Collider Physics at UC Davis

John Conway

From the LHC to the Universe

Taipei, Taiwan
15 Dec 2008

Collider Group

Our group is involved in two experiments:

- CDF at the Tevatron
  - trigger upgrade for high luminosity
  - top quark physics
  - physics with taus
- CMS at the LHC
  - endcap muons
  - forward pixels
  - physics: searches (Higgs, SUSY, TC,...)

Collider Faculty

- Richard Lander - founder and leader; retired
- Winston Ko - CMS group founder; MPS Dean
- Dave Pellett - CDF/CMS pixel project
- Mani Tripathi - CMS EMU
- Robin Erbacher - CDF Top/XFT Group Leader; CMS
- Max Chertok - CDF/CMS pixels and tau physics
- John Conway - CDF/CMS pixels and tau physics

Scientists

Our senior scientists play a key role in shaping and continuing the physics program in the group!

- Richard Breedon - leader in CMS EMU
- John Smith - expert on modern MC techniques
- Tim Cox - leader in CMS software project

Collider Postdocs

We have a great team of postdocs:

- Aron Soha (FNAL) CDF, CMS
- Andrew Ivanov (FNAL) CDF
- Christian Veelken (CERN) CMS
- Ricardo Vasquez (CERN) CMS
- Thomas Schwarz (FNAL) CDF, CMS

Graduate Students

Rob Forrest (CDF/FNAL) - XFT upgrade; tau physics

Will Johnson (CDF/FNAL) - trigger; stop search

Evan Friis (CMS/Davis) - pixel commissioning; Higgs w/taus

Sho Maruyama (CMS,FNAL) - tau trigger; physics

Matt Searle (CMS,CERN) - pixels; top resonances

Carley Kopecky (CMS, Davis) - technicolor search

David Cox (CDF/FNAL) - XFT upgrade; top physics

Charles Cox (CDF/FNAL) - tau triggers; Higgs search

James Dolen (CMS, Davis) - top resonances

Tia Miceli (CMS, Davis) - halo muons; physics with γ/μ

Milan Nikolic (CMS, Davis) - pixels; $H \rightarrow ZZ$

Mike Squires (CMS, Davis) - grid computing; top resonances

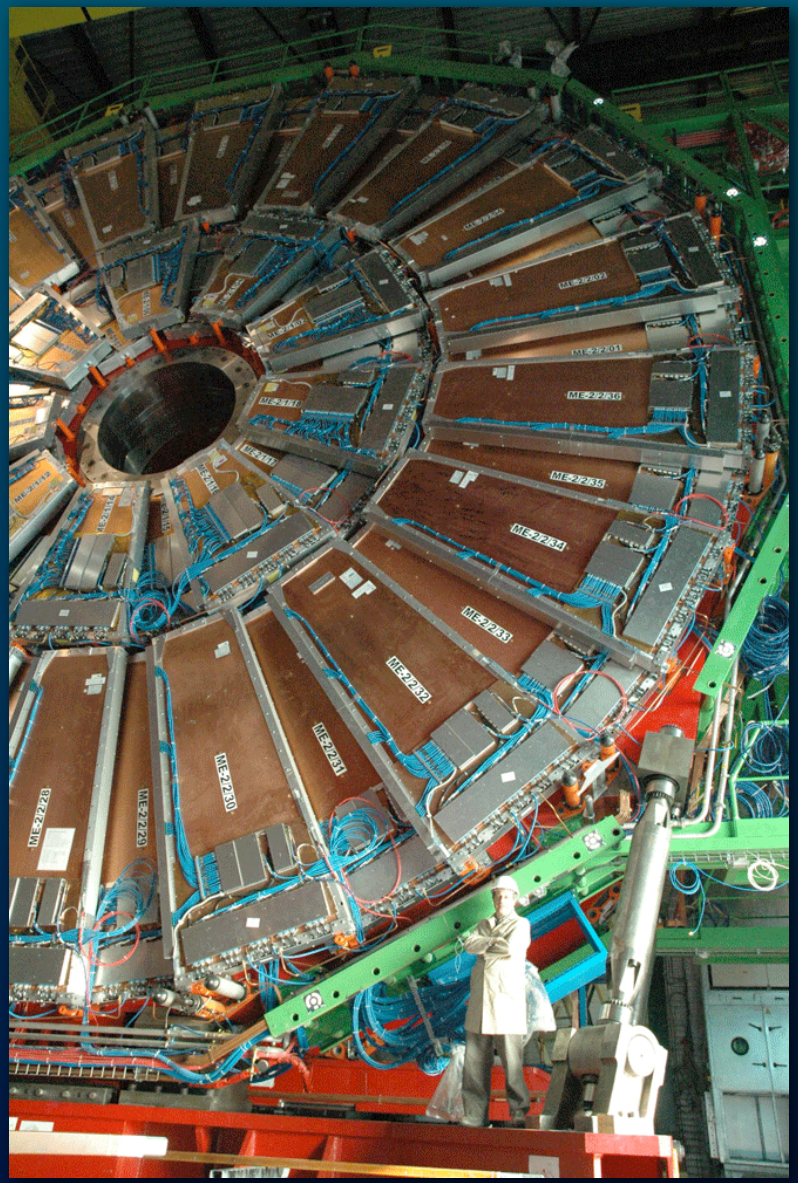
27 scientists at UC Davis work in the area of collider physics!

