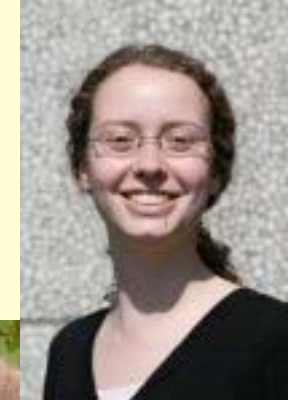


Super Module Construction

Johannes P. Wessels, IKP, WWU Münster

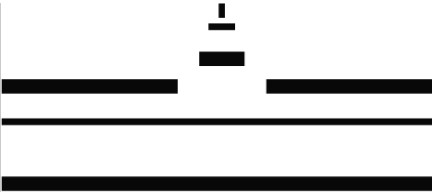
- presenting the work of Tom Dietel, Svenja Wulff, Eva Sicking, Helge Grimm, Uwe Westerhoff, Markus Rammler, Alex Wilk, Markus Heide, Bastian Bathen, Matus Kalisky, Wolfgang Verhoeven, Norbert Heine, Carsten Riemann, Robert Fleige



Central Receiving

- storage of hull elements, bus bars, cooling channels in special container
- chambers come
 - ◆ leak tested
 - ◆ with (fully) tested electronics
 - ◆ with cooling meanders attached
- chambers undergo quick HV test
- (replacement of caps?)



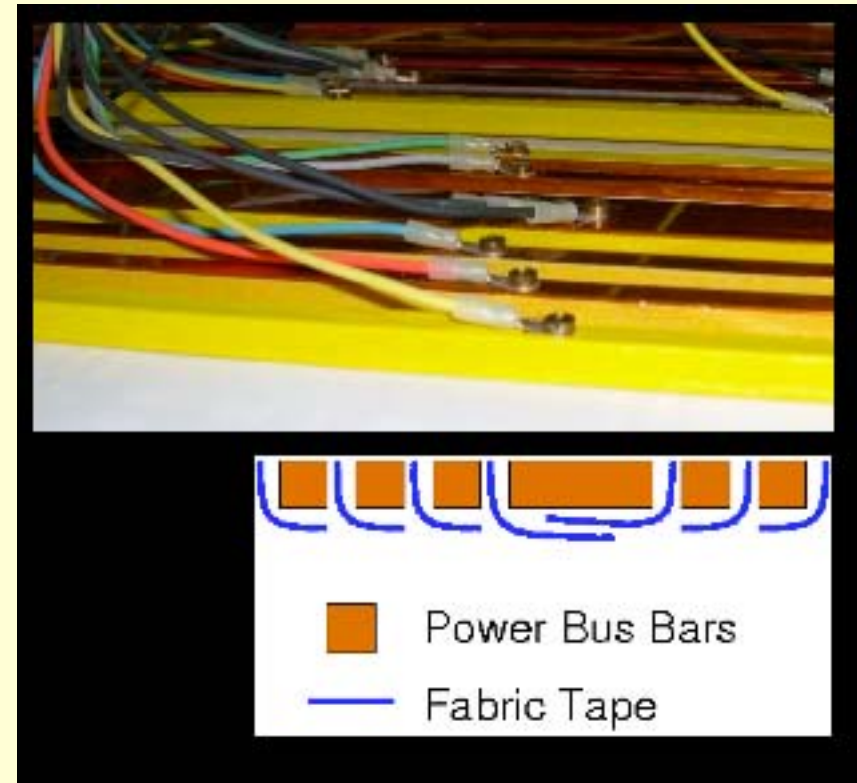


SM Assembly / Test Procedure

- assembly of power bus bars
- assembly of hull
- installation of layers
 - ◆ connect services (LV, HV, cooling, DCS, ORI, gas)
 - ◆ check leak tightness
 - ◆ configure
 - ◆ noise measurement
 - ◆ temperature profile
 - ◆ stress test
 - ◆ HV test
- data taking with cosmics

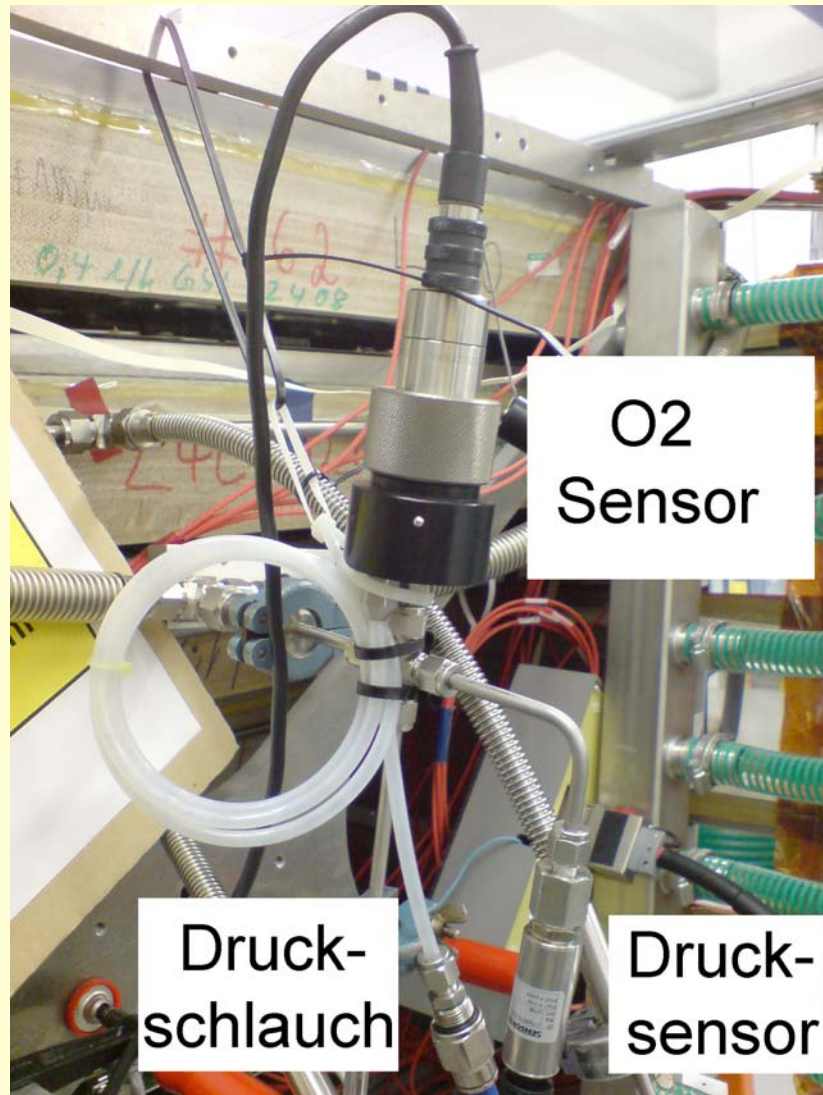
Details of the Hull Assembly

- mechanical assembly
 - ◆ many holes to be reworked
 - ◆ ~ 80 hours
- power bus bars as delivered
 - ◆ need careful inspection (Cu chips)
 - ◆ complete rewinding with fabric tape
- adds mechanical stability (+ 2mm)
- inspection, rewinding control, assembly with cooling channels on side wall ~ 120 hours



Leak Tests - Underpressure

Tom Dietel, Helge Grimm



- each layer flushed with 200 NI/h CO₂ for at least 5 hours
- flow of 50 NI/h CO₂ during measurements
- underpressure ~ 1 mbar
- Air (20% O₂) sucked through the layer
- O₂ content in gas flow recorded

Underpressure Fan Unit

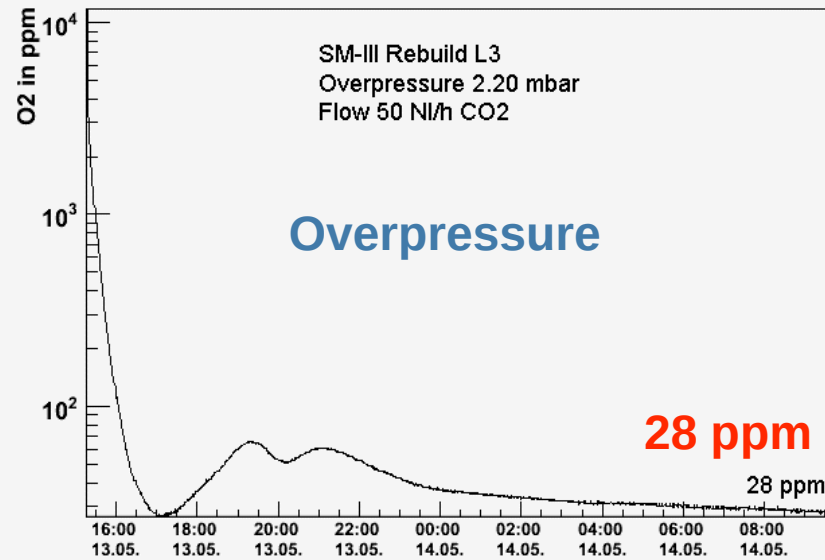
Helge Grimm, Norbert Heine, Wolfgang Verhoeven



