DØ Legacy – Students and Postdocs

Stefan Söldner-Rembold
University of Manchester

DØ Special Collaboration Meeting, Fermilab, June 10, 2014

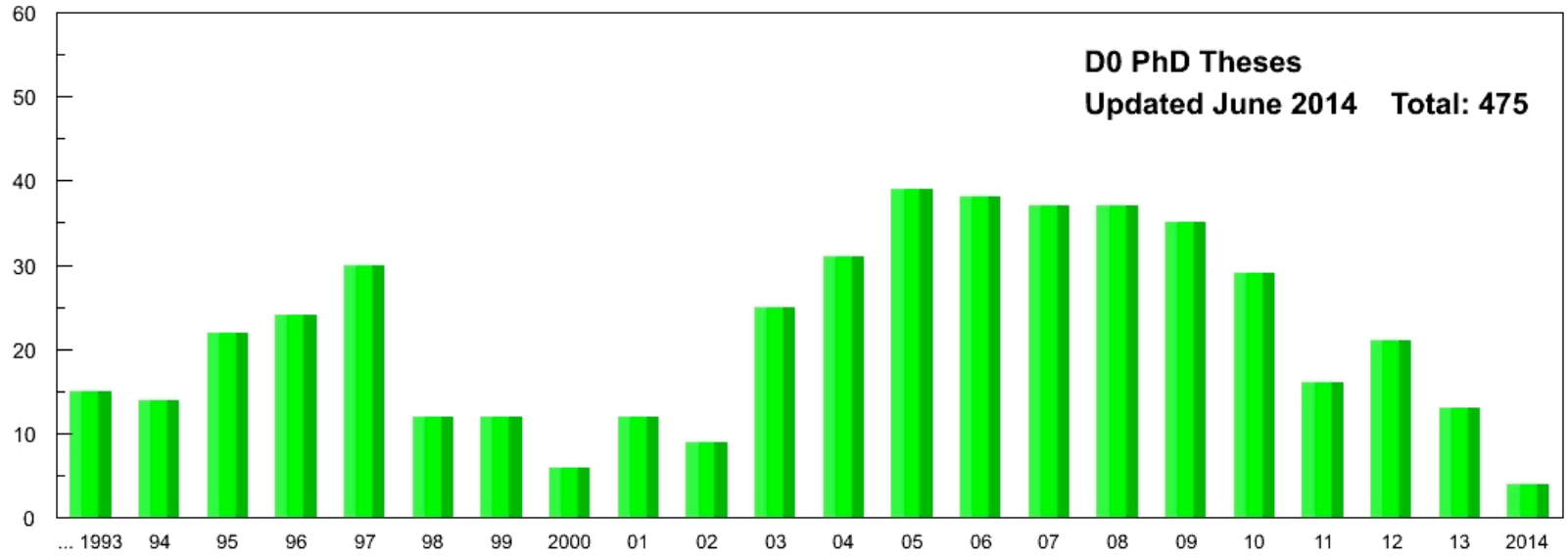
“Legacy”

The legacy of DØ takes many forms:

- The physics results and discoveries (top quark, Higgs boson, W boson mass, B_s oscillations, B baryons, New Phenomena searches, high energy jets..).
- The hardware which pushed the boundaries of detector physics and informed the design of next generation experiments.
- The software and novel analysis tools (Jet Energy Scale, b-tagging, particle identification, multivariate techniques, limit setting and statistical methods..).
- The data which will be preserved for future use.

This legacy would not exist without the students and postdocs, their enthusiasm and dedication. They are an important legacy not only to Particle Physics, but to science and the society.

