

The BCM1-F Subdetector of the Beam Conditions Monitoring System (BRM) for CMS

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OUTLINE OF THIS TALK

Motivation / History

CMS BRM System

BCM1-F

 Components

 DAQ

 Mounting and Installation

Measurements

Results

Outlook



MOTIVATION

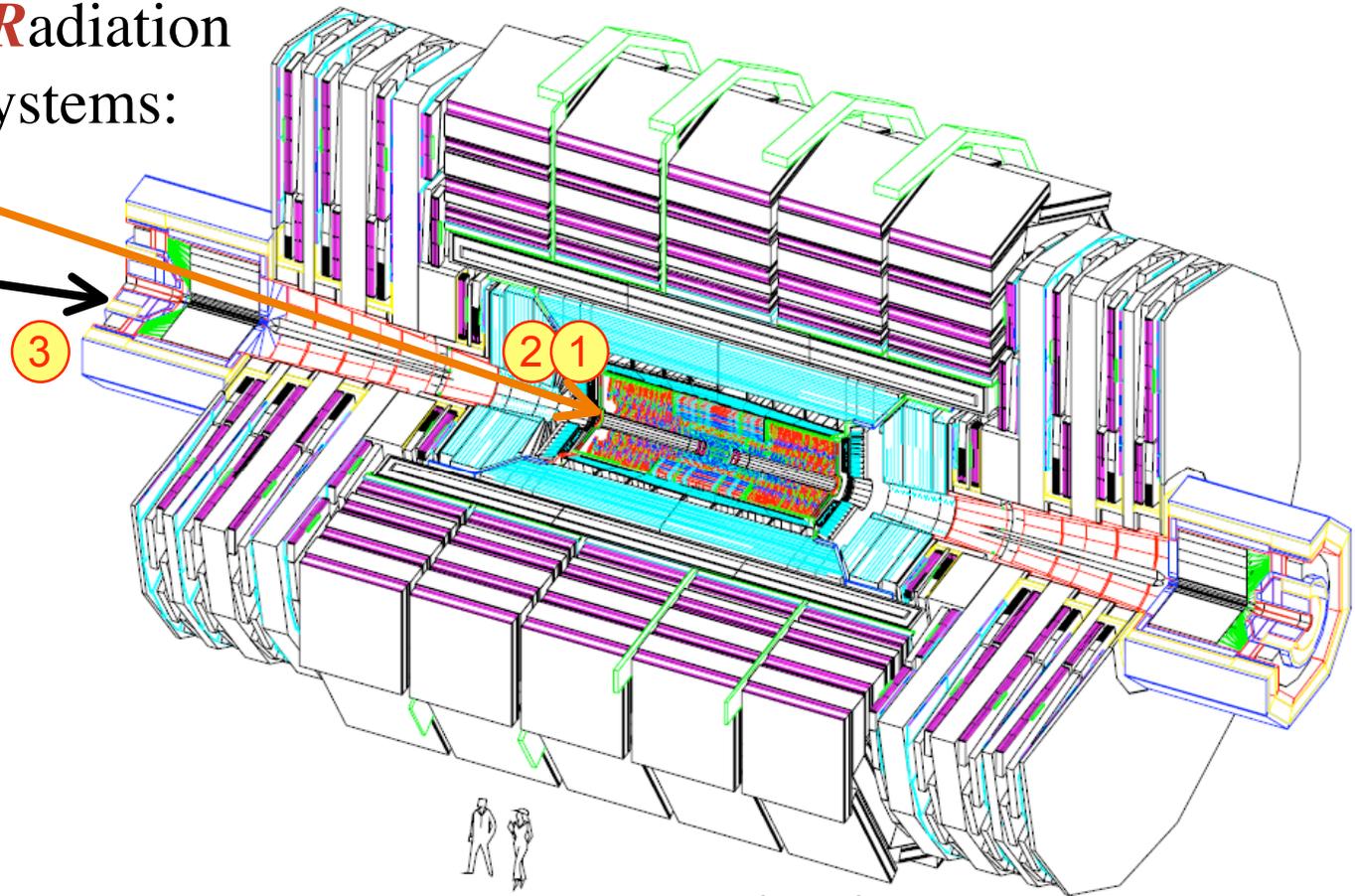
- First experience with sCVD sensor as beam monitor gained in ZEUS (HERA) (see 3rd NoRHDia workshop)
- Manpower needed for the commissioning of the CMS BRM system @ CERN, HERA shutdown, ILC delayed
- DESY Zeuthen's FCal group took over commissioning of BCM1-F and characterization of pCVD diamonds for the BCM1-L and BCM2 subdetectors
- Responsibility extended to readout hardware of BCM1-F
- Software development



