

TOB system test - preliminary results

Description of the setup

Tests performed so far

Thermal measurements

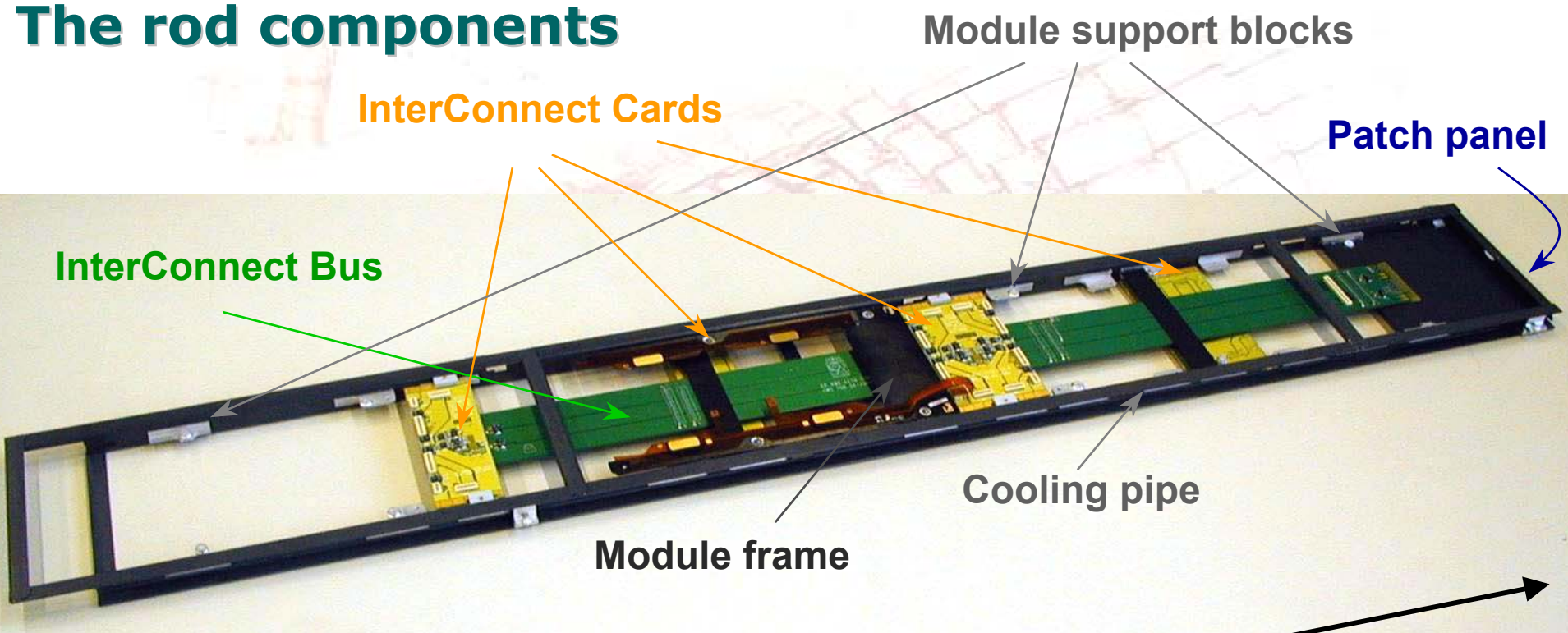
Electrical measurements

Study of noise

Physics signals (β source)