CMS

- Davis group was a founding member of US CMS in 1992 on the endcap muons (EMU) and the pixel detector
- Davis still plays a major role in both projects (as you will see in later talks)!
- Muon chambers are fully operational: beautiful results from cosmic runs
- Forward pixels installed and being commissioned

Endcap Muons

- Richard Breedon is resident full time at CERN this year, serving as CSC Operations Manager
- Tim Cox continues to lead the forward muon reconstruction effort at CERN



CMS Pixels

Davis is a key member on the Forward Pixels:

Lander developed bump bonding

Conway leads Transport/Installation

Chertok coordinated the installation at CERN

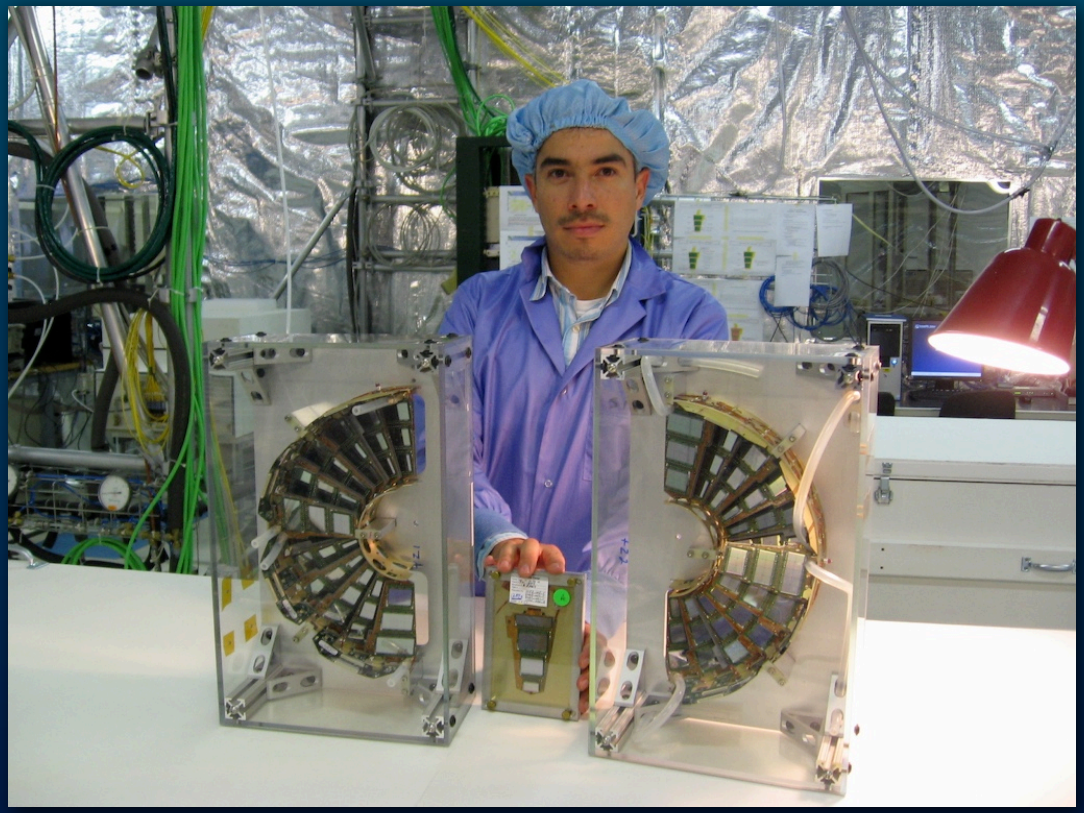
Pellett helped design/build installation fixtures

