

# Looking for physics beyond the standard model in Tevatron data

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..... in one slide .....



- Unfortunately we did not make any discovery for physics beyond the standard model
  - Not because we did not try
  - Pioneered many new types of searches
  - Advanced limits by in comparison to UA1/UA2 and LEP
  
- Fortunately we did not make fools of ourselves
  - We did not discover something that wasn't there (our colleagues at B0 have a long list to their credit)
  - We did not miss anything that was there (are we 100% sure of this ?)



# Archeology (1)



## ■ A long list of conveners of New Phenomena (SUSY/Exotics) working groups from 1992 to 2012

- Nick Hadley, Andy White
- Wyatt Merritt, Dave Cutts
- Sarah Eno, John Hobbs
- Marc Paterno
- Greg Landsberg, Eric Flattum
- Sharon Hagopian, Gustaaf Brooijmans
- Laurent Duflot
- Volker Buescher, Jean-Francois Grivaz
- Arnd Meyer, Yuri Gershtein
- Todd Adams, Patrice Verdier
- Arnaud Duperrin
- Mike Eads, Michel Jaffré

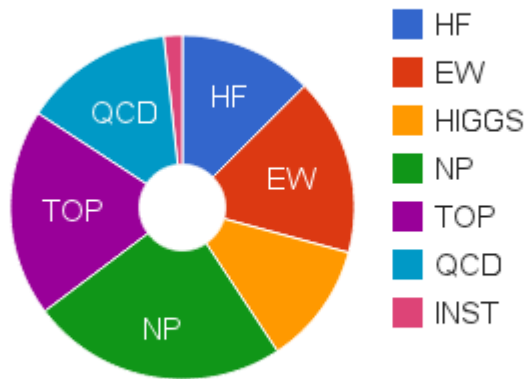
Not an exact chronological order, some have served more than one (2 year) term  
Any omission is my mistake



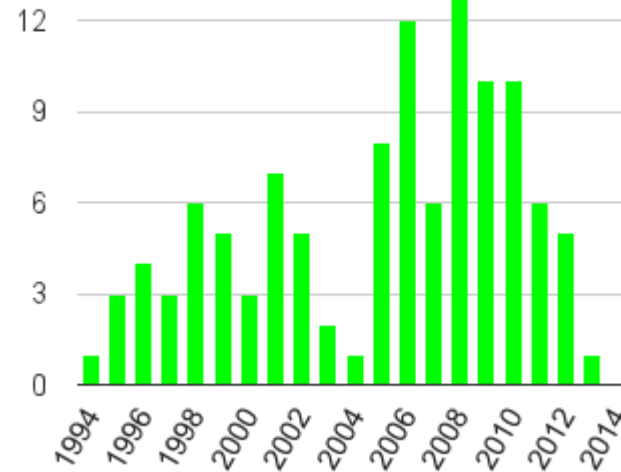
# Archeology (2)



**DØ Topics (Submitted)**



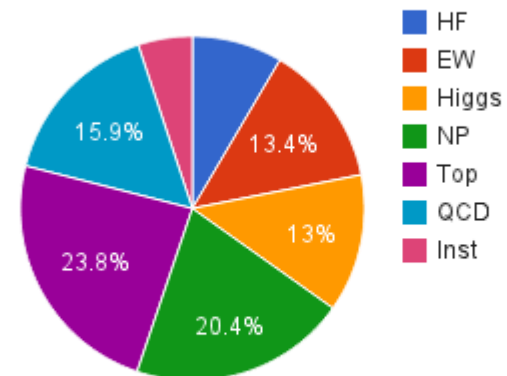
**DØ NP Publications**



## New Phenomena:

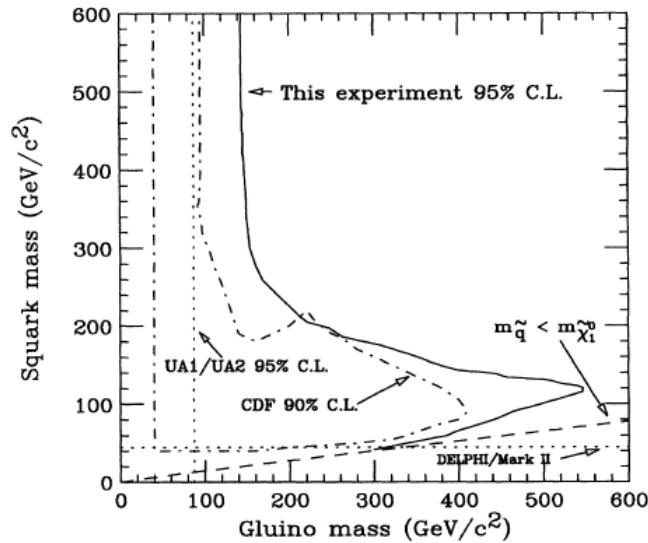
- 111 publications out of 462 (24%)
- 96 PhD theses out of 471 (20%)

