



Pixel-TPC testbeam analysis

Michael Lupberger

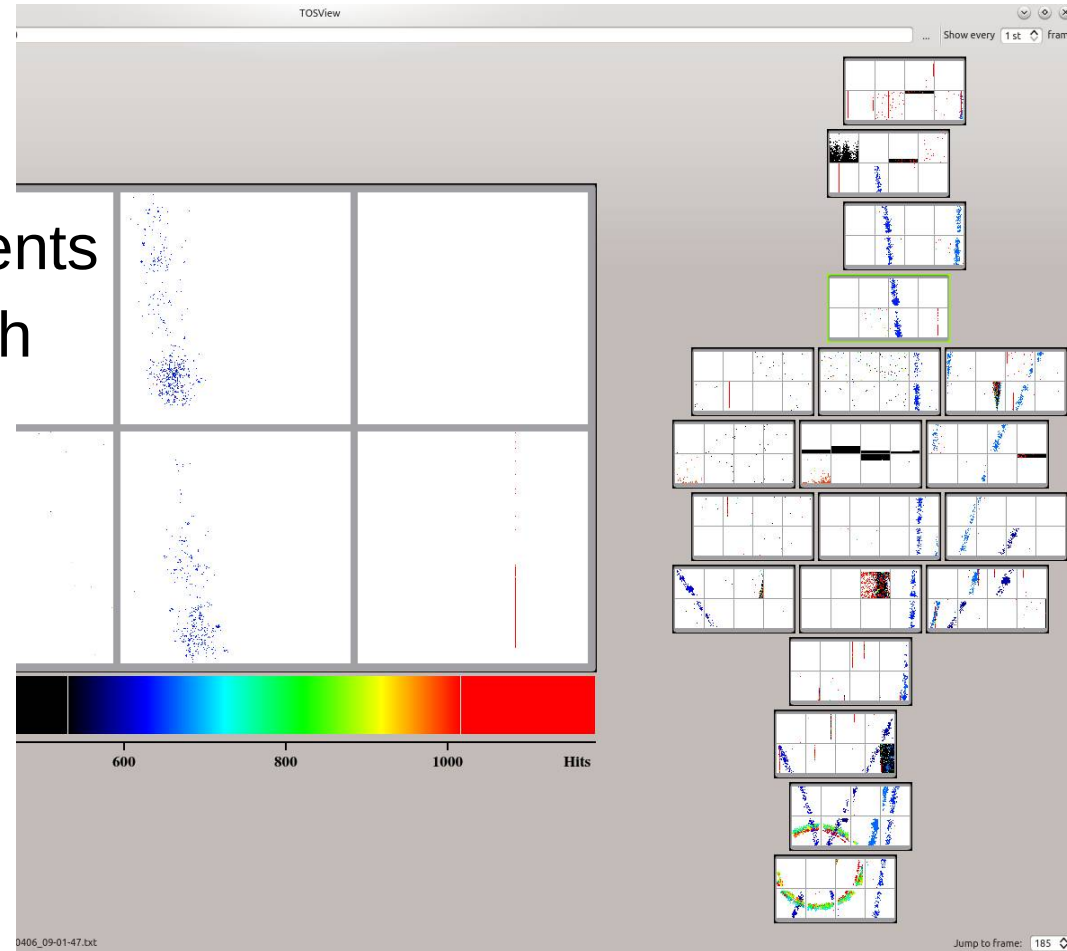
LCTPC-pixel meeting #17, May 28, 2015

Retrospect



Superb test beam! Thanks everyone for your help!

- Beautiful data!
- A lot of data: ~1.5 mio. events in about 170 runs each with different parameters
- Many things to study
→ lets start the analysis

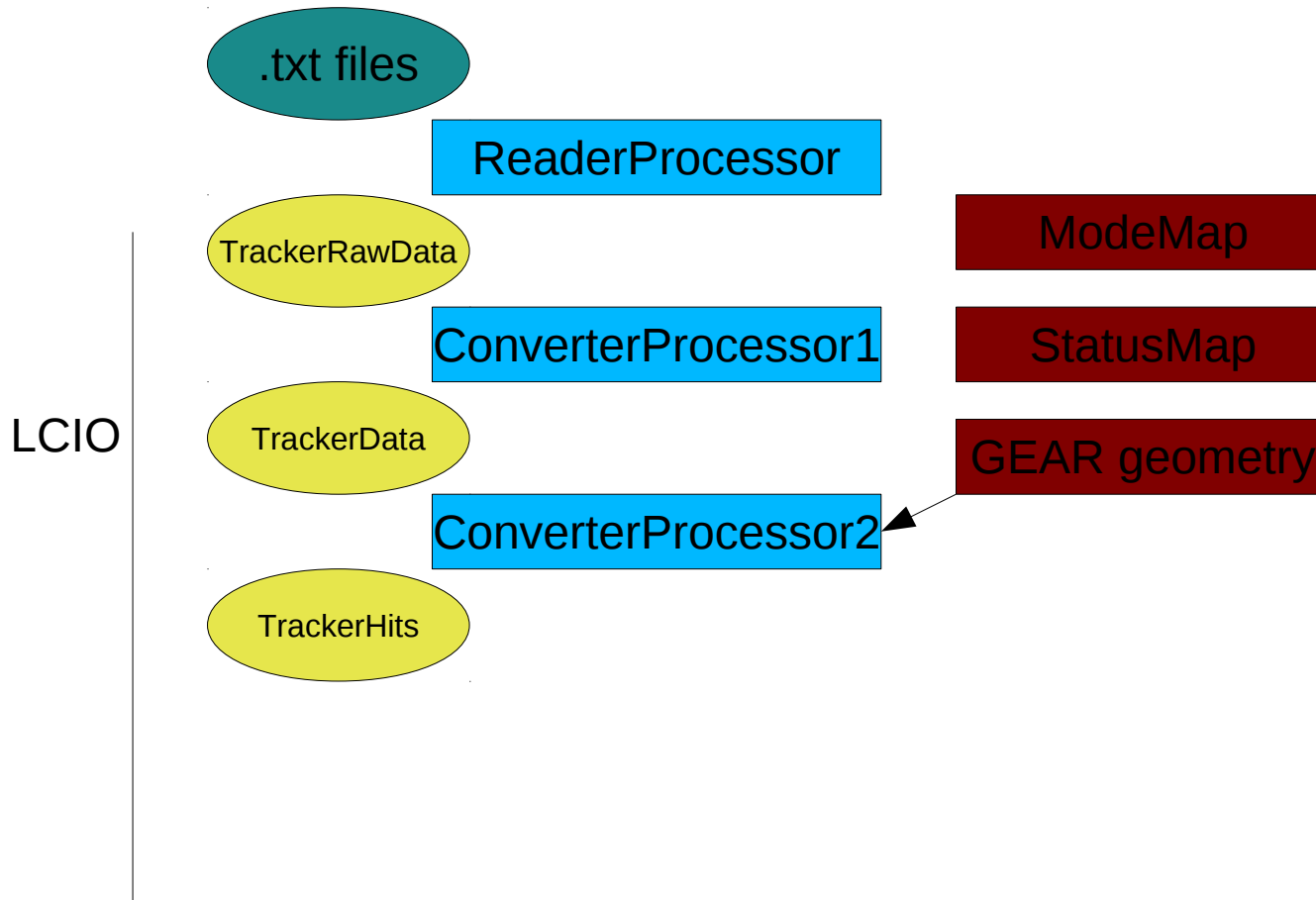


(Modular Analysis & Reconstruction for the LINear Collider TPC)

- Set up on 3 computers in Bonn
Developers account for Daniel and me, own branches
- Using Eclipse to write/manage code
- Looking at Steering files and Processors from Robert Menzens analysis (8-InGrid Module):

http://pi.physik.uni-bonn.de/pi_plone/lhc-ilc/view.php?lang=de&c=t&id=42

(Modular Analysis & Reconstruction for the LINear Collider TPC)



MarlinTPC: first steps



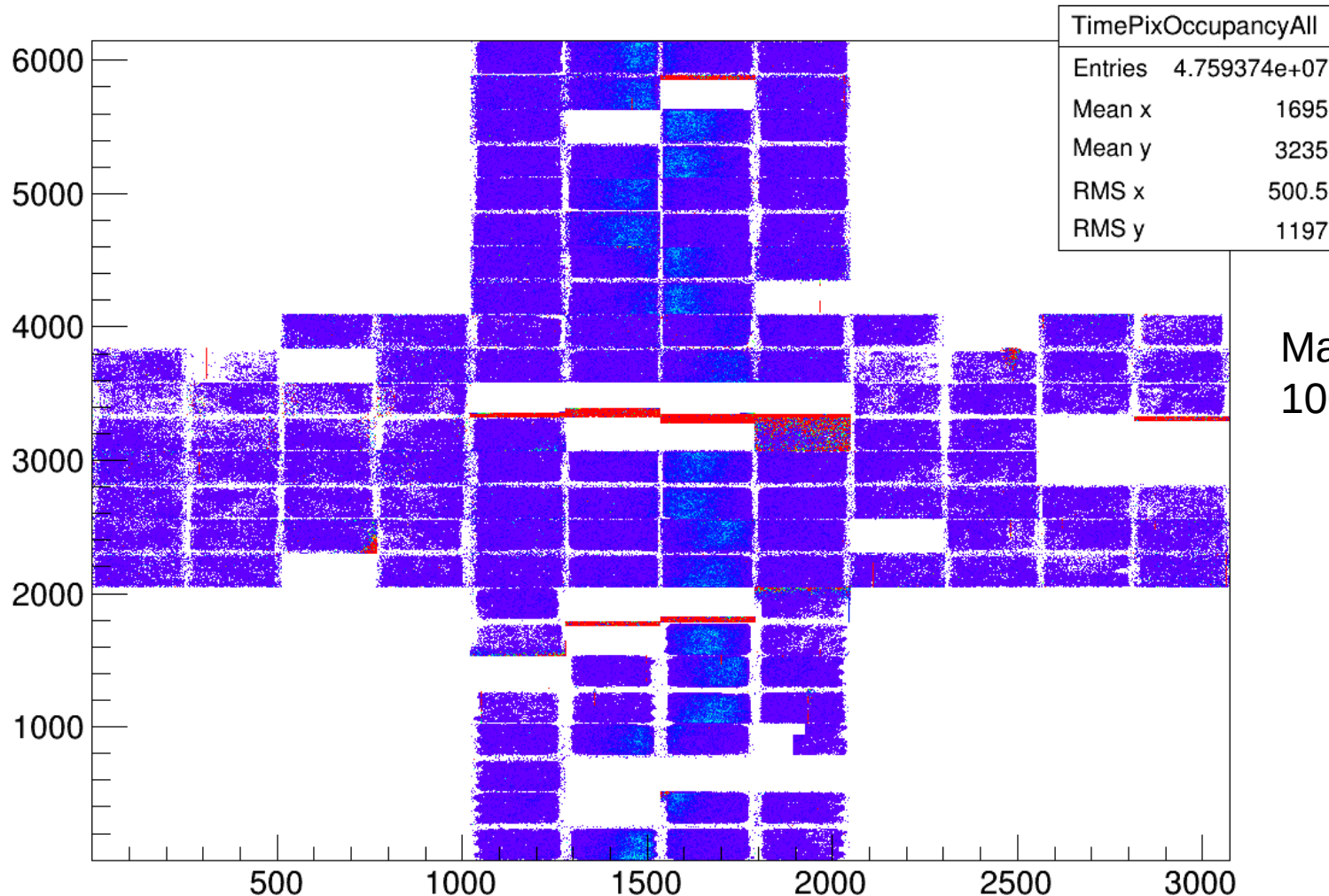
- Uses LCIO data format => convert data to LCIO
→ need a Processor to do this: TimePixXYReaderProcessor
extended to read multiple chips, optional: interchange chips
- ModeMap: simple as all pixels in TIME mode
- Remove signals from dead chips, rows, noisy pixel
→ create occupancy for each run and cut out too active pixels
Beam: expect ~ 100 e/cm on (depending on drift distance)
 ~ 25000 pixel => $p_{\text{hit}} \sim 0.4\%$ => in 10000 events $\bar{N} = 40$,
 $\sigma_N = \sqrt{\bar{N}} = 6.3$ => cut on $\bar{N} + 5\sigma_N = 72$ hits/pixel = 0.72%
=> save to cut on 1 or 2 % as maximum hits/pixel in a run
- Create StatusMap

