



Eucard2 – WP10 Future Magnets



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WP10 kick off meeting

CERN, 14 June 2013

Budget

(total and EU funding)

Beneficiary	Total Person-Months	Total Personnel direct costs	Total Personnel indirect costs	Total Sub-contracting cost	Total Consumable and prototype direct costs	Total Travel direct costs	Total Material and travel indirect costs	Total direct costs	Total indirect costs	Total costs (direct + indirect)	Total EC requested funding
CERN	86	812,232	487,339	-	442,000	54,500	297,900	1,308,732	785,239	2,093,971	159,977
CEA	40	238,916	150,517	-	160,000	17,000	-	415,916	150,517	566,433	241,231
INPG	43	141,384	84,830	-	12,000	8,000	12,000	161,384	96,830	258,214	93,603
INFN	39	144,495	86,697	-	113,000	11,000	74,400	268,495	161,097	429,592	155,727
KIT	16	94,224	100,800	-	80,000	10,000	-	184,224	100,800	285,024	106,850
SOTON	12	67,260	59,861	-	40,000	7,000	-	114,260	59,861	174,121	66,271
UNIGE	12	109,872	65,923	-	50,000	4,000	32,400	163,872	98,323	262,195	95,046
UT	20	131,580	78,948	-	50,000	8,000	34,800	189,580	113,748	303,328	109,956
BHTS	38	223,782	304,344	-	150,000	4,000	-	377,782	304,344	682,126	219,114
TUT	12	37,752	22,651	-	-	12,000	7,200	49,752	29,851	79,603	28,856
DTI	10	66,687	46,681	-	20,000	6,000	-	92,687	46,681	139,368	53,758
TOTAL:	328	2,068,184	1,488,592	-	1,117,000	141,500	458,700	3,326,684	1,947,292	5,273,975	1,330,389

The Eucard2 Collaboration, through the steering committee, has the right to modify the assignation of EU funding (the last 45%) according to change of scope or to lack of engagement of a partner.

Task 10.1 Coord

- **CERN: Lucio Rossi, WP and task 10.1 Coordinator; G. de Rjik:** General mgmt and coordination between WPs; Budget follow up; Secretariat & Archiving; keep list of Publications; Webpage and Indico support; Organization of General Meetings; organize relation with USA and JP collaborators; put in place roadmap to select between YBCO and Bi-2212; Organize the test as insert in a HF facility.
- **CEA (Philippe Fazilleau, WP and task 10.1 deputy Coordinator):** Reporting both internal and for EU; Control of MS and Deliverables (with their reports). Webpage (content) with task leaders; Relation with TIARA and other relevant EU projects; Organization of the Steering Committees of the WP **(10 per year, also via video)** and reviews (to be decided).

Task 10.2 Conductor

- **CERN (Luca Bottura, task 10.2 leader, Amalia Ballarino):**
Tech specs of HTS; Planning and Procurement of material: Powder (Nexans) and then Bi-2212 wire , through USA collaboration; YBCO : additional order to Bruker (about 5 km of final specs). Provide a parameters for downselection among Bi-2212 and Ybco
Measurements on strands/tapes: I_c , M vs T, B ;
metallurgy measurements (synchrotron X-ray)
Tech Specs of cables; cabling test for Rutherford Bi-2212 and cable production; Cabling test of Rooble YBCO and cable production; Measurements on cables I_c vs. B, T, ϵ_t ;

Task 10-2 cont.

- **UniGE (Carminé Senatore, Task 10.2 deputy leader)**: Measurements of: I_c , RRR, heat capacity, strain sensitivity, T_c distribution, percolation threshold, magnetic relaxation and pinning properties till 21 T. Measurements on basic material and on final conductor.
- **INPG (Pascal Tixador)**: Cable design; cable characterization (which ???) and protection; e.m. of the various cables. Also strand/tape?

Task 10.2 – cont.

- **KIT (Wilfried Goldacker, Anna Kario):** development of Roebel Coated Conductor Cable prototypes (short and medium samples (5m); Material Processing of YBCO tapes with striation (short samples); Characterization of mechanical and electrical properties of strands/tapes and cables with respect mechanical deformation (bending (77 K), torsion and tensile (4.2 K)) and ability for winding process.
- **Univ. of Twente, UT (Marc Dhallé,...):** Wire and cable mechanical characterization: I_c vs ε_l , ε_t (Pacman, Tarsis probe) J_c until 20 T, M (DC and AC), and interstrand resistance (both measurements and modelling).

Task 10.2 – Cont.

- Univ. of South Hampton SOTON (Yifeng Yang,...): Measurement of M and AC losses on wire/tapes and cables vs temperature (4-80 K).
- INFN-LASA (Giovanni Volpini): I_c measurement on wires/tapes and cable till 15 T, vs temperature.
- Bruker HTS (Alexander Usoskin): Development of process of YBCO tapes and production of tapes for the collaboration (about 5 km of 4mm mm wide tape equivalent) for RF&D, studies and tests.
- CEA (Philippe Fazilleau): observer, connection to task.10.3

Task 10.3 - Magnet

- **CEA (Maria Durante, Task 1.3 Leader)** : Design (in broad sense, FQ included) and construction of Ybco made coil, developing all necessary technology (insulation, stress restrain, joints, etc.), etc.. Participation to design of Bi-2212 coil. Goal are 5 T with large margin in stand alone and design of system for stress restrain in the background field of 12-15 T (to approach 16-20 T total)
- **CERN (Glyn Kirby, deputy Task 10.3 Leader)** : Design (especially for FQ) and support to construction of the YBCO; Design and construction of Bi-2212 coil in the collaboration with USA, with development of proper technologies (Insulation, joints, stress retain, etc.). System for magnetic measurement evaluation.

