

New Results (expected) for ICHEP 2010



New Phenomena

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Columbia University in New York

D0 France Meeting

May 4, 2010

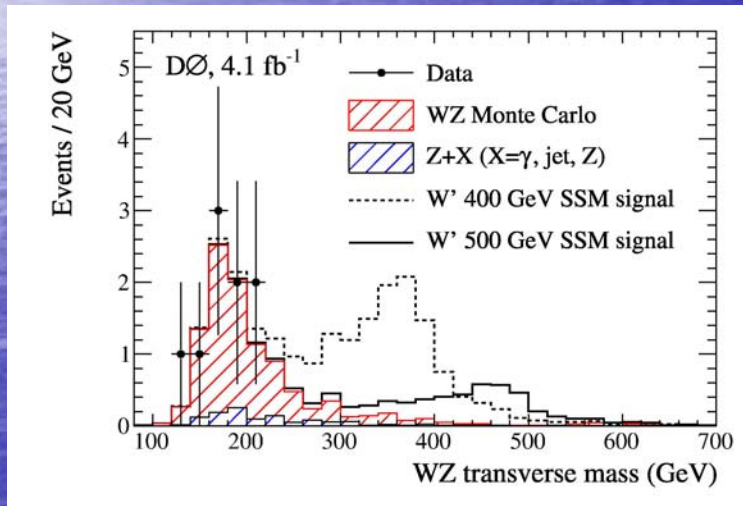
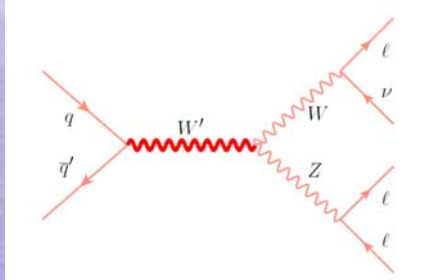
Outline

- **New Results**
 - Quick recap of the Publications so far
- **Status**
 - On going analyses
 - D0 France status
- **Plans for ICHEP 2010**
 - List of abstracts

Recent New Publications (2010)

- Phys. Rev. Lett. 104, 061801 (2010)

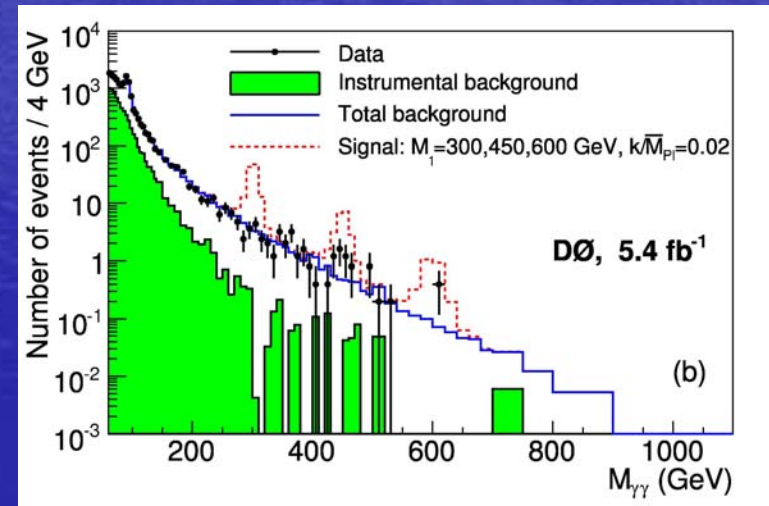
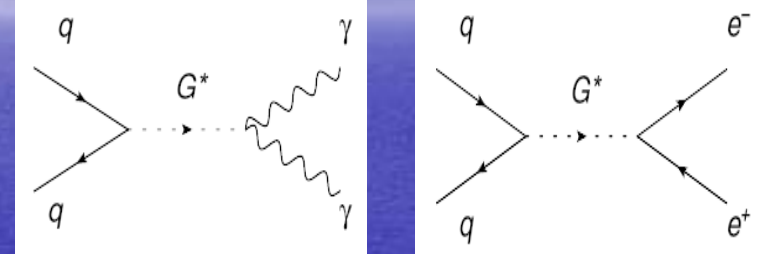
Ketino Kaadze, et al.



(February)

- Submitted to Phys. Rev. Lett.

Ning Zhou, et al.



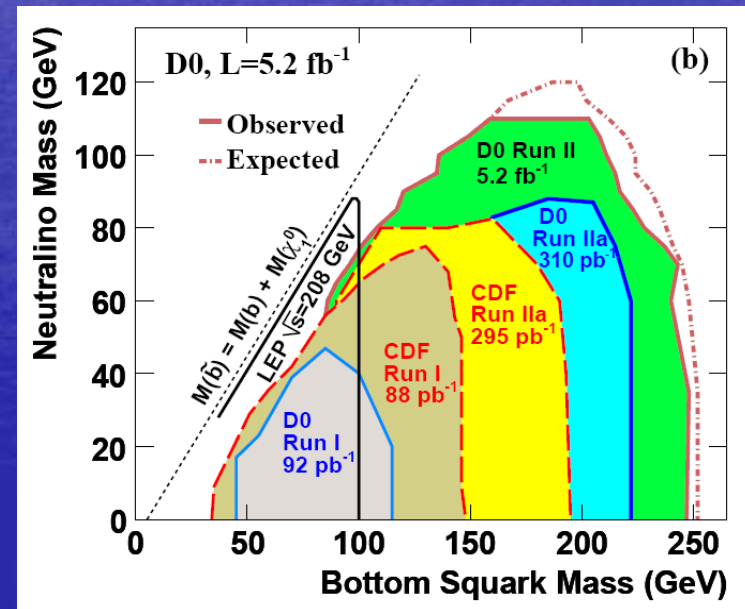
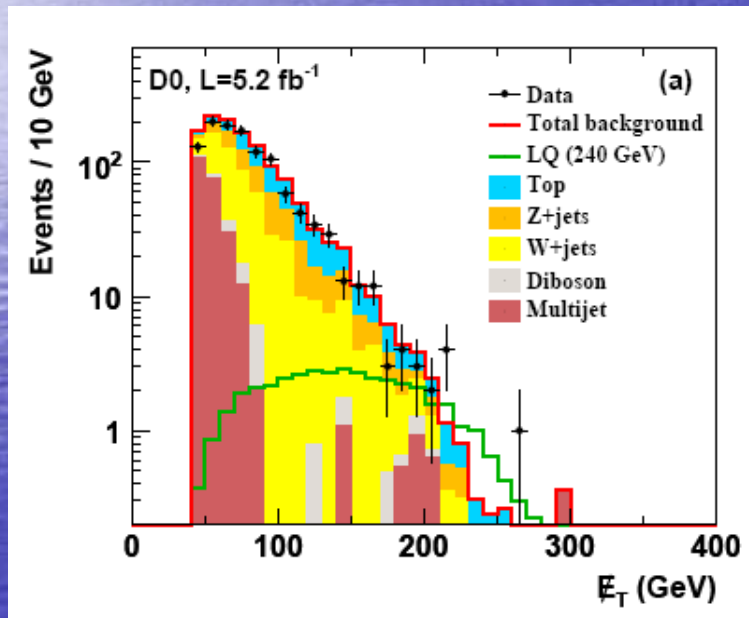
(April)

In final sign-off tomorrow

Version 1.6 David Hedin, Sergey Uzunyan
to be submitted to PRD-RC
Send comments to d0-run2eb-004@fnal.gov

by 4/22 5:00 PM (prelim result)
by 4/29 12:00 PM (publication)

Search for third-generation leptoquarks and scalar bottom quarks in $p\bar{p}$ collisions at $\sqrt{s} = 1.96$ TeV



