Cornell University
Laboratory for Elementary-Particle Physics

LEPP Site Report

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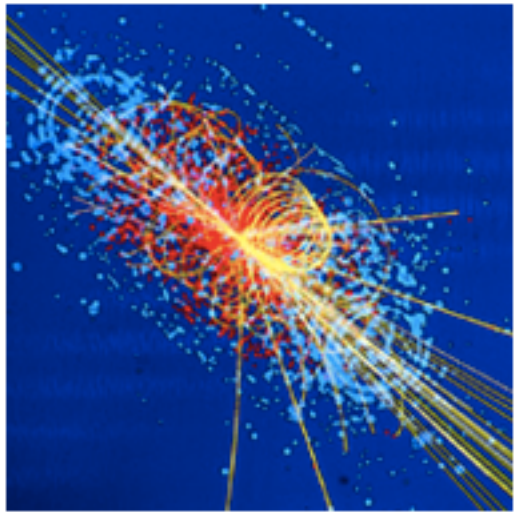
Research at LEPP

http://www.lepp.cornell.edu/Research/

Accelerator Physics: LEPP accelerator physicists are extending the capabilities of accelerators in particle physics and X-ray science.



Particle physics at the energy frontier: The Large Hadron Collider and the International Linear Collider will explore nature at unparalleled energies.

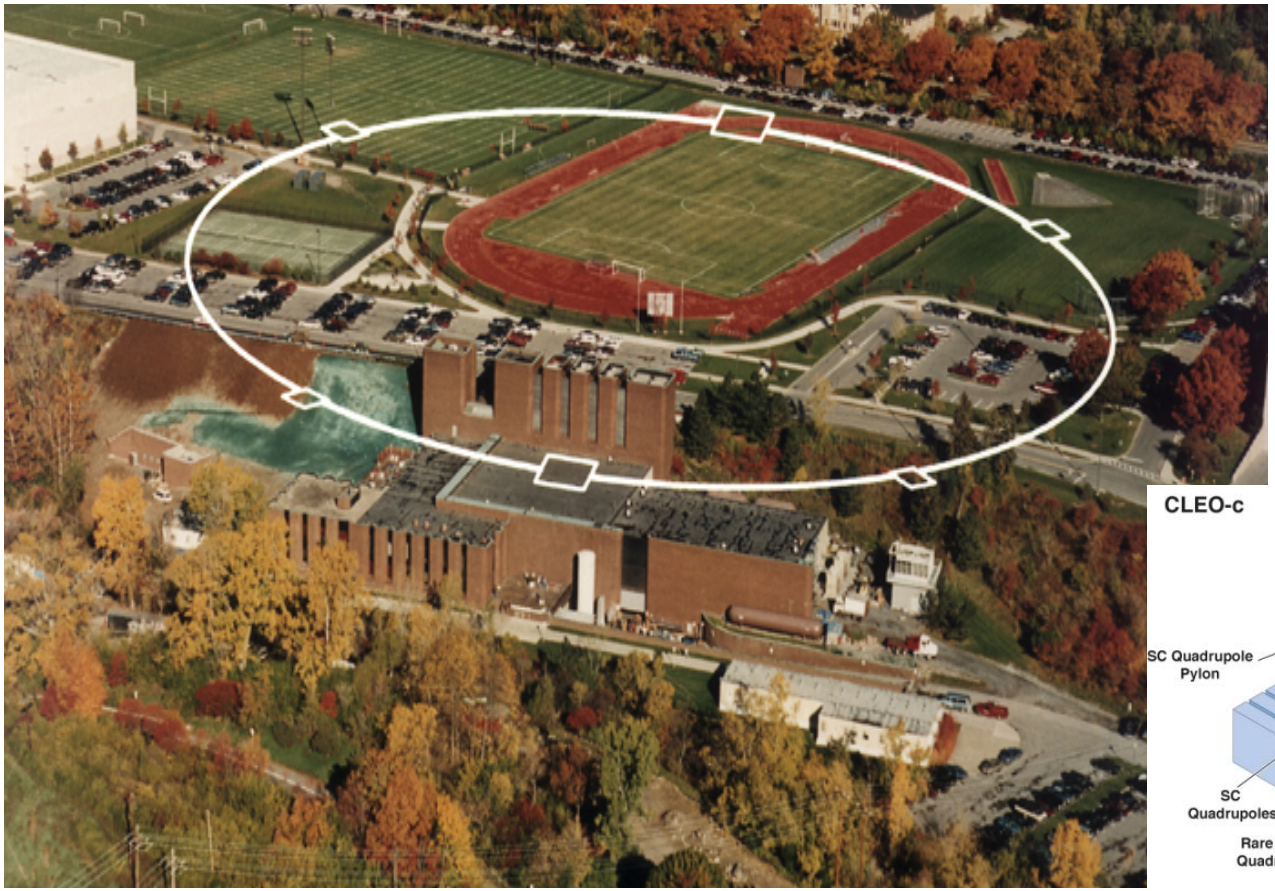
CESR and CLEO and the physics of heavy quarks: Cornell University is home to the Cornell Electron Storage Ring and the CLEO particle detector.