**DØ Theses by subject**

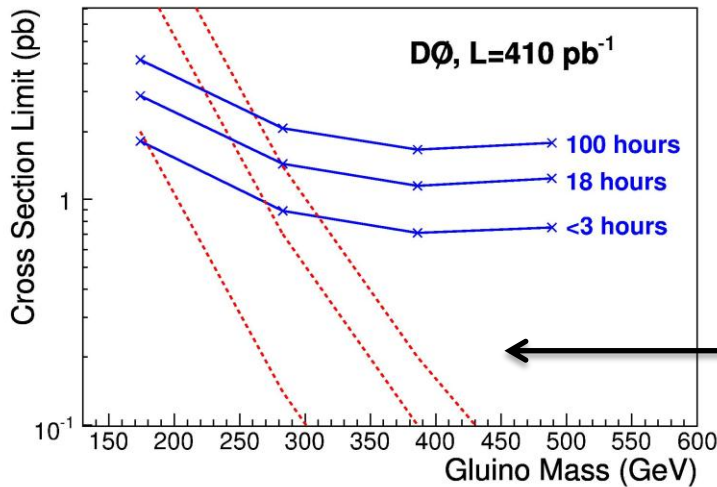




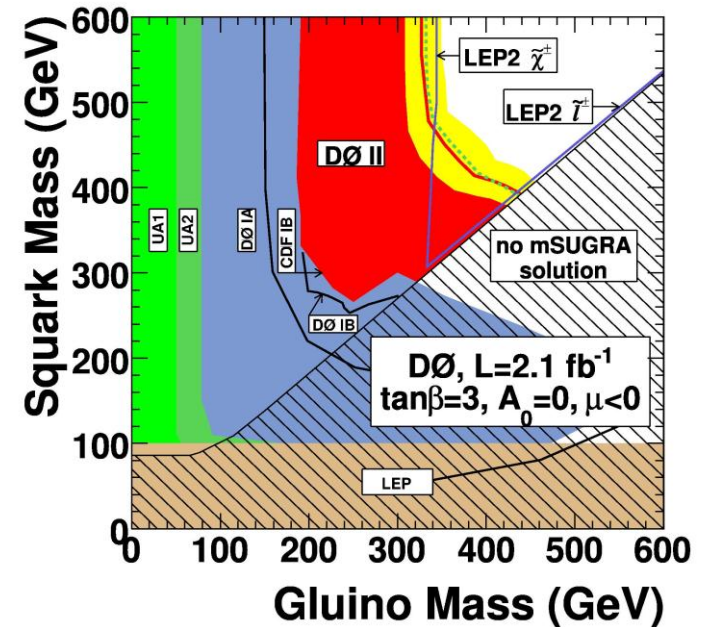
# Jets + missing ET



From  $14 \text{ pb}^{-1}$  in 1995 to  $2.1 \text{ fb}^{-1}$  in 2008:  
 $m_{\tilde{g}}$  limit goes from 144 GeV to 308 GeV



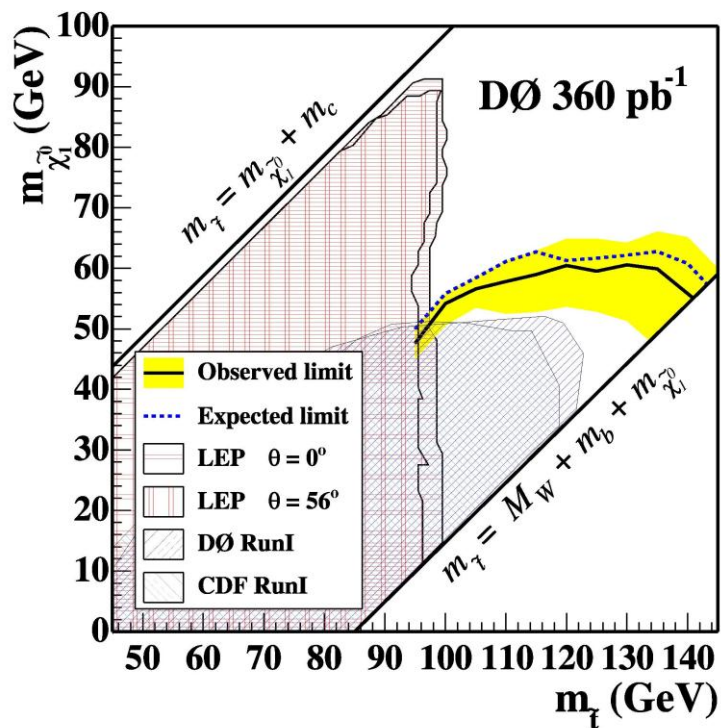
Stopped gluinos with long lifetimes:  
 Not really sure about live time /  
 efficiency estimation