- to be submitted this week

New Phenomena Status

New Phenomena (April 23, 2010)		Analyses			Person Power
		Topics	Lumi	Status	
Published or to be Published soon	Publications	1 $W' \rightarrow WZ \rightarrow \text{trilepton}$	4.1 fb ⁻¹	Published on 2/9/2010	K. Kaadze (Grad. end of spring), T. Gadfort, Y. Maravin, A. Askew Dr. Ning Zhou, John Parsons
		2 RS graviton $e\bar{e}/\gamma\gamma$	5.4 fb ⁻¹	Submitted 4/12/2010	
	Collab. Review	1 LQ3/sbottom	5.2 fb ⁻¹	Deadline April 29th	Sergey Uzunyan, Dave Hedin
	in EB review	1 Quirks	2.4 fb ⁻¹	in EB20 since Aug. 2009	Oleksiy Atramentov, Yuri Gershtein
		2 RPV e+mu	5.3 fb ⁻¹	in EB12 since Feb. 11	Pengfei Ding (starting PhD with Terry), L. Han, X. Hu, Y. Liu, H. Yin
in NP review	3 LQ1 enujj (Prel.)	5.4 fb ⁻¹	in EB15 since Feb. 18	Xinlu Huang (under graduate), T. Gadfort, G. Brooijmans, L. Zivkovic	
	4 $W' \rightarrow WZ \rightarrow l\bar{l}jj + l\nu jj$	5.4 fb ⁻¹	in EB14 since Mar. 25	T. Gadfort, L. Zivkovic, S. Caughron, G. Brooijmans	
	stop in $e\mu$	5.4 fb ⁻¹	in NP since Mar. 04	Dennis Mackin (Graduating spring 2010), Marj Corcoran	
13 on going efforts	Well Advanced	1 $\gamma\gamma + \text{MET}$ GMSB/UED	5.2 fb ⁻¹	ready < one month	Mark Cooke (Graduating spring 2010), John Parsons
		2 $VQ+q \rightarrow W/Z+q+q$	5.4 fb ⁻¹	ready < one month	Seth Caughron (Graduating 2010), Gustaaf Brooijmans
		3 lepton jets	5.8 fb ⁻¹	soon	Andy Haas, Yuri Gershtein
		4 $Z' \rightarrow ee$	5.4 fb ⁻¹	ready in few weeks	Ioannis Katsanos, Ning Zhou
	Progressing	5 SS dimuon (SUSY)		weekly Monday meetings	Angelo Santos (student), Pedro Mercadante, S. Novaes, Jason
		SS dimuon (UED)		weekly Monday meetings	Mansour (Master student \rightarrow done), Carsten Hensel, Andrey Schukin,
	any hope?	6 Compositeness dil	5 fb ⁻¹	was ready but now stalled	Dmitri Smirnov
		7 MIS	1 fb ⁻¹	unpredictable	J. Piper, J. Kraus, P. Renkel, J. Linnemann, Md Naimuddin, S. Protop
	started, starting	8 Trilepton SUSY		update next NP meeting	Mandy Rominsky, Bjoern Penning, and more.
		9 TC in 4 jets		update next NP meeting	Justace Clutter, Brendan Casey, Alice Bean
		10 CMSP		update in 2 meetings	Sungwoong Cho, J. Alimena, D. Cutts, E. Teich, S. Banerjee, M. Eads
		11 stop b-chargino (τ)		update next NP meeting	Philippe Gris
		12 $Z\gamma$ GMSB		update last week	Alan Wilson (students), Bing Zhou, Junjie Zhou
13 monophoton (LED)			plans presented in decem	Todd Adams	
Not yet started	intentions	14 di-b-jet glue prim			Brendan Casey
		15 TC νjj			Bandurin, Maravin, Dan Duggan
		16 gluino-gluino bbbb+MET			Rick Salcido, David Hedin, Sergey Uzunyan
		17 squarks & gluinos			Verdier
		18 $Z' \rightarrow WW \rightarrow l\nu jj$			Jadranka Sekaric, Joe Haley, Drew Alton, W
		19 stop $\rightarrow c + \text{MET}$			Rick Salcido, David Hedin, Sergey Uzunyan
		20 stop in dileptons			Saclay
		21 Jet substructure in multijets			Gustaaf: only pursue if hint of signal in first pass
		22 $\tau + \text{MET} + \text{jets}$			

• Let's zoom in...

D0 France et le NP

- **Philippe Gris**
 - published the stop in dileptons (1 fb^{-1} in 2009, $e\mu$, ee)
 - now working on stop in dileptons with tau (6 fb^{-1})
 - see today's presentation
 - to be combined with other channels (ee , $e\mu$, $\mu\mu$) \Rightarrow **Saclay** (Frederic Deliot, Slava, ...)?
 - beyond ICHEP timescale
- **Patrice Verdier**
 - Published the sqgl and LQ/T-Odd (2.5 fb^{-1} in 2008)
 - Update the sqgl forseen with the full Run II stat.
 - LQ searches meanwhile

The NP group is very active

Thursday 15 April 2010

11:00	Introduction/News (10') (transparencies)	Brooijmans, Duperrin
11:10	MC report and news (15') (transparencies)	Alan W Wilson
11:25	MET studies (15') (transparencies)	Alan W Wilson
11:50	stop emu group review status (20') (transparencies)	Dennis Mackin
12:20	MIS (30') (transparencies)	Peter Renkel

Thursday 01 April 2010

11:00	Introduction/News (10') (transparencies)	Brooijmans, Duperrin
11:10	ggMET Update (20') (transparencies)	Mark Cooke
11:30	LS Dimuon Update (20') (transparencies)	Alexey Popov
11:50	Zgamma Update (20') (transparencies)	Alan Wilson
12:10	lepton jets (20') (transparencies)	Yuri Gershtein

Thursday 18 March 2010

11:00	Introduction/News (10') (transparencies)	Brooijmans, Duperrin
11:10	W' -> WZ update (20') (transparencies)	Thomas Gadfort
11:30	Update on Vector Quarks (20') (transparencies)	Seth Caughron
11:50	Z' update (15') (transparencies)	Ioannis Katsanos
12:05	LS Dimuon Update (15') (transparencies)	Angelo Souza

Thursday 04 March 2010

11:00	Introduction/News (10') (transparencies)	Brooijmans, Duperrin
11:10	Z' and RS diEM publication status (20') (transparencies)	Ioannis Katsanos
11:30	TC in 4 jets (20') (transparencies)	Justace Clutter
11:50	Plans for the SUSY tripleton searches (20') (transparencies)	Mandy Rominsky

Thursday 29 April 2010

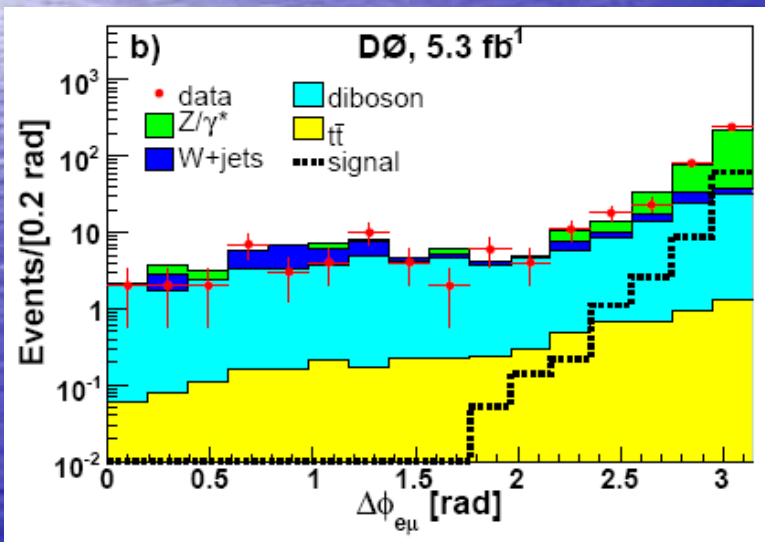
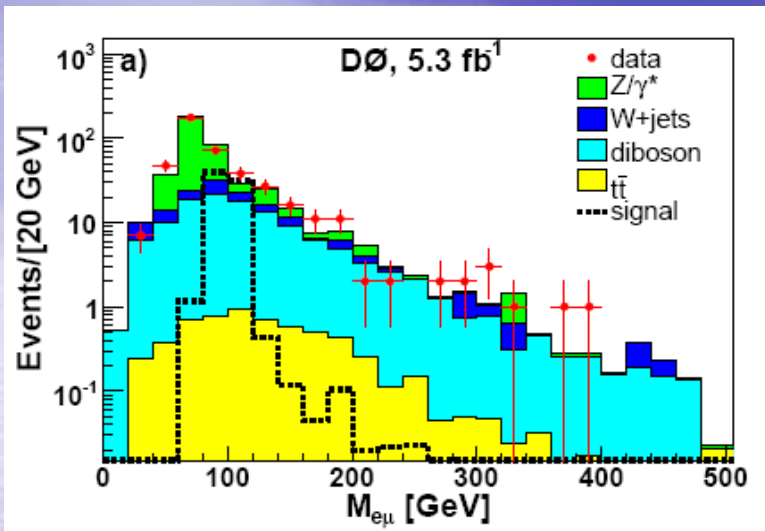
11:00	Introduction/News (10') (transparencies)	Brooijmans, Duperrin
11:10	stop in b+tau+sneutrino (25') (transparencies)	Philippe Gris
11:35	Technicolor search and gamma+jj (15') (transparencies)	Dmitry Bandurin
11:50	Technicolor in jjbb (25') (transparencies)	Justace Clutter
12:15	Z'->ee status (25') (transparencies)	Ioannis Katsanos
12:40	CMSP search status (25') (transparencies)	Sungwoong Cho

