

Study of Module results in Florence

- ARC measurements
- CMS-like measurements
- ARC CMS-like comparison
- Discussion on cut criteria
- Long Term

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Introduction

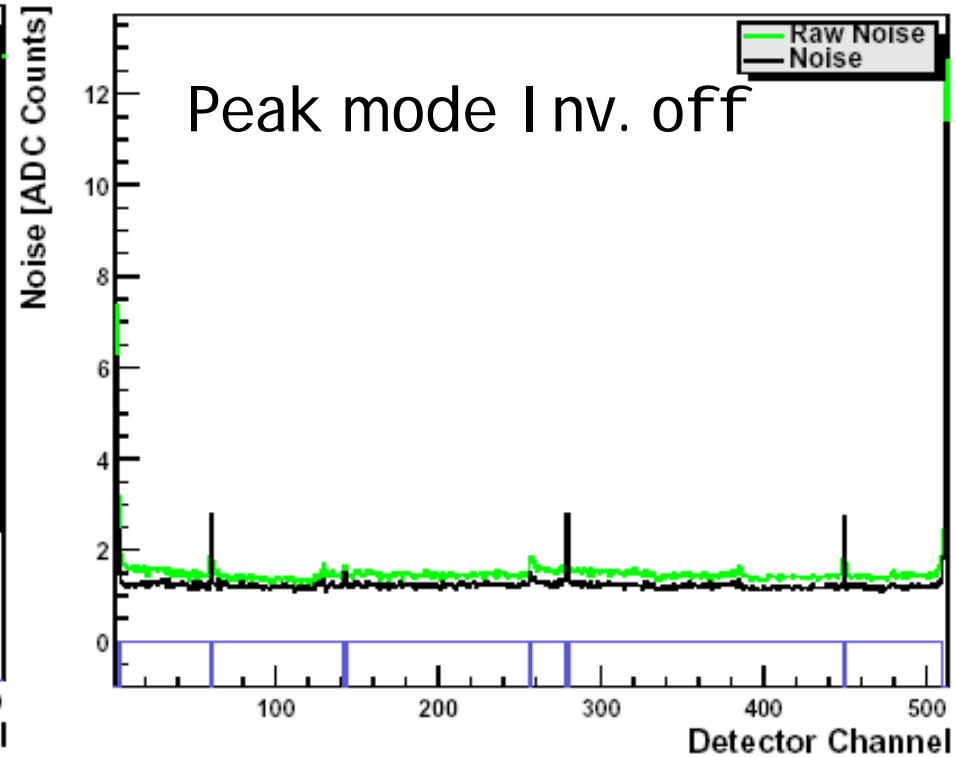
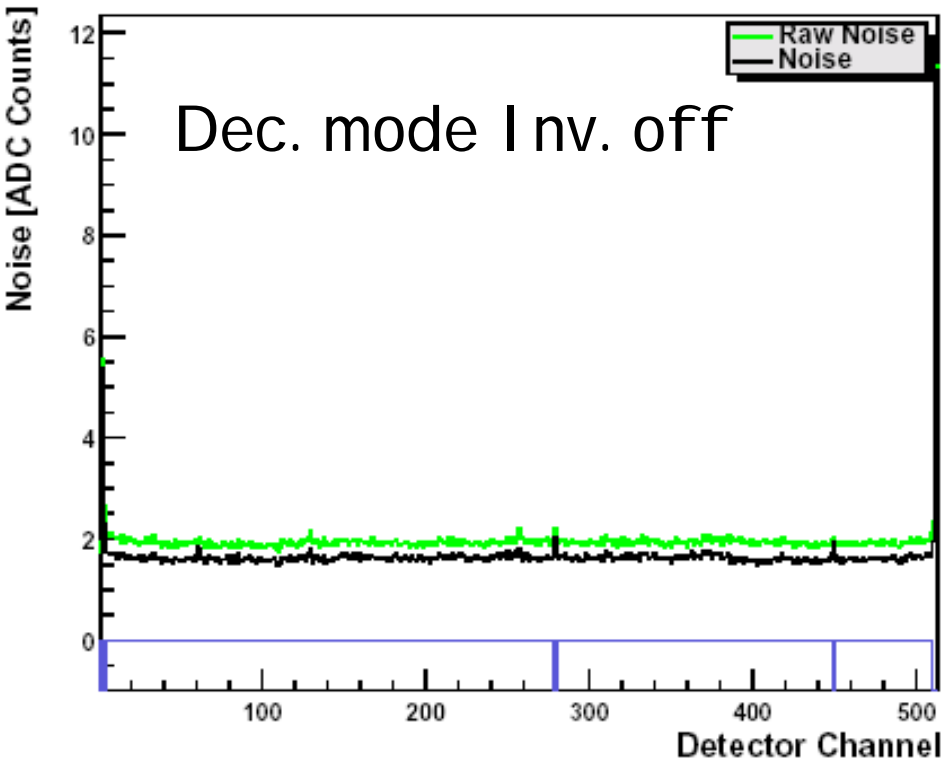
- The measurements shown are based on a sample of **5 TIB** modules
- **ARC: V5.01** running on Win2000
 - Data taken in PK and Dec mode with both Inv. On and Off; detectors biased at 300V (no calibration data due to poor quality pulse shape)
- **CMS-like** standard (fully copper) using Mirabito's client
 - Data taken in PK and Dec mode mostly with Inv. Off; detectors biased at 300V
- Data comparison are based on **Pedestal + Noise** only
- Long Term → first results with LT sw (Wim-Valery)