PhD Theses

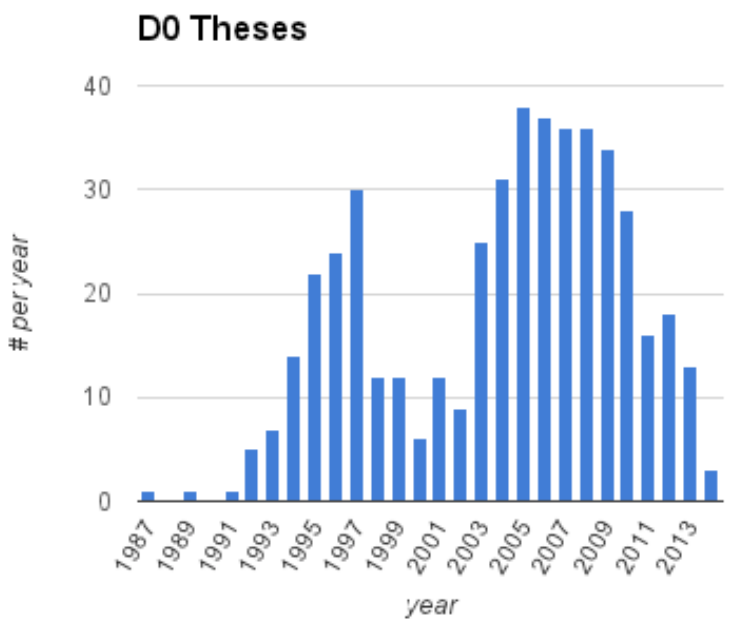


Run I Run II

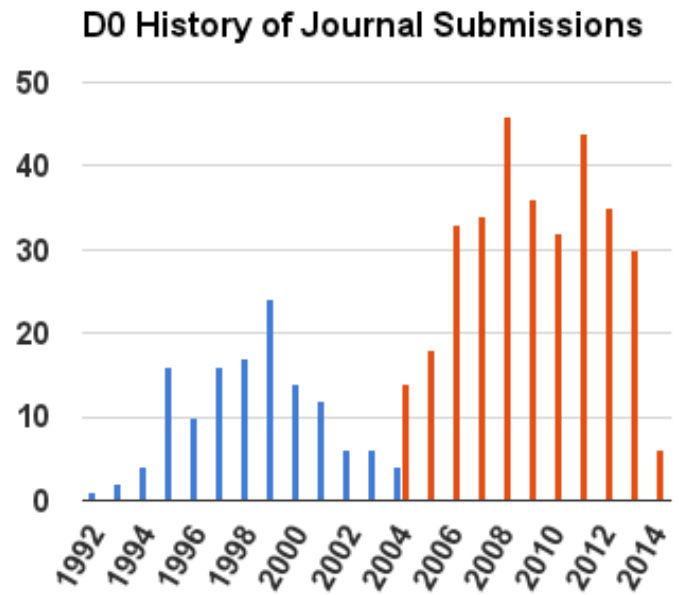
maintained by Sharon Hagopian

Correlations

471 theses



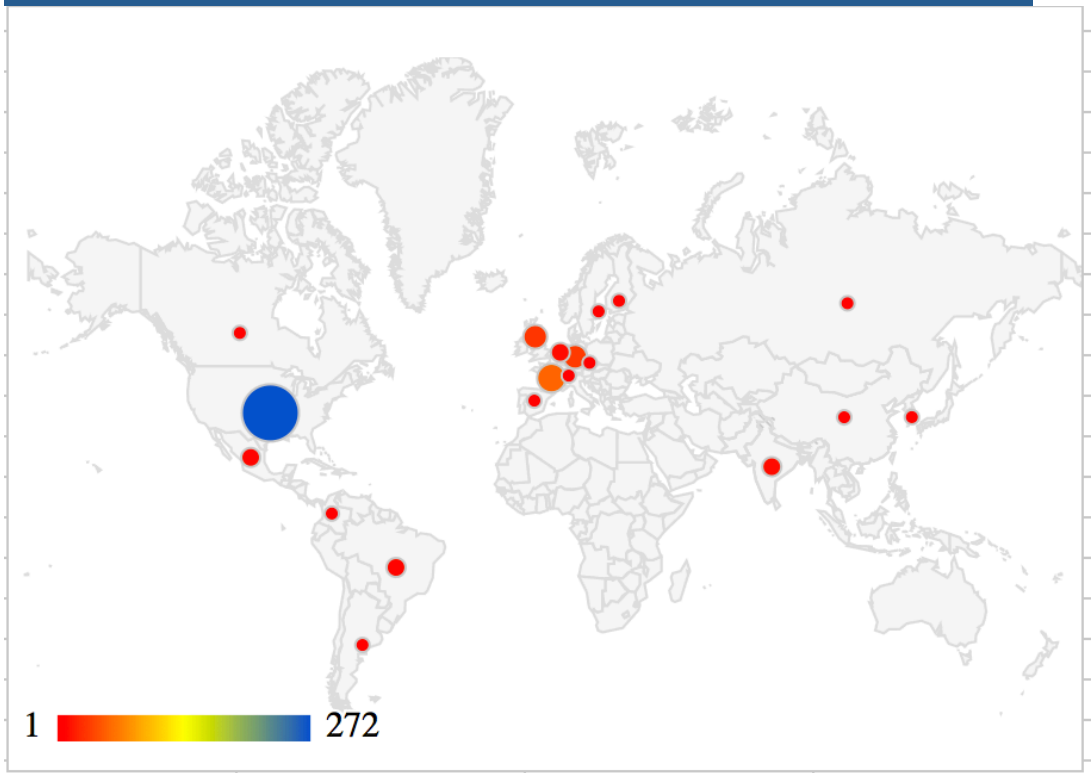
461 publications

