# Status of FMD

Forward Detector Workshop

CERN, 16 March 2004

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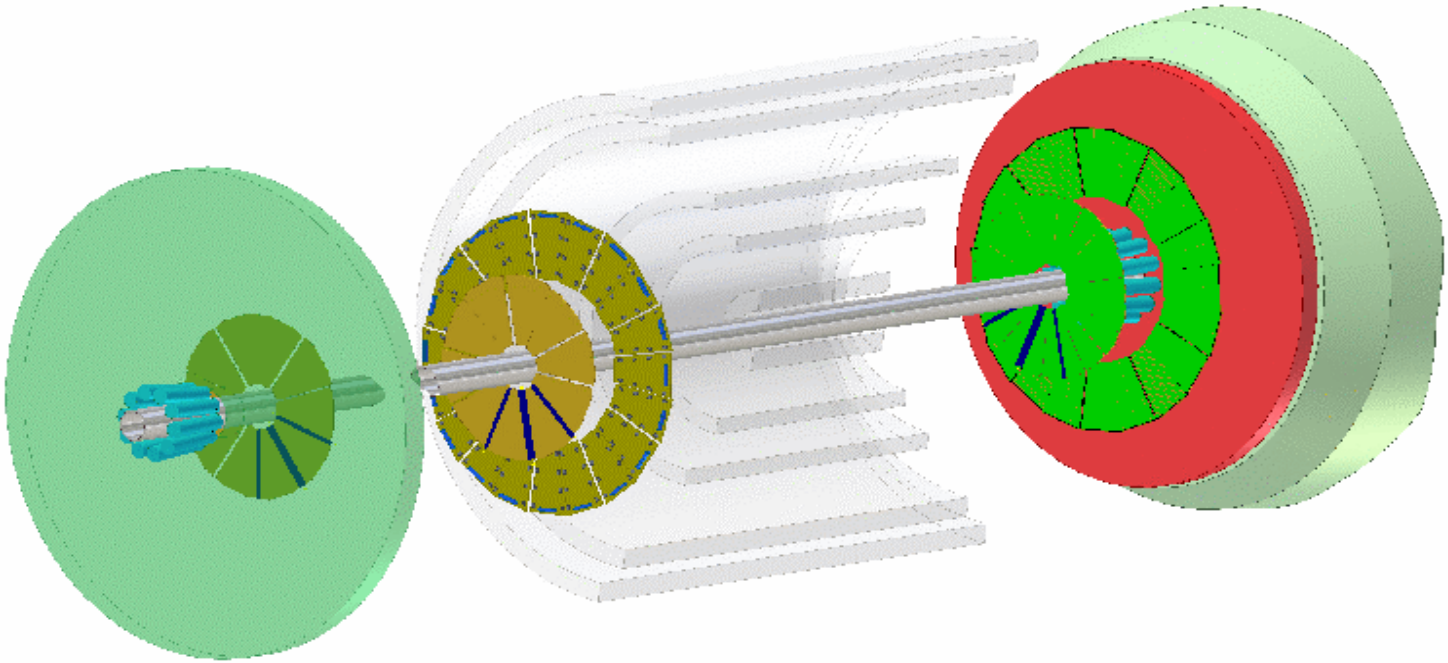
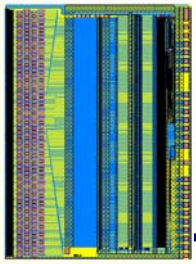
*Niels Bohr Institute*

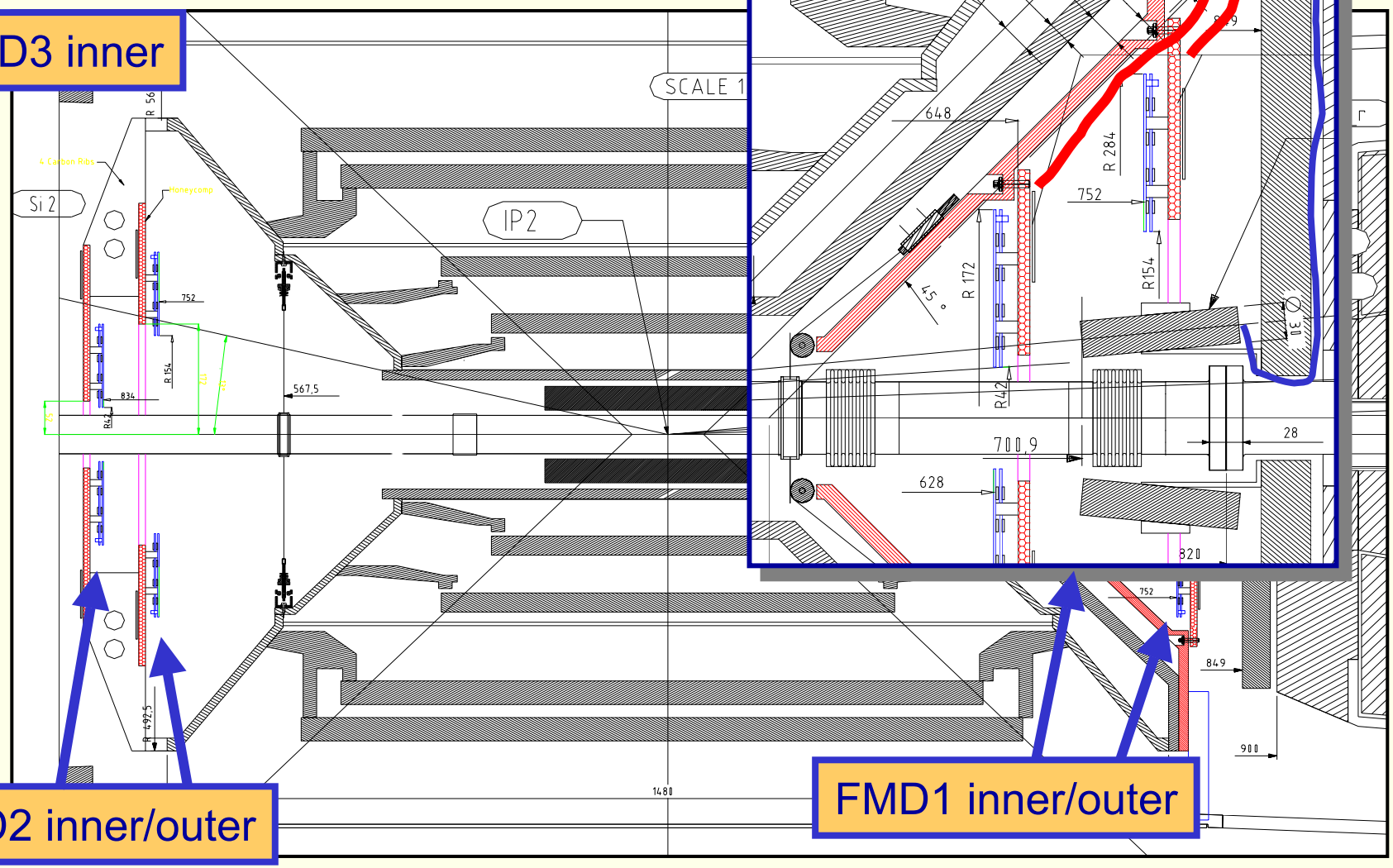
1. Integration and mechanical issues
2. Sensors
3. Preamp-shaper chips
4. Hybrids
5. Read-out strategy
6. Heat dissipation and cooling