Occupancy examples



Run 104: beam close to anode, 1000 frames

TimePix Occupancy All Chips



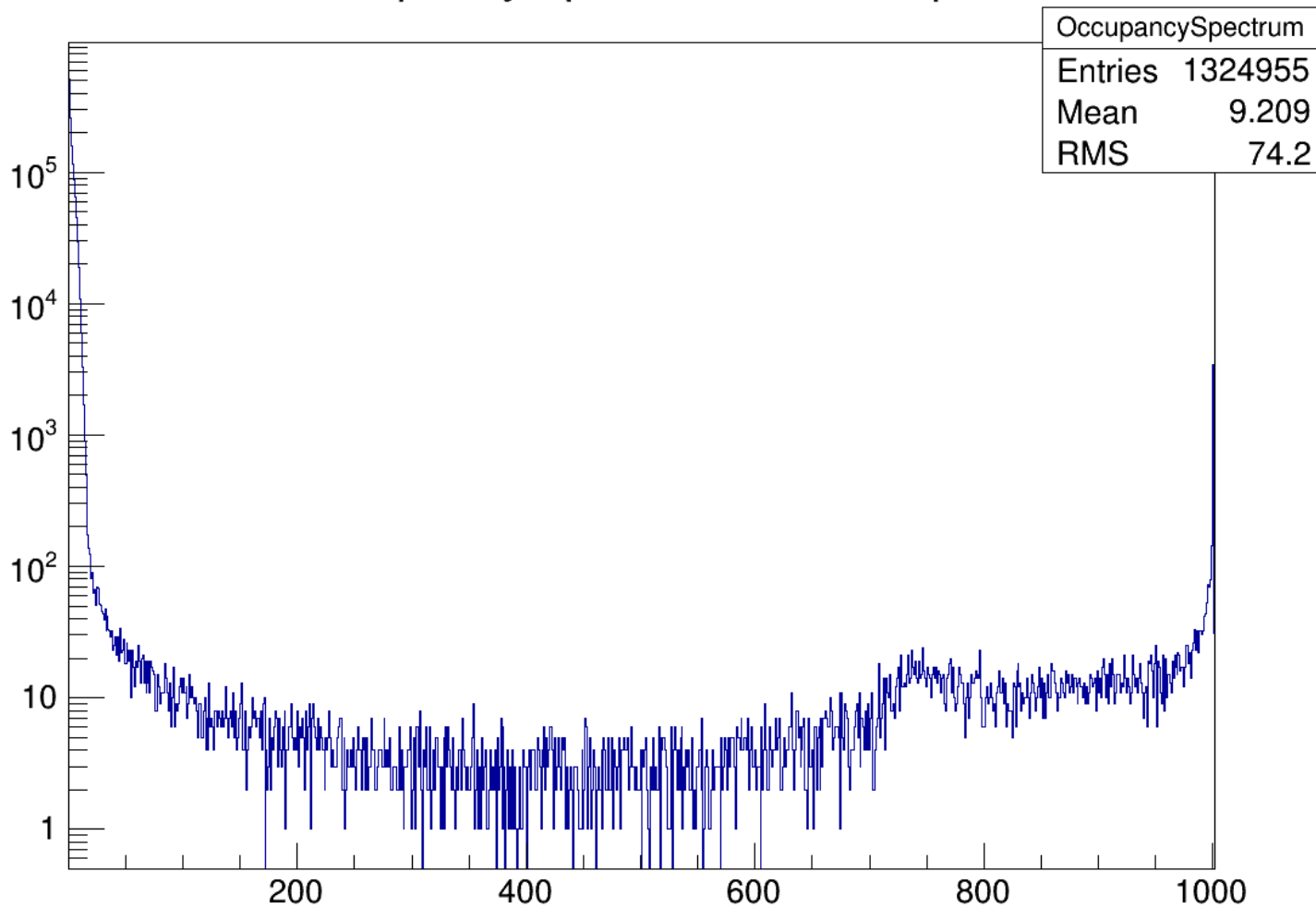
Maximum set from
1000 → 40

Occupancy examples



Run 104: beam close to anode, 1000 frames

Occupancy spectrum of all chips

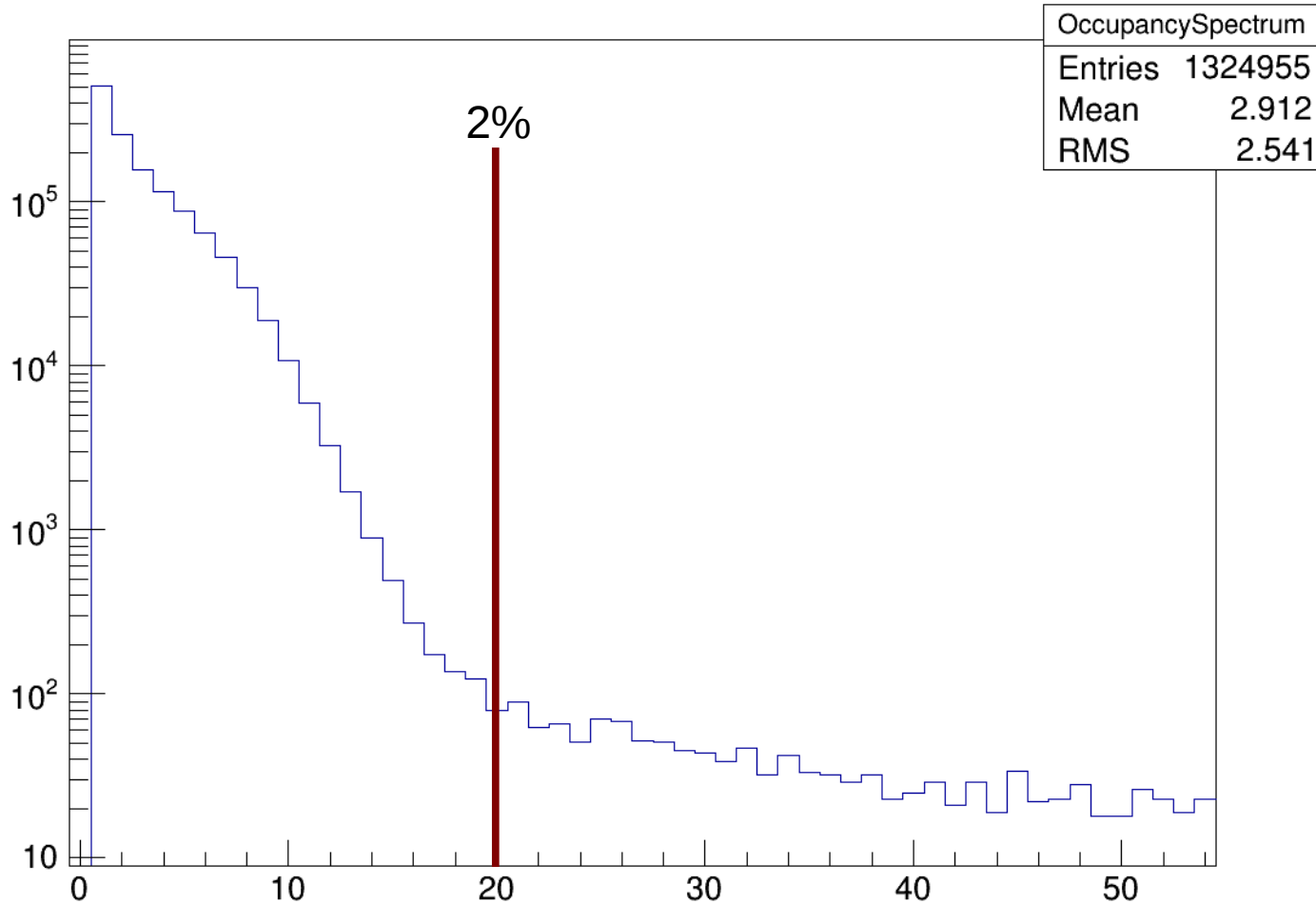


Occupancy examples



Run 104: beam close to anode, 1000 frames

Occupancy spectrum of all chips

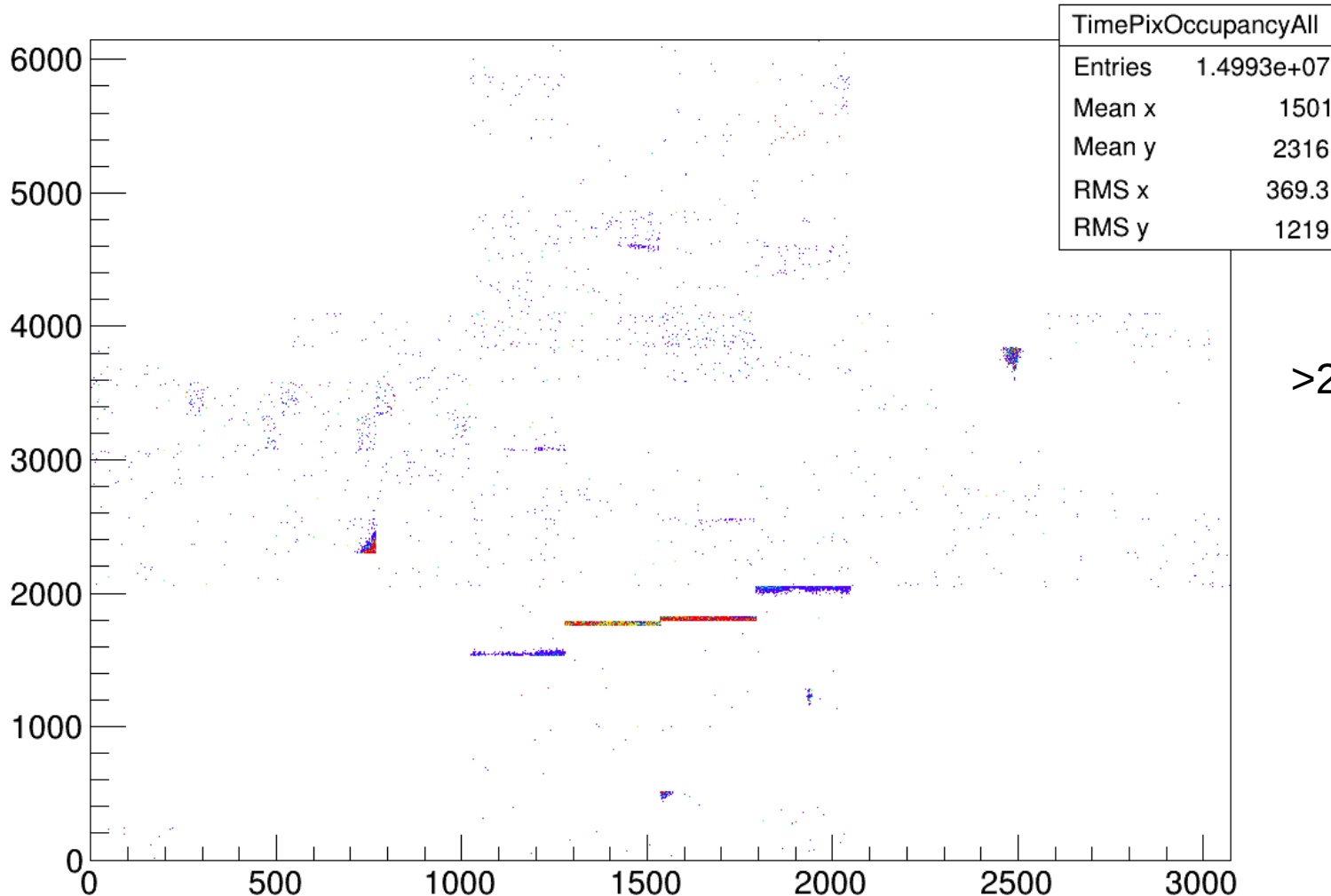


Occupancy examples



Run 104: beam close to anode, 1000 frames

TimePix Occupancy All Chips



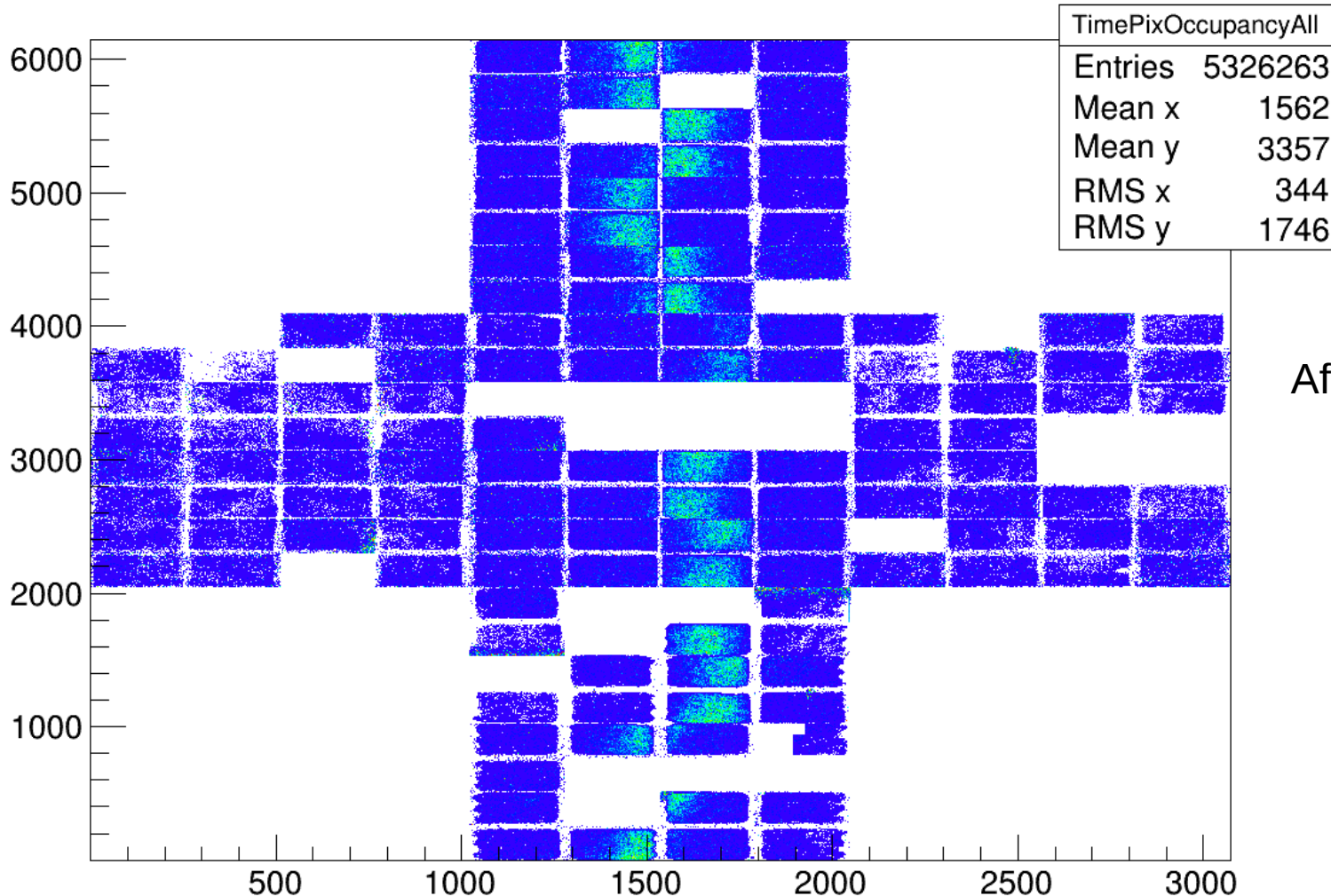
>20: Cut away

Occupancy examples



Run 104: beam close to anode, 1000 frames

TimePix Occupancy All Chips