Noise sensitivity

- Both systems have more sensitivity to noise measurements when used in Peak mode.
- This reflects in a number of noisy strips that is higher when calculated using data taken in Peak mode with respect to the one extracted from Deconvolution runs.
- The inverter circuitry reduces the common mode noise both in PK and Dec. modes
- As an example, from ARC (module 180):
 - 1 ADC count Dec Inv. Off → 0.5 ADC count Dec Inv. On
 - 0.7 ADC count Peak Inv. Off → 0.35 ADC count Peak Inv. On

Noise sensitivity (2)

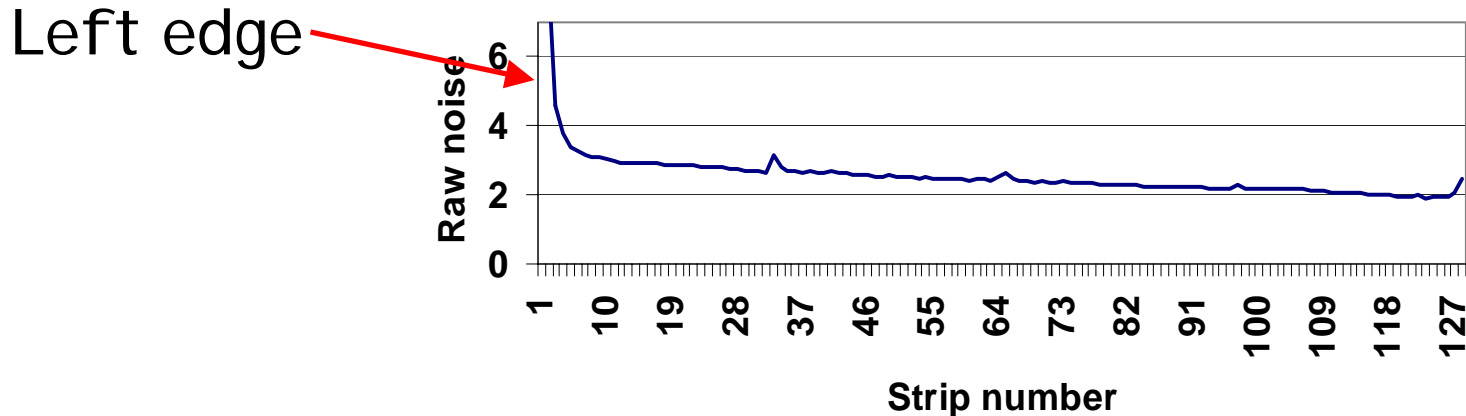
Tib173 biased at 300V



“Detector edge” effect

- We see this effect both in **PK** and **Dec**.
- Strips classified bad are the same using ARC and CMS systems.
- Reason still to be investigated.
- About **3 strips** on each edge.

30216680500180_300v



- Until something new is found we should keep these strips as they are.

CMS ARC comparison

Bad strip number list (an example → Tib180)

	Deconvolution		Peak		
	CMS Inv. Off	ARC Inv. Off	CMS Inv. Off	ARC Inv. Off	
30216680500180	1	1	1	1	
	2	2	2	2	Detector edge
	3	3	3	3	
			4		
			5		Only detected by CMS; sigma (1.27) close to limit
			6		Only detected by CMS; sigma (1.20) close to limit
			33		Only detected by CMS; sigma (1.21) close to limit
			129		Only detected by CMS; chip edge
			256		Only detected by CMS; chip edge
		257		257	Chip edge
			509		Only detected by CMS; sigma (1.28) close to limit
		510	510	510	510
		511	511	511	511
	512	512	512	512	

CMS ARC comparison (2)

- Summary table of bad strips (4 modules):

Module	ARC only	CMS only	Both	Total
180	0	7	7	14
177	0	13	12	25
005	1	1	21	23
168	2	3	7	12

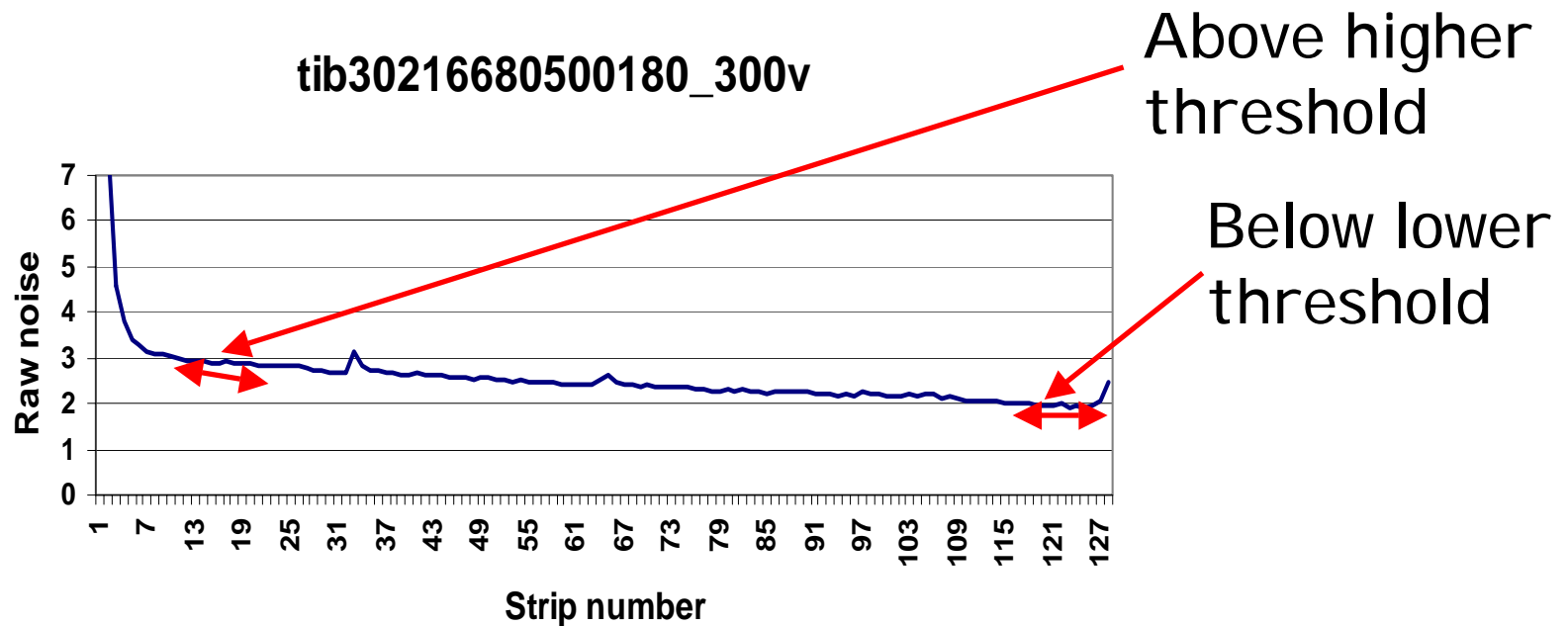
NB: Edge strips are included !