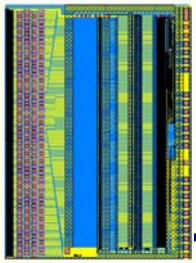
# Forward detector overview



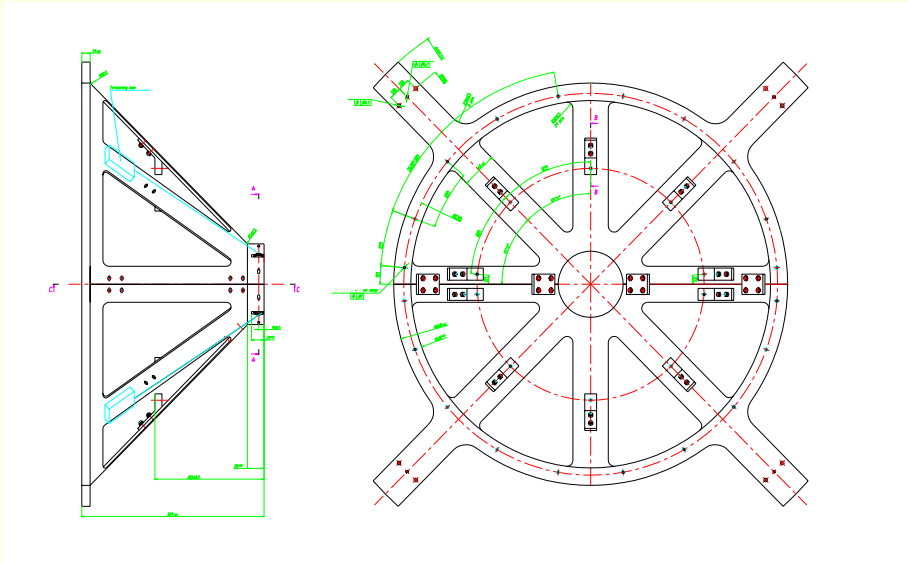


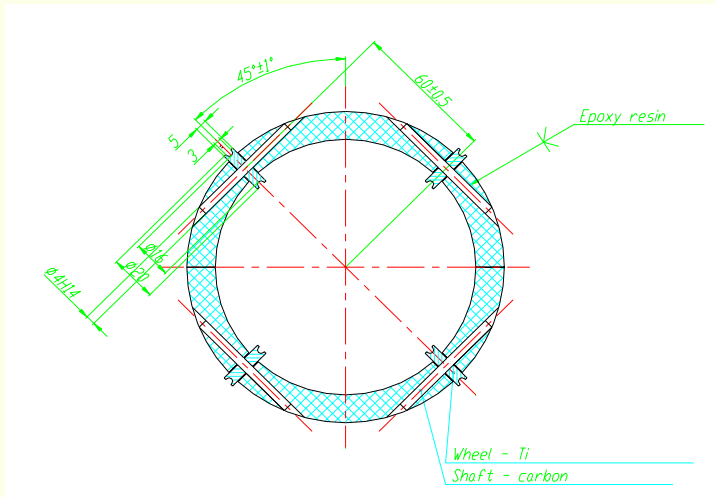
# Integration

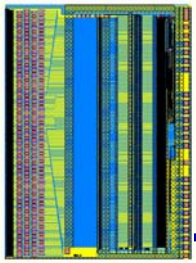




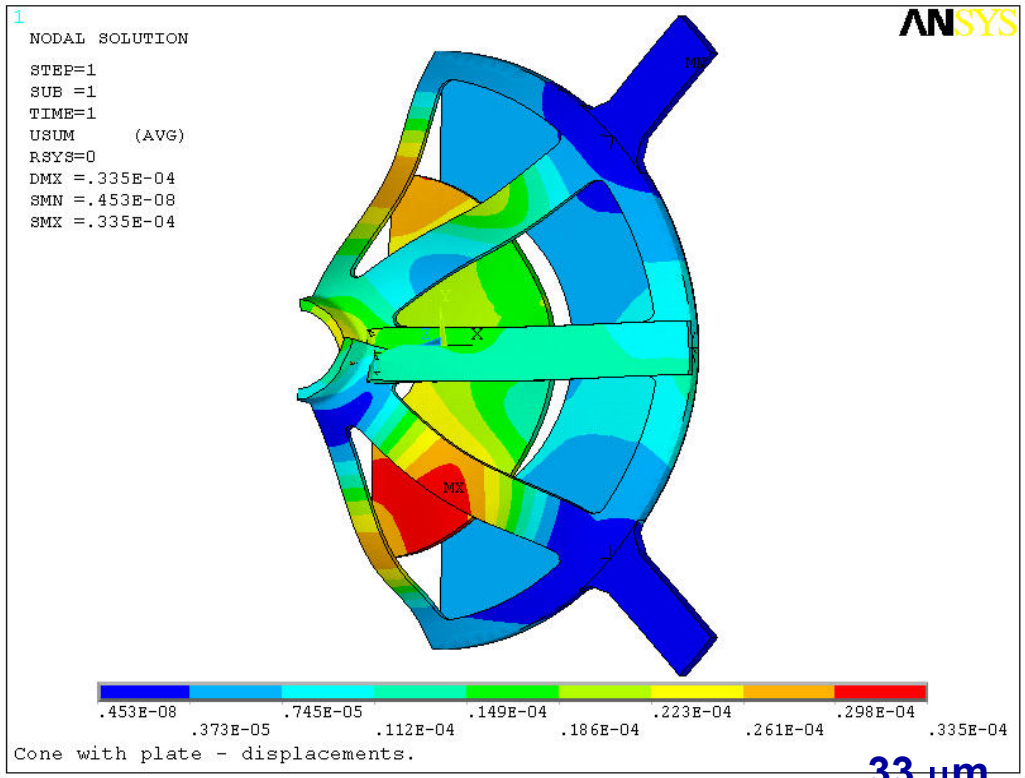
# Beam and FMD support cone RB26 side





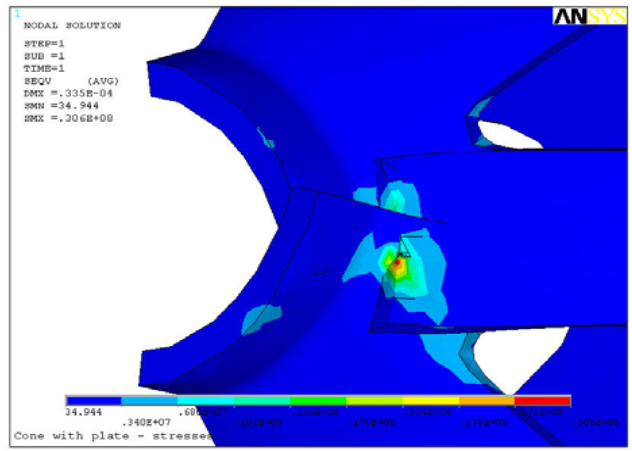


# Finite element calculations of beam pipe support




displacements

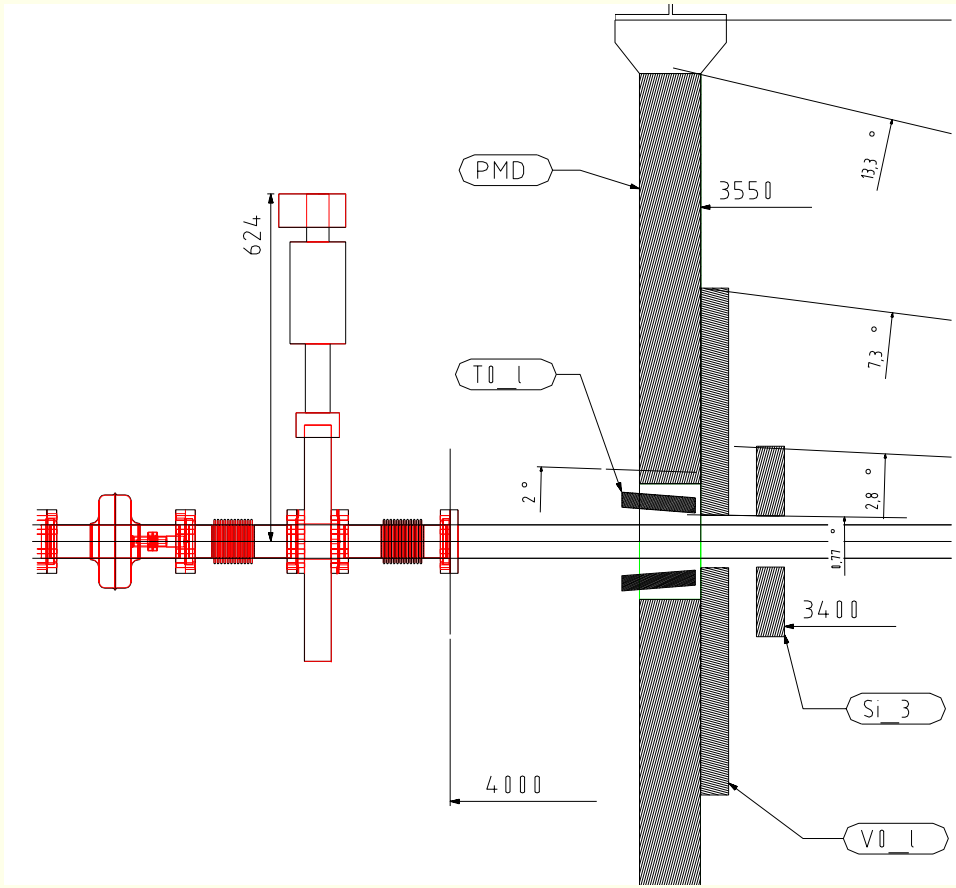
