

TEC+ Commissioning and Noise Analysis



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CMS Hamburg Meeting

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- TEC/Tracker Status at CERN
- TEC Commissioning
- Noise Studies
- Outlook

TEC $\pm$ – Status

- Both TECs were inserted into the tracker support tube

on 28.2 (+)



and 21.3 (–)



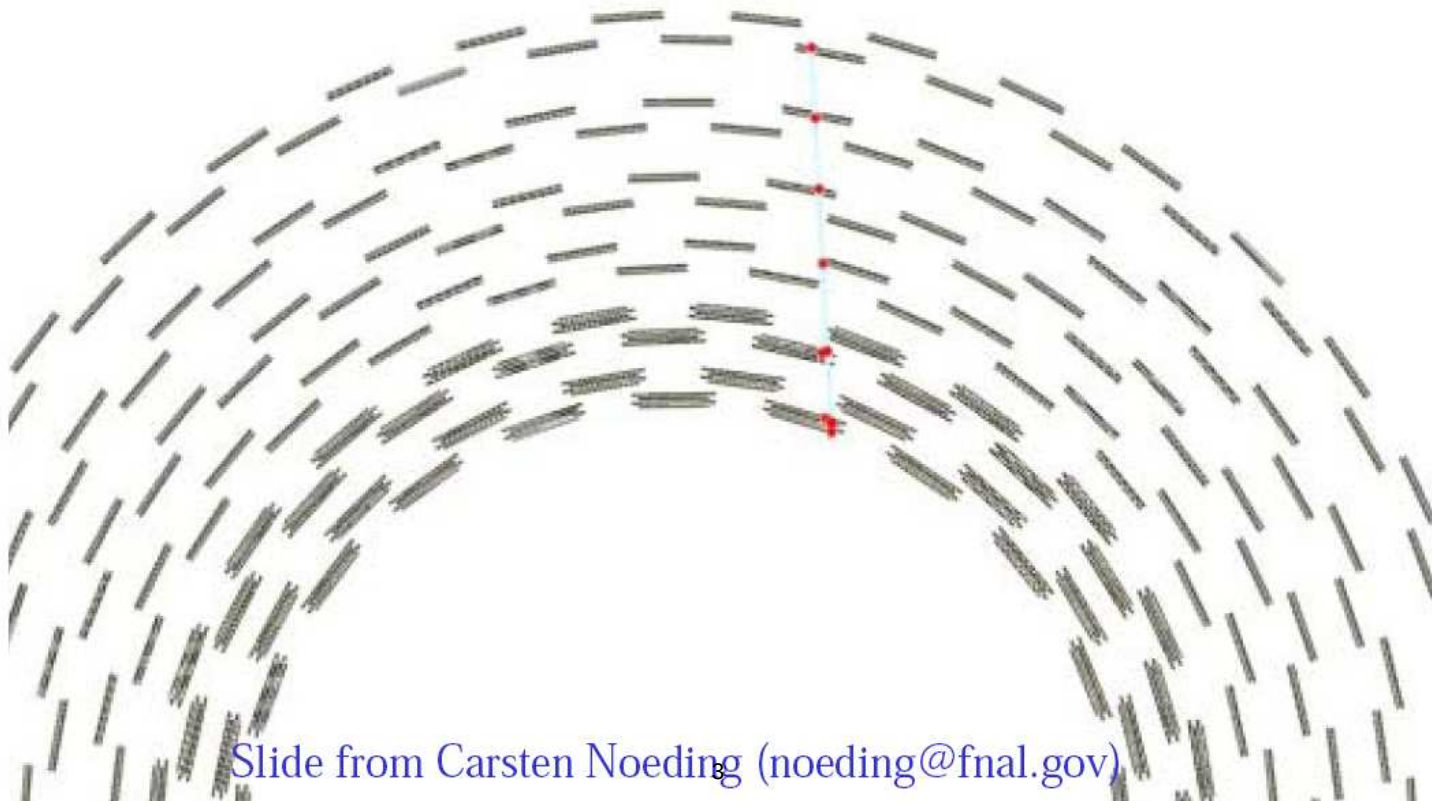
respectively

→ Tracker structure is completed

Tracker Status – Slice Test

Slice Test: Test 'slice' of the CMS Tracker is tested first 'warm' and then cold also taking cosmic data

- Size: 93 rods (720 modules, 28% of TOB+) from TOB, 640 modules from TIB/TID+ (36% of TIB/TID+) and 2 Sectors (800 Modules) from TEC+ (25%) (→14% of the whole tracker)



Commissioning

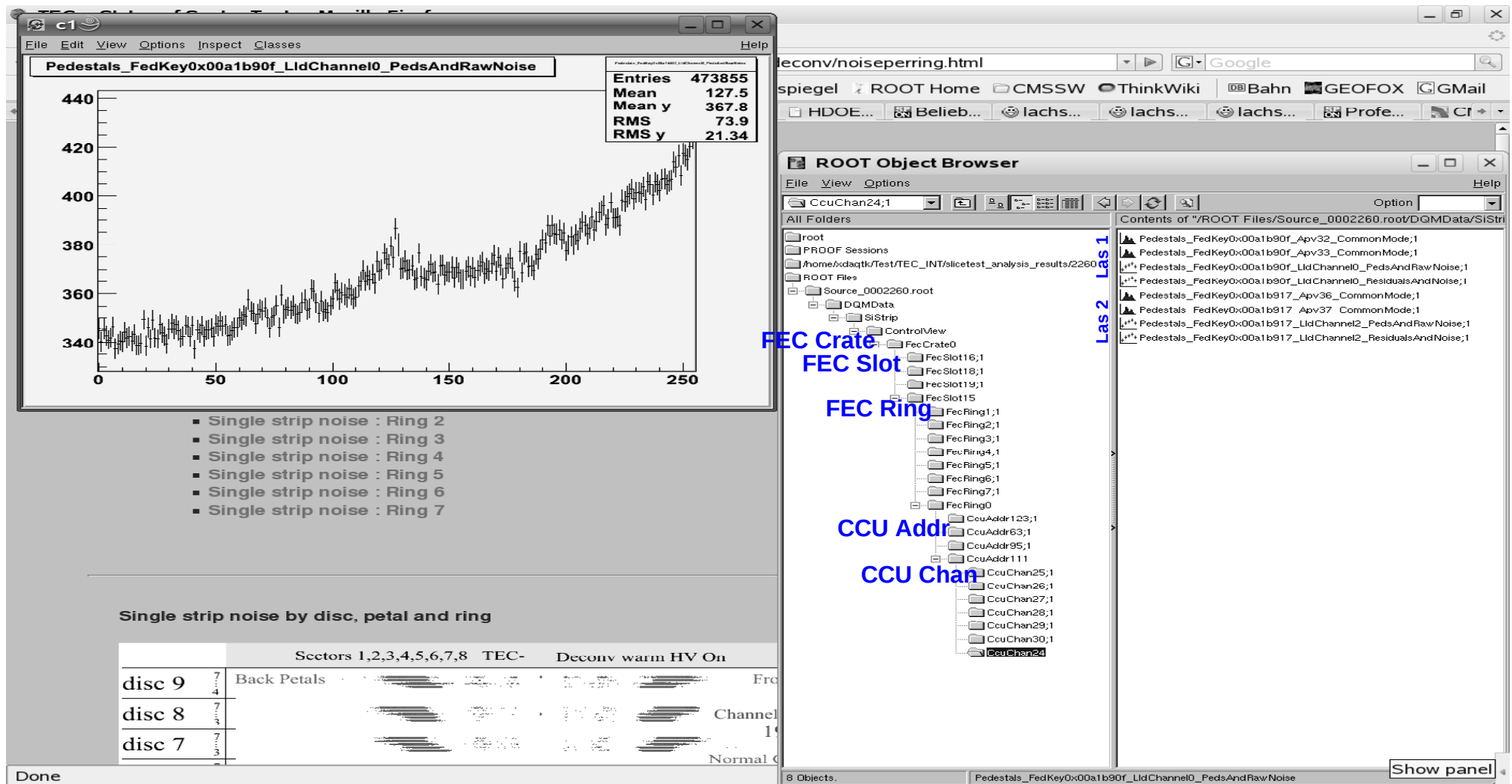
- TEC+ successfully commissioned after insertion.
- Gain Scan (7080), Timing (7096) and Pedestal (7102) (deconv HV on) taken afterwards to look at in detail

Used Tools

- Two-fold analysis structure:
 1. simple root scripts for quick glances
 - based on analysis which was used already for TOB
 2. Marcs Analysis which so far was used for TEC— Tests and is now ported to use 'Source'-Files

Used Tools II

- Using 'Source'-Files from R.Bainbridge (Produced using 2 modules from CMSSW_1_2_3)
- Contains information about all lasers in
FEC Slot → FEC Ring → CCU Addr. → CCU chan → Laser directory structure



Commissioning after Insertion

Features known before insertion:

- Sector 3 - Back Petal Disc 4 - Pos.2.1-Laser 1 → dead APV
- Sector 3 - Back Petal Disc 5 - Pos.7.3-APV2+APV3 → 2 bad APVs
- Both reproduced

List of features after insertion:

- From Opto-Analysis:

Low gain:

- S2-FP1-Pos.6.2-L2:
TickHeight = 162.1 (Gain 3) (next slide)
- S3-BP1-Pos.5.3-L1:
TickHeight = 393.4 (Gain 3)

