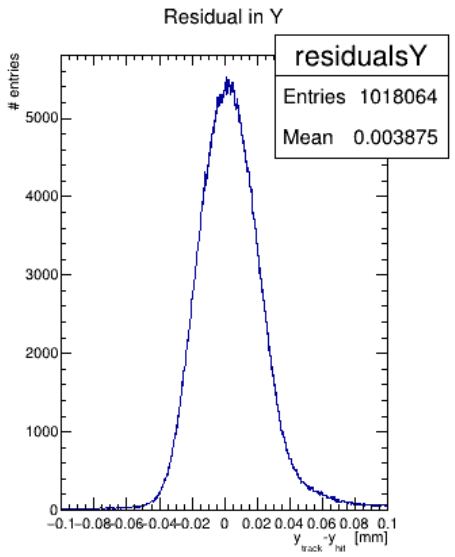



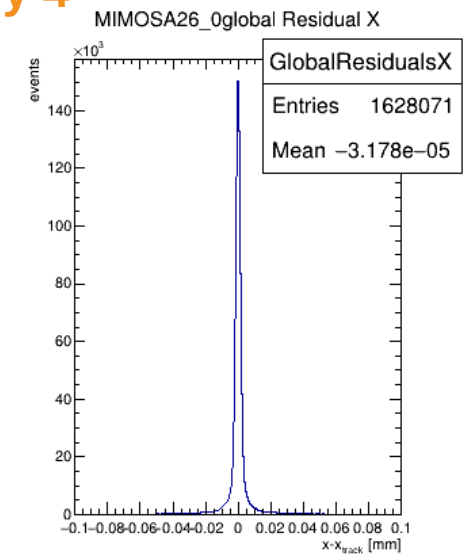



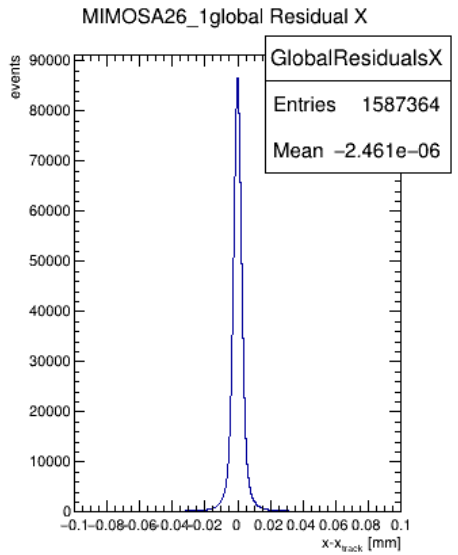



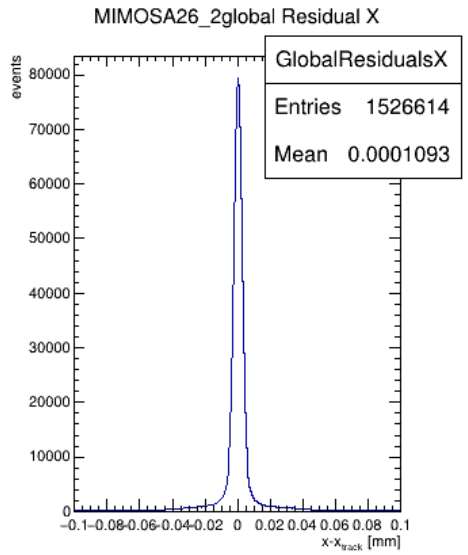
# Telescope Alignment Results

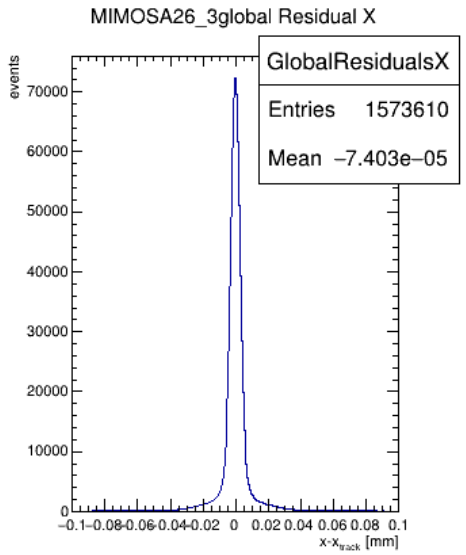
## Geometry 4

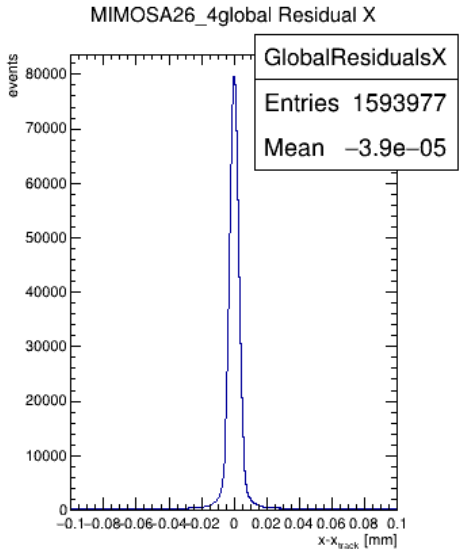
Reference Plane

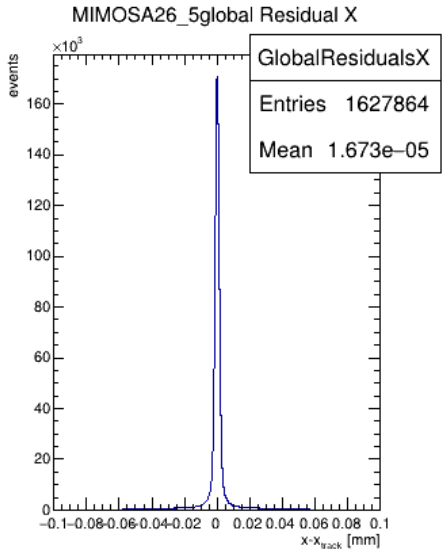


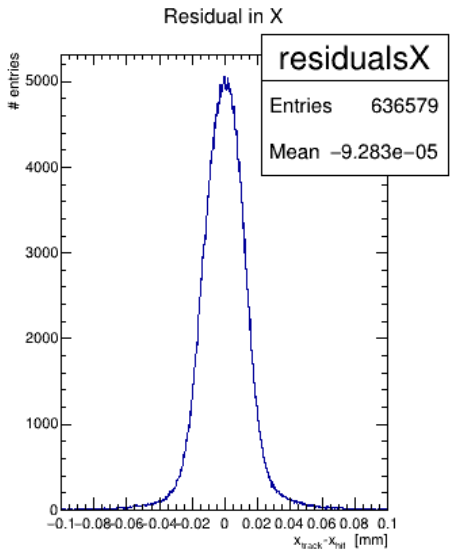



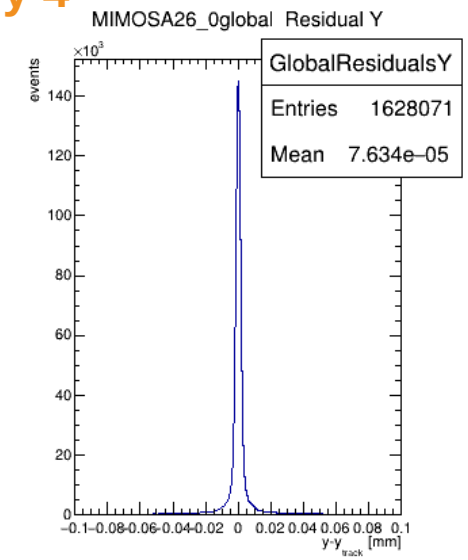



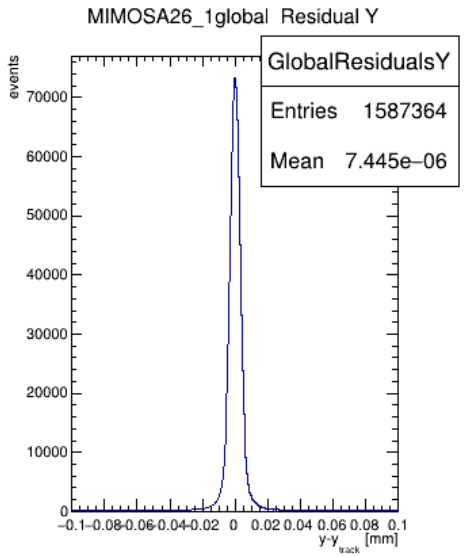



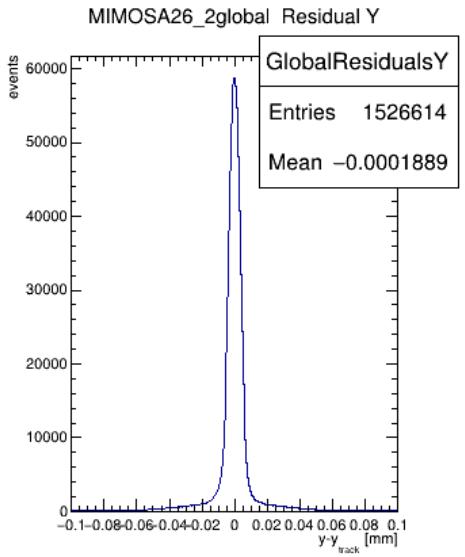
# Telescope Alignment Results

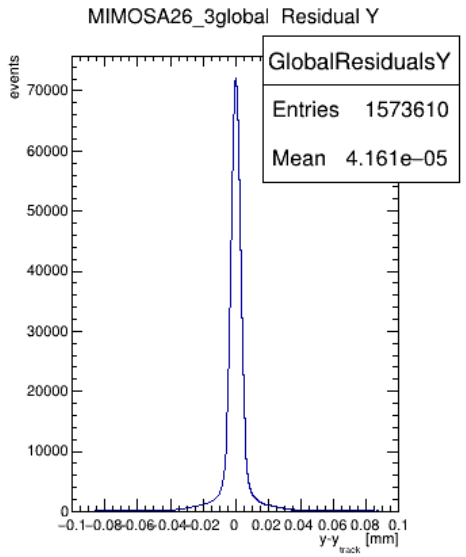
## Geometry 4

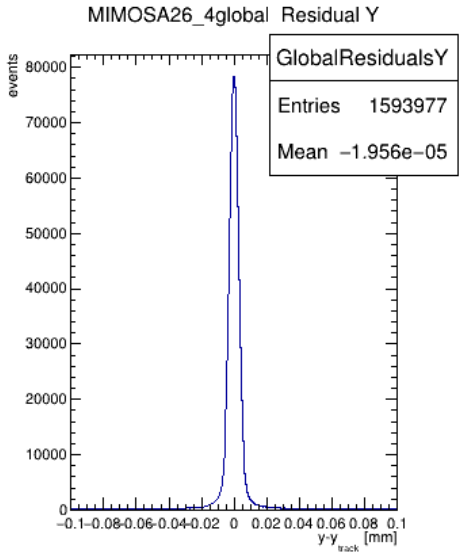
Reference Plane

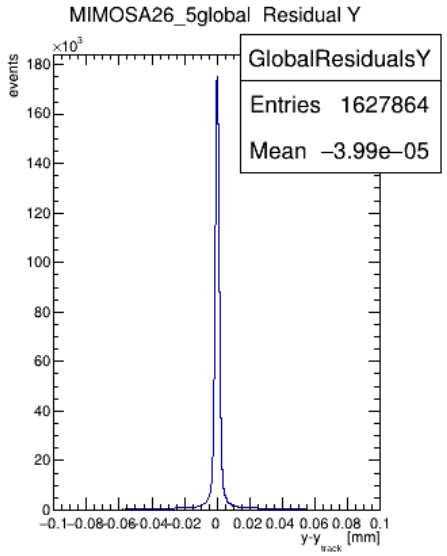


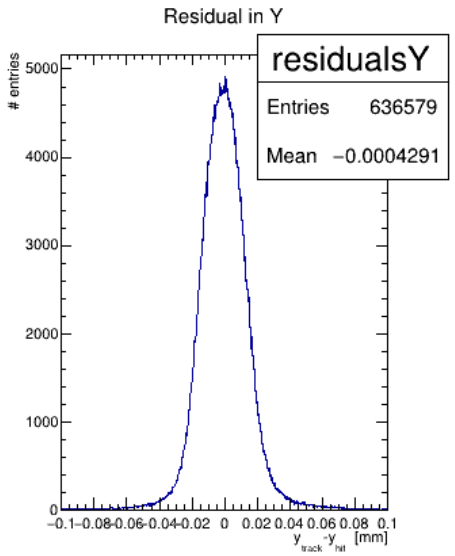



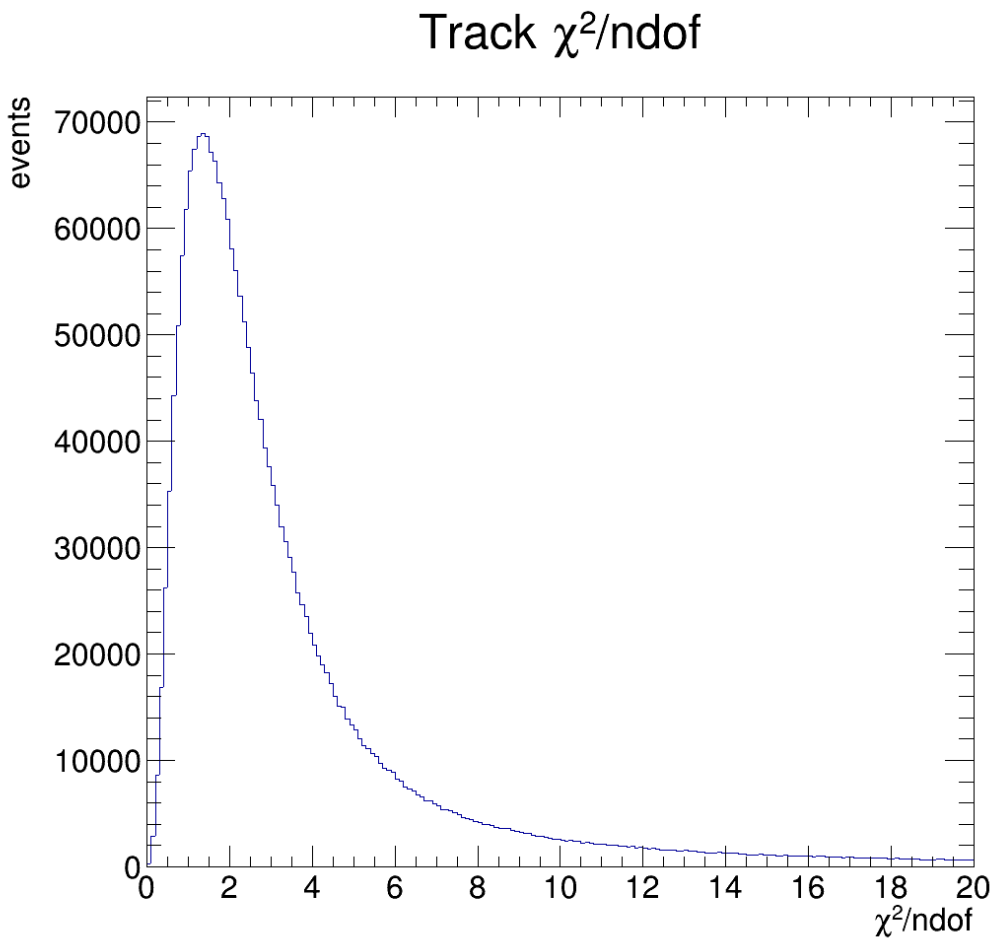



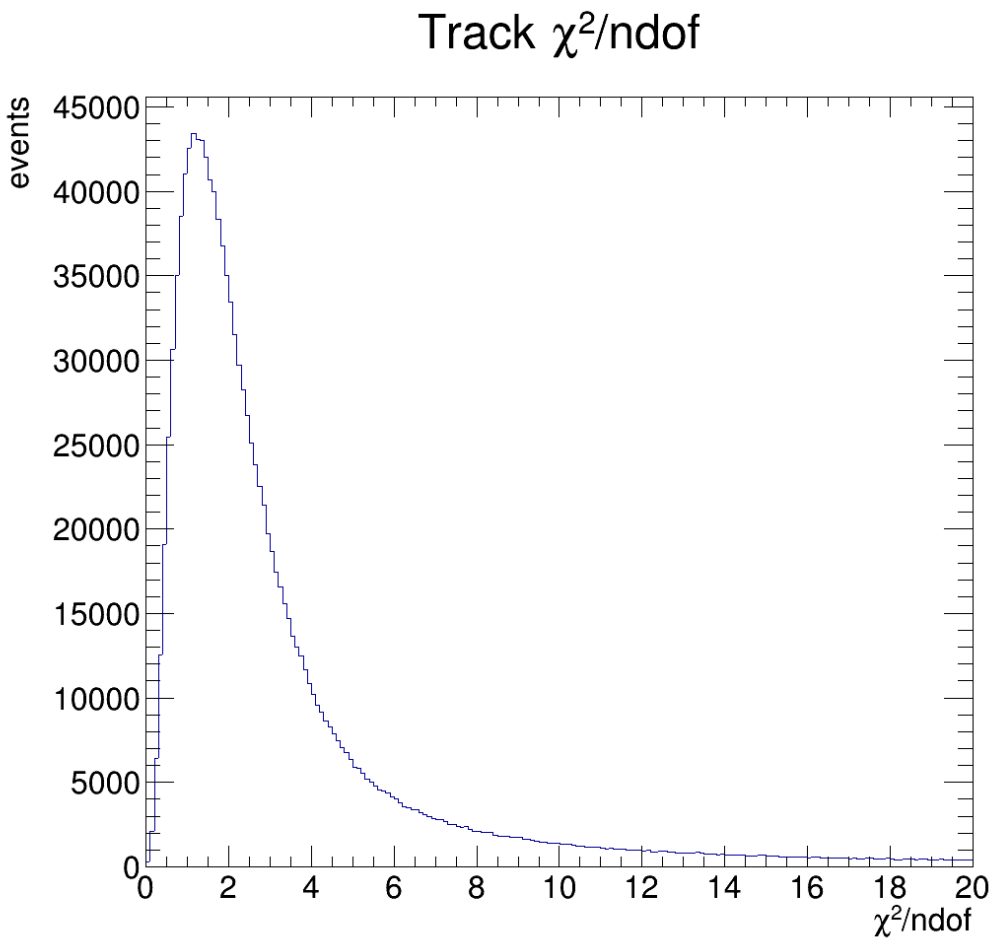



# Telescope Alignment Results

## Geometry 2

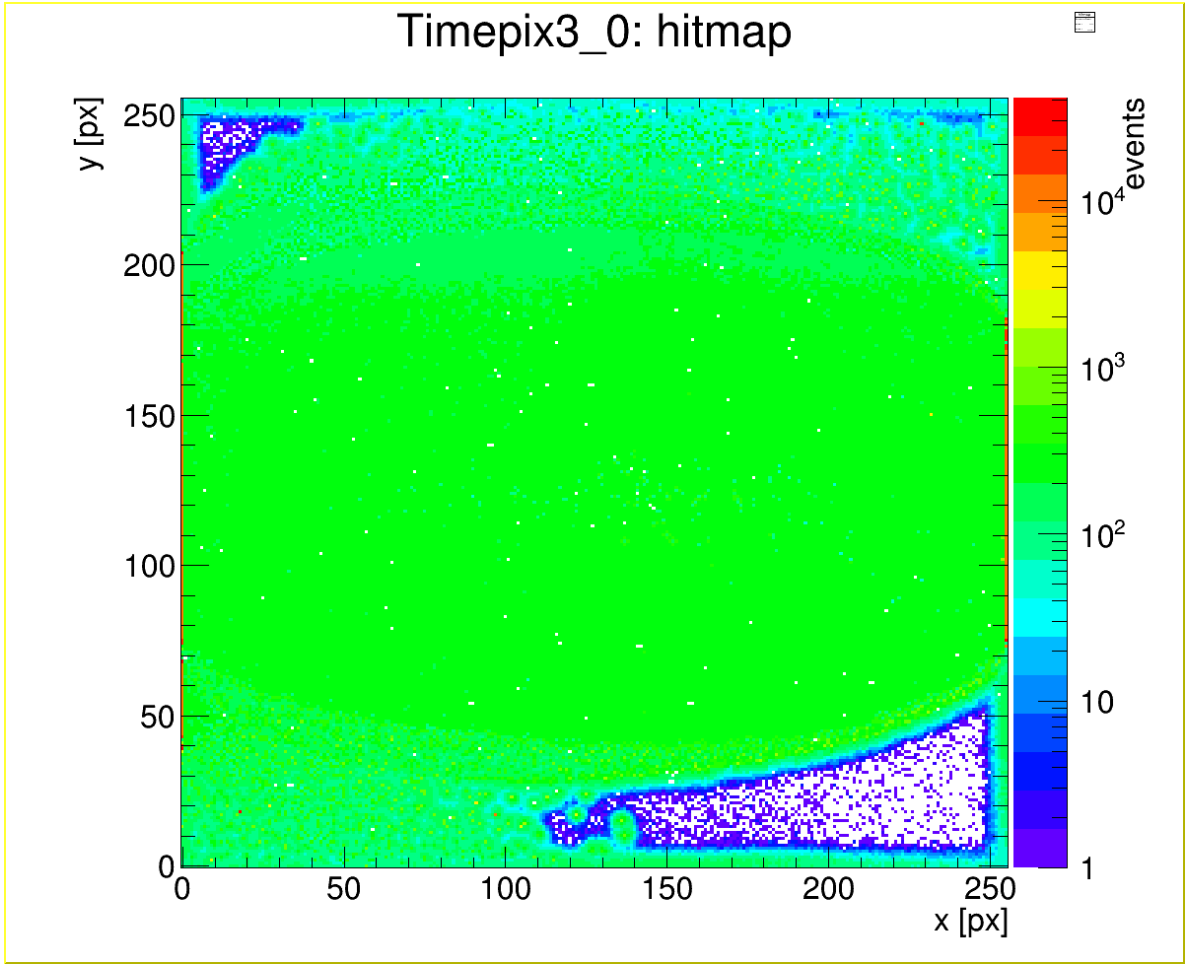



