CDF IB Electroweak Physics Results
&
CDF II Central Tracker
at LBNL

Young-Kee Kim

DoE Review, May 12–13, 1998

CDF Central Outer Tracker (COT)

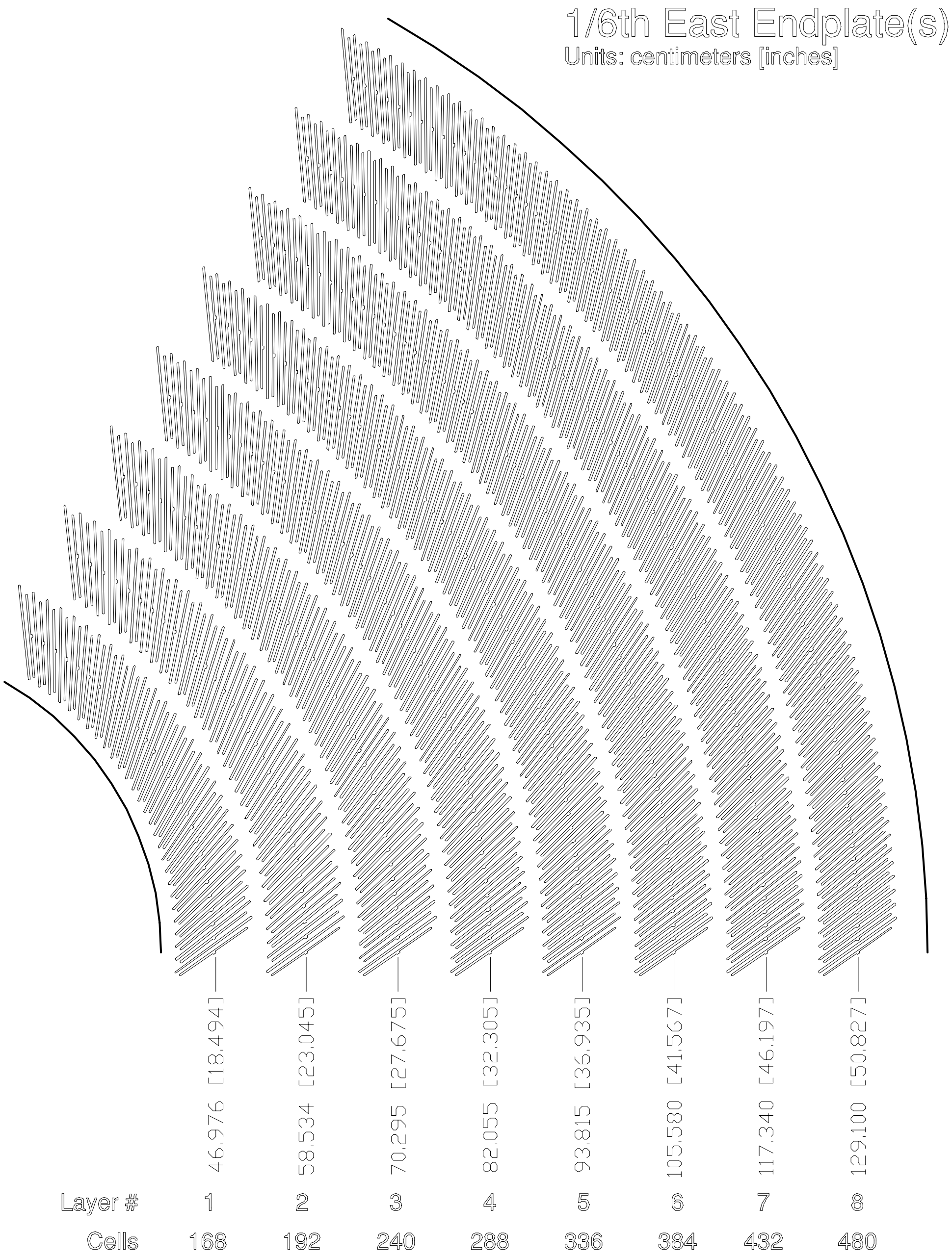
- The Central Outer Tracker (COT) is a large wire drift chamber very similar in concept to the existing Central Tracking Chamber (CTC), but with a very different technique.
- The COT design attempts to : in the high luminosity environment of Run II,
  - reproduce the functionality of the CTC
  - improve upon identified CTC deficiencies.
- Features :
  - Axial sense wires strung between precision machined endplates
  - Small Cells — 1/4 that of CTC (3.6 cm drift distance $\Rightarrow$ 0.88 cm in COT)
  - Fast gas ($CF_4 \Rightarrow T_{drift} < 132$ ns)
  - Benefits from CTC design

