

# Status of the CEBAF Control System

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*Controls Group*



# Overview

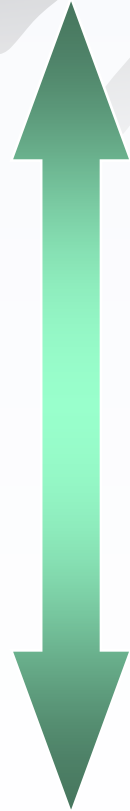
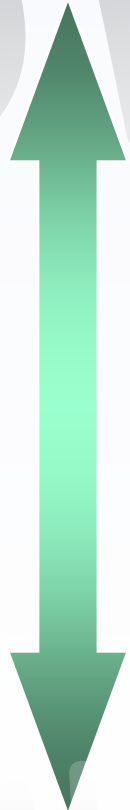
- Some measures of a control system
- CEBAF
- Control system history
- Evaluating the CEBAF control system
  - \* Front-ends
  - \* Middle tier
  - \* Operator interfaces

Collaborative

Standards-based

Commodity

Flexible



Isolated

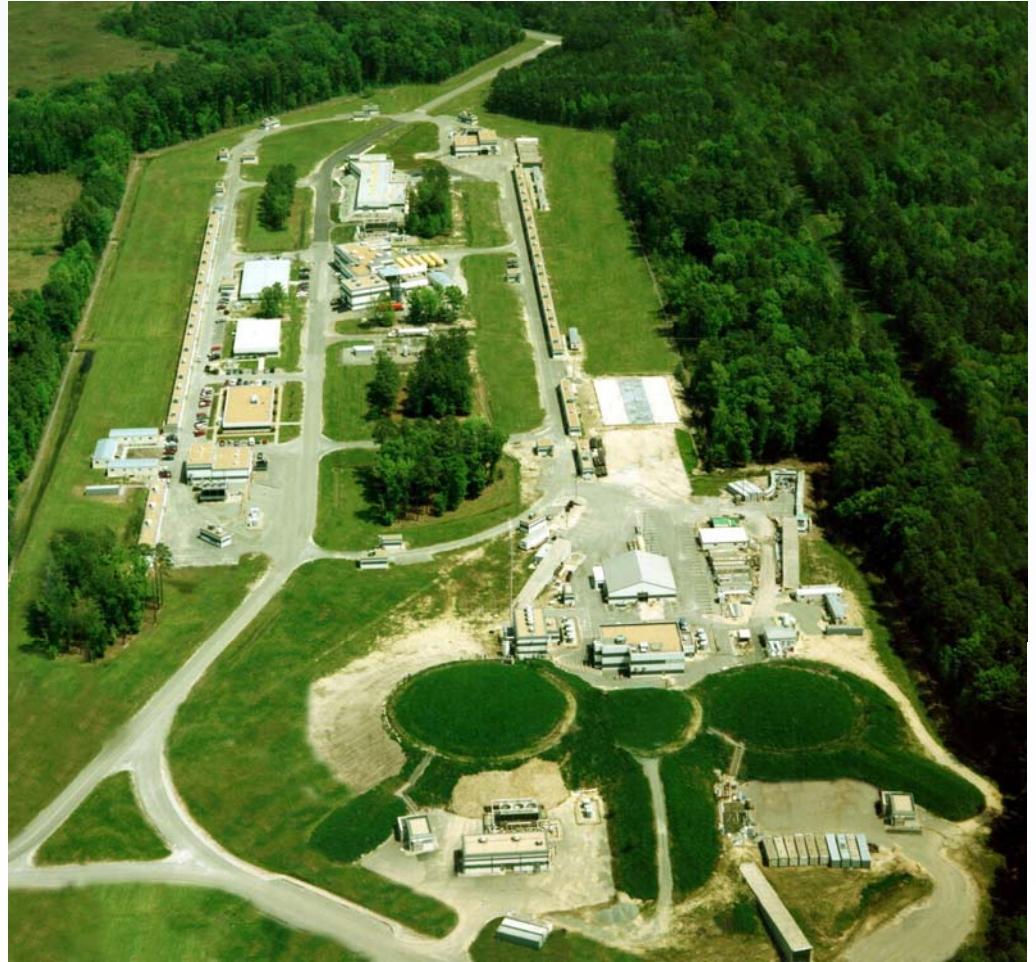
Non-standard

Single-vendor

Rigid

# CEBAF

- Multi-pass recirculation
- 6 GeV  $e^-$  beam
- 3 endstations
- 500 Mhz bunch rate (each hall)



