

20 years HLS experience at SLS

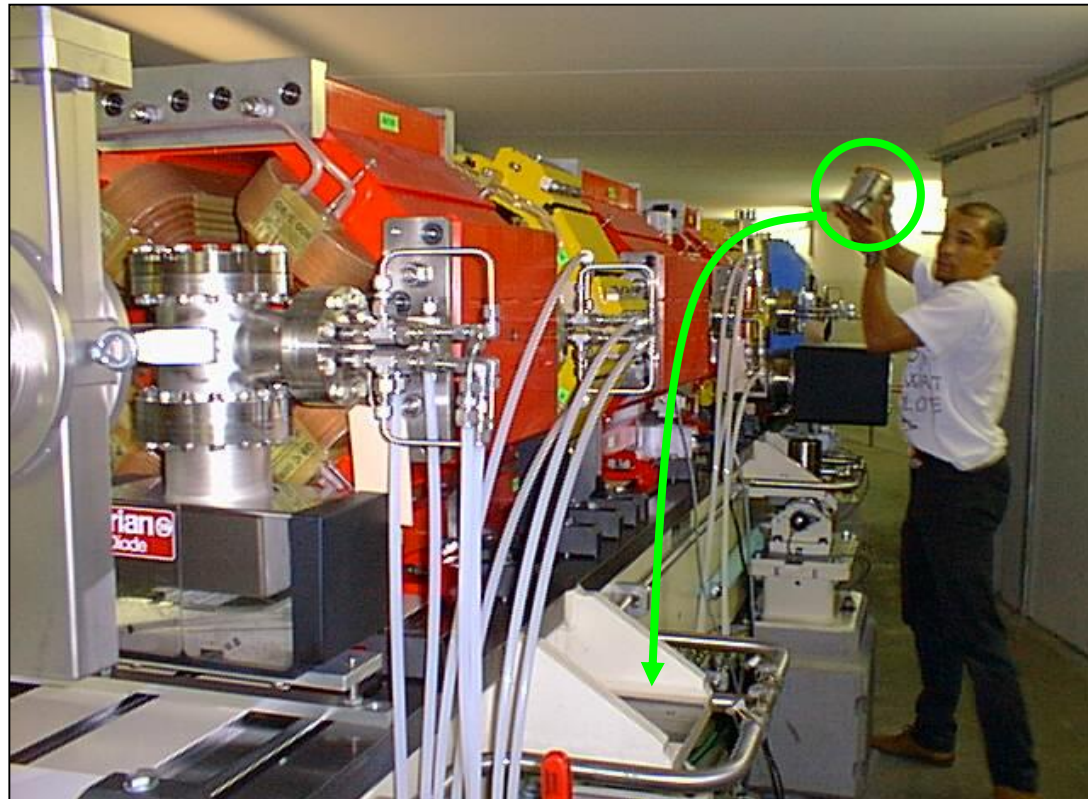
Edi Meier

Edi Meier + Partner AG

Winterthur, Switzerland

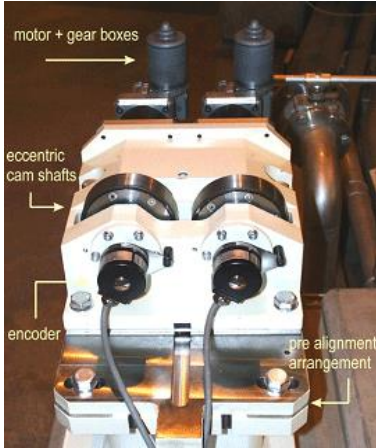
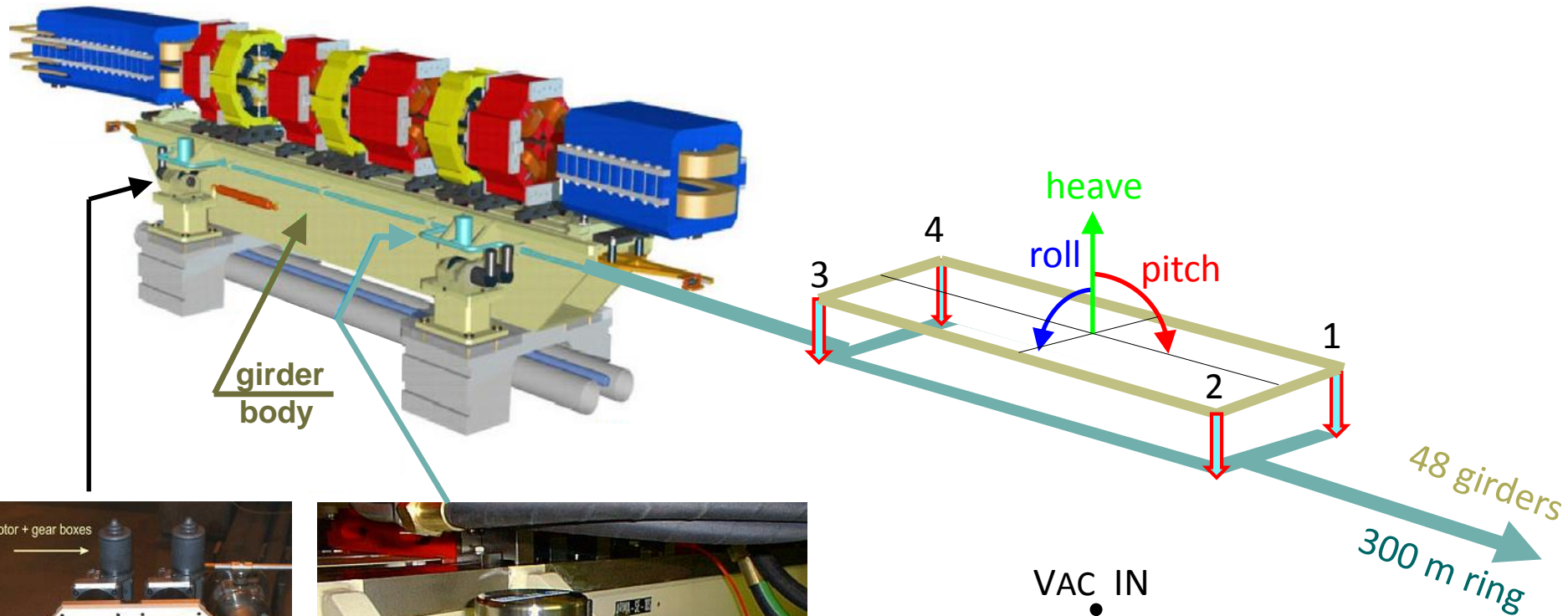
www.emp-winterthur.ch

edi.meier@emp-winterthur.ch



- 450m horizontal stainless steel tubes
- 192 HLS Sensors are installed on the four 0.01mm precise machined platforms
- continuous monitoring since 20 years
- sampling every 2 seconds

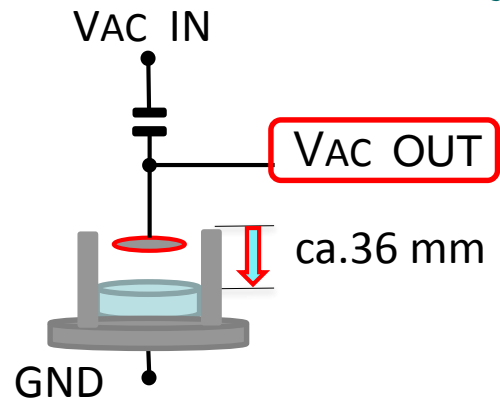
HLS principle for vertical position monitoring