Bad strip: Cut definitions

- **ARC** (extracted from ARCS manual)
 - r.m.s. of sigma: $\pm 3 * \text{trms} + \text{tmean}$
 - percentage: $(\pm 0.2 + 1) * \text{tmean}$
(where tmean and trms are the truncated mean and rms of the sigma distribution of an APV chip.)
- **CMS-like** (Torino macros)
 - Percentage cuts on:
 - Pedestals
 - Raw noise
 - CMN sub. Noise
 - calibration
 - logical OR of all cuts (it should be for all test systems)

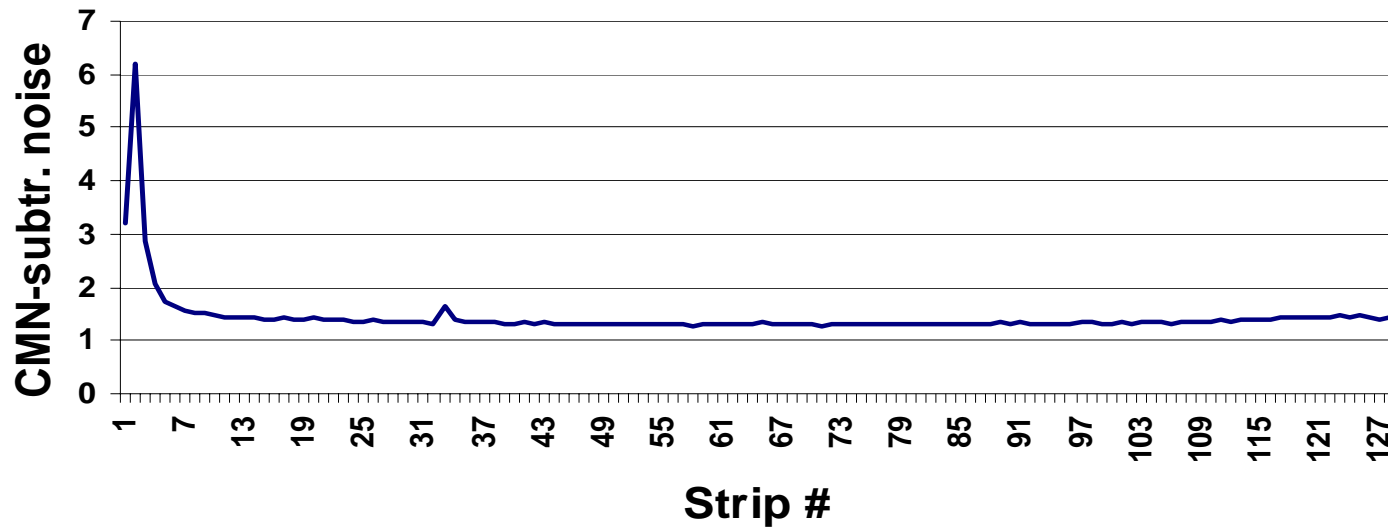
Cut on raw noise (CMS)

- Based on our experience strips marked bad by the cut on raw noise have CMN-subtracted noise within the limits.
- Proposal → relax the used cut on raw noise (from $\pm 20\%$ to a bigger value)