well advanced analyses

New Phenomena (April 23, 2010)		Analyses		
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	Collab. Review	1	LQ3/sbottom	5.2 fb-1 Deadline April 29th
	in EB review	1	Quirks	2.4 fb-1 in EB20 since Aug. 2009
		2	RPV e+mu	5.3 fb-1 in EB12 since Feb. 11
		3	LQ1 enujj (Prel.)	5.4 fb-1 in EB15 since Feb. 18
in NP review	4	$W' \rightarrow WZ \rightarrow lljj + lvjj$	5.4 fb-1 in EB14 since Mar. 25	
	1	stop in $e\mu$	5.4 fb-1 in NP since Mar. 04	
Well Advanced		1	$\gamma\gamma + \text{MET}$ GMSB/UED	5.2 fb-1 ready < one month
		2	$VQ + q \rightarrow W/Z + q + q$	5.4 fb-1 ready < one month
		3	lepton jets	5.8 fb-1 soon
		4	$Z' \rightarrow ee$	5.4 fb-1 ready in few weeks

**What are the 7 next
New Phenomena
Papers ?
(on the time scale of ICHEP)**

Paper 1: RPV $e+\mu$

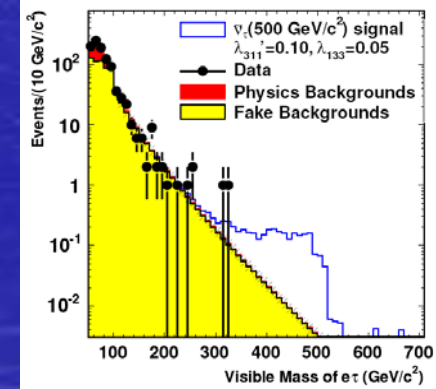
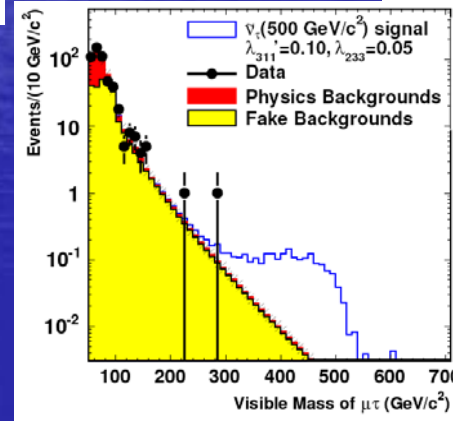
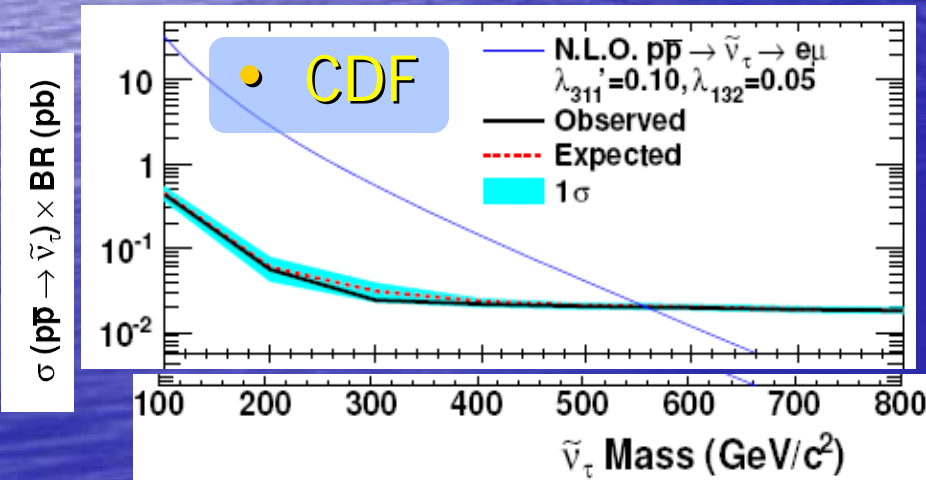
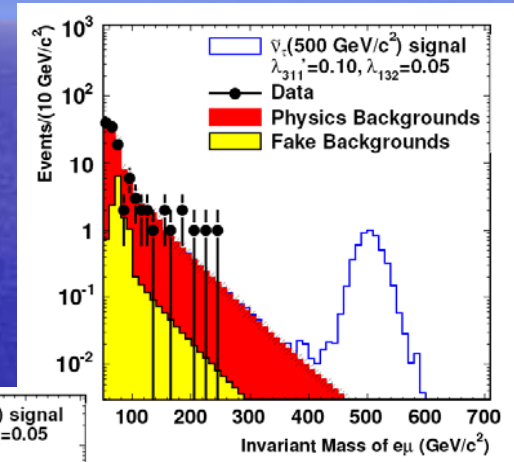
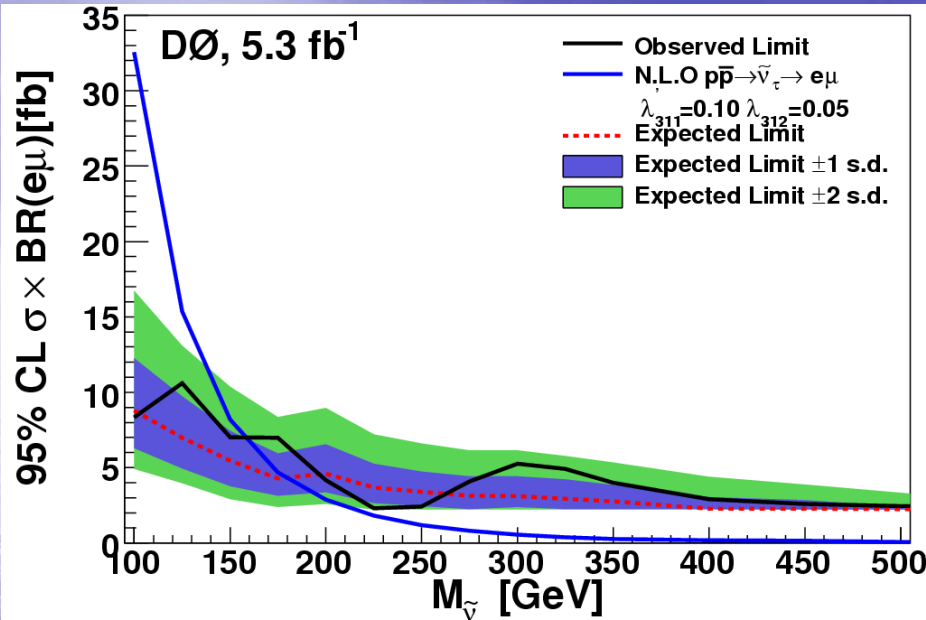


- This our next paper
 - 5.3 fb⁻¹, PRL or PLB
 - submission within ~2 weeks
- USTC/Manchester
 - Nice job by Pengfei Ding (et al.)
 - Appreciated editing work from Stefan S.
- Remaining issues:
 - applying the new muon smearing
 - Implies to rerun all the analysis (skimming etc.)
 - Δz for electron and μ tracks
 - Applying ANN requirement