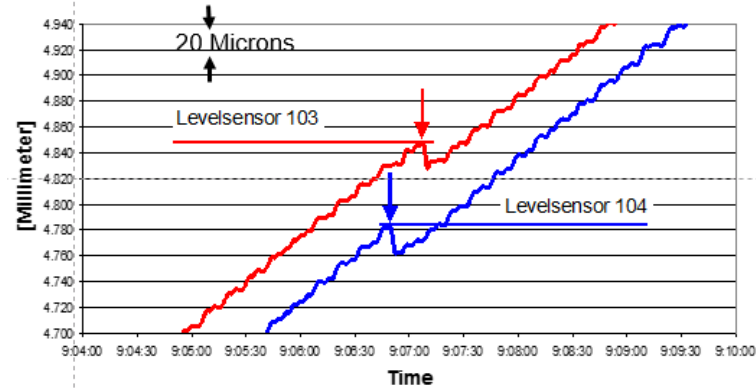
Excenter Motor



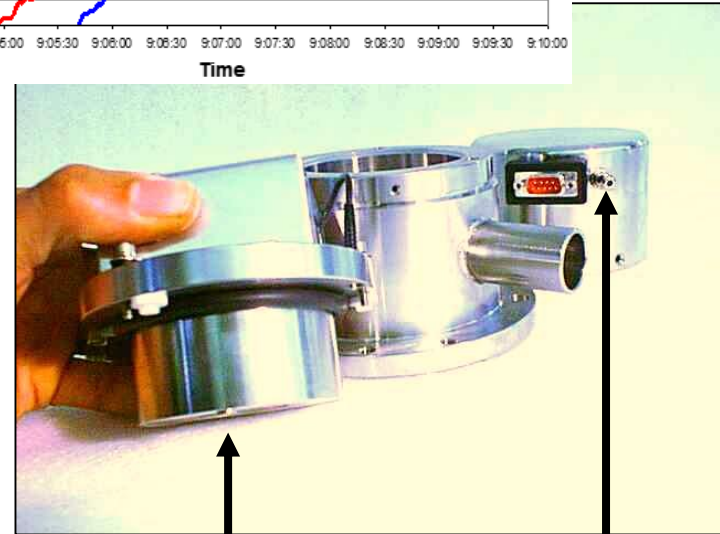
HLS Sensor



HLS Sensor: **useful** and **useless** features



surfaces
grinded

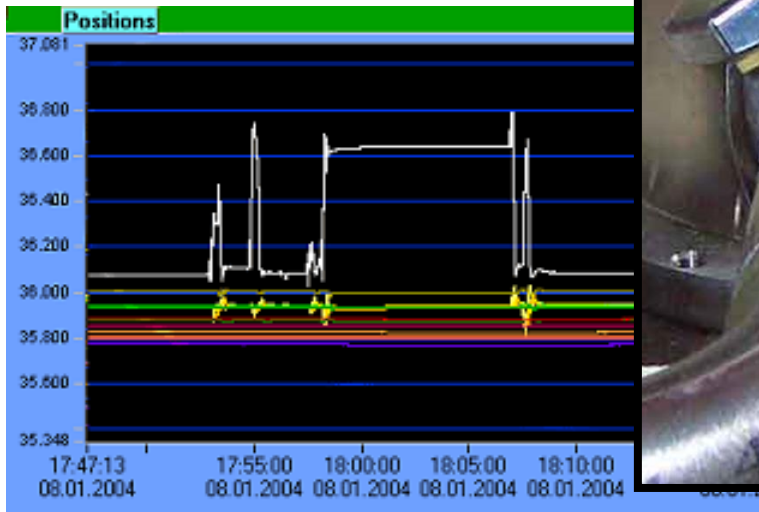


Touchpoint
not used

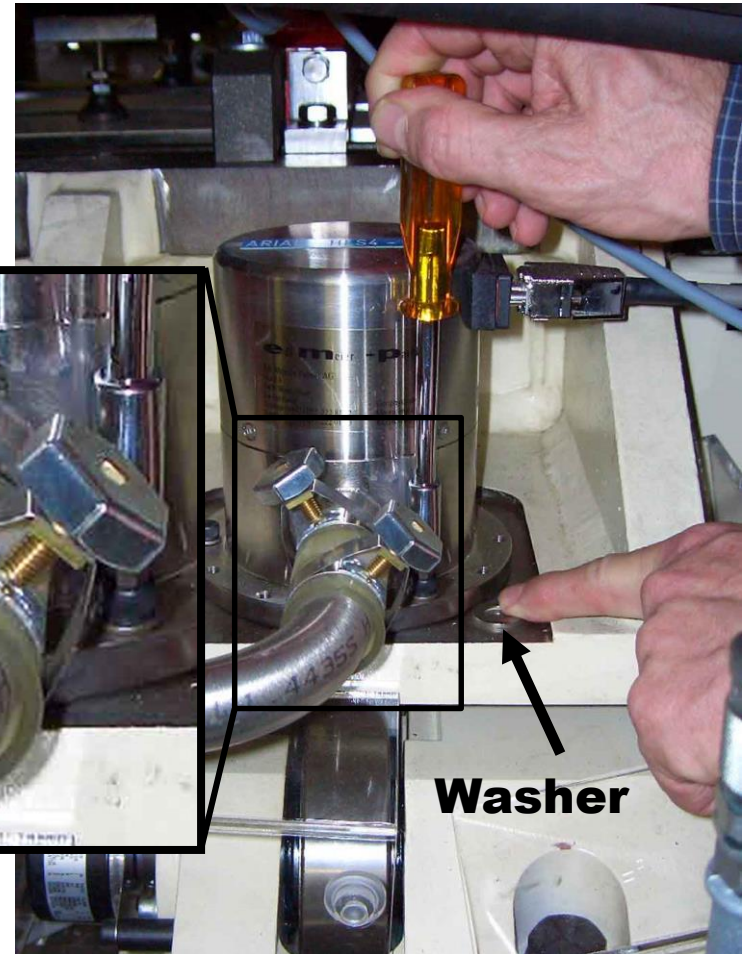
Temperature
sensor
external

In situ test after mounting the HLS sensor

Unscrewing the sensor Washer placed below sensor Sensor fixed again



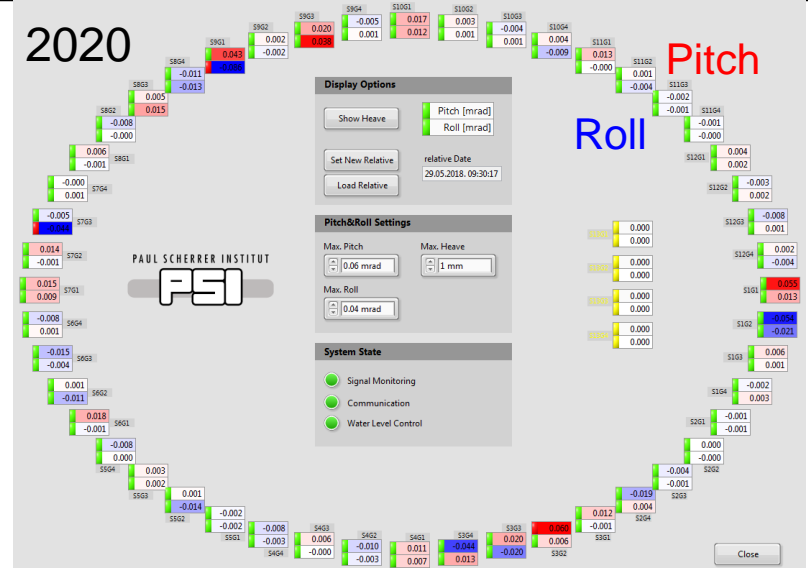
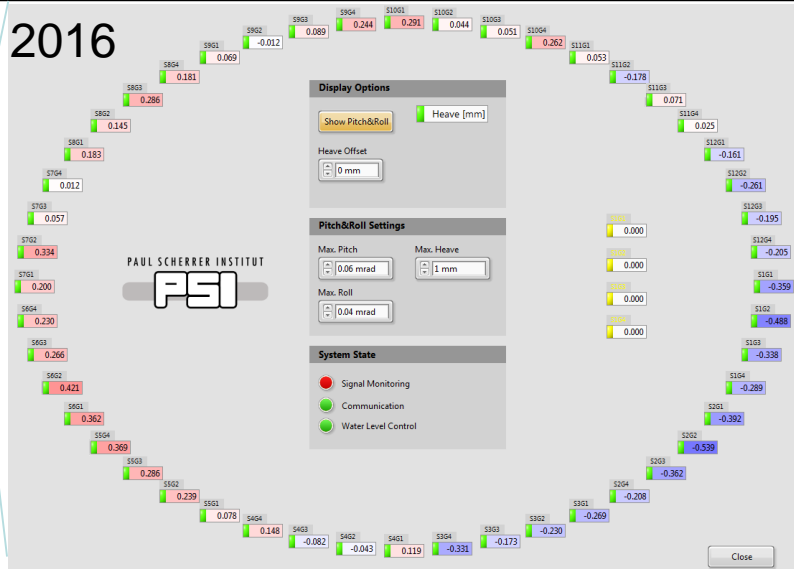
5 min