Conclusions and Future plans

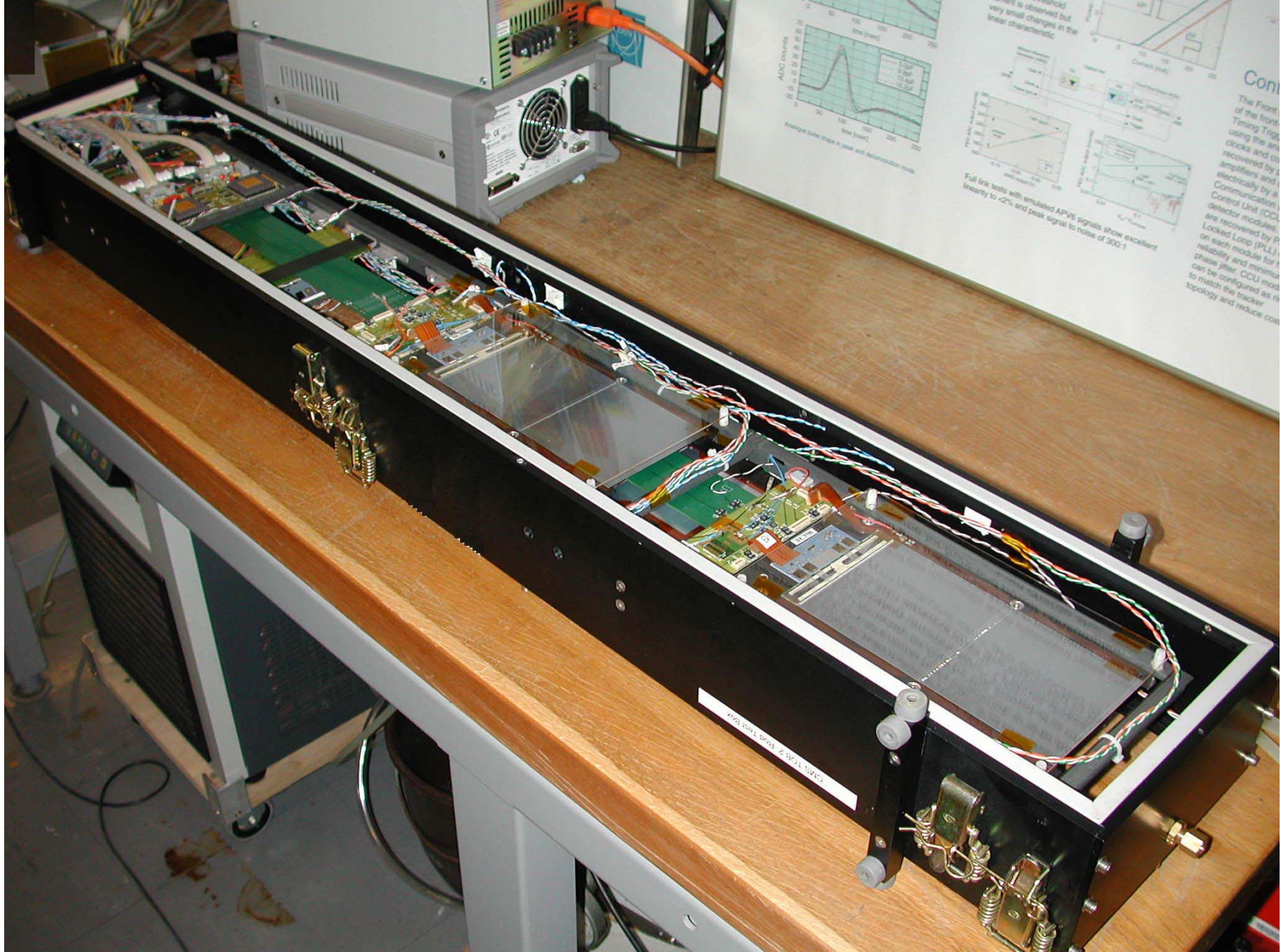
The rod components



15 cm

110 cm

All components "final" except for the CCUM



Le rod au chateau



C_6F_{14} Cooling plant

**Alu box, gas tight, with patch panel for pipes
(cooling and dry air) and other services
(It can house 2 rods)**

External temperature and humidity probes

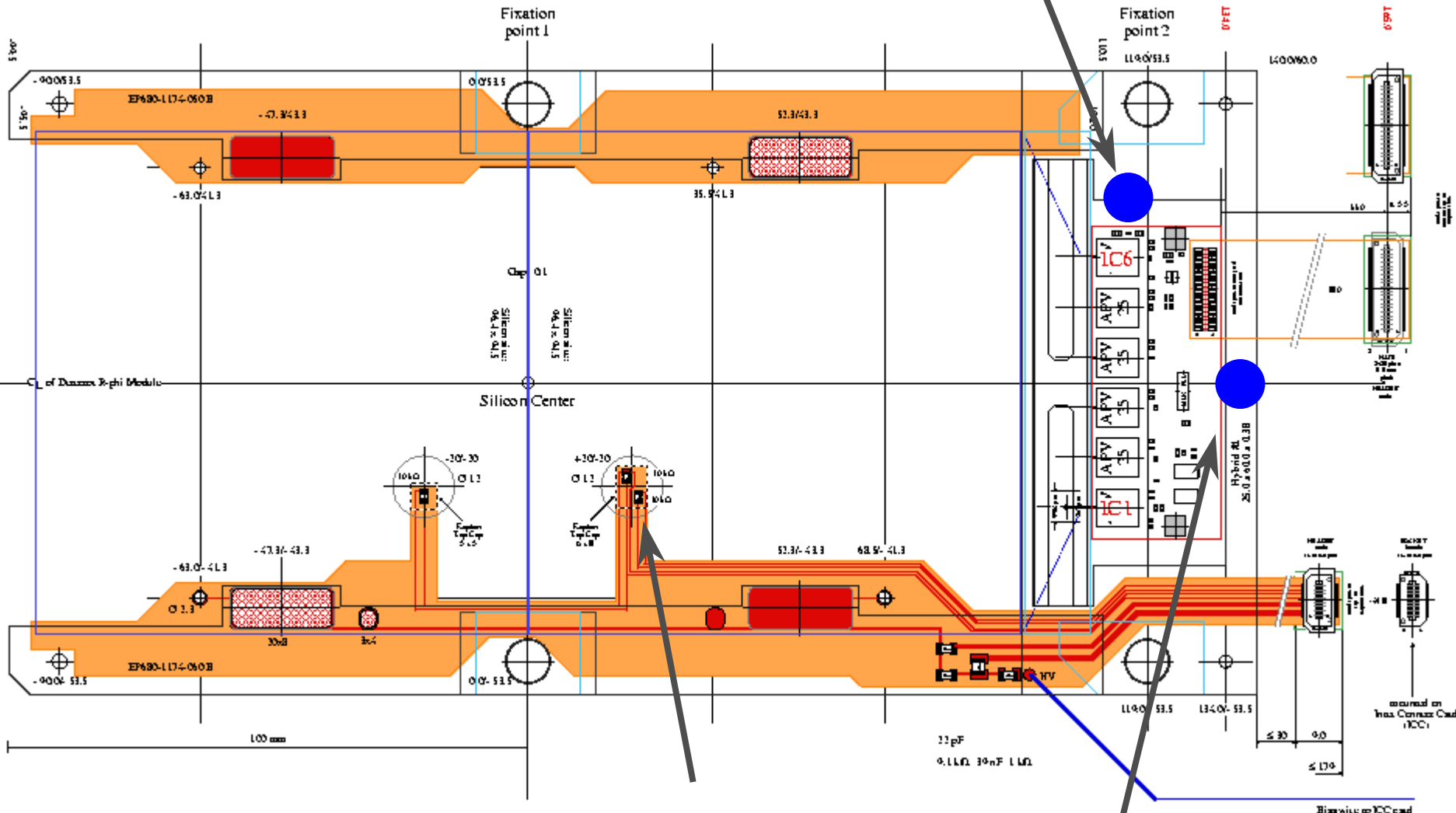
Modules, optohybrids, CCUM, high voltage

**Daq PC with 1 TSC, 1 FEC and 3 FED cards,
XDAQ Software, Monitoring, XROD.**



Probes on module

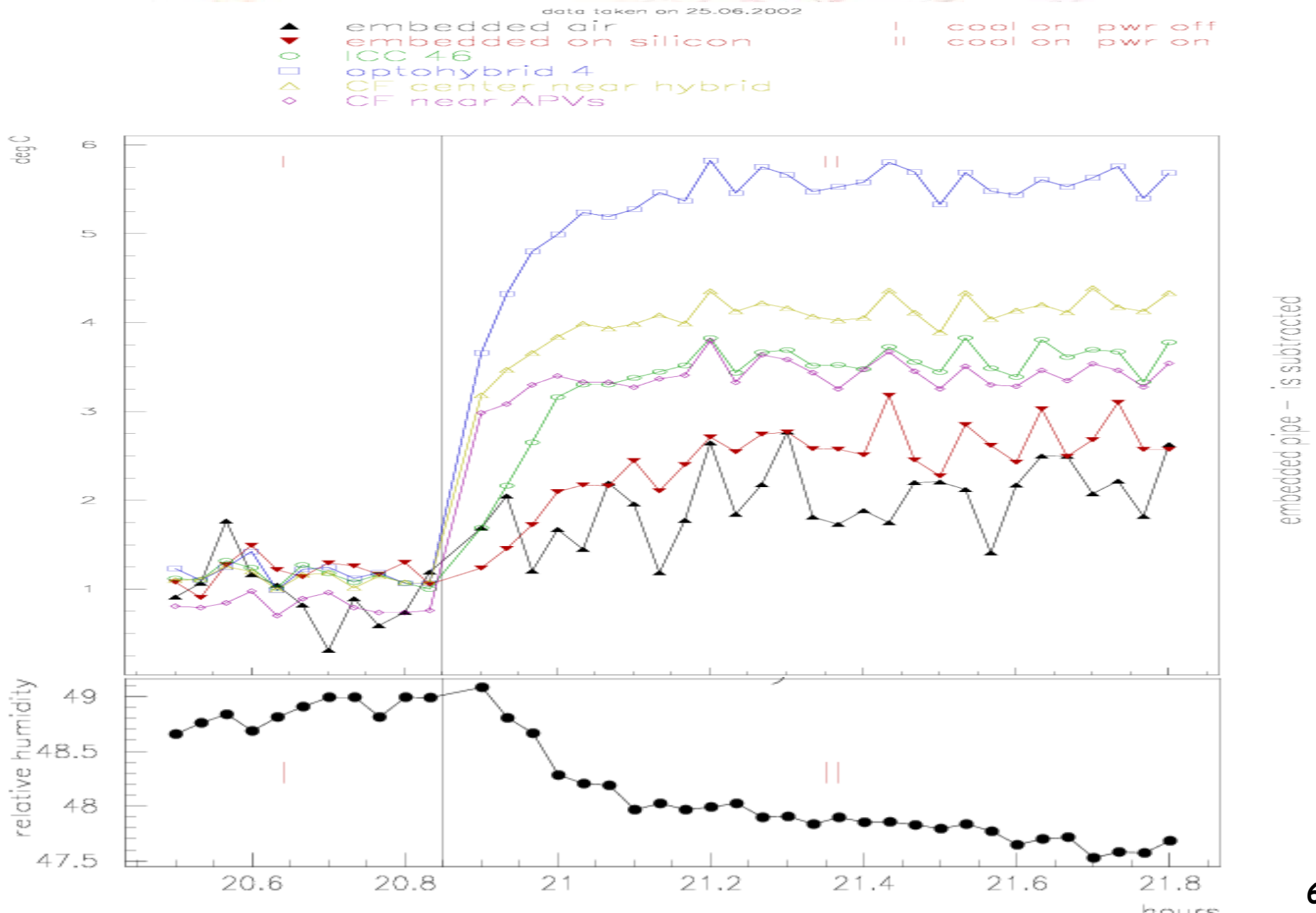
CF near APVs



Embedded on silicon

CF center near hybrid

Thermal Measurements





Electrical test of IC bus + IC cards, with Hybrids and OptoHybrids

Measurement of the voltage drop with full load along the bus

Optical link nominal working point obtained (at least for CERN optohybrids)

Time Alignment performed

All modules working properly and readout under bias

External temperature probes also readout

Cooling very stable

Grounding scheme similar to the "final" one implemented

Grounding Scheme

- **One single connection between the Rod ground and the main earth**
- **Mounting points of the detector frames through cooling pipe**
- **Grounding of Black box side plates**
- **Floating Power Supply ground terminals**
- **No connections among Power Supply ground terminals**
- **No connections between High Voltage return cables and the main earth**
- **One single connection between the shield of the FEC2ROD cables and the FEC crate ground**
- **Wrist straps connected directly to the main earth**

Running Conditions

The APV parameters were always set to:

**IPcasc = 52, IPsf = 34, ISha = 60, ISsf = 34,
IMuxin = 34, IPre = 98, VFp = 30, VFs = 60,
IPsp = 55, VPsp = 40**

**MODULES #1, #2 and #5 EQUIPPED WITH
CERN OPTOHYBRIDS, VIENNA ONES
EMPLOYED FOR #3, #4 AND #6.**

1 2 3 4 5 6 Rod numbering scheme

BIAS=8 and GAIN=3 FOR ALL THE DEVICES

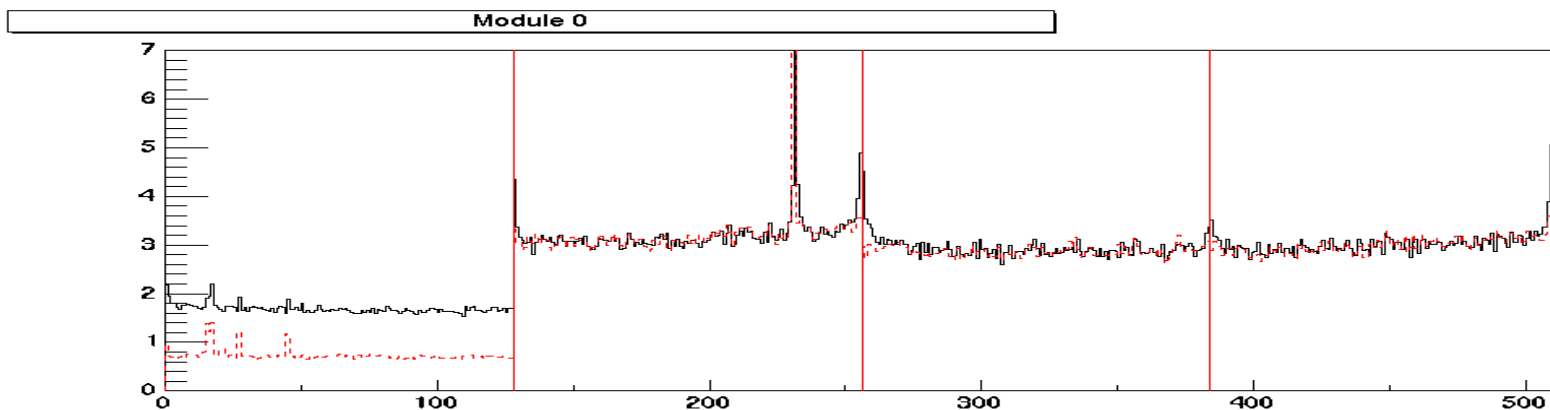
HV BIAS = 200 V FOR ALL THE MODULES

Statistics and Event Reconstruction

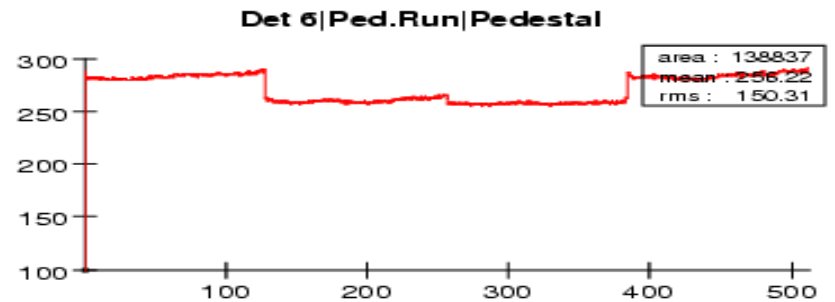
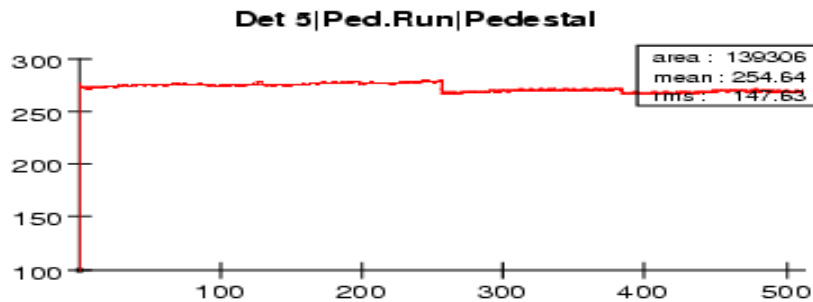
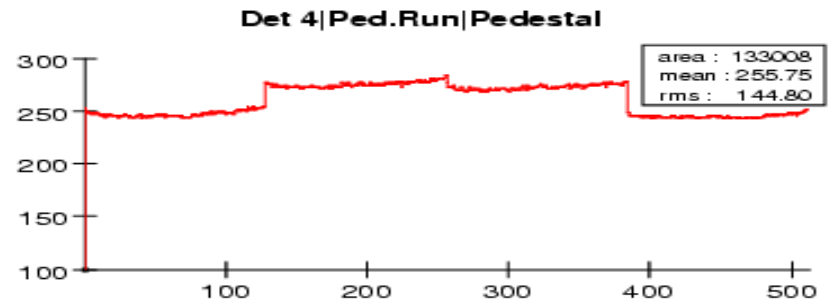
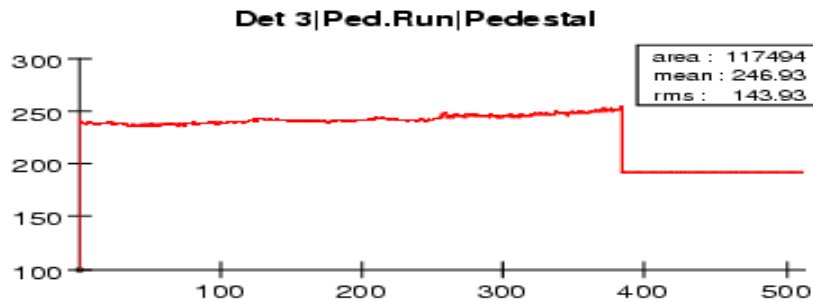
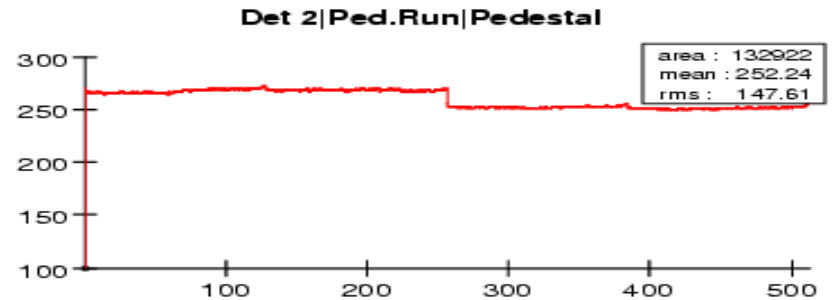
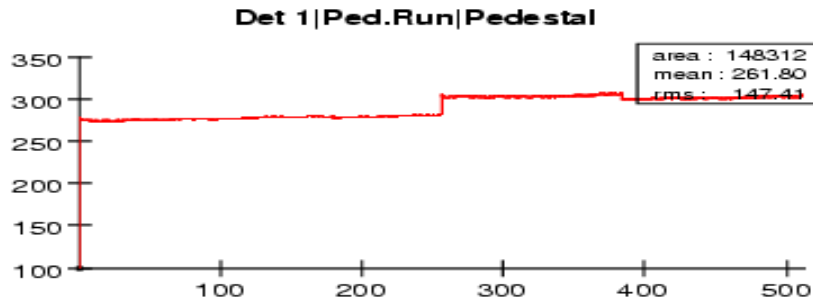
- Pedestal:
 - $ped_i = \langle ADC_i \rangle_{ev}$
- Total noise:
 - $\sigma(i) = \sqrt{\langle (ADC_i - ped_i)^2 \rangle_{ev}}$
- Differential noise:
 - $\sigma_d(i) = \sqrt{.5 \langle (ADC_i - ADC_{i+1})^2 \rangle_{ev} - .5 (\langle ADC_i - ADC_{i+1} \rangle_{ev})^2}$
- Common mode noise:
 - constant on APV (127 d.o.f.) $CMN_i = CMN_0 = \langle (ADC_i - ped_i) \rangle_{strip}$
 - linear on APV (126 d.o.f.) $CMN_i = B + Ai$
- Intrinsic noise:
 - $\sigma_{int}(i) = \sqrt{\langle (ADC_i - ped_i - CMN_i)^2 \rangle_{ev} - (\langle ADC_i - ped_i - CMN_i \rangle_{ev})^2}$
- Corrected raw data: $s_i = ADC_i - ped_i - CMN_i$
- Cluster finding:
 - consider only those for which $s_i / \sigma_{int}(i) > 3$
 - Good clusters if $n_{strip} > 0, S_{cl}^1 / N_{cl}^1 > 7$