RPV $e+\mu$

- CDF just submitted to PRL this RPV interpretation

- 1 fb^{-1}
- $e\mu, e\tau, \mu\tau$

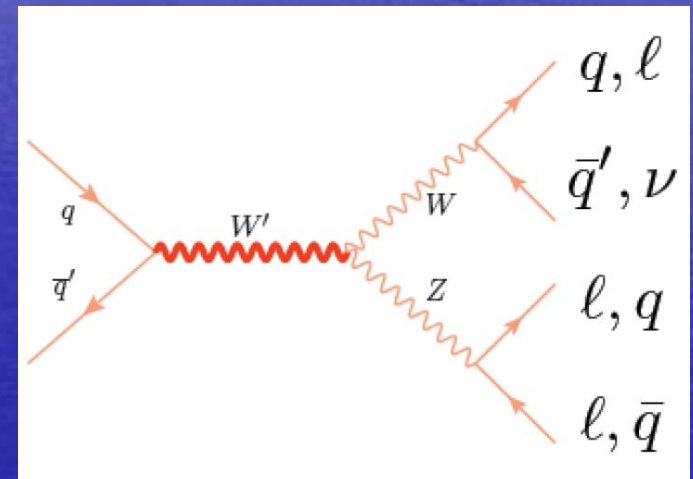


D0 France
May 4, 2010

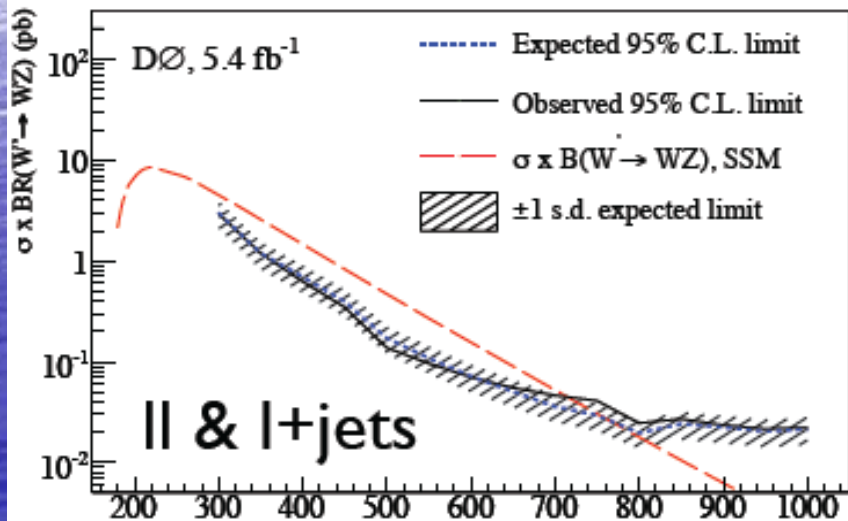
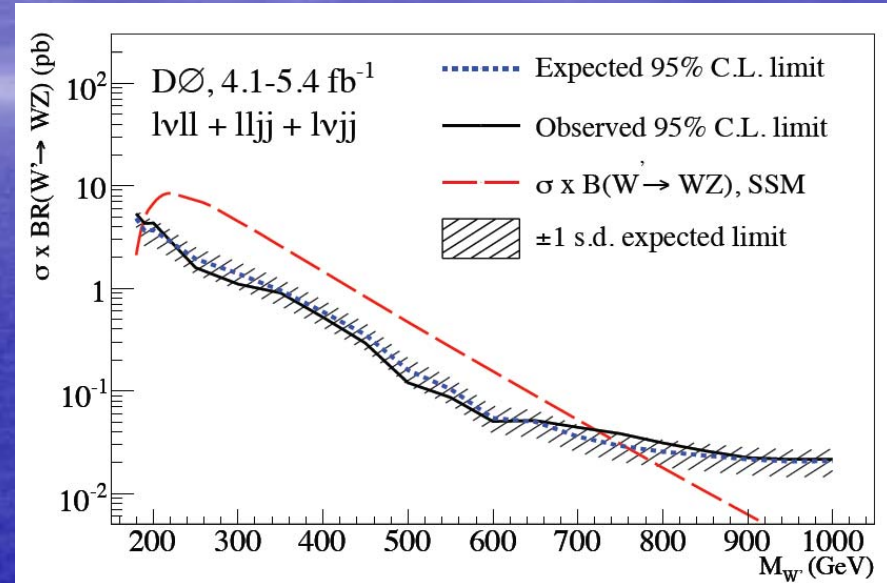
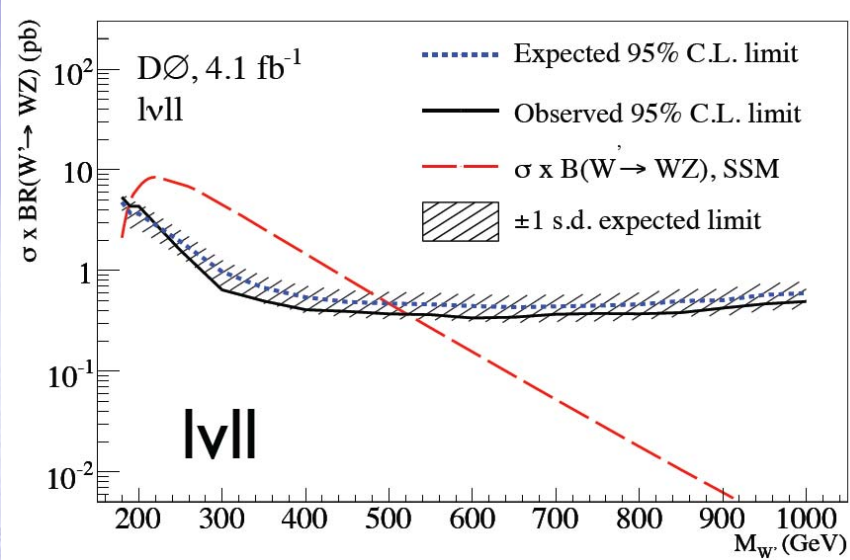
Paper 2: $W' \rightarrow WZ \rightarrow \text{leptons} + \text{jets}$

Thomas Gadfort, Lidija Zivkovic, Seth Caughron, Gustaaf Brooijmans,
Andrew Askew, Ketino Kaadze, Yurii Maravin

- In EB014 (Chair: Marc Besancon)
 - Authors preparing answers
- Few open questions at work
- What's to come:
 - New physics interpretations
 - Large W' width studies
 - Combination with trilepton result
 - JES/JER studies



$W' \rightarrow WZ \rightarrow l\nu ll + lljj + l\nu jj$



- Extending our D0 W' trilepton limits
 - 520 GeV \rightarrow 750 GeV
 - CDF preliminary limit is 515 GeV based on 2.9 fb⁻¹ ($l\nu jj$)

