# Responses to the recommendations of the first ESAC dipole review

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CERN

**Draft Fri 23/03**

# Questions asked to the reviewers

1. Is the magnet design globally credible?
2. Is the conductor design valid, what could be the open issues?
3. What risks are seen in the assembly process?
4. Are there unaddressed issues in the fabrication process?
5. Is the quench protection for the dipole sufficient?
6. Is the dipole sufficiently protected from the insert in case of quench or failure?
7. Is the schedule credible?

# Is the magnet design globally credible?

- *A comprehensive review and analysis of the past experiences, (i.e. LBNL HD2 and re-assemblies).*
  - Treated in the talk by Paolo Ferracin

- *Experimental plans to address all possible issues (such as stress and strain concentrations) found in this analysis by making mechanical models, winding tests and practice coils.*
  - Treated in the talk by Françoise Rondeaux
    - Tests in progress or in preparation: conductor expansion, 10-stack modulus and thermal contraction, layer-jump winding tests, Cu coil

- *The complete 3D analysis of the proposed design (in progress at the time of this review) shall be finalized as soon as possible, because many important choices are based on it (axial prestress, mechanical coupling between double pancakes and with mechanical structure, effect of winding tension, layout of the external shell); in the stress analysis of the coils we recommend checking also von Mises stresses.*
  - 3D model studies were made (Attilio Milanese): see talk by Paolo Ferracin

# Is the magnet design globally credible?

- *A thorough analysis that takes into account all deviations from ideal geometry and imperfection of various systems, to check how much the design is sensitive to tolerance, discrepancies and defects.*
  - The bladder and key system is imposing stress not strain and hence it is less tolerance dependent.
  - Following tolerance analysis the dimensioning inside the coil pack was modified: e.g. double pancake length, insulation layers between pancakes, 'virtual' lateral and axial spacers (see CATIA pictures)

- *A study of the thermo-mechanical stresses during cooldown and quench.*
  - Comment: Was not done for any of the $Nb_3Sn$ magnets built up to now !
  - For the coo-ldown case a thermal model was made with as result a 4 day coo-ldown scenario for low $\Delta T$ (see next slide). The resulting mechanical stress model is pending.
  - The quench stress can is still to be modeled (resource limited)

# Cool-down study

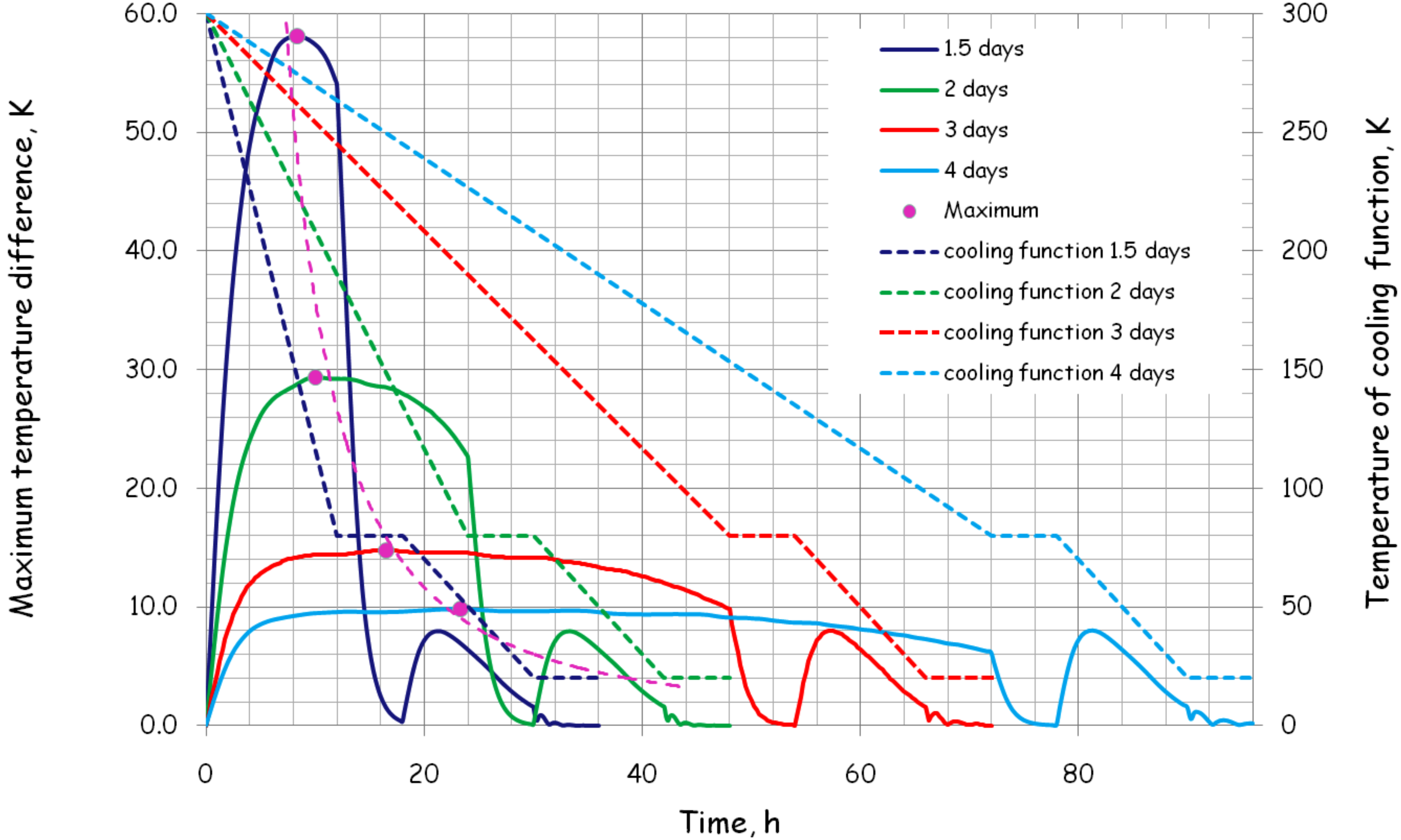



*Fig. 12 Evolutions of maximum temperature difference (solid lines) with the cooling functions for all considered variants of cool - down.*

SAFIRS-00428-A Page 18/23

- http://cdsweb.cern.ch/record/1352783/files/EuCARD-REP-2011-004.pdf

# Is the conductor design valid, what could be the open issues?

- *The conductor design looks valid, as appears to be confirmed by virgin strand tests.*
  - See talk by Luc Oberli

- *One possible issue is the stability of cabled strands, which should be tested on extracted strands.*
  - See talk by Luc Oberli

# Is the conductor design valid, what could be the open issues?

- *A serious issue might be the degradation due to cabling and external stress. This is a concern especially for the PIT route, which has higher probability of being used for its EU origin. Dedicated experiments and measurements must address this point. The cable is significantly bigger than any other cable recently used by $Nb_3Sn$ high-field magnets, therefore it may have unexpected issues.*
  - Measurements on 40 strand cable in preparation at Twente this year and later at Fresca
  - This year: measurement on 18 strand cable in Fresca

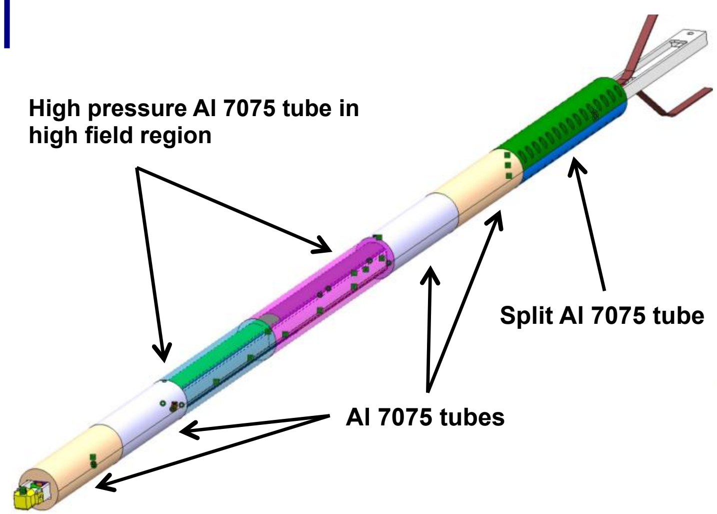
- *Cable tests by using the FRESCA transformer are a very good addition to the conductor qualification plan. Nonetheless most of the possible issues can be seen by extracted strand measurements, which we recommend should be initiated as soon as possible.*
  - See in the talk by Luc Oberli the topic on measured cabling degradation

