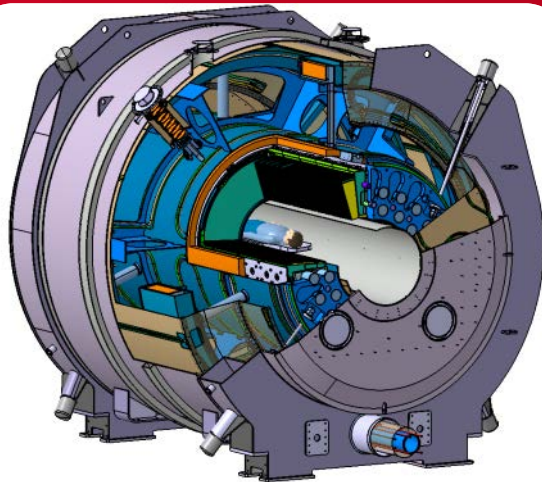


DE LA RECHERCHE À L'INDUSTRIE



Manufacturing completion of the Iseult/INUMAC Whole Body 11.7 T Magnet project

Lionel Quettier, CEA Saclay, Irfu



SIEMENS



bpi**france**

**French-German Initiative on Imaging of Neuro Disease Using
High Field Magnetic Resonance and Contrastophores**

THE ISEULT 11.7 T MRI PROJECT

- B0 / Aperture 11.75 T / 900 mm
- Field stability 0.05 ppm/h
- Homogeneity < 0.5 ppm on 22 cm DSV
- 170 wetted double pancakes for the main coil
- 2 shielding coils to reduce the fringe field
- NbTi conductor @ 1.8 K

Stored Energy	338 MJ
Inductance	308 H
Current	1483 A
Length	5.2 m
Diameter	5 m
Weight	132 t

Magnet parameters



Neurospin Center
CEA Saclay, France

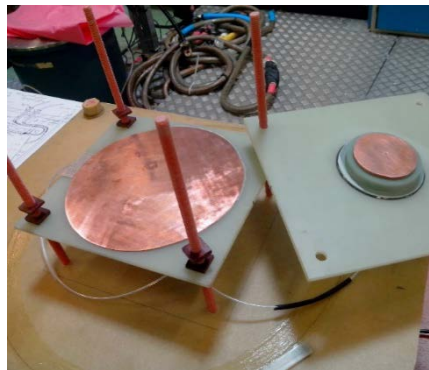
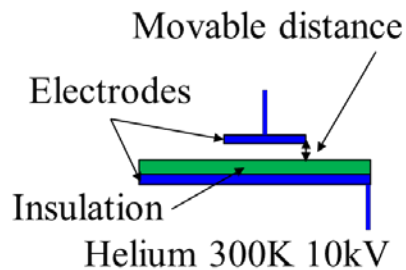
MAGNET ASSEMBLY STATUS IN SEPTEMBER 2016



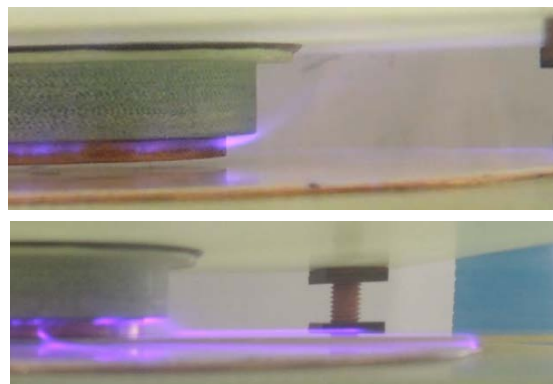
- Helium vessel closed, ready to be wrapped with MLI
- Final cold mass insulation test to perform
- Thermal shield ready to be integrated

INSULATION TEST (1/2)

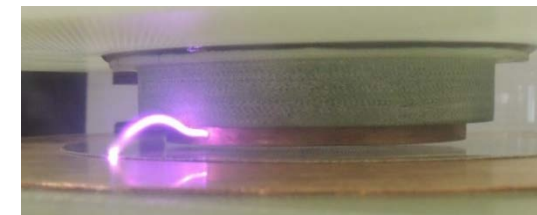
- Breakdown voltage of only 2 kV under helium measured against the 5.7 kV under atmospheric air specified at room temperature
- Activities undertaken to diagnose and to understand the failure



- Different discharge types:



Corona effect:
light along insulation, light in gas



Arcs: higher
luminosity, light lines

Partial discharges:
no light, some noise

- Studies shown the breakdown was due to surface discharges and not to a corona discharge or a “real breakdown”
- Breakdown located in one of the two shielding coils
- Nature of the breakdown indicated that the 2kV insulation would be actually sufficient to withstand the conditions generated during a rapid de-energization of the magnet and that the room temperature helium test of 5.7 kV is significantly pessimistic.
- However, modification of the dump resistor:
 - A 18.9 Ω resistance will be added in parallel with the initial one of 2.7 Ω
 - That leads to a maximum voltage of +/-1.75 kV, while the hot spot temperature is still only 173 K.