Noise figures obtained with the single module test setup

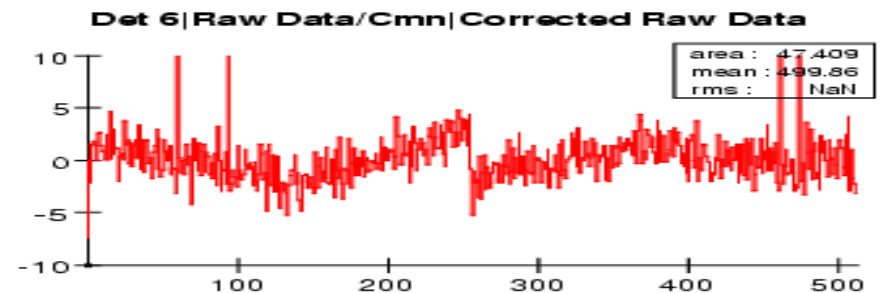
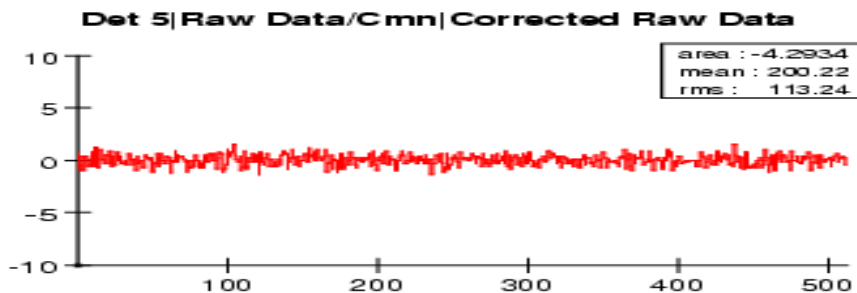
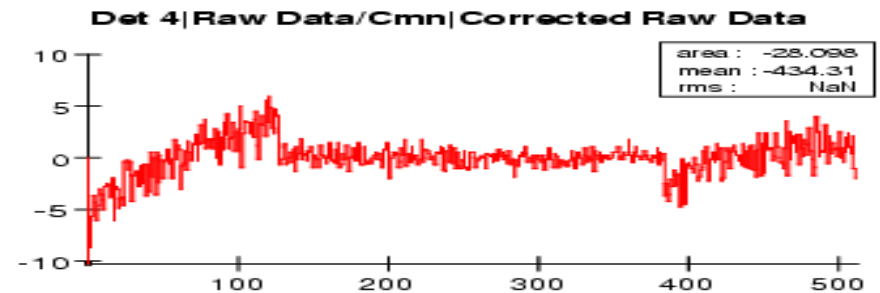
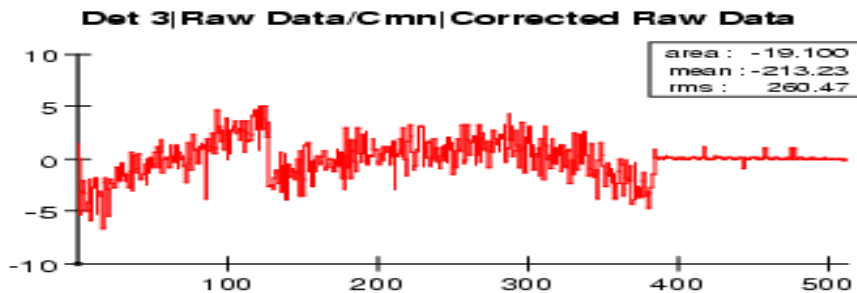
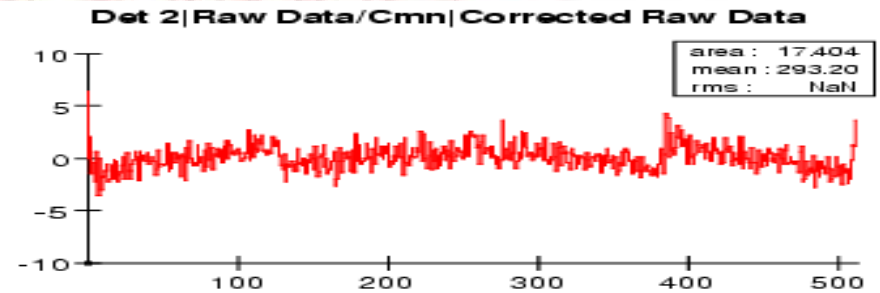
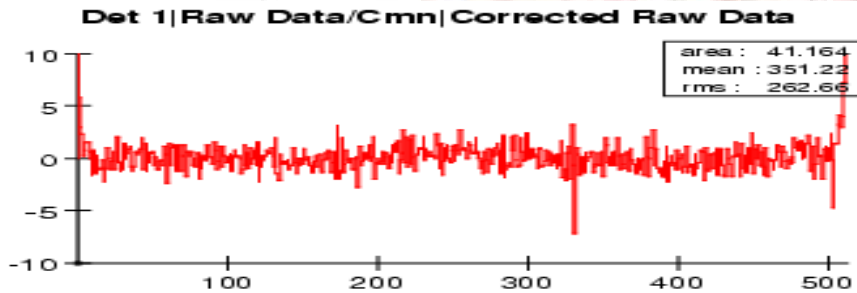
Based on a UTRI card, a CCU card and a data acquisition system equipped with a dedicated PC with 1 TSC, 1 FEC and 1 FED.



Pedestals

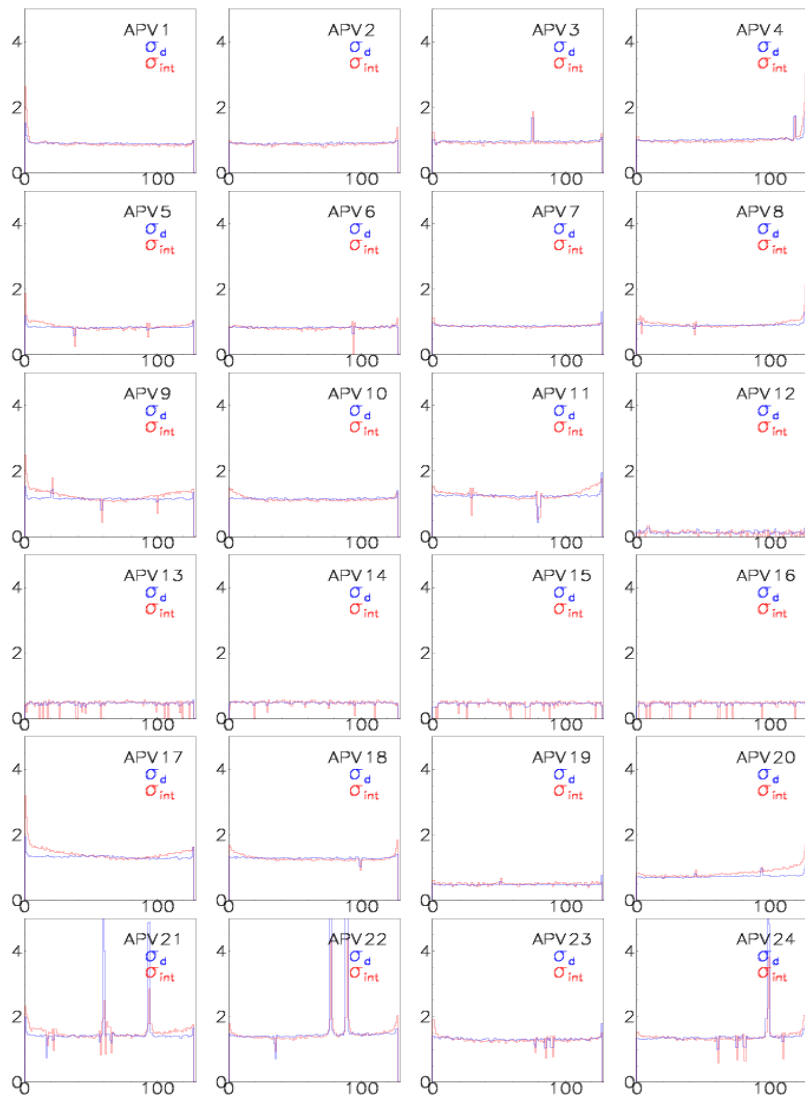


Why linear fit to CMN ?

