

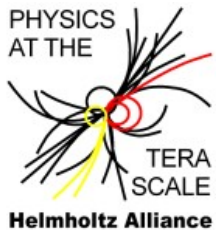
# Testbeam measurements with GEM + Timepix Module

Christoph Brezina<sup>a</sup>, Klaus Desch<sup>a</sup>, Julia Furletova<sup>a</sup>, Jochen Kaminski<sup>a</sup>, Christian Kahra<sup>c</sup>, Martin Killenberg<sup>a</sup>, Frederik Klöckner<sup>a</sup>, Markus Köhli<sup>b</sup>, Thorsten Krautscheid<sup>a</sup>, Christoph Krieger<sup>a</sup>, Felix Müller<sup>a</sup>, Uwe Renz<sup>b</sup>, Markus Schumacher<sup>b</sup>, Stefan Tapprogge<sup>c</sup>, Michael Zamrowski<sup>c</sup>,

<sup>a</sup> Universität Bonn, Germany

<sup>b</sup> Universität Freiburg

<sup>c</sup> Universität Mainz



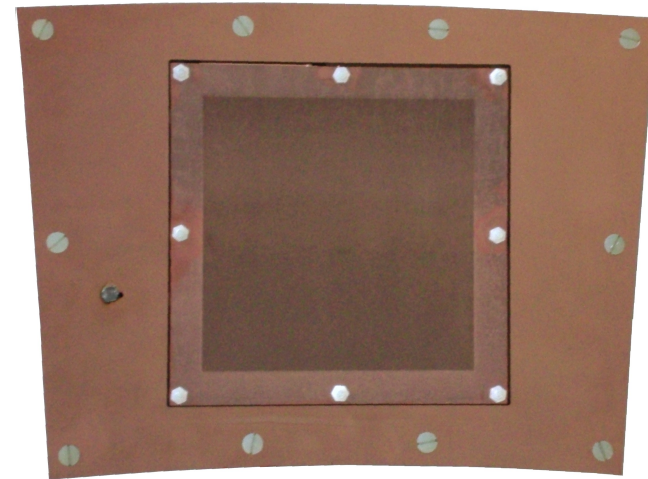
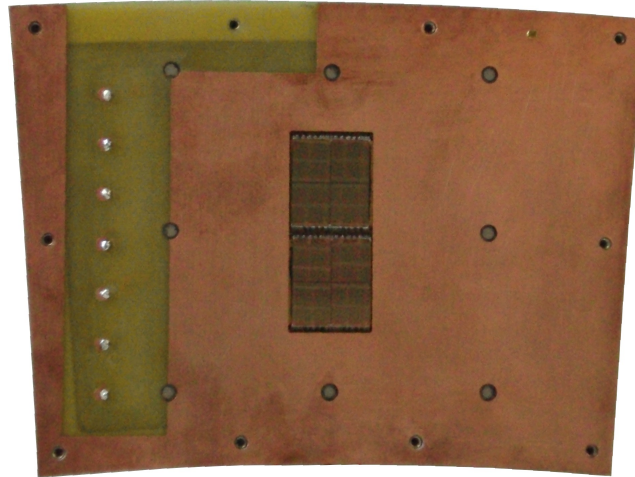
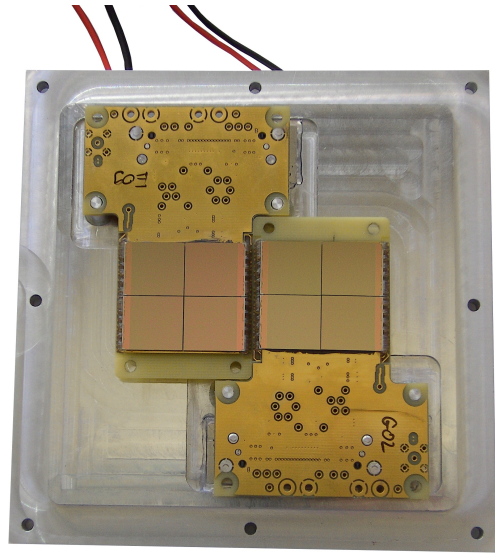
GEFÖRDERT VOM



LP Analysis Meeting #3

June 22nd, 2009

# Module with GEMs & Timepix



## Gas amplification stage:

3 standard CERN GEMS (60/70/140)

1 mm spacing between GEMs

## Readout:

2 quadboards (4 Timepix chips each)

