

Longterm Test of SubStructures (Petals)

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TEC (front) Petal:

- 28 modules of 10 different types (7rings)
- 68 optofibers in 3 MPO connectors
- 3 power groups (HV and LV) $W_{tot} > 55W$
- 4 interconnect boards with 2CCUs
- complicated cooling circuit
- and more...

**We assembled and tested one in Karlsruhe.
6 more integration centers will follow
to assemble and qualify ~400 petals of
different types for the TEC during
Y2005-2006.**

Kallsruhe Pilot Integration Center



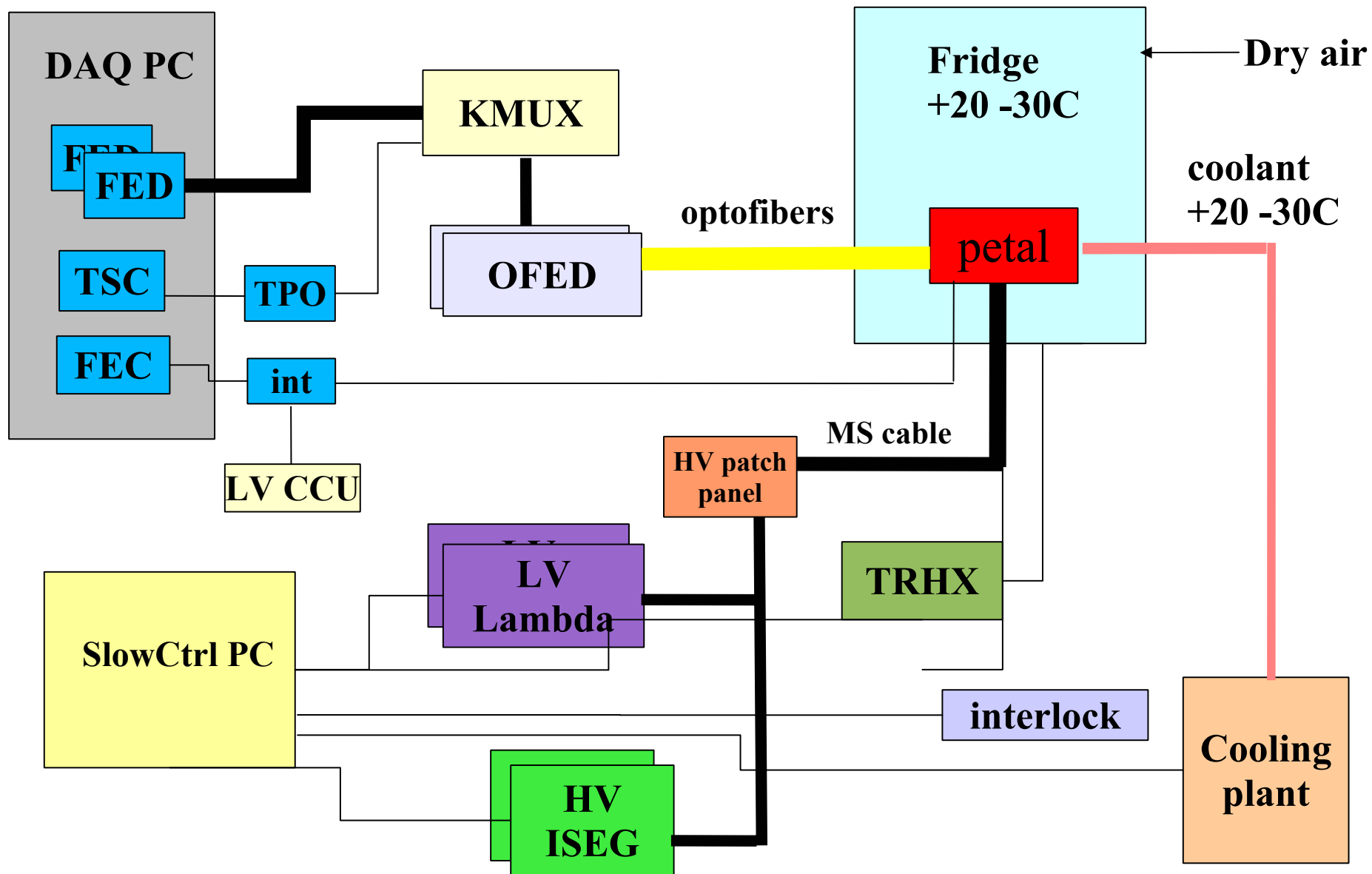
Longterm Setup

storage

Assembly setup

ARC

Standard Setup



Tunning

Needs tunning for the optocomponents and module delays.

1) AOH Tunning

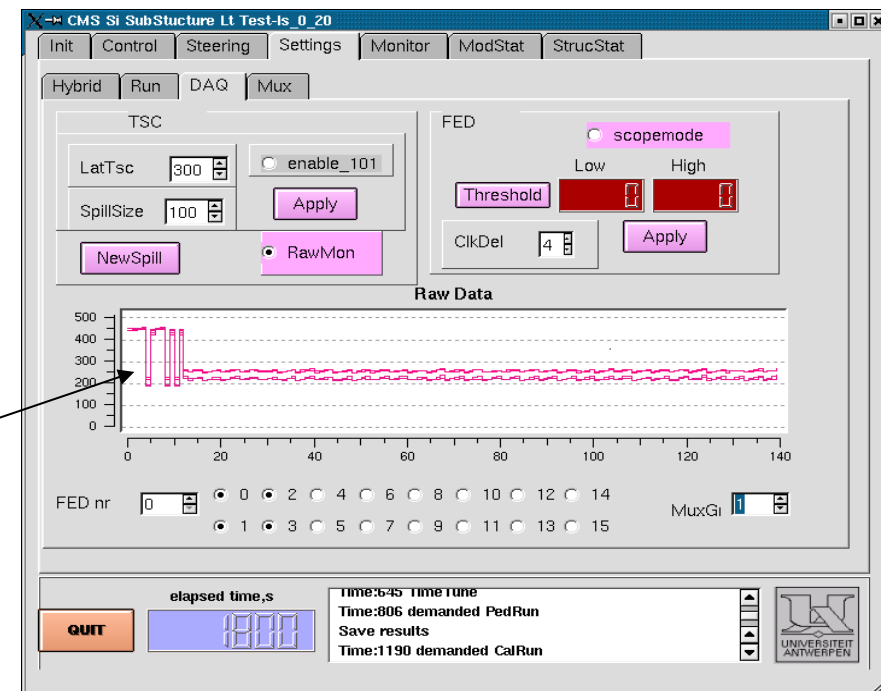
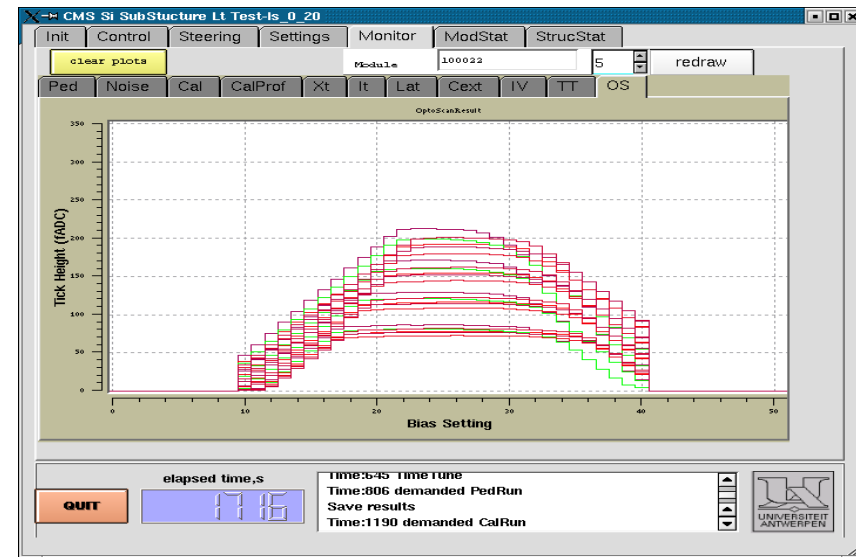
*(gain and bias scan)
do each time when
temperature is changed.*

2) Time Tunning

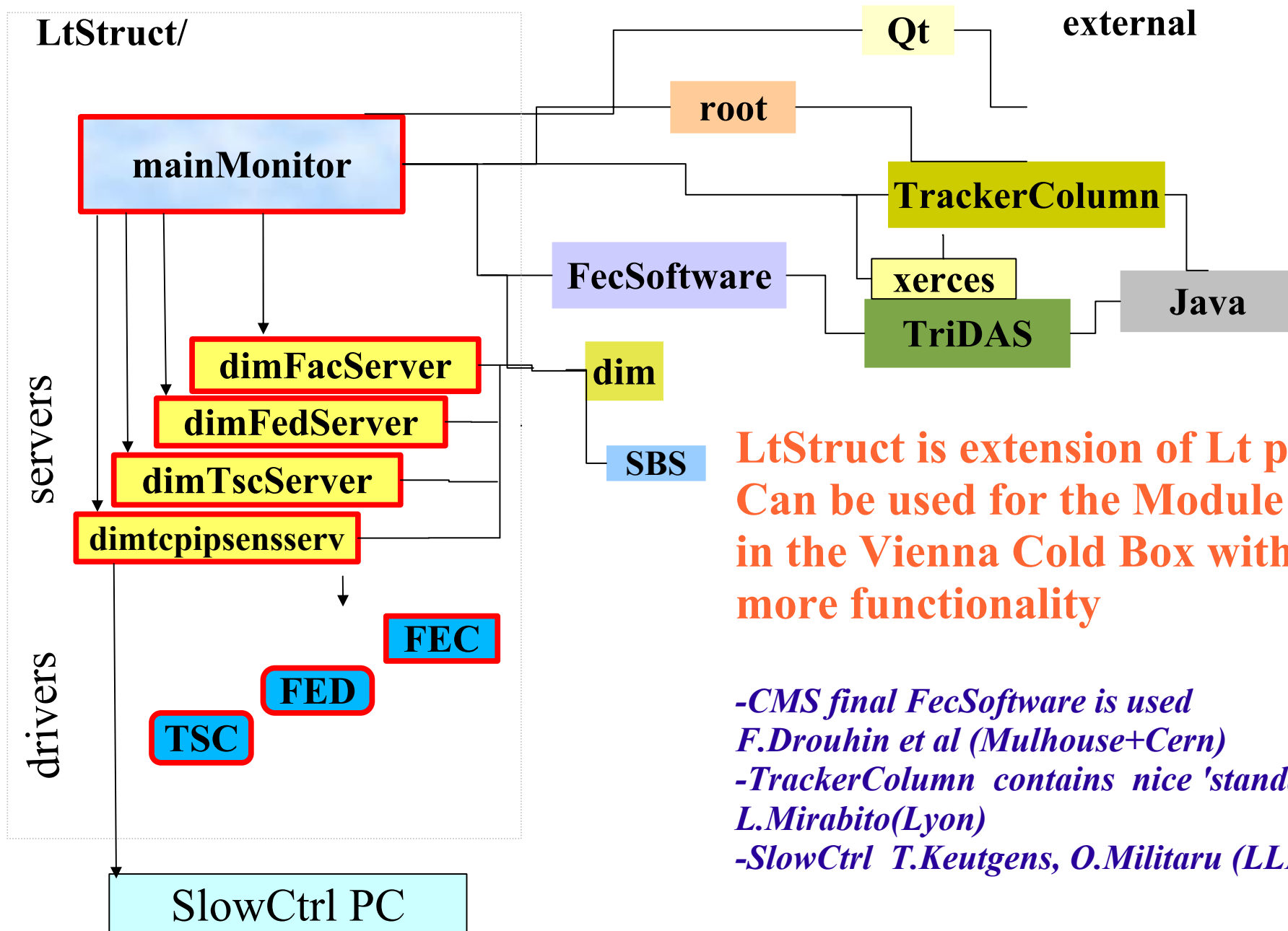
*-fedclk(related to the setup)
-PLL delay(optofiber length)*