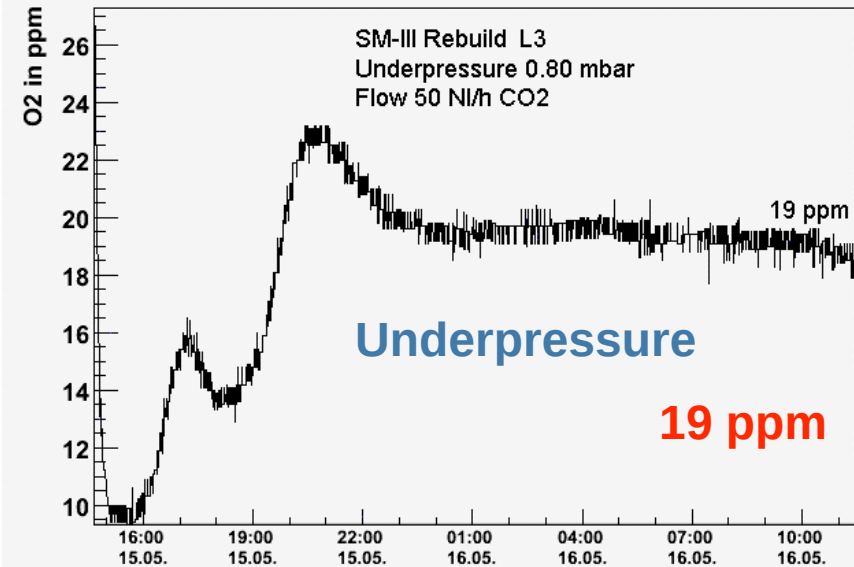
Results (Over- / Underpressure)

Tom Dietel, Helge Grimm

ORB510 O2 Measurement



ORB510 O2 Measurement



	L0	L1	L2	L3	L4	L5	total
GSI	12.9	6.6	3.7	9.6	9.5	4.0	46.3
MS	15.2	6.3	2.2	5.9	5.6	4.0	39.2

leak conductance in I/h

Documentation - SM III L5

#####

L5: Leak Conductances

#####

L5S0: 0.4 l/h #62

L5S1: 1.7 l/h #50

L5S2: 0.04 l/h #10

L5S3: 1.1 l/h #49

L5S4: 0.8 l/h #51

4.04 l/h

-> ca. -1.00 mbar underpressure: 10.5V bei 2.2A

-> ca. -1.50 mbar underpressure: 12 V bei 2.5A

-> $O_2 \text{ [ppm]} = \text{cond. [l/h]} * p\text{Diff [mbar]} * 1.000.000 / (5 * \text{Flow [l/h]} * 1000)$

-> $\text{cond. [l/h]} = O_2 \text{ [ppm]} * 5 * \text{Flow [l/h]} * 1000 / (p\text{Diff [mbar]} * 1.000.000)$

Underpressure @ 0.90 mBar

Start: 20.05.2008 19:00 50 NI/h CO2

End: 23.05.2008 11:00

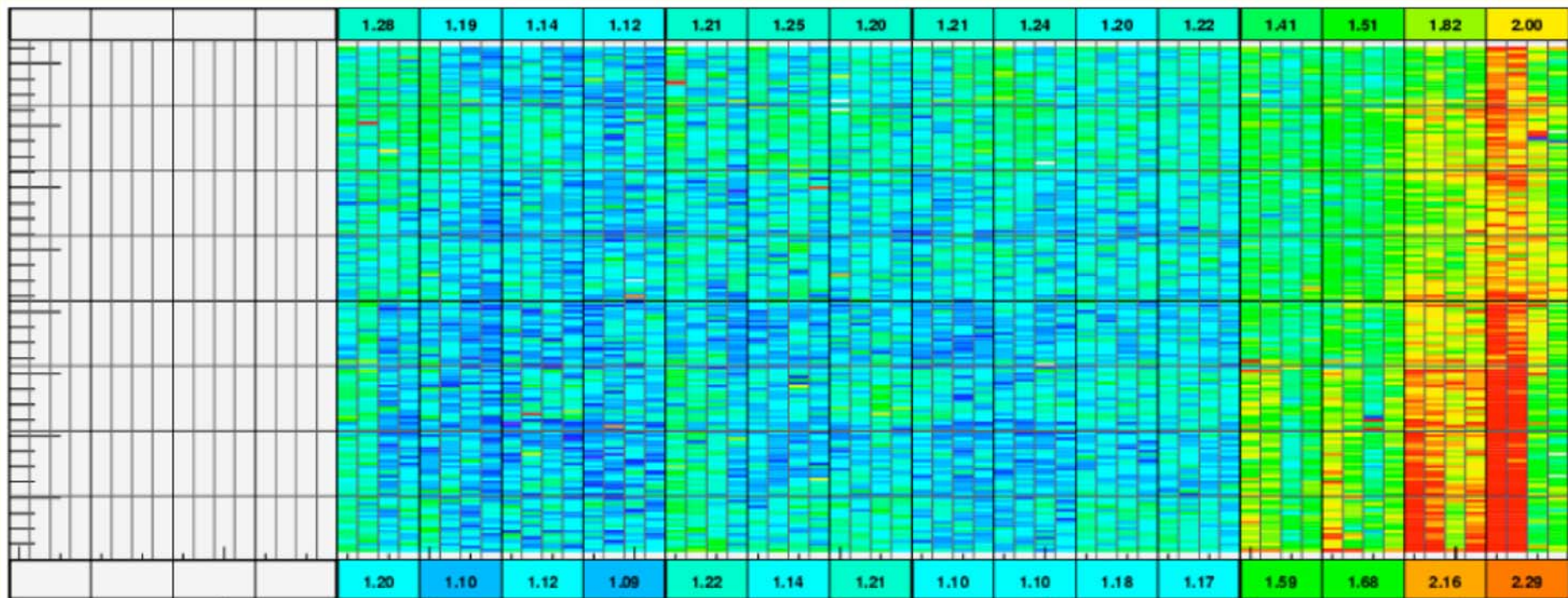
O2 ppm: 43 ppm reached (< 15 ppm = CO2 4.5 Specs)

(theroretical: 15 ppm)

Noise Measurements

Svenja Wulff, Eva Sicking, Tom Dietel

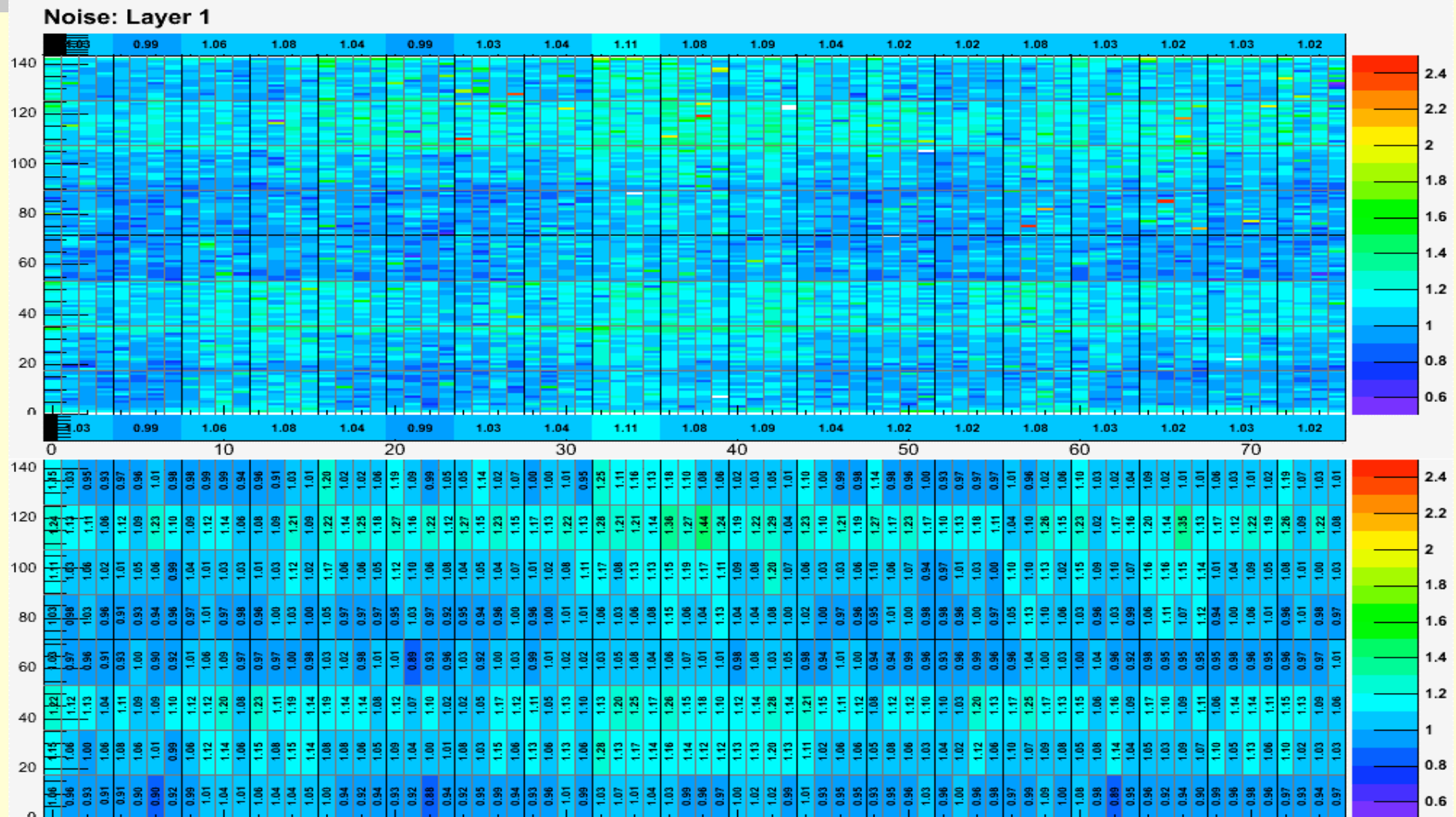
- ensure response of all MCMs
- verify proper grounding