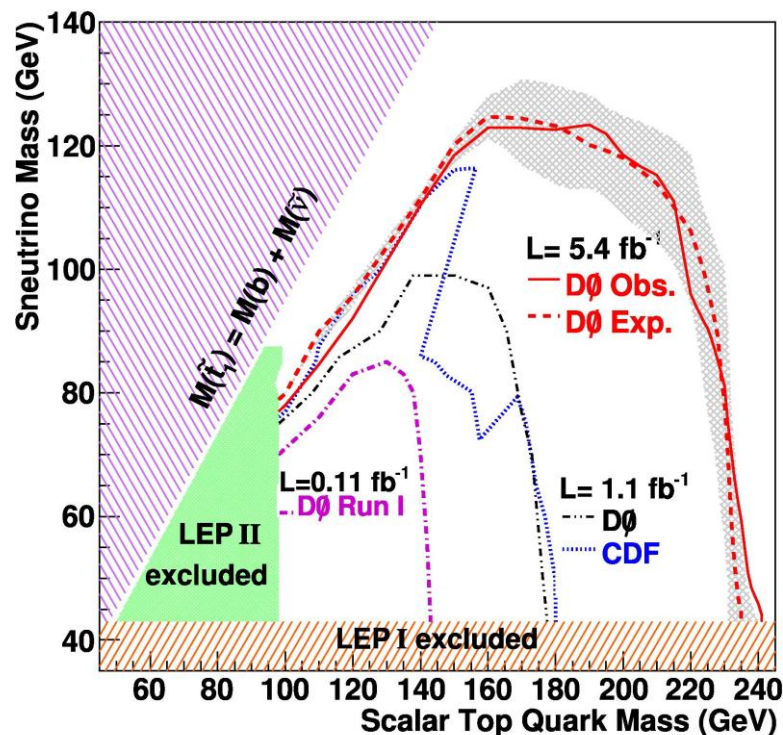
# Scalar Tops



Searched both for 2 and 3 body decays  
Did we really explore the full phase space of possibilities ?

One of the things that I disliked most about DØ analyses: the separation / differences between  $ee$ ,  $e\mu$ ,  $\mu\mu$ , .... Final states

We were sometimes very inefficient



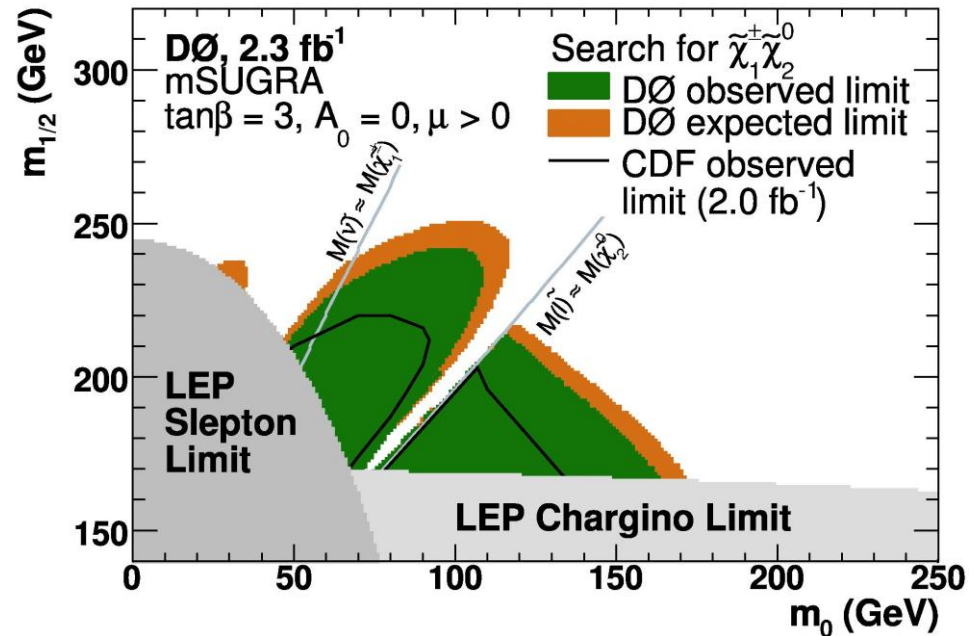
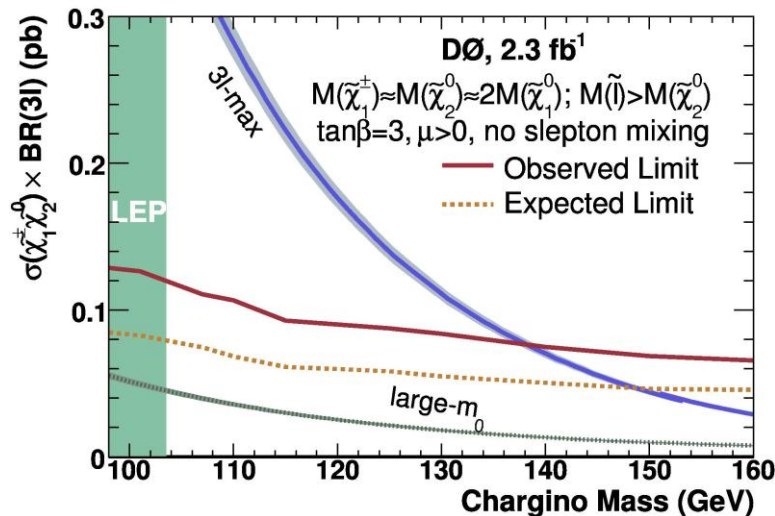
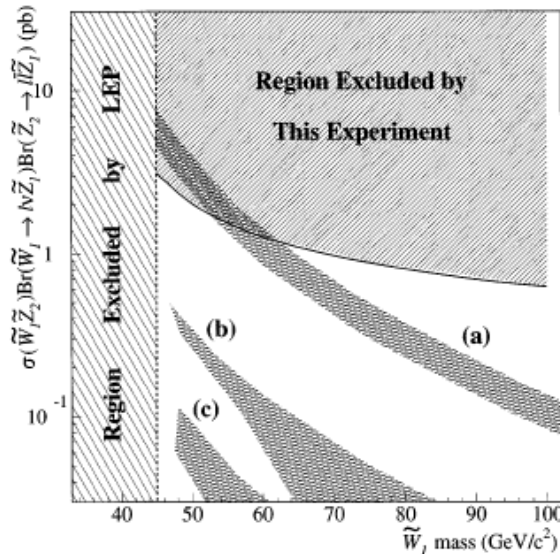


