

FROM RESEARCH TO INDUSTRY



TASK 10.3 : 5T HTS DIPOLE MAGNET DESIGN AND CONSTRUCTION

Kick off meeting WP 10

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14/06/2013

Subtask 10.3.1 HTS accelerator magnet design

- Explore magnet concepts suitable for HTS cable and ribbon based conductors providing magnetic field of accelerator quality in view of the 20 T HE-LHC dipole.
- Compare saddle winding design with block winding design. Study the maximum attainable stress level in both magnetic configurations.
- Adapt the protection scheme of superconducting magnet to the use of HTS conductor.

Subtask 10.3.2 Bi-2212 magnet developments

- Design and manufacture a prototype magnet using Bi2212 cable. This prototype will be intended to manage the wind and react manufacturing operation and to determine the highest stress allowable on such a cable.
- Bi-2212 dipole prototype must be designed to achieve 5T alone, or 20T as an insert, or to measure the limiting stresses on this material.

Subtask 10.3.3 YBCO magnet developments

- Design and manufacture an accelerator like prototype magnet using YBCO tape based conductor carrying at least 5kA at 4.2 K and 20 T.
- Study field homogeneity and current redistribution in the ribbon based conductor.
- Develop and test thin (5-30 μm) insulation systems compatible with coil epoxy impregnation.