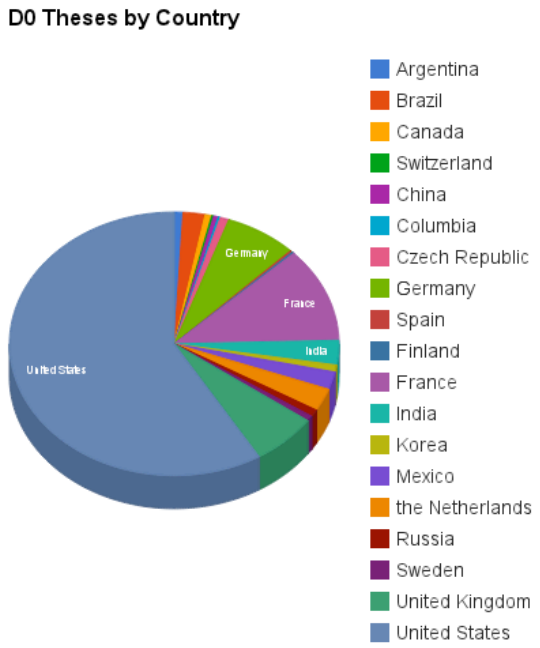


Who wrote the theses that didn't get published?

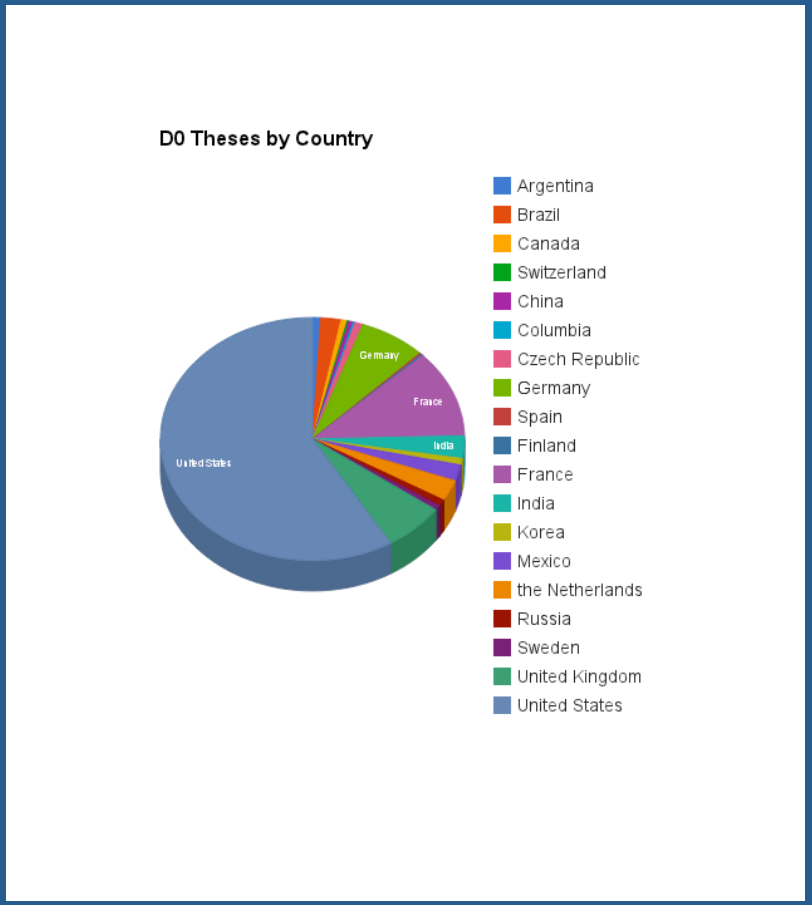
http://www-d0.fnal.gov/Run2Physics/WWW/results.htm#history
(maintained by Bob Hirosky)