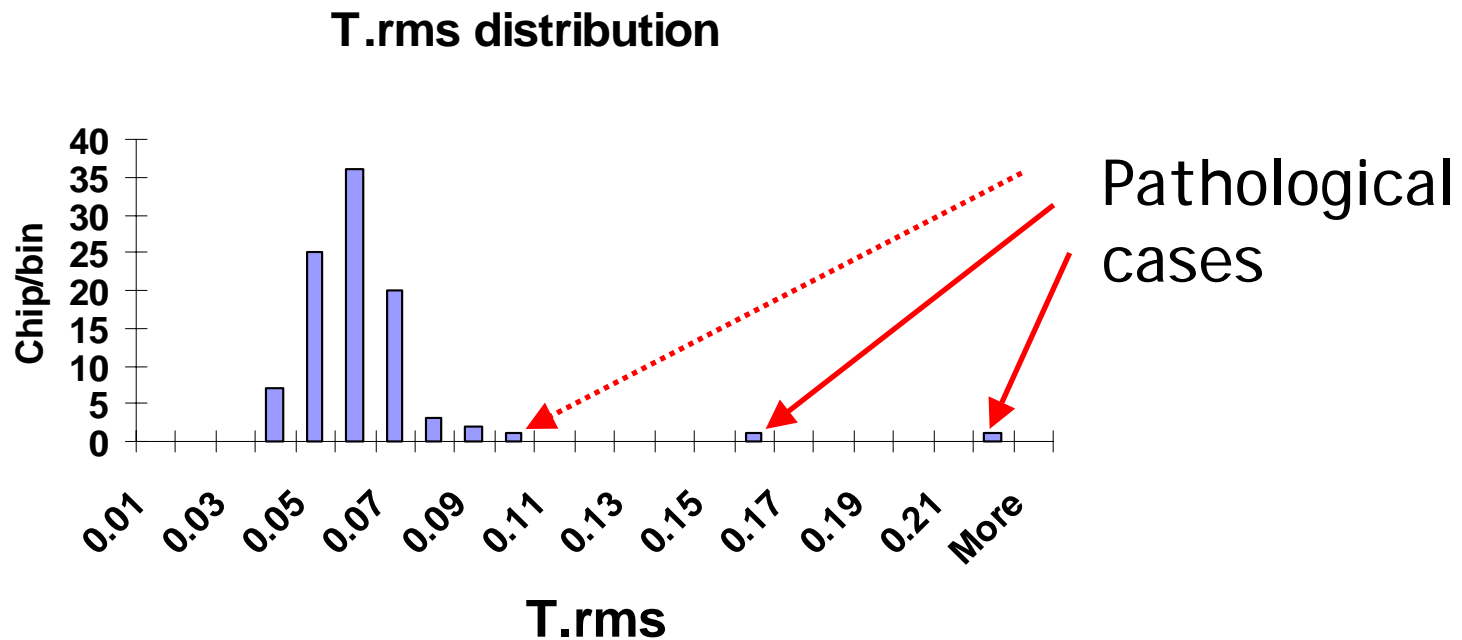
After CMN-subtr. the noise profile is, with the exception of the first 3 strips, flat and quite acceptable.

tib30216680500180_300v



Cut on r.m.s. of noise distribution (ARC and LT)

- Very unstable cut; the r.m.s. depends heavily on the largest fluctuations within the noise distribution.
- Truncated r.m.s. are adopted, but in some cases, even t.r.m.s is not homogeneous among different chips.



Cut on r.m.s. of noise distribution (2)

- Drop 'r.m.s. cut' and use 'percentage cut'

$$\langle \sigma_{\text{noise}} \rangle * (1 - p) < \sigma_{\text{noise}}^i < \langle \sigma_{\text{noise}} \rangle * (1 + p)$$

- Typically $p=0.2$...as we used in our analysis

Percentage Cut

The main problem is to answer this question:
“which is the correct (or most effective or best)
procedure to fix the ‘p-value’?”

My proposal is to look at the recently made modules
and build up a statistics of defective strips in terms
of their normalized noise.

