A DATABASE FOR MODELING THE BROOKHAVEN AGS BOOSTER*

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Abstract

A Database has been developed for Brookhaven's AGS Booster and its ancillary lines which contain both design and measured physical data for the accelerator lattice and its magnets and other components. This database may then be connected to programs for modeling, permitting the programs to use any degree of desired detail from the available data with a view toward increasingly model-based control of the accelerator. These methods are expandable to include the other machines in the AGS complex.

INTRODUCTION

We have used the InterBase (TM) database soft-ware in use on the APOLLO network at the Brookhaven AGS complex to provide a database for computer modeling of the AGS Booster. The software used was that chosen for the Booster control system (for reasons of compatibility) and does not represent an individual evaluation for this purpose.

The AGS Booster project consists of a main ring (one-fourth of the size of the AGS) together with three transfer-lines: Linac-to-Booster (for proton injection), Tandem Transfer Line-to-Booster (for heavy ion injection), and Booster-to-AGS (for injection to the AGS). The needs for modeling and control of these systems provided the primary motivations for the specifications of the database.

COMPONENTS DESCRIBED

The principal components of the accelerator necessary to modeling are its magnetic elements, the rf systems and the instrumentation. The database relations describing the various properties of these components are structured to separate properties according to how generic or specific they are; thus, in the case of a magnet, some properties are maintained under the design-type (generic) while misalignments are treated as a geometric property (location-specific) and measured field errors are treated as specific to individual magnet.

Relations defined are: one database relation defines the geometry of the ring and lines--but only those properties associated with the "lattice locations" are included here; particular components in this relation are referred to by their design-type and serial-number where more specific properties are stored. Another relation contains the properties apposite to the design-type--e.g., a particular type of quad, position-monitor, etc. A set of relations, one for magnets and one for each type of instrument, contain the properties which describe a particular physical device; thus, instrument calibrations, magnetic field errors, etc. are stored here. Magnet strings--magnet-groupings operated under a single power supply and not controllable separately--are described in another relations. Finally, we have added a "model" relation to contain descriptions particular to programs such as MAD or SYNCH use to describe lattice elements.

The advantage of such a structure is that the modeler can use data available to whatever depth of detail deemed appropriate to a particular calculation--from the generic description of the design type, through inclusion of measured misalignments and detailed field measurements where the results of such a program are available. In addition, this has provided a framework for storing the results of these measurement programs in an easily accessible form.

MODELING USE

Routines developed by the Modeling and Algorithms Group utilize the data stored in these relations to produce computer models of the machine and its lines and to provide programs for the interaction between measurement devices and control of correction magnets, etc.; other routines can produce an input set to programs such as MAD or SYNCH from the lattice relations and the relations describing the various elements. These form the beginnings of a system of model-based controls.

An additional database relation containing physics constants and general machine parameters was added to ensure consistent and compatible calculations among the various modeling and control routines.

EXTENSIONS AND FUTURE EXPANSION

As this system has provided for recording and detailed description of the AGS Booster, one can extend this mechanism to the original AGS to the extent that detailed data are available (and where detailed measurements are missing by using the more generic relations for those components). The future extension of the AGS complex toward its use as an injector for the Relativistic Heavy-Ion Collider (RHIC) can easily be included in this framework with the necessary extensions.

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