anode plane

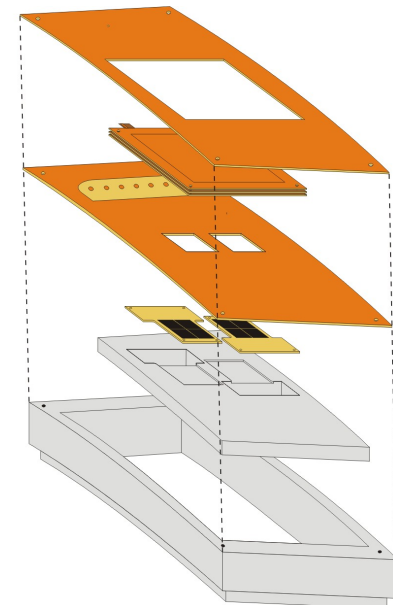
GEMs

readout plane

quad-boards

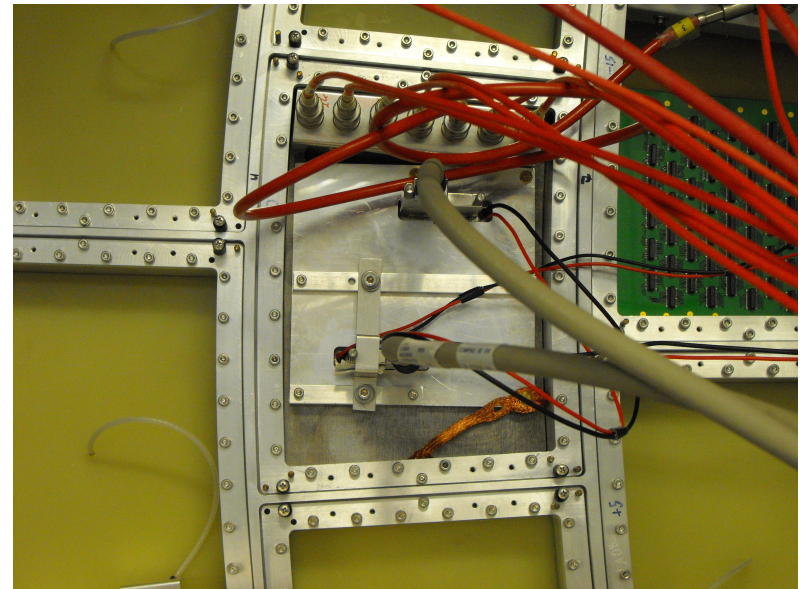
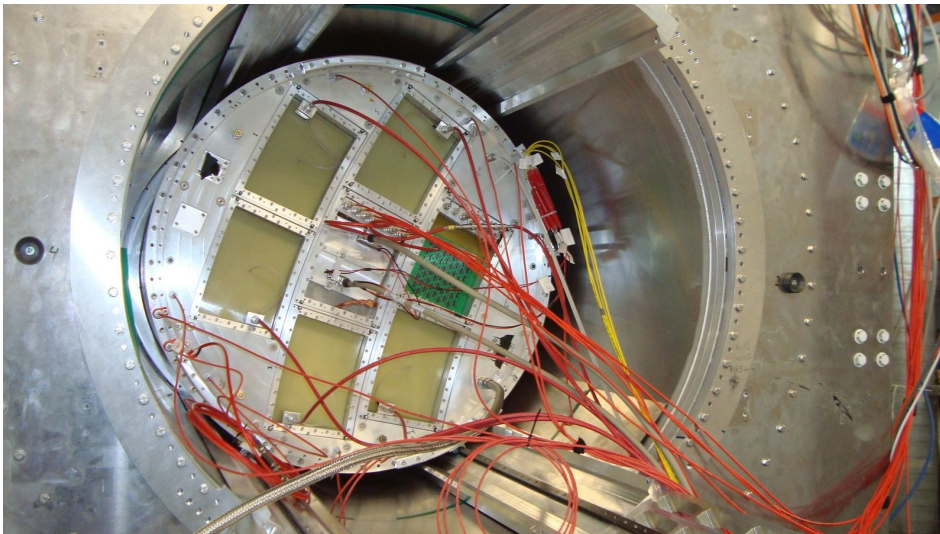
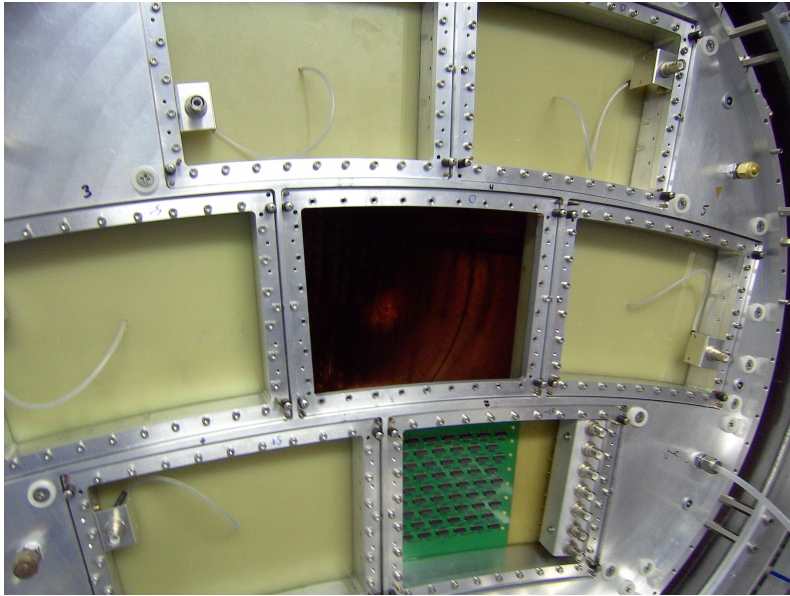
reinforcement of  
anode plane

