

PT status and planning

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Outline

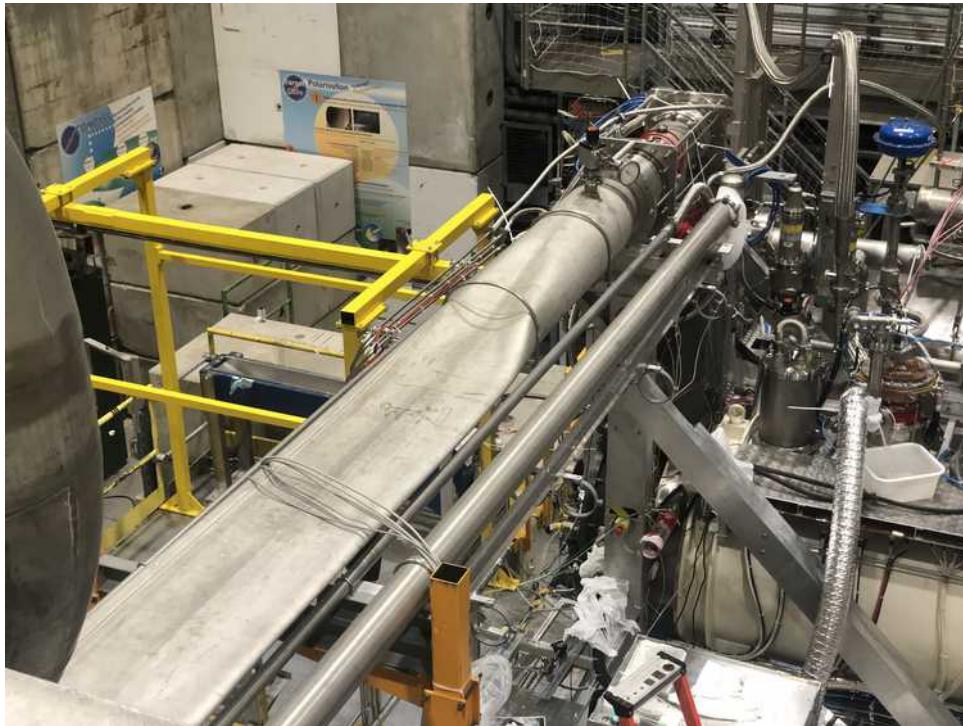
- Activities since last TB
- Current status
- Further polarisation tests and EoR planning
- Preparation for 2022

Activities since last TB

- ^3He pumping line repair
- 3rd material loading
- TE calibration
- Dipole problem
- First polarisation

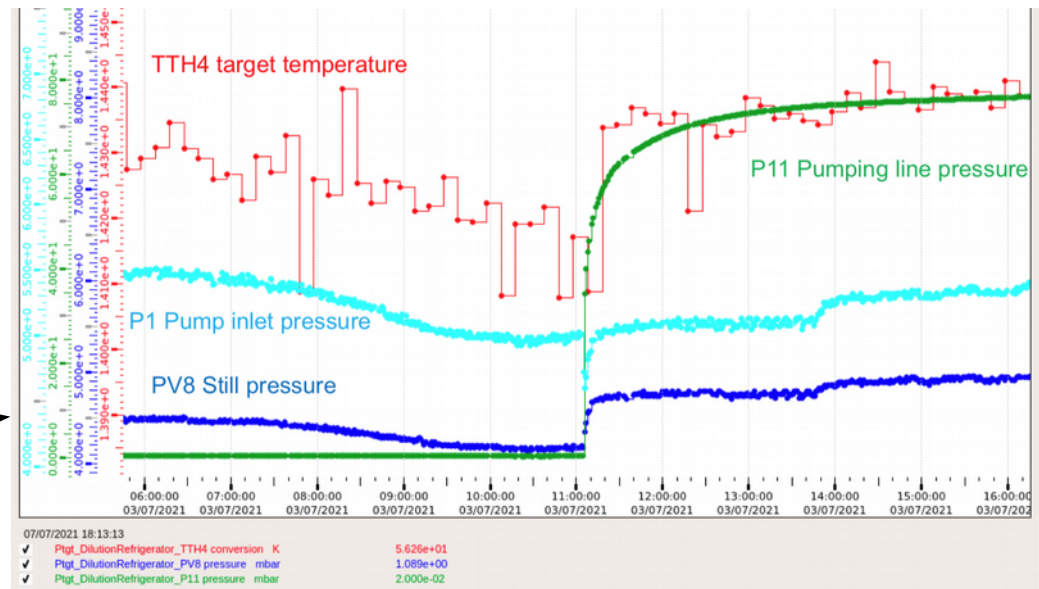
^3He pumping line

- ^3He pumping line found collapsed during routine check-up inside the area July 3



Caused by wrong mechanical design
Confirmed by calculations by BE dep.