33 μm

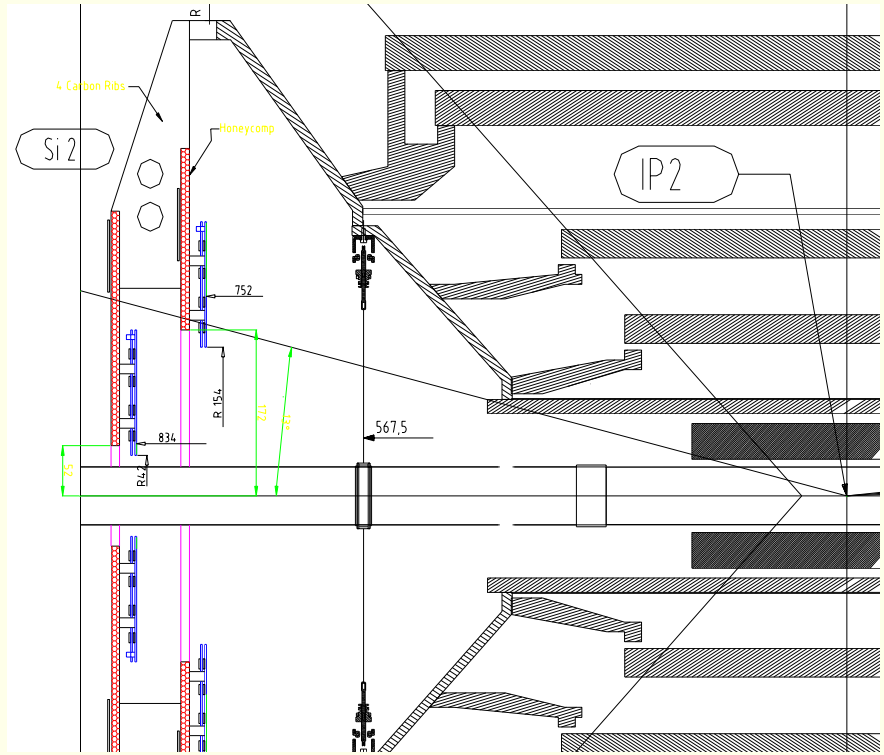



stresses

**Prototype beam-pipe support structure (crucial for LHC) in construction at NBI**

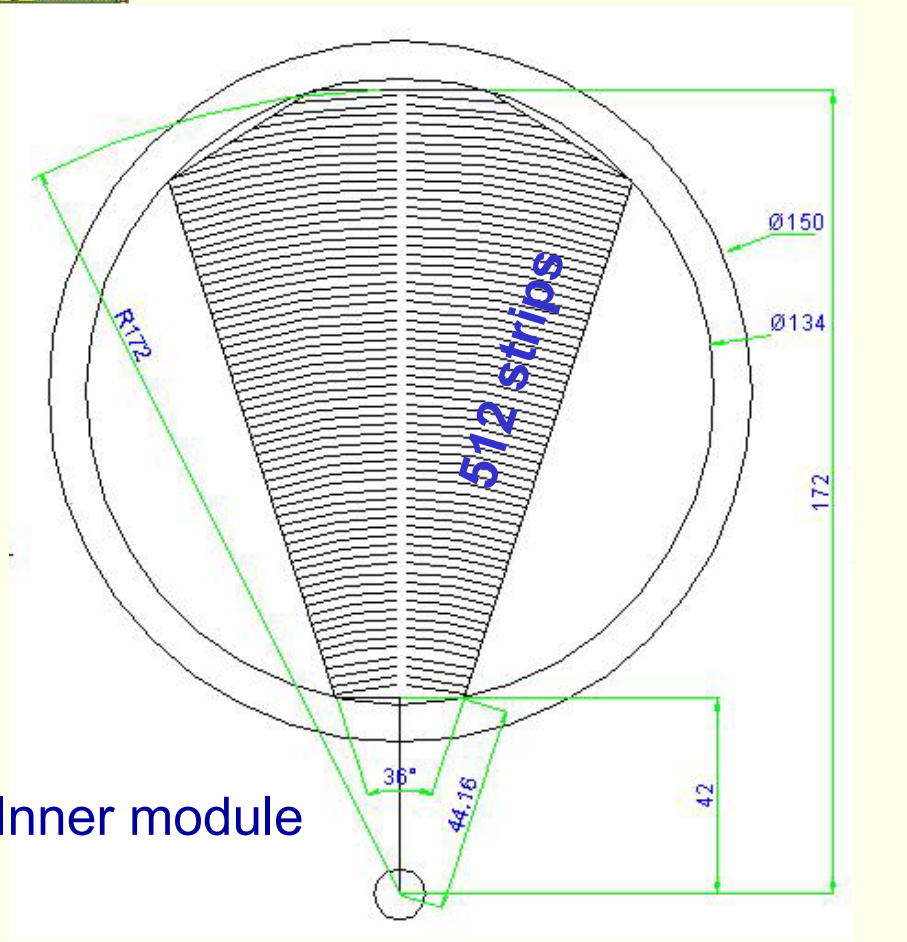
# RB24 Side: FMD2 & FMD3



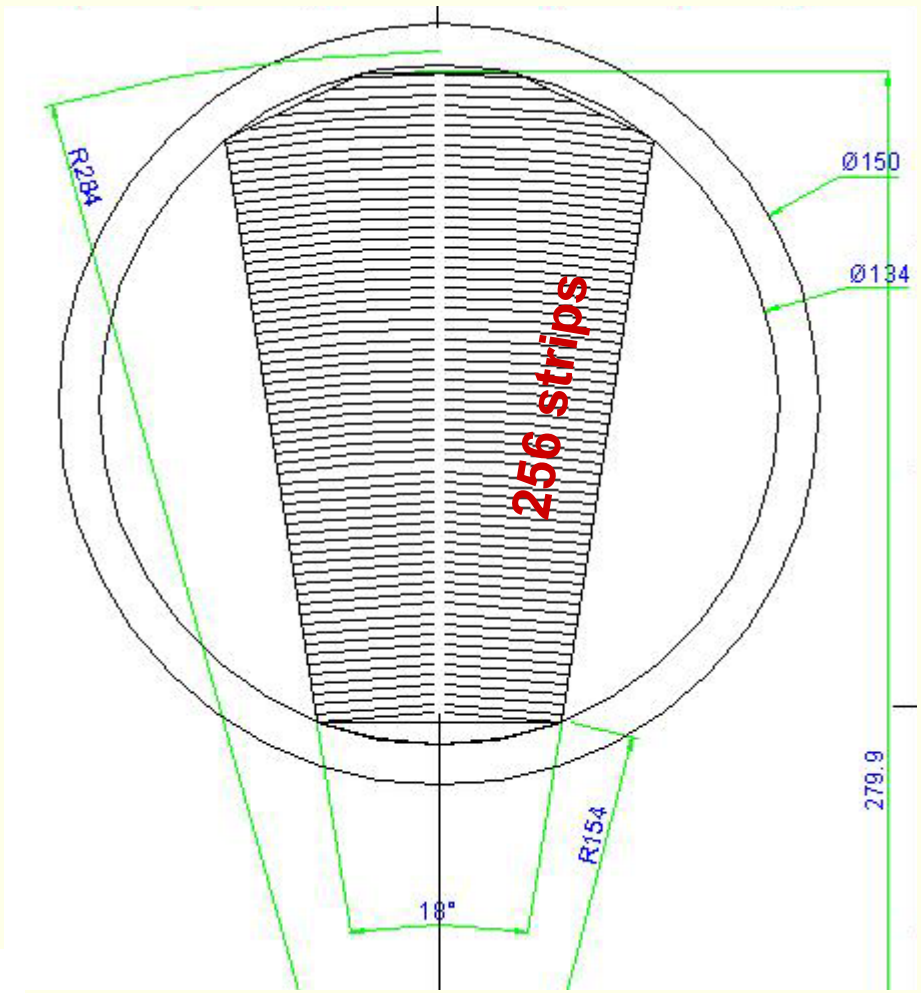




**Details of mounting not settled or designed**

# FMD sensors



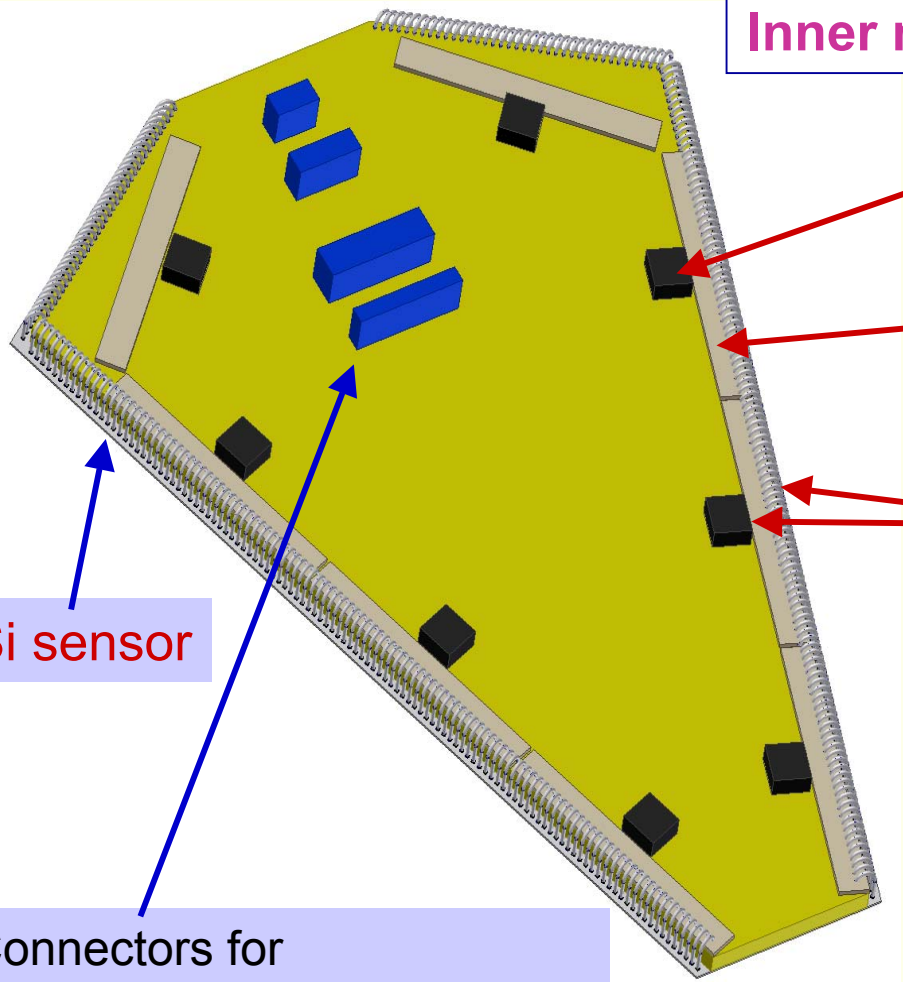

Inner module



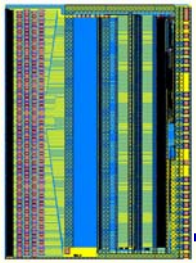