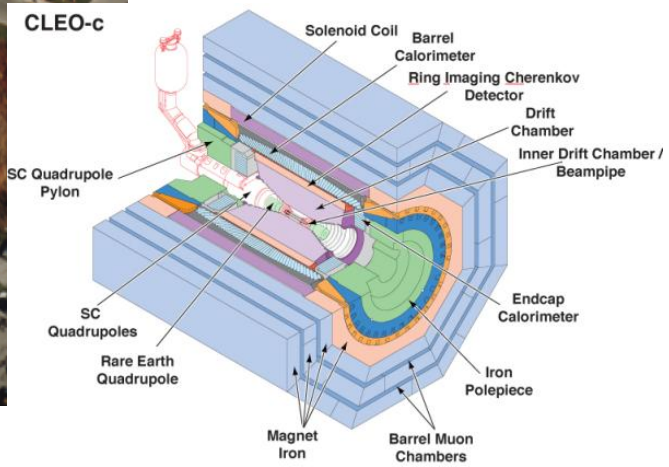
Accelerator Physics
- CESR
- SRF
- ERL
- ILC

Experimental Particle Physics
- CMS
- CLEO
- CDF
- ILC

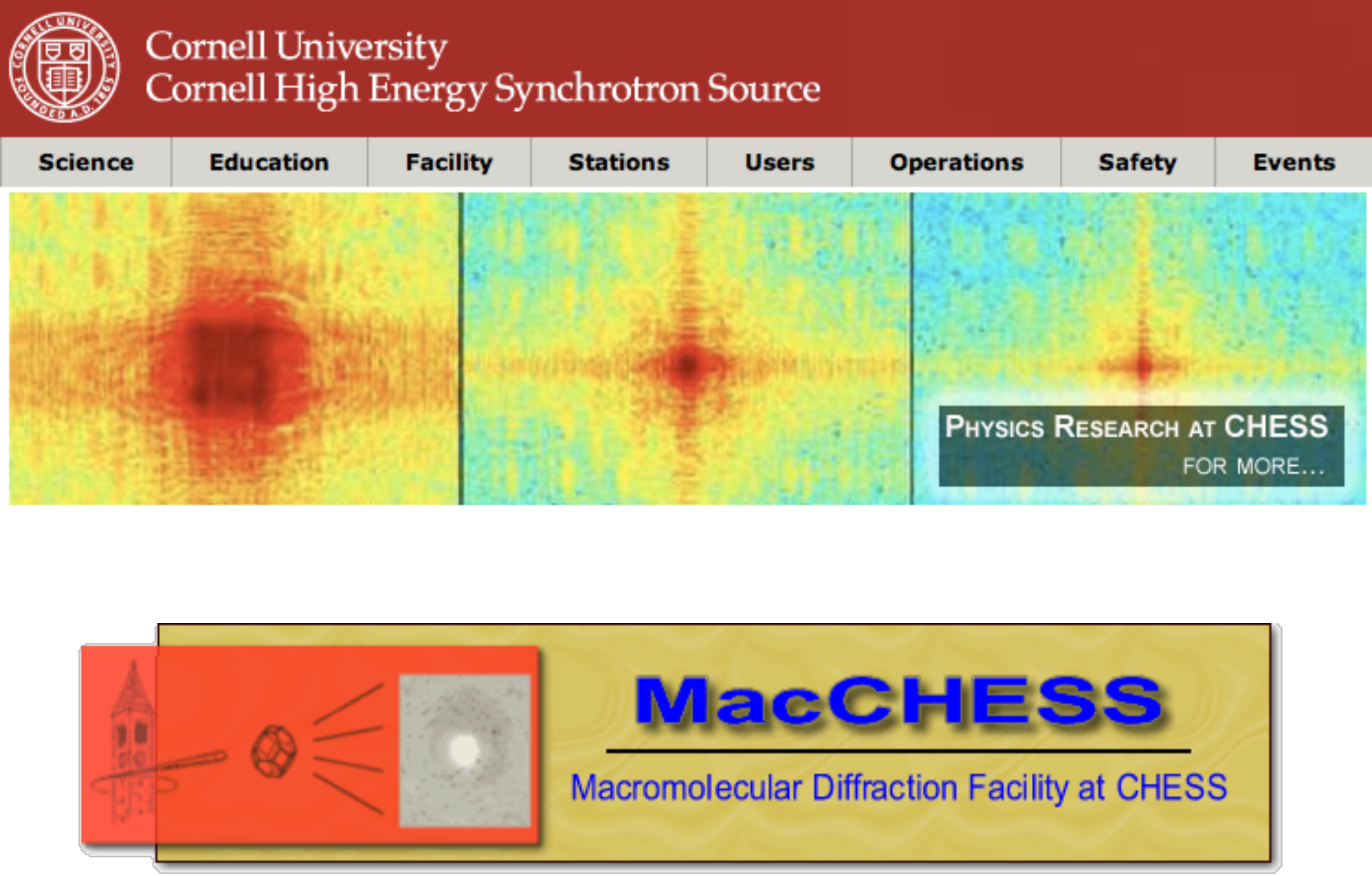
Theoretical Particle Physics

Cornell Electron Storage Ring