redframe





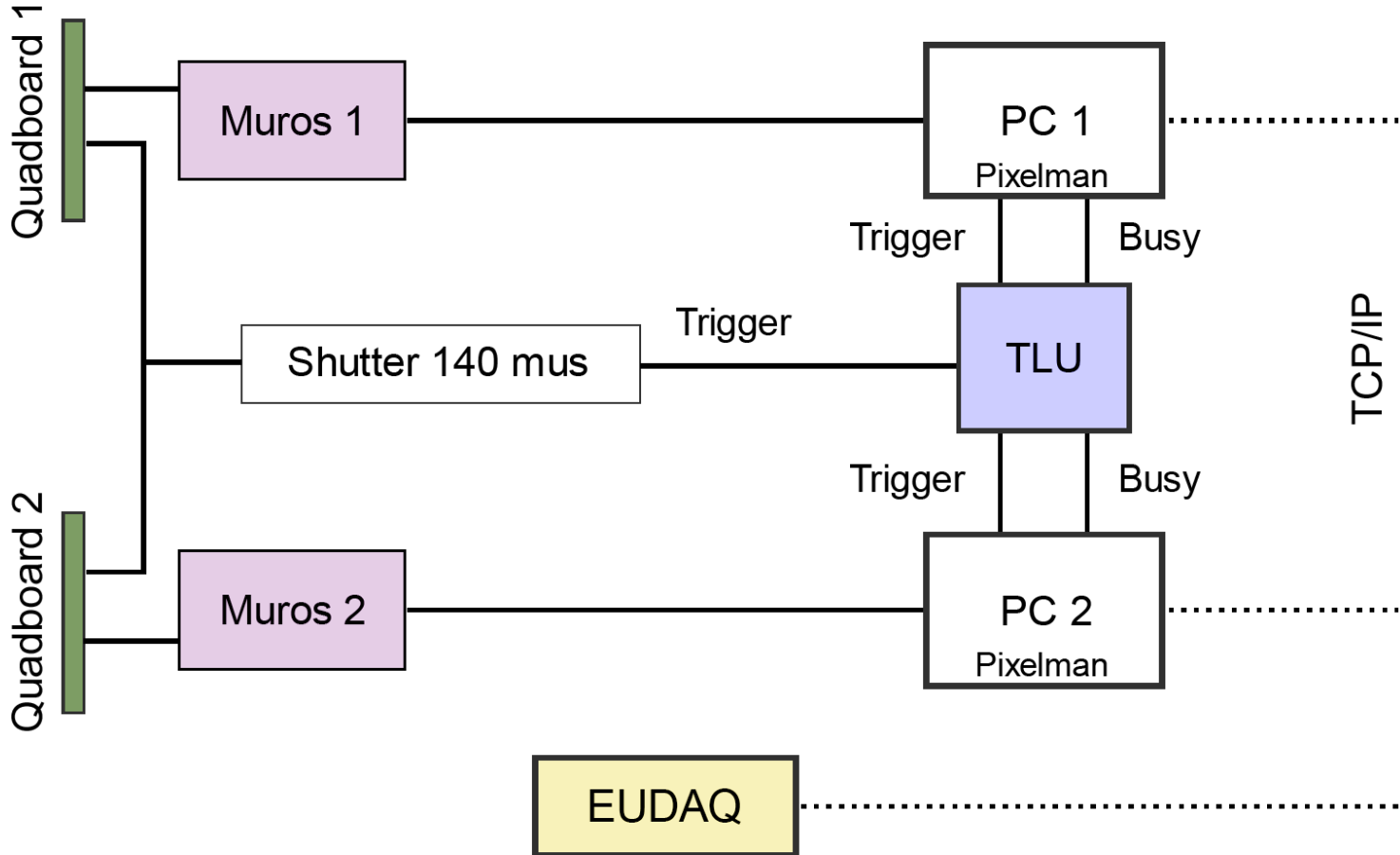
# Pictures from Installation



# Readout scheme



Using 2 Muros systems synchronized by TLU and EUDAQ



Data is written directly in the LCIO format.



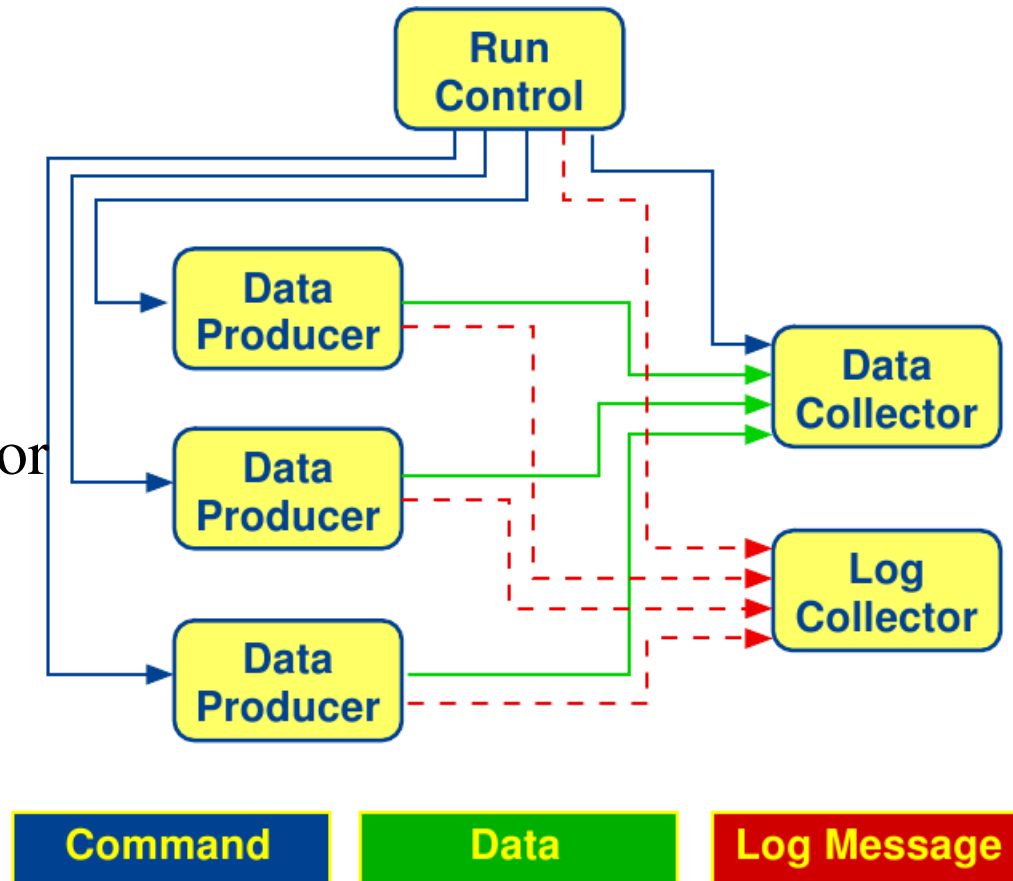
# EUDAQ: The Eudet Data Acquisition System



- DataProducer: Pixelman plugin communicates with EUDAQ
- Receives commands from Run Control
  - Sends data to Data Collector
  - Sends messages to Log Collector