Task 10.3 cont.

- **Grenoble-INP (Pascal Tixador)**: Design of HTS coils, analysis of e.m. behaviour, development of technology (small coils for investigation, tests under high fields)
- **Tampere University of Technology, TUT (Antti Stenvall)** : Modelling of HTS coil both YBCO and Bi-2212, Quench analysis and protection evaluation
- **Danish Technological Institute, DTI (Nikolaj Zangenberg)**: development of insulation technology for coated conductor, both gel and epoxy; fabrication and test of sample and then of all tapes/cable; study of extension to Bi-2212.
- **INFN (Massimo Sorbi)** : Quench computation and link to testing boundary conditions.

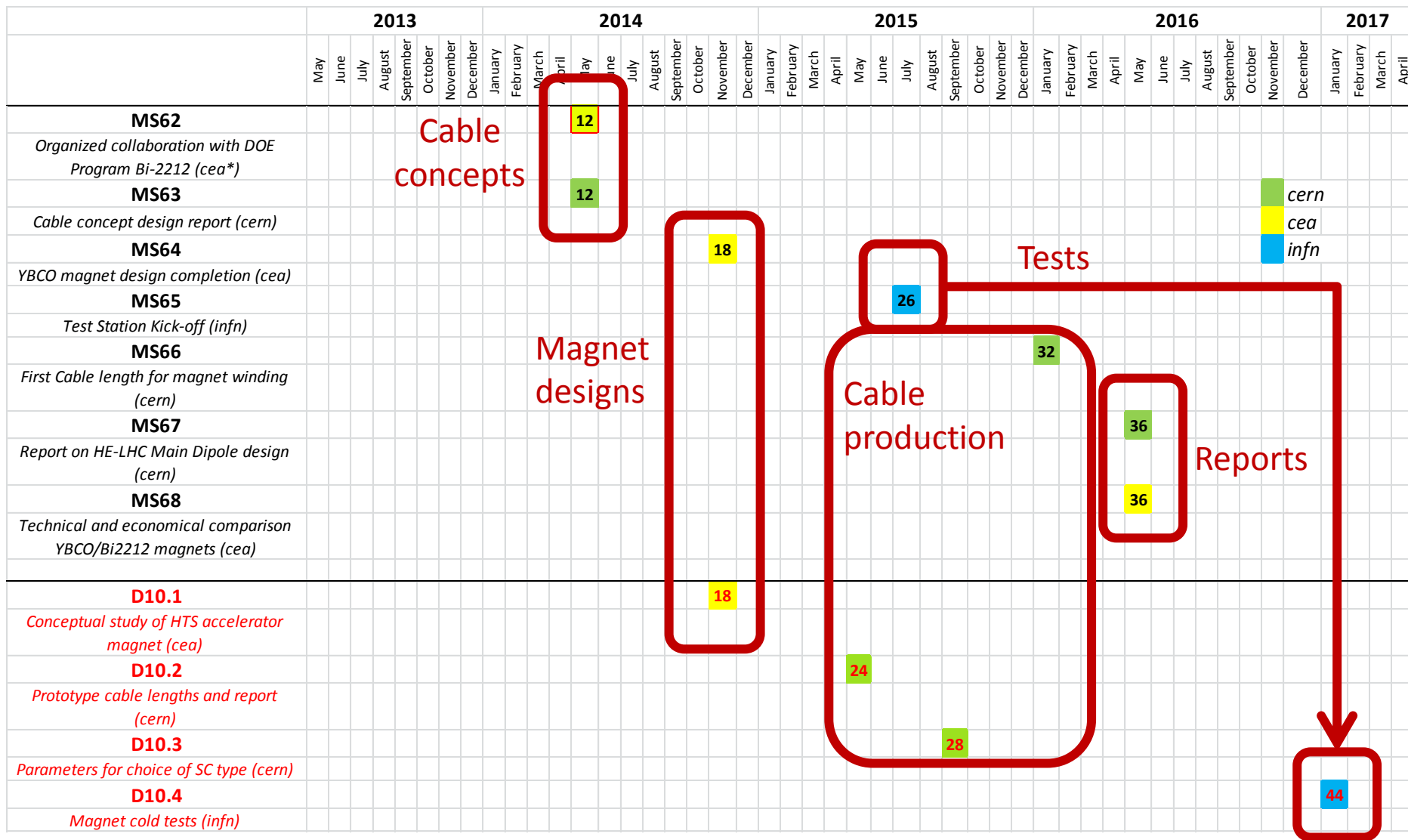
Task 10.4 standalone test

- **INFN (Giovanni Volpini Task 10.4 Leader)** : Preparation of test station at 4.2 K, with adaptation and upgrade of existing facility at LASA; Data acquisition and first analysis of results.
- **CERN (Marta Bajko Task 10.4 deputy leader)** : Participation to test, providing some equipment (possibly quench antenna, magnetic measurements, fiberglass for temperature and stress monitoring)
- **CEA (Maria Durante)**: participation to test and analysis
- **Tampere University of Technology, TUT (Antti Stenvall)** : participation to test and analysis
- **Danish Technological Institute, DTI (Nikolaj Zangenberg)**: participation to test and analysis

