

## Calendar

### Thursday, September 9

**2:30** Theoretical Physics Seminar

- Curia II

Speaker: J. Laiho, Fermilab

Title: Improving the Lattice Calculations of  $e/\nu$

**3:30** DIRECTOR'S COFFEE BREAK -

2nd Flr X-Over

**4:00** Accelerator Physics and Technology Seminar - 1 West

Speaker: L. Jin, University of Kansas

Title: Coherent Beam-Beam Effects in Storage-Ring Colliders

### Friday, September 10

**3:30 p.m.** Wine & Cheese - 2nd Flr X-Over

**4:00 p.m.** Joint Experimental Theoretical Physics Seminar - 1 West

Speaker: A. Khanov, University of Rochester

Title: Top Cross Section Measurement in the Lepton + Jets Channel with B-Tagging at DZero

## Wilson Hall Cafe

### Thursday, September 9

Aztec Tortilla soup

Hot Italian Sub \$4.75

Chicken Picata \$3.75

Thai Beef \$3.75

Roast Beef Cheddar on Kaiser Roll \$4.75

Beef Stromboli \$2.85

Marinated or Cajun Chicken Caesar

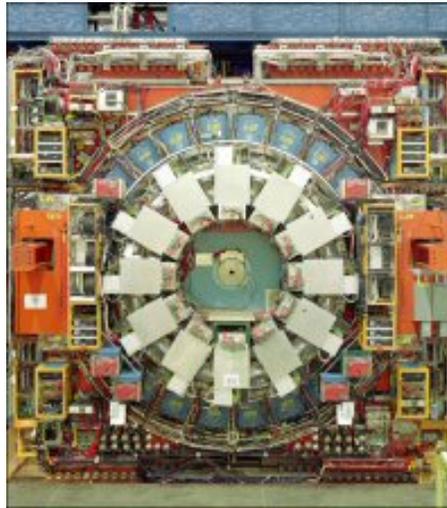
Salads \$4.75

[Wilson Hall Cafe Menu](#)

[Chez Leon](#)

## Weather

## Why We Care About the Top Quark: CDF Explains



The CDF Detector

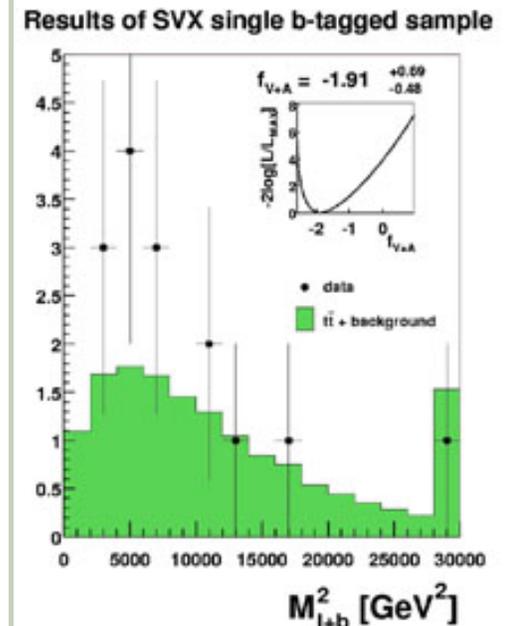
Fermilab's CDF and DZero experiments announced the discovery of the top quark March 2, 1995, confirming earlier evidence found in 1994 by CDF. So why, ten years later, are scientists at the world's highest energy particle accelerator laboratory still spending their days and nights studying the top?

"The top is unique--it has a big mass, which makes it very different from the other five quarks," explained Fermilab theorist Tim Tait. "If we can measure its properties precisely, we're likely to gain insight into completely new physics."

Like the electron, the top quark is one of the fundamental particles of nature. Unlike the electron and other quarks, it is extremely heavy, with a mass almost 200 times that of the proton. The top's large mass gives it a special role in electroweak symmetry breaking, the phenomenon that physicists believe gives mass to all the particles in the universe and whose nature has yet to be revealed. The

## Fermilab Result of the Week

### The Spin is In! CDF II Looks at Top Decay



Run I measurement of W polarization in the single b-tagged sample using matched b-quarks with the lepton from W decay. Points represent the data, while the shaded area denotes the signal-plus-background expectation. Inset shows the negative log likelihood as a function of the forbidden spin +1 fraction. The best fit to these data is where this curve is a minimum. (Click on image for larger version.)

The discovery of the top quark by CDF and DZero in 1995 was accompanied by the observation that the top quark mass is very large, nearly that of a gold nucleus. Run II offers the first chance to precisely measure properties of the top quark which might reveal hints to explain this puzzling mass.

CDF has tested the polarization of the W boson produced in the decay of a top quark. The polarization refers to the direction of the W-boson's intrinsic angular momentum ("spin") with respect to its direction of motion. Quantum mechanics says that this spin must point



Decreasing Clouds **74°/50°**

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Standard Model, the conventional theory of particle physics, puts the still-unobserved neutrally charged Higgs boson at the heart of electroweak symmetry breaking. Precise measurements of the top quark's properties will advance physicists' knowledge of electroweak symmetry breaking and the properties of the Higgs.