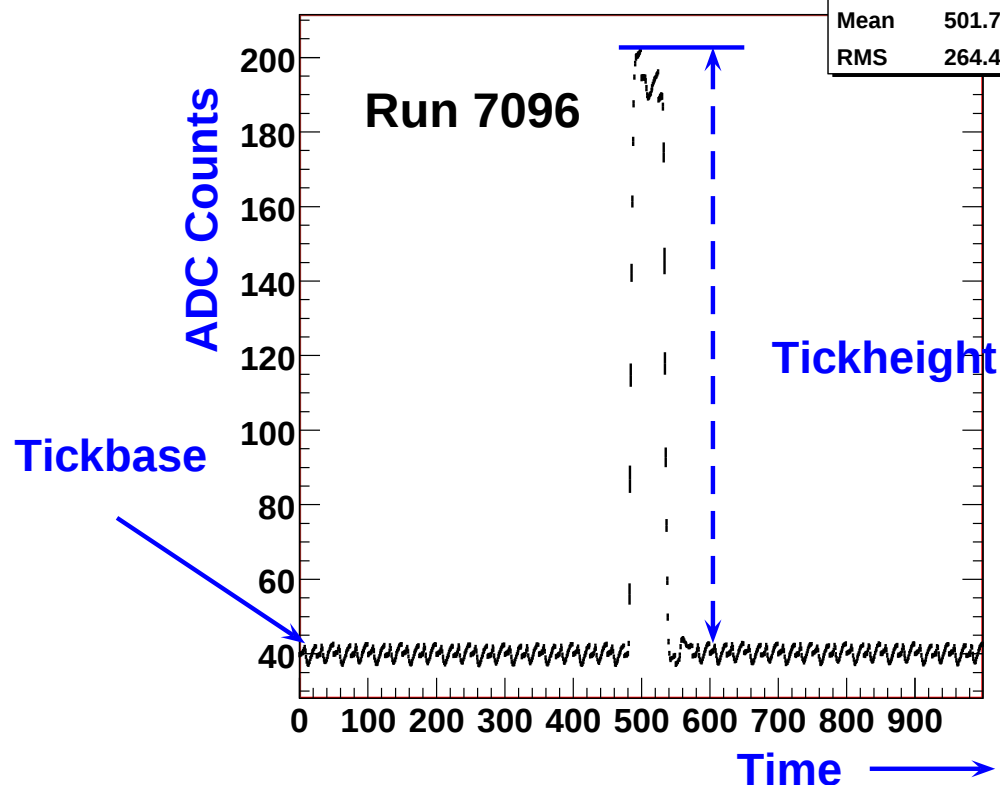
- From Noise-Analysis: Low Noise

- S2-BP6-Pos.5.4-L2

Commissioning after Inclusion into Slice Test

Sector 2-Front Petal 1-Pos.6.2-L2: Optical Fiber Cleaned

Sector 2 FP 1, Position 6.2/2

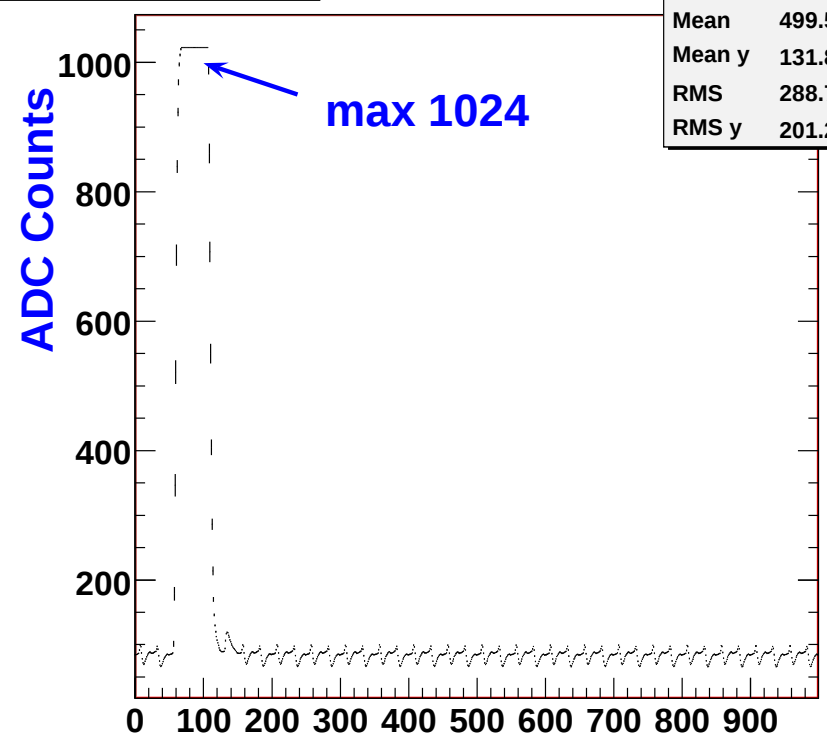


Before (Run 7096 gain 3)

tickheight ≈ 160

should be > 500

S2 FP1 6.2/2

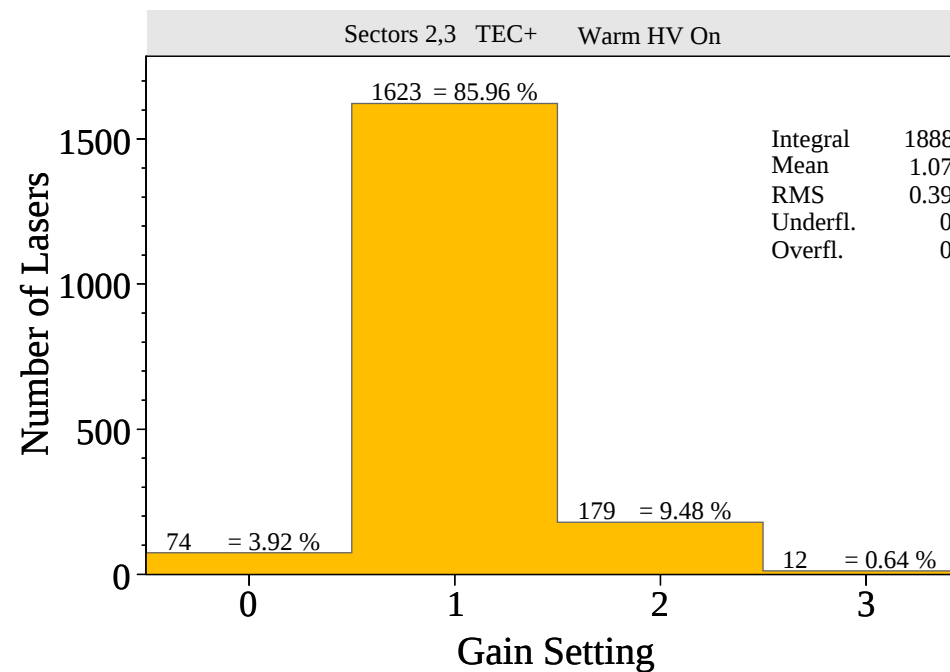
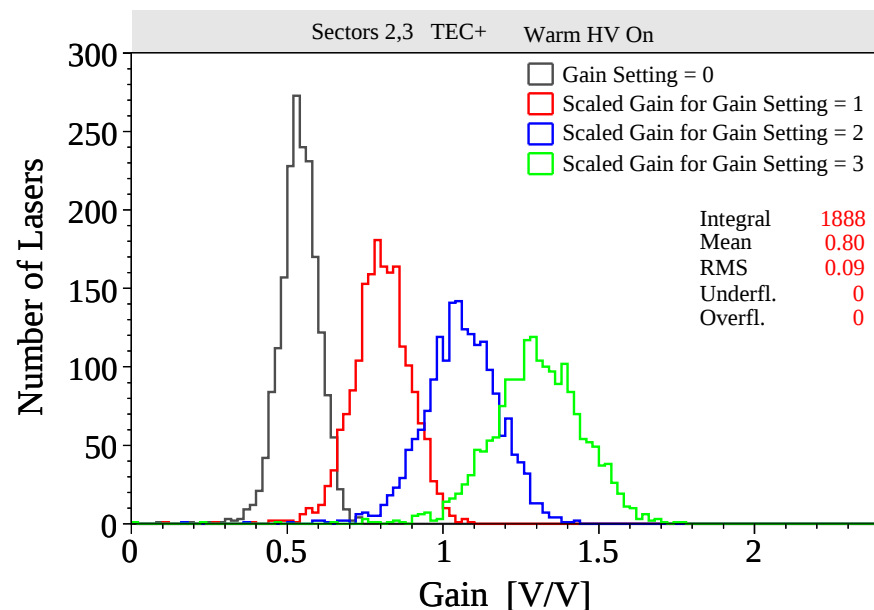


After (Run 7222 still gain 3)

Saturated $\rightarrow$ no new gain scan
was performed

$\rightarrow$ Problem solved

Gain Scan

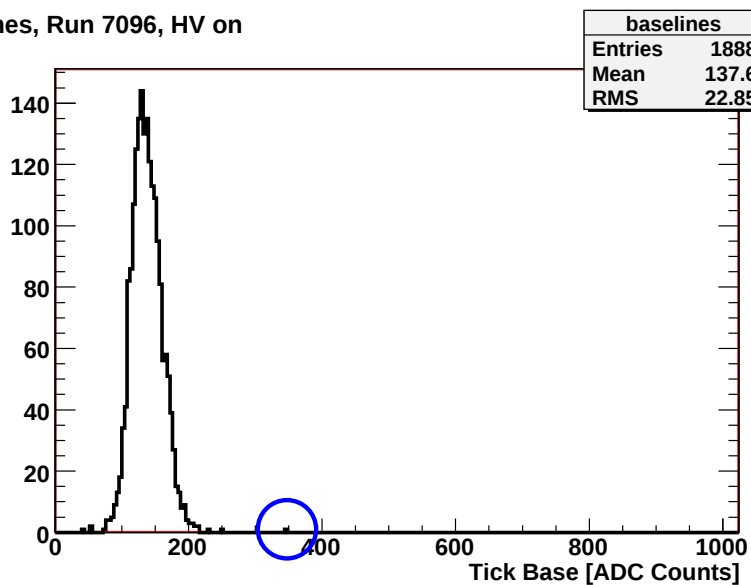


- Run 7080
- Few lasers in gain 3
- → all but 3 have tick above 500 (details in 2 slides)