A World-wide Collaboration

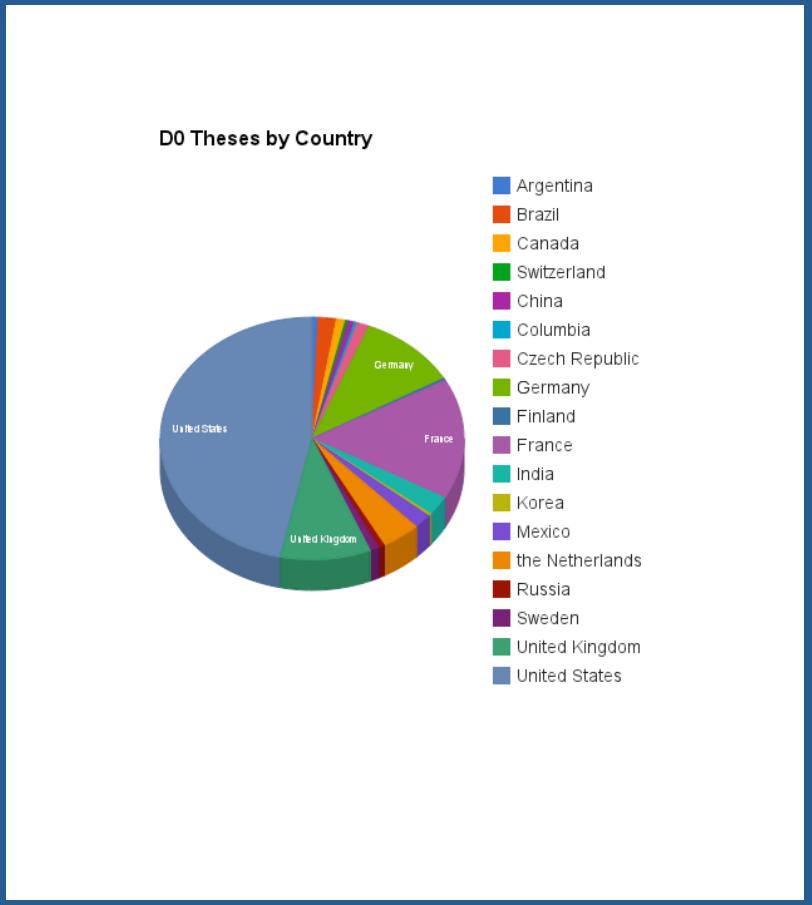




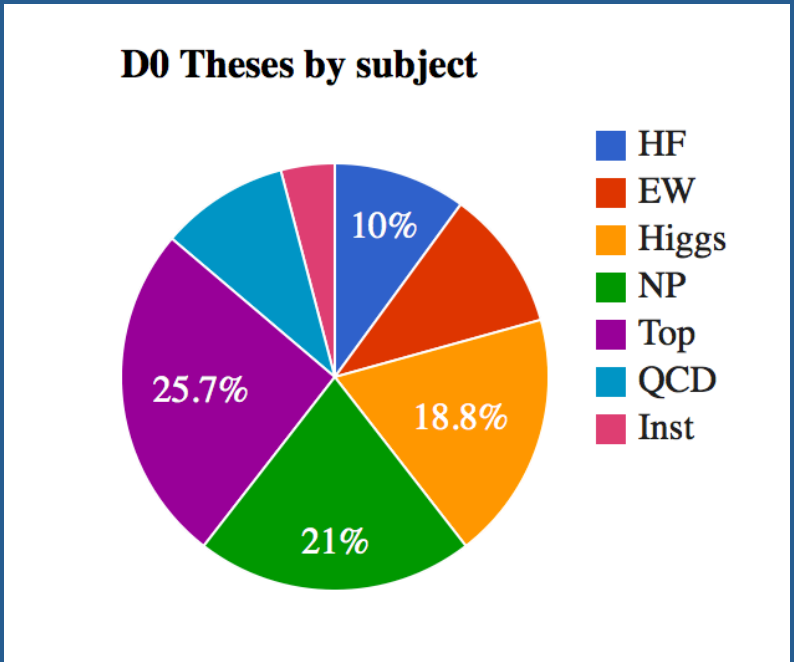
Run I

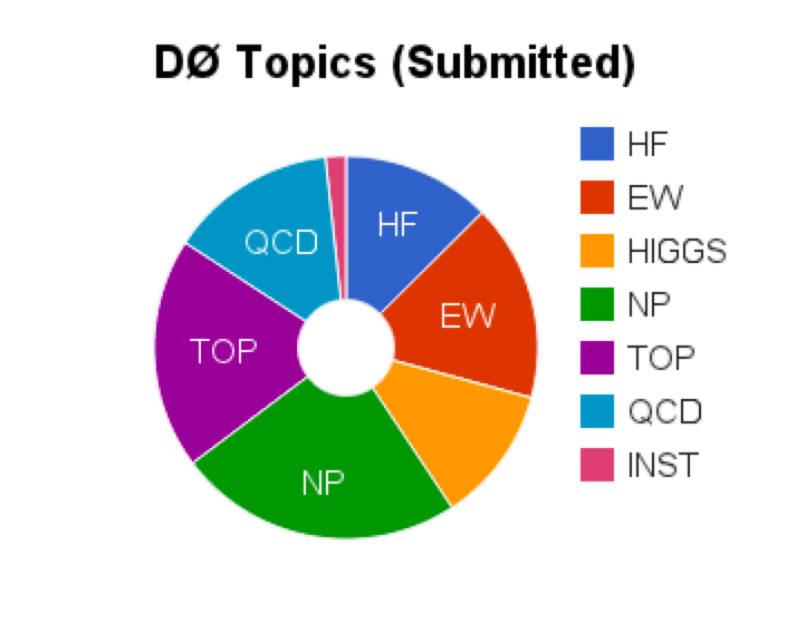


Run II



Even more international in Run II with many new countries joining DØ





The almost even distribution of thesis topics demonstrates the astonishing breadth of our physics programme.

How did it start ?

Richard Astur	MSU	Single Jet Inclusive Cross Section 1992
Jeffrey Bantley	Northwestern	Foward Drift Chamber in the 1990 Testbeam Run 1992
Ties Behnke	Stony Brook	Central Drift Chamber Design, Construction and Test 1989
Jim Cochran	Stony Brook	Search for Truth in the e-mu Channel at D0 1993
Sarah Durston	Rochester	Electromagnetic and Hadronic Shower Shapes and Position Resolution, and the Jet Energy Response 1993
Fabrice Feinstein	SACLAY	Etude d'un Detecteur a Rayonnement de Transition pour l'Experience D0 au FNAL 1987
Terry Geld	Michigan	The D0 Intercryostat Detector: Design Considerations and Test Beam Studies and Intial Performance 1993
