Distributed Beamline Control System at SSRL

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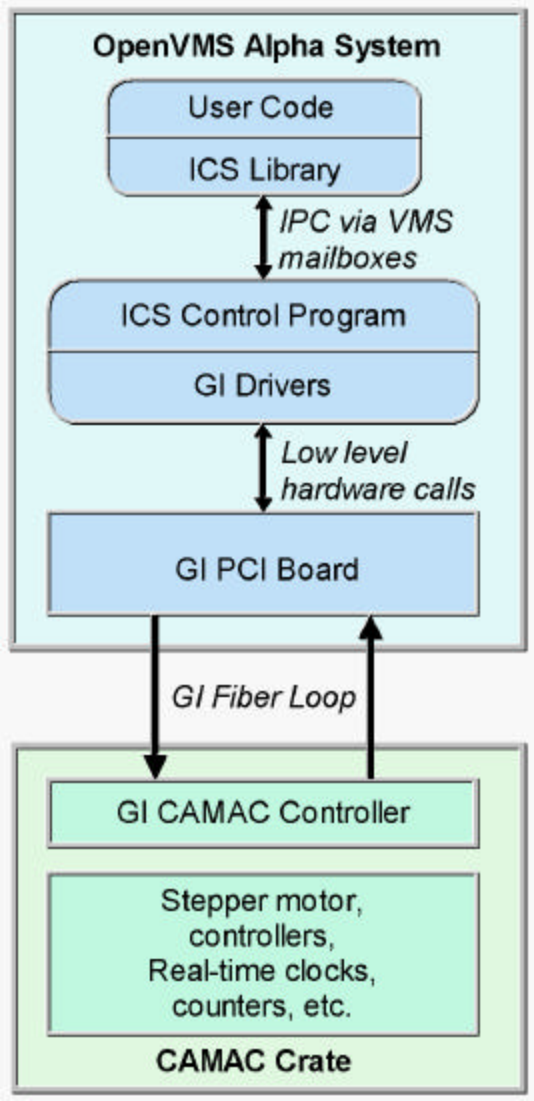
Overview

- **Introduction**
  - SSRL Beamline Control Systems
  - Specific Needs of Crystallography Beamlines
- **Distributed Control System**
  - Single Beamline Server Process
  - Multiple Hardware Hosts
  - Simultaneous User Interface Clients
- **General Purpose Control GUI**
- **Future Plans**

Current Control System at SSRL



- **CAMAC Modules**
  - Stepper motor controllers.
  - Real-time clocks, counters, etc.
- **Grand Interconnect (GI)**
  - Hosted by DEC Alpha systems running VMS.
  - Fiber optic connection to CAMAC crate(s).
- **Instrument Control System (ICS)**
  - GI driver calls wrapped in general purpose routines.
  - Asynchronous control using VMS ASTs.

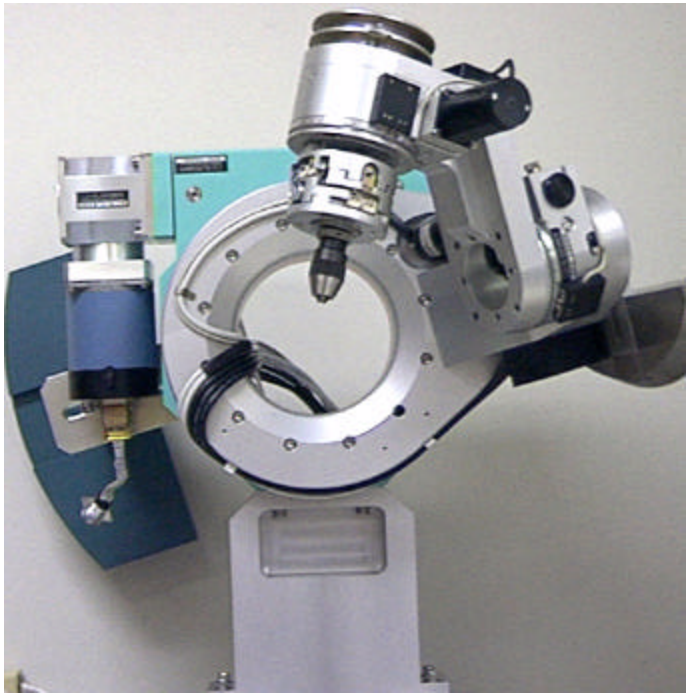
➔ **VMS Workstation Needed to Control Beamline**