prior to modification of WIENERS almost impossible task

Noise Measurements - Layer

Svenja Wulff, Eva Sicking, Tom Dietel



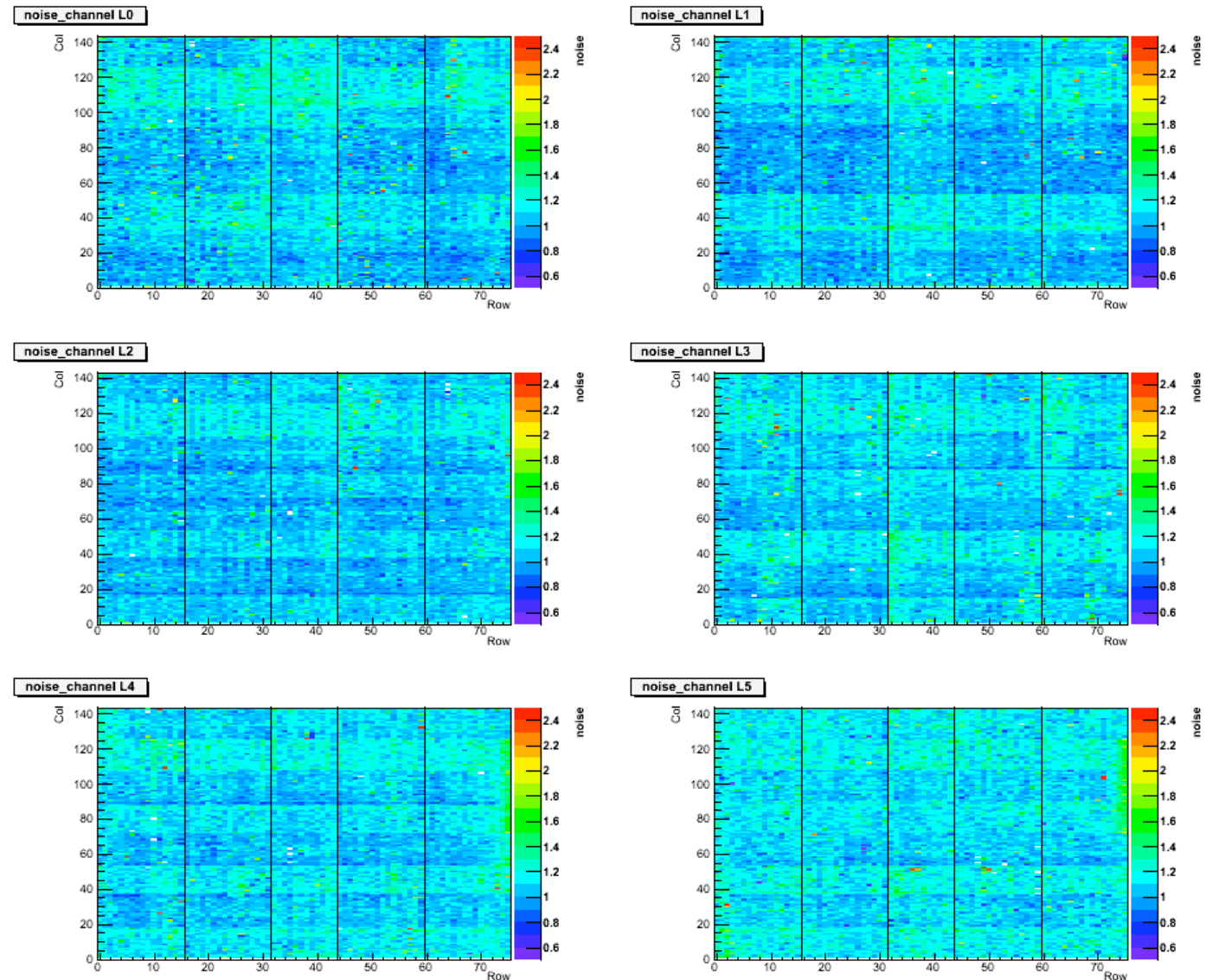
Wed Aug 20 14:39:01 2008

■ design goal ~ 1 ADC count reached

Johannes P. Wessels, Sibiu, 21.08.2008

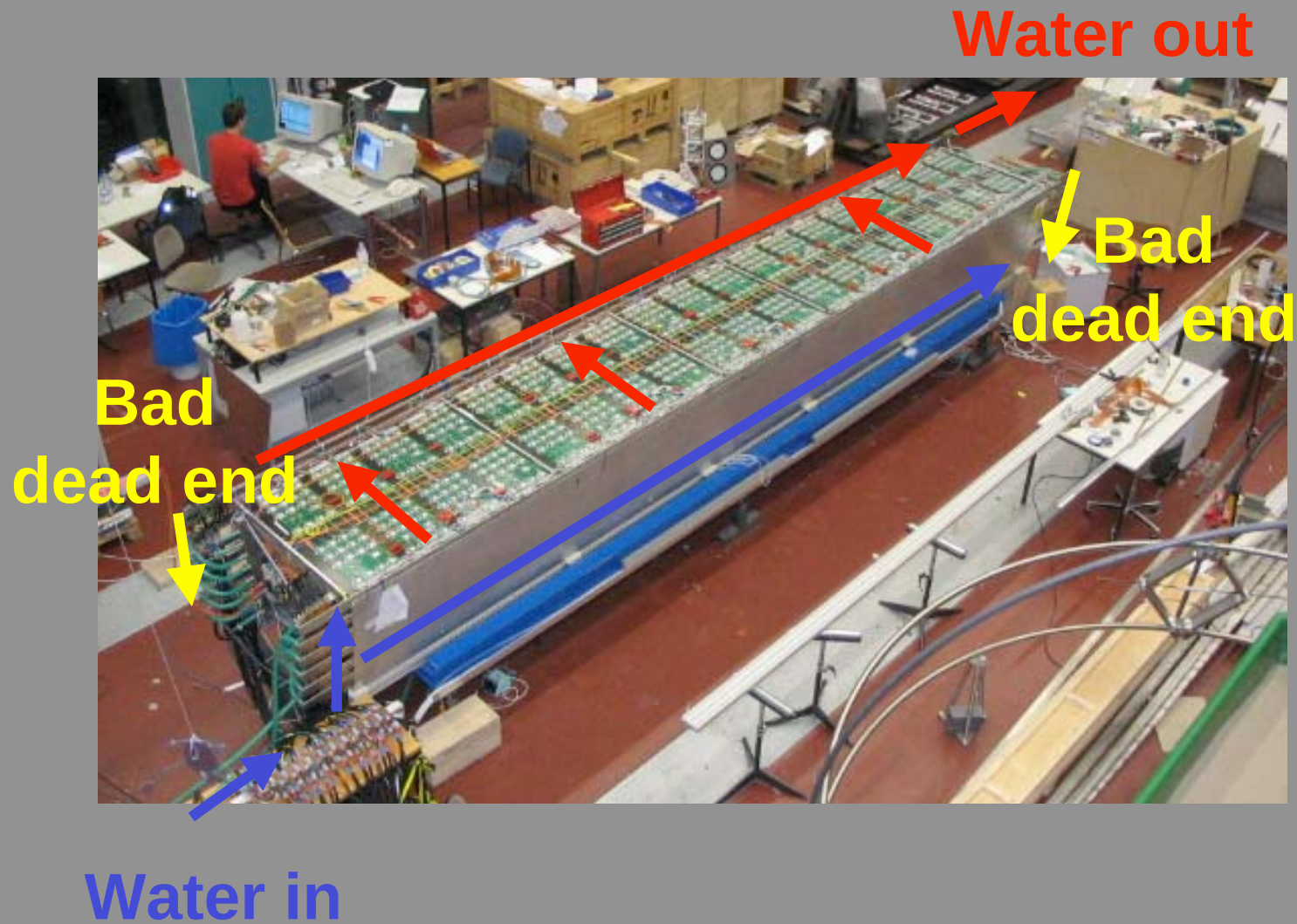
Noise Measurements - Super Module

Svenja Wulff, Eva Sicking, Tom Dietel

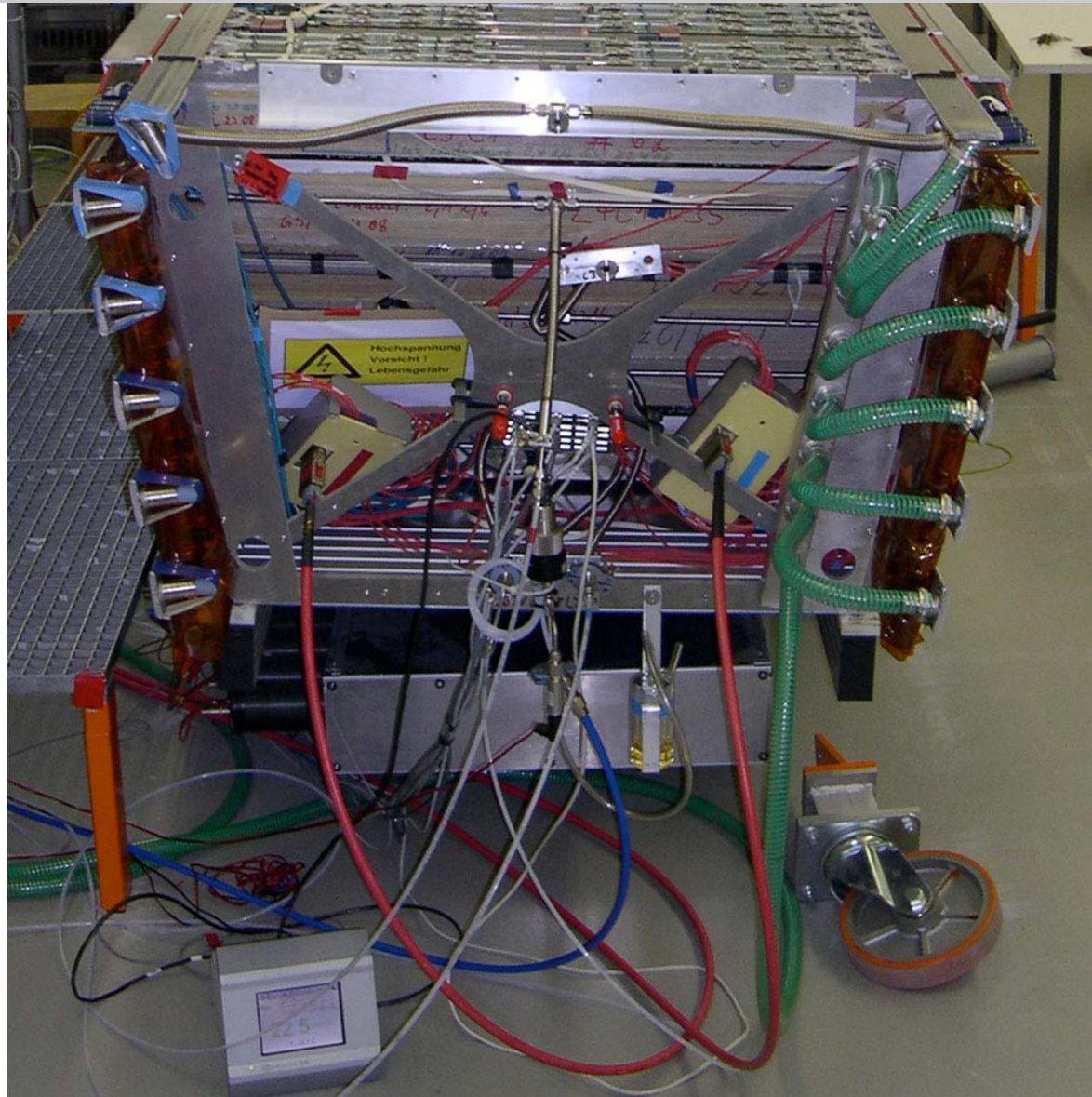