[read more](#)

### In the News

#### FYI: AIP Bulletin of Science Policy News, September 8, 2004:

#### Status of FY 2005 Appropriations Bills

The new fiscal year starts in a little over three weeks, and twelve of the thirteen appropriations bills are far from complete. As Congress returns to work this week, it faces a daunting work load beset by real time constraints in a highly partisan environment. This FYI reviews the status of the appropriations bills of greatest interest to the physics community. A subsequent FYI will look at some of the constraints to the completion of these bills.

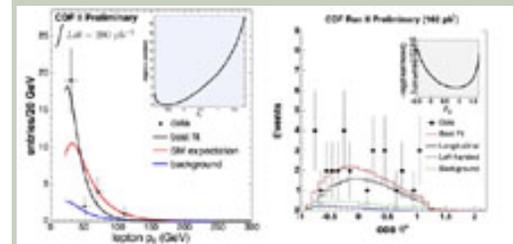


#### ENERGY AND WATER DEVELOPMENT APPROPRIATIONS BILL:

The House passed its version of this FY 2005 funding bill on June 25. The Senate bill has not cleared the subcommittee.

H.R. 4614 would increase the high energy physics budget by 2.7%; the nuclear physics budget by +6.5%, the basic energy sciences budget by +8.8%, the fusion energy sciences budget by +5.1%, and the advanced scientific computing

in one of three directions with respect to the W-boson's motion, referred to as right-handed, left-handed and longitudinal. Each time a top decays, experimentalists can measure how often each polarization state occurs. The fraction of a particular polarization is determined by the interactions in top decay. The left-handed part is a familiar piece of the weak interaction, which has no right handed term. The longitudinal part comes from the symmetry breaking mechanism that gives the particles their masses, and is huge for the top quark. All told, we should see 30% left-handed W bosons, 70% longitudinal W bosons, and no right-handed W bosons. If top has different interactions, however, or the masses are due to another effect, all bets are off!



Run II measurements of W polarization. At left, a measurement of the longitudinal fraction in the dilepton sample using lepton momentum. Points represent the data, the best fit to these data is denoted by the black line. At right, a measurement of the longitudinal fraction in the lepton-plus-jets sample using the decay angle of the W boson. Points represent the data, the best fit to these data is denoted by the red line. (Click on image for larger version.)

A recent analysis on Run I CDF data by a team from Rochester and Ohio State using matched b-quarks with the lepton from W decay as a "polarimeter" measured the fraction of the forbidden right-handed state to be < 0.18 at 95% CL. CDF also has two new measurements using Run II data: One team at the University of Michigan used lepton momentum and measured the longitudinal fraction to be < 0.59 at 95%

research budget by +15.7%. The only budget that would be cut is that for Biological and Environmental Research, by a proposed -10.9%. All figures are as compared to the current year's budget.

The House bill provides no funding for the Robust Nuclear Earth Penetrator, Advanced Concepts Research, Enhanced Test Readiness, and the Modern Pit Facility.

[Read more](#)

[CL](#) in the dilepton sample, and [0.88 +0.12 -0.47 \(stat.+ syst.\)](#) in the lepton-plus-jets sample. A second team at the University of Illinois at Urbana-Champaign used the decay angle of the W boson and found the longitudinal fraction to be [0.89 +0.11 -0.38 \(stat. + syst.\)](#) in the lepton-plus-jets sample.

So far, these results are consistent with top being just another quark, but expected deviations which might lead to an explanation of the top's weight problem might be subtle and therefore require a more precise measurement. As Run II continues to accumulate data, this polarization test will lead to closer scrutiny of the nature of top.



W polarization analysis group, from left to right: Nathan Goldschmidt (U. of Michigan), Ben Kilminster (Ohio State U.), and Trevor Vickey (U. of Illinois at Urbana-Champaign). Not pictured: Ken Bloom, Stephen Miller, David Gerdes and Dan Amidei (U. of Michigan), Kevin McFarland (U. of Rochester), Tony Liss (U. of Illinois at Urbana-Champaign). (Click on image for larger version.)

[Result of the Week Archive](#)

## Announcements

### **Fermilab Health Fair Today**

Fermilab's Semi-Annual Health Fair is today from 11:00 a.m. to 2:00 p.m. in the Atrium of Wilson Hall.

### **Yoga Presentation Today**

As part of the Fermilab Health Fair, Christopher Baxter of Universal Sprit Yoga will demonstrate yoga techniques in the Atrium of Wilson Hall today at 1:00 p.m.

### **Budker Seminar Tonight**

There will be a Budker Seminar Held on Thursday, September 9 in the Users' Center Music Room.

Talk Title: "Strand and Cable Studies for High Field Magnets"

Speaker: Bernardo Bordini

Location: Users' Center Music Room

Pizza, beer and soft drinks will be served at 6:00 p.m.

### **UEC Career Night Tonight**

The Fermilab UEC will be hosting a Career Night on Thursday, September 9 from 7:00 p.m. to 9:00 p.m. in One West. The talks are aimed at graduate students and young physicists, but everybody is welcome. Wine and cheese will be served from 6:00 p.m. to 7:00 p.m. For more information, contact a member of the Organizing Committee: Ken Bloom, Sharon Hagopian, Lydia Lobo, or Paul Sheldon.