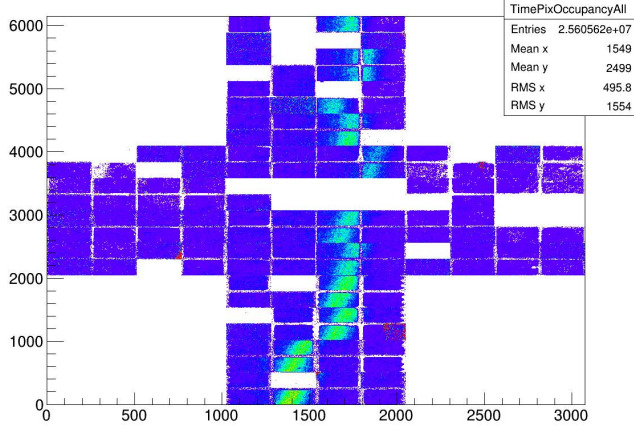
After cut

Occupancy examples

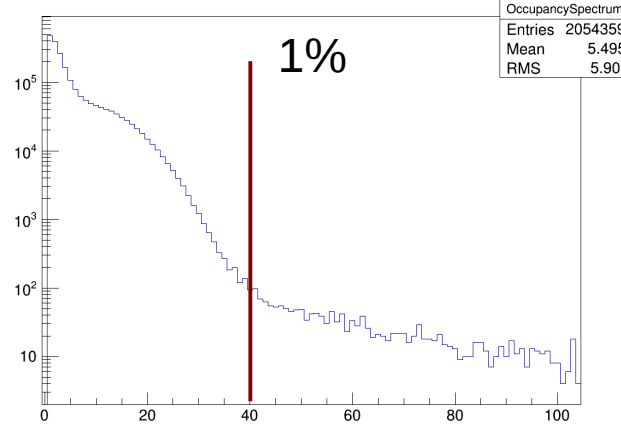


Run 143: beam some mm from anode, 4043 frames

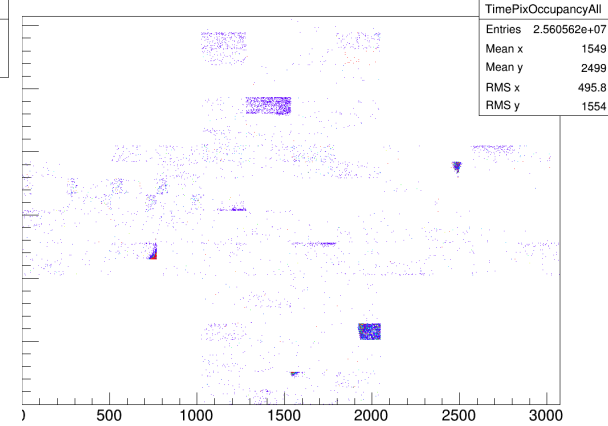
TimePix Occupancy All Chips



Occupancy spectrum of all chips



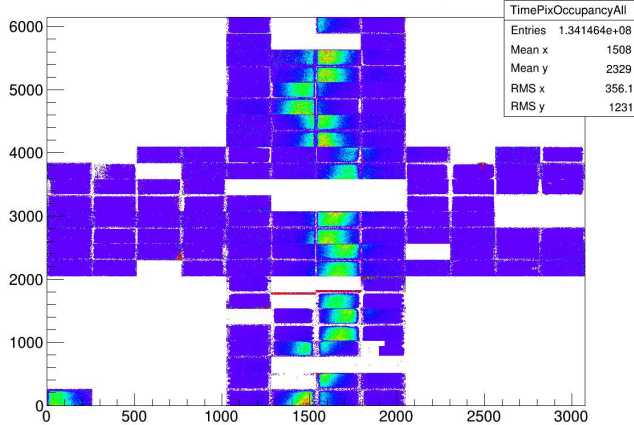
TimePix Occupancy All Chips



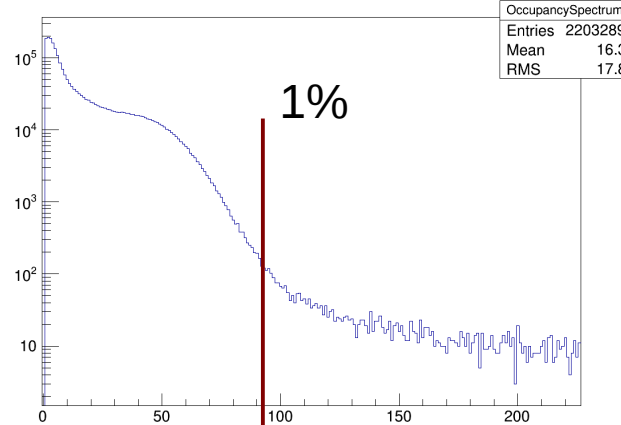
Full occupancy, maximum lowered

Cut away

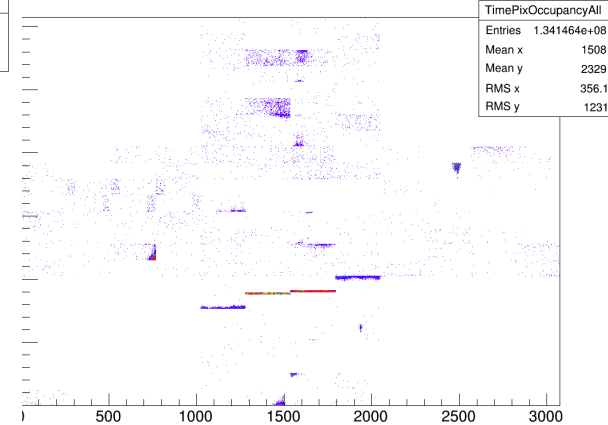
TimePix Occupancy All Chips



Occupancy spectrum of all chips



TimePix Occupancy All Chips



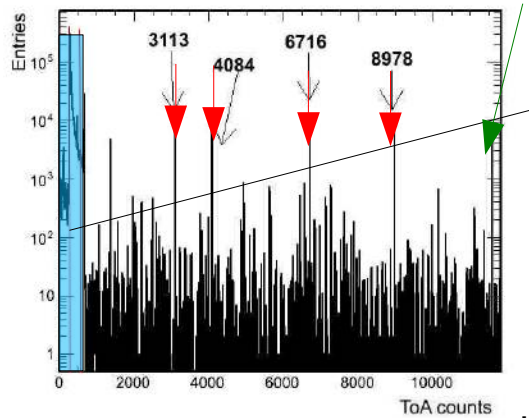
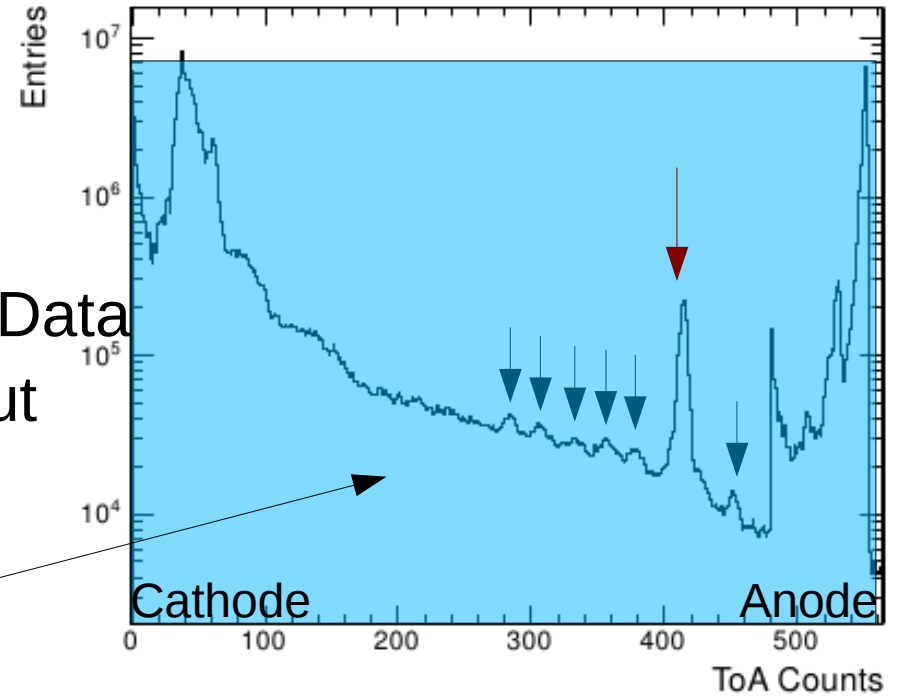
Run 091: beam about 40 cm from anode, 8800 frames