5 TIB modules →

Tib30216680500169

Tib30216680500177

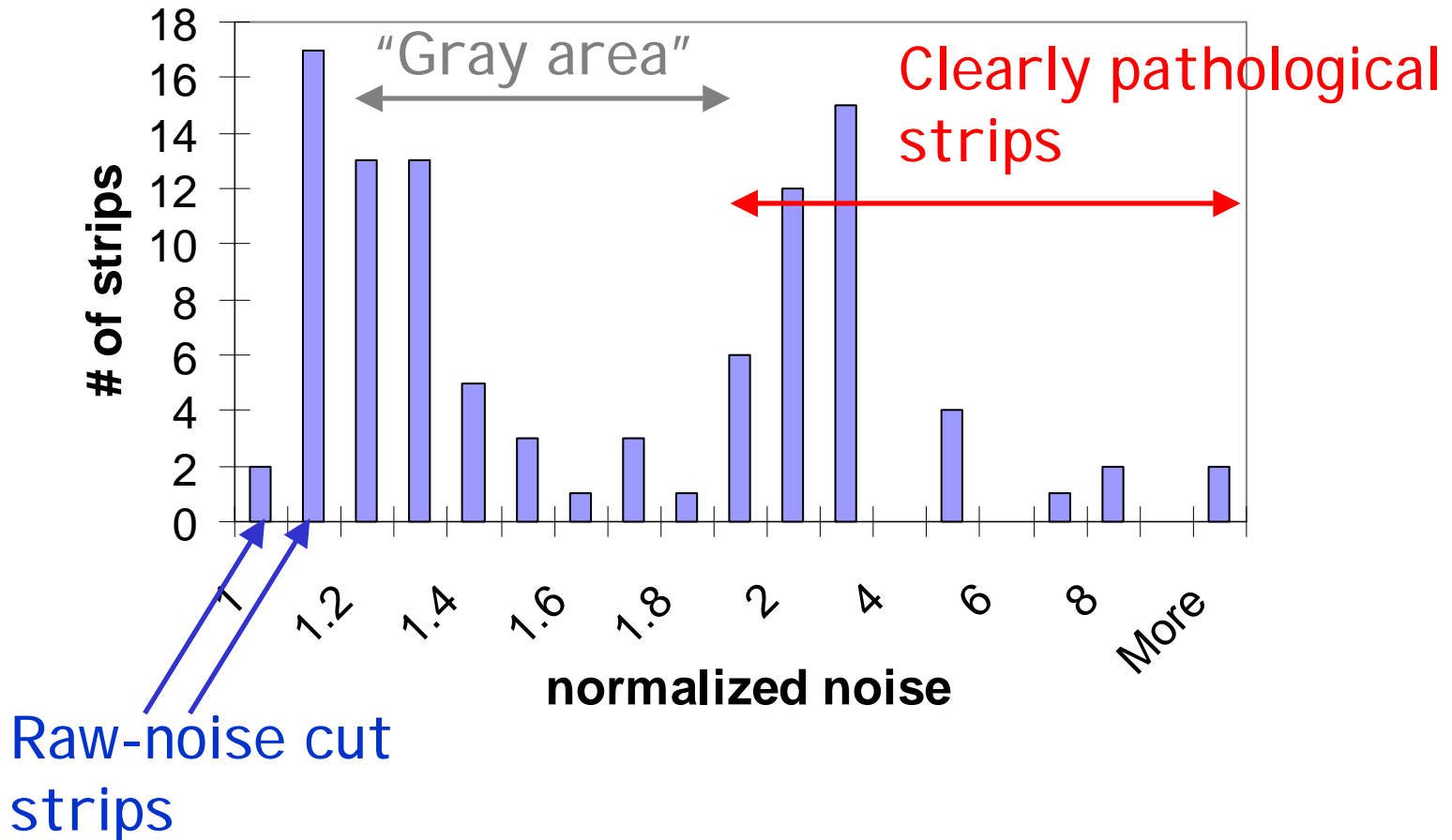
Tib30216680500180

Tib30216700400005

Tib30216700500168

Percentage Cut (2)

Noise/mean_noise (Peak mode)
CMS system
(only cut strips are plotted)



Percentage Cut (3)

- The 'p-value' should probably be located in the 0.2 → 0.5 range
 - Lower p-values mean safer modules from the read-out point of view (less risk to have the FED output saturated by noisy clusters)
BUT: higher module rejection rate...(\$\$\$)
 - Of course higher p-values mean lower module rejection rate
BUT: in case of 'non-gaussian' noise tails, higher risk to have noisy modules...

Percentage Cut (4)

- To fix p we should measure the **noise cluster rate** as function of p itself in a statistically significant sample of modules and define which is the maximum cluster rate that is tolerable by the DAQ.
- Could this procedure depend also on the detector type (ST or HPK)?
- Using the ARC system we can extract a raw data dump that can be analyzed using the most **FED-like cluster algorithms** available.
- → To be done ...

Long term test software

- Long term software, version 0.09, on a RedHat 7.0 Linux PC (PIII 1 GHz)

- Example of a scenario file used (peak mode):

```
0   Start      0
5   PedRun     i2cpedpeak
40  SaveRec    0
50  CalProfRun i2ccalpeak
1300 SaveRec    1
1310 Stop      0
```

Pedestal run



Calibration profile run
(it takes about **20 min**)

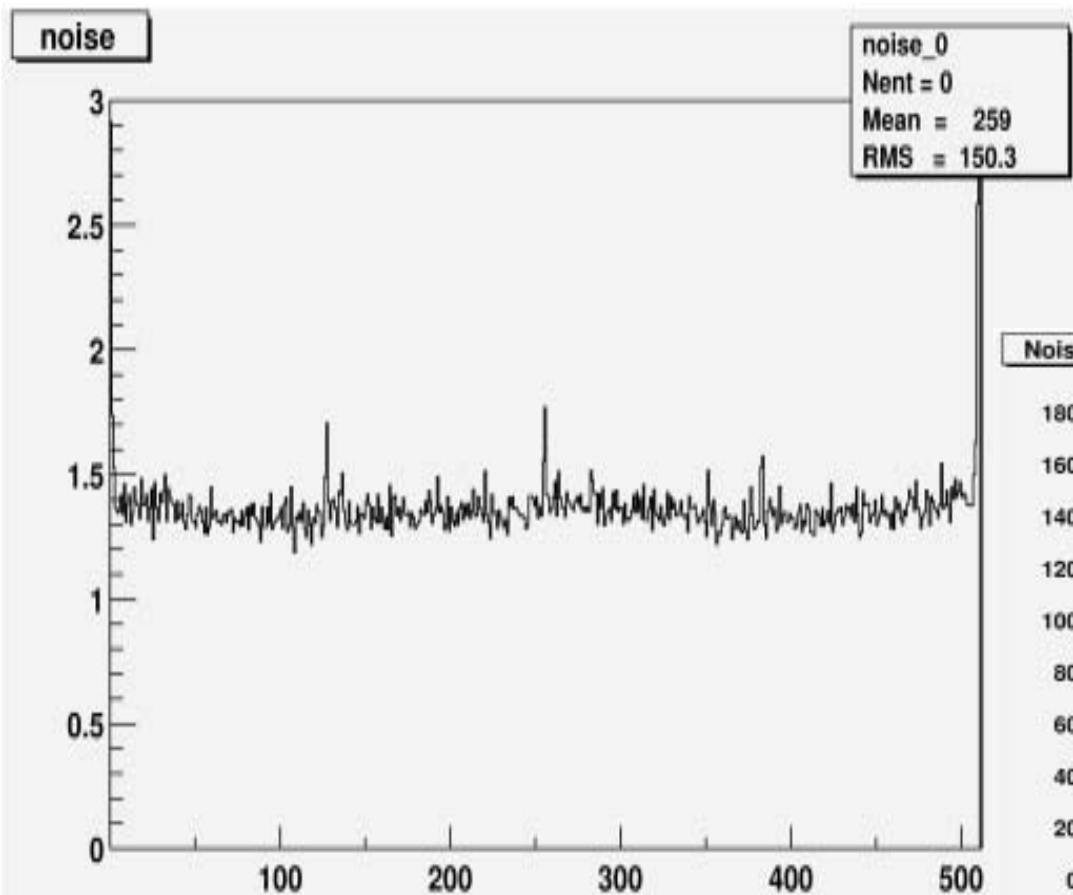
- Only two modules fully tested (tib302166805177 and tib302166805180), according to the previous scenario (peak and deconvolution)