## Geometry 4

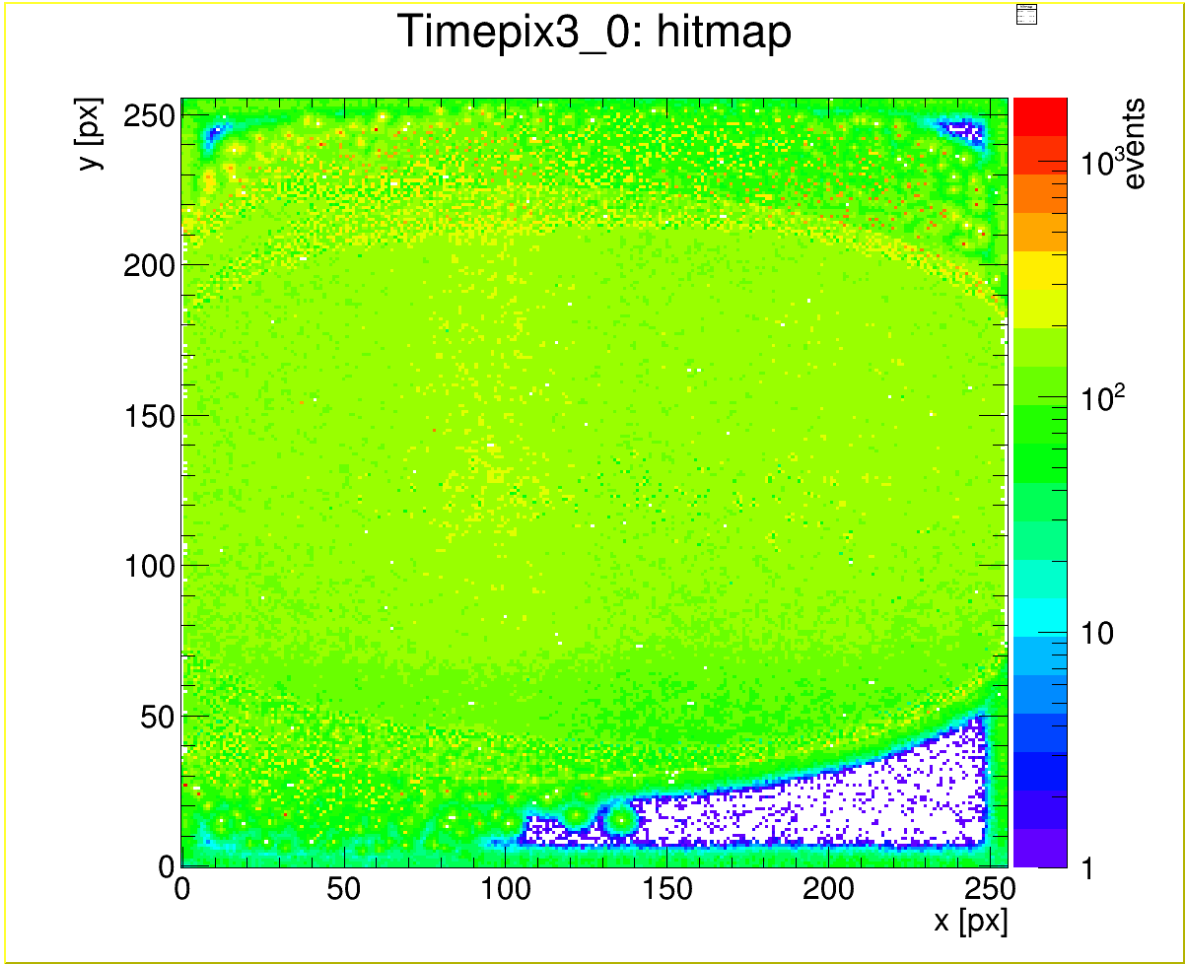


# Hit Maps

## Geometry 2



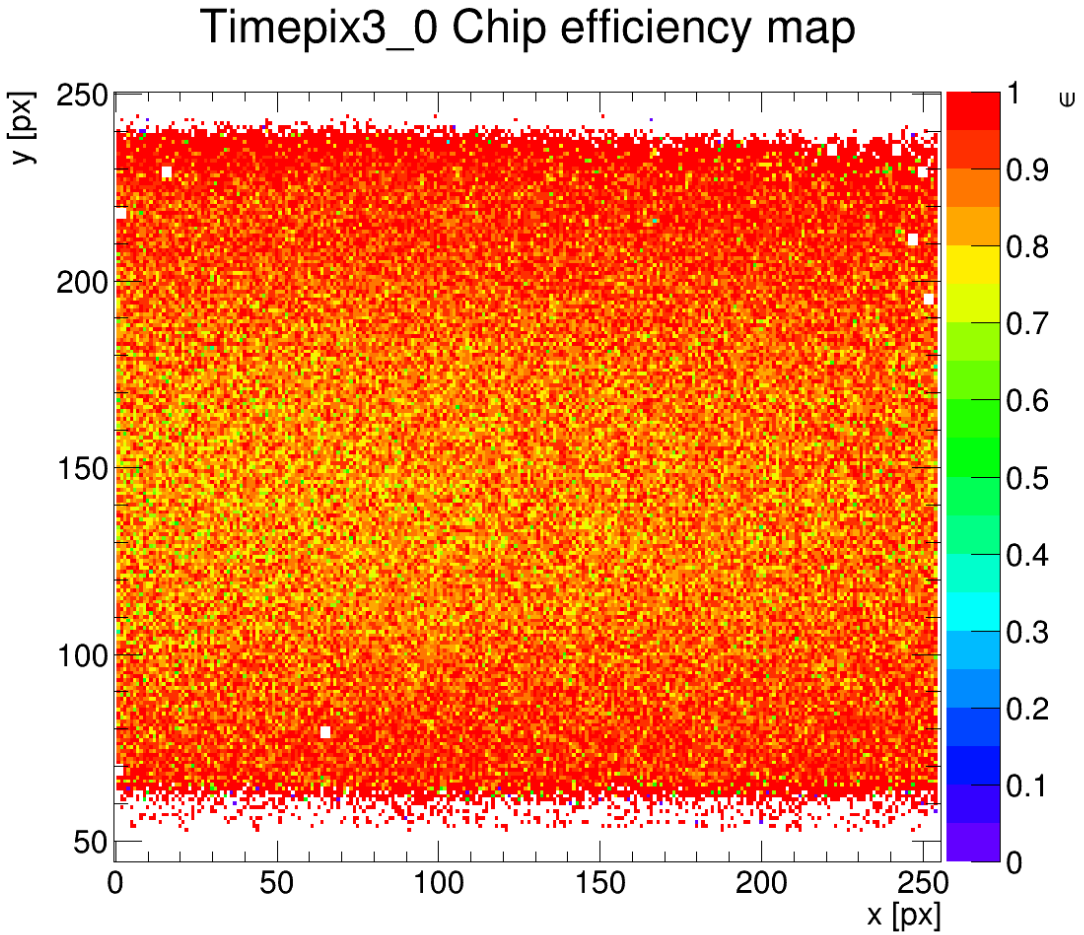

## Geometry 4

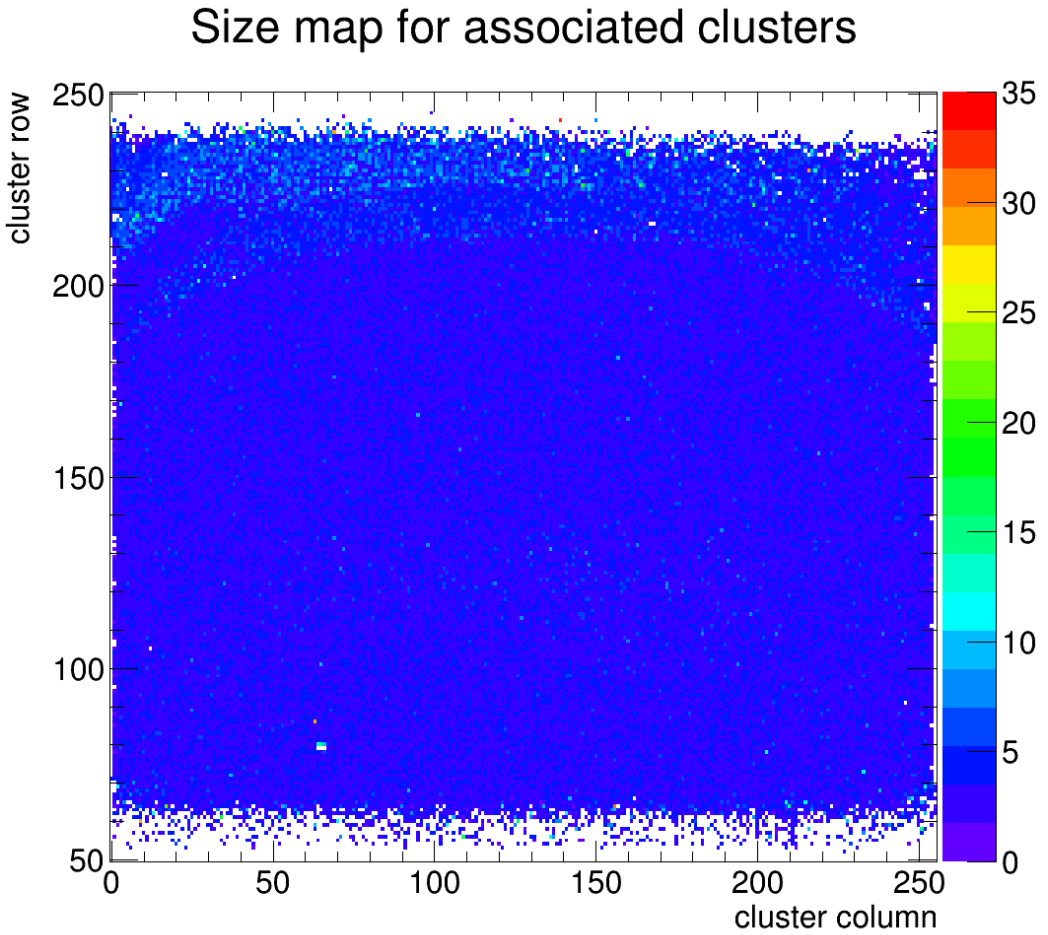


# Threshold Scan (Geometry 4)

## Chip efficiency and cluster size maps

Bias = 40 V
Threshold = 1096 LSB ~ 650 $e^-$

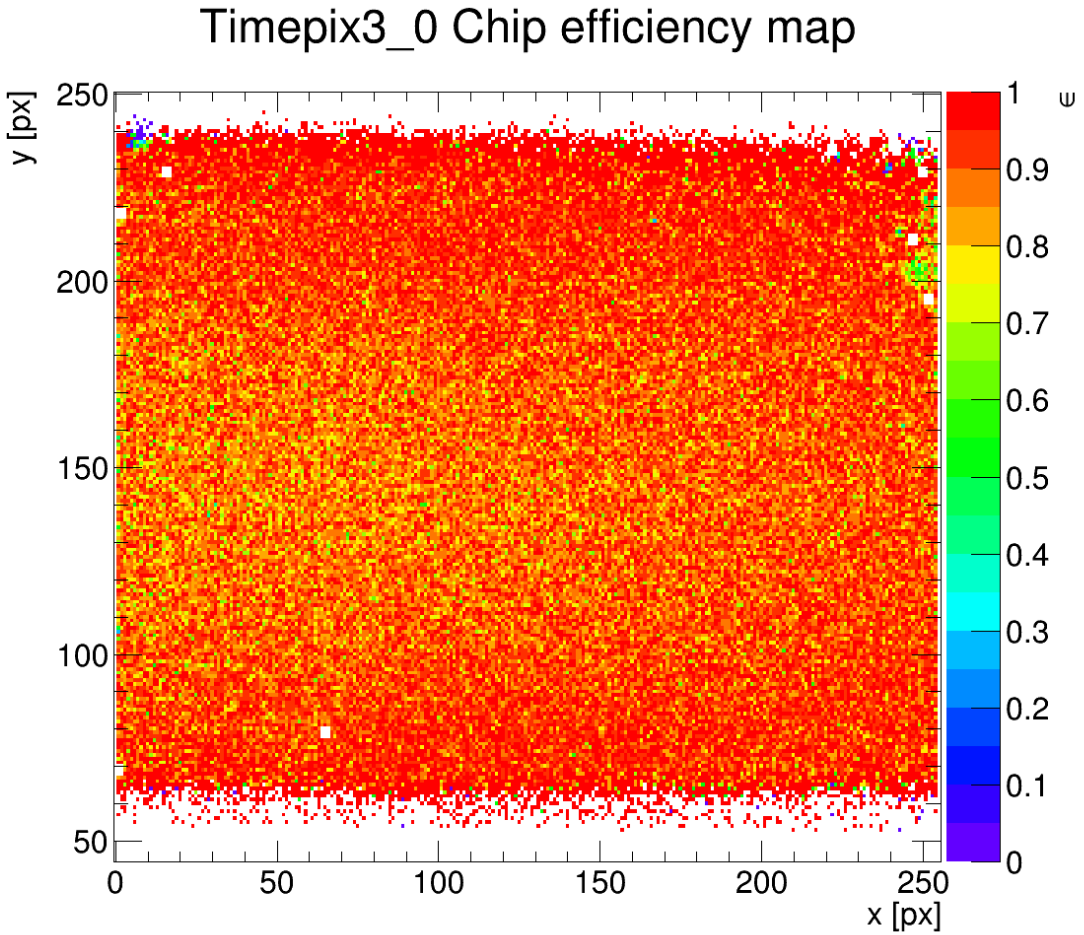


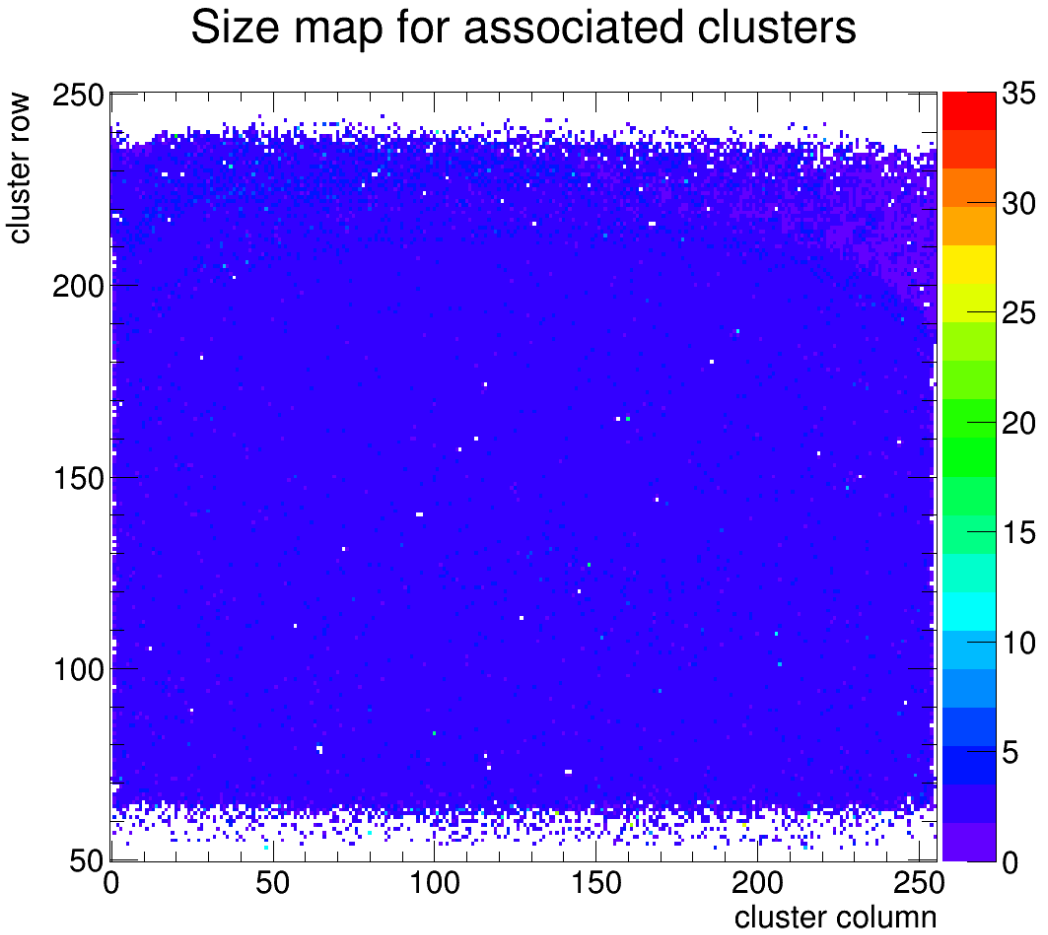



# Threshold Scan

## Chip efficiency and cluster size maps

Bias = 40 V
Threshold = 1021 LSB ~ 1400 $e^-$

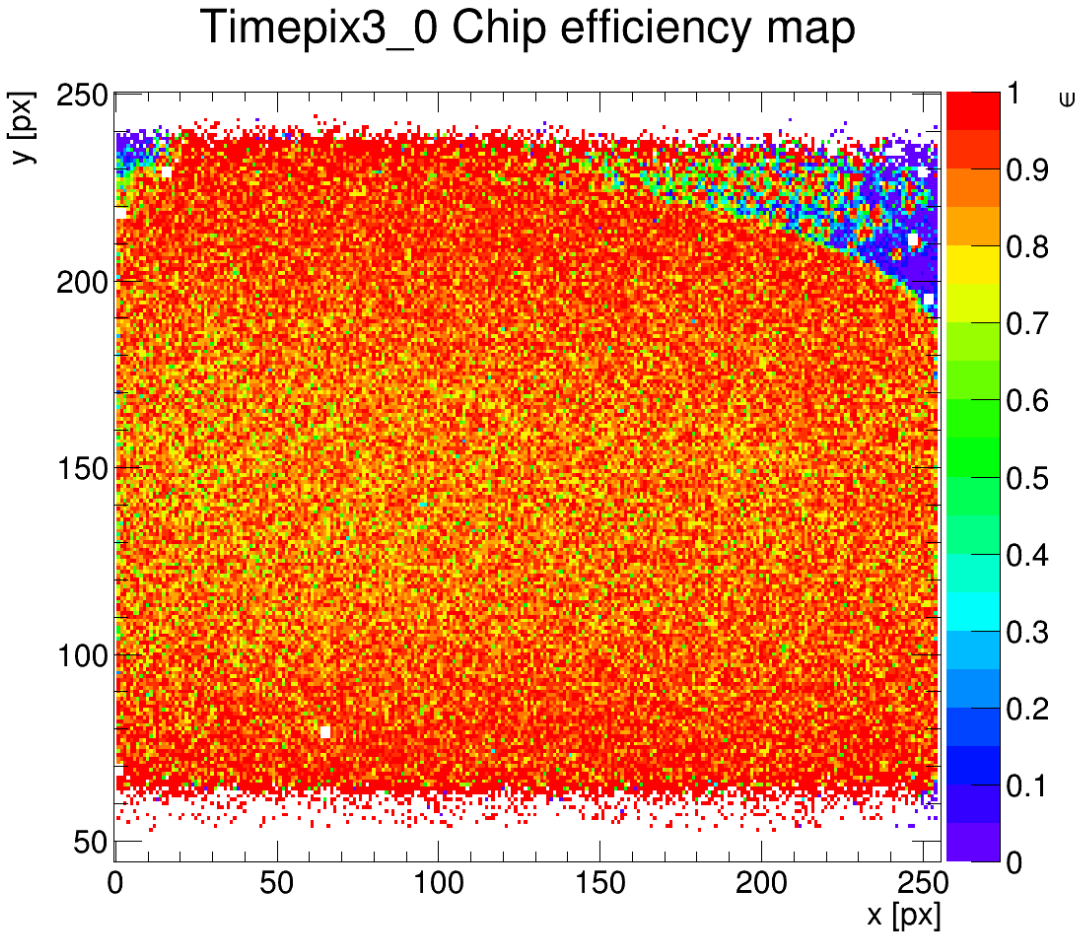


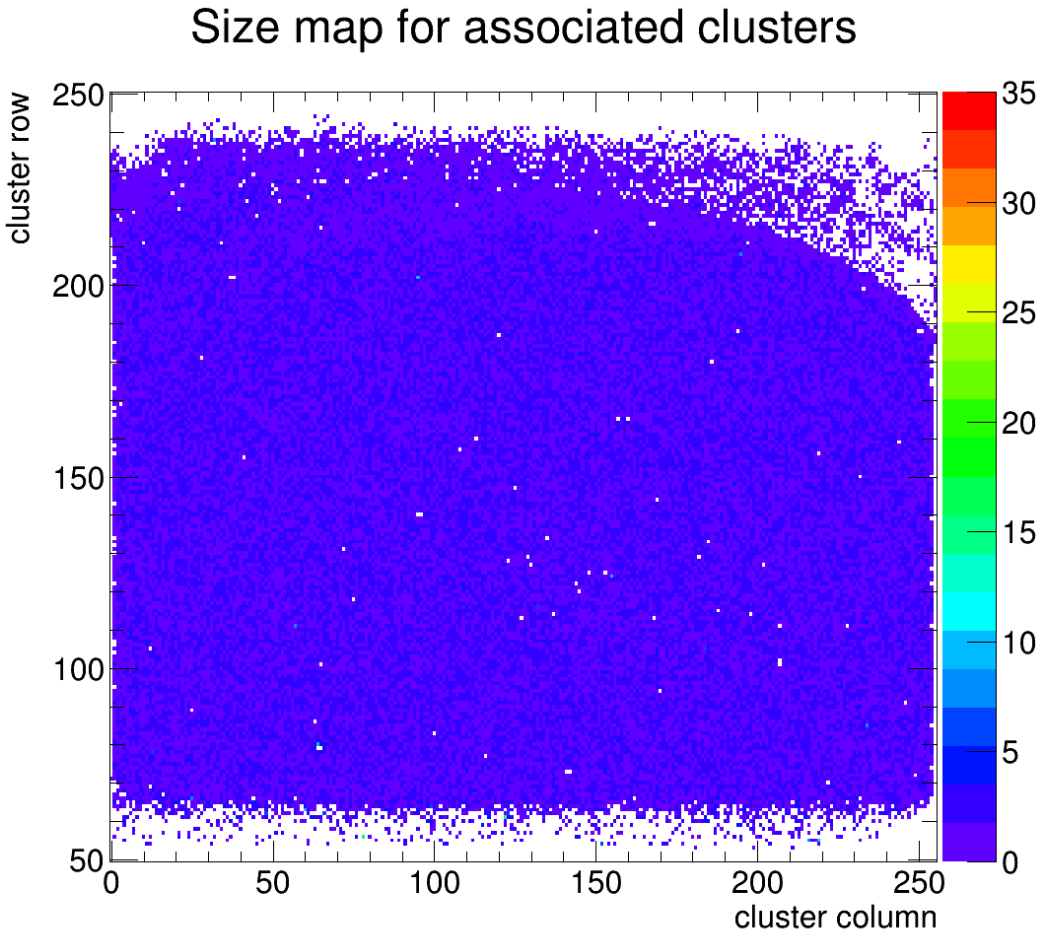



# Threshold Scan

## Chip efficiency and cluster size maps

Bias = 40 V
Threshold = 811 LSB ~ 3500 $e^-$

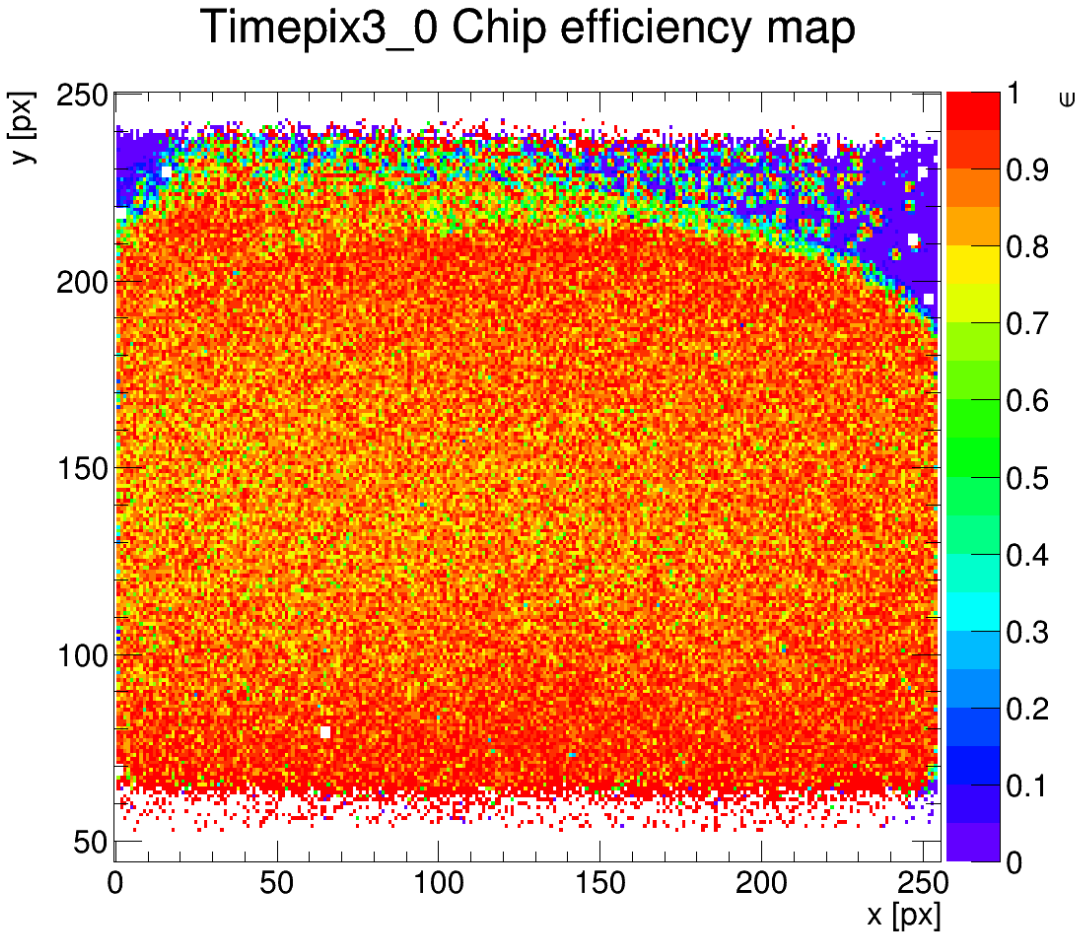


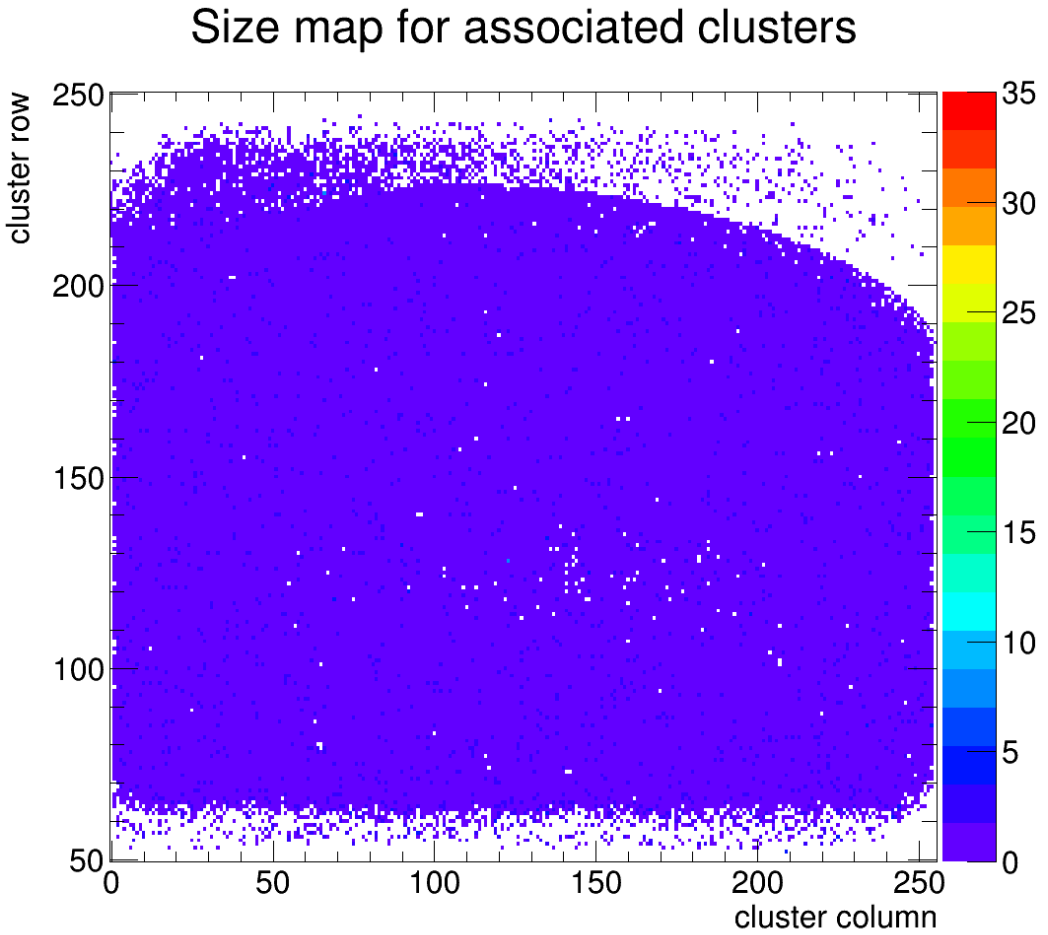



# Threshold Scan

## Chip efficiency and cluster size maps

Bias = 40 V
Threshold = 511 LSB ~ 6500 $e^-$

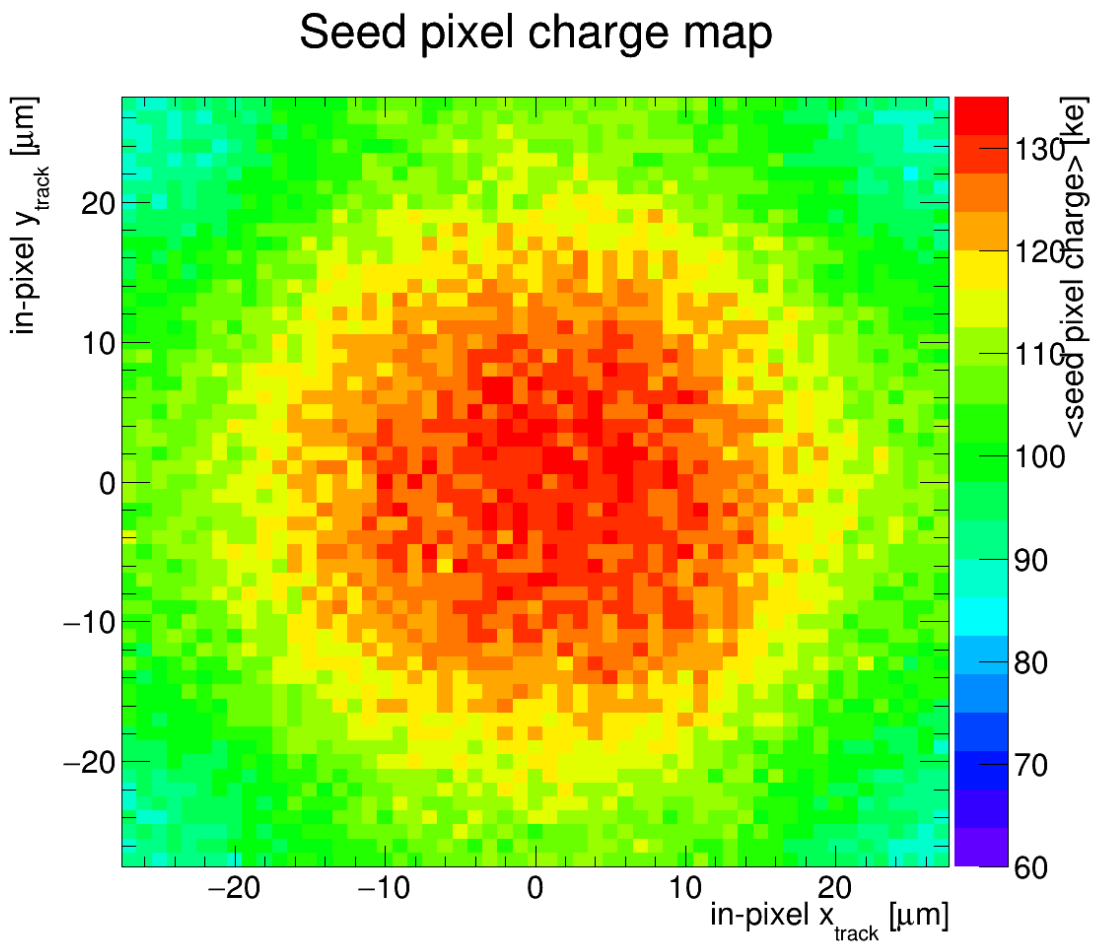


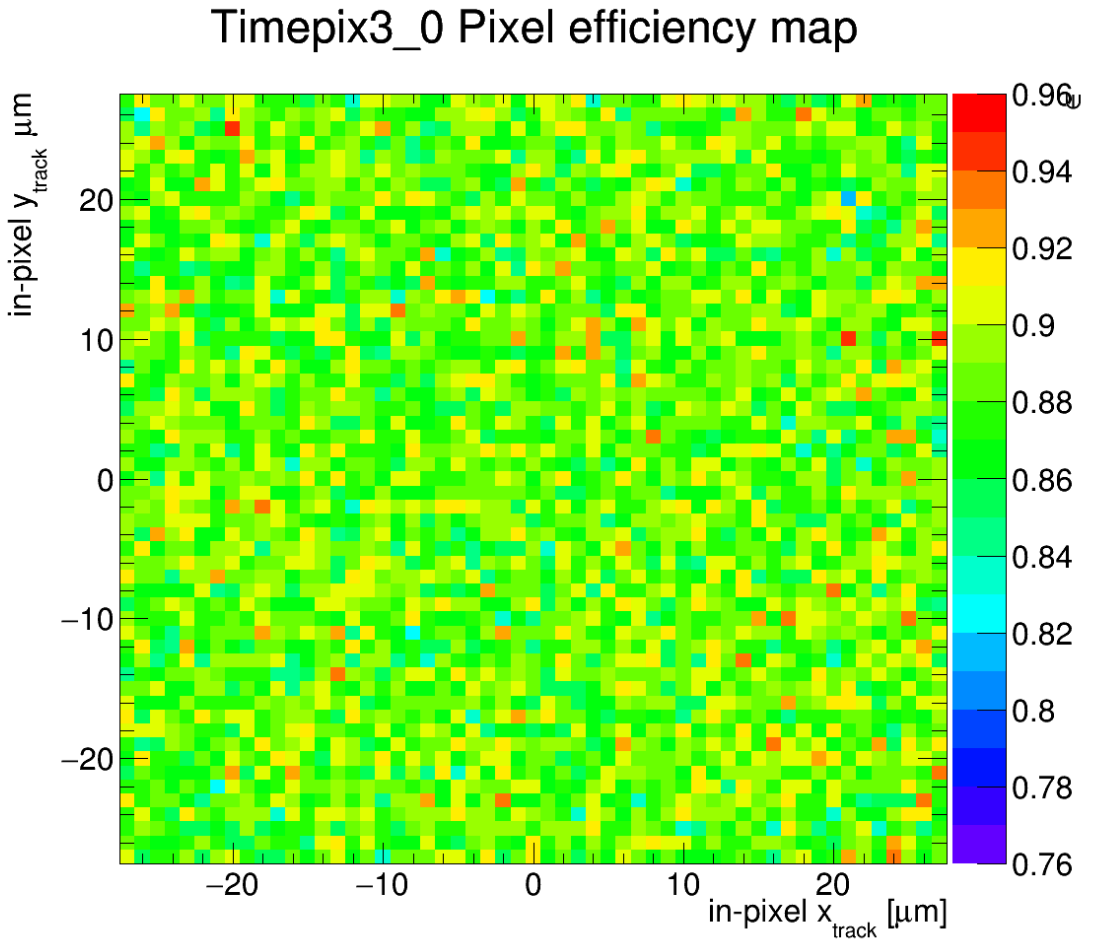



