

The DØ Experiment

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Tevatron Physics Goals

Precision tests of the Standard Model

- Weak bosons, top quark, QCD, B-physics...

Search for particles and forces beyond those currently observed

- Higgs, supersymmetry, extra dimensions...

Driven by these goals
the experiment
emphasizes

Electron, muon and
tau identification

Jets and missing
transverse energy

Flavor tagging through
displaced vertices

Addressing fundamental
physics questions

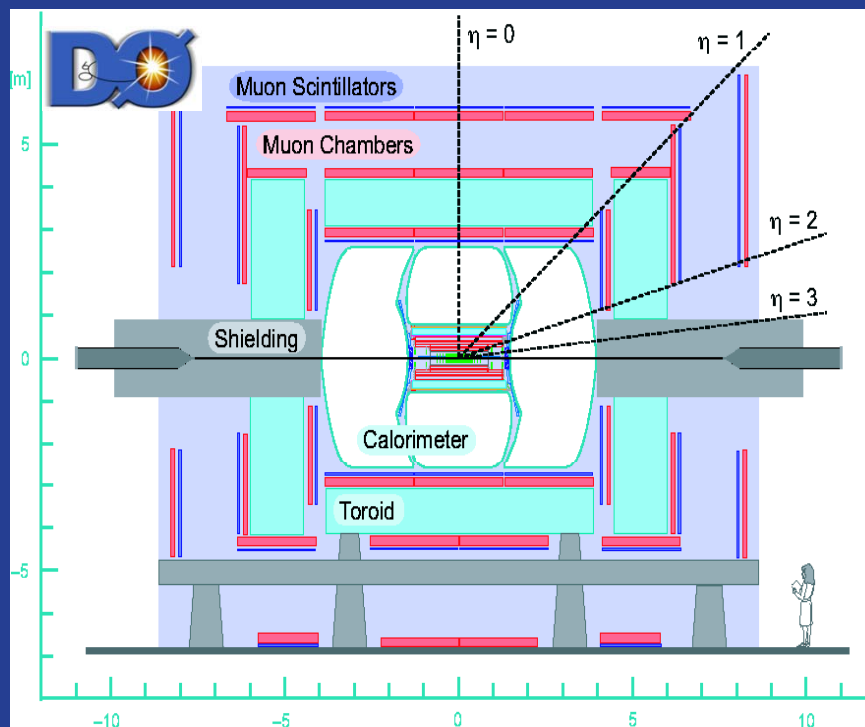
Quark sub-structure?

Origin of mass?

Matter-antimatter
asymmetry?

What is cosmic dark
matter? SUSY?

What is space-time
structure? Extra
dimensions?...



The DØ Collaboration

DØ is international Collaboration of 500 physicists from 19 nations (+1)

The DØ Collaboration

AZ U. of Arizona
CA U. of California, Riverside
FL Florida State U.
IL Fermilab
U. of Illinois, Chicago
Northern Illinois U.
Northwestern U.
Indiana U.
IN U. of Notre Dame
Purdue U. Calumet
IA Iowa State U.
KS U. of Kansas
Kansas State U.
LA Louisiana Tech U.
MD U. of Maryland
MA Boston U.
Northeastern U.
MI U. of Michigan
Michigan State U.
MS U. of Mississippi
NE U. of Nebraska
NJ Princeton J.
Rutgers U.
NY Brookhaven Nat. Lab.
Columbia U.
SUNY, Buffalo
SUNY, Stony Brook
U. of Rochester
OK Langston U.
U. of Oklahoma
Oklahoma State U.
RI Brown U.
TX Southern Methodist U.
U. of Texas at Arlington
Rice U.
VA U. of Virginia
WA U. of Washington

U. de Buenos Aires
LAFEX, CBPF, Rio de Janeiro
State U. do Rio de Janeiro
U. Federal do ABC, São Paulo
State U. Paulista, São Paulo

Simon Fraser U.
York U.

U. of Science and Technology
of China, Hefei

U. de los Andes, Bogotá

Charles U. Prague
Czech Tech. U. Prague
Academy of Sciences, Prague

U. San Francisco de Quito

I PC, Clermont-Ferrand
ISN, IN2P3, Grenoble
CPMM, IN2P3, Marseille
LAL, IN2P3, Orsay
LPNHE, IN2P3, Paris
DAPNIA/SPP, CEA, Saclay
IPN's, Strasbourg
IPN, IN2P3, Villarsbaranne

RWTH Aachen
Bonn U.
Freiburg U.
Göttingen U.
Mainz U.
LMU München
Wuppertal U.

Panjab U. Chandigarh
Delhi U. Delhi
Tata Institute, Mumbai

University College, Dublin

KTH, Korea U., Seoul

CINVESTAV, Mexico City

FOM/NIKHEF, Amsterdam
U. of Amsterdam / NIKHEF
U. of Nijmegen / NIKHEF

JINR, Dubna
ITEP, Moscow
Moscow State U.
IHEP, Prouvino
PNPI, St. Petersburg

Stockholm U.
Uppsala U.