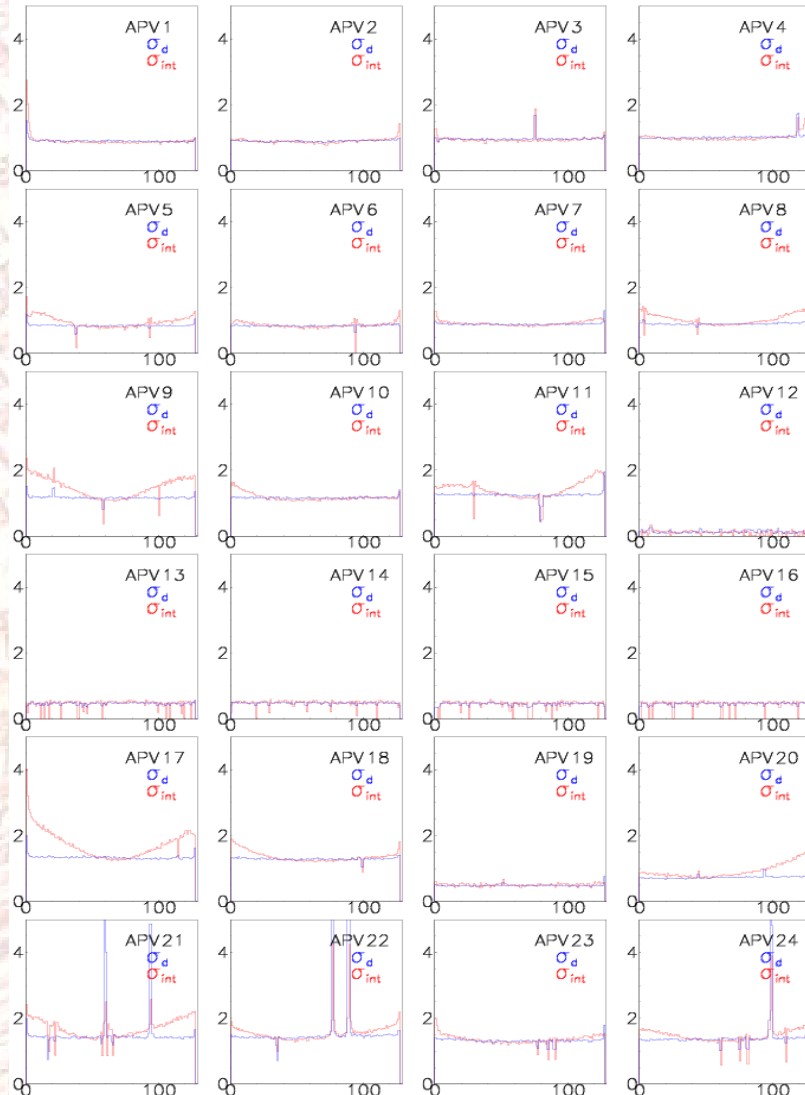


PEAK INVERTED

DECONVOLUTION INVERTED

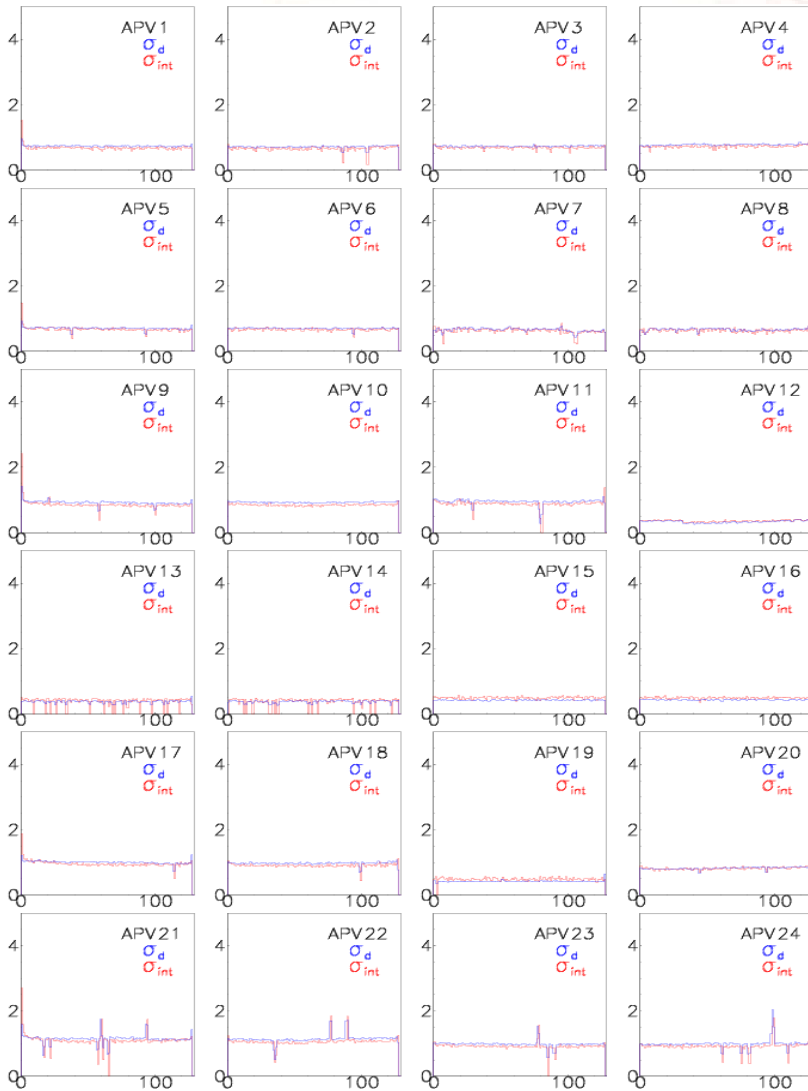


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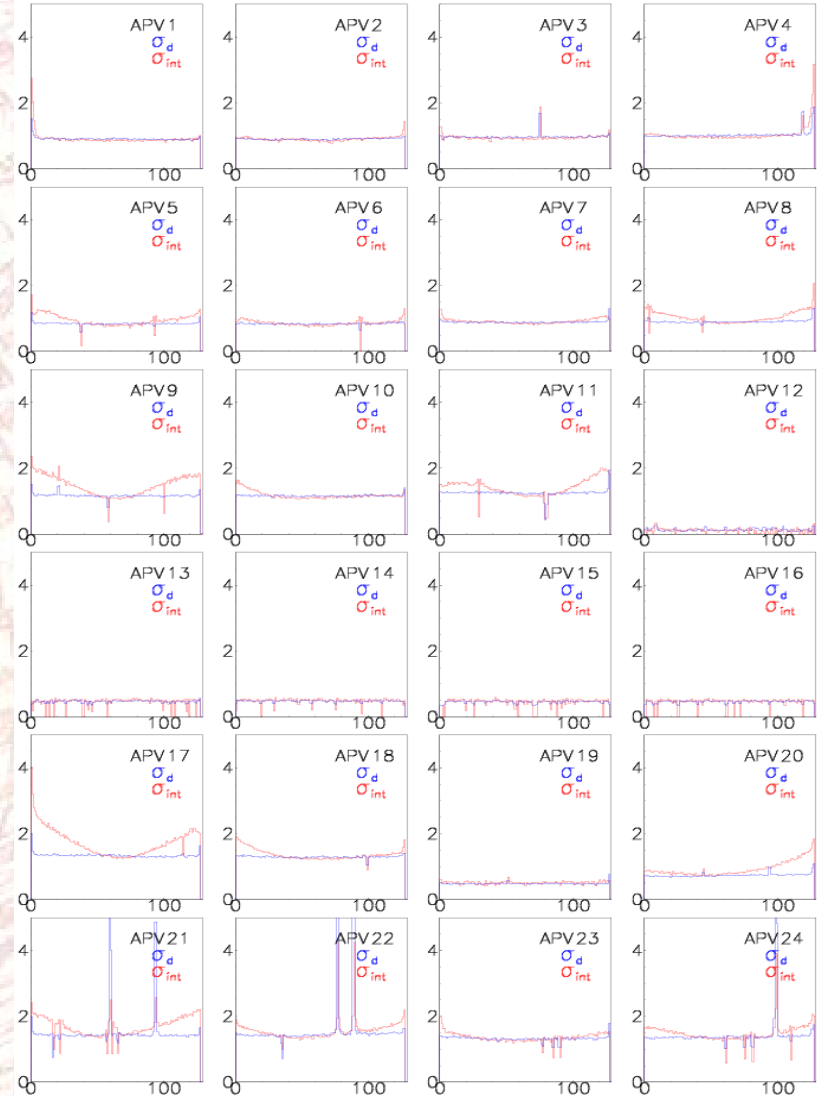


LINEAR FIT TO CMN

CONSTANT FIT TO CMN

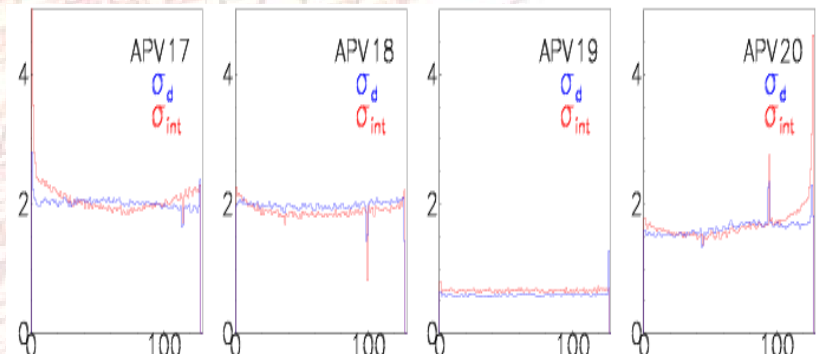
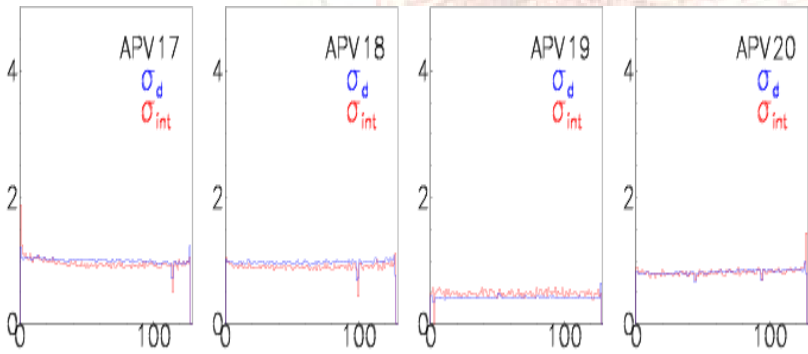
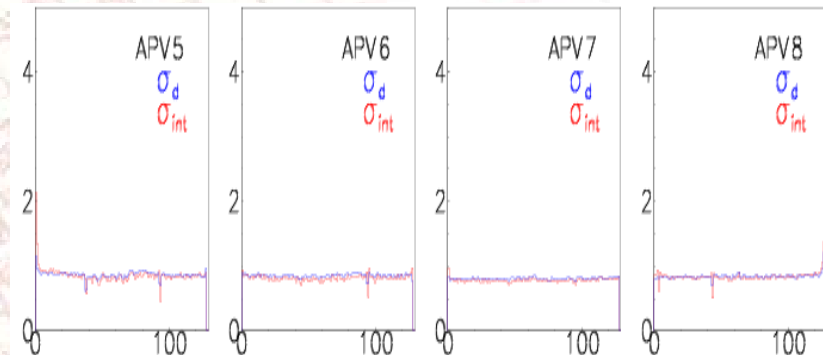
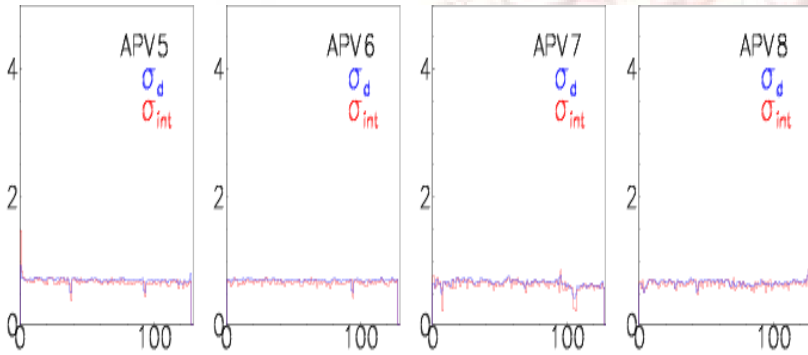


