



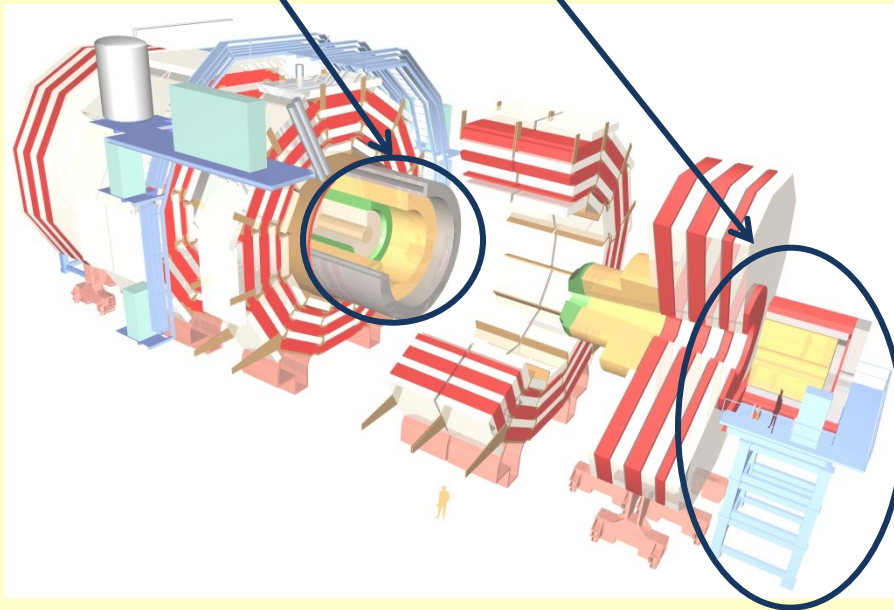
Fiber Optical Sensor operation in *CMS*

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(ATOMKI)

on behalf of the FOS4CMS Group

- Sensors placed to the following areas in CMS:
 - HF region negative side (Raiser and Castor table 10-6)
 - Tracker bulkhead on both side (10-10 sensor)
 - Experimental Cavern (60) in January 2011

} in 2009

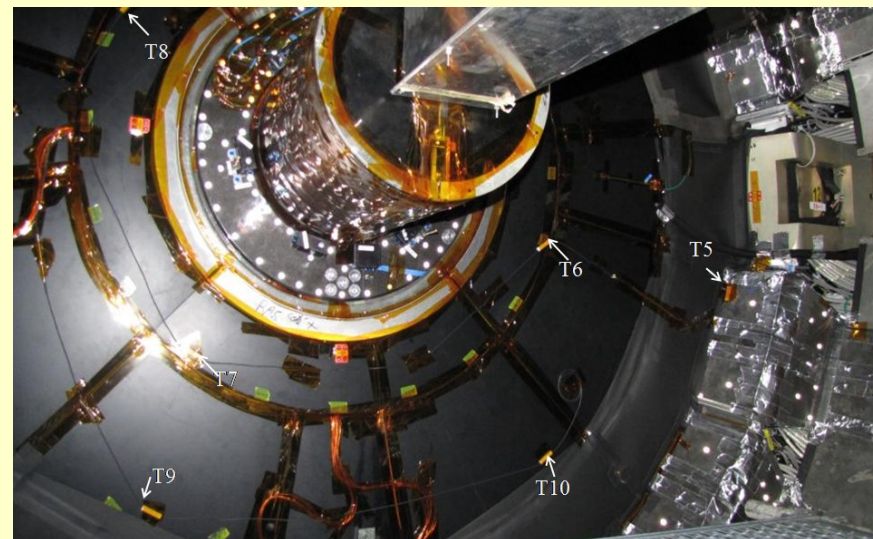
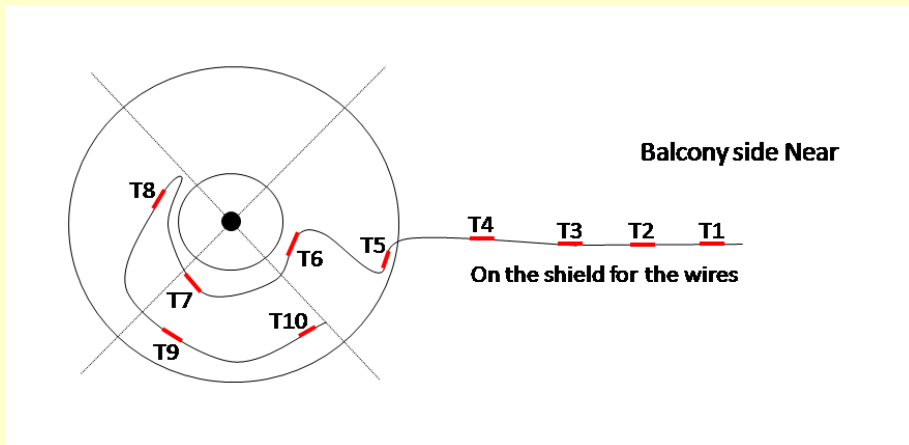


Aim:

- demonstrate feasibility
- follow mechanical changes induced by field (HF-)
- (2011) monitor the environment

Position of BulkHead Temperature sensors

Positive side:

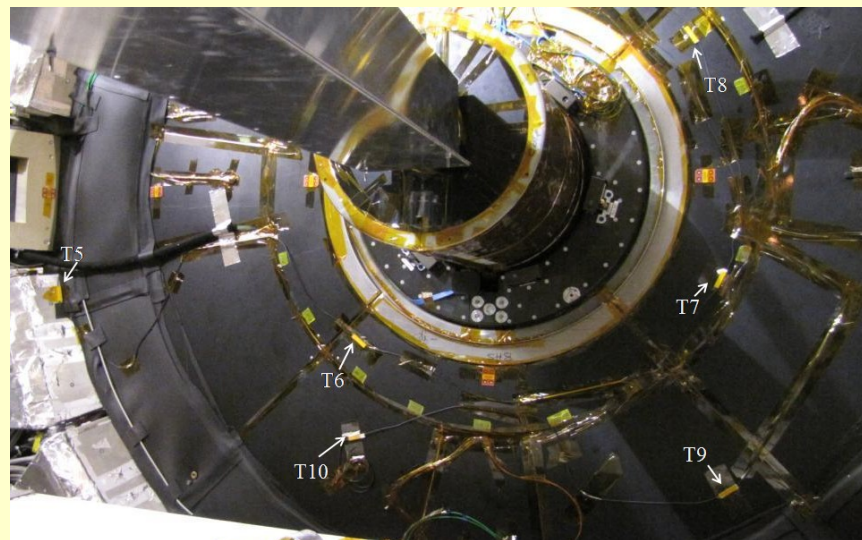
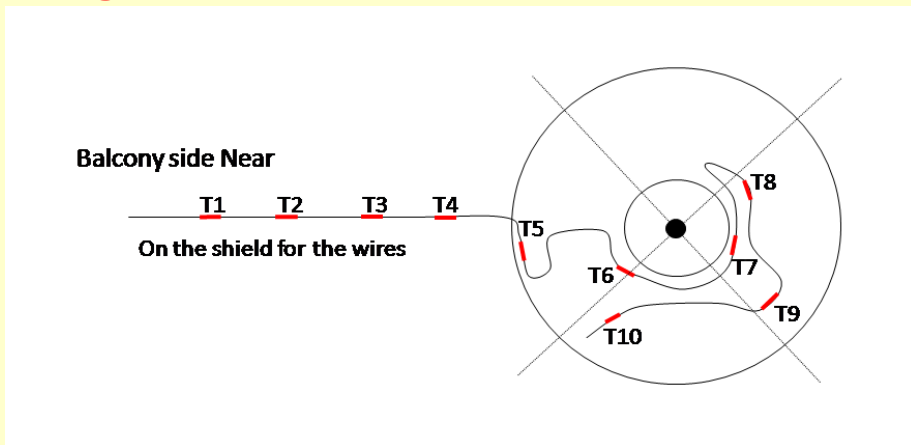


Positive Side (Z+):

Bragg's wavelength on Fibre 1:

	FBG Central Wavelength	Measure	Position
T1	1528.114	Temperature	Cable Tray
T2	1530.965	Temperature	Cable Tray
T3	1534.029	Temperature	Cable Tray
T4	1536.842	Temperature	Cable Tray
T5	1539.757	Temperature	Bulkhead
T6	1546.037	Temperature	Bulkhead
T7	1549.215	Temperature	Bulkhead
T8	1551.937	Temperature	Bulkhead
T9	1555.162	Temperature	Bulkhead
T10	1557.746	Temperature	Bulkhead

Negative side:



Negative Side (Z-):

Bragg's wavelength on Fibre 2:

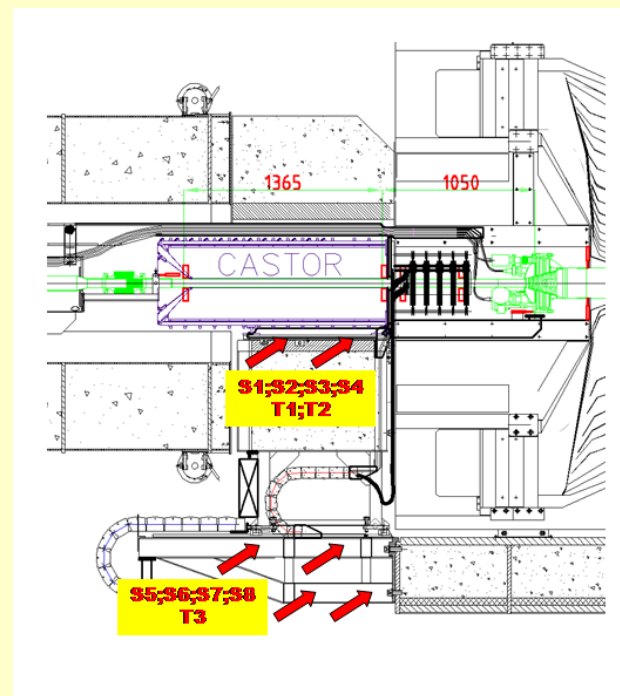
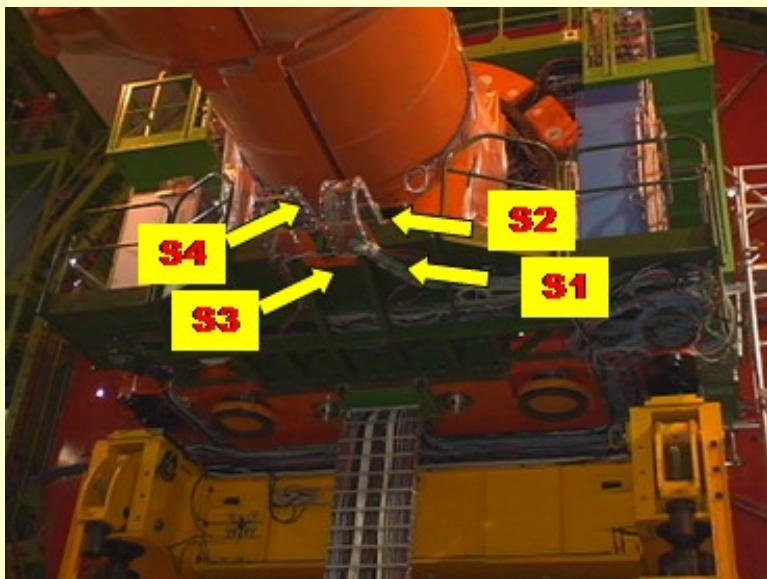
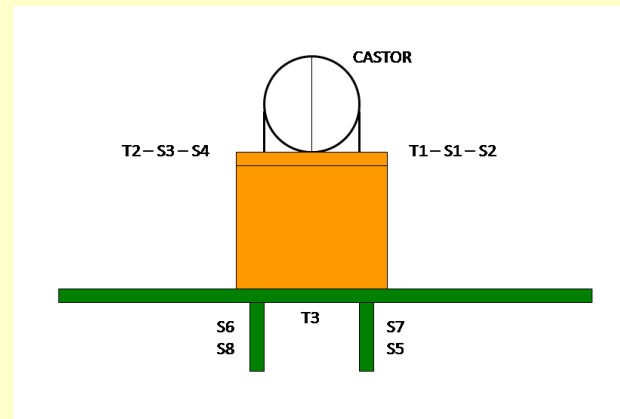
	FBG Central Wavelength	Measure	Position
T1	1528.054	Temperature	Cable Tray
T2	1531.092	Temperature	Cable Tray
T3	1534.165	Temperature	Cable Tray
T4	1536.782	Temperature	Cable Tray
T5	1540.201	Temperature	Bulkhead
T6	1546.360	Temperature	Bulkhead
T7	1549.089	Temperature	Bulkhead
T8	1551.718	Temperature	Bulkhead
T9	1554.996	Temperature	Bulkhead
T10	1557.776	Temperature	Bulkhead

CASTOR:

Bragg's wavelength on Fibre 3:

	FBG Central Wavelength	Measure	Position
T1	1530	Temperature	Castor Far *
T2	1533.037	Temperature	Castor Near
T3	1534.958	Temperature	Under Center
S1	1540	Strain	Castor Far + *
S2	1545	Strain	Castor Far - *
S3	1550	Strain	Castor Near + (not connected?)
S4	1555	Strain	Castor Near - (not connected?)
S5	1560.017	Strain	Under Far Down
S6	1565.048	Strain	Under Near Up
S7	1569.888	Strain	Under Far Up
S8	1575.334	Strain	Under Near Down