# CEBAF Control System History

- In the early 90s, not a modern system
- Two-tiered
- Closed technology
  - \* Single-vendor computer systems
  - \* Proprietary data-acquisition and control
  - \* Proprietary network protocol
  - \* Proprietary display technology



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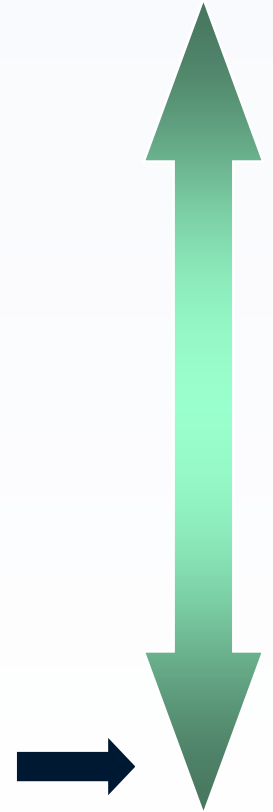
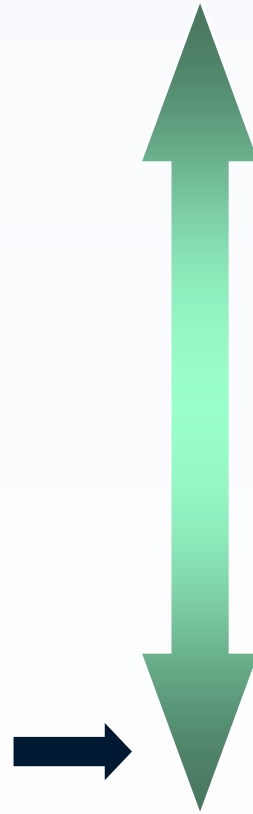
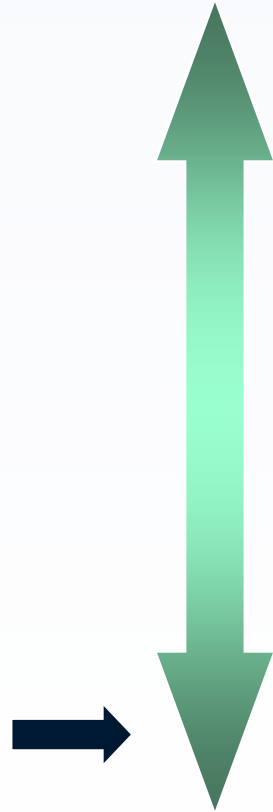


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# Current Control System

- 150 VME-based SBCs running EPICS on VxWorks
- 50,000 hardware control points
- 60 (mostly) Hewlett-Packard back-ends and servers
- 3,000 synoptic display screens
- Hundreds of applications



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# What's Wrong Now?

- VME is great for high channel density, high performance but...
  - \* Expensive for test stands and highly distributed applications
  - \* Too much overhead for one-off systems
  - \* Physically constraining
- HP makes outstanding hardware that is...
  - \* Expensive
  - \* A poor Java performer
  - \* Not well supported by vendors

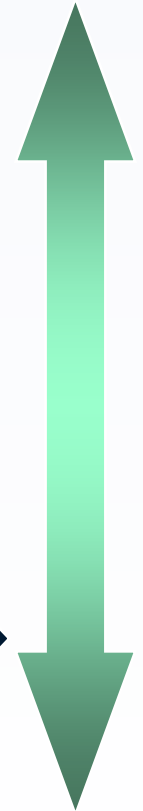
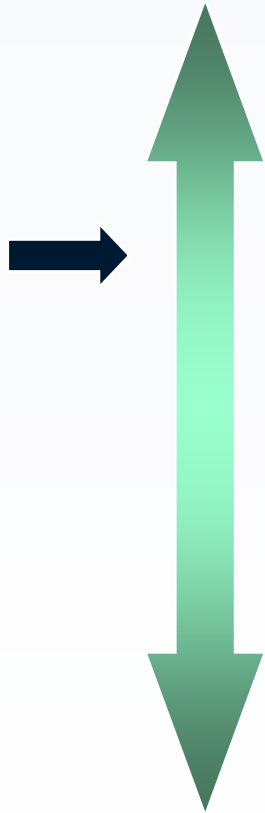


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# CEBAF Front-End Systems

- Limited variety of front-end hardware
  - \* 99% VME-based
- 12 GeV upgrade on the horizon
  - \* Requirements for new capabilities
  - \* Opportunities for substantial change