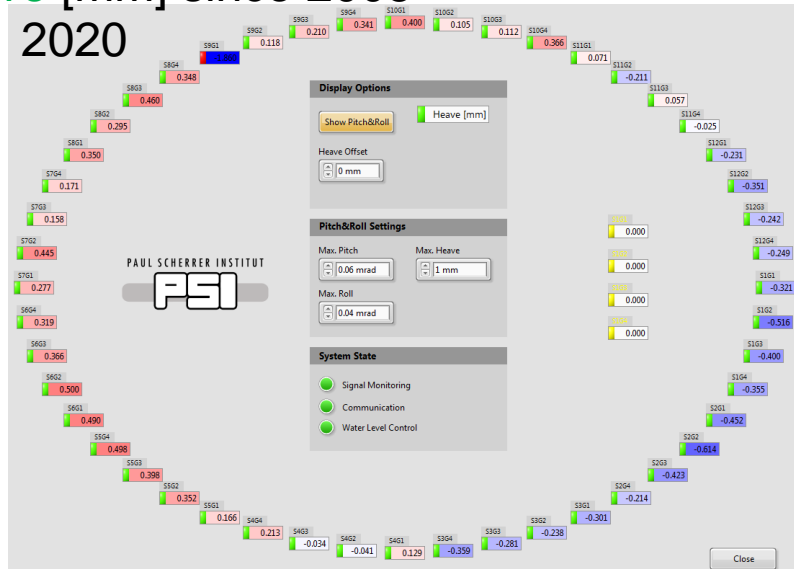
~~Thygothane-Polyurethan~~ -> PVC

Actual software running on HLS computer

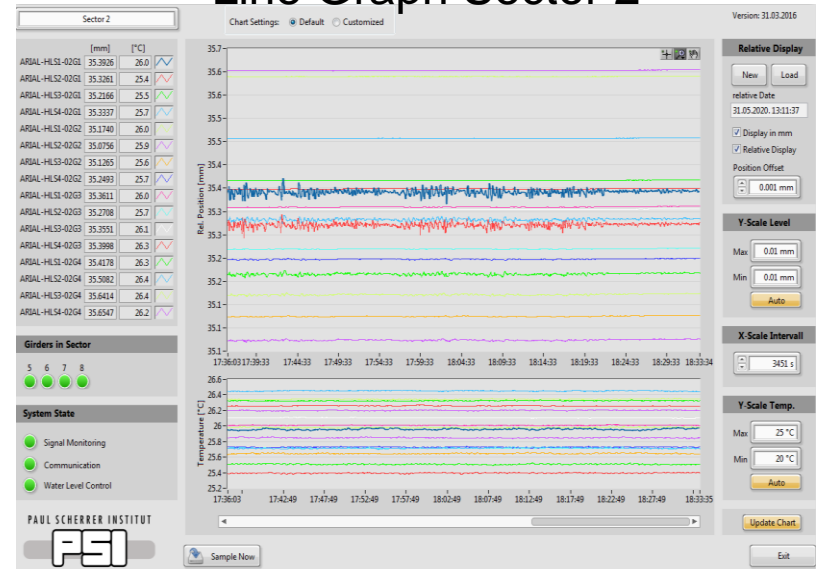
EMP
-> VPN



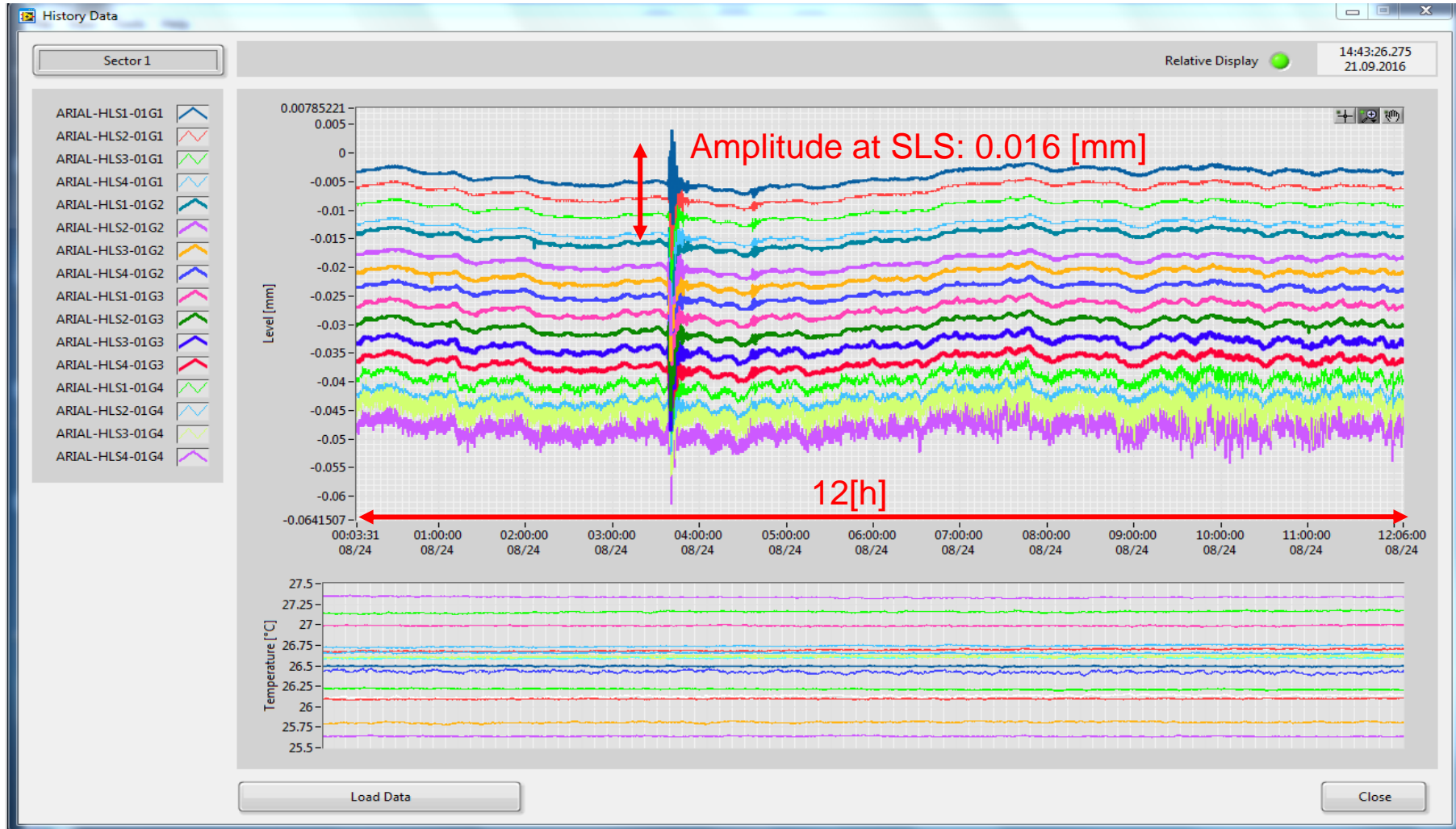
Heave [mm] since 2005



Line Graph Sector 2

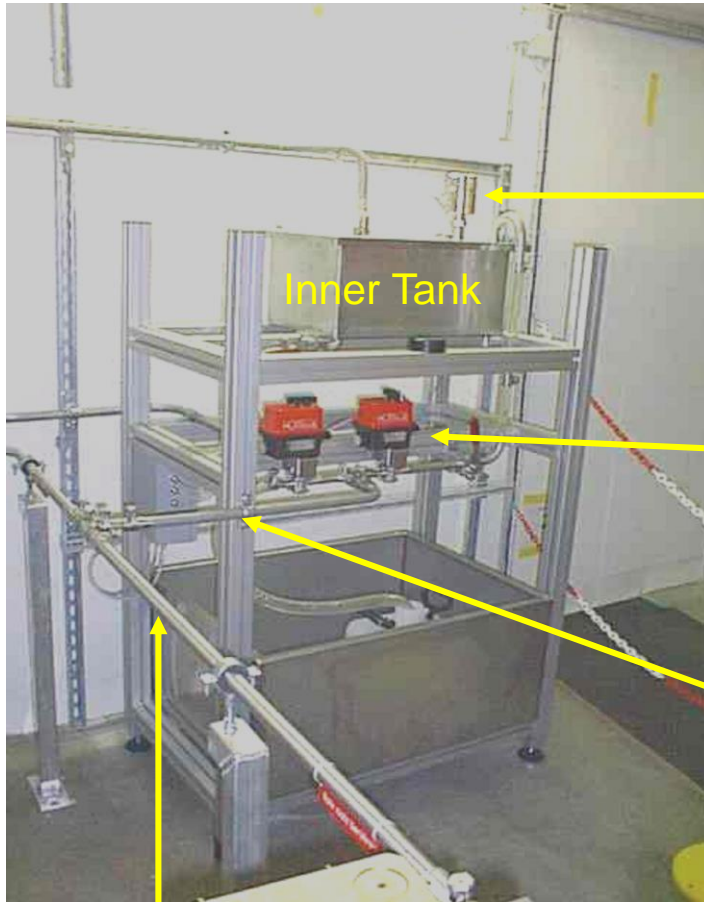


24.8.16



Filling and Calibration Tools