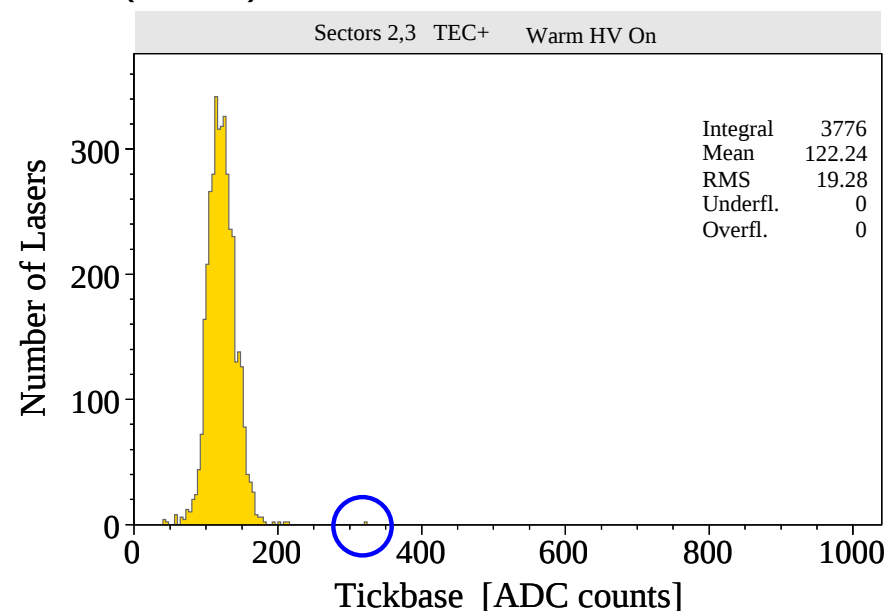
Timing – Baselines

Baseline is calculated from 100 Bins which do not contain the peak (mostly first 100)
Erik (Lasers)

Baselines, Run 7096, HV on

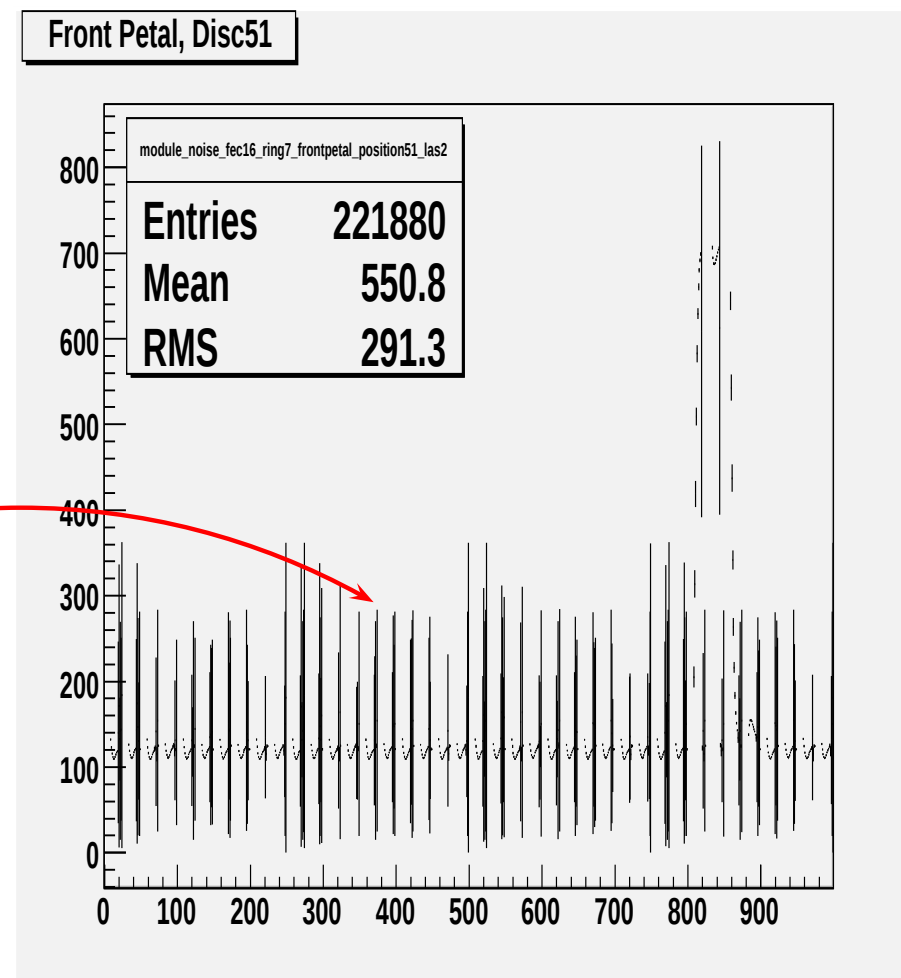
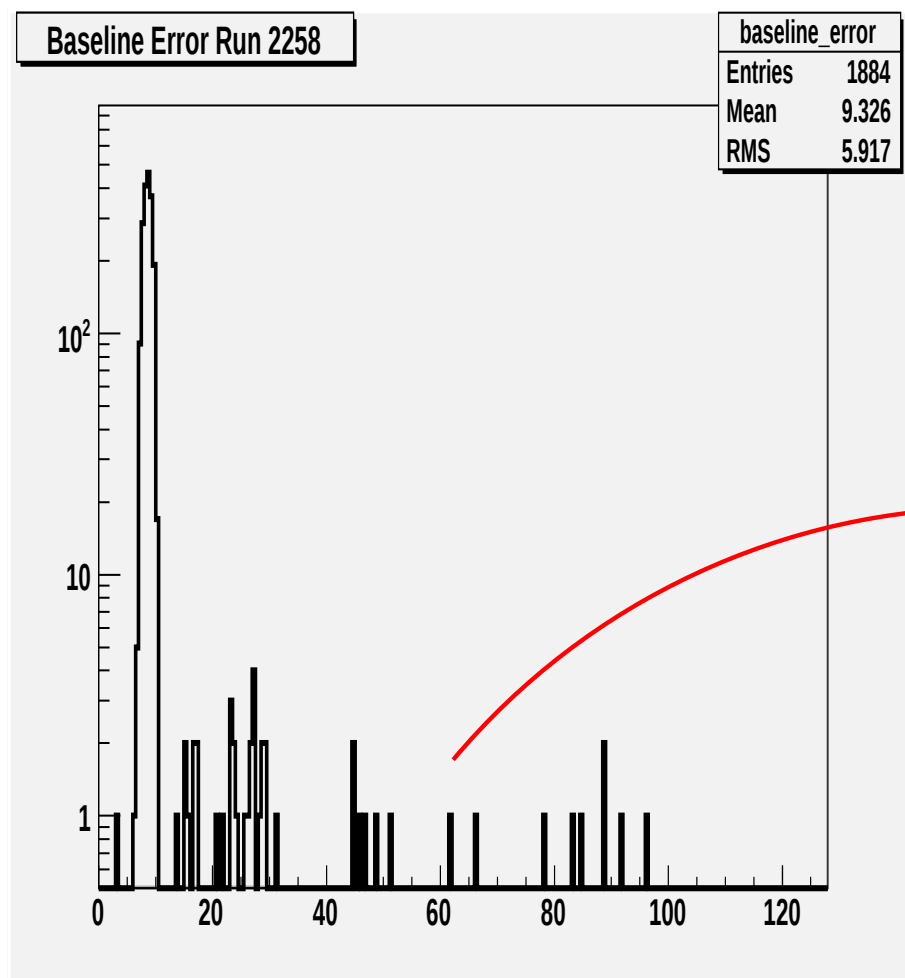


Marc (APVs)



- One Laser with high baseline → under investigation
- Otherwise fine → example for bad run

