

# Module Qualification with CMS system

*How to define bad channel?*

*Using noise, calibration measurements*

*Experience with TEC module :*

*test setup, soft, analyzing tools*

*Database and analysing tools*

*Local Db, Db action tables*

# Test Setup

**Hardware: CMS System**

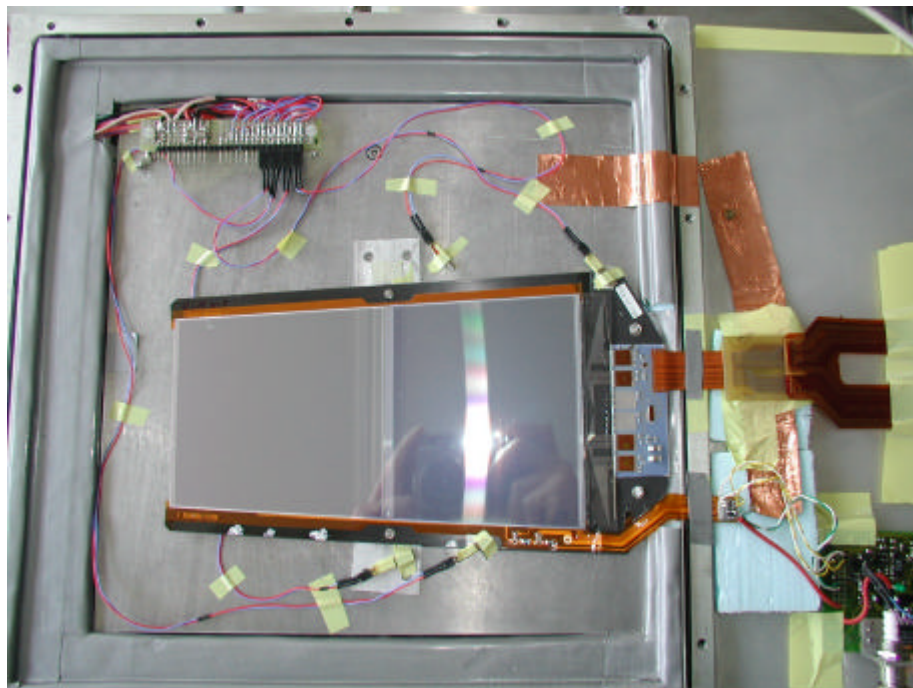
Small cold box

APV readout: FED, TCS, FEC

SlowCtrl: TRHX, CIO

**Tested module: TEC (Aachen)**

CMS like mounting



**Software: ModuleTest**

Test Procedure: Scenario

Module qualification

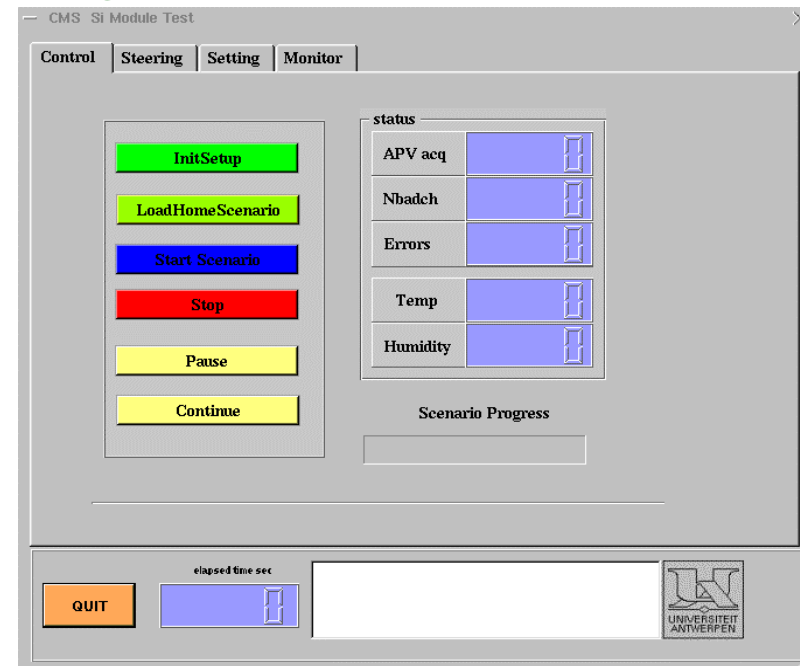
Module Longterm

Apvmode: peak, dec, inv

HV: On/Off

Cooling: Room/Cold(-20C)

PedRun  
CalRun  
CalProfRun  
LatRun  
BackPlane  
IVRun ..



# “Bad” channels definition

*proposed*

$$|pedestal(i) - ped| > Thr * ? ? ped$$

$$|rms(i) - rms| > Thr * ? ? rms$$

$$|cal(i) - cal| > Thr * ? ? cal).....$$

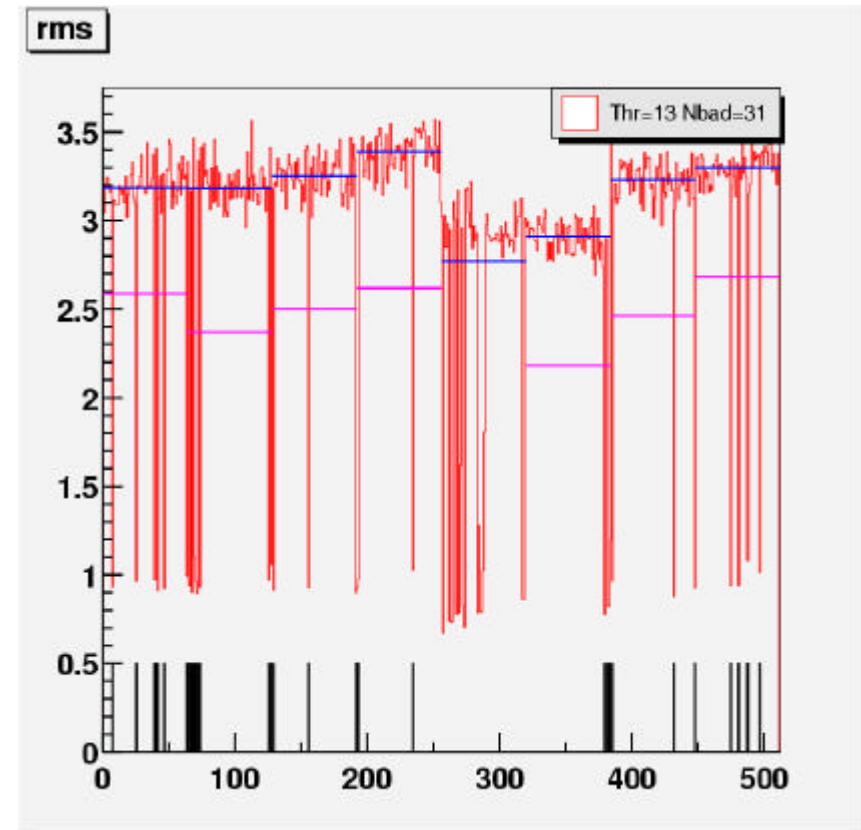
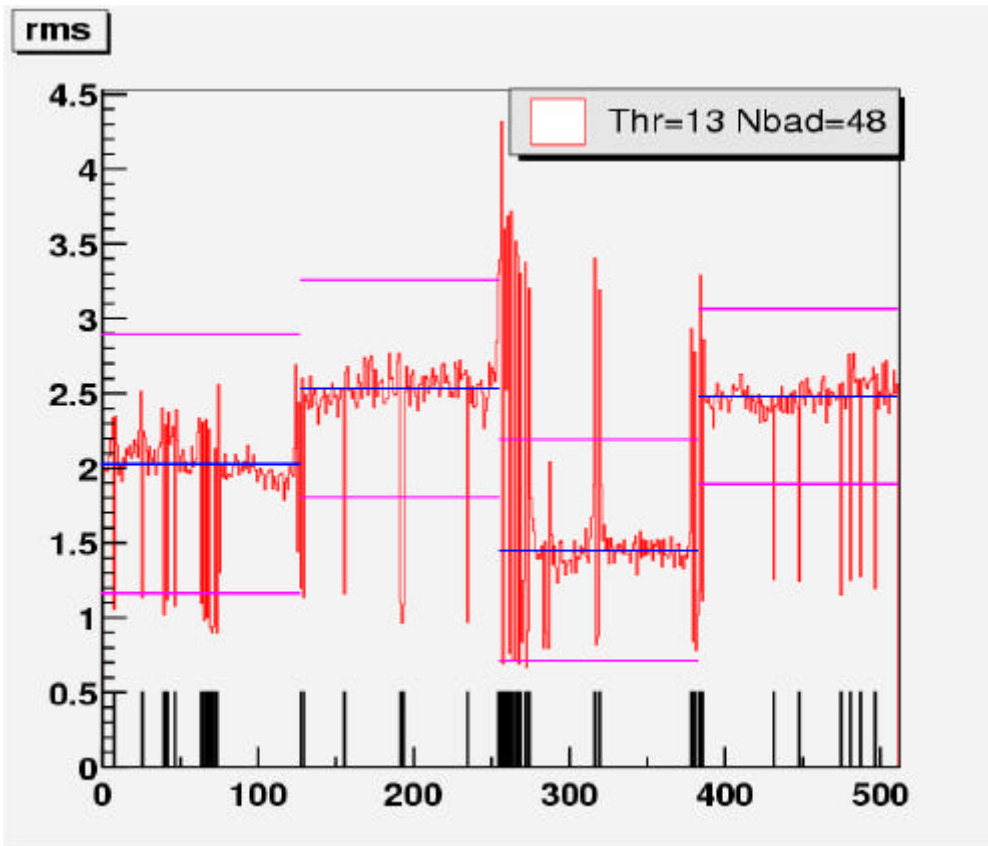
*RMS/Cal accuracy & uniformity ?*