Terry Heuring	Stony Brook	Electrons in the D0 Central Calorimeter: A study of the systematic Biases in the W Mass 1993
Jonathan Kotcher	New York	Response of the D0 Calorimeter to Cosmic Ray Muons 1992
Andrew Milder	Arizona	Dijet Angular Distributions at sqrt(s)=1.8 TeV using the D0 Detector 1993
Doug Norman	Maryland	A Search for First Generation Scalar Leptoquarks at sqrt(s)=1.8 TeV with the D0 Detector 1993
Bo Pi	MSU	The e/pi Ratio Difference Between Short and Long Integration Times with the D0 Calorimeter 1992
Domenic Pizzuto	Stony Brook	D0 Central Tracking Chamber Performance Studies 1991
Srini Rajagopalan	Northwestern	The dE/dx capablilities of the D0 Tracking System 1992
Jaehoon Yu	Stony Brook	Determination of the Strong Coupling Constant and a Test of Perturbative QCD Using W+Jets Process 1993

The second thesis

The Central Drift Chamber for the DØ experiment: Design, Construction and Test

A Dissertation Presented

by

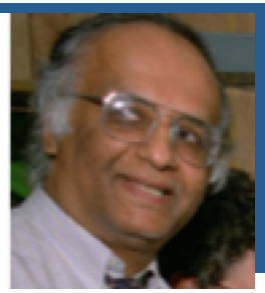
Ties Behnke

Department of Physics

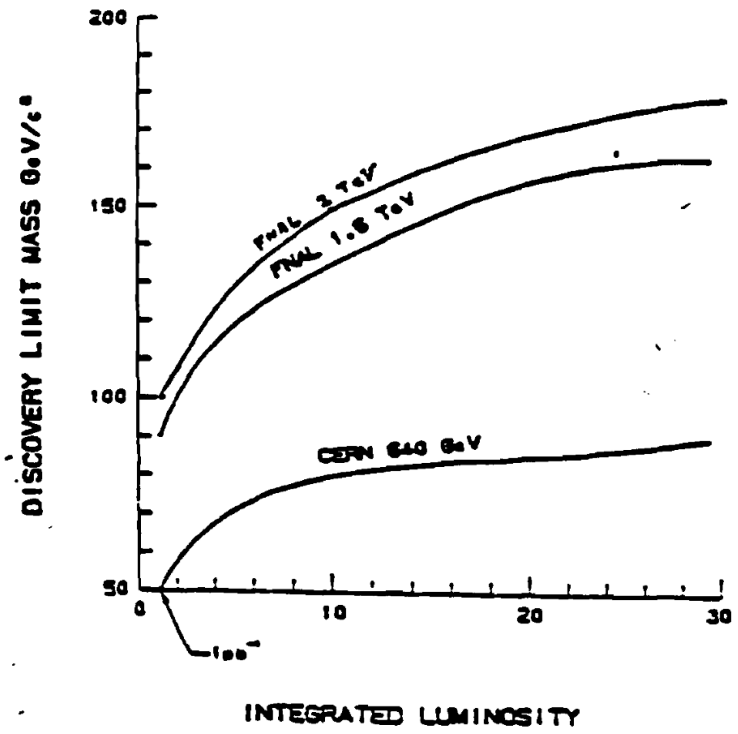
Paul Grannis
Professor
Department of Physics