The BRM System of CMS

BRM (*B*eam and *R*adiation
*M*onitoring) Subsystems:

- **BCM1-F/L**
- BCM2
- BSC
- PLT
- ...
- passive systems



Compact Muon Solenoid



BCM Subsystems

BCM1L: current integrating monitor

Location: $z = \pm 1.8\text{m}$, $r \sim 5\text{cm}$

4 stations in each z

Sensor: 1cm^2 pCVD Diamond

BCM1-F: Fast BCM unit, counting device

Location: $z = \pm 1.8\text{m}$, $r \sim 5\text{cm}$

4 stations in each z

Sensor: 0.25cm^2 sCVD Diamond

Electronics: Analog + optical signal transmission

Readout: bunch by bunch

BCM2: current integrating monitor

Location: $z = \pm 14.4\text{m}$, $r = 29\text{cm}$

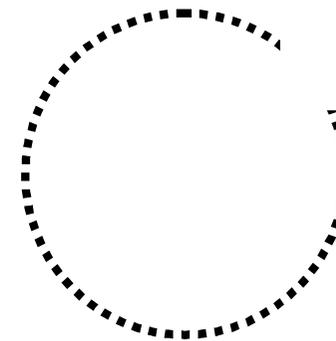
8 stations in each z

Sensor: 1cm^2 pCVD Diamond

Readout: $\sim 20\text{kHz}$

Sensors shielded from IP

= Frontend Module
(L-shape)



LHC orbit ($\sim 85\ \mu\text{s}$)
with abort gap



BCM1-F

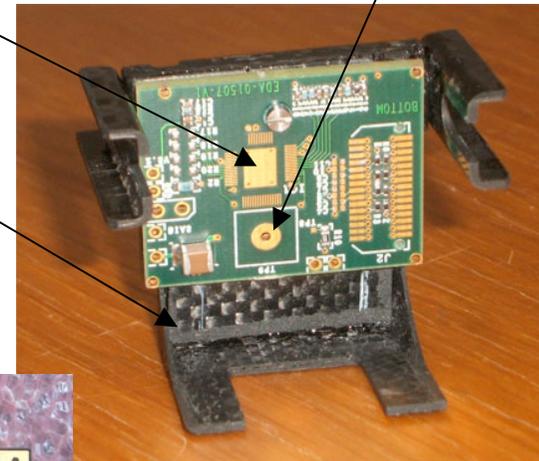
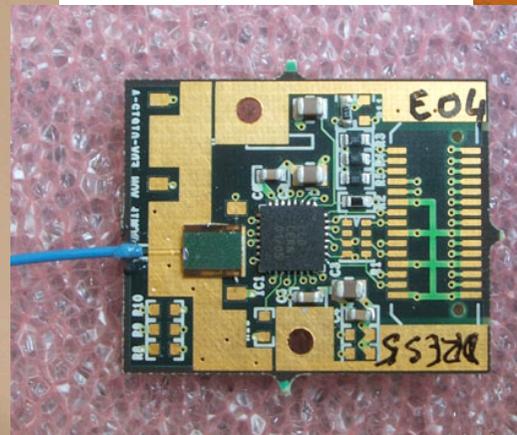
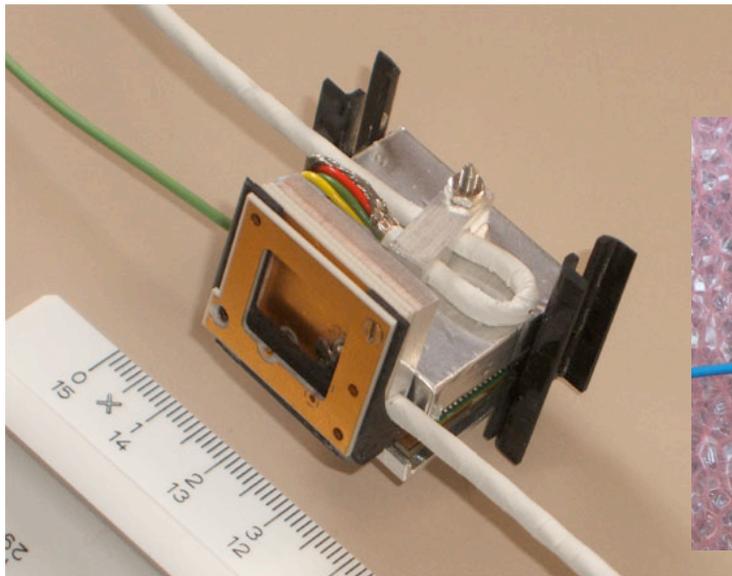
Sensor and preamplifier:

Sensor: sCVD 5 x 5 mm², E6 -> Rutgers: metallization, characterization -> CERN ●
Preamp: JK16 radhard (CERN), 25 ns shaping time ●

Analog Optical Hybrid (AOH):

Radhard laser driver, laser diode with monomode fibre

Support structure for BCM1-F/L (carbon fibre reinforced) ●



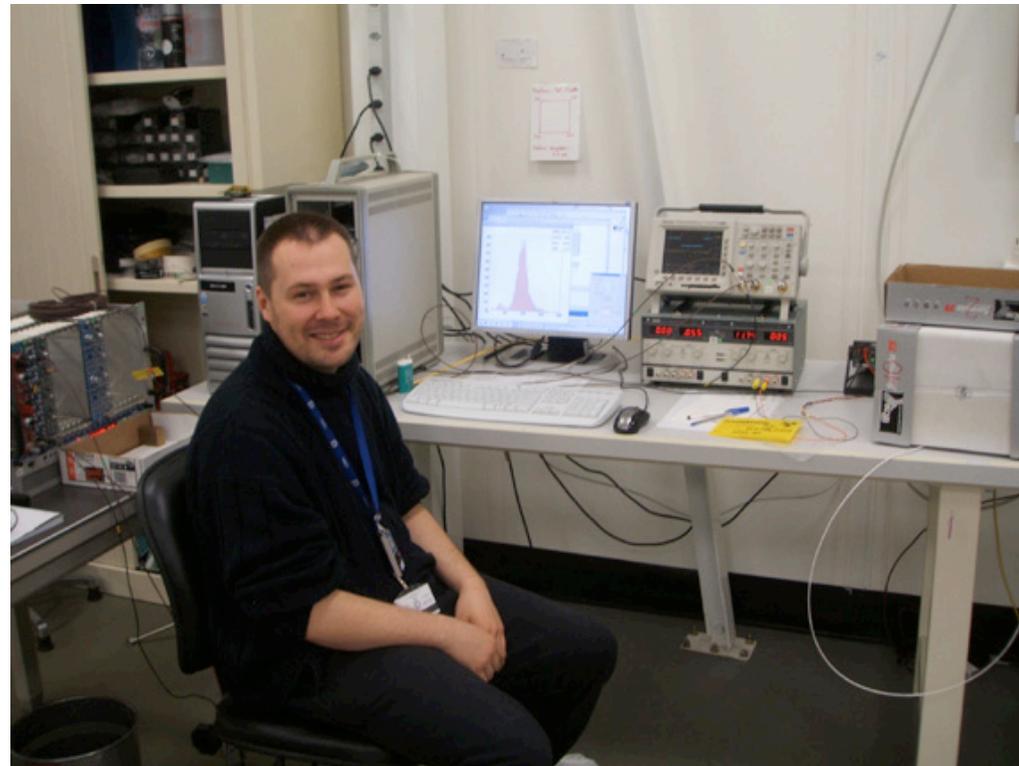
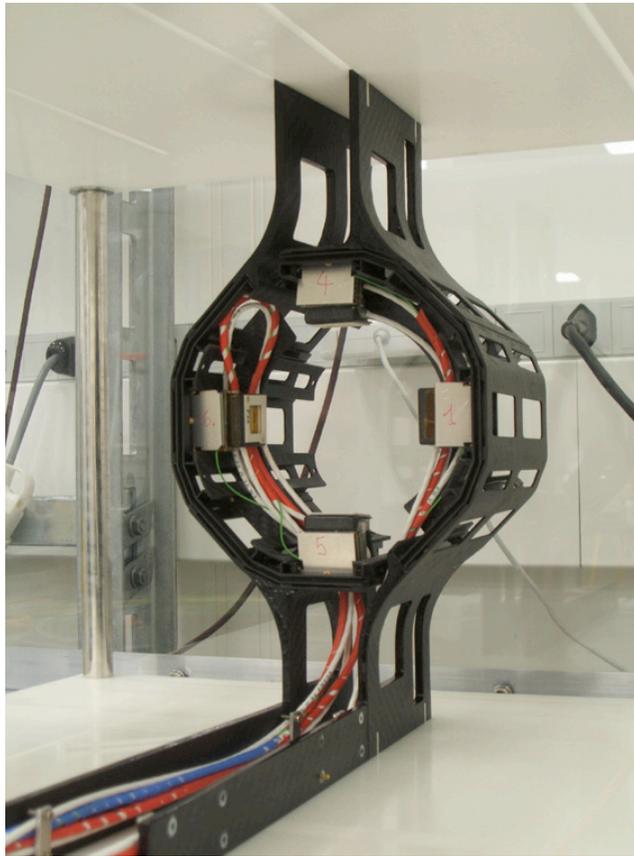
DAQ

