43rd Rencontres de Moriond
Electroweak Session
Experimental Summary

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John Adams Institute for Accelerator Science

La Thuile, Italy, 1-8th March 2008

Thanks to speakers for letting me use their slides.

Apologies for errors or omissions

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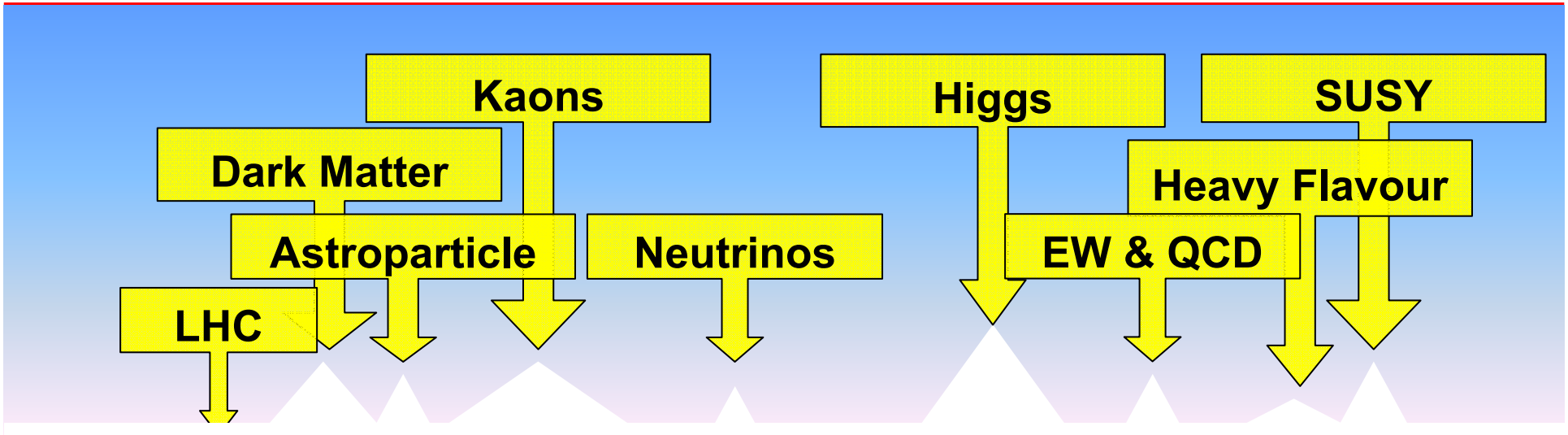
Outline

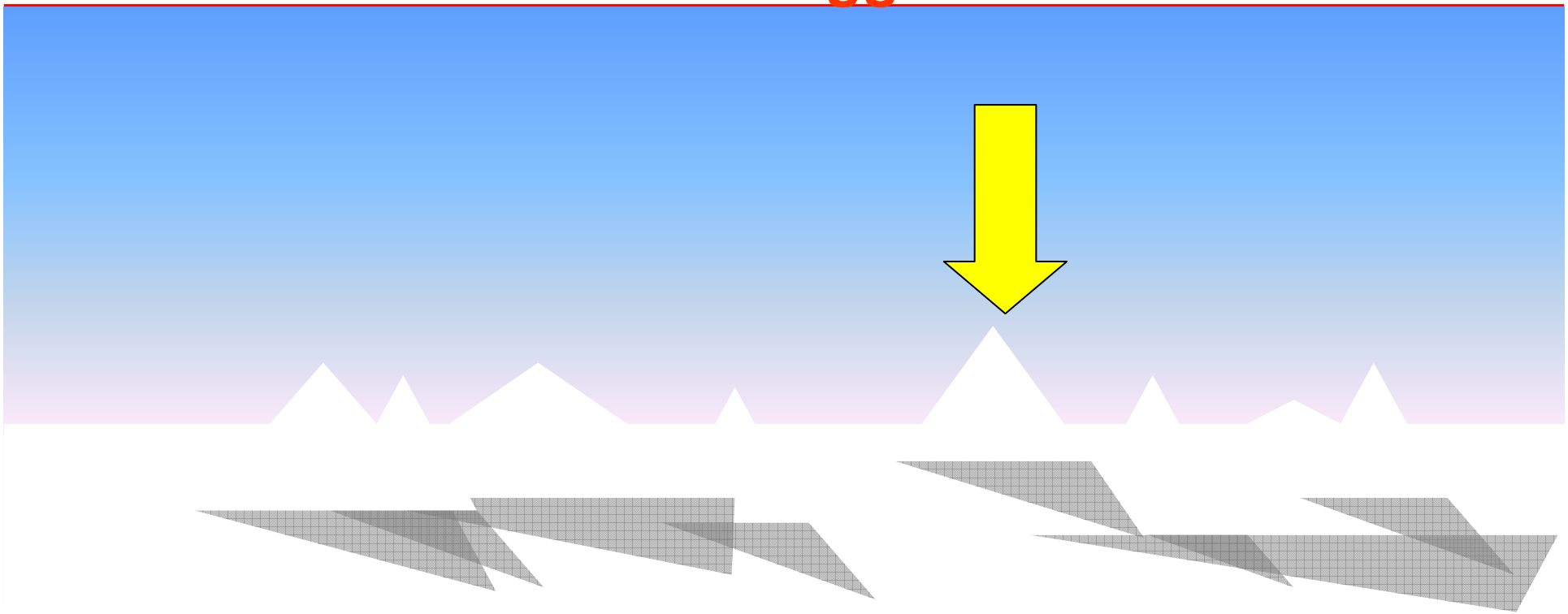


~60 talks
45 minutes

(- 5 minutes for jokes)
➔
40s per talk!!

ElectroWeak

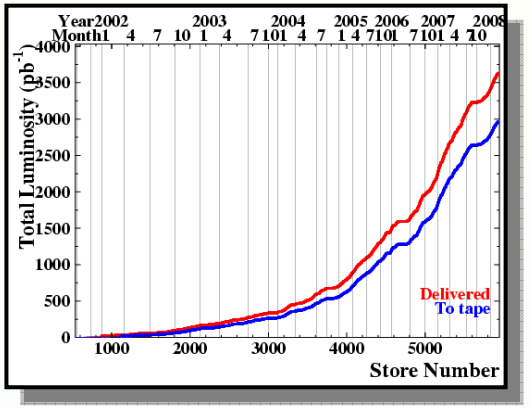
Searches for the Higgs



Higgs Searches

Yorita, Zivkovic, Haas

- Tevatron – CDF+D0 are powerful engines
- Tevatron performing well
  - ~3fb^{-1} useful data on tape
    - Hope 6 fb^{-1} (maybe 8?) by end 2009
    - Typical analyses use 1-2 fb^{-1}



- Combined limits are a big advance
- Many production × decay channels studied

  $\bar{q}q \rightarrow WH \rightarrow \ell\upsilon\ \bar{b}b$; $ZH \rightarrow \ell\ell\ \bar{b}b$; $ZH \rightarrow \bar{\upsilon}\upsilon\ \bar{b}b$

  $\rightarrow$ WH/ZH/VBF/ggH $\rightarrow \tau\tau$ + 2jets

  $gg \rightarrow H \rightarrow WW \rightarrow \ell\upsilon\ \ell\upsilon$

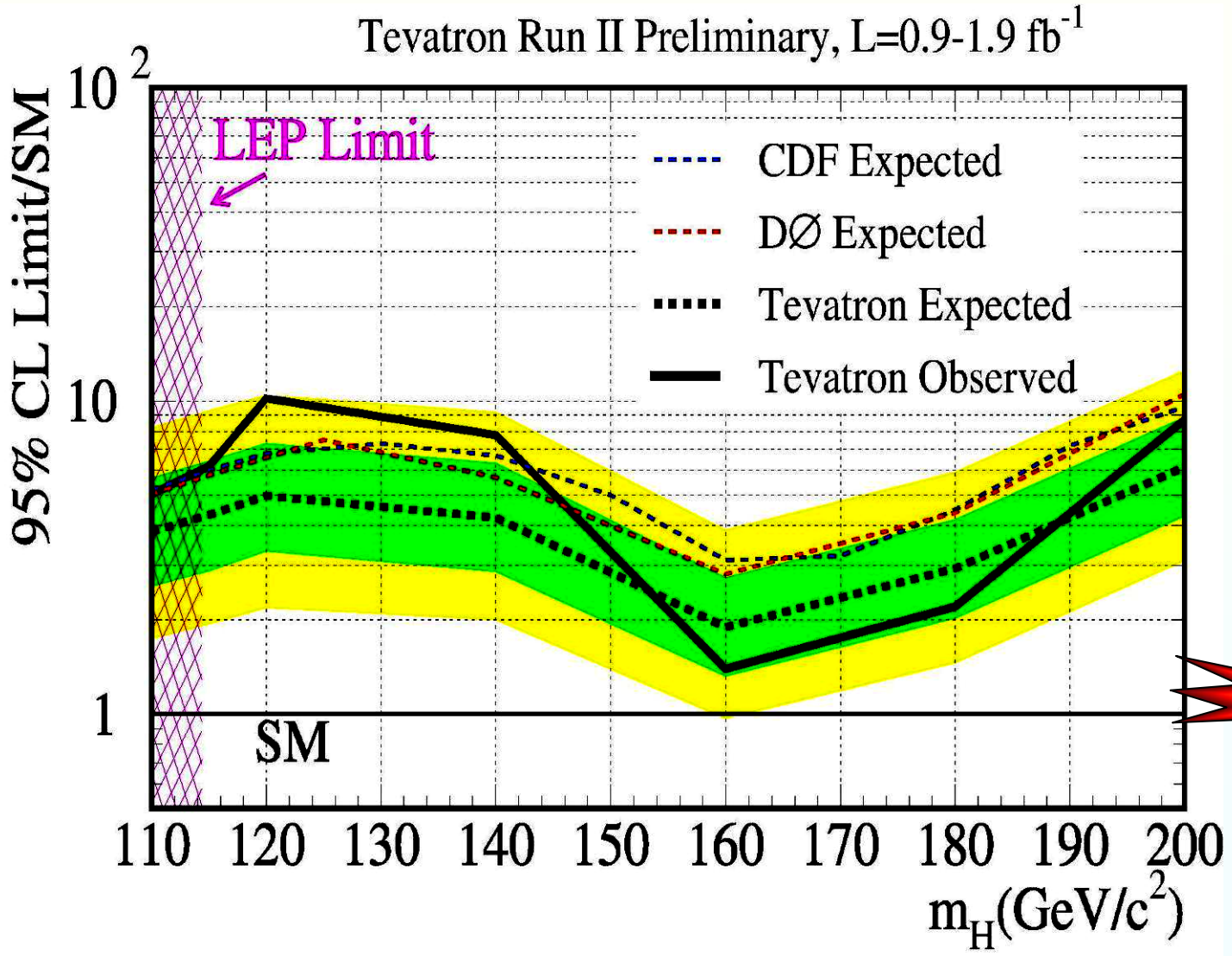
  $H \rightarrow \gamma\gamma,\ \tau^+\tau^-$ …

  $H(b) \rightarrow \bar{b}b(b)$

New

Combined Limit – SM Higgs

Yorita, Zivkovic



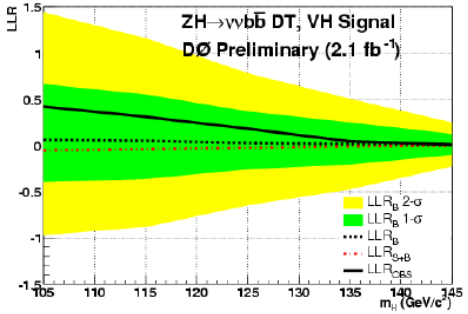
New

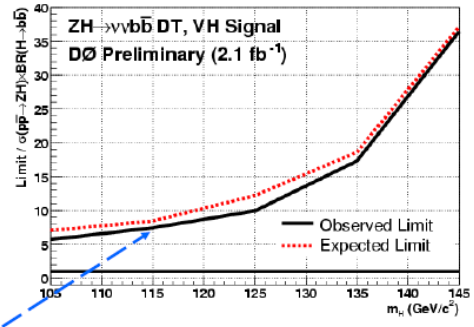
New SM Higgs Limit

YSF

Ochando, Masubuchi

- No deviation from the SM expectation was observed.
- Set limits, based on the DT output, on the SM Higgs boson production σ*BR(H->bb) (relative to the SM value) using a "modified frequentist", a.k.a CLs, approach.