Pressure change after the collapse
28/09/2021



^3He pumping line repair

- Target unloaded on July 5 at ~ 50 K
- ^4He pipes removed and scaffolding in place July 6
- ^3He pipe removed on July 7
- Welding of the pipe finished July 9
- In parallel – warming up the system to RT
- Pipe leak checked on July 14
- Unsuccessful installation attempt on July 15



^3He pumping line repair

- Pipe cut in two parts and fitted in position July 16
- Extra piece cut and welded, another dry installation
- Final welding, leak check and installation finished July 20

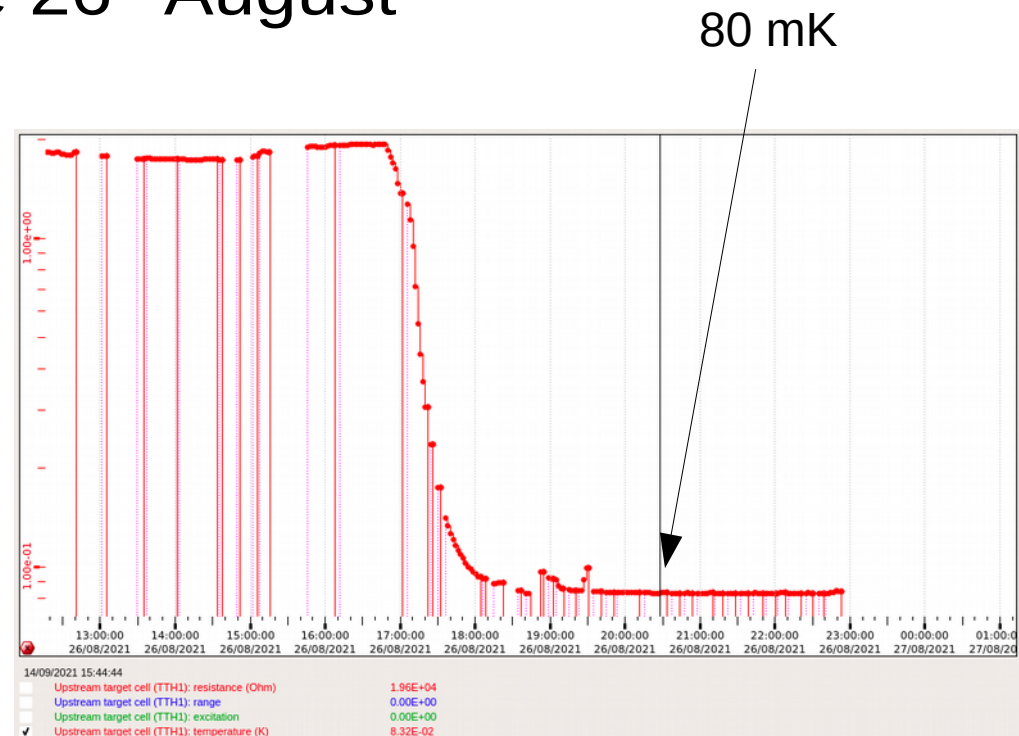
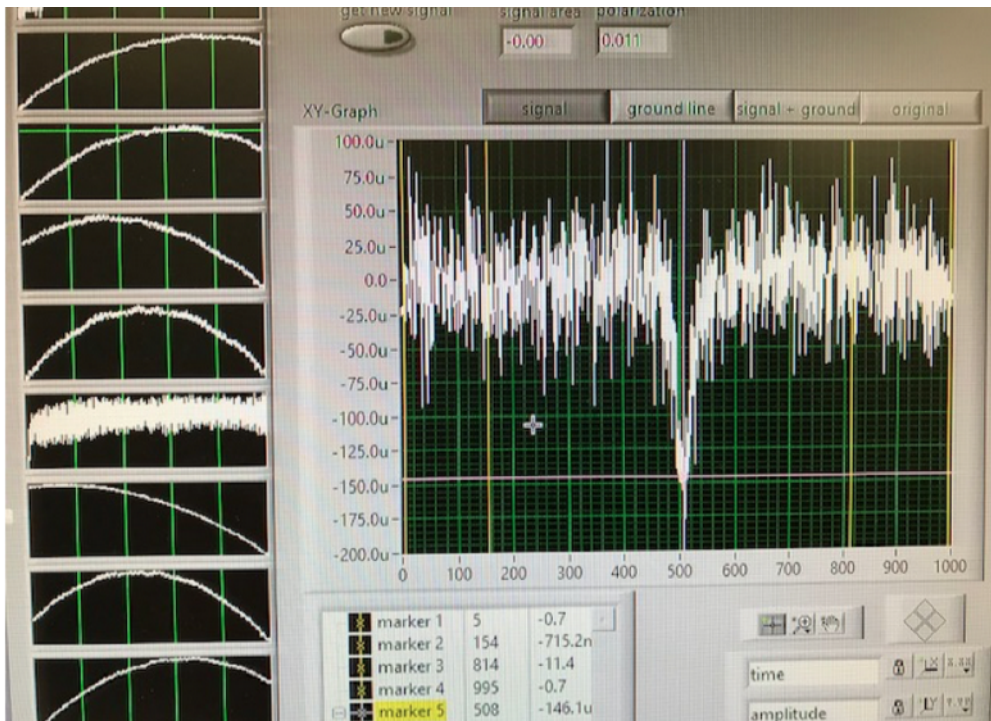