# Threshold Scan

## Seed pixel charge and pixel efficiency maps

Bias = 40 V
Threshold = 1096 LSB ~ 650 $e^-$

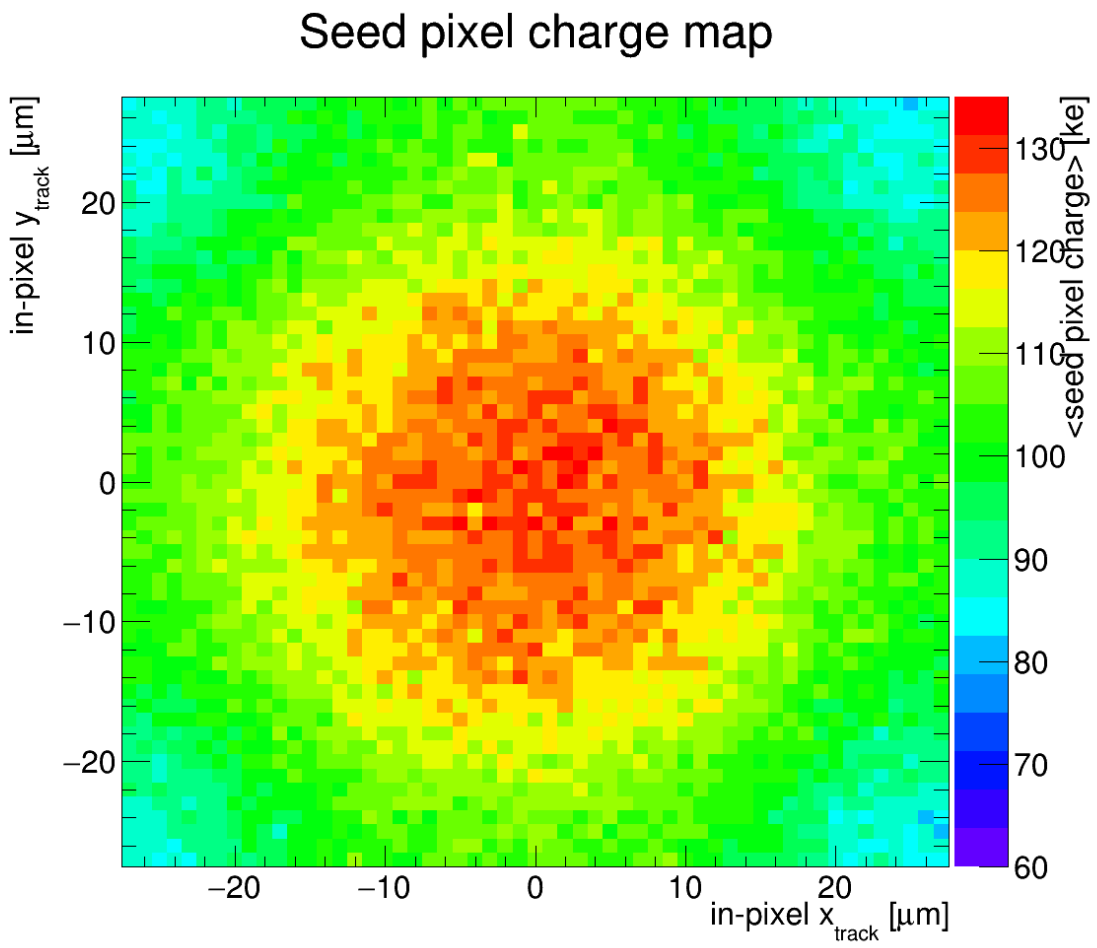


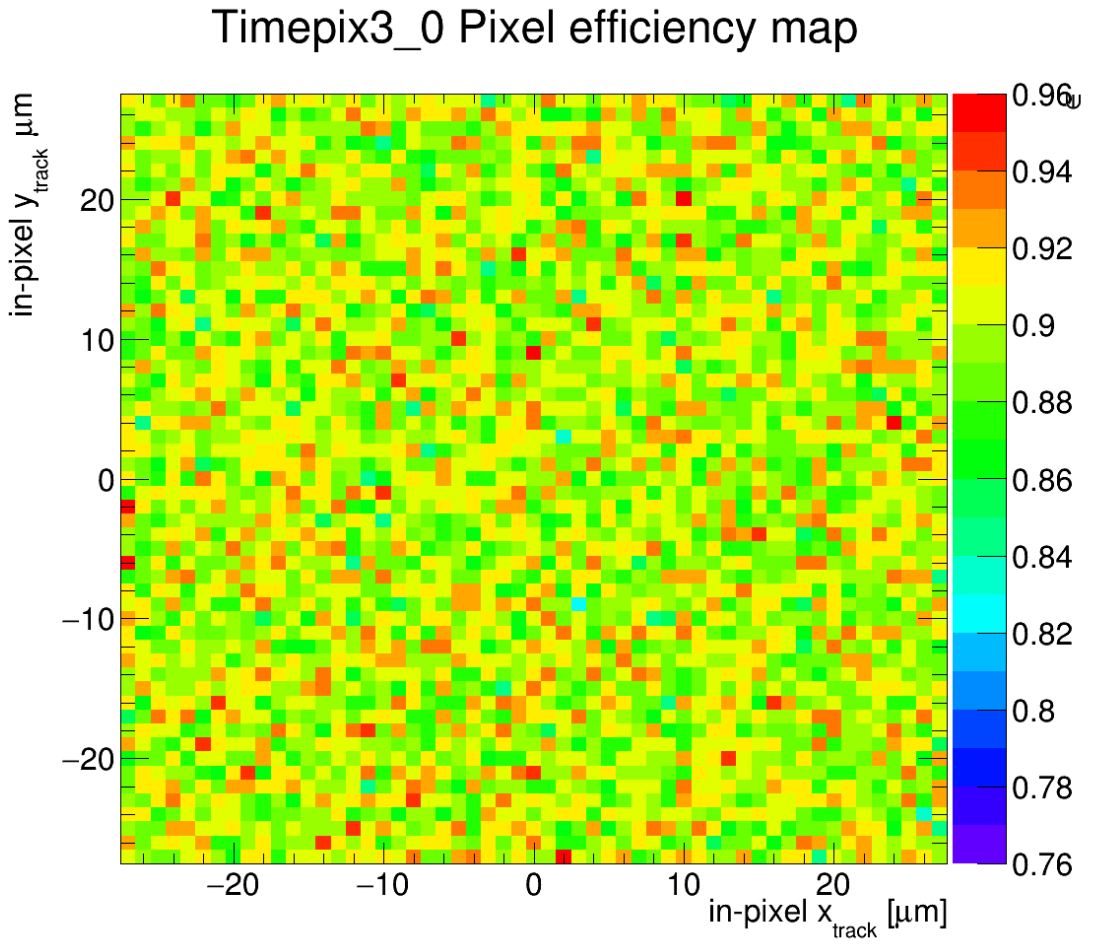



# Threshold Scan

## Seed pixel charge and pixel efficiency maps

Bias = 40 V
Threshold = 1021 LSB ~ 1400 $e^-$

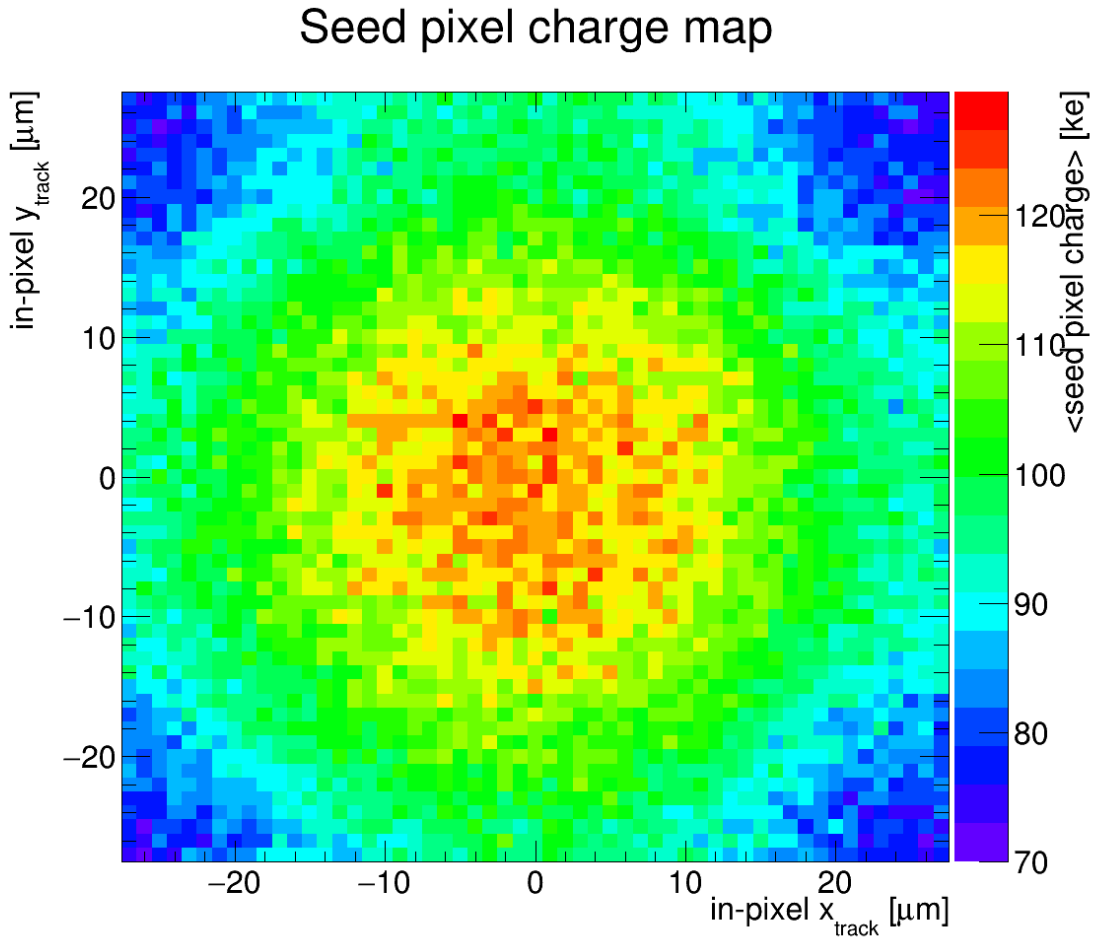


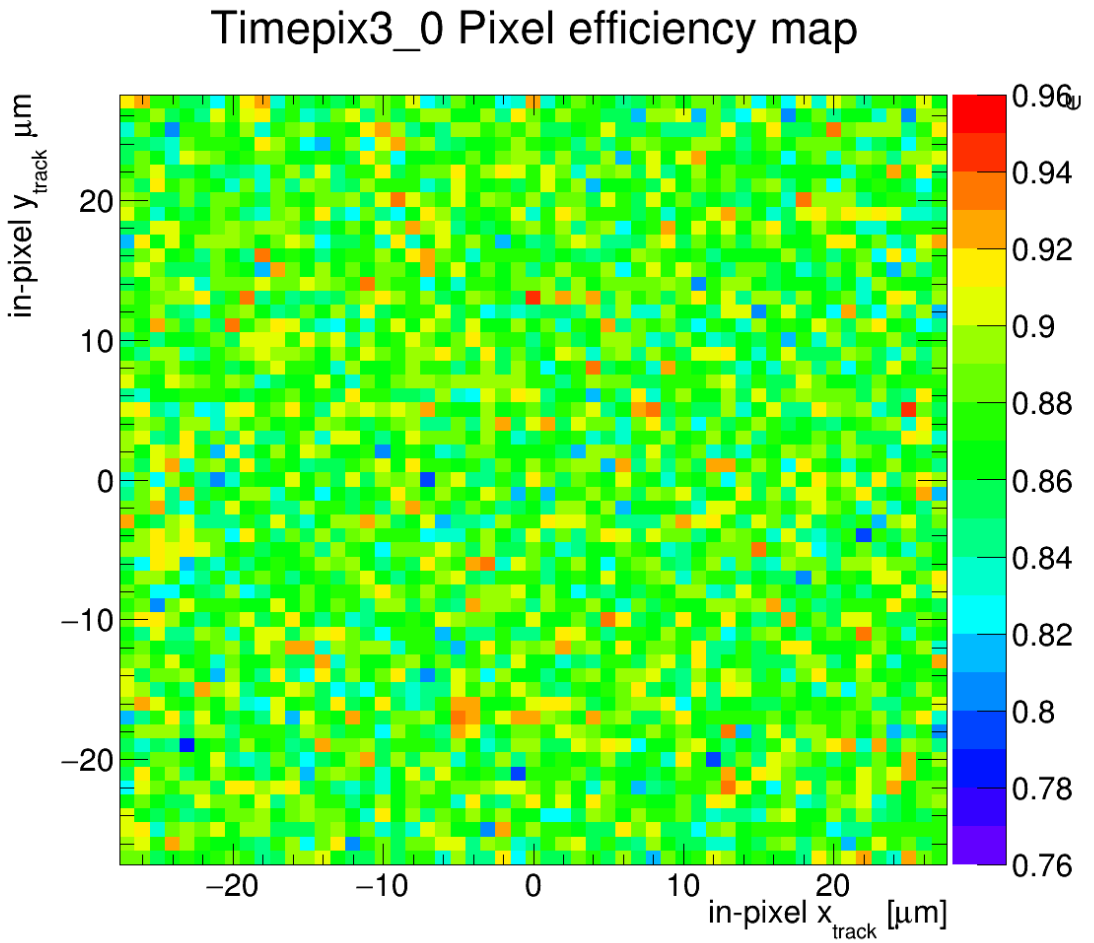



# Threshold Scan

## Seed pixel charge and pixel efficiency maps

Bias = 40 V
Threshold = 811 LSB ~ 3500 $e^-$

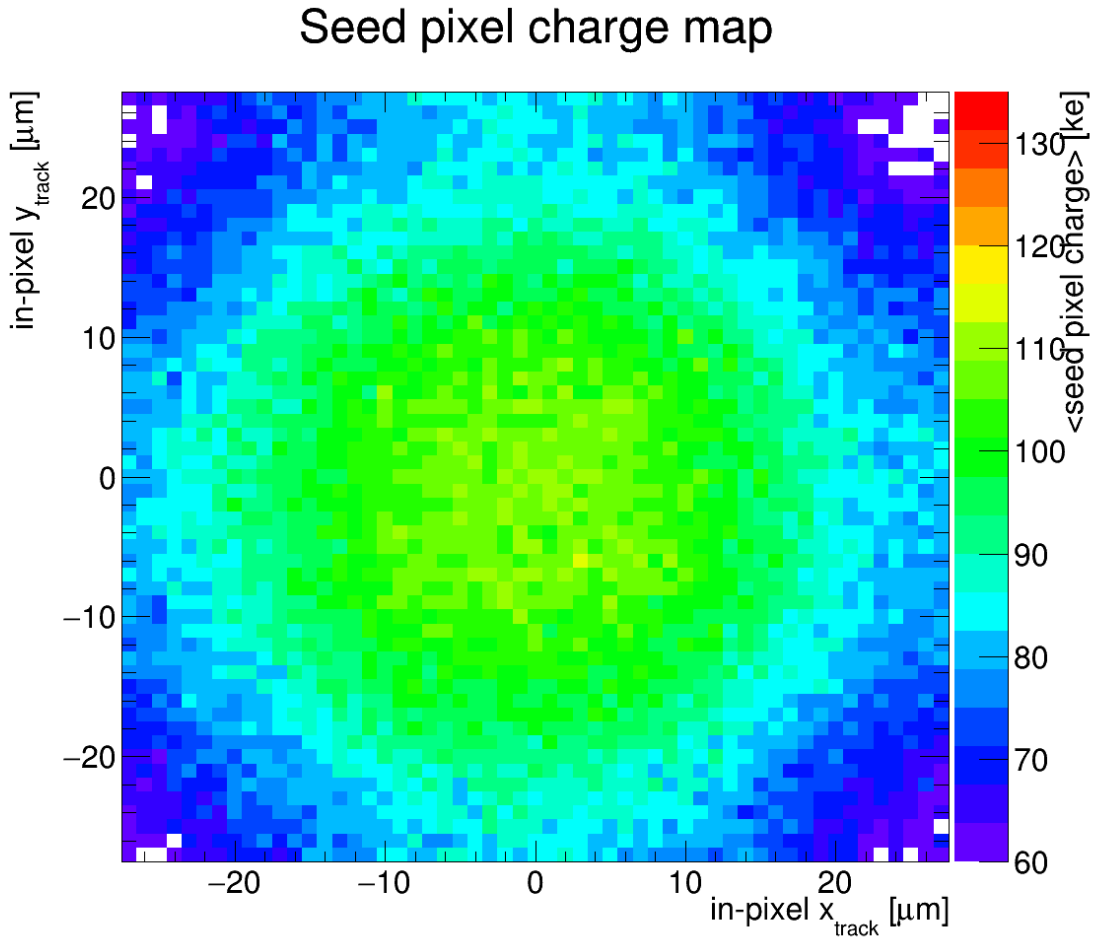


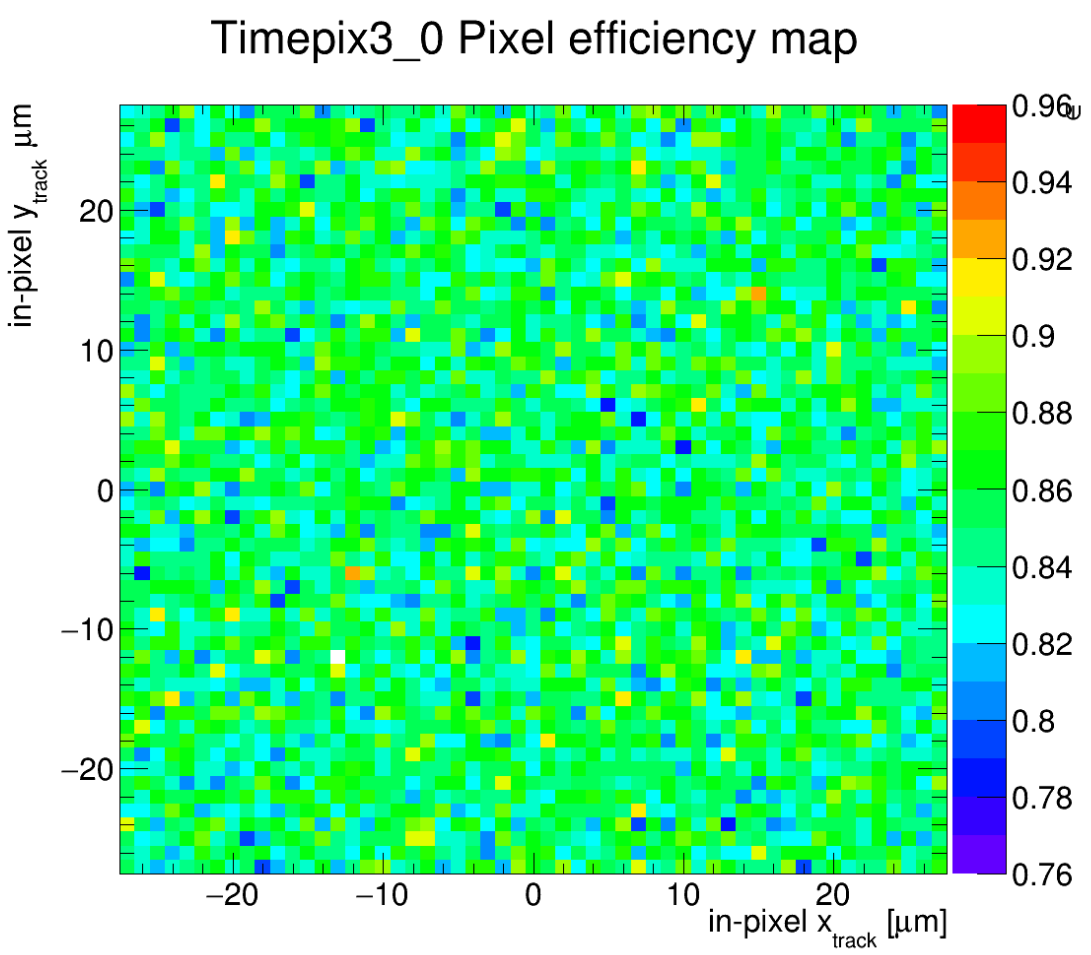



# Threshold Scan

## Seed pixel charge and pixel efficiency maps

Bias = 40 V
Threshold = 511 LSB ~ 6500 $e^-$

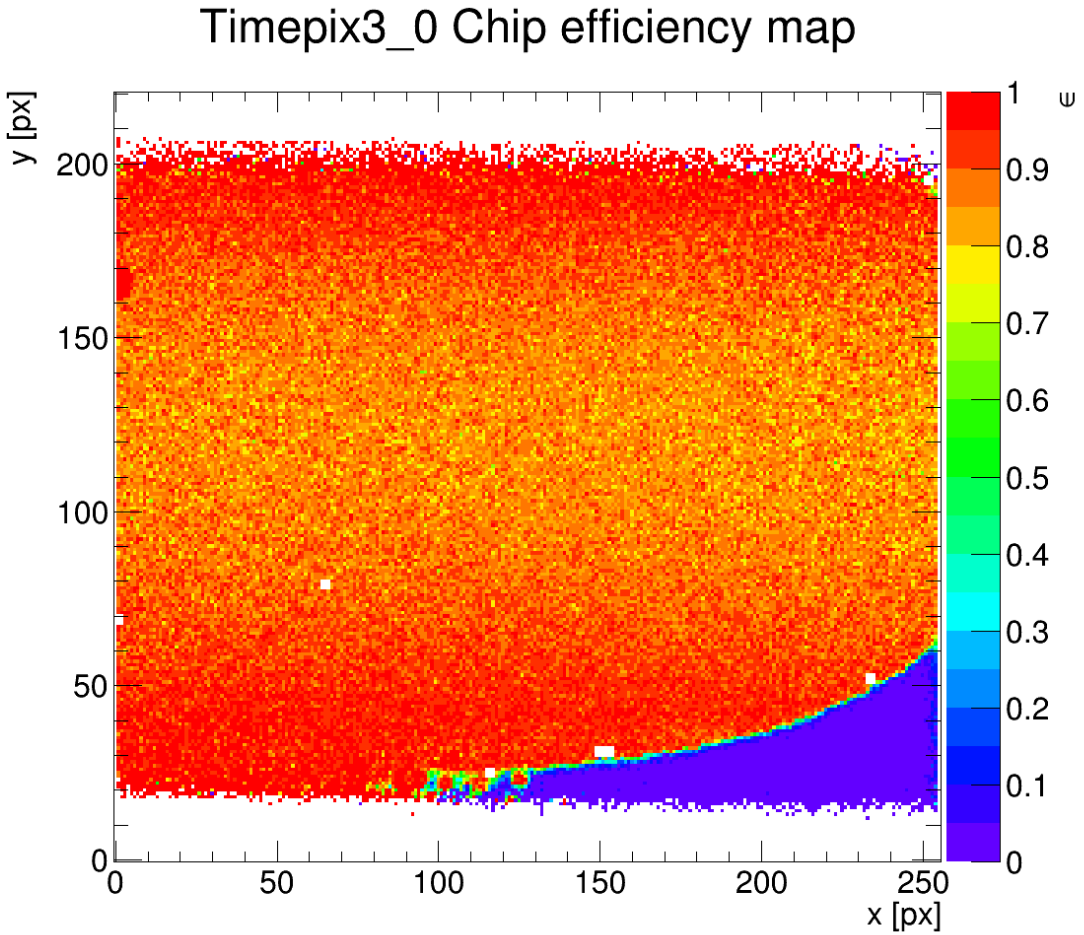


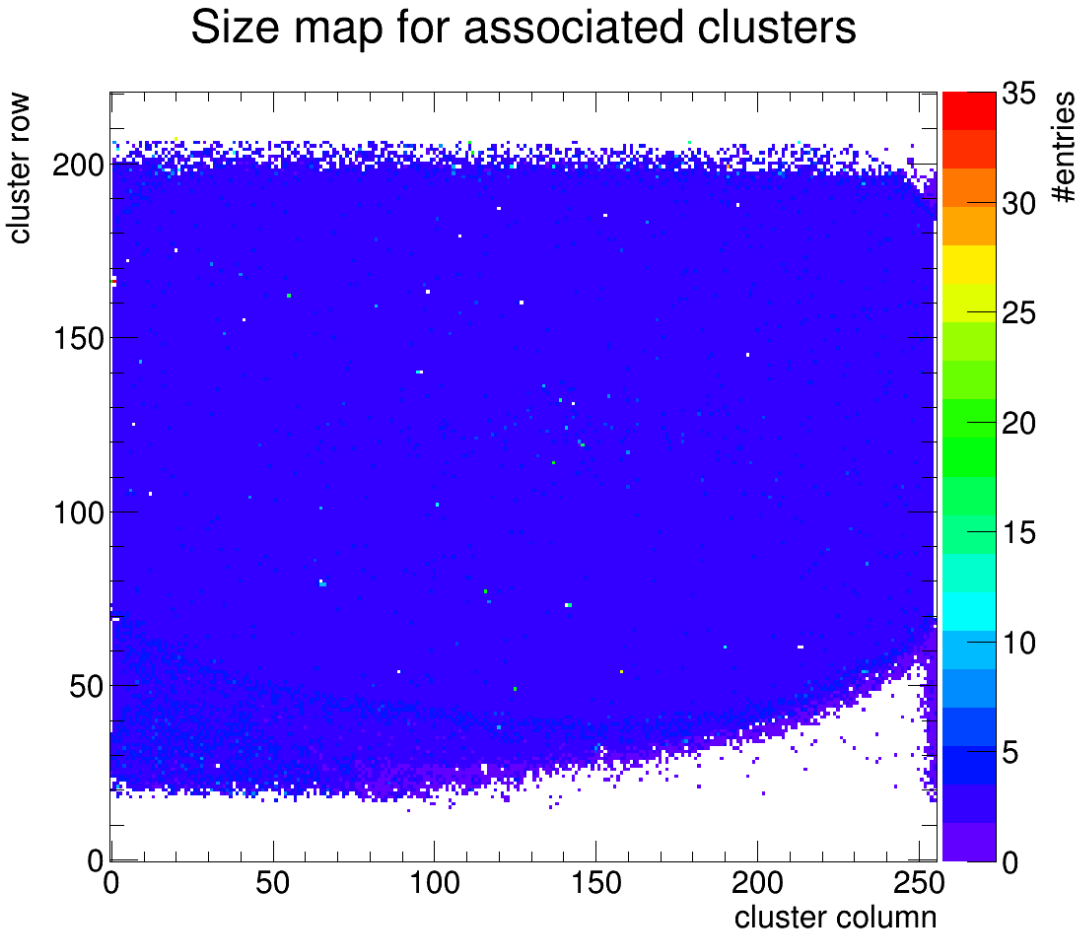



# Bias Scan (Geometry 2)

## Chip efficiency and cluster size maps

Bias = 20 V
Threshold = 1085 LSB ~ 800 $e^-$

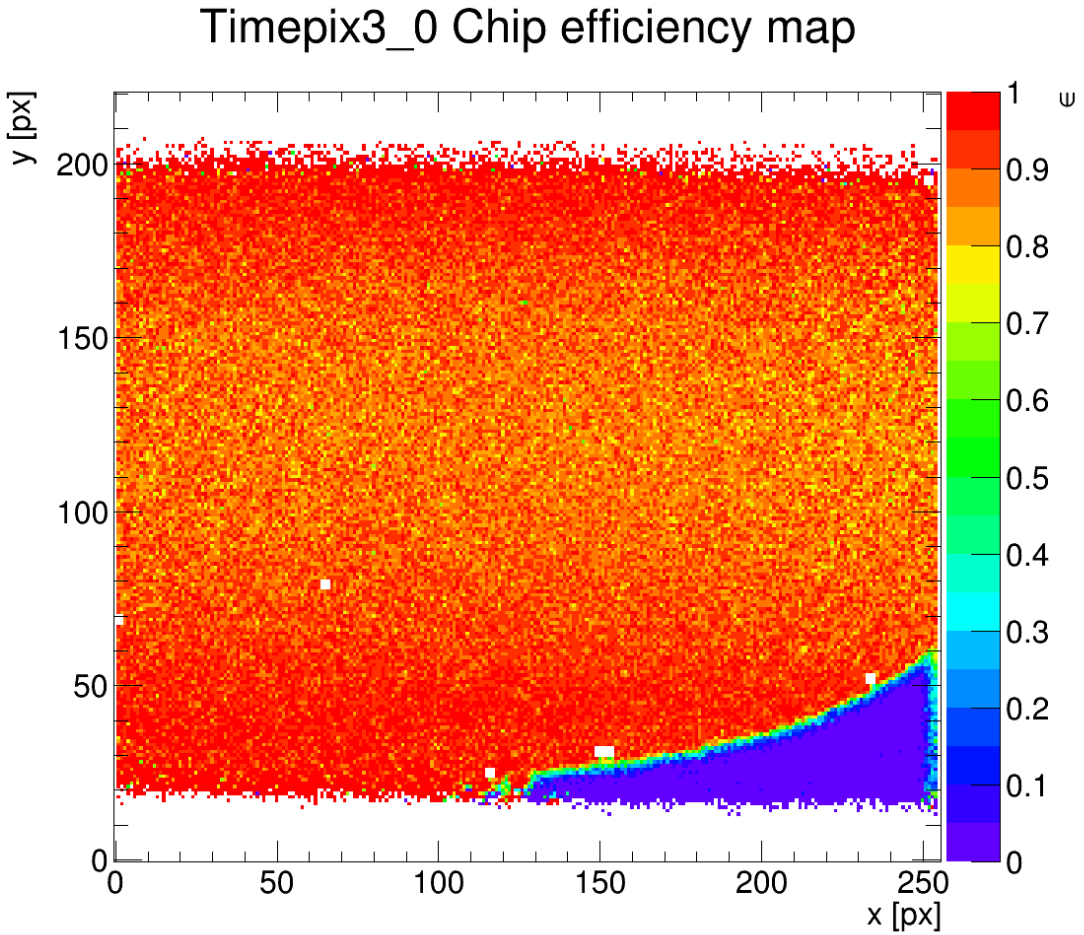