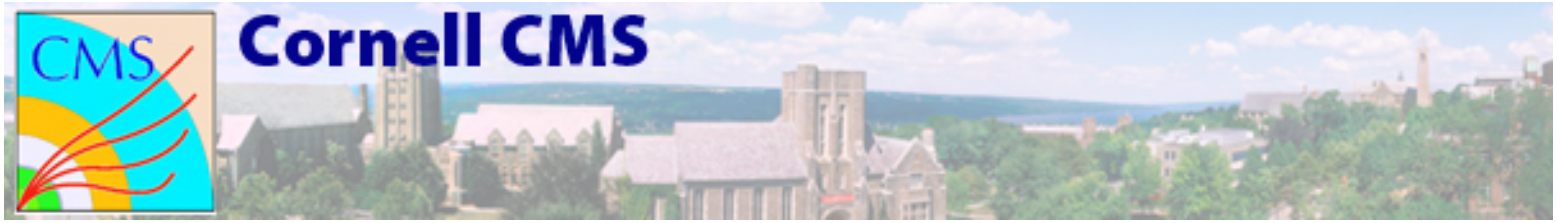


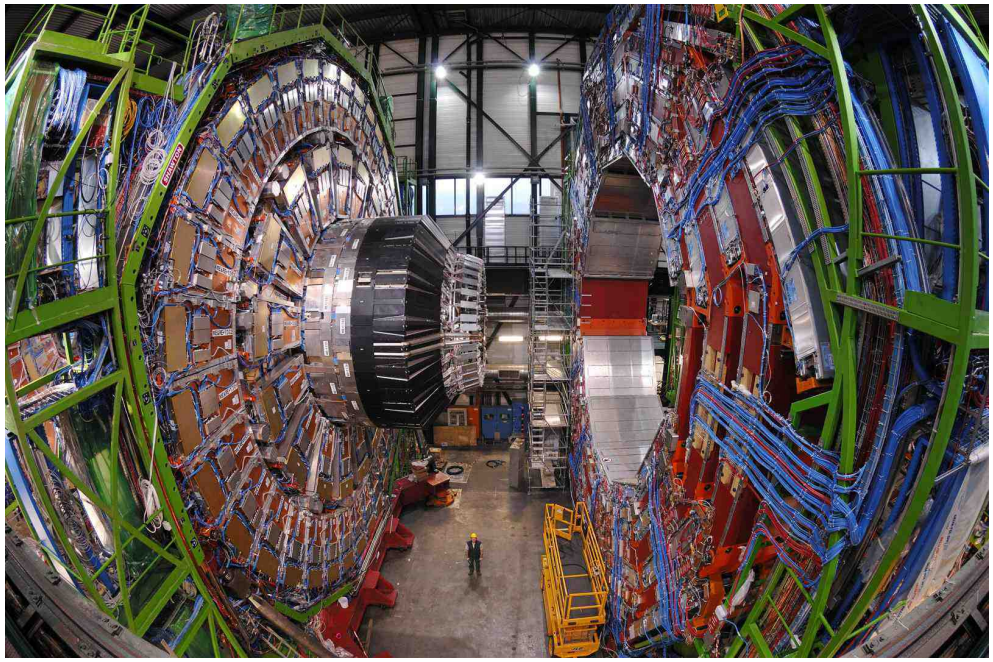
http://www.lepp.cornell.edu/Research/AP/CESR/



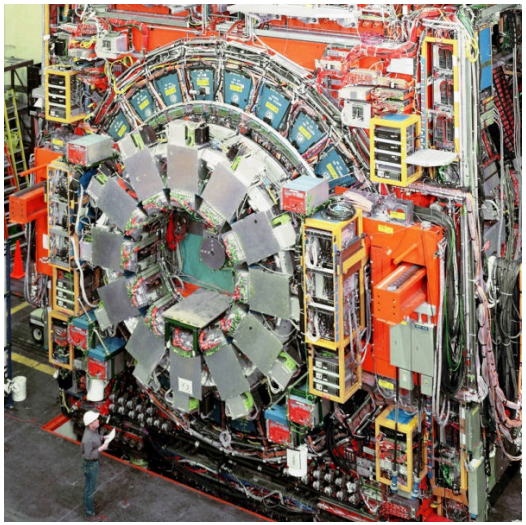
http://www.chess.cornell.edu/

Experimental Particle Physics





A view of the CMS detector (courtesy of CERN).