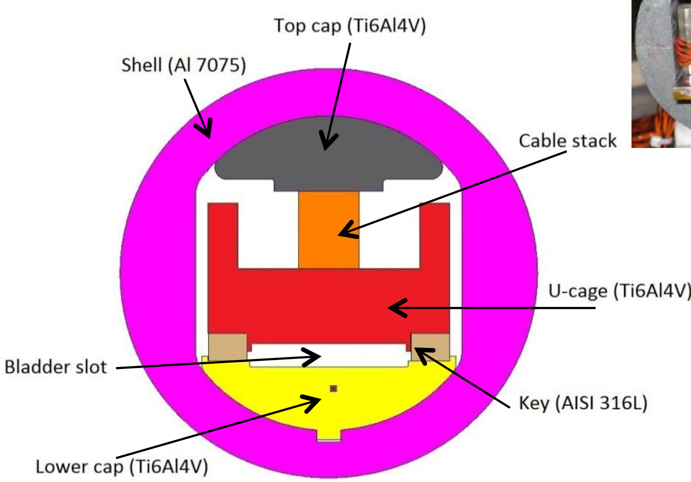
# Cable test under stress

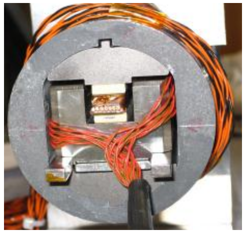
## $I_c$ vs. Transversal Pressure Cable Test in FRESCA 1/4

- A Sample holder for testing 10 mm wide superconducting Rutherford cables under transverse pressure of up to 200 MPa in the existing FRESCA test station (up to 20 mm with reduced pressure). The high pressure region of the sample holder will extend over the entire 600 mm field uniformity length in FRESCA

- The transverse pressure is provided by using the bladder and key method to create pre-stresses at room temperature. The final pressure is reached due to difference in thermal contraction in the different materials in the sample holder



*Effect of strain on $Nb_3Sn$: Status of the Research at CERN - Bernardo Bordini*

14

# What risks are seen in the assembly process?

- *The assembly plan is still at the conceptual level and needs more details for a thorough review.*
  - Study in progress: see talk by Juan-Carlos Perez

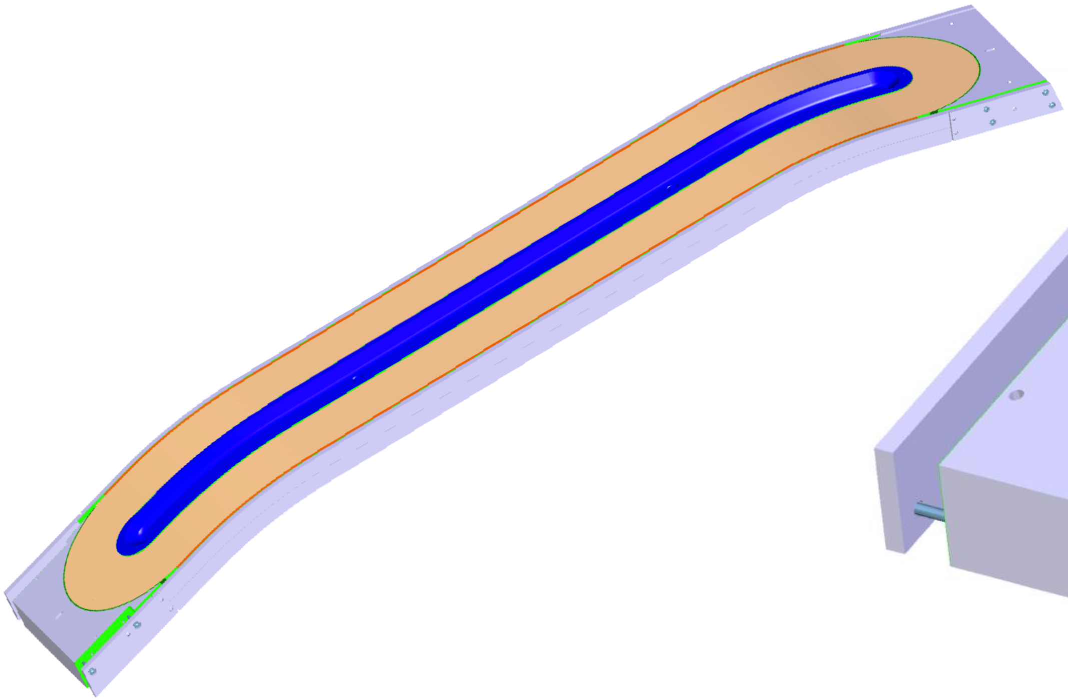
- *We recommend full-scale dummy coils for testing all assembly procedures, making a mechanical model and a cold test with adequate instrumentation. We suggest making two practice coils for each double-pancake: the first practice coil may have copper conductor and will be used to check tooling and procedures; the second practice coil should have $Nb_3Sn$ conductor of the same type that is planned for the real coils (possibly an underperforming batch), and will be used to check the fabrication processes (for instance the heat treatment) with the actual conductor properties (for instance expansion and contraction during heat treatment). The four practice coils can be used to make a full-scale dummy assembly and mechanical model for cooldown test (at least at liquid LN2).*

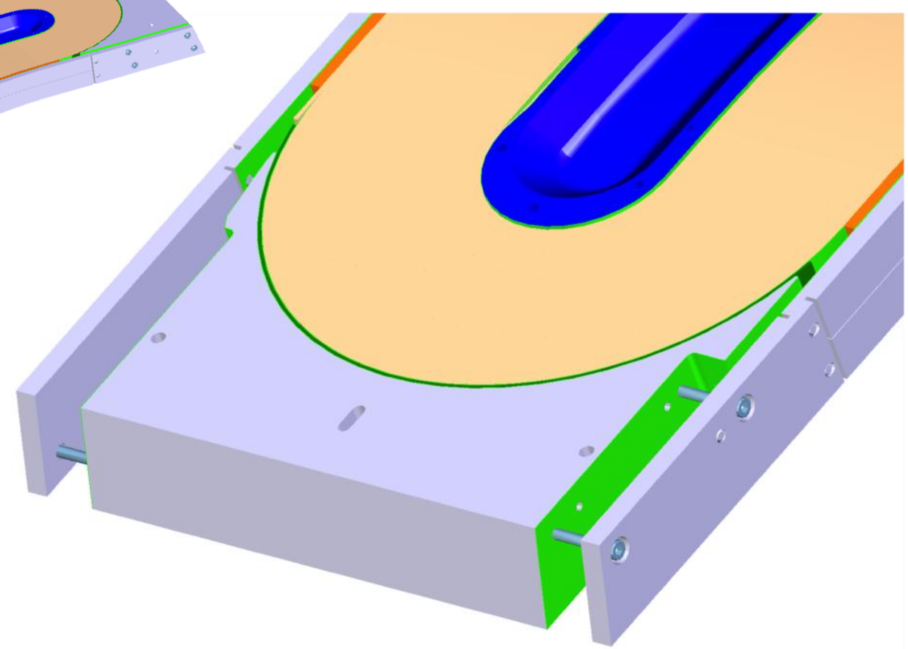
# What risks are seen in the assembly process?

- The structure will be tested with instrumented dummy coils (Al) at LN2 and then will be retested with (some of) the Cu coil. This will give us information on gradient in stresses. It is essentially for fine-tuning the structure
- The structure with dummy will be >6 months in advance on the first assembly. We are thinking of testing in the HFM test cryostat with LN2 early 2013.
- Cu dummy coils will be made for 1-2 and 3-4 (at least one for each)
- We do not have any low performing strand of the same type ! We are planning to buy more strand to allow for to allow making 4 + 1 double pancakes (conductor bookkeeping scenarios created for planning this)
- There is an option to make coils with “cheap” Bronze route strands, we do not know what we can get out of this , moreover it will require more resources and time

# What risks are seen in the assembly process?

- *The present assembly process is based on “ideal coils” (i.e., “paper coils”) whereas real coils will have manufacturing tolerances. Therefore the assembly process should have features that can accommodate these tolerances.*
  - Following tolerance analysis the dimensioning inside the coil pack was modified: e.g. double pancake length, insulation layers between pancakes, ‘virtual’ lateral and axial spacers (see CATIA pictures).  You triggered us to do this and in hind side this looks indispensible !