Timing Runs – Baseline Problems

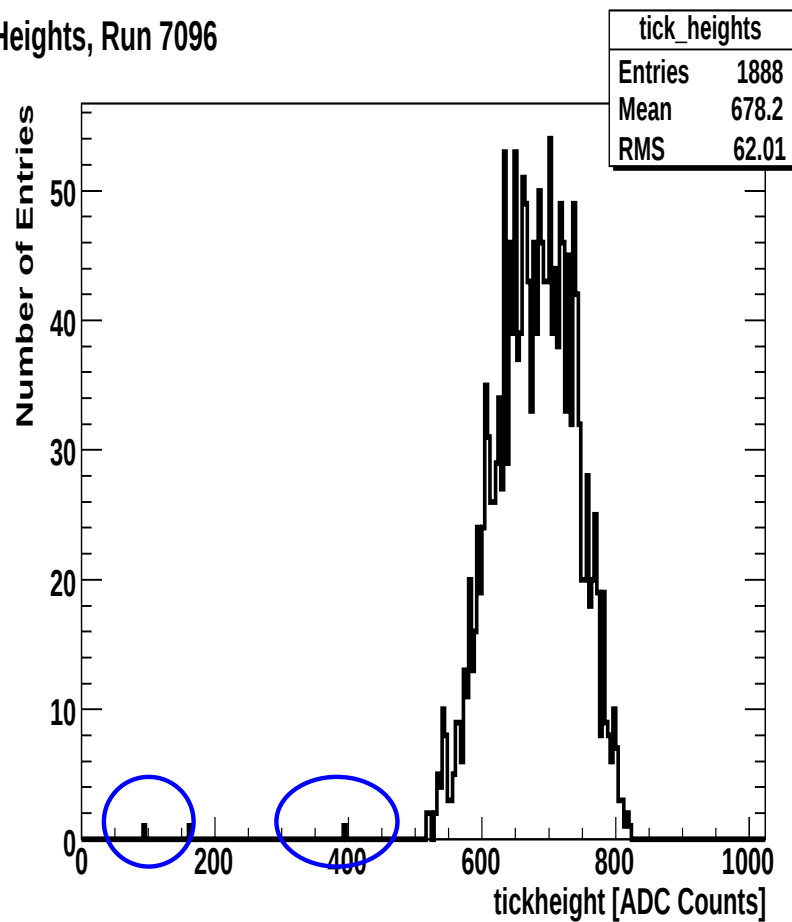


Can be localized directly after the run

Timing – Tick Height

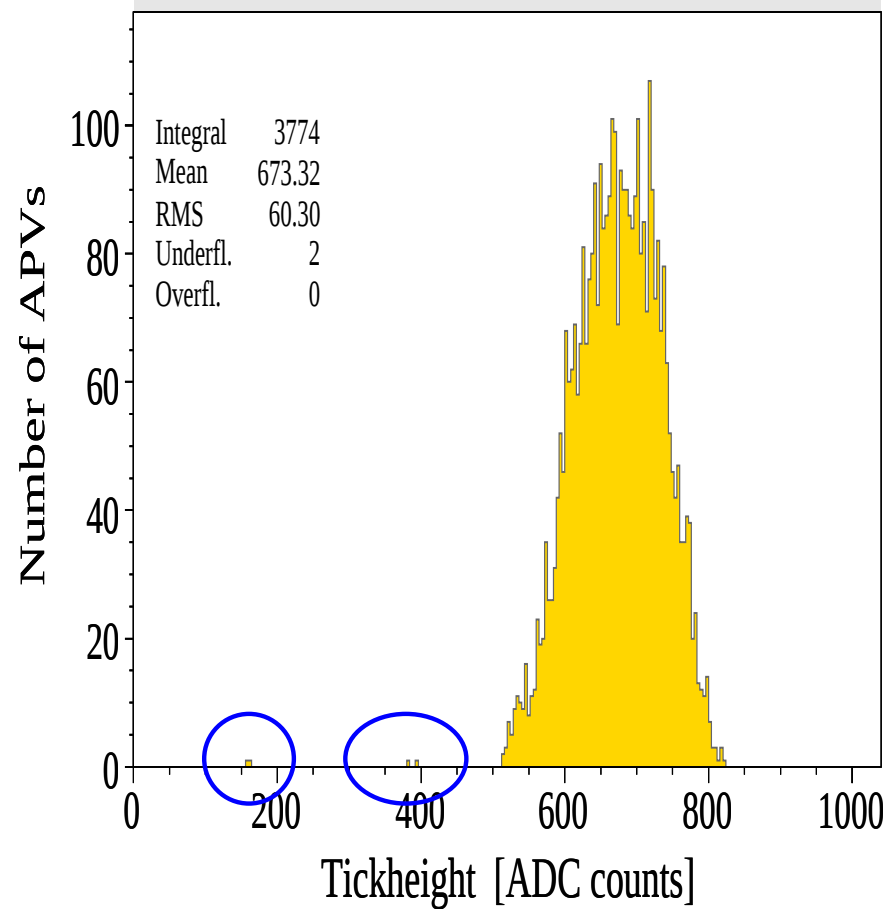
Erik (Lasers)

Tick Heights, Run 7096



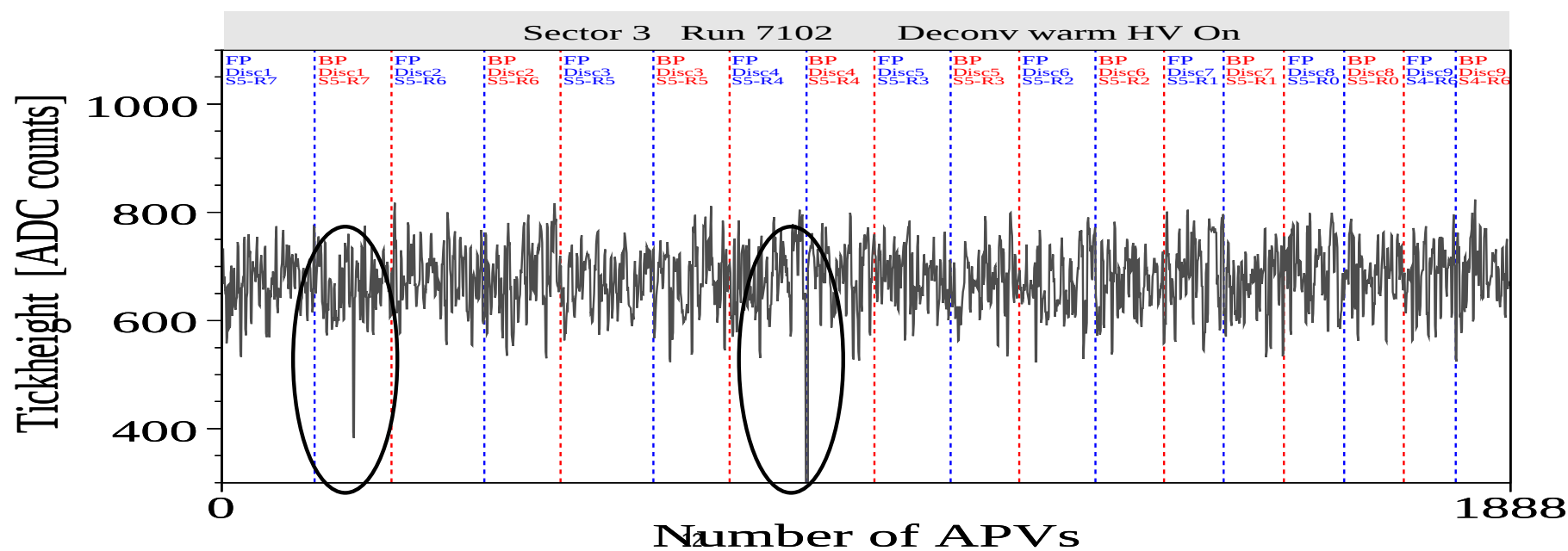
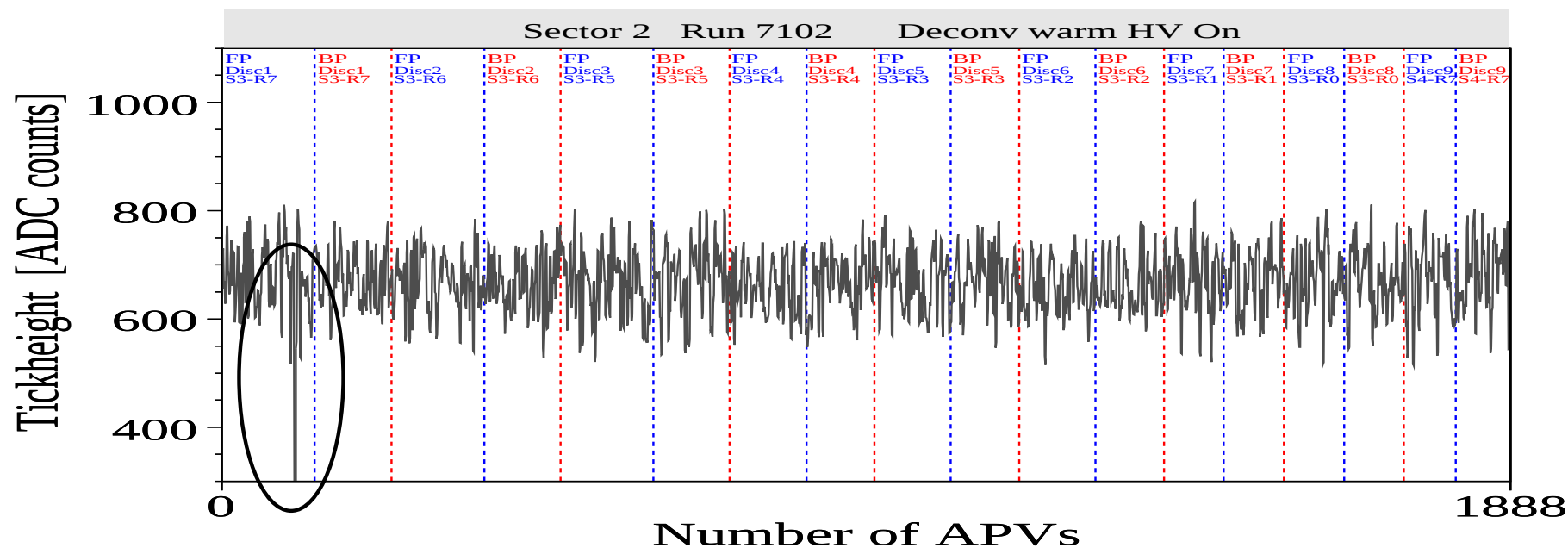
Marc (APVs)

