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EuroCirCol

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MEETING MINUTES

WP5 MEETINGS AT THE EUROCIRC COL KICKOFF MEETING

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Participants:	Akira Yamamoto; Antti Stenvall; Carmine Senatore; Clément Lorin; Daniel Schoerling ; Davide Tommasini; Ezio Todesco; Fernando Toral; Giovanni Volpini; Javier Munilla; Luca Bottura; Marc Dhalle ; Maria Durante (video); Paolo Ferracin; Pasquale Fabbriatore ; Stefania Farinon; Tiina Salmi Toru Ogitsu (video)
Link to Indico:	https://indico.cern.ch/event/395112/

Content

e-mail of participants to WP5	page 2
June 3 rd : scope & methods	page 3
June 4 th : trimming of tasks, distribution of work	page 6

E-mail of participants to WP5 (alphabetical order of institute) as known on June 5th

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June 3rd : scope & methods

First we proposed Fernando Toral as WP5 alternate coordinator, who accepted.

We went then through settling the scope, methods and reference assumptions for WP5, leaving the distribution of the work and the schedule to the sessions of June 4th.

We recall the deliverables of WP5 described in H2020-INFRADEV-1-2014-1

- 1) Explore design options for an accelerator dipole magnet producing 16 T
- 2) Identify the preferred dipole design options and perform a cost estimate
- 3) Develop a cost model (optimistic, likely and conservative)
- 4) Produce the engineering design of the selected baseline configuration

Following discussions during the WP5 meeting and the ones during the common meeting WP3-WP2-WP3, we agreed on the following choices & strategy:

- a) we consider a **single aperture** dipole magnet capable of producing 16T in a **50mm** gap, at **4.5K** with **10%** of margin on the load line. In case of a common coil version obviously the magnet is a double aperture. The choice for a single aperture comes from the consideration that at the present stage the inter-beam distance is not a leading parameter and that an initial program of twin aperture models R&D would be technically and economically un-efficient. The choice of the aperture has taken considering a common discussion with WP2 as well as cost considerations, which suggest that the gain in cost of a small decrease of the aperture would be relatively marginal with respect to the benefit of a larger aperture (dynamic aperture, clearance for beam screen and vacuum). The choice of the temperature has been taken considering that “in practice” a design capable of producing 16T at 4.5K should also be capable of producing the same field at 1.9K if required. Furthermore a margin of 10% at 4.5K roughly corresponds to a margin of 20% at 1.9K, though experience seems to suggest that it is “easier” to achieve targets at 4.5K than at 1.9K. During the first design phase, we will have to discuss whether to perform the electromagnetic and structural design referring to the short sample limit at 1.9K (about 16T+20%), to the short sample limit at 4.5K (16T + 10%), to the nominal field (16T), or else.
- b) The cost estimate will however be carried out for **double aperture** magnets;
- c) During the common meeting with WP2, the baseline injection energy has been confirmed at **3.3TeV**, corresponding to a bore field of about 1T. This level is considered appropriate for exploring the design options, at an initial stage, based on geometrical field quality. WP2 is nevertheless asking if the magnet team could provide a statement about possible implications if a much lower injection energy is chosen (**E.Todesco** offered to collect, analyze and provide data on this issue, some based on recent measurements of Nb3Sn magnets, though a detailed statement at this early stage may be non conclusive due to the complexity of the problem).
- d) we decided that, during an initial phase (the first 10 months), we will explore three options in parallel (block coil, costeta, common coil). Three institutes (CEA, CIEMAT, INFN) will explore **one option each**, treating both the magnetic and the structural aspects in **2D**. During this phase,

splitting electromagnetic and structural design between different institutes has been considered non efficient, furthermore it is a common understanding that the structural design represents a major part of the 2D work. CERN will perform a critical review of the state of the art;

- e) concerning quench protection, the three options will be explored by designing the magnets with sufficient copper to allow the protection of a 14 m long magnet keeping the maximum voltage to ground within **2kV** (to discuss, it may be needed to increase this limit or to find alternatives). On this subject we did not converge into an enthusiastic unanimous consensus: some consider that achieving 16T in a 50mm bore with accelerator field quality on a short dipole model would already be an enormous step forward with respect to the present state of the art, even if protection cannot be extrapolated to a longer magnet. We found a good compromise in deciding that we shall be ready to re-discuss this strategy in case the initial study will show that such an approach (designing a model magnet “ready to be extrapolated to a full length magnet”) is premature at this stage;
- f) also, at this stage, we consider too early to decide whether we will then have to stick to one “preferred” solution or it would be desirable (and feasible in terms of resources) to carry a complete study for two options until the end. We will take a decision and **redistribute** the work after the above initial phase;
- g) for the **conductor** we decided to consider, for the initial phase, the HL-LHC specifications, that will be specified shortly following a **dedicated meeting with the team working on conductors at CERN, UNIGE and UT**. During this meeting we will also discuss the technical details of the participation of UNIGE and UT in the conductor studies. Around spring 2016, after the initial phase, the study will continue on the basis of the best credible specification of a conductor available for delivery by 2019, when the magnet model designed though the WP5 would possibly start to be manufactured;
- h) we also discussed the need of precisely define and set the **material data** to be used for the studies: magnetic, electrical, structural, thermal ... We agreed that each task holder as well as concerned WP5 participants or informed will send to D.Tommasini the **list of data he needs**, as well as the **data he is presently using**. D.Tommasini will centralize this information, promote a critical review of the data and fill a reference repository for WP5.