# Are there unaddressed issues in the fabrication process?

- *Insulation material and thickness: because of the problems seen in the LARP HQ models (recently tested at LBNL) a review of the insulation is recommended, revisiting critically what has been developed and tested worldwide (e.g. by LARP, CERN, Rutherford, CEA). The whole insulation scheme should be able to withstand mechanical and electrical requirements with adequate margin.*
  - Insulation development in industry(direct orders) and by RAL (with studies):
    - Alumina coated metal parts: mandatory for Fresca2
    - Braided s-glass of 0.20 mm thickness
    - Decision by mid may what exactly to use on first Cu coil
- *Coil dimensions after winding (consider curing of coils with a ceramic binder as successfully demonstrated by FNAL and LARP).*
  - Winding tests: looks stable,  to be confirmed by Cu coil winding
- *Dimensions of reaction and impregnation cavity (how to accommodate conductor expansion?)*
  - Was carefully studied: See talks by Francoise Rondeaux and Juan-Carlos Perez (reaction and impregnation moulds)

# Are there unaddressed issues in the fabrication process?

- *Impregnation materials.*
  - Being tested in SMC and RMC: with the final scheme an RMC HAS to be made (see talk by Juan-Carlos Perez)
  - Under study at RAL: bonding tests, additives etc.

- *Splice design, including a permissible level of Joule dissipation.*
  - See talk of Juan-Carlos Perez
  - Being tested in SMC and RMC: with the final scheme an RMC HAS to be made (see talk by Juan-Carlos Perez)

- *Quench-inducing protection heaters (type; location; power requirement) and instrumentation plan (strain gauges; voltage taps; thermometers; field sensors: locations and number of each sensor).*
  - Under study, but not yet finalized: See talk of Maria Durante and Philippe Fazilleau

# Is the quench protection for the dipole sufficient?

- *The quench protection in case of a quench starting in the high field region is fine; although the transverse propagation (layer-layer, turn-turn) should be decreased in the simulations in order to make sure that computations are conservative. Specifically, as one of the worst scenario, the transverse normal zone propagation speed (in the presentation it was 25 cm/s) should be zero.*
  - See talk by Maria Durante and Philippe Fazilleau

- *The quench protection should be studied also in case of a quench starting in the low field region when the magnet is carrying its nominal operating current.*
  - See talk by Maria Durante and Philippe Fazilleau

- *You may consider another protection technique in which the magnet is subdivided by shunt resistors, e.g., each of the four coils will be shunted by a resistor. This subdivision, however, must consider the unbalanced forces that might result from the non-uniform current flows in the four coils induced upon quenching.*
  - We did not understand why this is better. The shunting makes diagnostics harder to do.

# Is the dipole sufficiently protected from the insert in case of quench or failure?

- *This analysis was not presented and should be done at a future time.*
  - Only partly done: to be addressed (resource limited)

# Is the schedule credible?

- *Implementing a resource-loaded schedule in order to understand and keep under control the resources needed for each task in the time frame set by the schedule.*
  - We made a RLS in ( version July11). We are making an update at the moment ( see picts )

- *The human resources available for this project appear inadequate to keep the present schedule. More manpower should be involved; the resources should be optimized to achieve the critical path objectives.*
  - See RLS

- *Many critical decisions need to be made; therefore we recommend a series of decision points and small readiness reviews.*
  - List of milestones ( see schedule )