*Wrong tunning means - DAQ error
(APV header not found)
can lose up to 10 optchannels*

**All data(noise,calibration,..)
has to be normalized to the
header amplitude or average**



Software structure



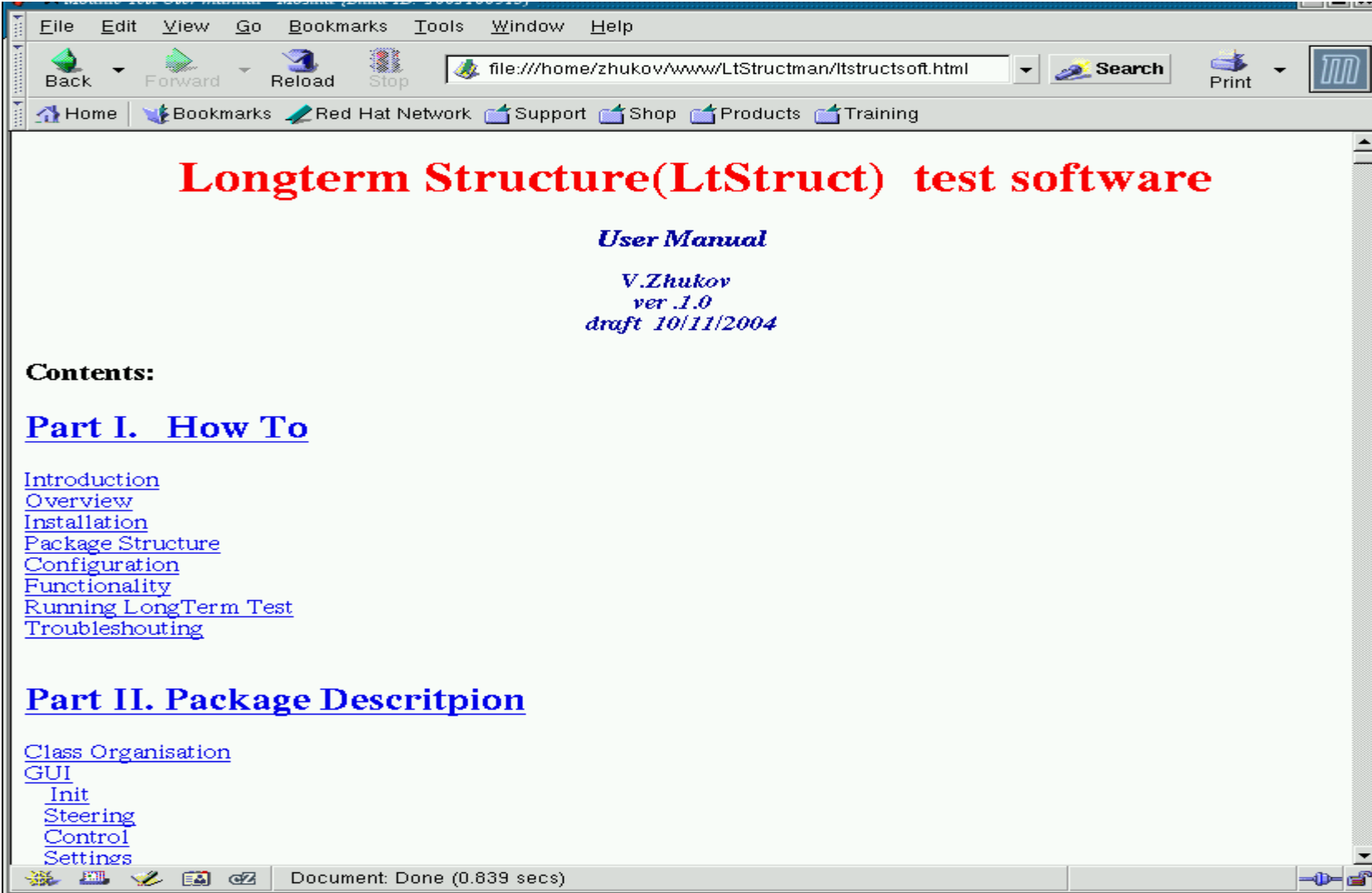
**LtStruct is extension of Lt package
Can be used for the Module Test
in the Vienna Cold Box with
more functionality**

- CMS final FecSoftware is used
F.Drouhin et al (Mulhouse+Cern)
- TrackerColumn contains nice 'standalone'
L.Mirabito(Lyon)
- SlowCtrl T.Keutgens, O.Militaru (LLN)

Have a look to [LtStruct User Manual](#)

<http://www-ekp.physik.uni-karlsruhe.de/~zhukov/Cms/LtStructman/lstructsoft.html>

or following links from our Antwerp support page



The screenshot shows a web browser window with the following content:

File Edit View Go Bookmarks Tools Window Help

Back Forward Reload Stop file:///home/zhukov/www/LtStructman/lstructsoft.html Search Print

Home Bookmarks Red Hat Network Support Shop Products Training

Longterm Structure(LtStruct) test software

User Manual

V.Zhukov
ver 1.0
draft 10/11/2004

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Document: Done (0.839 secs)

Data Analysis

DefectAnalyser (*CMS IN 2004/043 User manual*)

available as a part of the LtStruct package or standalone (see LtStruct page)

It does:

- **ROOT files inspection and data visualisation from different Modules, different Records, different files (ARC, Lt, LtStruct) and central Dbase.**
- **Analysis of results according to the approved criteria using cuts defined in *defanalset.xml* or xFlag(macro) settings files. Produce compatible Summary files.**
- **Produce XML file for the central database for ARC, LT, LtStruct**

Standalone operation via command mode

plot rms noise of all modules for Record1

mainAnalyser -comp seclt_s_1000.root -rec 1 -objname ' ALL 1 28 PeakInvOn/Noise/CMSubtractedNoise'

compare pulse height measured in ARC and for the same module on petal.

mainAnalyser -comp 'arc1234.root seclt_s_1000.root' -rec '1 4' -objname

'PeakInvOff/PulseShape/PulseHeight Module1/PeakInvOff/PulseShape/PulseHeight'

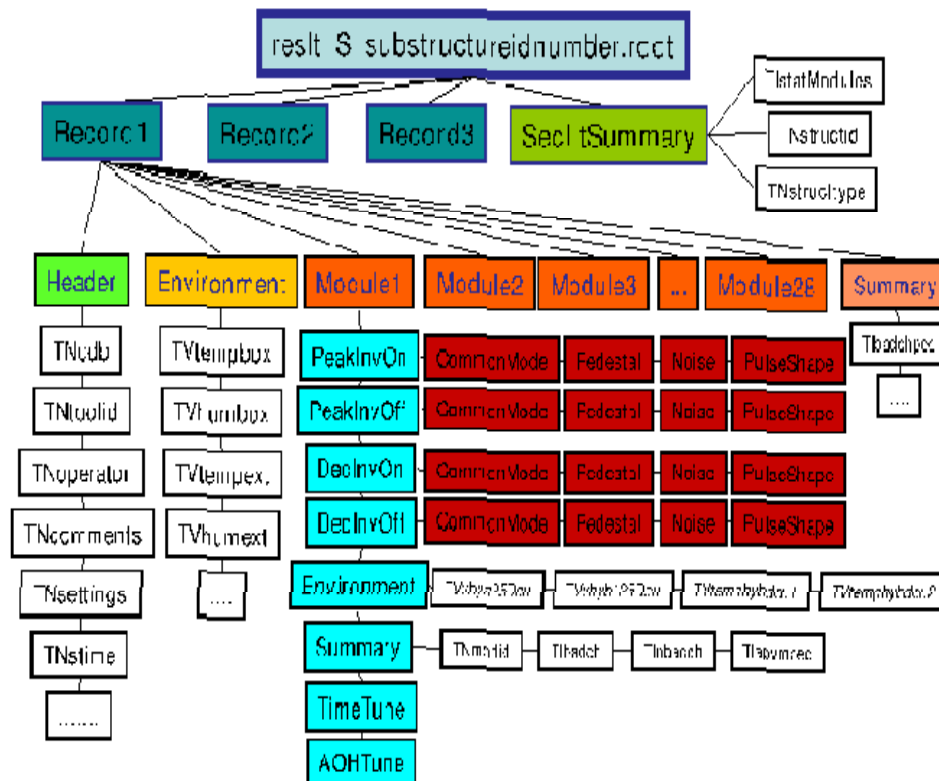
DefectAnalyzer from scenario command *Analyze* or GUI button in LtStruct

Test Procedure

Test Scenario is similar to the Module Longterm:
 basic set of tests repeated at least 3 times at different temperatures
 (Tcoolant)

- FIRST warm 20C
- COLD -20C
- LAST warm 20C

OptoScanRun	5 min
TimeTuneRun	3 min
PedRun	5 x4mode=20 min
CalProfRun	2h
LatRun (opt)	1h
IVRun(at warm)	2h (hv switch)



One cooling cycle +20 -20C with
 basic tests takes ~16 h.
 Two days - 3 cycles.

← Data stored in the ROOT file
 compatible with ARC and Lt.
 Size can be ~1Gb (20Records)
 Analyzed online and can be
 reanalyzed offline (DefAnalyzer)

Failure definitions

Module and AOH:

- Channels related(bad channel): same definitions as for the Lt(ARC), absolute cuts can be used if data are normalized
- $I_{leak}(450) < 2 * I_{measured_by_arc}$.
- Optocontact: header should be in the range (>150ADC?)
- Thermocontact: DCU measurements is in the range...

The whole structure:

- Ni2c errors < Nmax (defined), CCU ring stability in cold
- cooling performance (dT in-out) ...

Errors can be related to the Setup or to the Petal (difficult to disentangle)
f.ex:

- *i2c errors (APV,PLL,MUX,DCU, CCU) can be due to pickup noise*
- *Daq errors (apv header not found) can be due to wrong AOH settings or bad optocontact*
- *apv header (error bit) can be due to wrong fedclk timing*

In case of an error programm retries several times and if $N_{err} > N_{max}$ object is excluded from the current daq test.

SubStructure grading(proposal)

Combine results of tests (FIRST, COLD, LAST) with OR.

If FIRST&LAST are OK, check COLD test for wrong settings .