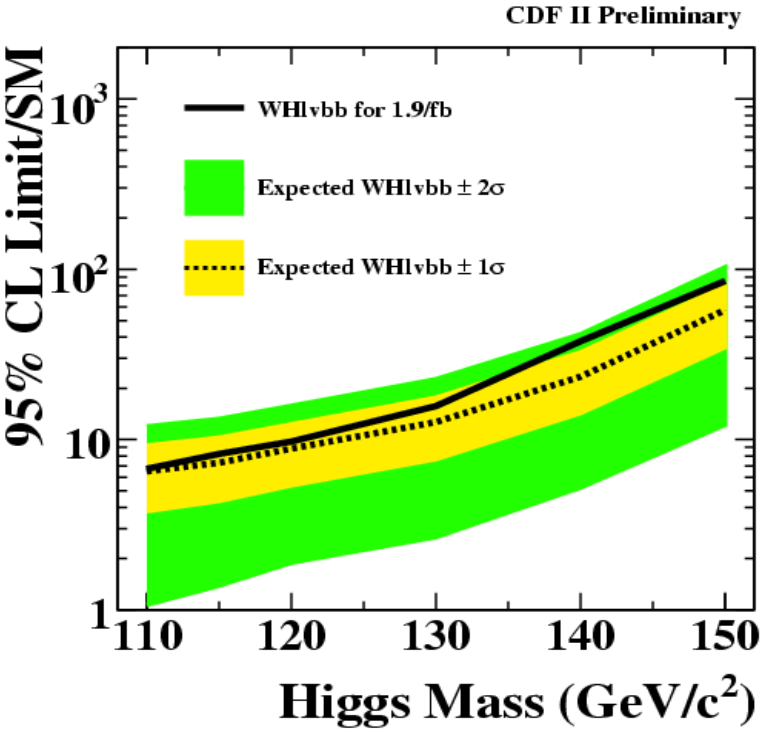


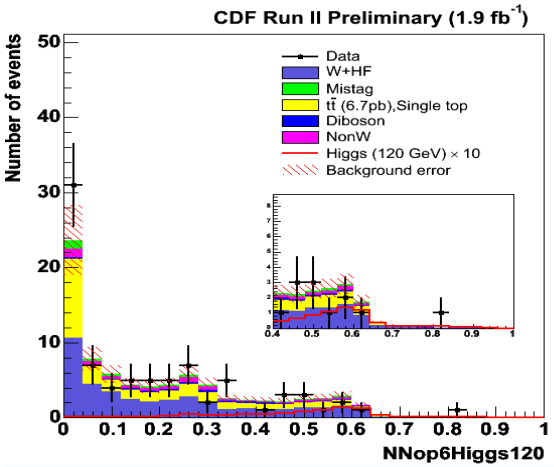


- For a mass of 115 GeV, the limit is a factor 7.5 larger than the SM cross section.
- Most sensitive DØ result for a low mass Higgs boson in a single channel.

New

Most sensitive for low-mass Higgs





1 event where there is no background!

Non-SM Higgs Search (SUSY)

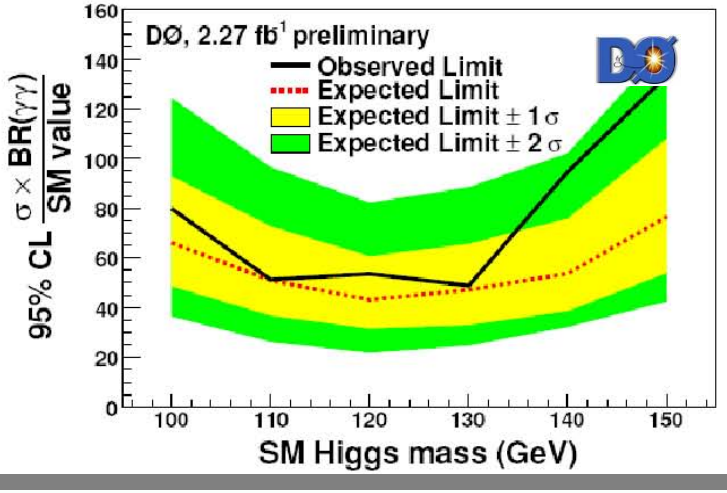
Haas

New

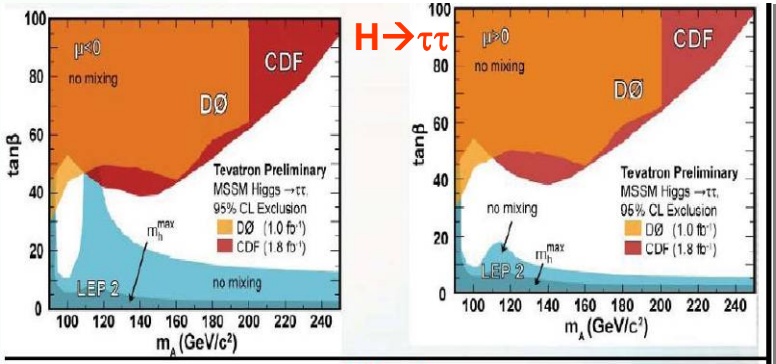
H→γγ

Also contributes to SM Higgs search!

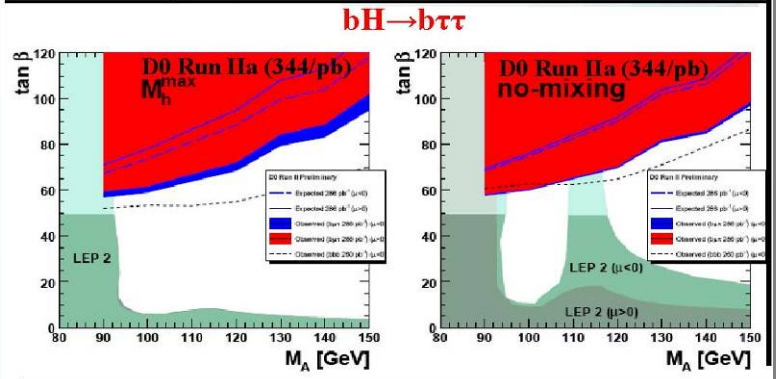
data	13827
$Z/\gamma* \rightarrow ee$	740.9 ± 102.3
jet+jet	4778.6 ± 1264.6
γ+jet	4677.2 ± 1245.8
QCD $\gamma\gamma$	3400.5 ± 711.0
total background	13597.2 ± 2548.5



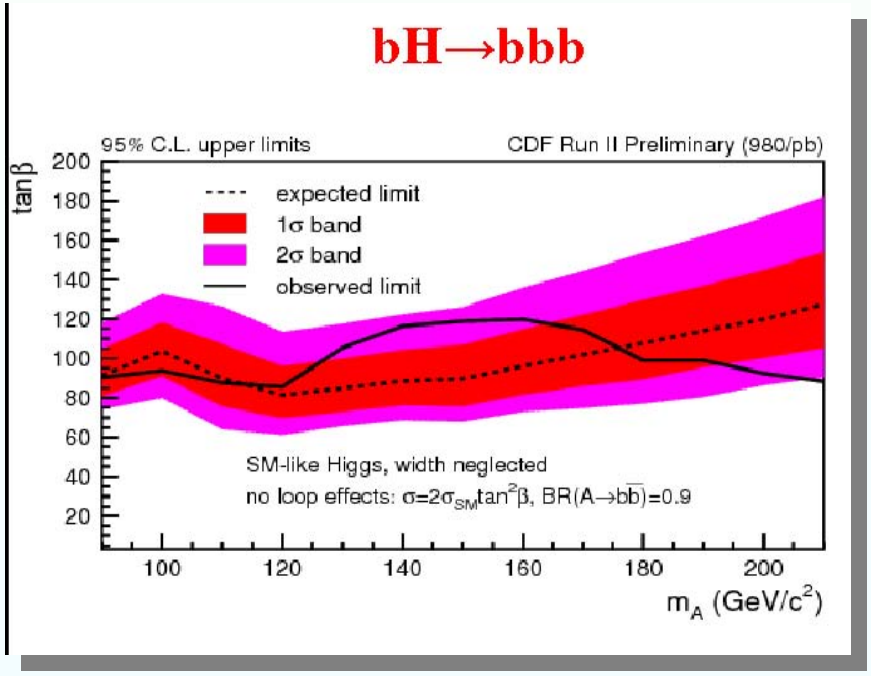
H→ττ



bH→bττ



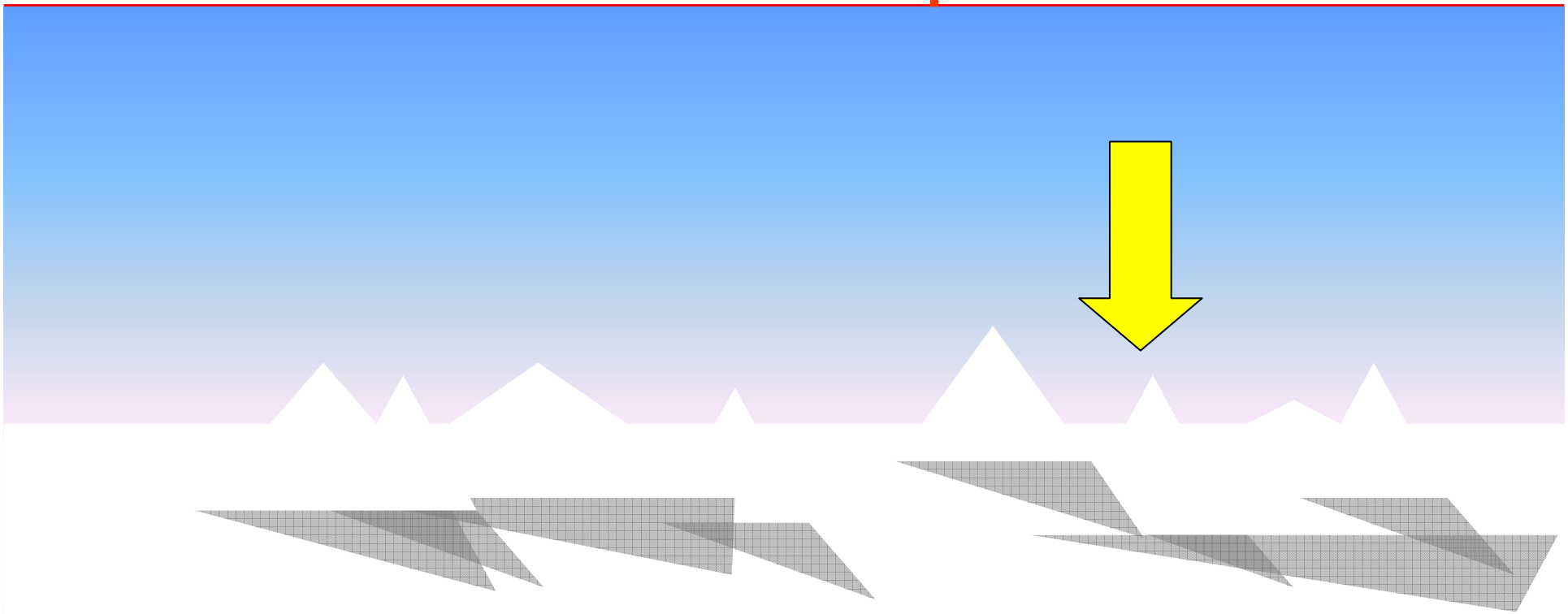
bH→bbb



Higgs Search mini-conclusion

- **Tevatron within a factor 2 of being able to exclude a high-mass Higgs**
- **Good progress with analysis methods**
  - **Sensitivity may improve**
  - **If discovered, probably only able to say that it is *consistent* with the SM**
  - **Otherwise, place limits on BTSM processes**
    - **Large tan β SUSY, for example**