Veelken is pixel DCS Software Coordinator

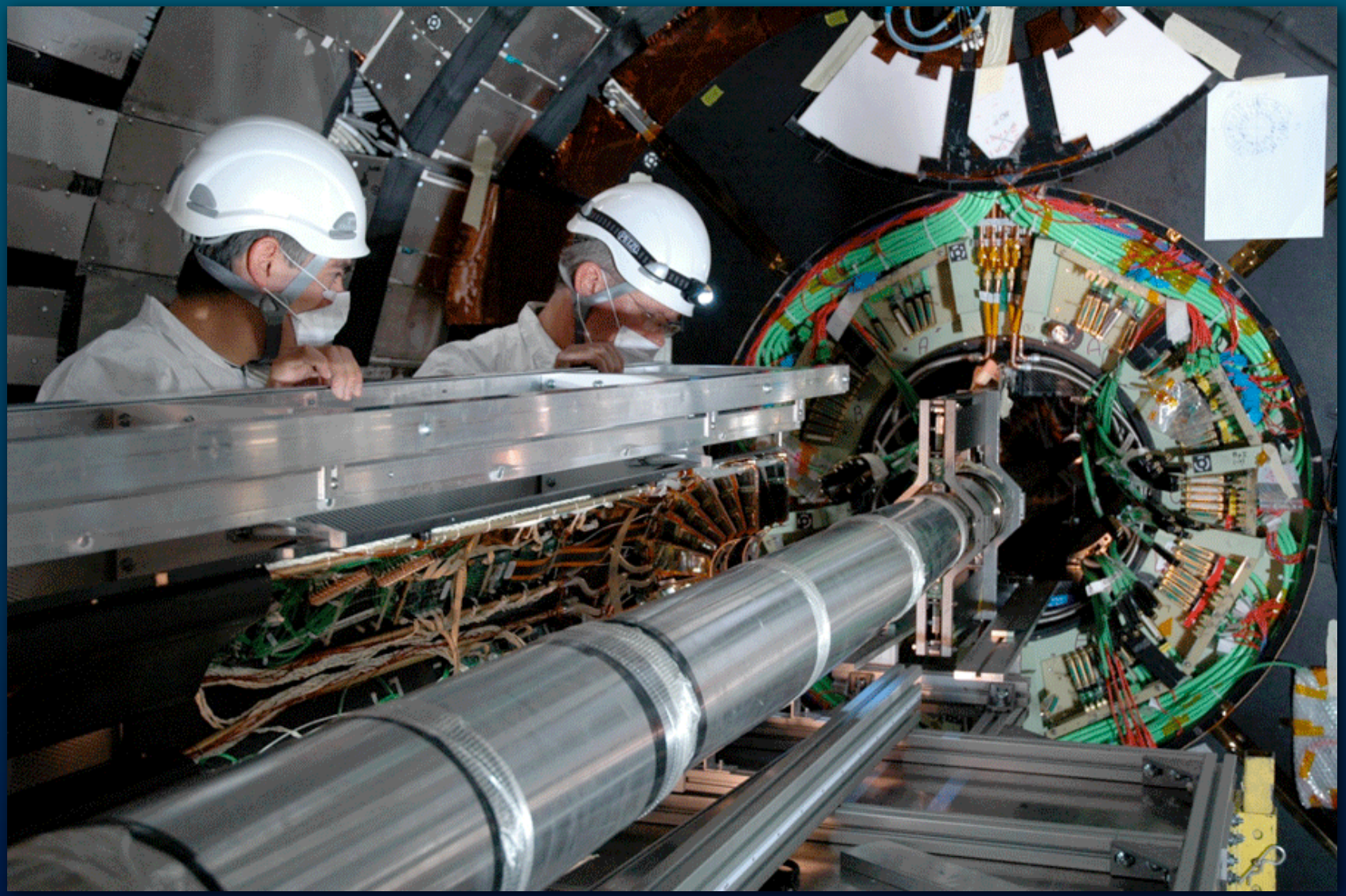
Vasquez is commissioning the detector at CERN