Grade	Nbadch_tot	NgradeBmodules	Ileak_tot(450V)
A	<1%	<50% Bmodules	< 2* Iarc_tot
B	<2%	no Cmodules	< 2* Iarc_tot
C	>2%	<50% Cmodules	> 2* Iarc_tot
D (major structure defects, useless)			

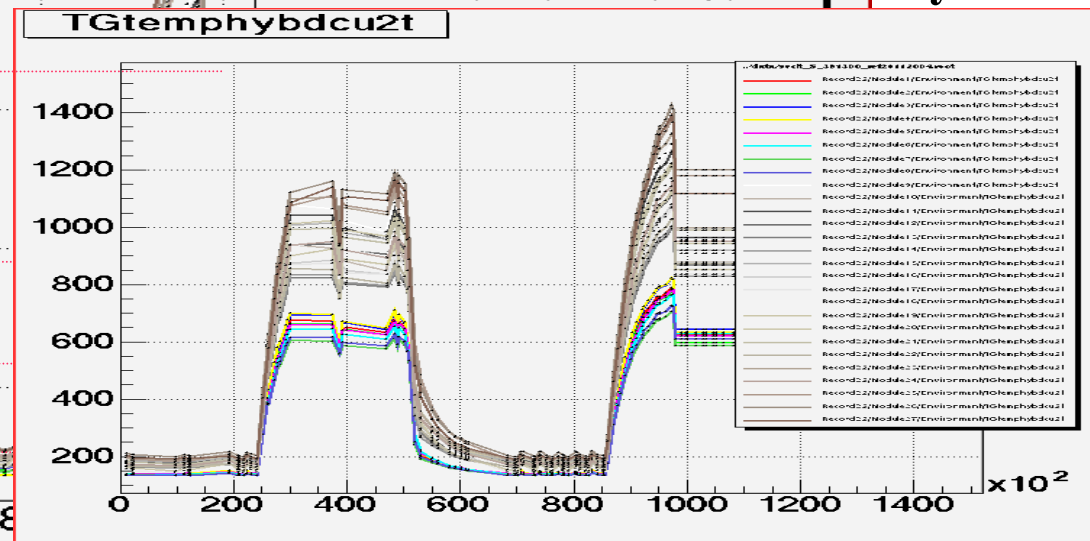
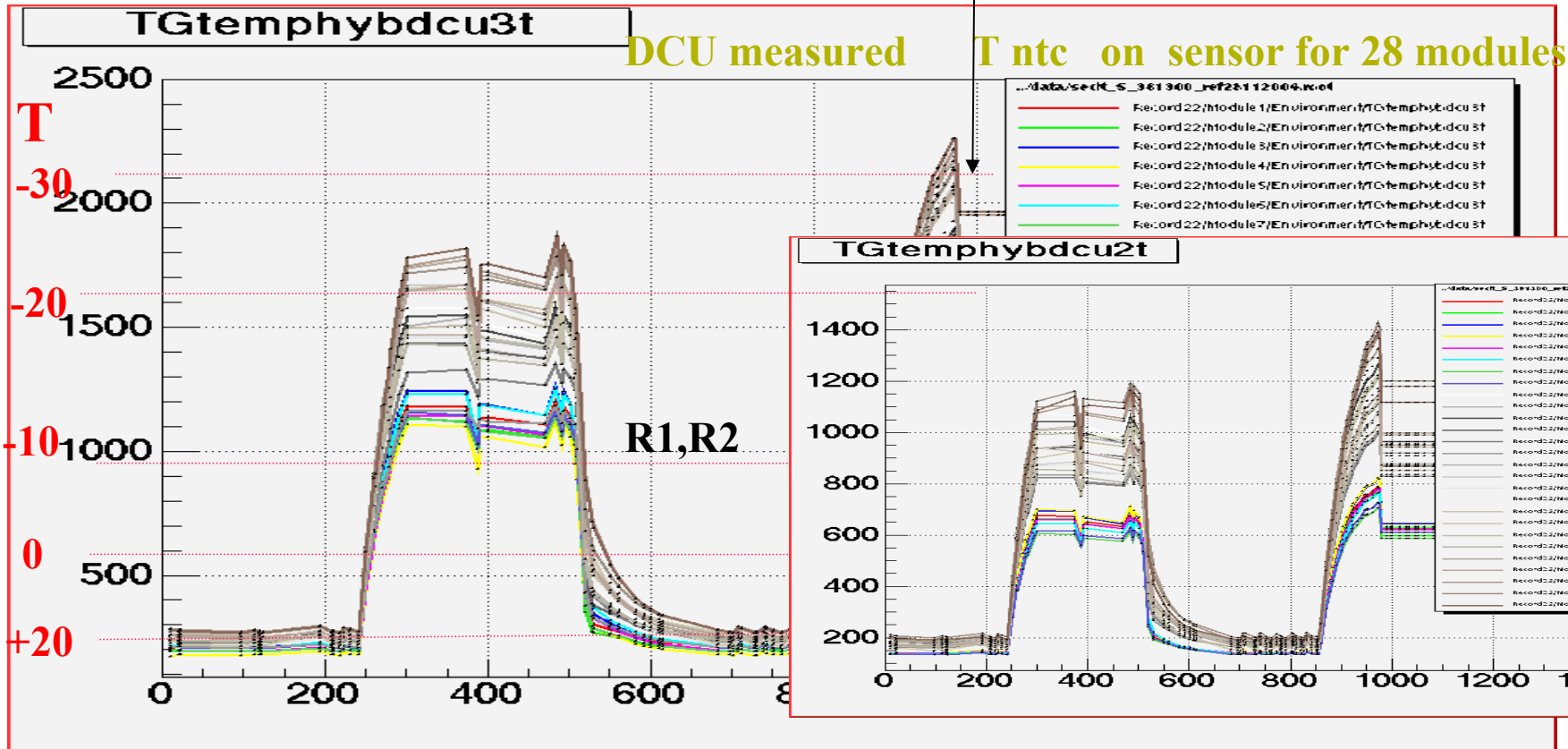
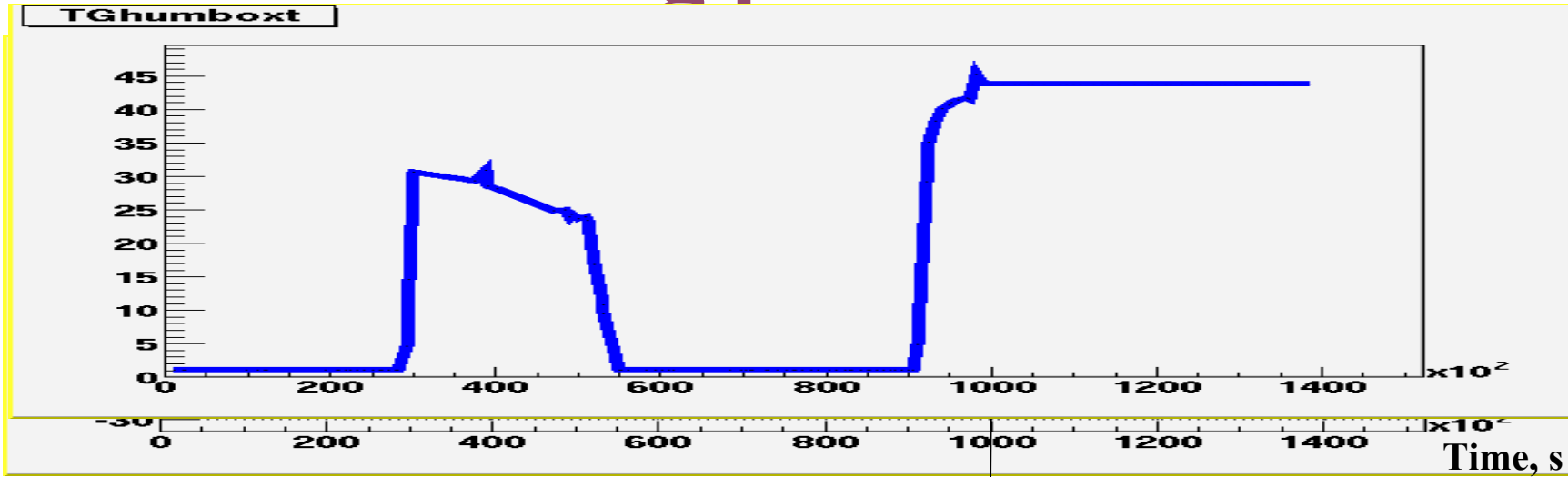
- no modules with high leakage pinholes (should be unbounded);
- no objects with $Ni2cerrors > Nmax$;
- $Ndaqerrors < Nmax$, otherwise test is not validated;
- ...

Repaire:

Exchange of failed objects in assembly setup with registration.

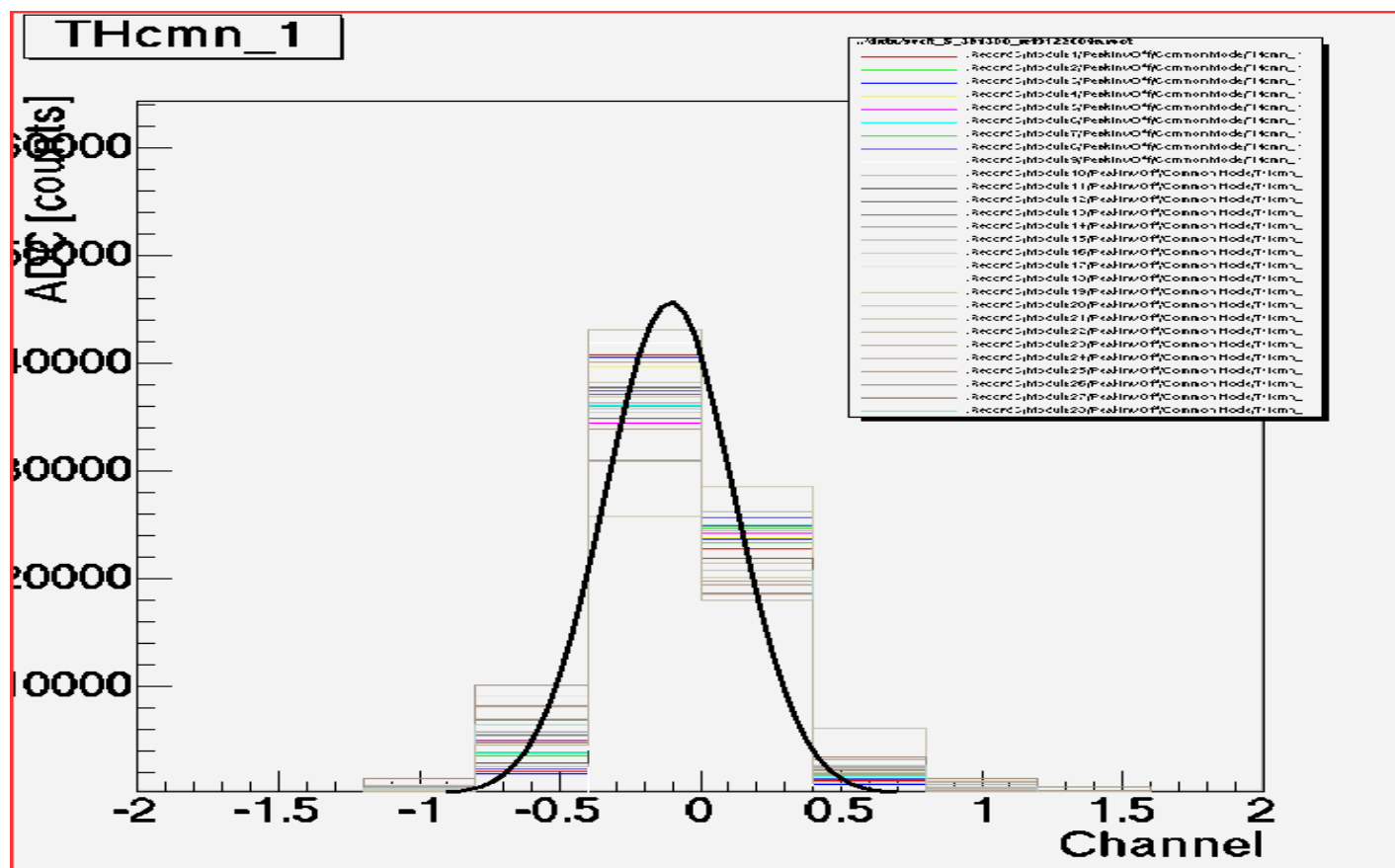
After the exchange repeat the test.