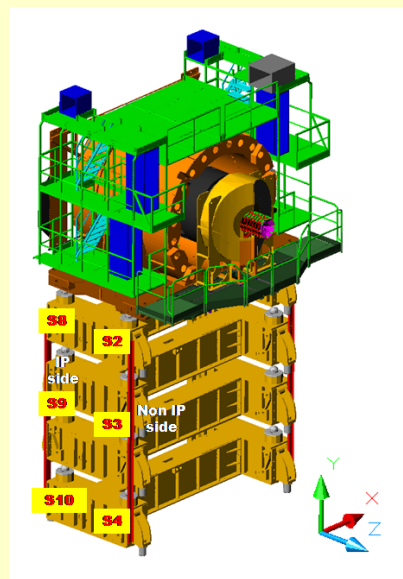
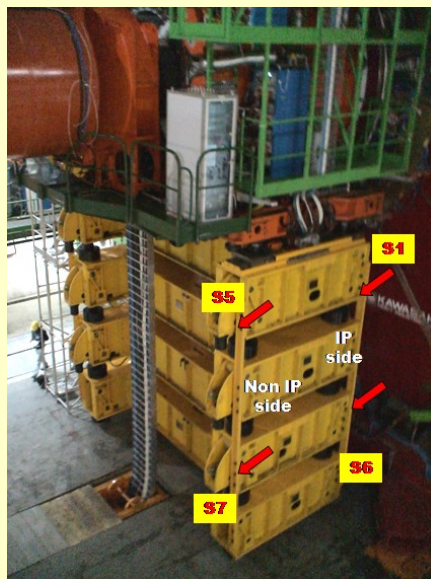
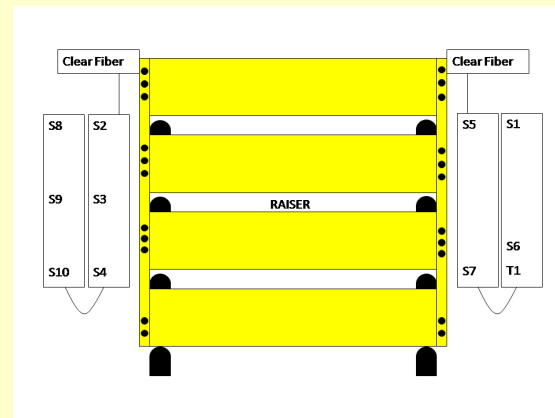
*: Sensors lost on July 23 2009.



RAISER:

Bragg's wavelength on Fibre 4:

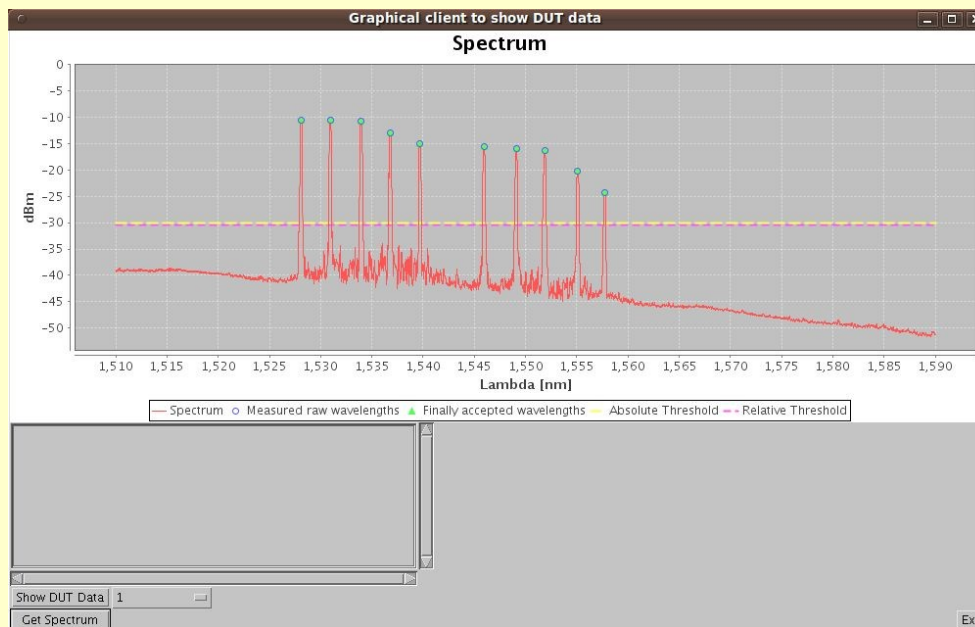
	FBG Central Wavelength	Measure	Position
S1	1530.268	Strain	Raiser Far + Up
S2	1535.725	Strain	Raiser Near - Up
S3	1540.398	Strain	Raiser Near - Mid
S4	1546.188	Strain	Raiser Near - Down
S5	1550.856	Strain	Raiser Far - Up
S6	1555.580	Strain	Raiser Far + Down
T1	1557	Temperature	Raiser Far + Down (not connected?)
S7	1560.740	Strain	Raiser Far - Down
S8	1565	Strain	Raiser Near + Up (not connected?)
S9	1570.692	Strain	Raiser Near + Mid
S10	1576.141	Strain	Under Near Down

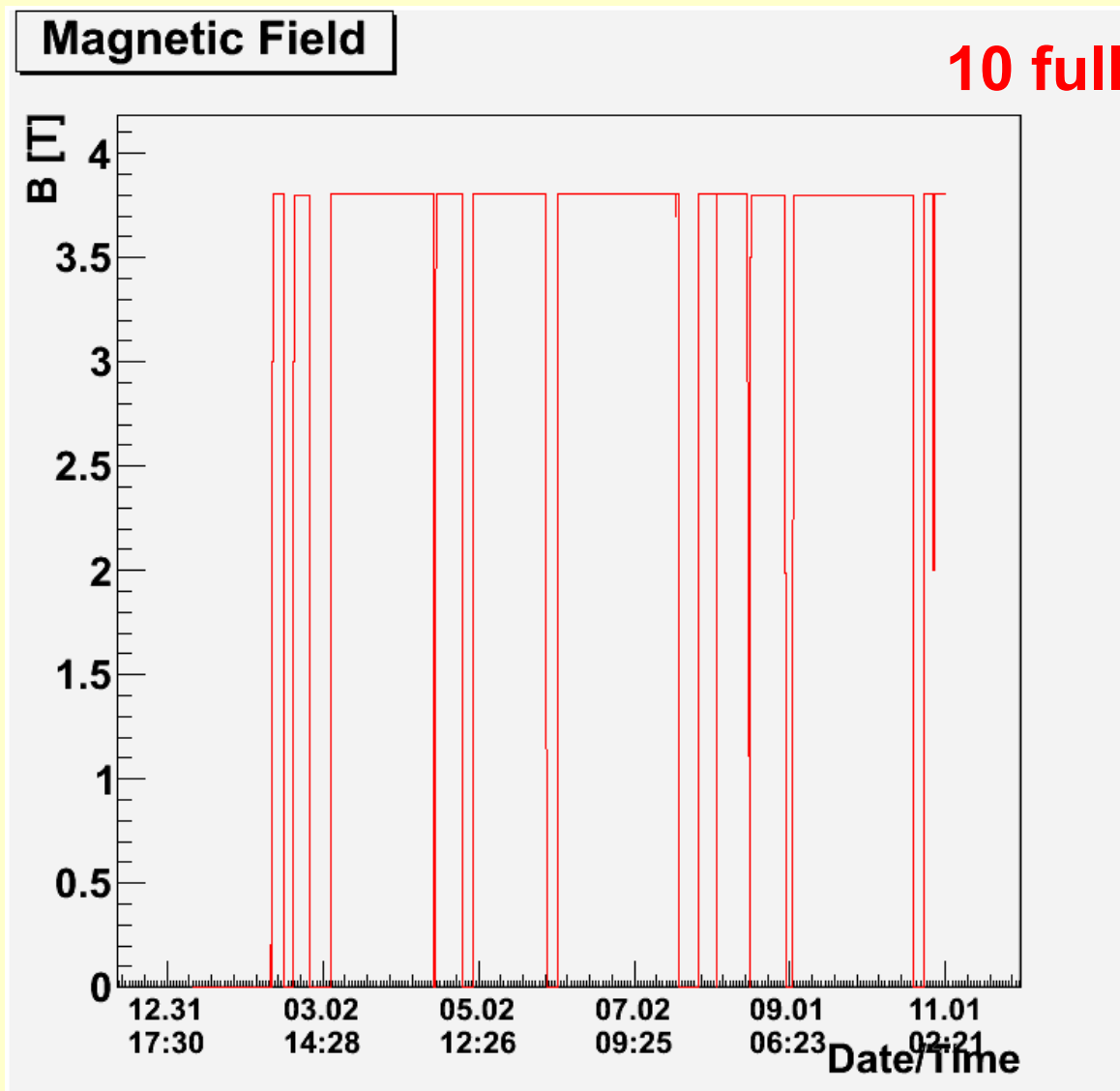


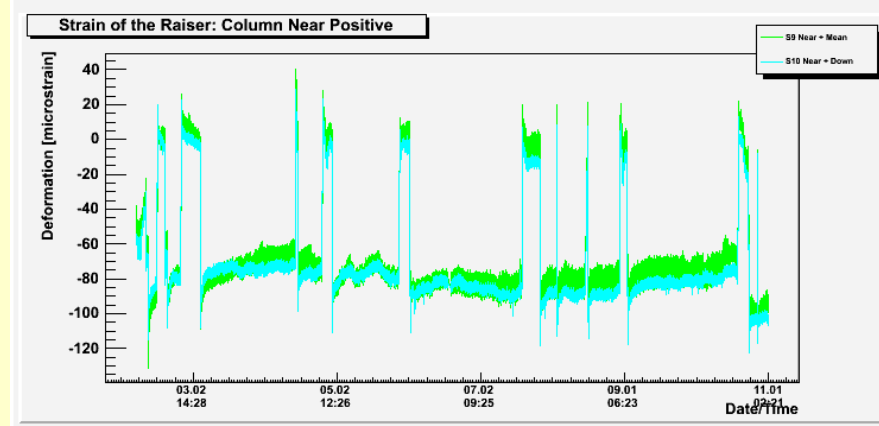
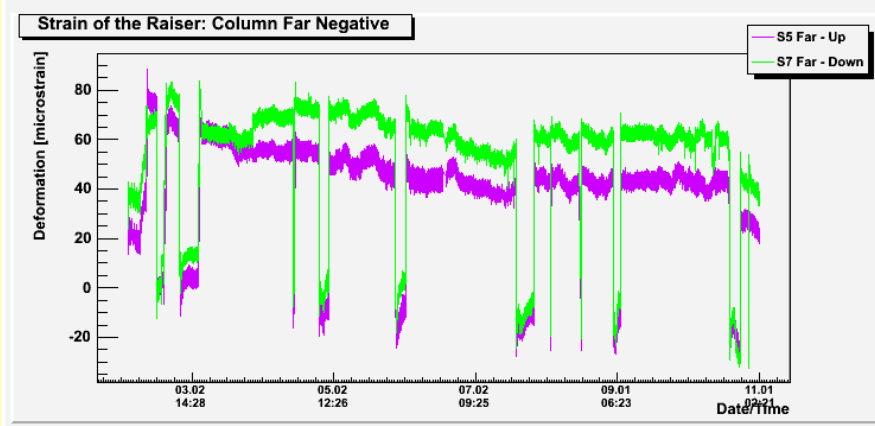
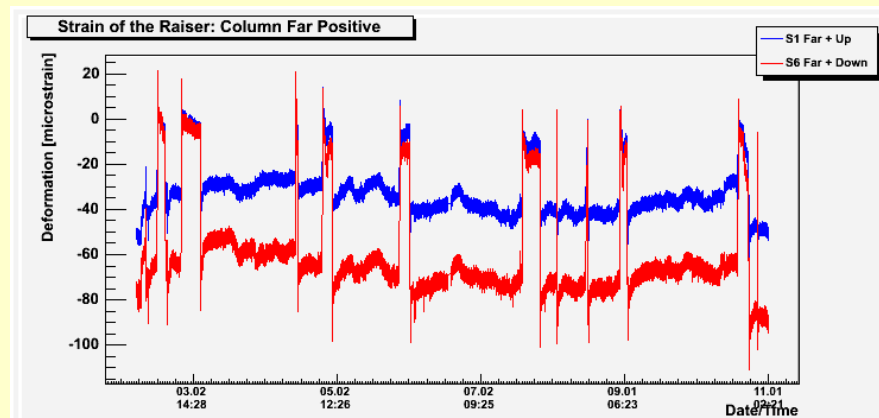
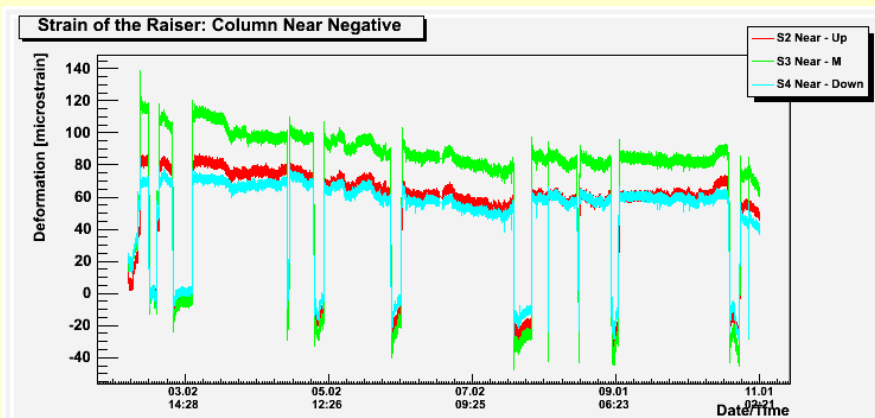
- Regular (monthly) reports are published
- Twiki page has been established for reports and dataset (~450k entries in 2010) access