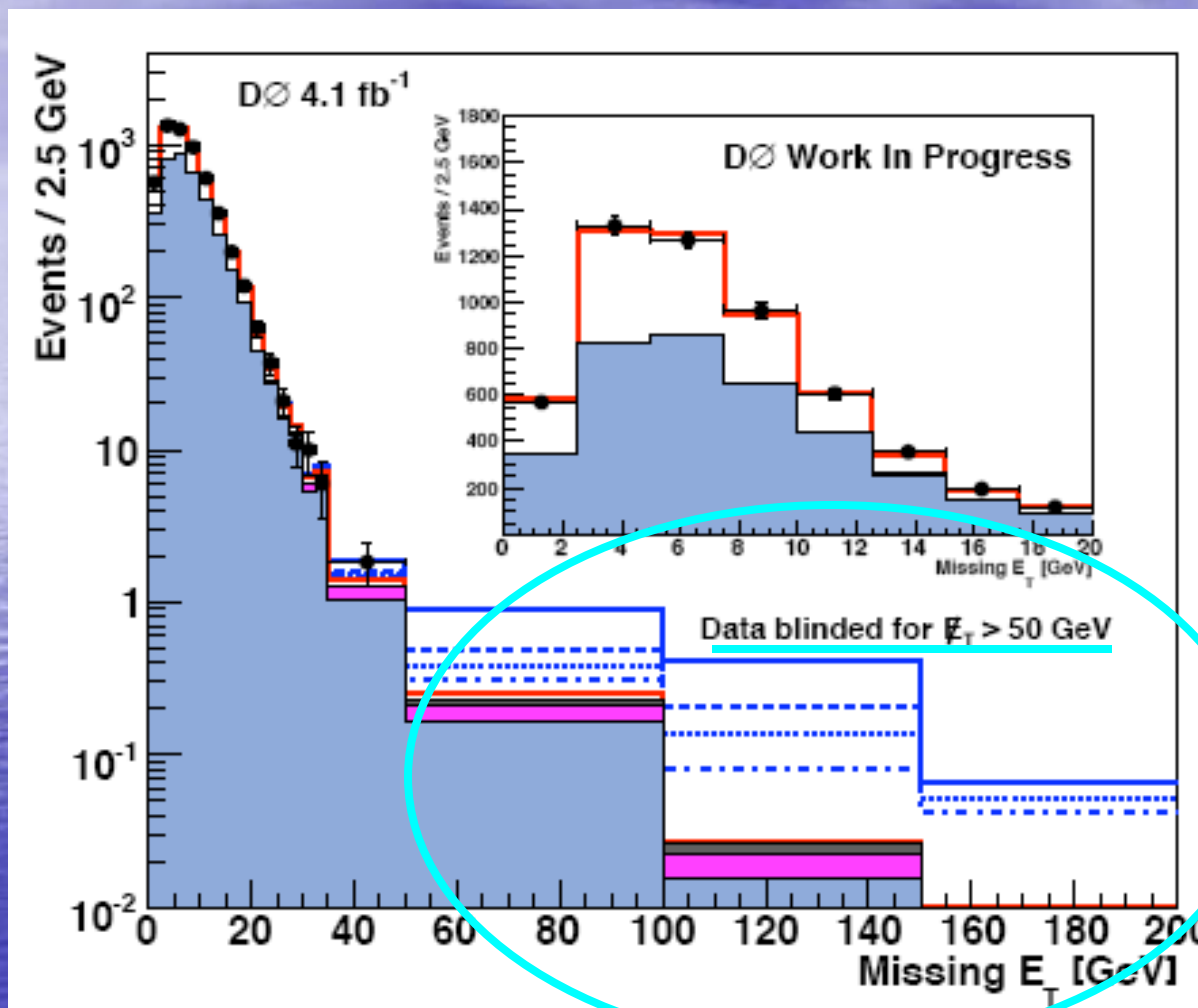
Paper 3: $\gamma\gamma$ +MET GMSB/UED

- $\gamma\gamma$ +MET



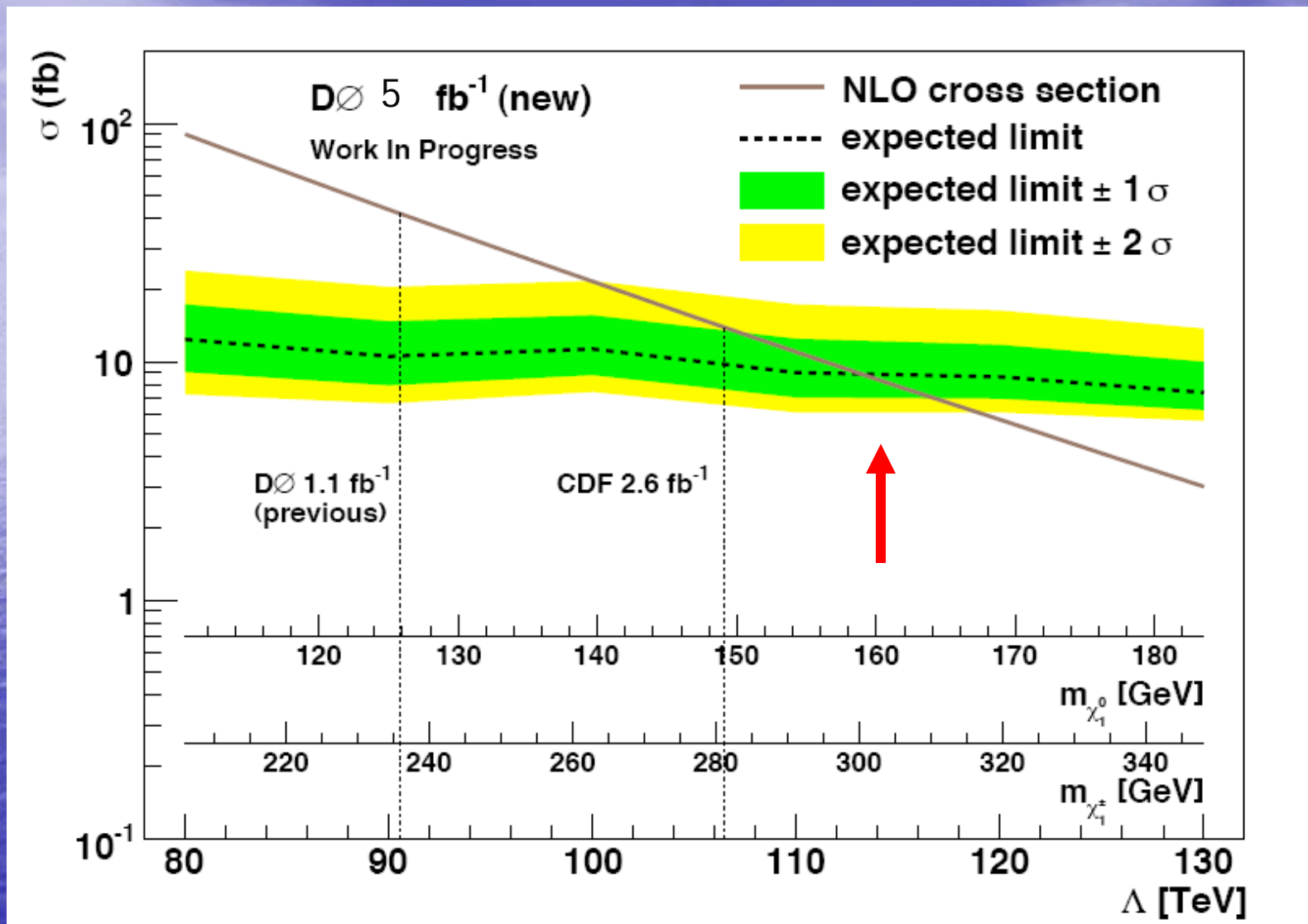
- Mark Cooke
 - 5.2 fb⁻¹
 - Analysis in group review expected May
- The lower efficiency seen for the track isolation cut in the UED and GMSB environment is now understood
- There are few remaining problems that are known (before unblinding)
 - $W\gamma$ and W +jets in the $e\gamma$ sample
- A nice piece of work!

