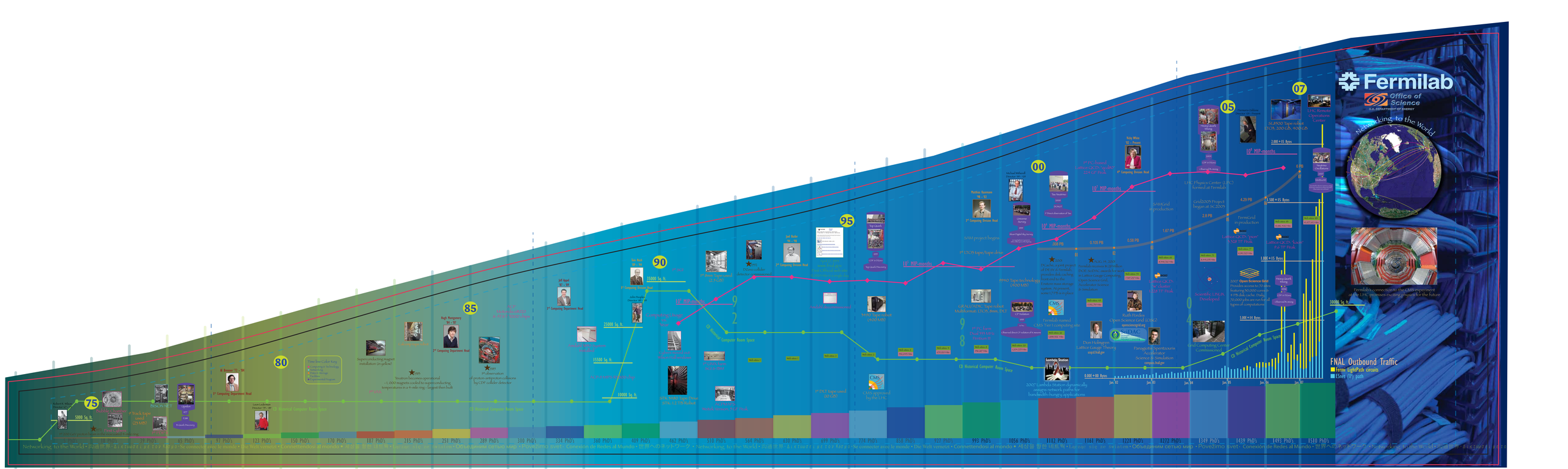

# Fermilab

Office of Science
U.S. DEPARTMENT OF ENERGY

## Networking to the World

Fermilab's connection to the CMS experiment at the LHC promises exciting physics for the future

**FNAL Outbound Traffic**
- 🟨 Fermi LightPath circuits
- 🟦 ESnet (IP) path

Time line Color Key
- ● Computing & Technology
- ● Networking
- ● Data & Storage
- ● Facilities
- ● Experimental Program

Robert R. Wilson
Director '67 - '79

5000 Sq. ft.

75

Bubble Chamber

★1972 1st 200 GeV proton beam in the evacuated 4-mile ring

First Cybers

9 Track tape used (23 MB)

BISON NET

1st PDP 11

Upsilon
1977
E288
B Quark Discovery

**Al Brenner '72 - '84**
**1st Computing Department Head**

Leon Lederman
Director '79 - '89

80

CD Historical Computer Room Space

Superconducting magnet installation (in yellow)

1st VAX

★1983 Tevatron becomes operational – 1,000 magnets cooled to superconducting temperatures in a 4-mile ring - largest then built

Calcomp tape robot

**Hugh Montgomery '84 - '87**
**2nd Computing Department Head**

85

★1985 1st observation of proton-antiproton collisions by CDF collider detector

ACP
Motorola 68020 & AT&T 32100 chips

CD Historical Computer Room Space

**Jeff Appel '87 - '89**
**3rd Computing Department Head**

Amdahl 5890 System Installed

15500 Sq. ft.

ACP-II MIPS R3000 chip

25000 Sq. ft.

10000 Sq. ft.

**Tom Nash '89 - '94**
**1st Computing Division Head**

John Peoples
Director '89 - '99

90

35000 Sq. ft.

1st SGI

Computing Usage vs. Year

$10^4$ MIP-months

Cybers moved out Wilson Hall windows

STK 3480 Tape Drive
STK: 1.2 TB Robot

1st 8mm Tape used (2.5 GB)

1st UNIX farm SGI & IBM

ACPMAPS Weitek Version, 5 GF Peak

9
2

CD Historical Computer Room Space

★1992 DZero collider detector commissioned

Web sites: 1

**Joel Butler '94 - '98**
**2nd Computing Division Head**

Web sites: 1

April 27, 1994
www.fnal.gov
First Official web site
12,000 Hits in a single day

Amdahl decommissioned

1st DLT tape used (10 GB)