UNIX Workstations Needed to Run User Interfaces

- **Data Collection Software Runs on Digital UNIX**
  - MAR 300, MAR 345 imaging plate systems.
  - ADSC Quantum4 2x2 CCD detector.
  - High capacity RAID storage system for diffraction data.
- **UNIX Workstations Used at Beamlines for Computation**
  - 500 MHz DEC Alphas running Digital Unix
  - SGI Octanes with dual R10000 CPUs running IRIX

➔ **UNIX Software Must Communicate with ICS System on VMS Machine**

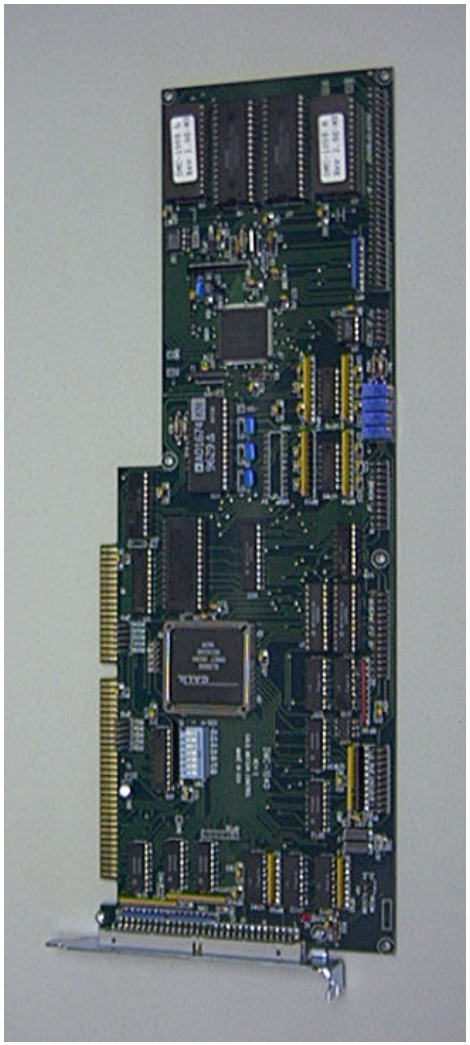
Additional Needs Of Crystallography Beamlines



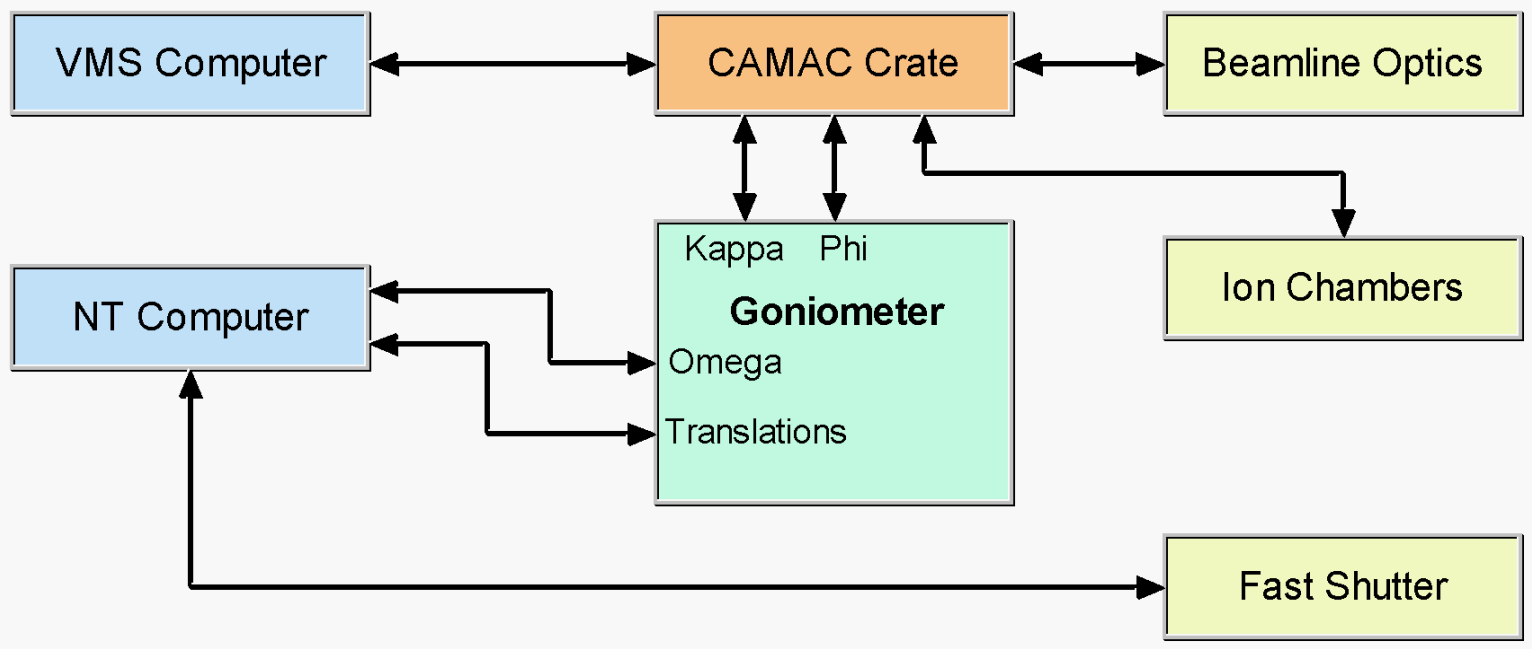
- **Huber Kappa Goniometer**
  - Translation stage driven by DC motors.
  - Omega axis may be driven by DC or stepper motors.
  - ➔ **ICS/GI/CAMAC does not support DC motors.**
- **Fast Shutters**
  - Short exposure times on BL9-1 and BL9-2 (~1 sec).
  - Need synchronization with data collection motor (< 1 msec).
  - ➔ **CAMAC timing too slow (latency > 10 ms).**