# Trileptons



Gained more than 1 order of magnitude in cross section sensitivity

Extended reach on sleptons/charginos

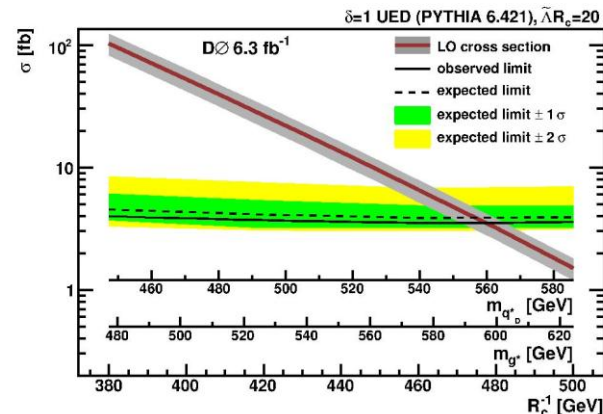
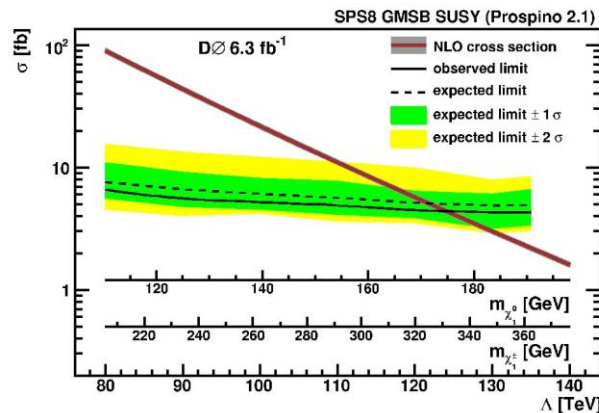
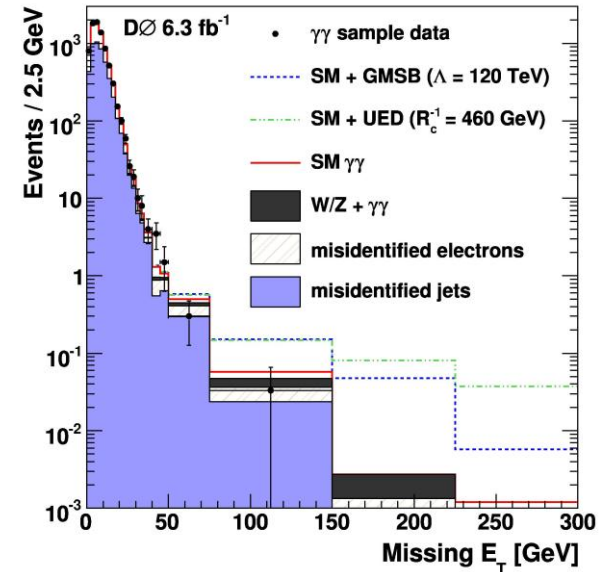
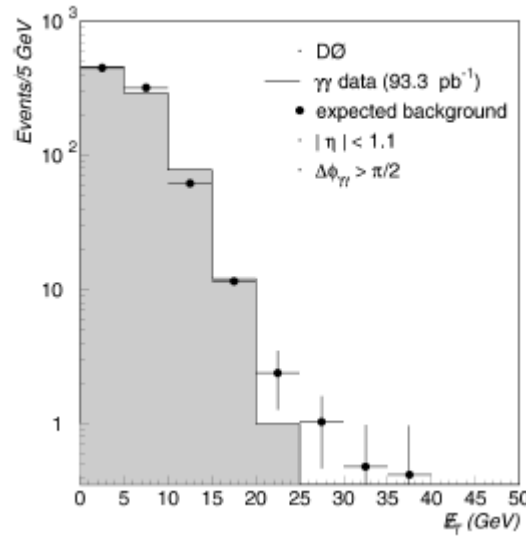