Filling station in the ring:
automatically refilled



Liquid levelmeter

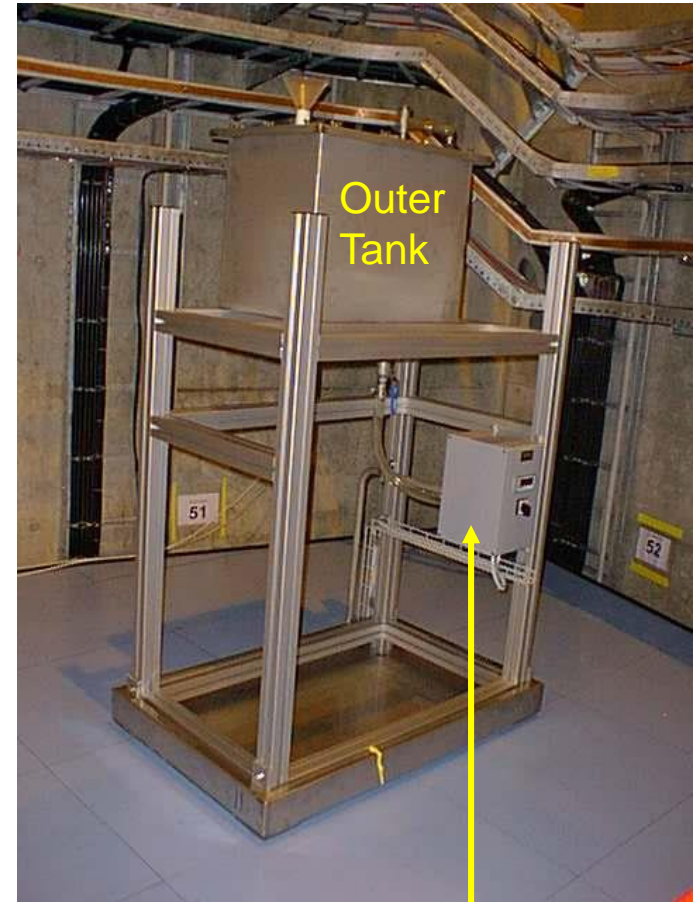
Inner Tank

Remotely controlled valves

Connection to measuring tube

Half filled measuring tube

Outer filling station:
manually refilled

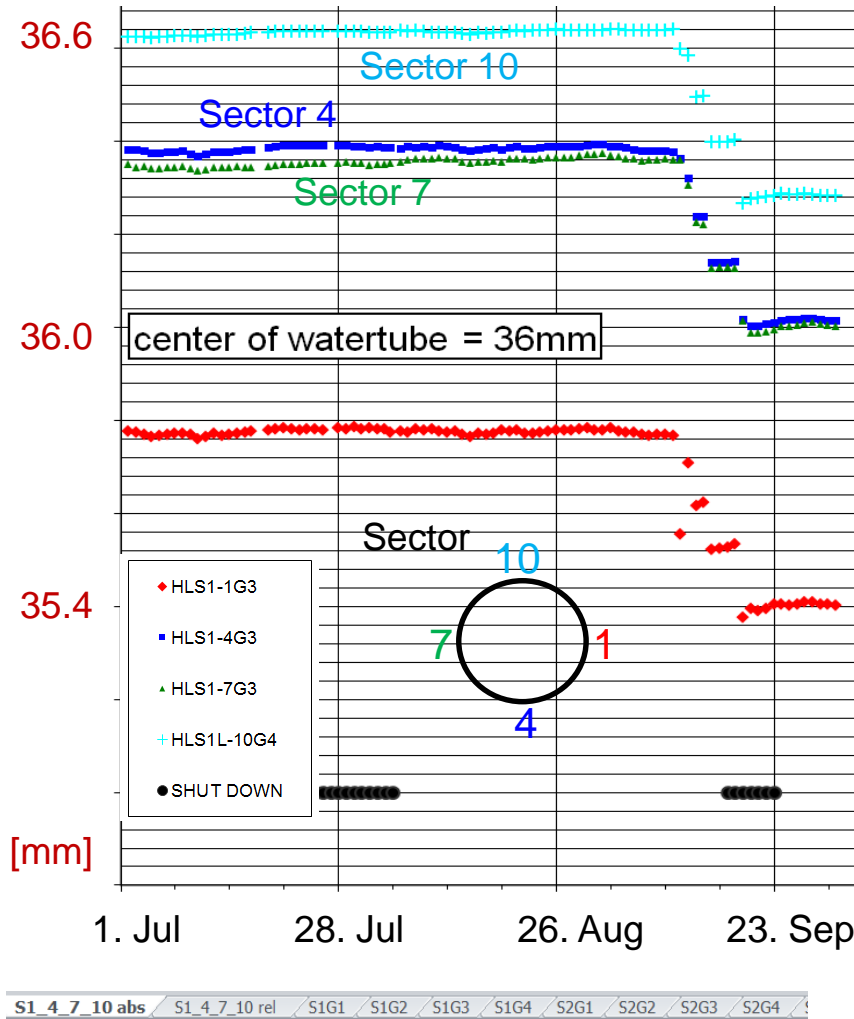


Outer Tank

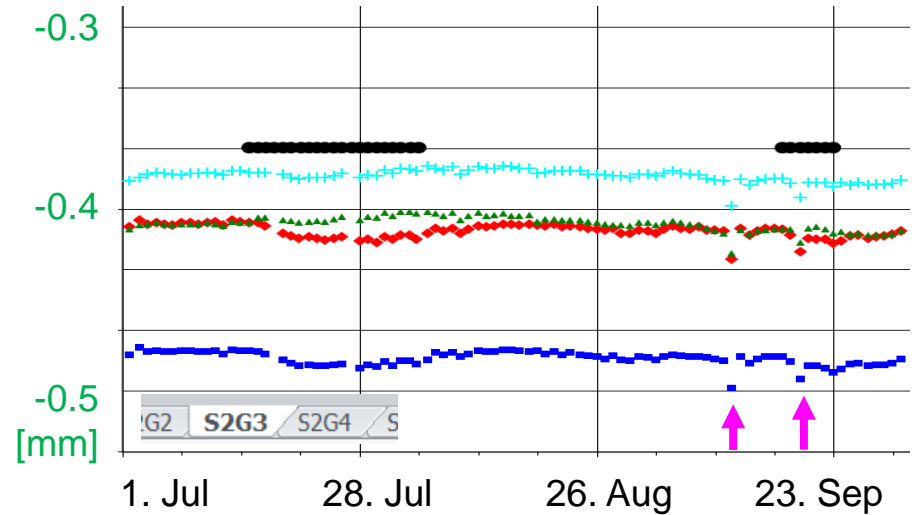