MarlinTPC: Check data quality



- Use time (=TOA) spectrum to look for:
 - Bit shifts in data (=> counts longer than shutter window)
 - Dead pixel (=> counts longer than shutter window)
 - Noise
 - The beam
 - DESYII repetition rate
 - Shutter window
- Can be done on Tracker(Row)Data
 - See effects of occupancy cut



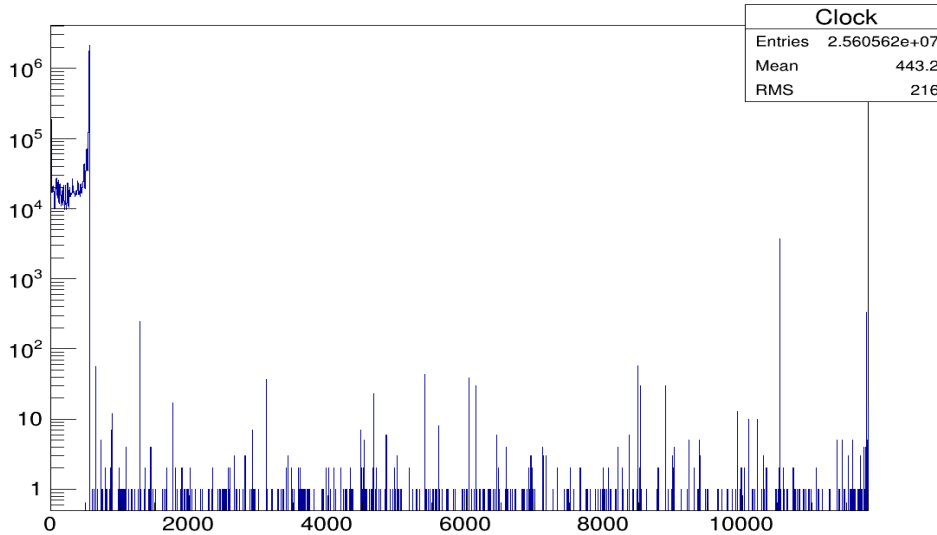
TOA spectrum examples



Run 143: beam some mm from anode, 4043 frames

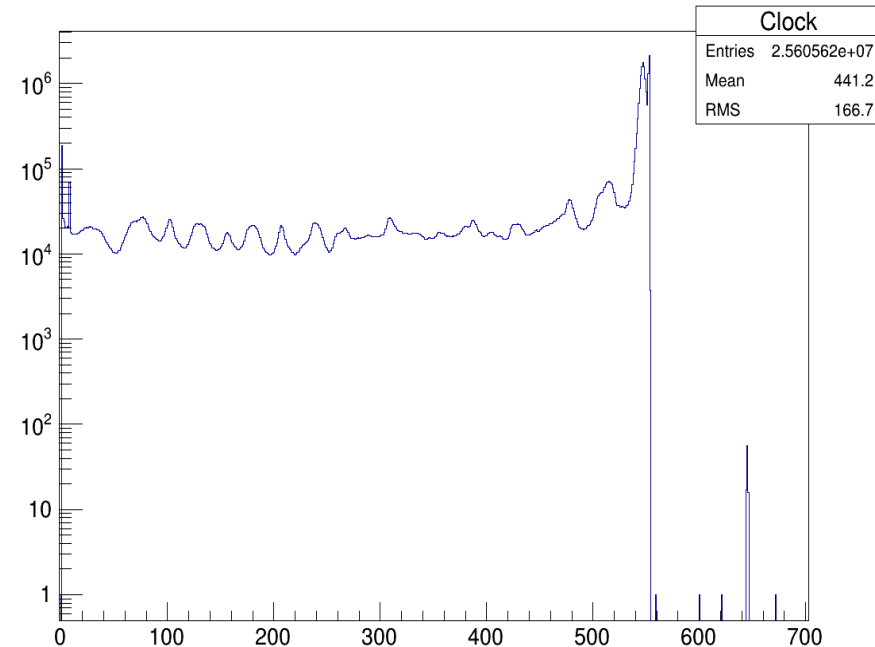
No cut

Clock



2200 pixel > 600TOA counts
1632 pixel in overflow (11810)

Clock

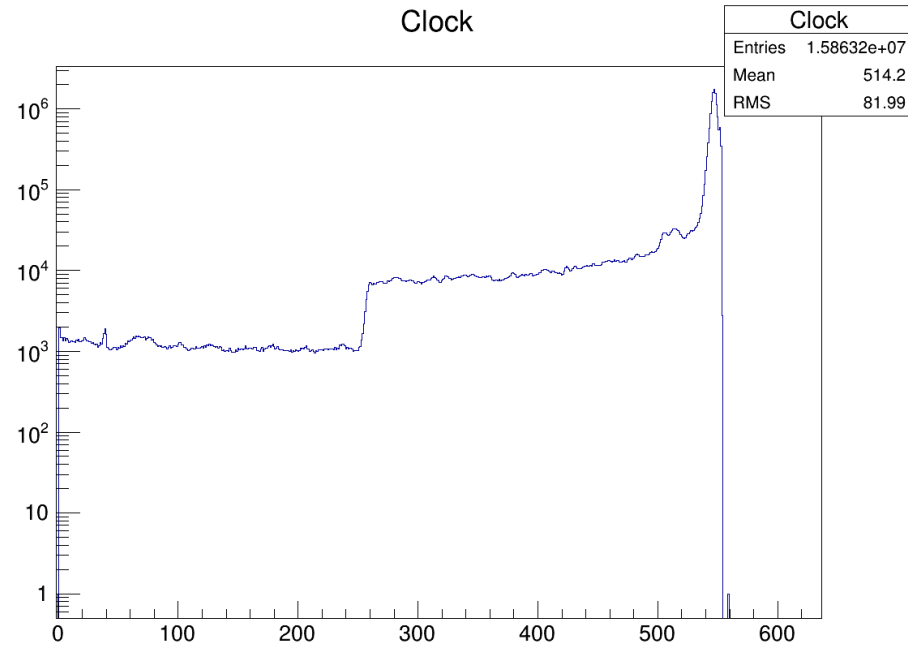
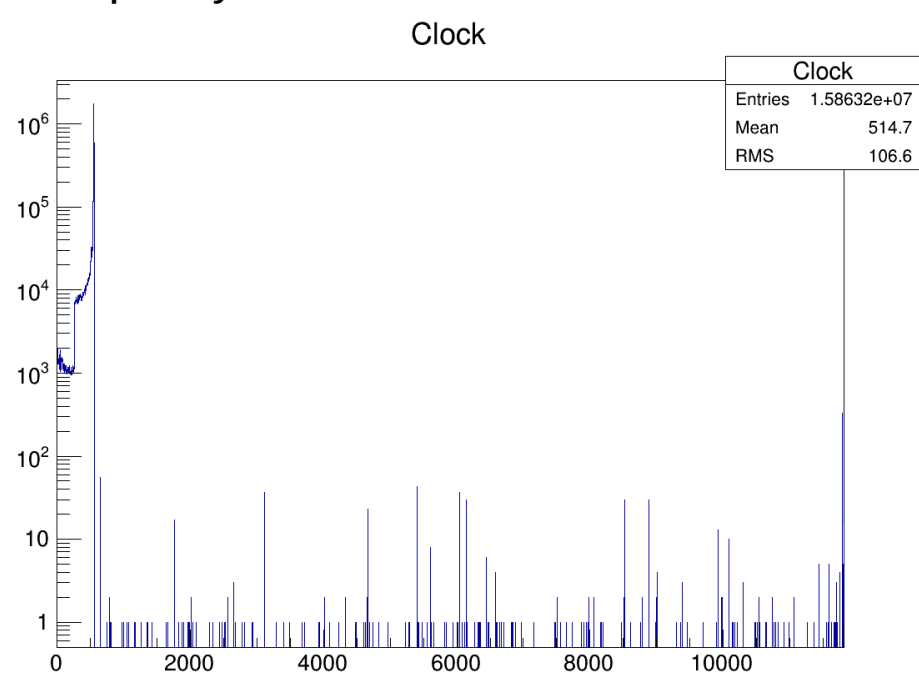


TOA spectrum examples



Run 143: beam some mm from anode, 4043 frames

Occupancy cut 1%



1115 pixel > 600 TOA counts, 39 pixel in overflow (11810)

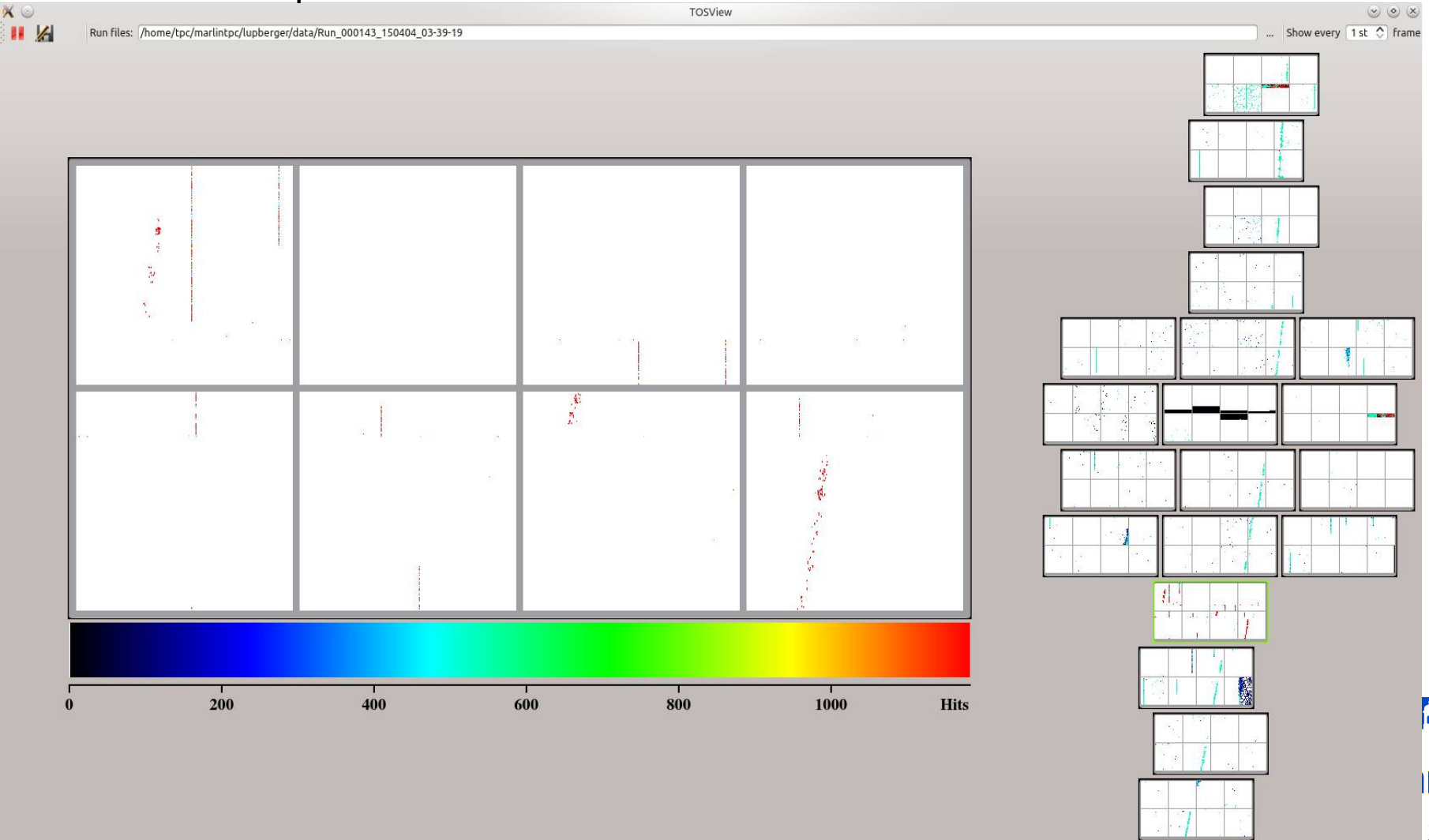
→ 1073 pixel in 4 events

15 frames with one or more pixel with TOA>600

Bad event



Run 143: beam some mm from anode, 4043 frames
Event 767: 626 pixel > 600 TOA counts