# Resource loaded schedule (May 2011) (example page)

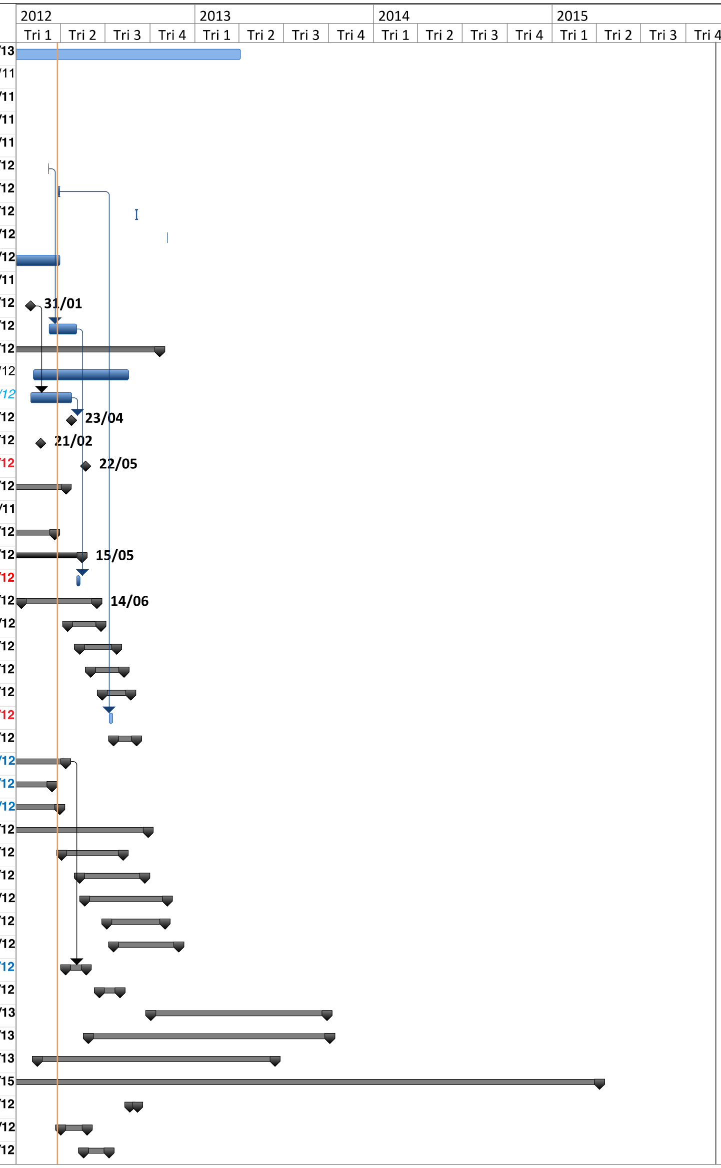


**EuCARD Task 3 High field dipole**

| program | Activity | person | code | material resources (KCHF) | personnel resources (PM) | begin date | end date | Jan-12 | | Feb-12 | | Mar-12 | | Apr-12 | | May-12 | | Jun-12 | | Jul-12 | | Aug-12 | | Sep-12 | | Oct-12 | | Nov-12 | | Dec-12 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | mat. (kCHF) | pers. (PM) | mat. (kCHF) | pers. (PM) | mat. (kCHF) | pers. (PM) | mat. (kCHF) | pers. (PM) | mat. (kCHF) | pers. (PM) | mat. (kCHF) | pers. (PM) | mat. (kCHF) | pers. (PM) | mat. (kCHF) | pers. (PM) | mat. (kCHF) | pers. (PM) | mat. (kCHF) | pers. (PM) | mat. (kCHF) | pers. (PM) | mat. (kCHF) | pers. (PM) |
| | ten-stack, short mechanical mock-up | F. Rondeaux | CEA | 0.0 | 0.45 | 1-Mar-11 | 31-Aug-11 | | | | | | | | | | | | | | | | | | | | | | | | |
| | spacer material characterization | J.C Perez | 99152 | 0.0 | 0.00 | 1-May-11 | 31-Oct-11 | | | | | | | | | | | | | | | | | | | | | | | | |
| | insulation characterization | A. Milanese | 99354 | 0.0 | 0.00 | 1-Mar-11 | 31-Oct-11 | | | | | | | | | | | | | | | | | | | | | | | | |
| | insulation characterization | M. Durante | CEA | 0.0 | 0.00 | 1-Mar-11 | 31-Oct-11 | | | | | | | | | | | | | | | | | | | | | | | | |
| | splice validation | P. Manil | CEA | 0.0 | 0.80 | 1-Oct-11 | 31-Dec-11 | | | | | | | | | | | | | | | | | | | | | | | | |
| | splice validation | A. Milanese | 99354 | 0.0 | 0.00 | 1-Oct-11 | 31-Dec-11 | | | | | | | | | | | | | | | | | | | | | | | | |
| | tests | A. Przybylski | CEA | 0.0 | 1.00 | 1-Mar-11 | 31-Dec-11 | | | | | | | | | | | | | | | | | | | | | | | | |
| | tests | T. Dalla Foglia | CEA | 0.0 | 1.00 | 1-Mar-11 | 31-Dec-11 | | | | | | | | | | | | | | | | | | | | | | | | |
| **structure manufacturing** | | CERN | | 150 | 2 | 1-Mar-11 | 31-Jul-11 | | | | | | | | | | | | | | | | | | | | | | | | |
| | shell drawings | J-C. Perez | 99152 | 0.0 | 0.05 | 1-Mar-11 | 15-Mar-11 | | | | | | | | | | | | | | | | | | | | | | | | |
| | stucture drawings | P. Manil | CEA | 0.0 | 0.50 | 1-Mar-11 | 15-May-11 | | | | | | | | | | | | | | | | | | | | | | | | |
| | procurement and assembly | J-C. Perez | 99152 | 110.0 | 0.75 | 1-Mar-11 | 31-Jul-11 | | | | | | | | | | | | | | | | | | | | | | | | |
| | procurement and assembly | A. Milanese | 99354 | 0.0 | 0.75 | 1-Mar-11 | 31-Jul-11 | | | | | | | | | | | | | | | | | | | | | | | | |
| | manufacturing | C. Fernandes | 99152 | 40.0 | 0.50 | 1-Jun-11 | 31-Jul-11 | | | | | | | | | | | | | | | | | | | | | | | | |
| **structure LN2 test** | | CERN | | 0 | 3 | 1-Jul-11 | 30-Sep-11 | | | | | | | | | | | | | | | | | | | | | | | | |
| | test  setup, test | J-C. Perez | 99152 | 0.0 | 0.75 | 1-Jul-11 | 31-Aug-11 | | | | | | | | | | | | | | | | | | | | | | | | |
| | instrumentation | M. Guinchard | 99152 | 0.0 | 0.25 | 1-Jul-11 | 30-Sep-11 | | | | | | | | | | | | | | | | | | | | | | | | |
| | test | M. Bajko | 99344 | 0.0 | 0.50 | 1-Aug-11 | 30-Sep-11 | | | | | | | | | | | | | | | | | | | | | | | | |
| | model and test | S. Caspi | 99353 | 0.0 | 0.50 | 1-Aug-11 | 30-Sep-11 | | | | | | | | | | | | | | | | | | | | | | | | |
| | model, test setup and test | A. Milanese | 99354 | 0.0 | 0.50 | 1-Jul-11 | 30-Sep-11 | | | | | | | | | | | | | | | | | | | | | | | | |
| | test | G. de Rijk | 99353 | 0.0 | 0.50 | 1-Jul-11 | 30-Sep-11 | | | | | | | | | | | | | | | | | | | | | | | | |
| | test | P. Manil | CEA | 0.0 | 0.45 | 1-Aug-11 | 30-Sep-11 | | | | | | | | | | | | | | | | | | | | | | | | |
| **Conductor procurement & qualification 2x15km** | | CEA/CERN | | 320 | 5 | 1-Jan-11 | 31-May-12 | | | | | | | | | | | | | | | | | | | | | | | | |
| | Developpment conductor procu. | L. Oberli | 99154 | 300.0 | 0.50 | 1-Jan-11 | 31-Mar-12 | | | | | | | 100 | 0.25 | | | | | | | | | | | | | | | | |
| | Pilot conductor procu. | C. Berriaud | CEA | 0.0 | 1.80 | 1-Jan-11 | 31-Mar-12 | | 0.20 | | | | 0.20 | | | | | | | | | | | | | | | | | | |
| | Pilot conductor procu. | O. Louchard | CEA | 0.0 | 0.00 | 1-Jan-11 | 31-Mar-12 | | | | | | | | | | | | | | | | | | | | | | | | |
| | characterization | L. Oberli | 99154 | 20.0 | 1.50 | 1-Oct-11 | 31-May-12 | | | | | 10 | 0.50 | 10 | 0.50 | | | | | | | | | | | | | | | | |
| | characterization | Tech X | 99154 | 0.0 | 1.25 | 1-Oct-11 | 31-May-12 | | | | | | | | | | | | | | | | | | | | | | | | |
| **Conductor  procurement & qualification 45km** | | CEA | | 40 | 5 | 1-Apr-11 | 31-Dec-12 | | | | | | | | | | | | | | | | | | | | | | | | |
| | procurement | C. Berriaud | CEA | 0.0 | 2.00 | 1-Apr-11 | 31-Oct-12 | | | | 0.20 | | | | 0.20 | | | | 0.20 | | | | 0.20 | | | | 0.20 | | | | |
| | procurement | O. Louchard | CEA | 0.0 | 0.00 | 1-Apr-11 | 31-Oct-12 | | | | | | | | | | | | | | | | | | | | | | | | |
| | characterization | L. Oberli | 99154 | 0.0 | 0.50 | 1-Apr-12 | 31-Dec-12 | | | | | | | | | | | | | | | | 0.25 | | | | | | | | 0.25 |
| | characterization | Tech X | 99154 | 40.0 | 2.00 | 1-Apr-12 | 31-Dec-12 | | | | | | | | | | | | | 10 | 0.50 | 10 | 0.50 | | | | | 10 | 0.50 | 10 | 0.50 |
| **cabling for 1 coil set** | | CERN | | 30 | 4 | 1-Jan-11 | 31-Dec-12 | | | | | | | | | | | | | | | | | | | | | | | | |
| | cable development | L. Oberli | 99154 | 10.0 | 0.50 | 1-Jan-11 | 31-Dec-11 | | | | | | | | | | | | | | | | | | | | | | | | |
| | cable development | A. Bonasia | 99154 | 0.0 | 0.50 | 1-Jan-11 | 31-Dec-11 | | | | | | | | | | | | | | | | | | | | | | | | |