Cooling performance



Common Noise

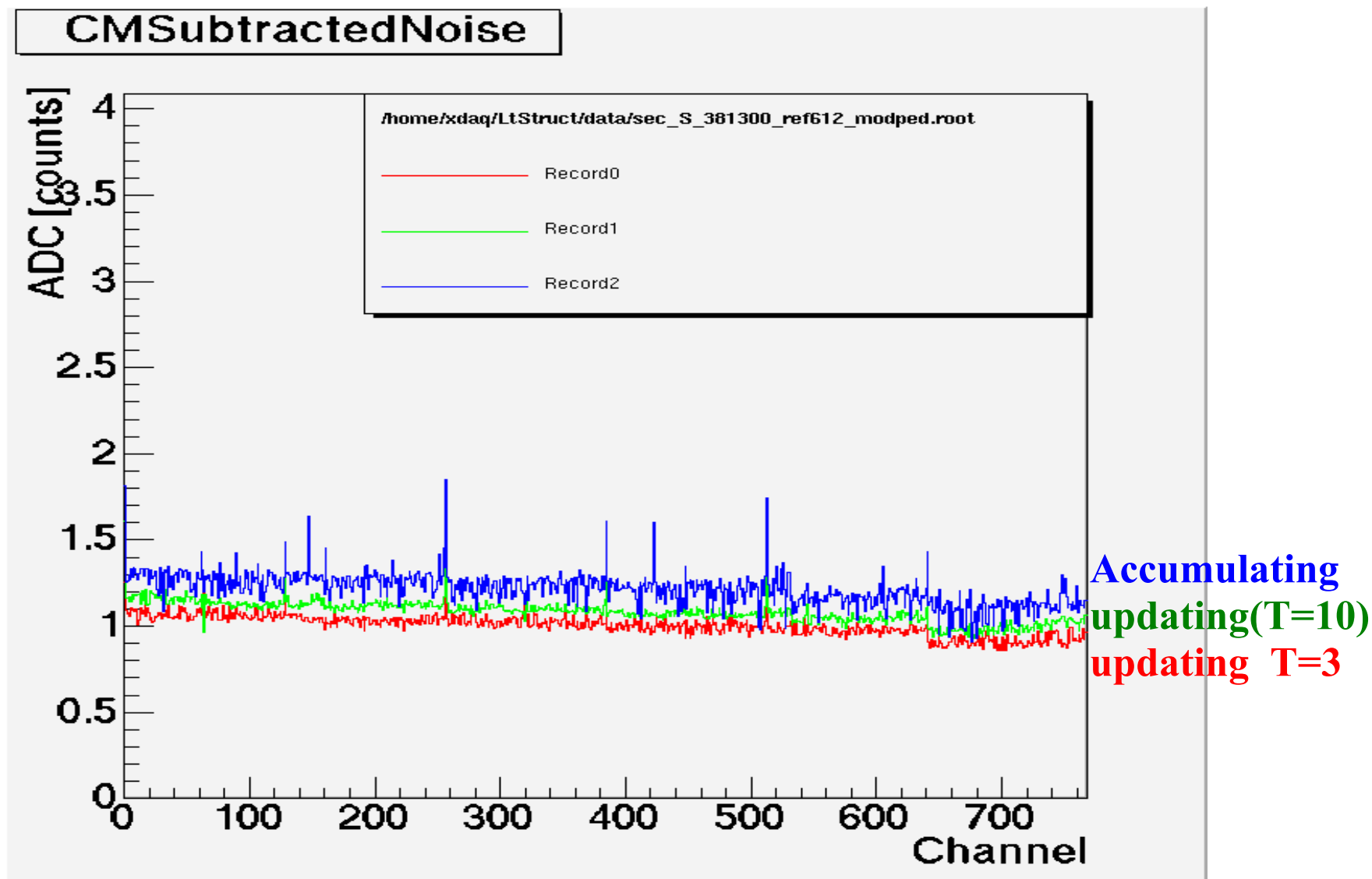
Setup qualification: **peakinvo**ff, HV=400V, T=20C
<cmn>=0.27+/-0.1 for 28 modules
 normalized to the header(250ADC)



All floating except the DAQ PC.

Comments on zero suppression

Can not use the present accumulating algorithm (modped=2 in settings.xml)
not enough resolution. Use updating with large cut ($T_{\text{skip}}=10$) to avoid truncation.

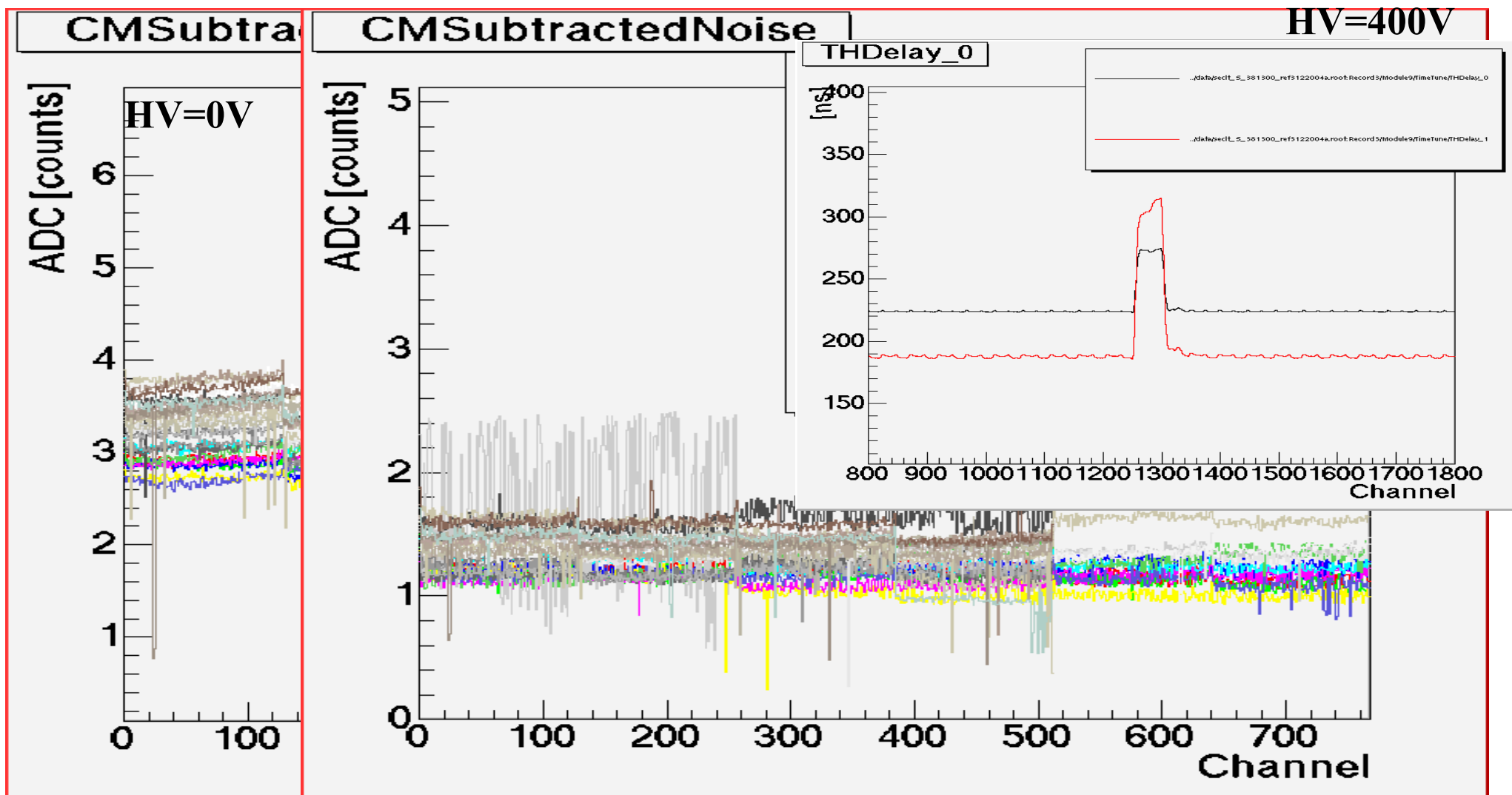


Noise 1

Normalized to the header rms noise.

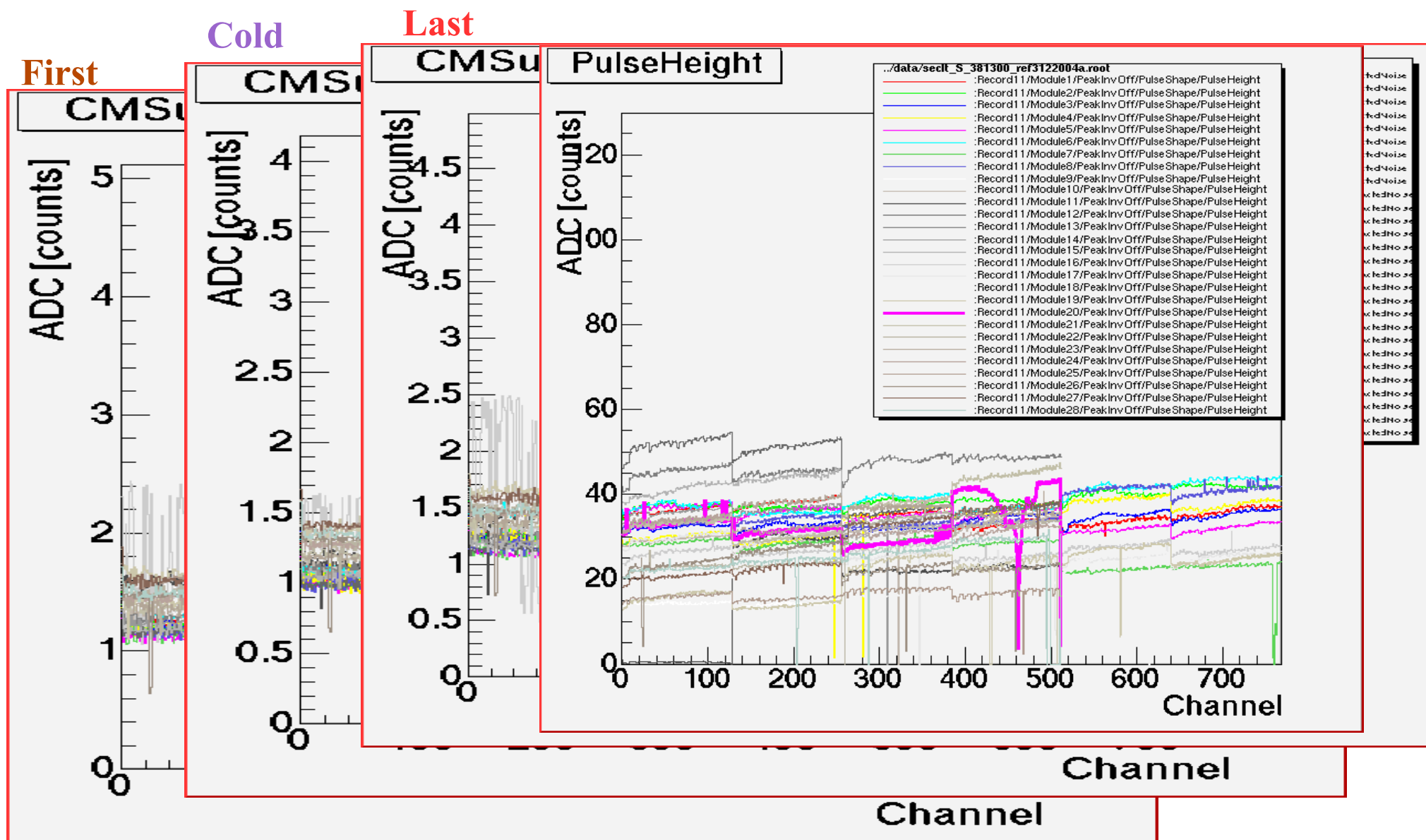
PeakinVOn T=20C HV=0. All 28 modules.