National U. of Kiev

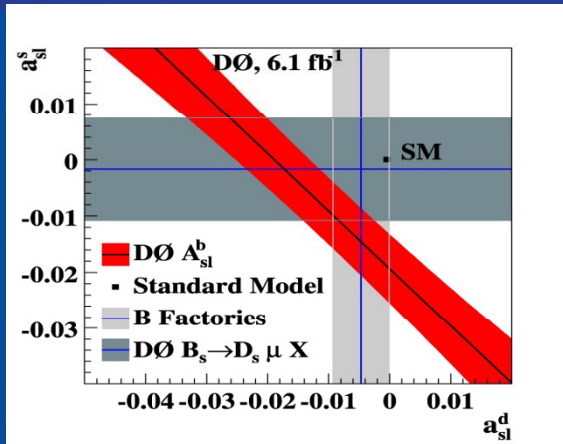
Imperial College London
Lancaster U.
U. of Manchester

Art Heinson, UC Riverside



- **Institutions**
 - 86 total, 37 US, 49 non-US
- **Collaborators**
 - 50% from US
- **Fermilab scientists represent ~6% of the collaboration**

Highlights of Successes of the DØ Experiment



- About 3 papers/month published
- ~ 100 preliminary results announced per year
- ~ 200 invited talks at conferences
- ~ 30 PhDs awarded over last year

Search for the Higgs Particle

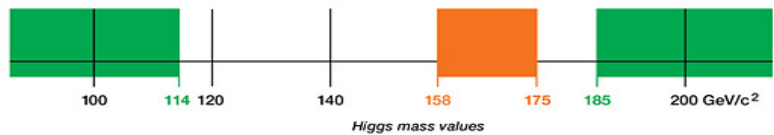
Status as of July 2010

95% confidence level

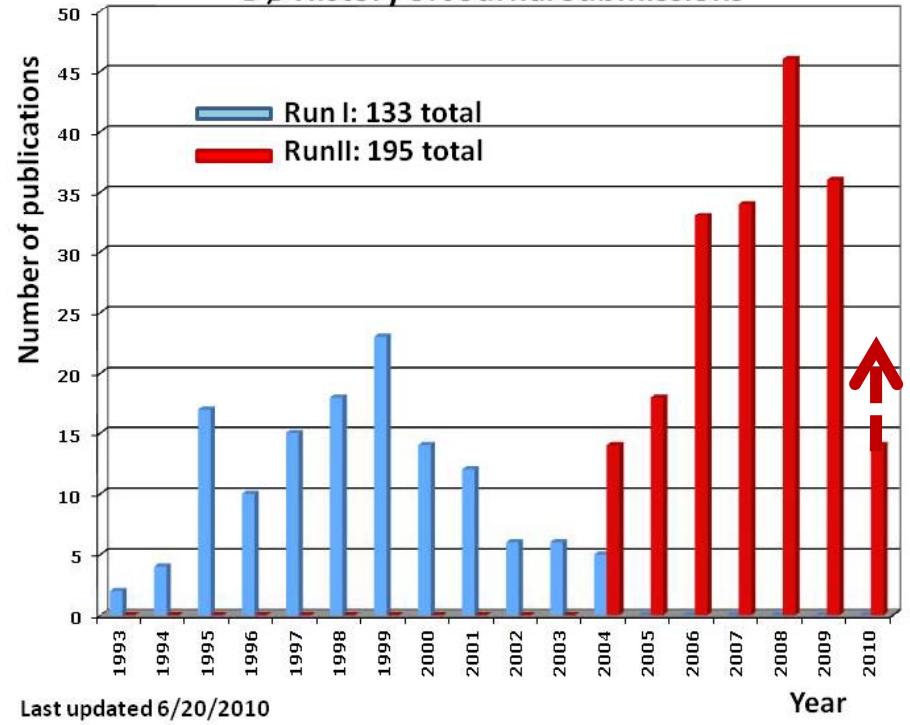
Excluded by
LEP Experiments
95% confidence level

Excluded by
Tevatron
Experiments

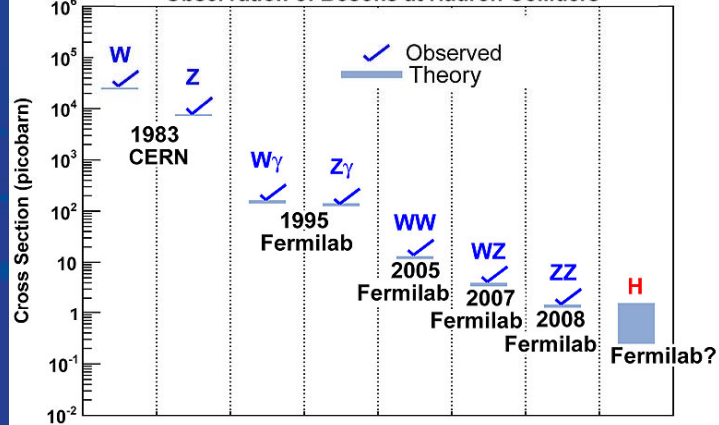
Excluded by
Indirect Measurements
95% confidence level