# PC 104



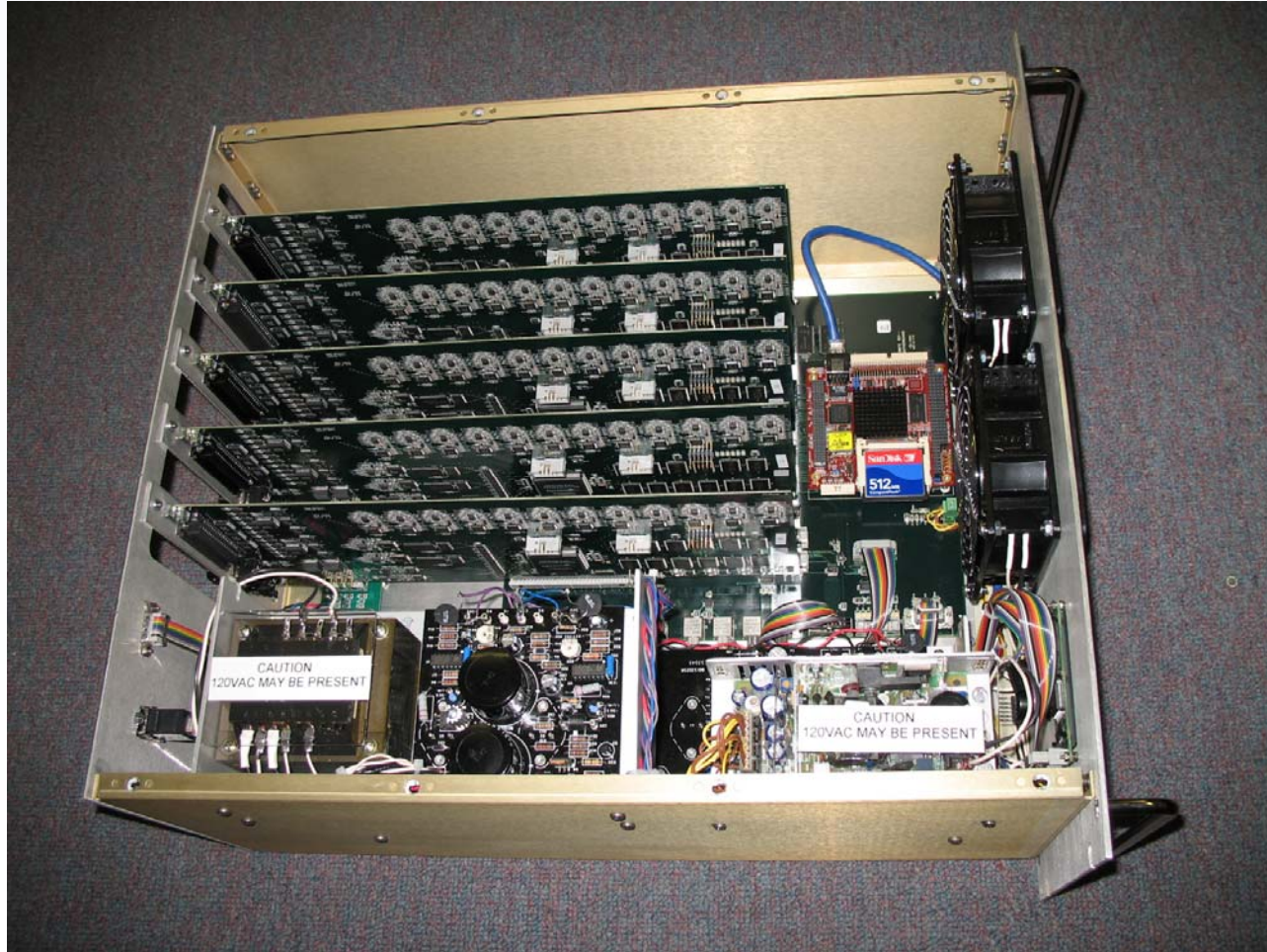
# Front-End Directions

- VME for high channel density
- PC 104 with Linux for low-determinism solutions
- PC 104 with RTEMS for real-time
  - \* Good match for the technologies
  - \* Open-source
  - \* True real-time OS
  - \* Good data throughput
  - \* RTEMS may be a long-term VxWorks replacement

# PC 104 Plans at CEBAF

- Implemented as a daughter board
  - \* Gives digital designers great flexibility
  - \* Requires only ISA (or PCI for PC 104+) connector
- Interface to fast data acquisition diagnostic system
  - \* 1-10 Mhz ADC
  - \* Clean integration into development tools and processes
- Pending success, a prototype for new digital RF system