We also discussed of mechanisms of **internal communication**.

We have several stages of communication:

- a) the reporting to the EU, typically based on a critical review of the activities carried during formal “**workshop meetings**” taking place twice per year. The next one is tentatively set on the days **24 and 25 November 2015**, the 24 being a general EUROCIRCOL WPs meeting (joint proposal WP2-WP3-WP5 being submitted by D.Schulte to M.Benedikt), and the 25th a specific WP5 general meeting (site and modalities to be decided)
- b) **monthly video-meetings** (next one by the end of June 2015). A monthly frequency has been judged as appropriate by most of participants. It has been suggested by many to have a specific

“recurrent” time; this will be **every last Friday of the month, at 10h00**. According to this rule, the **next video meeting will be on June 26th at 10h00**.

- c) **formal advancement meetings** (one monthly meeting out of three)
- d) **other meetings/discussions on spontaneous initiative**, where judged appropriate accompanied by a meeting report stored I the EuroCirCol web site (if it implies a travel under the EU budget a meeting report is an obligation)
- e) **in addition to the above**, D.Tommasini will explore a mechanism for centralizing a regular distribution of salient information coming from regular inputs from the task holders.

Finally, the need of settling a general forum “Towards 16T magnets” sharing information between the different high field programs (HL-LHC, FCC, EuroCirCol, US, JP ...) has been expressed.

This cannot be done “within the scope of WP5”, but the WP5 is promoting its need.

June 4th : trimming of tasks, distribution of work, planning.

As a consequence of the considerations discussed on June 3rd, it has been decided to **modify the task description of task 5.3 and task 5.4 keeping the same milestones, deliverables and manpower** : Task 5.4 and Task 5.5 have been grouped into a unique task (Task 5.4: “Magnet Conceptual Design”), and a “Conductor studies” task has been introduced as Task 5.5.

The task denominations and distribution of task leadership (some have been finalized off-line after the meeting) are summarized in Table 1, milestones and deliverables in Table 2 and 3 respectively.

Table 1: Task denominations and distribution of task leadership

Task	Denomination	Leader	Alternate
5.1	Coordination	CERN (D.Tommasini)	CIEMAT (F.Toral)
5.2	Design Options	CIEMAT (F.Toral)	CEA (C.Lorin)
5.3	Cost Model	CERN (D.Tommasini)	CEA (M.Durante)
5.4	Magnet Conceptual Design	INFN (S.Farinon)	CEA (M.Durante)
5.5	Conductor Studies	CERN (B.Bordini)	UT (M.Dhallé)
5.6	Quench Protection	TUT (A.Stenvall)	INFN (M.Sorbi)
5.7	Magnet Engineering Design	CEA (M.Durante)	CERN (D.Schoerling)

Table 2: Milestones (as in H2020-INFRADEV-1-2014-1)

Milestone	Description	Deadline
MS-5.1	WP established and hiring complete	5
MS-5.2	Baseline specifications and assumptions for accelerator magnet	10
MS-5.3	Specifications for conductors and conductor configurations	34
MS-5.4	High-field accelerator dipole conceptual design report	46
MS-5.5	Report on recommended follow-up R&D	47

Table 3: Deliverables (as in H2020-INFRADEV-1-2014-1)

Milestone	Description	Deadline
D-5.1	Overview of magnet design options	17
D-5.2	Identification of preferred dipole design options and cost estimate	26
D-5.3	Cost model (optimistic, likely and conservative)	39
D-5.4	Manufacturing folder for reference design short model	46

Considering the late start of the EuroCirCol with respect to the needs for the FCC design study, during the plenary session of the kickoff meeting M. Benedikt and D. Schulte recommended considering to internally anticipate the completion of critical milestones/deliverables. According to this recommendation, for WP 5 it has been decided to target at completing:

1. **the overview of magnet design options in 10 months, i.e. by March 31st, 2016;**
2. **the high-field accelerator dipole design report in 42 months, i.e. by November 30th, 2018**