Cooling Issue

Ana Marin



Cooling Tests as Proposed

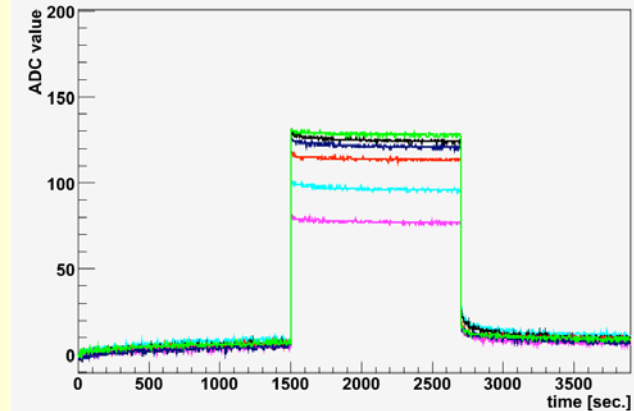


Cooling Tests

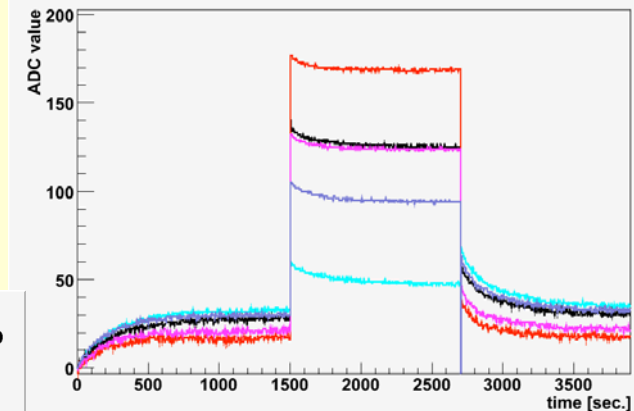
Uwe Westerhoff, Tom Dietel

- each layer tested during assembly
- variation of power consumption via different configurations
OFF -> STDBY_INIT -> CONFIGURED
-> STDBY_INIT -> OFF
- strong variations correlate with variations in cooling efficiency