*Dependence on settings ?*

*Uniformity -> has to be studied*

Apvmode=37, T=-20C HV=100V, <rms>(128)

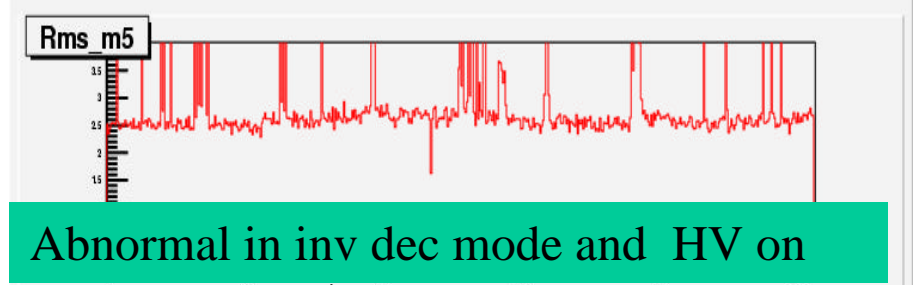
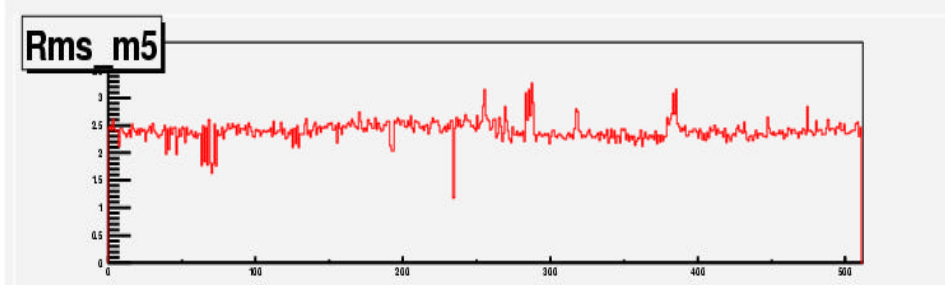
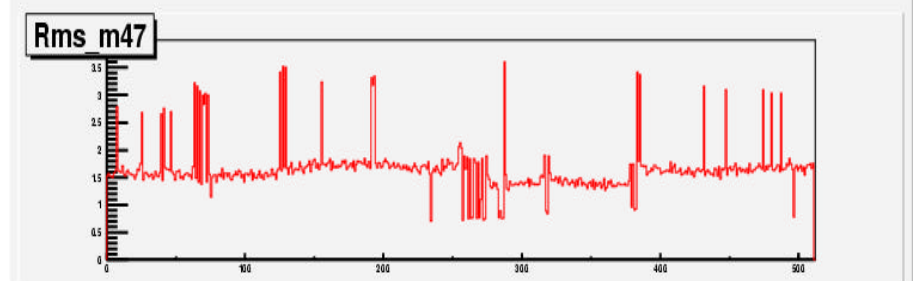
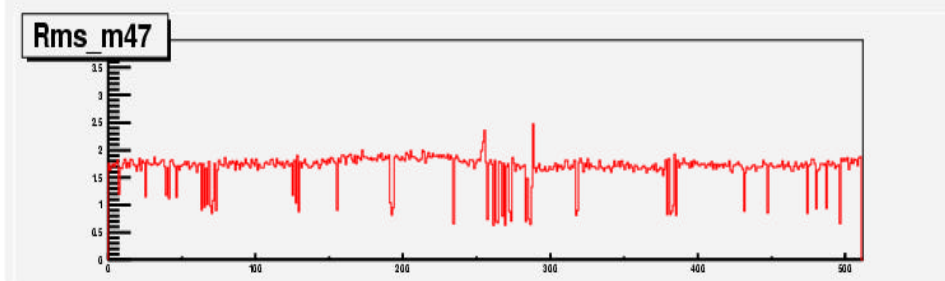
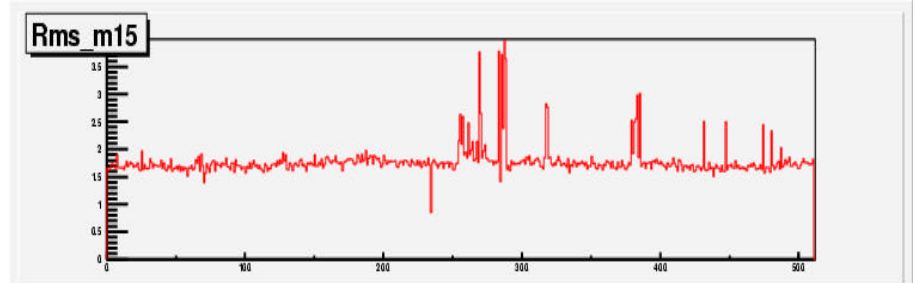
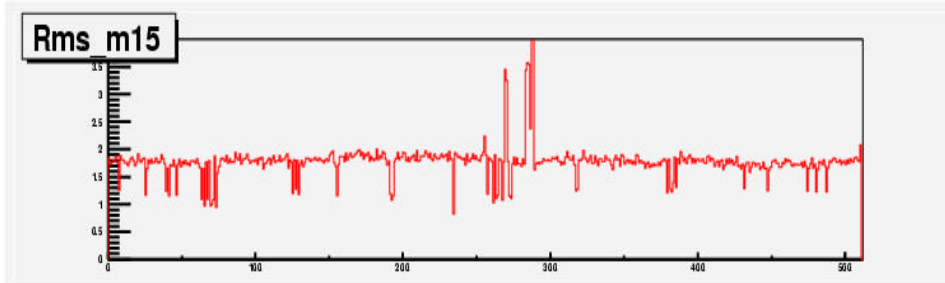
Mode=37, T=-20C HV=0V, <rms>(64)



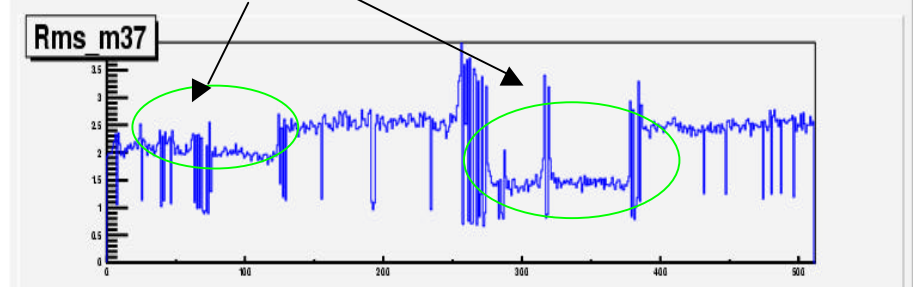
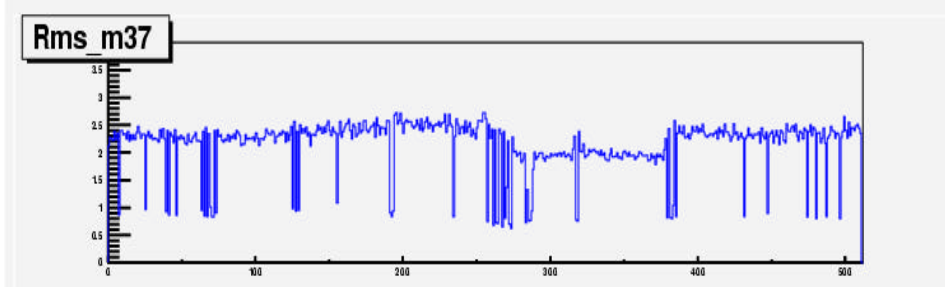
# RMS noise

