



## Overview of existing issues

Fred Hartjes  
NIKHEF

Nikhef/Bonn LepCol meeting  
June 3, 2019

# Basically four issues to investigate

## 1. Events where all pixels are hit simultaneously

- Likely not caused by HV discharge
  - => can be evoked by testpulses without any HV
- Maybe caused by LV/GND dips
  - To be investigated (Bas)
- Increasing threshold to 110 helps but gives very bad SE efficiency for T2K gas
  - => no option

We might live with this for the time being

## 2. Secondary emission

- Can we reduce it while keeping SE efficiency acceptable for T2K gas?
- Treatment of grid surface (materials with higher work function)
- Aluminum has about the worst record in this respect, almost any material is better
- **Only long term solution**

When using T2K gas there is chance on serious reduction of SE efficiency, marginal working point

## 3. Strong rate dependence caused by the high resistivity of SixNy layer

- **Only long term solution**

Works quite well at low rate ( $\sim 1$  kHz/cm<sup>2</sup>)

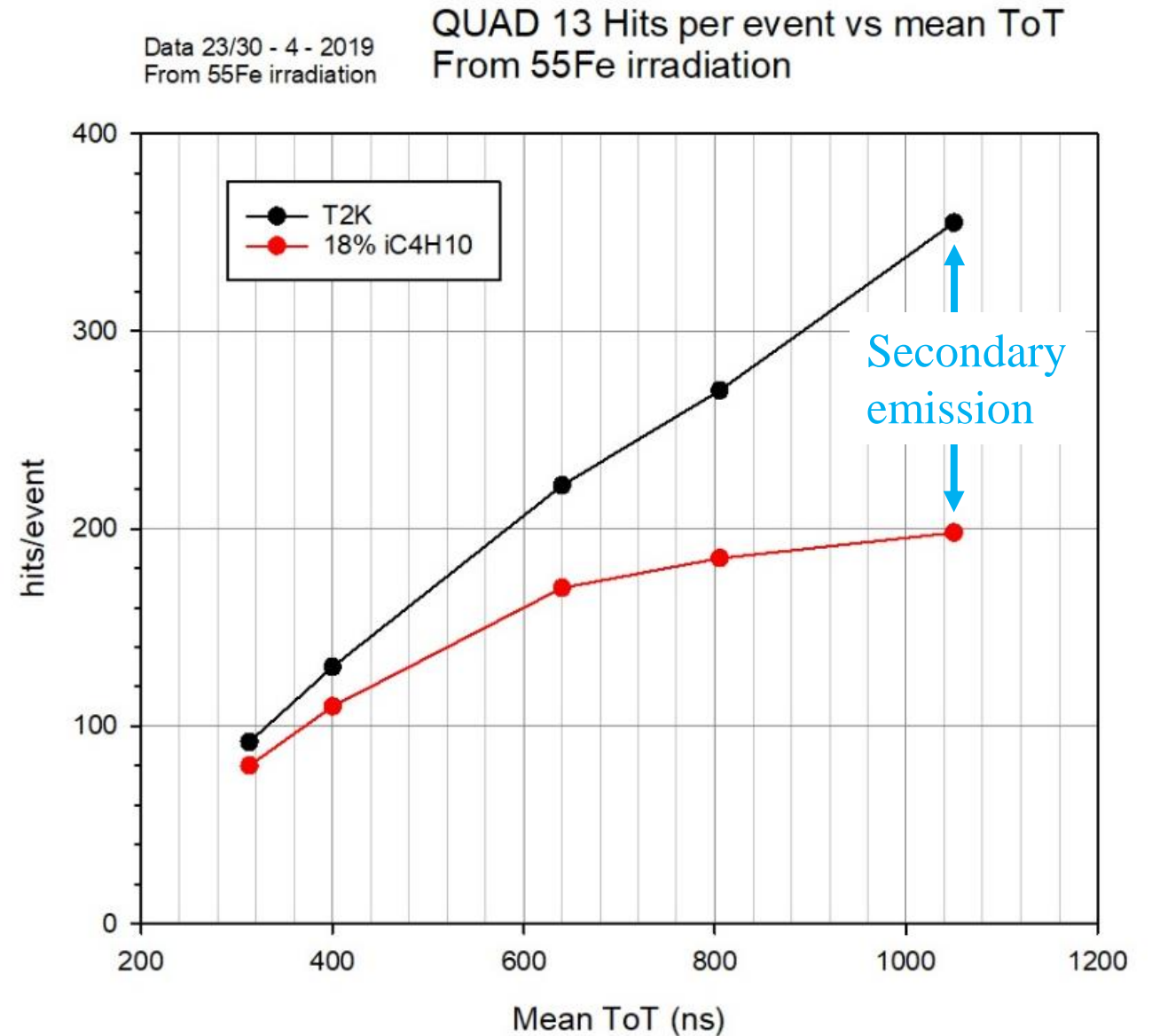
## 4. DAQ rate half of expected

- RO frequency now 80 MHz, 160 MHz possible
  - To be solved by Bas

We might live with this for the time being

# Hits vs ToT for T2K and 18% iC4H10

- Large number of secondary emission hits at higher efficiency

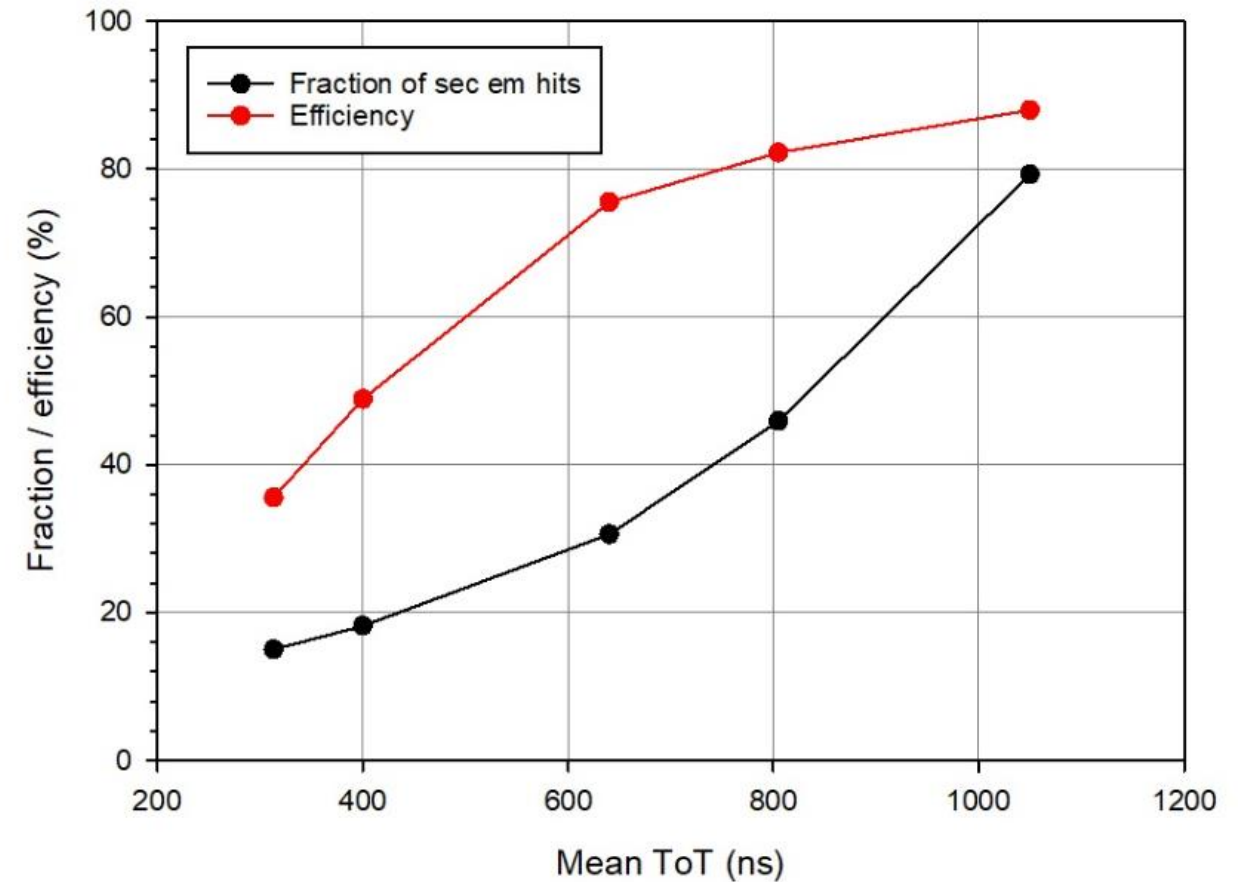


# Hits vs ToT for T2K and 18% iC4H10

- At SE efficiency above 80% we have more than 40% secondary emission hits

Secondary emission fraction vs mean ToT for T2K gas  
From  $^{55}\text{Fe}$  irradiation

