NOTES WP5 EUROCIRCOL KICKOFF MEETINGS June 3rd and 4th , 2015

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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 **4.2K** 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 4.2K should also be capable of producing the same field at 1.9K if required. Furthermore a margin of 10% at 4.2K roughly corresponds to a margin of 20% at 1.9K, though experience seems to suggest that it is "easier" to achieve targets at 4.2K 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 4.2K (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** (we will discuss this in detail when distributing the tasks), 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 (to discuss);

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, for example every last Wednesday of the month at 14h00 or similar (still to be fixed). No obligation for a reporting, opportunity for sharing "salient news"

c) **formal advancement meetings** (could be one monthly meeting out of two, or other TBD)

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.