Memorandum of Understanding on Computational Methods in Beam Dynamics

Between the

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Represented by Stephen Gourlay and Robert D. Ryne

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And the Division of Large Research Facilities of
Paul Scherrer Intitut (PSI), 5232 Villigen PSI, Switzerland
Represented by Leonid Rivkin and Andreas Adelmann

In recent years, the design and development of particle accelerators has become an activity involving significant international collaboration. At the same time, great strides have been made in advanced computing, particularly in regard to very large-scale parallel computations, necessary for performance optimization of present and the design of future accelerators. Given the great importance of particle accelerators, it is imperative that the most advanced high performance computing tools be brought to bear on their design, optimization, operation, and commissioning. Recognizing this, LBNL's Computational Research Division (CRD), Accelerator and Fusion Research Division (AFRD), and PSI have agreed to collaborate as follows:

Design of H5Part: LBNL/CRD, LBNL/AFRD and PSI will collaborate on future development, of H5Part. H5Part is able to store enormous data sets efficiently and also share data effortlessly between other programs and analysis tools. With H5Part a very simple file schema is defined, building on top of HDF5 (Hierarchical Data Format version 5). The API, which is oriented towards the needs of the particle physics and cosmology community, provides support for three types of common data types: particles, structured and unstructured meshes. H5part is being distributed as Open Source under a BSD-like license.

Beam Physics Simulations: LBNL/AFRD and PSI will collaborate in a theoretical and computational research program to understand space-charge effects in linear and circular accelerators as well as cyclotrons. The areas of research will include, but are not limited to, halo formation, equipartitioning, and resonance phenomena in the presence of space charge.

Code Validation Studies: Data obtained during the regular operation of the PSI cyclotrons will be used to validate accelerator modeling codes at PSI and LBNL.

Code Performance Studies: LBNL/CRD and PSI will compare the performance of the developed parallel codes on several computers in the US and Switzerland.

Modeling of 4th Generation Light Sources: Both PSI (with its FEL/LEG project) and LBNL have a strong interest in the design of future light sources. They also have a significant experience and expertise in the development of parallel computer codes for accelerator design. Building upon this foundation, PSI and LBNL will collaborate on the development and application of advanced computational tools for modeling 4th generation light sources. The near-term goal will be to develop a parallel capability for 3D multi-physics modeling of accelerators for future light sources, including space-charge, wake-field effects, coherent synchrotron radiation, and other phenomena. The long-term goal will be to develop capabilities for start-to-end modeling of 4th generation light sources.

Other areas of research: Further topics of research may be added by mutual agreement of the collaborating parties. Possible additional areas include benchmarking of a time dependent Maxwell solver (developed under a funded Ph.D. project at PSI) and research on high brightness electron guns and the transport and acceleration of ultra low emittance beams.

The collaborators will prepare a report once per year on the status of the collaboration, which will be provided to laboratory managers at the collaborating institutions.

The results of this collaboration shall be the property of the party generating such result and the generating party shall have the sole right to use and commercialize its own results, all parties shall have the right to use technical data generated by any party. However, patentable inventions are the sole property of the inventing party and use by another party shall be subject to licensing agreements which will be negotiated at a later date.

The duration of this agreement is initially for three years, after which time it can be renewed. The collaborators can withdraw from the agreement at any time if they so desire. No financial obligations will be incurred as a result of this collaboration.

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