LBNL Participation in COT

Physicists	Young-Kee Kim	
	Mark Lancaster (postdoc)	(7/97–12/97)
	Carmine Pagliarone (visitor)	(8/97–1/98)
	Lina Galtieri (administrative help)	
Grad. Students	Tony Affolder	(6/97 –)
	Athena Trattner	(6/97–8/97)
	Ben Lintner	(6/98 –)
	Greg Veramendi	(6/98 –)
	Jay Wacker	(6/98 –)
Under. Students	Jay Kane	(3/97 –)
	Jason Hamm	(12/96–6/97)
	Shiloh Hawley	(9/96–1/97)
	Lorraine Saddler	(1/98 –)
Senior Tech.	John Taylor	
Engineer	Derek Shuman	(5/96–12/97)
Designer	Rich Weidenbach	(6/96–1/98)
Tech.	Paul Wong	(2/98 –)
	Wes T.	(3/98 –)
Temp.Tech.	Faye Witharm	(8/97 –)
	Ronda Witharm (part time)	(10/97 –)

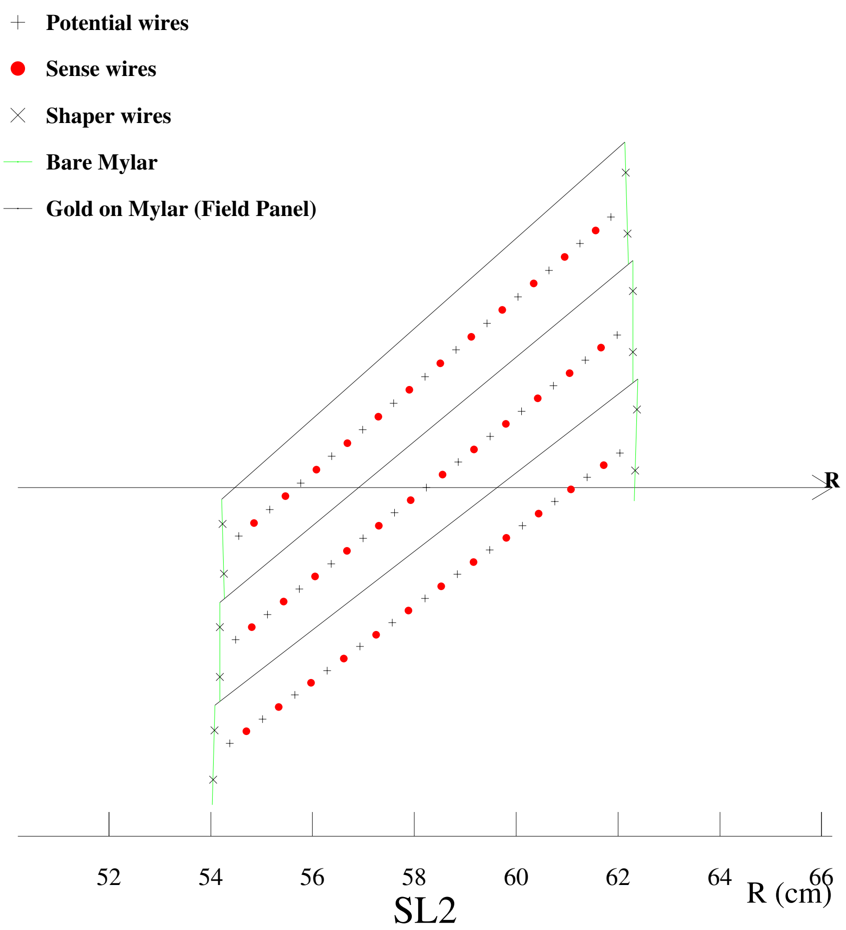
COT Can

- **Endplates** – $1\frac{5}{8}''$ Al, 40 ton Load, 7mm Deflection.
- **Inner Cylinder** – $0.1''$ Carbon Fiber/Epoxy Tube
- **Outer Cylinder** – $1/4''$ Al



COT Basic Cell

- wire plane
  - 12 sense, 13 potential, 4 shaper wires / cell
  - 40 μm diam. Au plated W at 135 g tension
- field sheet
  - 350 A gold on 0.25 mil mylar field planes
  - Electric field along drift trajectories is very uniform over most of the cell.
- cell tilted for 35^o Lorentz angle



LBNL RESPONSIBILITIES

I. COT Can

- Design and Fabrication of the Inner Support Cylinder (fabrication by an industrial vendor)
  Done !
- Conceptual Design of an Alignment Fixture
  Done !