Sectors 2,3 TEC+ Warm HV On



Run 7102 – TIB/TOB off

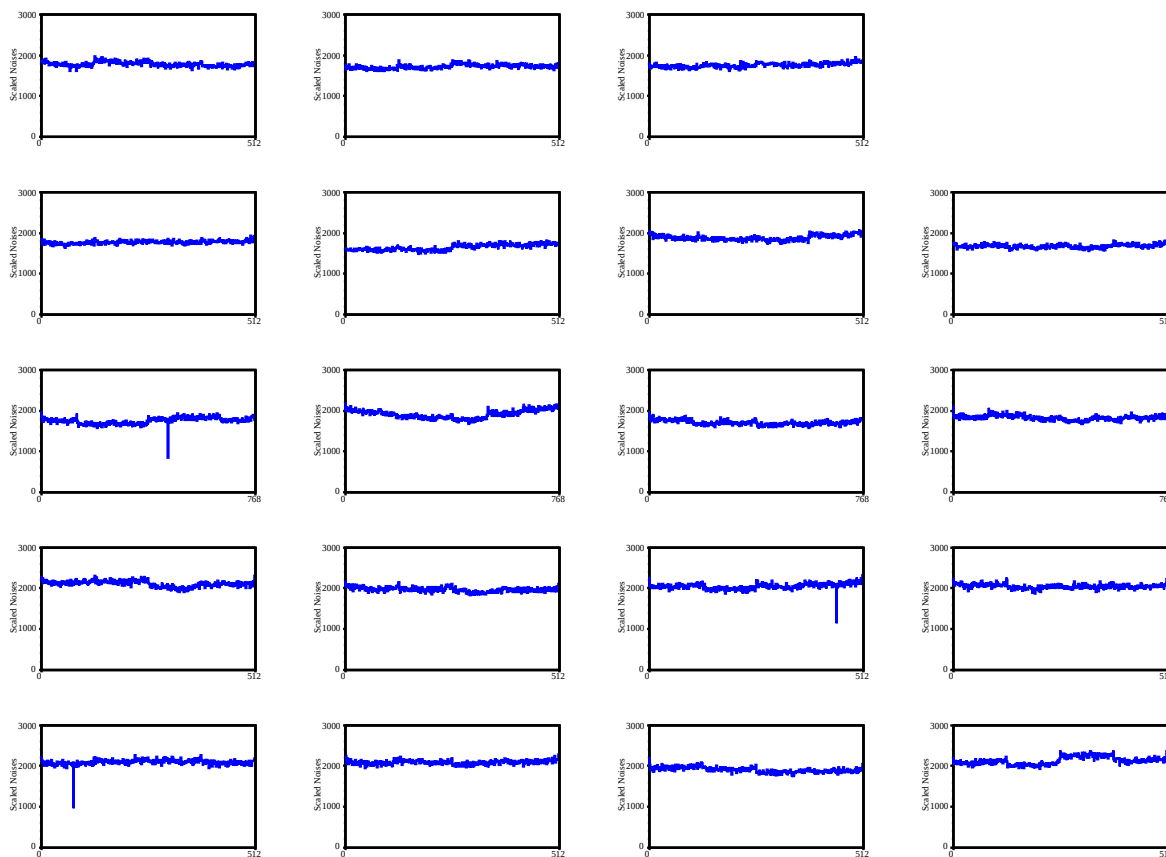
Timing – Tick Height per Sector



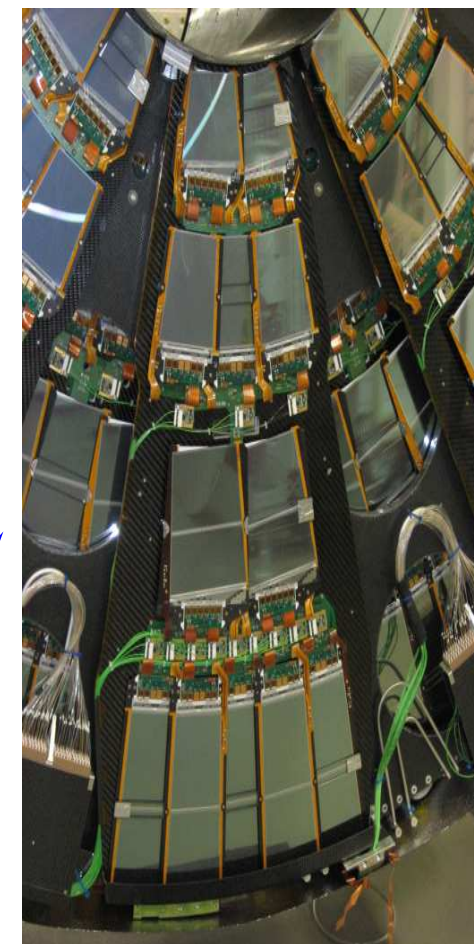
Noise per Petal – Sector 2/ Front Petal Disc 8