DR recovery

- Complete warm-up of the system by dry N₂ gas
- Multiple purging to remove possible humidity
- Leak check of ³He and ⁴He circuits
- Restart cooling 29th July
- Attempt to cool the magnet by cold He gas too slow
- Switch back to nitrogen cooling on 2nd August
- Material loading on 10th August
- Magnet at 4K on 18th August

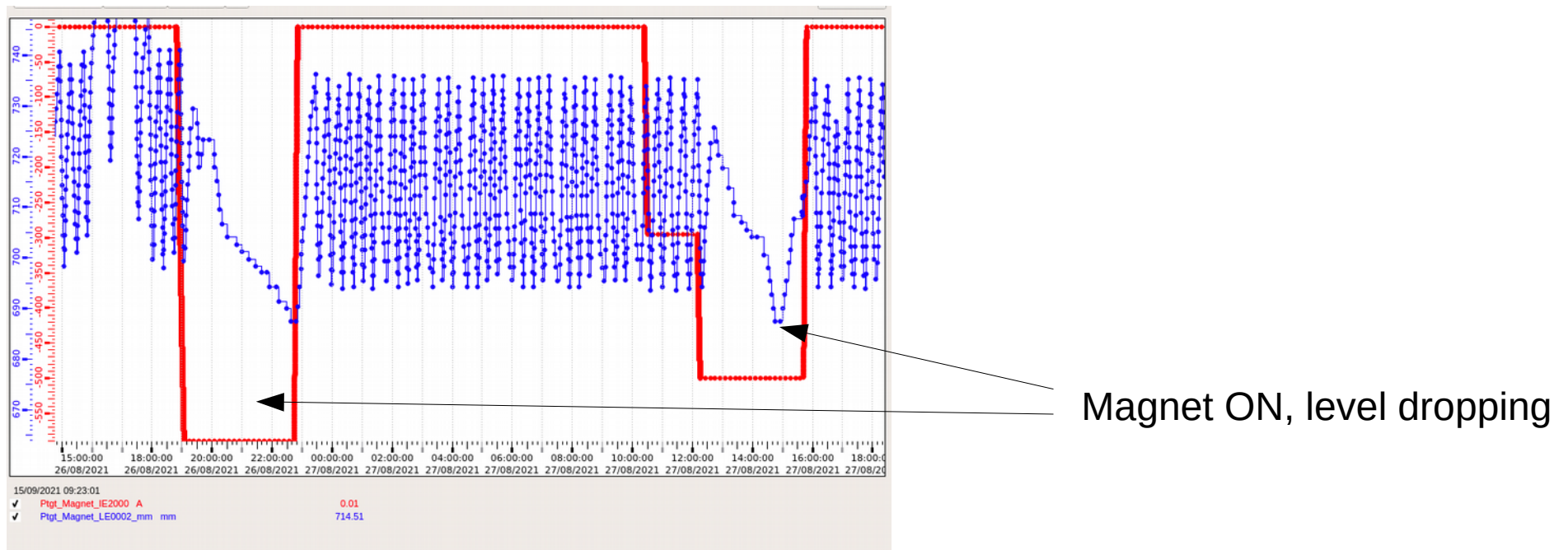
TE calibration & dilution mode

- TE calibration at 1.49 K 20th-23rd August
- Large noise on coils 1 & 6, but otherwise usable data
- Remove ⁴He from DR 23rd-25th August
- Condense ³He/⁴He mixture 26th August