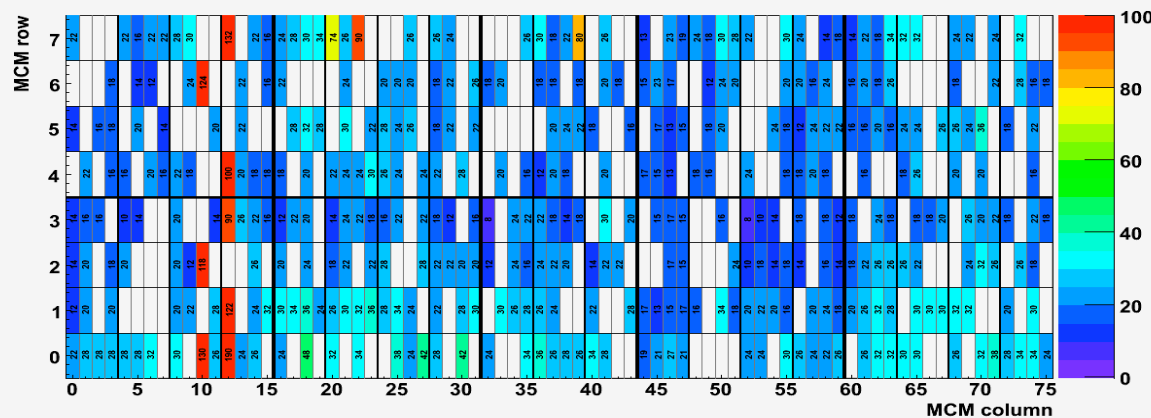
Layer 4, Stack 1, Column 9



Layer 4, Stack 0, Column 12



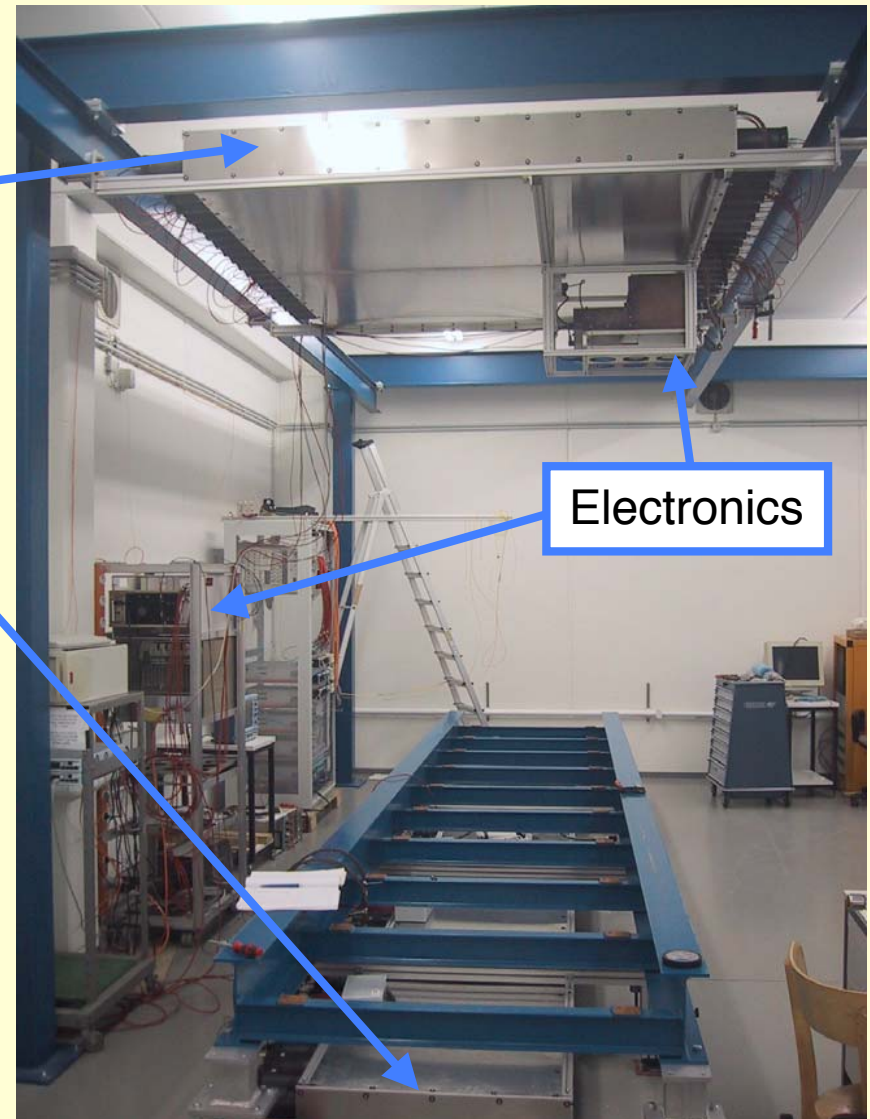
Cooling overview -- layer 4



Cosmic Ray Test Facility

in collaboration with V. Yurevich, L. Efimov, JINR

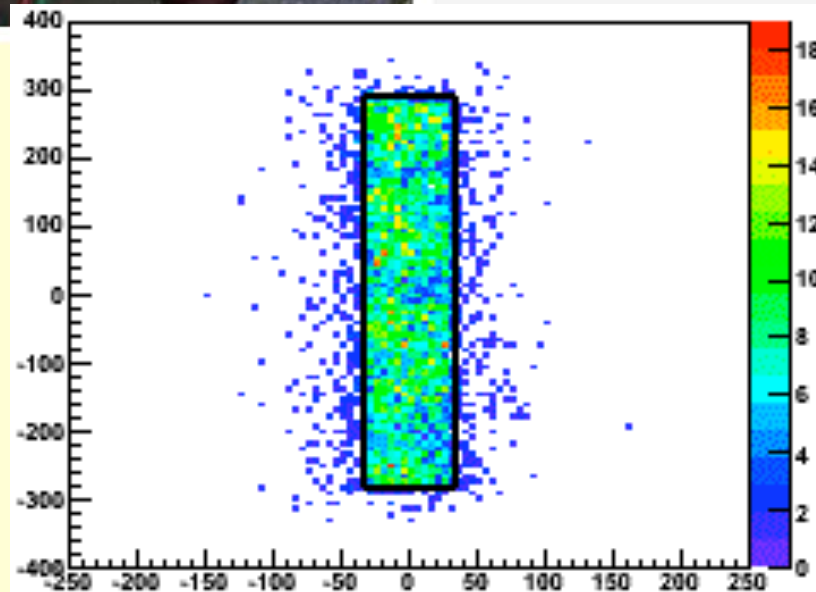
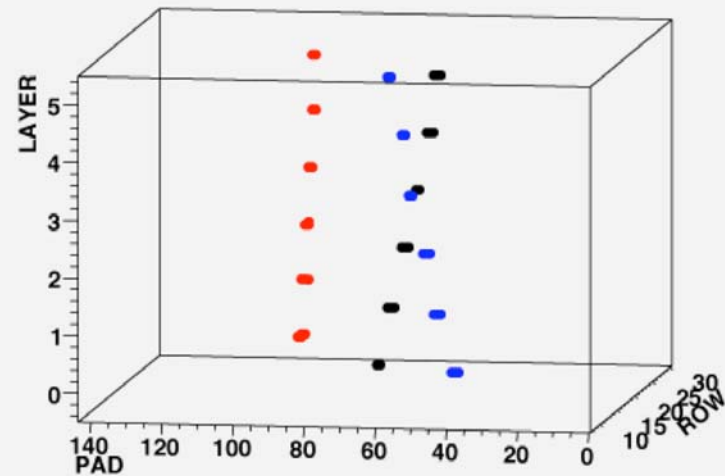
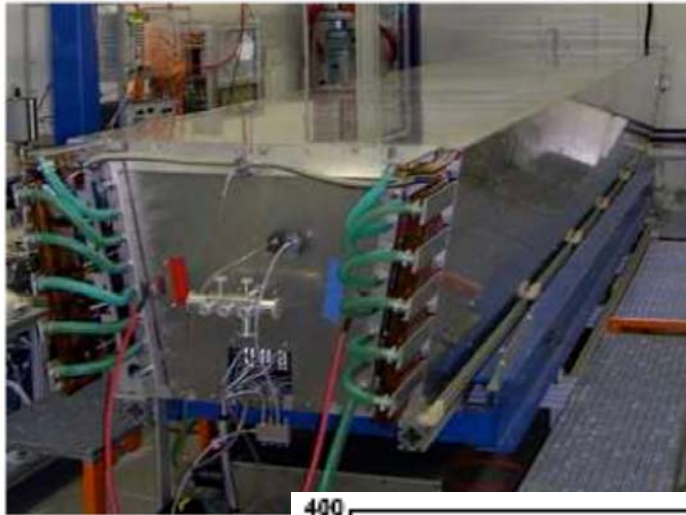
- Large scintillator arrays
 - ◆ top: $2 \times 2\text{m}^2$
 - ◆ bottom: $5 \times 1\text{m}^2$
 - ◆ typical rates: 10 - 100 Hz
several hundred per day and pad
 - ◆ shower trigger possible
- Relative gain calibration
- Chamber alignment within super module



Cosmic Ray Tests

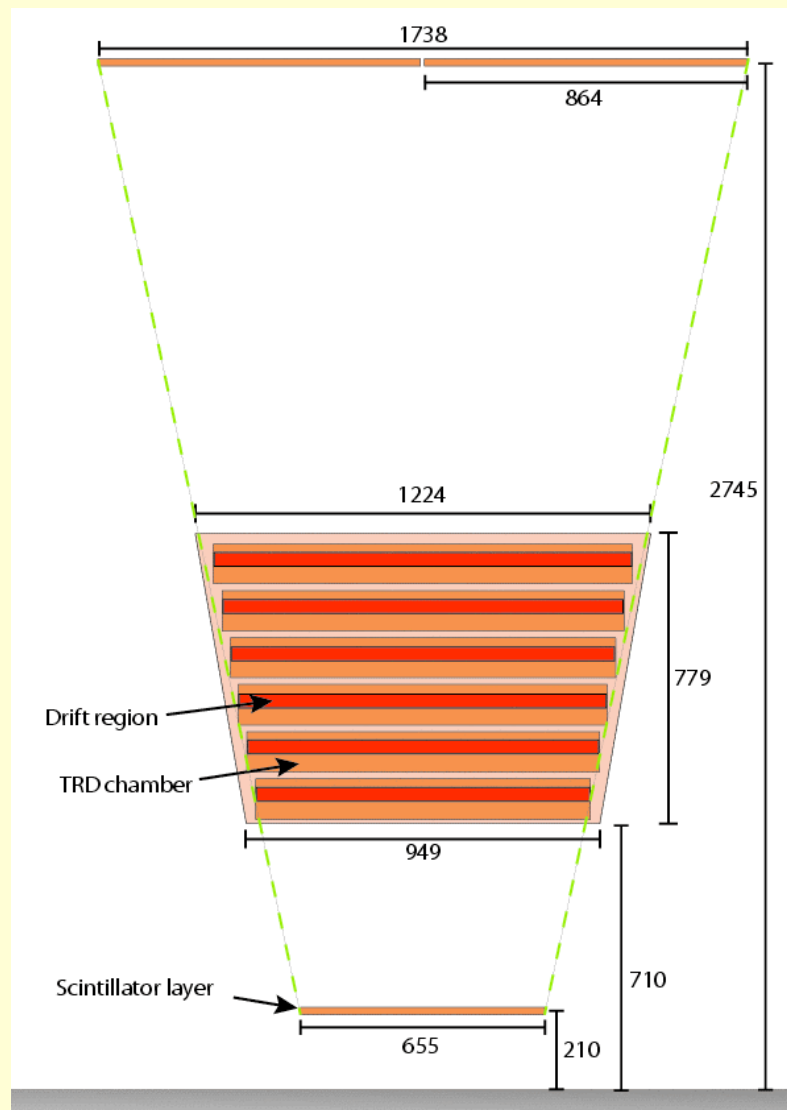
Svenja Wulff, Eva Sicking, Alex Bercuci, Dariusz Miskowiec, Tom Dietel