The CDF Detector

http://www.lepp.cornell.edu/Research/EPP/

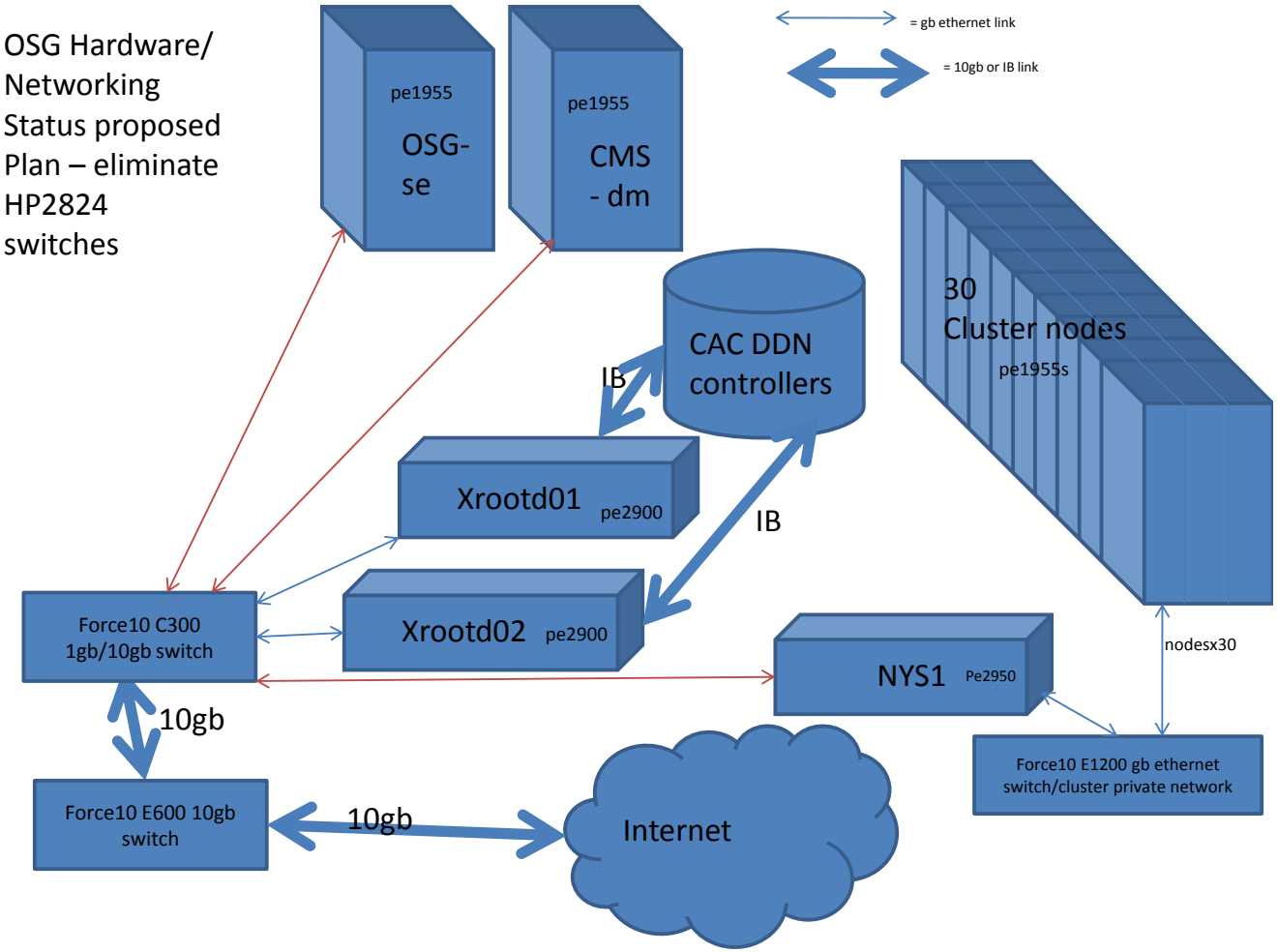
CMS Tier 3 Site

- Collaboration with Cornell Center for Advanced Computing (CAC) to form CMS Tier 3 Facility
  - 30 4-core Dell PE1955 blades with reasonably up to date Compute Element software
  - Storage Element:
    - abandoned dCache for xrootd/BestMan
    - added 100 TB of disk on a DDN 9900 storage controller connected by InfiniBand
  - Hardware due for refresh
  - Insufficient backend bandwidth to support traffic levels on xrootd backend servers
    - Working to simplify network setup (some already done) and upgrade xrootd servers