II. Field Sheet

- Develop Field Sheet Production Technique
  Done !
- Design and Fabrication of Production Fixtures
  Done ! (18 sets of productions fixtures)
- Fabrication and Test of Axial Field Sheets (1480 sheets)
  A bit more than half Done !

Inner Support Cylinder

- Serves to support an axial compressive load (no more than 30,000 lbs) and as a gas seal for the COT.
- Transparent to radiation.
- Carbon fiber/epoxy tube (2.5 mm thick) which fits into flanges on the end plates.
- Designed to be stiff in axial loading, and to have a large safety margin against buckling : Specified a minimum factor of safety of 10 against buckling failure.
- Finished !
- Load testing was done with 45,000 lb axial-load and 300 lb side-load.
- Delivered to Fermilab in Dec. 97.

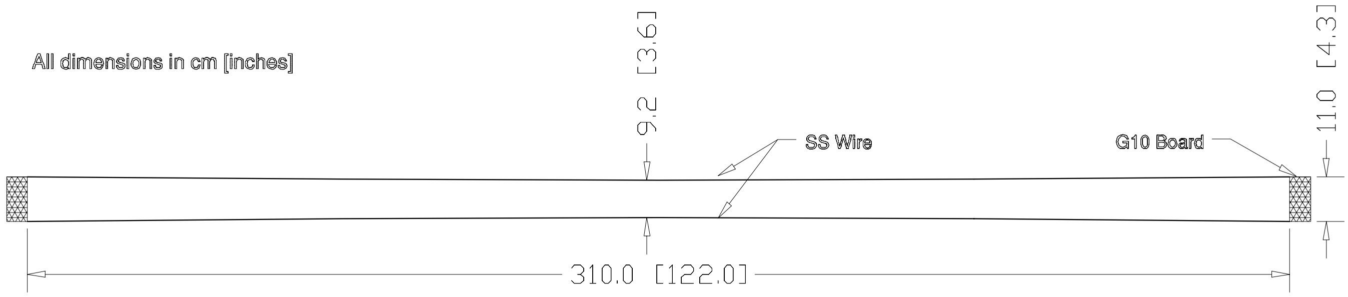
Alignment Fixture

- Serves the purpose of holding and aligning the two end-plates in the proper position to allow the Outer Cylinder to be built up between them.
- Conceptual Design Done in October 97.

  The End of LBNL Responsibility (Fermilab took over for detailed drawings and fabrication).

Field Sheet

Double-sided, 0.25mil gold-on-mylar, supported by 12mil stainless steel wires and Al end-boards. 22 lbs. tension.



Field Sheet Tolerance

- "No" epoxy wicking outside of the SS wires
  $\leftarrow$ A thin layer of epoxy causes glowing.
- The amount of epoxy needs to be controlled.
- Location of endcards with a $1-2$ mil accuracy.
- Field sheet length variation $< \pm$ 15 mil.
  $\leftarrow$ The endboard shims should be on the precision edge.
  $\leftarrow$ The precision edge is $0.3''$ wide, but the uncertainty in endplate deflection is large (not well known).
- Sheet length measurement with a few mil accuracy.
  The size of ledge is determined from this measurement and the endplate deflection measurement.
- Sheet sagging variation $<$ 5 mil.
- Amplitue of wrinkles $<$ 10 mil.
- Smooth cut on mylar edge.

Production Fixtures

- Automatic glueing machine.
- Fixtures to hold/locate endboards.
- SS wire tensioners during production.
- Trimming fixture.
- Testing fixtures.

Quality of the sheets

OUT OF ~800 FIELD SHEETS,

- SS wires not in endboard grooves ; 4 sheets
- SS sires slipped from endboards ; 5 sheets
- Puntures ; ~8 sheets
- Kinked SS wire ; 1 sheet
- Large wrinkles (amplitude > 10 mil)
  - 40 SL2 sheets : seem related to the quality of mylar
  - ~20 questionable SL8 sheets – need to be measured.
- Sagging (> ±5 mil)
  - None so far
- Length (> ±15 mil range)
  - ~10 sheets
- Endboard shims fell off - fixable ; ~25 sheets
  ← mostly at the beginning of production due to weak glue joint in endboards (done by MSU)
  MSU added more glue and okay.