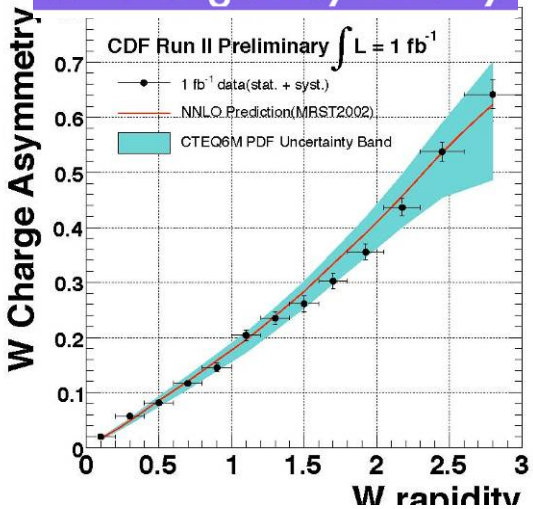
QCD with electroweak probes



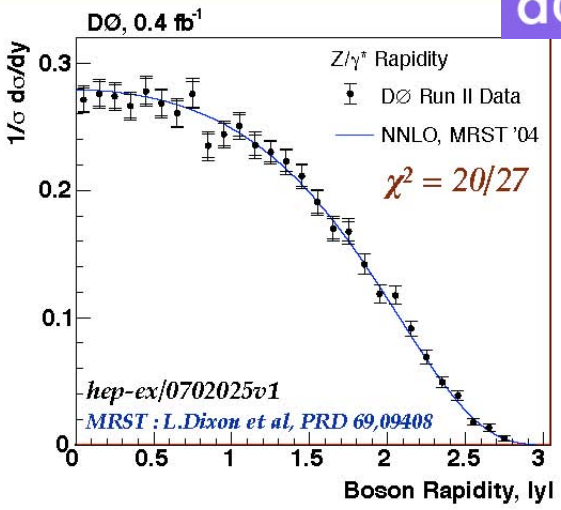
Tevatron Tests QCD

J Han

W Charge Asymmetry



dσ/dyZ



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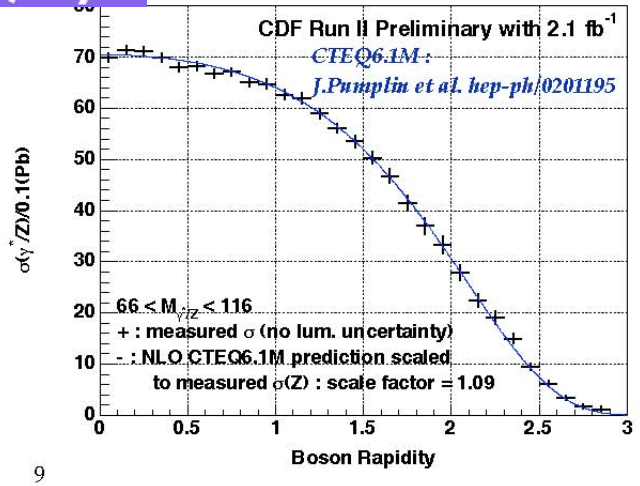
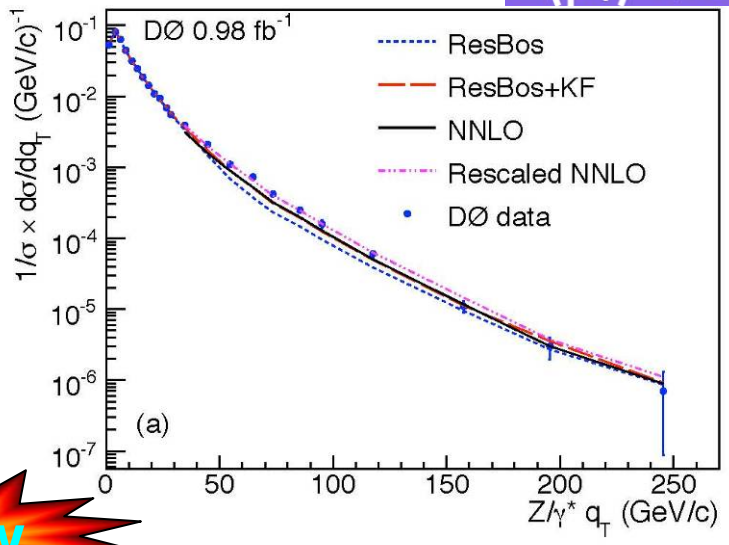
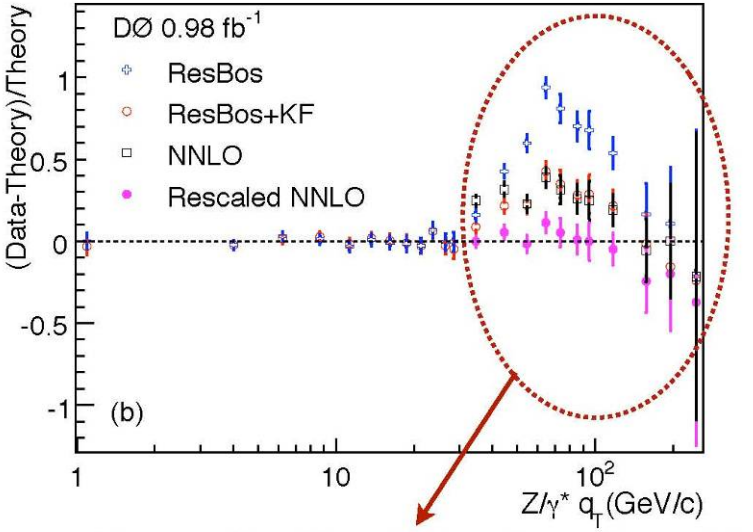


Z(pT) Measurement



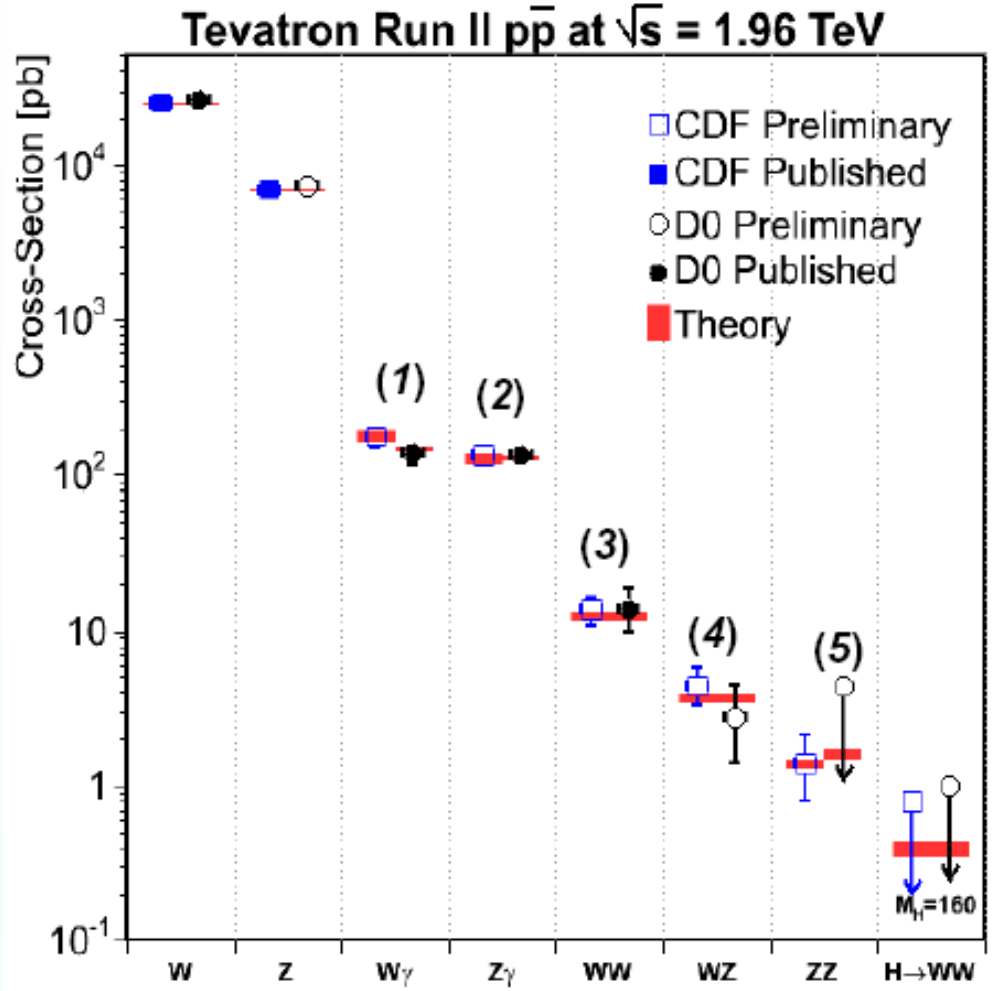
New



Normalization factor doesn't match

WW, WZ & ZZ production @ Tevatron

L Han



New

- Precise measurement from O(10^2)pb down to O(1)pb @ up to 2fb^{-1}, precise agreement to SM is observed
  - (1) First evidence of Wγ RAZ
  - (2) Zγ cross-section measurement
  - (3) WW/WZ→lνjj semi-leptonic
  - (4) WWZ TGC
  - (5) First evidence of ZZ

✓ *CDF results*
http://www-cdf.fnal.gov/physics/ewk/

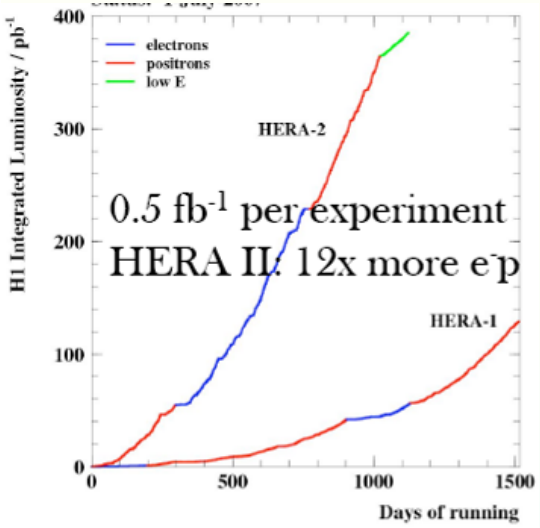
✓ *D0 results*
http://www-d0.fnal.gov/Run2Physics/WWW/results/ew.htm

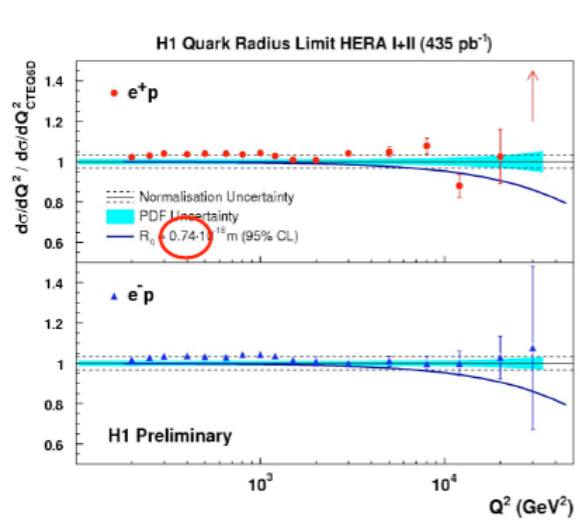
- More data coming, and digging hard for Higgs