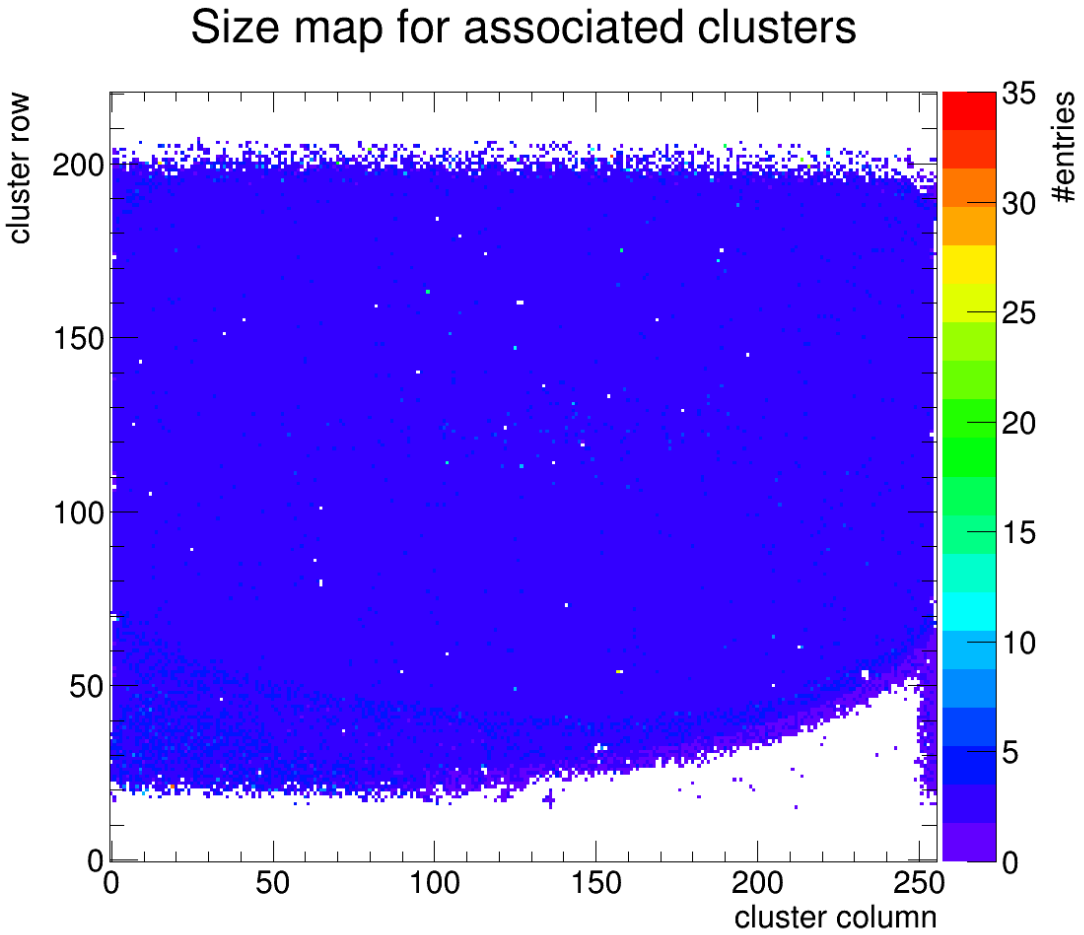



# Bias Scan

## Chip efficiency and cluster size maps

Bias = 30 V
Threshold = 1085 LSB ~ 800 $e^-$

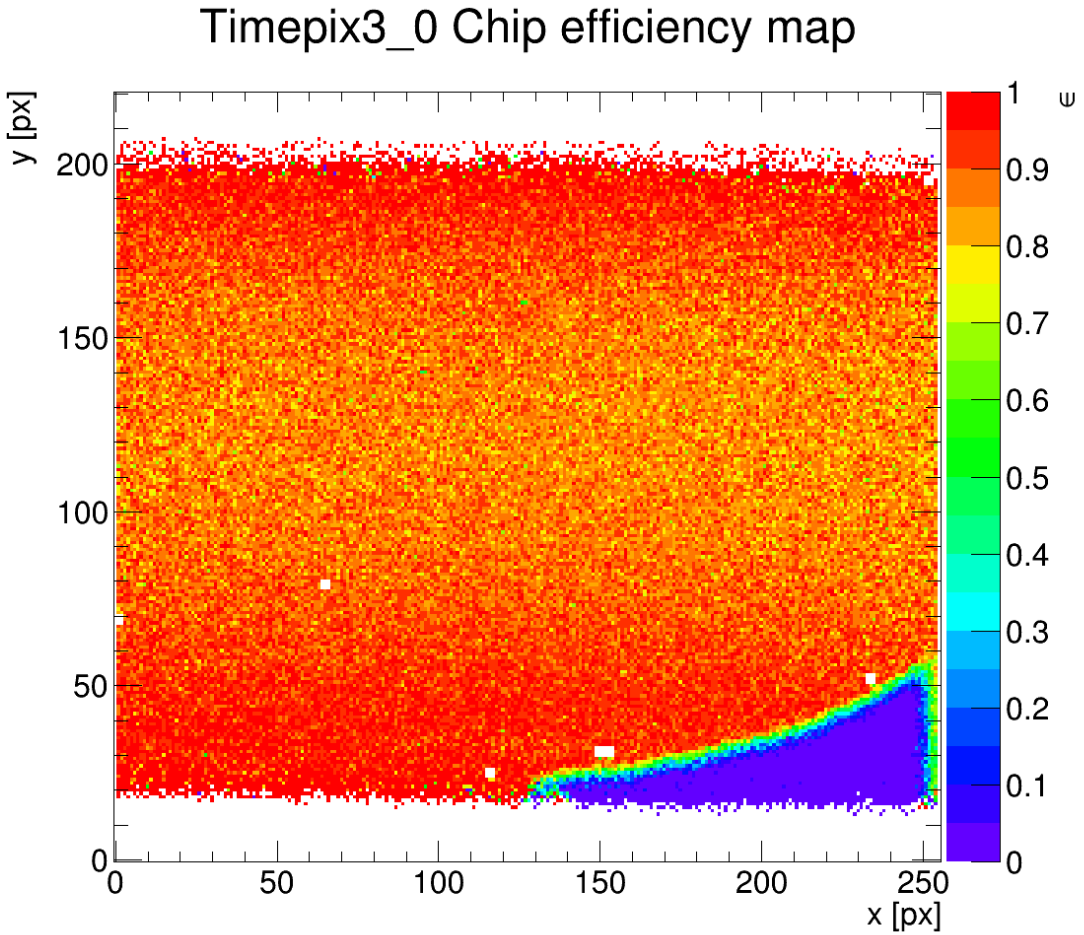


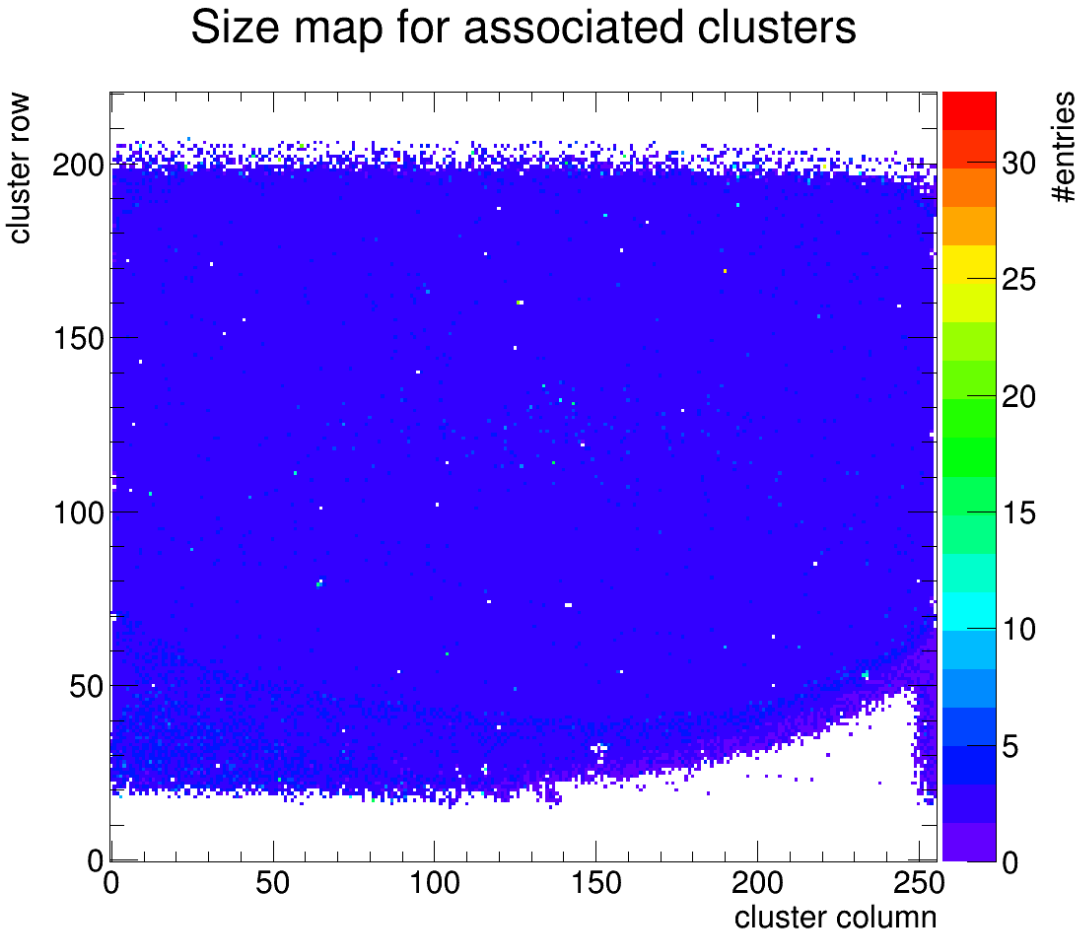



# Bias Scan

## Chip efficiency and cluster size maps

Bias = 40 V
Threshold = 1085 LSB ~ 800 $e^-$

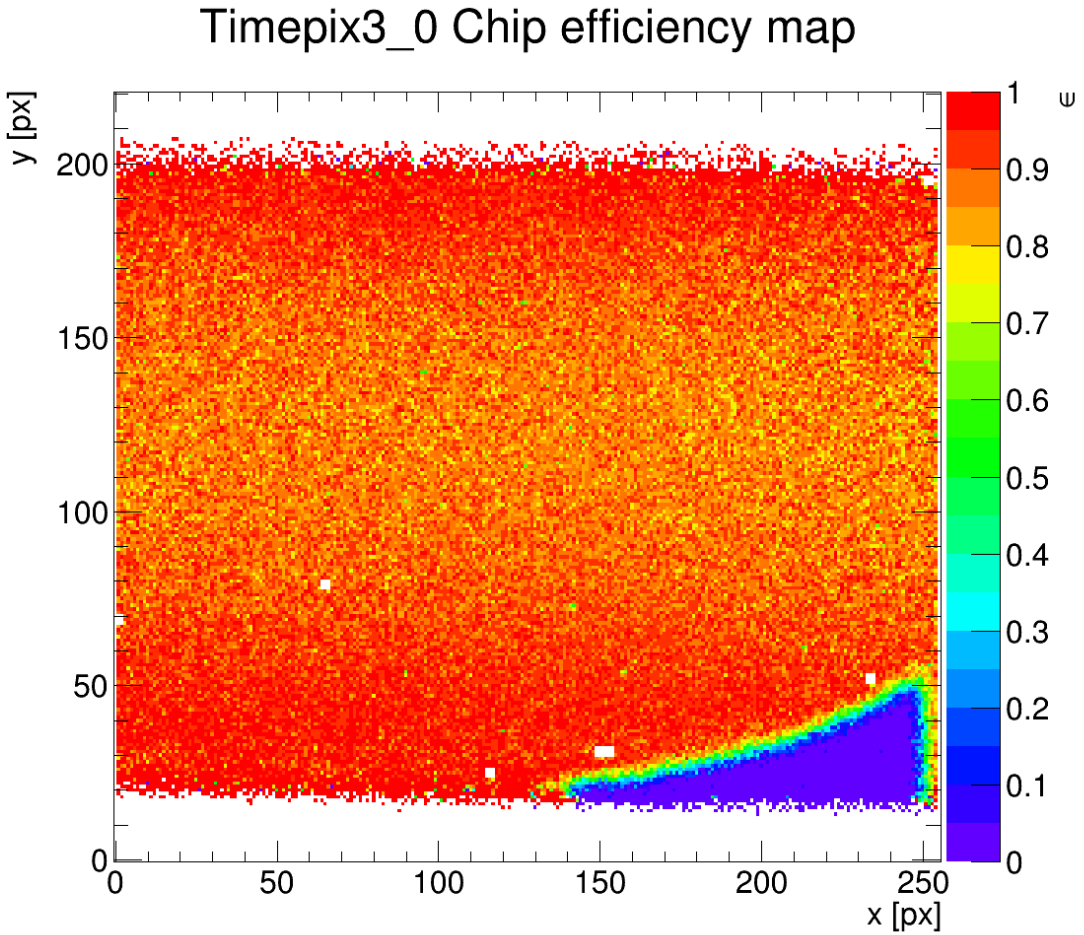


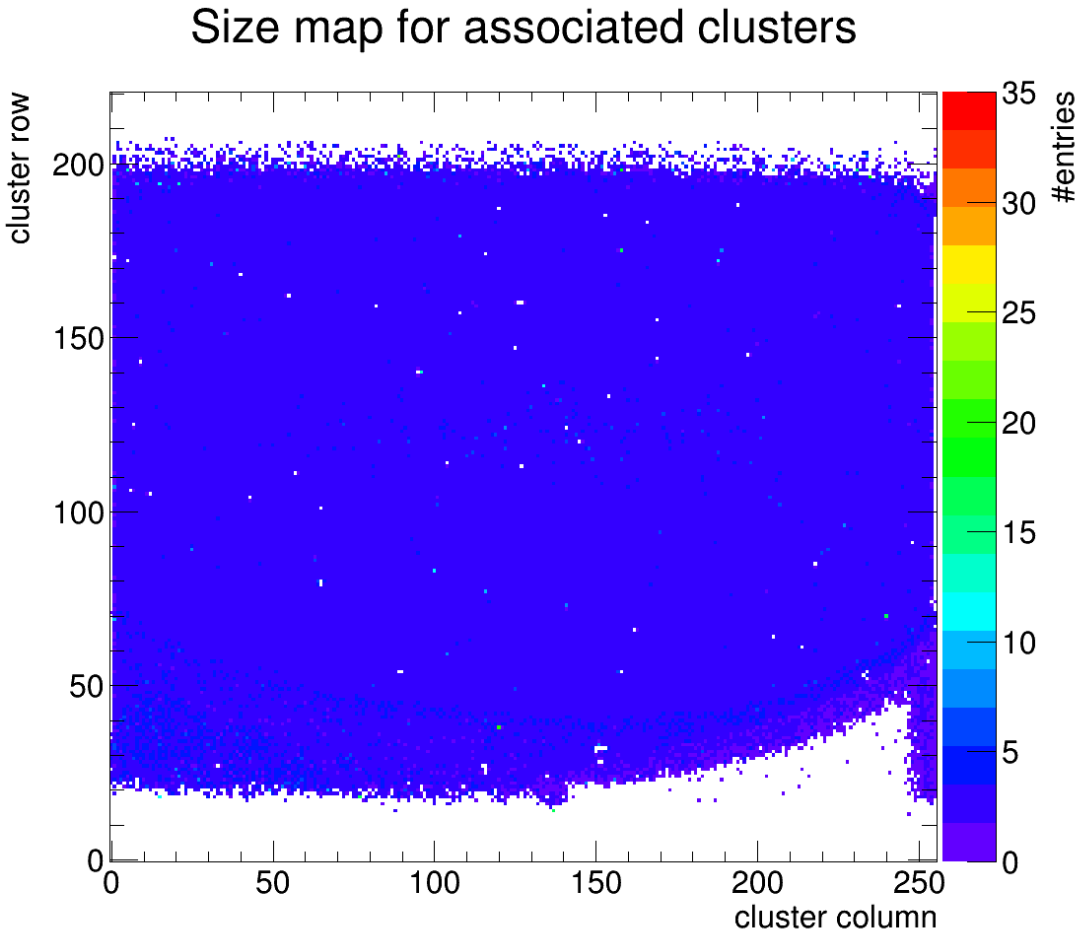



# Bias Scan

## Chip efficiency and cluster size maps

Bias = 50 V
Threshold = 1085 LSB ~ 800 $e^-$

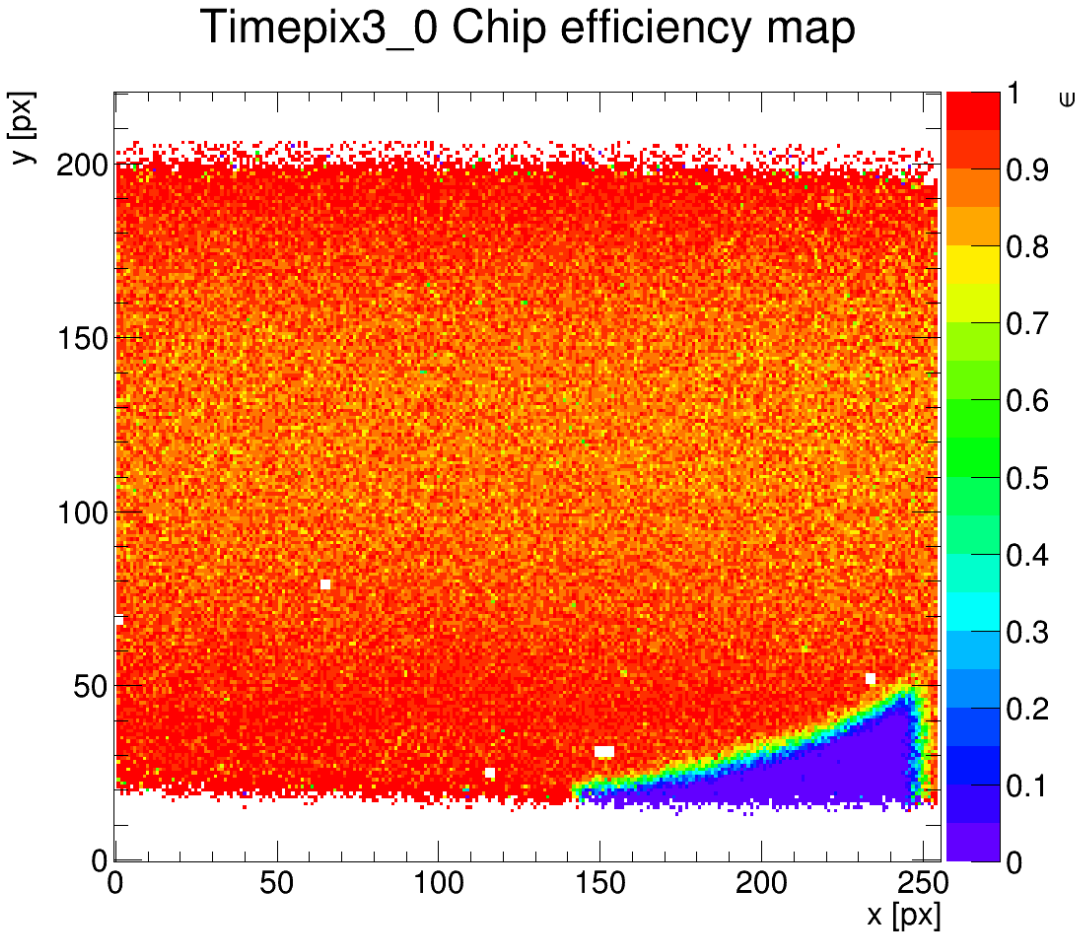


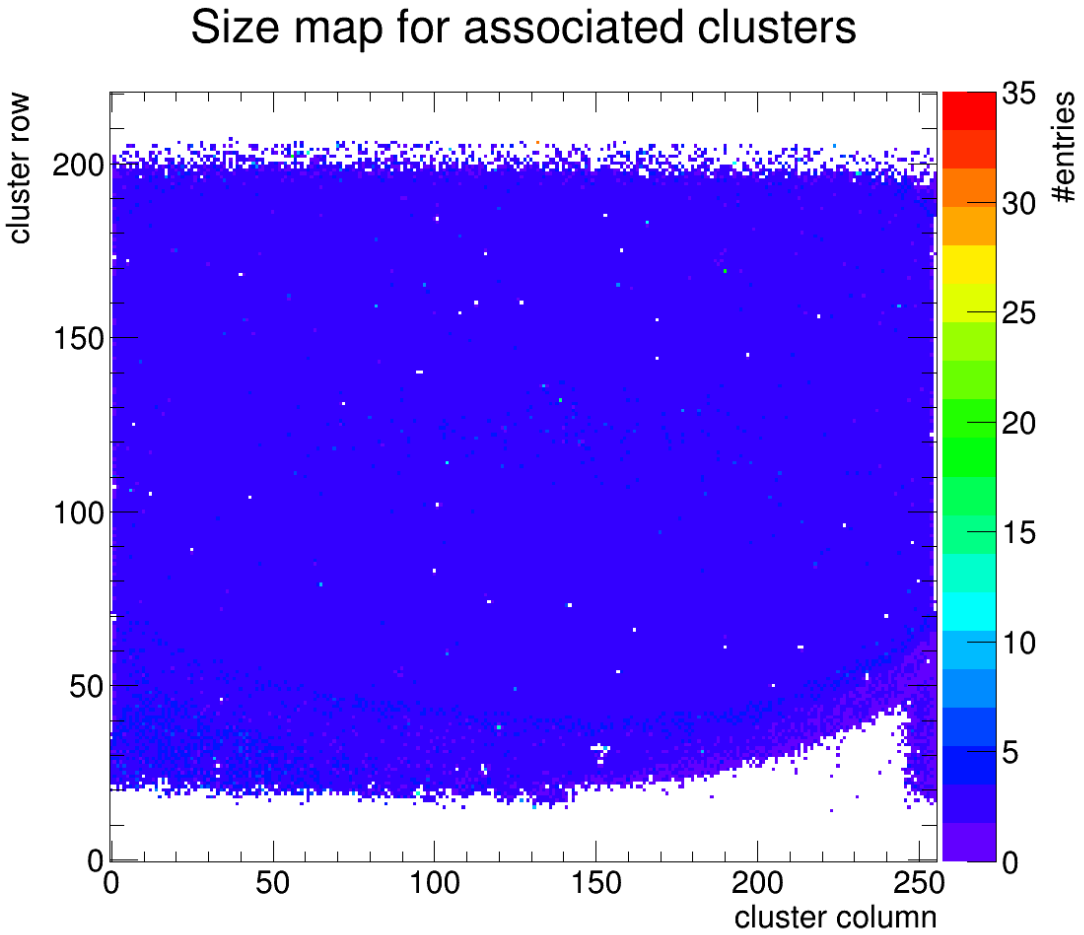



# Bias Scan

## Chip efficiency and cluster size maps

Bias = 60 V
Threshold = 1085 LSB ~ 800 $e^-$

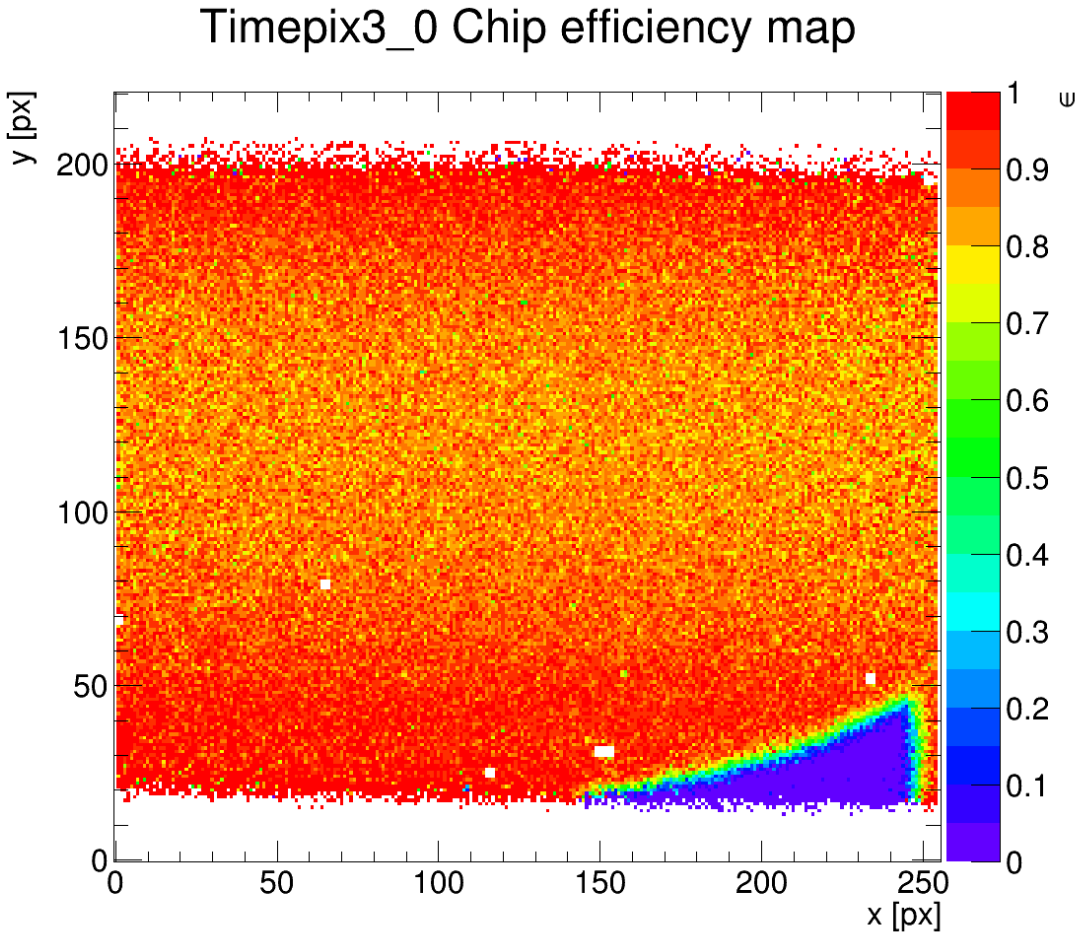


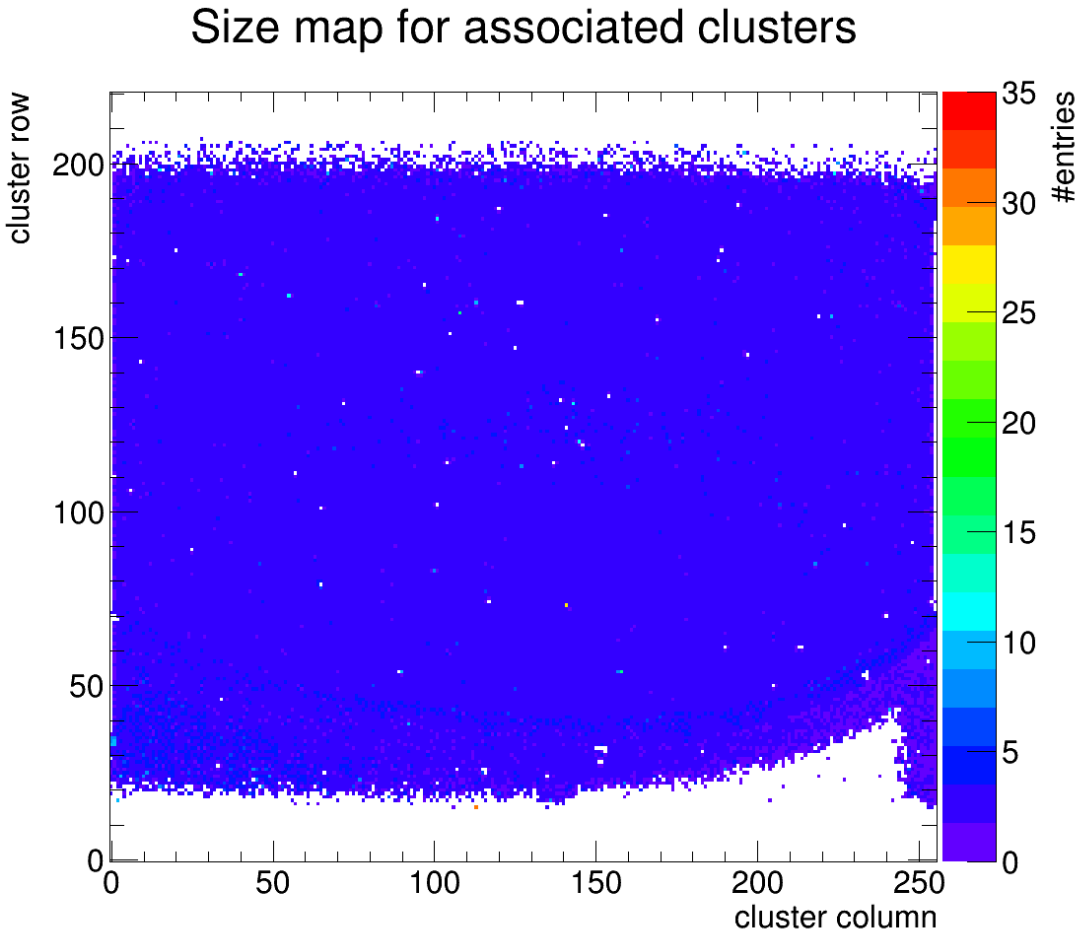



# Bias Scan

## Chip efficiency and cluster size maps

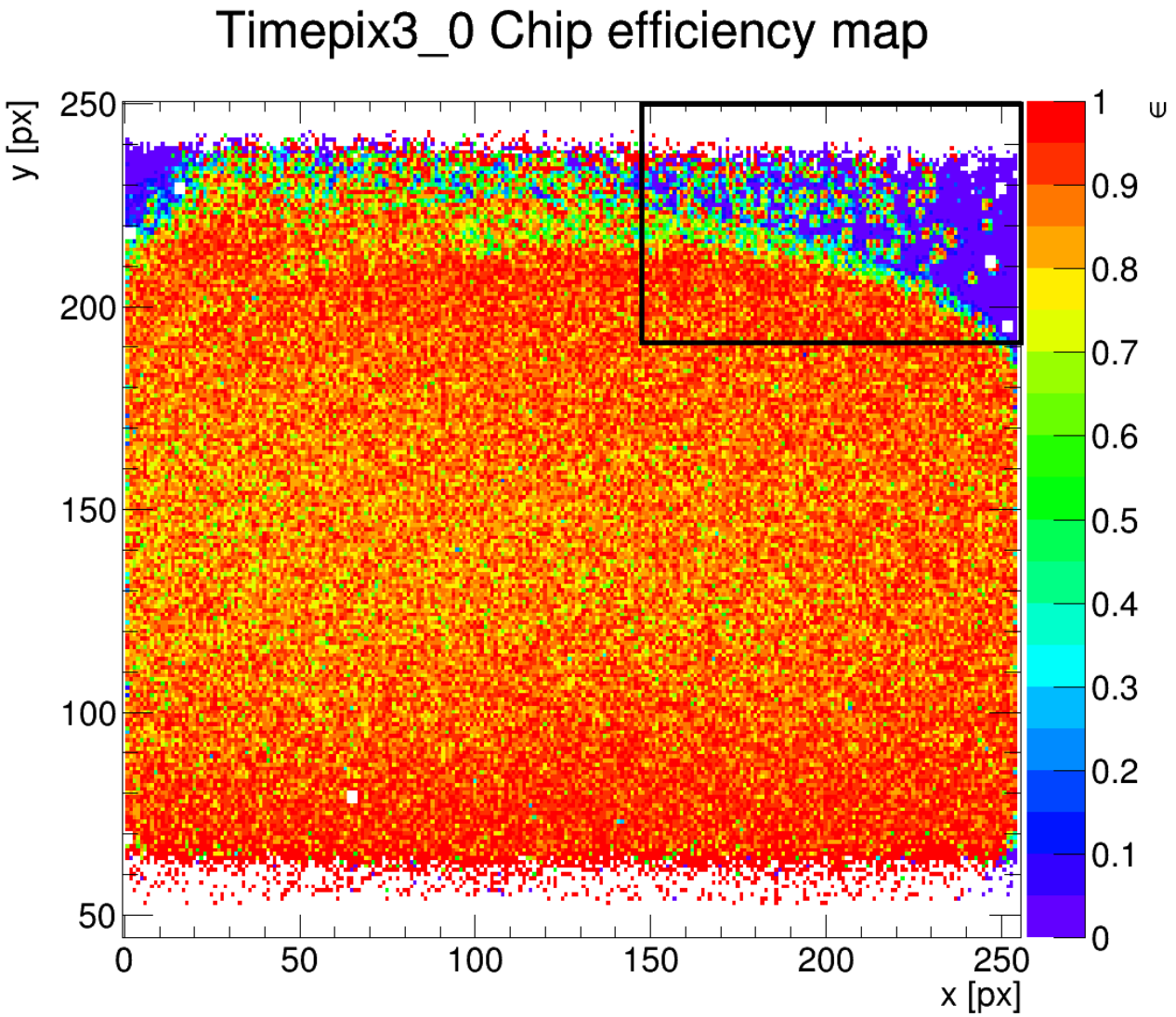
Bias = 70 V
Threshold = 1085 LSB ~ 800 $e^-$