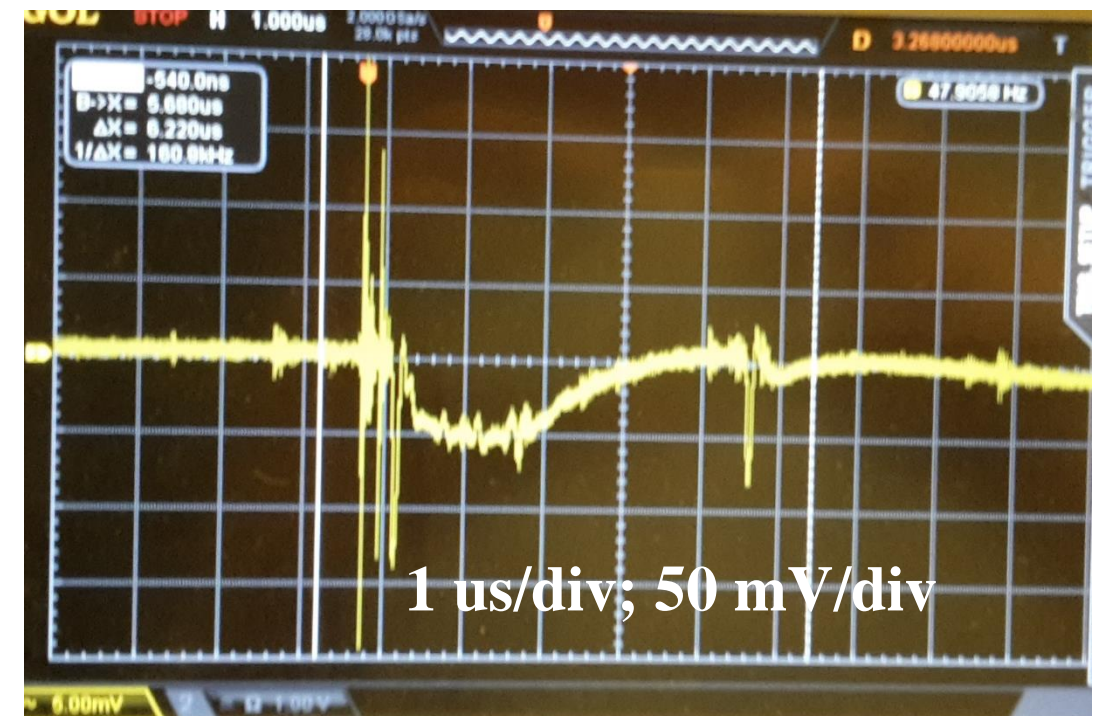
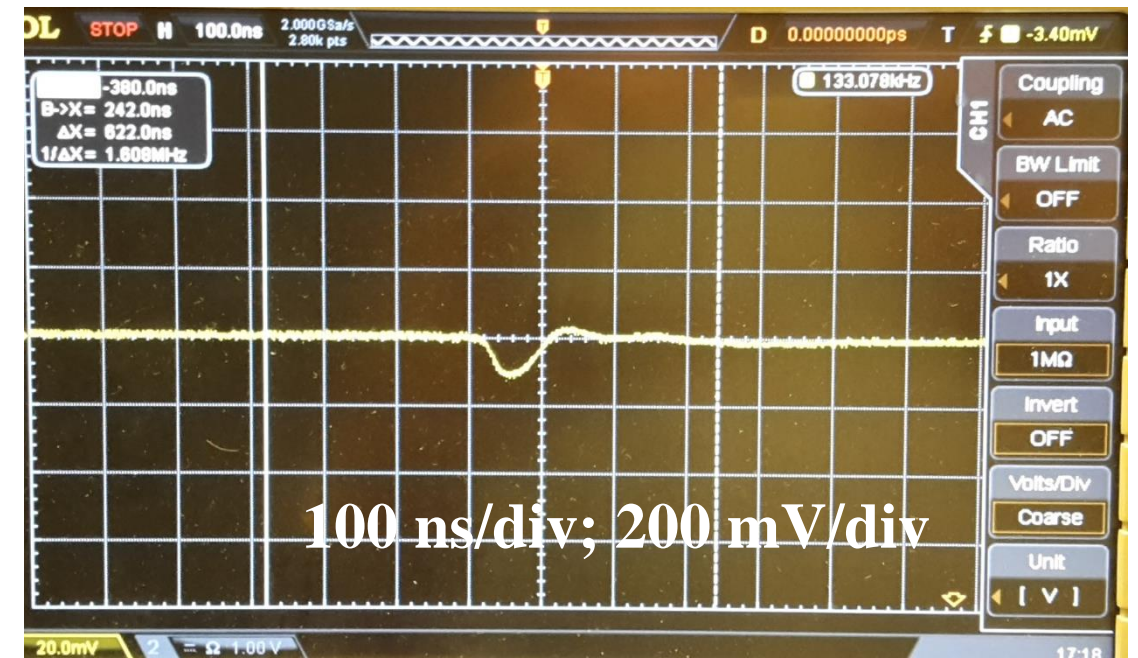
Data 23-30 - 4 - 2019  
From  $^{55}\text{Fe}$  irradiation





# Two phenomena on 1.5 V LV supply observed

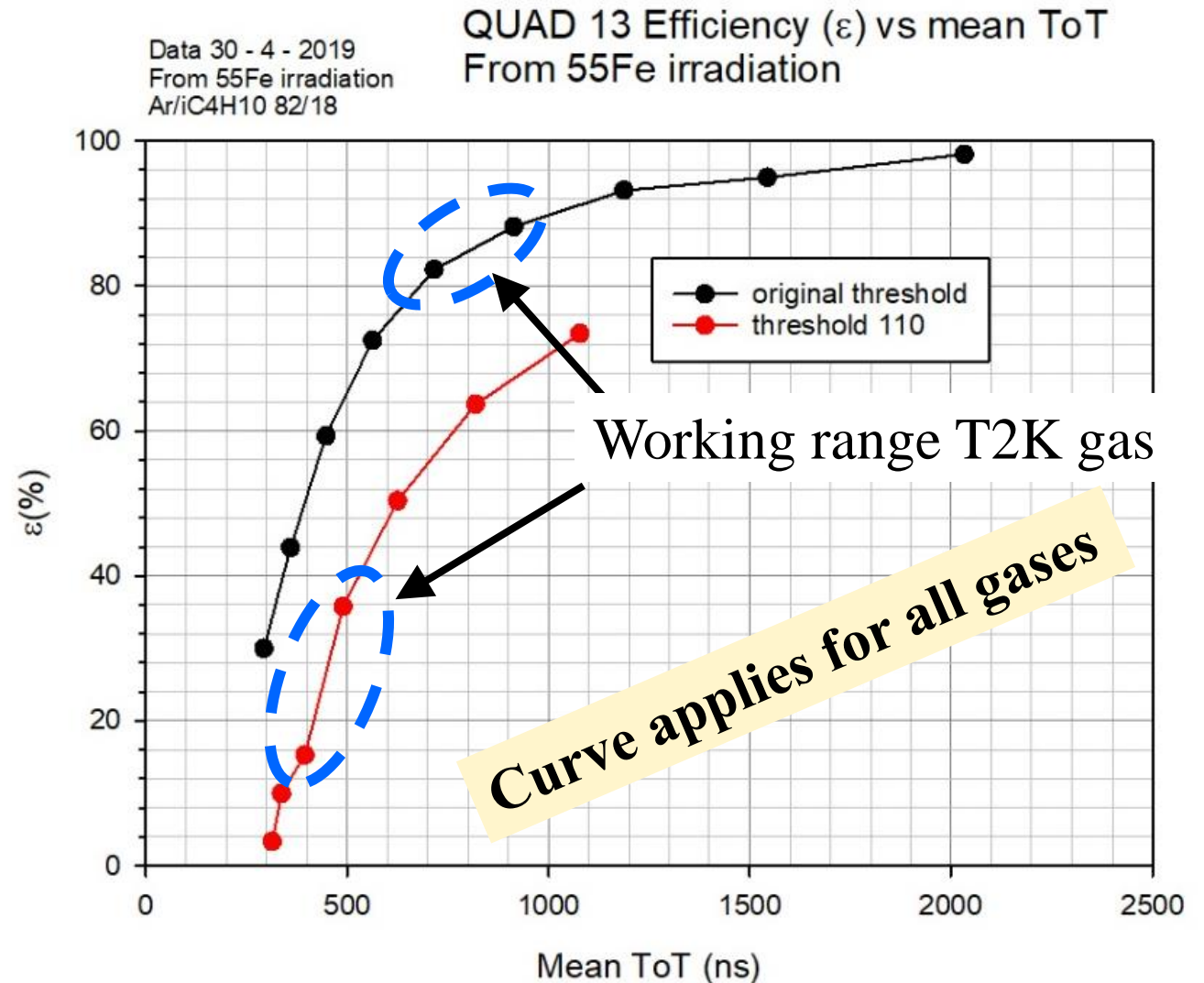
- Suddenly creating a large data flow
- 100 mV dip 50 ns wide
- 50 mV dip 2  $\mu$ s wide
- Are they responsible for hitting all pixels
- Bas may investigate this by rapid switching load on broken 1<sup>st</sup> series QUAD
  - Try faster regulator