DØ History of Journal Submissions



Observation of Bosons at Hadron Colliders



Areas of Fermilab Scientists Responsibilities

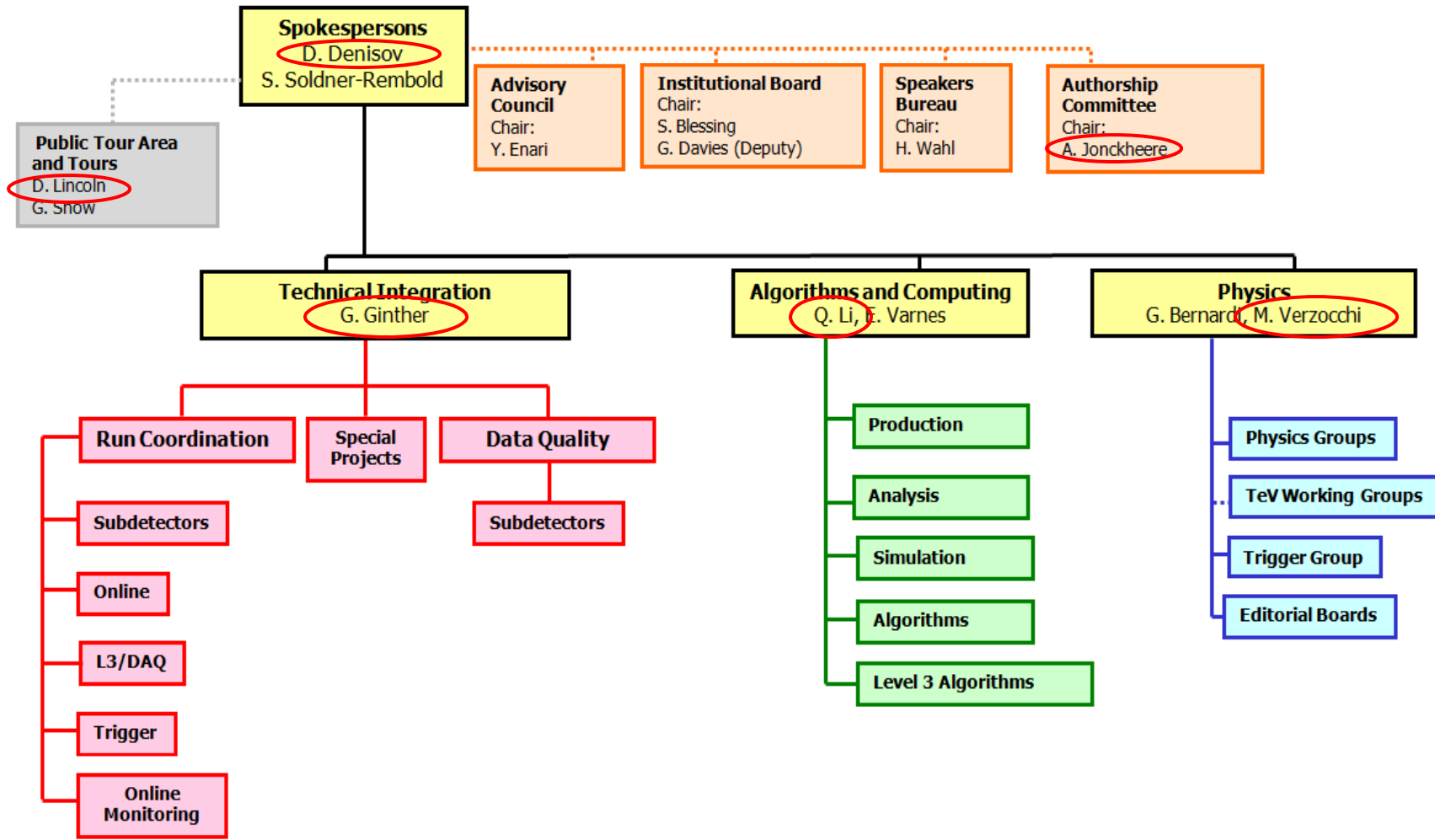
- Fermilab scientists, representing host Laboratory, play special role in the experiment to ensure that
 - The experiment activities are progressing safely
 - The detectors are working well and collecting data with high efficiency
 - The data collected is quickly processed and made available for analysis
 - The experiment publishes world-class results
- Long term participation of the Fermilab scientists in the experiment assures
 - Continuity of knowledge about detectors, algorithms and computing
 - Training of newcomers including students and postdocs
 - Quality of physics results based on deep expertise with detector, algorithms, computing and analysis