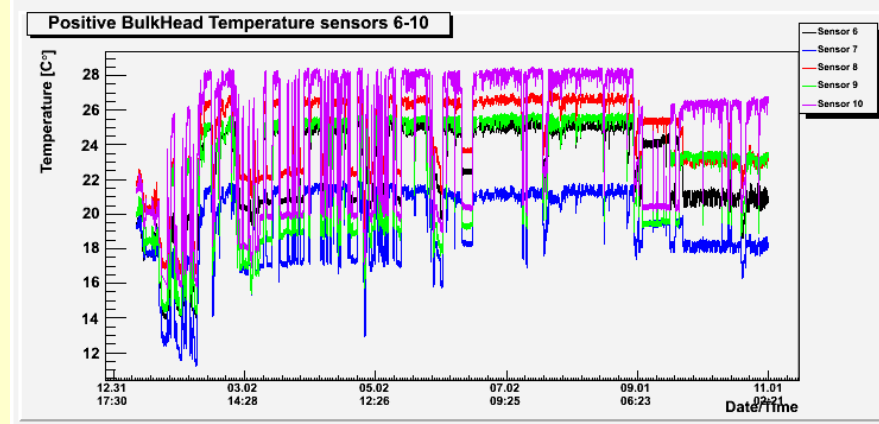
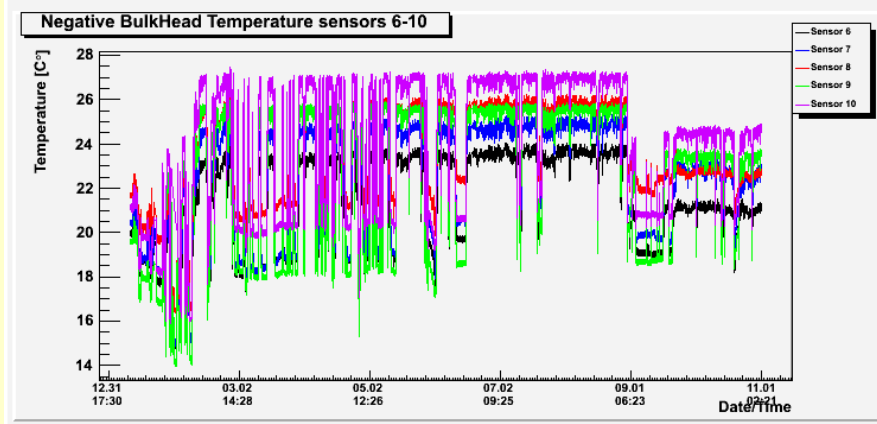
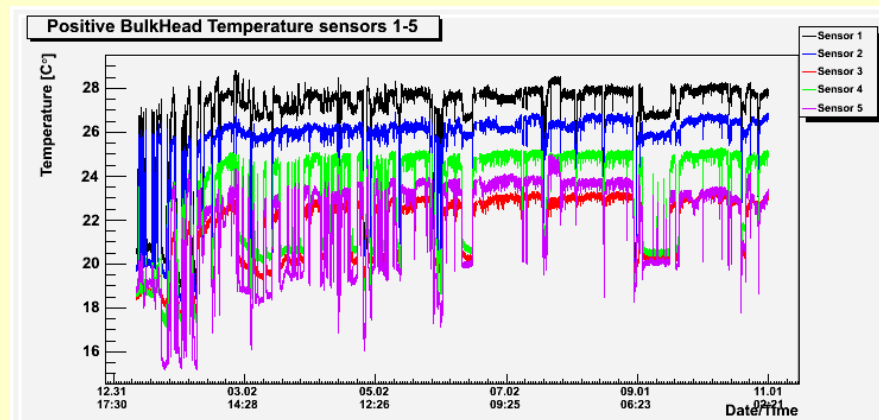
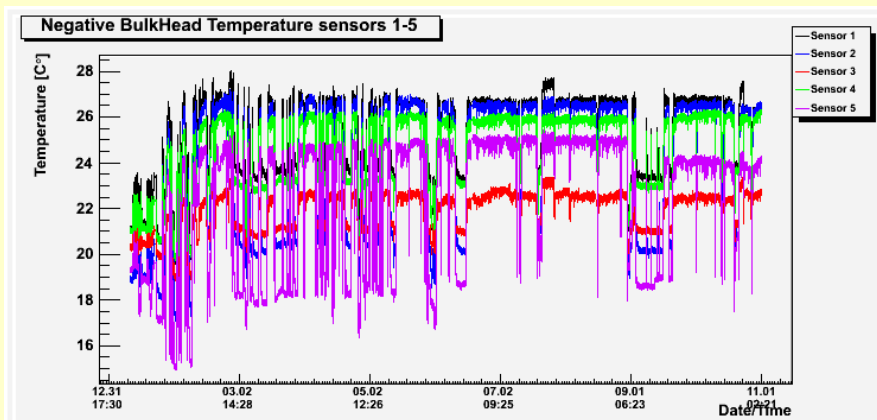
(<https://twiki.cern.ch/twiki/bin/viewauth/CMS/ProjectFOS>)

- Reports on ramp-up (comparison of ramps)
- DAQ has been revised:
 - LV → Java
 - DIM connection to the 'upper world'
 - S/W extension to 16 (32) DUT operation
 - refined satellite peak suppression method
 - new UI is on the way:

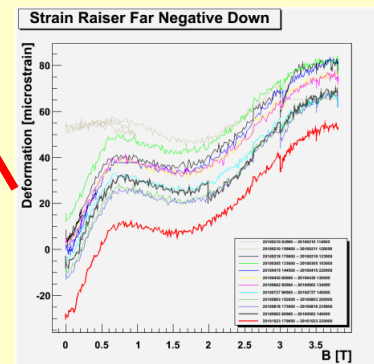
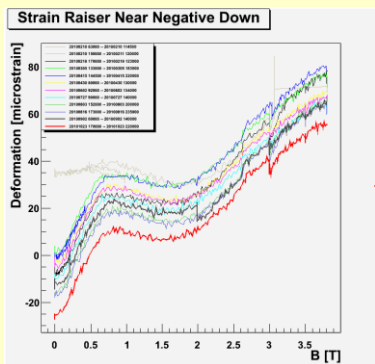
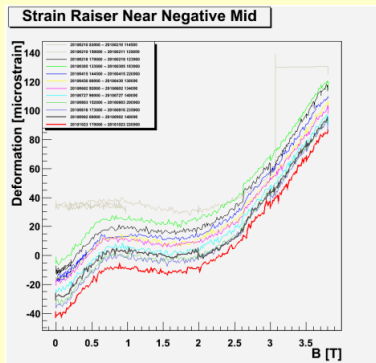
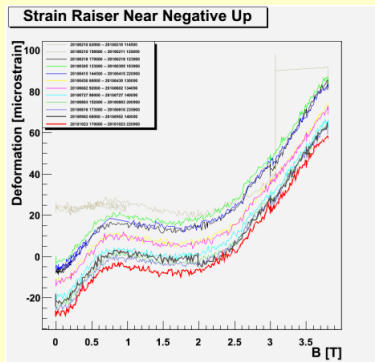


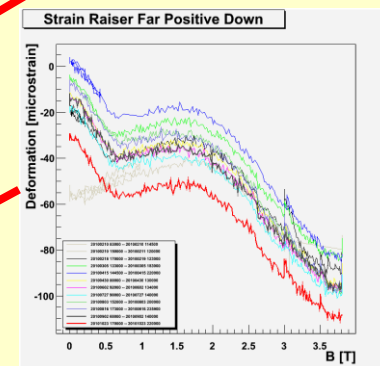
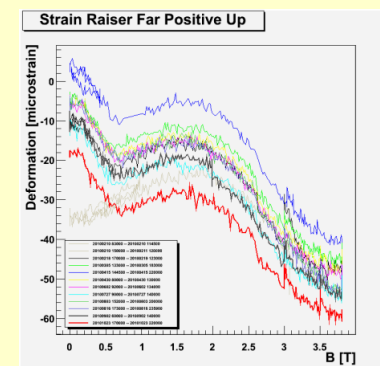
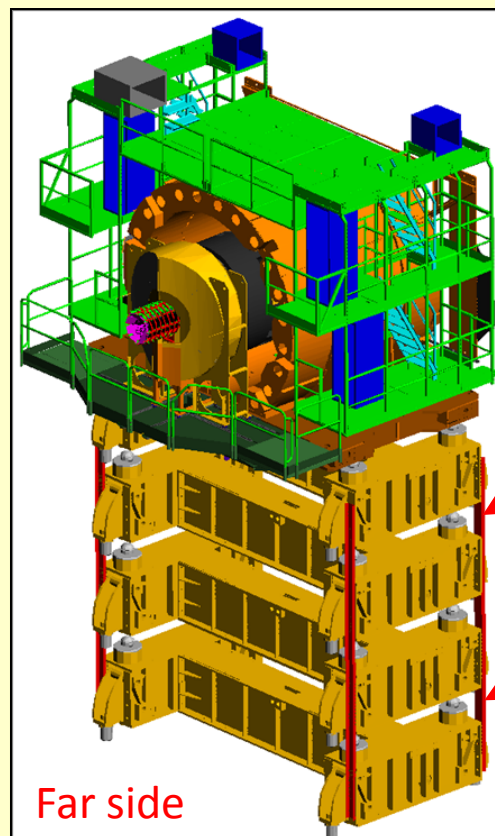
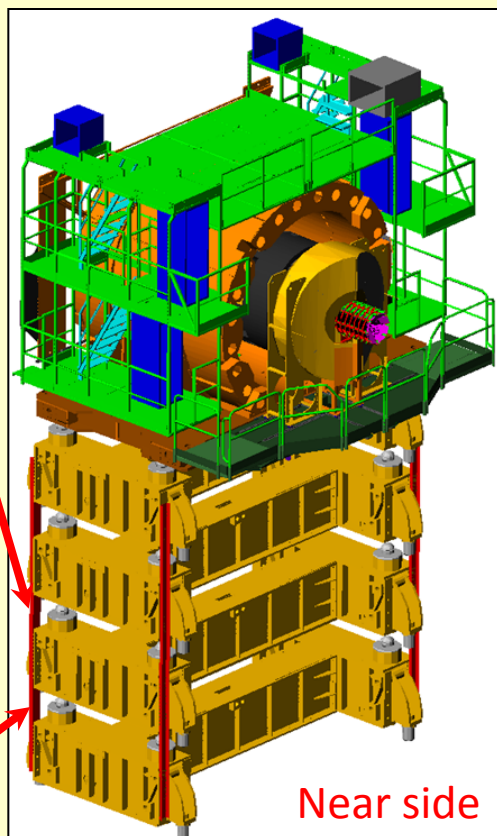
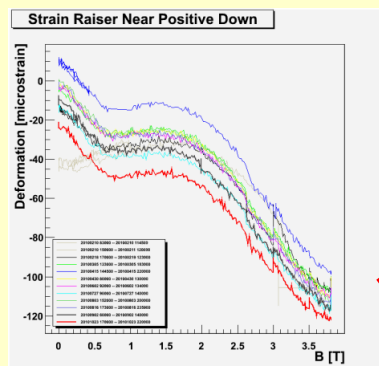
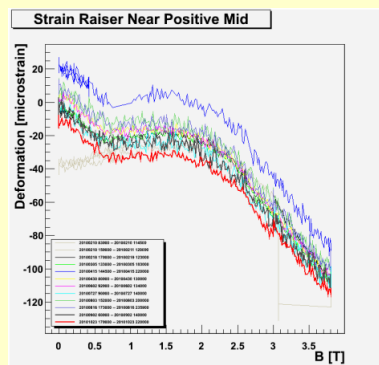