*Different apv mode HV=100V T=20C*

*cold T=-20C*



Abnormal in inv dec mode and HV on

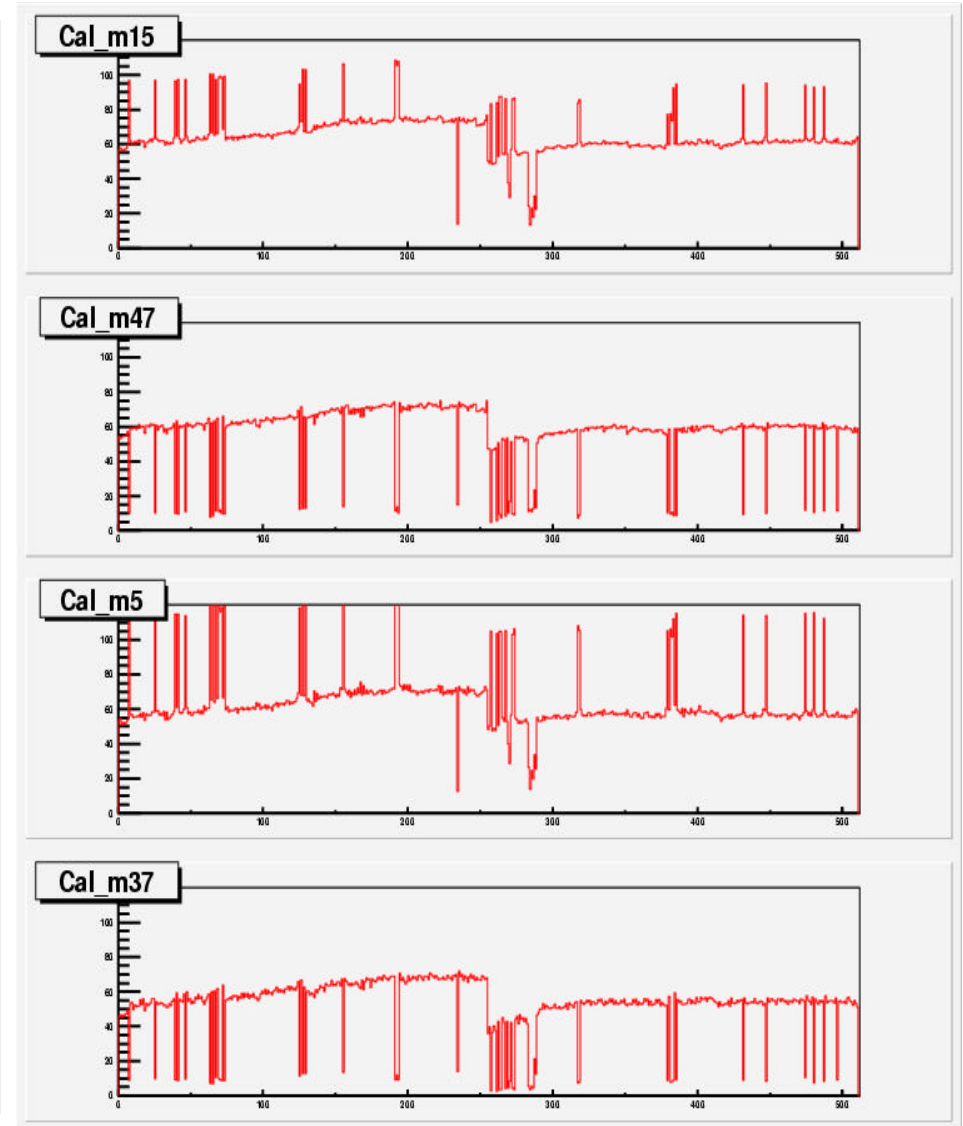
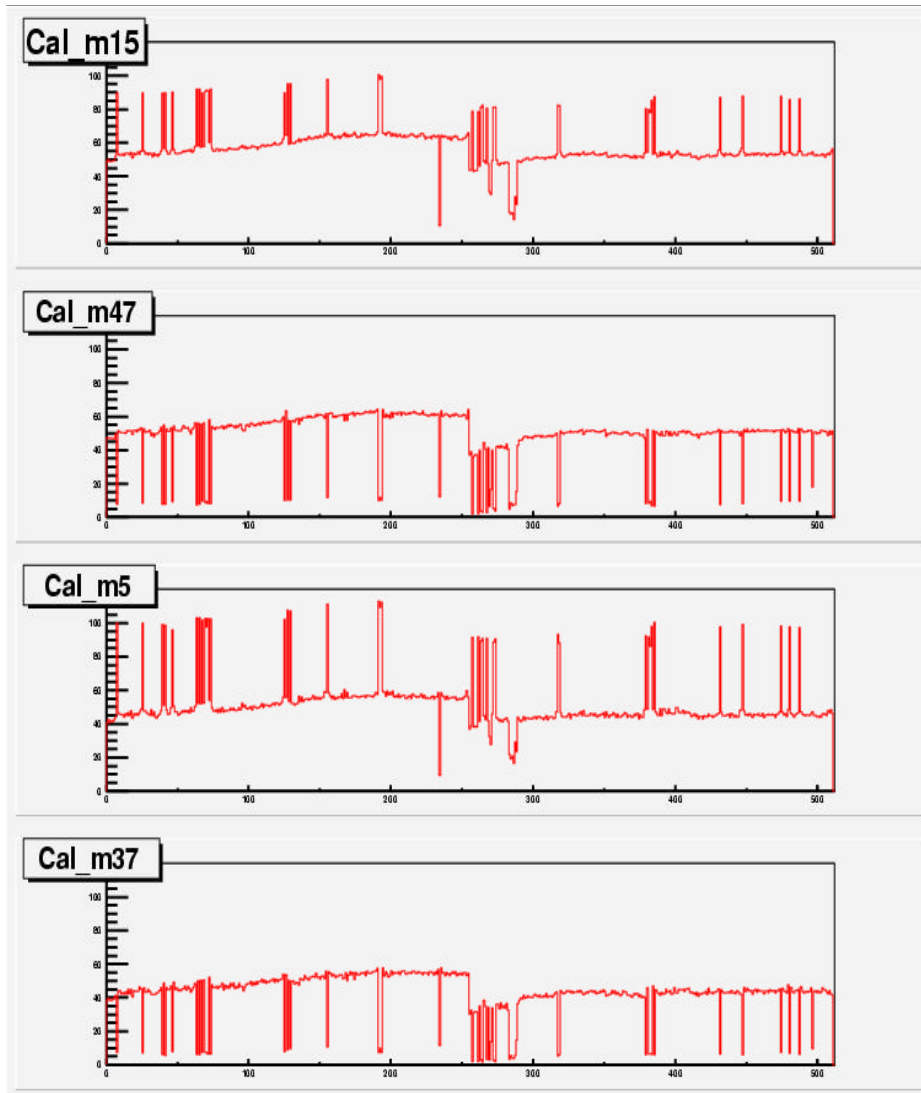