$\gamma\gamma$ +MET GMSB/UED

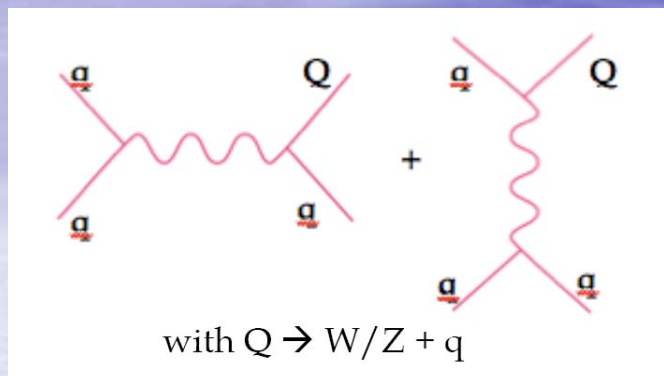


- Unblinding will happen during NP group review

$\gamma\gamma + \text{MET}$ GMSB/UED

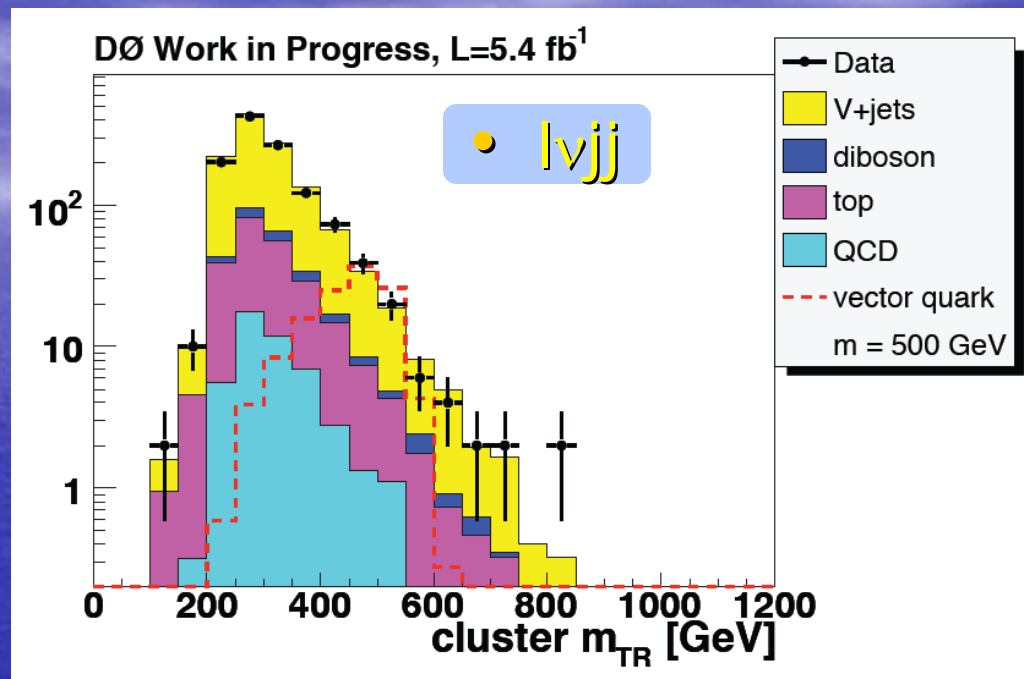


Paper 4: Vector Quarks



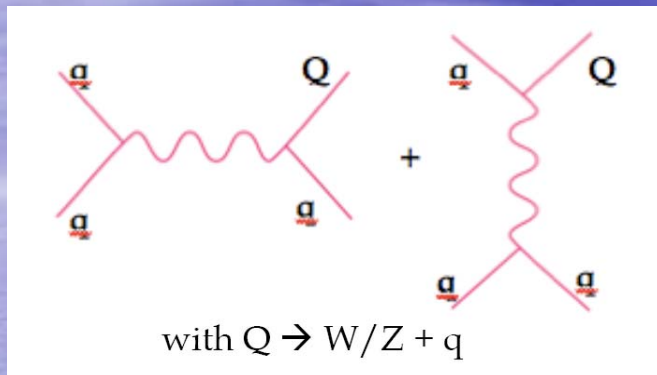
- Seth Caughron
– 5.4 fb⁻¹
- lvjj ~done

- VQ mass limit ~ 650 GeV



$$M_T^2 = \left(\sqrt{p_{TW,Z}^2 + M_{W,Z}^2} + p_{Tjh} \right)^2 - (\vec{p}_{TW,Z} + \vec{p}_{Tjh})^2$$

Vector Quarks



Cut hard to isolate a heavy object decaying to Z + jet:

- Leading jet $p_T > 100$ GeV
- dilepton $p_T > 100$ GeV
- $\Delta R(l_1, l_2) < 2.0$

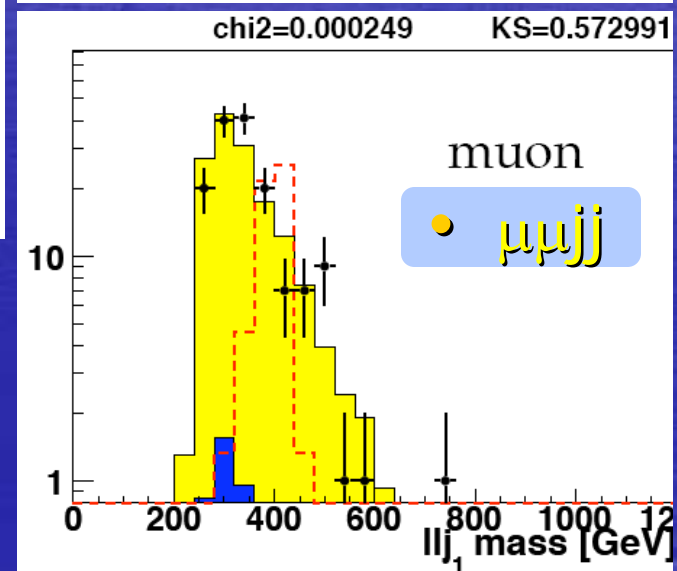
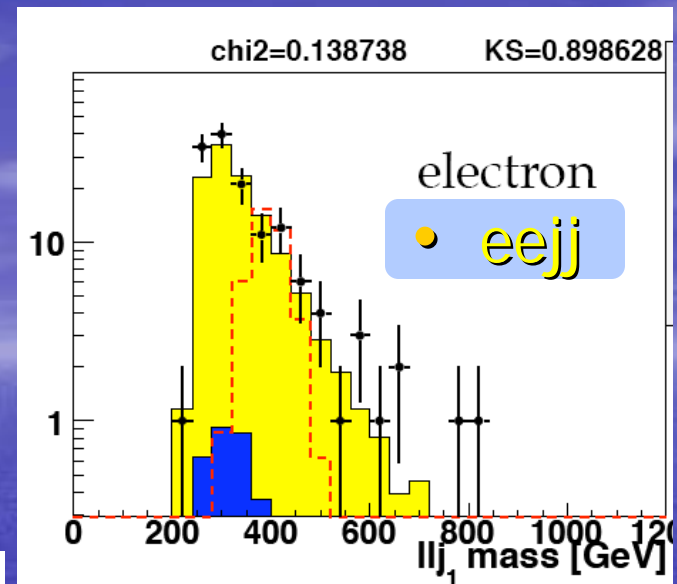
- **Seth Caughron**

- 5.4 fb^{-1}

- **$lljj$ at work**

- dilepton analysis uses same preselection, normalization as for $W' \rightarrow WZ$ analysis