# Deduced from 18% iC<sub>4</sub>H<sub>10</sub> measurements: Single electron efficiency vs mean ToT

- We have for Mean ToT = 1000 ns
- $\Rightarrow$  90% SE efficiency at original threshold
- $\Rightarrow$  ~ 70% SE efficiency at 110 threshold

■ **Threshold 110 not usable for T2K gas**



# Reference

# 18% iC4H10 threshold 110 cnts

■ 5 – 500 hits/track

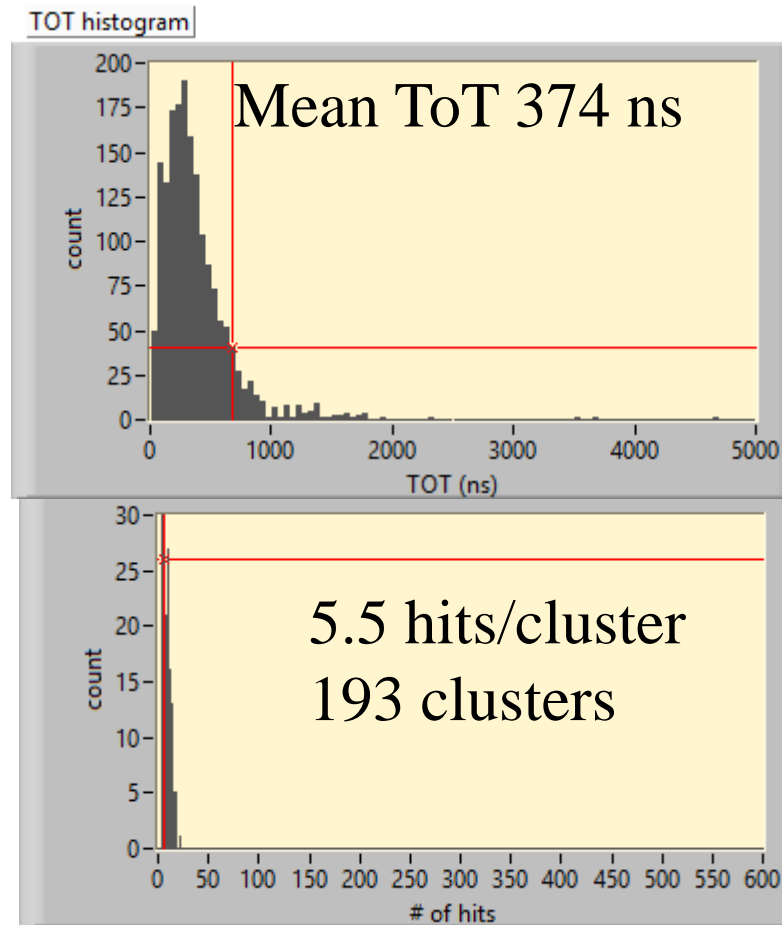


# **$^{55}\text{Fe}$ measurements with 18% iC4H10**

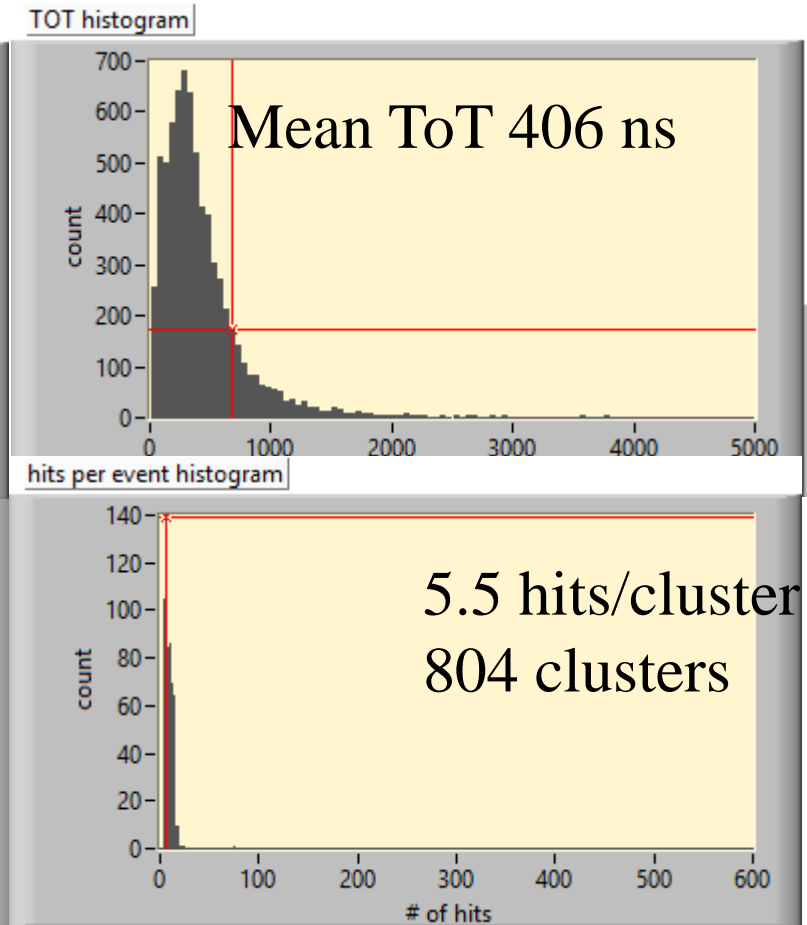
**Vgrid = -330 V**

- No micro discharges
- Only clusters of a few pixels wide

Chip 2



Chip 0

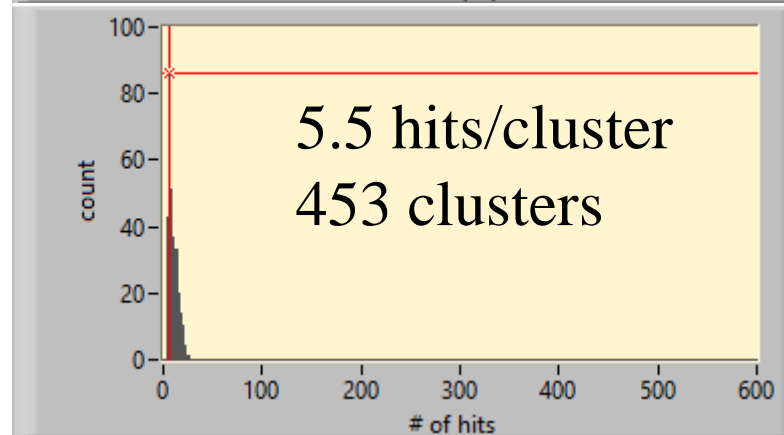
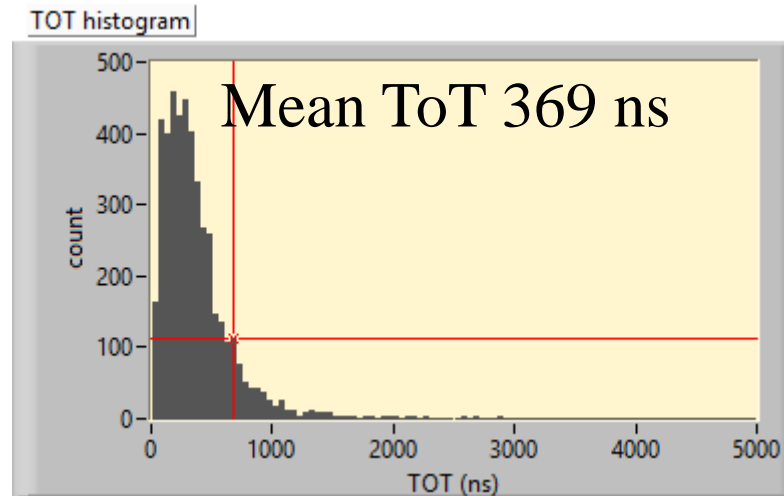


# **$^{55}\text{Fe}$ measurements with 18% iC4H10**

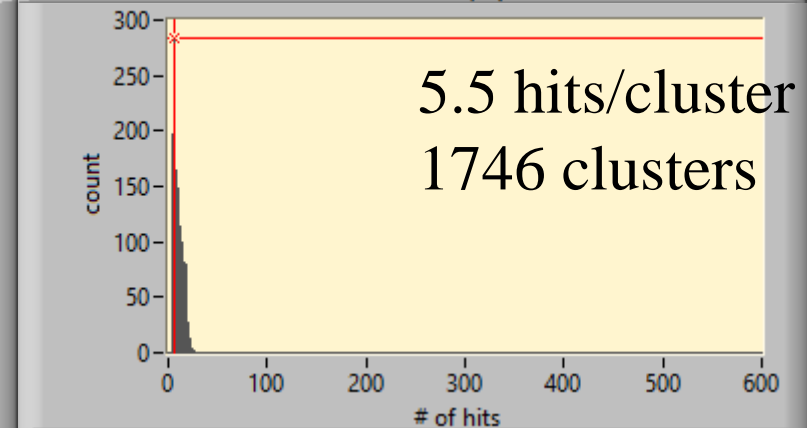
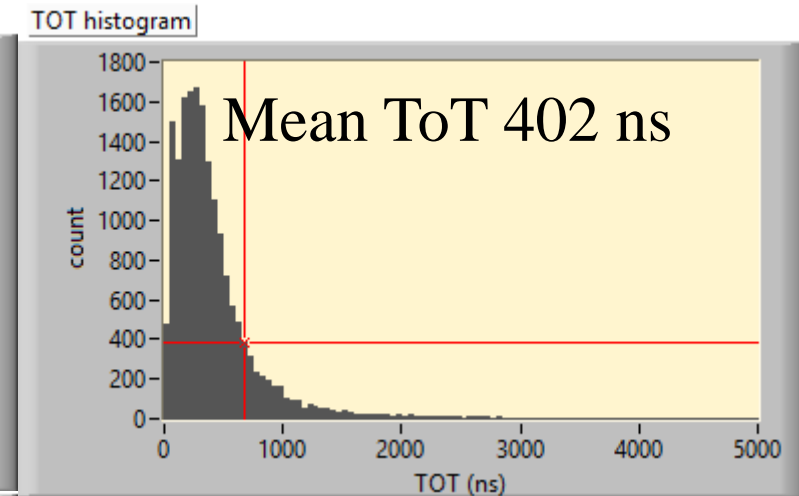
**Vgrid = -340 V**