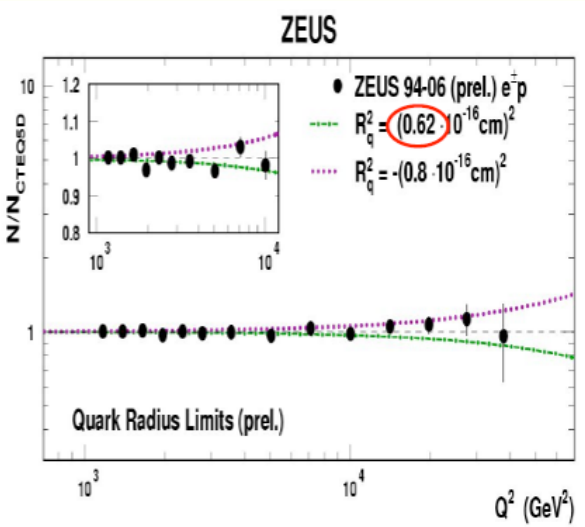
RAZ=Radiation Amplitude Zero

@ HERA

De Boer





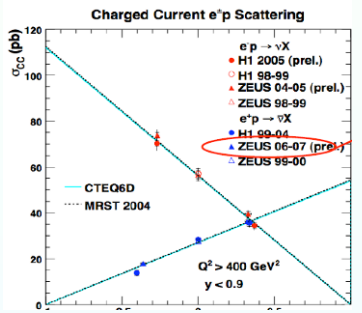


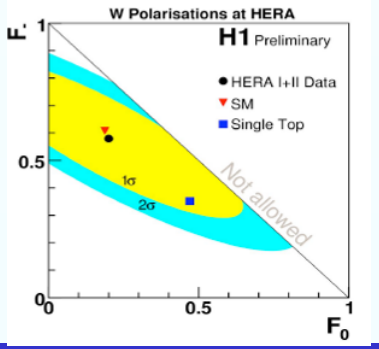
High Q^2 NC analyses allow to extract limits on quark radius < 0.001x proton radius

Competitive quark-Z couplings measured

Updated ZEUS CC cross section results HERA II

H1 measures single W production cross section at 4σ level and W polarisation for the first time





Searching for SUSY & friends

Seek and ye shall find (Matthew 7:7, Luke 11:9)

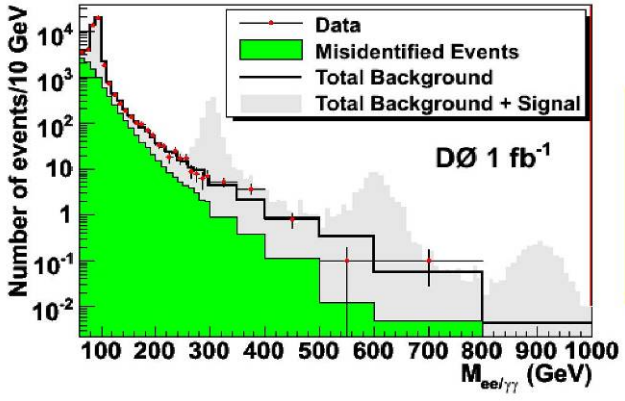
Photons and jets

Jaffre

- **Look for many things …**

- ✓ γγ/ee : Randall-Sundrum graviton
- ✓ γγ + MET : SUSY GMSB
- ✓ Single γ : Large extra dimension
- ✓ Anomalous γγ + MET production

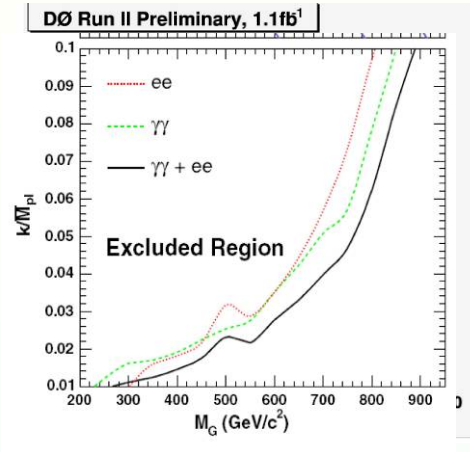
- ✓ Multijets + MET: SUSY
  - ✓ Squarks and gluinos
  - ✓ Stop
- ✓ Di-jet mass resonance



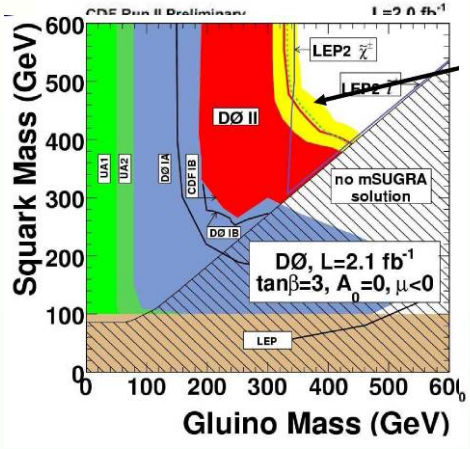
Photons and jets

Jaffre

- **Find nothing …**



RS Graviton



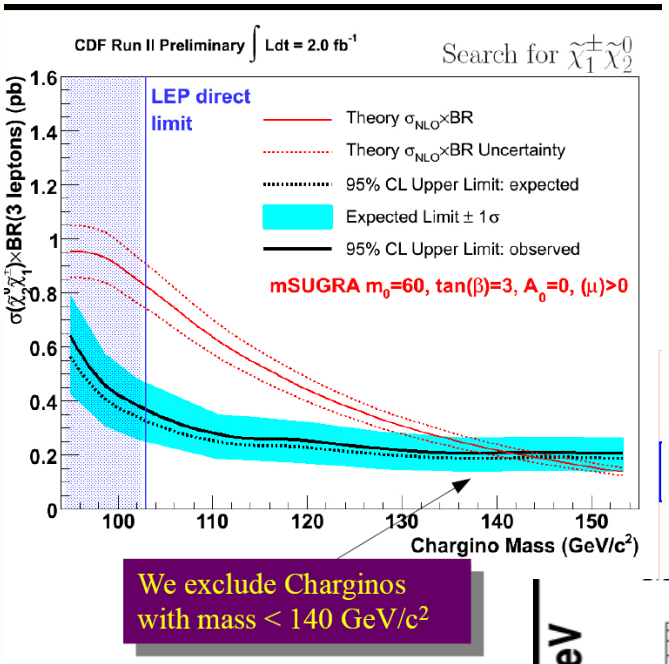
Squarks & gluinos

Model description	Observed mass exclusion range (GeV/c²)
Excited quark (f=f'=f_s=1)	260-870
Color octet technirho (top-color-assisted-technicolor (TC2) couplings)	260-1110
Axigluon and flavor universal coloron (mixing of 2 SU(3)'s cot(theta)=1)	260-1250
E6 diquark	290-630
W'(SM couplings)	280-840
Z'(SM couplings)	320-740

New

Searches with leptons

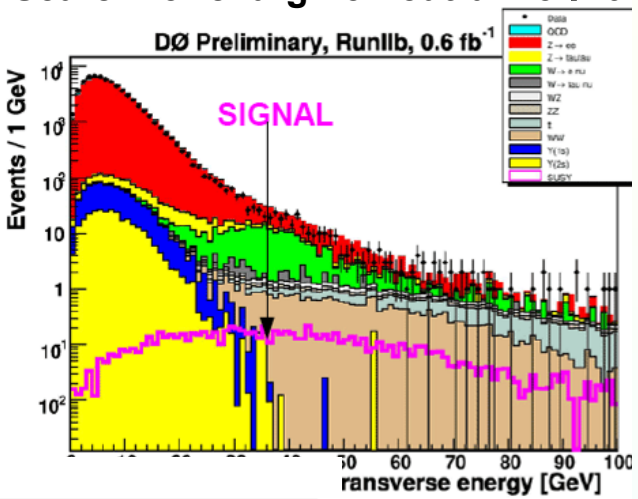
Dube



We exclude Charginos with mass < 140 GeV/c²

ee + Track updated to 1.7 fb⁻¹

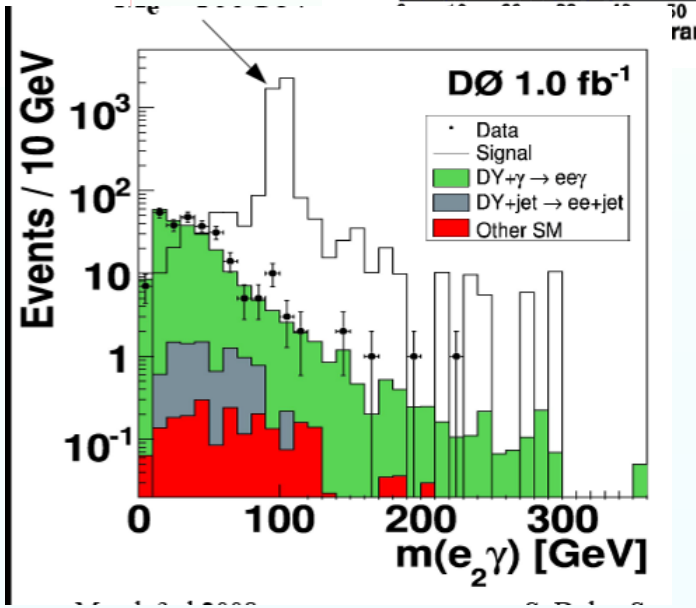
Search for chargino-neutralino→ ℓ

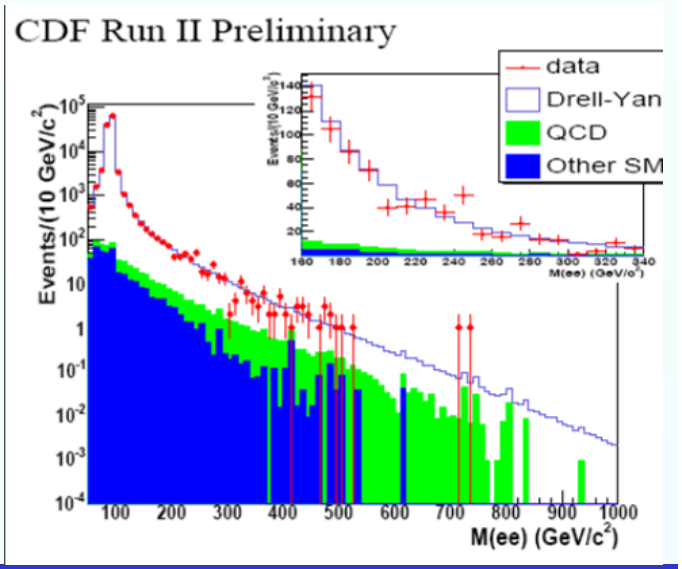


New

Z'