Small amplitude for one module (bad optcontact?) shows up at smaller noise at HV.



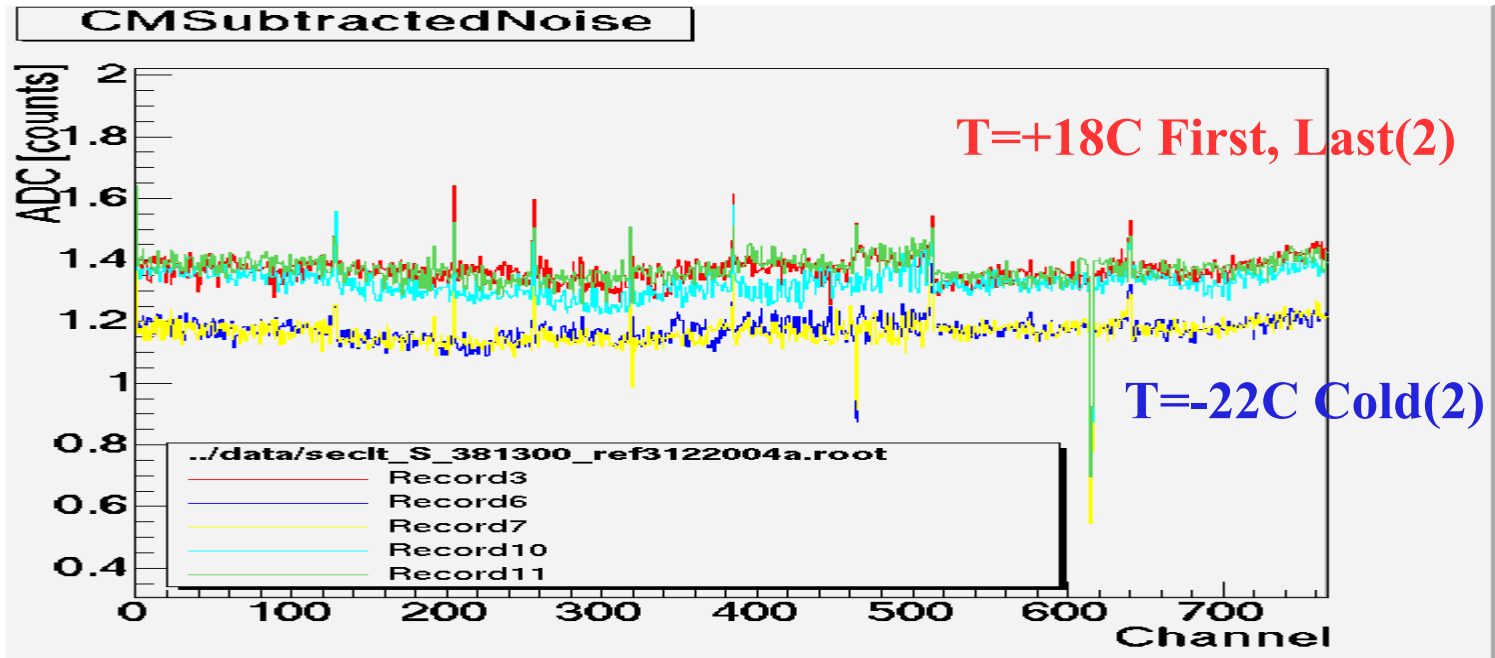
Noise 2

Noise (HV=400V) at FIRST(20C), COLD(-20C), LAST(16C) tests
 One module with pinhole (known) is waking up (Ileak=5mA)

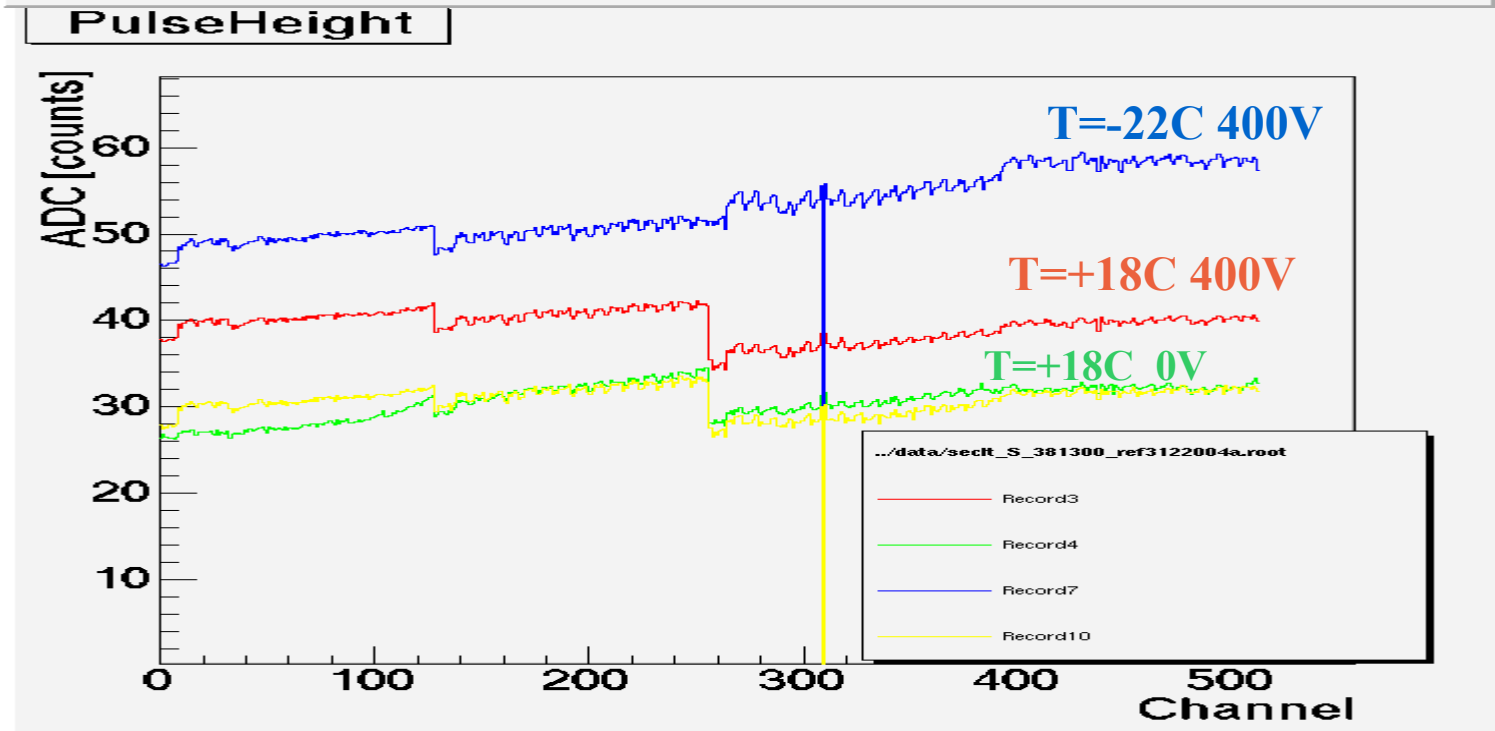


Temperature dependances

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M18
HV=400V
pinvon



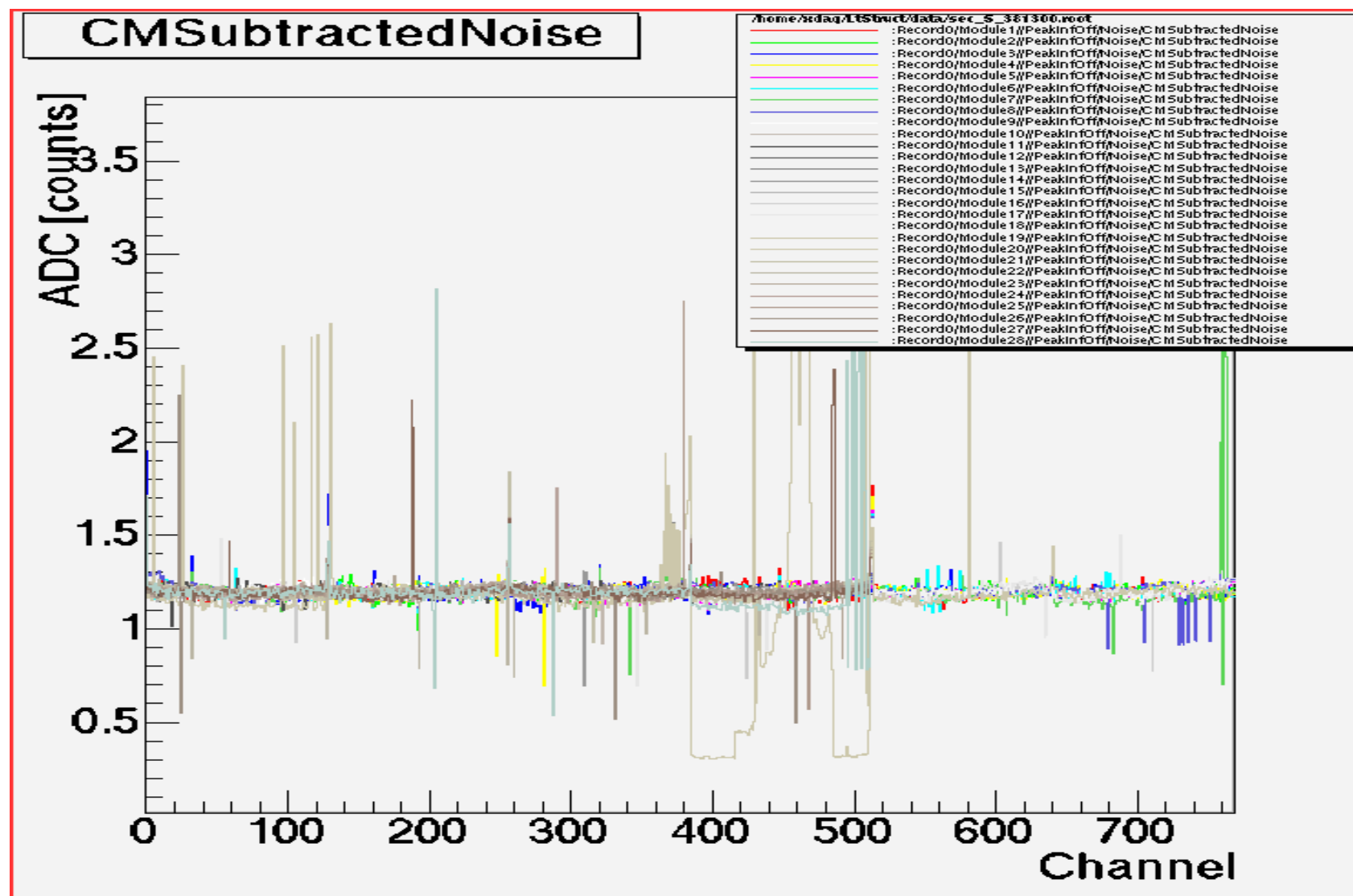
M14
pinvoff

Normalized
on header

Normalisation

Normalization to the average per chip rms noise is better.