Liquid control and pumping unit

Unexpected displacement during remote calibration

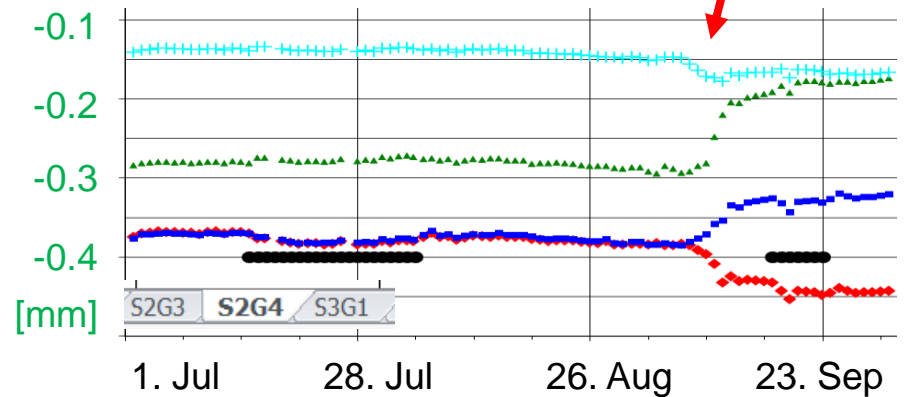
Absolute values during calibration 2019



Relative values show only a small deflection

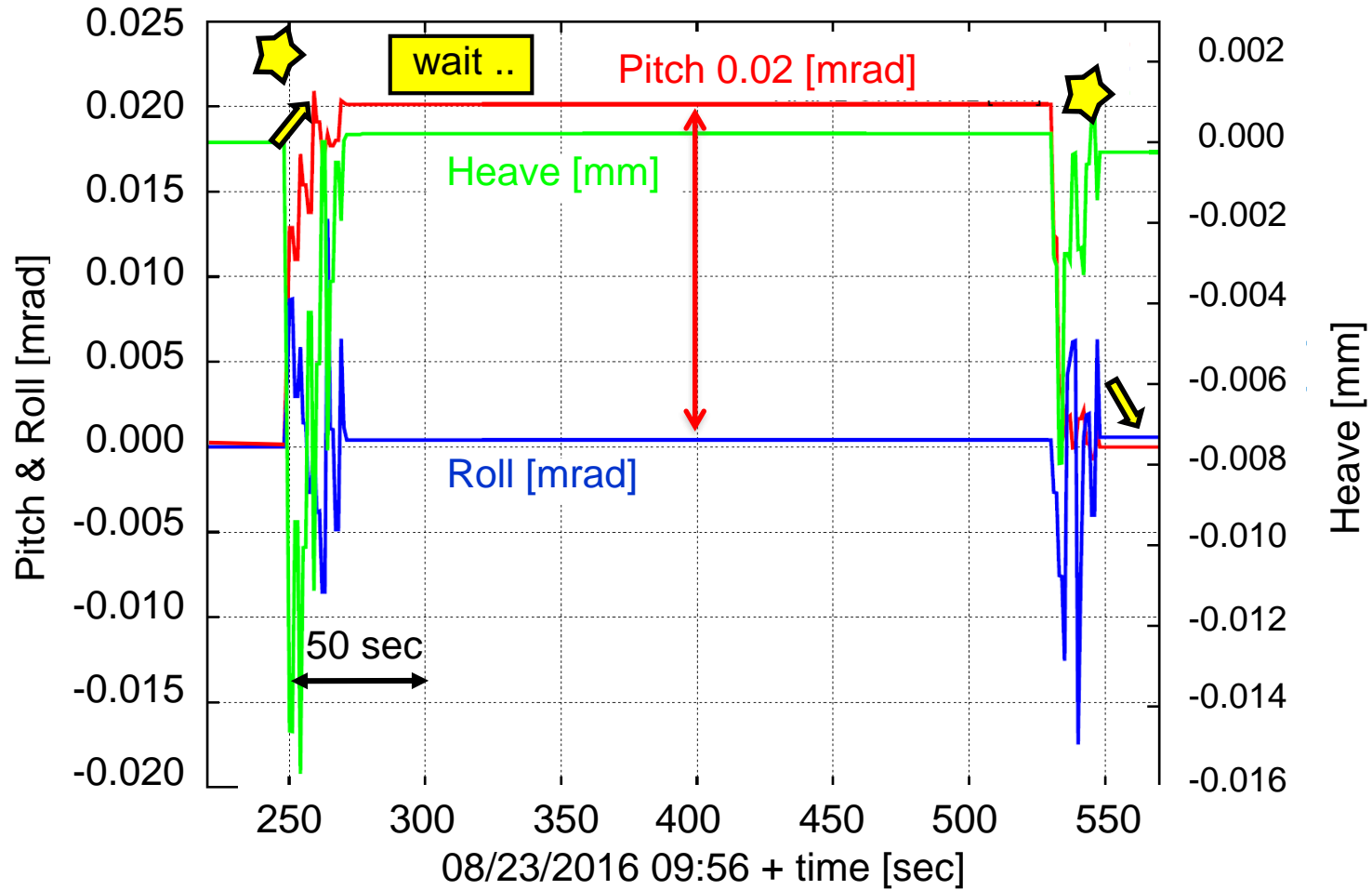
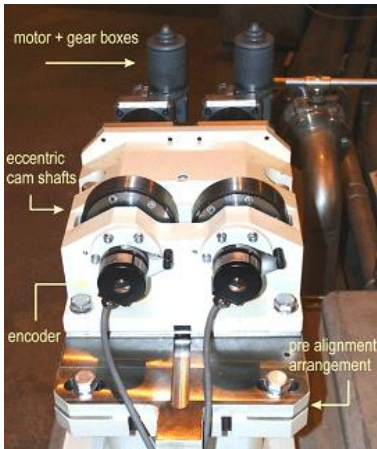
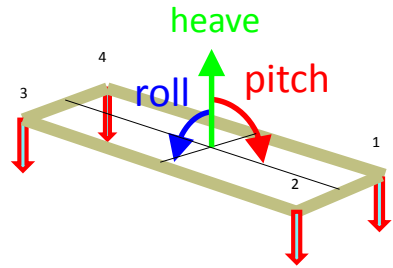


