Synchrotron SOLEIL superconducting RF status

SOLEIL cryomodule status

Cryogenic plant

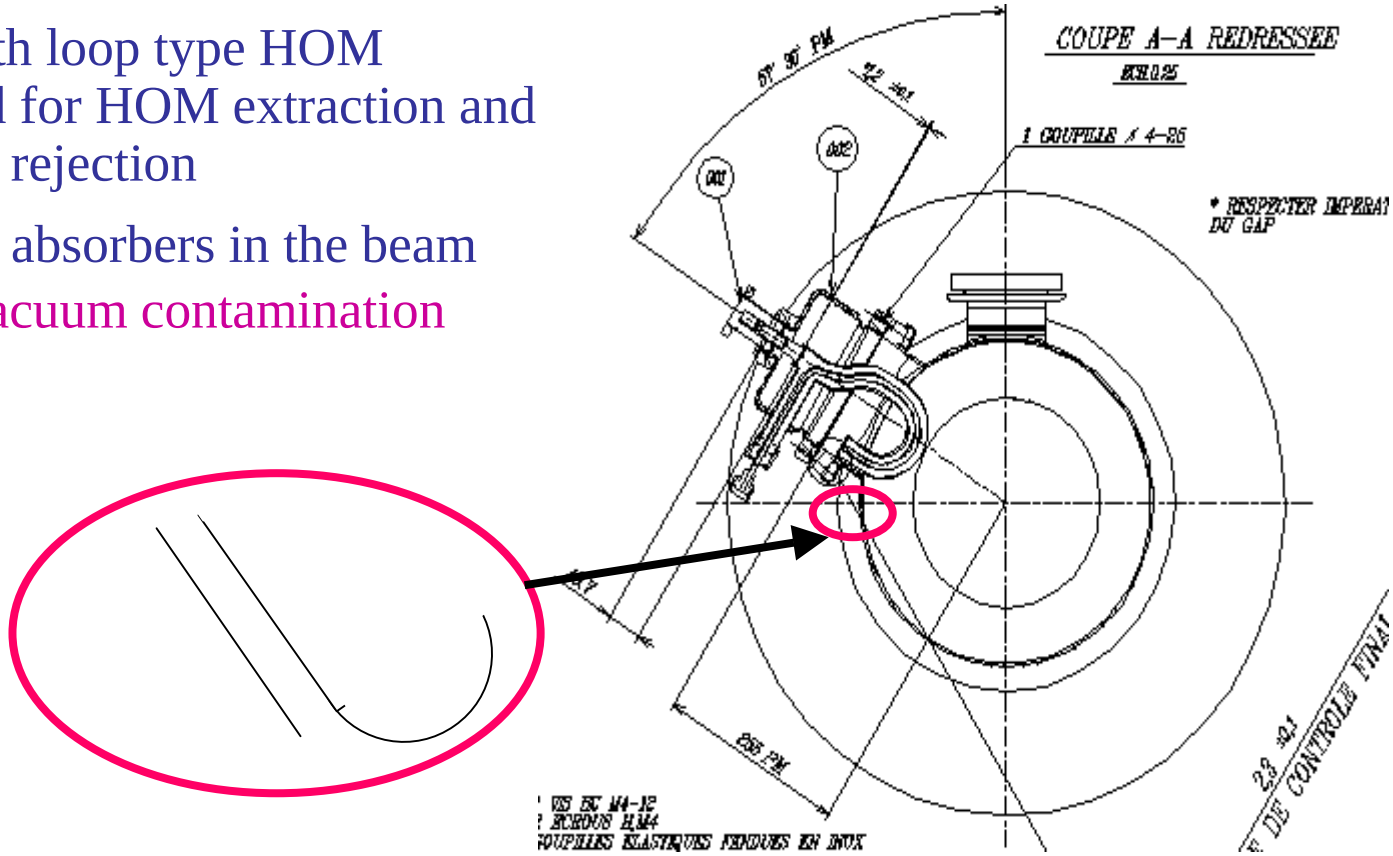
Design :

600 kW total power transferred to the beam (4 cavities)

Cell interconnecting tube diameter (400 mm) increased compared to Cu cavities ⇒ propagation of the HOM modes, HOM power extracted

HOM damping with loop type HOM couplers optimized for HOM extraction and fundamental mode rejection