■ reconstructed clusters

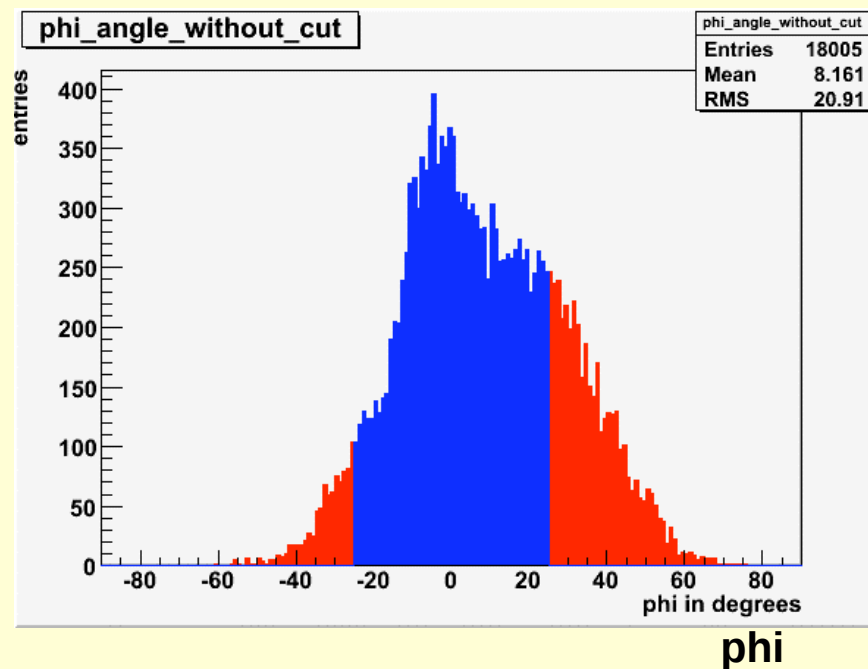


Distribution of Cosmic Tracks

cosmic trigger rate 100 Hz
1 M – 10 M events per SM
100 k – 1 M tracks per SM



Bastian Bathen

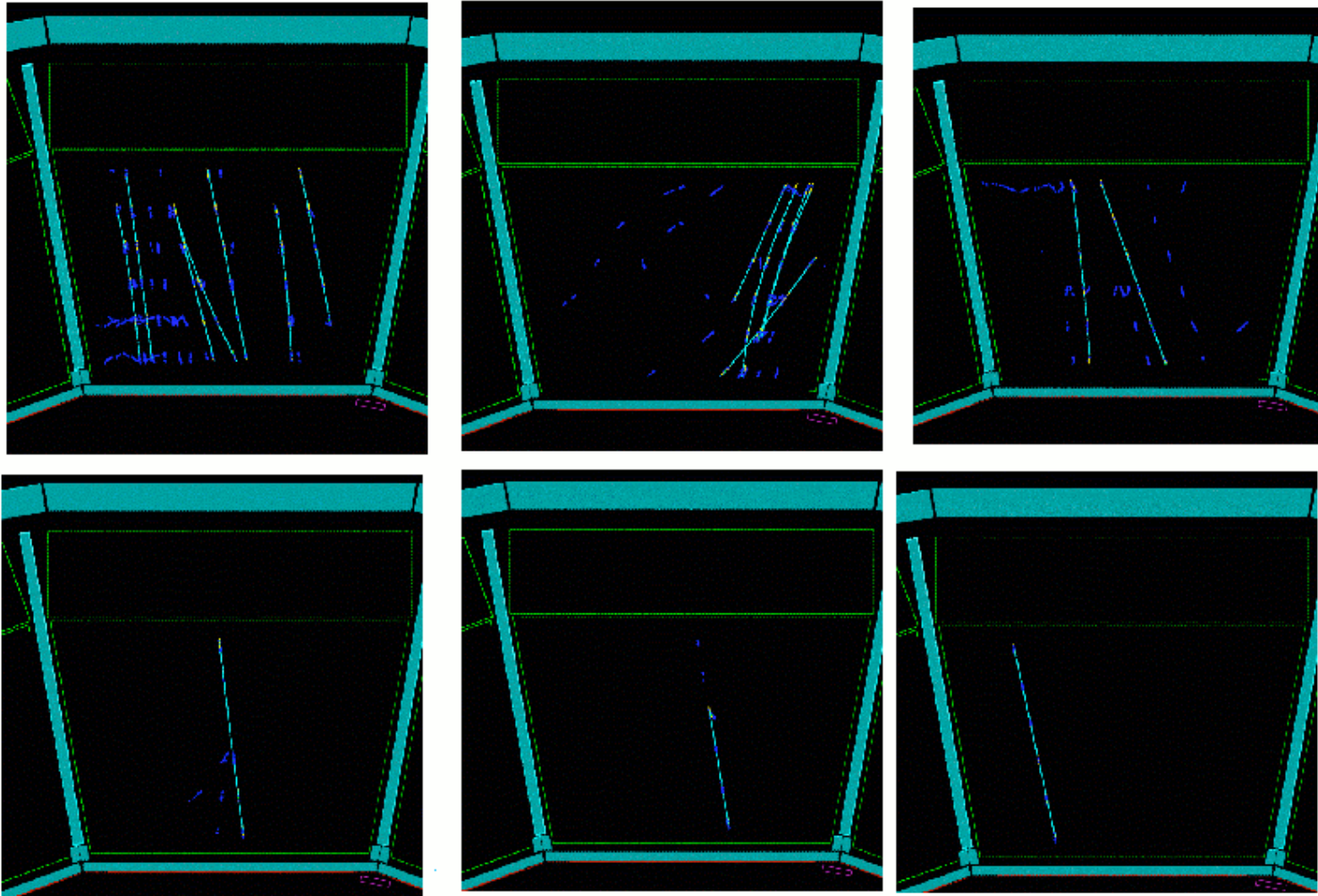


Johannes P. Wessels, Sibiu, 21.08.2008

Tracking Cosmics for Internal Alignment

Eva Sicking, Alex Bercuci

- reconstruction being optimized (see A. Bercuci's talk)

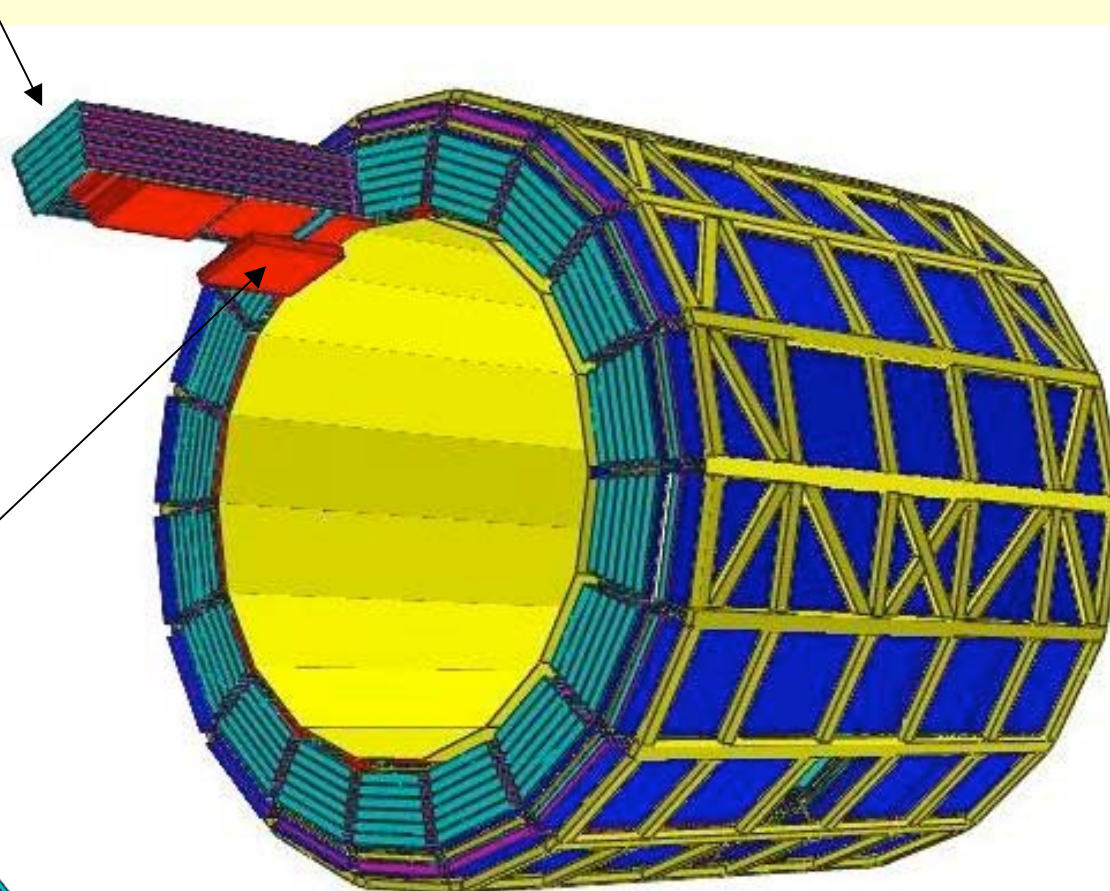
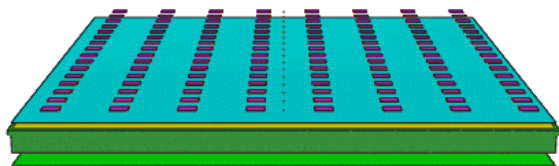


alignable objects in TRD

Dariusz Miskowiec

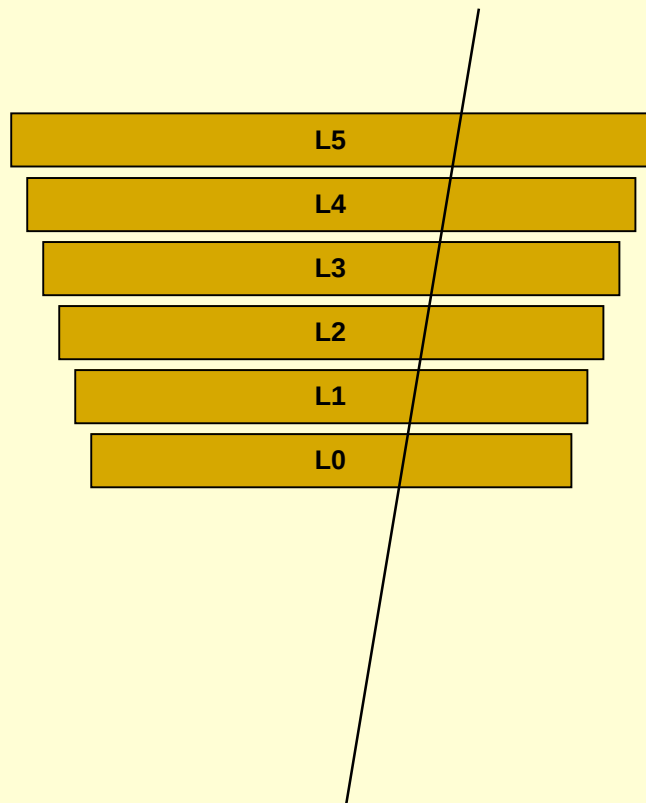
18 TRD supermodules
like **/TRD/sm03**
aligned by survey