DMC-1040 Controller from Galil Motion Control

- **4 Axes DC or Stepper**
  - (1) Omega axis
  - (3) Translations
- **Digital I/O**
  - Fast shutter control
  - Additional limit switches
- **Highly Programmable**
  - S-curve profiling for smooth acceleration
  - Synchronization of shutter and omega axis on-board
- **No Device Driver to Write**
  - ISA card for PC
  - Device drivers available for Windows NT



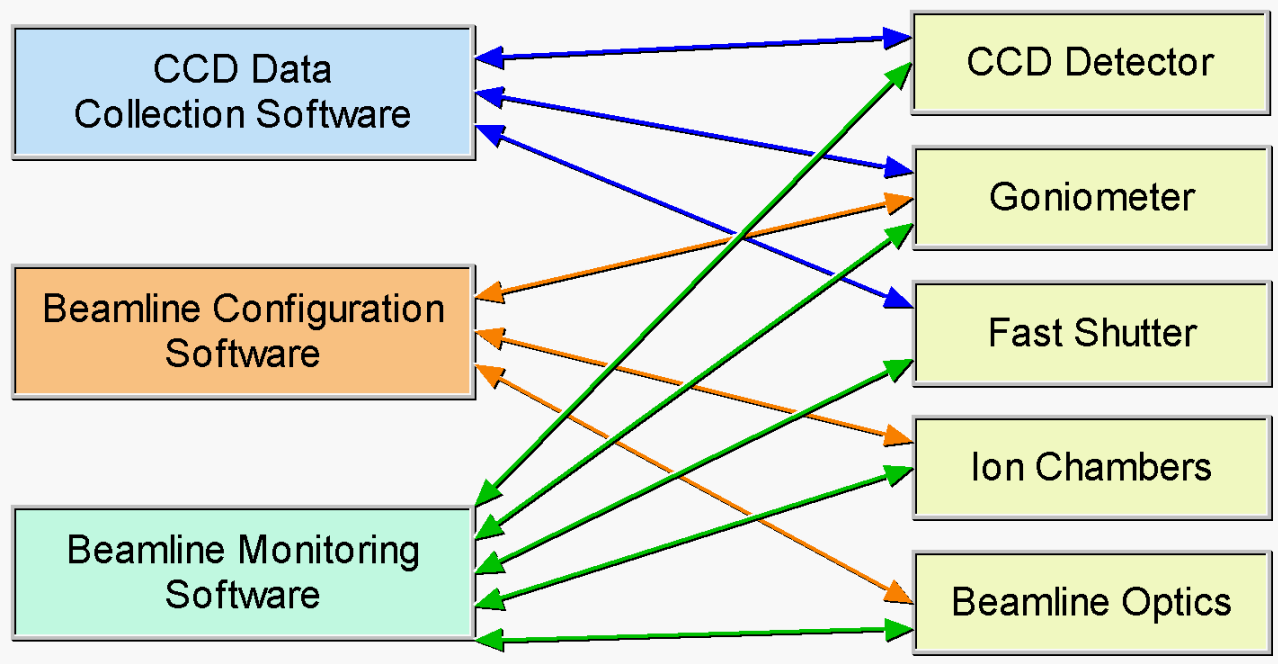
Problem 1: Multiple Hardware Hosts



➔ **Need Centralized Control of Beamline Components**

- Oversee operation of an arbitrary number of hardware hosts on multiple computing platforms.
- Maintain a single database of component positions.
- Coordinate motions and prevent collisions.