| | cabling and characterizatiion | L. Oberli | 99154 | 20.0 | 1.25 | 1-Jan-12 | 31-Dec-12 | | | | | | | | | 5 | 0.25 | | | | | | | 5 | 0.25 | | | | | 5 | 0.25 |
| | cabling | A. Bonasia | 99154 | 0.0 | 1.25 | 1-Jan-12 | 31-Dec-12 | | | | | | | | | | 0.25 | | | | | | | | 0.25 | | | | | | 0.25 |
| **Vertical test station construction** | | CERN | | 250 | 2 | 1-Jan-11 | 31-Jul-12 | | | | | | | | | | | | | | | | | | | | | | | | |
| | Test station | M. Bajko | 99344 | 0.0 | 0.25 | 1-Jan-11 | 31-Jul-12 | | | | | | | | | | | | | | | | | | | | | | | | |
| | Test station | C. Giloux | 99344 | 50.0 | 0.50 | 1-Jan-12 | 31-Jul-12 | | | 25 | 0.25 | 25 | 0.25 | | | | | | | | | | | | | | | | | | |
| | cryostat design and constructtion | A. VanderCraen | 99353 | 200.0 | 1.25 | 1-Jan-11 | 31-Aug-11 | | | | | | | | | | | | | | | | | | | | | | | | |
| **Furnace** | | CERN | | 578 | 4 | 1-Jan-11 | 31-Jan-12 | | | | | | | | | | | | | | | | | | | | | | | | |
| | procurement and installation | F. Lackner | 99353 | 578.0 | 3.50 | 1-Jan-11 | 31-Jan-12 | 156 | 1.00 | | | | | | | | | | | | | | | | | | | | | | |
| **Cu coil manufacturing** | | CEA | | 115 | 22 | 1-Nov-11 | 31-Mar-12 | | | | | | | | | | | | | | | | | | | | | | | | |
| | Cu coil manufacturing | J-C. Perez | 99152 | 115.0 | 1.75 | 1-Nov-11 | 31-Mar-12 | | 0.25 | 50 | 0.50 | | 0.25 | | | | | | | | | | | | | | | | | | |
| | Cu coil manufacturing | F. Rondeaux | CEA | 0.0 | 2.25 | 1-Nov-11 | 31-Mar-12 | | 0.25 | | 0.50 | | 0.50 | | | | | | | | | | | | | | | | | | |
| | Cu coil manufacturing | CDD Dipole | CEA | 0.0 | 5.00 | 1-Nov-11 | 31-Mar-12 | | 1.00 | | 1.00 | | 1.00 | | | | | | | | | | | | | | | | | | |
| | Cu coil manufacturing | P. Manil | CEA | 0.0 | 0.90 | 1-Nov-11 | 31-Mar-12 | | 0.30 | | 0.30 | | 0.30 | | | | | | | | | | | | | | | | | | |
| | Cu coil manufacturing | A. Milanese | 99354 | 0.0 | 1.75 | 1-Nov-11 | 31-Mar-12 | | 0.25 | | 0.50 | | 0.25 | | | | | | | | | | | | | | | | | | |
| | Cu coil manufacturing | M. Durante | CEA | 0.0 | 1.50 | 1-Nov-11 | 31-Mar-12 | | 0.30 | | 0.30 | | 0.30 | | | | | | | | | | | | | | | | | | |
| | Cu coil manufacturing | A. Przybylski | CEA | 0.0 | 2.50 | 1-Nov-11 | 31-Mar-12 | | 0.50 | | 0.50 | | 0.50 | | | | | | | | | | | | | | | | | | |
| | Cu coil manufacturing | T. Dalla Foglia | CEA | 0.0 | 2.50 | 1-Nov-11 | 31-Mar-12 | | 0.50 | | 0.50 | | 0.50 | | | | | | | | | | | | | | | | | | |
| | Cu coil manufacturing | JJ. Goc | CEA | 0.0 | 2.50 | 1-Nov-11 | 31-Mar-12 | | 0.50 | | 0.50 | | 0.50 | | | | | | | | | | | | | | | | | | |
| | Cu coil manufacturing | C. Fernandes | 99152 | 0.0 | 1.75 | 1-Nov-11 | 31-Mar-12 | | 0.25 | | 0.50 | | 0.25 | | | | | | | | | | | | | | | | | | |
| **1st CEA SC double pancake manufacturing** | | CEA | | 0 | 15 | 1-Apr-12 | 31-Jul-12 | | | | | | | | | | | | | | | | | | | | | | | | |
| | coil manufacturing | F. Rondeaux | CEA | 0.0 | 2.00 | 1-Apr-12 | 31-Jul-12 | | | | | | | | 0.50 | | 0.50 | | 0.50 | | 0.50 | | | | | | | | | | |
| | Cu coil manufacturing | CDD Dipole | CEA | 0.0 | 4.00 | 1-Apr-12 | 31-Jul-12 | | | | | | | | 1.00 | | 1.00 | | 1.00 | | 1.00 | | | | | | | | | | |
| | coil manufacturing | P. Manil | CEA | 0.0 | 1.20 | 1-Apr-12 | 31-Jul-12 | | | | | | | | 0.30 | | 0.30 | | 0.30 | | 0.30 | | | | | | | | | | |
| | coil manufacturing | M. Durante | CEA | 0.0 | 1.20 | 1-Apr-12 | 31-Jul-12 | | | | | | | | 0.30 | | 0.30 | | 0.30 | | 0.30 | | | | | | | | | | |
| | coil manufacturing | A. Przybylski | CEA | 0.0 | 1.75 | 1-Apr-12 | 31-Jul-12 | | | | | | | | 0.25 | | 0.50 | | 0.50 | | 0.50 | | | | | | | | | | |
| | coil manufacturing | T. Dalla Foglia | CEA | 0.0 | 1.75 | 1-Apr-12 | 31-Jul-12 | | | | | | | | 0.25 | | 0.50 | | 0.50 | | 0.50 | | | | | | | | | | |
| | coil manufacturing | J-C. Perez | 99152 | 0.0 | 0.50 | 1-Apr-12 | 31-Jul-12 | | | | | | | | | | 0.25 | | 0.25 | | | | | | | | | | | | |
| | coil manufacturing | A. Milanese | 99354 | 0.0 | 0.50 | 1-Apr-12 | 30-Jun-12 | | | | | | | | | | 0.25 | | 0.25 | | | | | | | | | | | | |
| | coil manufacturing | CERN fellow | 99354 | 0.0 | 0.50 | 1-Apr-12 | 31-Jul-12 | | | | | | | | | | 0.25 | | 0.25 | | | | | | | | | | | | |
| | coil manufacturing | JJ. Goc | CEA | 0.0 | 1.75 | 1-Apr-12 | 31-Jul-12 | | | | | | | | 0.25 | | 0.50 | | 0.50 | | 0.50 | | | | | | | | | | |
| **1st CERN SC double pancake  manufacturing** | | CERN | | 90 | 7 | 1-Aug-12 | 31-Oct-12 | | | | | | | | | | | | | | | | | | | | | | | | |
| | coil manufacturing | J-C. Perez | 99152 | 90.0 | 1.00 | 1-Aug-12 | 31-Oct-12 | | | | | | | | | | | | | | | 30 | 0.25 | 30 | 0.50 | 30 | 0.25 | | | | |
| | coil manufacturing | G. de Rijk | 99353 | 0.0 | 0.75 | 1-Aug-12 | 31-Oct-12 | | | | | | | | | | | | | | | | 0.25 | | 0.25 | | 0.25 | | | | |
| | coil manufacturing | CERN fellow | 99354 | 0.0 | 1.50 | 1-Aug-12 | 31-Oct-12 | | | | | | | | | | | | | | | | 0.50 | | 0.50 | | 0.50 | | | | |
| | coil manufacturing | C. Fernandes | 99152 | 0.0 | 1.00 | 1-Aug-12 | 31-Oct-12 | | | | | | | | | | | | | | | | 0.25 | | 0.50 | | 0.25 | | | | |
| | coil manufacturing | A. Przybylski | CEA | 0.0 | 0.60 | 1-Aug-12 | 31-Oct-12 | | | | | | | | | | | | | | | | 0.20 | | 0.20 | | 0.20 | | | | |
| | coil manufacturing | T. Dalla Foglia | CEA | 0.0 | 0.60 | 1-Aug-12 | 31-Oct-12 | | | | | | | | | | | | | | | | 0.20 | | 0.20 | | 0.20 | | | | |
| | coil manufacturing | JJ. Goc | CEA | 0.0 | 0.60 | 1-Aug-12 | 31-Oct-12 | | | | | | | | | | | | | | | | 0.20 | | 0.20 | | 0.20 | | | | |
| | coil manufacturing | P. Manil | CEA | 0.0 | 0.90 | 1-Aug-12 | 31-Oct-12 | | | | | | | | | | | | | | | | 0.30 | | 0.30 | | 0.30 | | | | |

