

# Cryogenic aspects for CC MDs

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CERN – Geneva, Switzerland

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# Outlook

- General layout
- Brief conclusions from SM18 tests
- SPS cryogenic operation – aspects for MD
- Conclusions and perspectives

# General layout

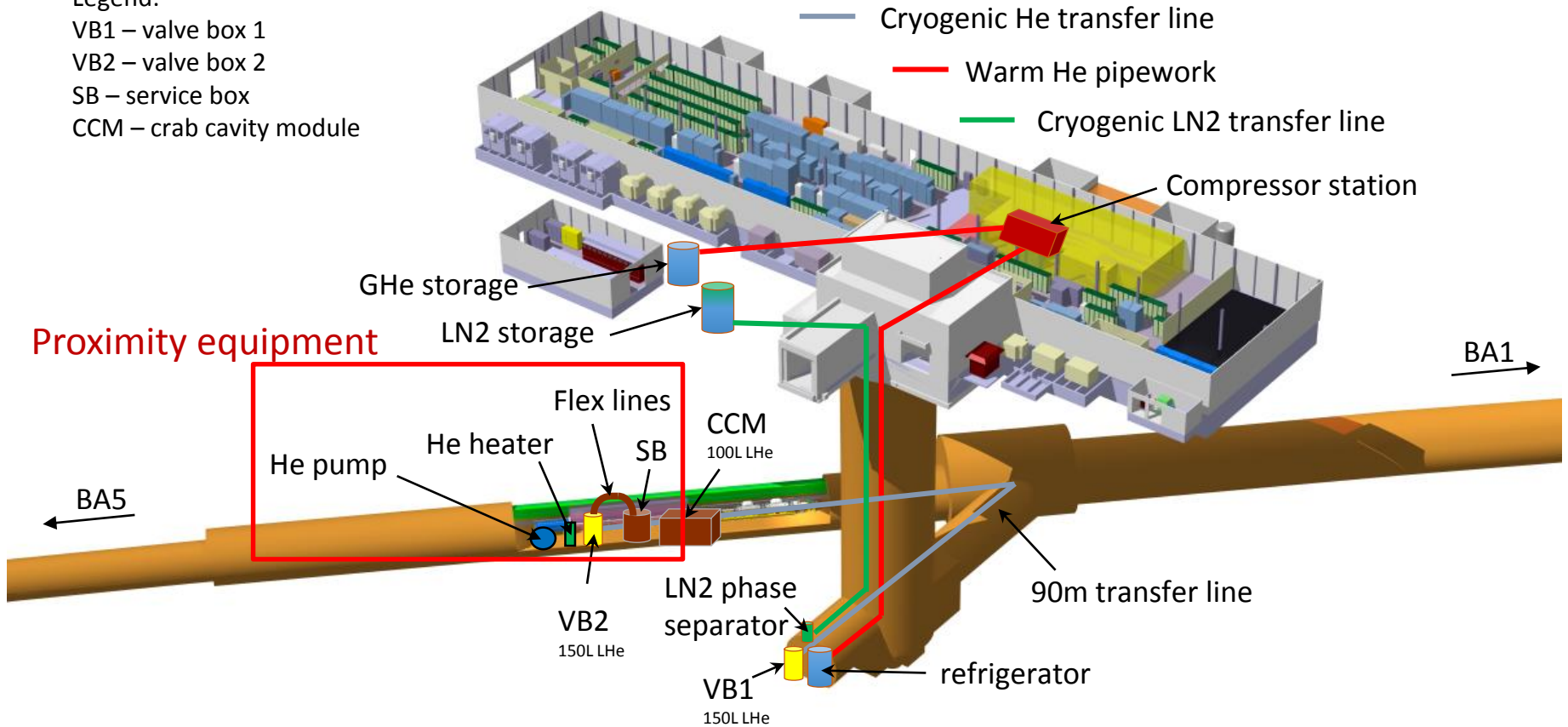
Legend:

VB1 – valve box 1

VB2 – valve box 2

SB – service box

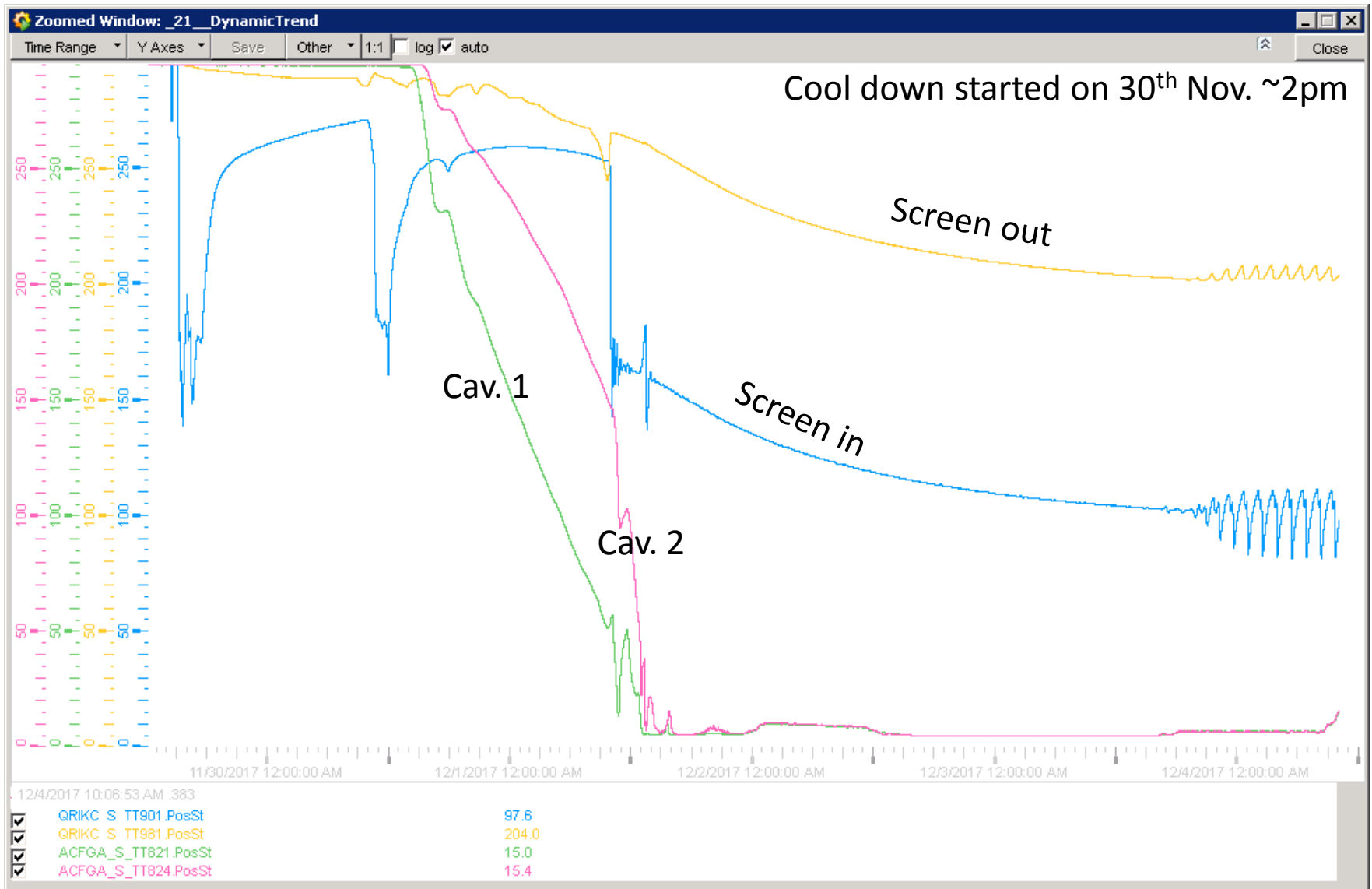
CCM – crab cavity module



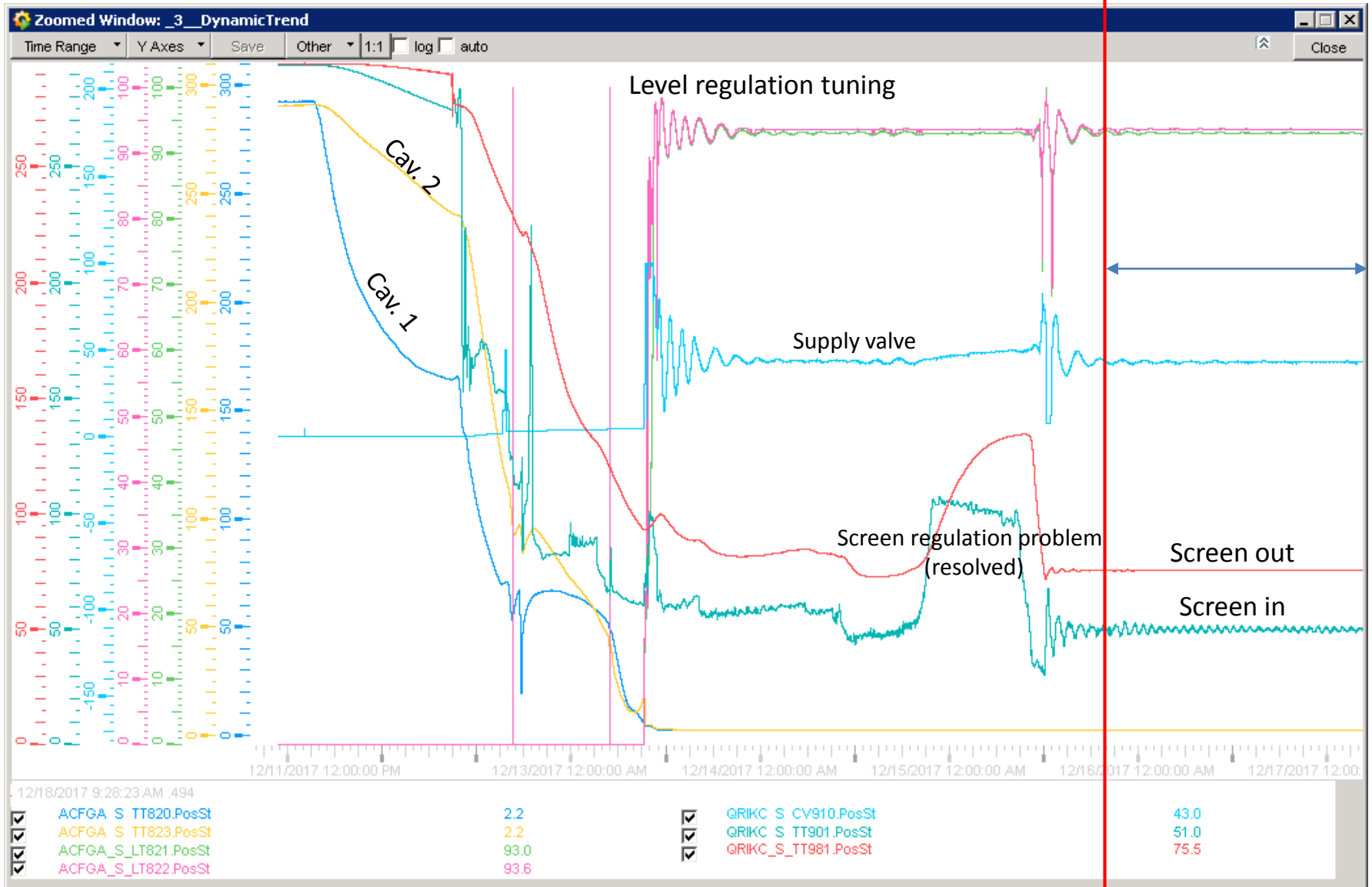
Main functions of the proximity equipment:

- makes direct refrigeration interface to the crab cavity module
- allows for operation of the cavities with superfluid helium at 2 K