Outer module

**Final negotiations with (Micron/Hamamatsu) ongoing.**

# Hybrids



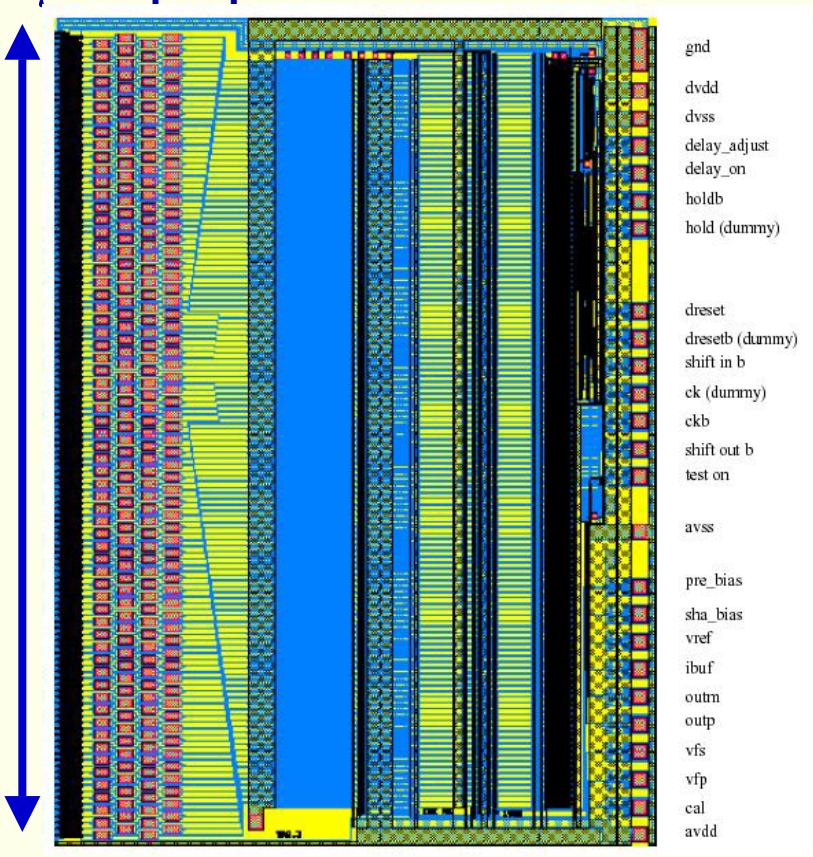

- Custom production of adapted VA1
- Hybrid design settled with IDEAS.



# Preamp-shaper chip

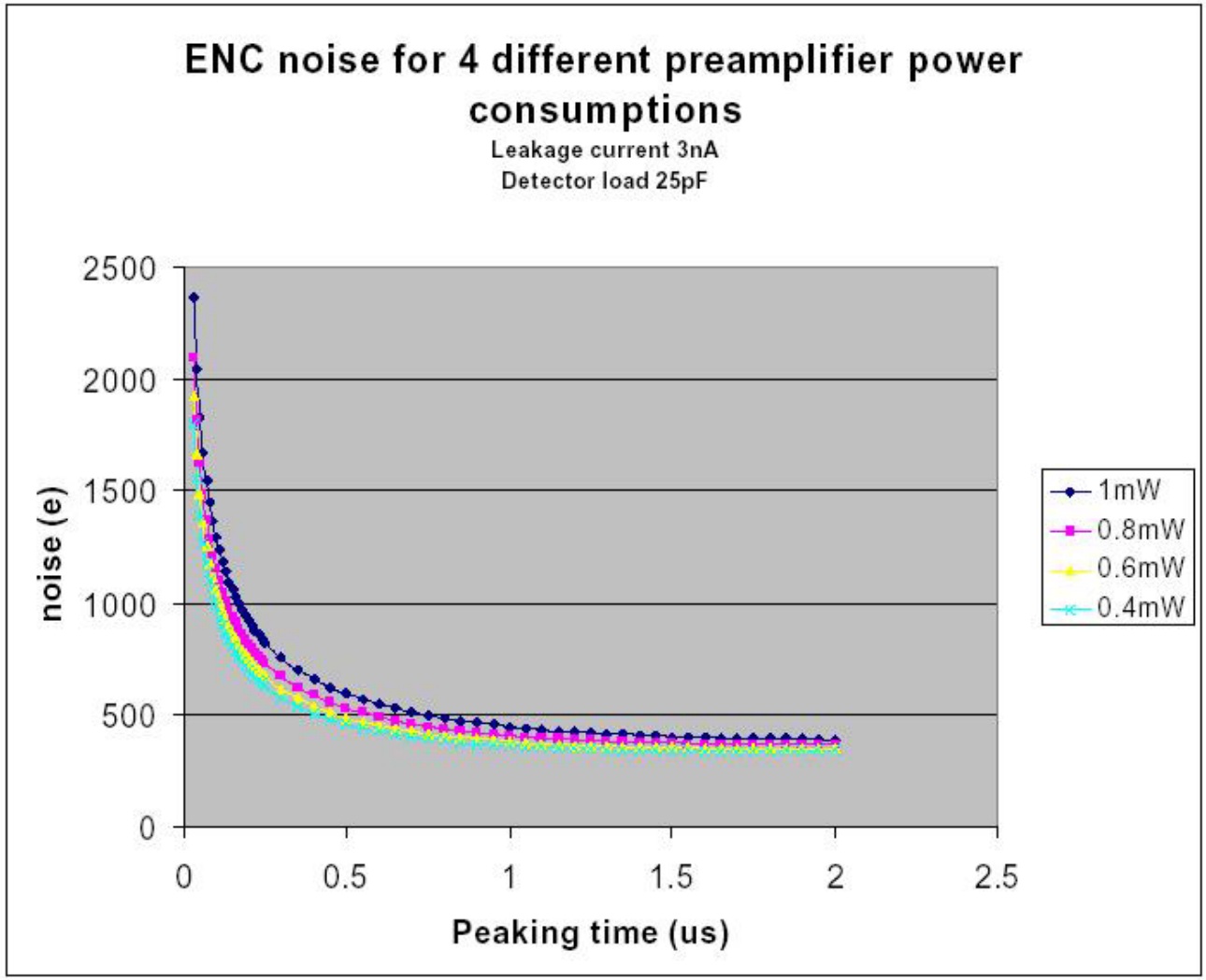
## VA1_ALICE

50 μm input pitch




| | |
|---|---|
| Radiation hardness | > 500-1000 krad |
| Peaking time | 0.7-2.0 μsec (optimised at 1.2-1.4 μsec) |
| Noise (ENC) | < 500 e- (= 0.02 MIP) |
| Capacitance matching | 5-25 pF |
| Dynamic range | 0-20 MIPs (or ±10 MIPS) |
| Highly integrated | 128 channels per chip |
| Read-out speed | ~ 10 MHz |
| Test and calibration circuits | included |
| Power consumption | 0.6 mW per channel |
| Compatibility with ALTRO | requires level shift |
| Early prototype | VA1' useful |
| Affordable cost | yes |
| Channel count | 51,200 (400 chips à 128 channels) |