- No micro discharges
- Only clusters of a few pixels wide

Chip 2



Chip 0

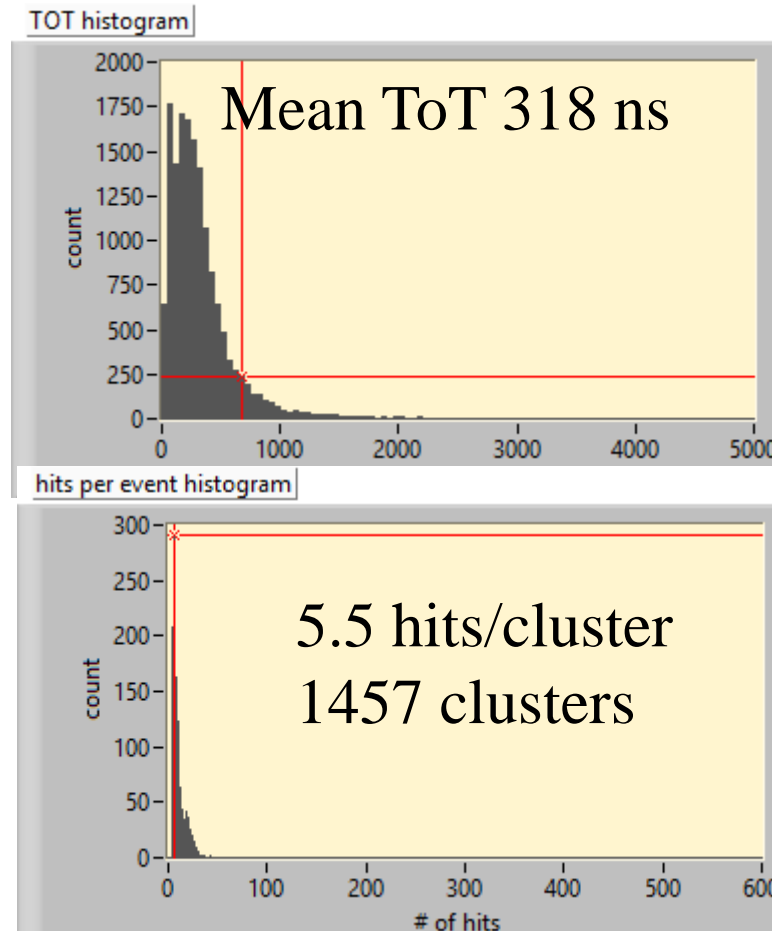


# **$^{55}\text{Fe}$ measurements with 18% iC4H10**

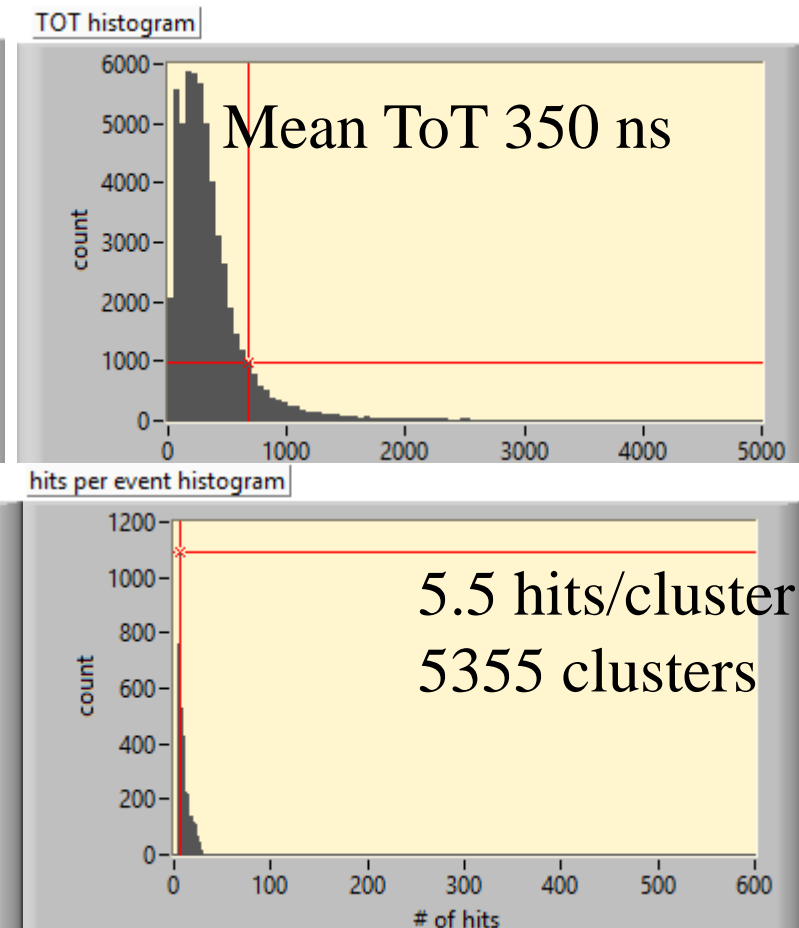
**Vgrid = -350 V**

- No micro discharges
- Only clusters of a few pixels wide

Chip 2



Chip 0

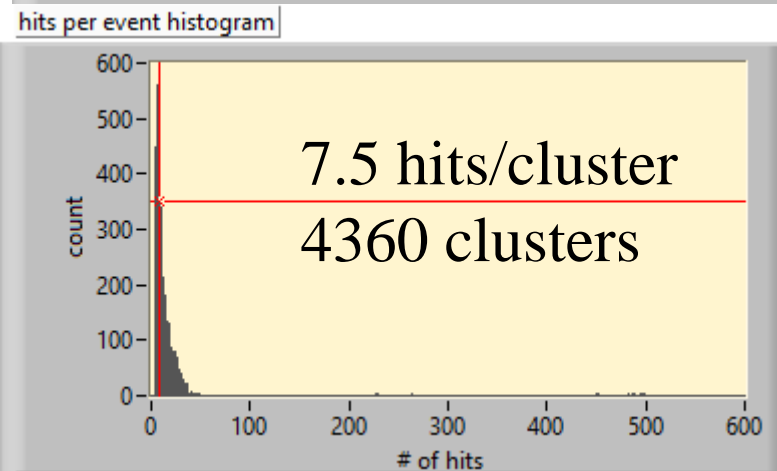
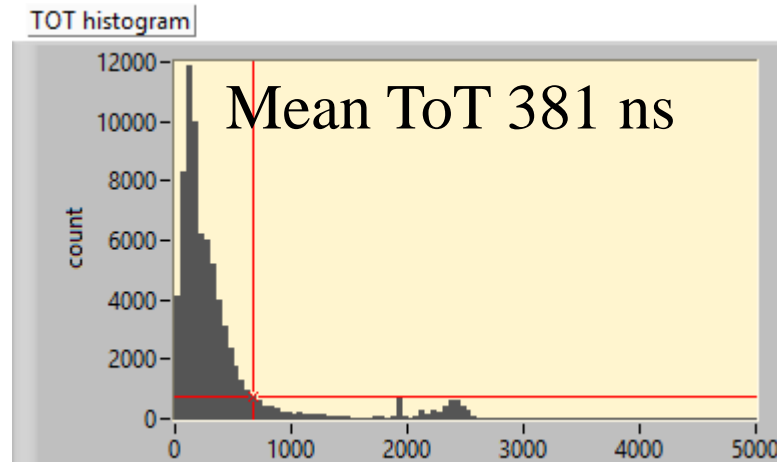


# **$^{55}\text{Fe}$ measurements with 18% iC4H10**

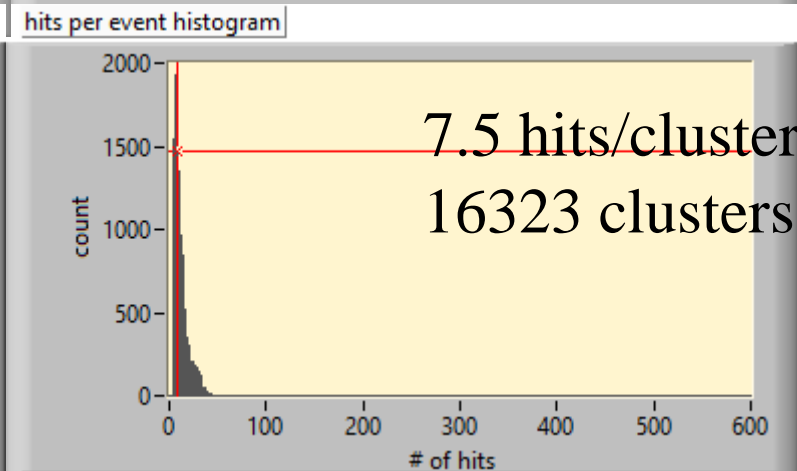
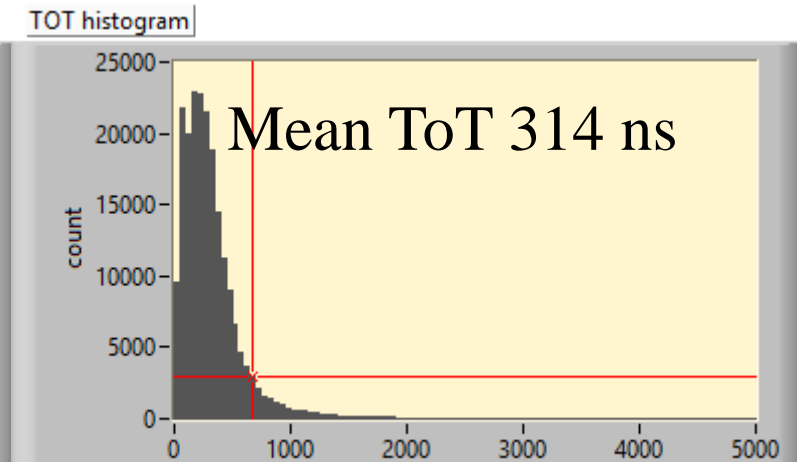
**Vgrid = -360 V**