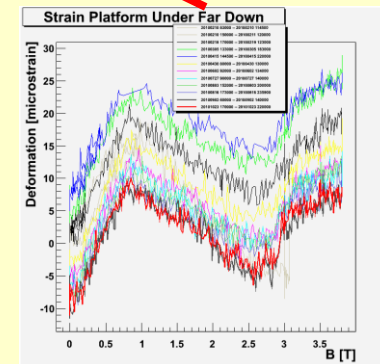
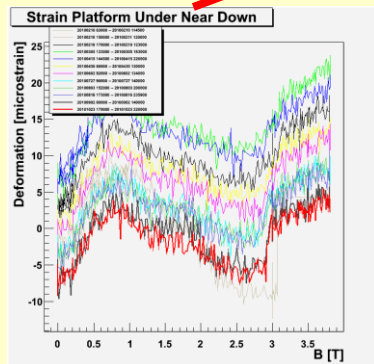
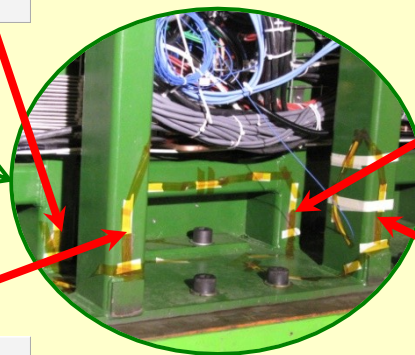
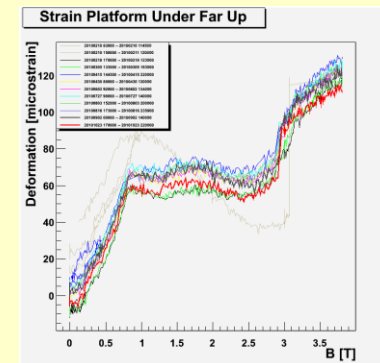
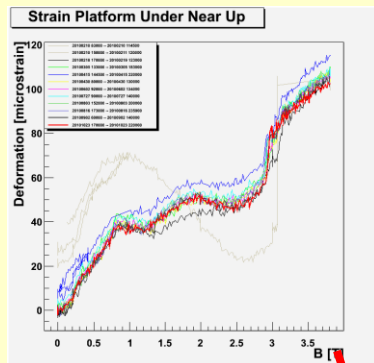
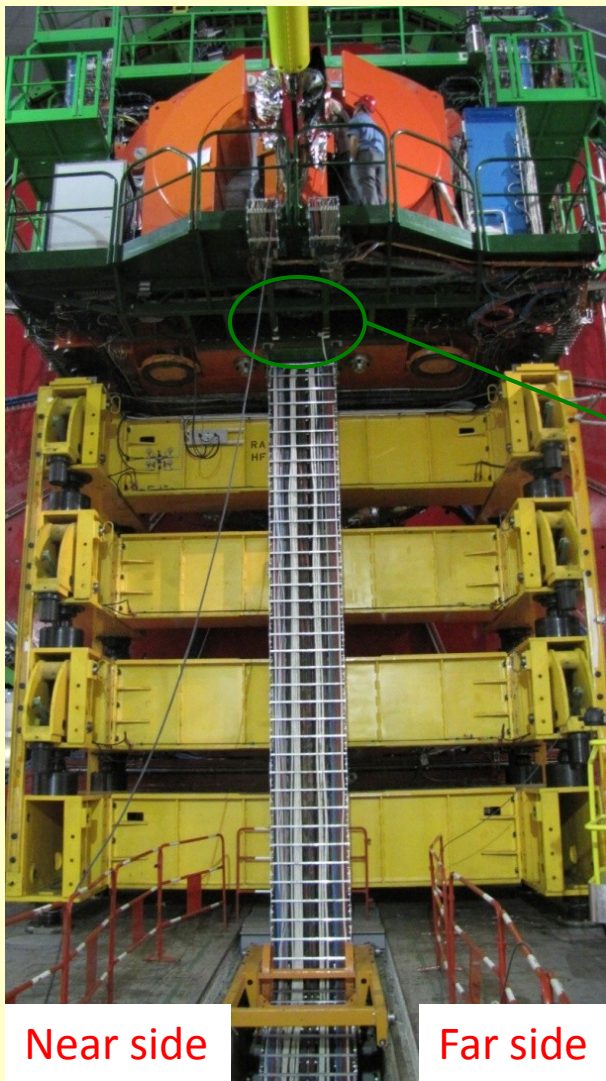




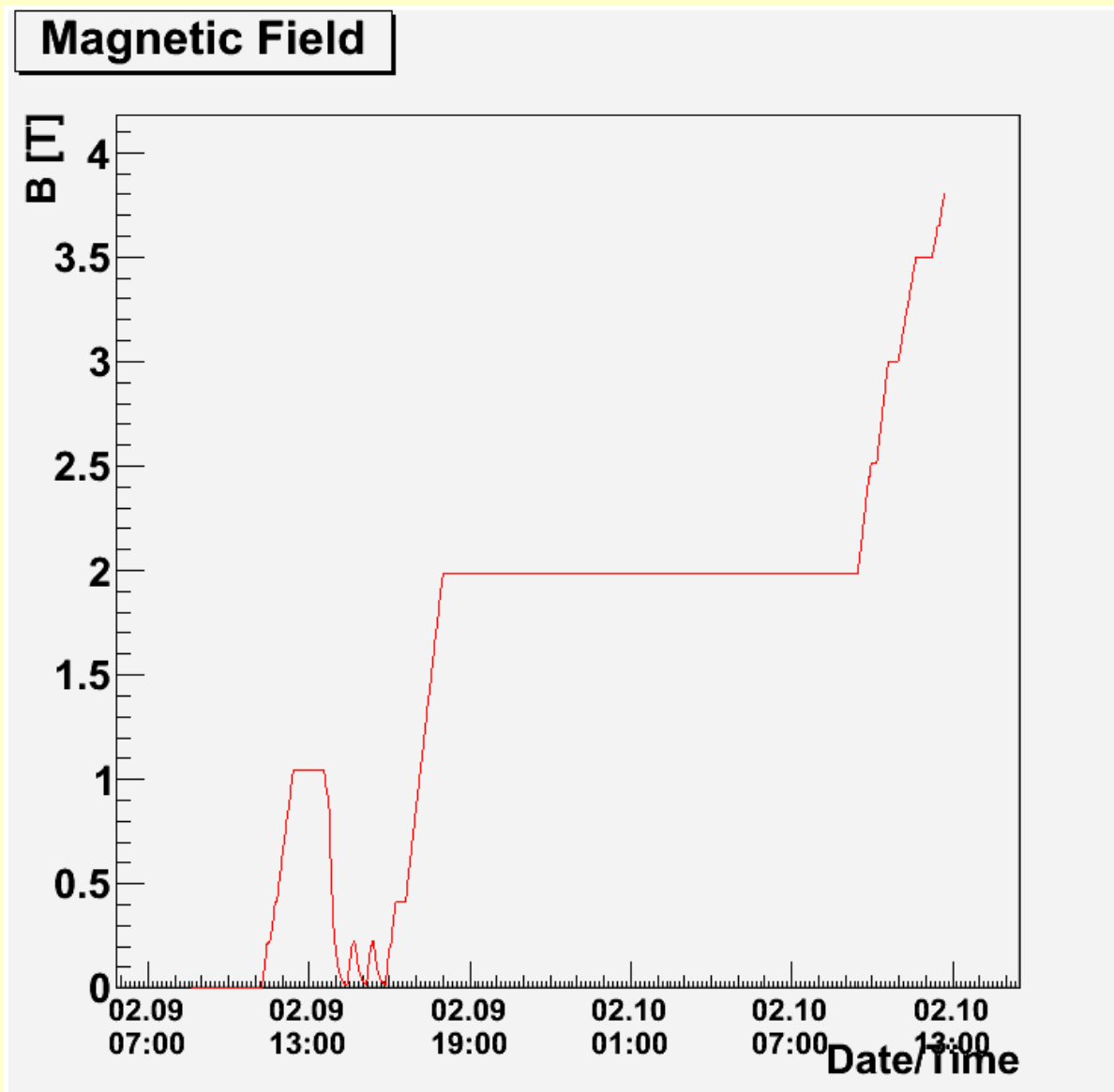
Temperature measured by FOS follows the activity of Tracker