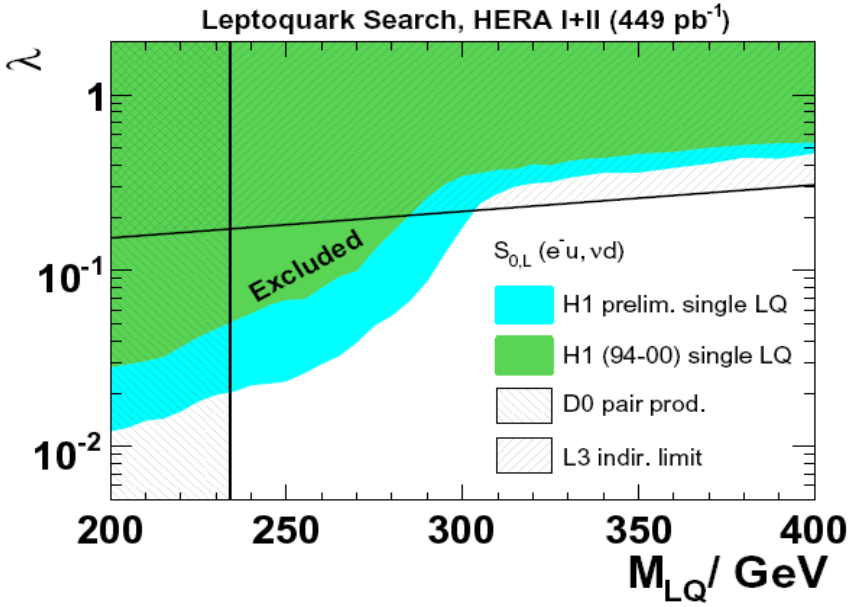
Excited Electrons



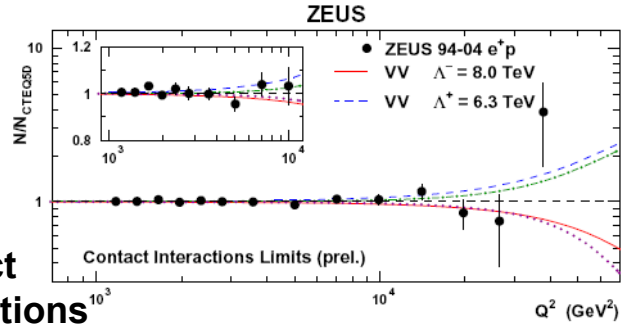


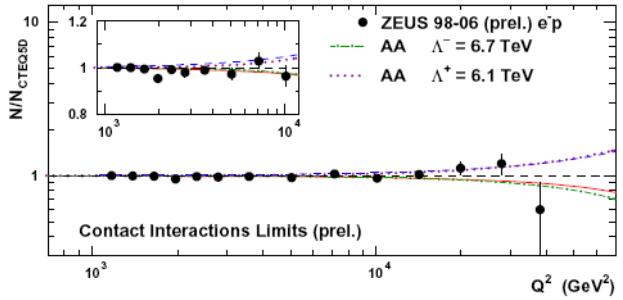
Exotica @ HERA

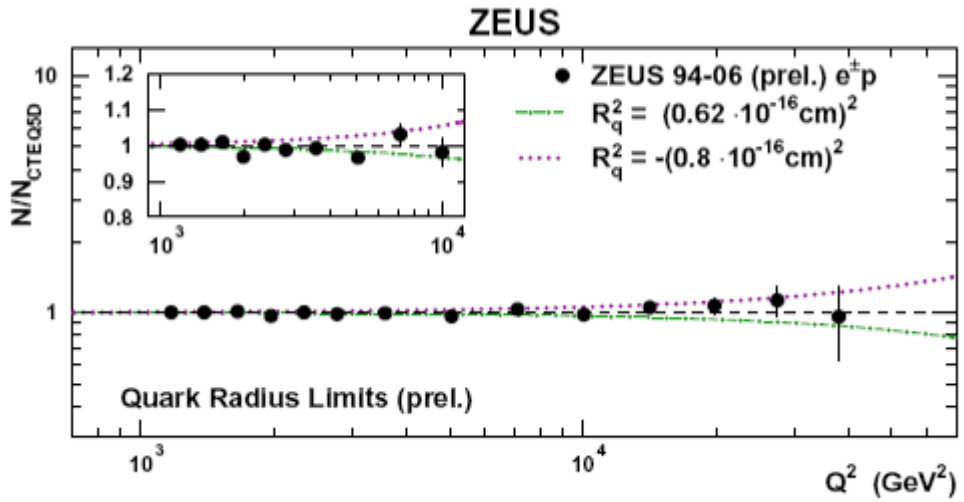
Barbagli

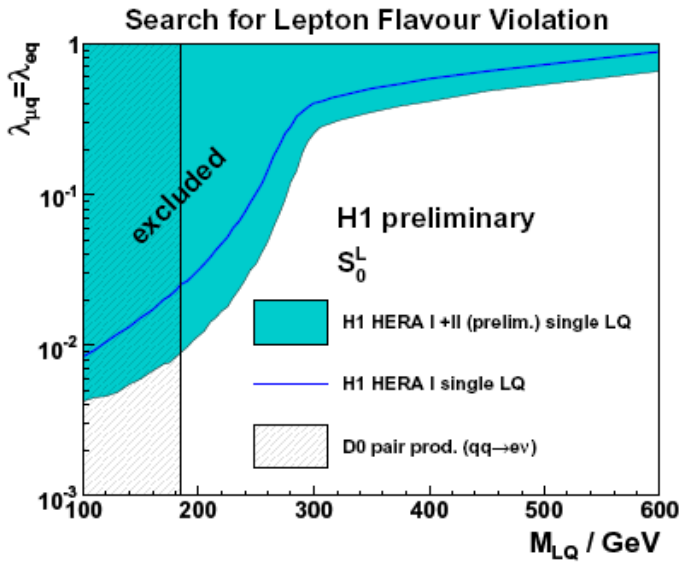


Contact interactions









Model-Independent searches @ HERA

Sauvan

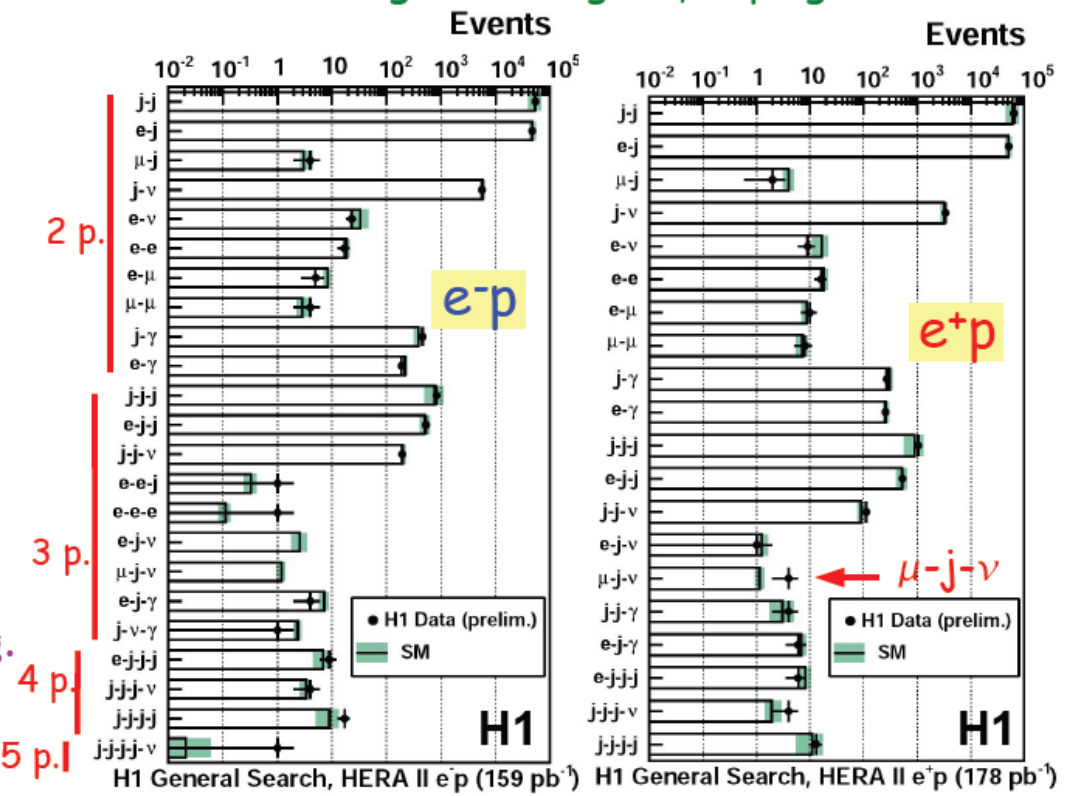
General Search

A signature based search: investigate all high P_T topolgies

- H1, full HERA II data (337 pb^{-1})

  HERA I data published (117 pb^{-1}) [PLB 602(2004)14]

- Isolated particles
  - → e, γ, μ, jet, ν
- A common phase space
  - → P_T^{part} > 20 GeV
  - → 10 < θ^{part} < 140 deg.



→ Good agreement with SM in most classes

→ Good understanding of the detector and of SM processes

Model-Independent searches @ HERA

Sauvan

- **Isolated leptons**
- **e^+p**
  - **HERA-II: ~1.6 × HERA-I**

Extrapolate from HERA-I

(H1) expect ~26, see 21

i.e. HERA-II expected ~15

see ~10

significance

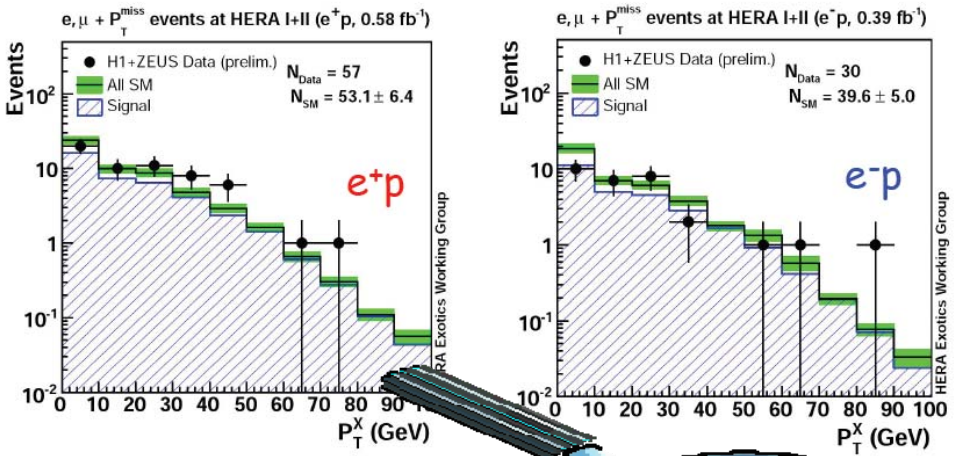
~unchanged

	$P_T^X > 25$ GeV	electrons data / SM	muons data / SM
e+	H1 294 pb^{-1}	11 / 4.7 ± 0.9	10 / 4.2 ± 0.7
	ZEUS 286 pb^{-1}	3 / 3.9 ± 0.6	3 / 3.6 ± 0.5
e-	H1 184 pb^{-1}	3 / 3.8 ± 0.6	0 / 3.1 ± 0.5
	ZEUS 206 pb^{-1}	3 / 3.2 ± 0.6	2 / 2.4 ± 0.4