Here average chip noise is normalized to 1.2. PeakinVOn 400V 28modules

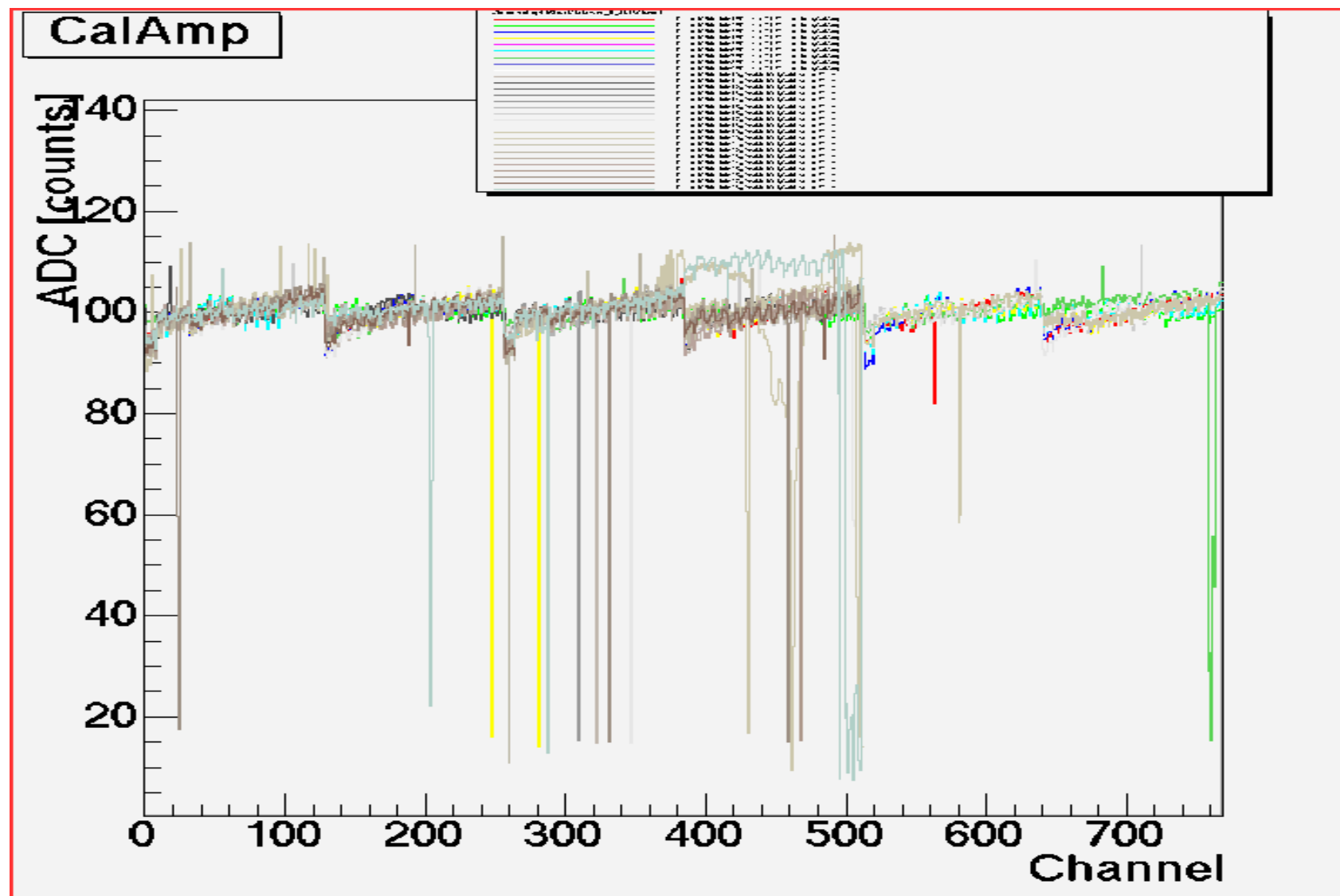


Normalisation

Same for the Calibration amplitude (normalized to 100ADC).

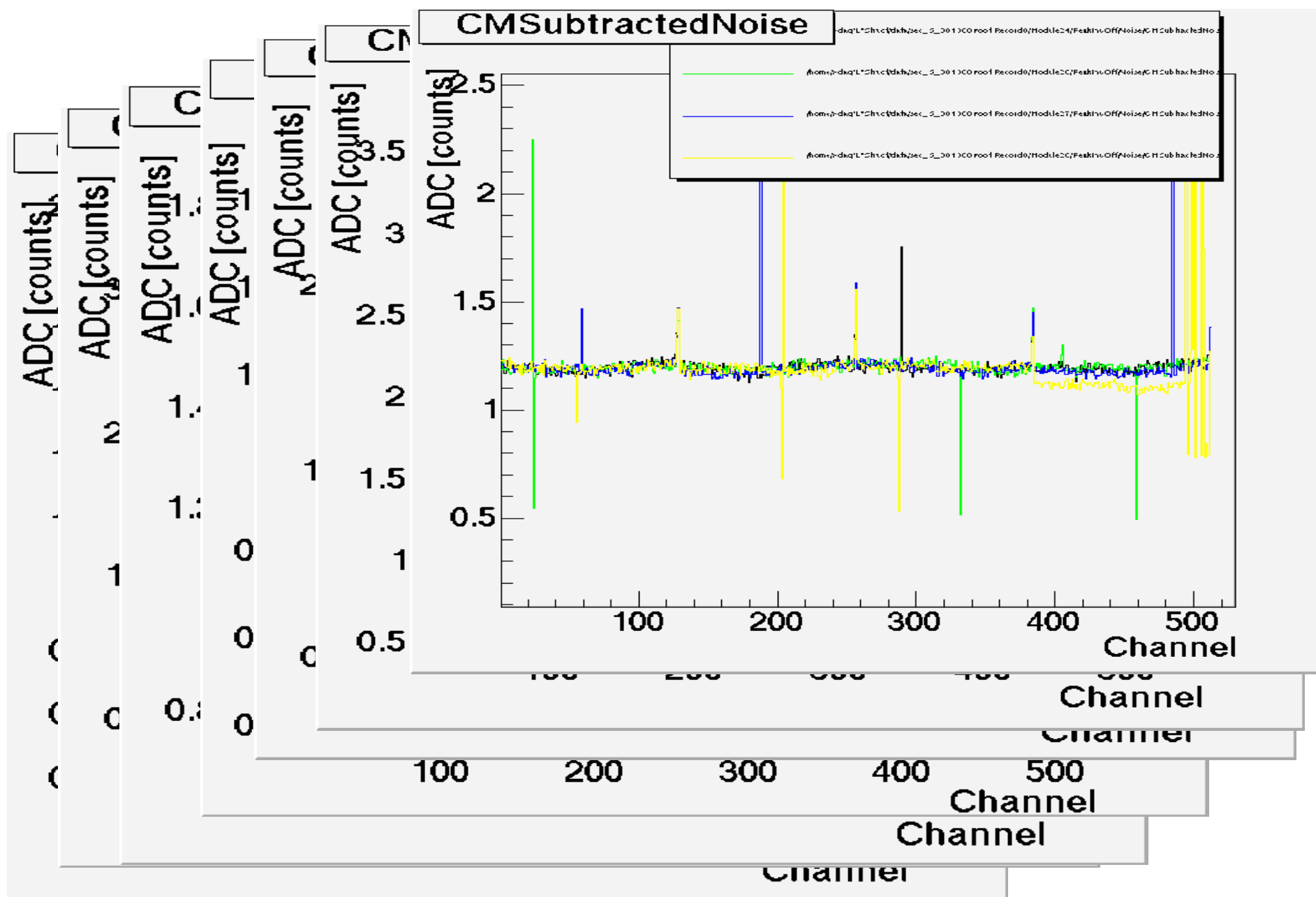
Bad channels should be masked during averaging.

PeakinVOn T=20C HV=400V 28 modules.



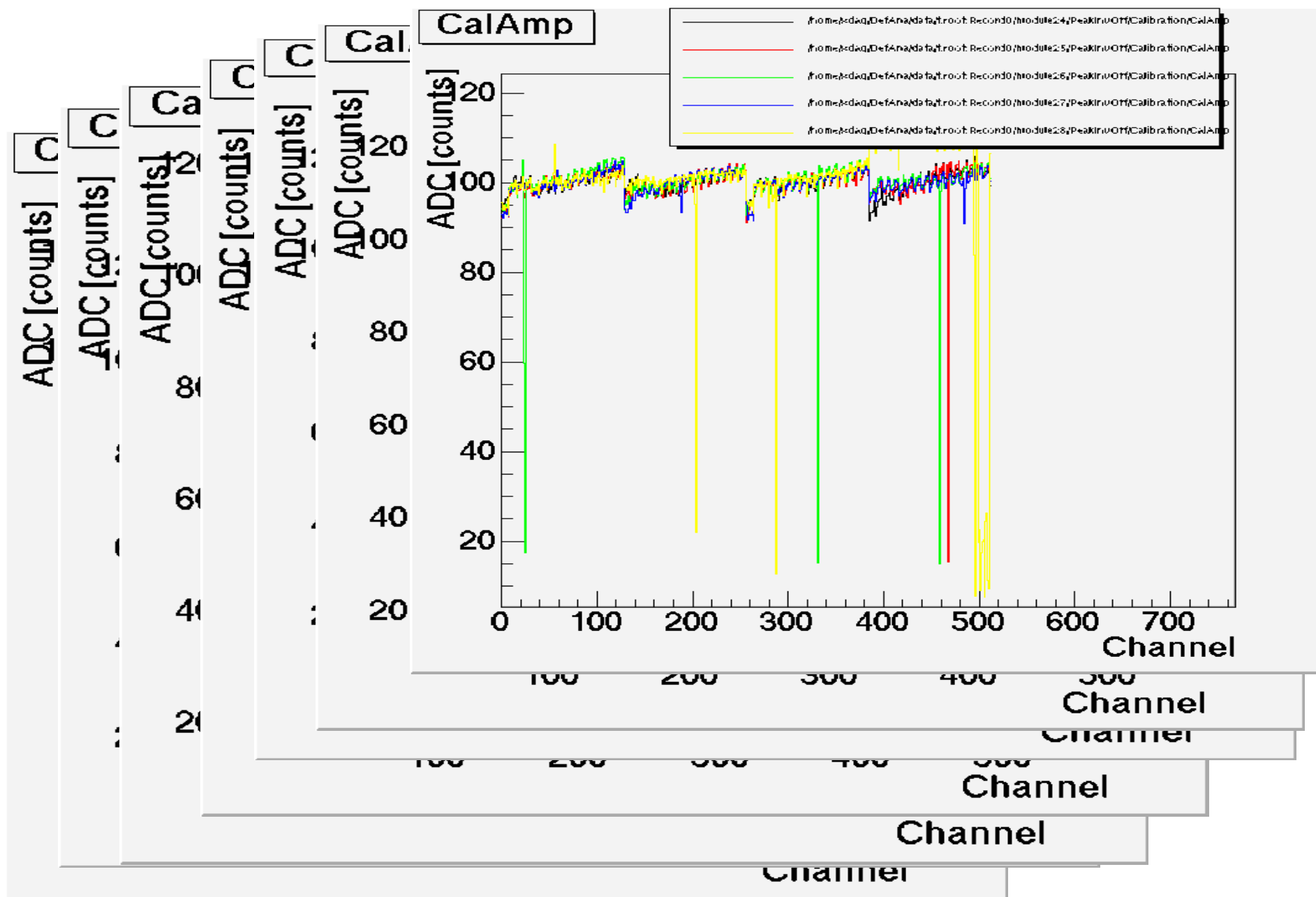
Normalisation and cuts

Can use absolute cuts now for the noise:

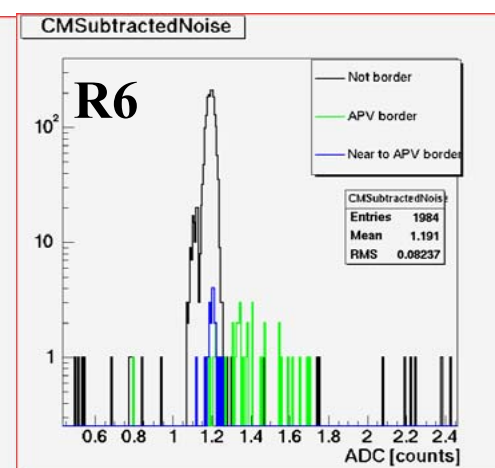
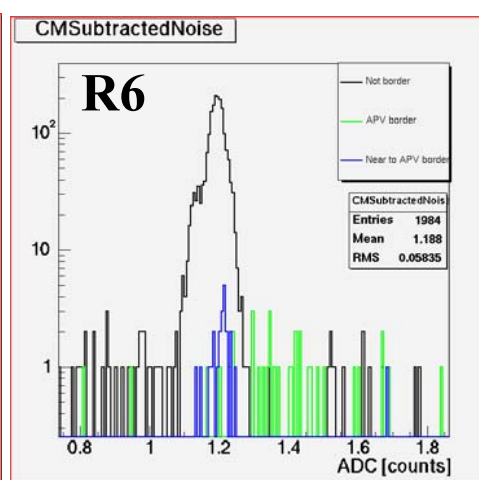
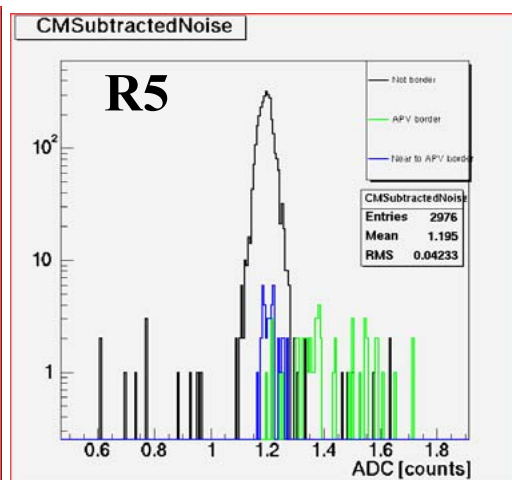
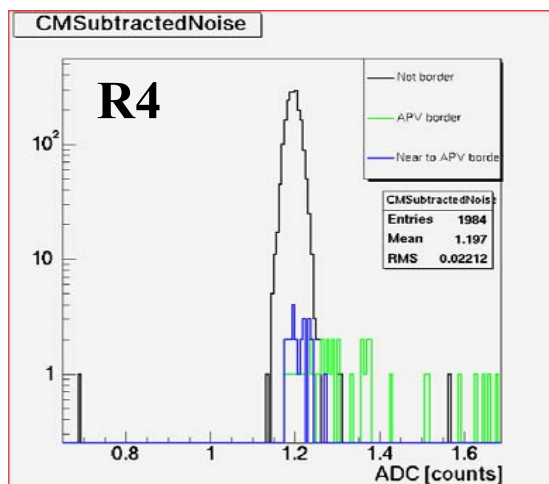
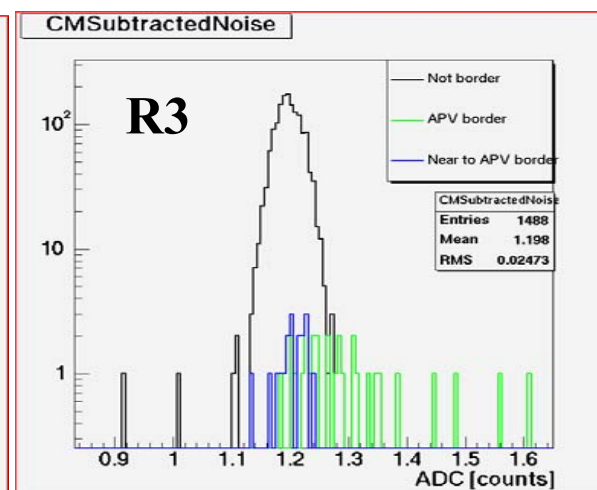
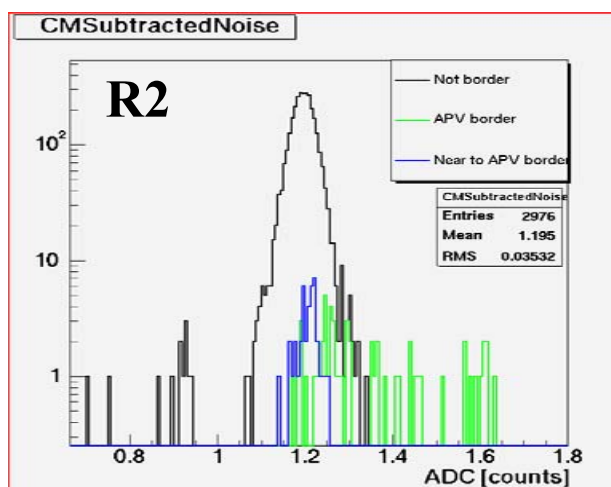
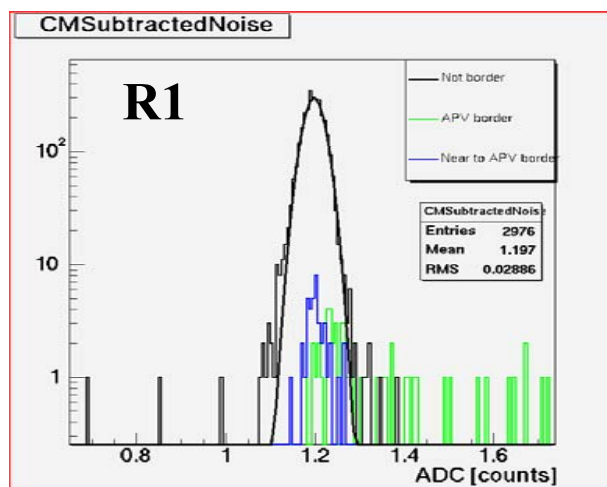


Normalisation and cuts

And calibration:



Bad channels Cuts

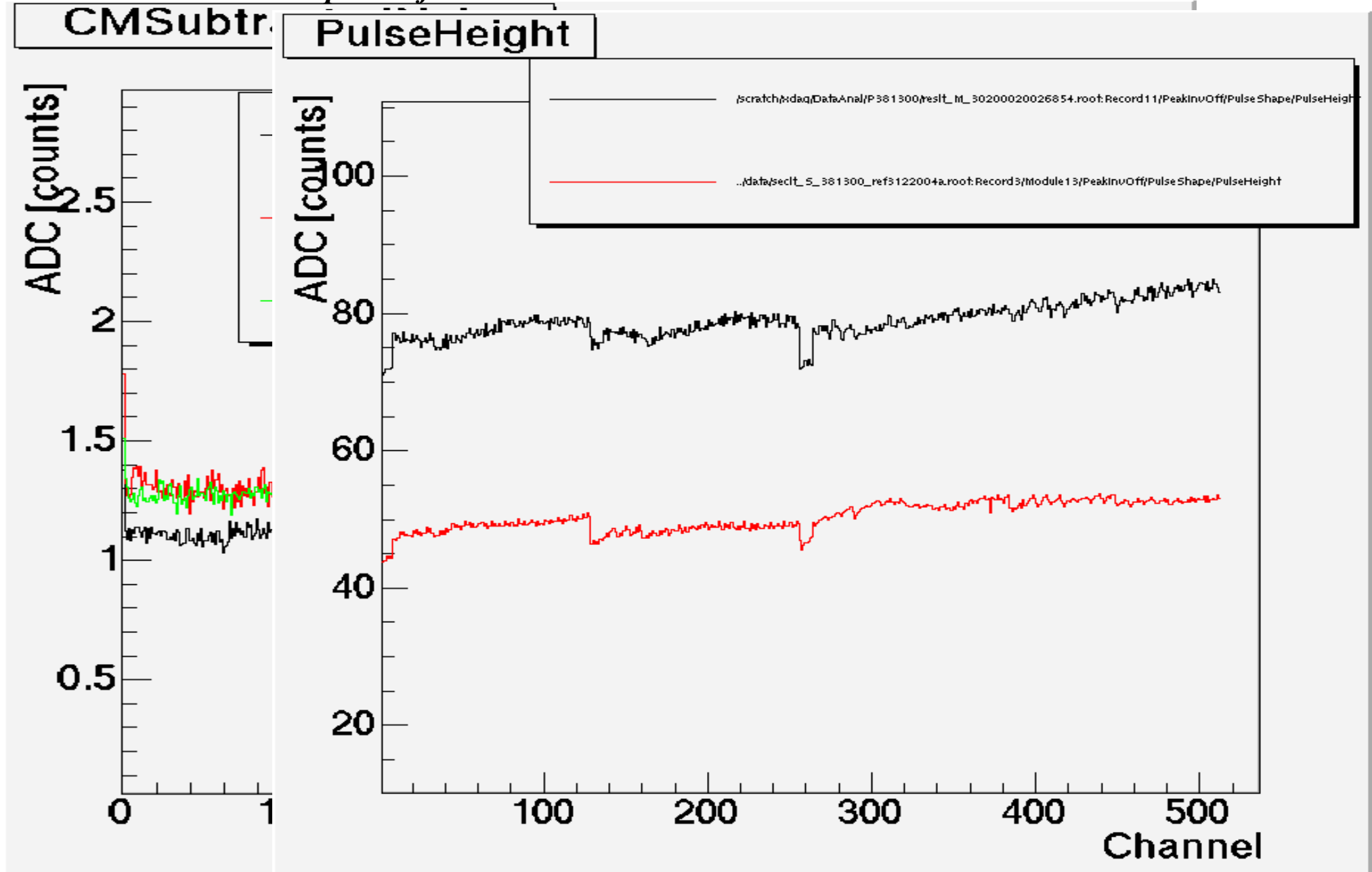


Rms noise peakinvoff HV=400V
5 sigma cut may work for noise
and calibration.