- No micro discharges

Chip 2



Chip 0

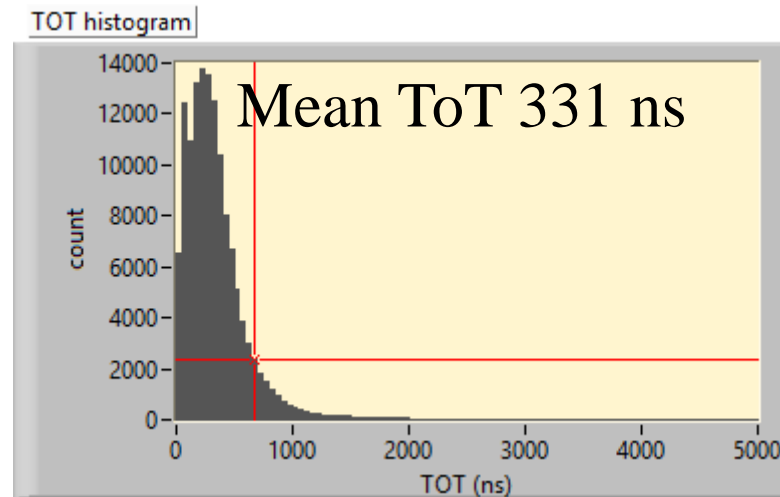


# **$^{55}\text{Fe}$ measurements with 18% iC4H10**

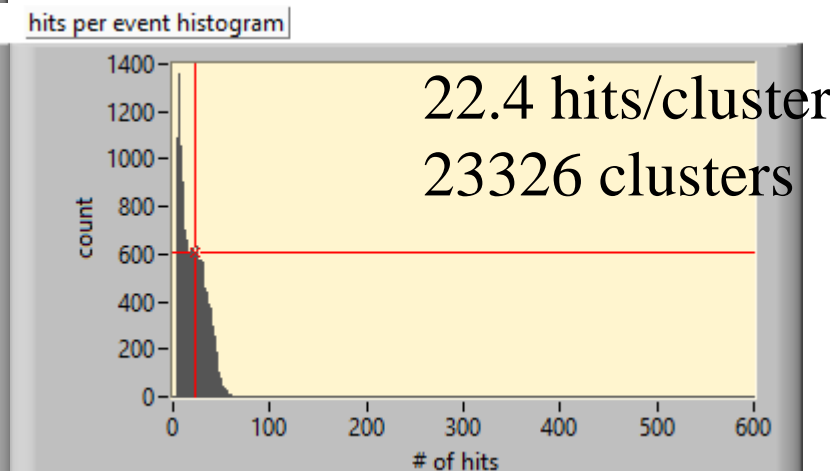
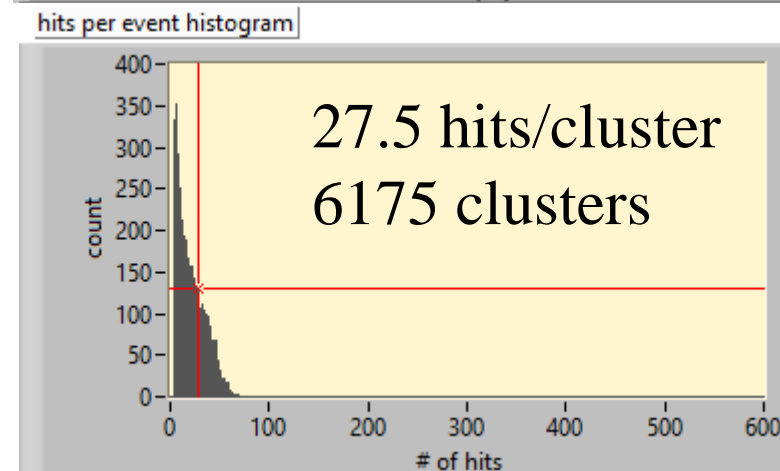
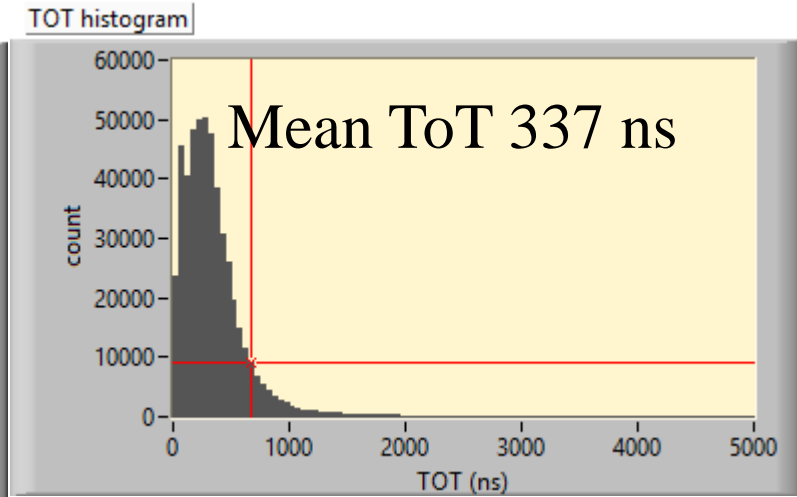
**Vgrid = -370 V**

■ No micro discharges

Chip 2



Chip 0

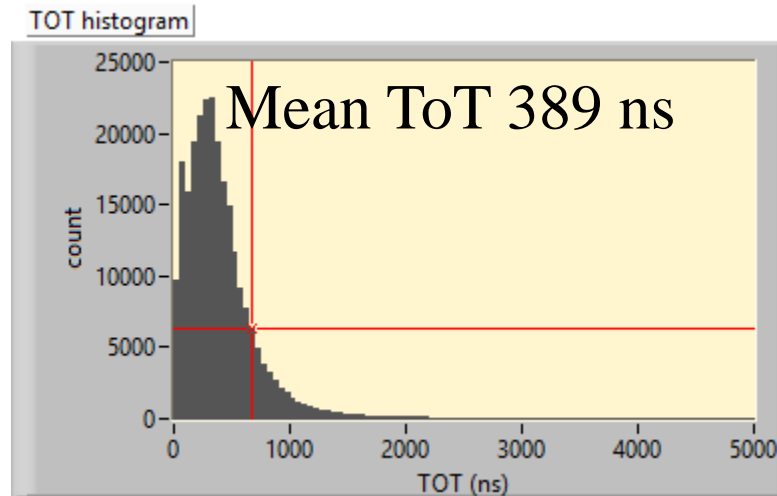


# **$^{55}\text{Fe}$ measurements with 18% iC4H10**

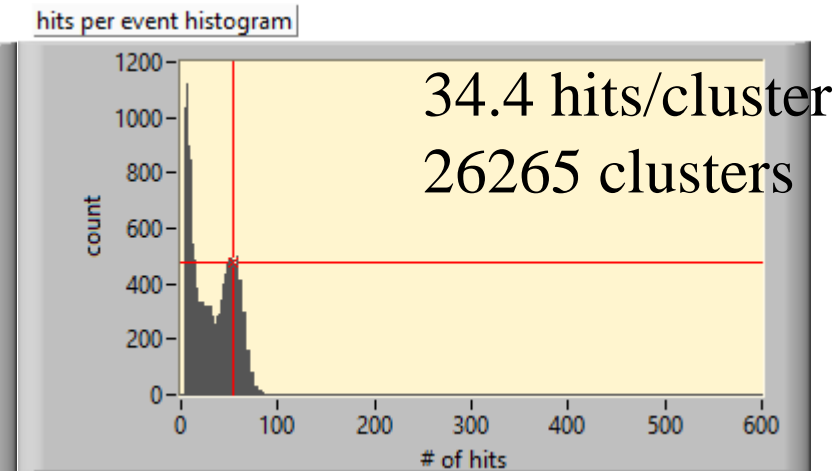
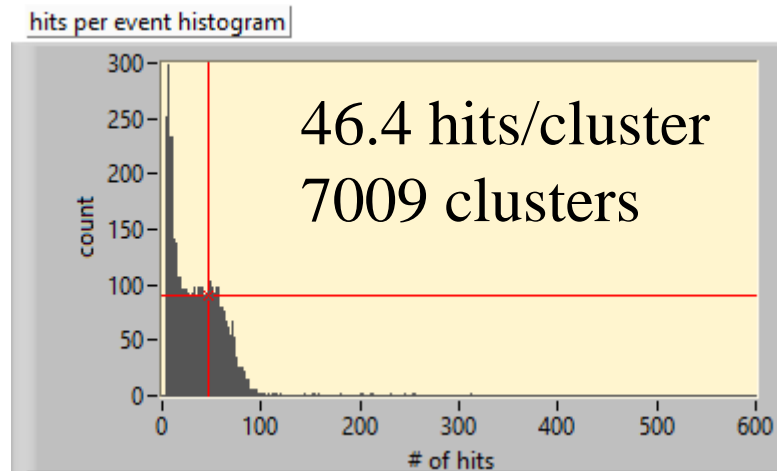
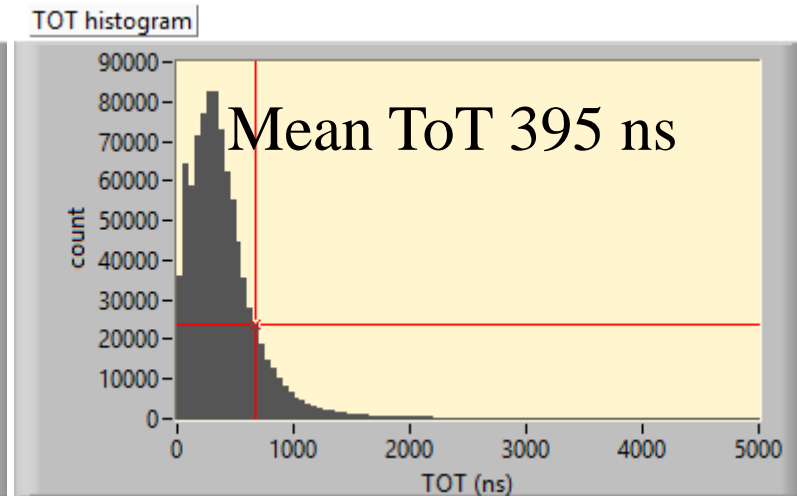
**Vgrid = -380 V**