# Manufacturing schedule (March 2012) page 1

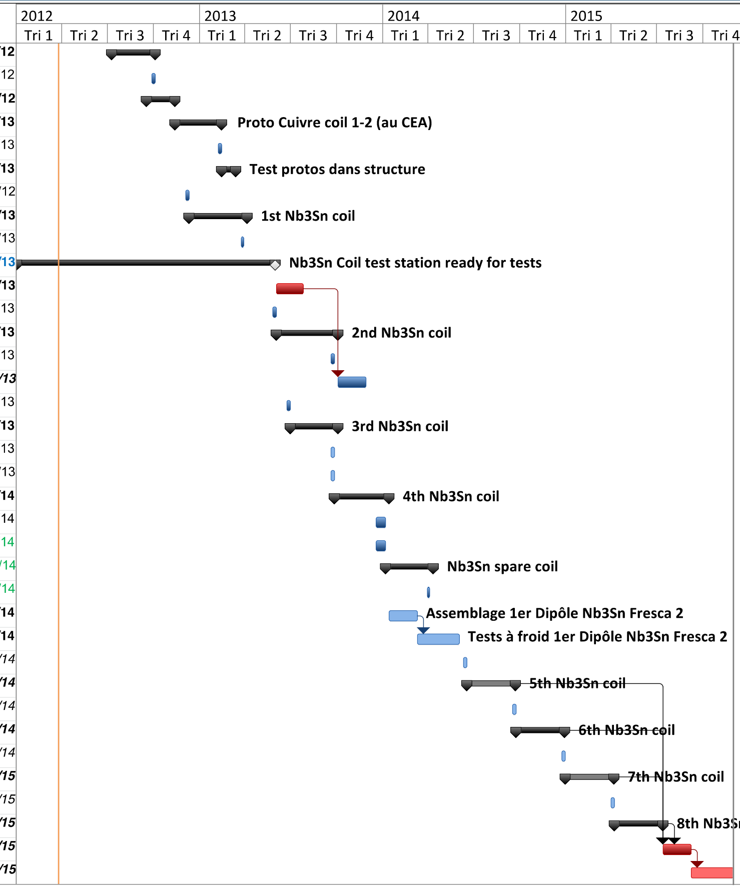
| N° | | Nom de la tâche | Priorité | Durée | Début | Fin |
|---|---|---|---|---|---|---|
| 1 | | Interaction dipôle/insert (20% Melanie) | 500 | 742 jours | Mar 11/05/10 | Mer 03/04/13 |
| 2 | ✓ | Spécifications, design préliminaire Dipôle | 500 | 471 jours | Mer 01/04/09 | Mer 19/01/11 |
| 3 | ✓ | Revue design dipôle | 500 | 2 jours | Jeu 20/01/11 | Jeu 20/01/11 |
| 4 | ✓ | Design Dipôle (Magn 2D, Mech 2D, Magn 3D, Mech 3D, concept 3D, mechanical structure) | 500 | 92 jours | Lun 24/01/11 | Mar 31/05/11 |
| 5 | ✓ | SMC performance review | 500 | 1 jour | Lun 12/12/11 | Lun 12/12/11 |
| 6 | ✓ | Conductor progress review | 500 | 1 jour | Jeu 08/03/12 | Jeu 08/03/12 |
| 7 | | FRESCA II magnet ESAC review | 500 | 2 jours | Mer 28/03/12 | Jeu 29/03/12 |
| 8 | | Coil manufacturing readiness review | 500 | 1 jour | Lun 03/09/12 | Lun 03/09/12 |
| 9 | | ESAC review for Fresca 2 dipole and insert | 500 | 1 jour | Lun 05/11/12 | Lun 05/11/12 |
| 10 | | Etudes Protection Dipôle Nb3Sn Fresca 2 | 500 | 340 jours | Lun 06/12/10 | Ven 30/03/12 |
| 11 | ✓ | Etude configuration jonctions et connexions | 500 | 7 mois | Mer 01/06/11 | Jeu 15/12/11 |
| 12 | ✓ | Décision largeur câble FRESCA II | 500 | 0 jour | Mar 31/01/12 | Mar 31/01/12 |
| 13 | | Décision épaisseur câble FRESCA II | 500 | 2 mois | Ven 09/03/12 | Jeu 03/05/12 |
| 14 | | Essais préliminaires | 500 | 670 jours? | Lun 22/03/10 | Dim 21/10/12 |
| 92 | | Essais isolation intercouche | 500 | 7 mois | Lun 06/02/12 | Ven 17/08/12 |
| 93 | | *Essais Isolation conducteur* | *500* | *3 mois* | *Mar 31/01/12* | *Lun 23/04/12* |
| 94 | | Choix isolation conducteur FRESCA II | 500 | 0 jour | Lun 23/04/12 | Lun 23/04/12 |
| 95 | ✓ | Choix Isolation intercouche | 500 | 0 jour | Mar 21/02/12 | Mar 21/02/12 |
| 96 | | Choix matière central post 1-2 | 500 | 0 jour | Mar 22/05/12 | Mar 22/05/12 |
| 97 | | Etudes Gamme de montage et procédures | 500 | 352 jours | Mer 01/12/10 | Jeu 12/04/12 |
| 104 | ✓ | Conception détaillée structure mechanique | 500 | 256 jours | Lun 06/12/10 | Mer 30/11/11 |
| 113 | ✓ | Conception détaillée composants et outillages de bobinage proto coil 3-4 | 500 | 166.25 jours | Lun 25/07/11 | Mar 20/03/12 |
| 129 | | Conception détaillée outillages de réaction coil 3-4 | 500 | 100.5 jours | Jeu 22/12/11 | Mar 15/05/12 |
| 142 | | Mise à jour dossiers suite au choix de l'épaisseur nominale du câble | 780 | 5 jours | Ven 04/05/12 | Jeu 10/05/12 |
| 143 | | Conception détaillée outillages d'imprégnation coil 3-4 | 500 | 110.25 jours | Jeu 12/01/12 | Jeu 14/06/12 |
| 153 | | Conception détaillée composants et outillages de bobinage proto coil 1-2 | 500 | 50 jours | Lun 16/04/12 | Ven 22/06/12 |
| 159 | | Conception détaillée outillages de manutention et transport | 500 | 53.5 jours | Jeu 10/05/12 | Mar 24/07/12 |
| 166 | | Conception détaillée outillages de réaction coil 1-2 | 500 | 48.25 jours | Ven 01/06/12 | Mer 08/08/12 |
| 172 | | Conception détaillée outillages d'imprégnation coil 1-2 | 500 | 42.5 jours | Lun 25/06/12 | Mer 22/08/12 |
| 178 | | Mise à jour dossiers pour correction central posts (trace dpc 1-2 intégrée à la bobine) | 680 | 5 jours | Lun 09/07/12 | Lun 16/07/12 |
| 179 | | Composants assemblage bobines (pièce intérmédiaire) | 500 | 33 jours | Jeu 19/07/12 | Lun 03/09/12 |
| 186 | | Conception détaillée outillages de réalisation jonctions | 500 | 81 jours | Ven 16/12/11 | Mer 11/04/12 |
| 189 | | Approvisionnement composants coil pack mock-up | 500 | 188 jours | Lun 20/06/11 | Mer 14/03/12 |
| 194 | | Approvisionnement composants structure mécanique (aimant et masse froide) | 500 | 200 jours | Lun 20/06/11 | Ven 30/03/12 |
| 202 | | Approvisionnement composants et outillages de bobinage protos Cu 3-4 et 1-2 | 500 | 239.25 jours | Ven 21/10/11 | Jeu 27/09/12 |
| 229 | | Approvisionnement outillages reaction 3-4 | 500 | 90 jours | Mar 03/04/12 | Mer 07/08/12 |
| 233 | | Approvisionnement outillages imprégnation 3-4 | 500 | 95 jours | Jeu 10/05/12 | Jeu 20/09/12 |
| 237 | | Approvisionnement composants et outillages bobinage coil 1-2 | 500 | 121 jours | Lun 21/05/12 | Lun 05/11/12 |
| 247 | | Approvisionnement outillages réaction 1-2 | 500 | 85 jours | Jeu 05/07/12 | Mer 31/10/12 |
| 251 | | Approvisionnement outillages imprégnation 1-2 | 500 | 95 jours | Jeu 19/07/12 | Mer 28/11/12 |
| 255 | | Approvisionnement outillages réalisation jonctions | 500 | 30 jours | Jeu 12/04/12 | Mer 23/05/12 |
| 259 | | Approvisionnement outillages de manutention et transport | 500 | 30 jours | Mer 20/06/12 | Mar 31/07/12 |
| 263 | | Nb3Sn conductor cabling | 500 | 248 jours | Mer 03/10/12 | Ven 27/09/13 |
| 269 | | Nb3Sn conductor insulation | 500 | 343.5 jours | Lun 28/05/12 | Jeu 03/10/13 |
| 282 | | Approvisionnement composants bobines Nb3Sn 1 à 4 | 500 | 338 jours | Mar 14/02/12 | Jeu 13/06/13 |
| 301 | | Approvisionnement composants bobines Nb3Sn 5 à 8 | 500 | 1547 jours | Mer 01/04/09 | Mar 07/04/15 |
| 332 | | Approvisionnement Composants assemblage bobines (pièce intérmédiaire) | 500 | 12 jours | Mar 21/08/12 | Mer 05/09/12 |
| 336 | | Réalisation et Test Structure mock-up | 500 | 40 jours | Lun 02/04/12 | Ven 25/05/12 |
| 339 | | Préparation Proto Cuivre coil 3-4 | 500 | 36 jours | Ven 18/05/12 | Lun 09/07/12 |