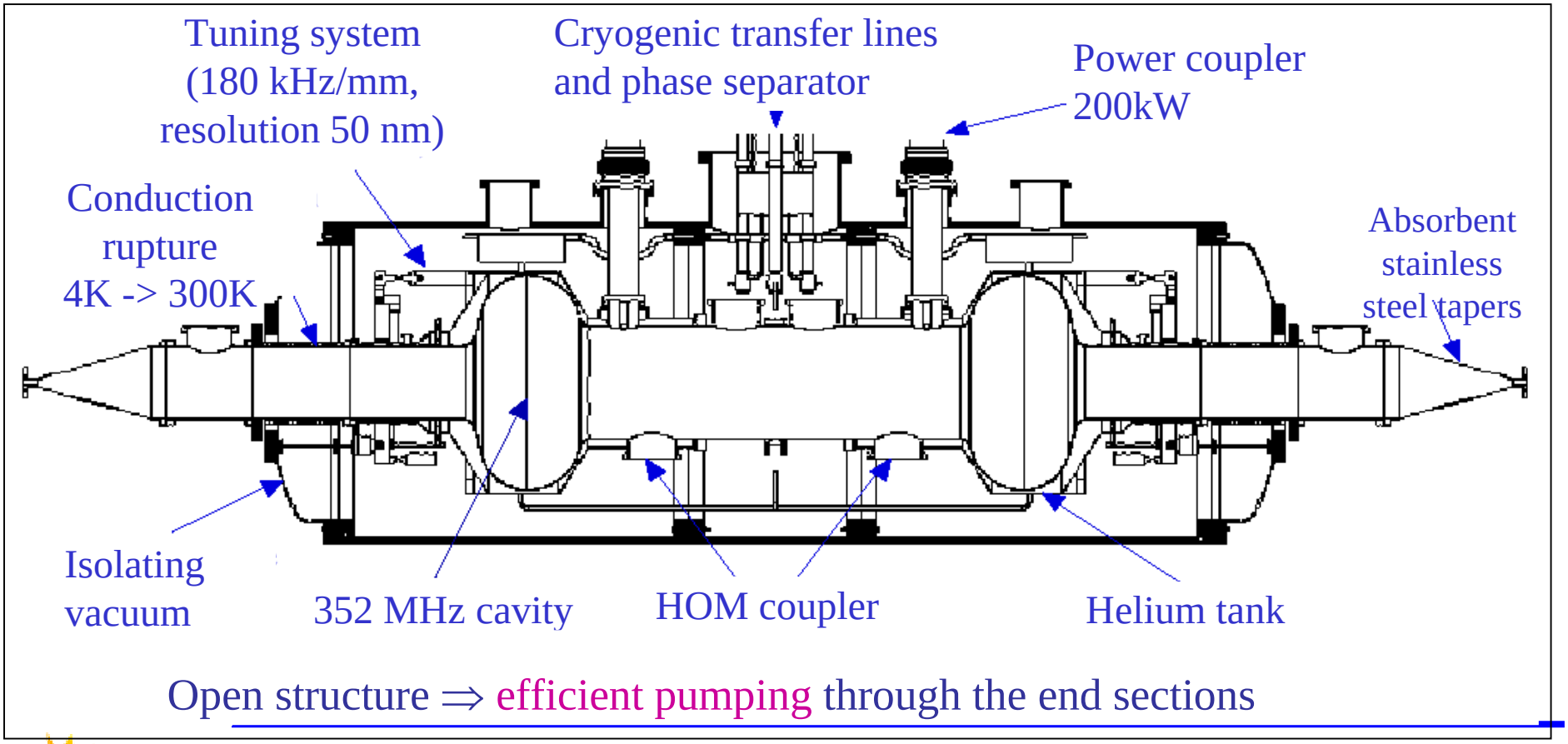
No need for ferrite absorbers in the beam tube ⇒ possible vacuum contamination avoided



Design cont'd :

For HOM frequency higher than the cutoff frequency of D 400 mm tube damping in Glidcop tapers

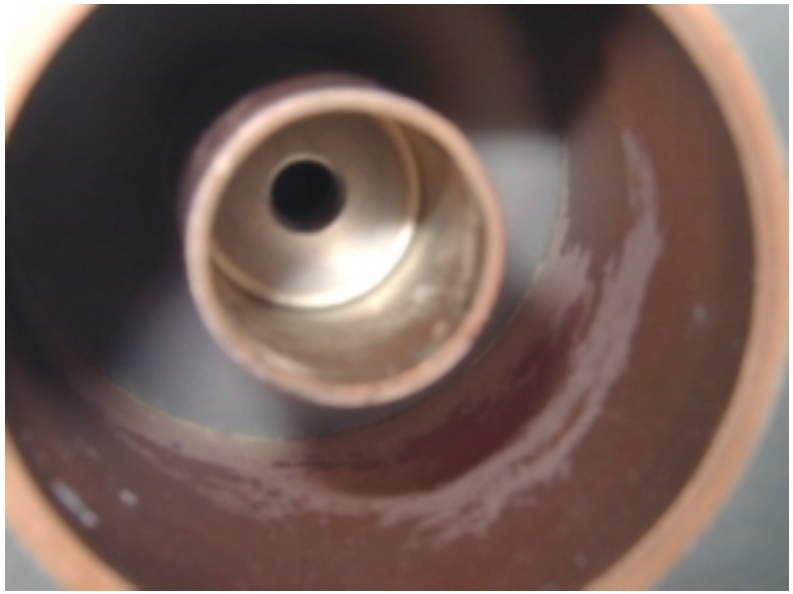
First application of CERN technology of Nb plated Cu to a cavity with high beam loading