- In e+p H1: 21 / 8.9 ± 1.5 (3 σ)
  ZEUS: agreement with the SM
- In e-p agreement with SM for both H1 and ZEUS

e^+p data	H1	ZEUS
P_T^X>25 GeV	**11/3.4**	7/5.7

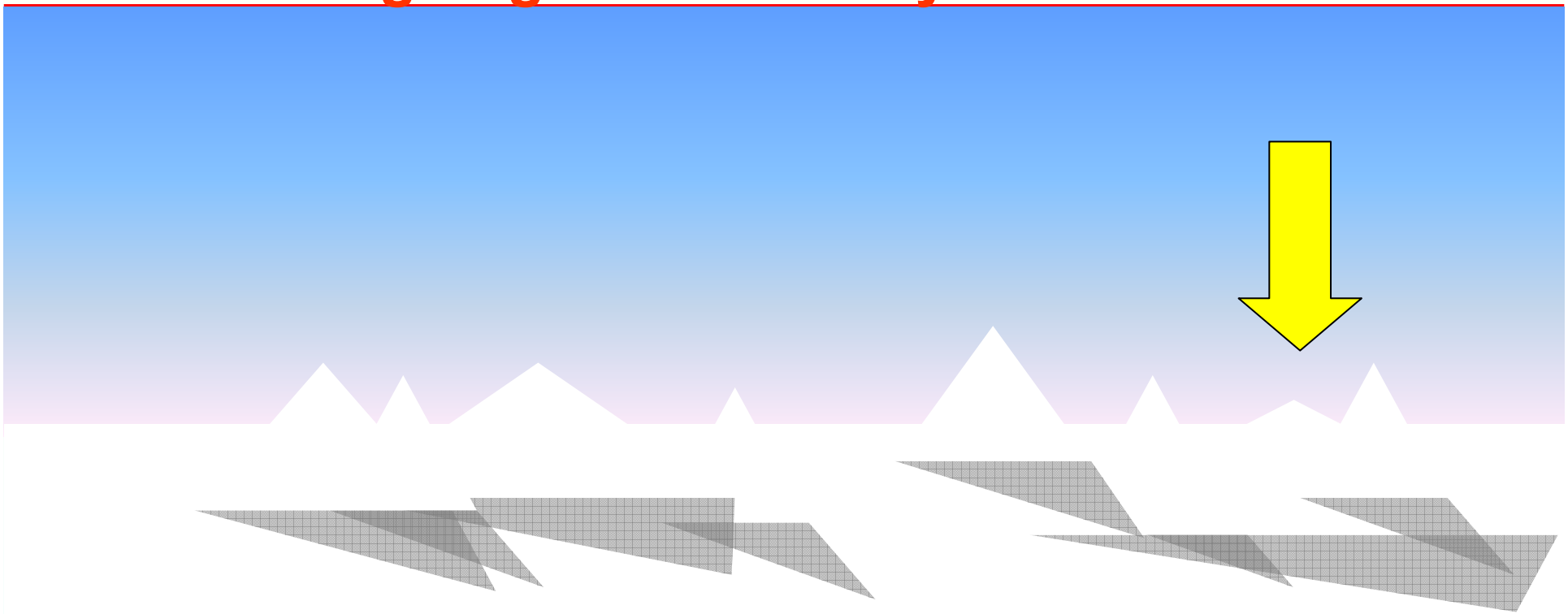
→ Total luminosity: 0.97 fb^{-1}



- Good agreement with the SM in
- Fluctuation in e+p for P_T^X > 25 Ge

1.8σ

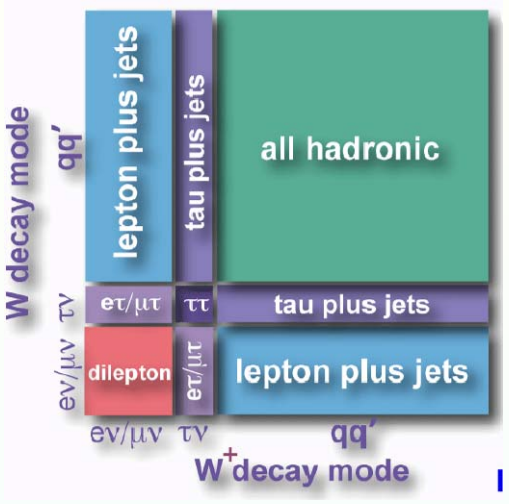
Weighing in with Heavy Flavour

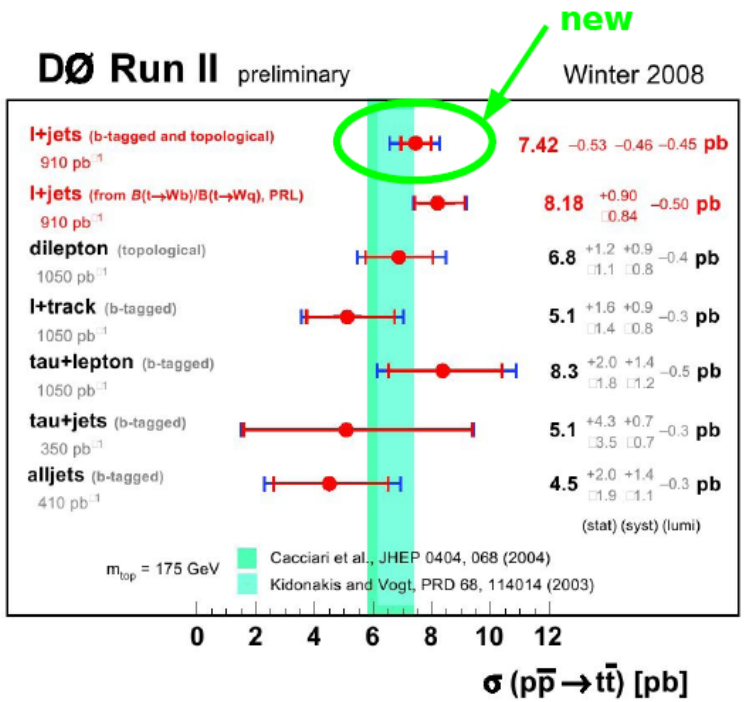


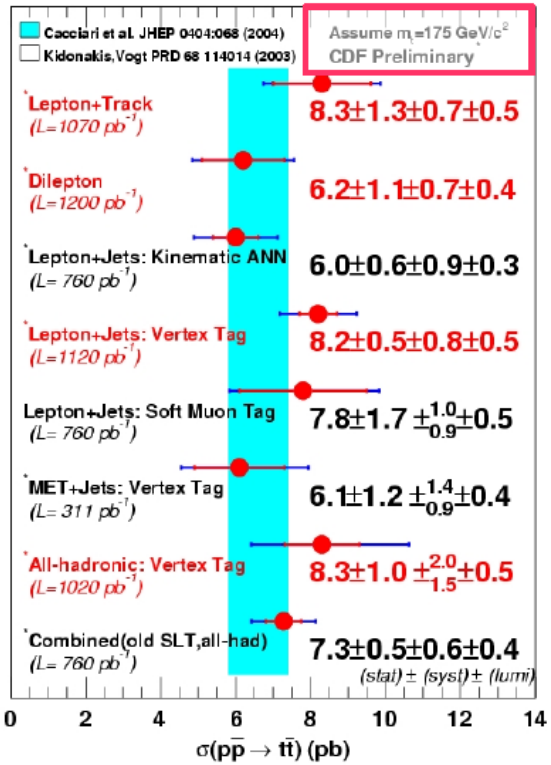
Top mass from top cross-section

Besancon

$\bar{t}t \rightarrow \bar{b}b\, W^+W^-$







New

Measurements consistent with each other

Measurements consistent with SM predictions

Di-lepton

Lepton+jet

models

$$M_{top} = 174.5^{+10.5}_{-8.2}(stat+syst)^{+3.7}_{-3.6}(theory)\,GeV$$

$$M_{top} = 174.1^{+9.8}_{-8.4}(stat+syst)^{+4.2}_{-6.0}(theory)\,GeV$$

$$m_{top} = 170.7^{+4.2}_{-3.9}(stat) \pm 2.6(syst) \pm 2.4(theory)\,GeV$$

}D0{

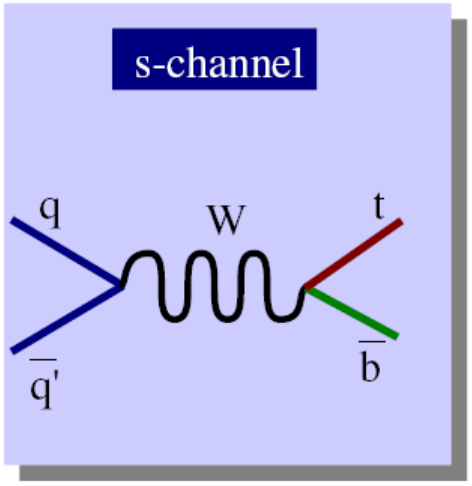
$$M_{top} = 166.9^{+5.9}_{-5.2}(stat+syst)^{+3.7}_{-3.8}(theory)\,GeV$$

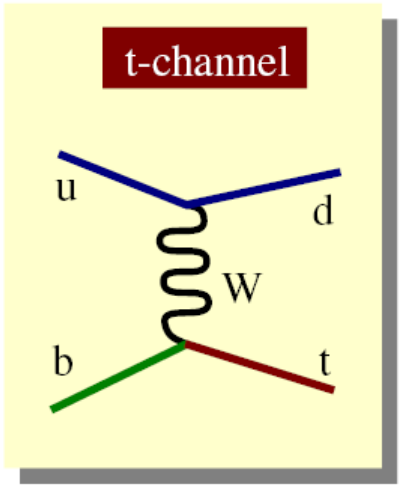
$$M_{top} = 166.1^{+6.1}_{-5.3}(stat+syst)^{+4.9}_{-6.7}(theory)\,GeV$$

CDF

Single top production

Schwienhorst

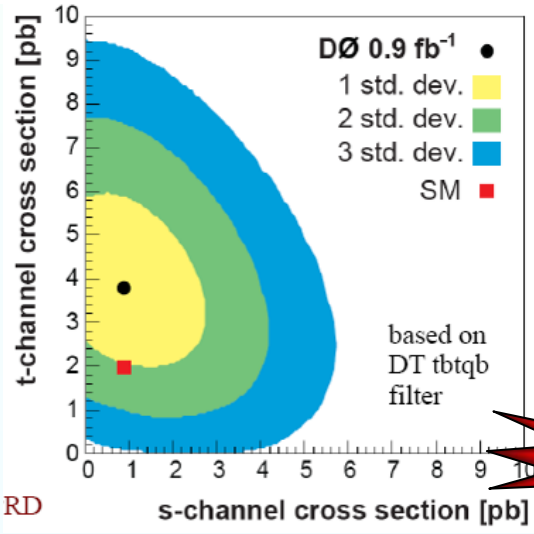




SM cross section:

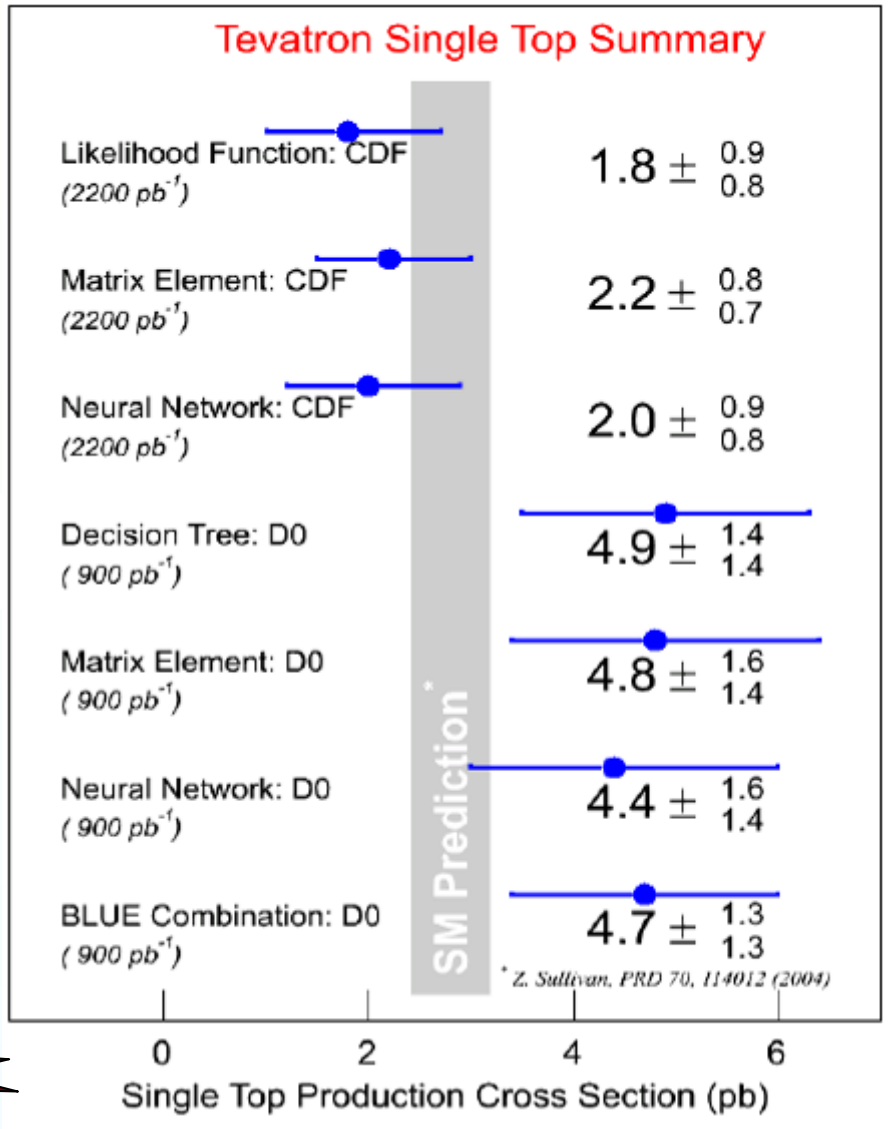
$\sigma_{tot} = 3$ pb

$\sigma_s = .88$ pb $\sigma_t = 1.98$ pb



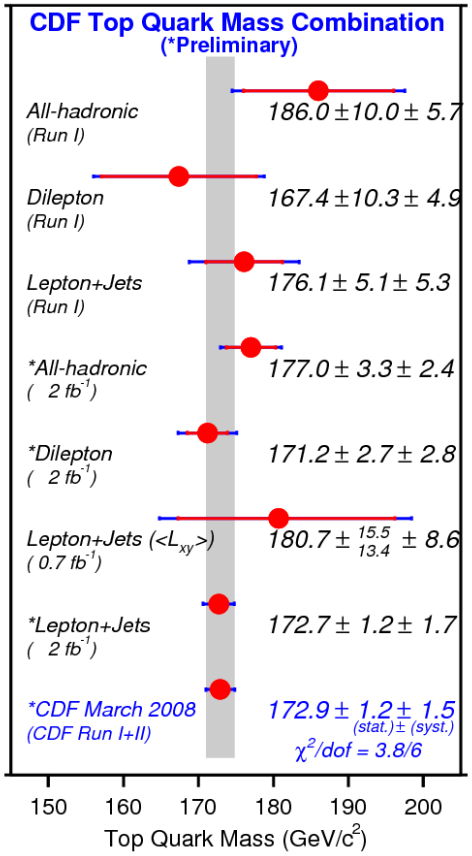
New

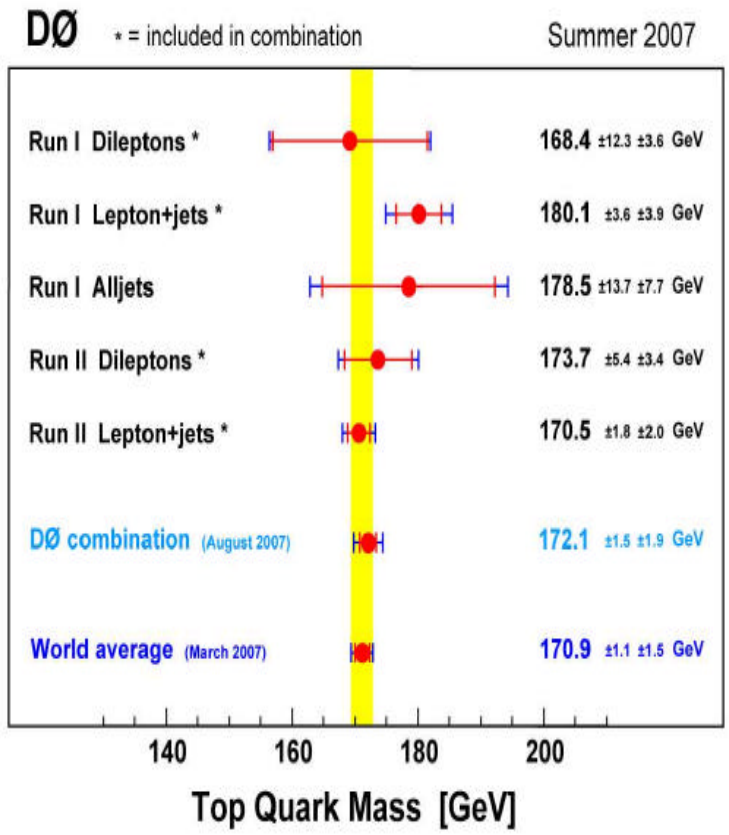
s+t



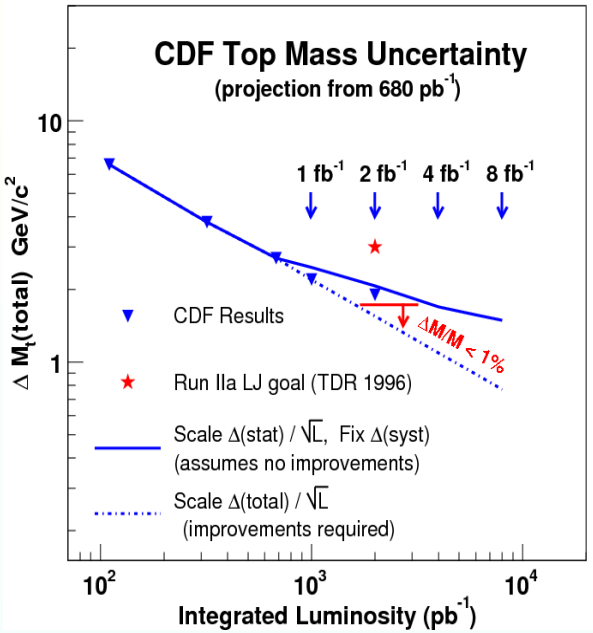
Top Mass and other properties

Chen





New

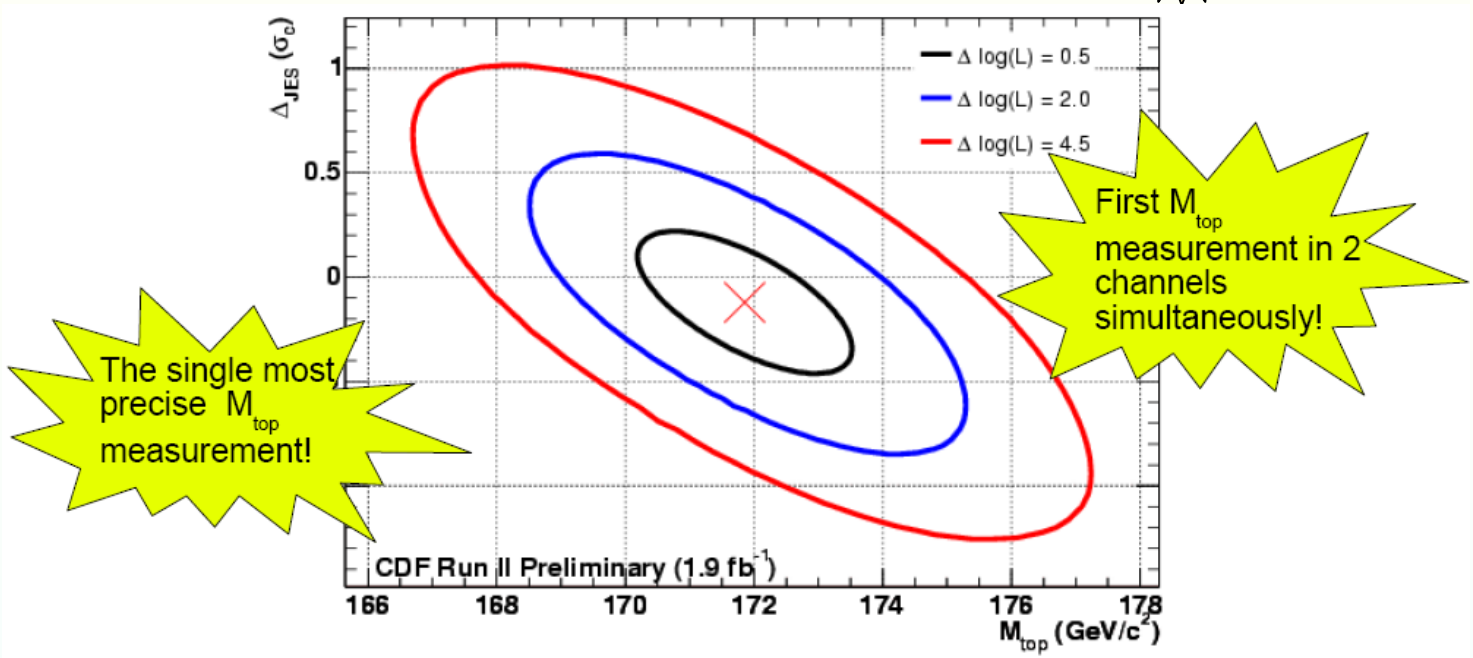


- **Top quark mass well measured to 1.1% level!**
- **Up to date, within uncertainties, all measured quantities are consistent with the Standard Model expectations.**
  - **Top charge, W helicity , *R_b*, *charged Higgs search*, *FCNC***
- ***Analysis in progress or not reported here,***
  - ***Life time, decay width, top spin correlation, etc.***
- **This is just the beginning of the sensitive studies of the Top quark properties! There are much room ahead for surprises!**

New M_{top} measurement

YSF

Fedorko



M_{top} =171.9 +/- 1.7 (stat.+JES) +/- 1.0 (syst) GeV/c^2
= 171.9 +/- 2.0 GeV/c^2