Before polarisation

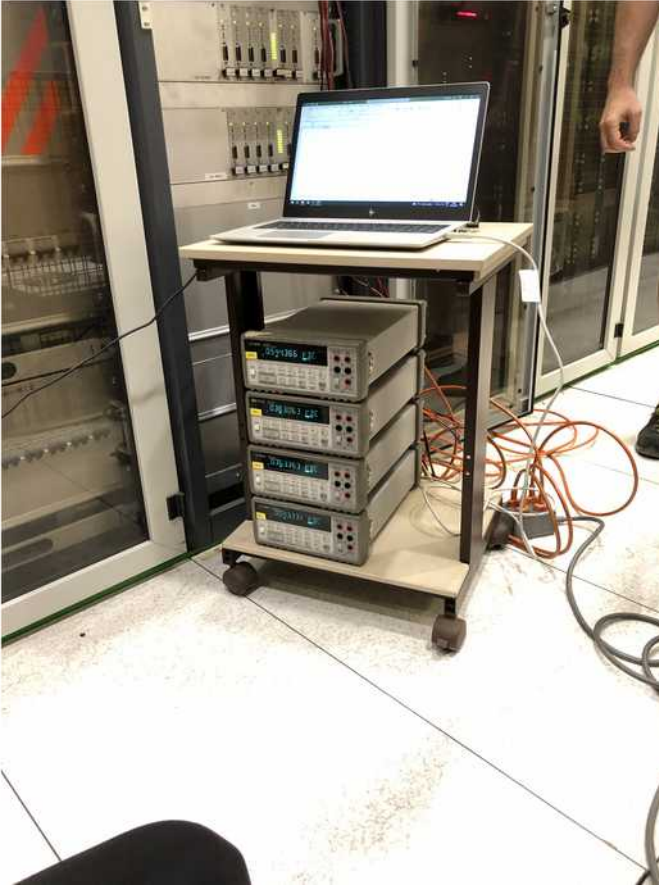
- Check dipole magnet direction → wrong, corrected by power converter people
- Stability test of dipole magnet → serious problem
- Unable to keep Lhe level in magnet when dipole on



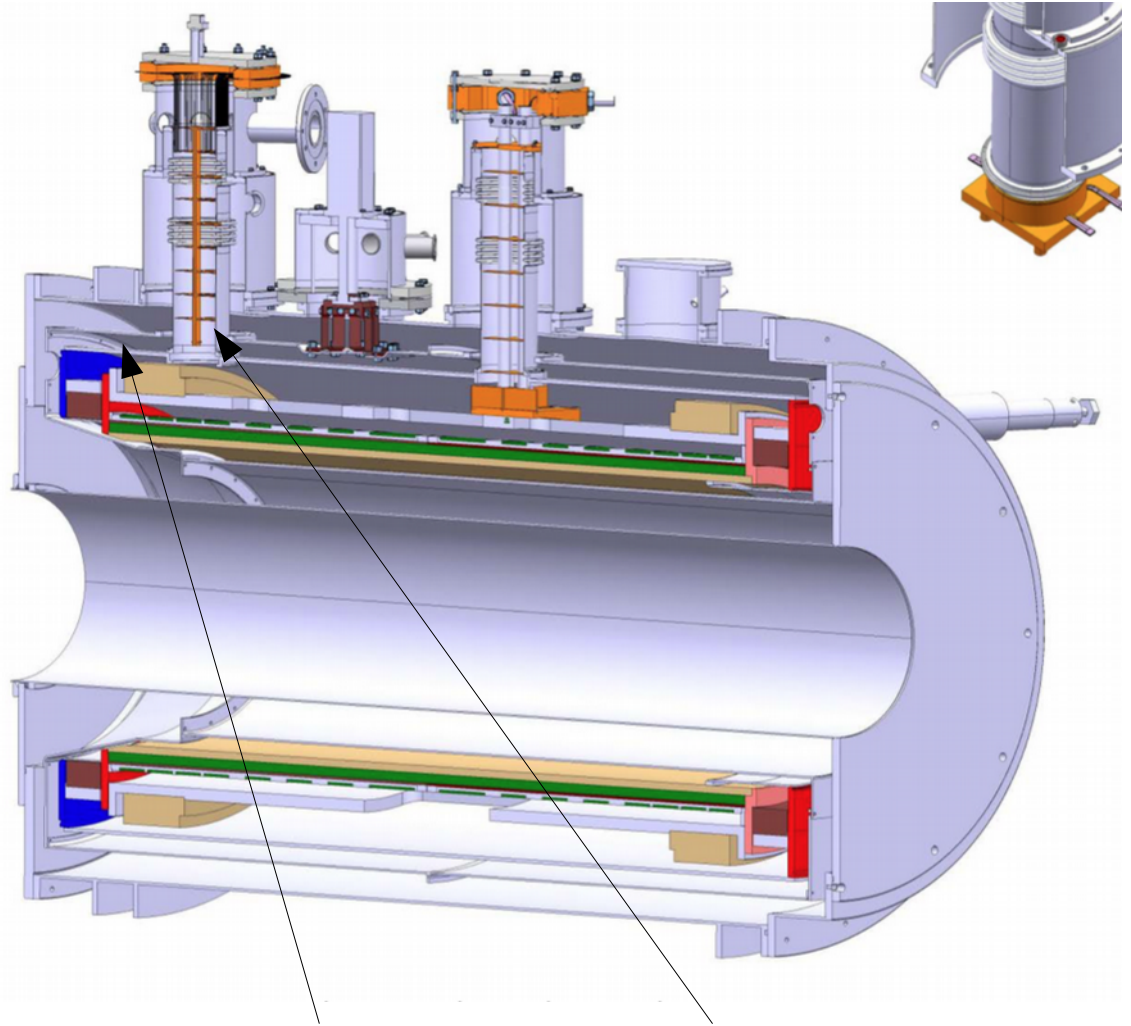
Dipole investigation

- Investigation with Alexey D and EP-DT August 30-31
- Measure voltage across coil during ramp and no-ramp
- No pathologies observed!
- Probable cause: too high temperature of magnet radiation shield
- Probable cause of that: corrosion of Cu/Al contact during 2019 cavity modification (long exposure to air)
- Solution: retune LHe flow and filling
- Strong recommendation: get a new transfer line for LHe
- Repair probably possible with magnet in place