# Close up to periphery

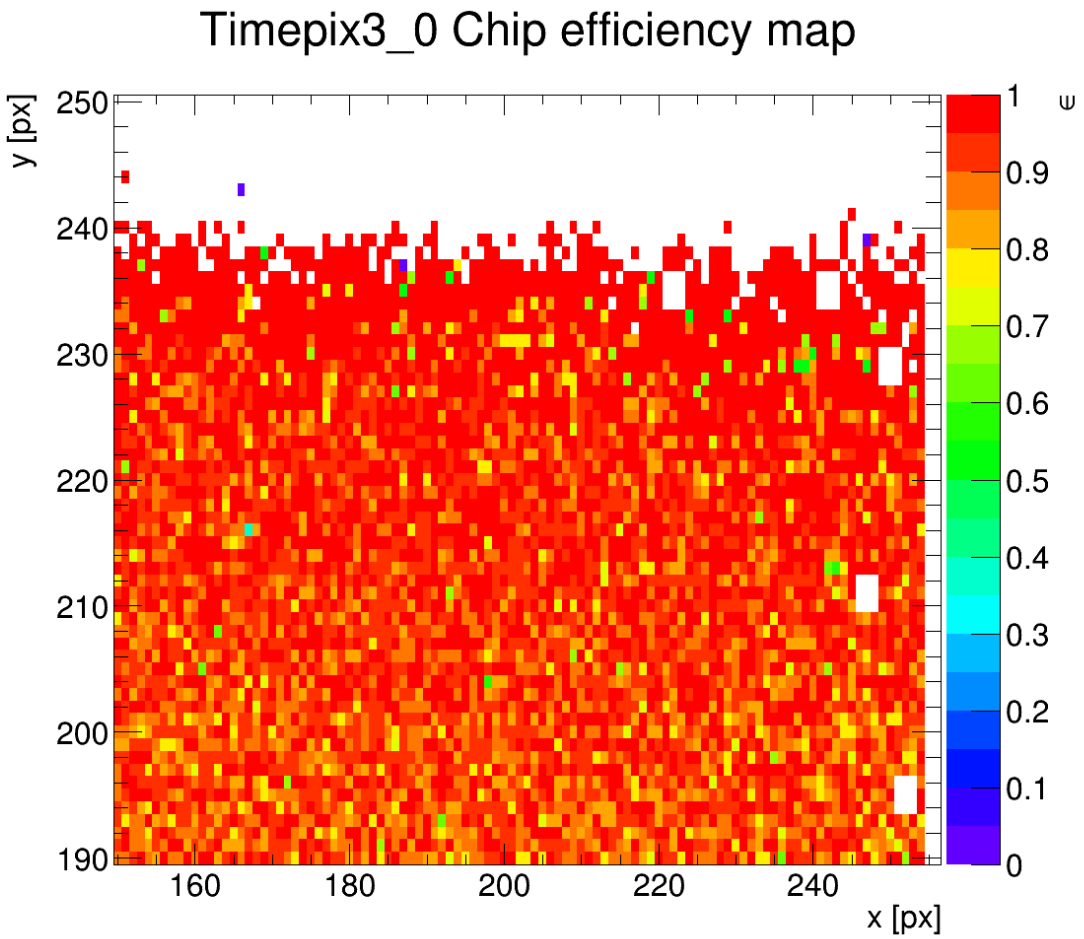
## Cut in upper right corner of sensor

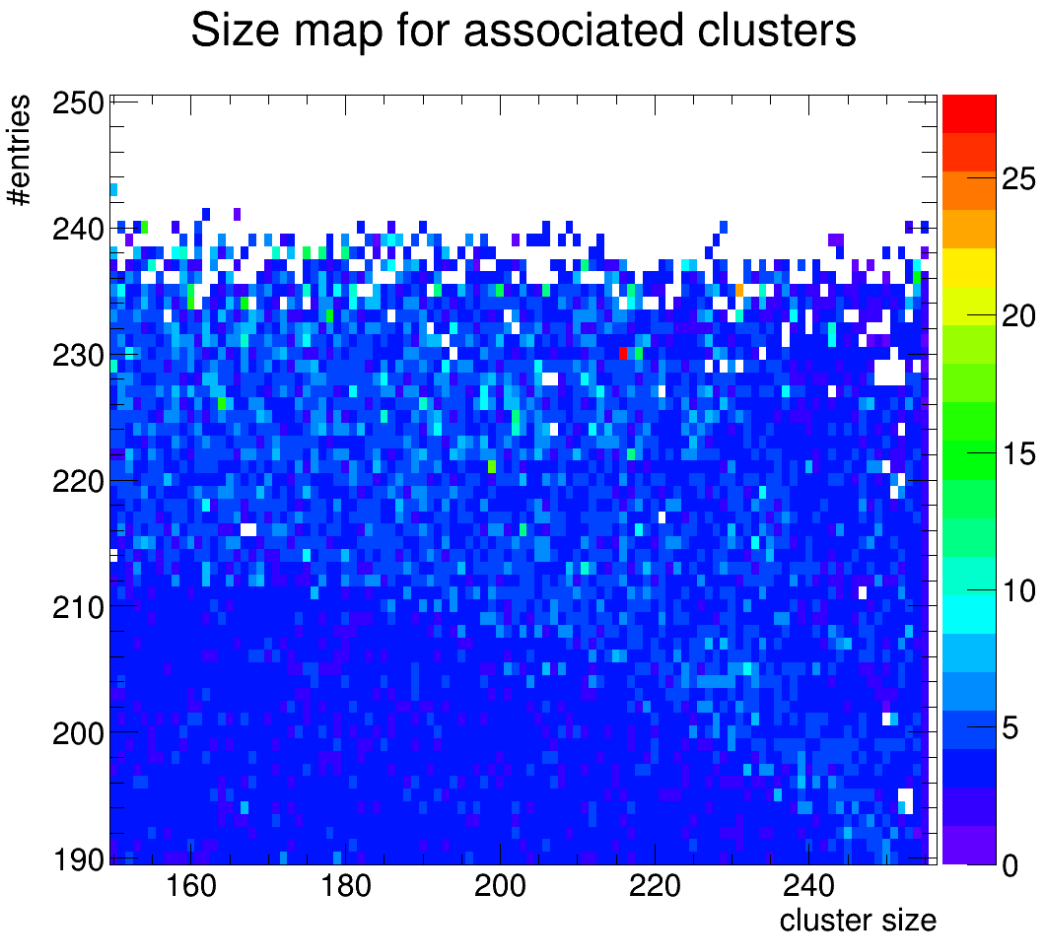


# Close up to periphery

## Chip efficiency and cluster size maps

Bias = 40 V
Threshold = 1096 LSB ~ 650 $e^-$

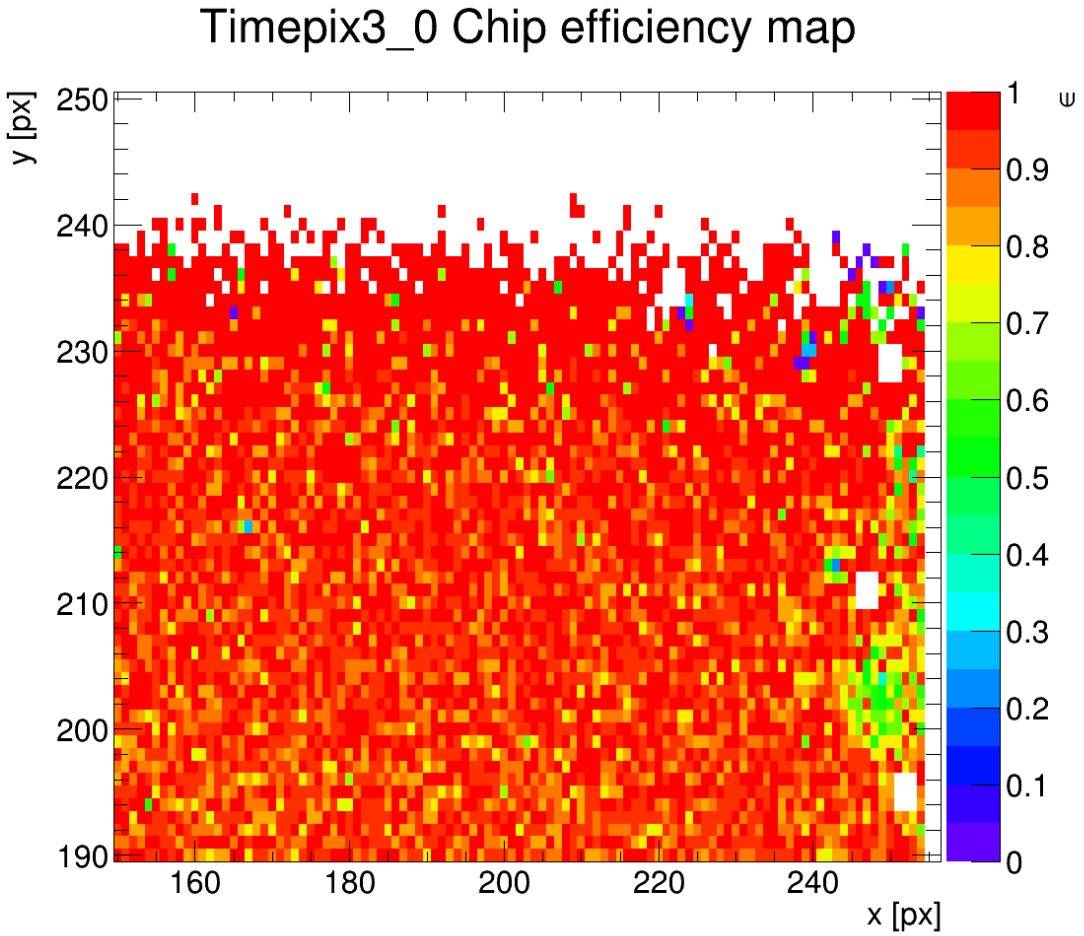


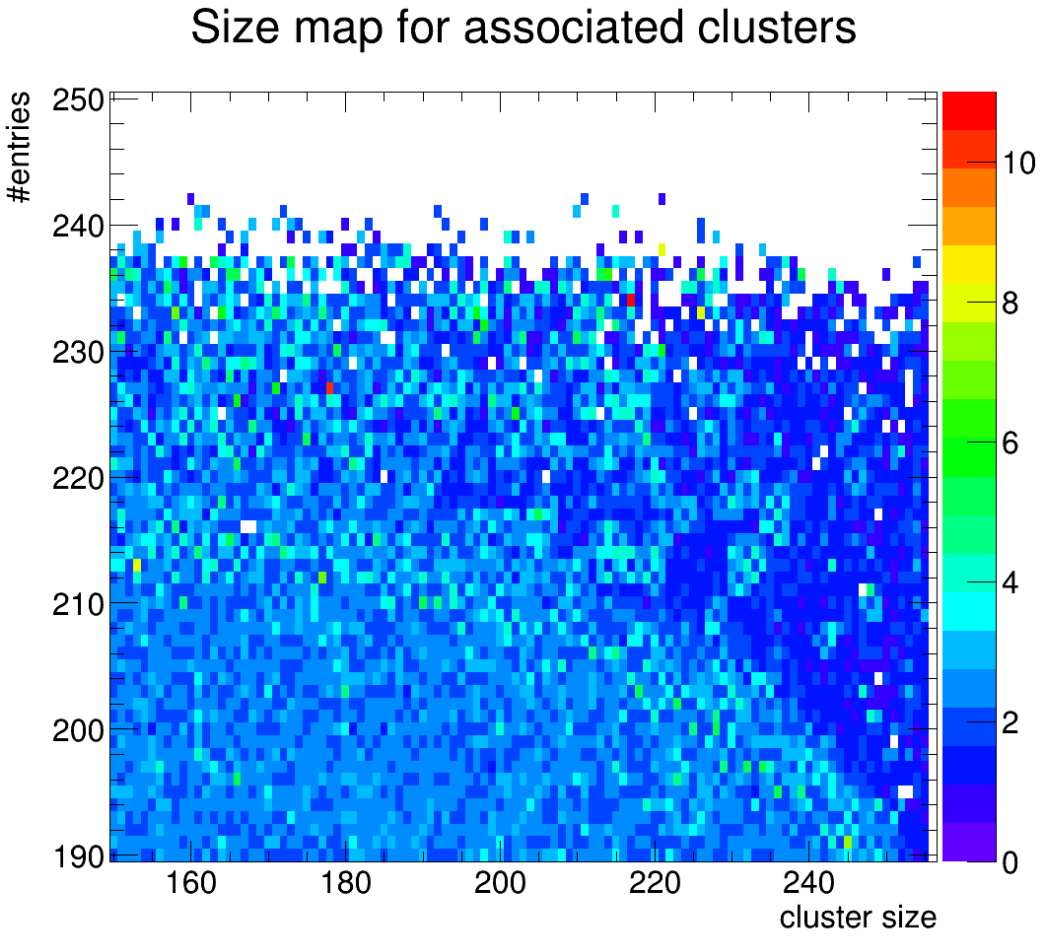



# Close up to periphery

## Chip efficiency and cluster size maps

Bias = 40 V
Threshold = 1021 LSB ~ 1400 $e^-$

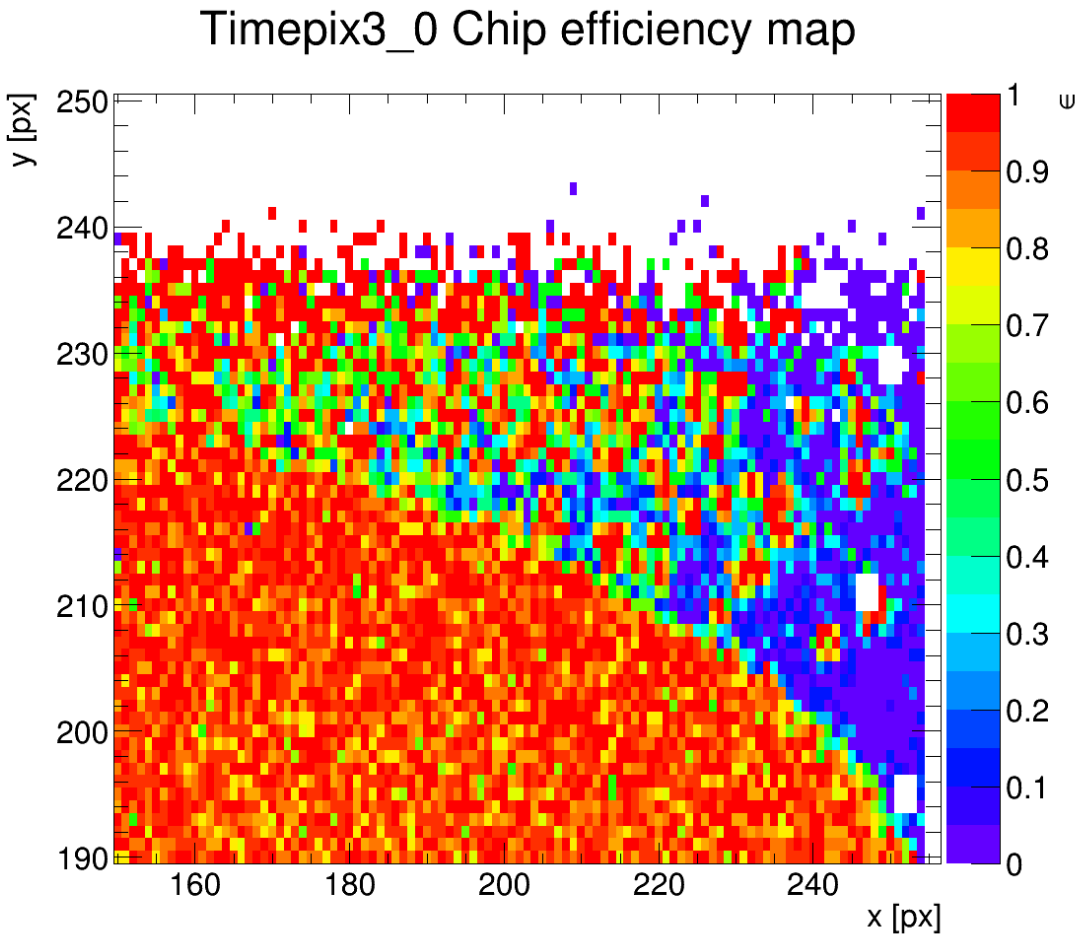


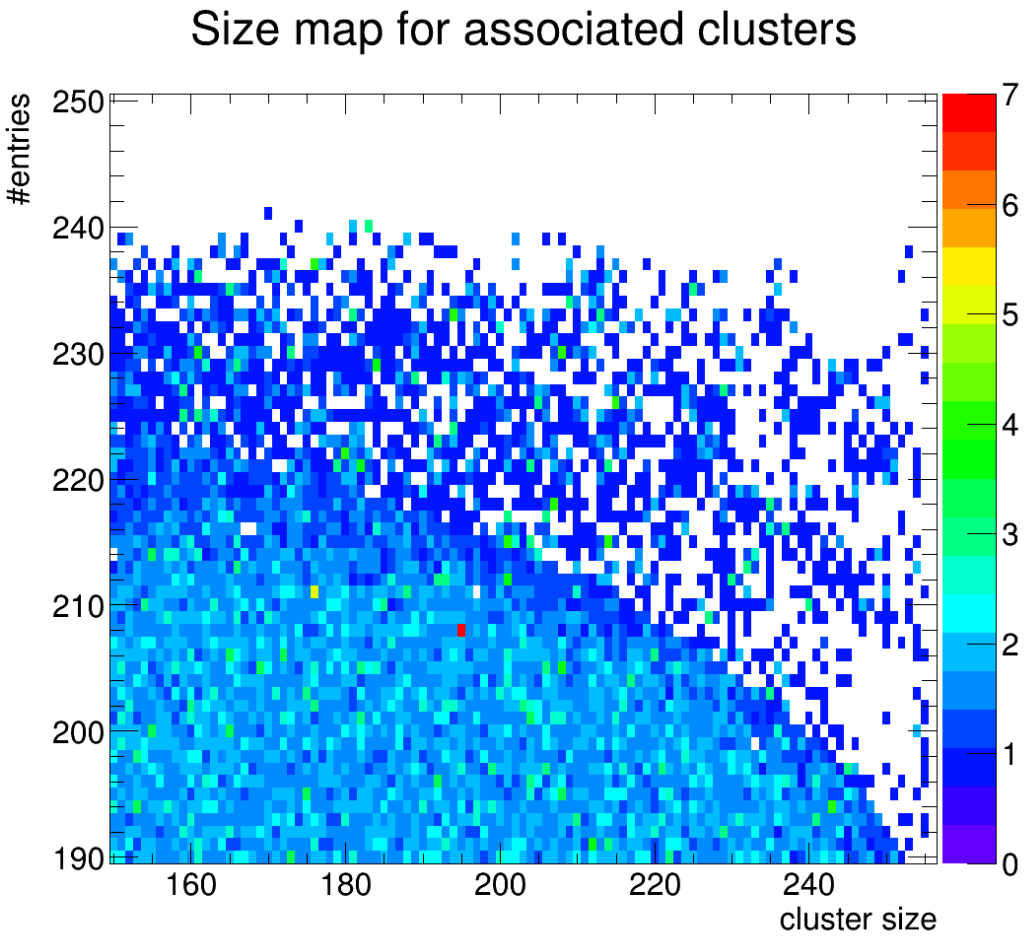



# Close up to periphery

## Chip efficiency and cluster size maps

Bias = 40 V
Threshold = 811 LSB ~ 3500 $e^-$

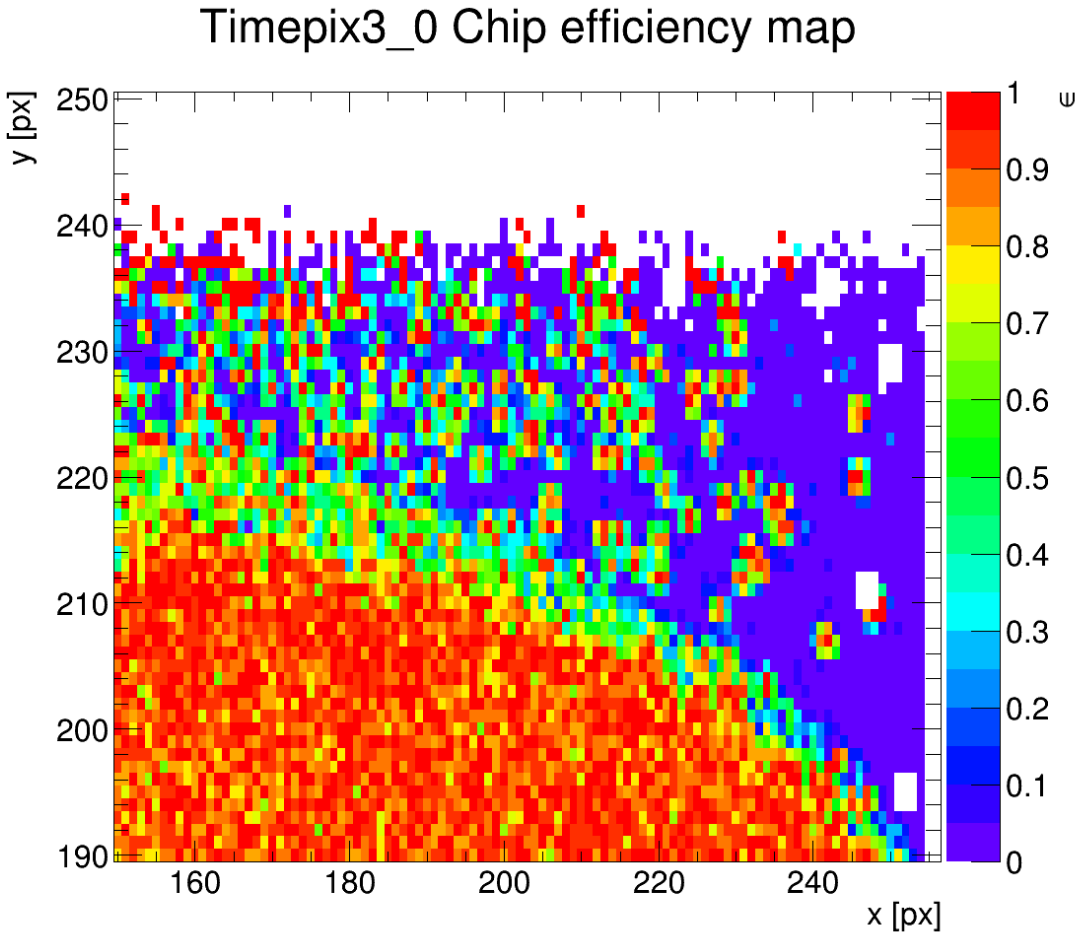


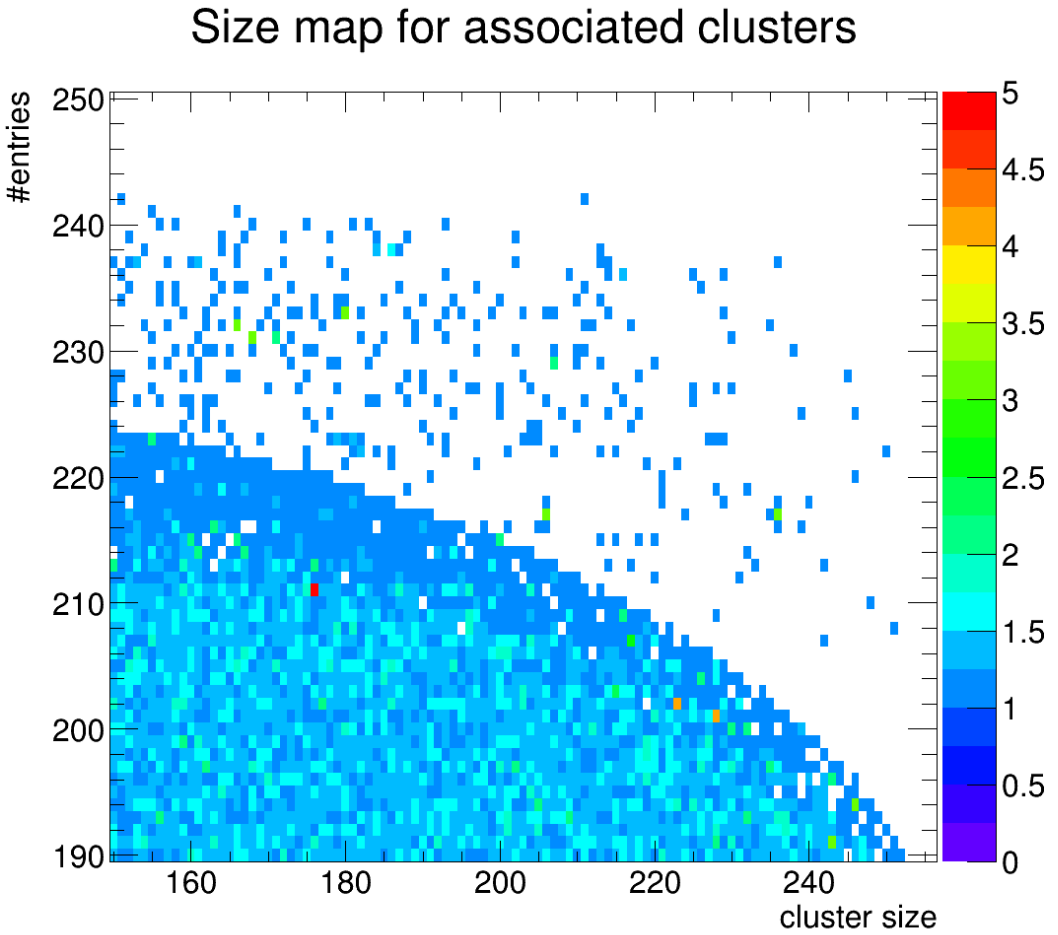



# Close up to periphery

## Chip efficiency and cluster size maps

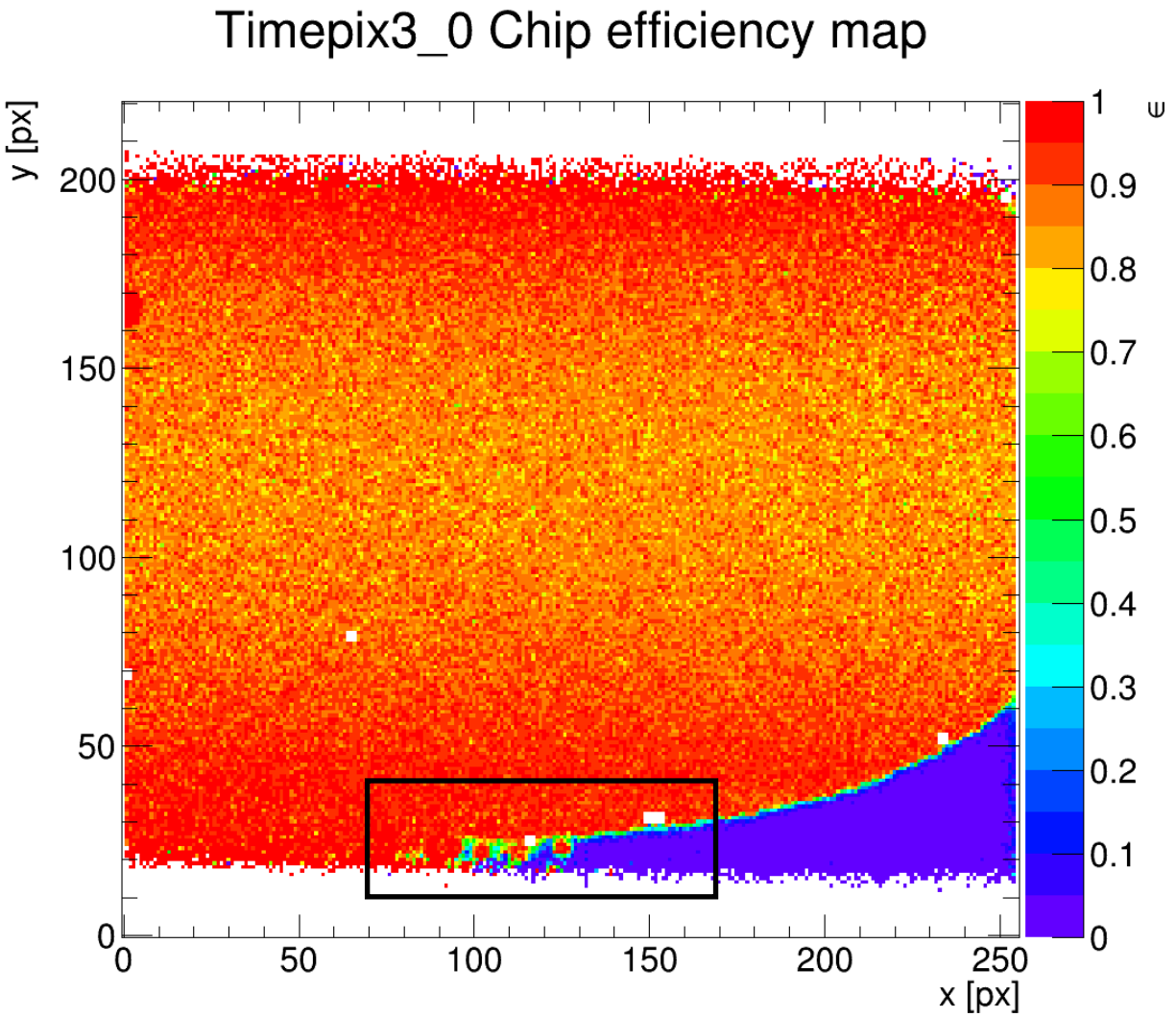
Bias = 40 V
Threshold = 511 LSB ~ 6500 $e^-$



