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Letter of Intent about a European SC RF Facility

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Abstract

The European partners of the TESLA Technology Collaboration and other interested institutions intend to propose a new European SCRF facility to be built and operated in the EU 7th Framework Program (FP7) by a collaboration of all interested European laboratories and institutes.

15 March 2006

Letter of Intent about a European SC RF Facility

To: CERN Council Strategic Planning Group

From: European partners of the TESLA Technology Collaboration and other interested institutions

Subject: European Super-Conducting RF Facility

The European partners of the TESLA Technology Collaboration and other interested institutions intend to propose a new European SCRF facility to be built and operated in the EU 7th Framework Program (FP7) by a collaboration of all interested European laboratories and institutes. This facility would permit to build and test high performance SCRF structures and to integrate them into modules.

For the last 10 years DESY together with its partners in the TESLA Technology Collaboration has been operating a major SCRF facility. Due to its age, the advancement of technology and cavity performance requirements this facility needs to be replaced by a next generation cavity preparation, assembly, and test facility in order to meet the increased requirements posed by projects like the ILC. The facility includes a considerable infrastructure such as clean rooms, cryogenics, surface preparation, ultrahigh vacuum installations, RF test equipment etc.

We intend to ask CERN to host such a facility from 2008 in close collaboration with DESY and the other European participating laboratories or institutes, thereby taking advantage of the existing CERN facilities which will gradually become available following completion of LHC construction and making the best use of the expertise developed for the construction of the XFEL. The resources necessary to build and run such a facility have still to be evaluated. A first estimate yields an amount of 30-50 M€ Taking advantage that the FP7 will, for the first time, allow the possibility of funding a new infrastructure, we intend to send a Letter of Intent to EU by the end of the year 2006, and make a firm proposal early 2007 aiming for EU FP7 resources allocation early 2008.

A world-wide analysis of the status of the SC RF technology clearly reveals that the following facts:

- Most new accelerator-based projects, in construction or recently proposed, make wide use of Superconducting RF technology. SCRF has become a key technology for advanced accelerators and is finding multiple applications in a variety of fields. This has been mainly driven by the outstanding achievements of the TESLA Collaboration over the past 10 years. As a consequence, the SCRF technology has been selected for the ILC, which will require a large number of high performance cavities.
- The dramatic improvement of the SCRF technology has only be possible because of the formation of a dedicated international SCRF infrastructure at DESY, improving on the available experience (mainly derived from LEP at CERN and CEBAF at JLAB) and allowing systematic tests that have led to a better understanding of the process involved and definition of the best preparation and fabrication procedures.
- The construction of the European XFEL in Hamburg will provide a considerable experience in the production and industrialization of a large-scale SCRF accelerator in Europe.
- The first two points notwithstanding, the R&D effort needs to be pursued vigorously to improve further the basic understanding and better control and optimize the complete process from material preparation to cavity fabrication of various designs. The aim of the R&D is a substantial further improvement of the maximum accelerating field, a reduction of its spread, as well as cost minimization.

The leading position held up to now by Europe in SCRF expertise acquired within the TESLA collaboration is challenged by the following developments:

- The existing SCRF facility at DESY has aged and no longer meets the required increased performance needs.
- The TTF accelerator has become part of a VUV-FEL user facility with limited availability for R&D,
- the XFEL at DESY is planned to be built with the technology developed so far at TTF with a focus on industrialization but without any need for major improvement of high gradients cavities,
- the US and Japan are both in the process of building new SC RF infrastructures and test facilities in order to develop their expertise in this technology and establish R&D to push SC RF beyond its present technical limitation

Because of the currently leading expertise of Europe, we are in an excellent position to significantly advance the production of SCRF cavities and modules. A European facility to build and test such structures and to integrate them into modules is urgently needed.

This infrastructure would be used to develop SCRF structures for applications primarily at the ILC, but also for high intensity protons sources such as the SPL project at CERN or others. It would also facilitate a continuous technology transfer to Industry. Such a facility would ideally complement the goals of facilities in the US and Japan. It would also provide excellent opportunities to maintain Europe's leading position in SCRF, develop the knowledge and expertise in Europe and train the new generation of accelerator experts.

The optimization of the fabrication and production process of the future generation of SC RF modules, especially for the ILC, is the key goal of the proposed program, which will encompass the following components

- high quality cavities;
- high power couplers, High-Order Mode couplers;
- tuners;
- embedded magnet package;
- Beam Position Monitors (BPM)
- cryostat vessel

Such a next generation cavity preparation facility necessitates a considerable infrastructure. It should be located in a large laboratory like CERN or DESY, where the corresponding expertise and infrastructure are largely available, thereby saving considerable expenditure. A unique opportunity opens as the facilities developed at CERN for LEP and for LHC become gradually available from 2008. These include:

- expertise in RF technology, cryogenics, ultra-high vacuum, material engineering and surface preparation;
- cryogenics installation and some of the LHC magnet test and measurement benches;
- clean rooms and surface preparation facilities for ultra-high vacuum.

For all the reasons above, we intend to propose to build and operate such a new infrastructure in the EU FP7 program by a collaboration of all interested European laboratories.

Your support for this project to both ESFRI and EU is essential to allow Europe to maintain his currently leading role in the key SCRF technology.

Date: 14 March 2006

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