Open structure ⇒ efficient pumping through the end sections

4 K results at ESRF

- Passive operation with a 200 mA beam : No HOM driven instability ⇒ HOM power effectively absorbed in the dampers
- RF voltage conditioning :
  - 5 MV achieved with short RF pulses
  - 4 MV achieved in CW, with some problems :
    - high fundamental power coupling probably due to dipolar HOM couplers close to accelerating cells and notch filters not correctly tuned on fundamental frequency
    - overheating and some quench-like events with pressure bursts in LHe circuit, HOM couplers not sufficiently cooled by LHe



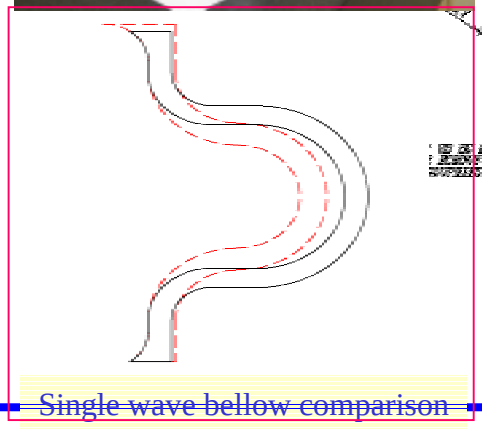
4 K results at ESRF cont'd

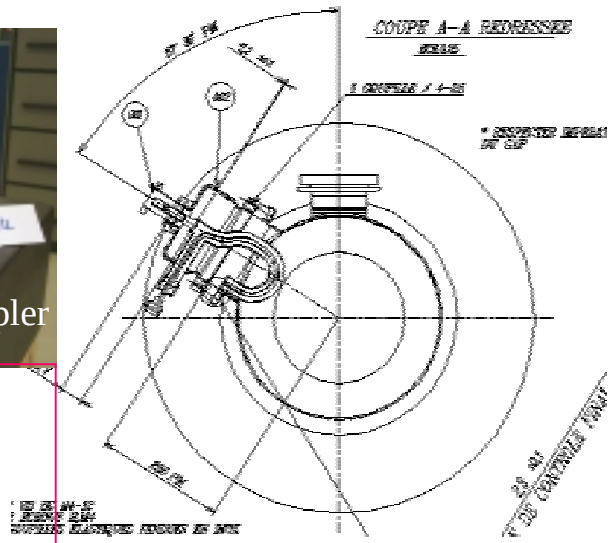
- Cryogenic losses 140/117 W (total/static) / the calculated losses : 100/40W
- At high gradient, some multipacting observed in the main RF couplers, eventually leading to some vacuum trips
- Acceleration of 150 mA of beam and 30 hours lifetime with 3 MV from SC SOLEIL cavity and 360 kW of beam power achieved
- Successful run test at 170 mA => 380 kW beam power : no thermal run-away, stable behavior, no beam loss
- **300 K results :** SC cavity transparent to the beam