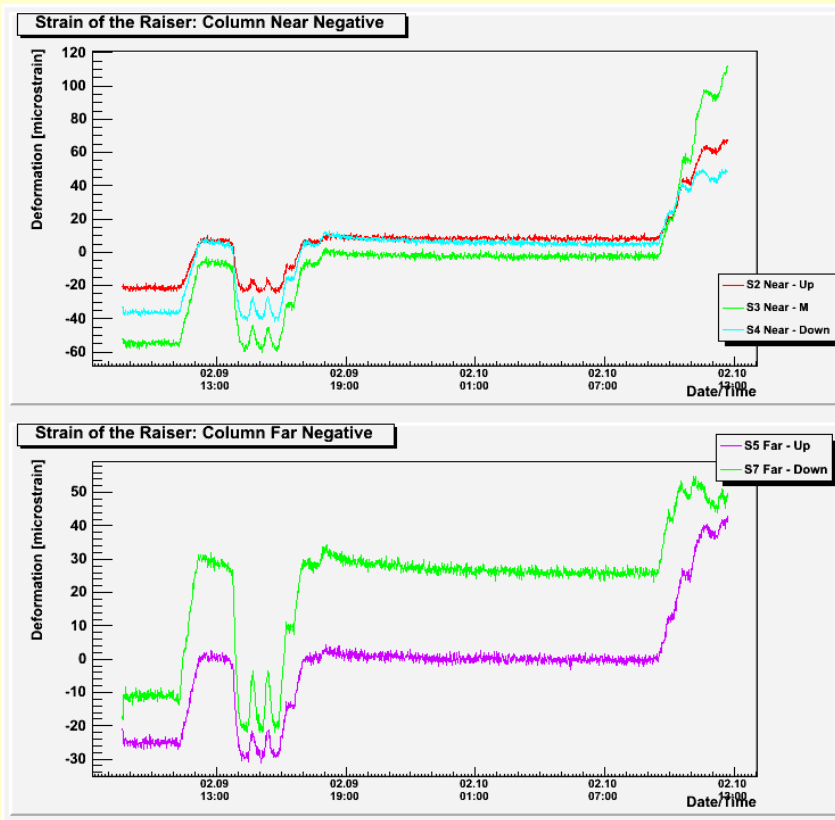




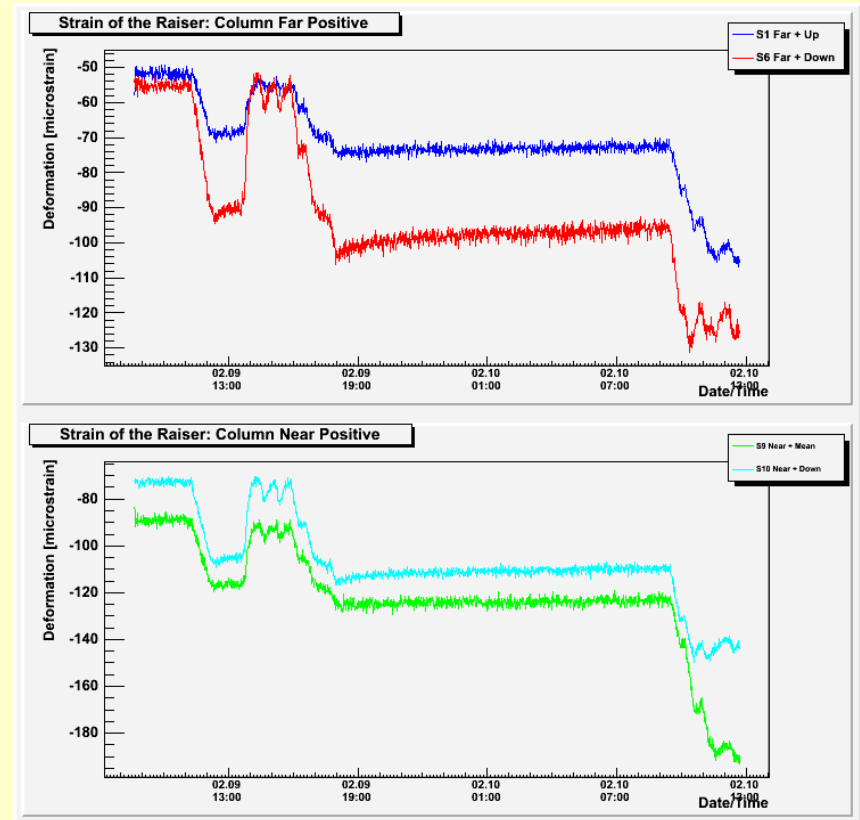
OPERATION 2011



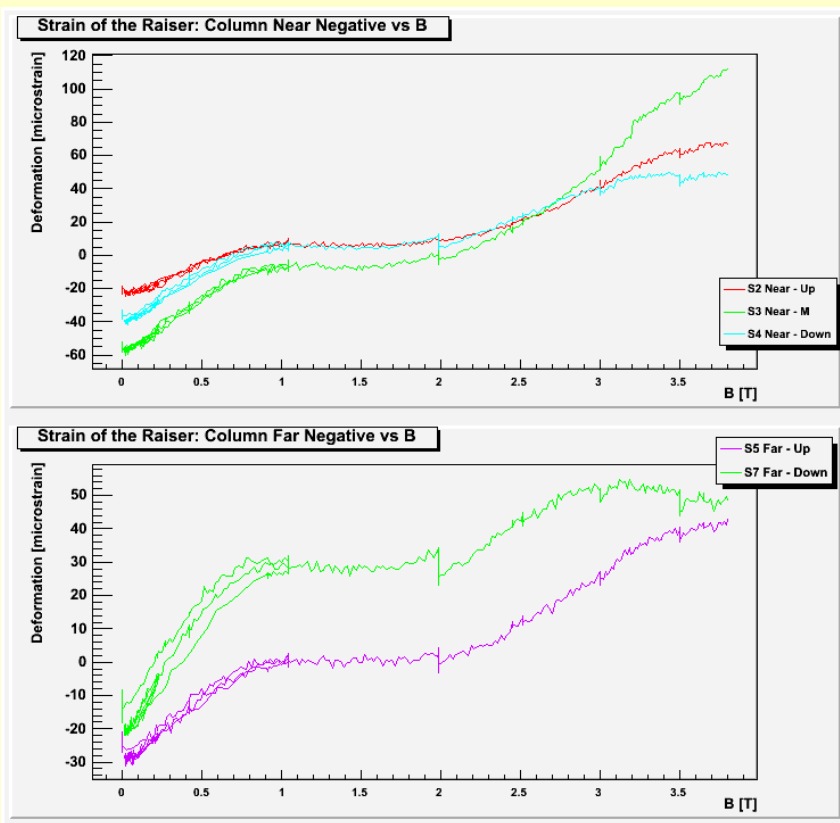
Non IP side



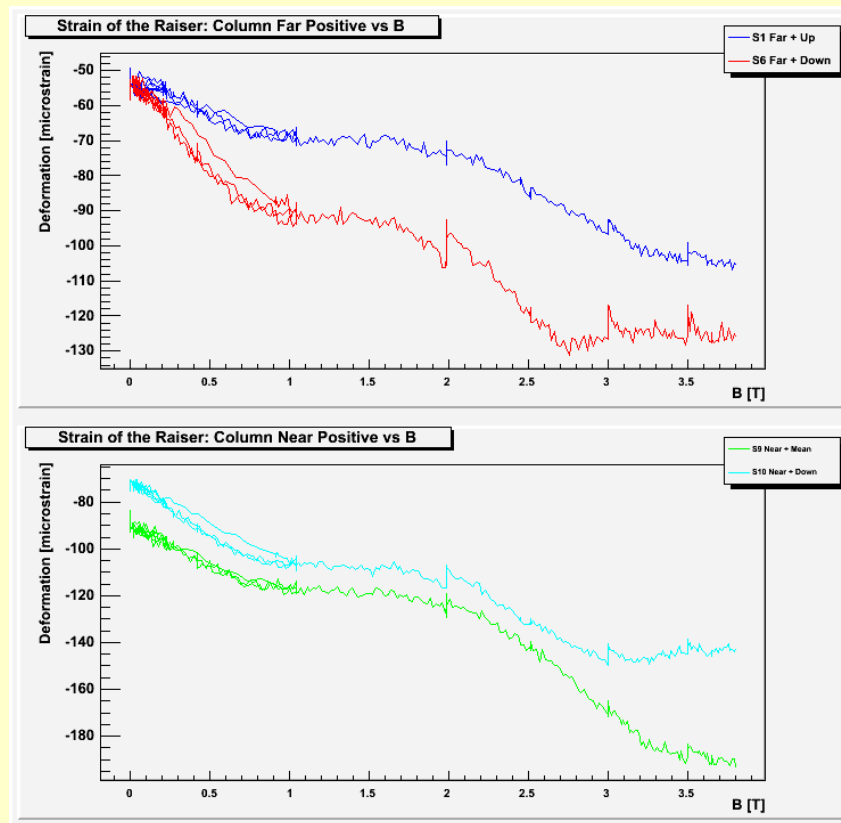
IP side



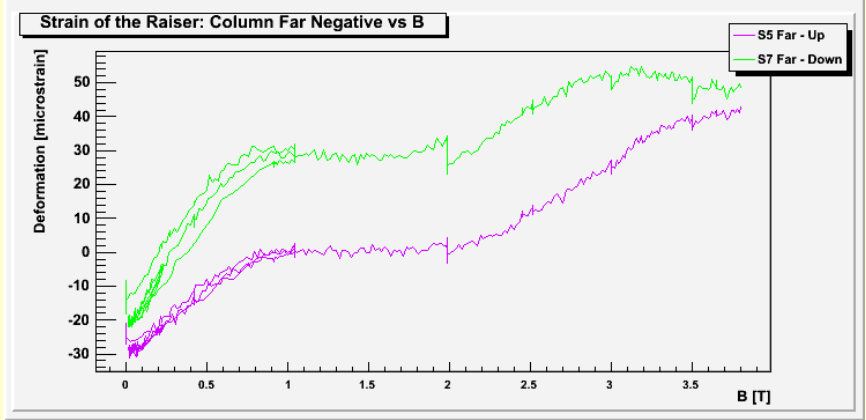
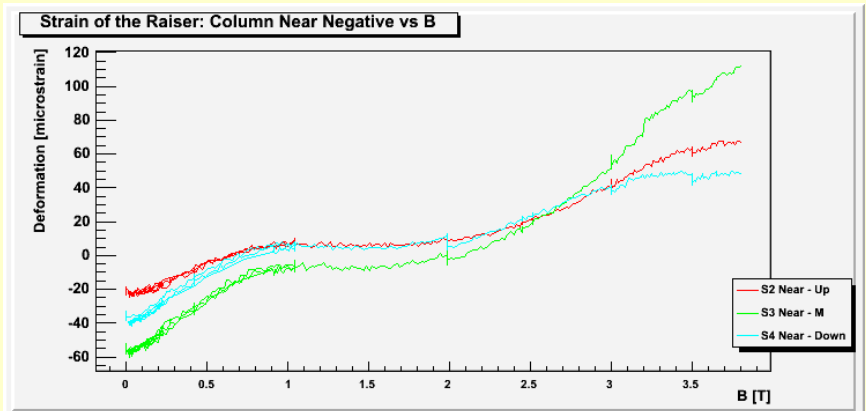
Non IP side



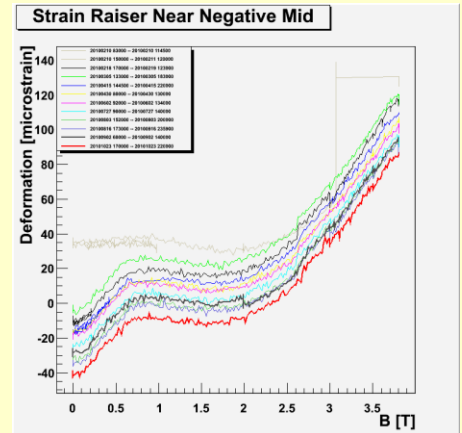
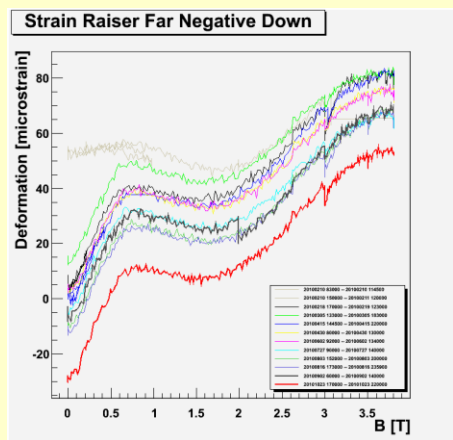
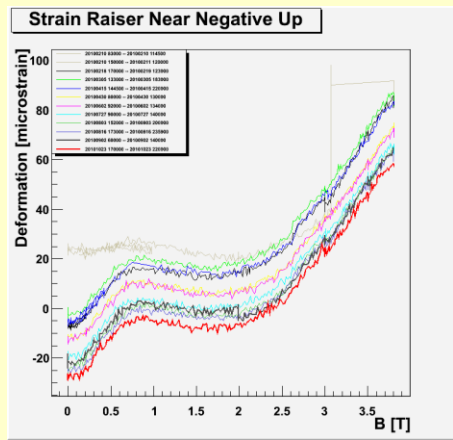
IP side



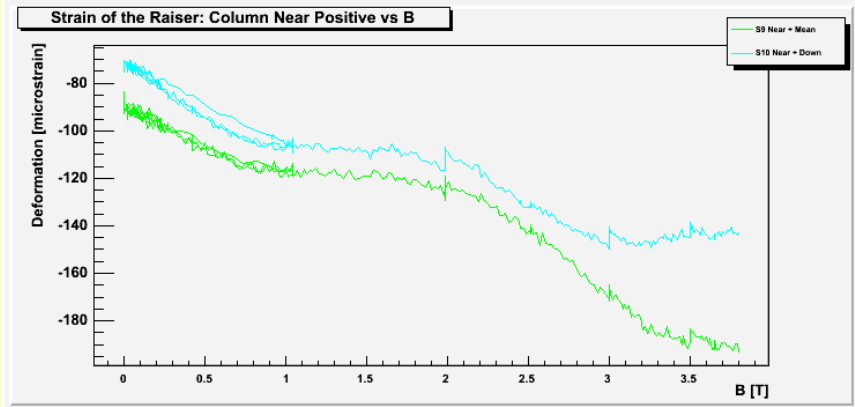
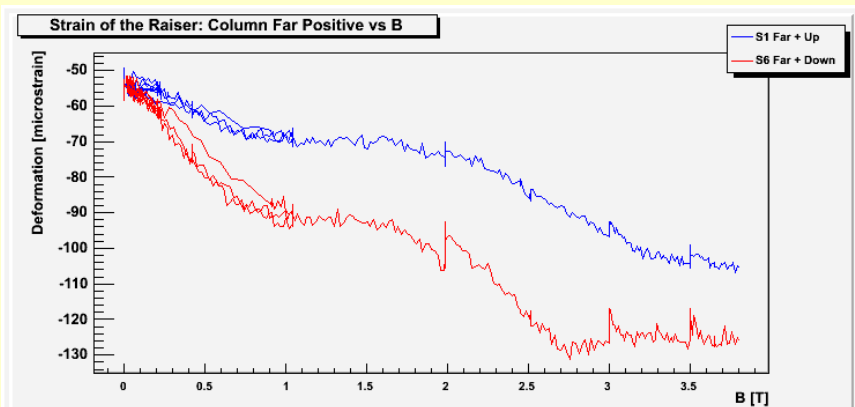
2011 first ramp up non IP side



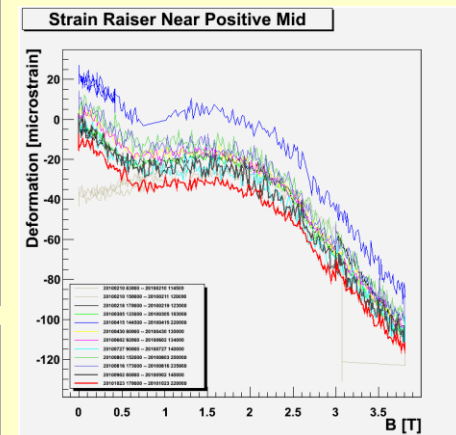
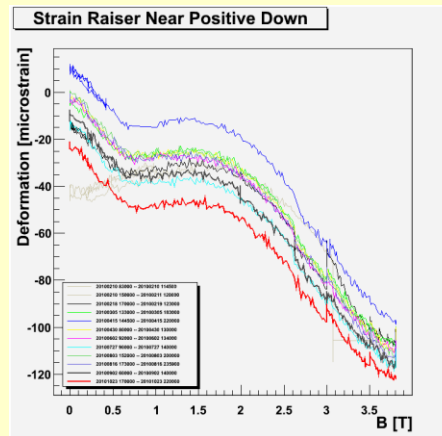
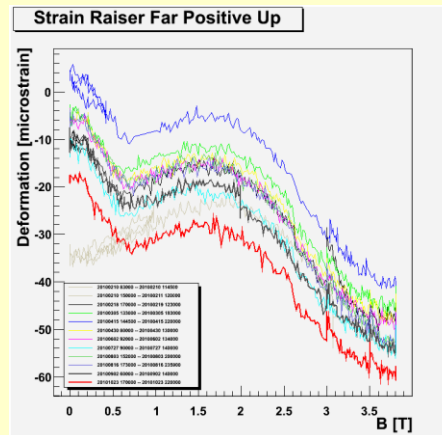
2010 all ramp up non IP side