Dipole investigation



Voltage measurement



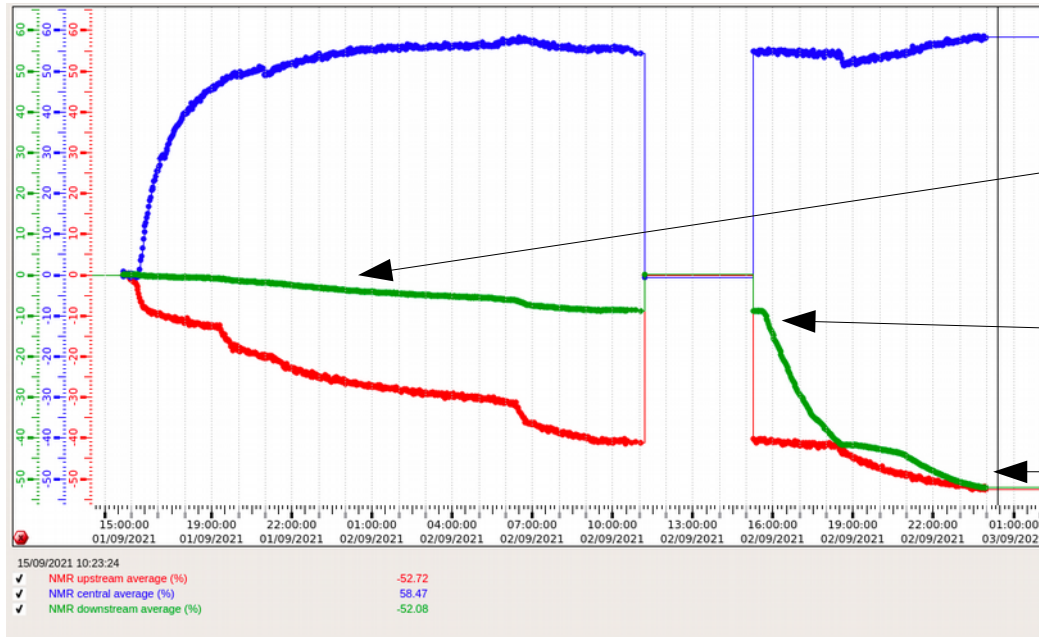
Thermal screen

Copper chimney

Polarisation buildup

- First polarisation build-up on 1st September (originally planned for end of May)
- Several problems encountered:
 - Mix up in TE calibration constants
 - Low power in downstream cell (splitting Up/down)
 - Bad magnetic field homogeneity
 - Unstable EIOs (frequency and power)
 - EIOs frequency range limited
 - First DNP in 6LiD after 15 years! →
after 15 years in storage → change of the material properties