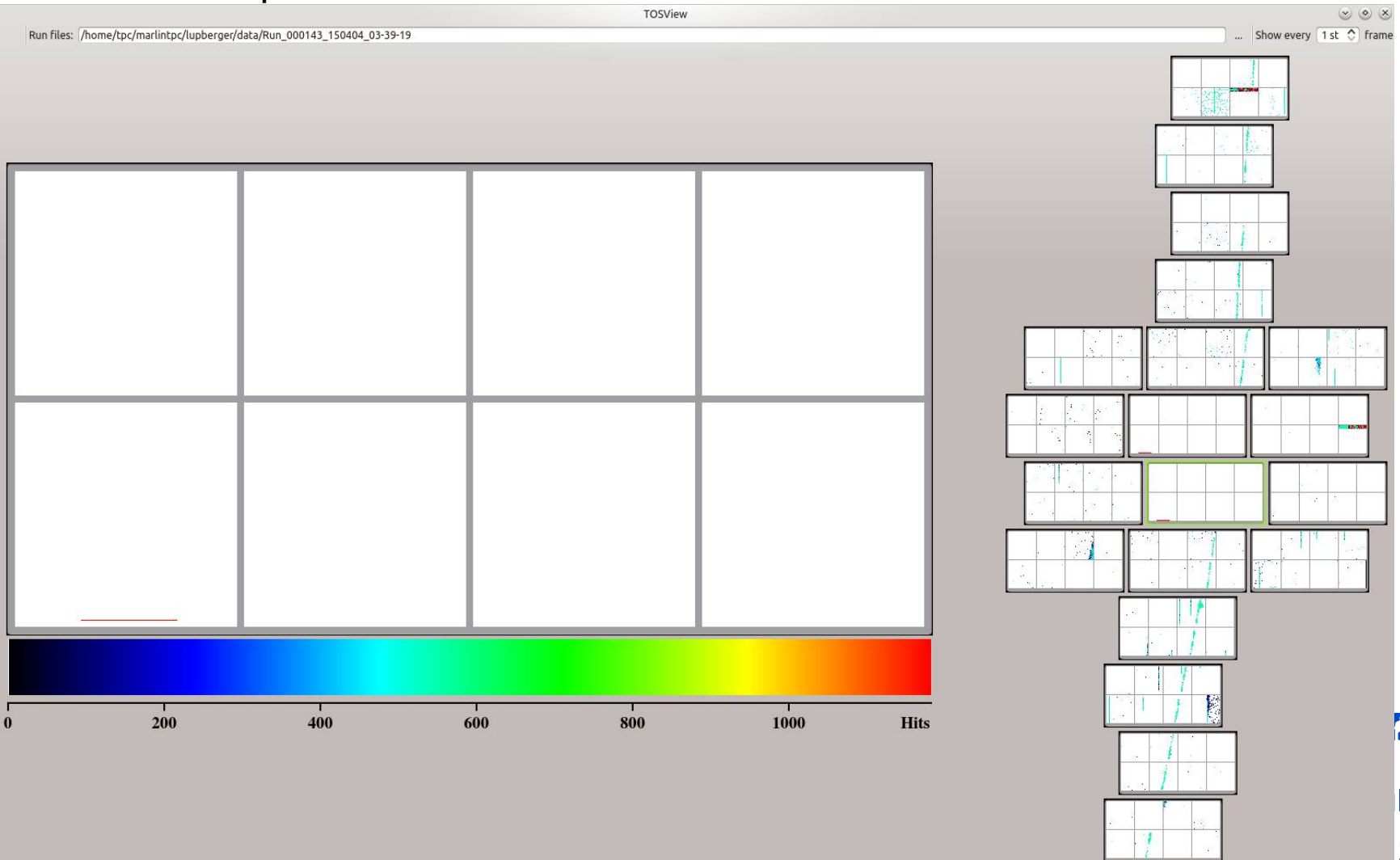


Bad event



Run 143: beam some mm from anode, 4043 frames

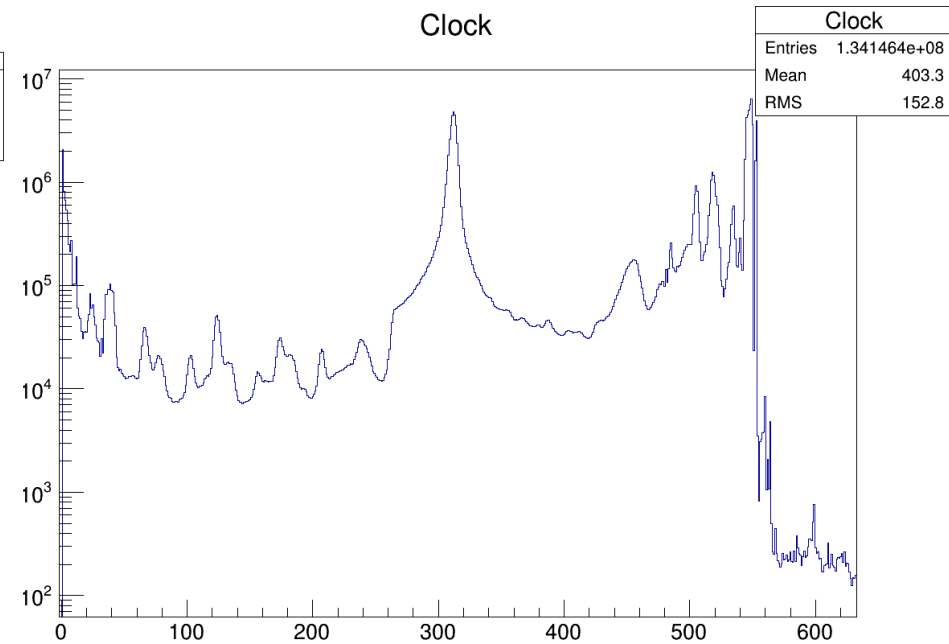
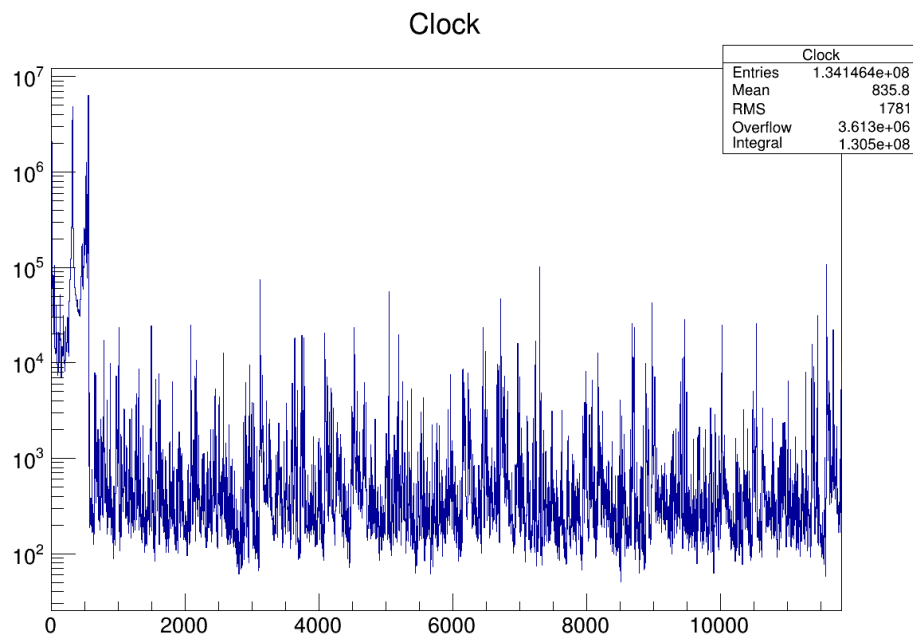
Event 1363: 221 pixel > 600 TOA counts



TOA spectrum examples



Run 091: beam about 40 cm from anode, 8800 frames
No cut



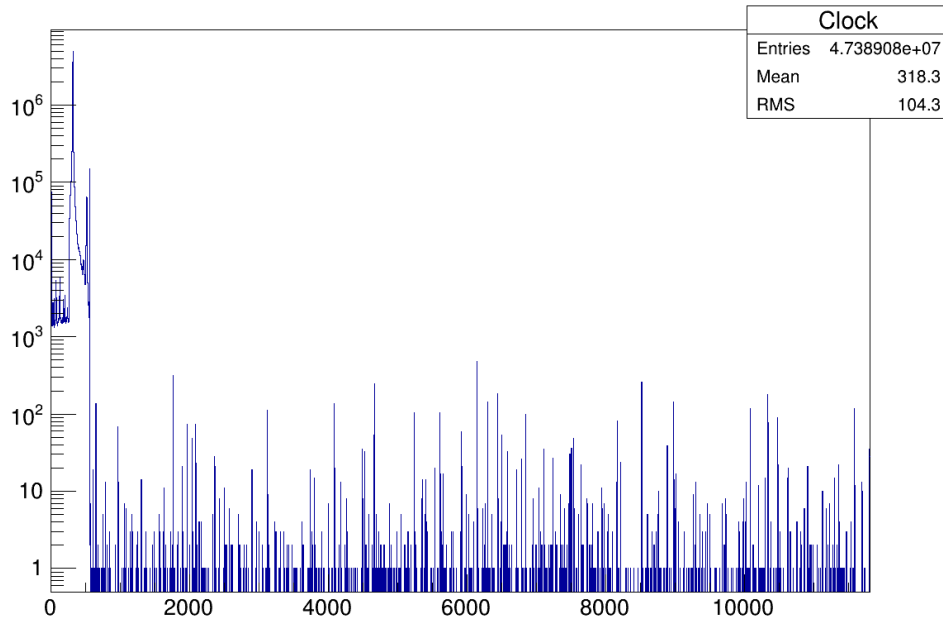
2.8E7 pixel > 600 TOA counts,
3.6E6 pixel in overflow (11810)

TOA spectrum examples

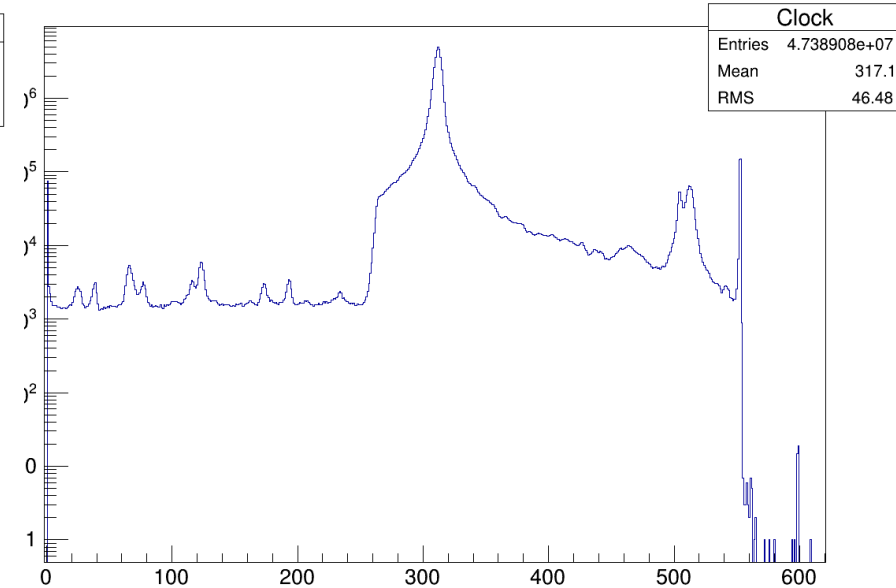


Run 091: beam about 40 cm from anode, 8800 frames
Occupancy cut 1%

Clock



Clock



9119 pixel > 600 TOA counts, 114 pixel in overflow (11810)
→ 8135 pixel in 1 event, 824 pixel in 3 events