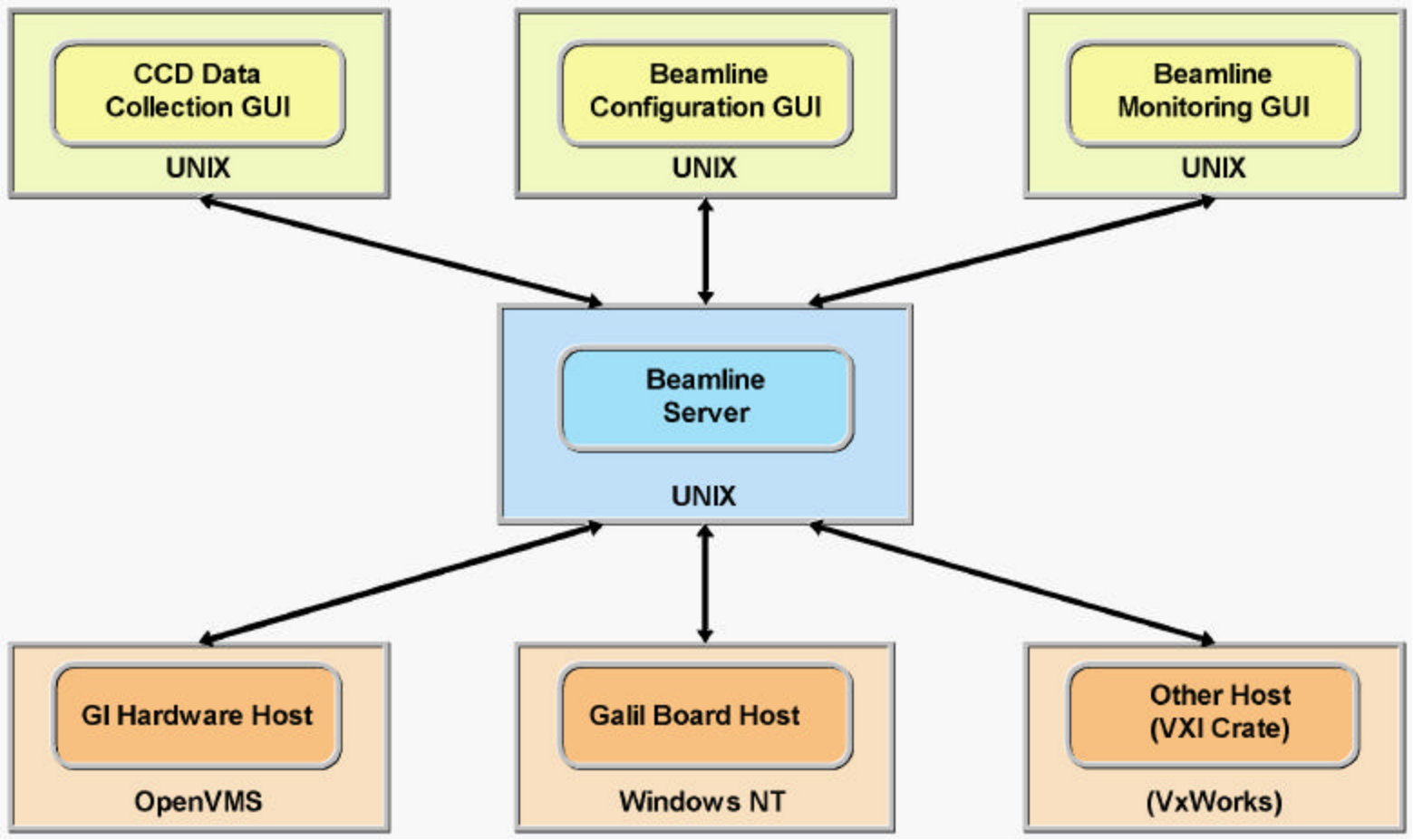
Problem 2: Multiple, Simultaneous User Interfaces