Responses on 1st review, GdR, 28-29 March 2012

# Manufacturing schedule (March 2012) page 2

| N° | | Nom de la tâche | Priorité | Durée | Début | Fin |
|---|---|---|---|---|---|---|
| 343 | | **Proto Cuivre coil 3-4** | **500** | **62.75 jours** | **Lun 09/07/12** | **Jeu 04/10/12** |
| 354 | | Expédition au CEA outillages de bobinage et réaction coil 3-4 | 500 | 1 sm | Jeu 27/09/12 | Jeu 04/10/12 |
| 355 | | **Préparation Proto Cuivre coil 1-2** | **500** | **41 jours** | **Lun 17/09/12** | **Mar 13/11/12** |
| 359 | | **Proto Cuivre coil 1-2 (au CEA)** | **500** | **57 jours** | **Mar 13/11/12** | **Mer 13/02/13** |
| 370 | | Expédition au CEA outillages de bobinage et réaction coil 1-2 | 500 | 1 sm | Jeu 07/02/13 | Mer 13/02/13 |
| 371 | | **Test protos dans structure** | **500** | **20 jours** | **Jeu 14/02/13** | **Mer 13/03/13** |
| 374 | | Vérification et Dédoublage conducteur Nb3Sn coil 01 | 500 | 1 sm | Mar 04/12/12 | Mar 11/12/12 |
| 375 | | **1st Nb3Sn coil** | **500** | **74 jours** | **Mar 11/12/12** | **Ven 05/04/13** |
| 386 | | Transfer from CERN to CEA - 3-4 winding and reaction tooling | 500 | 1 sm | Lun 25/03/13 | Ven 29/03/13 |
| 387 | | Nb3Sn Coil test station | 500 | 360 jours | Lun 02/01/12 | Ven 31/05/13 |
| 392 | | **Test in LHe of 1st Nb3Sn (coil 3-4)** | **500** | **2 mois** | **Lun 03/06/13** | **Ven 26/07/13** |
| 393 | | Vérification et Dédoublage conducteur Nb3Sn coil 02 | 500 | 1 sm | Lun 27/05/13 | Lun 03/06/13 |
| 394 | | **2nd Nb3Sn coil** | **500** | **89 jours** | **Lun 03/06/13** | **Jeu 03/10/13** |
| 405 | | Transfer from CERN to CEA - 1-2 winding and reaction tooling | 500 | 1 sm | Ven 20/09/13 | Jeu 26/09/13 |
| 406 | | ***Test in LHe of 2nd Nb3Sn (coil 1-2)*** | ***500*** | ***2 mois*** | ***Ven 04/10/13*** | ***Jeu 28/11/13*** |
| 407 | | Vérification et Dédoublage conducteur Nb3Sn coil 03 | 500 | 1 sm | Lun 24/06/13 | Lun 01/07/13 |
| 408 | | **3rd Nb3Sn coil** | **500** | **69 jours** | **Lun 01/07/13** | **Jeu 03/10/13** |
| 419 | | Transfer from CERN to CEA - 3-4 winding and reaction tooling | 500 | 1 sm | Ven 20/09/13 | Jeu 26/09/13 |
| 420 | | Vérification et Dédoublage conducteur Nb3Sn coil 04 | 500 | 1 sm | Ven 20/09/13 | Ven 27/09/13 |
| 421 | | **4th Nb3Sn coil** | **500** | **69 jours** | **Ven 27/09/13** | **Lun 13/01/14** |
| 432 | | Transfer from CERN to CEA - 1-2 winding and reaction tooling | 500 | 1 sm | Jeu 19/12/13 | Lun 06/01/14 |
| 433 | | Vérification et Dédoublage conducteur Nb3Sn spare coil | 500 | 1 sm | Jeu 19/12/13 | Mar 07/01/14 |
| 434 | | Nb3Sn spare coil | 500 | 69 jours | Mar 07/01/14 | Ven 11/04/14 |
| 445 | | Transfer from CERN to CEA - winding and reaction tooling | 500 | 1 sm | Lun 31/03/14 | Ven 04/04/14 |
| 446 | | **Assemblage 1er Dipôle Nb3Sn Fresca 2** | **500** | **2 mois** | **Mar 14/01/14** | **Lun 10/03/14** |
| 447 | | **Tests à froid 1er Dipôle Nb3Sn Fresca 2** | **500** | **3 mois** | **Mar 11/03/14** | **Lun 02/06/14** |
| 448 | | *Vérification et Dédoublage conducteur Nb3Sn coil 05* | *500* | *1 sm* | *Mer 11/06/14* | *Mer 18/06/14* |
| 449 | | ***5th Nb3Sn coil*** | ***500*** | ***69 jours*** | ***Mer 18/06/14*** | ***Lun 22/09/14*** |
| 460 | | *Vérification et Dédoublage conducteur Nb3Sn coil 06* | *500* | *1 sm* | *Mer 17/09/14* | *Mer 24/09/14* |
| 461 | | ***6th Nb3Sn coil*** | ***500*** | ***69 jours*** | ***Mer 24/09/14*** | ***Lun 29/12/14*** |
| 472 | | *Vérification et Dédoublage conducteur Nb3Sn coil 07* | *500* | *1 sm* | *Mer 24/12/14* | *Mer 31/12/14* |
| 473 | | ***7th Nb3Sn coil*** | ***500*** | ***69 jours*** | ***Mer 31/12/14*** | ***Lun 06/04/15*** |
| 484 | | *Vérification et Dédoublage conducteur Nb3Sn coil 08* | *500* | *1 sm* | *Mer 01/04/15* | *Mer 08/04/15* |
| 485 | | ***8th Nb3Sn coil*** | ***500*** | ***69 jours*** | ***Mer 08/04/15*** | ***Lun 13/07/15*** |
| 496 | | ***Assemblage 2ème Dipôle Nb3Sn Fresca 2*** | ***500*** | ***2 mois*** | ***Mar 14/07/15*** | ***Lun 07/09/15*** |
| 497 | | ***Tests à froid 2ème Dipôle Nb3Sn Fresca 2*** | ***500*** | ***3 mois*** | ***Mar 08/09/15*** | ***Lun 30/11/15*** |



# Is the schedule credible?

- *The project leader may soon need to prioritize these two competing goals (accelerator features vs. schedule).*
  - Done:  favoured field value over homogeneity, do not require rad-hard, fast ramp, no vacuum tight aperture tube, no special cooling features.

- *We suggest speeding up the conductor procurement since the main parameters (strand diameter, percentage of copper) have been agreed upon, whereas the conductor production can always be affected by external factor (mistakes, ITER, other unforeseen events).*
  - See Luc Oberli's talk for conductor procurement schedule (39 km PIT delivered from which 31 km available)
  - See bookkeeping tables on next slide