■ No micro discharges

Chip 2



Chip 0



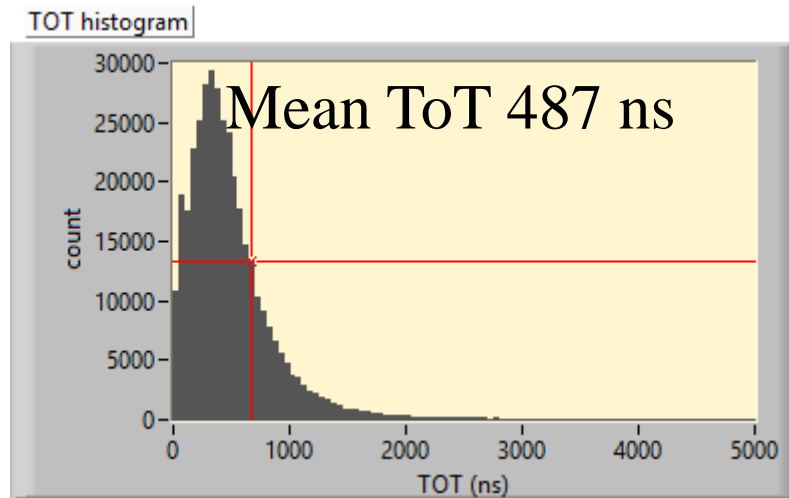


# **$^{55}\text{Fe}$ measurements with 18% iC4H10**

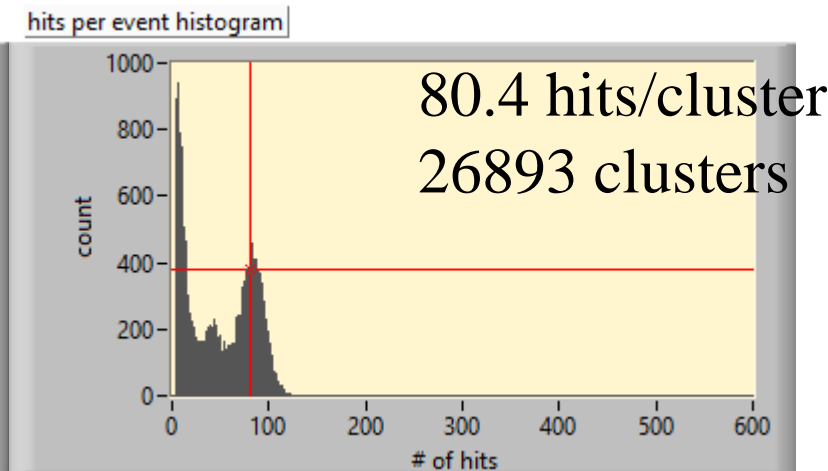
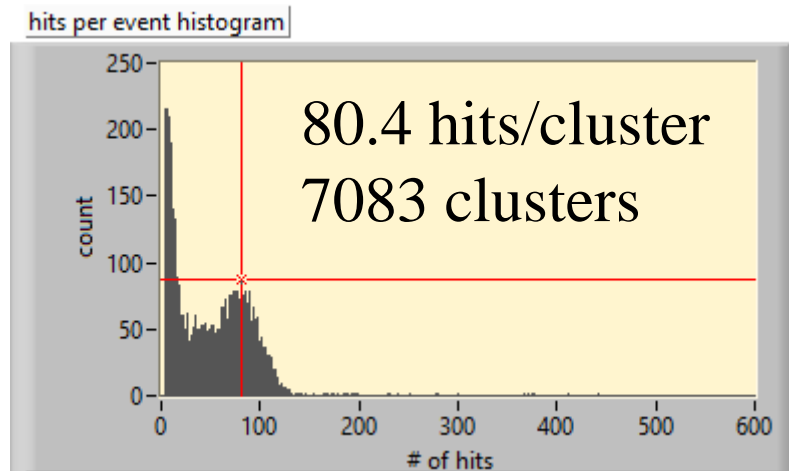
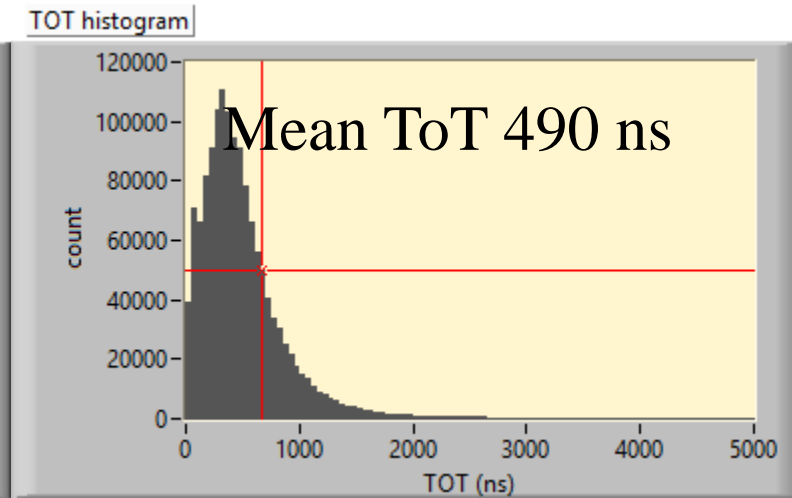
**Vgrid = -390 V**

