

Project name

Virtual Accelerator Control Room

Classification (accelerator: subsystem)

Accelerator: Controls

Institution(s) and personnel

Indiana University, Physics Department:

Shyh-Yuan Lee (professor), Dazhang Huang (graduate student), S.S. Shei (computer specialist, CS department, Indiana University)

Argonne National Laboratory, Advanced Photon Source:

Stephen V. Milton (staff scientist), William P. McDowell (staff scientist)

Argonne National Laboratory, Argonne Wakefield Accelerator

Wei Gai (staff scientist)

Fermi National Accelerator Laboratory

Paul C. Czarapata (staff engineer)

Contact person

Shyh-Yuan Lee
shylee@indiana.edu
(812) 855-7637

and

Stephen Milton
milton@aps.anl.gov
(630) 252-9101

Project Overview

The linear collider is certain to be an international collaboration and will require a sophisticated communications network to insure timely and cost effective development of the many complex systems. In this regards, the ability to perform machine studies on remote machines is very appealing as it allows collaborators from around the world to interact in a near natural fashion while not having to leave their home laboratory.

We would like to define and test the idea of the virtual accelerator control room (VACR). As envisioned, one would be able to organize a machine studies to occur at some laboratory and would carry out the study while still at the home (remote) VACR. This would be done in close collaboration with the host laboratory and would almost certainly involve, during the course of the study, a member of the host laboratory. Some issues that need to be addressed are the definition of the virtual control room and the sociological issues surrounding this, the various protocols, voice and visual communication methods, and network security. Other issues such as response time of signals over the network or video channel delivery would also be addressed to insure that remote operation was transparent to the user and as close as one could come to being in the local control room. We envision something beyond mere remote operation; this has been possible for years.

Rather we wish to implement a true remote accelerator control room environment. This takes what has been discussed in recent Global Accelerator Network workshops such as the most recent one held at Cornell University in March 2002 (<http://www.lns.cornell.edu/public/GAN/>) and attempts to put it into practice.

Description of first year project activities

There are a number of issues that need to be addressed regarding the implementation of a virtual accelerator control room in an appealing manner. First one must clearly define and specify the interface and desired capabilities. This is very important as basic human interaction and sociology dictate certain needs and sensitivities. Interface protocols and network security measures are also needed. One finally needs to test the entire system in a realistic environment. In the first year we intend to perform all of the above.

Currently, remote operation of the APS accelerator complex as well as other accelerators is possible. This by no means should be viewed as a virtual accelerator control room. There are many items missing. Most significantly is the ability to respond in real time with a counterpart that is located elsewhere. This goes from verbal interaction to the ability to view what they are viewing to the ability to exchange notes and drawings. We would set up mechanisms to allow all of these interaction methods and so learn what works best.

High-speed network capability is the key making the virtual accelerator control room a reality. Argonne National Laboratory is heavily involved in the Globus Network project and Indiana University is a contributor to this as well. This is to be a backbone for extremely high-speed network capabilities. We would capitalize on access to this technology and on the existing resident expertise at these two institutions. Furthermore, we would attempt to use other existing technologies presently installed at ANL, Indiana University, and Fermilab whenever possible. This ranges from simple computer systems, to the network capability, to testing on the APS accelerator systems.

This idea of a virtual remote control room system is not entirely new. Successful remote operation of major scientific apparatus has already been proven. One need only look at our colleagues in Astronomy to witness a highly effective virtual control room system in action. The accelerator field is lagging behind somewhat in this technology; however, we will draw heavily on the lessons learned on these existing systems.

This is an ideal project for student participation so we are also requesting support to fund one graduate physics student year equivalent. An experiment utilizing the VACR has already been envisioned and is part of another submitted Expression of Interest (S.Y. Lee, Flat Beam Generation in Photocathode RF Guns and Advance Beam Manipulations). These would be carried out at both the Advanced Photon Source and at the A0 Facility at Fermilab. We will use these experiments to test the VACR while at the same time learn more about the generation, measurement and control of flat beams as well as the use of quadrupole-mode transfer functions in bunch compression schemes. Details of both of these are given in the above referenced EoI.

Spin-offs into future work is likely as such a capability can be used for accelerator systems other than just those related to linear colliders. In fact, this would be nicely imported to other synchrotron light sources around the world or to the beamlines contained around those machines.

Budget

All funds will be distributed through Indiana University.

Number	Item	Cost
3	Polycom Viewstation	\$12,000
2	Real time video broadcasting system	\$6,000
1	Year Graduate Student Cost (Stipend, Tuition, Insurance)	\$27,000
	Indirect costs IU (26% off site rate)	\$11,700
	Total	\$56,700