Sector 2 - Run 7102
Deconv warm HV On
Front Petal Disc 8

Ring
↓



Ring
↓

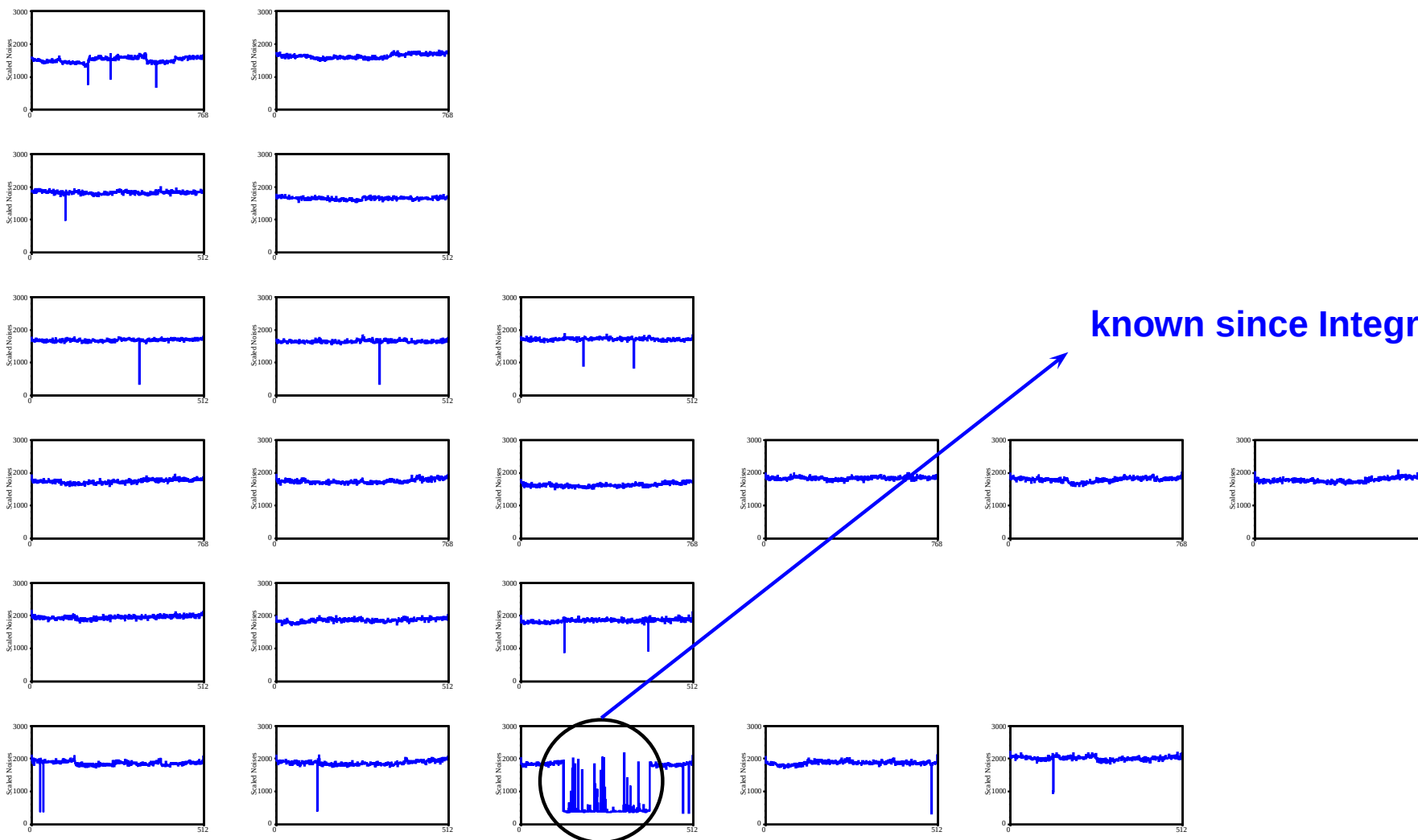


Noise per Petal – Sector 3/ Back Petal Disc 5

Sector 3 - Run 7102
Deconv warm HV On
Back Petal Disc 5

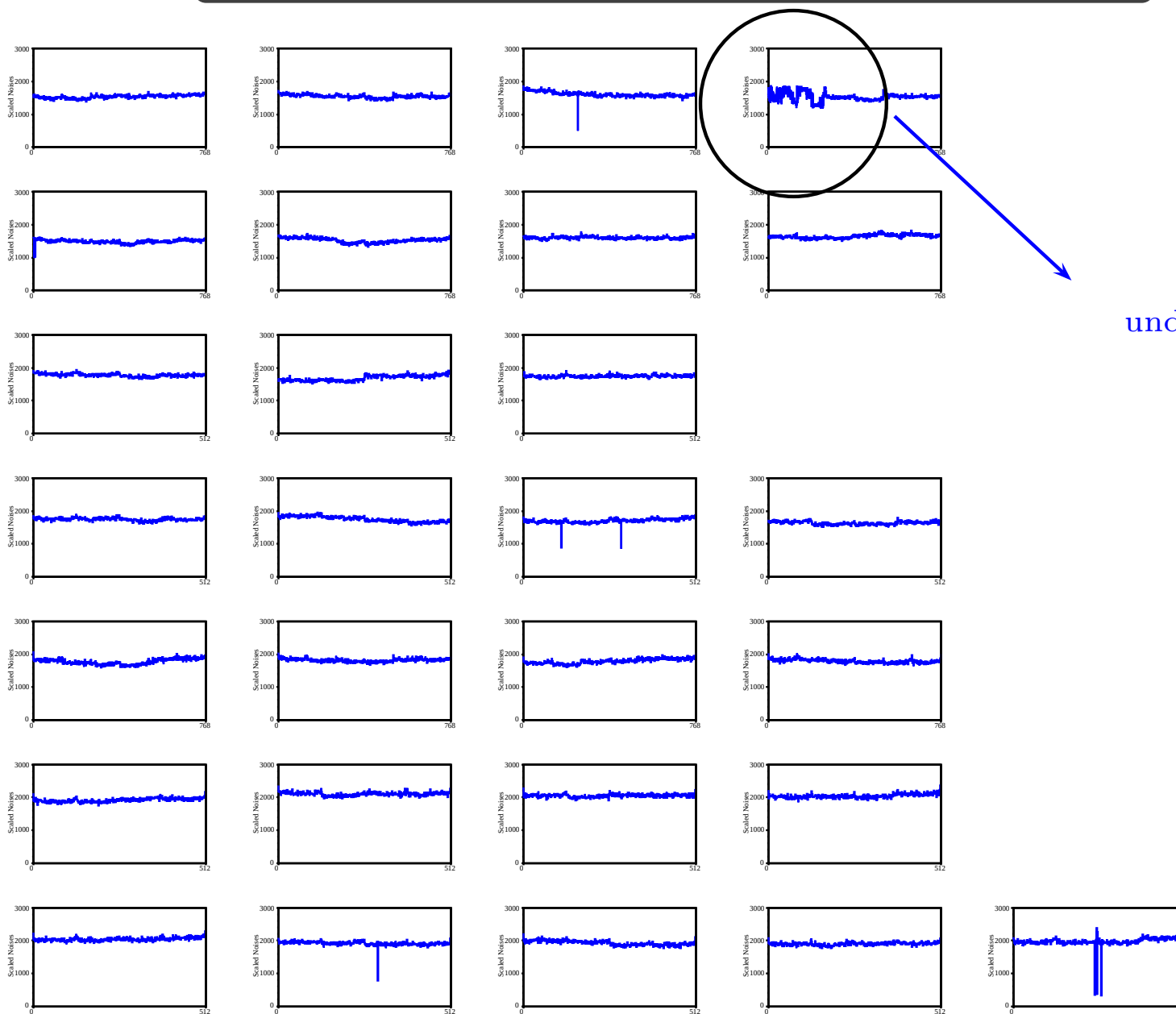
CMS Noise

Ring



Noise per Petal – Sector 2/ Front Petal Disc 3

Ring
↓



Sector 2 - Run 7102
Deconv warm HV On
Front Petal Disc 3

CMS Noise

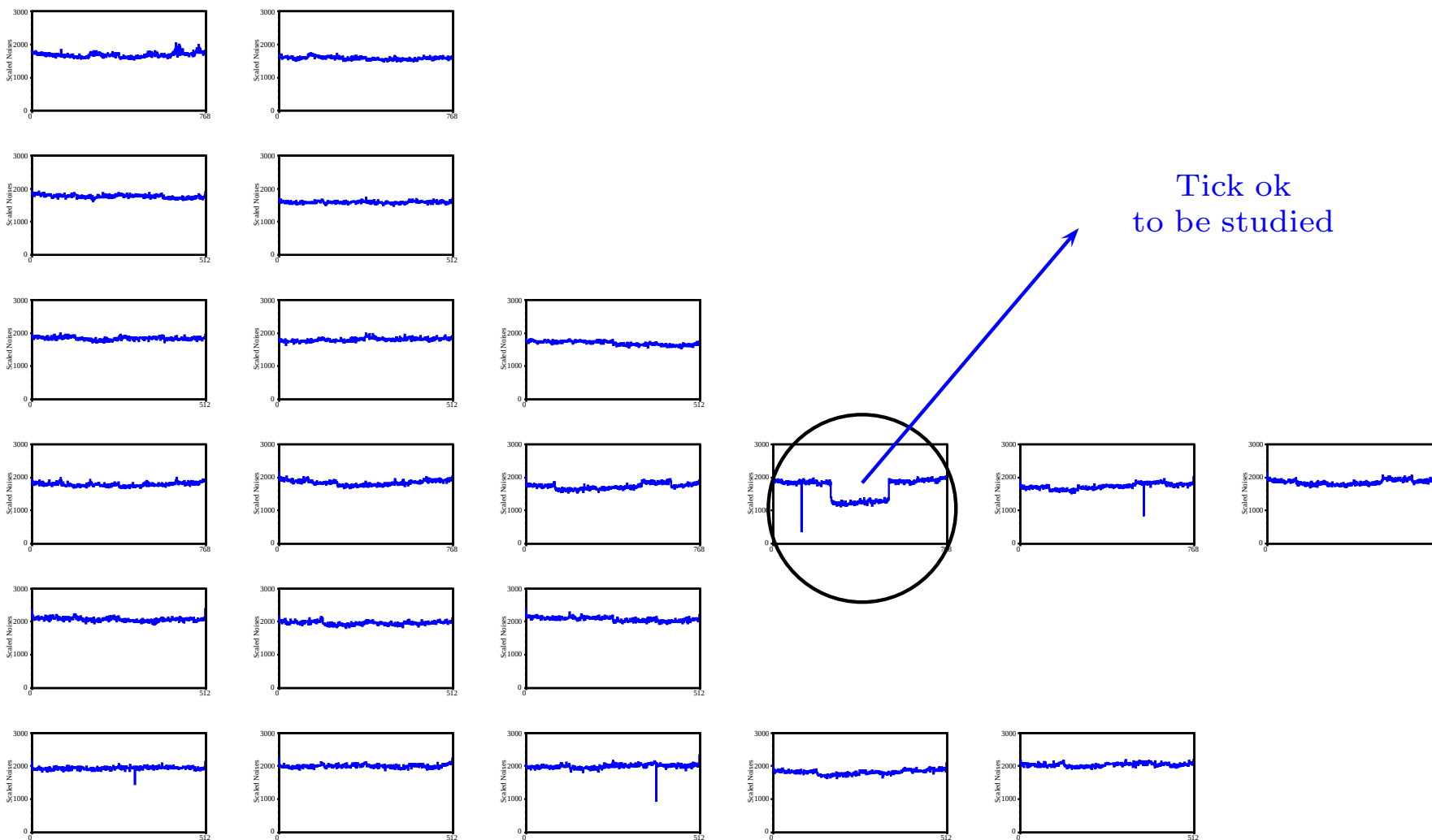
Tick ok
under investigation

Noise per Petal – Sector 2/ BP Disc 6

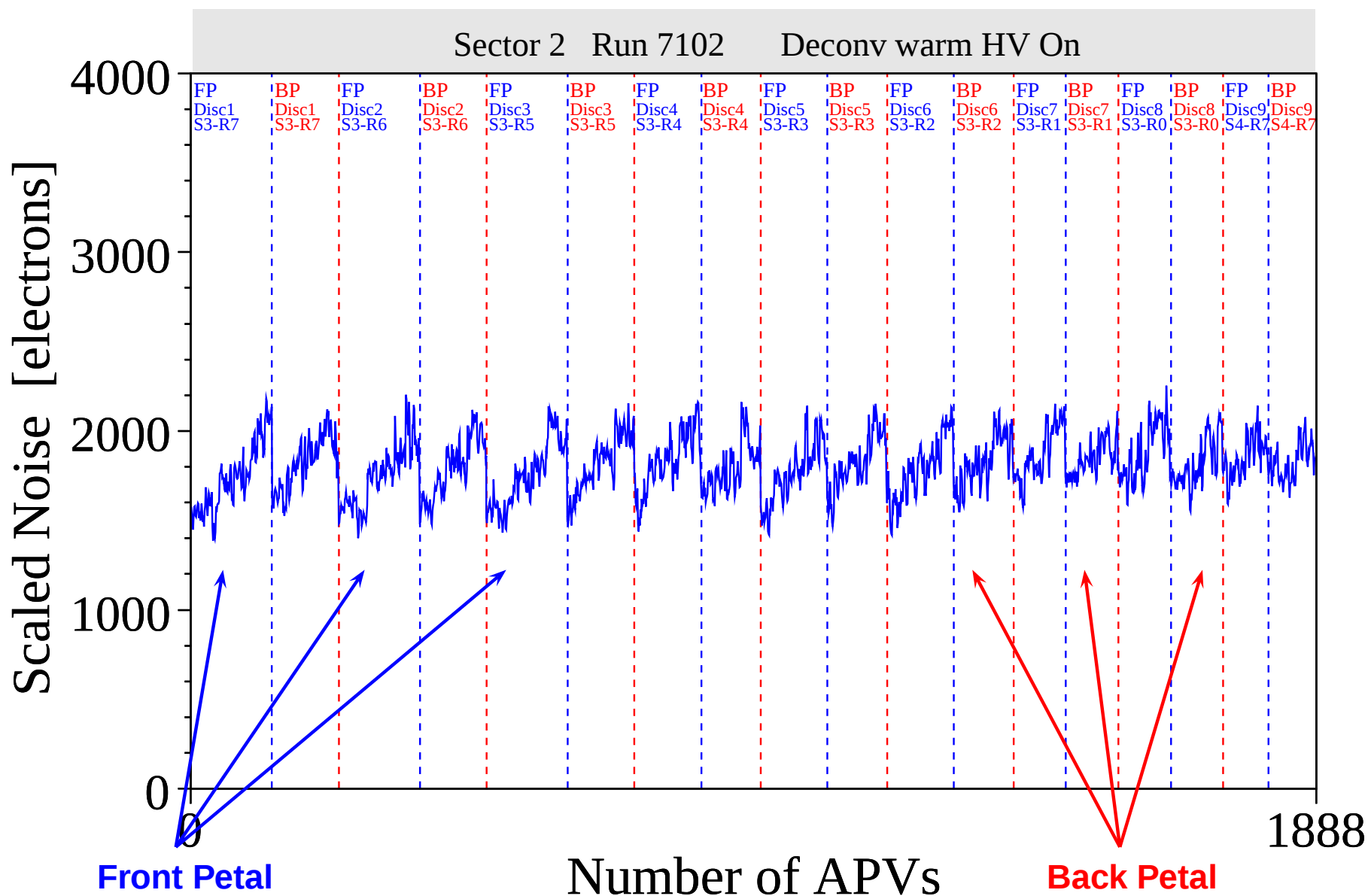
Sector 2 - Run 7102
Deconv warm HV On
Back Petal Disc 6