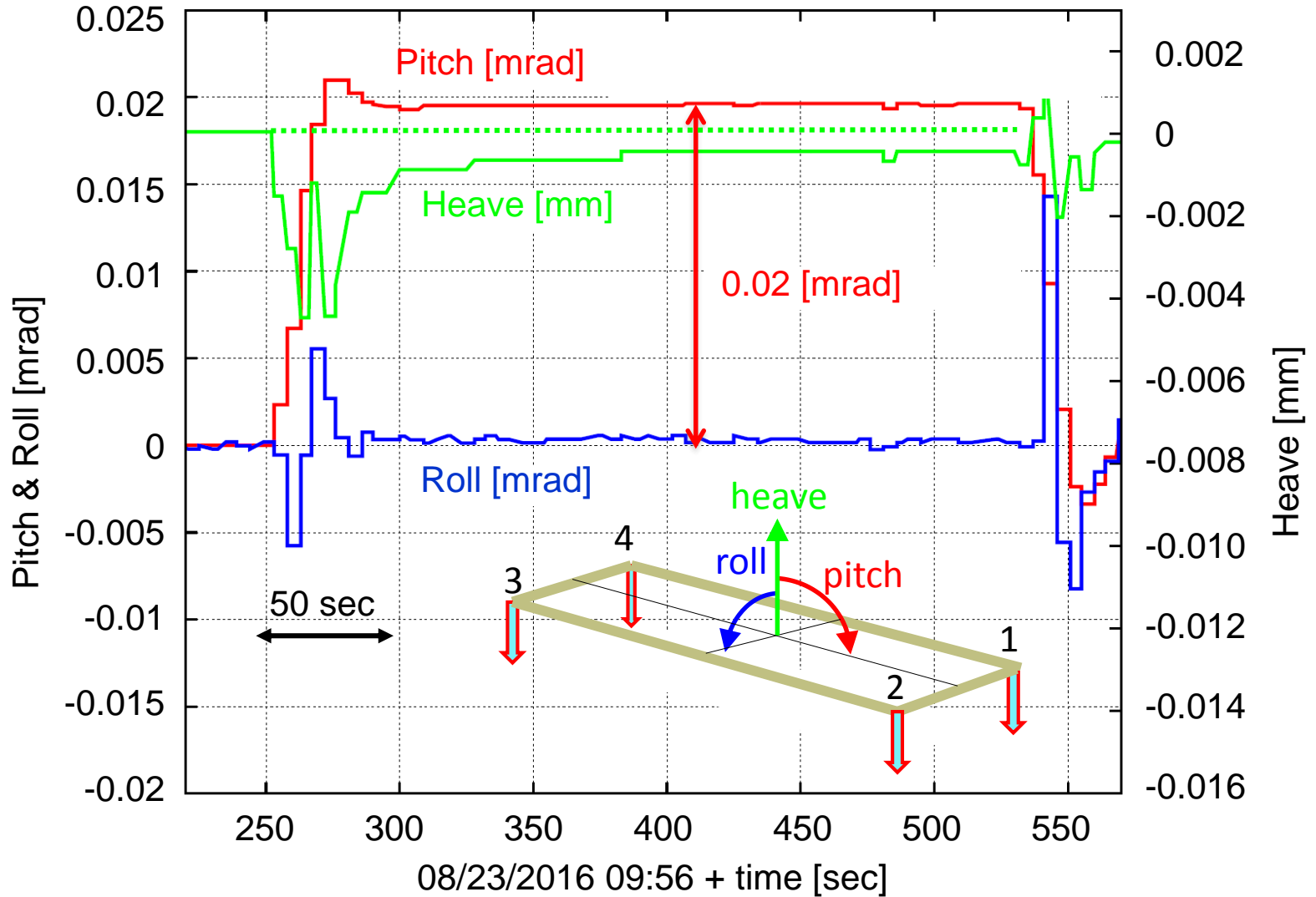
Water loss in cooling system → deformation of girder foundation, irreversible !