Long term test software in Florence

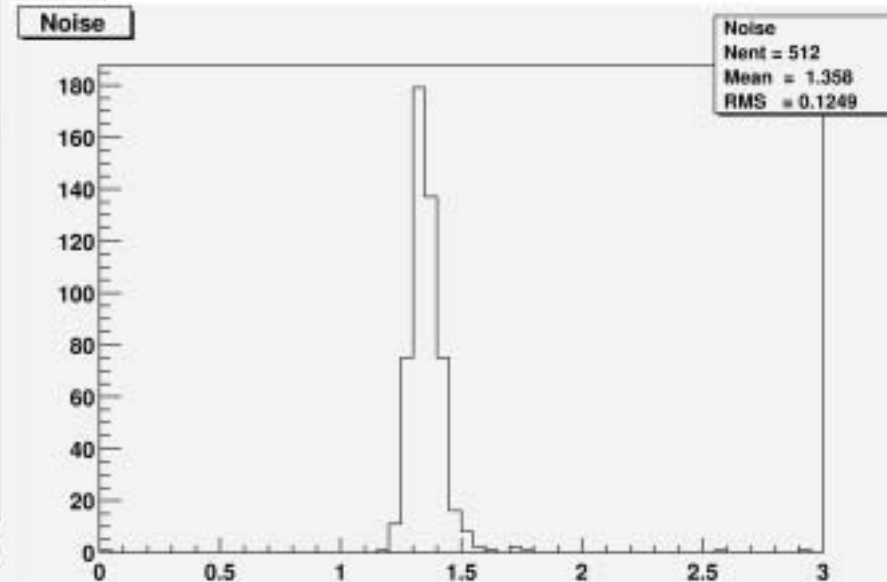
- We had some problems during installation and run of the software (save of XML file for a calibration profile run), now solved.
- We can't still:
 - Save more than one XML file on each run (this means we should restart the program each time);
 - Save XML data directly from the scenario file (need to press the button), to be solved in the next release;
 - Upload to the database XML file with data from 6 chips;
 - Understand the cuts (more doc. needed);
 - Have a human-readable list of bad strips.

Tib302166805180

Bad strips → Peak mode (not inverting): 1, 2, 511, 512
Dec mode (not inverting): 1, 512