## DataCollector:

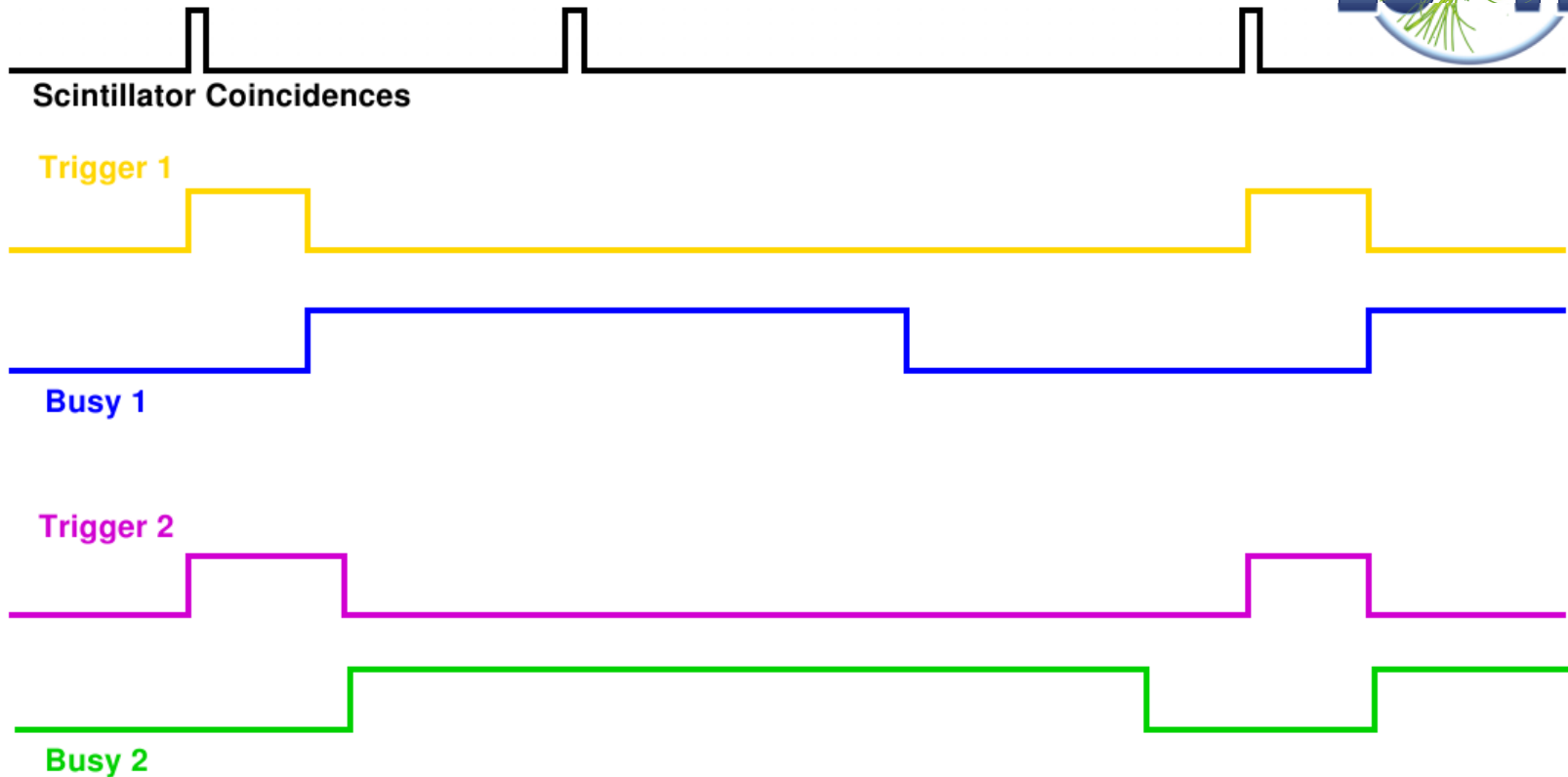
- Receives raw data
- Performs event building
- New: Plugin mechanism
- LCIO converter plugin for every raw data format





- Timepix measures clock cycles to end of shutter window
    - ⇒ precise length, small jitter
  - Software shutter is not precise (Windows timing: 1ms)
    - ⇒ use precise hardware pulse generator
  - Software problem:
    - Latest Pixelman version does not support hardware shutter any more
      - ⇒ Bypass the Muros and give shutter signal directly to chip
- Attention: Shutter and readout have to be synchronized. Opening the shutter while reading out the chip will disrupt the communication. Chip has to be reset. TLU inhibits triggers while device is busy.

# The TLU Trigger-Busy-Handshake



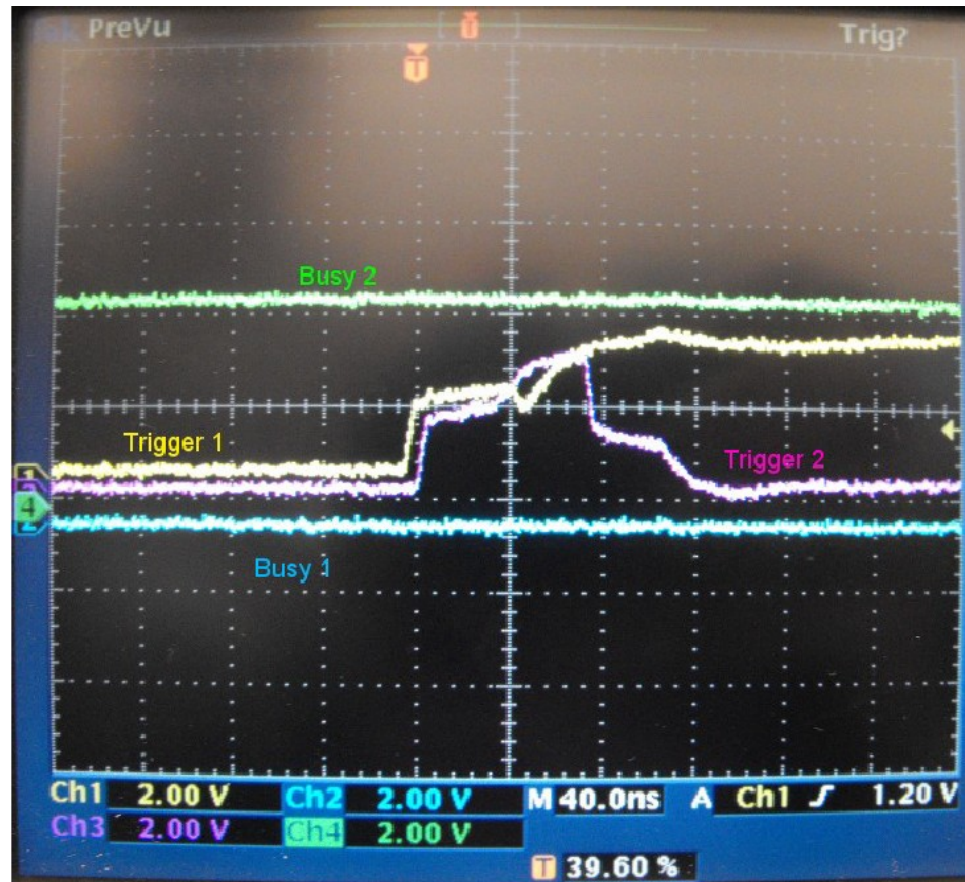
- TLU signalizes trigger for each device
- DAQ device asserts busy, TLU takes down trigger
- TLU blocks all further triggers while any of the devices is busy