Contribution of Fermilab the DØ Experiment

- Fermilab's scientists are critical for the experiment's success
 - ~50% of the experiment leadership
 - ~20 % of the experiment conveners and groups leaders
- Operations positions
 - ~25% Fermilab scientists
- Fermilab personnel share of shifts
 - Experts ~30%, Captains ~30%
- Computing and algorithms
 - ~25% of leaders are from Fermilab
- Physics analysis
 - All Fermilab scientists are involved in physics analysis
 - ~15% of physics organization leaders are from Fermilab

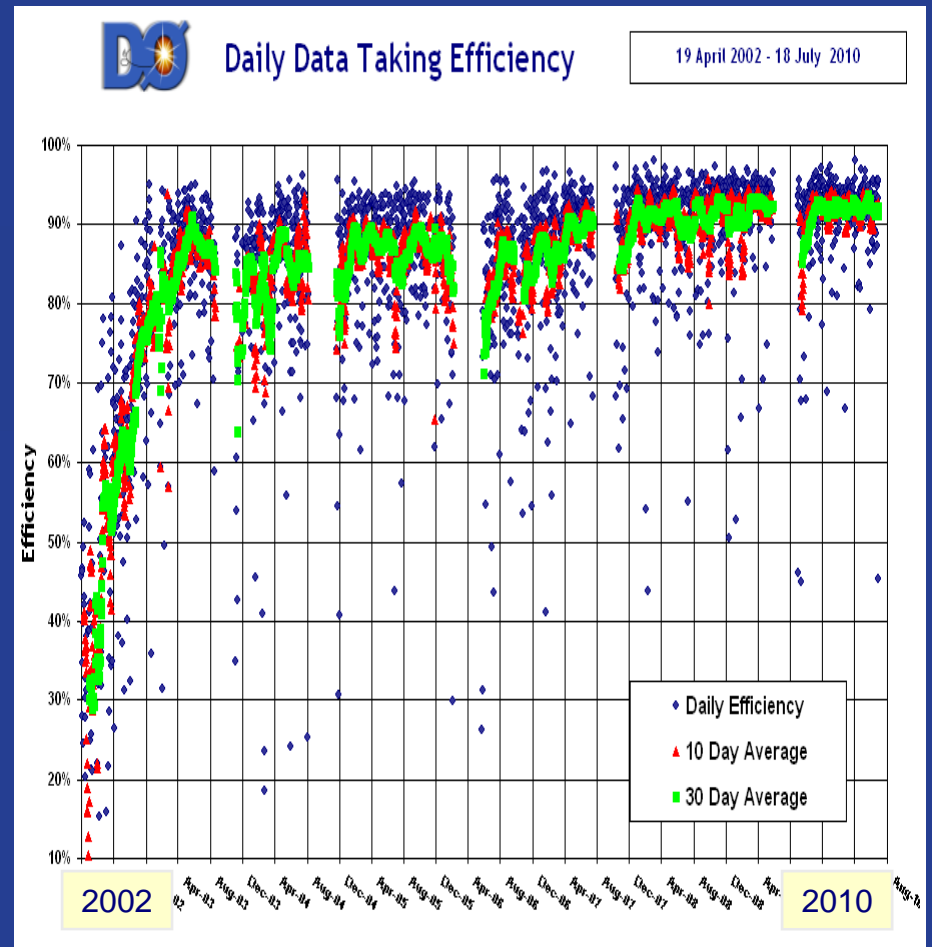
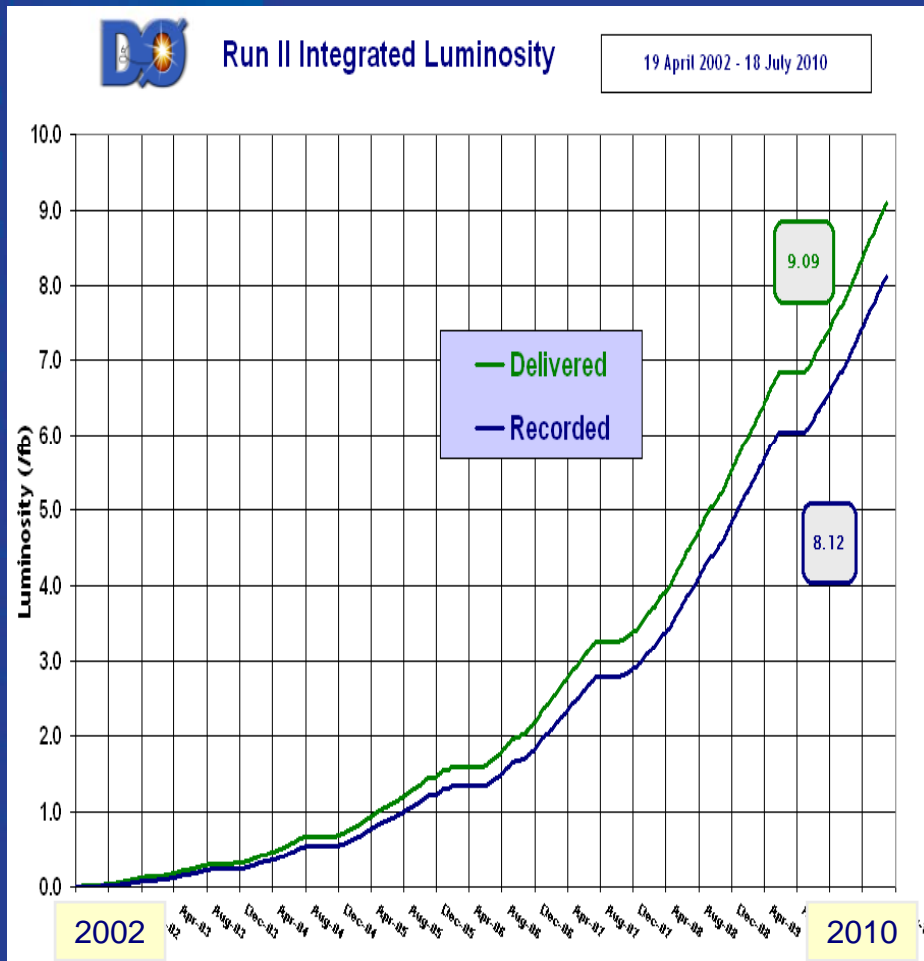
Experiment Organization