# GMSB and Extra Dimensions



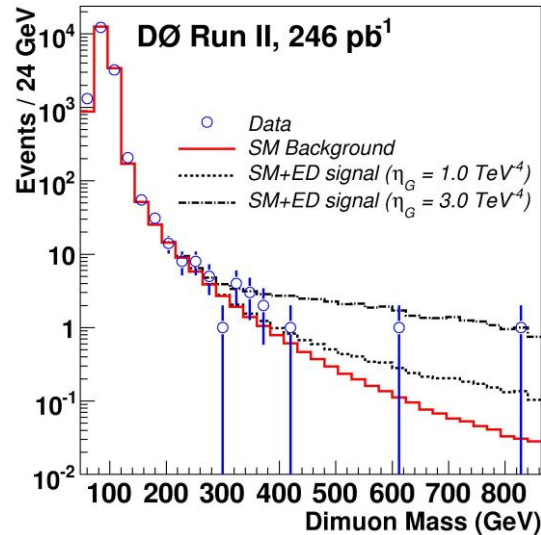
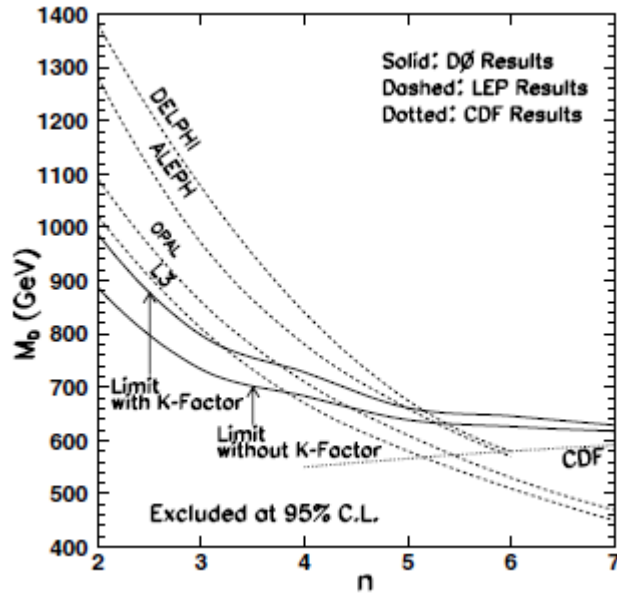
Diphoton events with missing transverse momentum:  
note the MET of the highest event



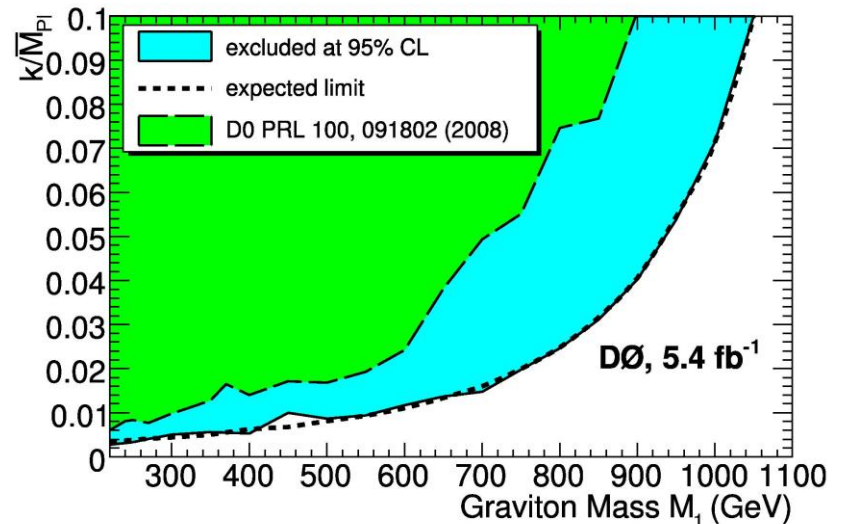
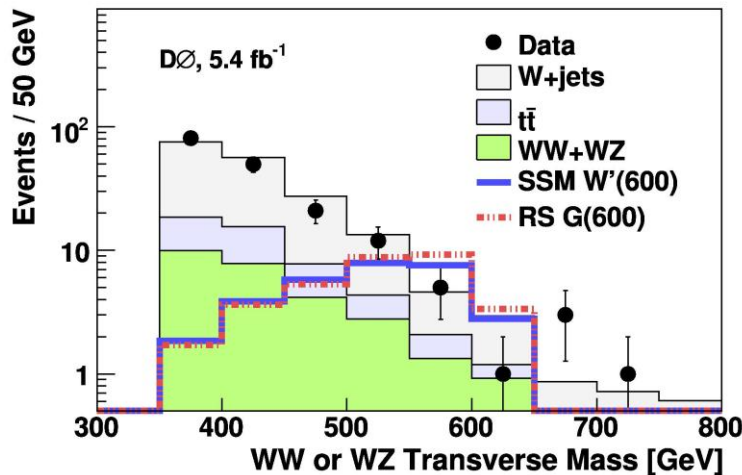