Summary : CDF II Central Tracker

- Inner Support Cylinder
  - Delivered in Dec. 1997.
- Alignment Fixture Conceptual Design
  - Done in Oct. 1997
- Field Sheet Production
  - Technique Development, Fixtures, etc. – Done
  - Started Production on Jan. 26, 1998.
  - SL8 and SL2 Field Sheets – Done.
  - Now fabricating SL4 Field Sheets.
  - Production is scheduled to be done by the end of July 1998.
- During 1998 summer, two students will be working at Fermilab on Prototype chamber, Center supports.
- After Field Sheet Production
  - Now discussing our involvement in COT commissioning with U. Penn. and Fermilab.

Run IB Electroweak Physics

Since last DoE Review

Bill Ashmanskas – Ph.D. Student
Mark Lancaster – Postdoc
Young-Kee Kim
Kevin Einsweiler

- W Mass with Harvard, Argonne, Purdue groups.
  - LBNL Involvement
    - CTC alignment (Bill Ashmanskas)
    - Track Momentum scale (Mark Lancaster, Young-Kee Kim)
    - W Production and Detector models (Mark Lancaster)
- W Width using $W \to e\nu$ (Bill Ashmanskas, Ph.D. thesis)

Both measurements use W transverse mass distributions : Share/Cross-check W Production and Detector models.

W Mass Measurement

- IB $W \to \mu\nu$ Preliminary Result ($\sim$2 years old)
  $M_W = 80.430 \pm 0.100 \pm 0.040 \pm 0.110$ GeV

- Electron Energy Scale Inconsistency between
  E/p method (p normalized to $M_{J/\psi \to \mu\mu}$) and
  $Z \to ee$ method, normalized to PDG value,
  (that D0 uses)

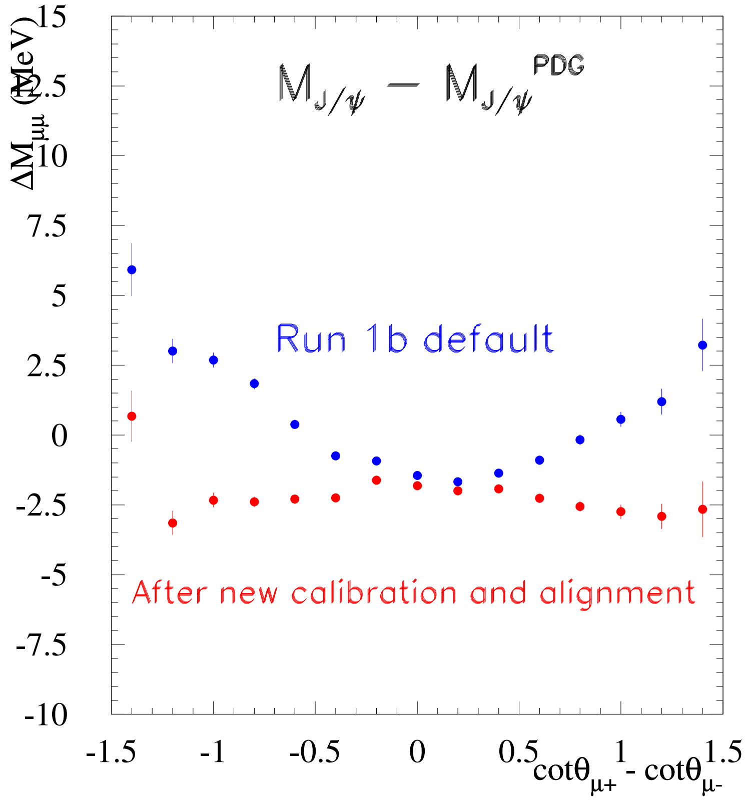
- Bottom up approach
  - CTC re-calibration using 1/2 milion $J/\psi \to \mu\mu$ data
  - CTC alignment using $W \to e\nu$ data

- Momentum, Energy Scale checks with new calibration & alignment in Progress

- W Production and Detector modeling are in a good shape.
  $\leftarrow$ Andrew Gordon (Harvard) Ph.D. thesis
  $\leftarrow$ Bill Ashmanskas (Berkeley) Ph.D. thesis

- Planning to finish up the analysis by the end of this summer.