20470<3-30=45-0<3000



GROUNDING ON COOLING PIPE

GROUNDING ON COOLING PIPE REMOVED

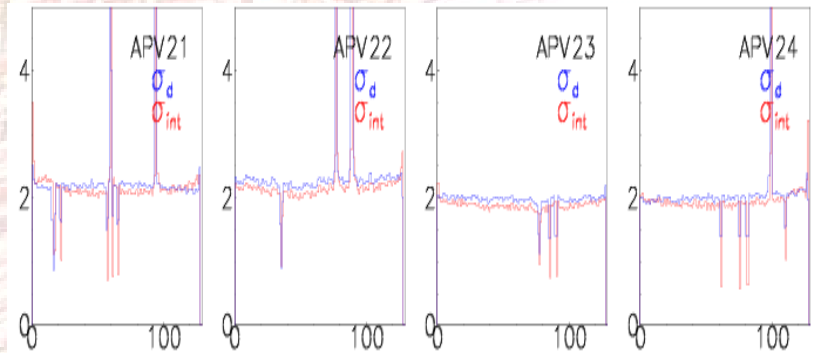
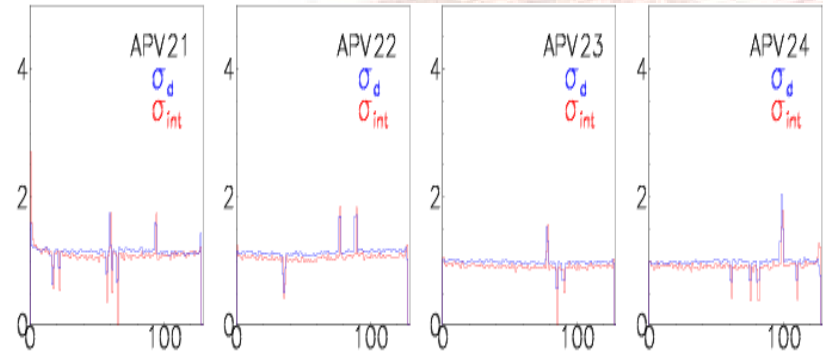
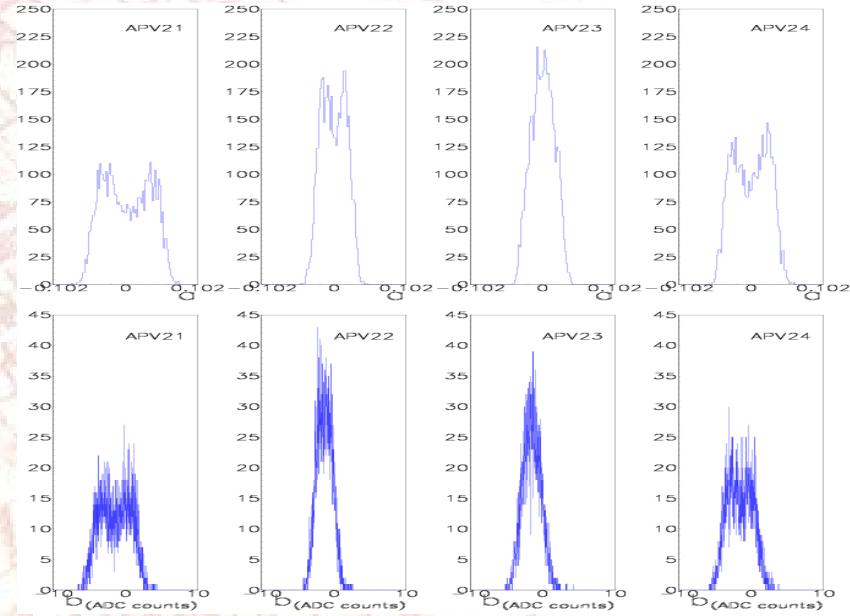
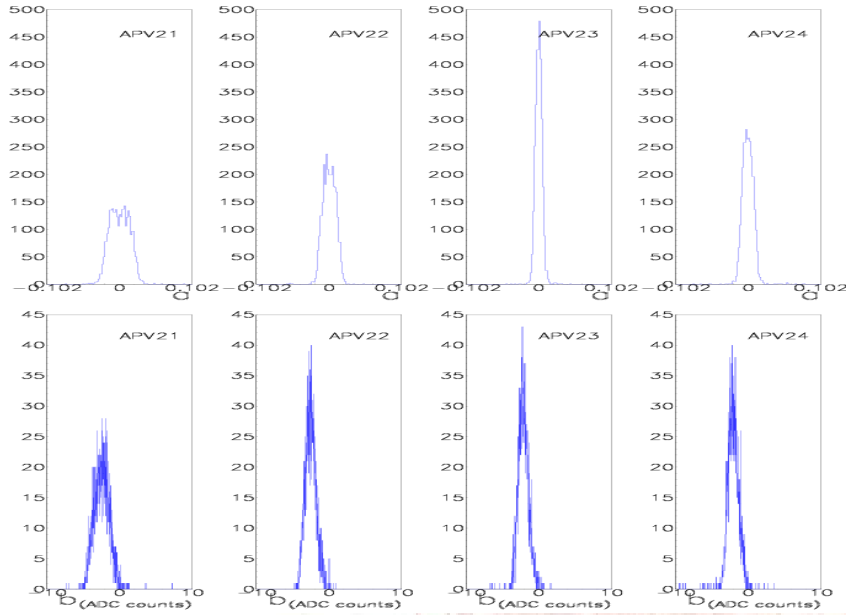


200470<3-30=45-0<30000

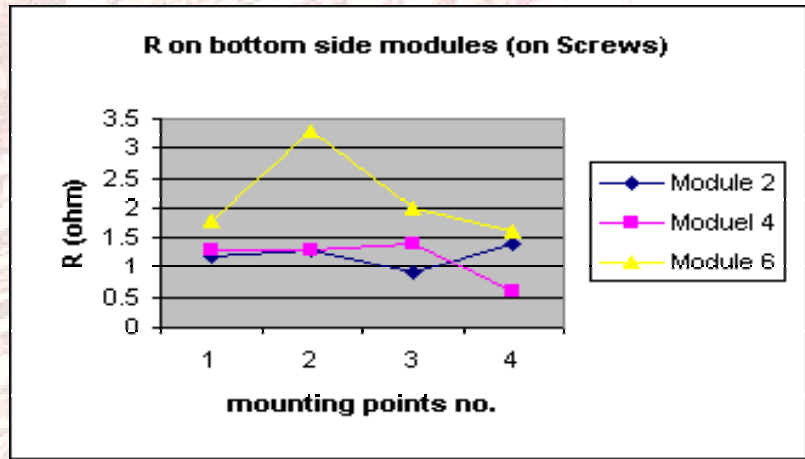
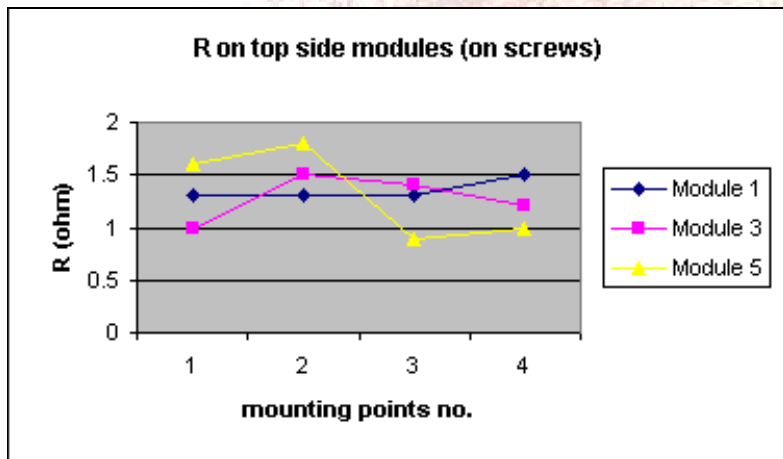
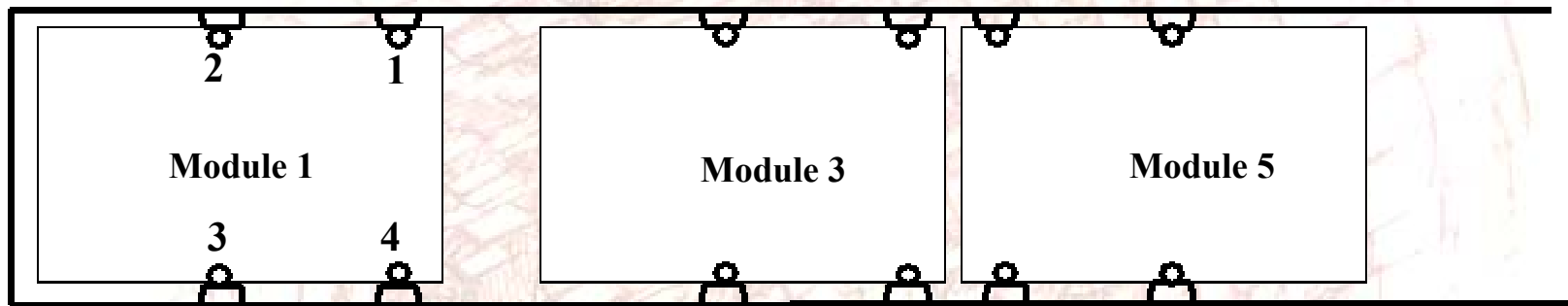
GROUNDING ON COOLING PIPE