- **VQ mass limit ~ 500 GeV**



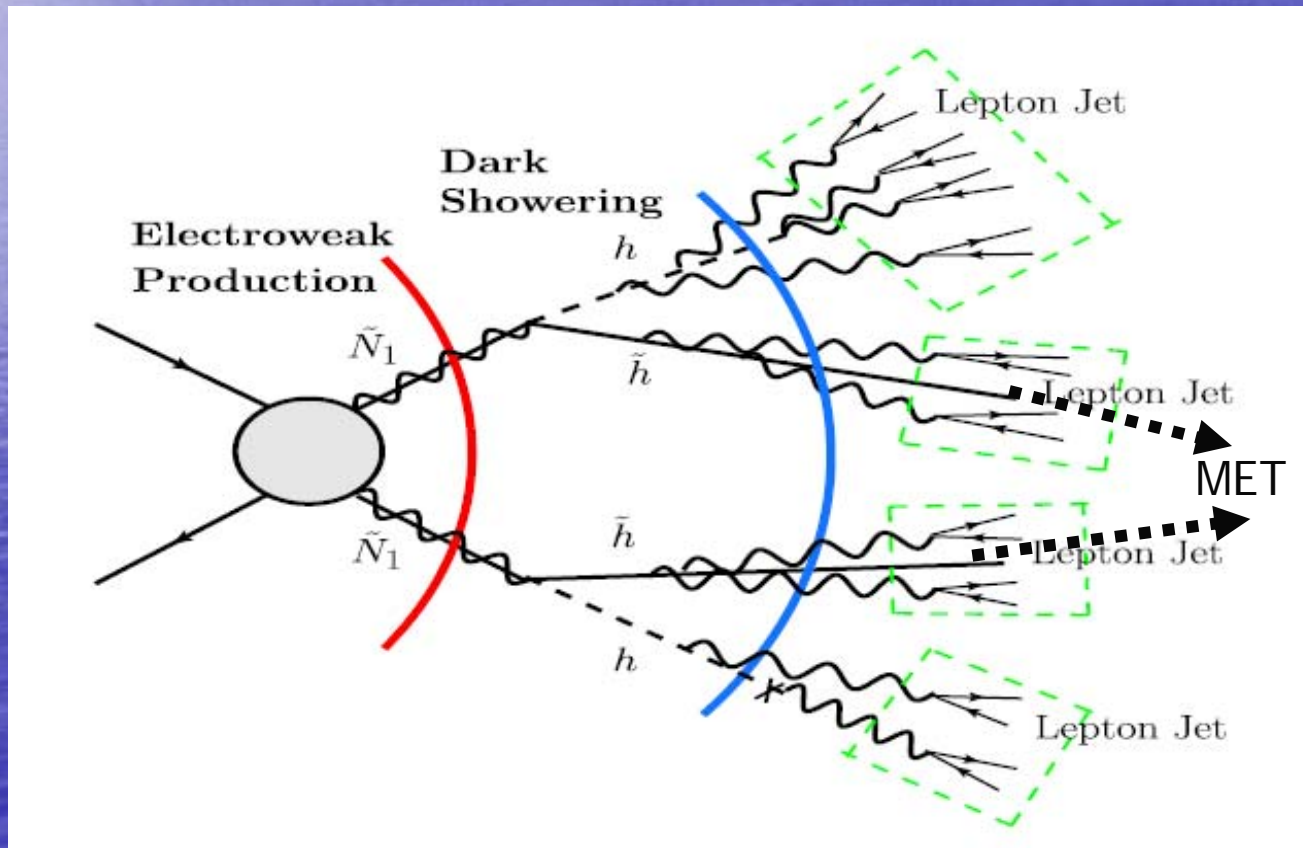
- **Analysis note under way**

Paper 5: jets of leptons

Search For Dark Sectors

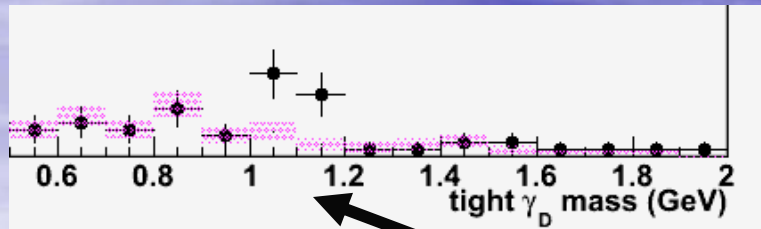
D. DeMair (Rutgers)
Y. Gershtein (Rutgers)
A. Haas (SLAC)

Signatures vary depending on the model. We settled on four fairly independent analyses that have some sensitivity in almost any scenario



jets of leptons

Inclusive 2LJ + MET

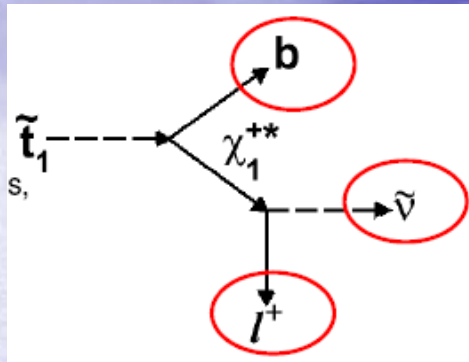


Summary

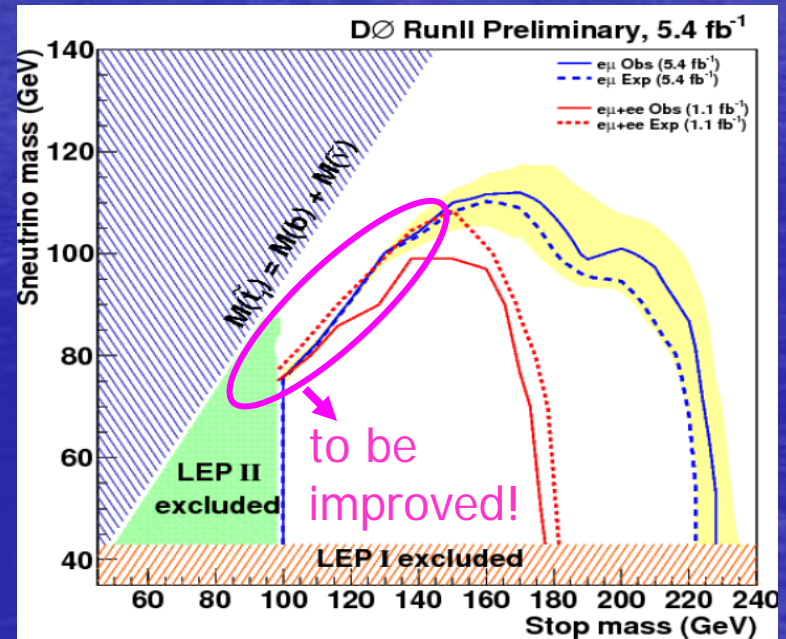
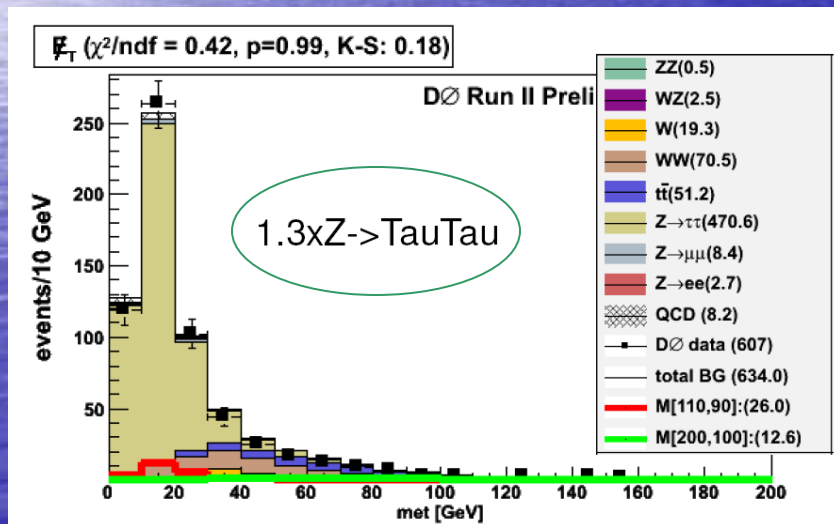
- After some interesting times, close to convincing ourselves that there is no evidence of hidden sectors in D0 data
- Converging on four analyses that for now will be a definitive word on existence of such sectors
- Methods and plots seem to be fixed – need a bit more work on limit setting and presentation
- How to publish? It's basically 4 (ok, may be 3) different analyses, may not be enough space to describe in single PRL
 - theorists will press for details!!
 - go through review process once, but split in two PRLs and submit in rapid succession?