Transport/Installation

- completed shipment of half disks to CERN last December

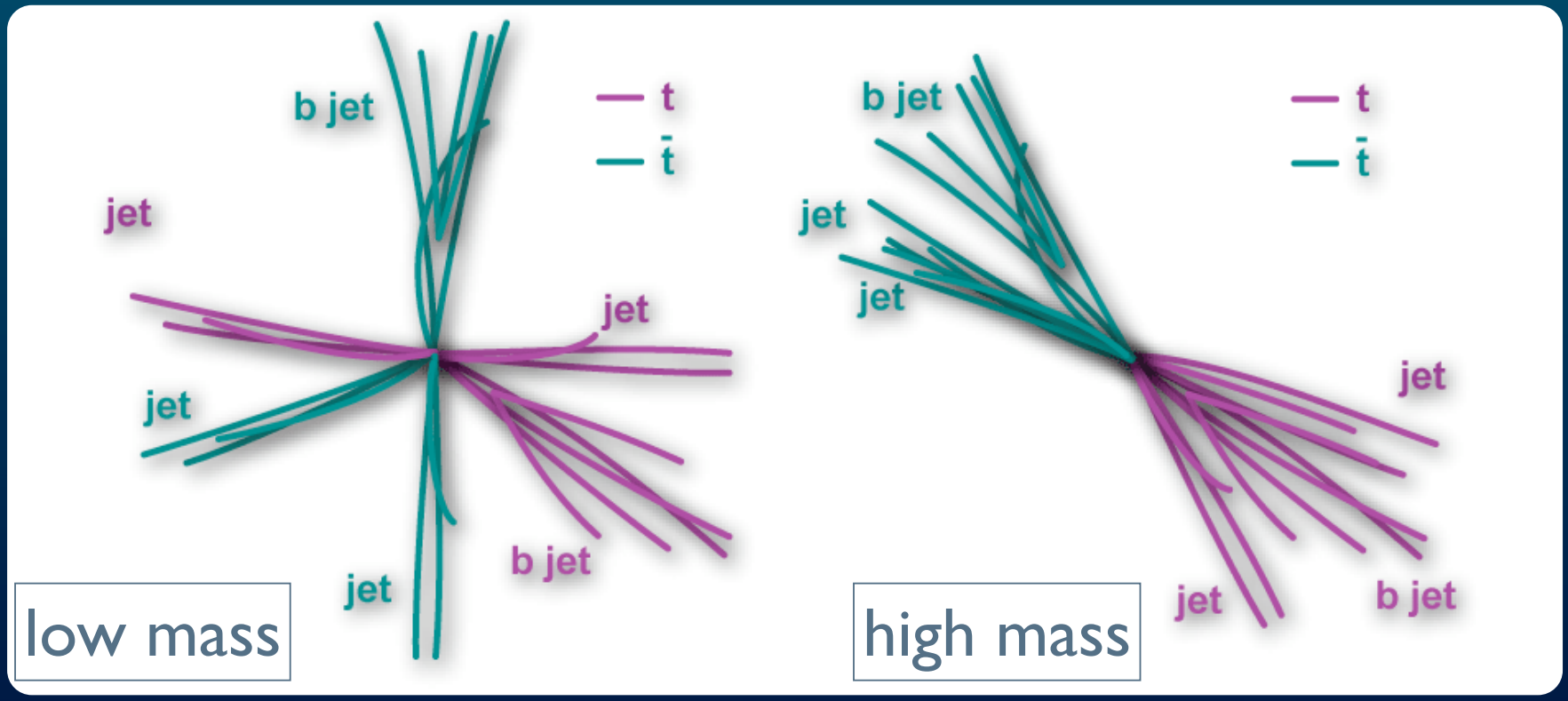