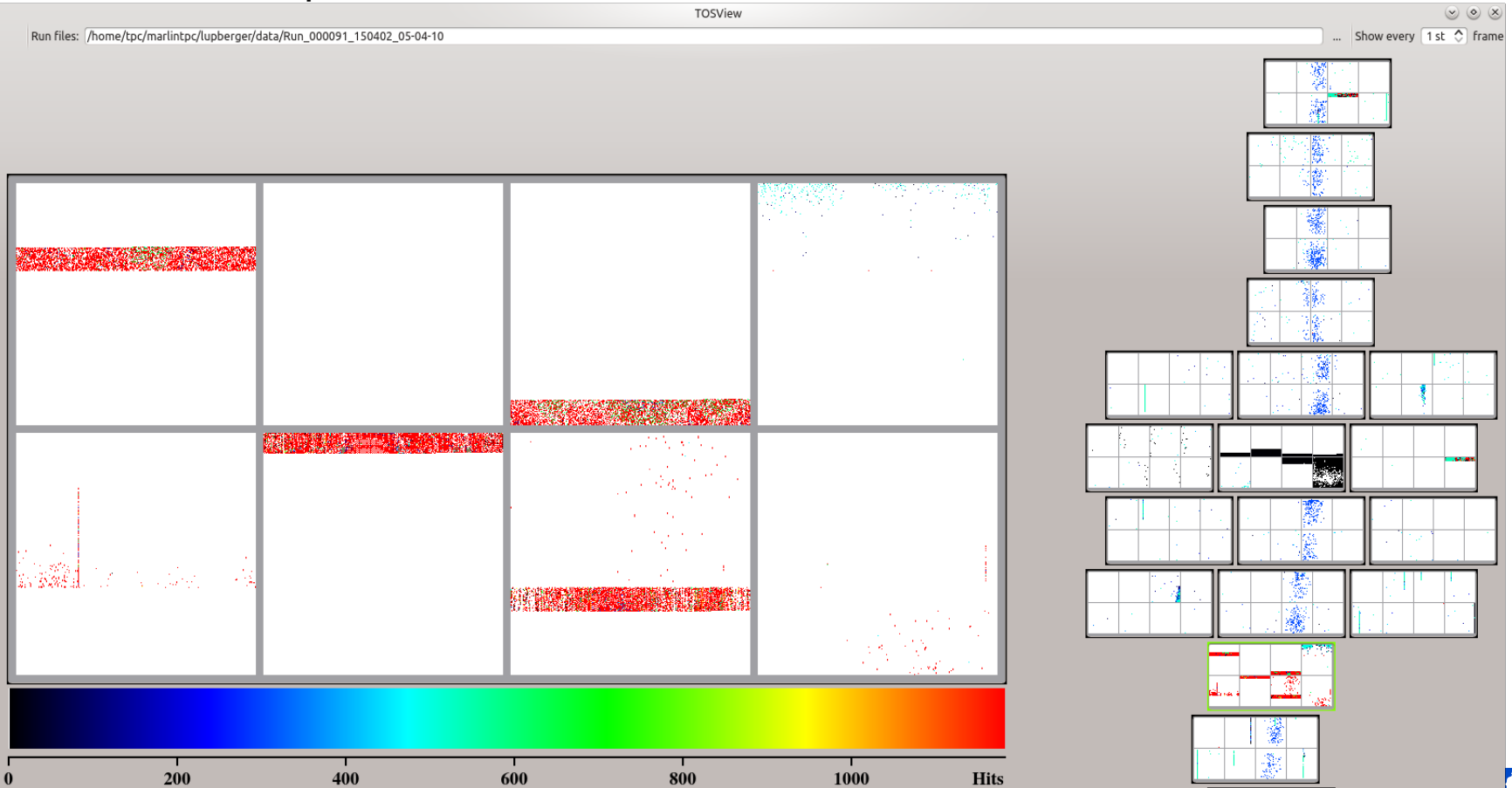
16 frames with one or more pixel with TOA>600

Bad event



Run 091: beam about 40 cm from anode, 8800 frames

Event 8521: 8135 pixel with TOA counts > 600



Ongoing



- Converting test beam data to LCIO
 - Interchange chips in data (not correctly set in test beam)
- Automatic chain:
 - Generate occupancy with no cuts
 - Generate StatusMap
 - Generate PixelSpectrum and Occupancy with cuts
 - Convert to hits