# SM18 – first cool down (4.5 K)



# SM18 – first cool down (2 K)



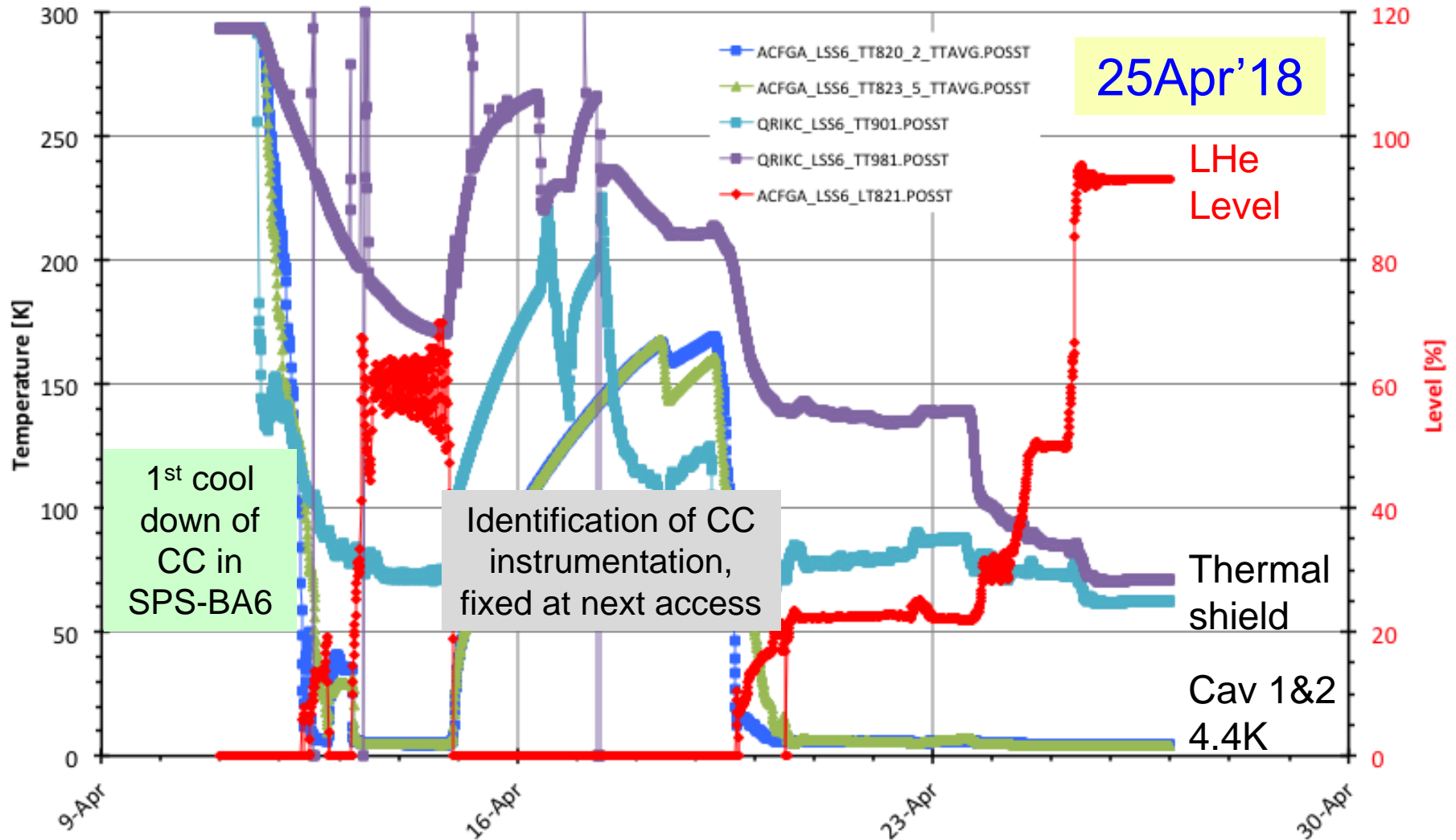
# SM18 – lesson learnt (crab cryomodule)