http://www.lepp.cornell.edu/Research/EPP/CMS/
http://www.cac.cornell.edu/

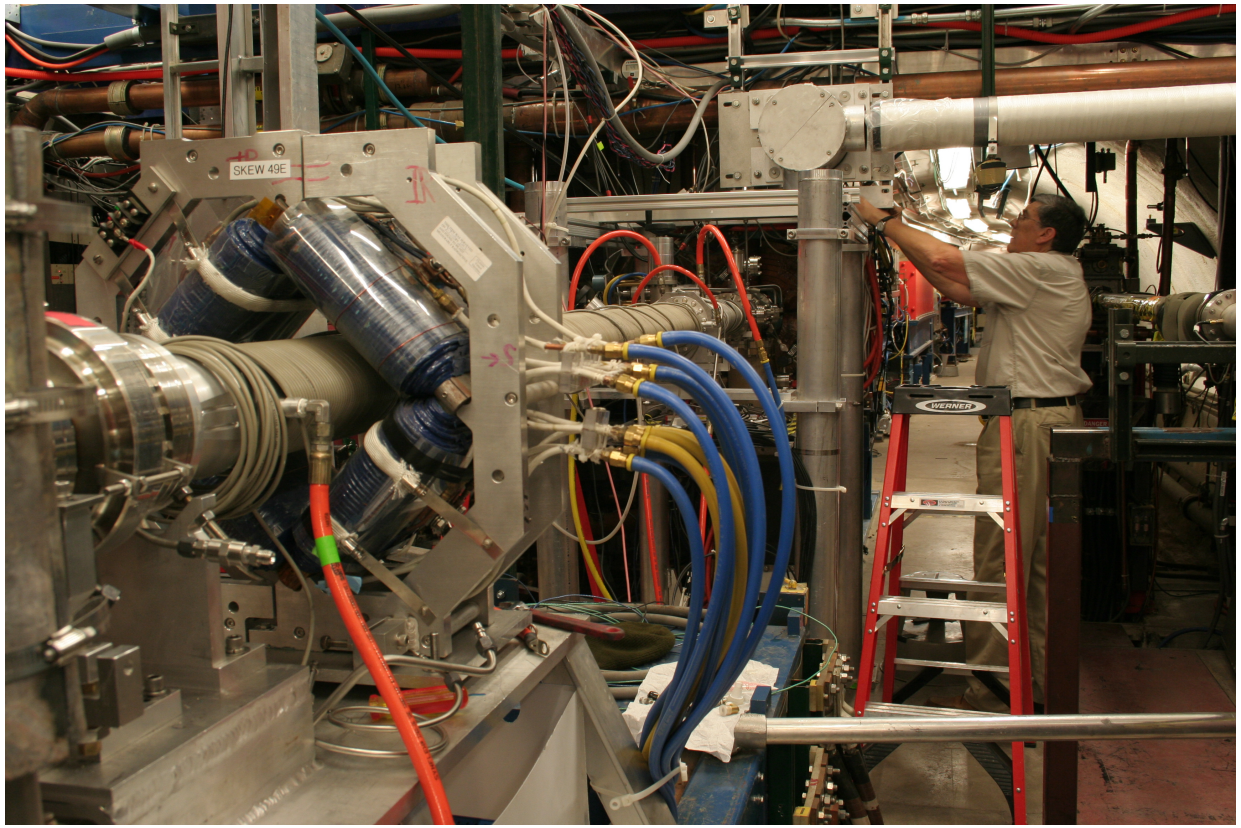
CMS Tier 3 Site

OSG Hardware/
Networking
Status proposed
Plan – eliminate
HP2824
switches