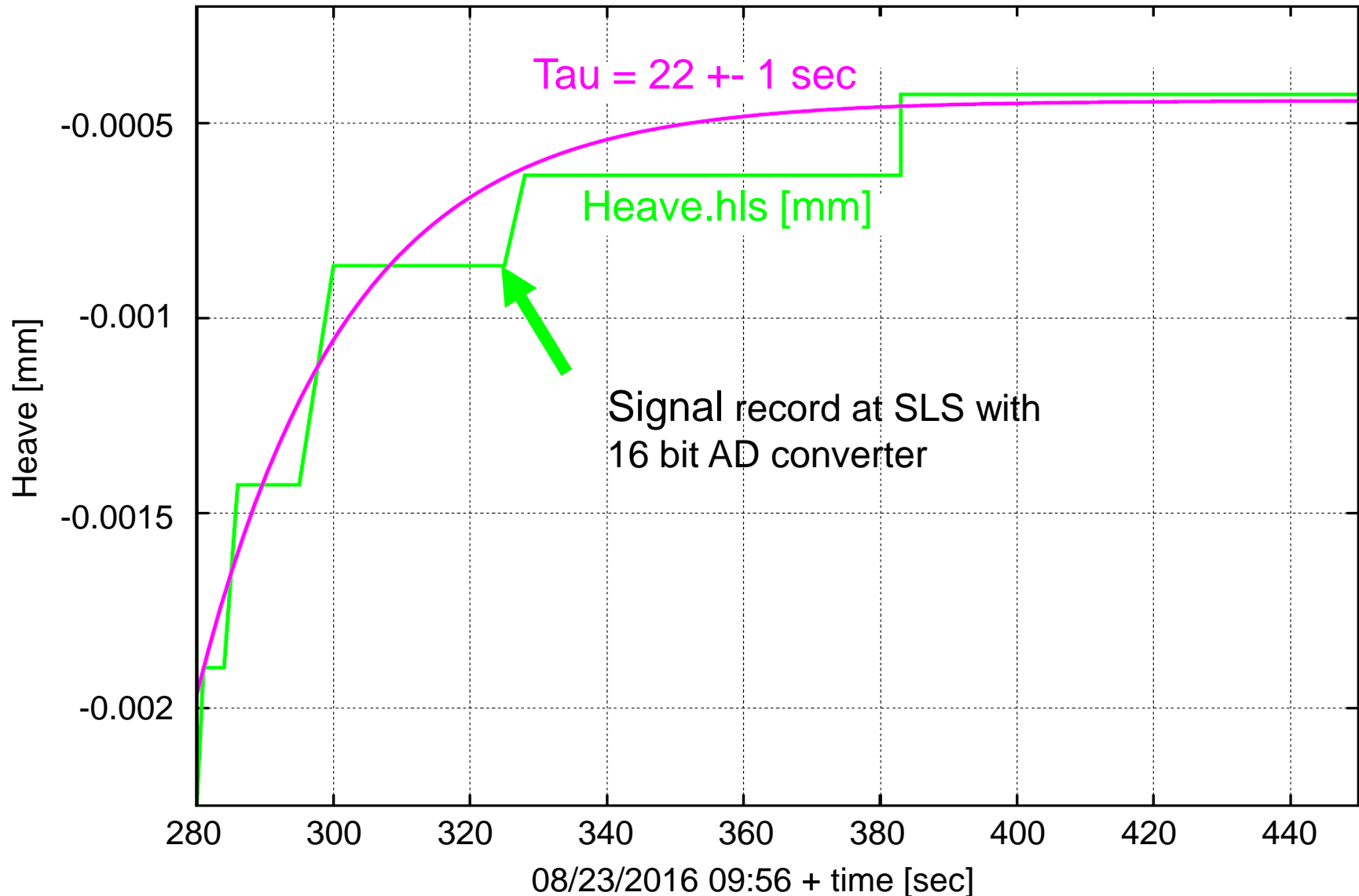
Manually set Pitch of a Girdler

Girder **Pitch** set to 0.02 mrad with excenter motors





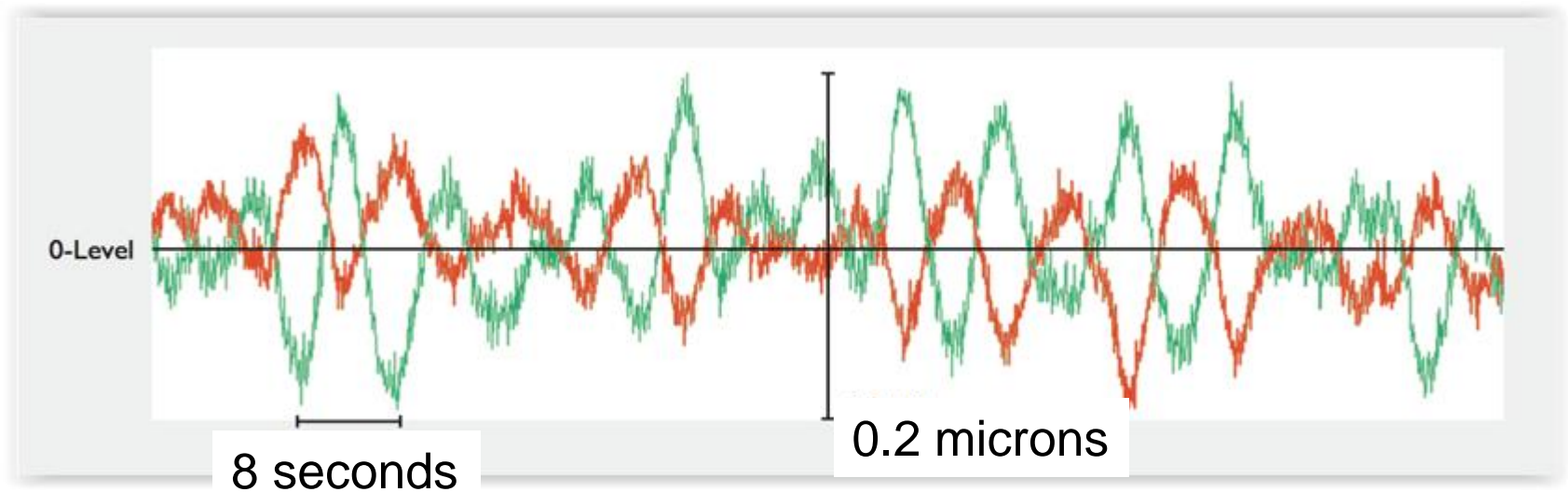
End value predictable – higher resolution required



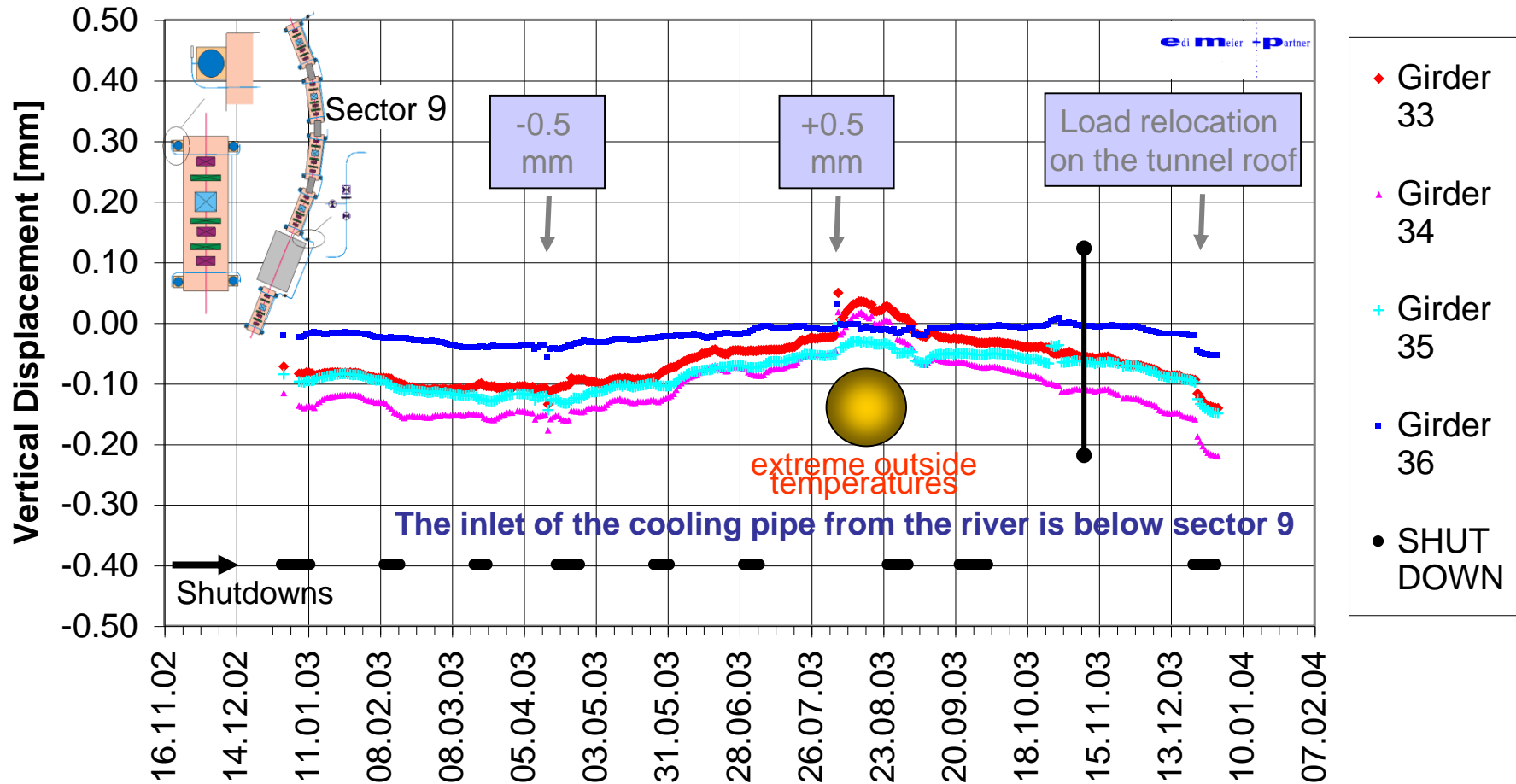
HLS in nuclear waste research Rock-Laboratory in Canton Jura