# The Extra Dimension Industry

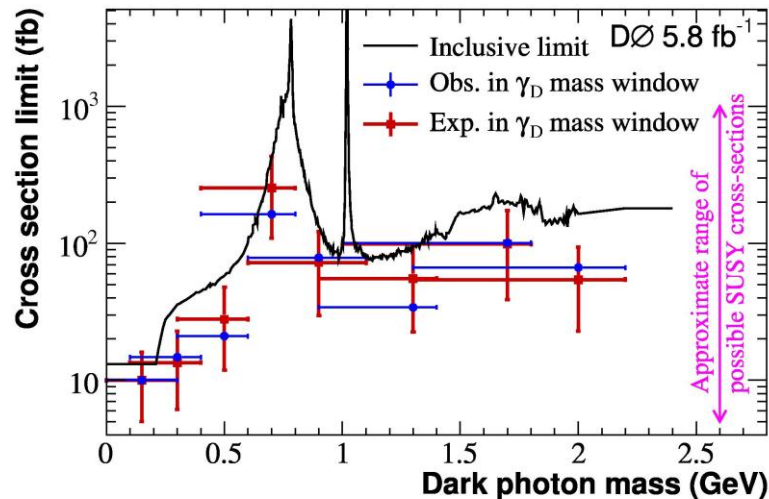
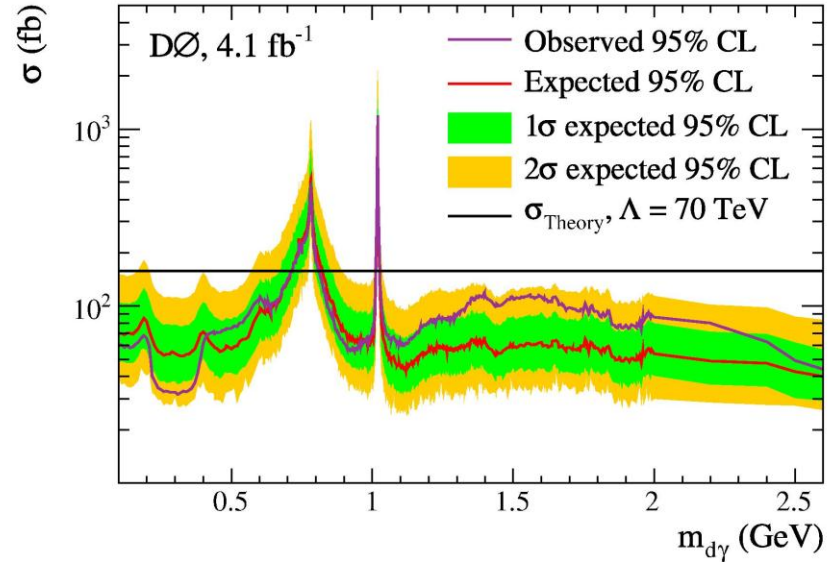
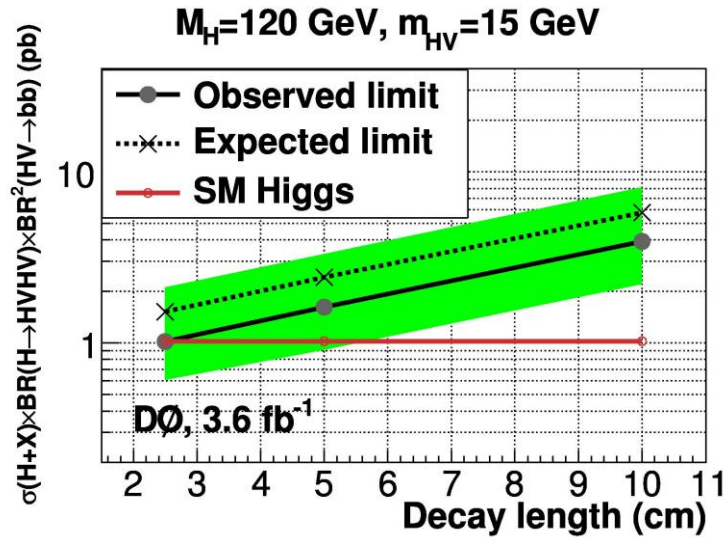