- Frontend module (sensor / preamp and laser driver)
- Optical fibre
- “Optobahn” receiver
- Fanout
- ADC (integrating or sampling); sampling: 2ns period -> 500 Ms/s
- sampling ADC read out via optical link (PCI card inside PC)
- dump as binary data to the local disk, see also “software”
-> interface to CMS “under construction”, publish & subscribe
- investigation of TDC planned, integration into readout planned



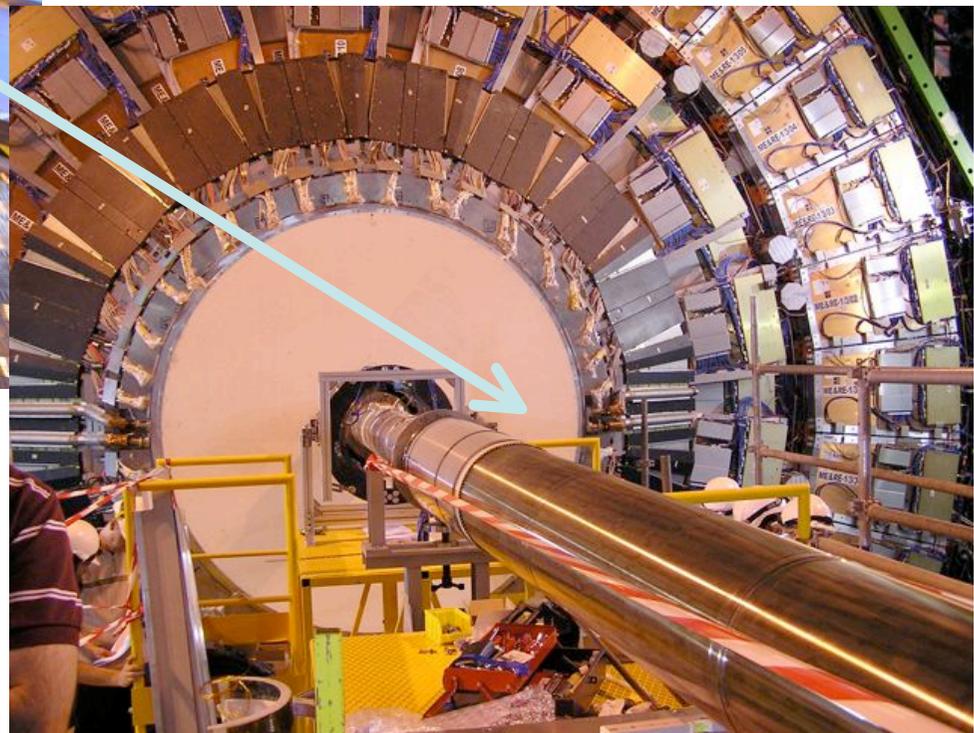
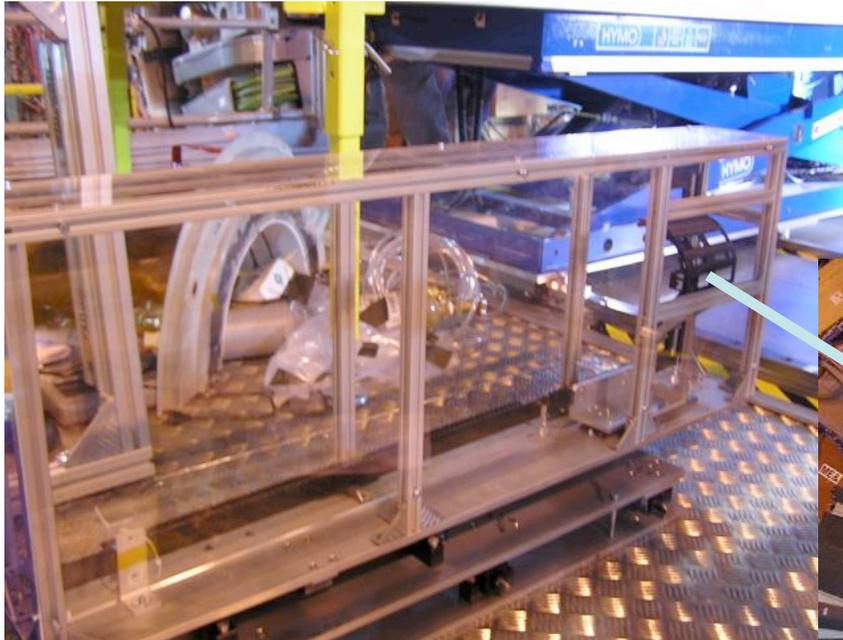
Mounting and Testing