Paper 6: SUSY stop in $e\mu$

$$\tilde{t}\tilde{t} \rightarrow b\bar{b}e\mu\tilde{\nu}\tilde{\nu}$$

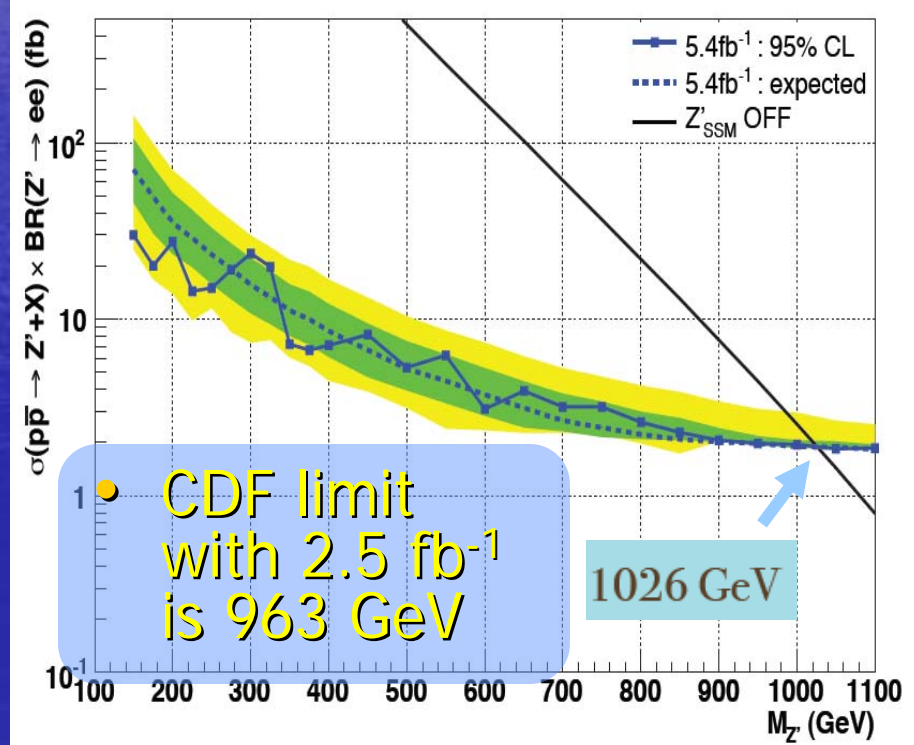
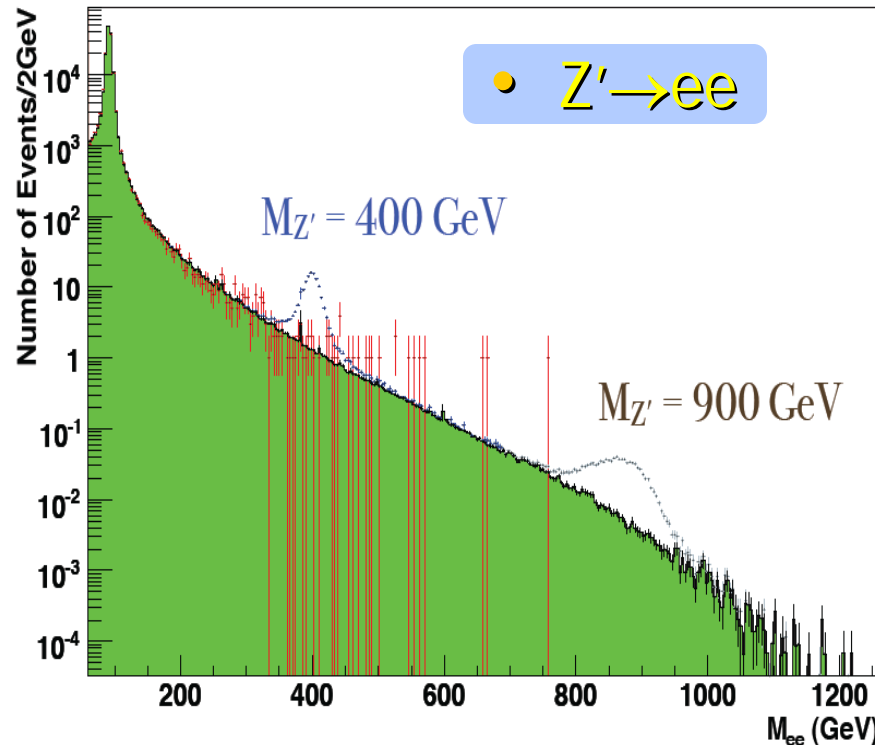


- Dennis Mackin
 - 5.4 fb⁻¹
- In NP group review
- Some issues at work
 - Low MET region in IIa
 - Z → ττ background



Paper 7: $Z' \rightarrow ee$

- Ioannis Katsanos
 - 5.4 fb⁻¹
 - based on Dr. Ning Zhou RS graviton analysis framework
- steadily progressing



NP: note that there are still 3 sub-working groups with weekly meetings

- SUSY: Chargino-Neutralino/UED

- trilepton: Mandy Rominsky et al.
- LS-dimuon: Angelo Santos (student), Pedro Mercadante, Jason Mansour (Master student →back to Germany), Carsten Hensel, Andrey Schukin, Alexey Popov.

- CMSP:

- Sungwoong Cho, J. Alimena, D. Cutts, E. Teich, S. Banerjee, M. Eads, S. Park, Y. Xie

- MIS:

- J. Piper, J. Kraus, P. Renkel, J. Linnemann, Md Naimuddin, S. Protopopescu

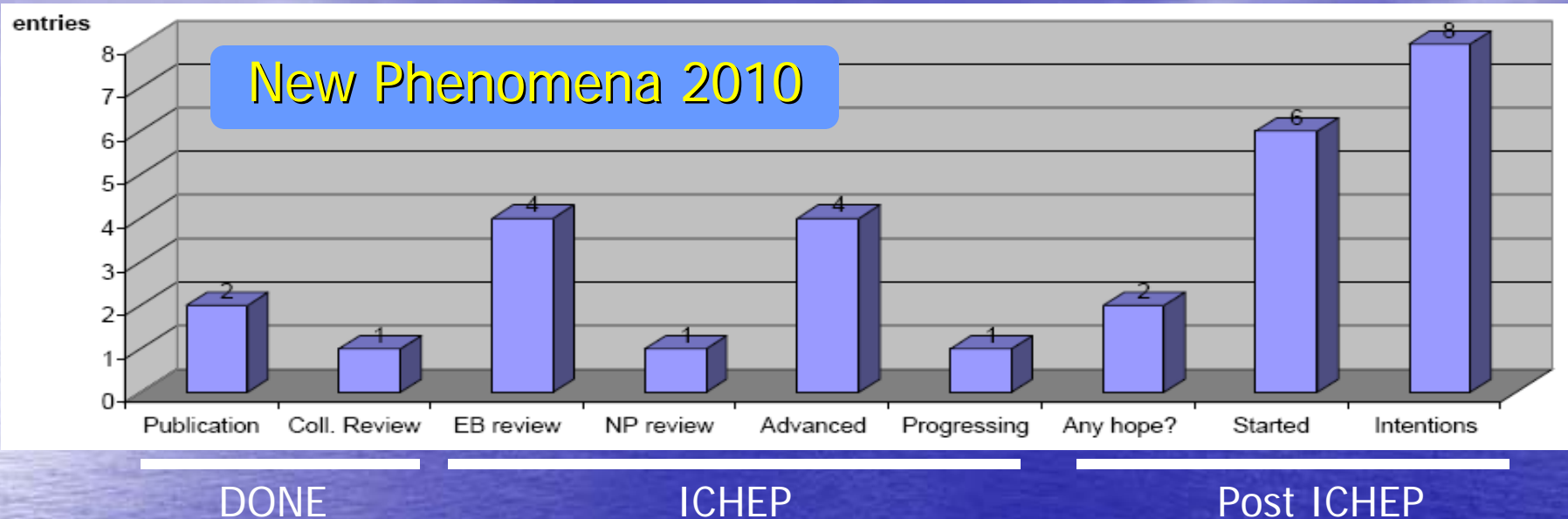
ICHEP 2010 abstracts

11 abstracts now

The New Phenomena group plan to submit ~~5 abstracts~~

- **Resonances**
 - “Searches for Extra Dimensions and Heavy Resonances with the D0 Detector”
- **Leptoquarks**
 - “Searches for Leptoquarks with the D0 detector”
- **SUSY**
 - “Searches for Supersymmetry with the D0 detector”
- **Hidden Valley**
 - “Searches for signals from Hidden Valleys with the D0 detector”
- **CMSP**
 - “Search for Charged Massive Long-Lived Particles with the D0 detector”

NP activities summary (current status)



- Already 3 publications in 2010 (W' , RS, Sbottom/LQ3)
- ICHEP 2010 new papers: (with high C.L.)
 1. RPV $e+\mu$
 2. W' (trilepton+semileptonic)
 3. Z'
 4. Light stop $e\mu$
 5. GMSB/UED $\gamma\gamma+\text{MET}$
 6. LQ1
 7. Vector Quarks
 8. Lepton jets (dark sector)