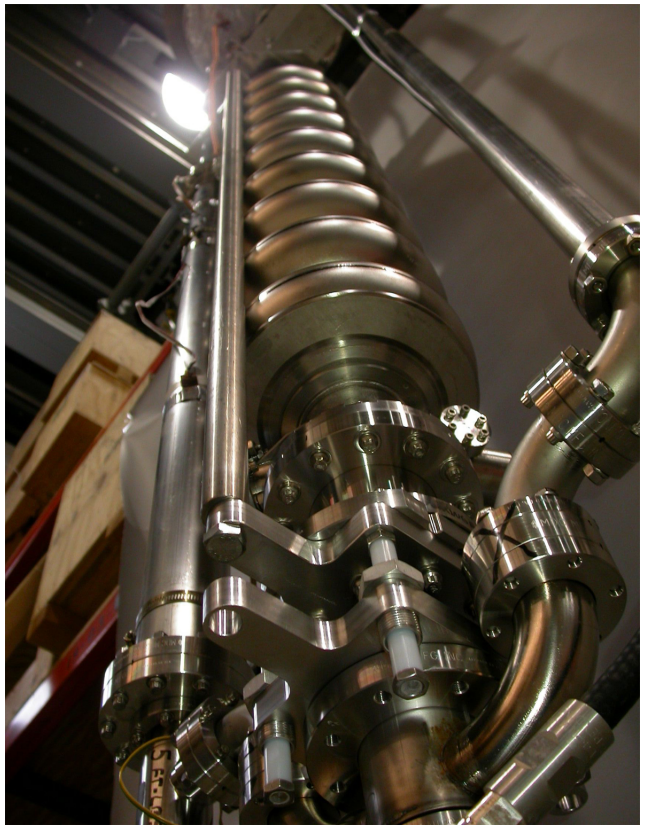


http://www.lepp.cornell.edu/Research/EPP/CMS/
http://www.cac.cornell.edu/

CESR Test Accelerator (CesrTA)



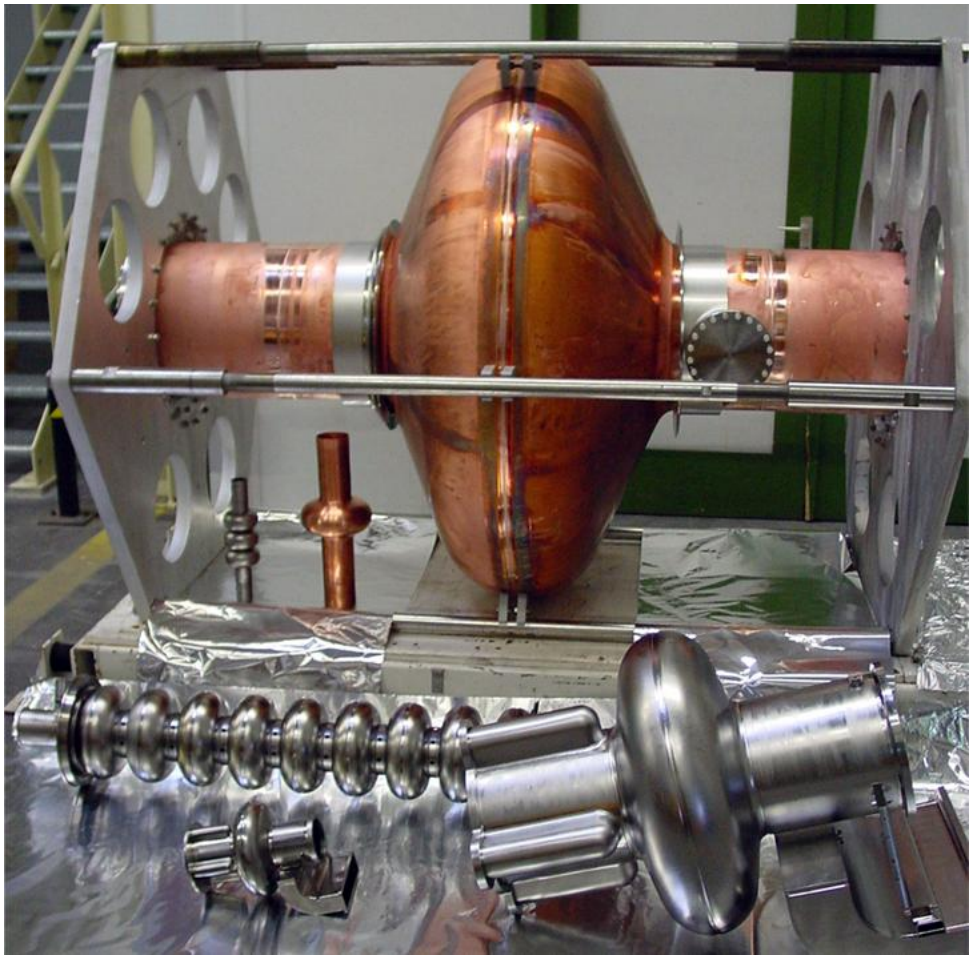
CesrTA L3 downtime vacuum installation.