- Assembled modules mounted onto carriages and tested again
- CMS like environment (power supplies, cables, distributions)

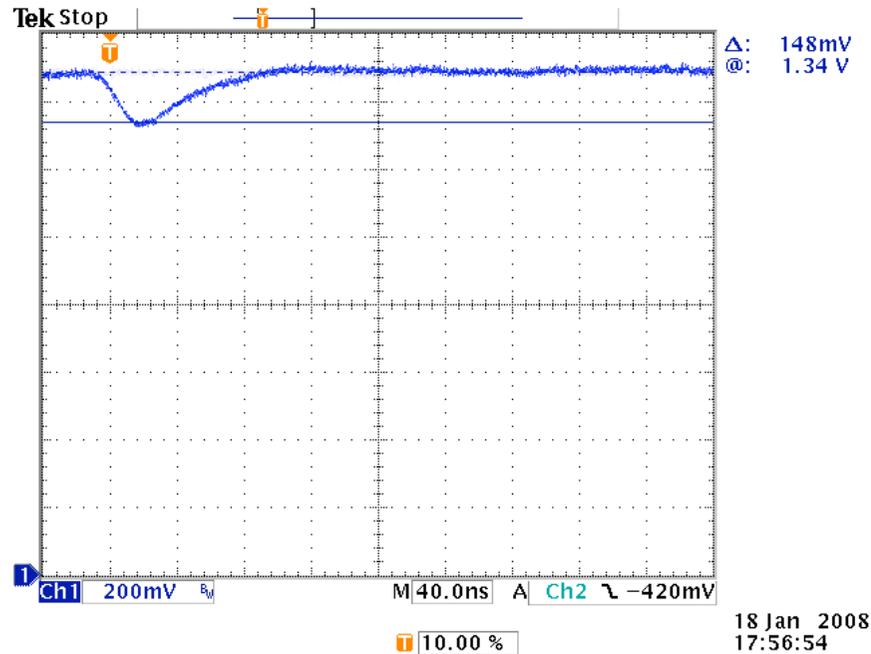


Mounting in CMS

- Carriage -> Installation Cassette -> final position in CMS

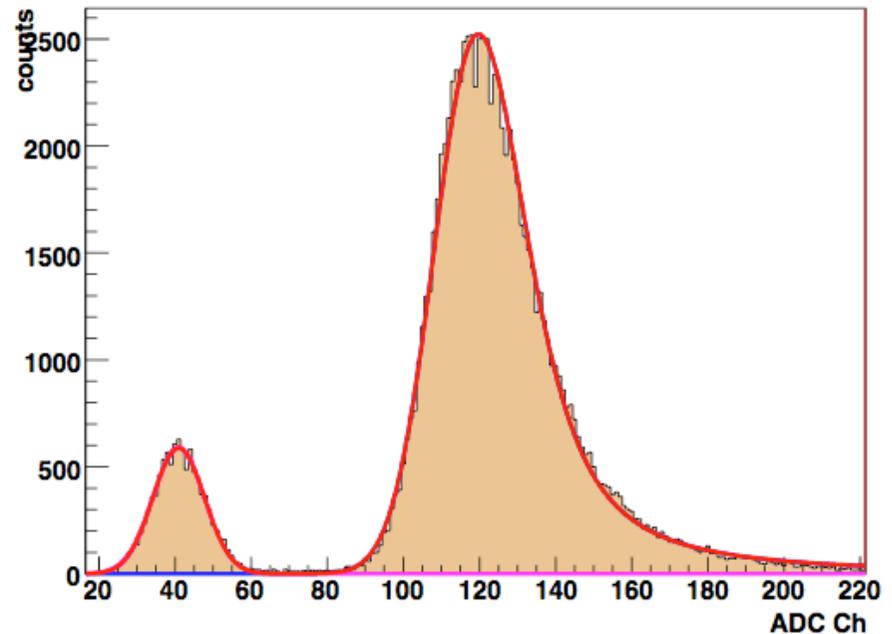


MEASUREMENTS (1)



detected particle (^{90}SR)
@ output of optical receiver

M10_3_400V_t_hiStat



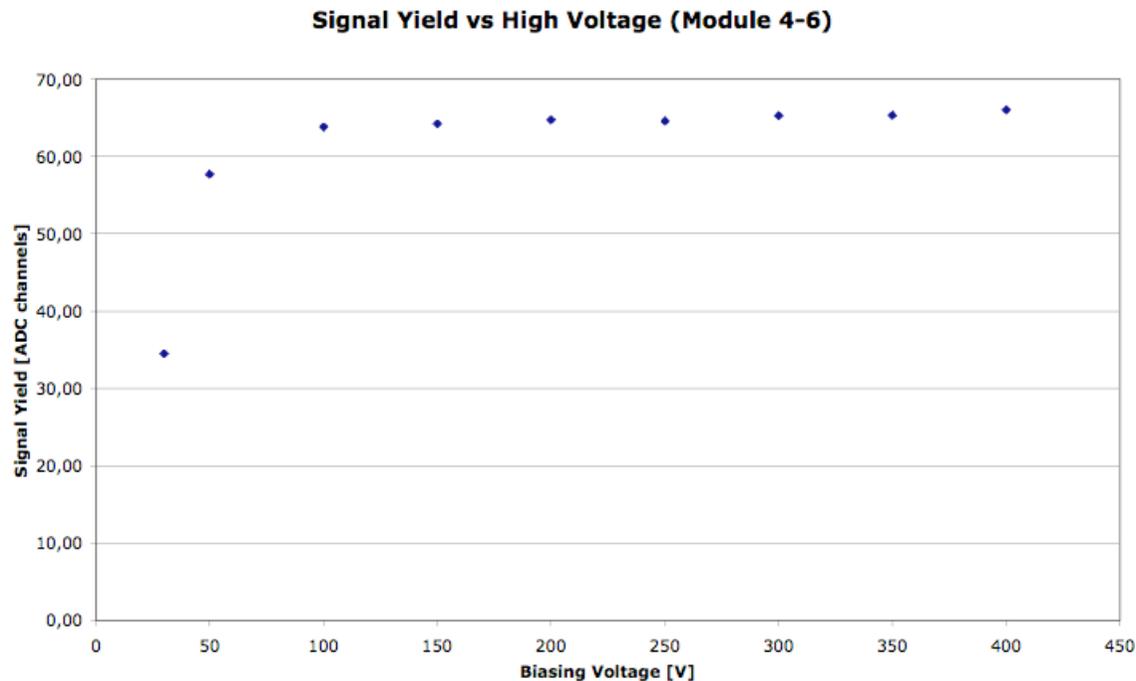
measured spectrum (^{90}SR)
Data acquisition system



MEASUREMENTS (2)

Full set of measurements for each frontend module:

Current/voltage, spectra from ^{90}Sr and test pulses



RESULTS

- 10 frontend modules BCM1-F/L fully commissioned
- 4 + 4 mounted onto carriages (ready to install)
- Readout and control software developed



OUTLOOK

- Installation into CMS end of June or begin of July
- Investigation of the first steps of the LHC right from the beginning
- Provide CMS and the machine with bunch by bunch information