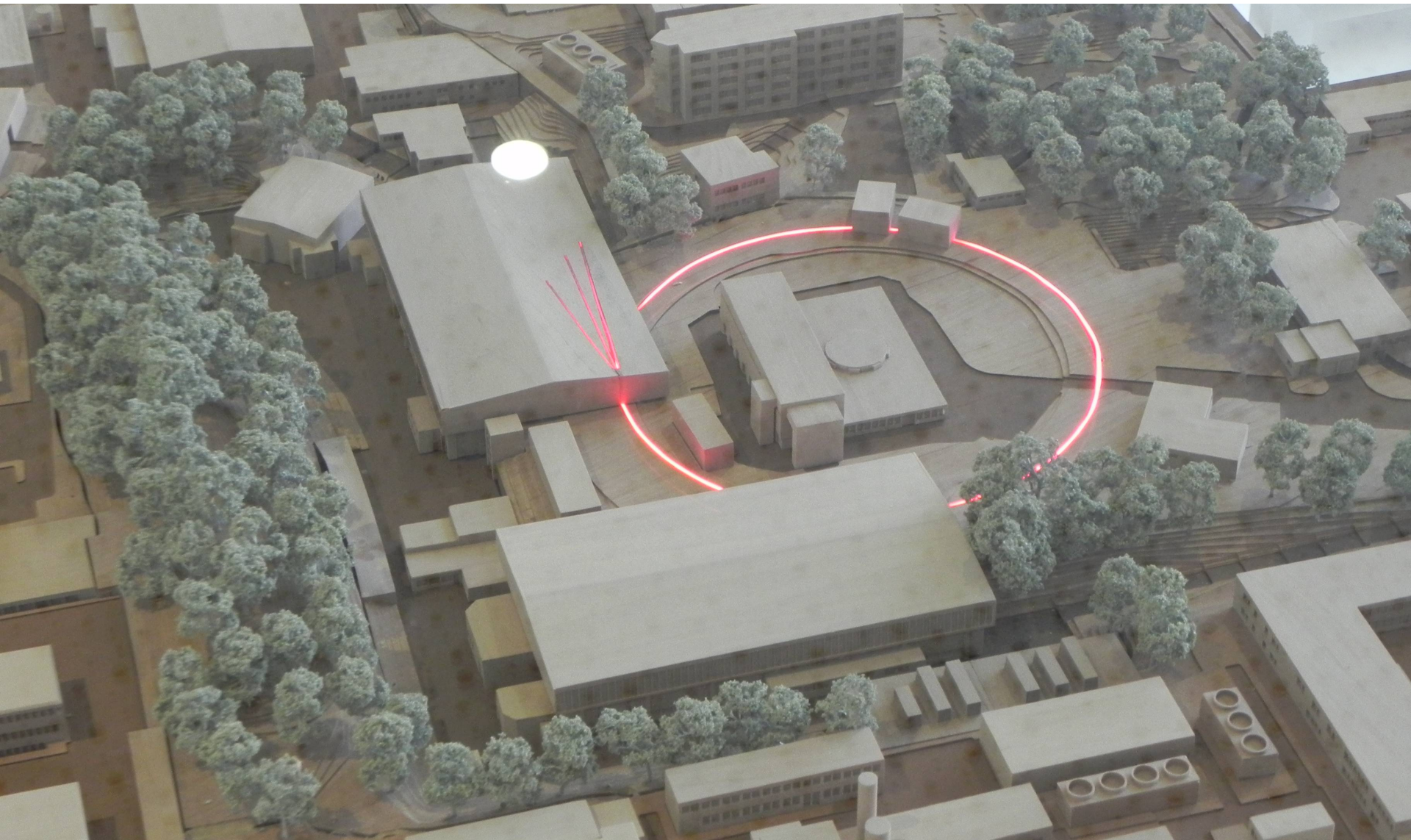


- Need real gear geometry (microscope measurements)
- Work on hits

Backup



Testbeam: DESY II



Testbeam area T24/1

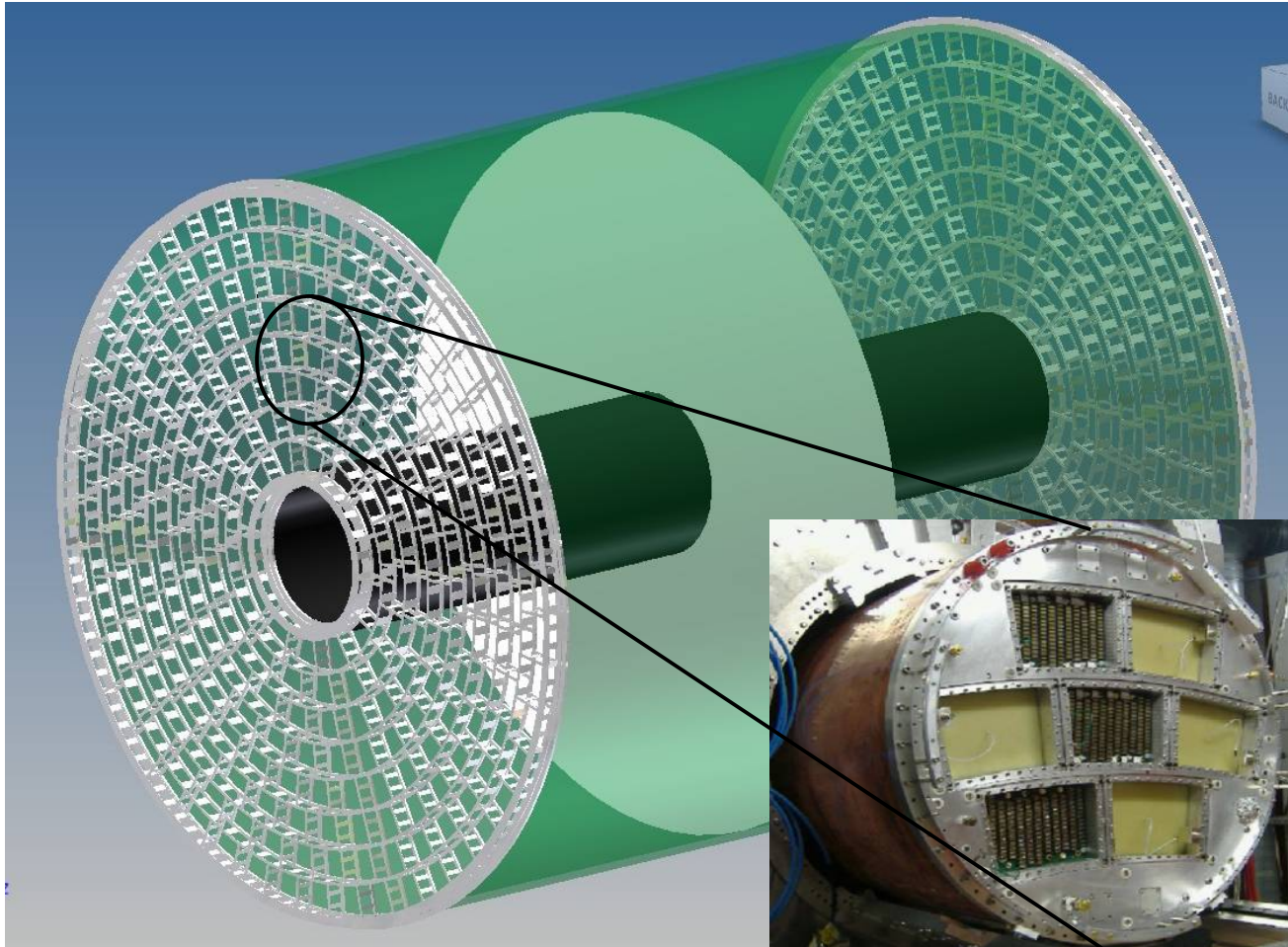
PCMAG (1T magnet) + TPC Prototype



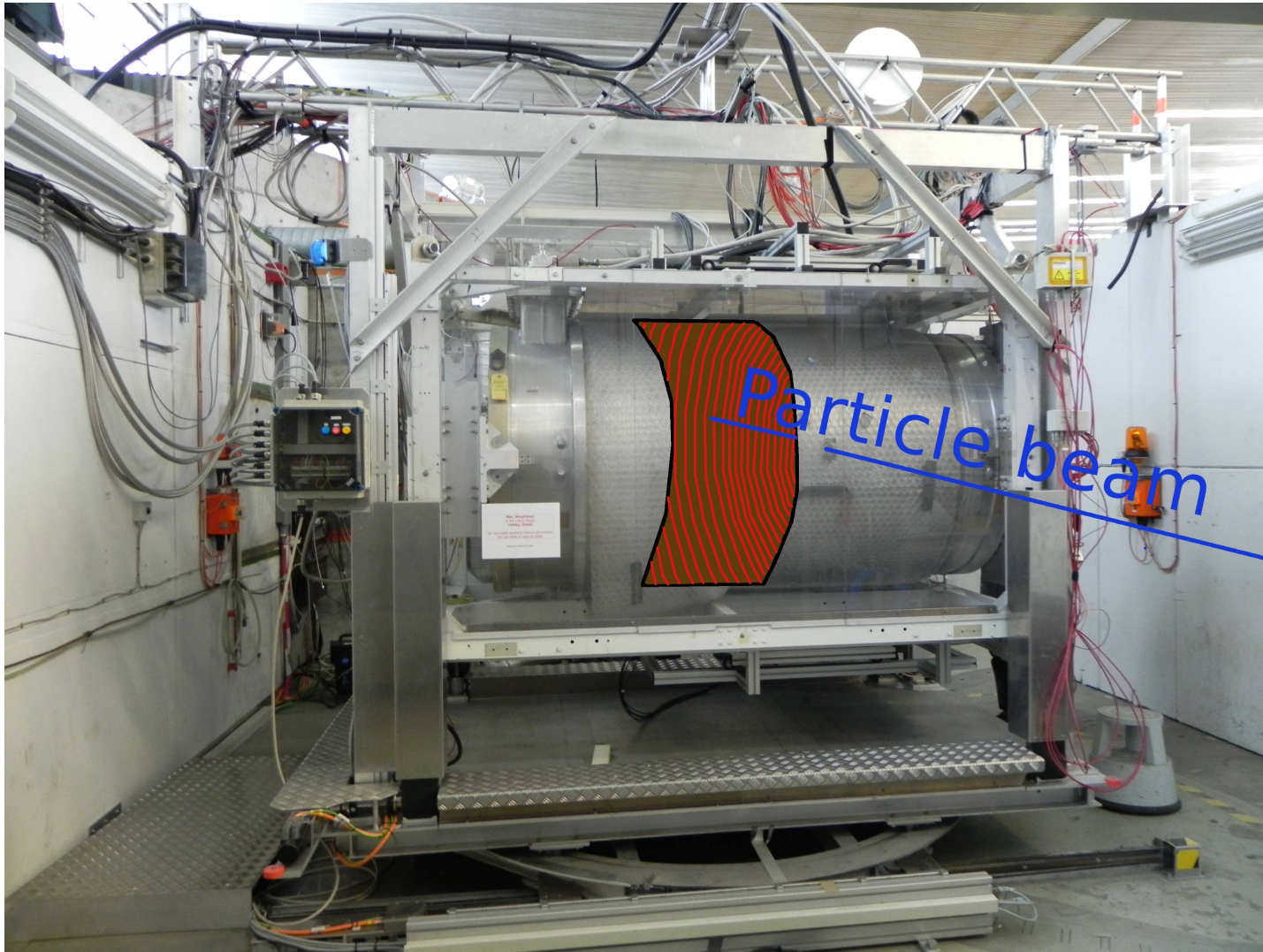
Testbeam area T24/1

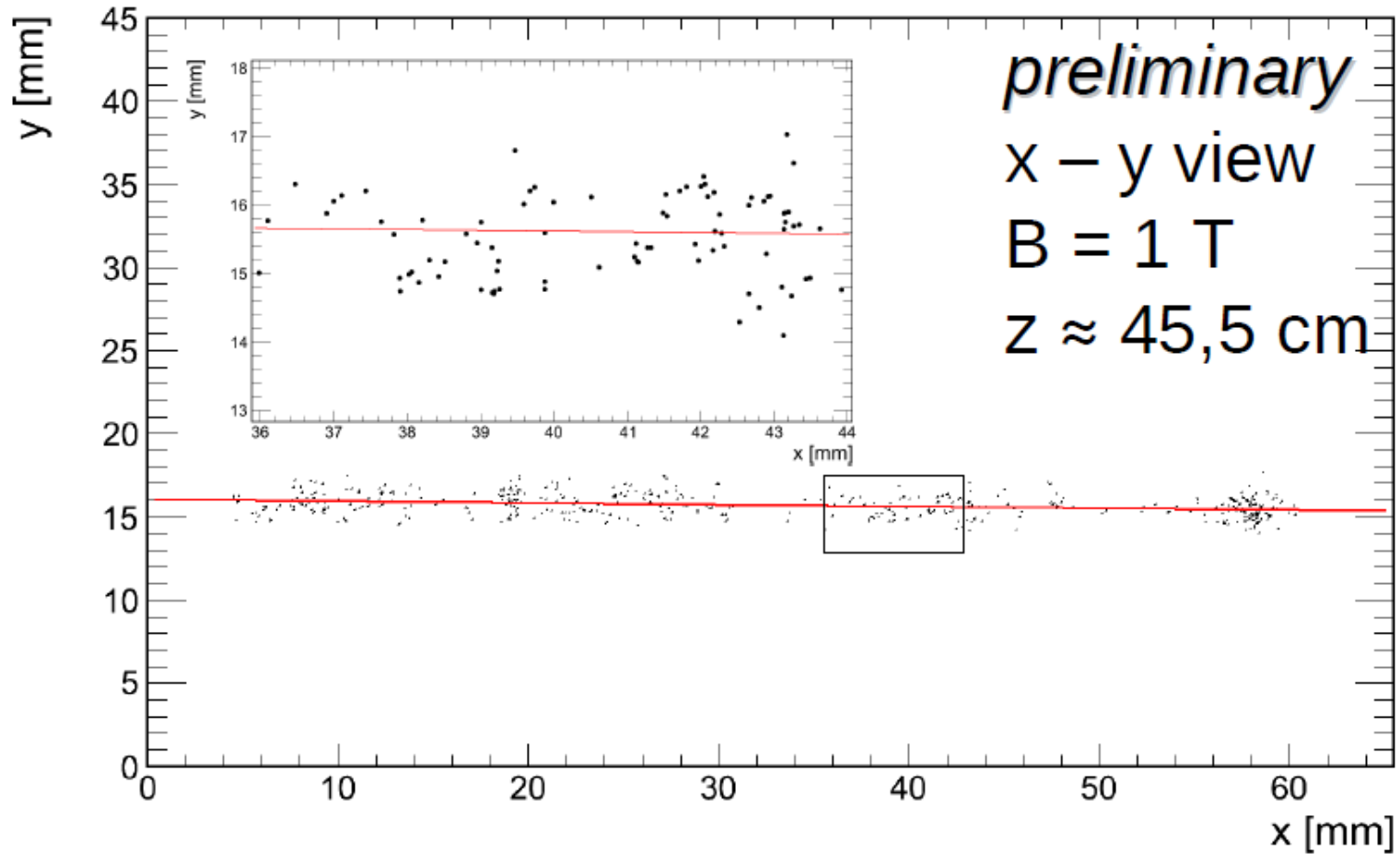


PCMAG (1T magnet) + TPC Prototype

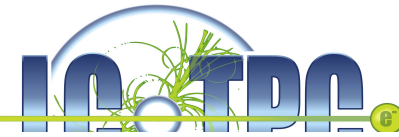


Prototype for ILD (Detector at ILC) TPC





Testbeam 2015



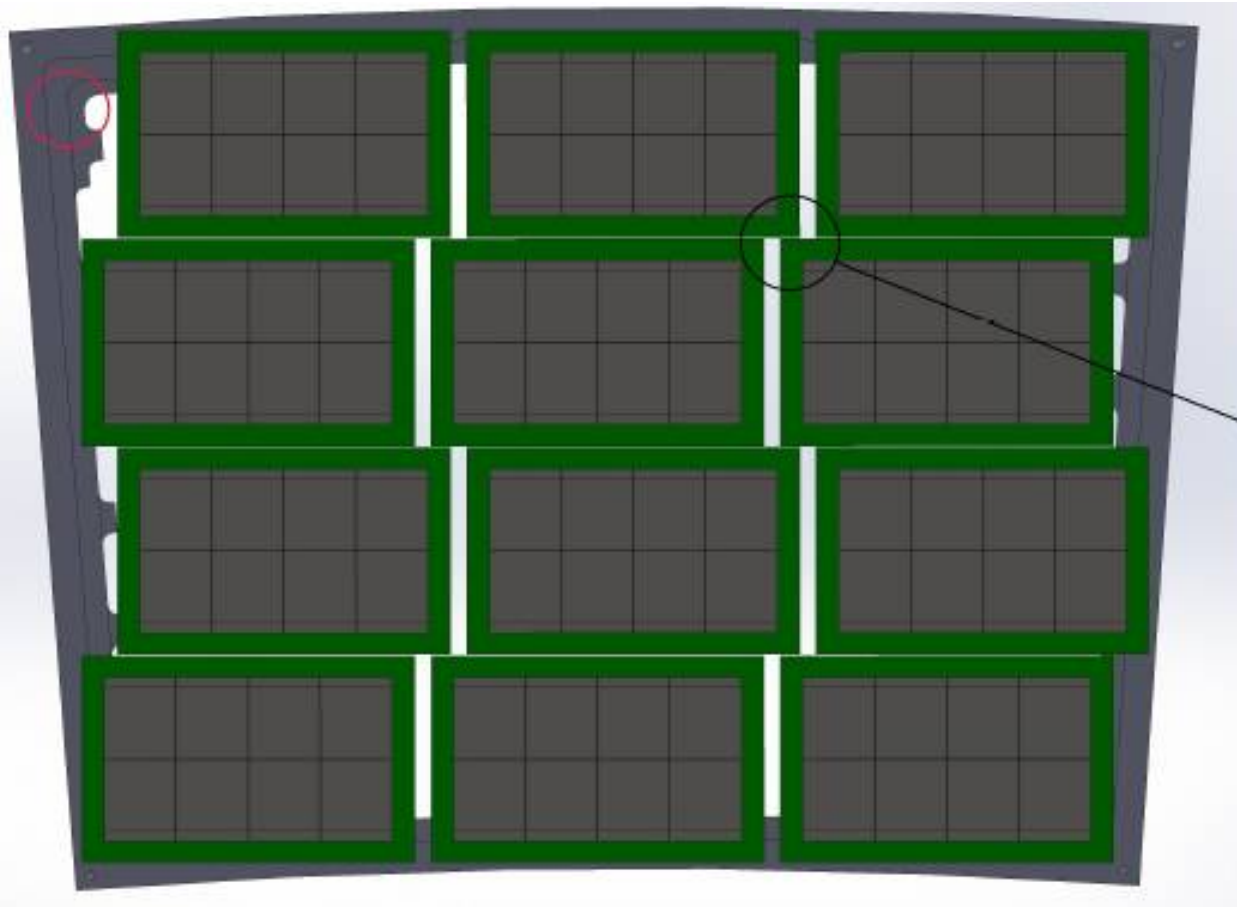
DESY Testbeam Schedule 2015 - Version 1 - 16/11/2014

Ralf Diener, Norbert Meyners, Marcel Stanitzki - DESY Test Beam Coordinators

Week		TB21		TB22		TB24/1		TB24	Announced
		DATURA	none	ACONITE/DURANTA	none	EUDET in PCMAG	PCMAG	none	
5-Jan-15	2								
12-Jan-15	3	Startup		Startup		Startup			
19-Jan-15	4	CMS-Pixel-Ph1							
26-Jan-15	5								
2-Feb-15	6								
9-Feb-15	7	ALICE-ITS		CLIC-PIX					
16-Feb-15	8								
23-Feb-15	9			CALICE-AHCAL					
2-Mar-15	10								
9-Mar-15	11			Mue3					
16-Mar-15	12			ATLAS ITK Pixel				PICSEL	
23-Mar-15	13			ATLAS ITK Pixel					
30-Mar-15	14	ALICE-ITS		ATLAS ITK Pixel					
6-Apr-15	15	CMS-Pixel-Ph1							
13-Apr-15	16								
20-Apr-15	17	CMS-Pixel-KA		ATLAS-Strip-Module		LorentzAngle			
27-Apr-15	18			ATLAS-Strip-Module		LorentzAngle			
4-May-15	19								
11-May-15	20							SiPM	
18-May-15	21	CMS-TRK-EPI						SiPM	
25-May-15	22								
1-Jun-15	23			CALICE-AHCAL		LorentzAngle			
8-Jun-15	24					LorentzAngle			
15-Jun-15	25	CMS-Pixel-Ph1						PICSEL	
22-Jun-15	26								
29-Jun-15	27								