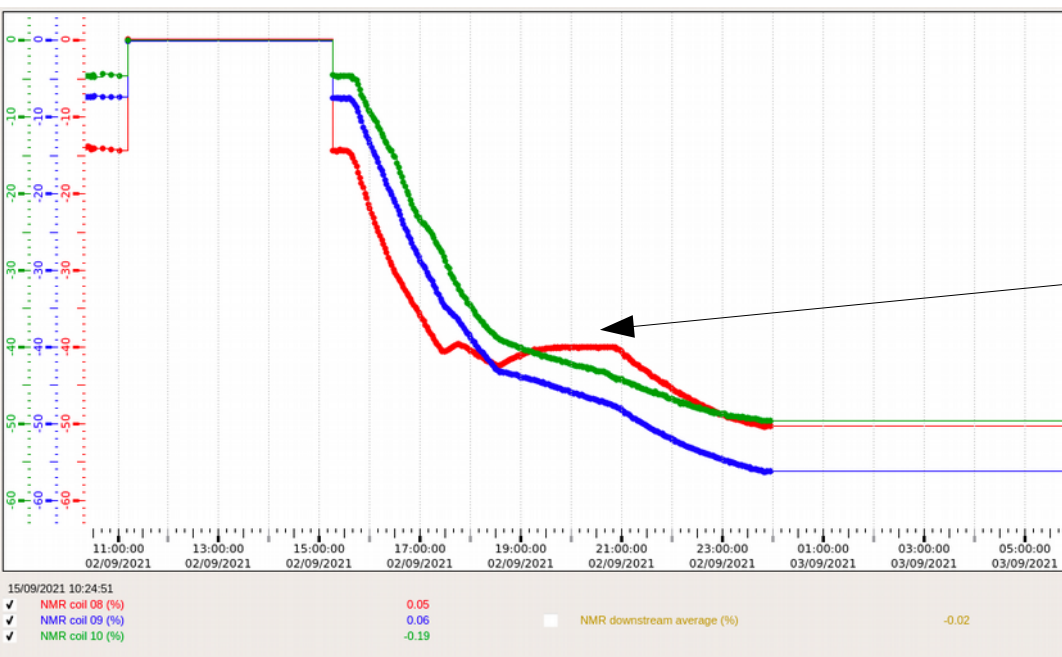
Polarisation buildup



Almost no build up in downstream (splitting of power up/down)

Gunn diode installation, Separate generator for downstream

~50 % polarisation in ~24 hours, Error in TE signals handling-> Reality about 1/2 of the value!!

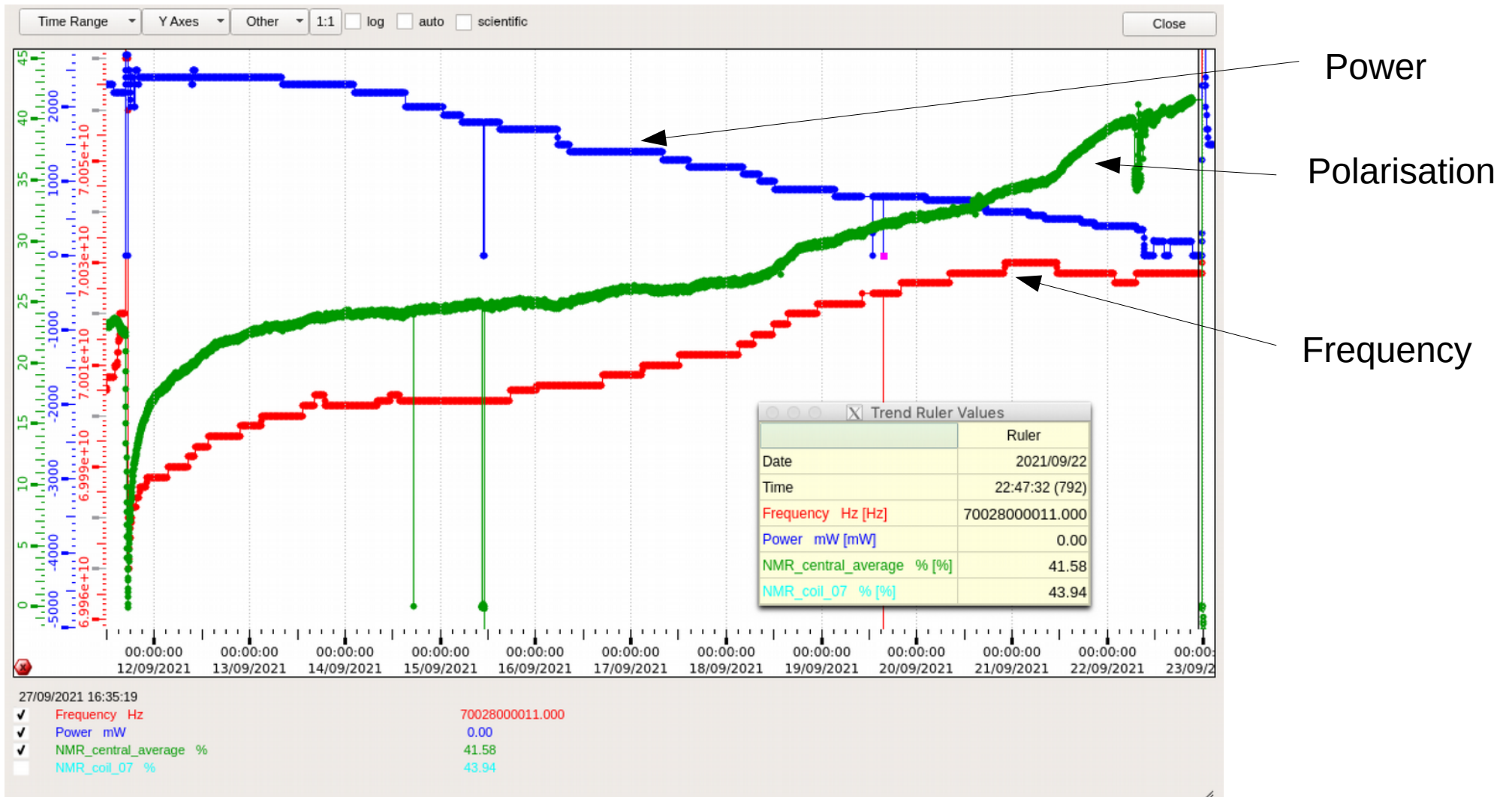


Very different behaviour among NMR coils
Variation in field → variation in optimal frequency