THERMAL SHIELD ASSEMBLY (1/2)

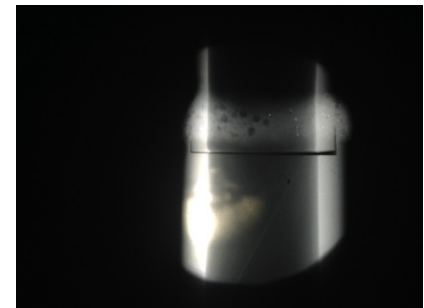


MLI installed around the cold mass



Thermal shield integration

Thermal shocks followed X-ray / US controls of all the aluminum welds



THERMAL SHIELD ASSEMBLY (2/2)



MLI wrapped around the thermal shield

VACUUM VESSEL ASSEMBLY (1/2)



Vacuum vessel integration



Loading of the
suspension rods



Vacuum vessel closure

VACUUM VESSEL ASSEMBLY (2/2)



- Pumping
- Final leak tests of internal cryogenic circuits with the cryostat under vacuum ($<10^{-10}$ mbar.l/s)

SHIPPING PREPARATION



Shipping frame



Iseult leaving the
manufacturing area



Loading on the
truck



Packing



Departure from
the factory

2 WEEKS OF TRANSPORT FROM BELFORT TO SACLAY



INSERTION INTO THE ARCH



PREPARATION OF NEUROSPIN SITE

- Current leads, electrical, vacuum and cryogenic ancillary equipment delivered and commissioned