# Calibration

*Max Amplitude of CalProfile (best at HV=0)*

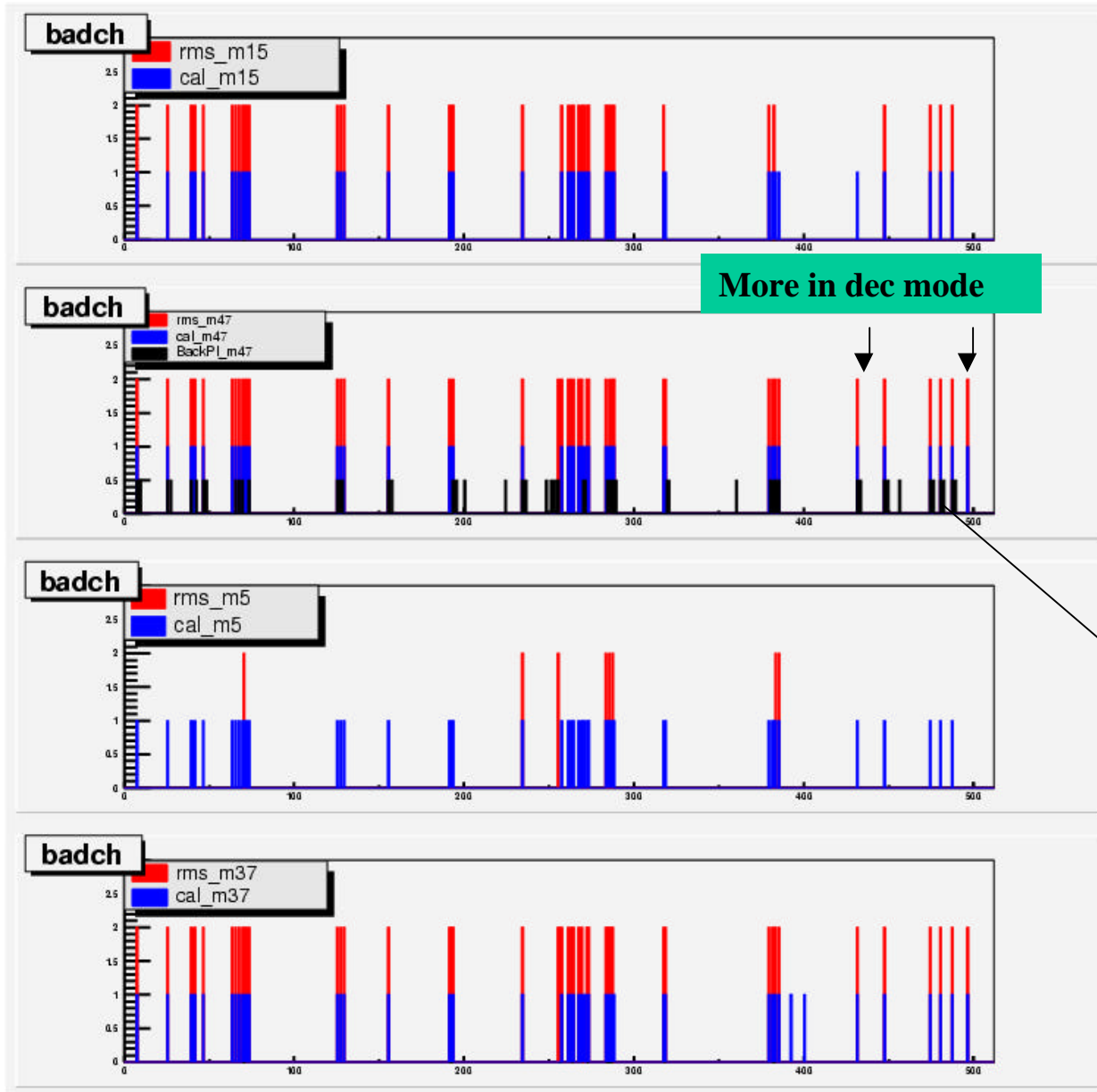
*Different apv mode HV=0V T=20C*

*T=-20C*



# “Bad” channels

$T=20C$ ,  $HV=100V$



*Bad channels masks from rms and calprof in different modes.*

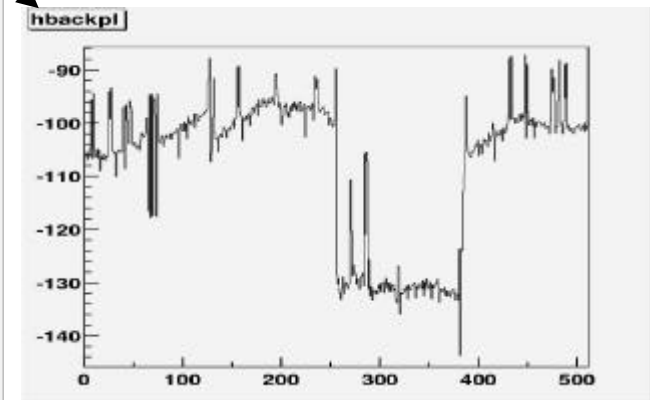
*Fixed Thresholds:*

$Thr_{rms}=15$

$Thr_{cal}=10$

$Thr_{backpl}=4$

*backPlane pulsing*



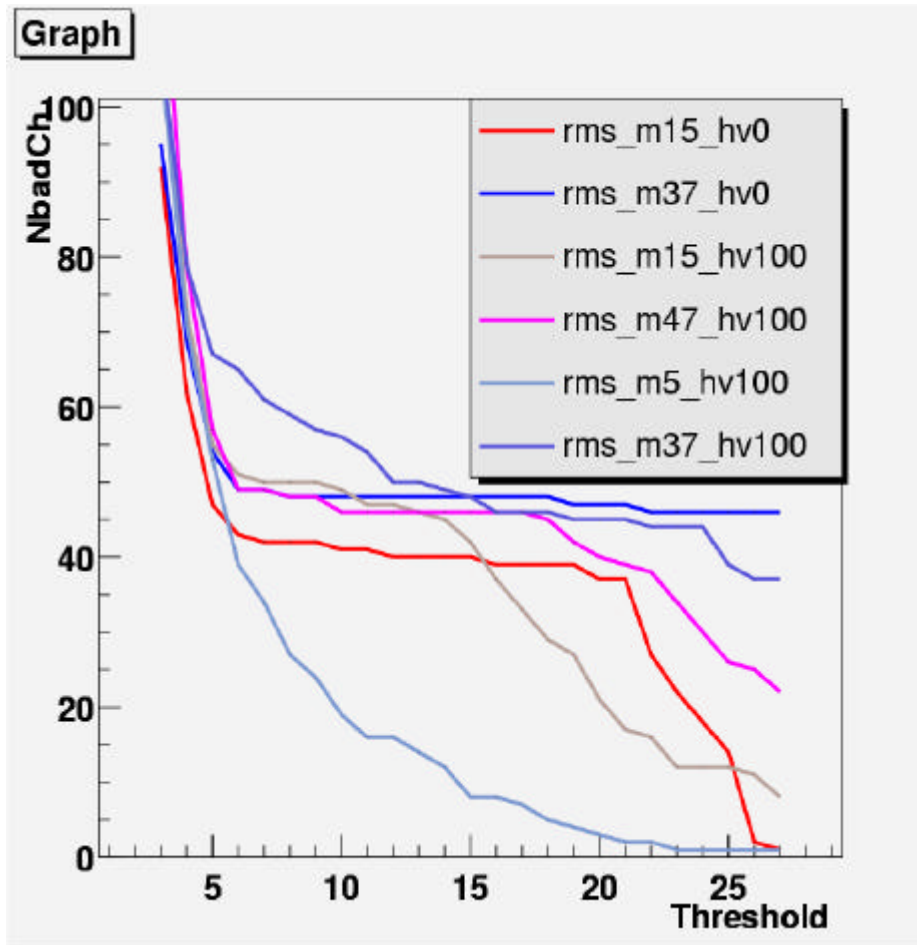
# Thresholds (1)