CMS Noise

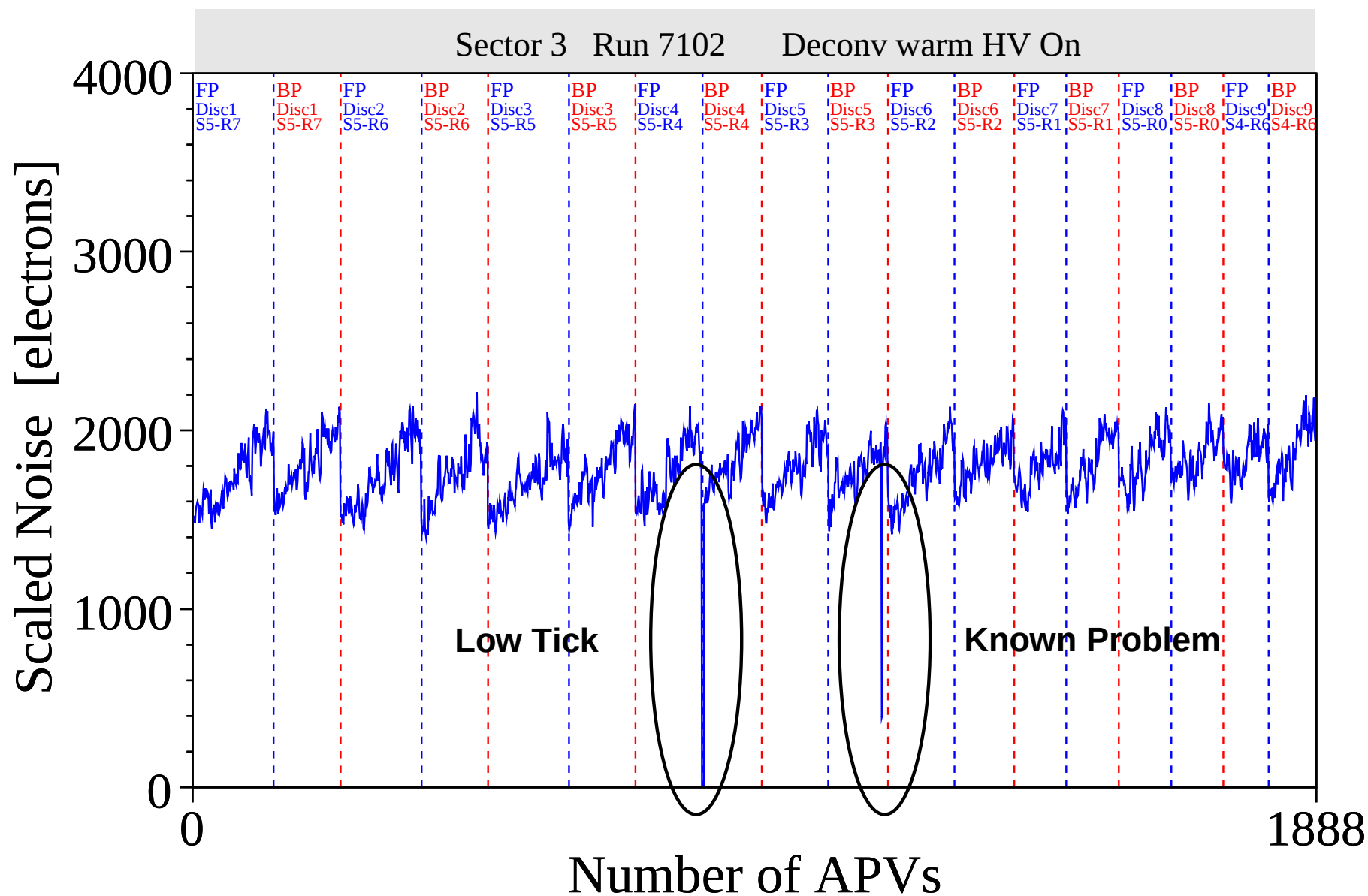
Ring

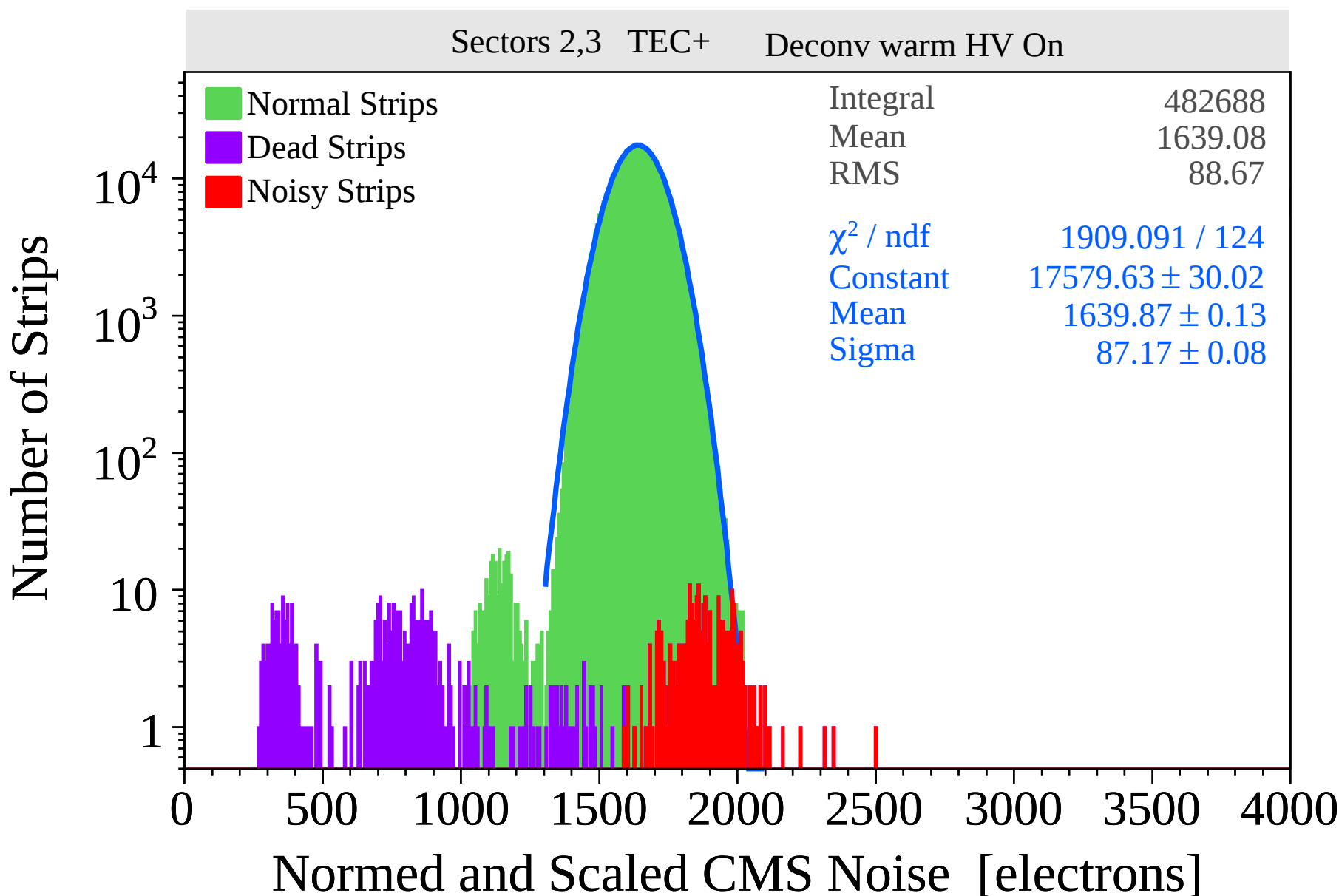


Noise Behaviour – Sector 2



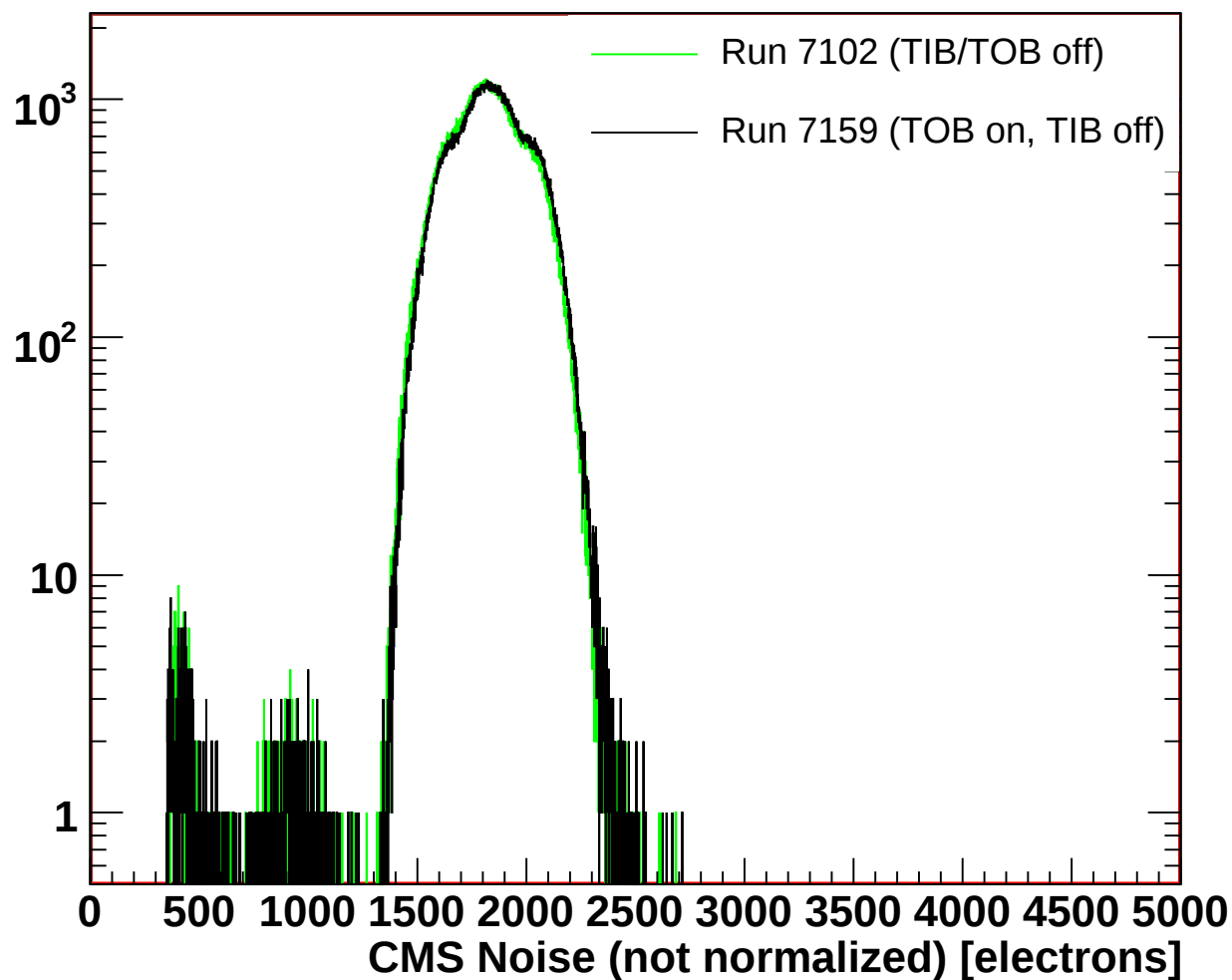
Noise Behaviour – Sector 3



Noise Combined

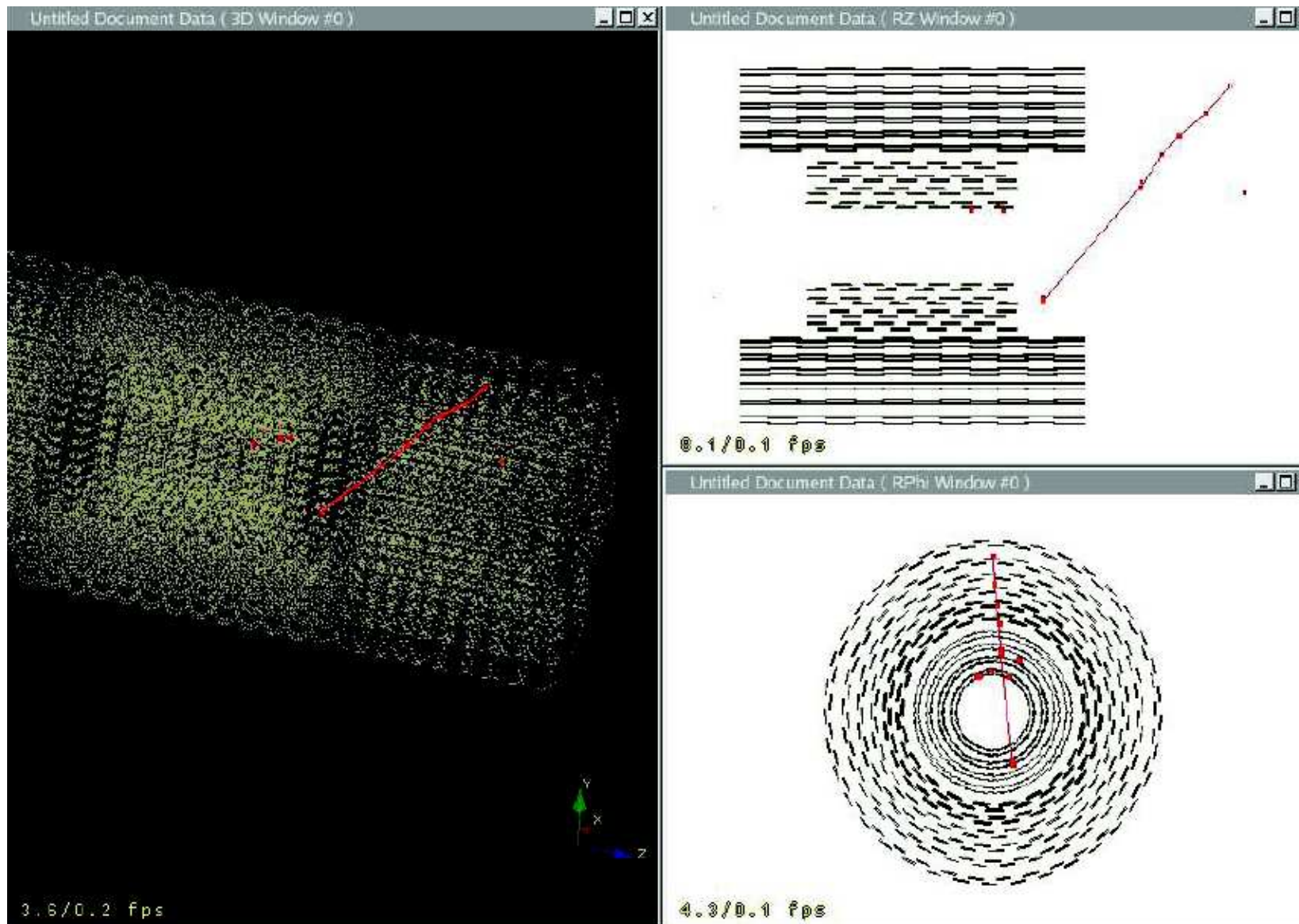
Noise – After Insertion: TIB/TOB off $\leftrightarrow$ TIB off TOB on

CMS Noise, ENC, Run 7102 vs. Run 7159



No change, but more studies to be performed

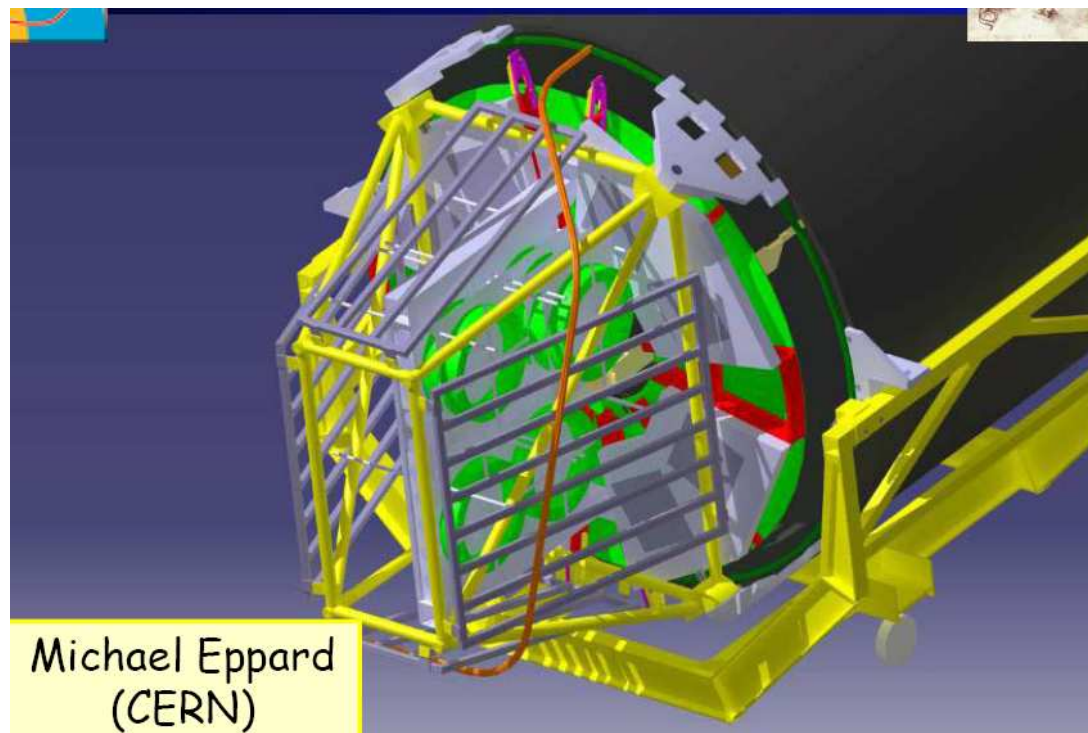
What else



First successfully reconstructed event in TEC (and TID!) (T.Bergauer)

... more 'else' ...

- Preparations for moving tracker to P5 are progressing
- Many studies concerning grounding of various tracker parts within CMS
- Service channels to provide tracker with all necessary cables and pipes under intensive studies
- Plan is to keep schedule even if the engineering run should be skipped



Summary and Conclusion

- TEC+ successfully commissioned
- Analysis revealed known and few unknown features
- → some could already be fixed, others are under investigation
- Noise studies started
- Extensive set of studies ahead



END



BACKUP

DQM in General

- Several DQM levels available
- 'Standard DQM' produces very large sets of plots ($> 30 \text{ k!}$) also providing tool to look for outliers
- Also performs reconstruction up to track reconstruction
- Problems with events with large (> 1000) cluster multiplicity
- Identical procedure for
 - Online DQM
 - Quasi-online: Operating during
 - Offline DQM
- but: Rather inflexible during operation and also not providing all necessary information especially for commissioning
- Packages used here should be embedded into larger system to have all commissioning information comprised