Web sites: 2

95

Top Quark
1995
CDF & DZero
Top Quark Discovery

3490 Tape robot (400 MB)

Web sites: 2

CMS approved by the LHC

$10^5$ MIP-months

Web sites: 2
332,043 Hits

Web sites: 4
670,120 Hits

**Matthias Kasemann '98 - '02**
**3rd Computing Division Head**

SAM project begins

1st LTO3 tape/tape drive

GRAU/ADIC Tape robot
Multiformat: LTO3, 8mm, DLT

9
8

1st PC farm
Dual 333 MHz
Pentium III

Web sites: 8
938,287 Hits

CD Historical Computer Room Space

Michael Witherell
Director '99 - '05

Universe Survey
1999
Sloan Digital Sky Survey
Surveyed galaxies & quasars to within a billion years of the Big Bang

9940 Tape technology (400 MB)

CP Violation
1999
KTeV
Observed direct CP violation of K mesons

Web sites: 20
1,204,379 Hits

00

Tau Neutrino
2000
DONUT
1st Direct observation of Tau

$10^6$ MIP-months

.008 PB

★2001 DCache, a joint project of DESY & Fermilab, provides disk caching front end to the Enstore mass storage system. At present, some 1.7 PB is in place

Fermilab named CMS Tier 1 computing site

Web sites: 26
1,898,506 Hits

Lambda Station

2007 Lambda Station dynamically assigns network paths for bandwidth-hungry applications

01

0.105 PB

★AUG. 14, 2001 Fermilab receives $1.28 Million DOE SciDAC awards for work in Lattice Gauge Computing, Open Science Grid, Accelerator Science & Simulation

Web sites: 45
5,332,753 Hits

Don Holmgren
Lattice Gauge Theory
usqcd.fnal.gov

0.00E+00 Bytes

1st PC-based Lattice QCD: "qcd80" 224 GF Peak

$10^7$ MIP-months

**Vicky White '02 - Present**
**4th Computing Division Head**

02

0.58 PB

Web sites: 54
7,397,237 Hits

Ruth Pordes
Open Science Grid (OSG)
opensciencegrid.org

SciDAC

Panagiotis Spentzouris
Accelerator Science & Simulation
compass.fnal.gov

SAMGrid in production

03

1.67 PB

Web sites: 66
8,348,766 Hits

Lattice QCD: "w" cluster 1.228 TF Peak

0
4

LHC Physics Center (LPC) formed at Fermilab

Grid2003 Project began at SC2003

04

2.8 PB

Web sites: 72
8,441,091 Hits

Scientific LINUX Developed

Grid Computing Center Commissioned

CD Historical Computer Room Space

05

Heavy Quark Mixing
2006
CDF & DZero
Observed $B_s$ mixing

Piermaria Oddone
Director '05 - Present

FermiGrid in production

Lattice QCD: "pion" 3.328 TF Peak

4.29 PB

Web sites: 77
8,910,325 Hits

5.00E+14 Bytes

2007 **Open Science Grid** Provides access to 70 sites featuring 30,000 cores & 4 PB disk cache. Daily, 70,000 jobs are run for all types of computations

1.00E+15 Bytes

Lattice QCD: "kaon" 9.6 TF Peak

Web sites: 85
10,816,406 Hits

1.50E+15 Bytes

06

07

$10^8$ MIP-months

6 PB

Web sites: 101
10,977,612 Hits

SL8500 Tape robot
LTO3, 200 GB, 400 GB

2.00E+15 Bytes

Neutrino Oscillations
2007
MiniBooNE

LHC Remote Operations Center

30000 Sq. ft.

Jan. 02 | Jan. 03 | Jan. 04 | Jan. 05 | Jan. 06 | Jan. 07

5 PhD's | 18 PhD's | 39 PhD's | 65 PhD's | 97 PhD's | 123 PhD's | 150 PhD's | 170 PhD's | 187 PhD's | 215 PhD's | 251 PhD's | 289 PhD's | 310 PhD's | 334 PhD's | 360 PhD's | 409 PhD's | 462 PhD's | 510 PhD's | 564 PhD's | 630 PhD's | 699 PhD's | 774 PhD's | 858 PhD's | 927 PhD's | 993 PhD's | 1056 PhD's | 1112 PhD's | 1161 PhD's | 1221 PhD's | 1272 PhD's | 1349 PhD's | 1439 PhD's | 1493 PhD's | 1510 PhD's

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