Pixel Installation

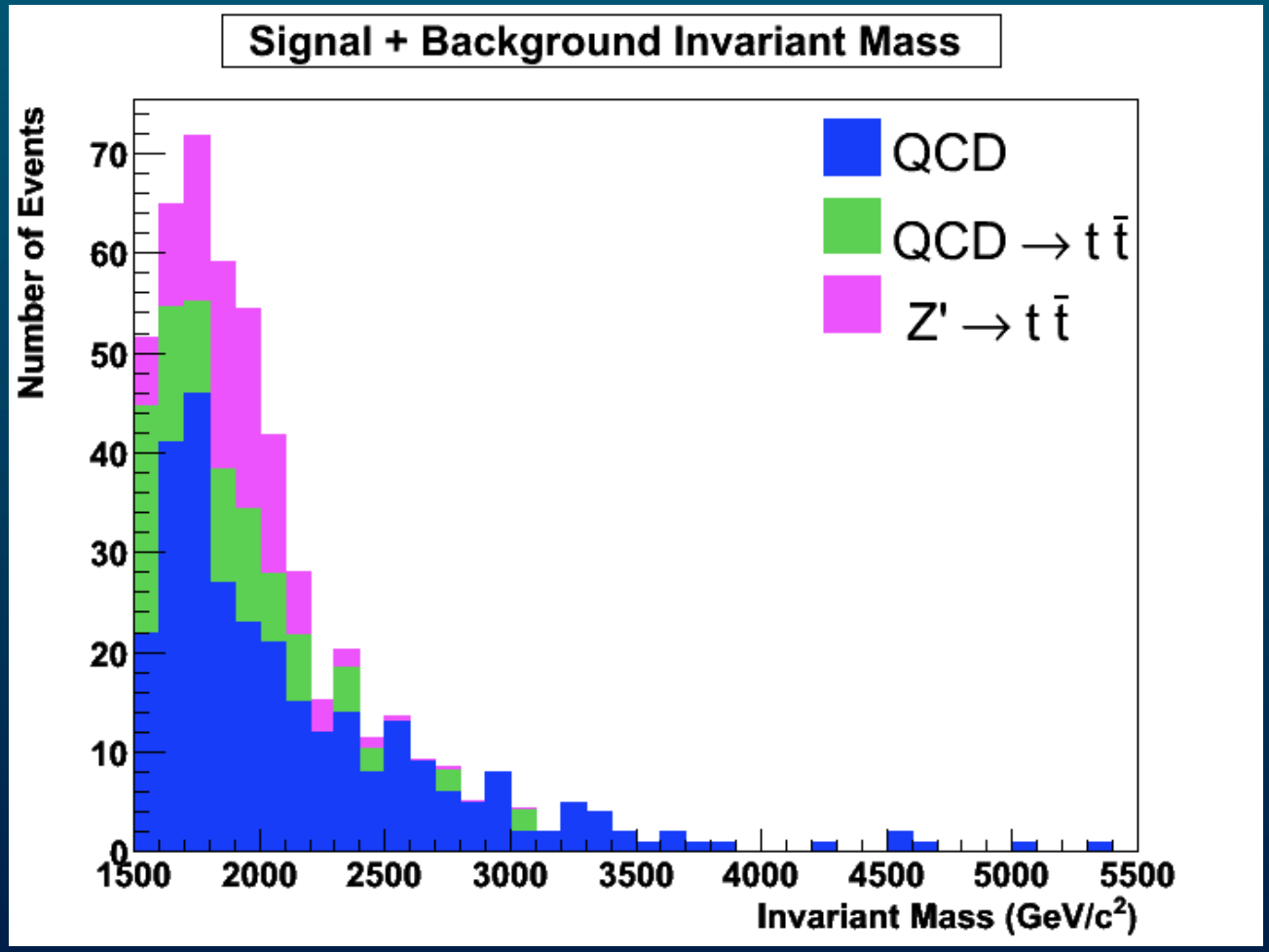


Early LHC discoveries?