*N “bad” channels vs Threshold T=room*

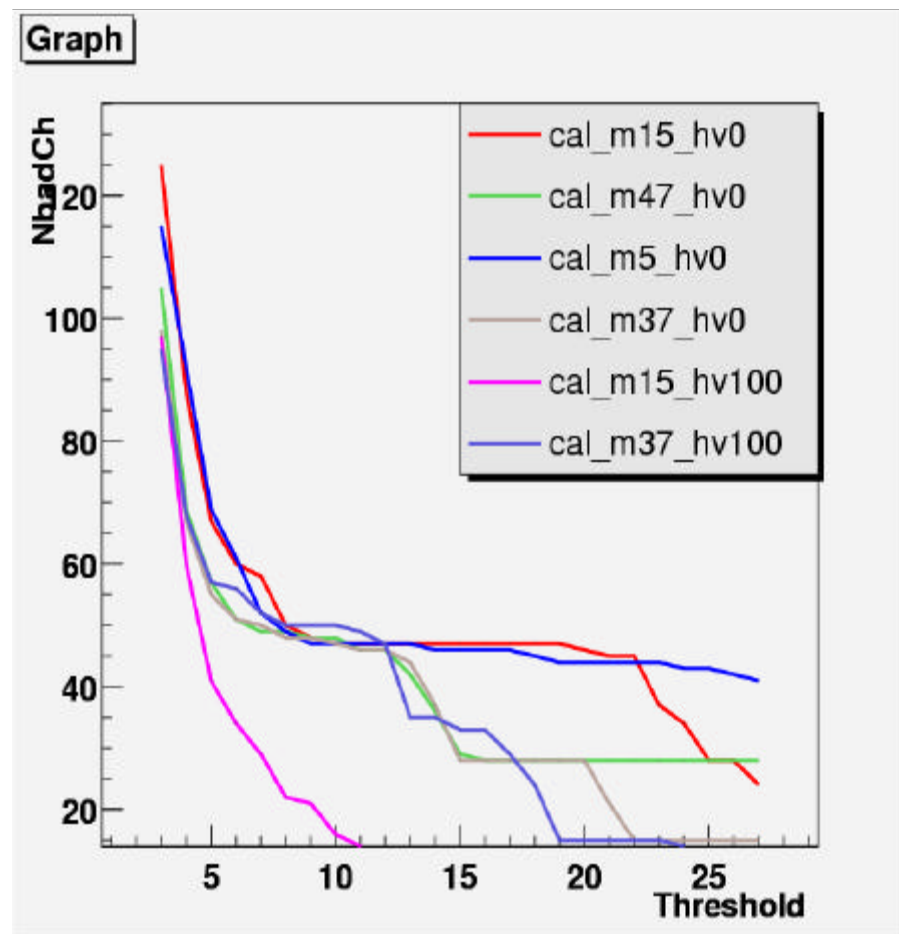
*Different Apv mode, HV(0/100V)*

*Biggest plateau in peak/dec, HV=0, but more bad strips in dec mode!*

*Rms noise T=room*



*Calibration Profile Amplitude T=room*



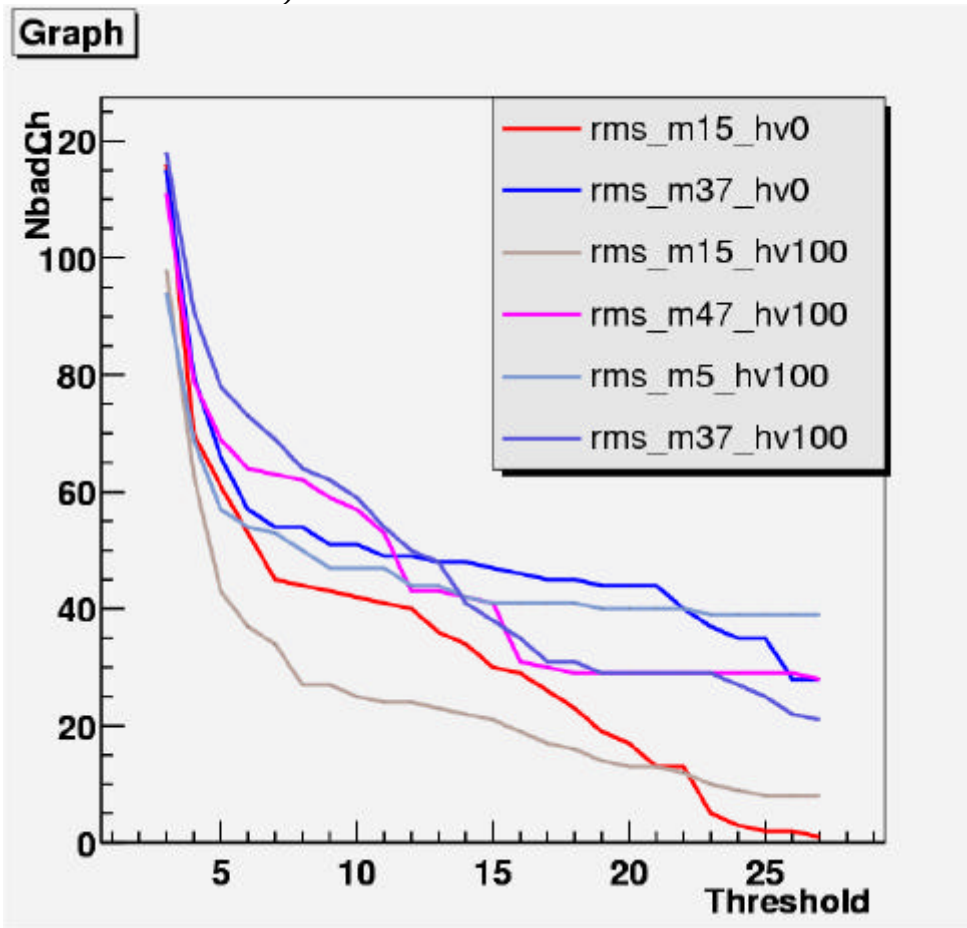
# Thresholds (2)

*N “bad” channels vs Threshold T=cold*

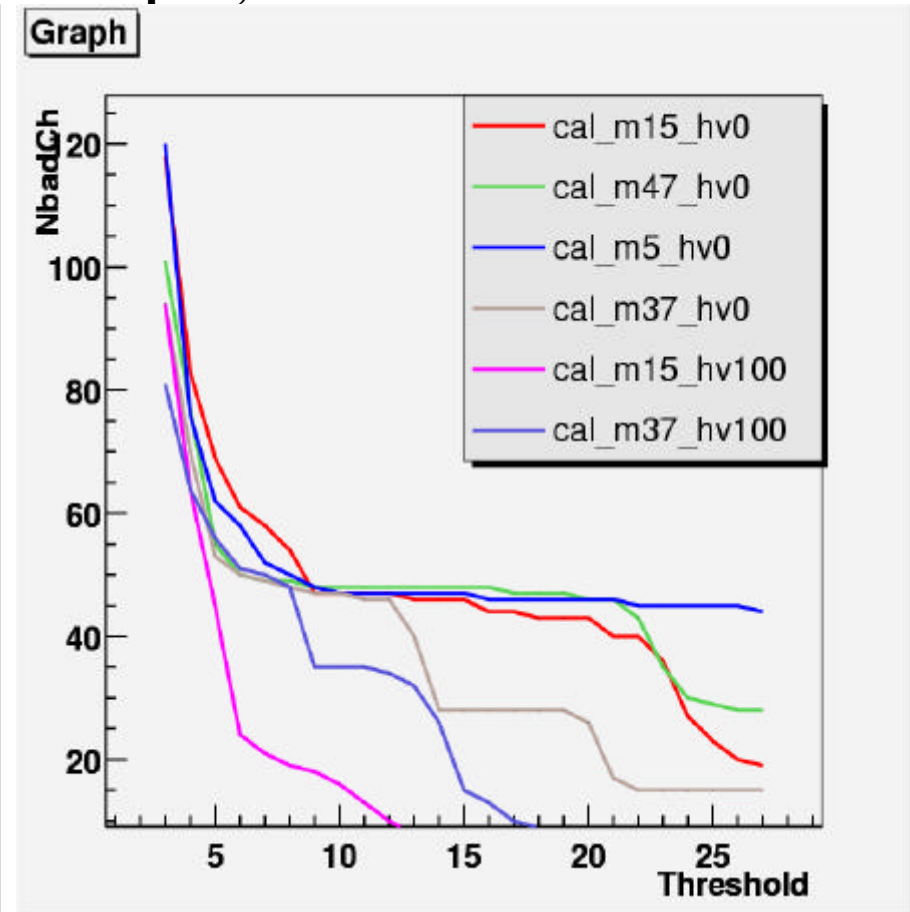
*Rms, CalA distributions depend on temperature!*