# TLU problem



TLU does not always block the trigger correctly



- Event numbers get out of sync
- Communication with Timepix chip is disrupted

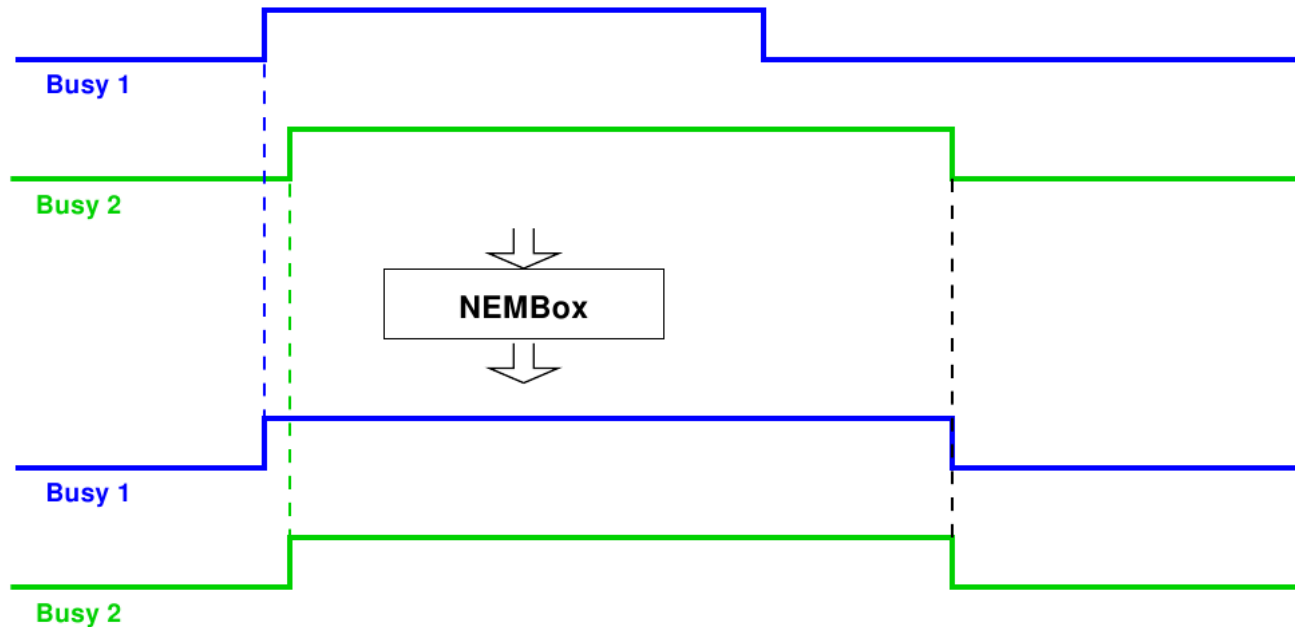
# Solution to the TLU problem



Special “OR” realized using a programmable logic box (NEMBox):

Channels are raised asynchronously

Channels are lowered synchronously

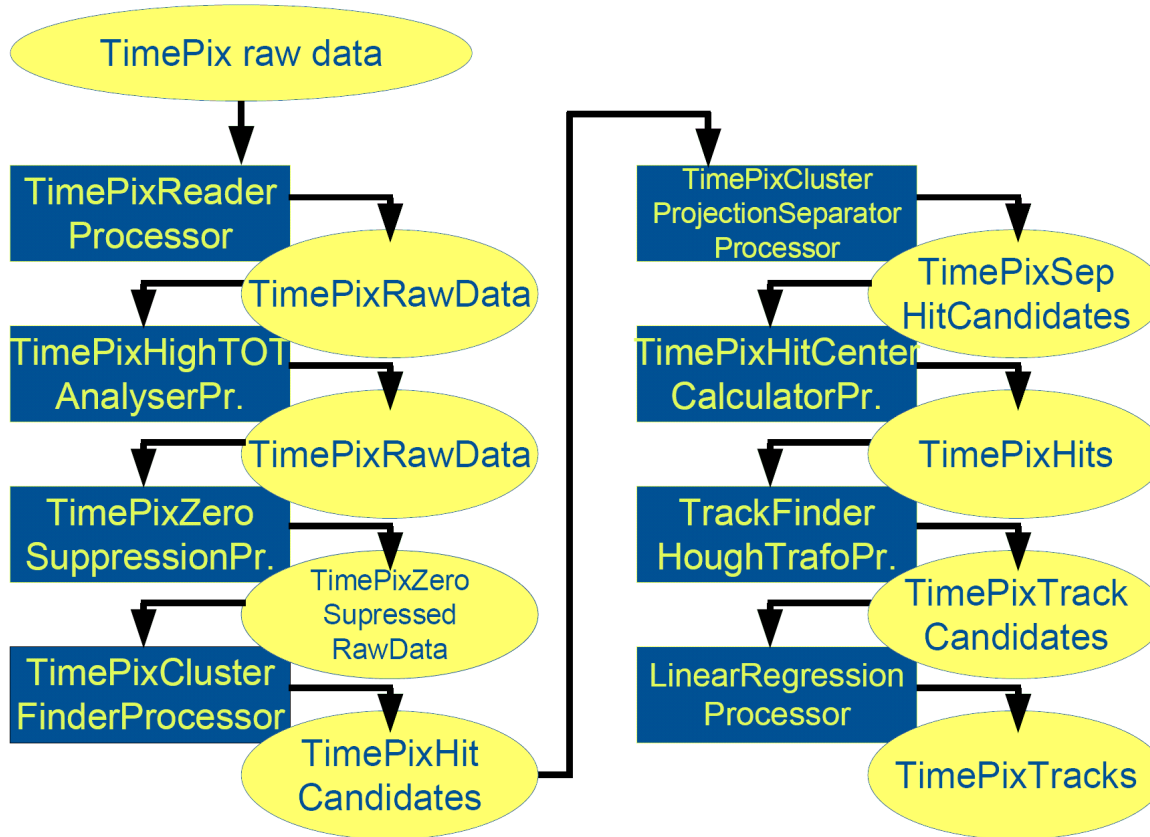


=> Trigger works fine

# MarlinTPC for Timepix data



Reconstruction and analysis chain for Timepix data has been established and verified.