# Conductor delivery bookkeeping

EuCARD

| | PROCUREMENT | | | | | | | | | | | | USE | | | | | | Stock | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Order | | | | | | Delivery | | Summary | | | Use | | | Summary | | | Stock PIT | Stock RRP | Stock total |
| date | Order name | Strand type | Firm | Order date | Institute | Order amount (km) | Delivery date | Delivery amount (km) | Delivery PIT | Delivery RRP | Delivery total | cable for | magnet/ coil id | amount (km) | Use PIT | Use RRP | Use total | (km) | (km) | (km) |
| | | | | | | | | | 0 | 0 | 0 | | | | 0 | 0 | 0 | 0 | 0 | 0 |
| 01/06/11 | Qualif. | PIT | Bruker | 01/09/10 | CERN | 9.0 | 01/06/11 | 9.0 | 9.0 | 0.0 | 9.0 | | | | 0 | 0 | 0.0 | 9.0 | 0.0 | 9 |
| 15/01/12 | | | | | | | | | 0.0 | 0.0 | 9.0 | cable dev | | 8 | 8 | 0 | 8.0 | 1.0 | 0.0 | 1 |
| 01/02/12 | Qualif. | PIT | Bruker | 01/08/10 | CERN | 10.0 | 01/02/12 | 10.0 | 10.0 | 0.0 | 19.0 | | | | 0 | 0 | 8.0 | 11.0 | 0.0 | 11 |
| 01/02/12 | Qualif. | PIT | Bruker | 01/03/11 | CERN | 5.0 | 01/02/12 | 5.0 | 5.0 | 0.0 | 24.0 | | | | 0 | 0 | 8.0 | 16.0 | 0.0 | 16 |
| 01/03/12 | Pilot | PIT | Bruker | 01/04/11 | CEA | 15 | 01/03/12 | 15 | 15 | 0 | 39.0 | | | | 0 | 0 | 8.0 | 31.0 | 0.0 | 31 |
| 01/04/12 | Qualif. | RRP | OST | 01/09/10 | CERN | 10.0 | 01/04/12 | 10.0 | 0.0 | 10.0 | 49.0 | | | | 0 | 0 | 8.0 | 31.0 | 10.0 | 41 |
| 25/04/12 | | | | | | | | | 0 | 0 | 49.0 | Dilatation | | 1.6 | 1.6 | 0 | 9.6 | 29.4 | 10.0 | 39.4 |
| 24/05/12 | | | | | | | | | 0 | 0 | 49.0 | 10-stack | | 1 | 1 | 0 | 10.6 | 28.4 | 10.0 | 38.4 |
| 01/06/12 | Pilot | RRP | OST | 01/04/11 | CEA | 15 | 01/06/12 | 15 | 0 | 15 | 64.0 | | | | 0 | 0 | 10.6 | 28.4 | 25.0 | 53.4 |
| 01/06/12 | | | | | | | | | 0 | 0 | 64.0 | SMC4a | dpc#2 | 2.3 | 2.3 | 0 | 12.9 | 26.1 | 25.0 | 51.1 |
| 01/07/12 | | | | | | | | | 0 | 0 | 64.0 | RMC1 | 1dpc | 3.9 | 3.9 | 0 | 16.8 | 22.2 | 25.0 | 47.2 |
| 01/08/12 | | | | | | | | | 0 | 0 | 64.0 | SMC4b | dpc#2 | 2.3 | 0 | 2.3 | 19.1 | 22.2 | 22.7 | 44.9 |
| 19/09/12 | | | | | | | | | 0 | 0 | 64.0 | Fresca2 | dpc34-1 | 12 | 12 | 0 | 31.1 | 10.2 | 22.7 | 32.9 |
| 01/02/13 | Prod. | PIT | Bruker | 01/06/12 | CEA | 25 | 01/02/13 | 25 | 25 | 0 | 89.0 | | | | 0 | 0 | 31.1 | 35.2 | 22.7 | 57.9 |
| 01/02/13 | Prod. | RRP | OST | 01/06/12 | CEA | 25 | 01/02/13 | 25 | 0 | 25 | 114.0 | | | | 0 | 0 | 31.1 | 35.2 | 47.7 | 82.9 |
| 07/05/13 | | | | | | | | | 0 | 0 | 114.0 | Fresca2 | dpc12-1 | 10.6 | 10.6 | 0 | 41.7 | 24.6 | 47.7 | 72.3 |
| 04/06/13 | | | | | | | | | 0 | 0 | 114.0 | Fresca2 | dpc34-2 | 12 | 12 | 0 | 53.7 | 12.6 | 47.7 | 60.3 |
| 02/09/13 | | | | | | | | | 0 | 0 | 114.0 | Fresca2 | dpc12-2 | 10.6 | 10.6 | 0 | 64.3 | 2.0 | 47.7 | 49.7 |

| | PROCUREMENT | | | | | | | | | | | | USE | | | | | | Stock | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Order | | | | | | Delivery | | Summary | | | Use | | | Summary | | | Stock PIT | Stock RRP | Stock total |
| date | Order name | Strand type | Firm | Order date | Institute | Order amount (km) | Delivery date | Delivery amount (km) | Delivery PIT | Delivery RRP | Delivery total | cable for | magnet/ coil id | amount (km) | Use PIT | Use RRP | Use total | (km) | (km) | (km) |
| | | | | | | | | | | | 0 | | | | | | 0 | 0 | 0 | 0 |
| 01/06/11 | Qualif. | PIT | Bruker | 01/09/10 | CERN | 9.0 | 01/06/11 | 9.0 | 9.0 | 0.0 | 9.0 | | | | 0 | 0 | 0.0 | 9.0 | 0.0 | 9 |
| 15/01/12 | | | | | | | | | 0.0 | 0.0 | 9.0 | cable dev | | 8 | 8 | 0 | 8.0 | 1.0 | 0.0 | 1 |
| 01/02/12 | Qualif. | PIT | Bruker | 01/08/10 | CERN | 10.0 | 01/02/12 | 10.0 | 10.0 | 0.0 | 19.0 | | | | 0 | 0 | 8.0 | 11.0 | 0.0 | 11 |
| 01/02/12 | Qualif. | PIT | Bruker | 01/03/11 | CERN | 5.0 | 01/02/12 | 5.0 | 5.0 | 0.0 | 24.0 | | | | 0 | 0 | 8.0 | 16.0 | 0.0 | 16 |
| 01/03/12 | Pilot | PIT | Bruker | 01/04/11 | CEA | 15 | 01/03/12 | 15 | 15 | 0 | 39.0 | | | | 0 | 0 | 8.0 | 31.0 | 0.0 | 31 |
| 01/04/12 | Qualif. | RRP | OST | 01/09/10 | CERN | 10.0 | 01/04/12 | 10.0 | 0.0 | 10.0 | 49.0 | | | | 0 | 0 | 8.0 | 31.0 | 10.0 | 41 |
| 25/04/12 | | | | | | | | | 0 | 0 | 49.0 | Dilatation | | 1.6 | 0 | 1.6 | 9.6 | 31.0 | 8.4 | 39.4 |
| 24/05/12 | | | | | | | | | 0 | 0 | 49.0 | 10-stack | | 1 | 0 | 1 | 10.6 | 31.0 | 7.4 | 38.4 |
| 01/06/12 | Pilot | RRP | OST | 01/04/11 | CEA | 15 | 01/06/12 | 15 | 0 | 15 | 64.0 | | | | 0 | 0 | 10.6 | 31.0 | 22.4 | 53.4 |
| 01/06/12 | | | | | | | | | 0 | 0 | 64.0 | SMC4a | dpc#2 | 2.3 | 0 | 2.3 | 12.9 | 31.0 | 20.1 | 51.1 |
| 01/07/12 | | | | | | | | | 0 | 0 | 64.0 | RMC1 | 1dpc | 3.9 | 0 | 3.9 | 16.8 | 31.0 | 16.2 | 47.2 |
| 01/08/12 | | | | | | | | | | | 64.0 | SMC4b | dpc#2 | 2.3 | 2.3 | 0 | 19.1 | 28.7 | 16.2 | 44.9 |
| 19/09/12 | | | | | | | | | 0 | 0 | 64.0 | Fresca2 | dpc34-1 | 12 | 0 | 12 | 31.1 | 28.7 | 4.2 | 32.9 |
| 01/02/13 | Prod. | PIT | Bruker | 01/06/12 | CEA | 25 | 01/02/13 | 25 | 25 | 0 | 89.0 | | | | 0 | 0 | 31.1 | 53.7 | 4.2 | 57.9 |
| 01/02/13 | Prod. | RRP | OST | 01/06/12 | CEA | 25 | 01/02/13 | 25 | 0 | 25 | 114.0 | | | | 0 | 0 | 31.1 | 53.7 | 29.2 | 82.9 |
| 07/05/13 | | | | | | | | | 0 | 0 | 114.0 | Fresca2 | dpc12-1 | 10.6 | 0 | 10.6 | 41.7 | 53.7 | 18.6 | 72.3 |
| 04/06/13 | | | | | | | | | 0 | 0 | 114.0 | Fresca2 | dpc34-2 | 12 | 0 | 12 | 53.7 | 53.7 | 6.6 | 60.3 |
| 02/09/13 | | | | | | | | | 0 | 0 | 114.0 | Fresca2 | dpc12-2 | 10.6 | 0 | 10.6 | 64.3 | 53.7 | -4.0 | 49.7 |

# Is the schedule credible?

- *To minimize any possible delay of the program, the EuCARD-HFM team should take full advantage of the work presently underway at LBNL. Currently, coil windings for HD3 are taking place. We recommend that key engineers and designers observe in person the most critical steps of HD3 coil fabrication at LBNL in order to learn firsthand the details and subtlety of coil fabrication.*
  - Several visits done + we are profiting from a recruitment

- *As stressed before, the construction of each double pancake and the assembly process need to be assessed through the construction of dummy coils and a mechanical model. These activities are time consuming and should be supported by the maximum possible effort to successfully achieve the final milestone.*
  - See schedule: we know that every step is time consuming, the official end of EuCARD is not a brick wall.
  - Following the Jan 2011 review the deliverables were redefined
    - Test structure with 1 SC double pancake by April 2013
    - Outside EuCARD: test full magnet by Dec 2013