- looking for ttbar resonances (extra dimensions, new gauge bosons) using all hadronic final state:

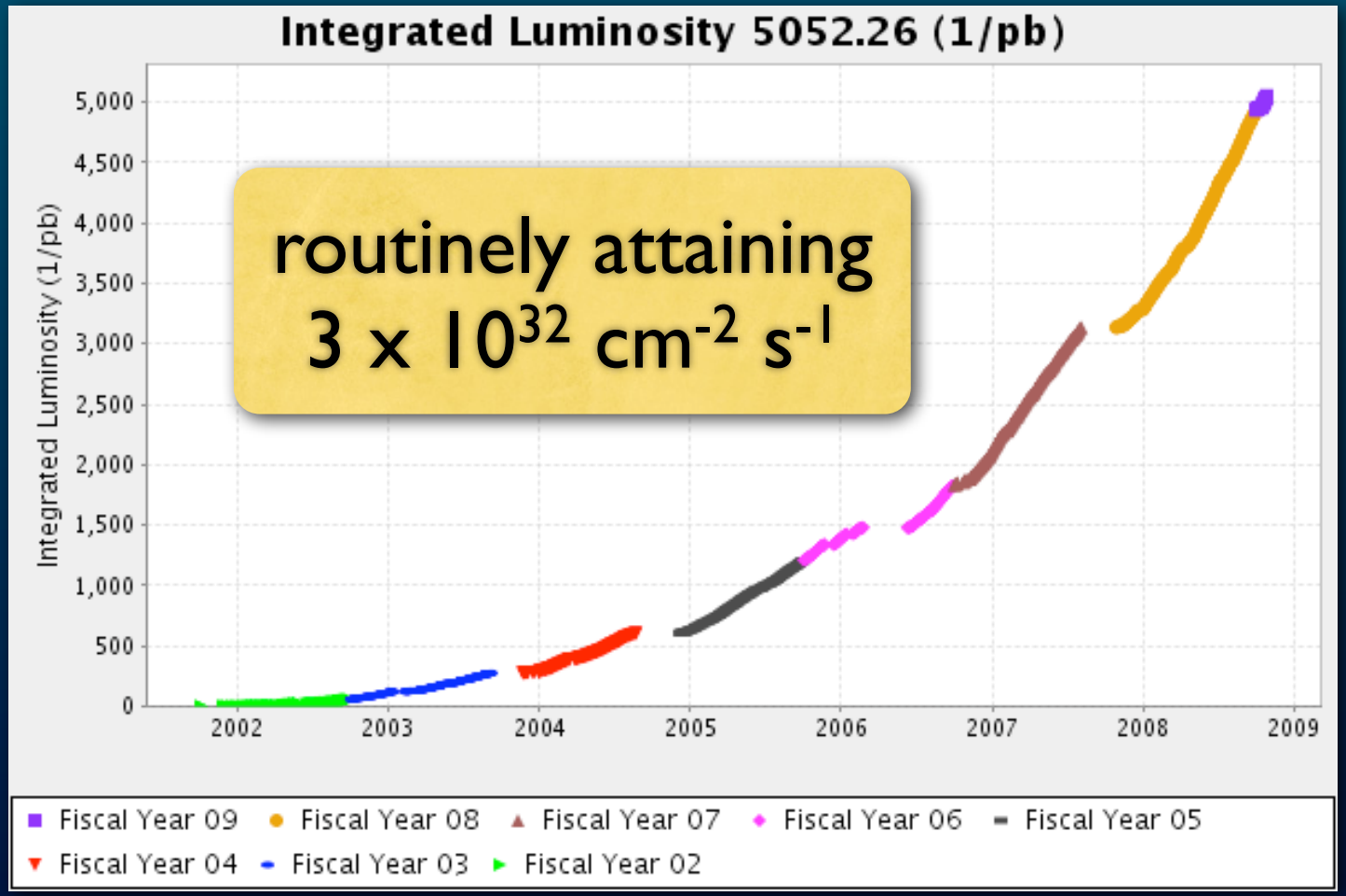


$t\bar{t}$ Resonances at the LHC



Meanwhile, in Batavia...