■ No micro discharges

Chip 2



Chip 0

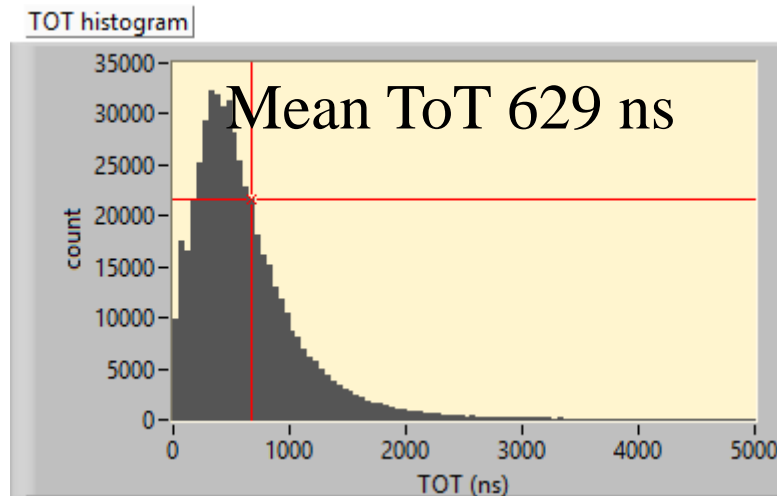


# **$^{55}\text{Fe}$ measurements with 18% iC4H10**

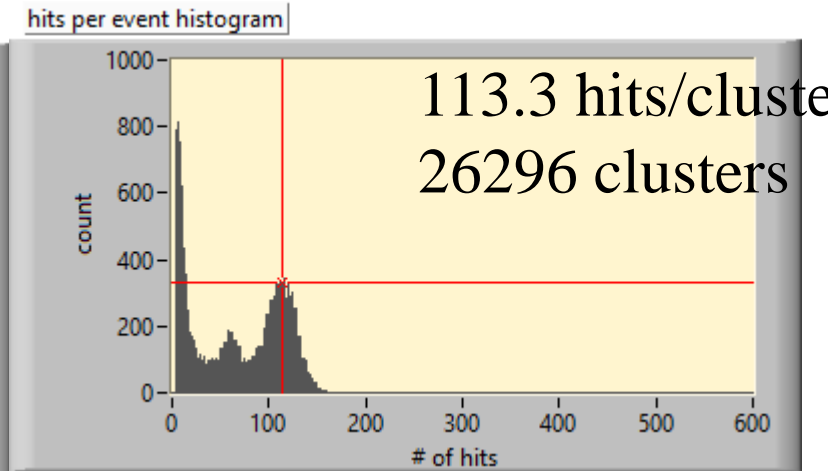
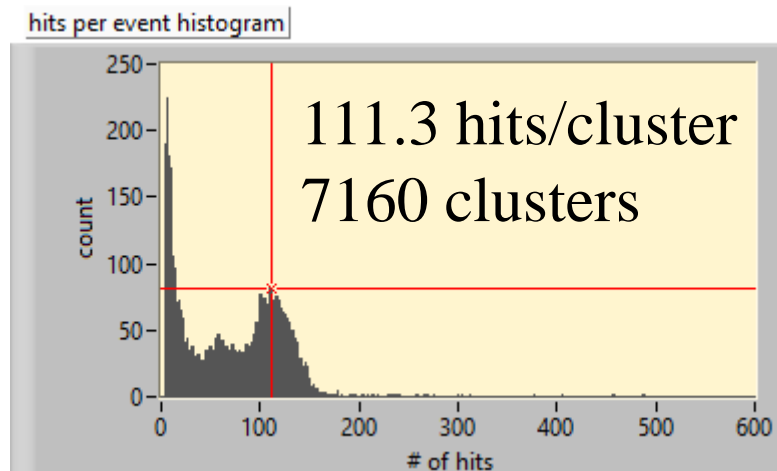
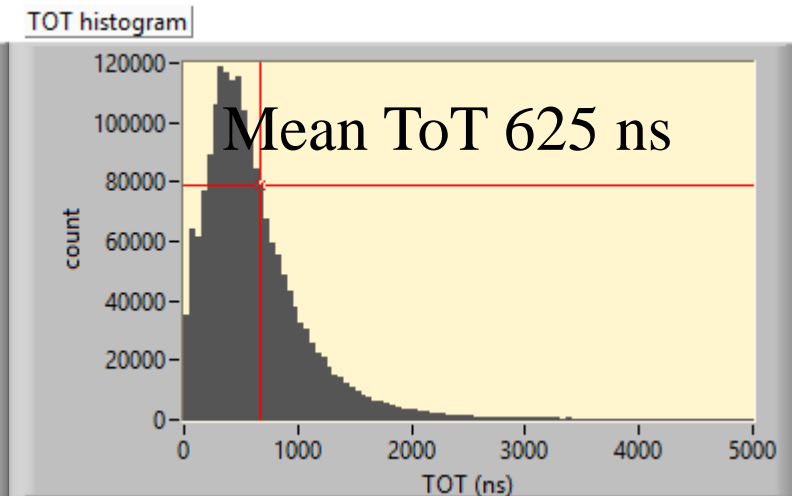
**Vgrid = -400 V**

■ No micro discharges

Chip 2



Chip 0

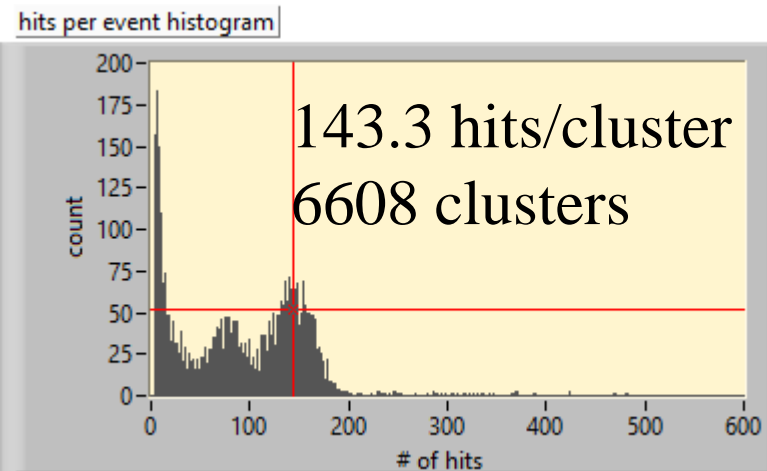