**The cool down and commissioning was very satisfactory for cryogenic operation, some comments (lesson learnt) as from commissioning are listed hereafter.**

- Cryogenic hydraulics – globally pipe sizing is correct, inter cavity piping to be improved (diameter > 30 mm, required supply in the middle of two cavities to equilibrate flow shearing between both cavities during cool down),
- Sizing of supply valves correct – **OK for SPS operation**,
- 2 K heat exchanger works as foreseen – **OK for SPS operation**,
- Instrumentation: 2 K TTs – values shifted as screwed on He tank – to be installed in the liquid for 2<sup>nd</sup> prototype and series production, VLP PT – **had to be recalibrated before SPS operation**
- Some of TTs (HOMs) delaminated from measurement points – to be installed in pre-drilled hole for next prototype – **cannot be repaired for SPS operation**
- Static heat load measured at 18 W with screen slightly overcooled (between 50 – 70 K) – **OK for SPS operation**

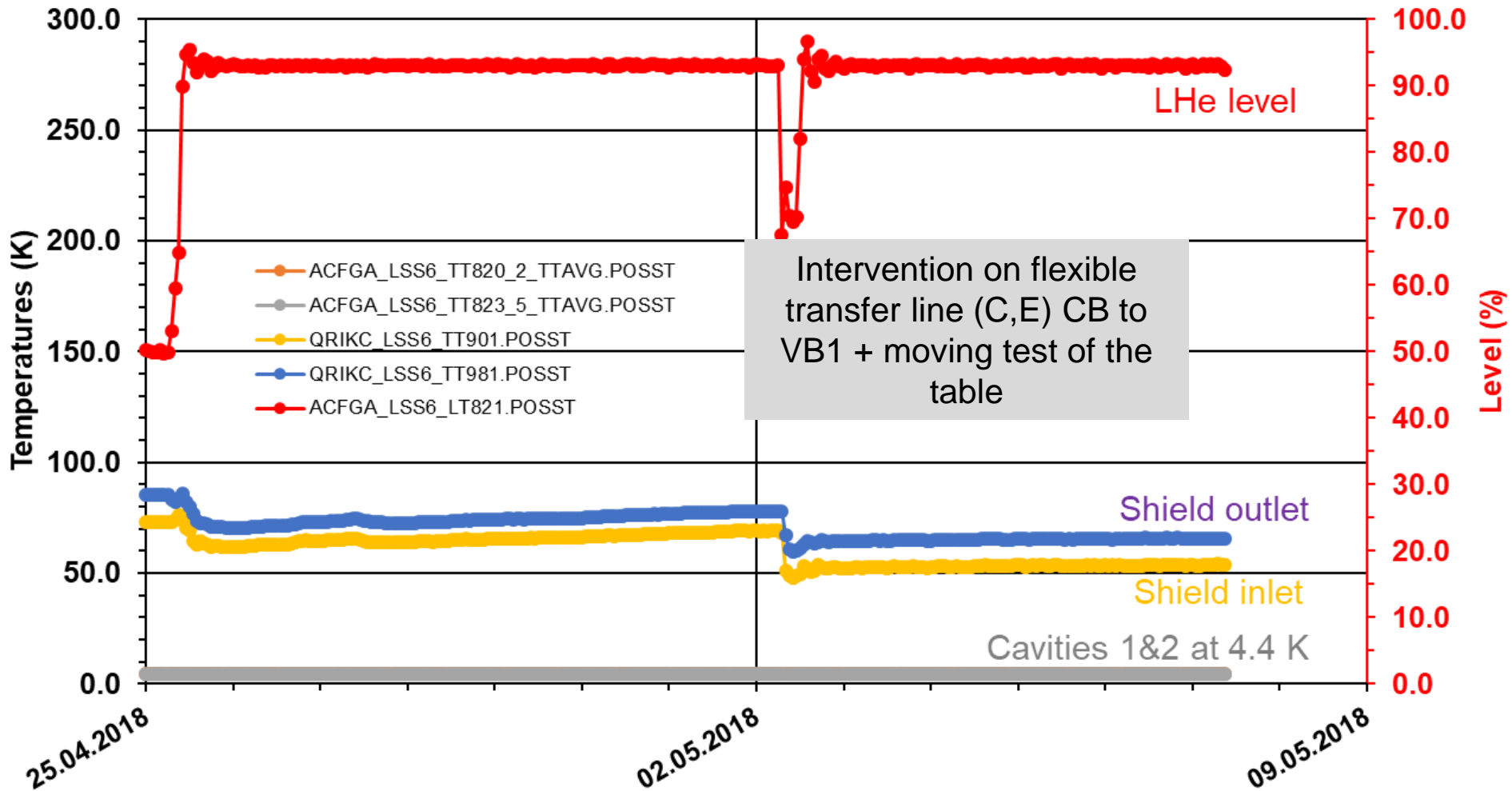
**Thanks to all participants of this first cold commissioning of the Crab module !**