Polarisation buildup

- Mix up in TE calibration constants → understood and corrected (NMR amplifier)
 - Low power in downstream cell → solved by Gunn diode
 - Bad magnetic field homogeneity → improved, in progress
 - Unstable EIOs (frequency and power)
 - EIOs frequency range limited
- Two new Gunn diodes
Next year (Yamagata)
- Finally proper build-up study started September 11
 - Polarize only central cell with Gunn diode

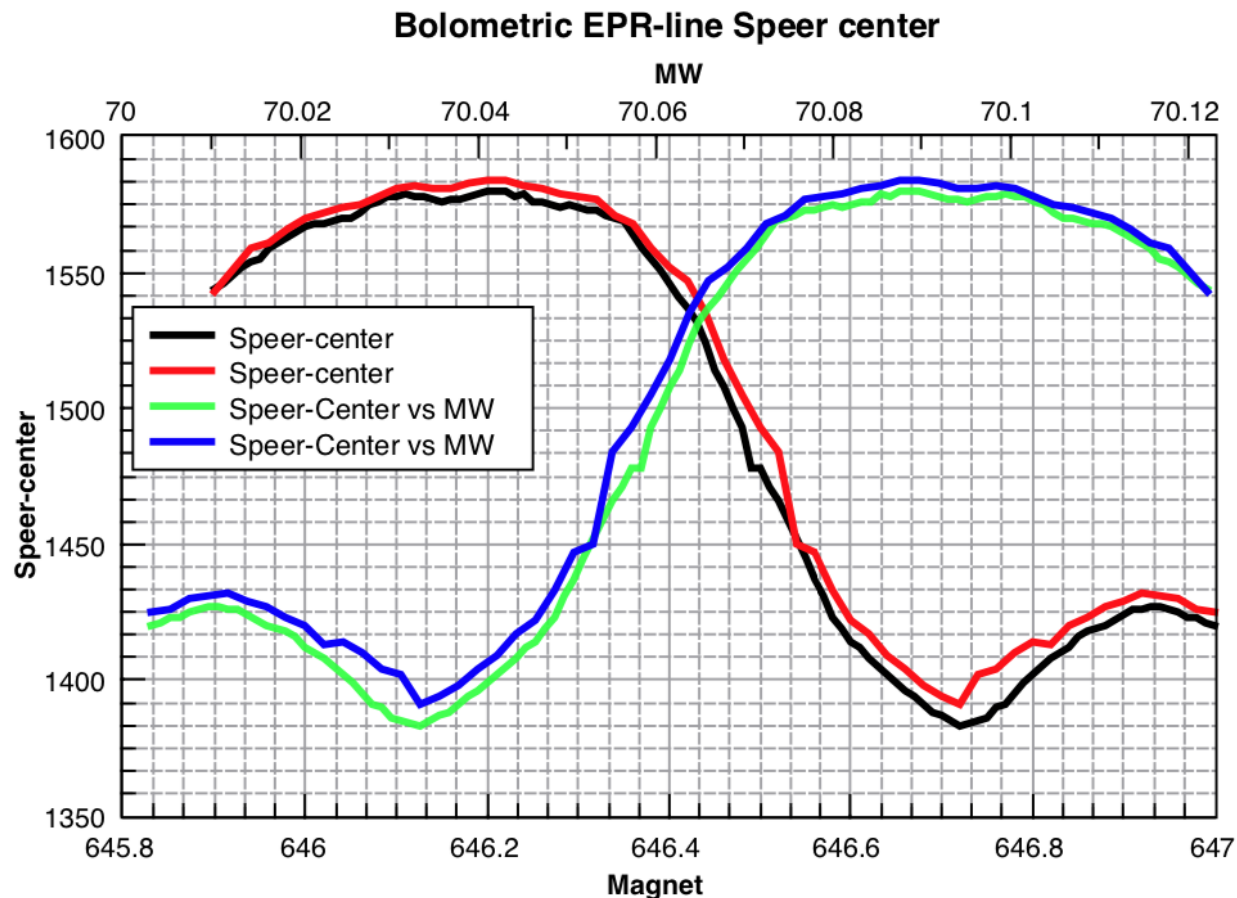
Polarisation continued



Reached average polarisation in central cell about +41%
Build-up time rather long → learning curve

Polarisation continued

- New MCS functionality: change current in steps of $\pm 10\text{mA}$
- We measured bolometric EPR spectrum



Polarisation continued



Power

Polarisation

Frequency

Reached average polarisation in central cell \sim -40%

Build-up time already faster

Gerhard and Genki operated the Gunn diode remotely (thanks!)