2011 first ramp up IP side

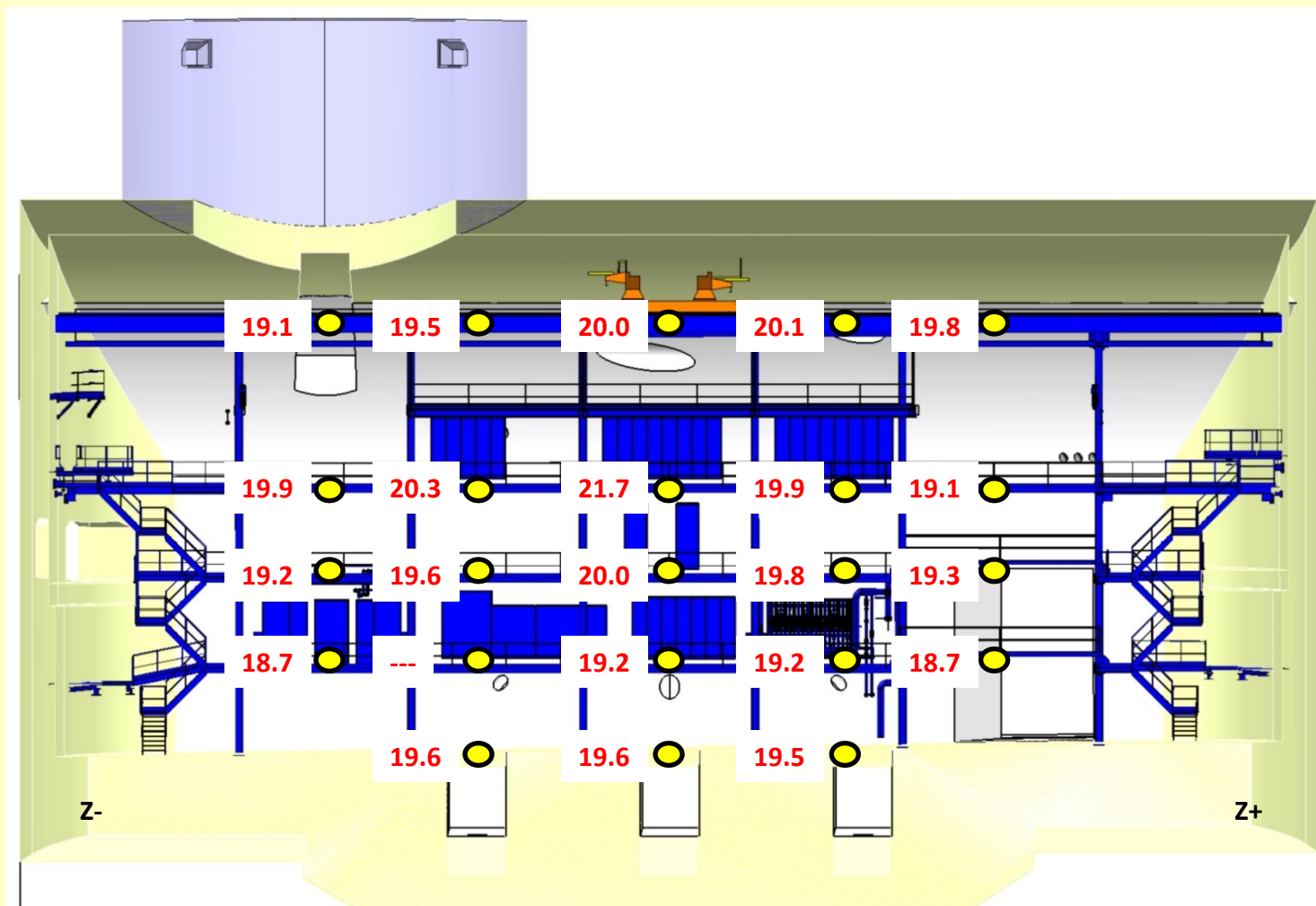


2010 all ramp up IP side

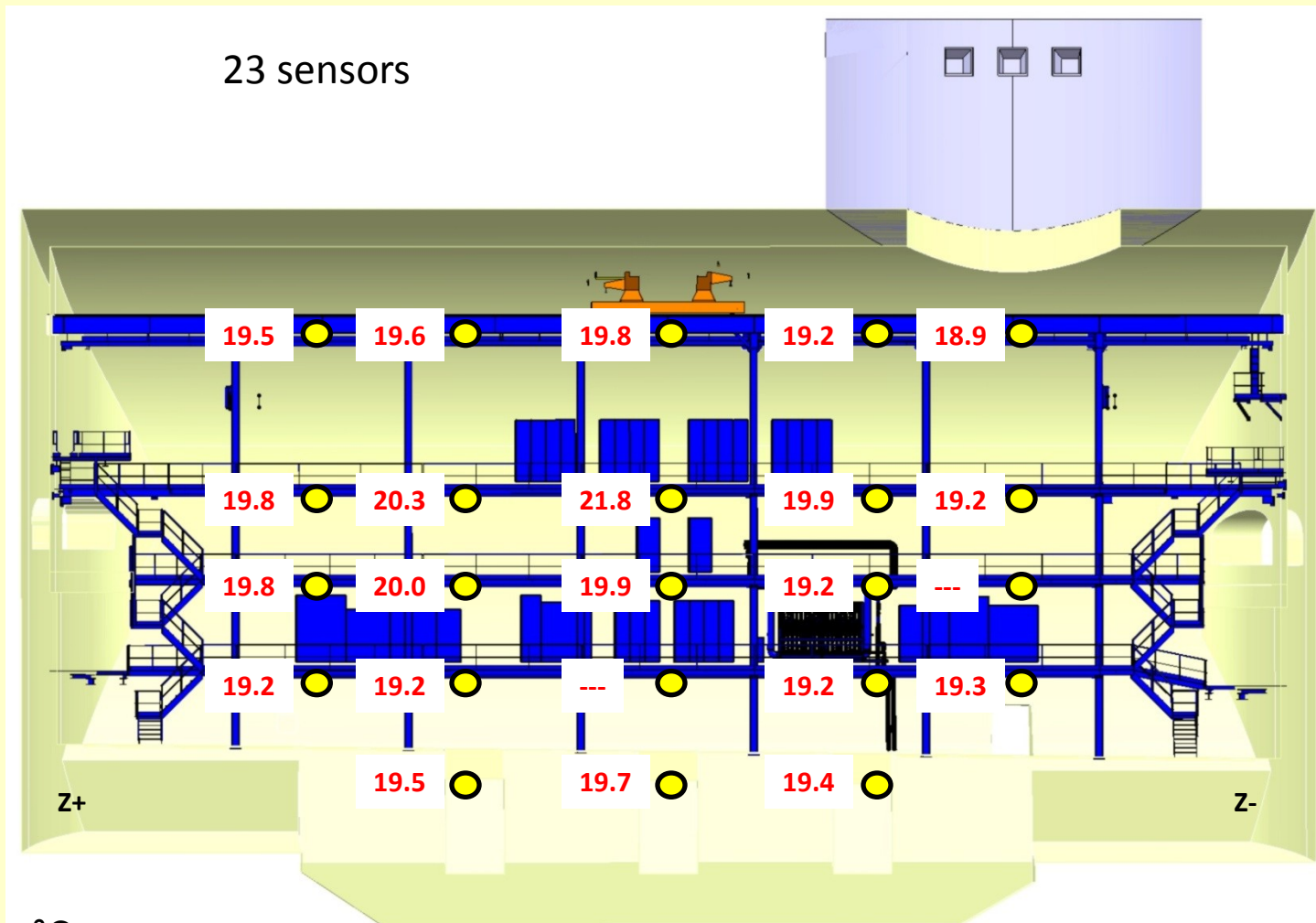


ADDITIONAL TEMPERATURE SENSORS IN UXC

- Additional 60 FBG T sensors has been installed in UXC:
 - 23 sensors on wall near side
 - 3 sensors on wall +Z side
 - 23 sensors on wall far side
 - 8 sensors on shaft far side
 - 3 sensors on wall -Z side
- 4 sensors needs a recalibration