Example:

Cluster separator




clusters defined by combining neighboring pixels



overlapping clusters are separated at local minima



Some processors have to be modified to deal with quadboards: universität  **bonn**  
e.g. Some mappings are not available



He:CO<sub>2</sub> 70:30:

Different drift distances

Different angles

Different particle energies

Different GEM settings

T2K Gas:

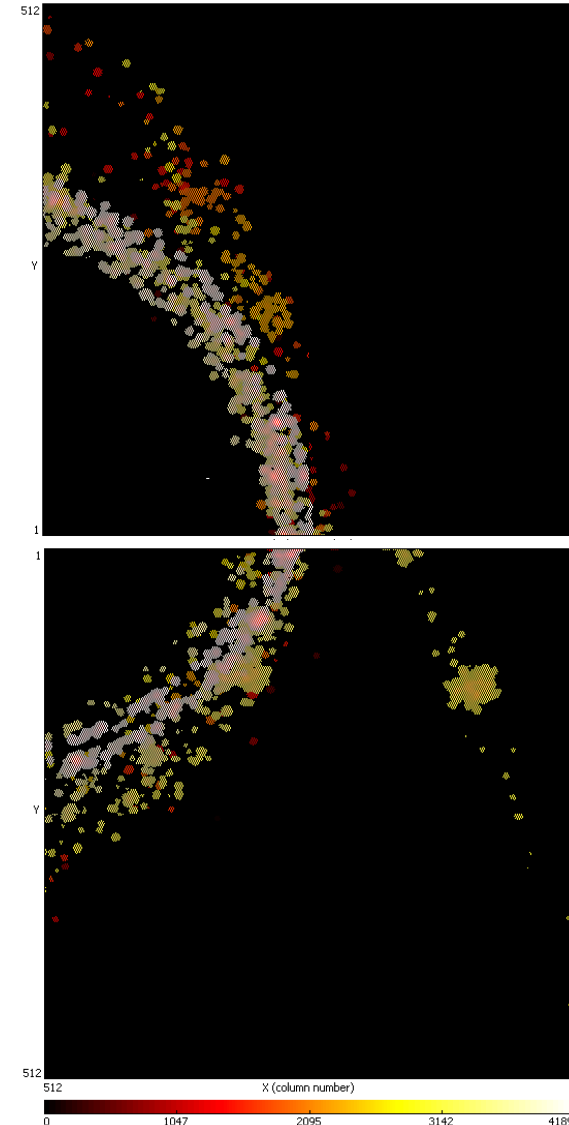
Different drift distances

Different angles

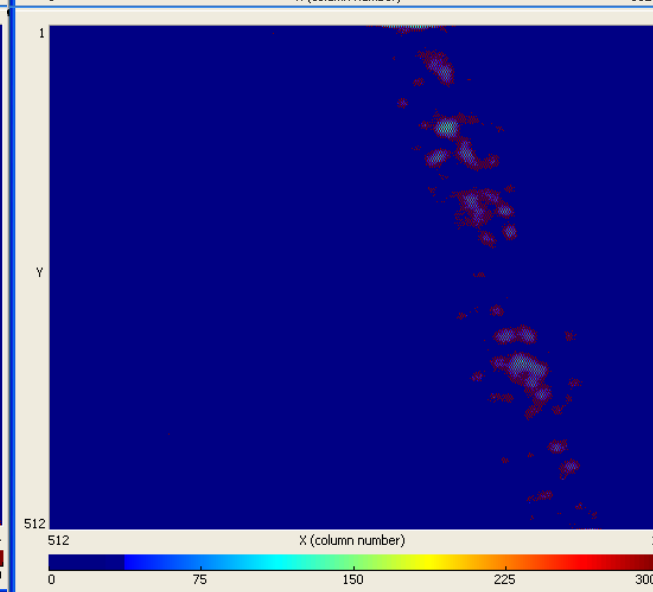
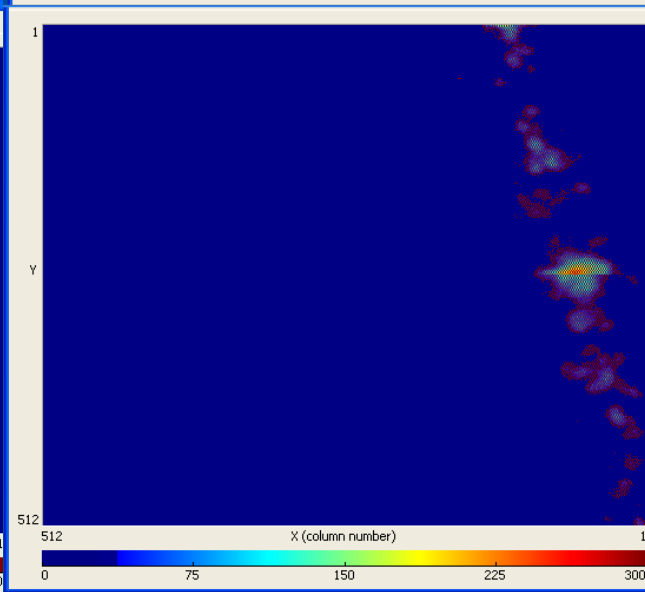
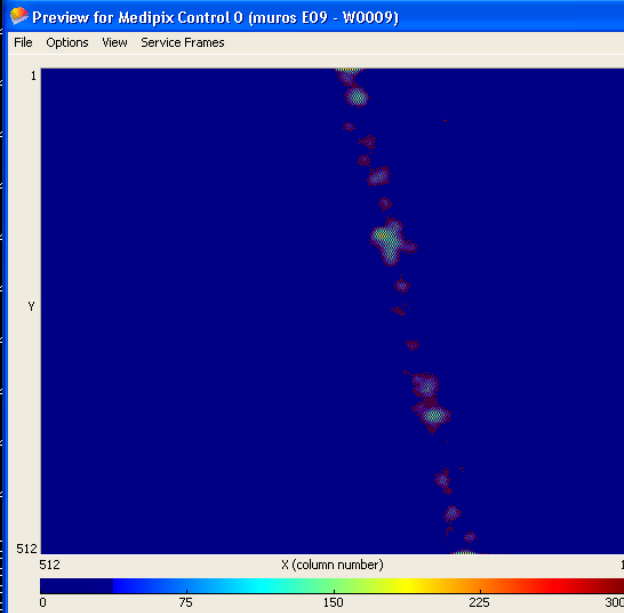
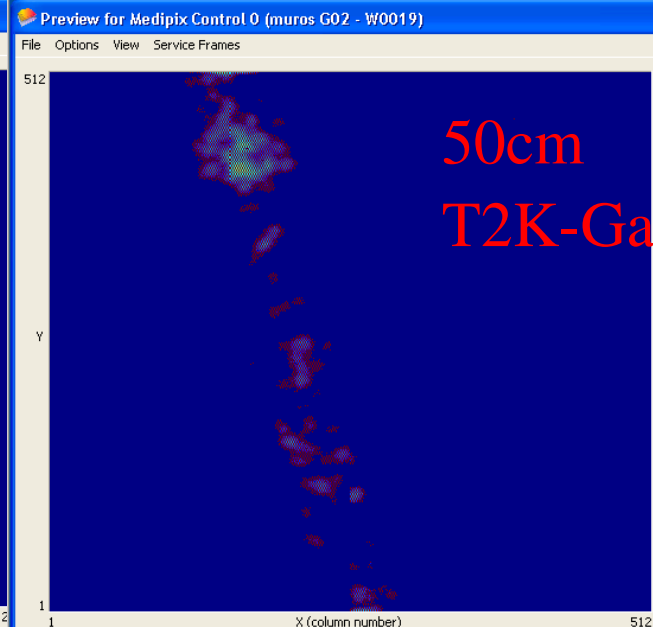
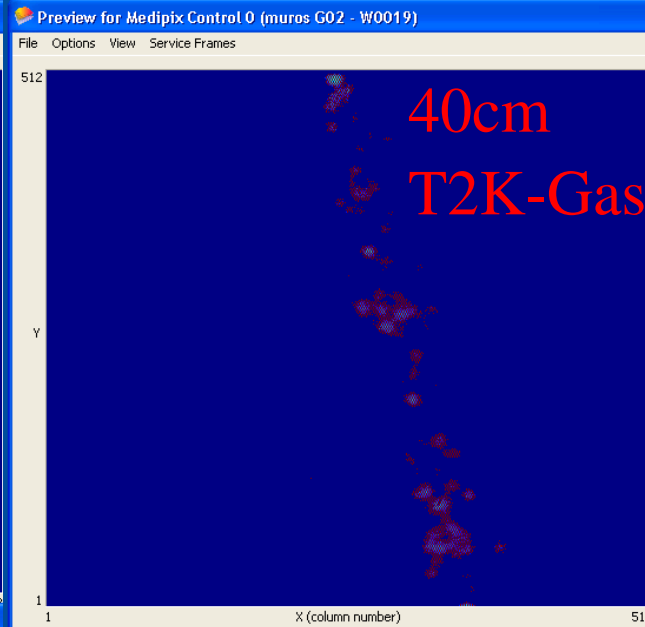
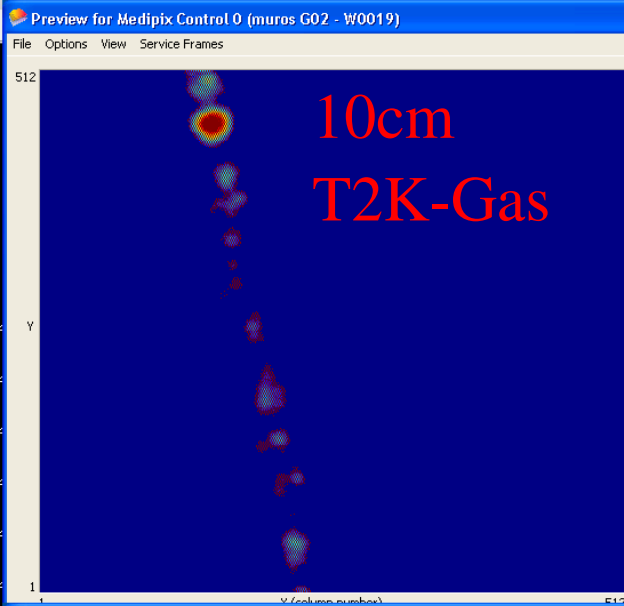
Different particle energies