*Which are the truly “bad” channels?*

*Rms noise, T=cold*

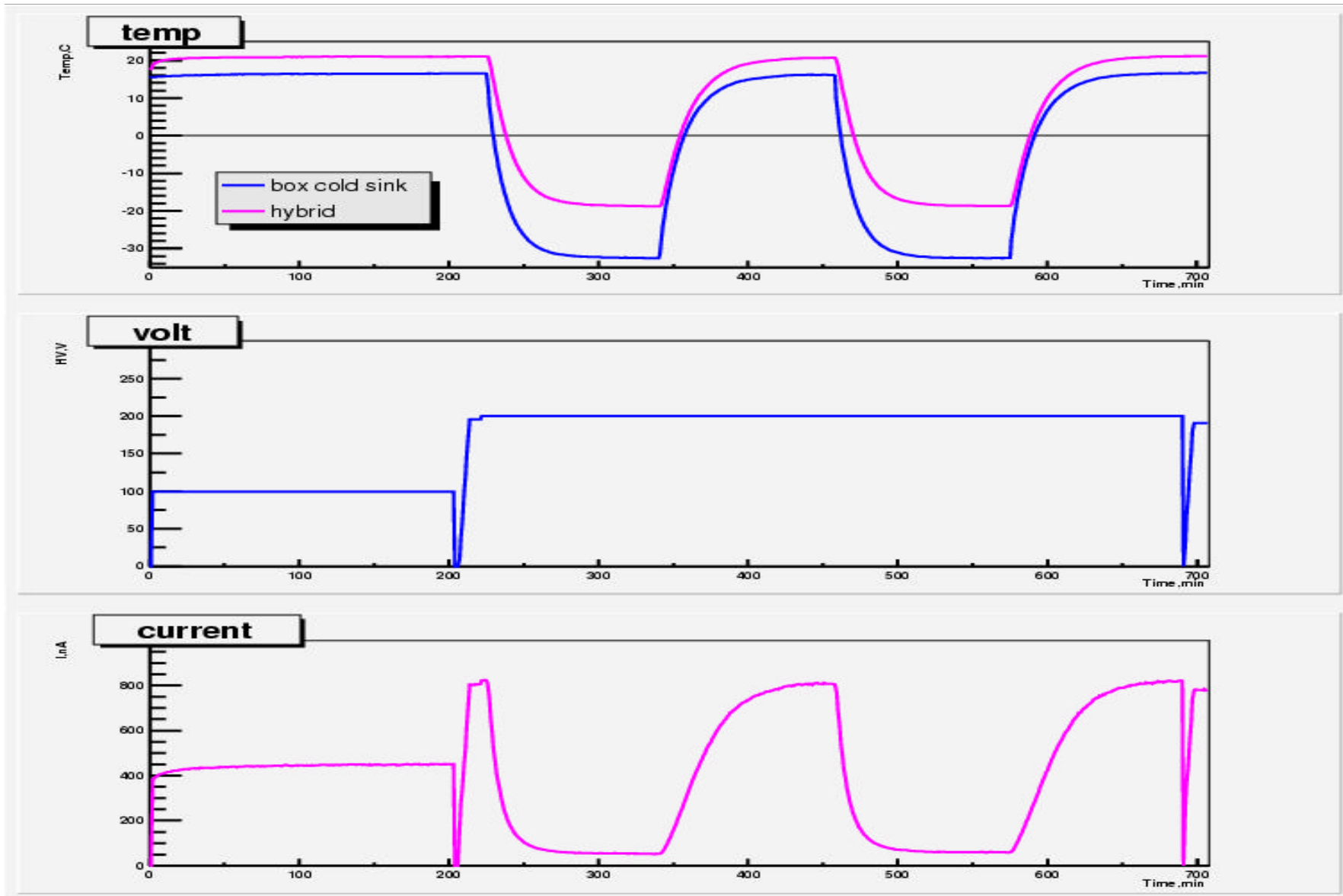


*Calprof, T=cold*



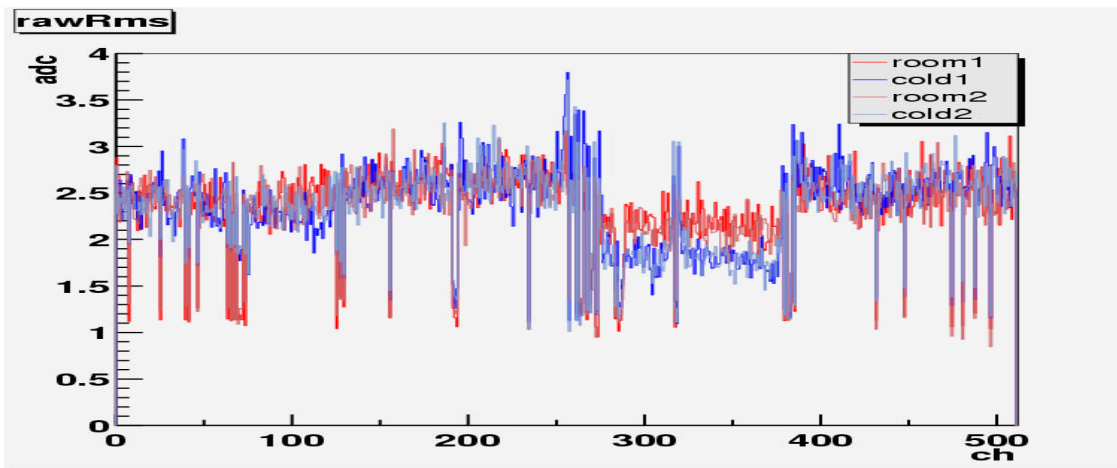
# Long Term test (1)