We still live in a 3d world





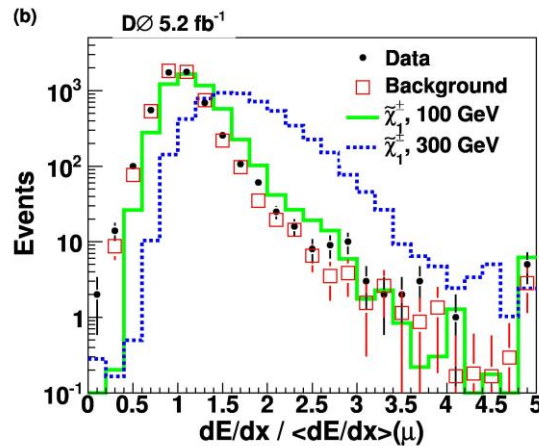
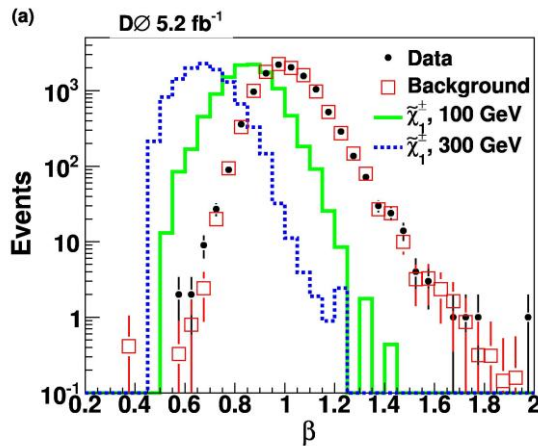
# String theory inspired models



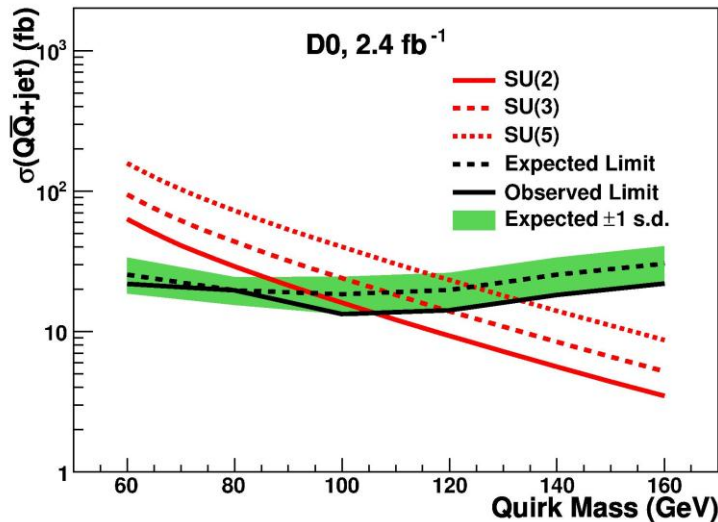
**We were the first to board this boat**  
**In addition to ATLAS/CMS a lot of new experiments at low energy**



# Garisto doesn't like neologisms



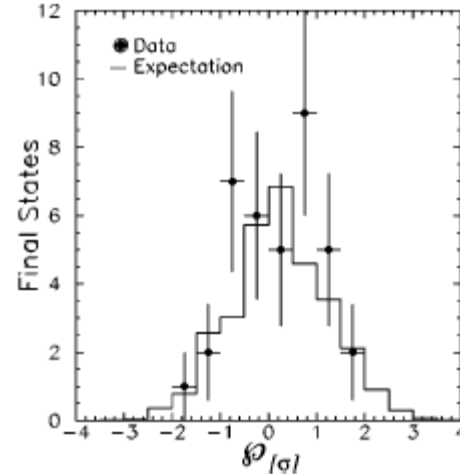
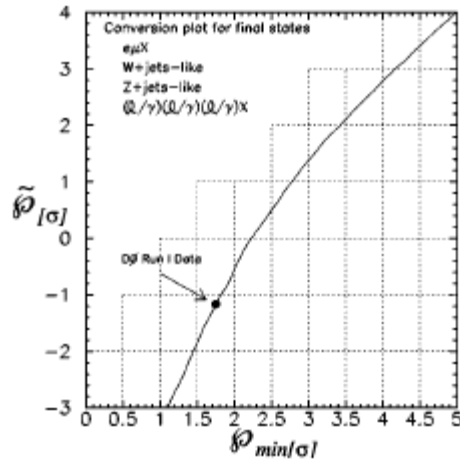
Standard searches for slowly moving heavy massive particles