D0 Collaboration Organization



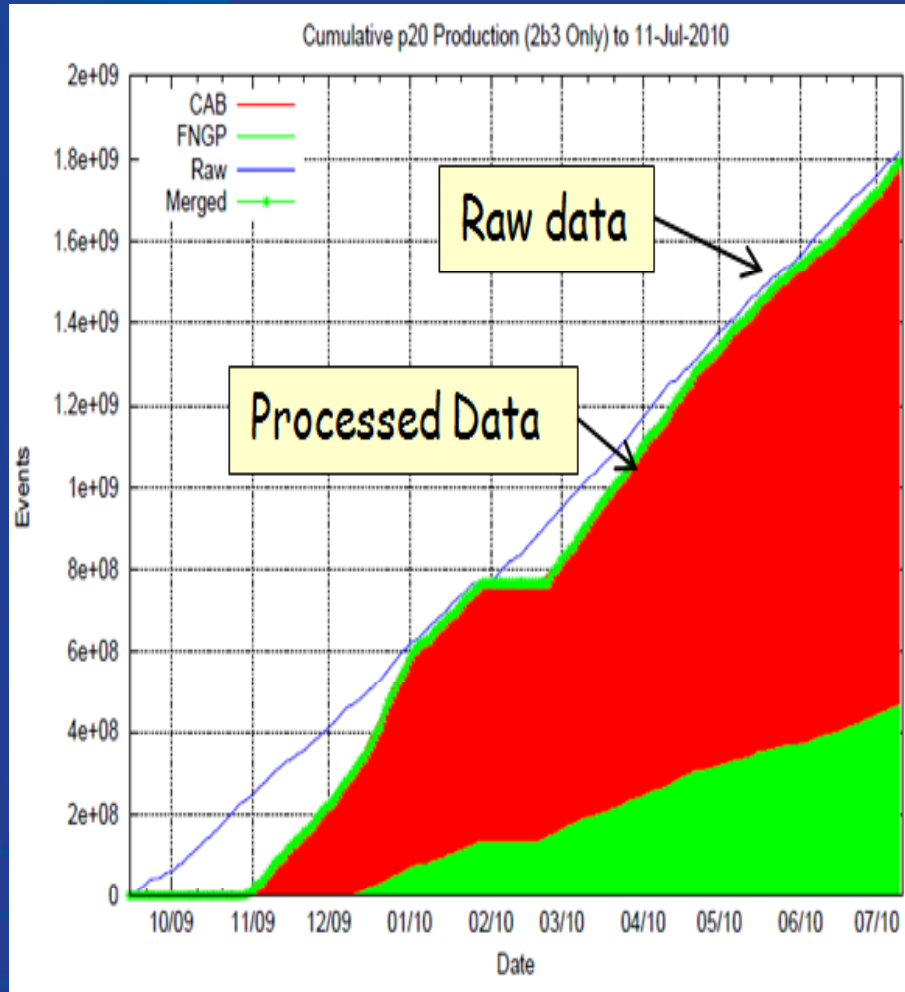
Tevatron Performance and Data Collection