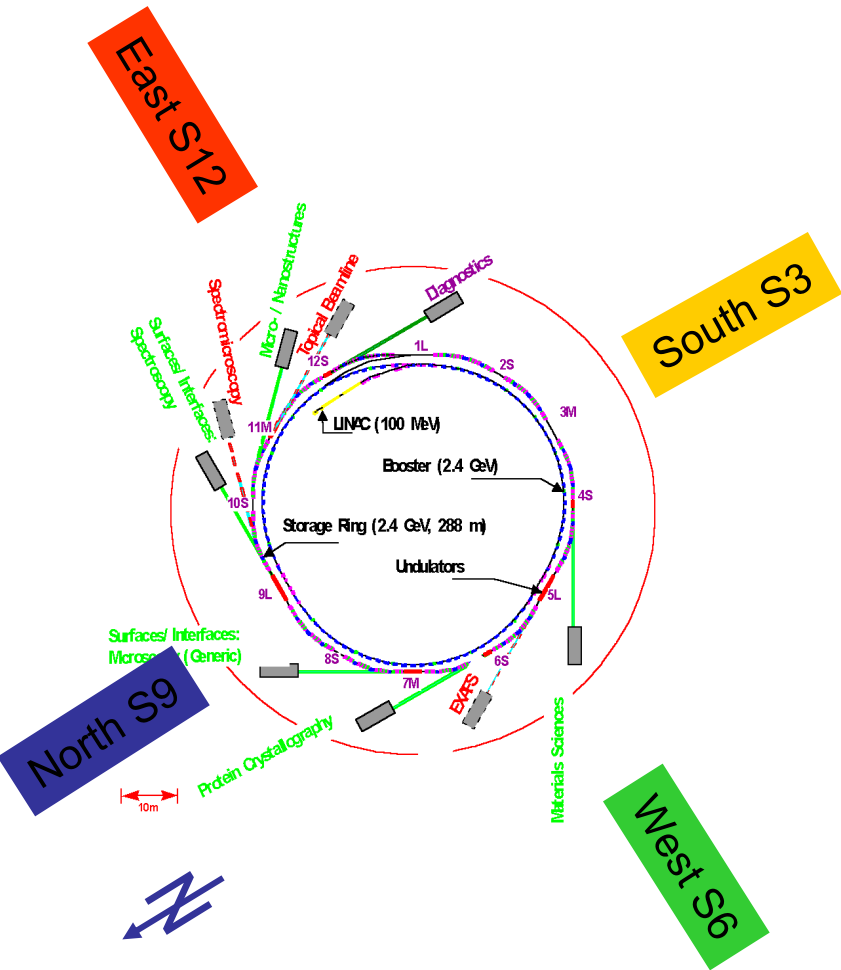
- 2 HLS Sensors, 50m Tube
- 24 bit Seismic Dataacquisition
- 20 Samples per second
- Nanometer Resolution

Ground motion induced by Atlantic waves – 800 km far away !

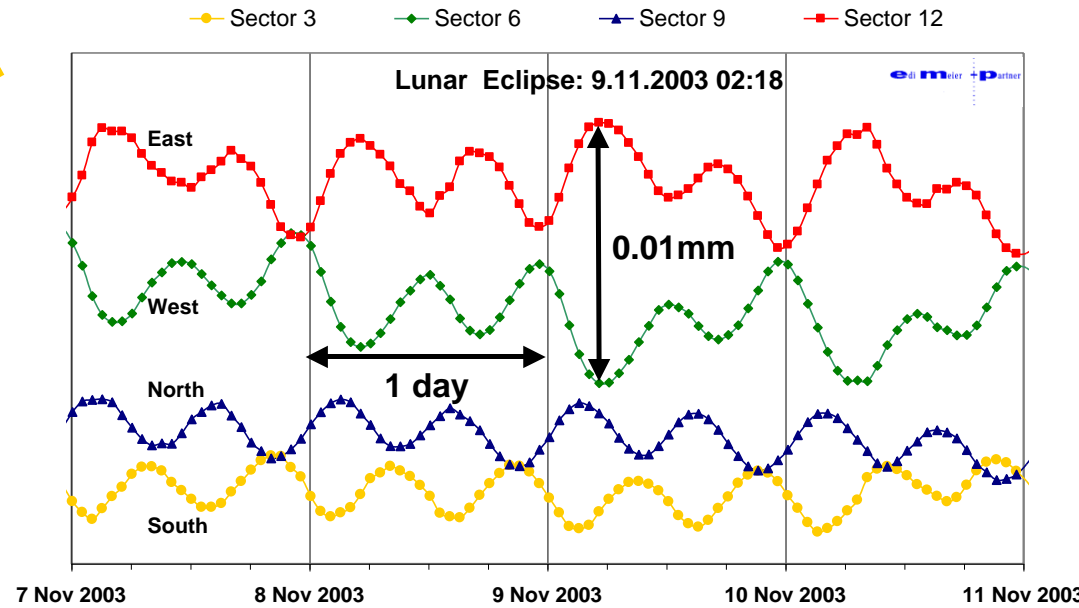


SLS Hydrostatic Levelling System : Sector 9





Ground deformation at the SLS during Eclipse



- It is convenient to have the sensors at table height
- Do not use Tygothane Polyurethan, use PVC for connecting the Levelsensors to the tube system
- no wavebrakers in the tubes are needed
- In situ calibration is recommended
- 24 bit A/D converters are recommended
- No touchpoint is needed when the sensors are longterm-stable and enough redundant sensors are installed