# Close up to periphery

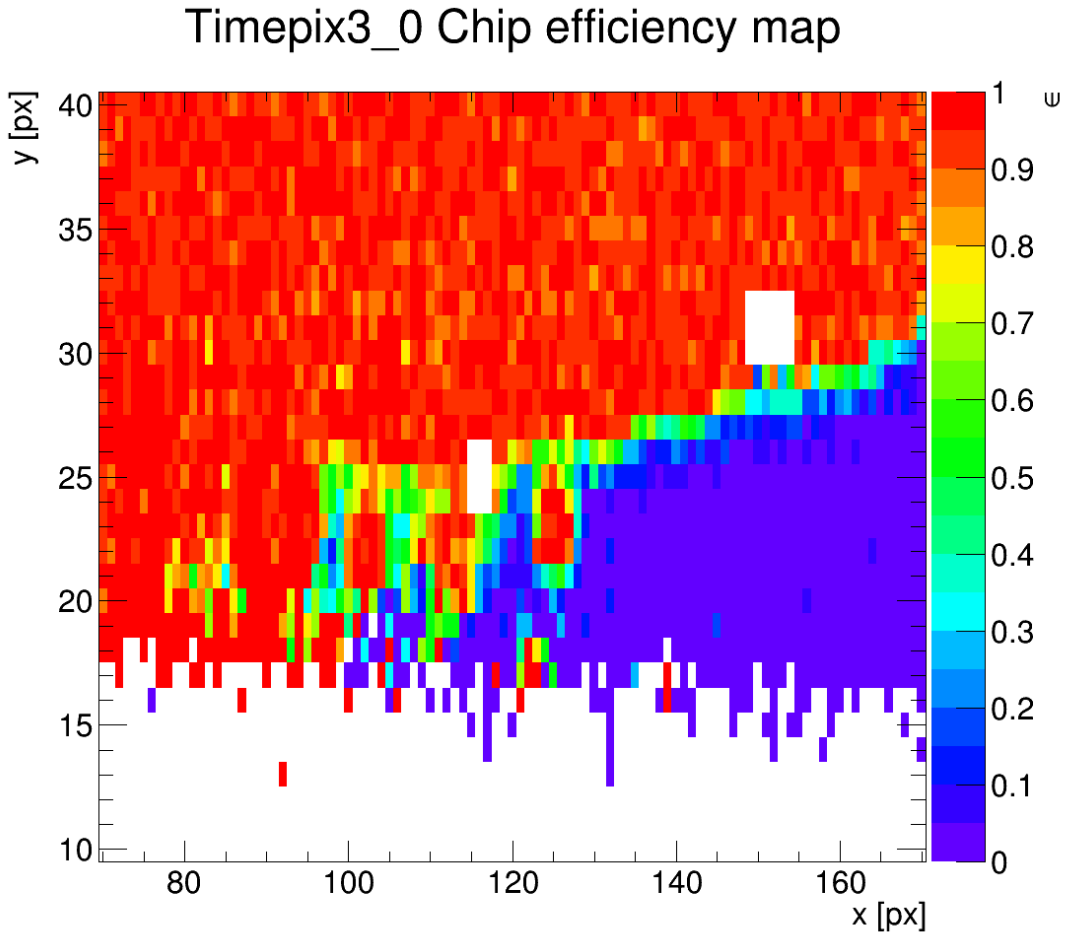
## Cut in bottom center region of sensor

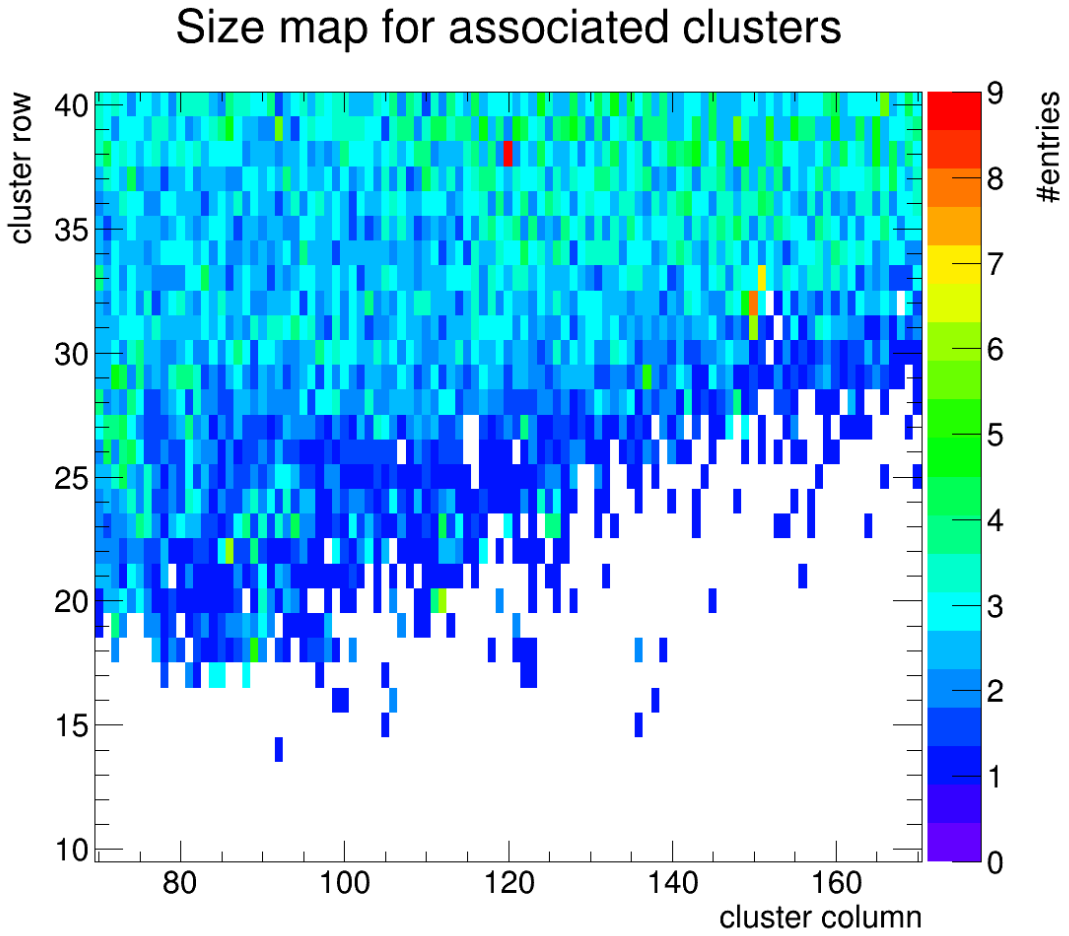


# Close up to periphery

## Chip efficiency and cluster size maps

Bias = 20 V
Threshold = 1085 LSB ~ 800 $e^-$

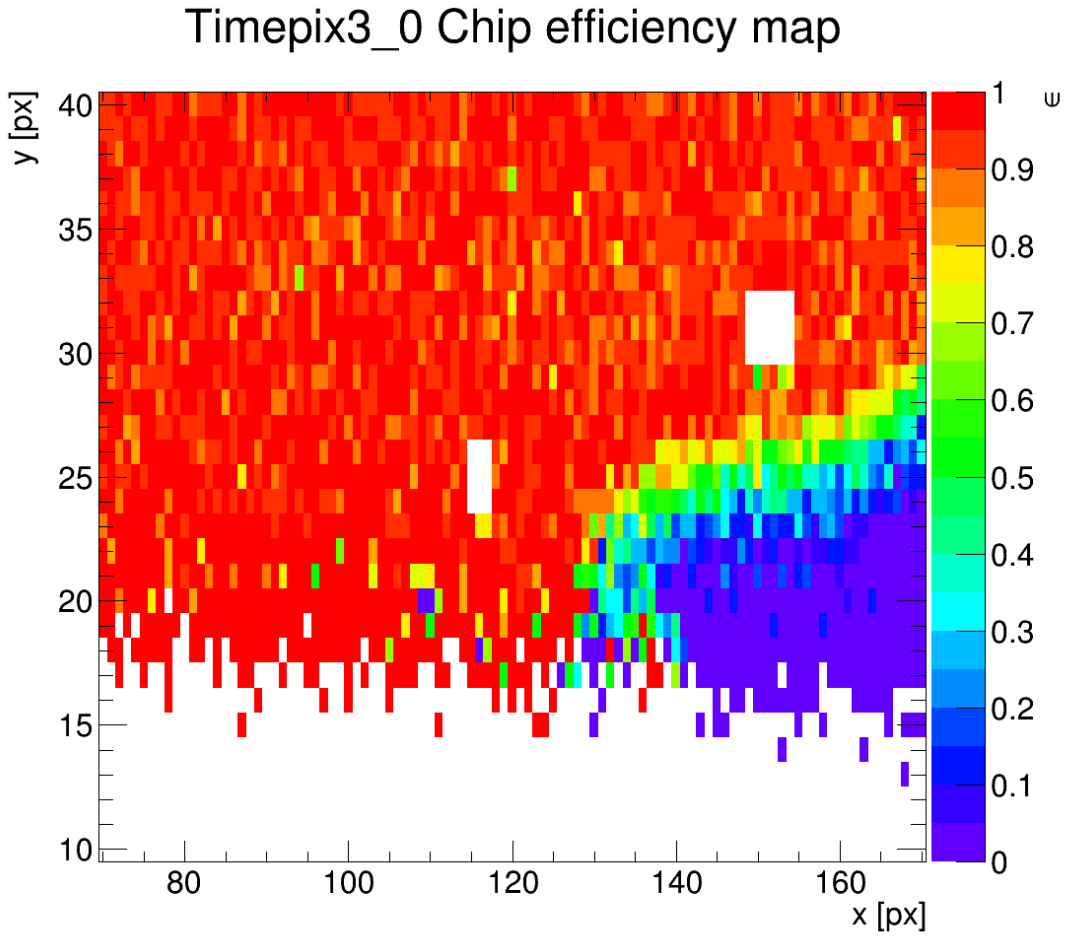


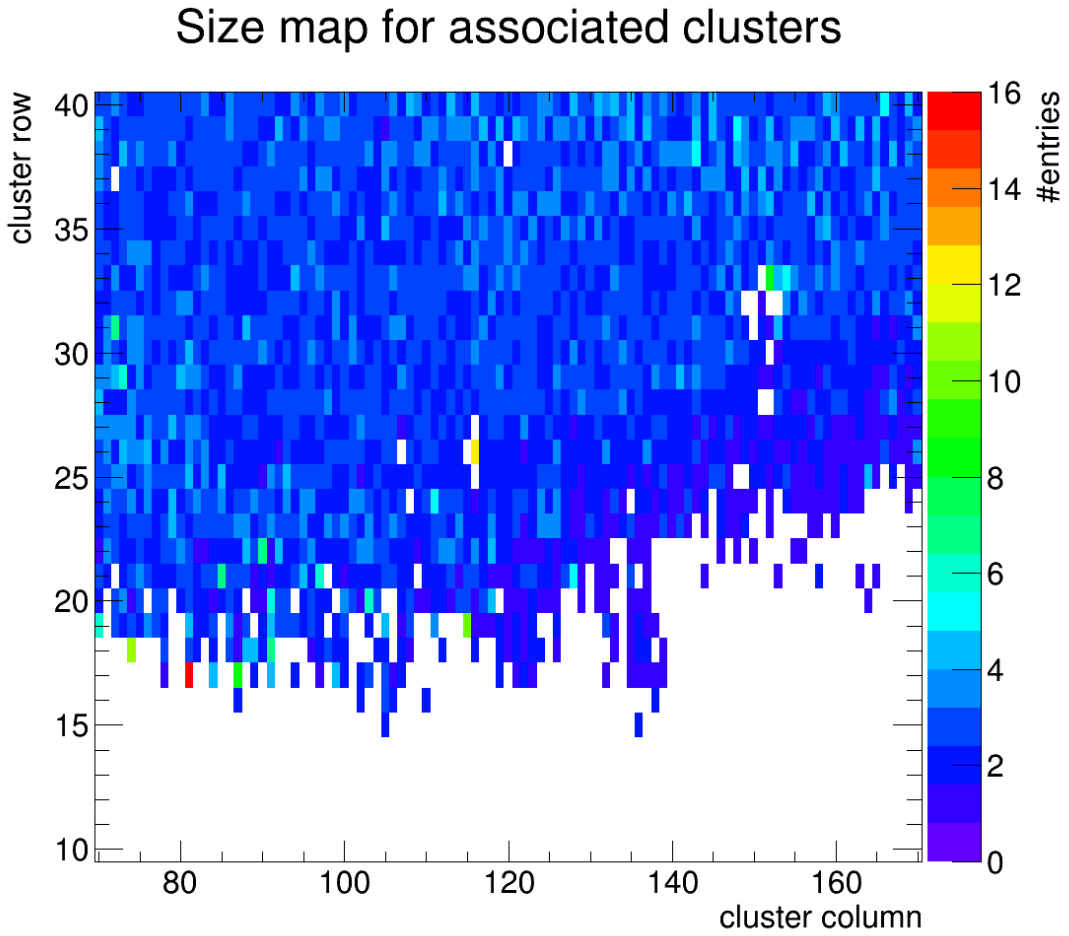



# Close up to periphery

## Chip efficiency and cluster size maps

Bias = 40 V
Threshold = 1085 LSB ~ 800 $e^-$

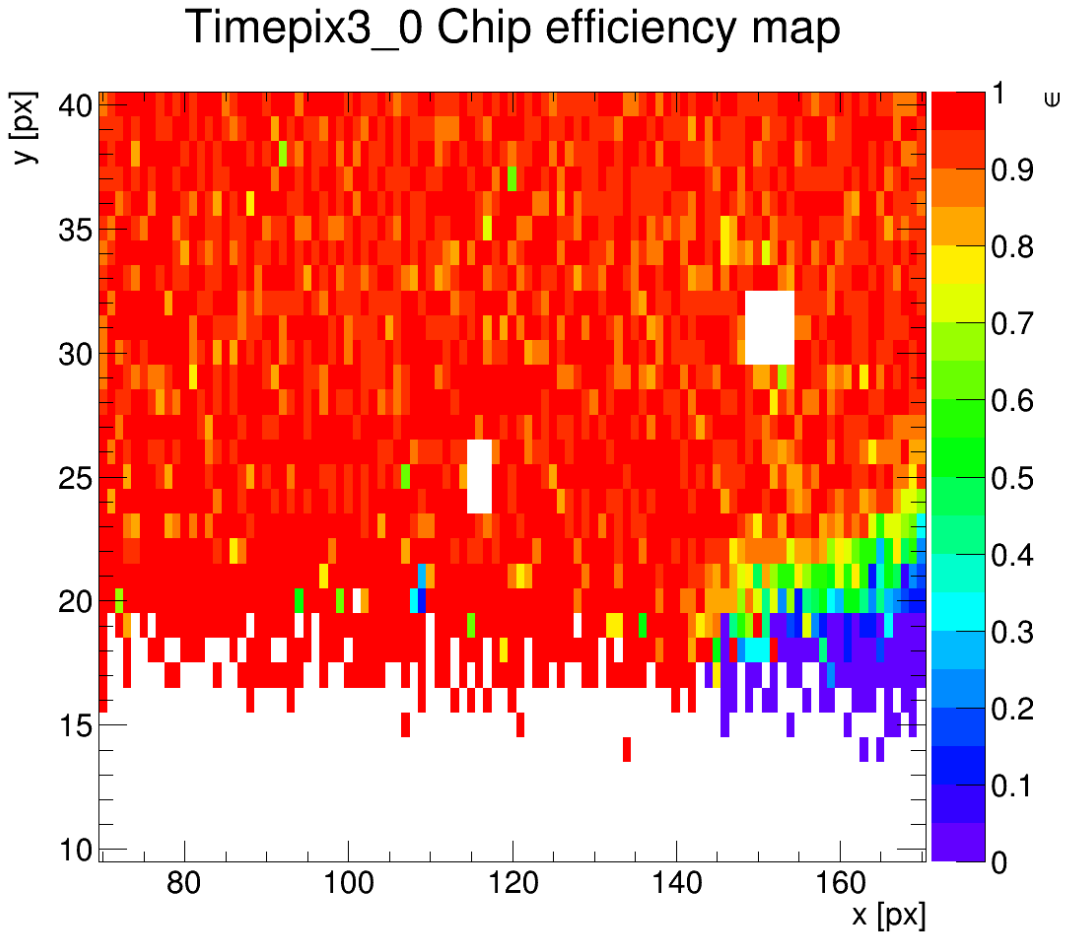


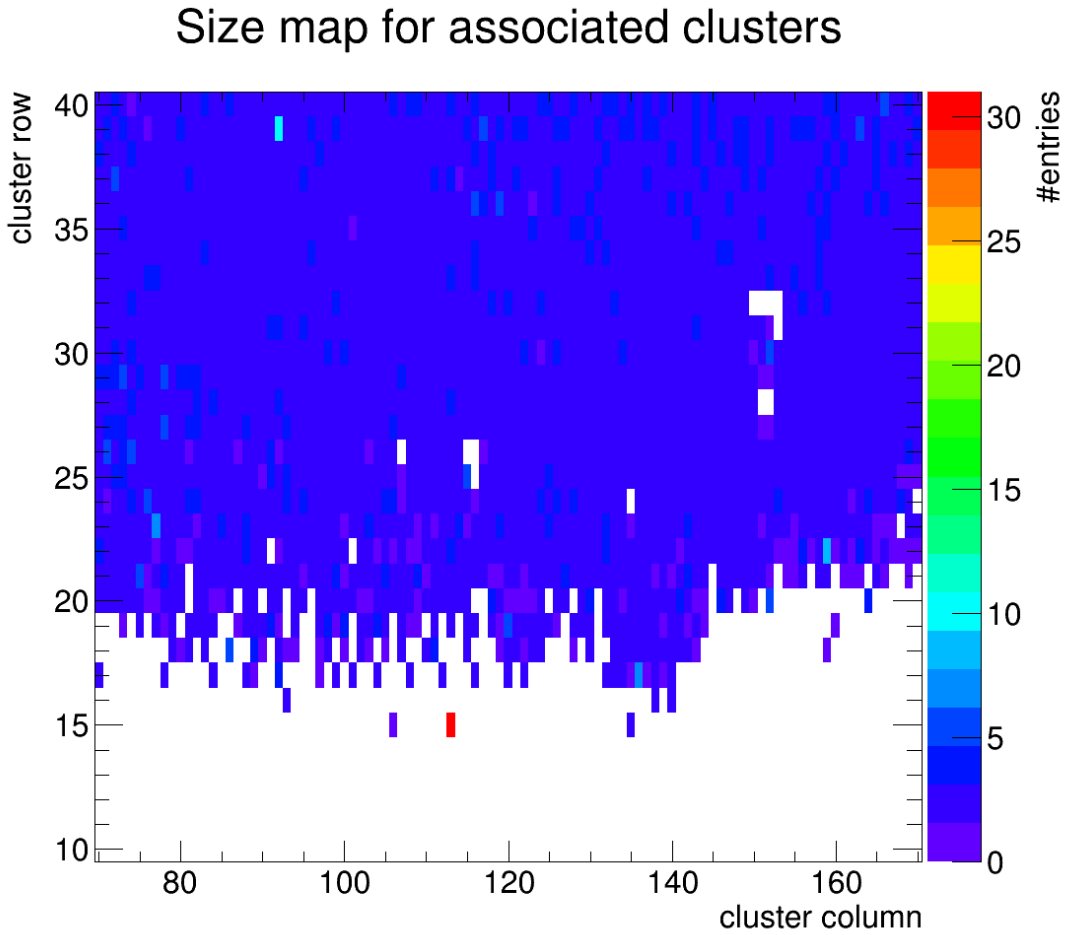



# Close up to periphery

## Chip efficiency and cluster size maps

Bias = 70 V
Threshold = 1085 LSB ~ 800 $e^-$



# References and Acknowledgements

The measurements leading to these results have been performed at the **Test Beam Facility at DESY Hamburg (Germany)**, a member of the Helmholtz Association (HGF).

- The DESY II test beam facility" ( https://doi.org/10.1016/j.nima.2018.11.133 )
  NIMA, Volume 922, 1 April 2019, Pages 265-28

- M. Williams, J. Kröger, L. Huth, P. Schütze, S. Spannagel. (2020, December 22). **Corryvreckan - A Modular 4D Track Reconstruction and Analysis Software for Test Beam Data** (Version 2.0). Zenodo. http://doi.org/10.5281/zenodo.4384186

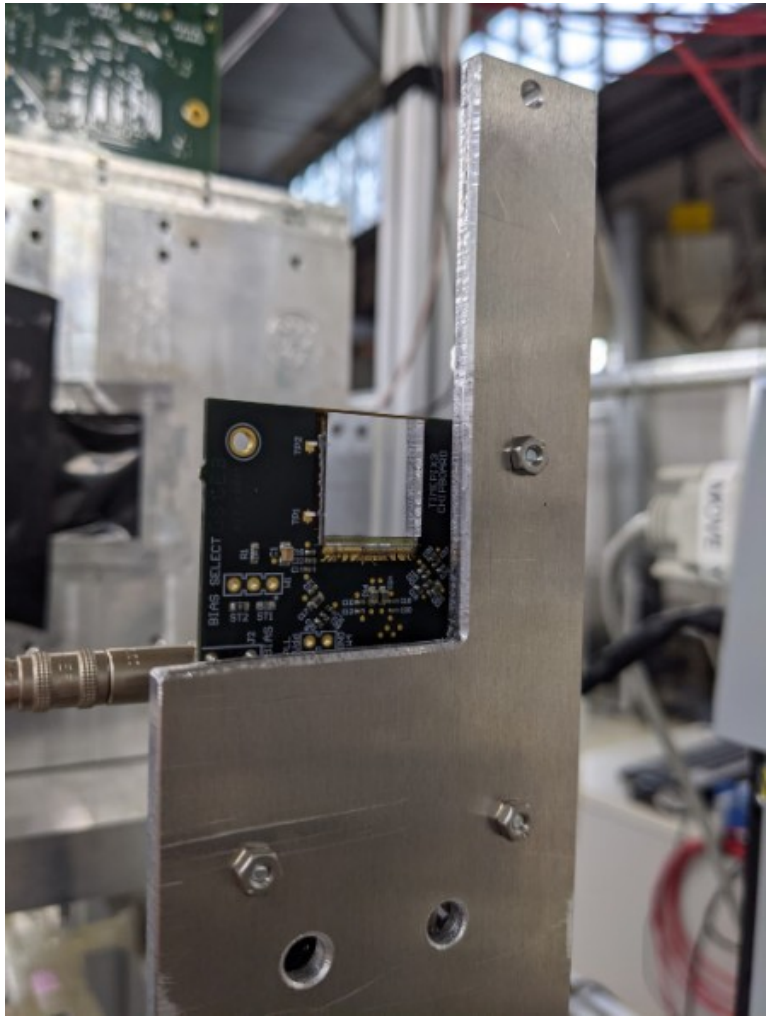
**Test Beam Team**

- Lennart Huth
- Keerthi Nakkalil
- Simon Spannagel
- Annika Vauth
- Anastasiia Velyka