*Preliminar list of cuts
(based on one petal) is
available*

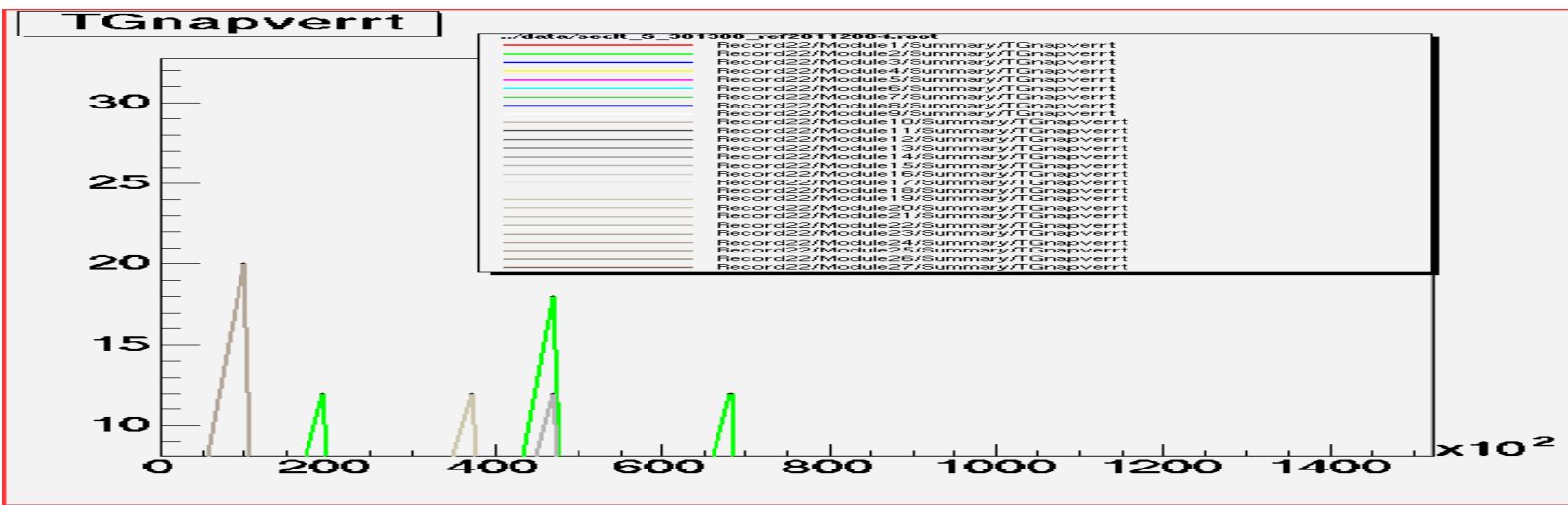
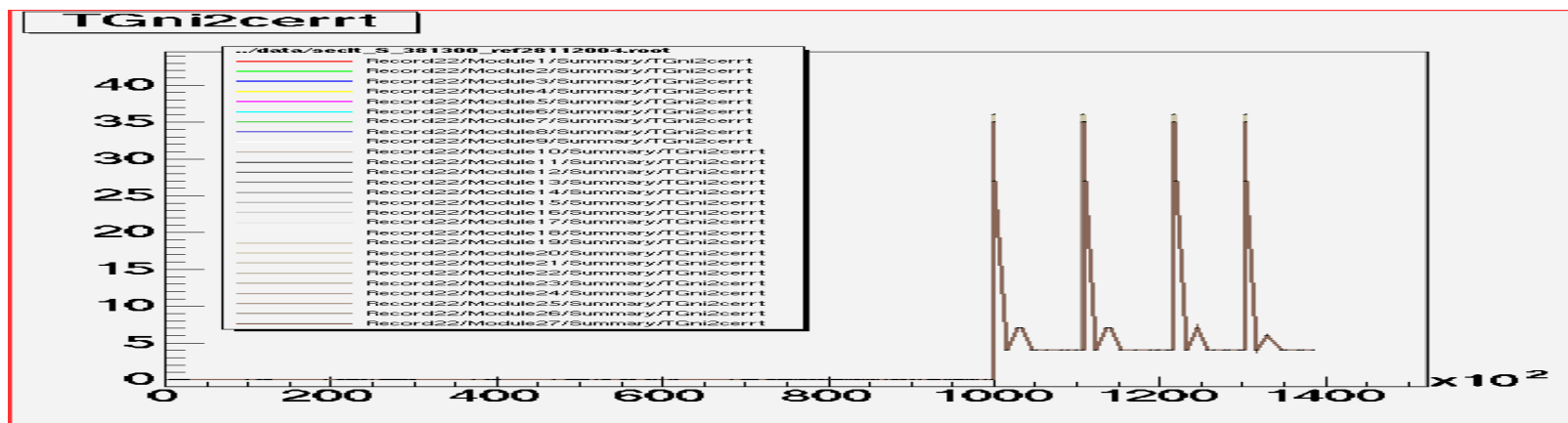
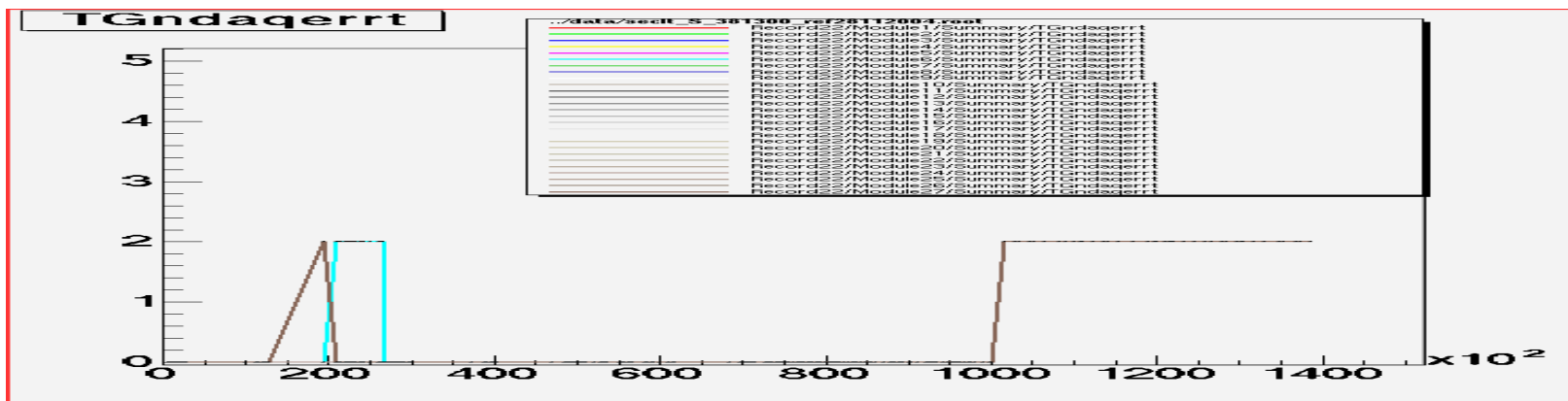
Comparison of ARC, Lt and LtStruct

R4 module tested in ARC, Lt and on the Petal, HV=400V , warm
here another calamp used for Lt.



Errors

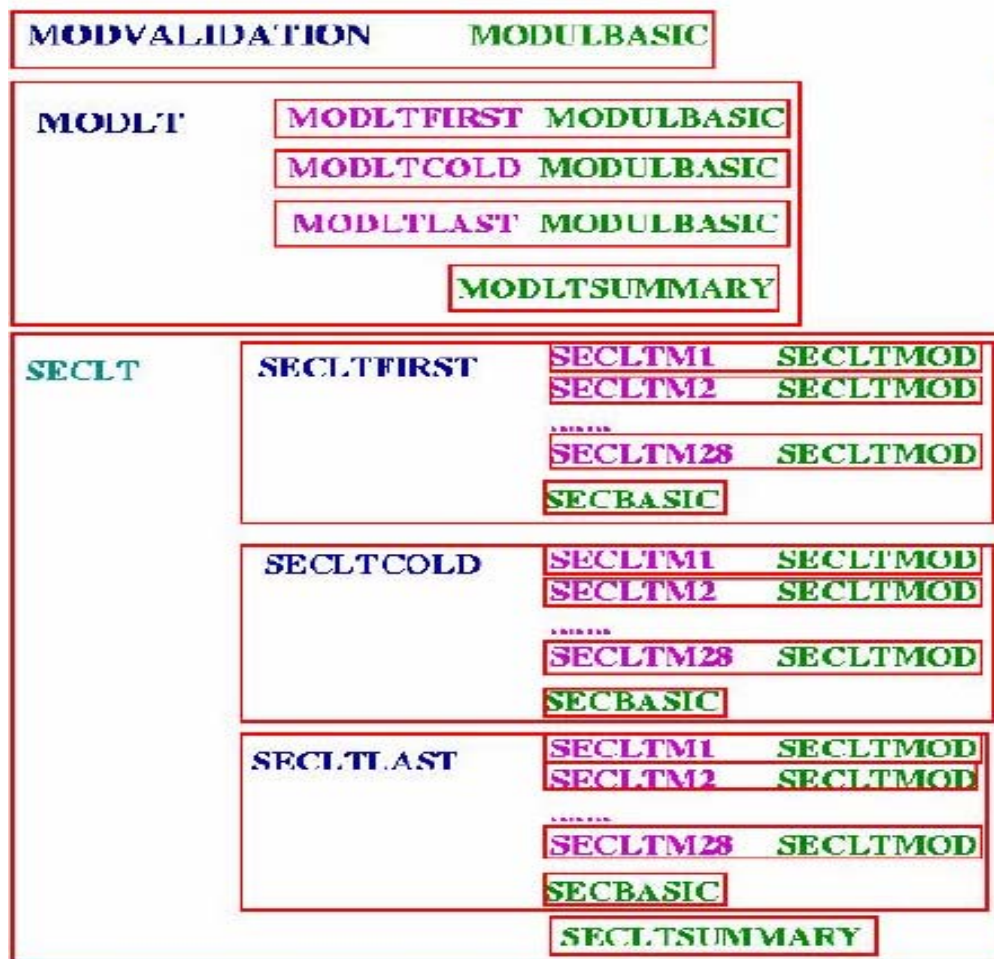
Nerrors per or 'bad' run test: *i2c(acknowledg)* , *daq(no header)*, *apv(bad address)*



DataBase XML file

Analysed data can be parsed from the ROOT file into XML template: *seclt.xml* using standalone DefectAnalyser.

Template can be finalized with existing data.



actions:

basic
 composite 1
 composite 2
 composite 3

Relations between
 modvalidation, Lt and
 LtStruct xl templates

Only 3 Records used for parsing
 tagged in scenario:

....
SaveRec 1 SECLTFIRST

...
SaveRec 2 SECLTCOLD

....
SaveRec 5 SECLTLAST

....

Conclusion

Summary:

Petals assembly and LongTerm setups are functioning and ready to assemble and test ~one petal/week per Integration Center.

To do:

- Further optimisation of selection criteria and Db actions
- Individual IV curves with HV switch matrix.
- Heating in the fridge for faster Tcycling
- Optimize stored variables, size of the ROOT file

Problems under investigation:

- daq stability: ccu ring stability, fed stability(in multified operation)
- temperature stability CoolingPlant+Fridge: critical since AOH is very sensitive
- assurance of good optocontact during assembly.