*LongTerm Scenario: Thermocycling (one cycle ~3h), dry air RH~<5%*

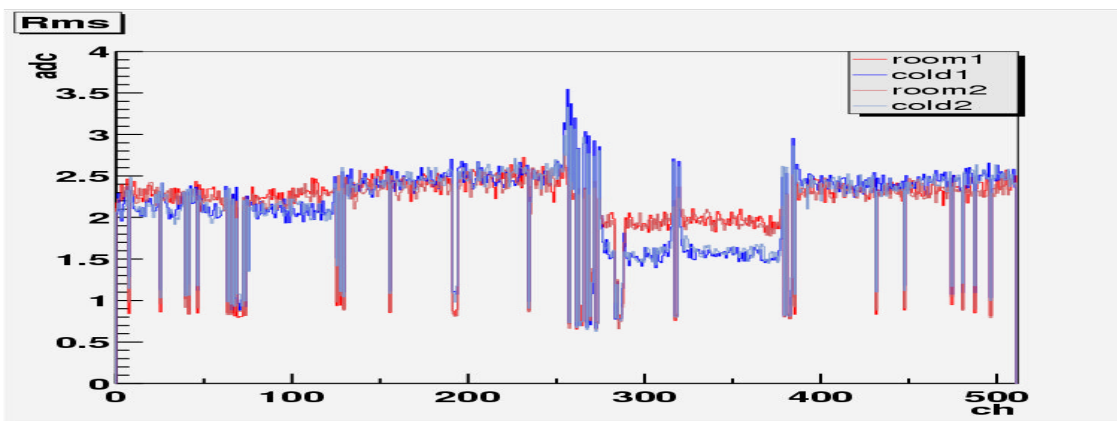


# Long Term test (2)

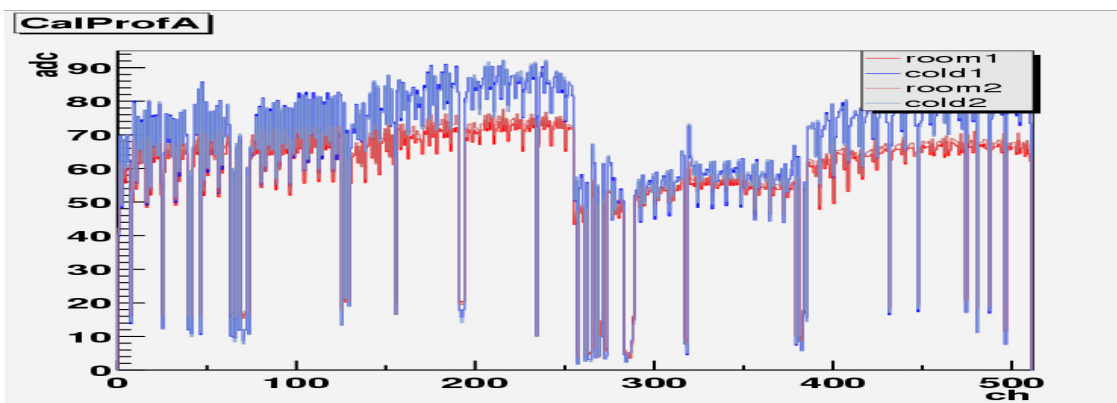
Apvmode=decinv, HV=200V



*RMS and CalA profile during Tcycling(4 points)*



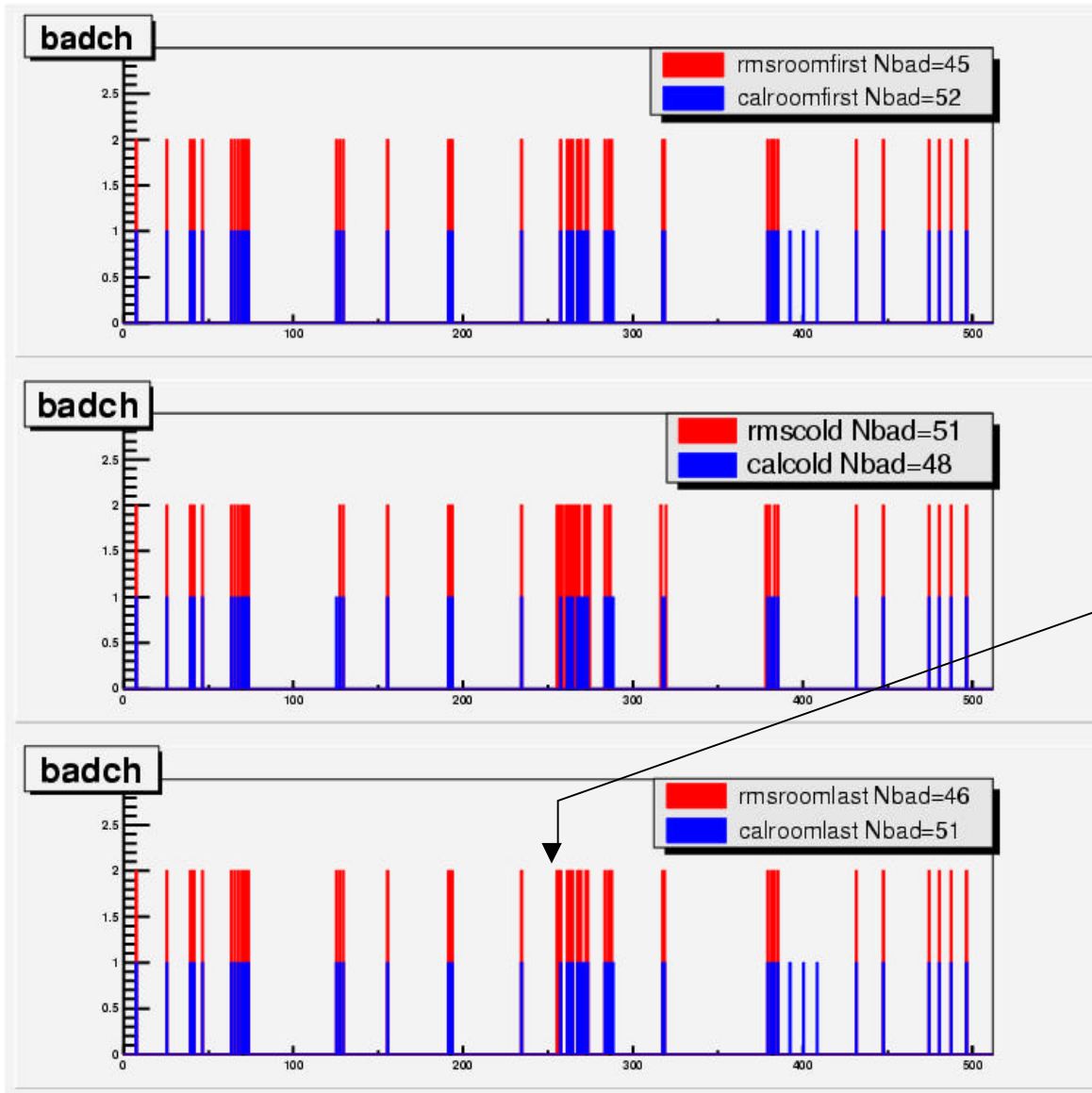
*RawRms and Rms noise are stable and almost the same at the cold and warm operation.*



*The calA is bigger at cold. CalProfile has calA for one Cdrv group less at HV=on.*

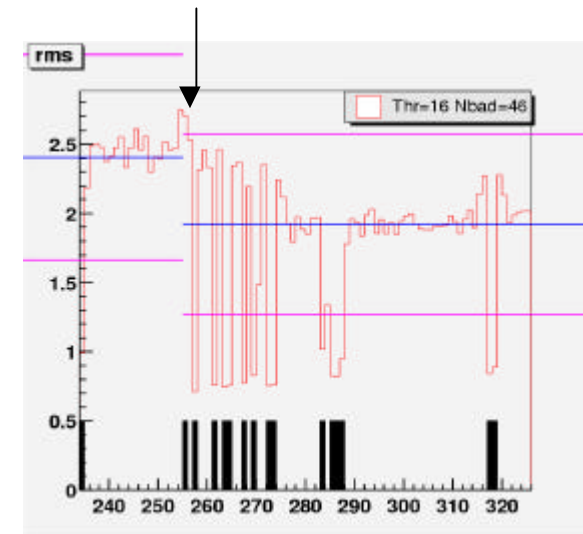
# Long Term test (3)

## Evolution of "bad" channels (fixed thresholds)



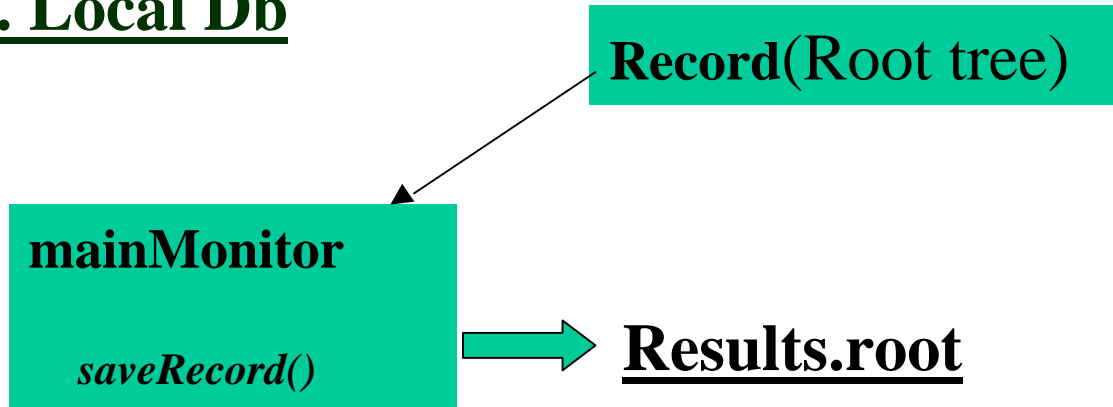
*No new real 'bad' channels after 10 Tcycles*

*One extra channel on the chip edge due to rms/cmn calculation accuracy*



# Database and analyzing tools (1)

## 1. Local Db



Data from all tests:  
*Int\_t, Float\_t, TH1F\*,  
 TGraph ...*

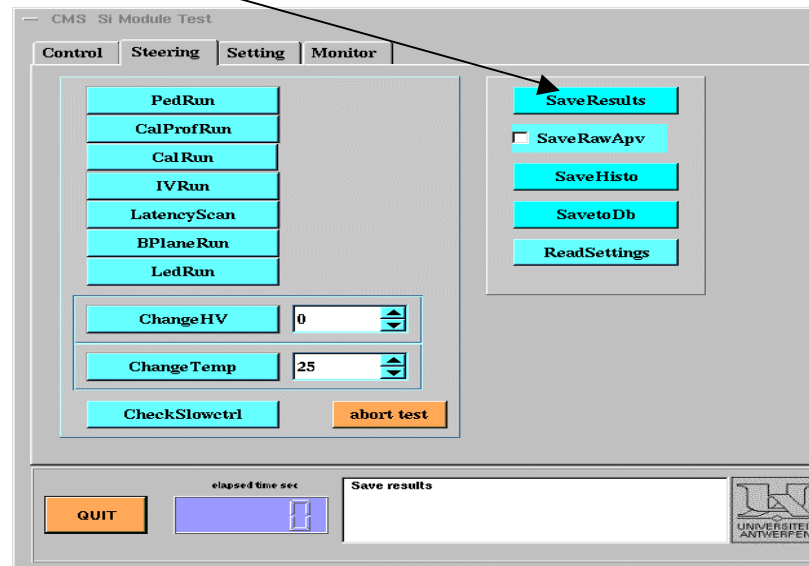
```
Class Record: TObject{
private:
Int_t ev;
Float_t timestart;
TObjArray*theOAHyb;
TObjArray* theOASensor;...

public:
void setev(Int_t); ...
```

Save Record many times from Scenario or button

### Scenario

- 1 Start
- 10 PedRun
- 20 Save
- 30 CalRun
- 40 Save
- .....



