ACCELERATOR PHYSICS AND TECHNOLOGY OVERVIEW

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Background

The 1986 Summer Study on the Superconducting Super Collider displays the maturation of work begun in a 1982 Snowmass Summer Study. Preliminary work on the possibility of a Superconducting Super Collider began in the Snowmass Summer Study of 1982.[1] Continued work was carried out within the Accelerator Physics community in general and particularly by members of the Reference Designs Study Group set up at the end of 1983. Thanks to their intense effort, the report of this group was available for the 1984 Snowmass Summer Study[2] where it served as a focus for further extensive work.[3] Subsequently, a Central Design Group was established to pursue all aspects involved in the conceptual design of a Superconducting Super Collider. Their work and that of collaborating laboratories and scientists resulted in the publication of a Conceptual Design of the Superconducting Super Collider some months prior to the 1986 Summer Study.[4] With this substantial (5 volume!) work in hand, the Accelerator Physics component of the 1986 Summer Study set for itself three goals:

I. Assist in evaluating and improving the SSC Conceptual Design from the perspective of High Energy Physics (this work to be a joint effort with High Energy Experimentalists).
II. Evaluate and improve the SSC Conceptual Design from the perspective of Accelerator Physics.
III. Advance the state of the art in Accelerator Theory and Design.

As is evidenced in the reports that follow, the members of the various Accelerator Physics Working Groups met these goals remarkably well.

Work on Making the SSC a Versatile Facility

Throughout the 1986 Summer Study there was excellent interaction and collaboration between accelerator designers and potential accelerator users. This joint effort is apparent in several reports, and particularly evident in the work of the group involved in Interaction Region Layout and Design and the group involved in Test Beams. One exciting highlight of this work is the possibility of a beam bypass that would allow great flexibility in the staging of the experimental program.

Evaluation of the SSC Design

The unanimous evaluation of the various Accelerator Physics Working Groups is that the Conceptual Design Report gets very high marks. There is every indication that the SSC can be made to work as desired. Indeed, there may even be the very attractive possibility of increasing the beam luminosity to as much as 10^{34} for certain experiments. This would make possible the search for very rare events having very distinctive signatures.

During the course of the Summer Study several areas requiring further examination were identified. However, no insurmountable difficulties are foreseen.

Advances in Accelerator Theory, Design, and Technology

As a result of the research spurred by the SSC design, there have been significant advances both in accelerator theory and technology. In the area of theory and design, substantial progress has been made with regard to computing, understanding, and controlling nonlinear orbit effects arising from sextupole and higher order magnetic multipoles. With time, the routine computation of such effects may become as common as the standard detailed computations involved in lattice design in the linear approximation.

In the area of technology, promising results have been obtained with short prototype superconducting high field dipoles, and innovative new concepts have been developed for magnet correction.

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References

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