Tevatron is performing extremely well with over 9 fb⁻¹ delivered



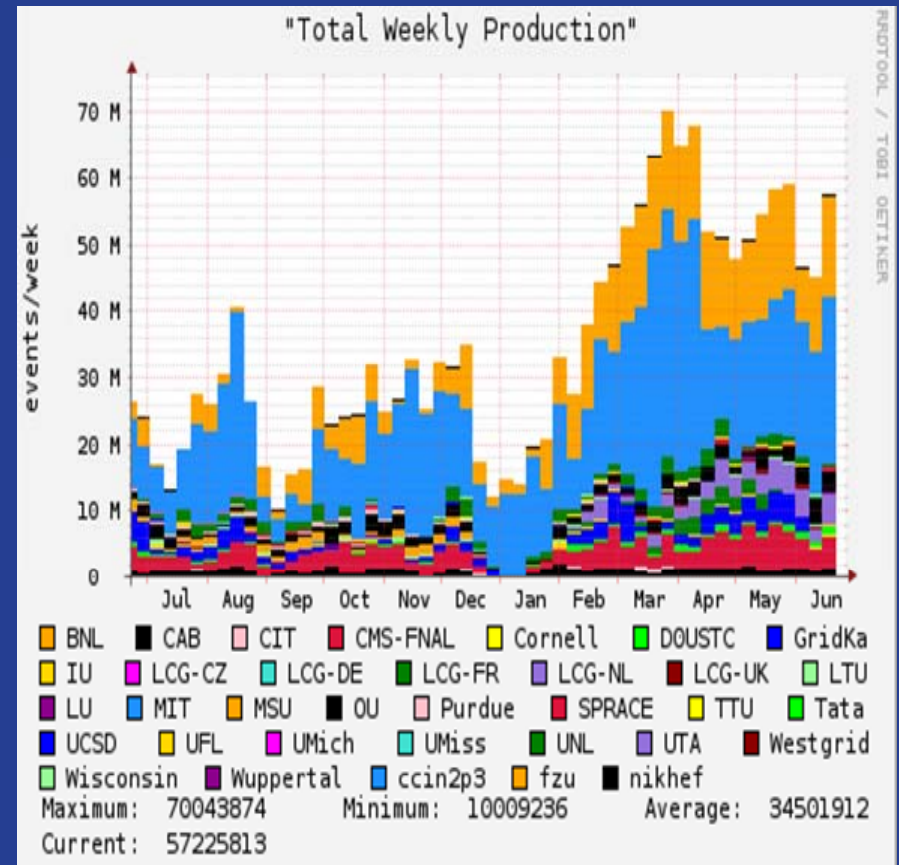
DØ is collecting data with over 90% data taking efficiency

Data Processing and Monte Carlo Generation



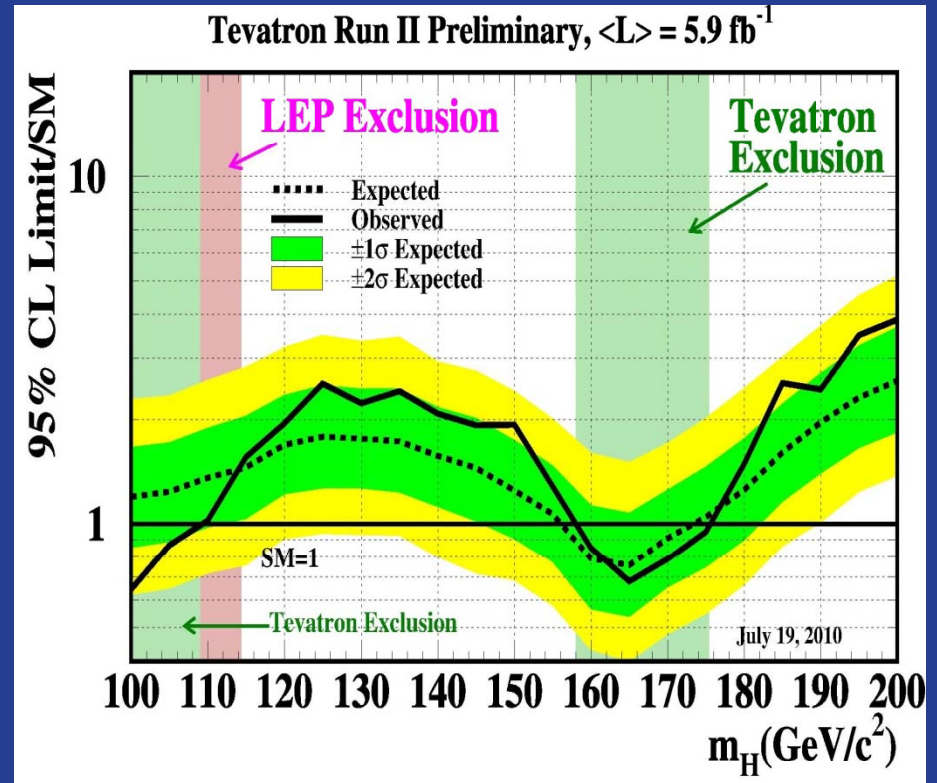
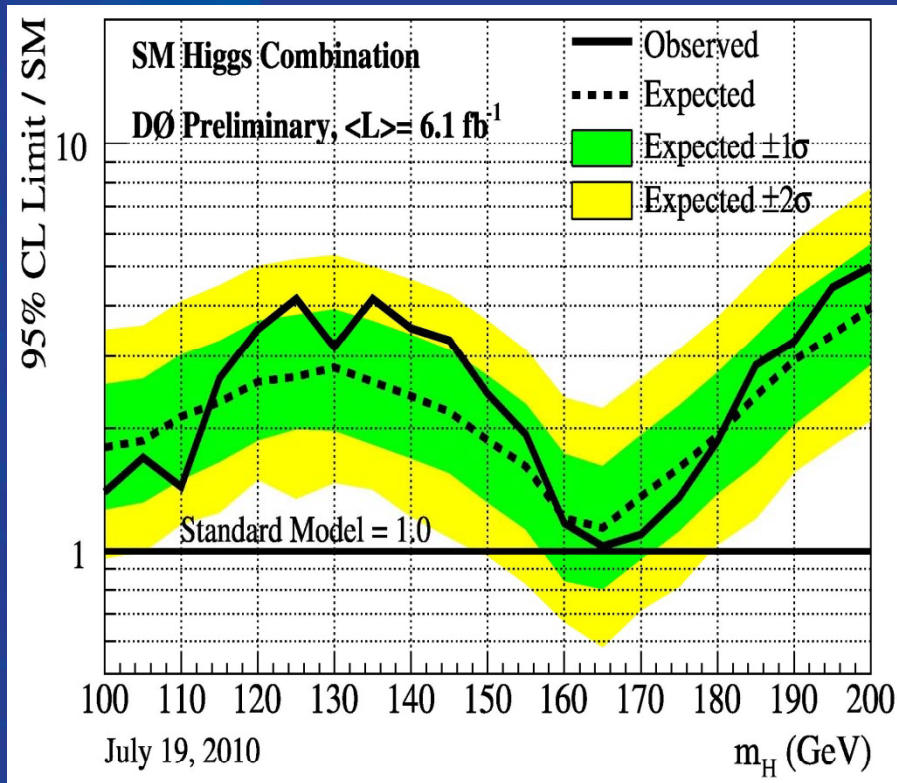
Timely processing of all raw data on Fermilab's farms