Tevatron has delivered over 5 fb^{-1} !!



Davis in CDF

- Davis group has been in CDF since 1999
- have made contributions to
  - silicon (Run 2a, b)
  - tau triggering (Run 2a, b)
  - XFT upgrade (Run 2b)
- At least ten Run 2 CDF papers published or soon to be published in 2007-2009 were authored by Davis folks

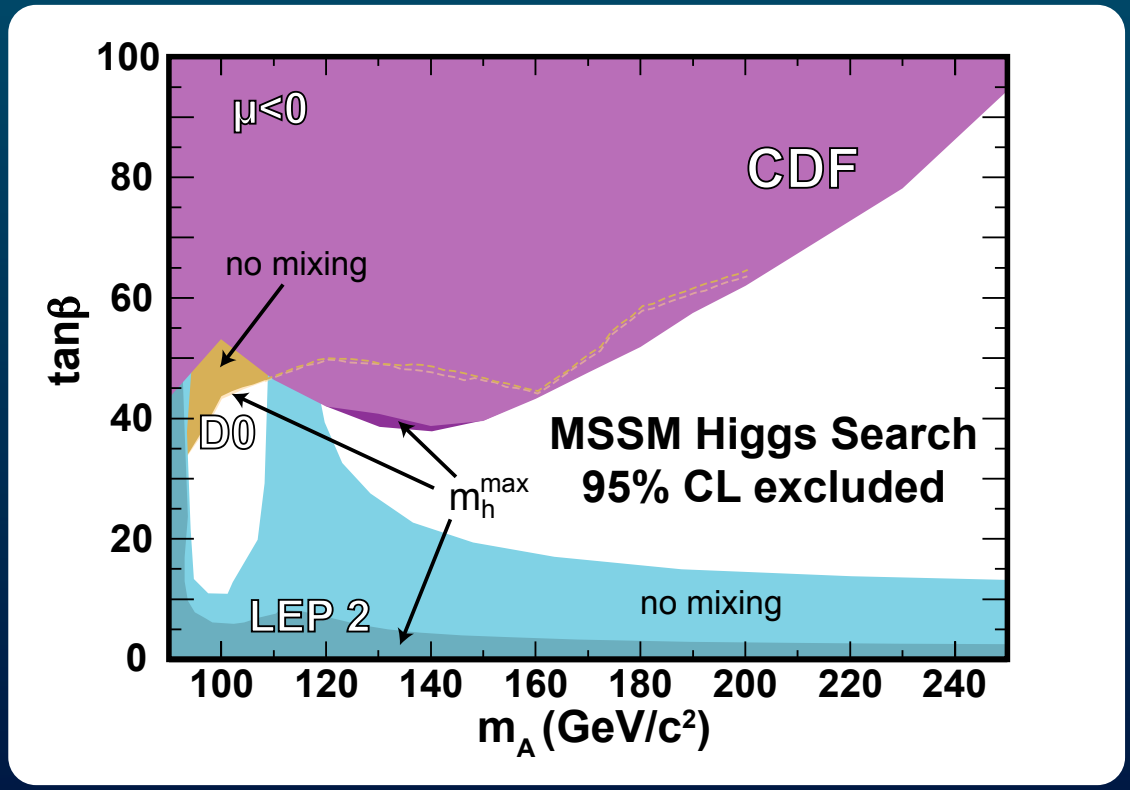
Davis CDF Physics

It's all about the third (and fourth?) generation!