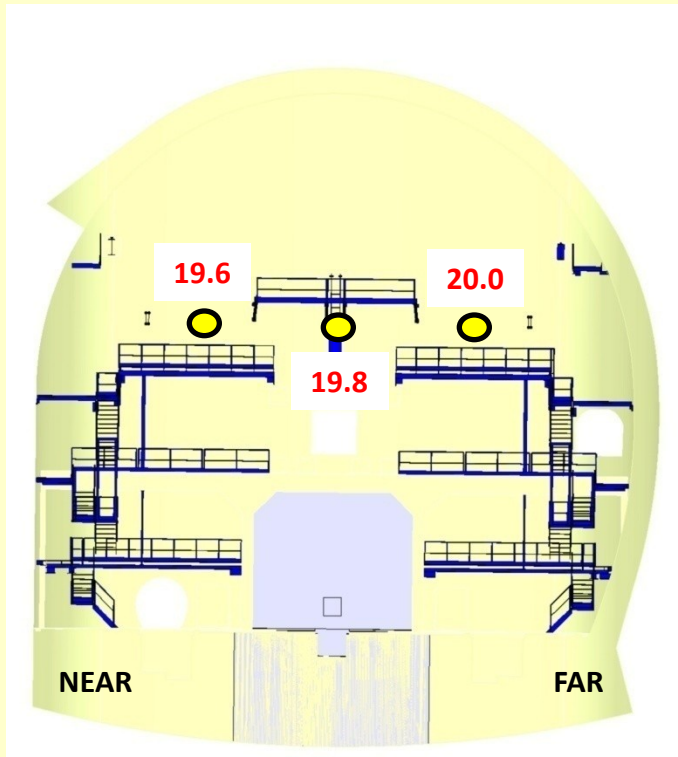


All values in °C

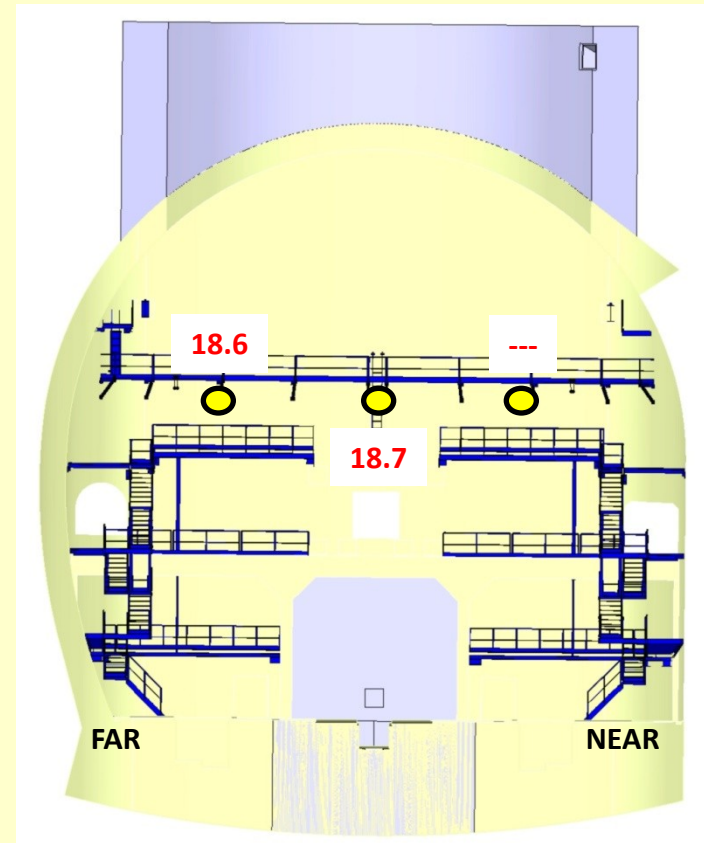


All values in °C

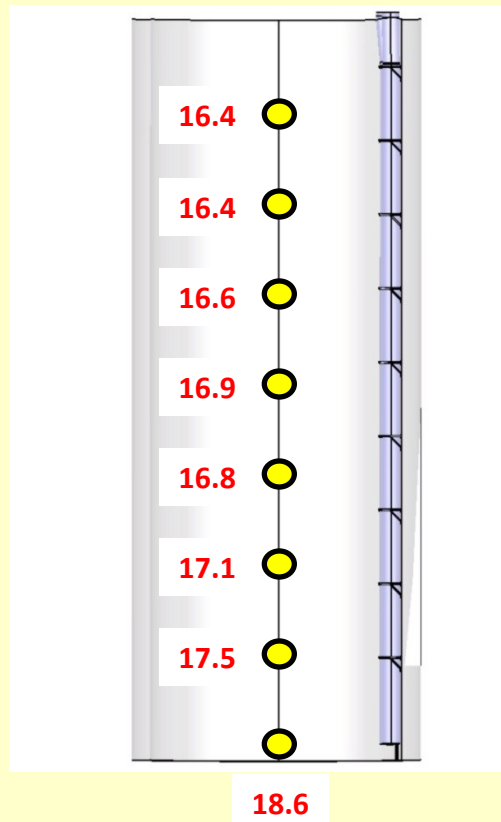
UXC +Z



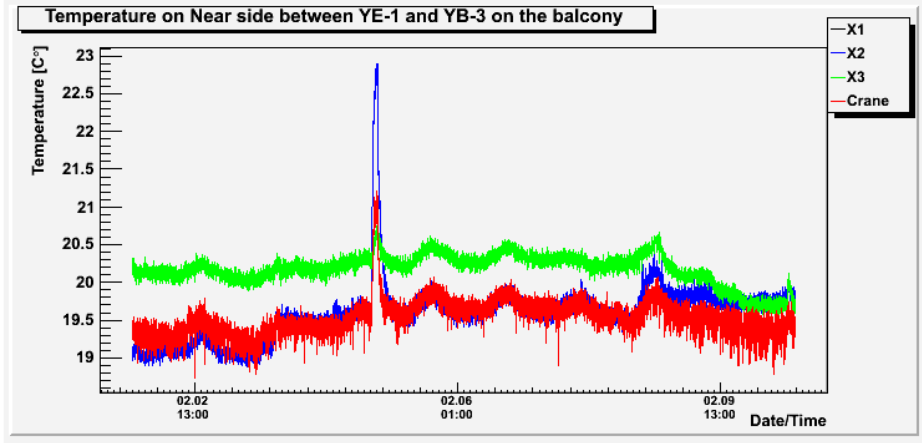
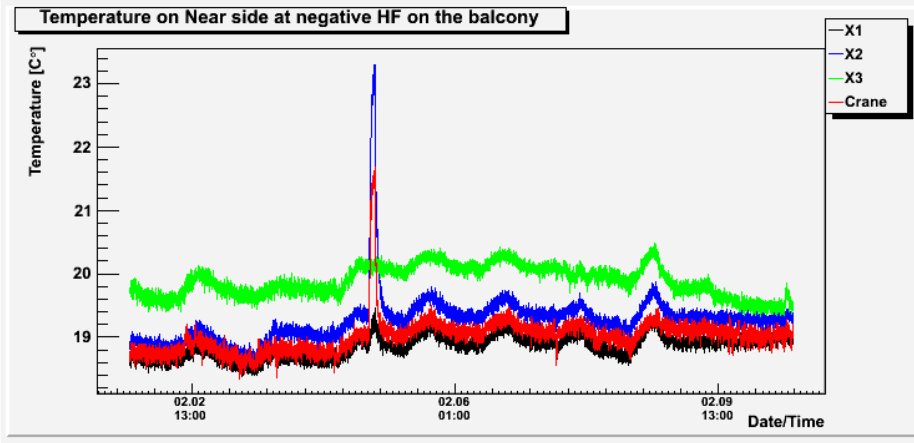
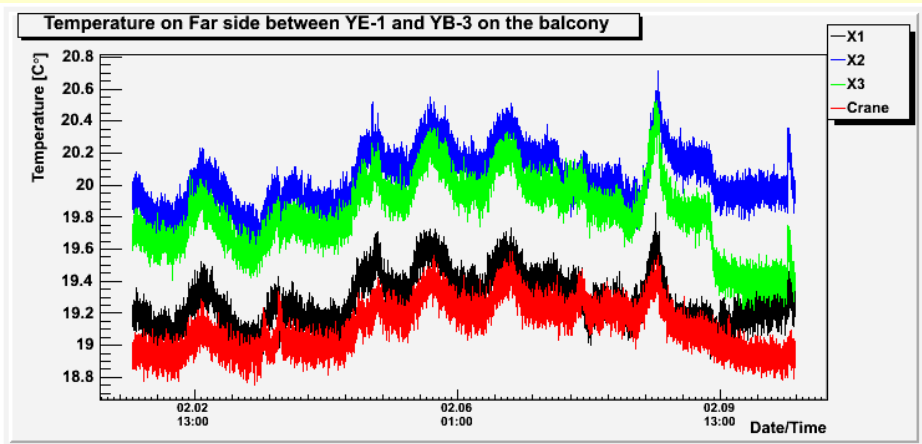
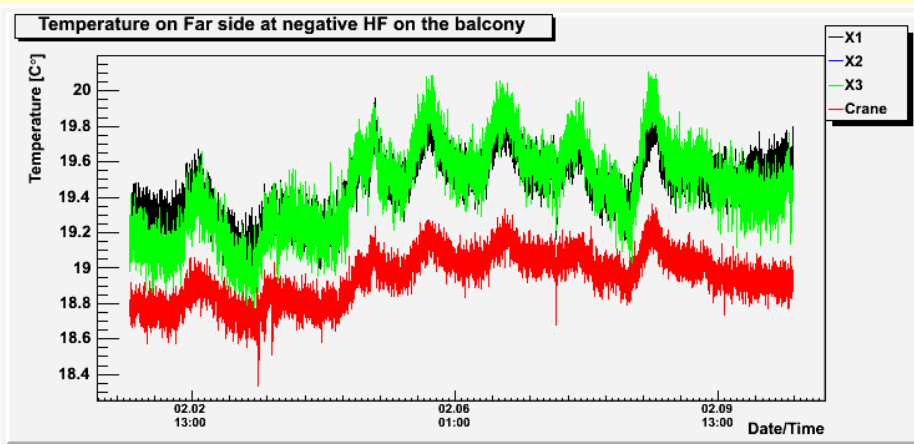
UXC -Z

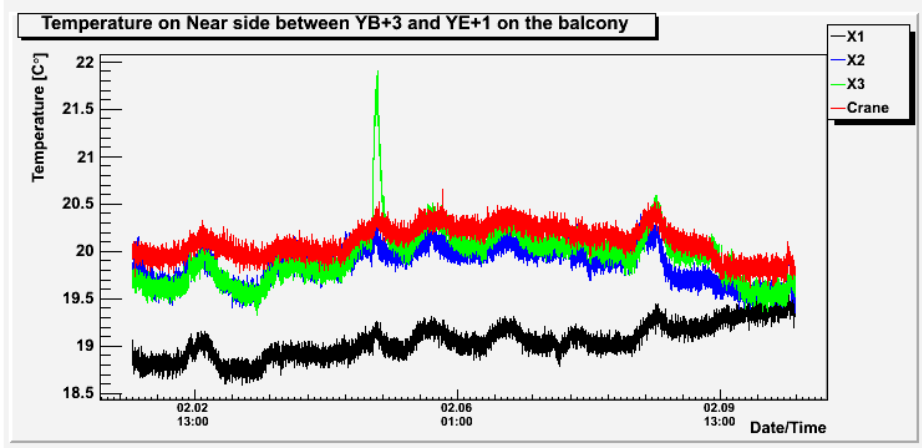
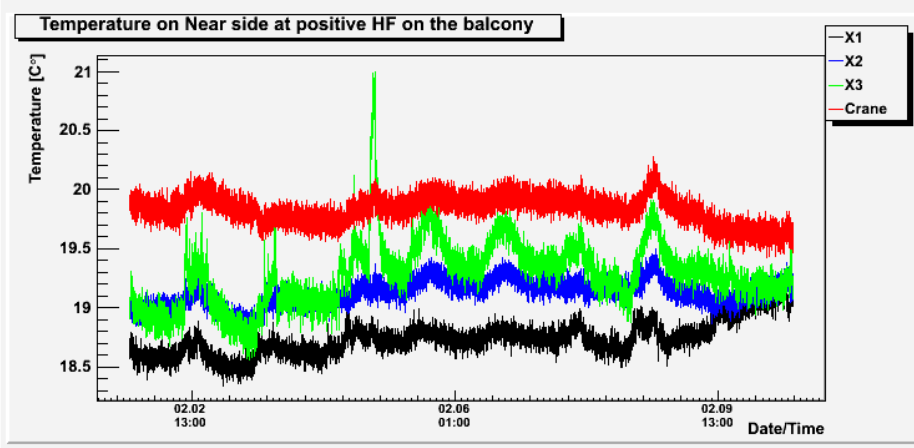
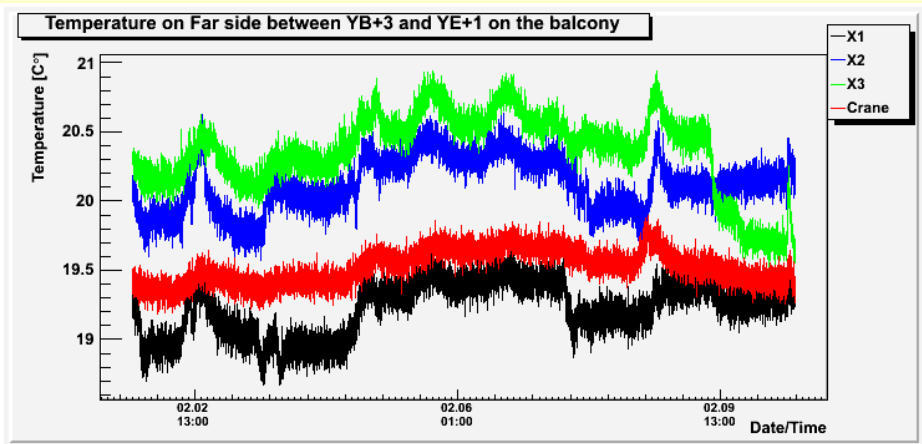
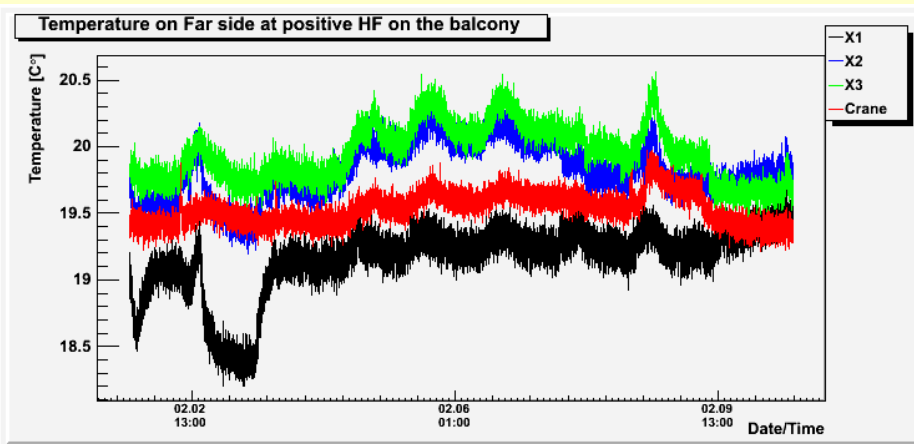