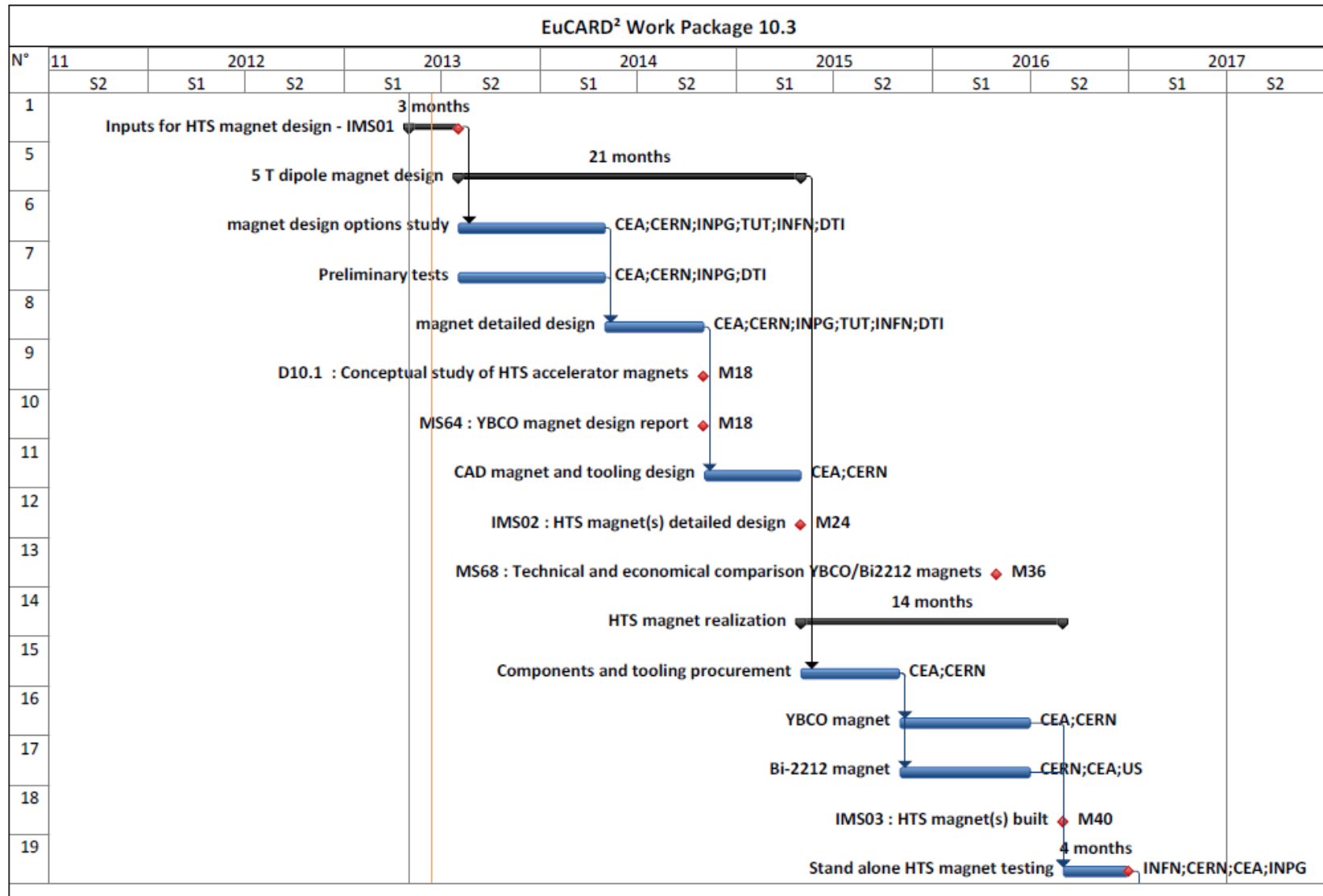
EuCARD² Deliverable and milestones

- | | | |
|--|-----|------------|
| <ul style="list-style-type: none"> ■ D10.1 Conceptual study of HTS accelerator magnets (report) The report must contain all key elements of the novel magnet design, considering electromagnetics, mechanical, thermal, stability and protection aspects. | M18 | 31/10/2014 |
| <ul style="list-style-type: none"> ■ MS64 YBCO magnet design report | M18 | 31/10/2014 |
| <ul style="list-style-type: none"> ■ MS68 Technical and economical comparison YBCO/Bi2212 magnets | M36 | 30/04/2016 |

Internal milestones proposal

- | | | |
|--|-----|------------|
| <ul style="list-style-type: none"> ■ IMS01 Inputs for magnet HTS design <ul style="list-style-type: none"> ■ HTS dipole constraints ■ Bi2212 conductor objectives ■ YBCO conductor objectives | M3 | 31/07/2013 |
| <ul style="list-style-type: none"> ■ IMS02 HTS magnet(s) detailed design | M24 | 30/04/2015 |
| <ul style="list-style-type: none"> ■ IMS03 HTS magnet(s) built → D10.4 for task 10.4 : Magnet Cold test | M40 | 31/08/2016 |
| | M44 | 31/12/2016 |

SCHEDULE PROPOSAL



PARTICIPANTS (FROM BUDGET FILES)

| Beneficiary short name (all costs in €) | Person-Months on Task 10.3 | Consumable and prototype direct costs | Travel direct costs |
|--|---------------------------------------|--|--------------------------------|
| CERN | 24 | 150 000 | 12 000 |
| CEA | 34 | 150 000 | 8 000 |
| INPG | 19 | 12 000 | 4 000 |
| INFN | 4 | | 2 000 |
| TUT | 10 | | 10 000 |
| DTI | 8 | 20 000 | 4 000 |
| | | | |
| Total: | 99 | 332 000 | 40 000 |

CEA

- Maria Durante, maria.durante@cea.fr, HTS magnets, link with Tasks 10.2 and 10.4
- Philippe Fazilleau, philippe.fazilleau@cea.fr, design, protection studies
- Mélanie Devaux, melanie.devaux@cea.fr, design options studies, magnet realization
- Jean-Michel Rey, j-m.rey@cea.fr, design option studies
- 2 engineers for electromagnetics and mechanical design, tbd
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CERN

- Glyn Kirby , Glyn.Kirby@cern.ch, overview structural assembly ideas, main CERN contact
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- 1 coating/insulation expert tbd
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WP10.3 CONTRIBUTIONS

| Institute | CEA | CERN | INPG | TUT | DTI | INFN |
|-------------------|---|--|---|---|---|---|
| Contact | Maria Durante | Glyn Kirby | Pascal Tixador | Antti Stenvall | Nikolaj Zangenberg | Giovanni Volpini |
| Activities | <p>Design and construction of YBCO made coil, development of proper technology</p> <p>Participation to design of Bi-2212 coil</p> | <p>Design and support to construction of the YBCO</p> <p>Design and construction of Bi-2212 coil in the collaboration with USA, development of proper technologies</p> <p>System for magnetic measurement evaluation</p> | <p>Design of HTS coils</p> <p>Analysis of e.m. behavior</p> <p>Development of technology (small coils for investigation, tests under high fields)</p> | <p>Modeling of HTS coils both YBCO and Bi-2212</p> <p>Quench analysis and protection evaluation</p> | <p>Development of insulation technology for YBCO conductor</p> <p>Fabrication and test of samples and then of all tapes/cables</p> <p>Study of extension to Bi-2212</p> | <p>Quench computation</p> <p>Link to test boundary conditions</p> |

To start magnet design options studies we need :

- to know the objectives for YBCO and Bi-2212 **conductors** as a starting point for magnet design options
- to define the **parameter list** for the magnet(s)
- to define **preliminary tests** necessary to validate possible design options (modulus measurements, bending tests, Ic measurements under compression, joints configuration, ..)
- **An initial phase of studies of magnet configurations should start this summer.**
- We would like to organize a **brainstorming meeting** (face-to-face or video) before the end of July. The objective is to share and discuss our ideas and experiences on HTS magnets and produce a state of the art picture, with a set of magnet configuration options to be studies in the following months.
- Please let us know your availability for a video conference **between July 18th and July 25th.**

THANKS FOR YOUR ATTENTION

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