A Quark in the Life of a Student

Getting Started

- An unlikely student
  - Started on SSC
  - Amal brought me to D0

- Started a QCD color coherence analysis
  - But got opportunity to work on Run 1 e+e- channel
  - In late ’83
    - Learned from ‘14 analysis that contributed to the 1979 CDF top mass limit
    - Not without frustrations

Early Work

- The top group was dealing early on with the knowledge that top was heavy
  - In late ’83, I was doing larger simulation studies to tighten triggers to lower rates
    - There was a lot of debate about event 417 (the Run 1 ‘knee’ event)
      - What did it mean about top?
      - What could be said about the top mass based on this event?
      - I came to my own judgment of where the ‘interpretation’ of the data was: I did not believe this skeptic event was capable of answering the dilemma

- I had been working on jets, and became convinced they were the key to effectively identifying high mass top
  - I was encouraged to follow my hunches, but a very clear standard was always clear from the position I worked with (M. Naran)

- The dilepton effort became increasingly clustered around a few people: R. Hall, J. Barton, J. Cochran, M. Naran
  - Our meetings were informal, in a corner office, no thanks
  - I did not socialize outside of work much with these guys, but they were the group I lived most with for the next year:
    - For some reason, J. called me “Dr. D. of importance” without my permission
    - Jim has an ‘interesting’ sense for his password choices 😄

The Mission:

- We knew top was heavy
  - Devise ‘high mass’ analysis
    - ‘HM’ in columns to right
    - Compared to PRL analysis
  - The HM/DM
    - ‘HM’ could have tighter jet cuts and electron D. cuts

- What is shown at right is the first pass at a tuned ‘high mass’ analysis
  - Signal masses: 100, 120, 140, 170 and 180 GeV
  - Z+2e background estimate

Optimization

- Many ingredients were studied to obtain maximum efficiency and luminosity, and minimum background
  - Electron ID
  - Jet cuts, quality and energy scale
  - Use of missing energy
  - New variables of kinematic selections

- On right is shown lookup and entry from SLC, where these efforts are planned out for this analysis
  - Ladder entry (in black) where this list was gone back to and modified
  - Many of these affect the other channels too, of course

1994 was a very busy time,

This was the first time in my research or academic career when I realized I could really make a contribution. So many interesting things were going on at D0, and I was very happy to have the chance to be part of them. I myself was thoroughly unconvincing of the existence of the top quark, and the arguments and discussions at D0 in late 1993 thru early 1995 were extremely formative for me. I am grateful circumstance put me there.

Taking Stock

- In late 1994, much of the basic work to change an optimized analysis was done, in conferences/proceedings
  - However, there were many steps to introducing a final analysis
    - No BMV had seen most of our data
    - Simulation samples were continually improved
    - Cuts, analysis methods, and DM were being refined

- Early 1995, the Top Group made a very effective and efficient push to finalize this effort: a conclusion
  - I remember this as a decisive transition to a new business line, aggressive and methodical set of meetings and discussions about what selections to keep, methods were made, luminosity was useful
  - A LOT`n’WORTH
  - The left adjudges help giving optimization results to the preanalysis for defining this analysis
    - Note: we all owed about 4 & 5 of our dannish 224 pa-16’ and we would analyze and discuss (which was we 40 pa-9?)
  - What is shown in the table are the relative efficiencies for matching, topological and pattern recognition selections
  - This further new standard at end was changed

What Survived?

- The optimized kinematic selection for high mass top
- Improved electron ID
- Use of Missing Energy, except when both in-time particles and out-of-time particles were simultaneously present
  - A 25% increase in luminosity for ‘ee’
  - Actually, ‘ee’ ended up with more luminosity than CDF by the end of Run 1
- What didn’t make it
  - Multivariate selection
  - Electron candidates without tracks
  - Event shape variables

Endgame

- In Feb., we were ready to document our results for the CDF Technical Review, a potentially painful process:
  - Final implementations of corrections, updated #s, etc.
  - Initial impact channel was beginning becoming clear but was not yet major news
  - Lots of excitement and debate
  - Was the top peak - lots of statistical discussions
  - What is shown left is a critical discussion related to finishing the 10 week for confirmation review, and preparing the final documentation
  - Note the first bullet WM for review - this is the paragraph on the propagation of error that was proposed for what became the Collaboration RMS.

- The second expansion was the ‘1036’ addition that getting significant was happening. The meetings with a in apr called a formation process that we confirmed a ‘discovery’
  - Just a few months of correctness, efficiency, cross-checks, priorities, etc.
  - Someone I just didn’t think to mention the punch line

Top Turns Ten
20 October 2005