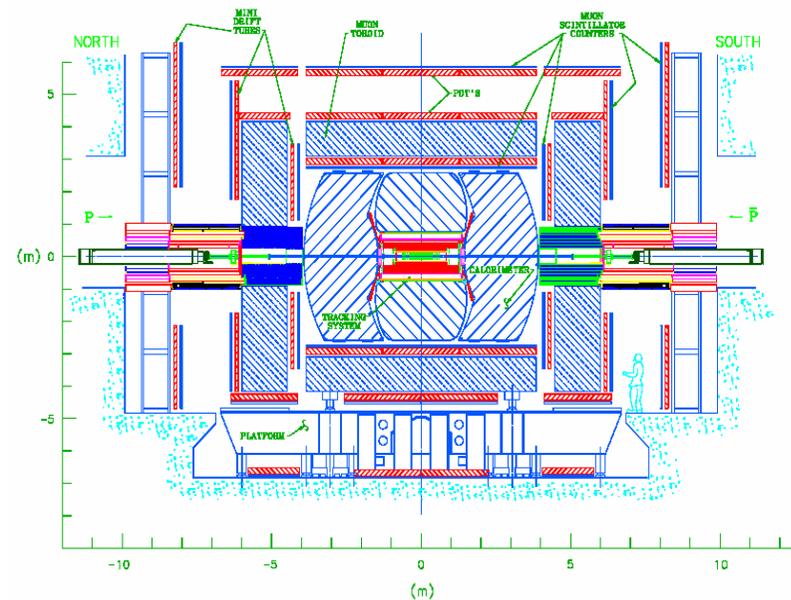


Commissioning a Large Detector: A Personal Perspective

- DZero History & Milestones
 - Proposed 1983
 - Complete 1991
 - Commissioning 1991-1992
 - Run I May 1992-1996
 - Top Discovery Feb 24 1995
 - Upgrade 1996-2001
 - Commissioning 2001-2002
 - Run II 2002-2009



Stages & Durations

- **Several phases, not distinct, overlapping**
- **Commissioning**
 - **Technical (pre beam, ~2 yr)**
 - **Subsystem/Software Installation and Verification**
 - **Integration & Timing**
 - **Physics Commissioning (not necessarily sequential, ~1 yr)**
 - **Survey & Calibration**
 - **Trigger Definitions**
 - **Definition/Evaluation of Particle Identification**
- **Discovery(?)**
 - **Primarily luminosity, manpower dependent**
- **Consolidation(~4 yrs)**
 - **Improved surveys & tools, calibration**

Commissioning

- Intense, frustrating, iterative, but ultimately rewarding phase. Not necessarily beam or manpower limited, but “expertise or specialist limited”
- Pre- Beam (2 yrs): Data integrity, Rate Studies, Noise Studies, Calibration Runs, Software convergence
- With Beam (6-12 mo)
 - Luminosity needed for “fundamentals”
 - Timing
 - Survey: i.e. magnet off/on for tracking
 - Calibration: i.e. em/hadronic response (vs azimuth)
 - Trigger: i.e. calibrations, efficiencies, rates
 - Luminosity to acquire “candles” or resonances
 - Lepton ID (electron, muon) & efficiency
 - Overall EM and Hadronic energy scale
- Analysis to complete definition of objects (12-24 mo)
 - B & τ ID
 - First pass jet energy scale and resolution
 - Missing Et: really sensitive to noise, cracks, nonlinearities – prone to surprises!

The Extreme Example: Jet Calibration

- Since DZero had no magnetic tracker → Developed in-situ technique.
 - For Run I took approximately three-four years from 1992-1996.
 - Even with experience, Run II a similar time scale (new calorimeter electronics, new luminosity regime)
- Step 1: EM calibration (1-2 year)
 - Based on resonances to understand linearity
 - Dependent on definition of electron ID which involved test beam, tracking, calorimetry
 - Relative calibration between test beam and detector to tune ID, sampling weights (several years, most difficult)
 - Azimuthal calibration which required understanding of trigger biases, significant analysis
- Step 2: Measurement of hadronic response (2 years)
 - Dependent on a well-understood, robust jet algorithm
 - Based on photon-jet and jet-jet balance, ID and systematics understood
 - For Tevatron statistics limited
- Step 3: Other effects (1-2 years)
 - Offset (calorimeter noise)
 - Showering correction between parton→particle→calorimeter levels
 - Underlying event - ever increasing luminosity!

DZero Run I Physics Output Experience

- ~ Six months required to establish tools for first results/searches. From DPF, Nov. 1992:
 - *W and Z Decays to Electrons/Muons in/at D0*
 - *Top Quark Search in D0 from Lepton+ Jets Mode*
 - *Two Jet Energy and Rapidity Distributions*
 - ...
- ~ Two years for results requiring all object ID and decent understanding of backgrounds, consistent with first three DZero pubs:
 - *First Generation Leptoquark Search in pbarp Collisions at sqrt s = 1.8 TeV* Phys. Rev. Letters {72} 965 (1994)
 - *Search for the Top Quark in pbarp Collisions at sqrt s = 1.8 TeV* Phys. Rev. Letters {72} 2138 (1994)
 - *Rapidity Gaps between Jets in pbarp Collisions at sqrt s = 1.8 TeV* Phys. Rev. Letters {72} 2332 (1994)
 - ...
- **Multiyear for full understanding of detector and precision results.**
 - *Measurement of the W Boson Mass* Phys. Rev. Letters 77, 3309 (1996).
 - *The Inclusive Jet Cross Section in pbarp Collisions at sqrt (s) 1.8 TeV.* Phys. Rev. Lett. {82} 2451 (1999)
 - ...

Comments on “LHC physics...” viewed from DZero Record:

- **If discovery requires**
 - first pass identification of muons & electrons, possible in the first 6 months of running.
 - full panoply of objects, something like two+ years.
 - final calibration of all objects, it will be a multi-year process.
 - For scale: DZero current b-tagged all-jets analysis similar to preprint is now in progress.
- **Final comment: requires a careful, thoughtful balance between immediate and long term goals.**