Different GEM settings

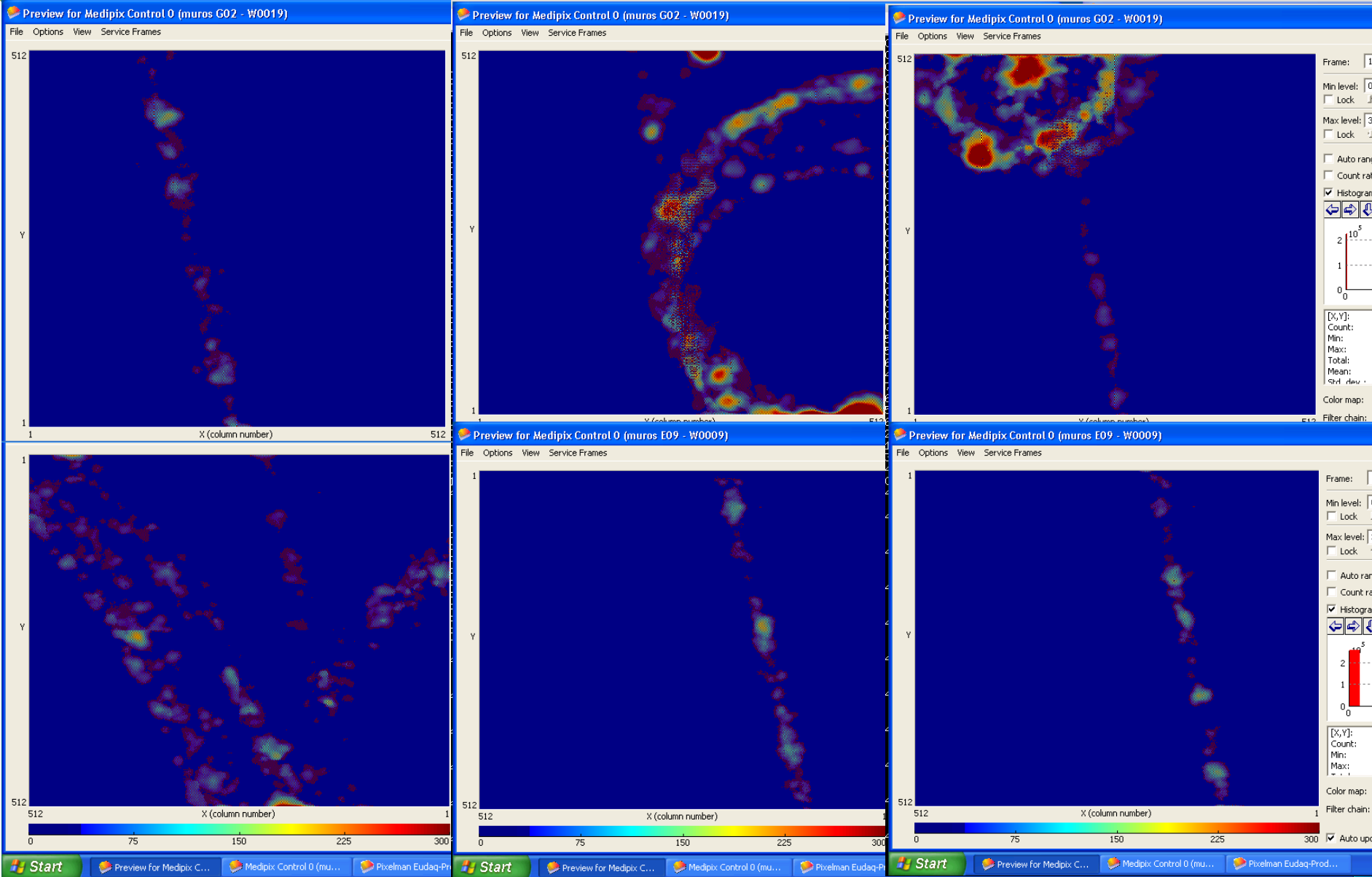
Laser dots



# Some Pictures (I) – straight tracks

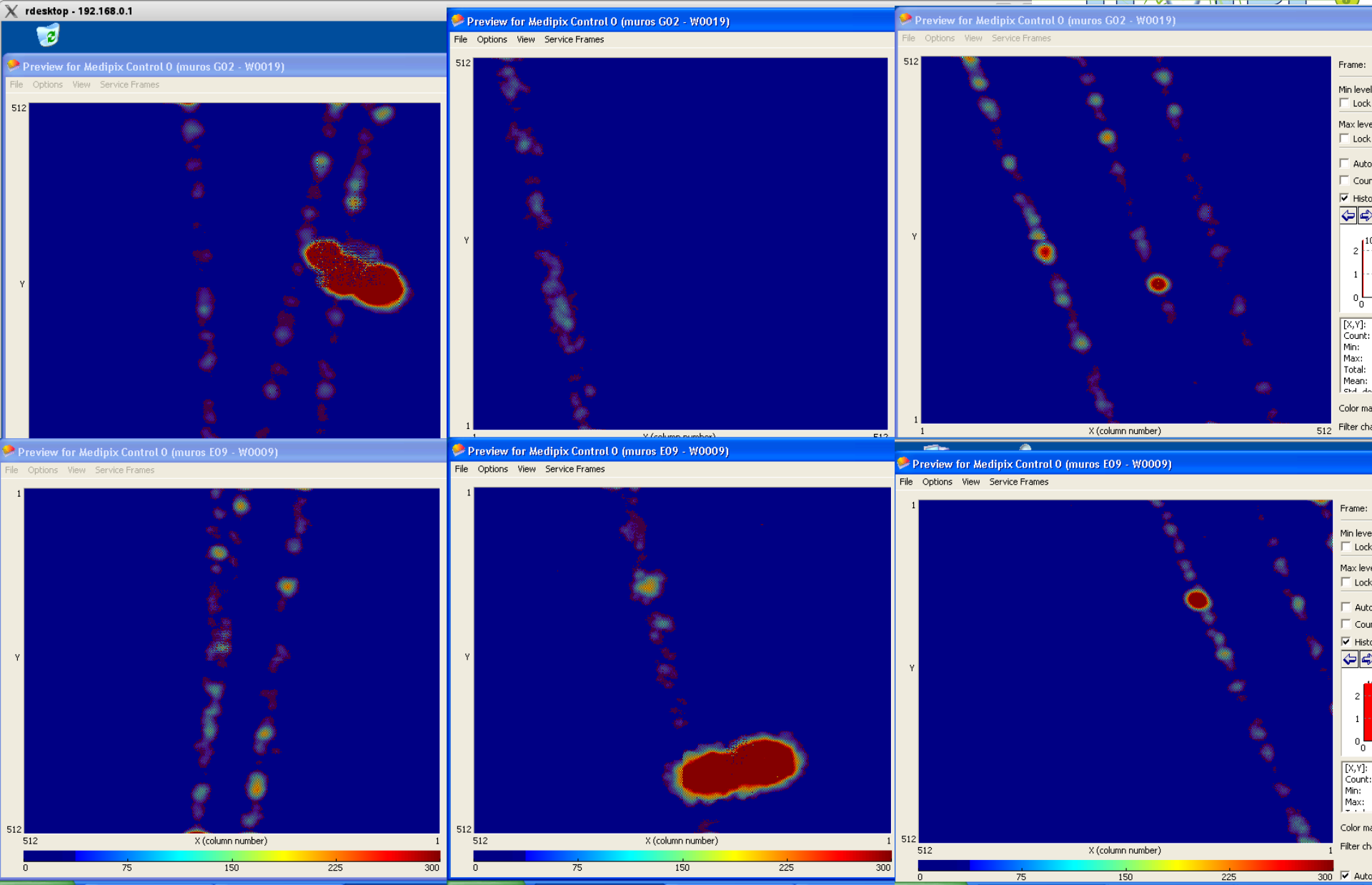


# Some Pictures (III)





# Some Pictures (III)



# Thank you!



We would like to thank everyone who helped us before and during the test beam.

The FLC group, especially

Klaus Dehmelt, Christoph Rosemann, Takeshi Matsuda, Ralf Diener,  
Bakul Gaur, Oliver Schäfer

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