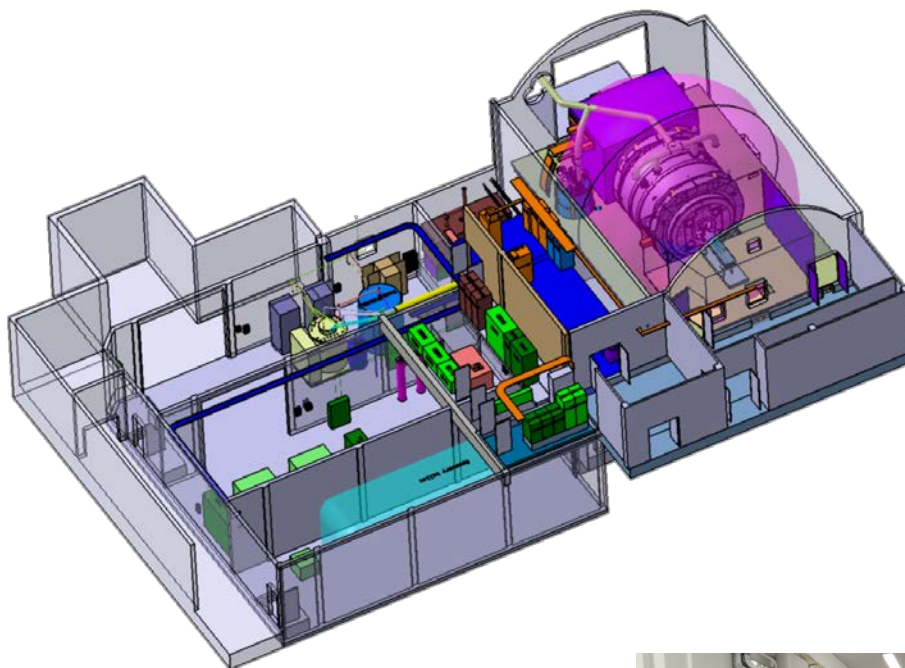
Power supplies



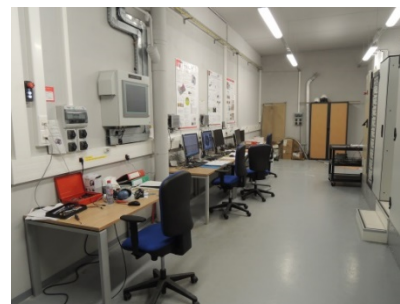
Cryo-lines



48 V Batteries



Current leads



Control room



Vacuum circuit



MCS/MSS/DAQ

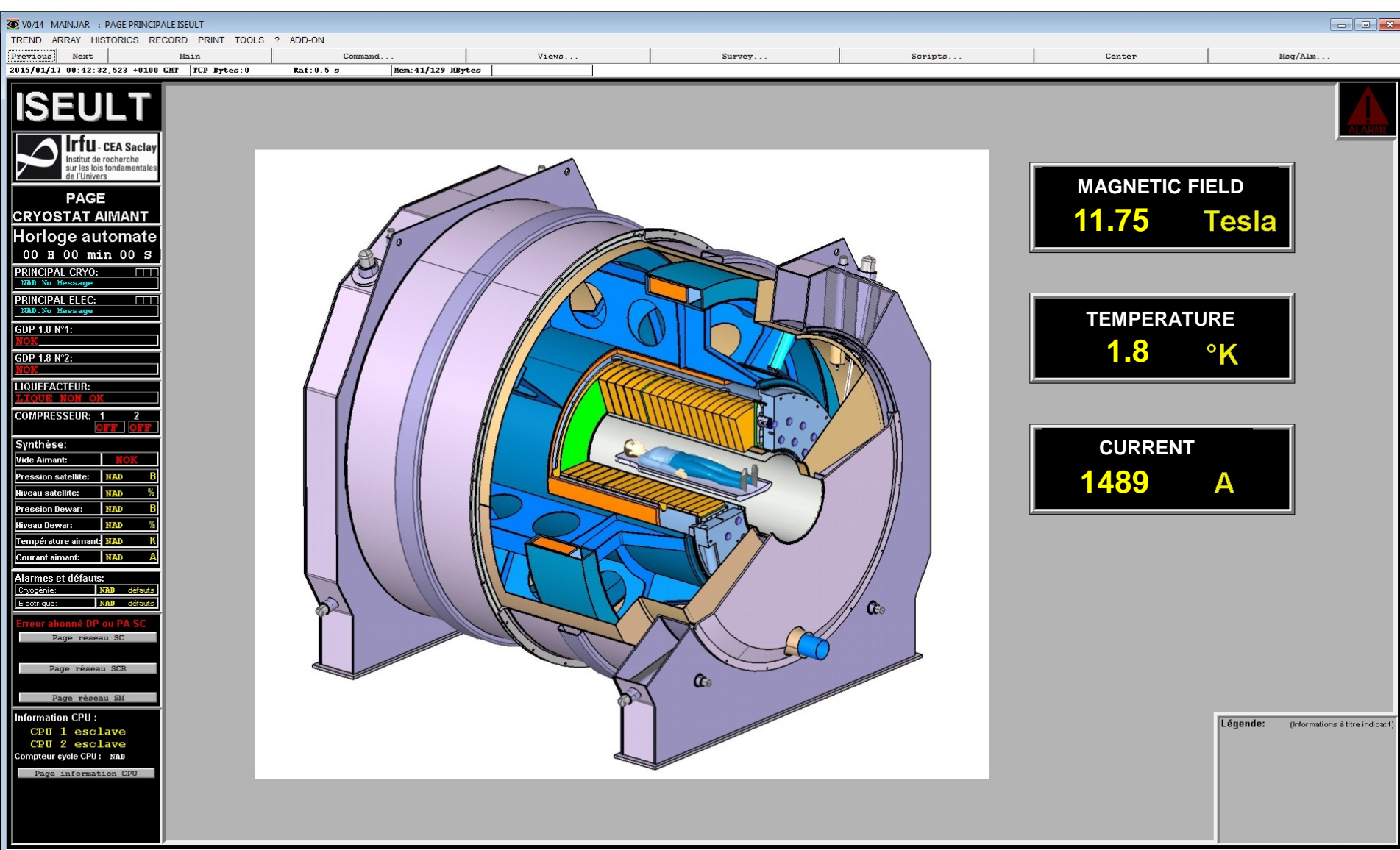


Dump resistor

NEXT COMMISSIONING STEPS

- Connection of the magnet with the ancillaries (cryogenic, powers supplies, MCS/MSS/DAQ)
- Insulation tests, vacuum tests and magnetic measurements at room temperature
- Cooldown of the magnet (6 weeks), with regular checks of the field map
- Tests at low current of the MSS/MCS
- Ramp-up the field to 3T
- Magnetic measurements and shimming with passive iron shims
- Ramp-up to 7T and magnetic field homogeneity verification
- Ramp-up to 11,75T and final shimming (active shimming)

IN 2018, WE SHOULD SEE





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Warm thanks to all the people from CEA, GE Power and Siemens involved in the design and the manufacturing of this unique magnet and to French Agency Bpi France for its financial support.

***And join us, positions are opened at CEA !
(please contact me at the end of session)***