Stony Brook

August 1989



plot by R. Raja (1948-2014)



Ties Behnke is now working on the LC at DESY

Ties Behnke in action with Central Drift Chamber

In particular the following questions will be addressed by the DØ detector: Low p_t processes (minimum bias physics)

- mini jets
- multiplicity at high $\sqrt{s}$

Precision measurement of the W/Z properties

- mass difference
- decay widths
- production mechanism
- rare decays
- decay asymmetries

Test of QCD at very large q^2

- jet topological cross section
- compositeness searches
- direct photon study

Searches for new states. extensions of the standard model

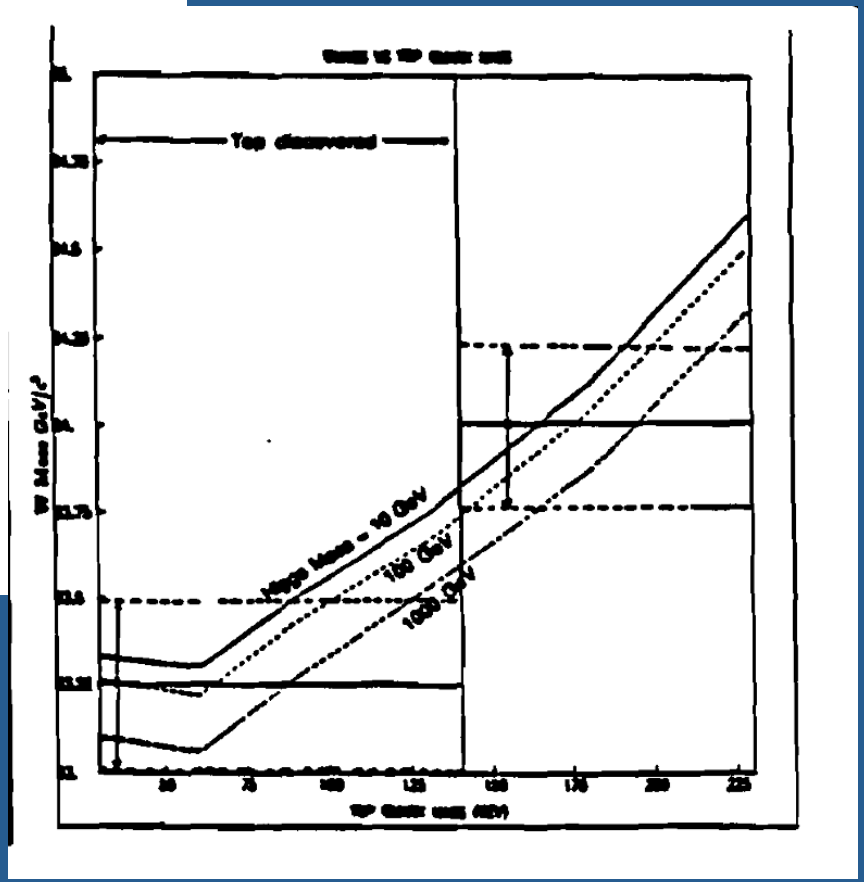
- new families
- Higgs Sector
- heavy Leptons
- new quarks (including the top)
- additional gauge bosons

New phenomena at large q^2

- supersymmetry
- technicolor
- strings???
- ...

Assumes 125 MeV precision of W mass measurement

M(W)



m(top)