Peak mode,
not inverting,
300 V bias

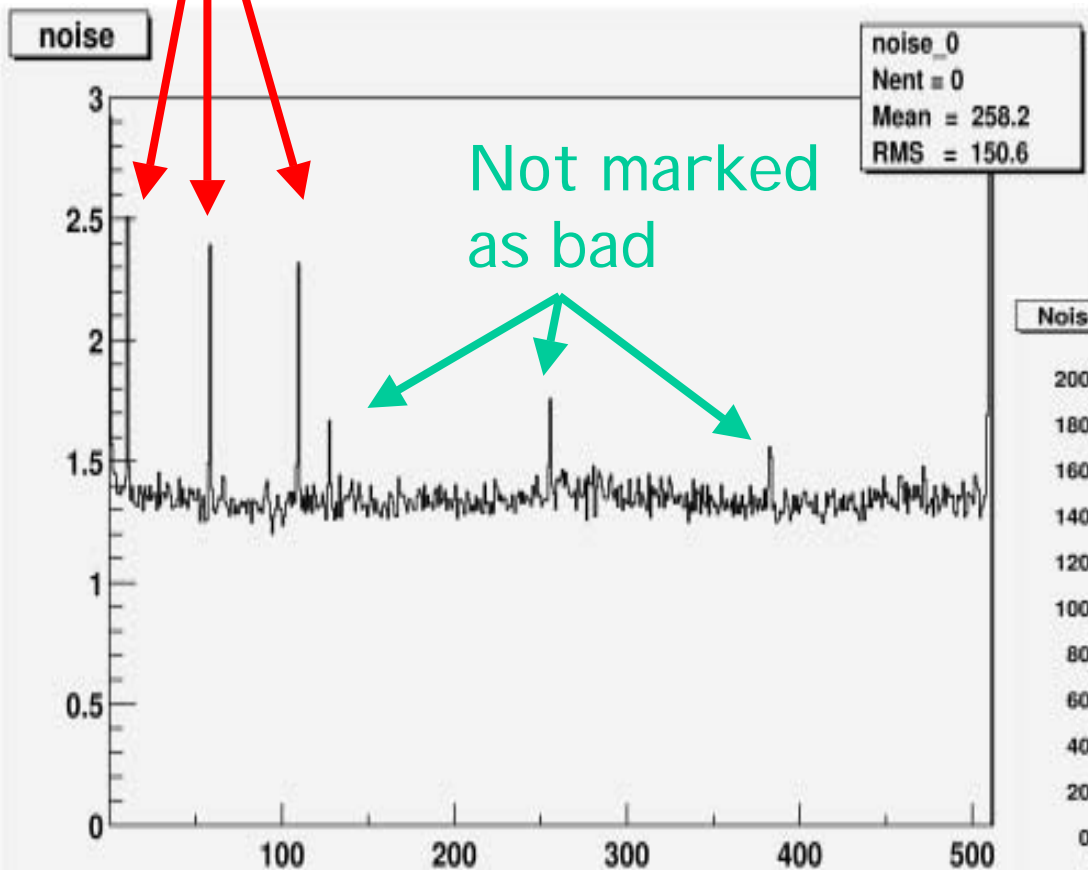


Tib302166805177

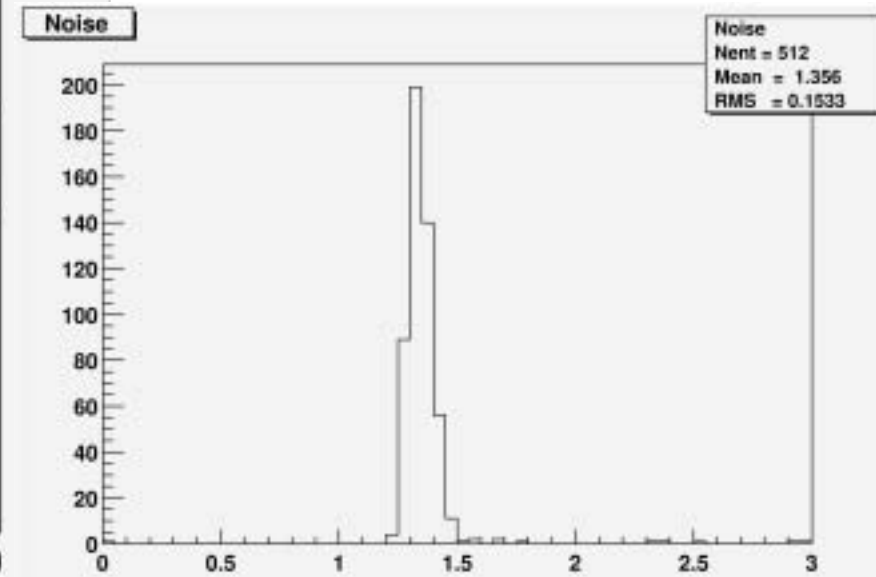
Peak mode (not inverting): strip 1, 2, 12,
60, 111, 511, 512