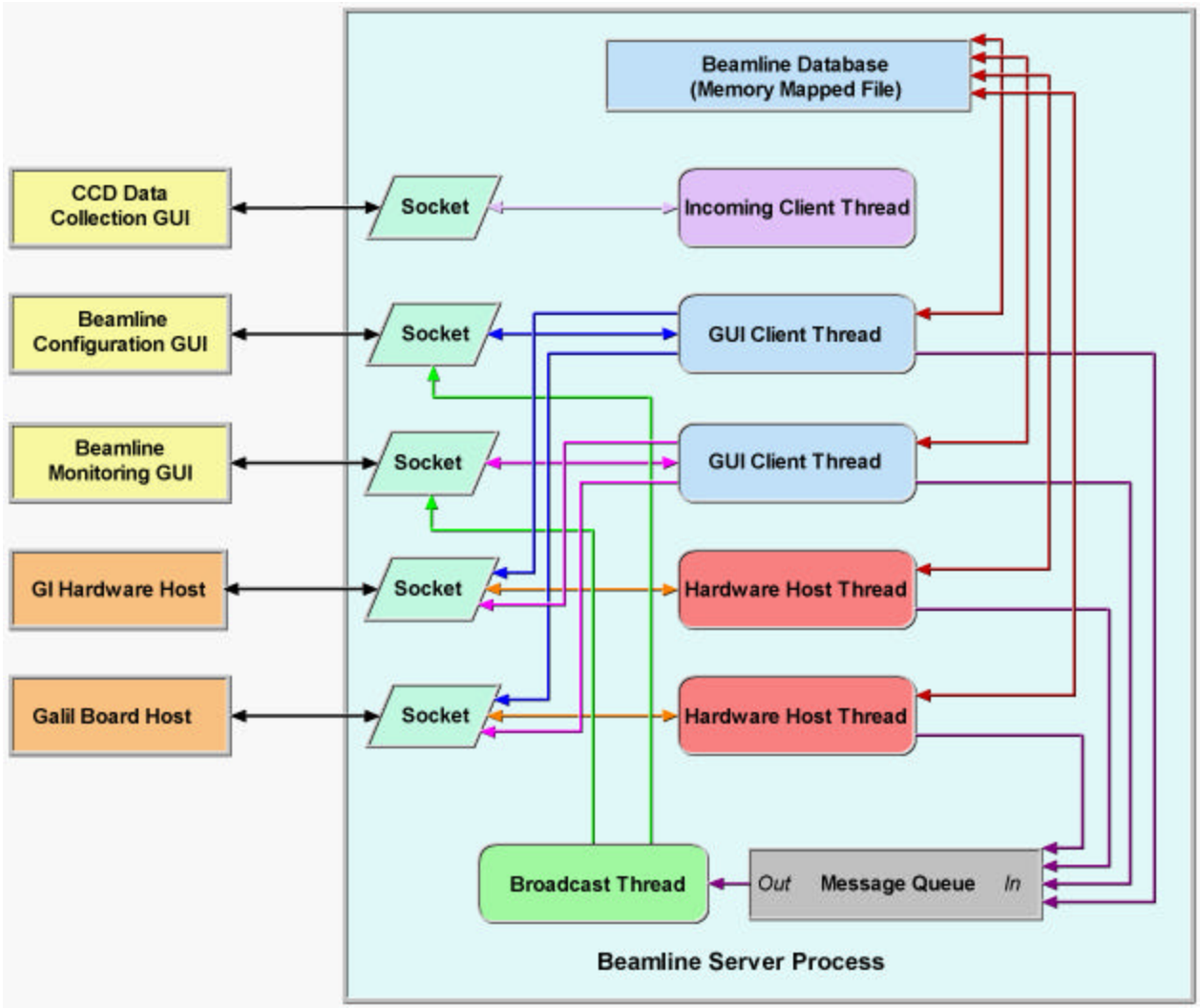
➔ Need Centralized Authorization of User Interfaces

- Prevent conflicts between user interfaces.
- Oversee transfer of control between processes.
- Allow interfaces to run anywhere on the network.
- Protect beamline from unauthorized access.