Gaussian+Linear Fit, Not lineshape fit



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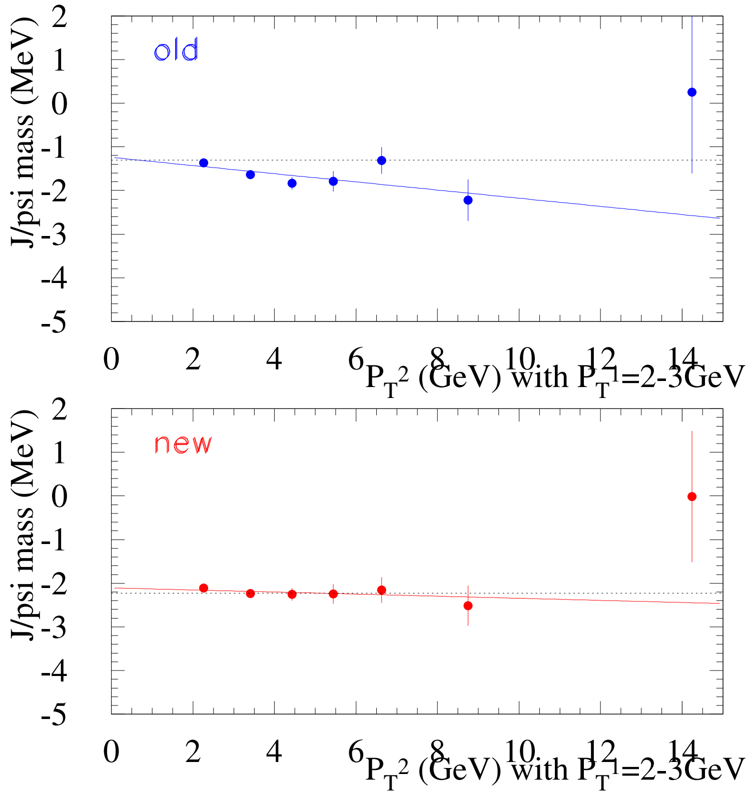
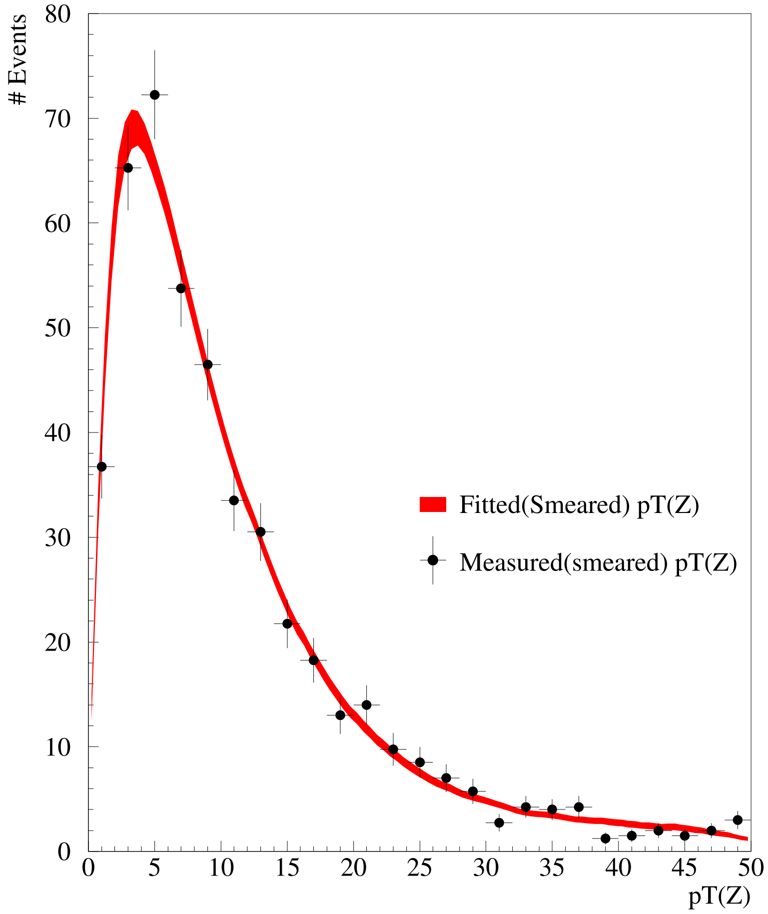


Input P_T^W Distribution $\leftarrow$ $P_T^{Z\to\ell\ell}$ Distribution



Parton Distribution Functions $\leftarrow$ W Charge Asymmetry