Quirks: new fermions with new  $SU(n)$  degree of freedom, form bound state observed as heavily ionizing particle



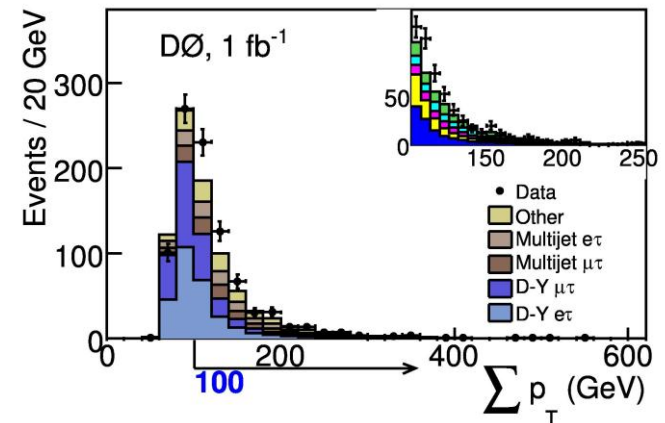
# Did we really search everywhere ?



According to SLEUTH / QUAERO the Run I data are particularly uninteresting ....

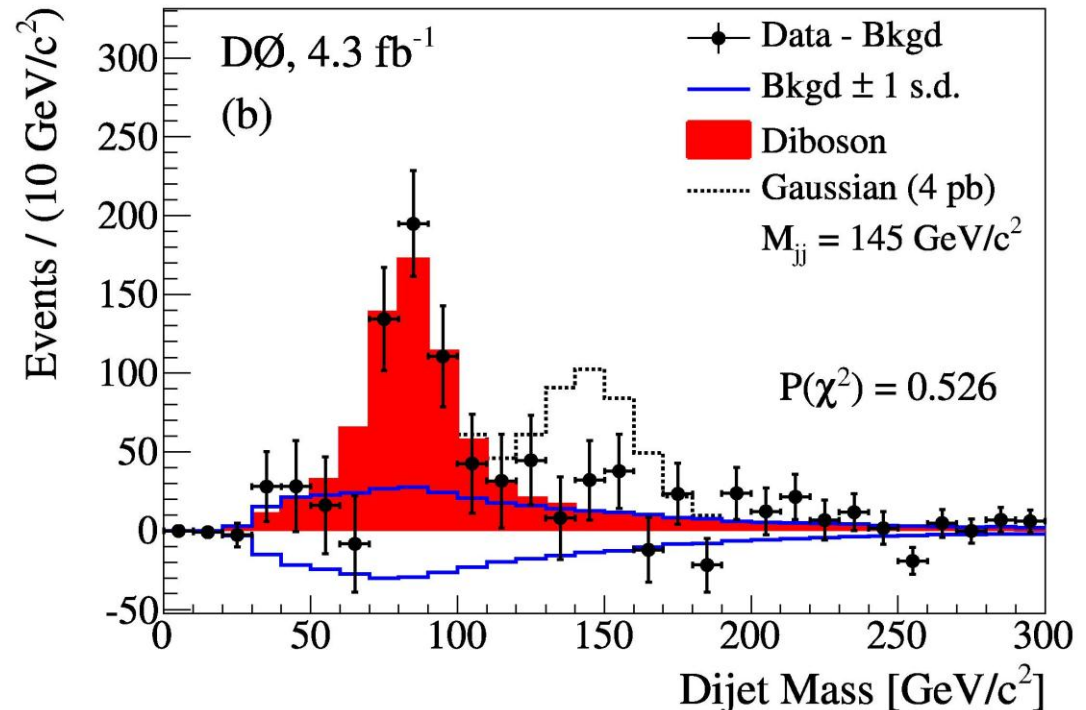
electroweak scale is demonstrated by testing the method on a particular signature in each set of final states. No evidence of new high  $p_T$  physics is observed in the course of this search, and we find that 89% of an ensemble of hypothetical similar experimental runs would have produced a final state with a candidate signal more interesting than the most interesting observed in these data.

Same thing also in Run II (most discrepant state is lepton+tau+jets+MET)





# Beat on the brat (The Ramones)



You know how the story goes:

- A fraction of the CDF collaboration together with the theory group makes a discovery and a lot of noise
- We tell them they are wrong, the rest of CDF tells them they are wrong
- They are very unpleasant about this (theory group too....)
- A few years later they tell you that they have finally understood what they did wrong and sell it like a big discovery





# Conclusions



- I did cover only a subset of all the searches done in Run I and Run II
- Finding something new would have been nice
- Finding something new at the LHC would really energize the field, keep on trying
- We did everything correctly, did we ?
  - I would have expected that with  $> 100$  analysis at least one  $2.5 \sigma$  fluctuation would appear
- Three questions to conclude:
  - What was the first NP paper published by DØ ?
  - And the last one ?
  - How many NP meeting did I attend ?