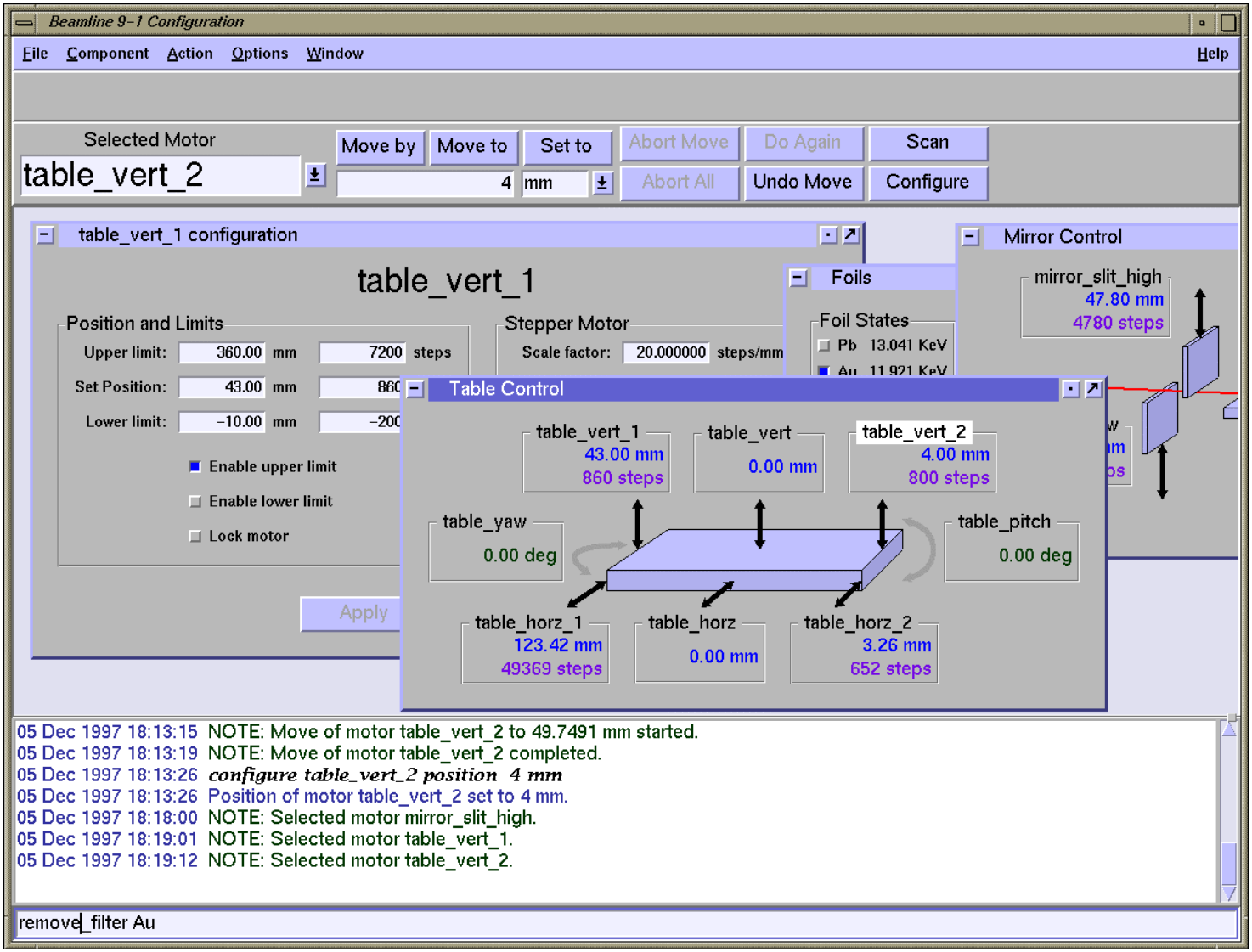
Solution: Distributed Control System (DCS)



DCS Beamline Server Process



Example: General Beamline Control GUI



Status and Future Plans

- **Rollout of Distributed Control System**
  - Initial test on BL7-1 and BL9-1, Fall 1997.
  - Full installation on BL9-1, January 1998.
  - Use in testing BL9-2, Spring 1998.
  - Installation on BL7-1, Summer 1998 shutdown.
- **Further Development**
  - Adaptation of CCD data collection software.
  - Adaptation of MAR imaging plate software.
  - Goniometer control and crash-avoidance routines.
  - Ports of server to OpenVMS and Windows NT.
  - Interface to Sean Brennan's SUPERvisor.
- **Other Applications of the DCS Paradigm**
  - Multisession data collection software.
  - Multisession data processing software.

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