ILC cavity test set up at Cornell.

http://www.lepp.cornell.edu/Research/AP/ILC/
http://www.lepp.cornell.edu/Research/EPP/ILC/
https://wiki.lepp.cornell.edu/ilc/bin/view/Public/CesrTA/

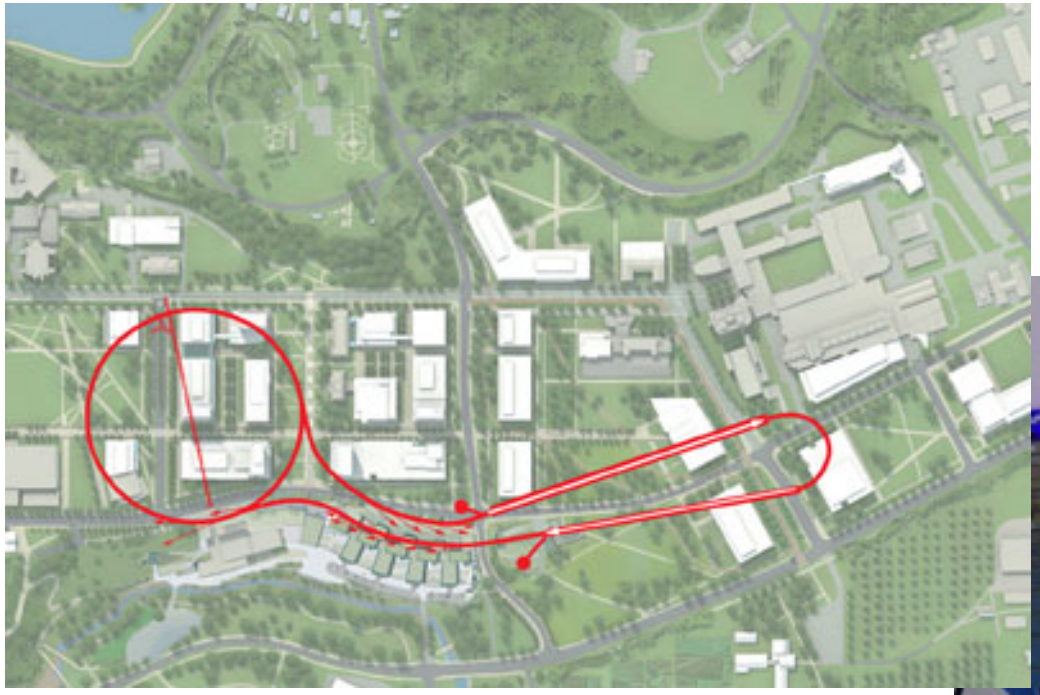
Superconducting RF



A collection of SRF cavities developed at Cornell with frequencies spanning 200 MHz to 3 GHz.

http://www.lepp.cornell.edu/Research/AP/SRF/

Energy Recover Linac (ERL)



Arial view of ERL expansion to CESR.

Superconducting RF cavity for the ERL injector prototype

http://erl.chess.cornell.edu
http://www.lepp.cornell.edu/Research/AP/ERL/

LEPP Computing

http://www.lepp.cornell.edu/Resources/Computing/

service-lepp@cornell.edu

Network Infrastructure

- 2 buildings, 2 trailers, and 1 Annex; connected via 1Gb fiber
- Cisco 7400 Firewall
- 1Gb Extreme Networks core switches with 1Gb/100Mb HP Procurve edge switches
- 10Gb BLADE Networks switches for low-latency parallel processing and iSCSI SAN
- 802.11G Wireless network - Cisco Aironet 1100 Aps
- 20 subnets including 2 control systems
- OpenVPN, FreeNX, LogMeIn, and ssh for off-site access
- >1,000 computers running Linux, Windows, VMS, Mac OS X, Tru64, and Solaris, with a total of ~2,000 network-attached devices.
- 7 FTE's

Backups

- NetBackup: Linux, Tru64, Solaris, VMS
  - 360 tape 12 drive Qualstar tape robot (eight AIT-2 drives and four AIT-4 drives)
  - Three SL3 servers running NetBackup 6.0MP4
- Rsync: Linux, Tru64, Solaris
  - Disk-to-disk replication using rsync & bash scripts
  - Incrementals saved for quick and easy recovery
- BackupExec: Windows
  - Nightly incremental backups to disk array
  - Monthly full backups to AIT-5 tape
- Mac OS X
  - AIT-4 tape backups using Retrospect
  - Disk backups using Time Machine and Carbon Copy Cloner

Network Monitoring & Infrastructure Tools

- Zenoss - reachability and service monitoring for critical systems, process and disk space monitoring, performance graphs, SNMP trap collection, etc.
- OCSNG & GLPI - System inventory and package deployment; Computing Stockroom
- NetDisco - Network device and node inventory, network topology.
- PathView - troubleshooting, monitoring, and reporting network operation
- Cricket - historical graphs of various network statistics, mostly SNMP.
- SNORT, arpwatch, argus
- FlowScan & TopTalkers - traffic through our firewall broken down by protocol and service, derived from the router's cacheflow data.
- BigSister - reachability and service monitoring for critical systems, process and disk space monitoring, SNMP trap collection.