Monte Carlo generation is greatly improved due to strong contributions from all over the world



Higgs Searches

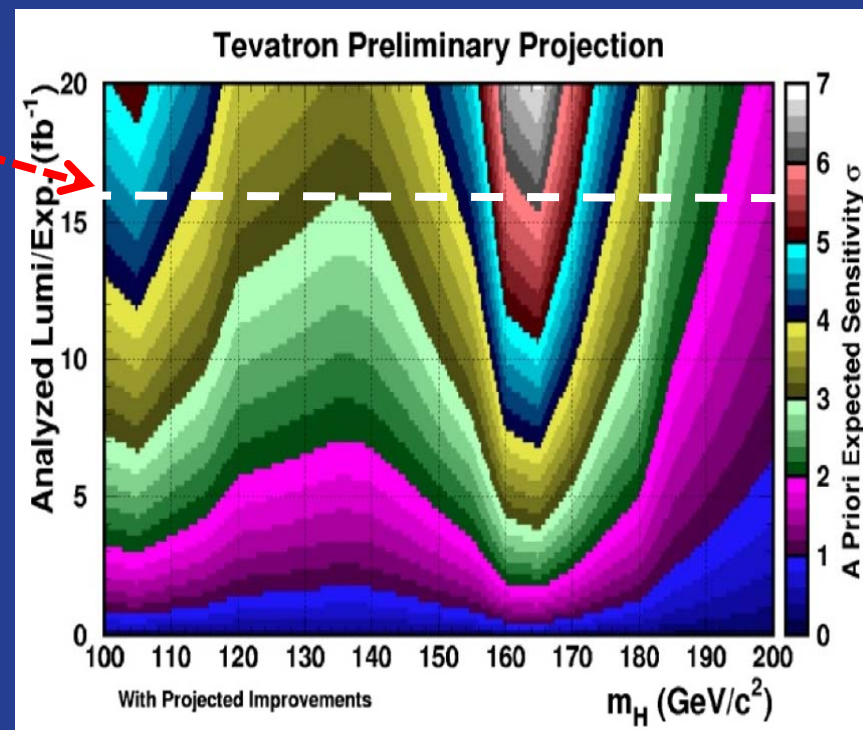
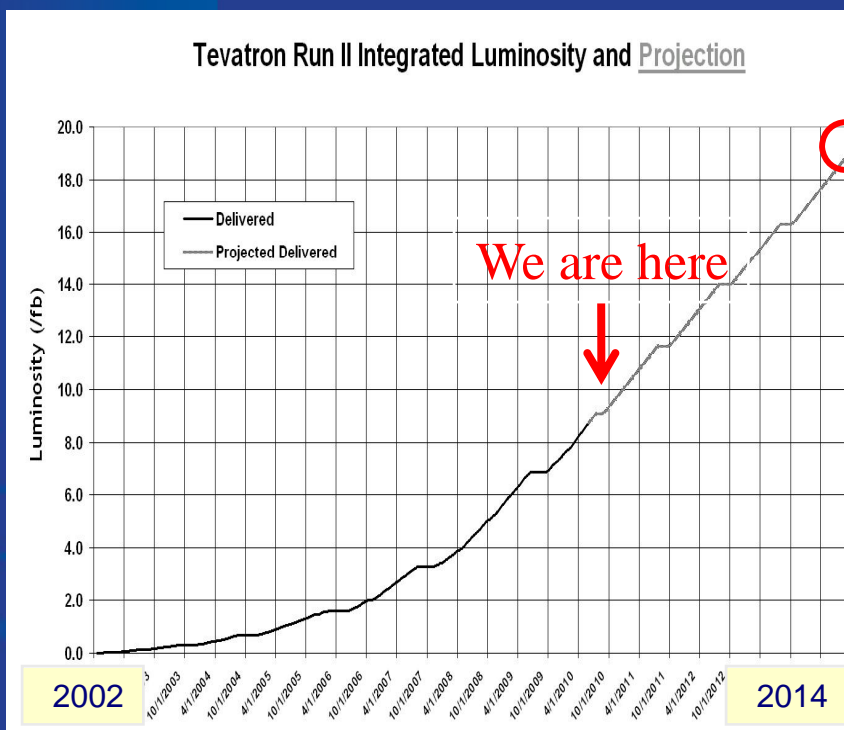
- Combining 10's of analysis channels into Higgs search summary
 - DØ only combination and Tevatron combination