# Backup

# Test Beam Setup

## Geometry 4

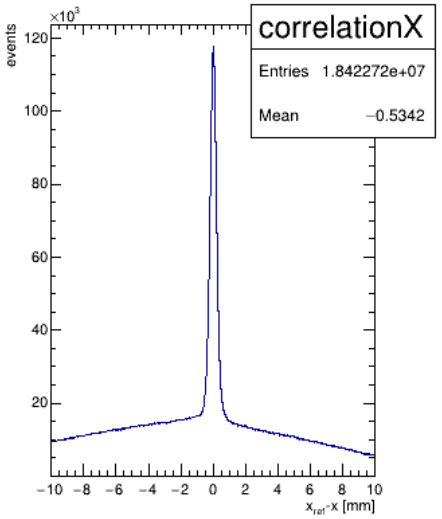



# Telescope Alignment Results

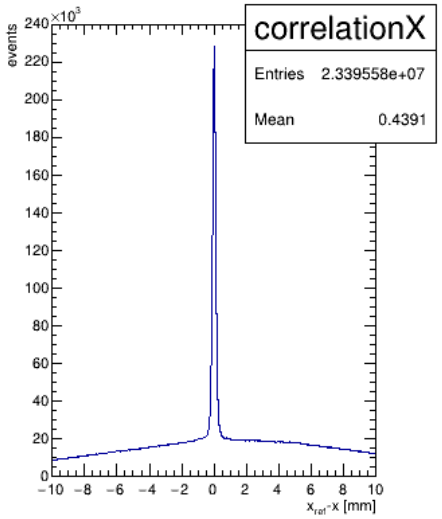
## Geometry 2

Reference Plane

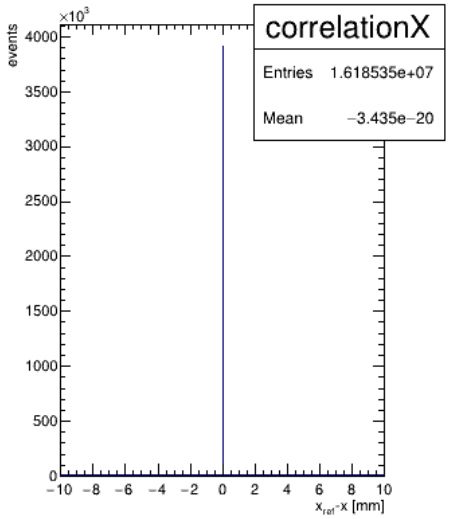
MIMOSA26_0: correlation X



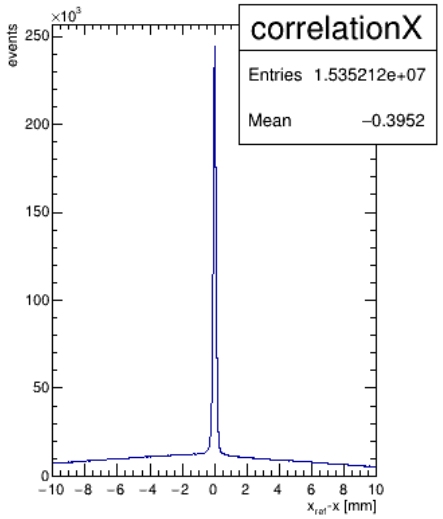

MIMOSA26_1: correlation X



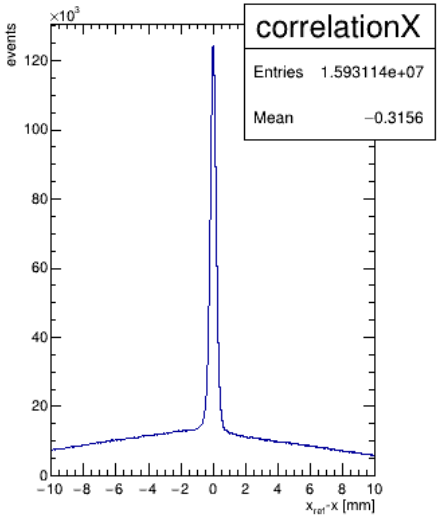

MIMOSA26_2: correlation X



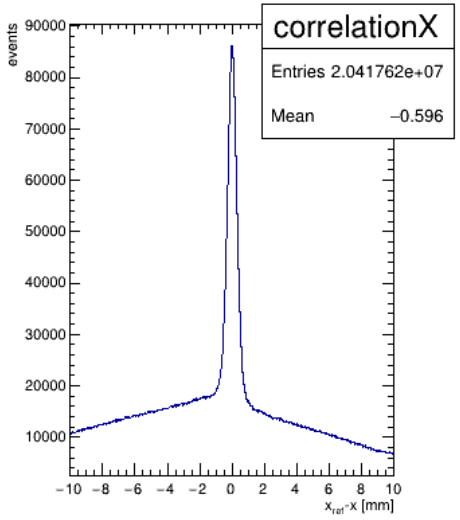

MIMOSA26_3: correlation X



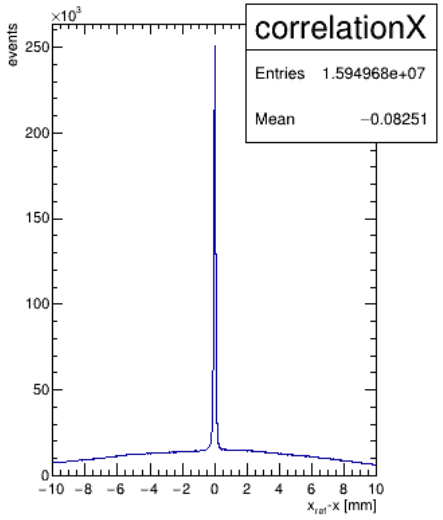

MIMOSA26_4: correlation X




MIMOSA26_5: correlation X



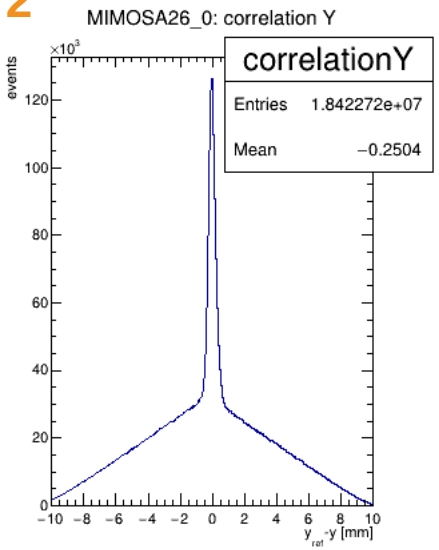

Timepix3_0: correlation X

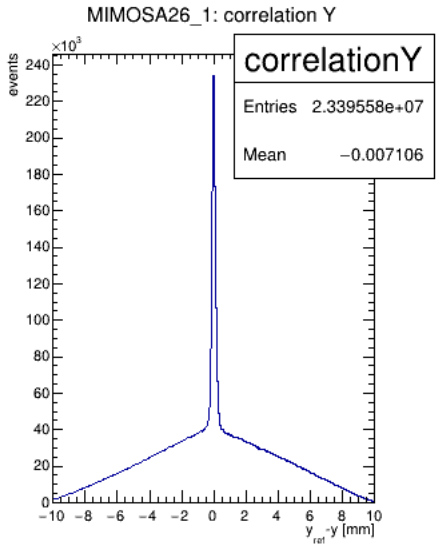


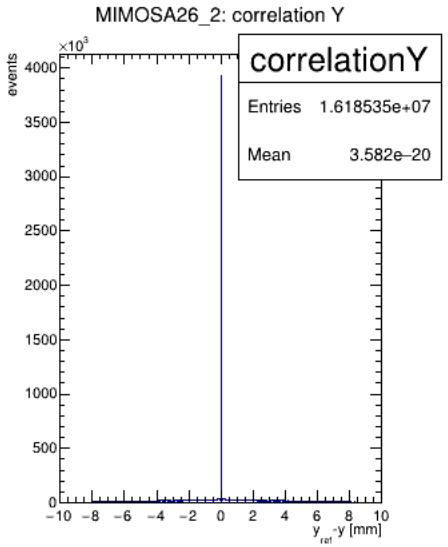
# Telescope Alignment Results

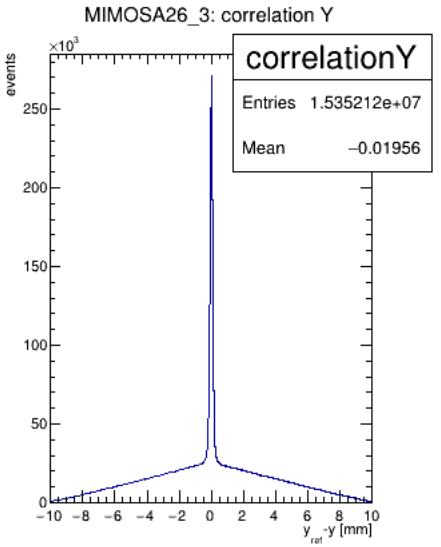
## Geometry 2

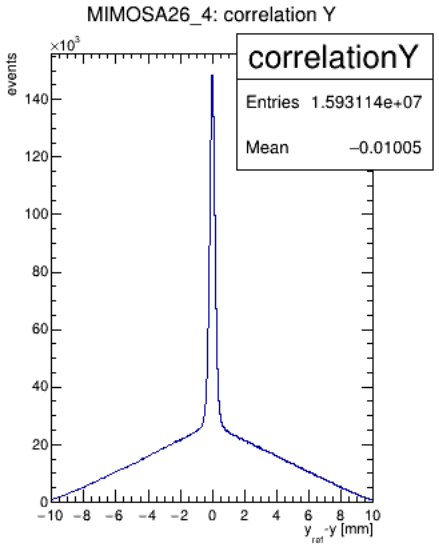
Reference Plane

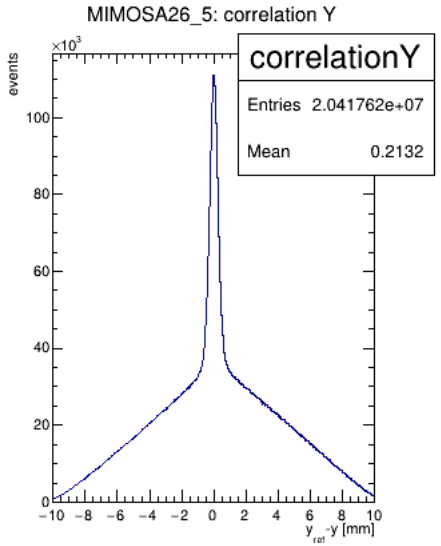


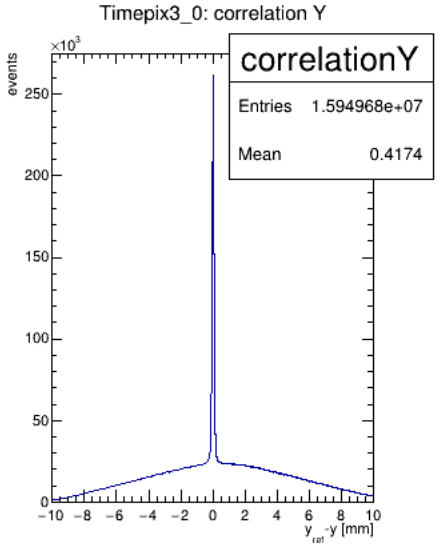



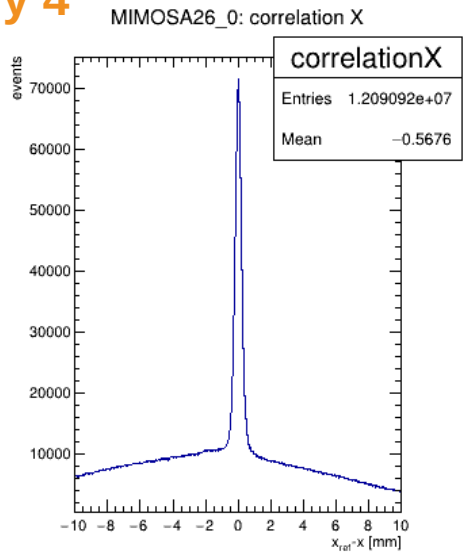



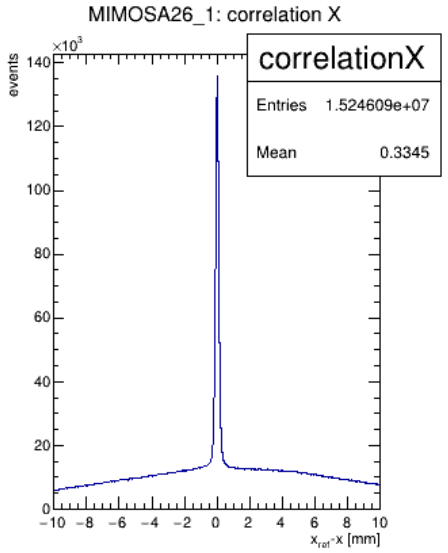



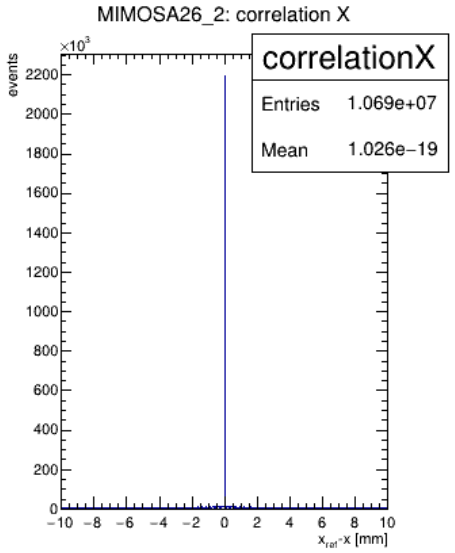
# Telescope Alignment Results

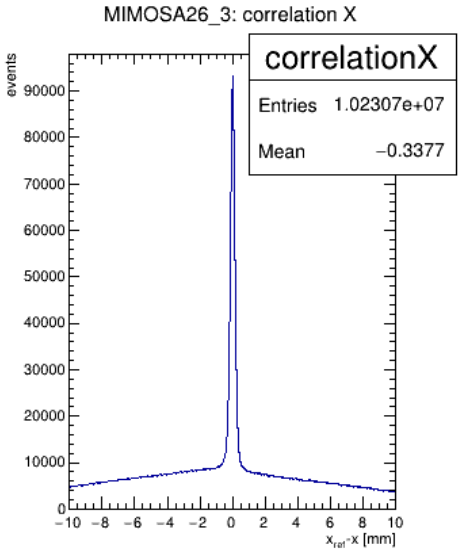
## Geometry 4

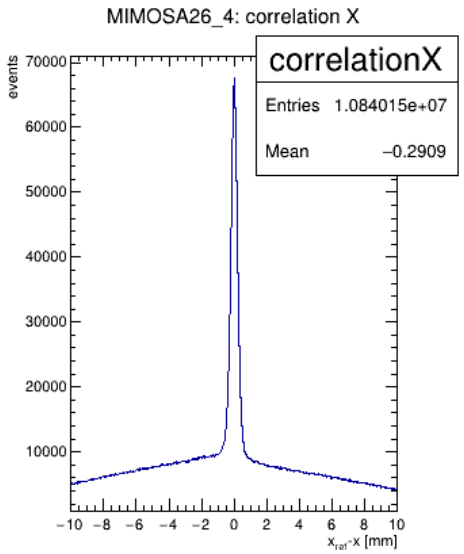
Reference Plane

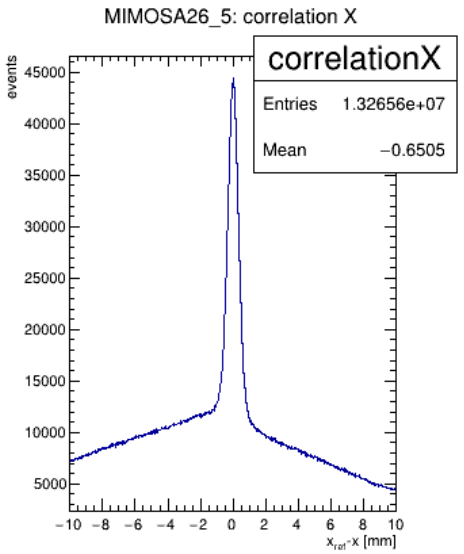


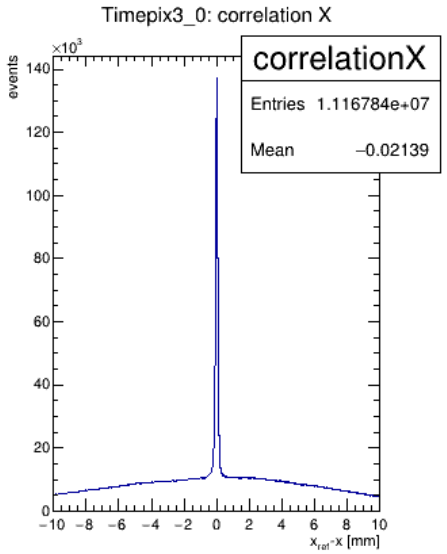



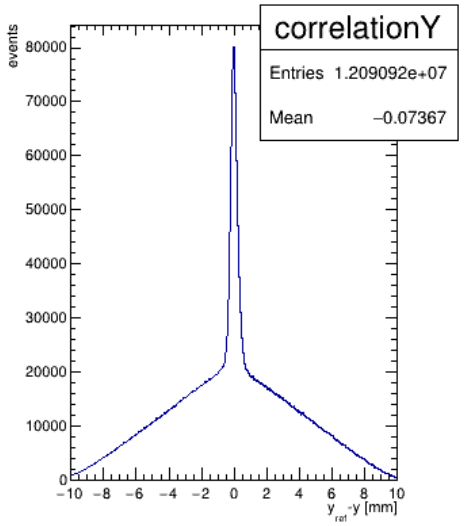



# Telescope Alignment Results

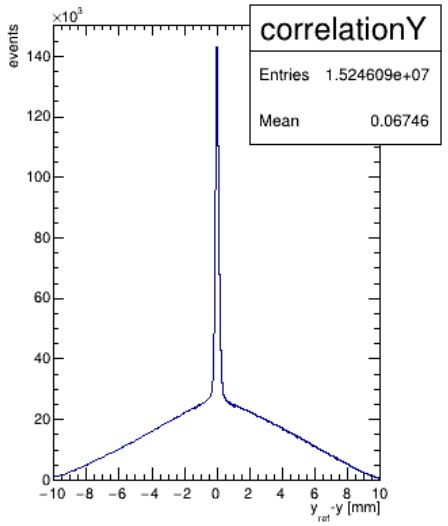
## Geometry 4

Reference Plane

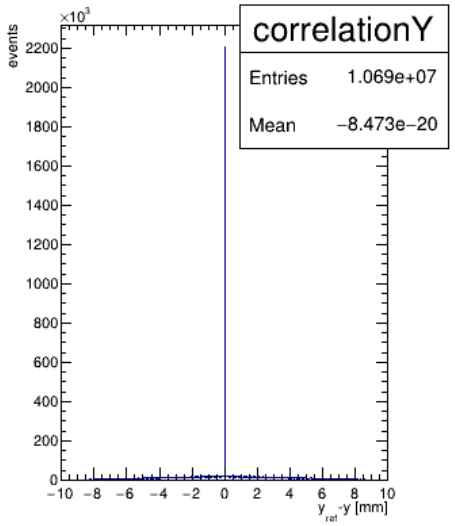
MIMOSA26_0: correlation Y



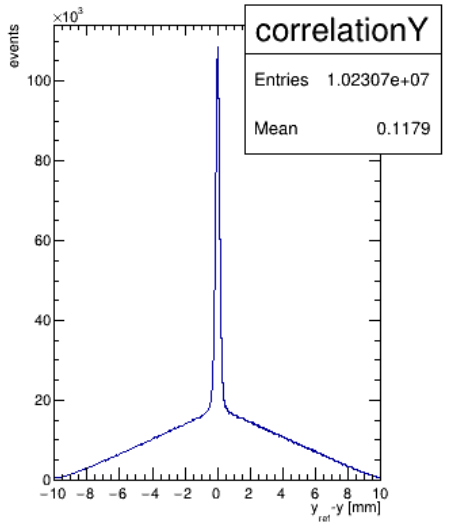

MIMOSA26_1: correlation Y



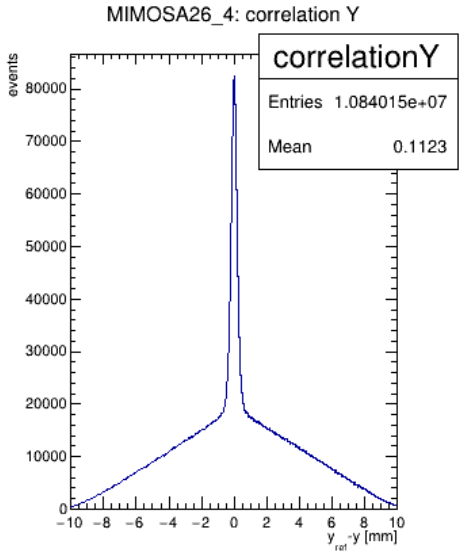

MIMOSA26_2: correlation Y



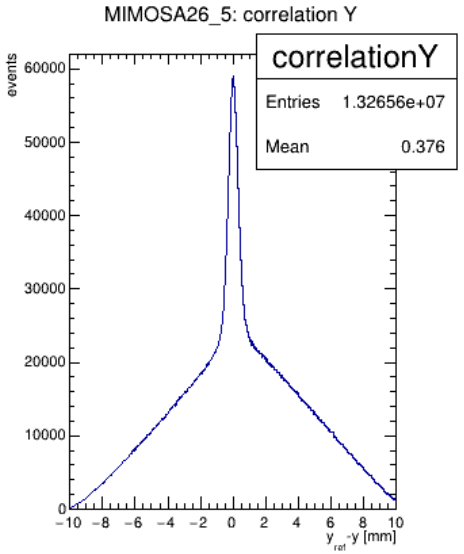

MIMOSA26_3: correlation Y



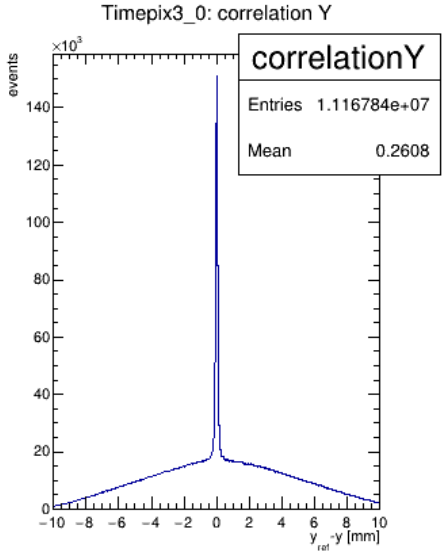

MIMOSA26_4: correlation Y




MIMOSA26_5: correlation Y

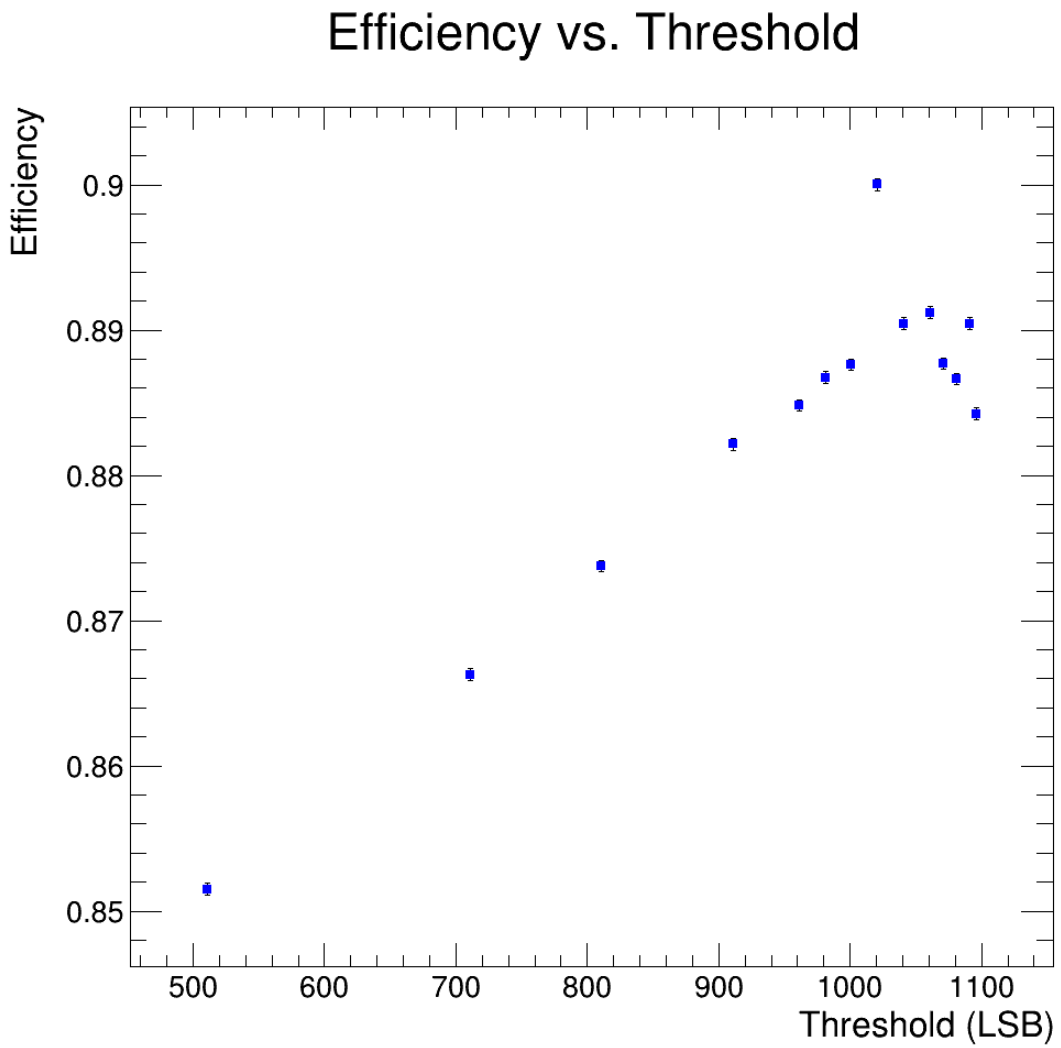



Timepix3_0: correlation Y



# Threshold Scan (Geometry 4)

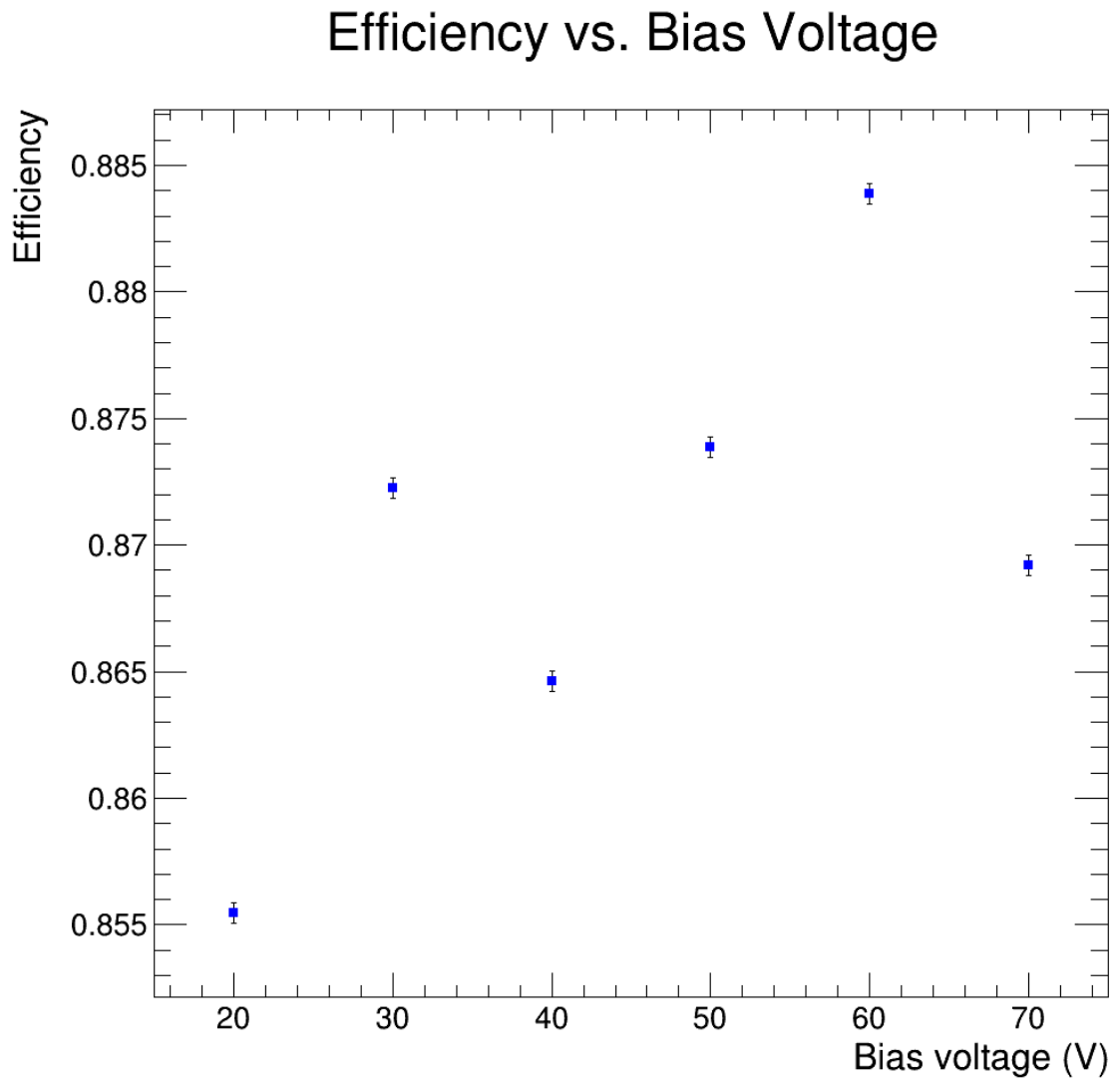
## Efficiency vs. Threshold (Voltage Bias = 40 V)




Baseline = 1163 LSB

# Bias Scan (Geometry 2)

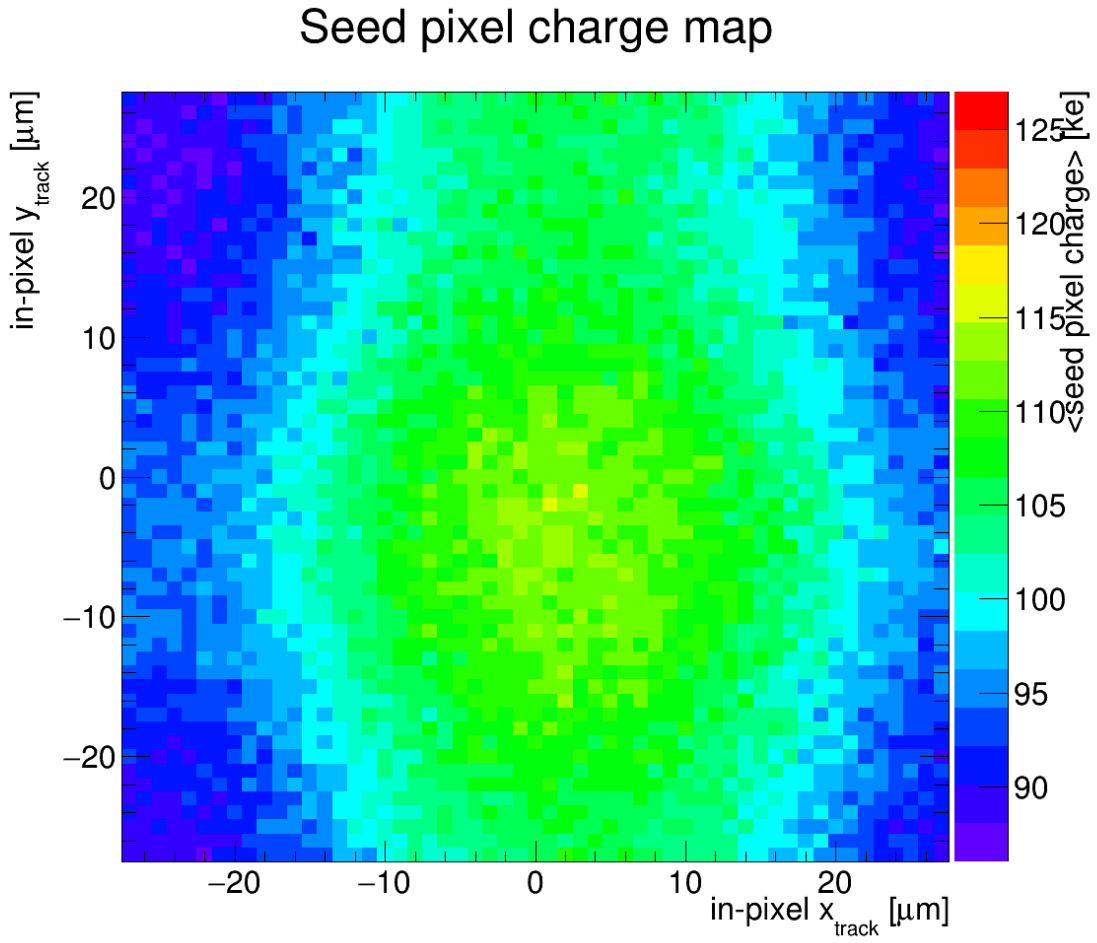
## Efficiency vs. Bias Voltage (Threshold = 1085 LSB)