GROUNDING ON COOLING PIPE REMOVED

200470<3-30=45-0<3000

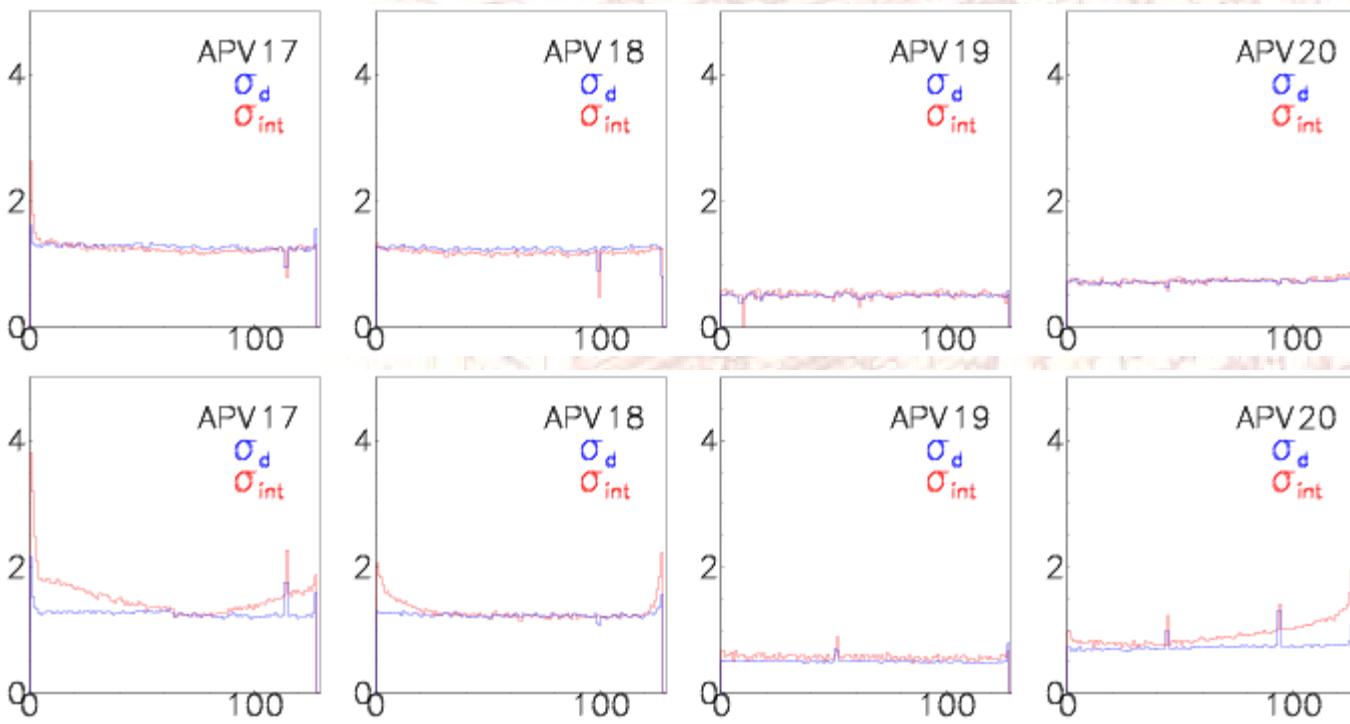


Measurement of resistances between the ground and the mounting points of the detector frames



Further noise studies

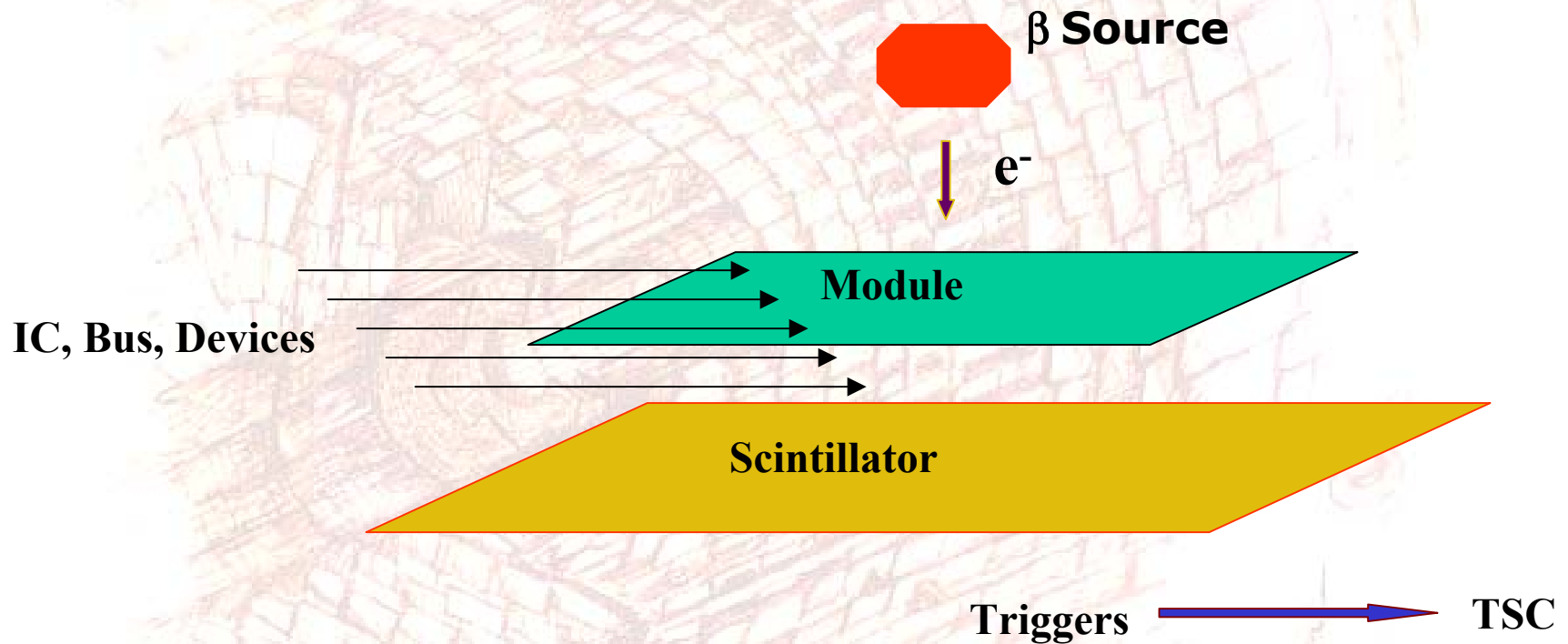
The noise is found to depend on the internal trigger frequency in pedestal runs



Trigger = 20 Hz
(best configuration)

Trigger = 2 KHz
(worst configuration)

Setup for Physics Signal Measurements



Physics Signals (β source)