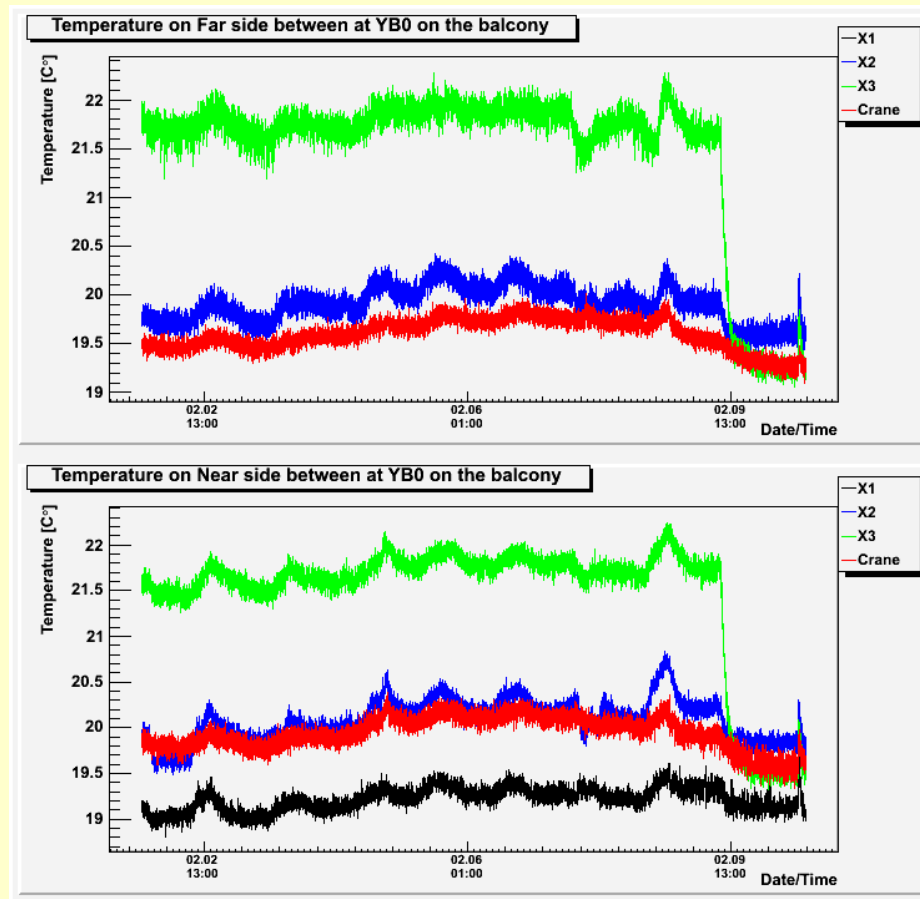
All values in °C

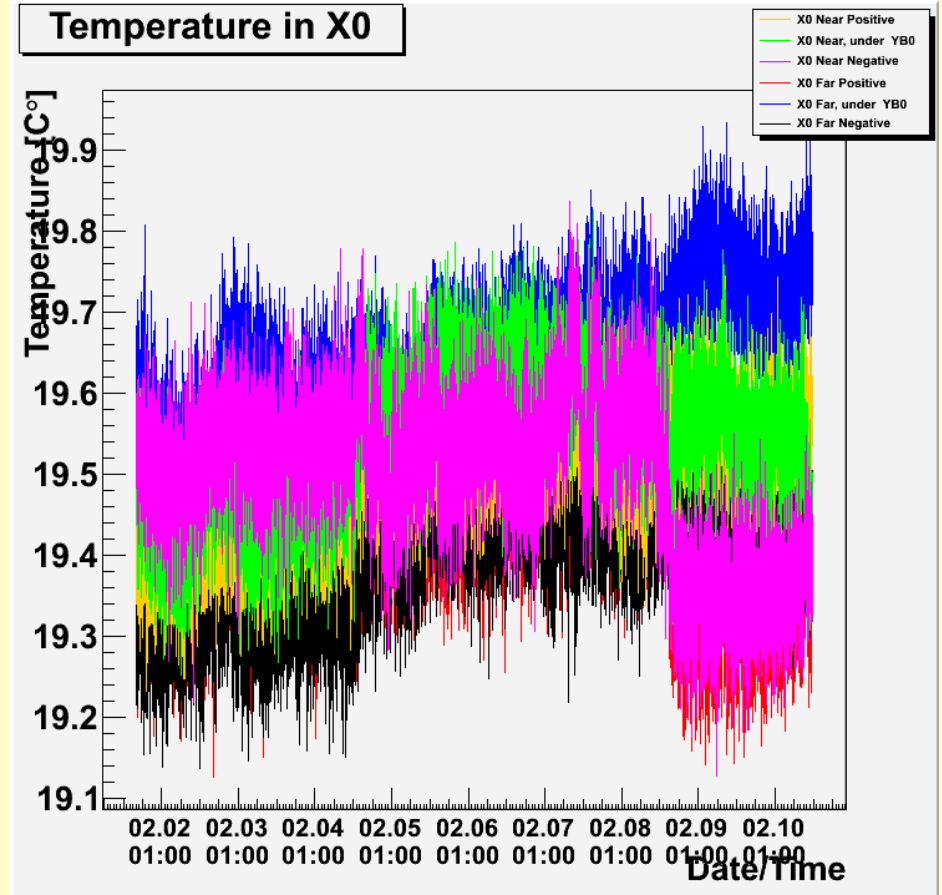
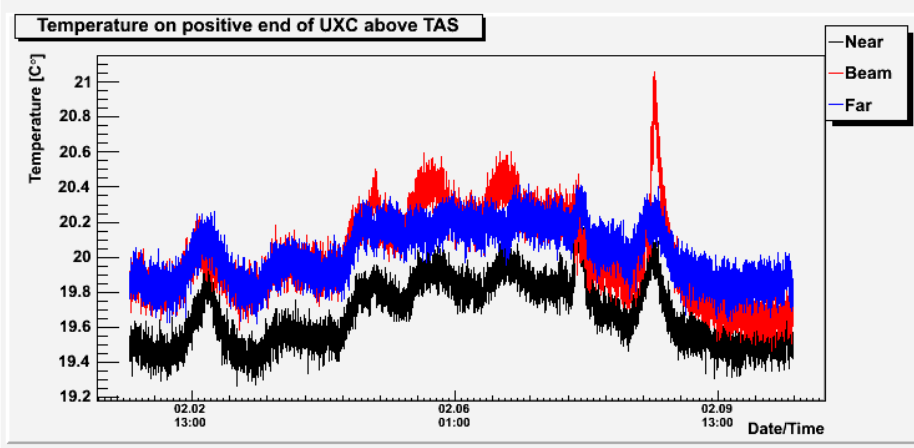
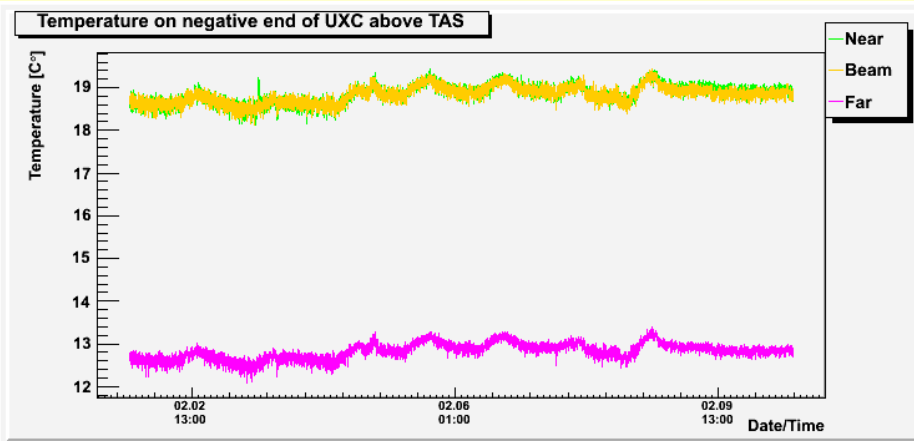


All values in °C

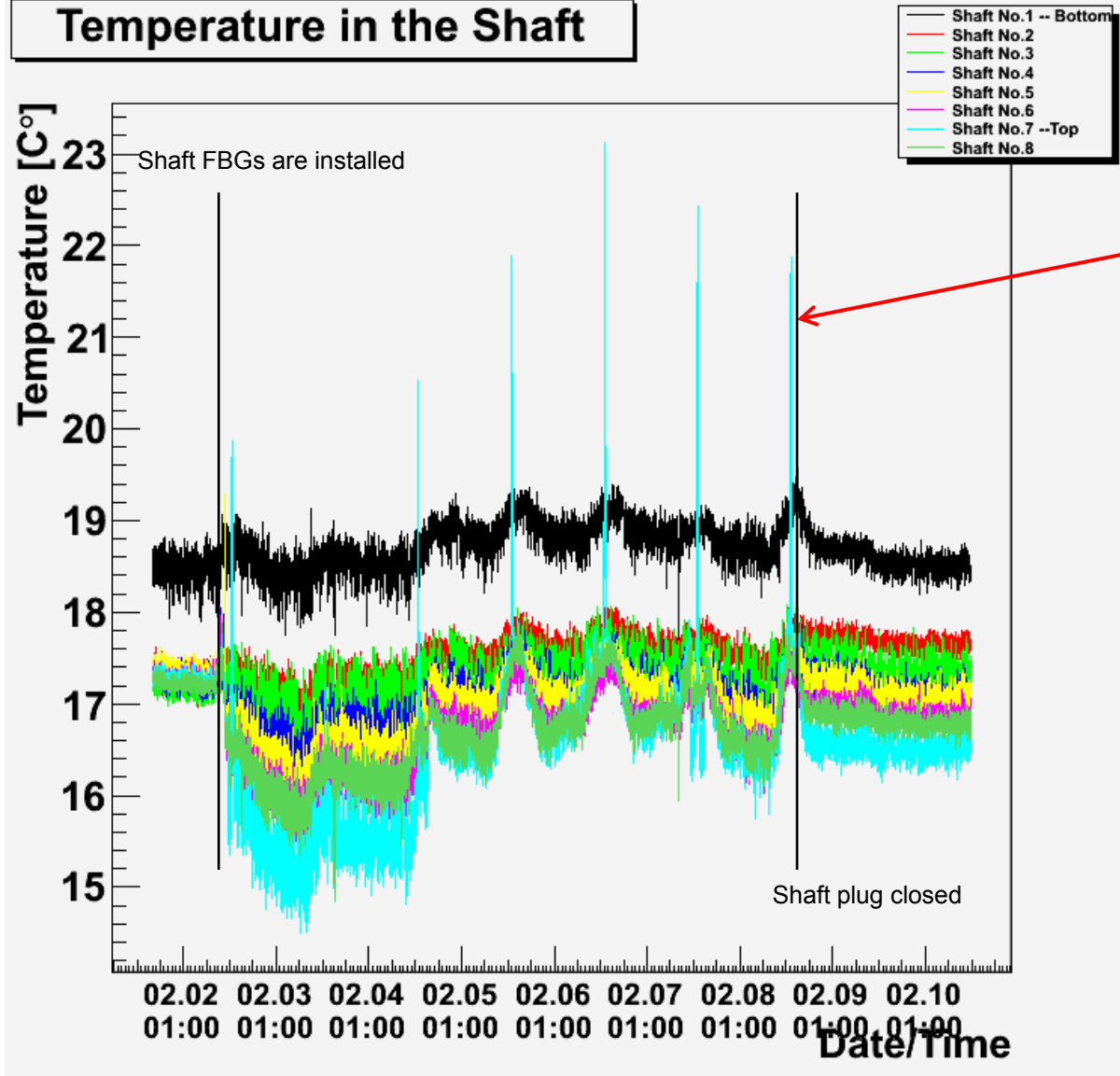




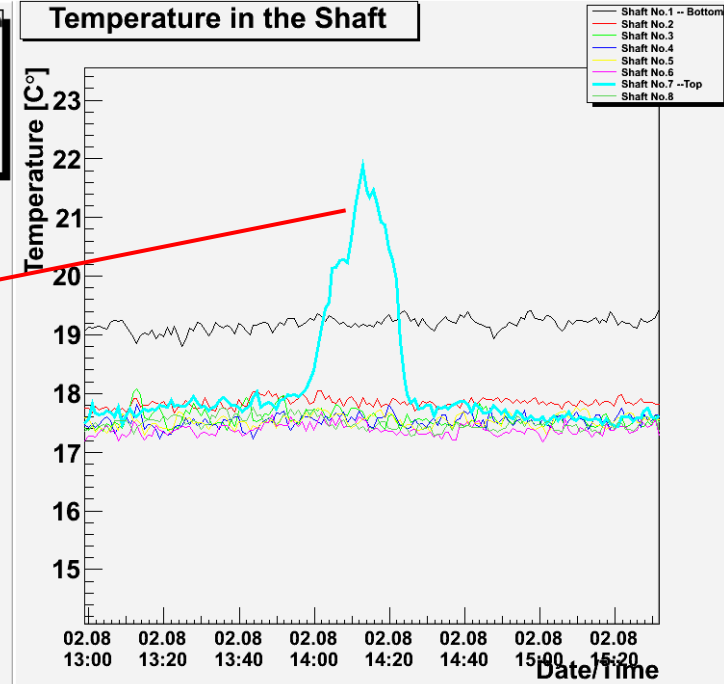




Temperature in the Shaft



Temperature in the Shaft



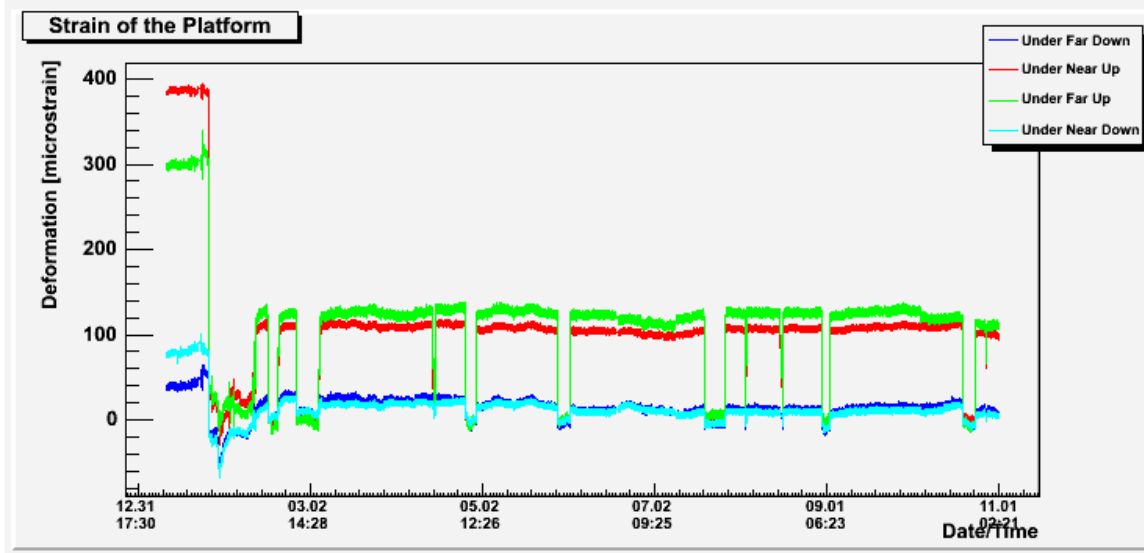
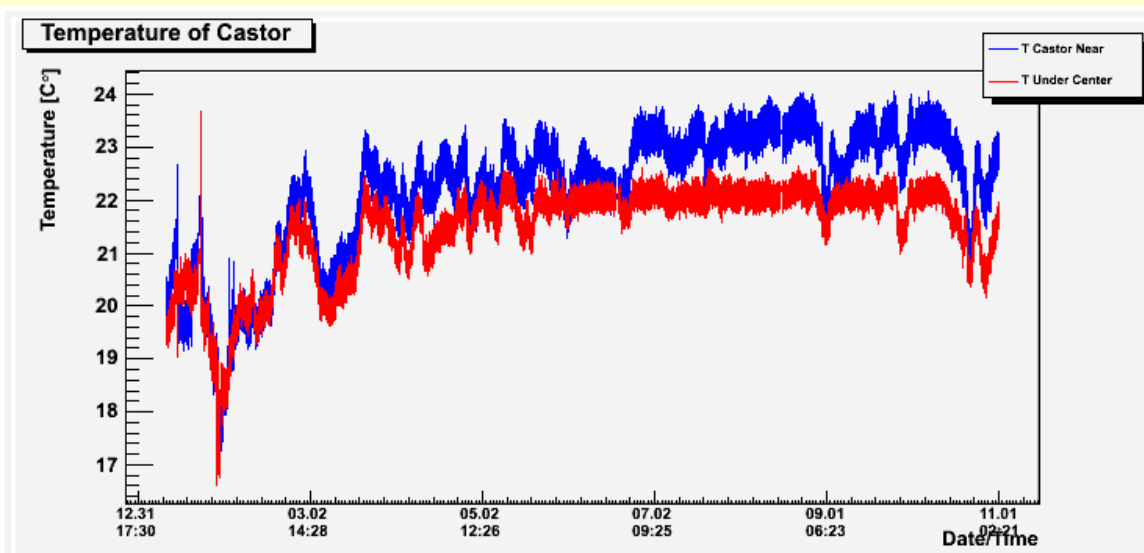
Happens at the same time (every day a bit later than before) – Direct sunlight?

- During 2009 & 2011 ~100 FBG sensors have been installed in CMS
- An automatic DAQ of FBGs has been set up
- FOS system is in 24/7 operation since a year and could follow:
 - Tracker operation (temperature)
 - Magnet cycles induced mechanical changes of HF-
- Recently a T-sensing FOS network has been installed in UXC that identified the benchmark events
- FOS data are integrated into the Sensors4CMS project



Backup slides





Negative side

Positive side