VMS

- Central infrastructure services (Mail, print services, DHCP, DNS, NTP)
- LEPP Stockroom
- 12-node VMS Cluster for running CESR Control System

Tru64

- Central infrastructure services
  - Centralized monitoring (SNORT, arpwatch, argus, BigSister, Cricket, NetDisco)
  - Directory services (Kerberos, NIS, DNS)
  - Apache, MySQL, Mail, News, NTP, RT

Solaris

- 148 node Grid Engine 6.1u2 queuing system
- NFS and NIS servers

Mac OS X

- ~70 Laptops and workstations
- Legacy database and web servers
- Apple Remote Desktop for package deployment
- LogMeIn, ARD, and ssh for remote access
- AIT-4 tape backups using Retrospect
- Disk backups using Time Machine and Carbon Copy Cloner

Windows

- ~300 systems
- Mostly Windows XP with some Windows Server 2003, Windows 2000, NT
  - NT4 Domain
- New deployments of Windows 7 workstations
  - Active Directory domain with Windows Server 2008 R2 Enterprise controllers
    - Still using BIND on UNIX to support DNS views
- AutoDesk Vault, Disk, MS Project, and Replicon servers
- Workstations & laptops
- Virtual machines on KVM
- Remote Desktop Apps and LogMeIn for access from Linux and OS X
- System imaging and deployments via Acronis
- Package deployment via OCSNG
- Symantec Endpoint Protection 11 (Firewall and anti-virus)
- Locally attached server storage & Linux RAID (and Samba) servers
- LPR printing to Linux CUPS server

Linux

- ~300 systems
- Mostly SL4 and SL5 with some SL3, RH9, and RH7.3
- 13 Apache Servers, 7 MySQL Servers, 2 GlassFish, & 2 Zope databases
- 36 NFS servers, 3 Samba servers
  - 13 large disk servers with 3ware hardware RAID for ~75TB
  - Samba servers access local storage and filesystems over NFS
- Various servers: Zenoss, OCS Inventory NG, GLPI, Squid Web Proxy, Cyrus-Imapd, ELOG, SVN, TWiki, Invenio, and Indico
- Three 64-bit SL5.5 KVM servers with local software RAID5
- CUPS server for Linux, also accepts LPR jobs from Windows and VMS
- 200 core Grid Engine 6.0u8 farm
- Desktops, Workstations, Consoles, and Displays
- System configuration and package deployment automated using custom scripts and tools

CESR Control System

- 12 node VMS cluster
  - DNS, NTP, DHCP
- Linux infrastructure servers (Apache, MySQL, GlassFish, NFS, Samba, NTP)
- Linux operator workstations and display consoles
- Windows devices and terminals
- VxWorks and RTEMS embedded systems (~150)
- Dedicated BPM and Instrumentation subnets
- Current Projects
  - Continue migration to pure Linux control system (~18 months)
  - Continue introduction of EPICS and integration with ERL Control System
  - Deploy 10Gb iSCSI SAN
  - Deploy SL high-availability cluster for infrastructure services using Red Hat Cluster Suite.
  - Improve isolation of control system from “public” network

ERL Control System

- Primarily EPICS on Linux (SL4),
  - archiving data using EPICS Channel Archiver
    - Dedicated server running Archive Daemon and Archive Engines
    - One year of archived data served by separate Archive Data Server
    - Investigating alternatives for full ERL
- Linux and VME hosted IOCs
- Experimenting with DOOCS
- Linux Apache, NFS, Samba, NTP, and console servers
- Windows consoles for device support
- Currently >100 devices and controllers (Coldfires, BPMs, DSPs, PLCs, etc.)

Current Projects

- Network upgrades
  - Replace Cisco firewall with Vyatta 3520 10Gb network appliance
  - Upgrade to 10Gb connection between buildings and trailers using Blade Networks switches
  - Deploy 10Gb iSCSI SAN using Infortrend S16E-R1240
- General
  - Upgrade to NetBackup 7 and add iSCSI disk storage.
  - Consolidate Unix, Windows (and Mac) backups to NetBackup 7
  - Increase virtualization using KVM & move guests to iSCSI storage
  - Continue moving services to Linux from VMS, Solaris, and Tru64

Current Projects

- Windows
  - Continue deployment of Active Directory and Windows 7
  - Investigating improved package deployment (Group Policy, SCCM, Cfengine, future OCSNG release)
- Linux
  - Deploy SL high-availability clusters for infrastructure services using Red Hat Cluster Suite.
  - Integrate Linux infrastructure with AD (Likewise)
  - Lab-wide upgrade to 64-bit SL5
  - Enhance security through firewalls and use of tools like SELinux and Fail2ban
  - Move to class-based system configuration tools (Cfengine)
- Mac OS X
  - Begin deploying OCSNG Agent for system inventory

Cornell Laboratory for Accelerator-based Sciences and Education

- Cornell High-Energy Synchrotron Source
  - http://www.chess.cornell.edu
- Laboratory for Elementary-Particle Physics
  - http://www.lepp.cornell.edu