Additional issues

- Implemented 0.6 T option for solenoid (for alignment)
- Dipole cannot be operated (probably software issue)
- Raw water lost Sunday ~23:00 → cold-box stopped
→ recovered by TCR/first line ~00:30

Planning

- Magnet fix – dipole and homogeneity ~today/tomorrow
- Faster positive polarisation build-up, start ~tomorrow?
-use MW modulation from beginning
- EPR measurement with MW modulation?
- TE @1K 12th-16th October
- Relaxation measurement at 1K?
- Unloading 19th or 20th October

Preparation for 2022

- Non-exhaustive list:
 - magnet trim coils polarity
 - magnet transfer line (Tino Cryolab)
 - ^3He pumping line reinforcement
 - ^4He pump maintenance → ordered/paid (Yamagata)
 - leak detector maintenance
 - cryocooler maintenance
 - 2 new Gunn diodes installation
 - magnet screen repair? TBD!
- Man-power for 2022 under discussion

Thank you!

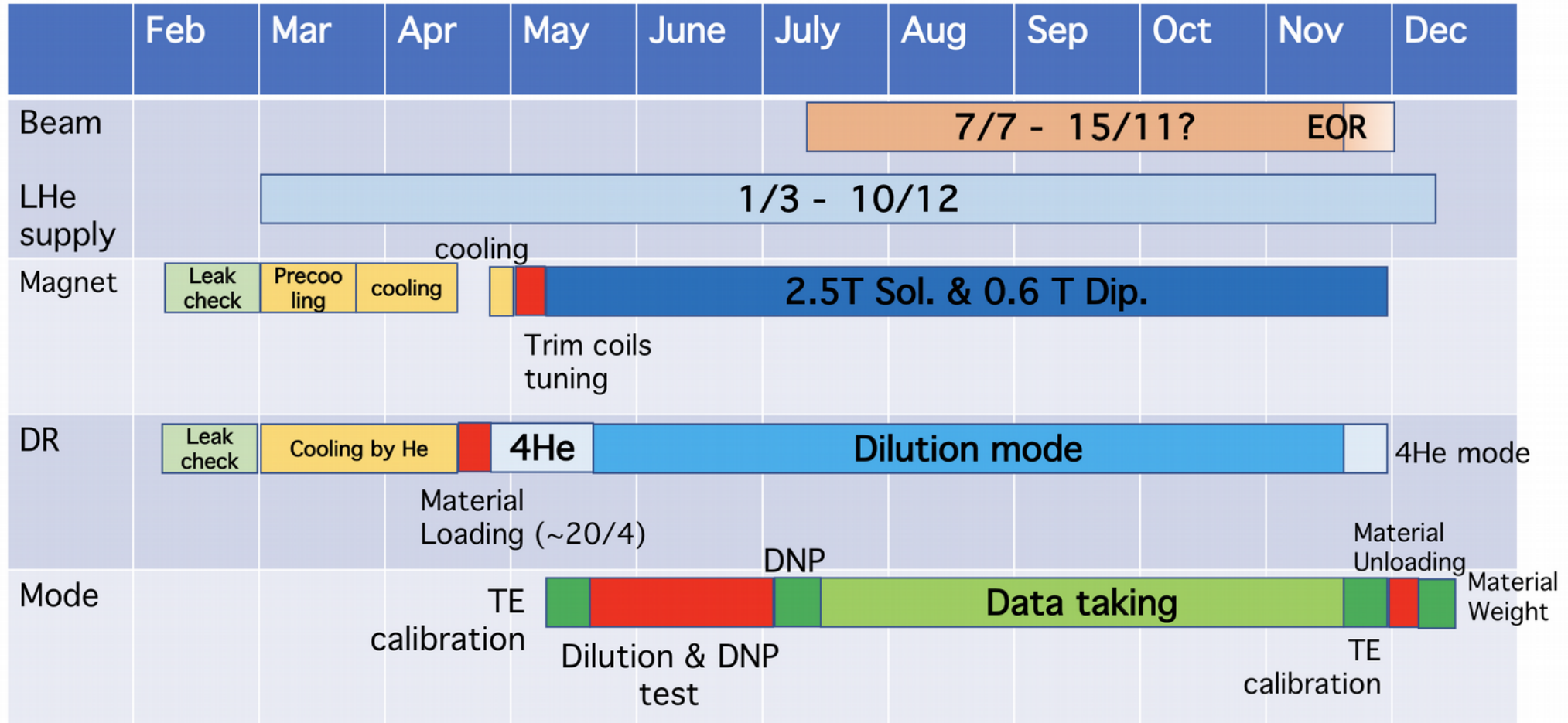
Spare

Acknowledgements

- Special thanks to:
- Christophe – part of PT team for quite some time already
- Stefano, Tino(Cryolab), Triloki, Livio, Alexey D., EP-DT team
great support from non PT people
- Gerhard R., Kaori, Stefan R.
great help on site and from remote
- Jaakko, Tapio, Werner
great remote help and discussions

- Sorry if I missed someone

Planning



EoR planning being discussed, will depend on the test beams