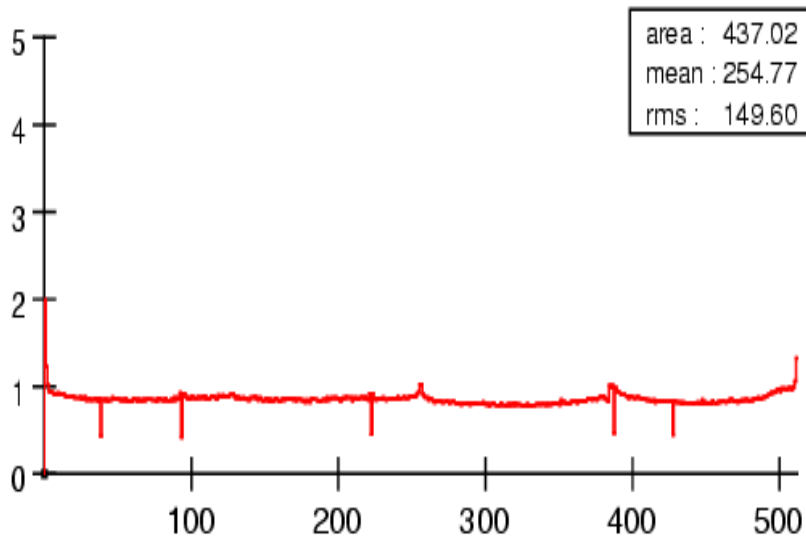
Measured on module #2 (intrinsic noise more or less flat)

Trigger rate 22.5 KHz, Gate 4 ns, DAQ rate 20 Hz on disk

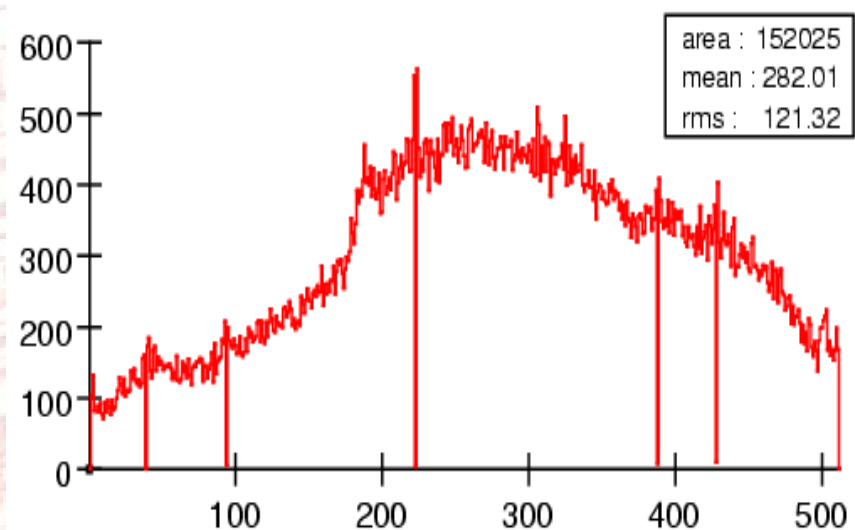
Geometrical inefficiencies. Absorption in Bus, IC, Devices

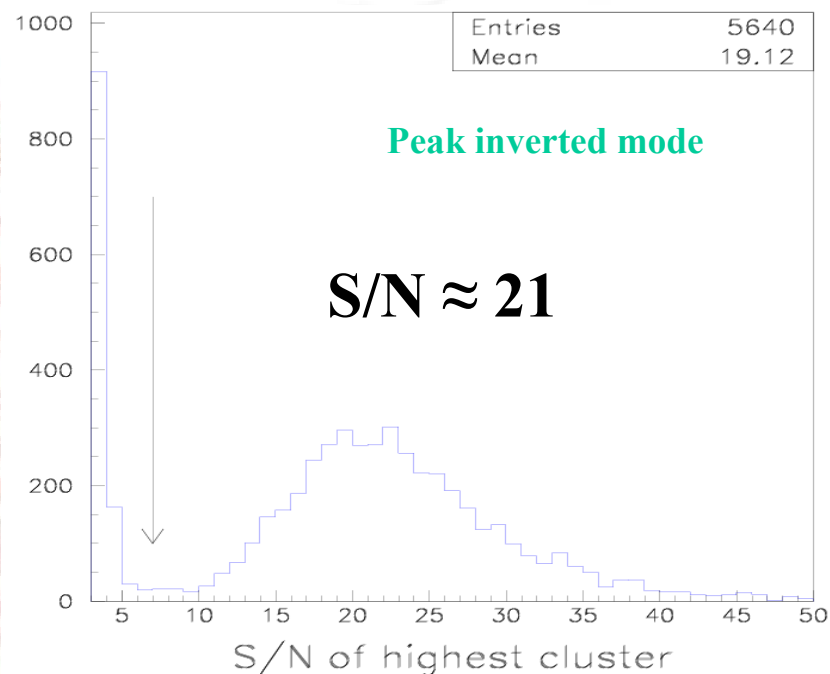
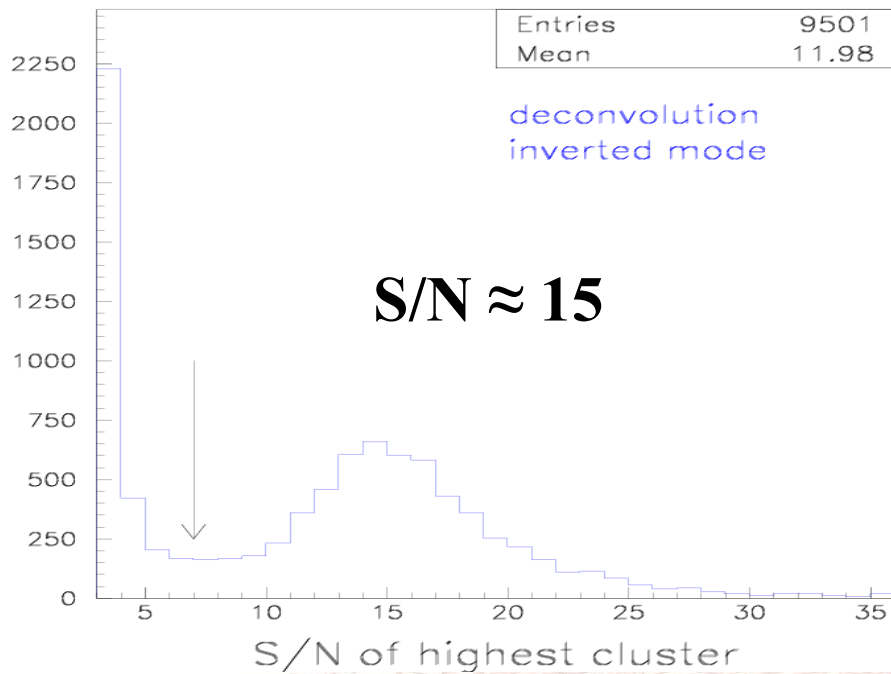
Deconvolution Inverted

Det 2|Ped.Run|Noise

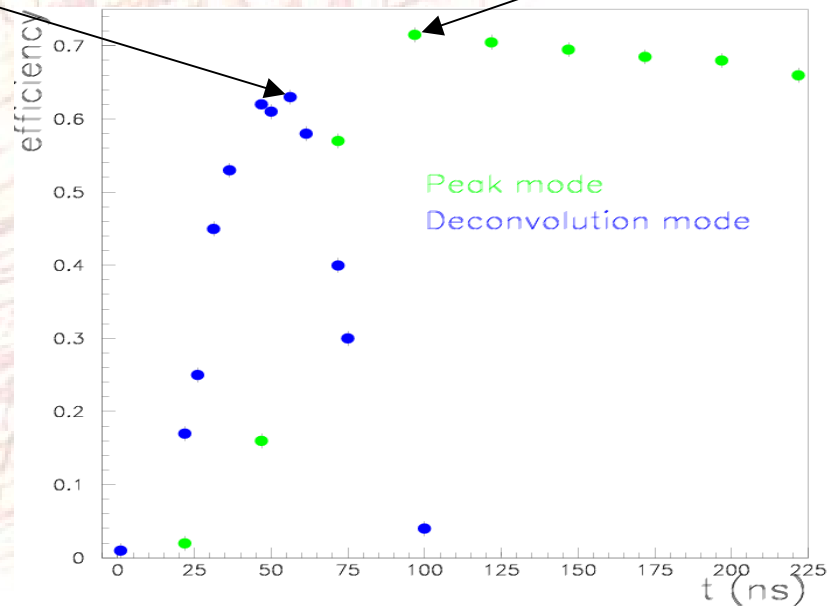


Det 2|Clusters|Highest S/N cluster|Cluster position





Similar S/N performance for the other modules



Conclusions and Future Plans

Thermal measurements confirm earlier tests

Most of the basic electrical measurements done

Still progress to be made in understanding the noise in the setup

- **Statistical analysis on the noise in progress**
- **Now removing temperature probes**

At present: $S/N \approx 15$ (deconvolution)

$S/N \approx 21$ (peak)

Move to DS rod as soon as SS rod tests finalised