540 TRD chambers
like **/TRD/sm03/st3/pl0**
aligned with tracks
3240 parameters



Alignment Procedure

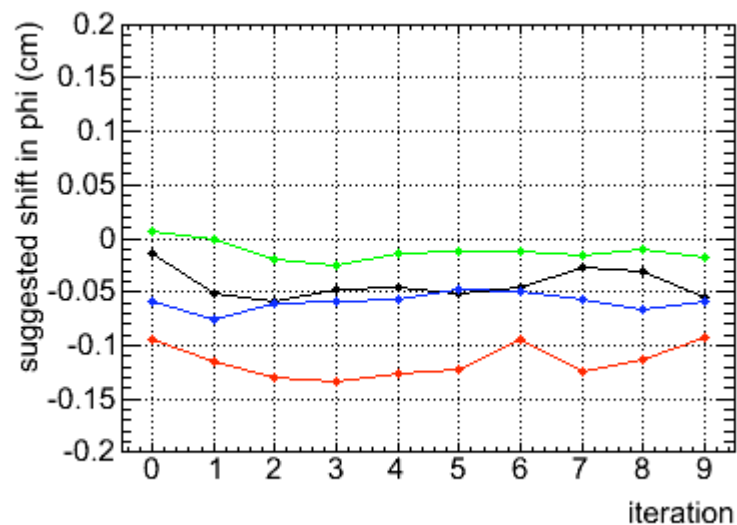
Eva Sicking, Dariusz Miskowiec



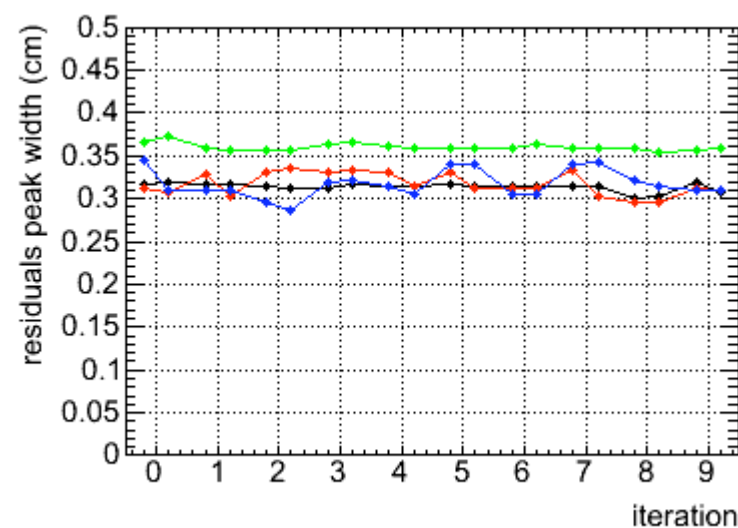
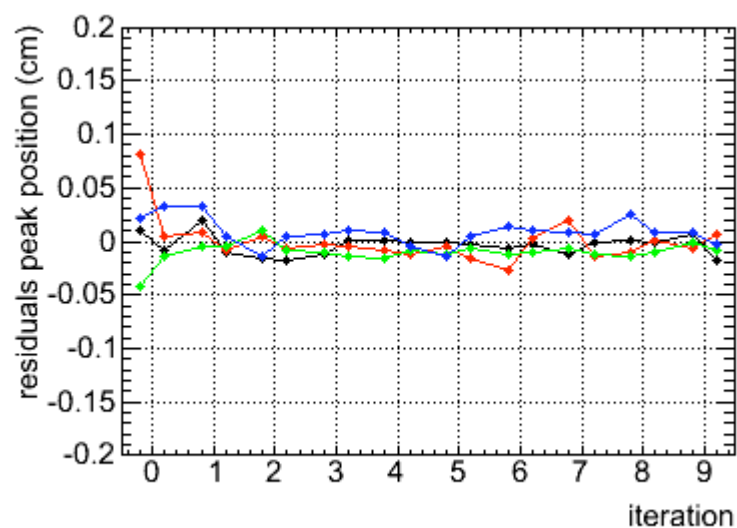
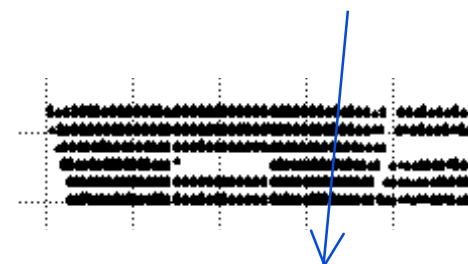
- keep L0 and L5 fixed
- adjust inner ones to all (at least 4) others (iteratively)
- fit straight tracks
- use "fast" minimizer for all possible shifts and tilts (6)

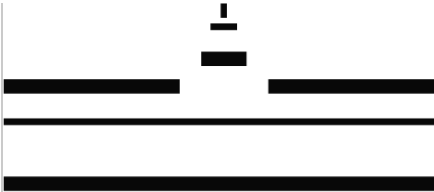
Münster cosmics, SM4

Eva Sicking, Dariusz Miskowiec



SM4, stack 1





Cosmics - Resolution

Eva Sicking, Dariusz Miskowiec

dataset	what	aligned to what	residuals peak width
Cosmics	L3	L0,L1,L2,L4,L5	0.30 cm
sim v4-11-Release	L3	L0,L1,L2,L4,L5	0.18 cm
sim v4-11-Release	L0	TPC	0.22 cm
sim v4-11-Release	L5	TPC	0.80 cm
sim v4-06-Release	L3	L0,L1,L2,L4,L5	0.07 cm
sim v4-06-Release	L0	TPC	0.11 cm

- while resolution was poor, centroids from different groups of tracks align to better than 0.1 mm
- Xe-tail -> Ar-tail

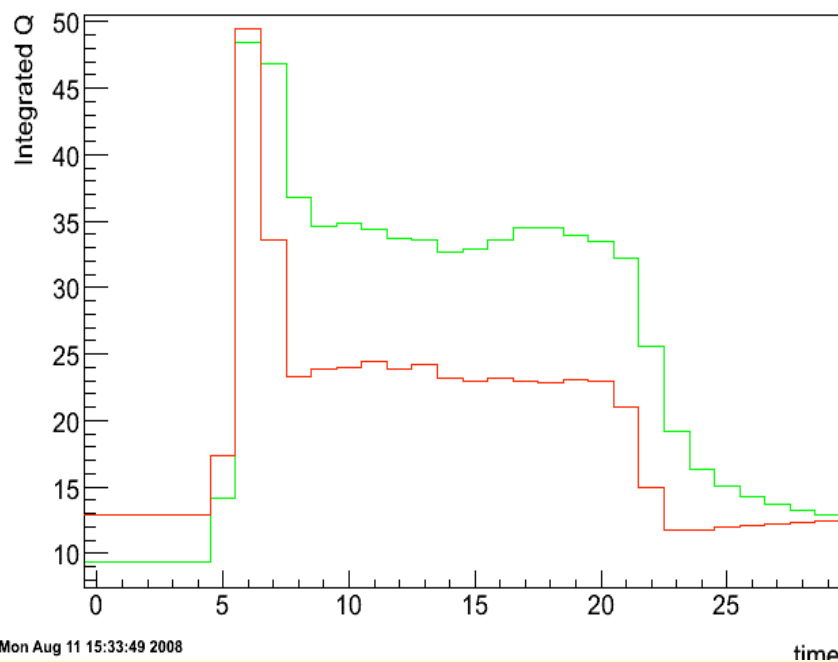
Reconstructed Clusters

Svenja Wulff

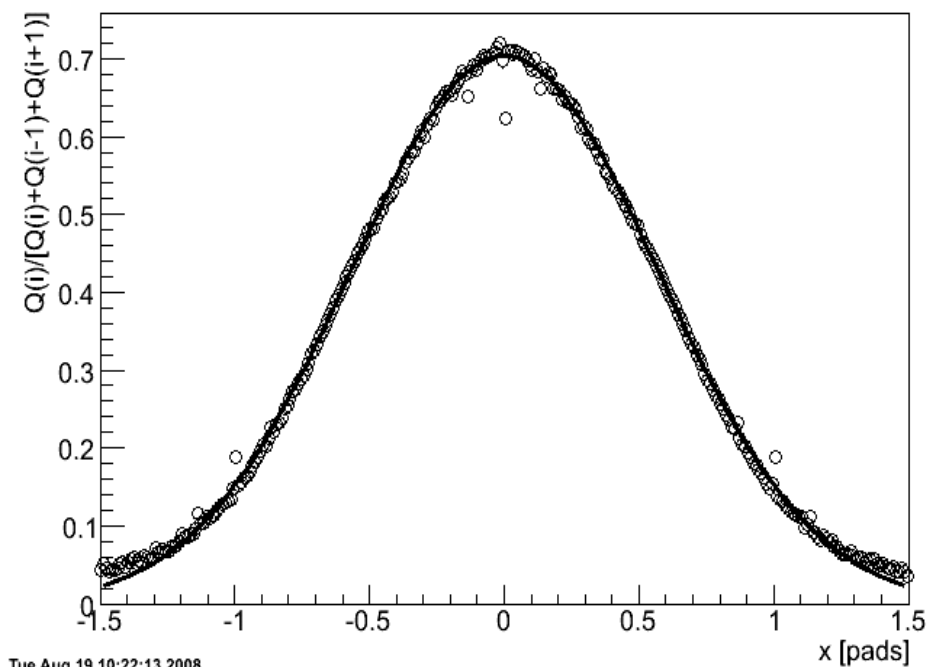
- integrated charge
with and without tail
cancellation