Job to do next weeks (10 July 2013)

- Put in order listings and have it on web in a usable form...
- Make nice format for presentation and documents with logos of all WP10 Institutes...
- Launch formal agreement with FSU (D. Larbalestier) in form **of simple MoU** to signed by CERN in name of Eucard2 for the Bi-2212 collaboration (with clause to make easy to exchange material, and personnel).
- I remind you the politics for publication. Of course each one is owner of its own work but this is a collaborative effort: **in doubt better to co-author than to exclude.**
- IP: respect the rules of the CA.

Schedule of WP10



From the « DOW Eucard² » dated: 2013-02-13

Milestones

Milestone number ⁵⁹	Milestone name	Lead beneficiary number	Delivery date from Annex I ⁶⁰	Comments
MS62	Organized collaboration with DOE Program Bi-2212	cea 6 (cern)	12	Report
MS63	Cable concept design report	cern 1	12	Report
MS64	YBCO magnet design completion	cea 6	18	Report
MS65	Test Station Kick-off	infn 19	26	Report
MS66	First Cable length for magnet winding	cern 1	32	Prototype
MS67	Report on HE-LHC Main Dipole design	cern 1	36	Report
MS68	Technical and economical comparison YBCO/Bi2212 magnets	cea 6	36	Report

- Concerns only the « official » milestones with EU,
- Reports should be 1 to 2 pages,
- milestones « alarm » in charge of coordination, 2 months before,
- MS62 driven by cern, but cea is mentionned
- « sub » milestones : presented in the tasks description

Deliverables

Deliverable Number ⁶¹	Deliverable Title	WP number ⁵³	Lead beneficiary number	Estimated indicative person-months	Nature ⁶²	Dissemination level ⁶³	Delivery date ⁶⁴
D10.1	Conceptual study of HTS accelerator magnets	10	cea 6	20.00	R Report	PU	18
D10.2	Prototype cable lengths and report	10	cern 1	20.00	R Report	PU	24
D10.3	Parameters for choice of SC type	10	cern 1	20.00	R Report	PU	28
D10.4	Magnet Cold test	10	infn 19	40.00	R Report	PU	44

Deliverables

D10.1) *Conceptual study of HTS accelerator magnets*: The report will contain all key elements of the novel magnet design, considering electromagnetics, mechanical, thermal, stability and protection aspects. (Task 10.3) [month 18]

D10.2) *Prototype cable lengths and report*: This is the first unit length of 10 kA class HTS cable, usable for characterization and short winding tests. (Task 10.2) [month 24]

D10.3) *Parameters for choice of SC type*: The outcome of a mid-term meeting is a set of parameters deemed important for the decision between the two SC materials (Bi-2219 and YBCO) and the criteria on which to make a successful choice. (Task 10.1) [month 28]

D10.4) *Magnet Cold test*: The test will include: warm measurements, cold down, electrical quality assurance at cold, power test, training curve, magnetic measurements and finally re-training for memory effects (Task 10.4) [month 44]

- Reports should be 6 to 10 pages, main goal is to demonstrate the work is achieved (references to detailed reports or papers)
- Very limited number of deliverables, importance of being on time,
- deliverables « alarm » in charge of coordination, 3 months before,

Technical program - 1

- Development of YBCO cable (real cable) will take time. Task 10.2 needs certainly more time to get usable cable.
- While YBCO is our PRIMARY choice (**following Eucard and the fact that EU Industry is on YBCO**), I would suggest to start with Bi-2212 cable. We are providing advanced powder form Nexans to ASC-FSU.
 - Design cable, magnet and tooling for a Bi-model in cos θ (alternative ideas to be considered but we need to get early a real **model magnet**)
 - Rutherford Cable «easy»; stresses for first coil (5 T minimum field) can be not excessive
 - Ask USA a design in // to ours for a similar size CCT magnet
 - We can share all magnet technology with USA (+ advanced)
 - Test and comparison (we can test also at variable temperature!!! And measure losses.

Technical program - 2

- YBCO: concentrate on material development ($\uparrow J_c$ with $B//c$) and on cable configuration
 - Cable development is going to be long
 - But we need to start now!!!
 - Vigorous program with Roebel
 - Conceptual study for layout best suited to Roebel: $\cos \vartheta$, CCT? Block flat coils? Blocks with flare ends? A mix of them?
 - Who volunteer to study alternative solution?
 - Tape around channel...
 - «Desperate» Rutherford Cable made out with tape?
- Any other crazy ideas?