The first thesis

LE TITRE DE DOCTEUR EN SCIENCE

par

Fabrice FEINSTEIN

ETUDE D'UN DETECTEUR A RAYONNEMENT DE TRANSITION POUR L'EXPERIENCE D0 AU FNAL

Soutenue le 14 décembre 1987 devant la commission d'examen

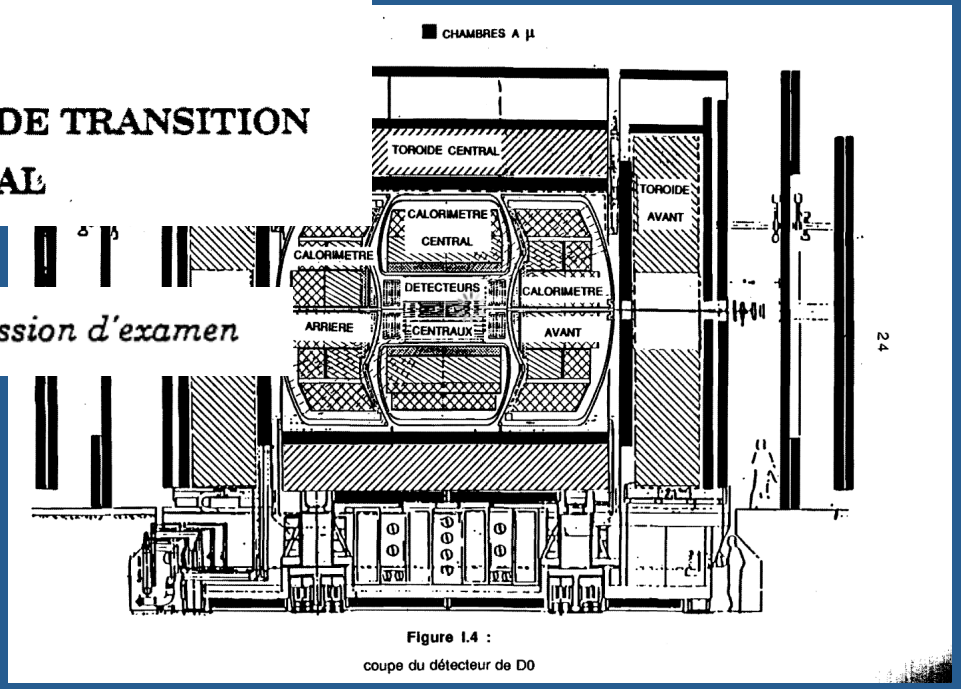
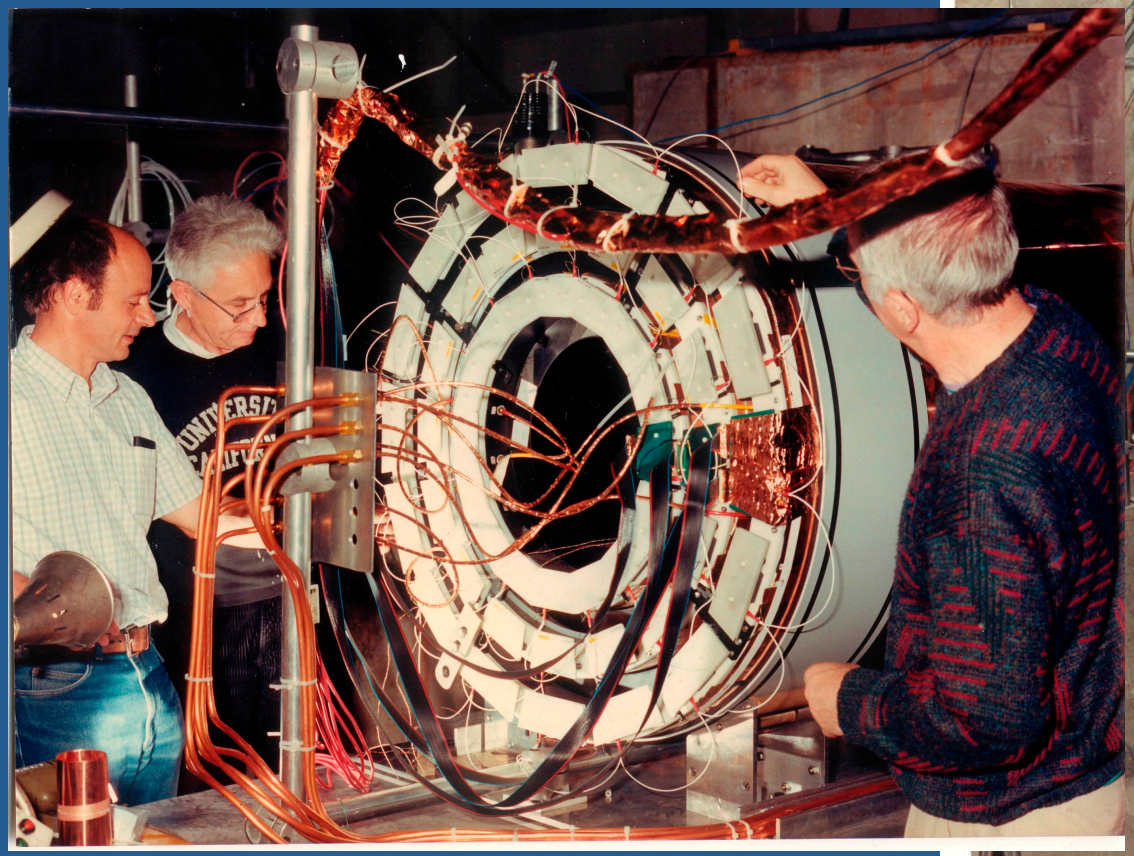


Figure I.4 :
coupe du détecteur de D0

Fabrice Feinstein now works on γ-ray astronomy at Montpellier

LUPM LABORATOIRE MONTPELLIER UNIVERS & PARTICULES

Transition Radiation Detector



1988 Saclay Group

Non scholae sed vitae discimus !