- With major contributions from Fermilab scientists Tevatron excludes Higgs in the 158-175 GeV mass range
 - Tevatron is steadily reducing range of allowed Higgs mass
- In all remaining to study mass range sensitivity is within factor of 1.8

Higgs Future Tevatron Projections

- Search for SM Higgs boson is one of the major physics goals of the Tevatron
- Tevatron is steadily reducing region of allowed Higgs masses
 - Updated LHC operating parameters and schedule provides window of opportunity
 - With Tevatron running through 2014 we will be able to see evidence of Higgs existence in all allowed mass range!



Personnel Needs and Resources

- We have estimates for resources required to run the experiment through 2014 based on our past experience and future plans
 - ~ 80-100 FTEs total needed
- ~30 FTEs are required for control room shifts and experiment management
 - Well defined collaboration rules for shifts
 - No issues are anticipated with experienced and enthusiastic managers
- ~60 FTEs are needed for algorithms, computing and detector support activities
 - Many experiment groups and individuals have very high level of commitment to the detectors, algorithms and computing contributions they made
 - Fermilab provides critical support in many areas
 - There is substantial influx of collaborators
 - ~30 over last year
 - Only ~4% decrease in collaboration membership over past year
 - Newcomers are regularly trained in specific areas to replace departing experts
 - Funding agencies are supportive
 - Support of DOE groups and targeted help by DOE – supplemental funding
 - Support of NSF groups
 - International Fellows program by the laboratory
 - ~\$1M visitors budget provided by the laboratory
 - Facilitates availability of ~40 FTEs
- **International Finance Committee re-confirmed long term support for DØ groups**

The DØ Experiment Resources

- Table below summarizes
 - Actual manpower efforts in operations, algorithms, computing and management in 2009
 - Expected manpower needs in 2011 and beyond
- Total experiment manpower in 2009 estimated at ~280 FTEs
 - Through 2014 estimate is ~170-190 FTE

Physicist FTE's	Operations	Algorithms	Computing	Management	Support Total
2009 actual	50	27	13	10	100
2011 and beyond estimate	~50	~20	~10	~10	~90

- Matching collaborators to tasks is well known challenge for the experiment management
 - Working closely with the experiment groups, individuals, funding agencies and the laboratory
 - Have been able to meet this challenge efficiently
 - Assuming that support continues and based upon the interest and commitments from the collaboration, we expect to have the necessary manpower to run through 2014

Support for Guests and Visitors

- Fermilab provides opportunities for many scientists to participate actively in exciting Tevatron program
- **International Fellowship program**
 - ~2 International Fellows selected from large number of applicants to work on DØ per year
 - From students to professors from non-US groups
China, UK, Czech Republic, Korea, Russia, France, Germany...
 - Improves international cooperation and enhances Tevatron program
- **Guests and visitors support**
 - To address critical for the experiment needs
 - Teaching buyout for the experiment leadership
 - Support for foreign students and post-docs to stay at Fermilab
 - This support is very productive providing ~40 FTEs to the experiment per year via splitting support with collaborating groups
- Fermilab provides excellent environment where scientists from all nations feel welcome and work as colleagues at the energy frontier accelerator

Summary

- Fermilab is providing excellent support for energy frontier program
- Over 100 new exciting results from DØ over past year
- Fermilab physicists participate in all key areas of the experiment from operations to physics analysis
 - 28 FTEs will be involved in the experiment in FY10 and FY11
- Exciting potential for fundamental physics results
 - Legacy measurements
 - Hints of physics beyond Standard Model
 - Search for the Higgs boson