# Fast Data Acquisition Board

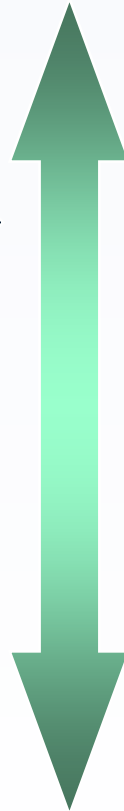
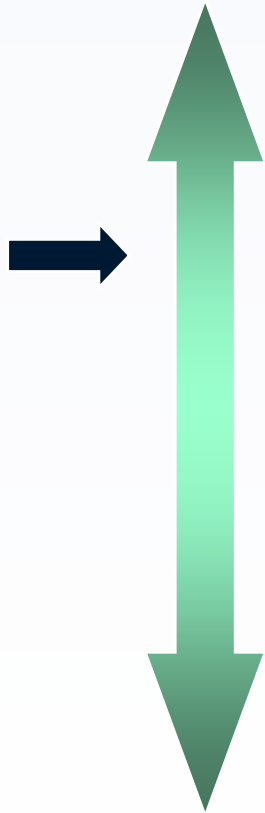


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# The Middle Tier

- Multi-processor K370s hosted all services six years ago
  - \* File server
  - \* Physics modeling
  - \* Archiving
  - \* Name services
- HP hardware and support are expensive





# A Flexible Environment

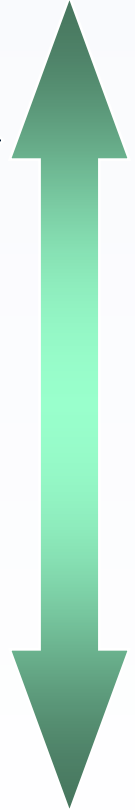
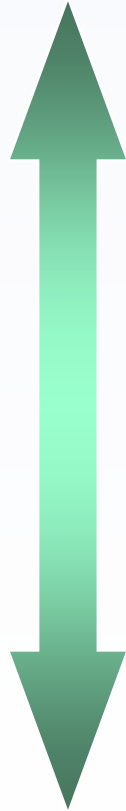
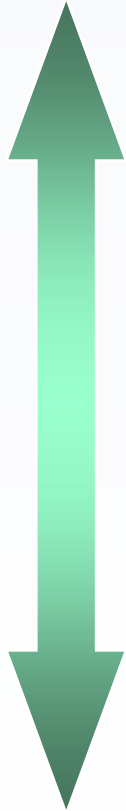
- Server computers can be OS-agnostic
- Match hardware capabilities against requirements
  - \* Sun hardware running Solaris
    - File server
    - Oracle database server
  - \* Linux
    - Archiving
    - Model server
    - Name services
    - Gateways
    - Proxy IOCs

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# Control System Back Ends

- Operational environment entirely HP
  - \* No HP-specific technologies in use
  - \* Architecture-transparent user and development environment
    - Uniform presentation layer for users
    - Eliminates OS-specific software build tools
- Future lies with Linux
  - \* Price/performance
  - \* Worldwide acceptance
  - \* Standard architecture



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# Control Room Display Wall

- Big, expensive PC
- Displays up to eight video feeds
  - \* Viewers
  - \* Synchrotron light monitors
  - \* Oscilloscope output
  - \* Cameras (future)
- Programmable
  - \* Window management
  - \* Video tuning (contrast, brightness, cropping, hue)

# CEBAF Control Room



# Summary

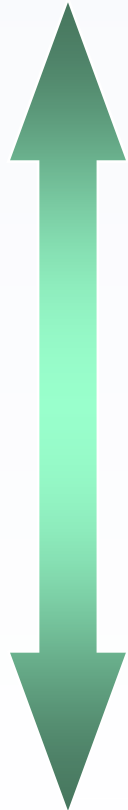
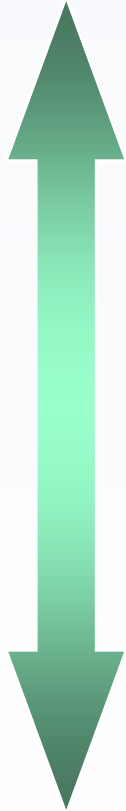
- **Cost effective, robust control system**
  - \* Collaborative
  - \* Standards-based
  - \* Commodity software and hardware
  - \* Flexible for users
- **CEBAF is part of the way there, with the path towards utopia ahead**

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