(based on Seneca the Younger, AD 65)

- Many of our students and postdocs have moved on to join other experiments, mainly ATLAS, CMS, LHCb, plus experiments at the intensity frontier (g-2, NOvA, LBNE…).

- In 2011, the overlap between the Tevatron and LHC author lists was about 400.

- Many former DØ students and postdocs play a leading role on these experiments.

- Many students and postdocs are now applying their knowledge and skills outside Particle Physics, benefitting science and society.

Financial Impact

- Value of a PhD student
  - $2.2M (US Census Bureau, 2002) = $2.8M (2013 $)
- Number of students trained at DØ
  - 462

Financial Impact = **$1.3 billion**

- An excellent investment !

inspired by J. Womersley's Tevatron Symposium talk

Destinations

Medical Physics

Particle Physics

Education

Financial Services

Security/Intelligence

Science Politics
(e.g. DoE, STFC)

Big Data

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Medical Physics

Particle Physics

Education

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Security/Intelligence

Science Politics

(e.g. DoE, STFC)

Big Data

It is impossible to cover all these, so I will just show you a few recent examples..

Measurement of the W Boson Mass in Proton-Antiproton Collisions at a Center of Mass Energy of 1.96 TeV

Northwestern, 2010

UNIVERSITY OF KWAZULU-NATAL
INYUVESI YAKWAZULU-NATALI

Sahal Yacoob began at UKZN in 2012 and is currently building a group to investigate the fundamental properties of matter.

Sahal ‘s goal is to establish experimental particle physics in his native South Africa.

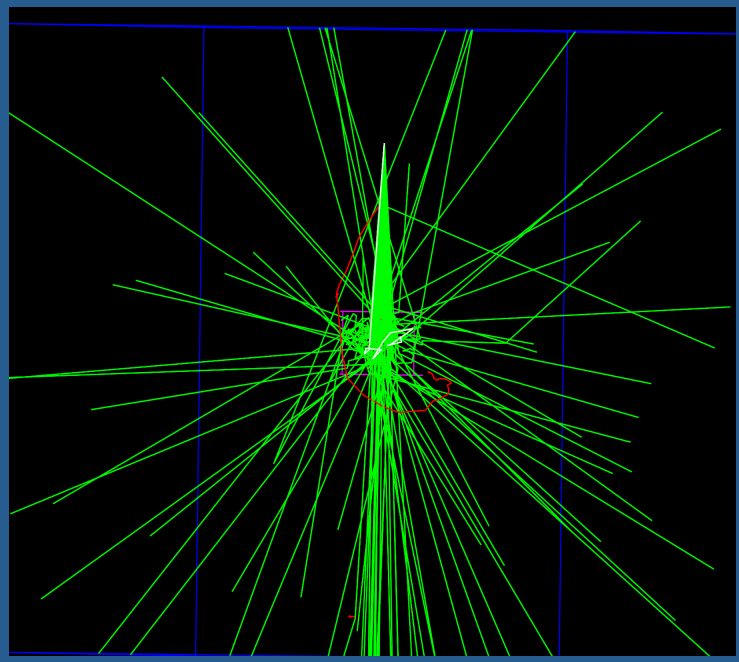
RICE UNIVERSITY

Search for the Rare Decay $B_s^0 \to \mu^+\mu^-$ at DØ

by

Michelle Victoria Prewitt

THE UNIVERSITY OF TEXAS
MD Anderson
Cancer Center



Michelle Prewitt works on testing and development of dosimetry devices.

This work includes GEANT4 applications (see figure).

What was special about working for DØ?

- Every student/postdoc could work on his own publishable analysis/channel/data sets.

- Every student/postdoc could work on (and have responsibility for) a component of the detector or the software.

This helped to develop many “transferable skills”:

- Project management skills.
- Ability to work with large and complex data sets.
- Work in international environment.

Creating an academic environment

University of DØ

There were concerns that students/postdocs are not exposed to an academic environment similar to a university when working at the Lab.

In early 2010, The University of DØ was therefore reestablished with the goal of organizing academic-style lectures for the DØ collaborators.

June 13, 2014 (Friday)

Speaker: Rick Van Kooten
Indiana University

Title: *"P5 for Students & Postdocs"*

Summary