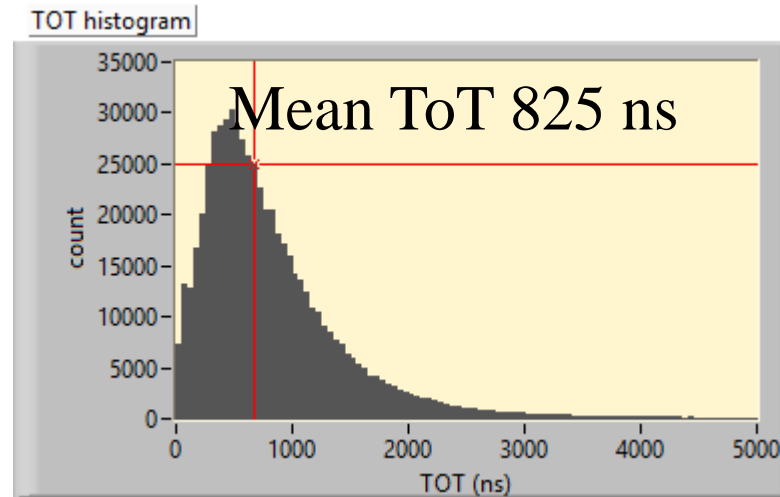


# **$^{55}\text{Fe}$ measurements with 18% iC4H10**

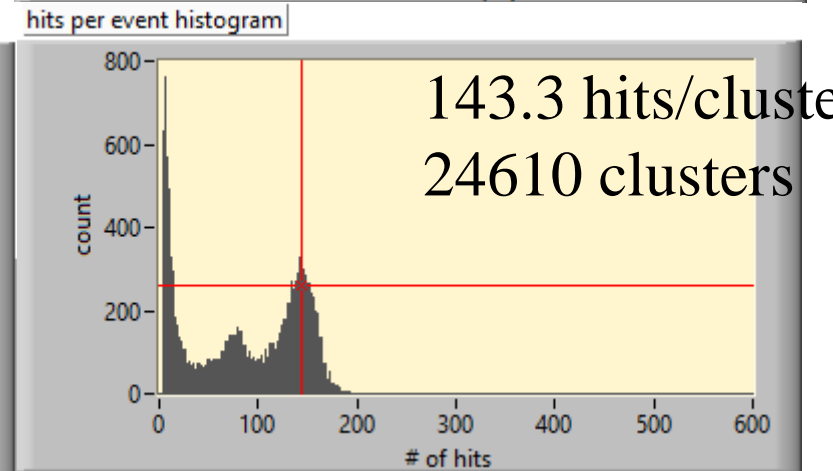
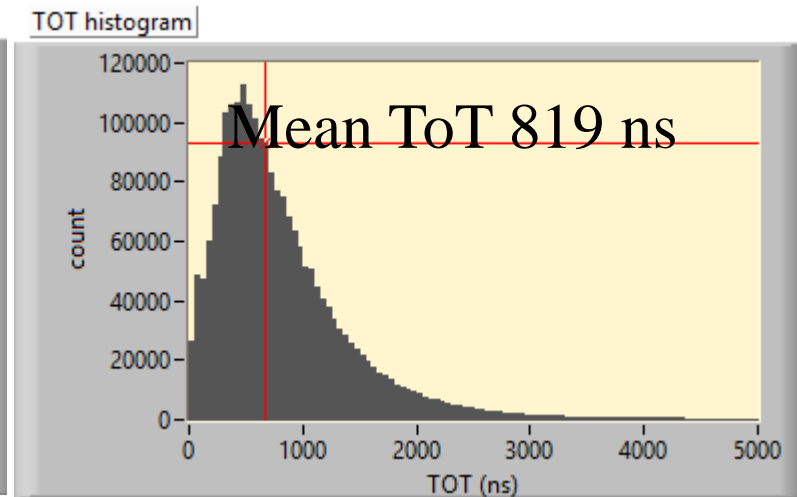
**Vgrid = -410 V**

■ No micro discharges

Chip 2



Chip 0



# **$^{55}\text{Fe}$ measurements with 18% iC<sub>4</sub>H<sub>10</sub>**

**V<sub>grid</sub> = -420 V**

■ One micro discharge

Chip 2

Chip 0