- top physics
  - top cross section
  - top properties
  - searches for new physics in top sample
- tau physics
  - Higgs with taus
  - supersymmetry with taus

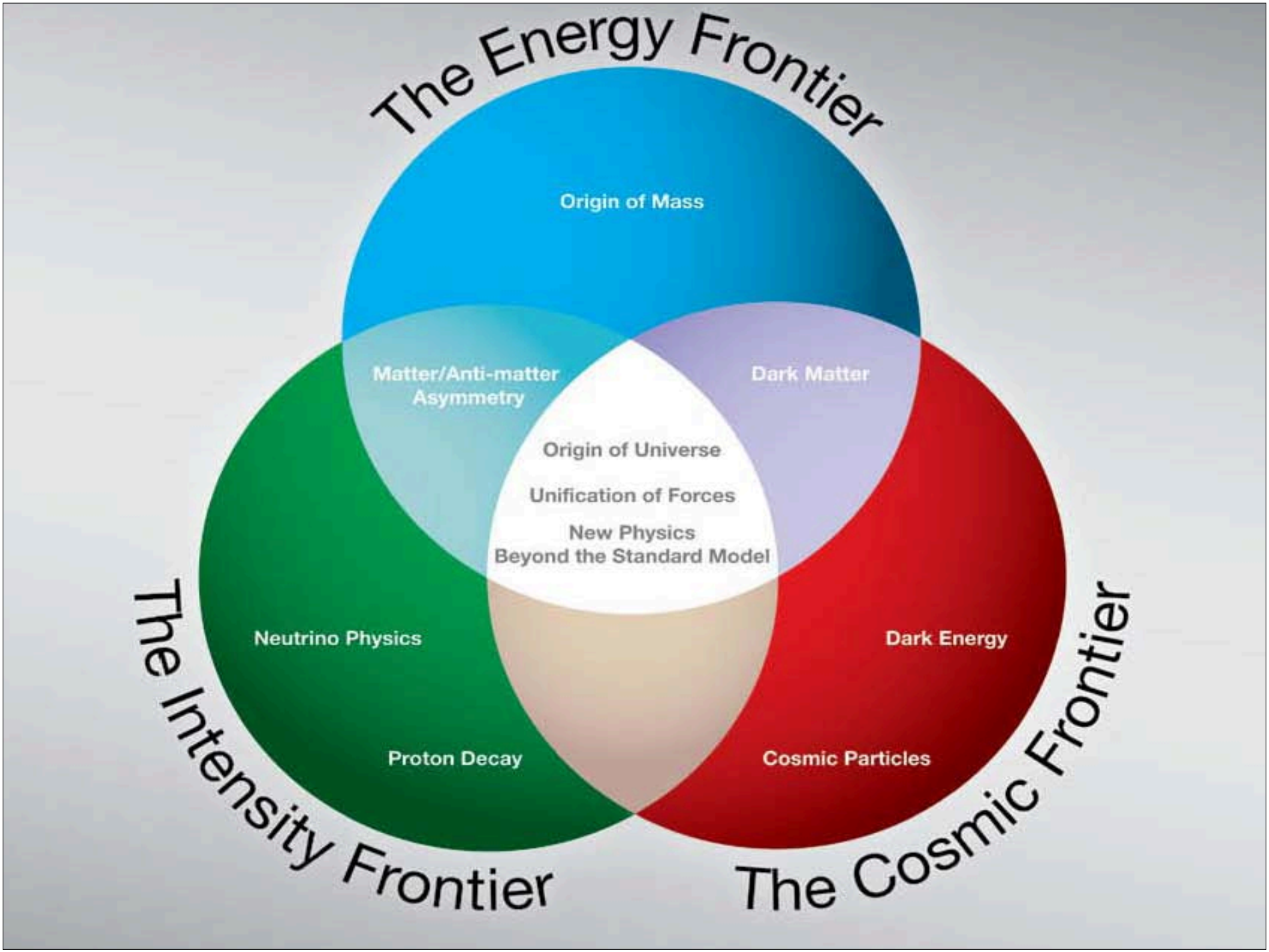
MSSM Higgs: Tau Pairs

- world's best limits on high tanβ SUSY!
- more data = more sensitivity



Tevatron Discoveries

- This is the year to watch the Tevatron!
- We have some interesting anomalies:
  - high p_T lepton plus jets events
  - high p_T like sign dilepton events
  - multi-muon events...


The Energy Frontier
Origin of Mass
Matter/Anti-matter Asymmetry
Dark Matter
Origin of Universe
Unification of Forces
New Physics Beyond the Standard Model
Neutrino Physics
Proton Decay
Dark Energy
Cosmic Particles
The Intensity Frontier
The Cosmic Frontier