Cryomodule refurbishment

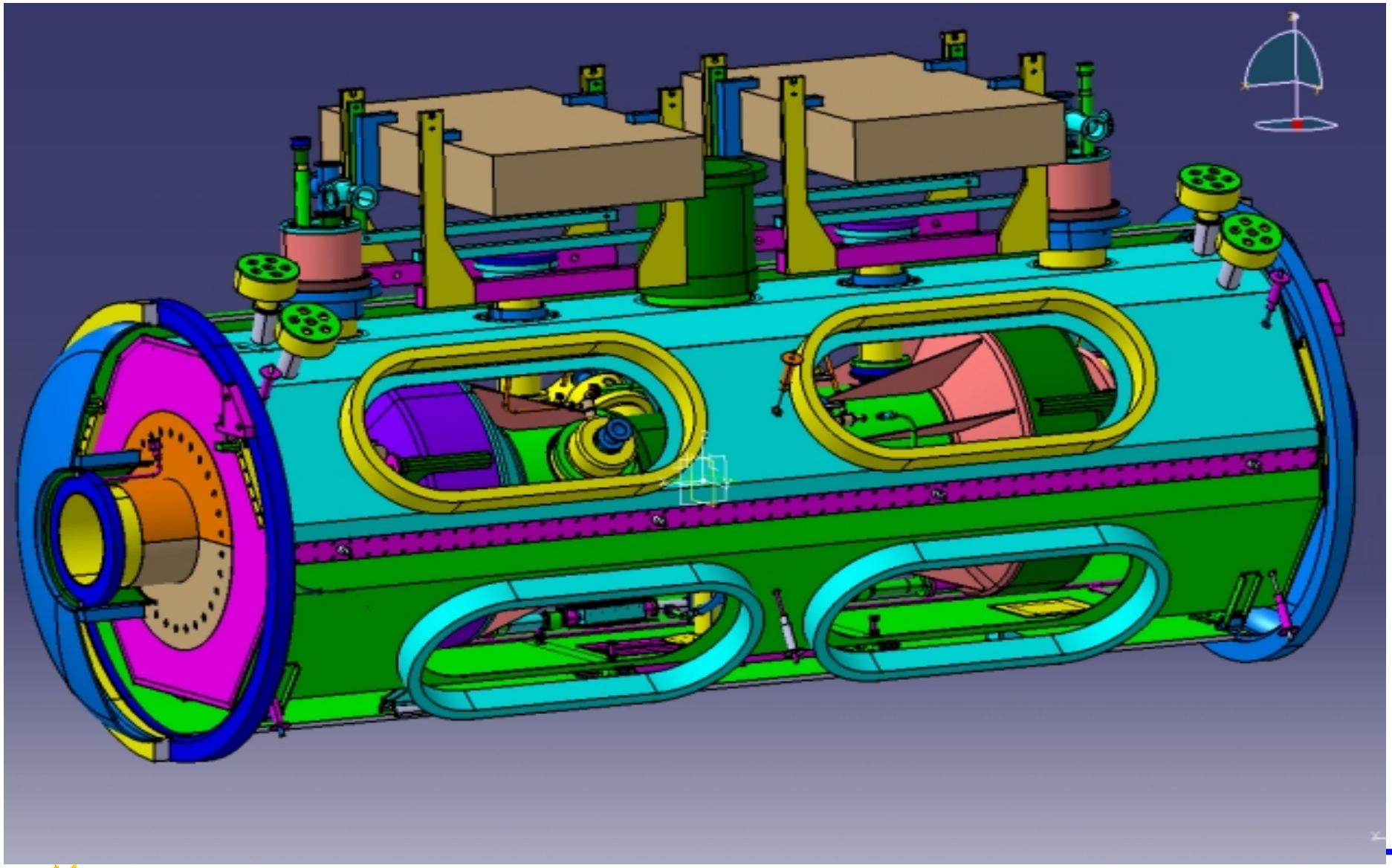
- Reduce static losses : add a copper shield cooled by liquid N_2 and thermal straps anchored on cold shield to draw heat from HOM couplers, tuning system, coaxial lines, etc...
- Improve the dipole HOM couplers tuning of notch filter : single wave bellow for better fundamental mode rejection and machining
- Improve HOM coupler cooling : by feeding LHe from bottom of the cryomodule and thermal straps
- HFSS calculation for the need of 4 HOM couplers : no need


Dipolar HOM coupler


Single wave bellow comparison



Refurbishment cont'd



Refurbishment cont'd

- Replace instrumentation : radiation-proof cables and sensors with a wider temperature range to follow up cool-downs
- Modify LHe circuitry to accommodate N_2 screen and HOM LHe feeding
- Mechanical studies of the cryomodule finished
- SOLEIL beam specs revised (500mA, 2,75GeV, 1150keV radiation losses) and installation of the 2nd cryomodule $\Rightarrow$ only 3 MV/cryomodule
  Lengthen main coupler antenna to increase coupling :
  - $Q_{ext} : 2.10^5 \rightarrow 1.10^5$ *(for better matching)*
  - Calculation : 10 mm
  - Measurements : 9.8 mm