# VA1_ALICE noise simulations



# Radiation environment

Doses and Fluences in Central ALICE (10 years running):

FMD:

4.2 cm

|

|

28 cm

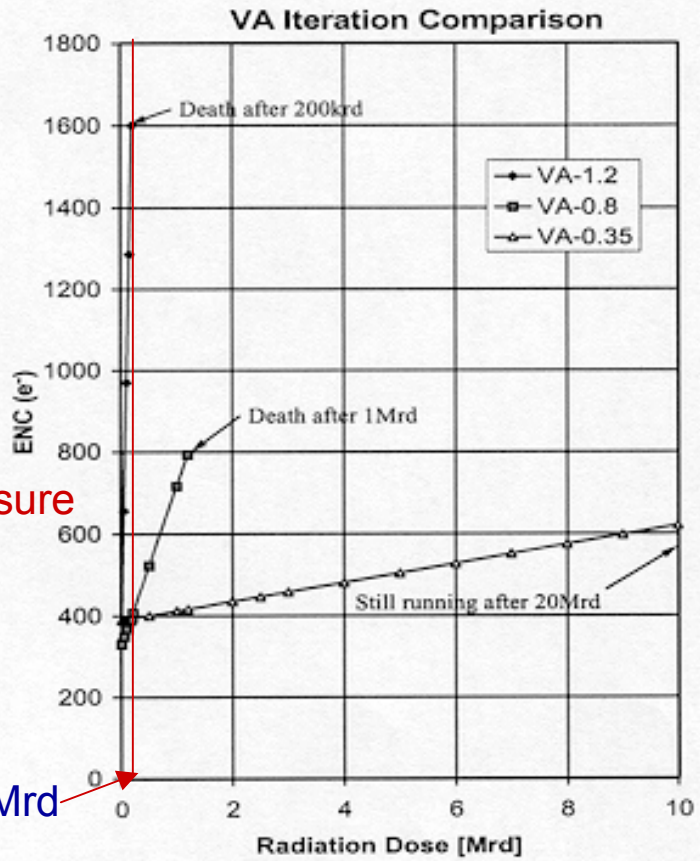
SSD2

TPC(in)

| Radius [cm] | Dose [Gy] | Neutrons [cm**-2] | h-Φ [cm**-2] |
|---|---|---|---|
| 3.9 | 2450 | 8.2E+11 | 3.5E+12 |
| 7.6 | 560 | 5.7E+11 | 1.3E+12 |
| 14 | 200 | 4.6E+11 | 5.5E+11 |
| 24 | 100 | 4.3E+11 | 3.2E+11 |
| 40 | 40 | 4.1E+11 | 2.3E+11 |
| 45 | 26 | 4.0E+11 | 2.0E+11 |
| 78 | 13 | 3.6E+11 | 1.5E+11 |

relevant for RCU exposure

Belle measurements



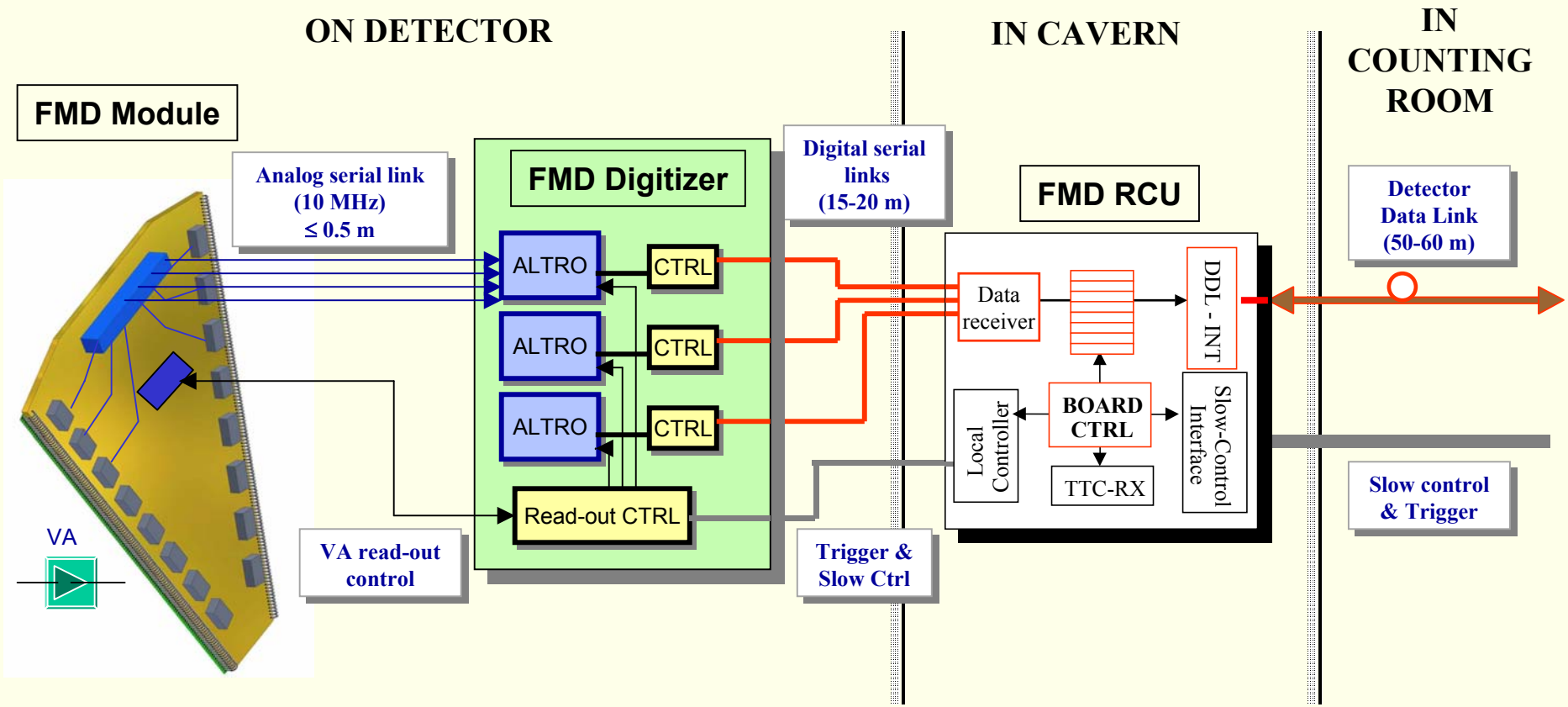

Doses in FMD:

| | Dose [Gy] | h-Φ [cm**-2] |
|---|---|---|
| FMD1 | 80-1300 | 8.6-13.0E+11 |
| FMD2 | 40-2100 | 1.3-6.1E+11 |
| FMD3 | 900-3100 | 2.2-5.2E+11 |