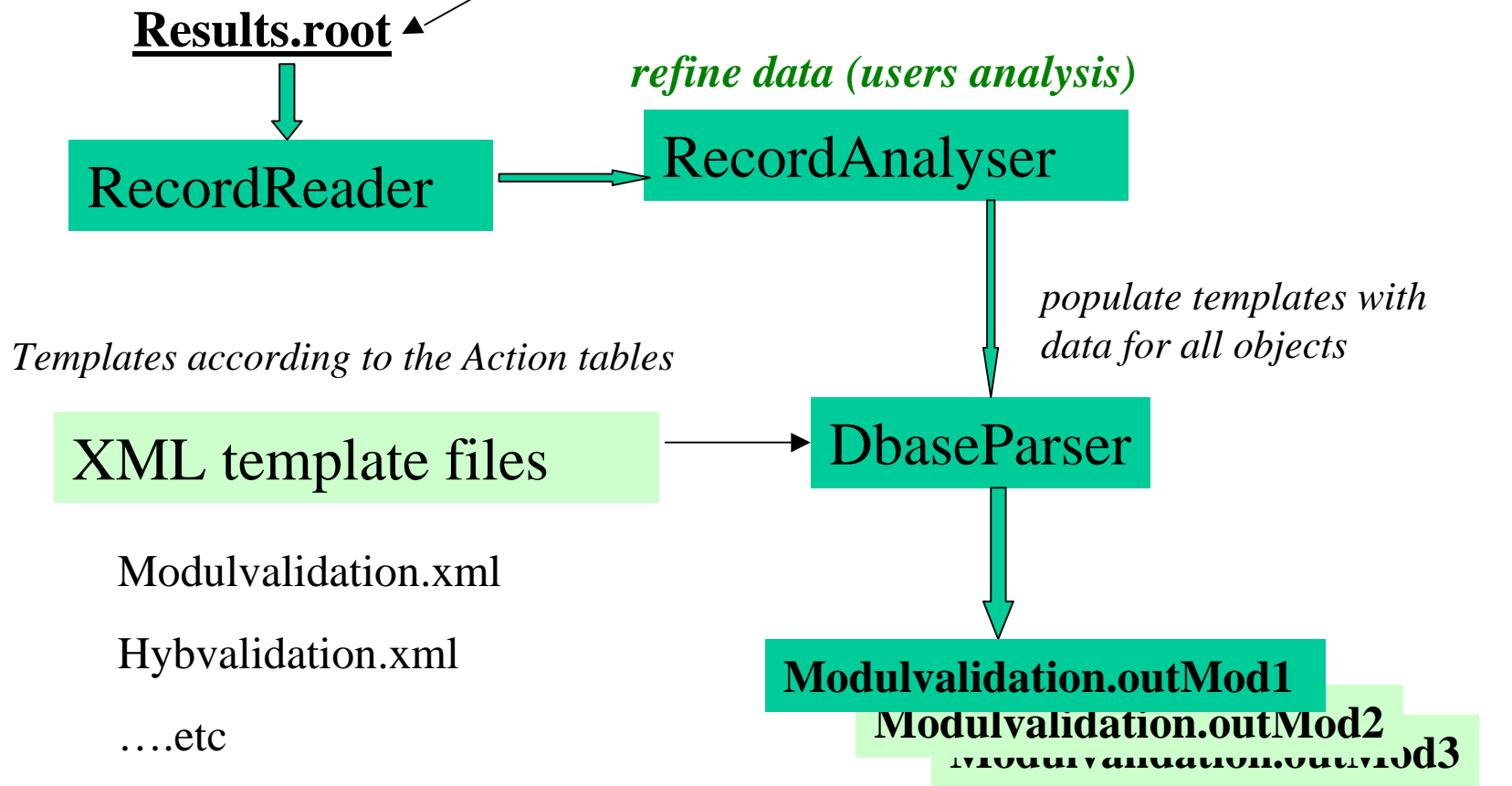
# Database and analyzing tools (2)

## 2. Central Db

*We can write Db xml file:*

*1) from the local DB*

*2) directly from the mainMonitor button*



*\*.xml files ready to send to the central Db*

## Database and analyzing tools (3)

### Example analysis and parsing to xml

( *standalone or root macro*):

```
RecordReader* reader=new RecordReader("results.root");
vector<int> modid=reader->ModId();
RecordAnalyser* recanal=new RecordAnalyser();
DbParser* parser=new DbParser("MODVALIDATION.XML");
if(reader->nextRecord())
for(int i=0;i<modid.size();i++) {
parser->populate(modid[i],recanal->Analyze() );
parser->write(); }
delete parser;
delete reader;
```

Tools are available from Antwerpen cvs

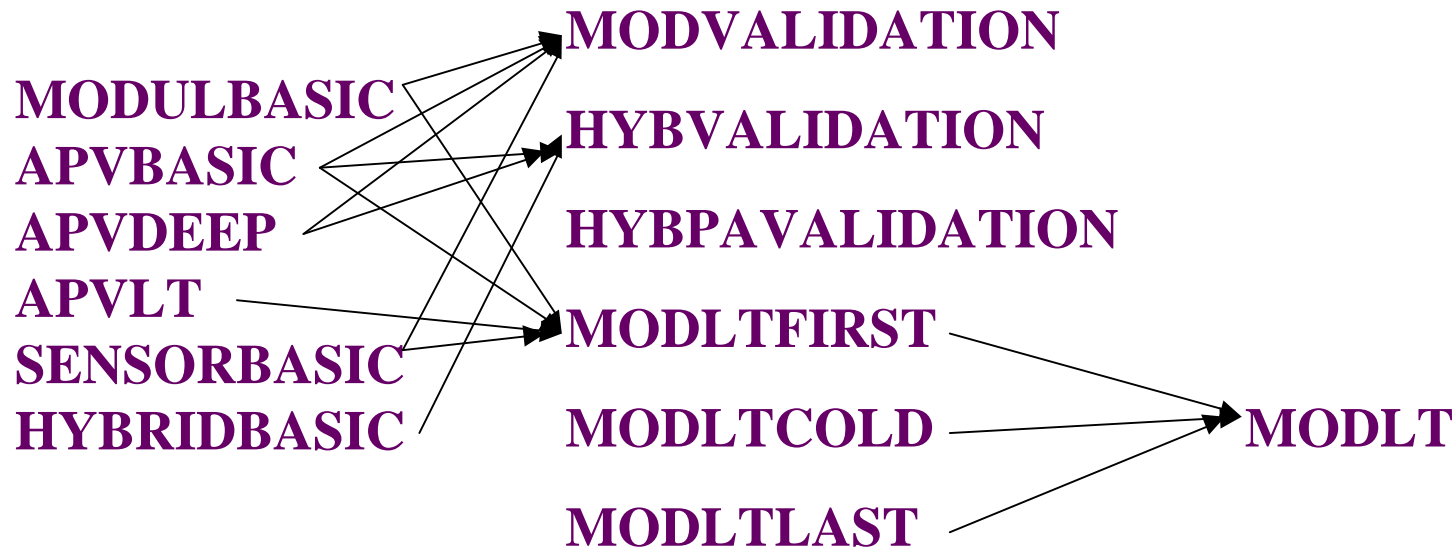
# Db Actions (1)

Hybrid/Module qualification, Longterm with CMS system

**Basic actions:**

**Composite1:**

**Composite2:**



*(Also version with only 1 composite)*

**More details: [//hep.uia.ac.be/cms/testing/](http://hep.uia.ac.be/cms/testing/)**

# Db Actions (2)

*These basic actions contain summary information: status, Grade, environment, conditions,etc*

**MODULBASIC**

**SENSORBASIC**

**HYBRIDBASIC**

**HYBPARIDBASIC**

```
<action>
<action_descriptor input_id='111'
name="MODULBASIC" object_name="MOD"
version="1" />
<action>
<result name="modulbasic_val" value="" />
<result name="Tdate" value="" />
<result name="tool_id" value="" />
<result name="status" value="" />
<result name="Settings" value="" />
<result name="ModuleGrade" value="" />
<result name="NbadCh" value="" />
<result name="TempExt" value="" /> ...
```

*These contain more detailed info:  
pedestals, calprofiles, flags*

**APVBASIC**

**APVDEEP**



**APVLT**

```
<action>
<result name="pedestal" value="" />
<result name="noise" value="" />....
```

**Settings file:**

**Name of the  
local file with all  
settings**

# summary

- 1. Threshold for the “bad” channels definition depends upon operation settings; apvmode, hv(on/off), temperature. ..**
  -  **Select threshold on the NbadCh plateau (need statistics)**
  -  **Select operation mode for particular test (pedrun, calprof, backplane,etc) to get the largest plateau.**
- 2. Successful operation of the module qualification and longterm tests. All basic tests are implemented.**
- 3. The Database actions are defined and will be committed end of the week. Analyzing tools are provided, data can be stored in the local Db and parsed into xml file for the central Db.**

# Coming soon...

## 1. Speeding up...

*✍ TCP/IP socket OnLine Monitor as a Root session (instead QT plots)*

*✍ Threading of tests and slowcontrol (instead timers)*

## 2. New Functionality...

*✍ PLL, MUX, DCU yes/no tests*

*✍ Module registration and settings files selection*

## 3 More analyzing tools...

*✍ RecordAnalyser template and implementations using ORCA calibration algorithms*

## 4 Check with ARC system