- pad response
function
 $\sigma \sim 0.57$ pad units

S=2 L=0



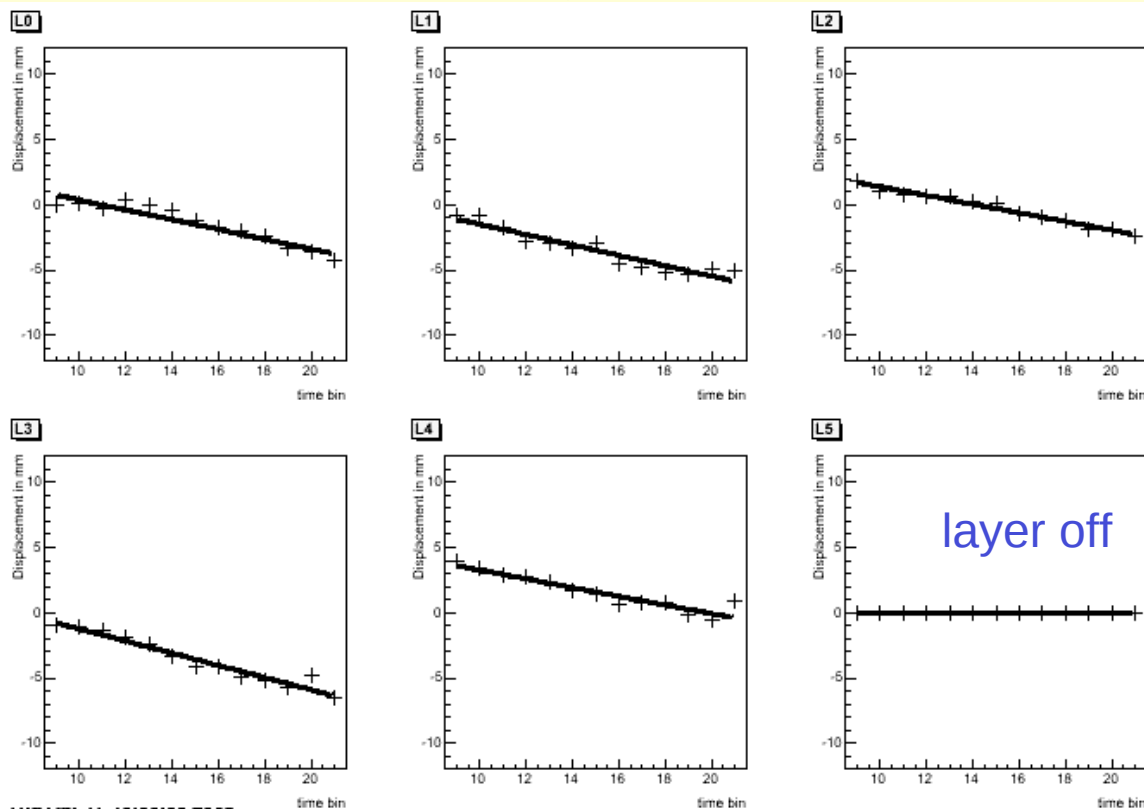
L1



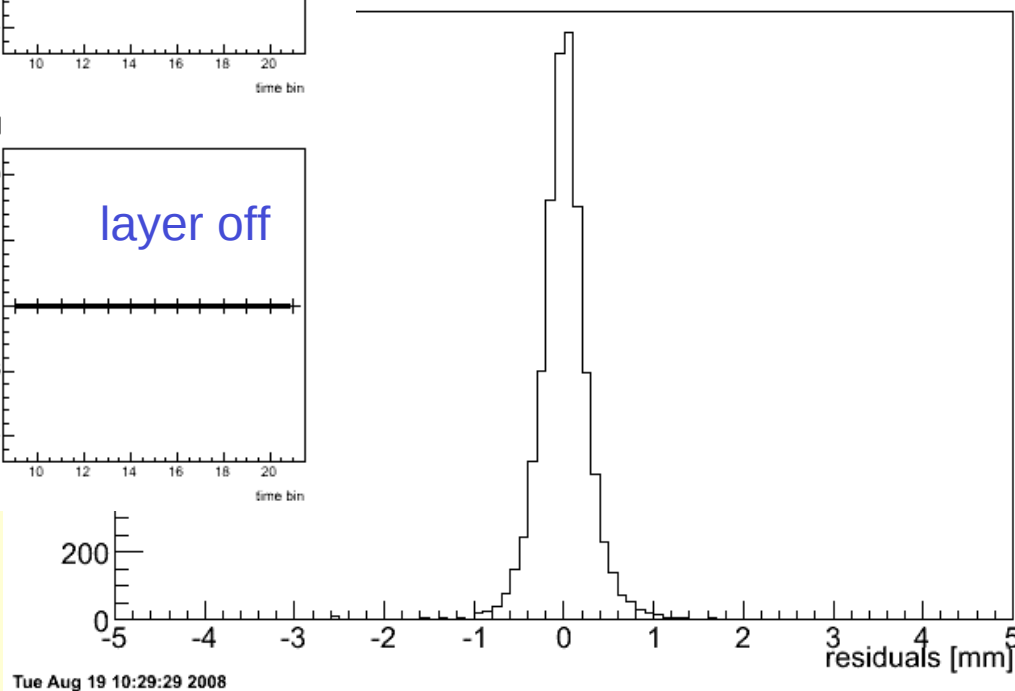
Reconstructed Tracks

Svenja Wulff, Eva Sicking, Alex Bercuci, Dariusz Miskowiec, Tom Dietel

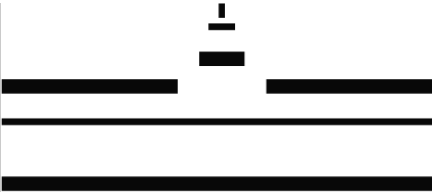
- fitting each layer



- residuals in layer 1
 $\sigma \sim 250 \mu\text{m}$



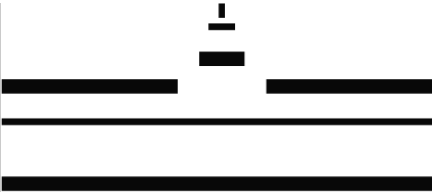
- still evaluating optimum cuts for gain calibration



Earlier Anticipated Schedules

- Super module II
 - ◆ start of production: 19.3.2007
 - ◆ duration: 8 weeks
 - ◆ finished: 11.5.2007
- Super module III
 - ◆ start of production: 14.5.2007
 - ◆ duration: 6 weeks
 - ◆ finished: 22.6.2007
- Installation July, 3-31
- Afterwards: 1 SM every 6 weeks

-> $15 \times 6 = 80$ weeks
super module assembly finished
by 1/2009



De Facto Dates

- Super module II
 - ◆ start of production: 04.04.2007
 - ◆ delivered to CERN: mid-July 2007
- Super module III
 - ◆ start of production: mid-July 2007
 - ◆ delivered to CERN: mid-September 2007
- Super module IV
 - ◆ start of production: mid-September 2007
 - ◆ delivered to CERN: Xmas 2007
- Super module V
 - ◆ start of production: mid-February 2008
 - ◆ delivered to CERN: mid-April 2008
- Super module III
 - ◆ start of production: 15.04.2008
 - ◆ finished 28.5.2008
 - ◆ delivered to CERN: not yet

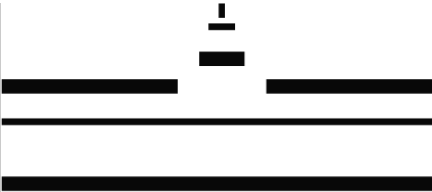
14 weeks - 1st assembled in MS

8 weeks - DCS/RO problems

12 weeks - Wiener noise

2*4 weeks - gas leaks

**6 weeks - 3 weeks for L0-L4
HV chain not stable**



Future

- Super module VI
 - ♦ hull is ready
 - ♦ chambers ready for shipping
- Super module VII
 - ♦ bus bars partially finished
 - ♦ chambers missing electronics
- Super module I + II
 - ♦ to come out during shutdown (1/2 2009)
 - ♦ chamber repair
- Super module VIII - XIX ?

Thank You