With this week: 14 weeks left (including Christmas and new year)

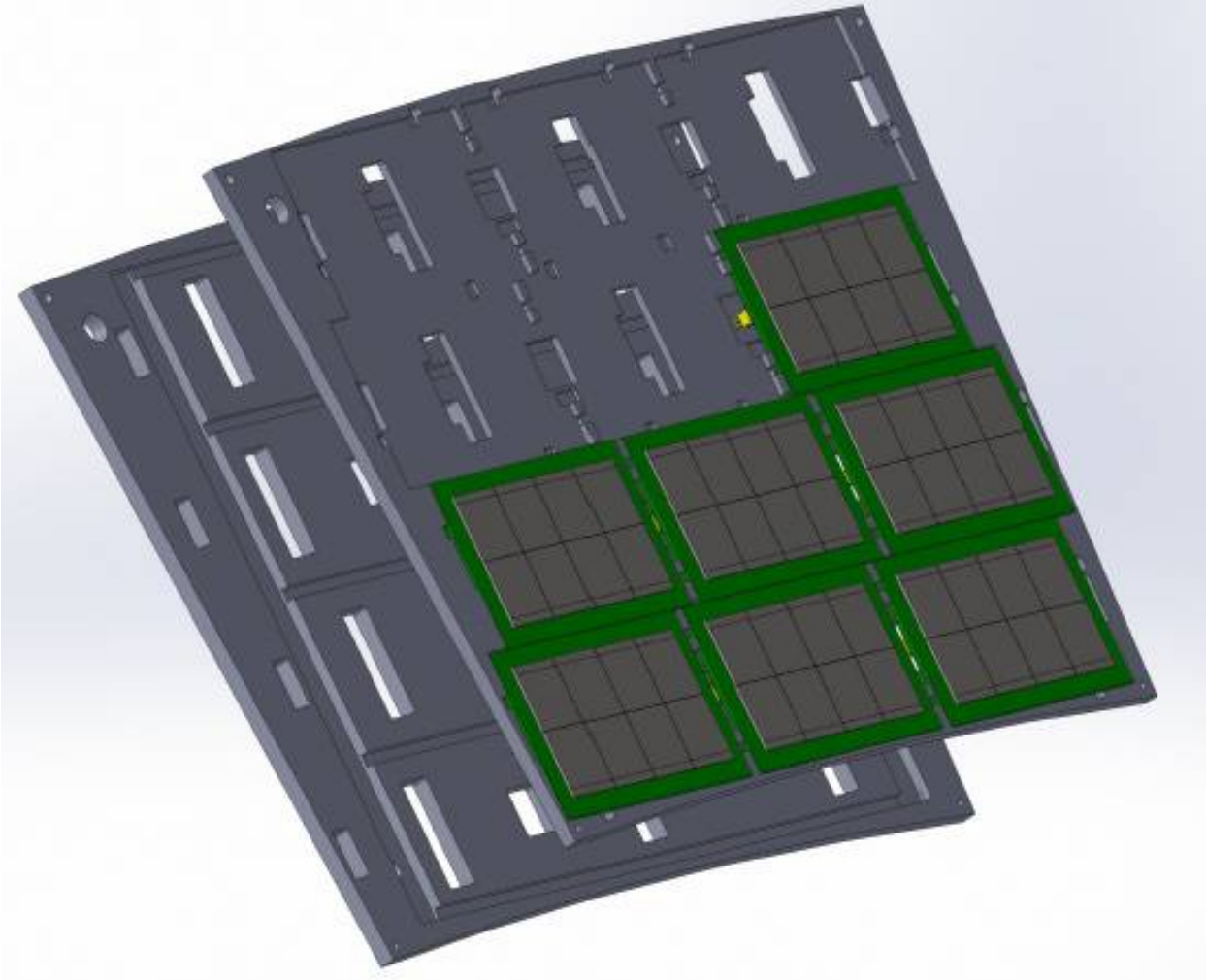
96 Chip module



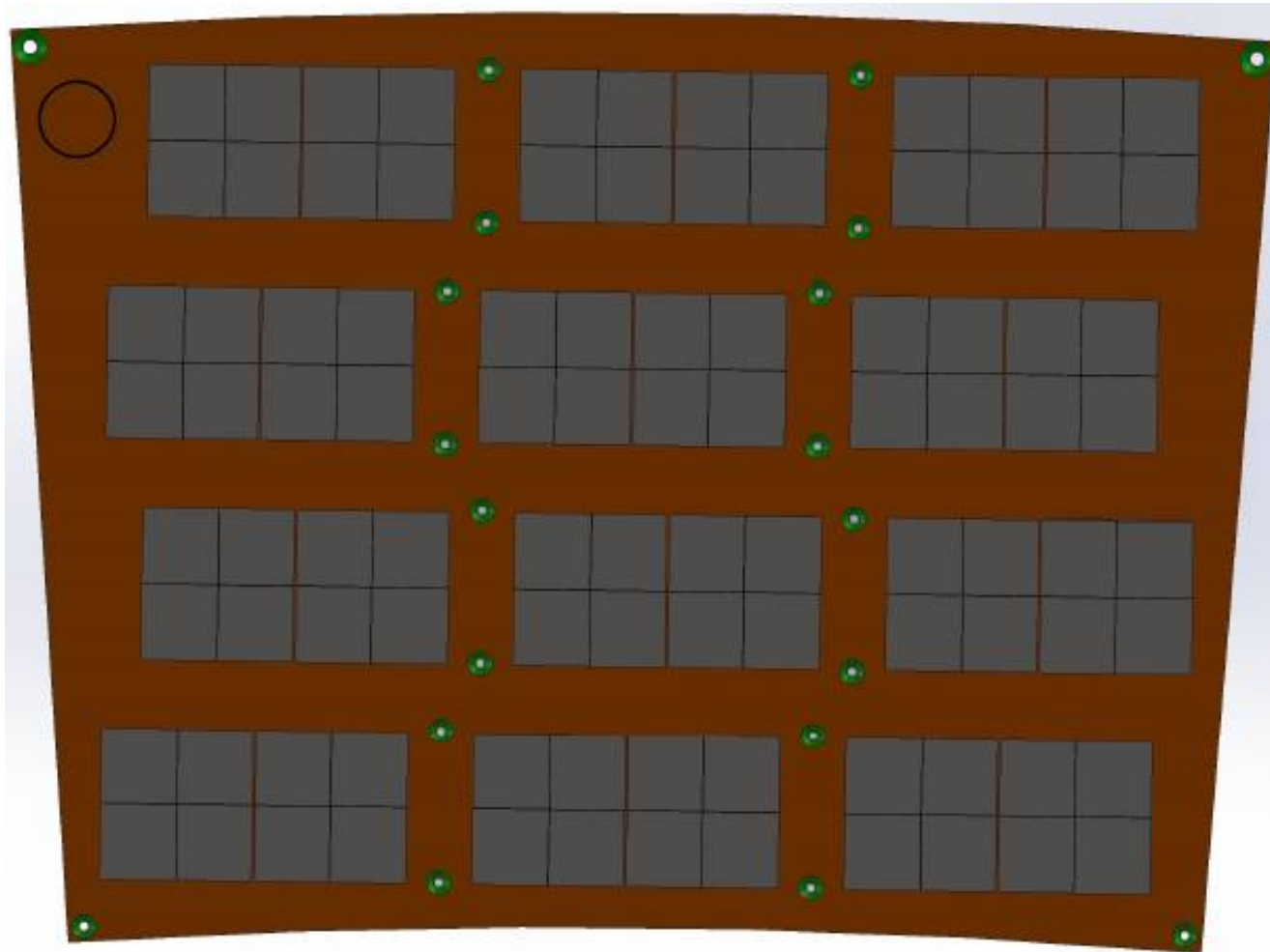
Setup



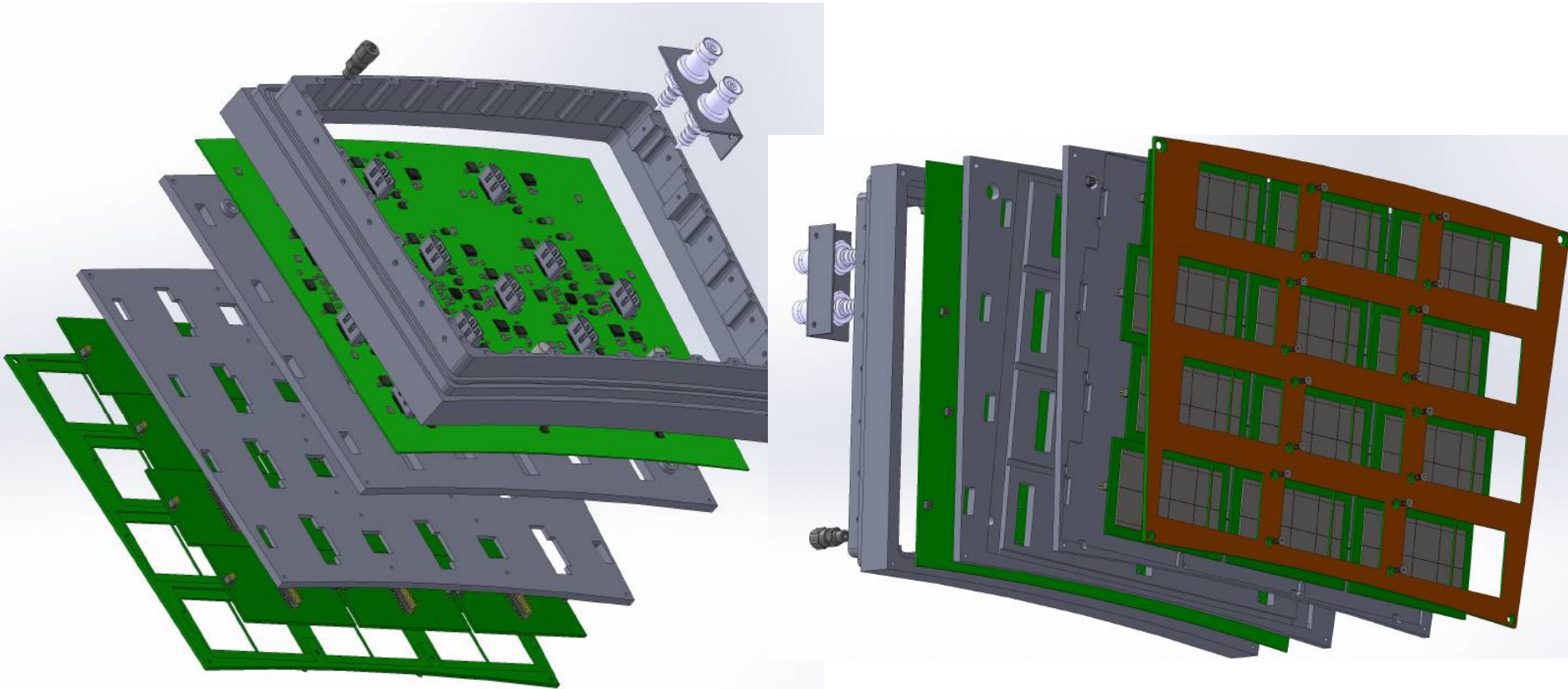
Support structure includes water cooling



Anode plate



Setup



Setup



- 1 module fully equipped with 96 InGrids
- 2 modules partly equipped with each 32 InGrids

- → 160 InGrids on 20 Octoboards

- 25 HDMI plugs
- 5 power boards

- Water cooling
- High voltage

Setup



3 modules (one with 12 octoboards, 2 with 4 octoboards)

Full track length