=0.31 Mrd

# Previous read-out strategy

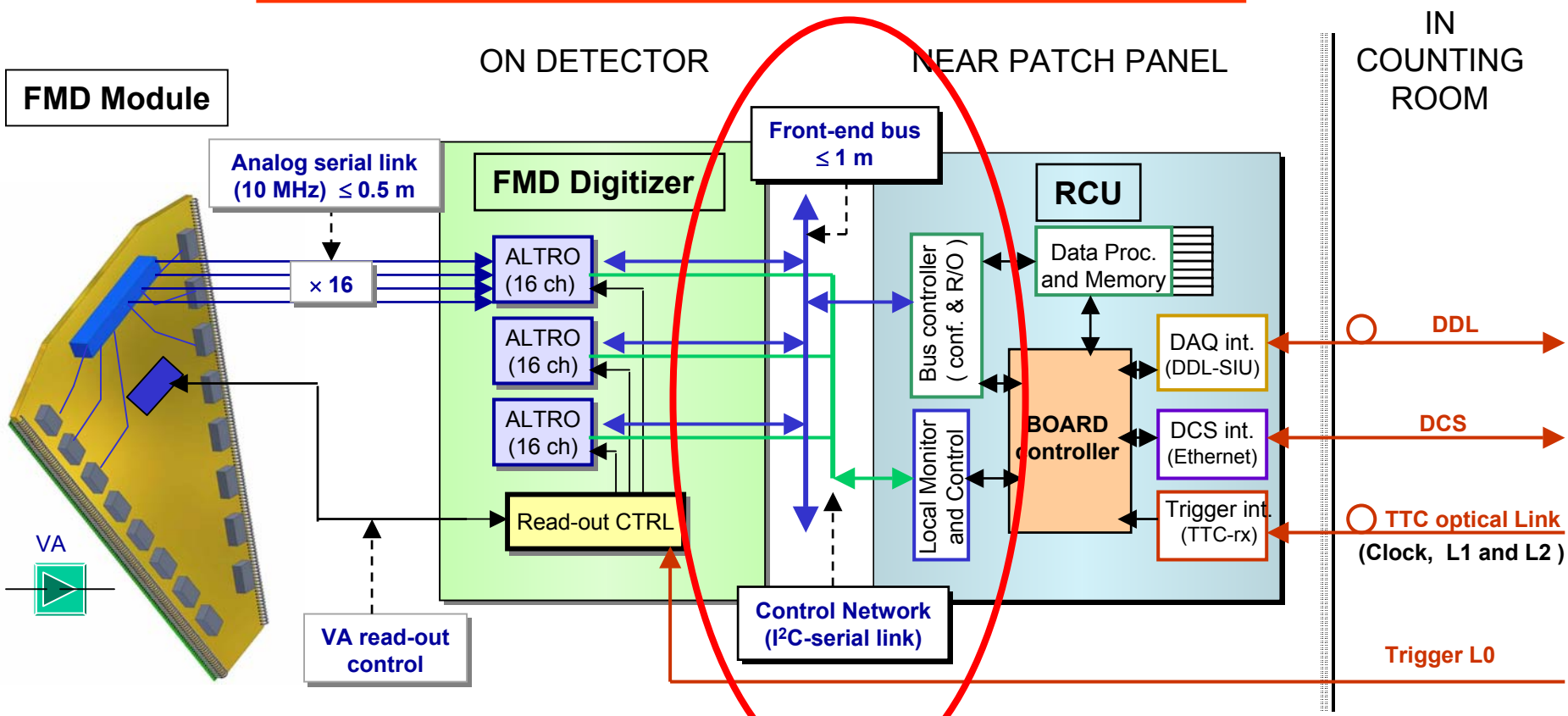
## FMD Read-Out and Control Electronics




BSN, 21 Nov 2002

# New read-out strategy

## FMD Read-Out and Control Electronics



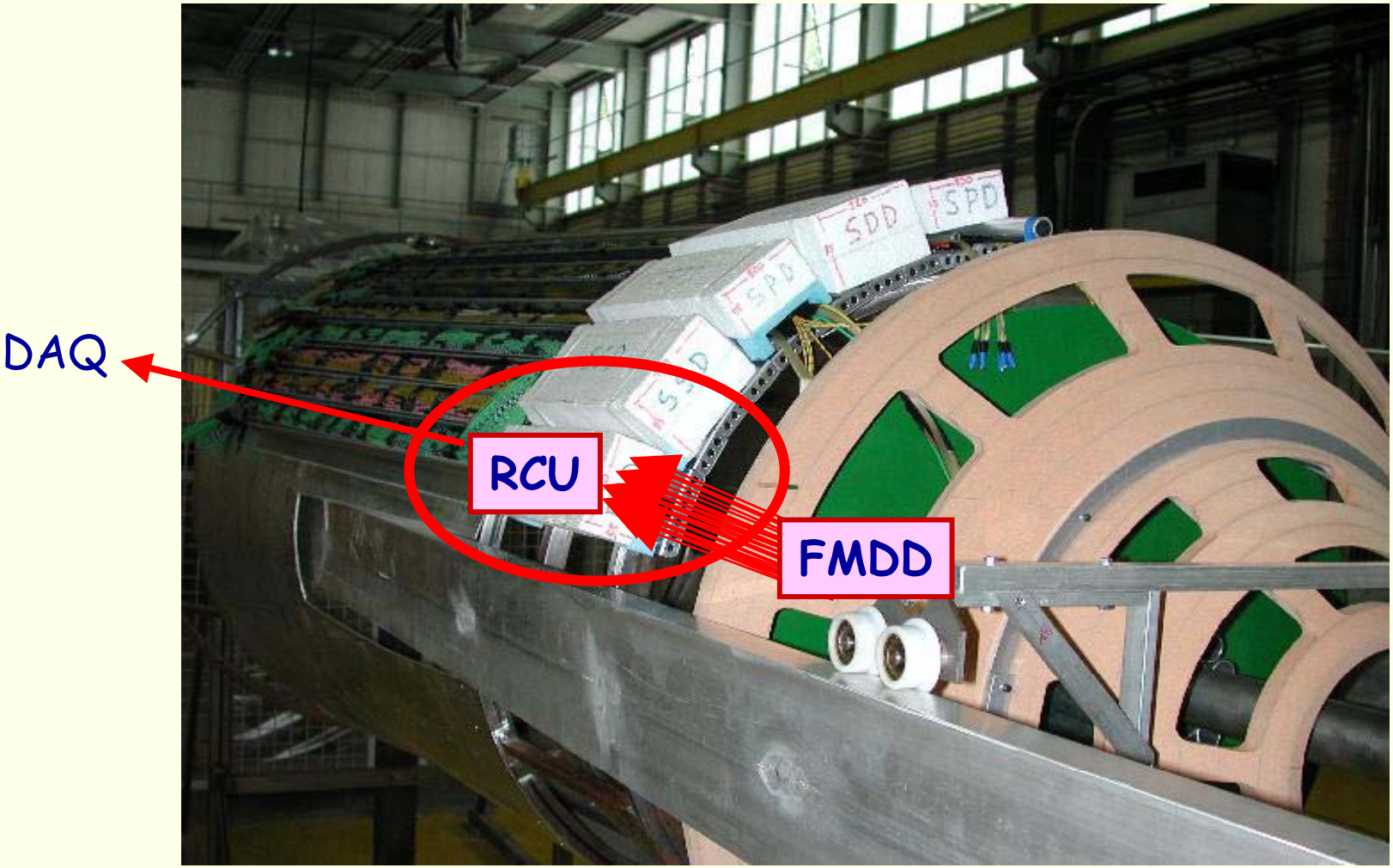

1 ring: 10/20 modules
Full FMD: 70 modules

2 Digitizers
10 Digitizers

1 RCU per ring system
3 RCU's

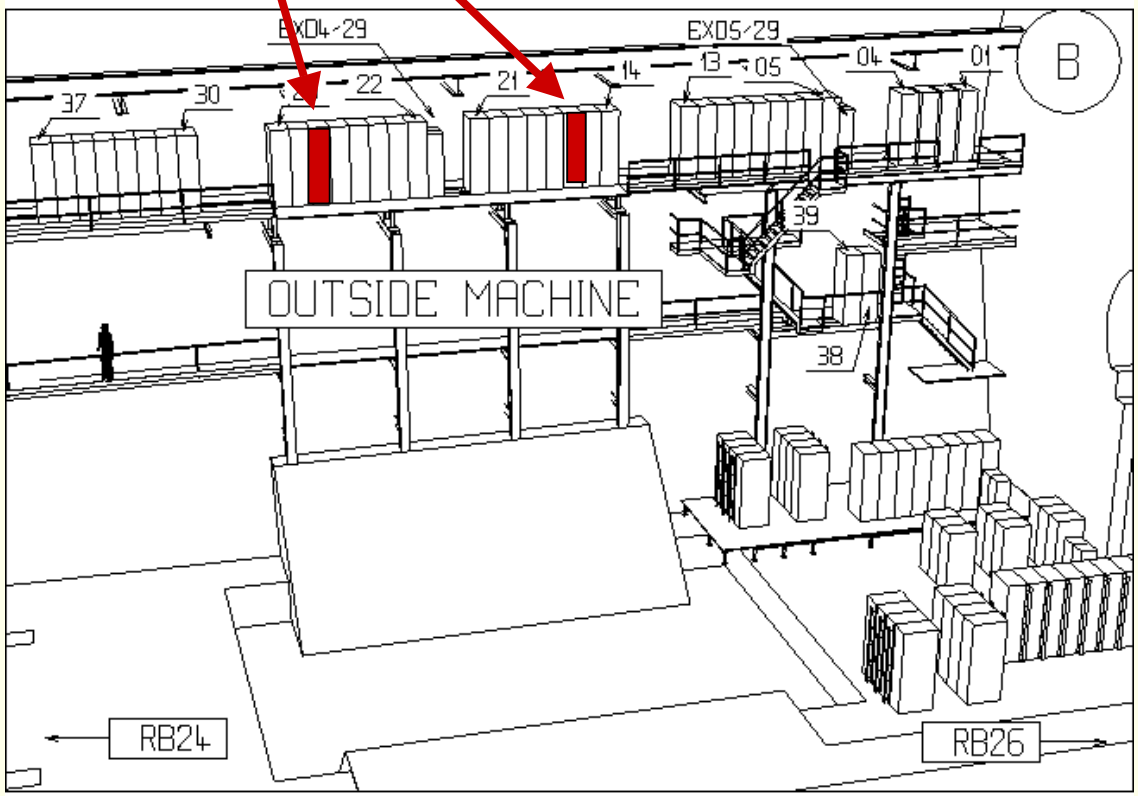
BSN, 17 Feb 2004

# Proposed new RCU location

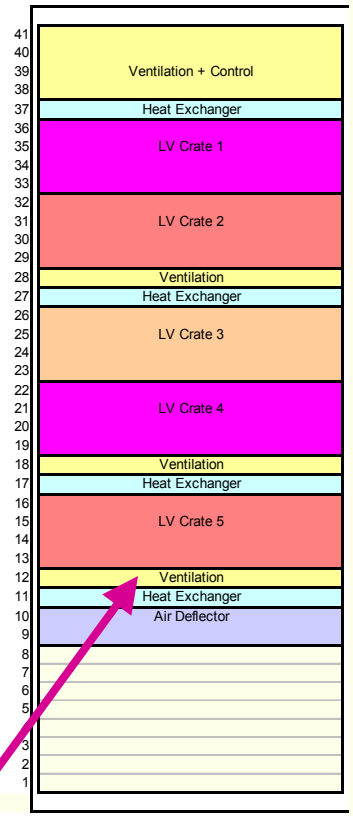


# Rack allocation

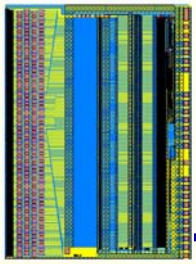
FMD racks: B27 + B16




Rack Number: **A13**
type: LHC-41
Sub Detector-Function: **TPC-LV**
JPV, 11/2/2004




**Example (TPC) of rack space allocation:**



# Heat dissipation

Heat dissipated by FE electronics of one FMD ring:

VA1-ALICE preamp chip (128 channels): 75-125 mW
× 80 chips = 6-10 W / ring (previously 19 W)

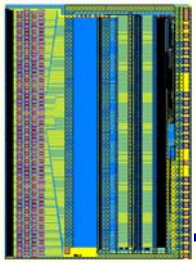
Read-out electronics and power distribution: 5-10 W / ring

**Concern:**

**Temperature conditions inside cone not defined /unsatisfactory**

**Recent temp. simulations indicate > 70 deg. C at FWD dets. location on RB26.**

**Substantial work on airflow etc. needed.**



# Post Doc position at NBI

**Post Doc for the ALICE Silicon-Forward Multiplicity Detector**
**Niels Bohr Institute**

The High Energy Heavy Ion Group at the Niels Bohr Institute, University of Copenhagen, has a post doc position available to help in building the FMD.

We are seeking af person with documented expertise in Silicon detector design, construction and operation and experience in front-end and read-out electronics.

The position is available immediately. The appointment is formally for one year, with possibility of prolongation up to 5 years.

For further information contact: J.J. Gaardhøje, email: gardhoje @ nbi.dk
or B.S. Nielsen, email: borge @ nbi.dk
Applications, including CV, list of publications, names of 3 referees, details of past experience to:
J.J.Gaardhøje, Niels Bohr Institute, Blegdamsvej 17, 2100 Copenhagen, Denmark