# First cool down in SPS (4.5 K)



# SPS stable operation (4.5 K)

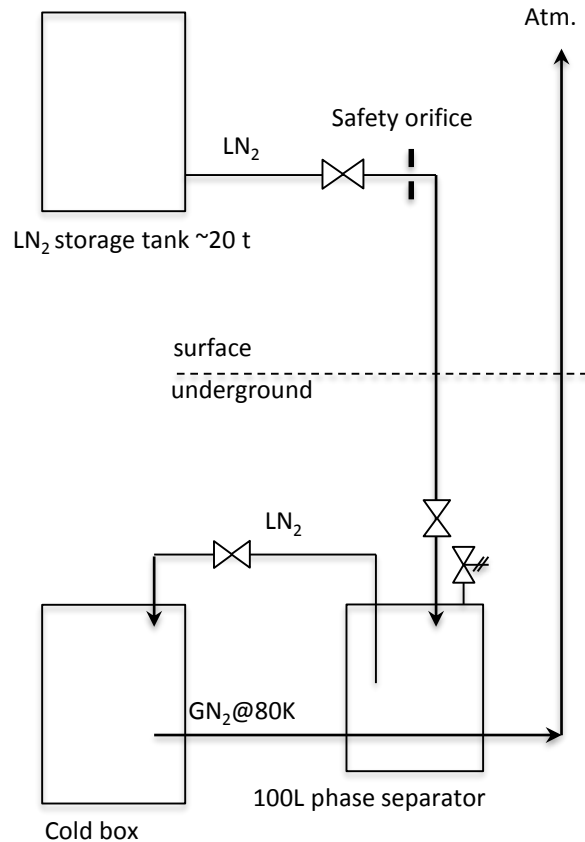
## SPS BA6\_Crab Cavities Cryomodule Operation Stability





# Perturbation with LN2

## Operational problem:



The SPS cryogenic cold box requires LN<sub>2</sub> installation for boost of capacity and cleaning of impurities in helium circuit with 80 K adsorber. The safety orifice installed on the outlet from the storage tank is regularly clogging with H<sub>2</sub>O impurities present in the storage tank, blocking circulation of the N<sub>2</sub> in the system.

The temporary solution for the orifice periodic cleaning (problem mitigation) has been put in place. Next cleaning with reduced cryo capacity foreseen during next week.

Necessary refrigeration capacity is foreseen to be delivered during whole MD program.

# Conclusions and perspectives

- Lesson learnt from SM18 gave/gives good outlook on SPS operation of the cryo-module,
- The module is operating stably at 4.5 K and is ready for any RF tests, tuning, conditioning or MD program,
- Flexibility of the cryogenic infrastructure for 0.5 m transversal displacement of the table was successfully tested (displacement with 4.5 K LHe),
- Cryogenic production plant is suffering from periodic LN2 system clogging – dedicated mitigation was put in place,
- **CRG confirms full readiness of the SPS cryogenic system for any MD program on the crab cavity module at 4.5 K,**
- First testing of 2 K helium pumps is foreseen in May/June 2018.

Thank you for your attention!