Milestones

- Modifications planned partly at CEA, partly at CERN (clean room and power test-stand)
- Collaboration agreement SOLEIL - CEA, SOLEIL – CERN should be signed within the next weeks
- Time schedule:
  - July 2003 : Cryomodule moved from ESRF to CERN
  - December 2003 : Disassembly of Cryomodule at CERN
  - Other steps : Rinsing and vertical RF test of the cavities
  - April 2004 : Delivery of the two first HOM couplers
  - November – December 2004 : Power and cryogenic tests at CERN
  - Beginning 2005: Start commissioning of the cryomodule on SOLEIL ring

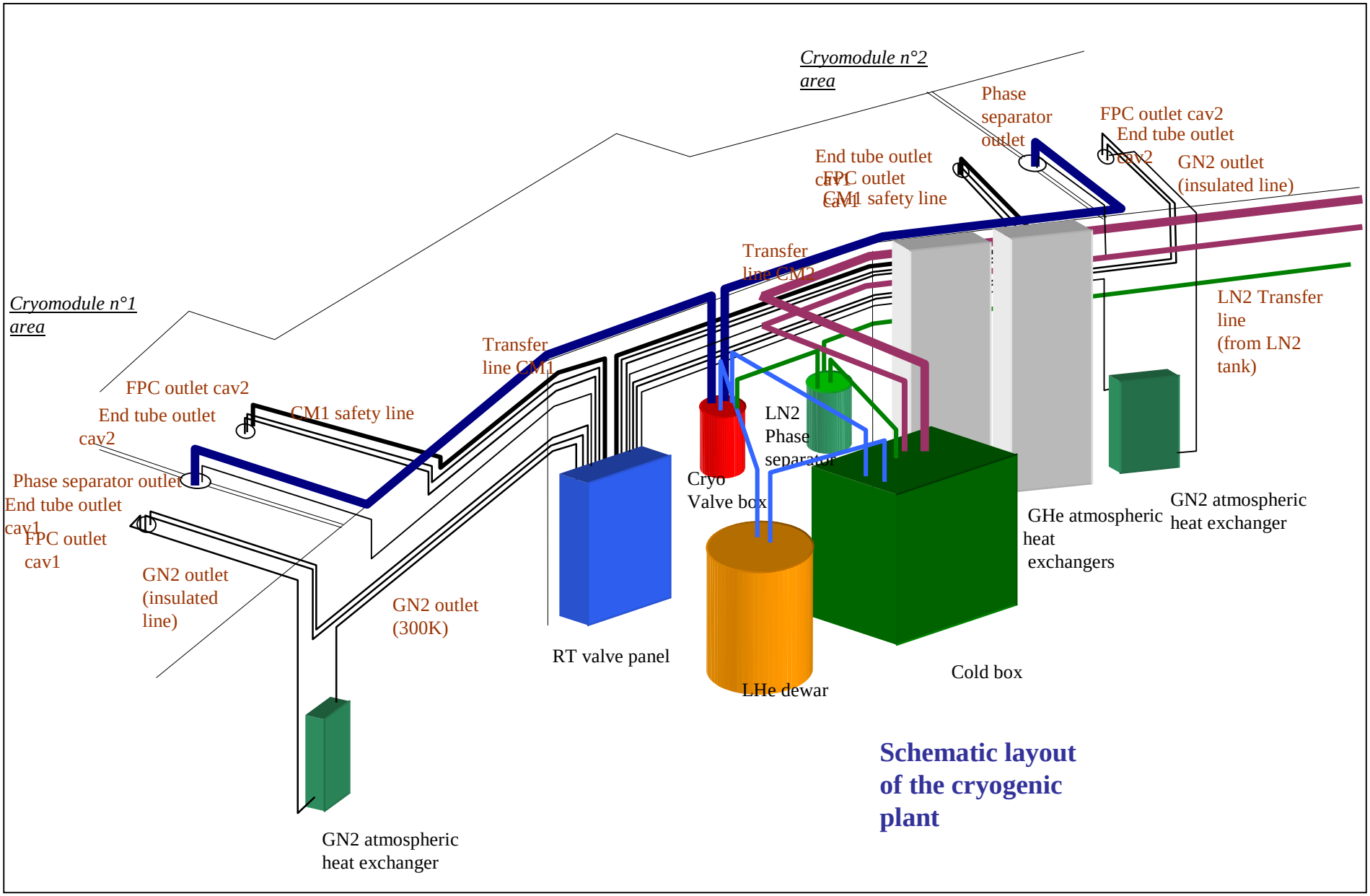
Milestones

- Cryogenic source : call for tender will be issued in October 2003, commissioning with cryomodule beginning 2005

- Fabrication of a 2nd Module based on improved specs including modifications listed above

  o Early 2004: Placing orders

  o Year 2006: Installation on SOLEIL in order to reach full performance



Schematic layout of the cryogenic plant