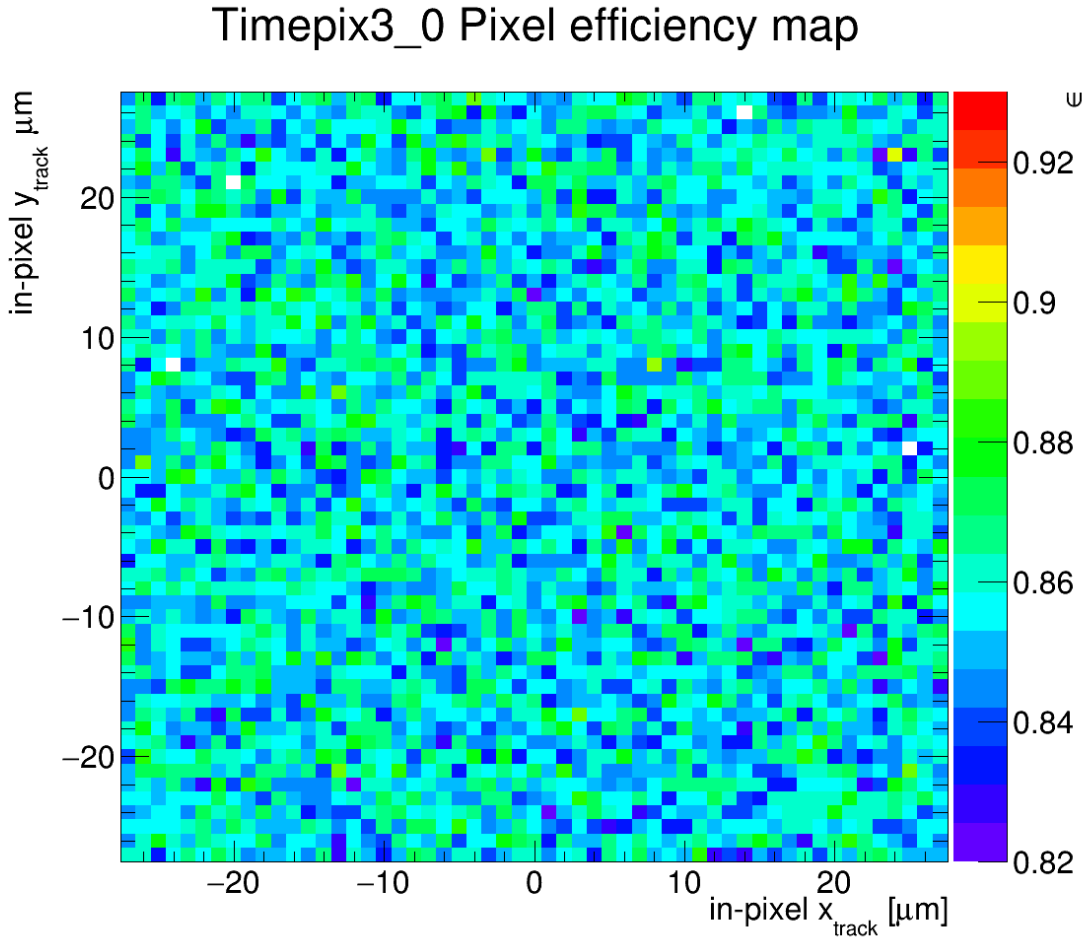


# Bias Scan

## Seed pixel charge and pixel efficiency maps

Bias = 20 V
Threshold = 1085 LSB ~ 800 $e^-$

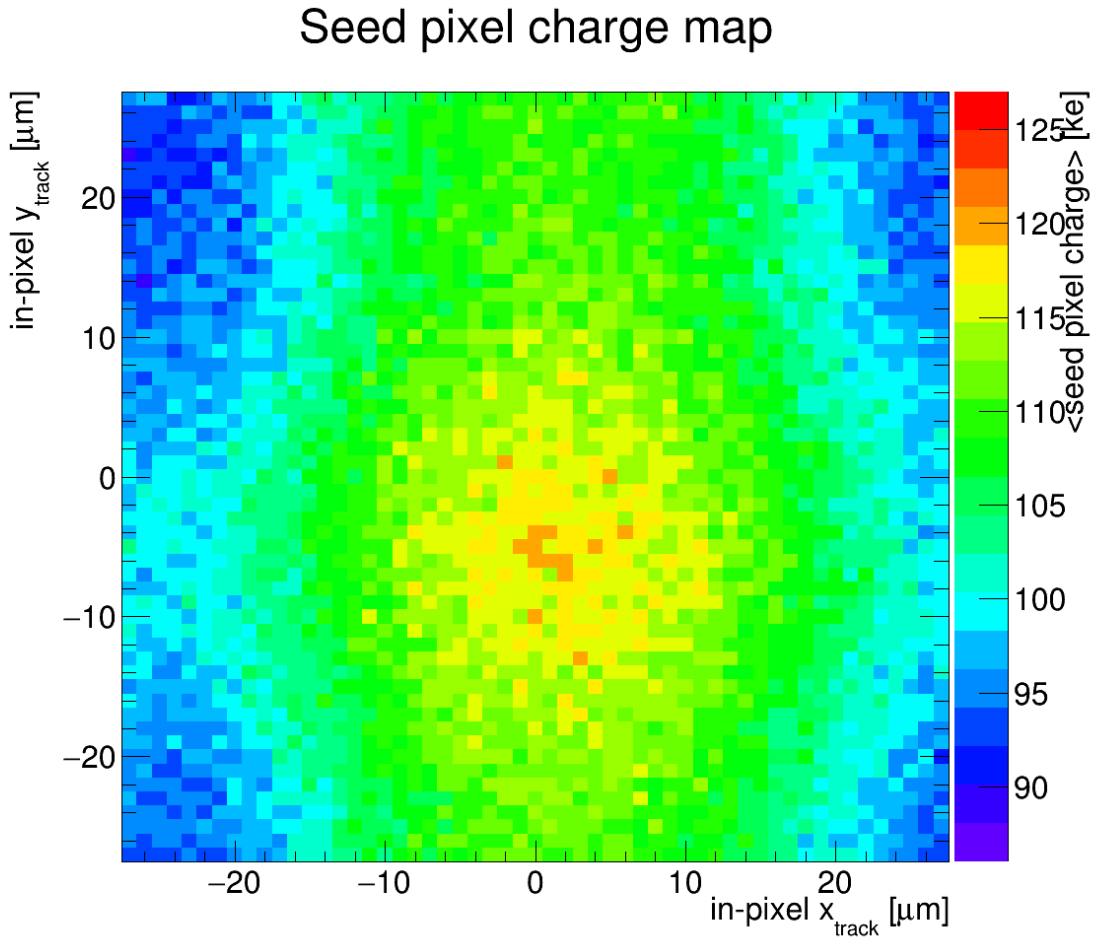


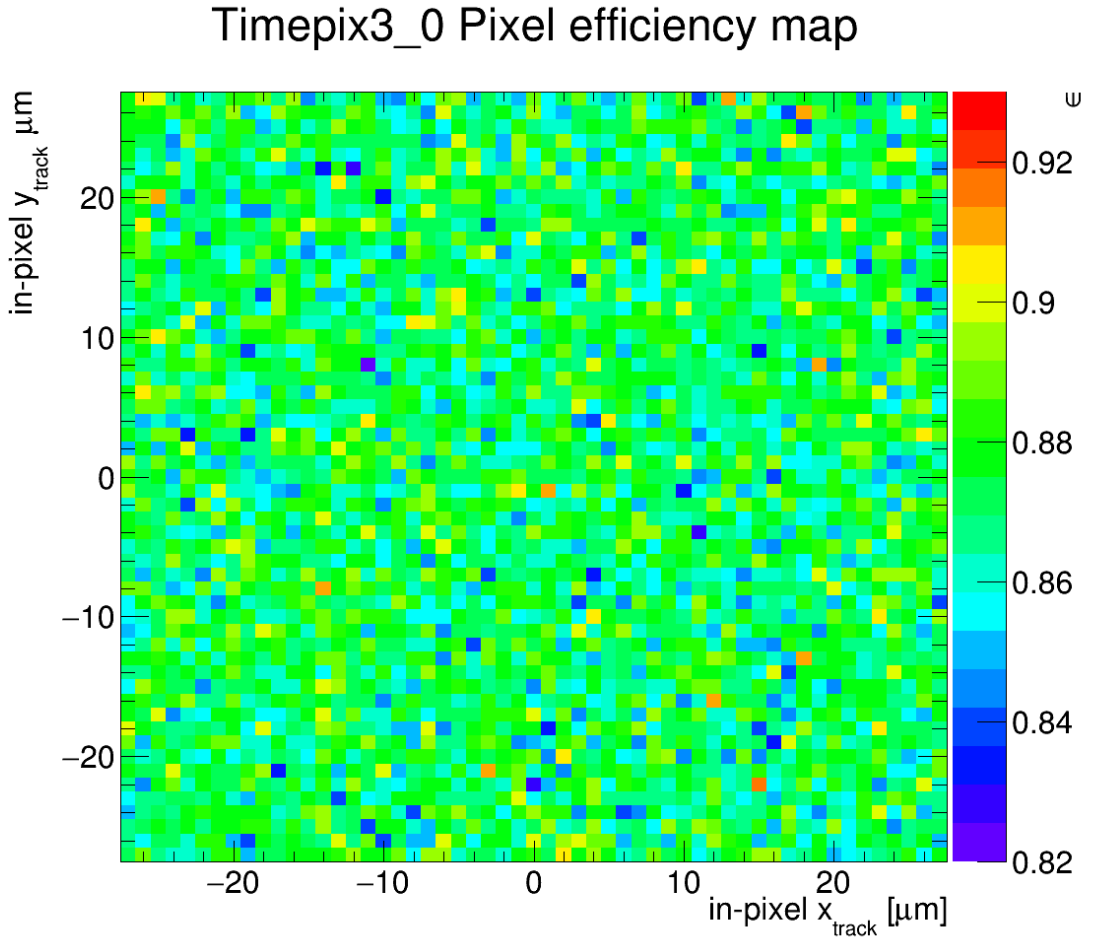



# Bias Scan

## Seed pixel charge and pixel efficiency maps

Bias = 30 V
Threshold = 1085 LSB ~ 800 $e^-$

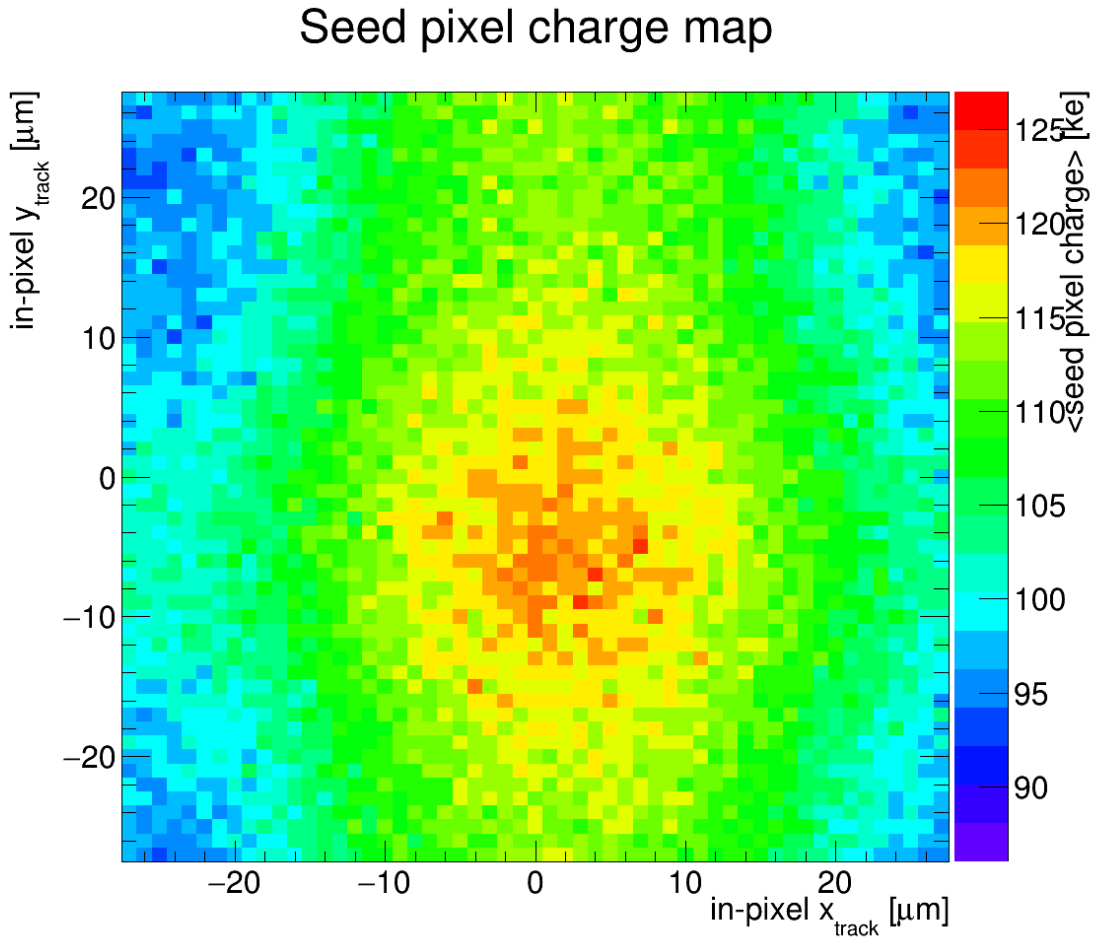


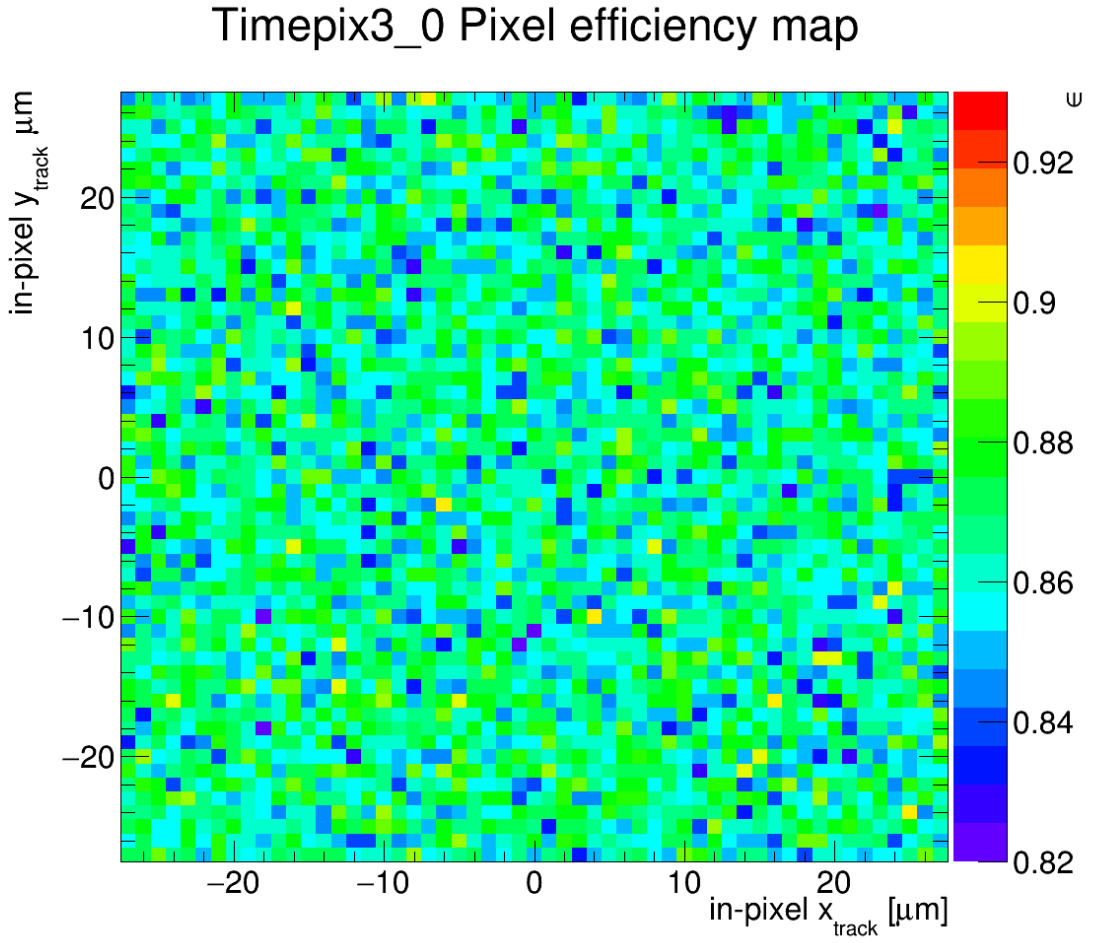



# Bias Scan

## Seed pixel charge and pixel efficiency maps

Bias = 40 V
Threshold = 1085 LSB ~ 800 $e^-$

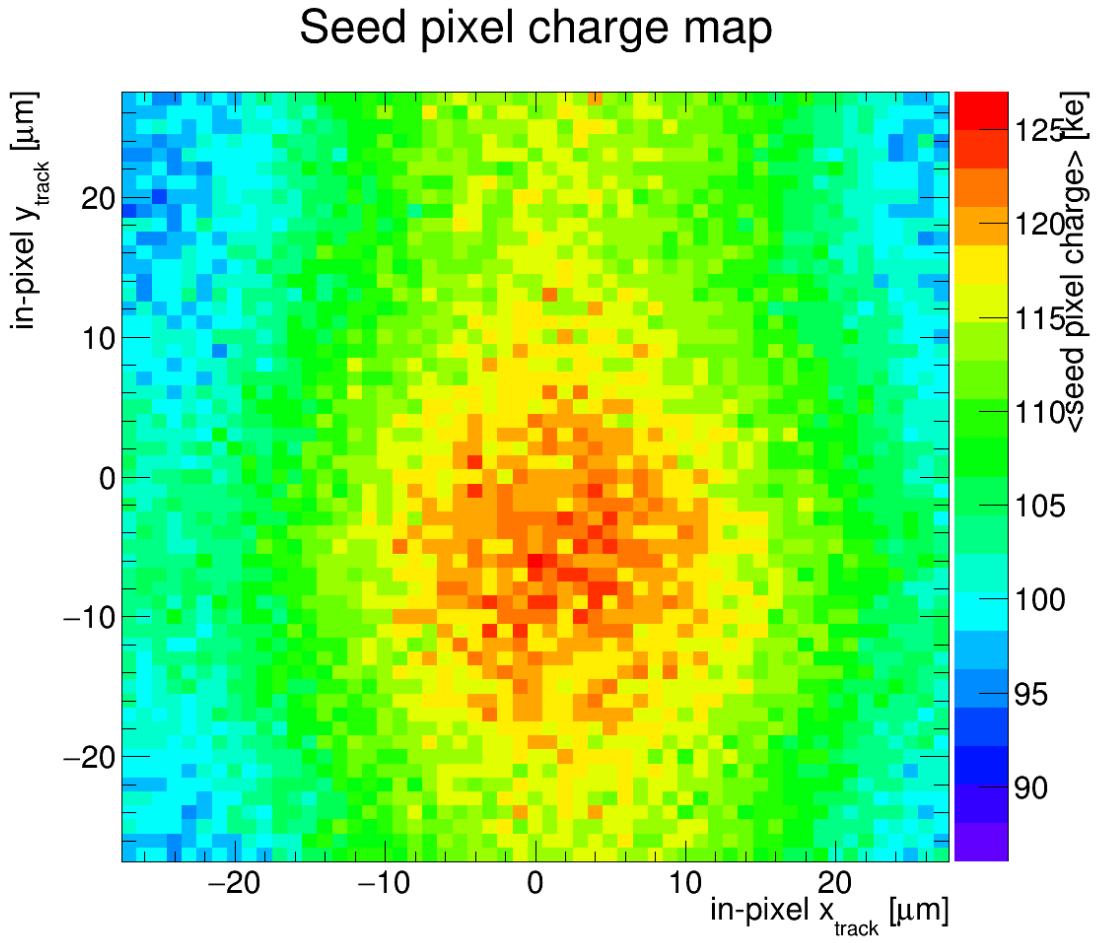


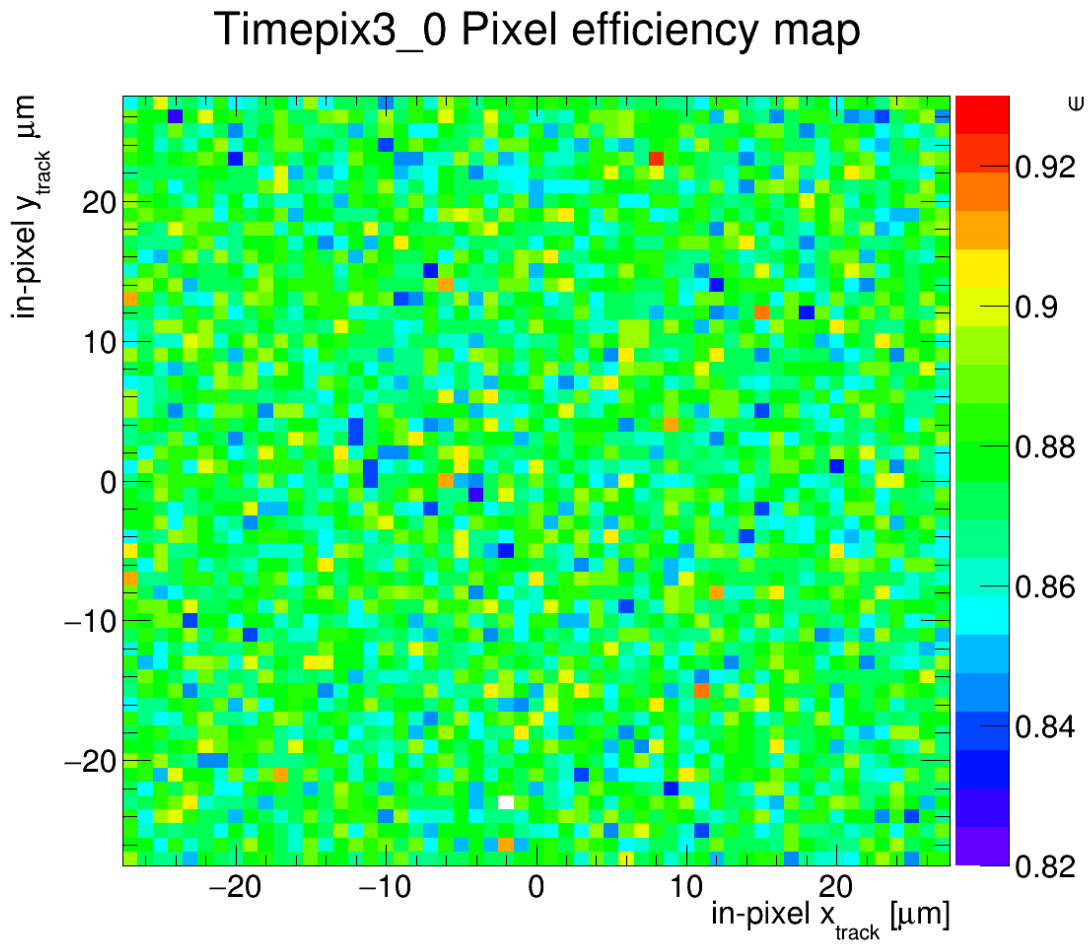



# Bias Scan

## Seed pixel charge and pixel efficiency maps

Bias = 50 V
Threshold = 1085 LSB ~ 800 $e^-$

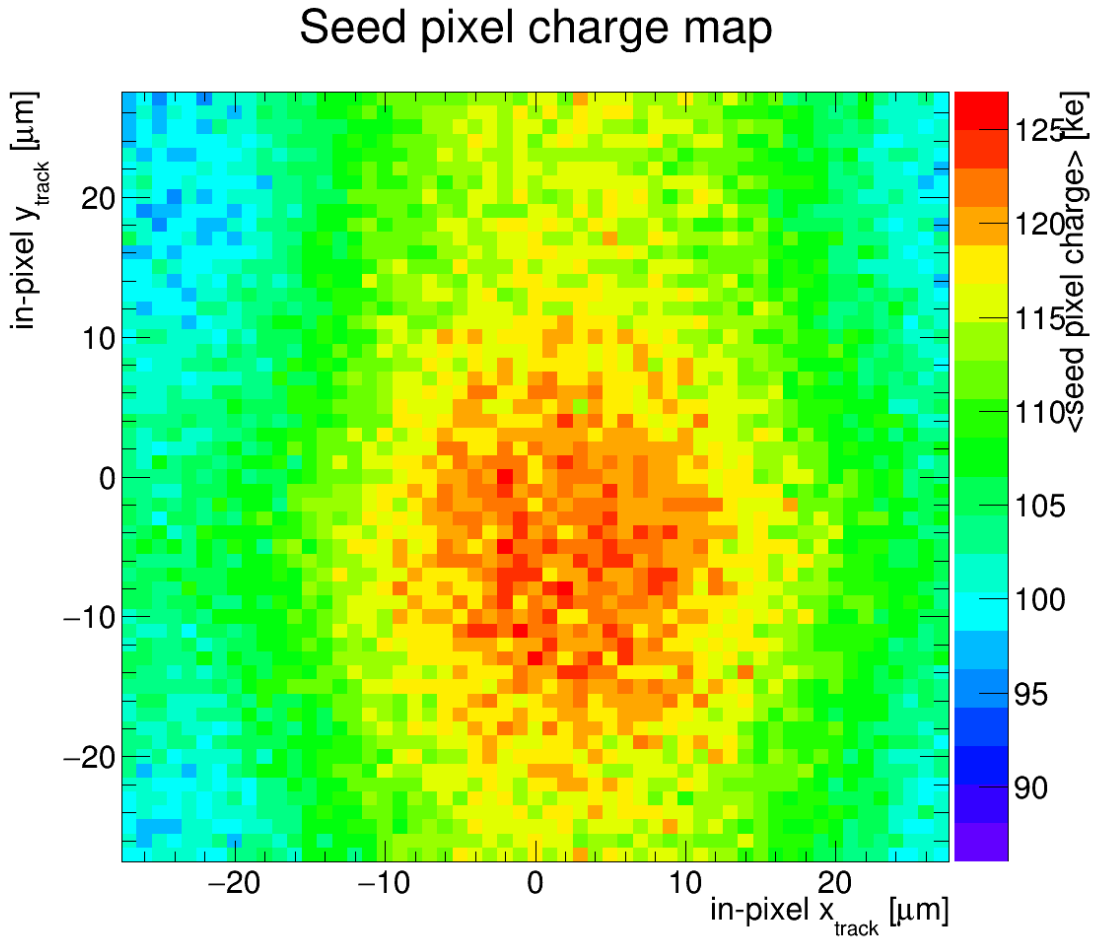


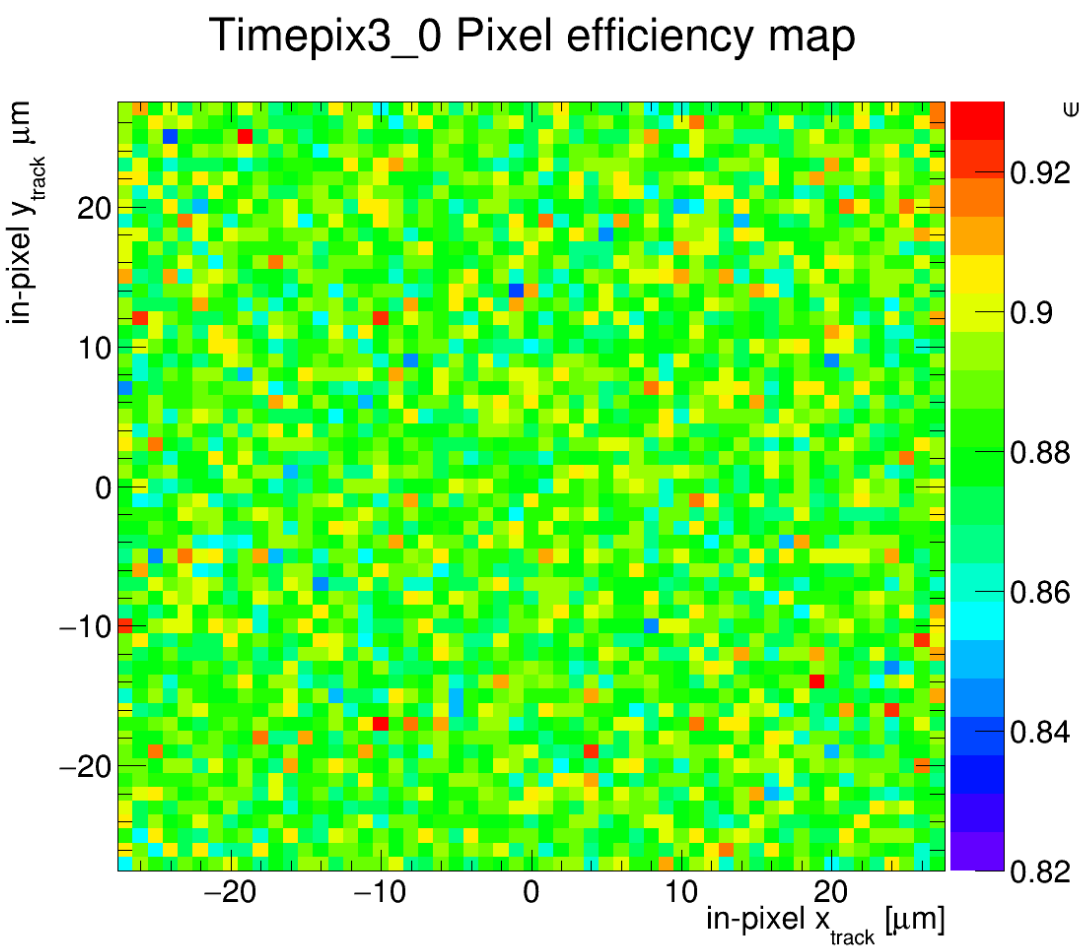



# Bias Scan

## Seed pixel charge and pixel efficiency maps

Bias = 60 V
Threshold = 1085 LSB ~ 800 $e^-$



# Bias Scan

## Seed pixel charge and pixel efficiency maps

Bias = 70 V
Threshold = 1085 LSB ~ 800 $e^-$