Dec mode (not inverting): strip 1, 2, 511,
512

Bad strips →

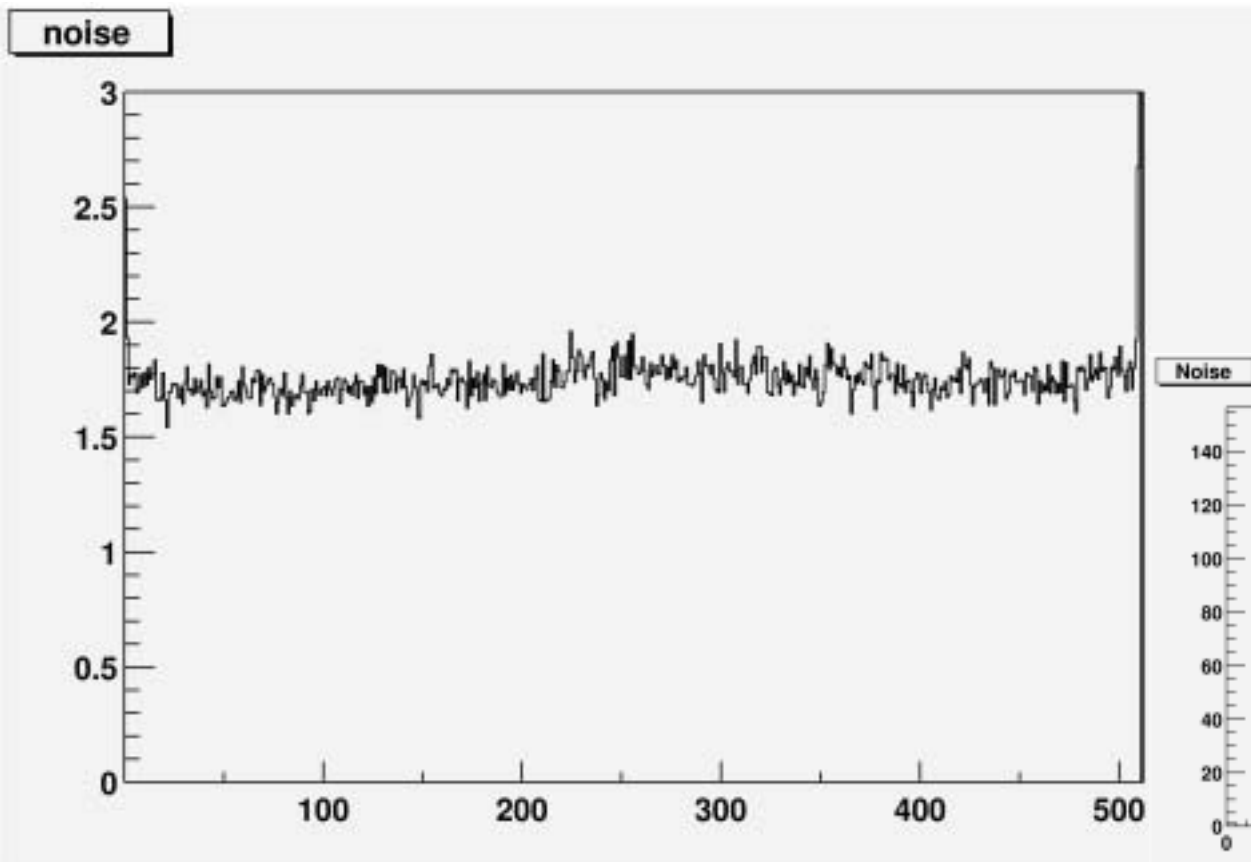


Peak mode, not
inverting, 300
V bias

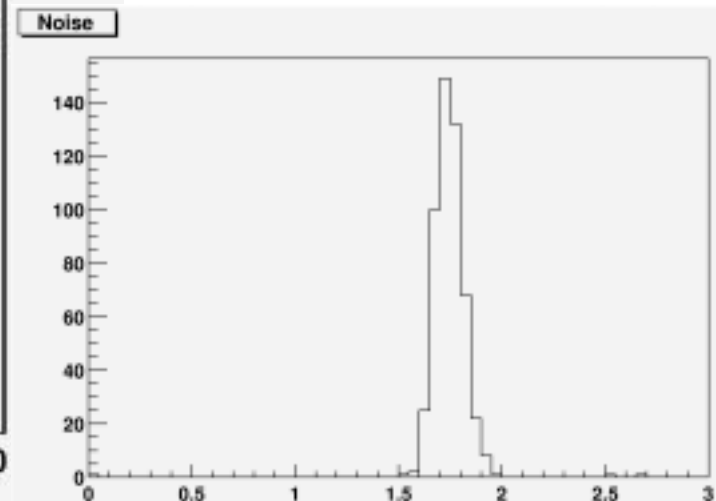


Tib302166805177

Bad strips → Dec mode (not inverting): strip 1, 2, 511, 512

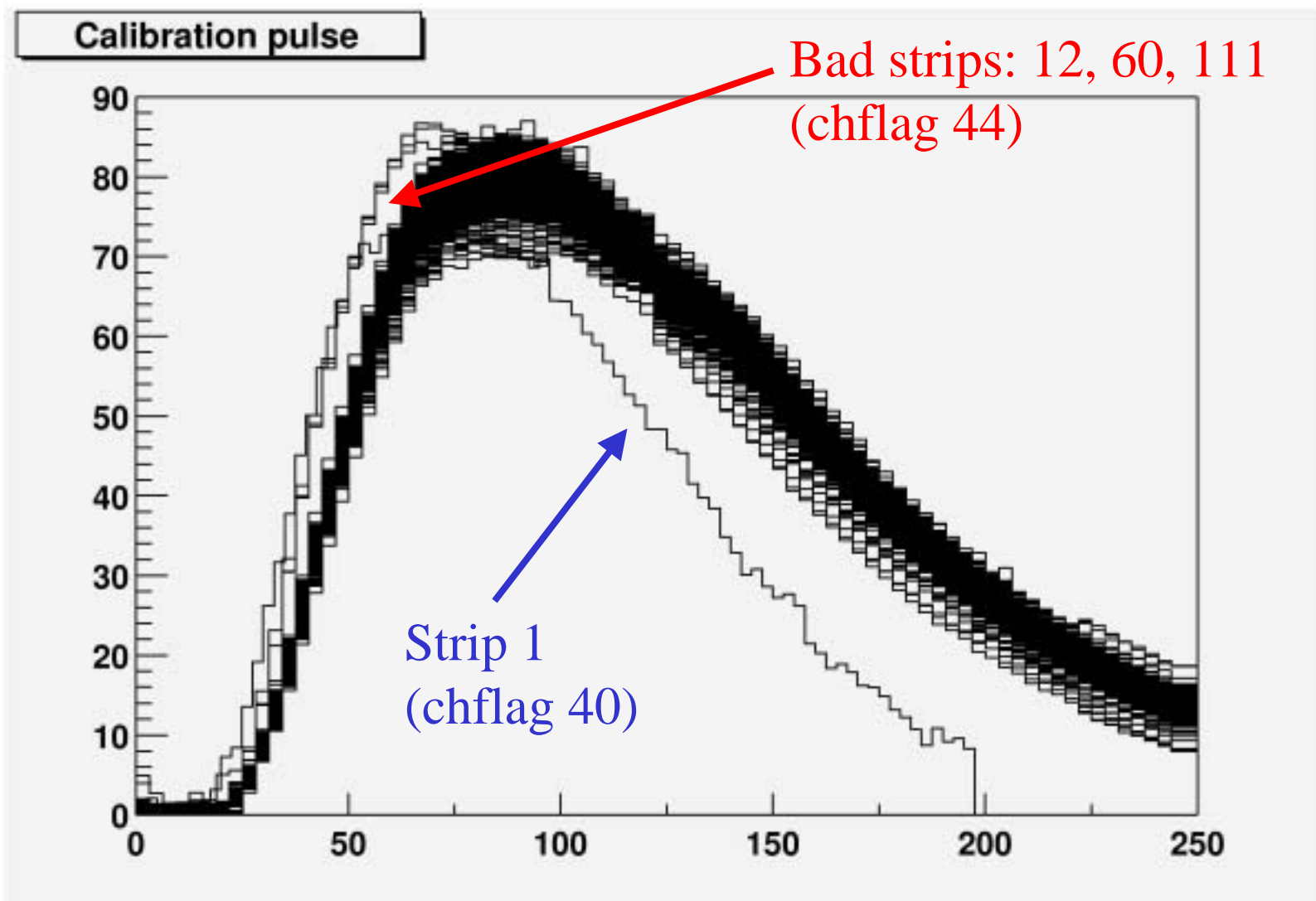


Dec. mode, not
inverting, 300
V bias



Tib302166805177

Peak mode, not inverting, 300 V bias



Conclusions

- Both ARC and CMS systems are commissioned and we are collecting detailed information for debugging and comparison with other test setups.
- Bad strip definition necessitates a better understanding of the modules behaviour with respect to the noise.
- From the hw point of view:
 - ARC system needs a fix to solve the noise problem with full modules (new FE adapt.);
 - CMS system is waiting for the Vienna cold box and the electrometers for a final LT setup integration
 - LED systems and MUX card are still missing.
- From the sw point of view:
 - ARCS needs some minor bug corrections and is still not possible to write data on DB
 - LT sw is being tested, more work is needed
- All in all the test systems are almost ready to enter the module production phase.