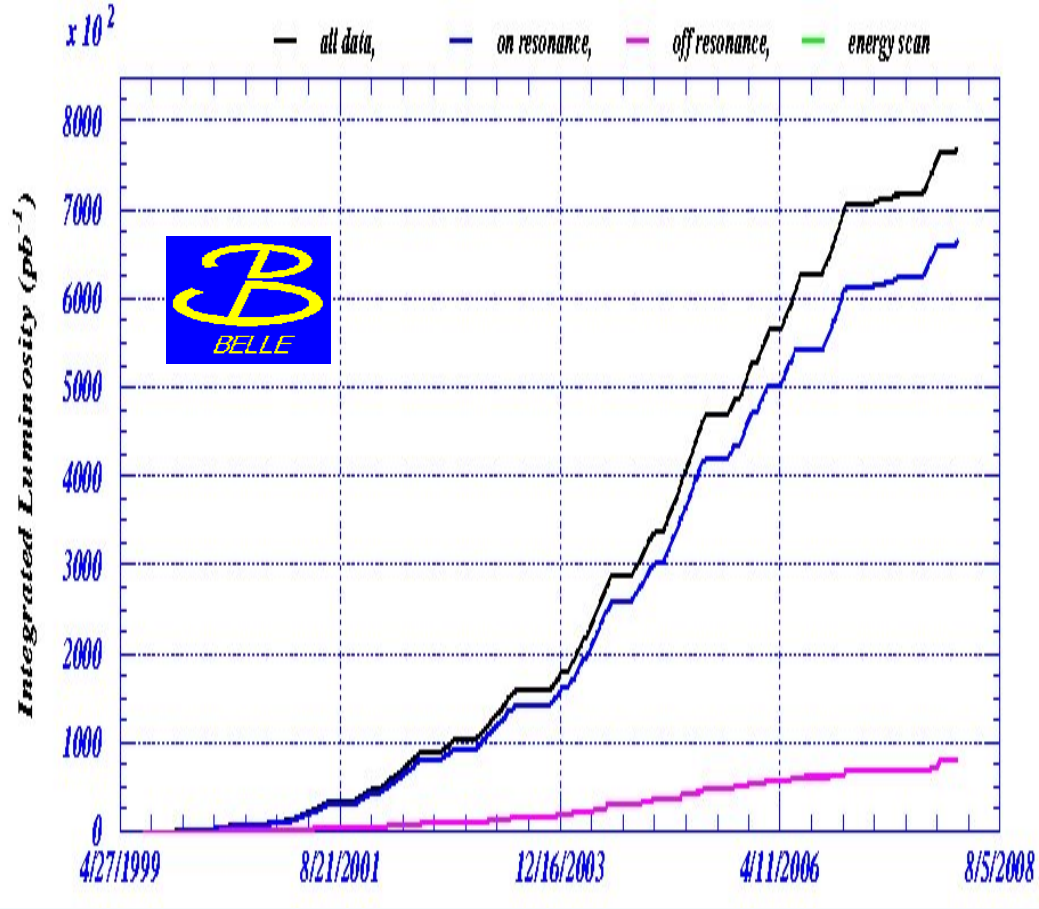
New

- **2fb^{-1}**
- **lepton+jets and di-lepton channels**

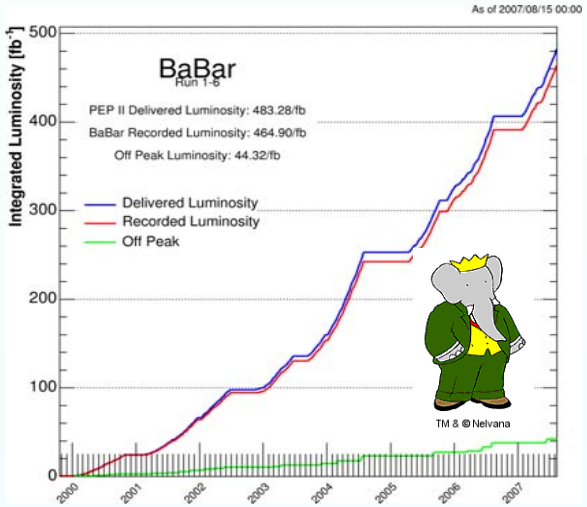
B-factory integrated luminosities

Aushev

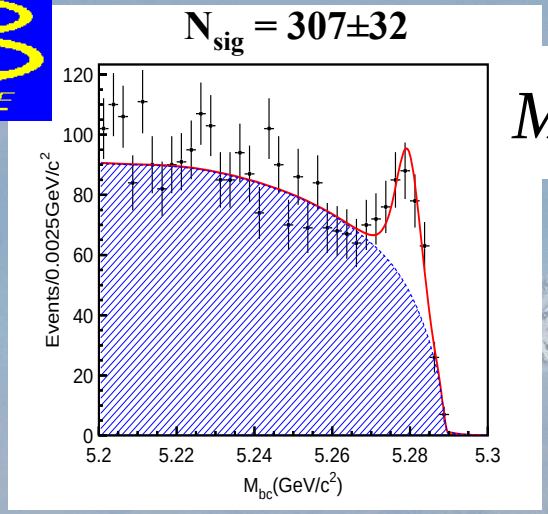
BELLE: 7700 fb^{-1}



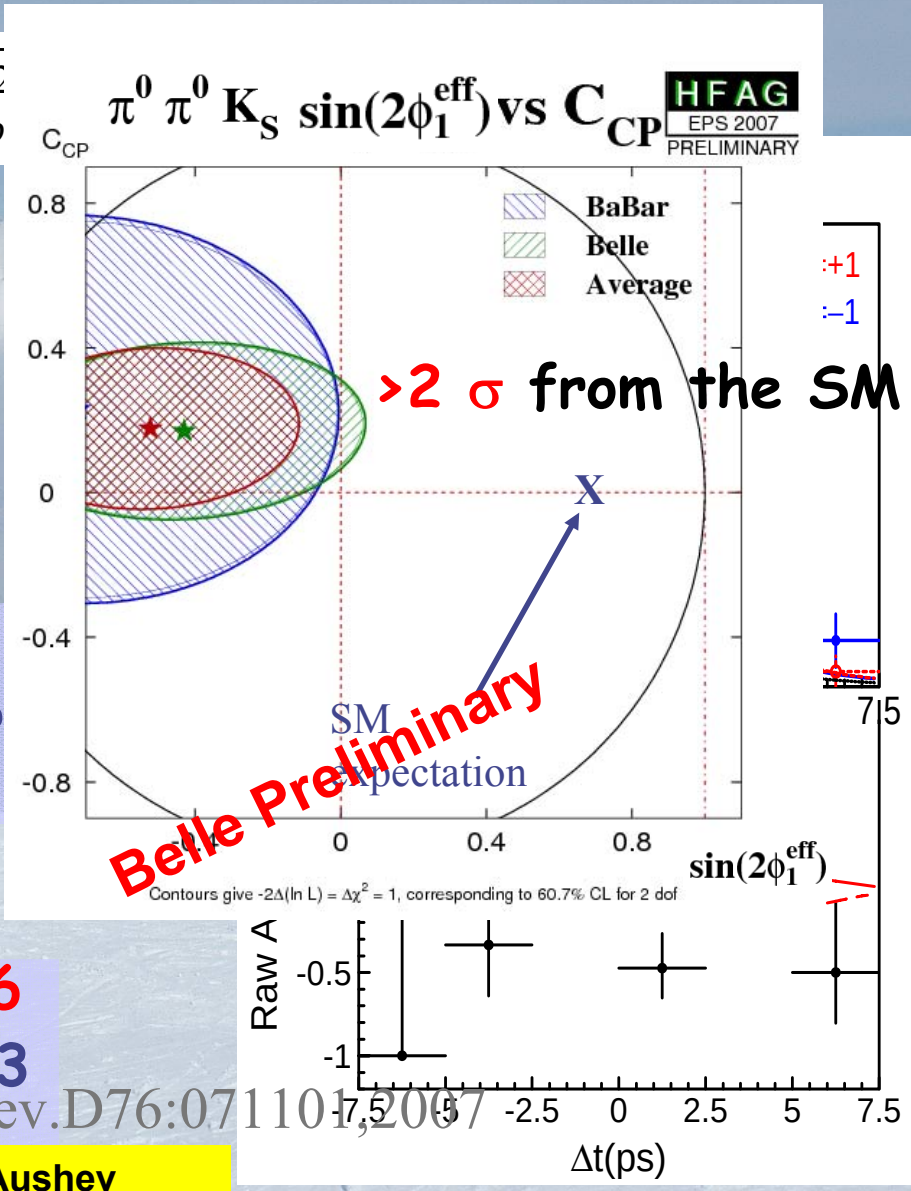
BaBar: 510 fb^{-1}



TCPV in $B^0 \to K_S\pi^0\pi^0$: $b \to s\,\bar{q}q$



$$M_{bc} = \sqrt{E_b^2}$$



$S = -\sin 2\varphi_1$

Belle	+0.43+/-0.49+/-0.09
BaBar	+0.72+/-0.71+/-0.08
Average	+0.52+/-0.41

$A = -C$

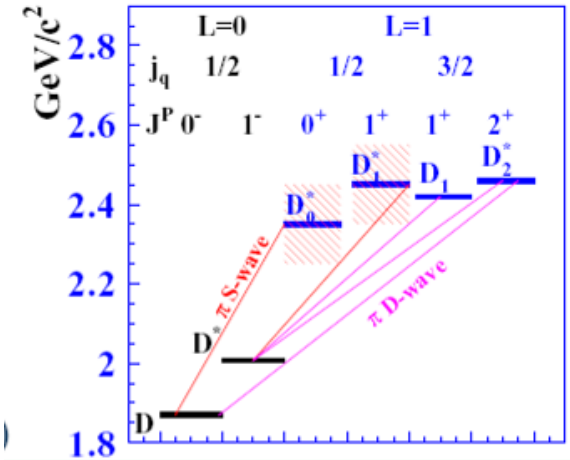
Belle	-0.17+/-0.24+/-0.06
BaBar	-0.23+/-0.52+/-0.13
Average	-0.18+/-0.22

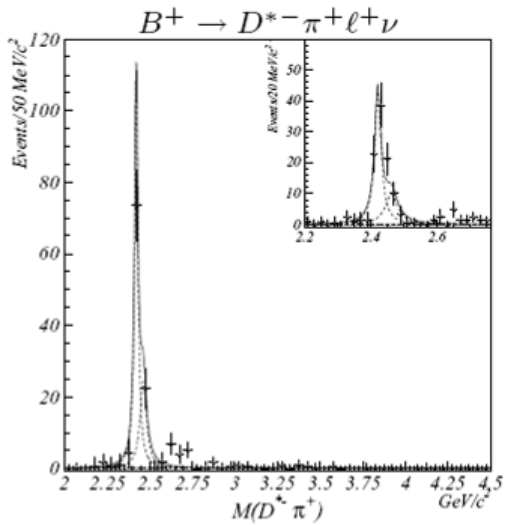
Phys.Rev.D76:071101,2007

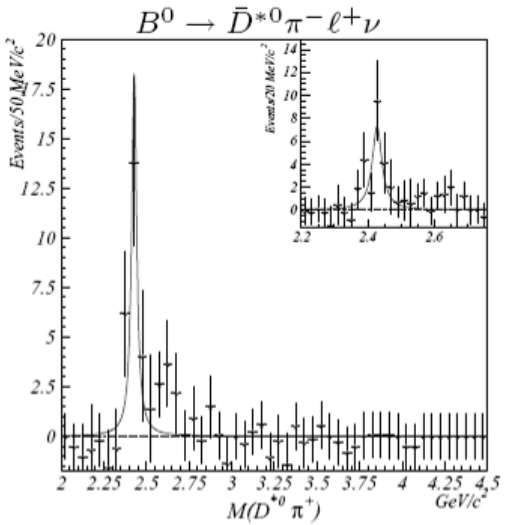
Aushev

B→D**ℓν (BELLE)

Liventsev



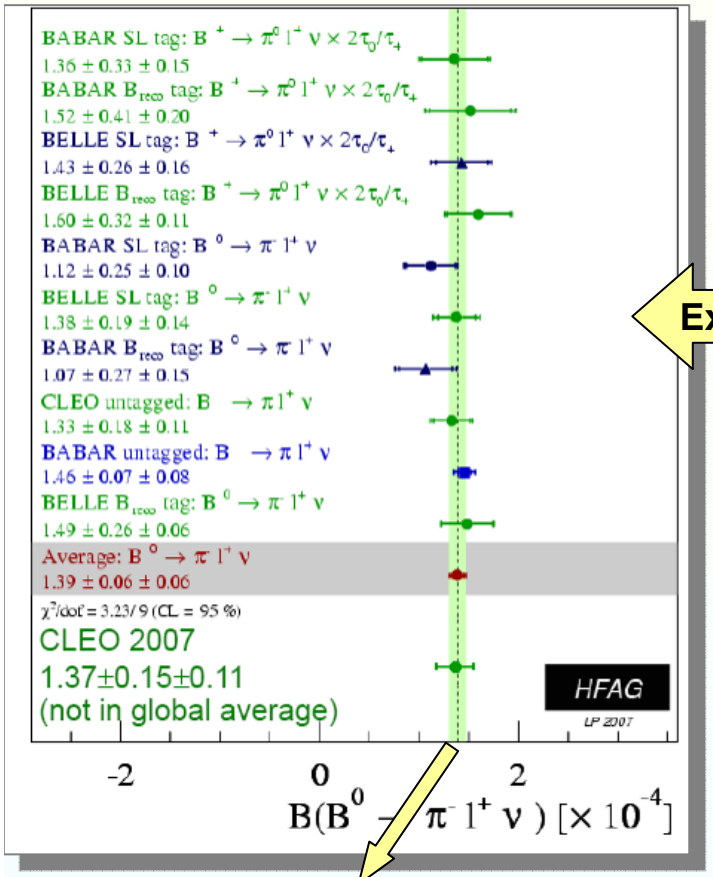




- $B \to D^{**}\ell\nu$ were studied with fully reconstructed B tags;
- $B \to D_2^*\ell\nu$, $D_2^* \to D\pi$ decay was observed and measured for the first time, its properties were studied;
- A large branching ratio for $B \to D_0^*\ell\nu$ was observed in a fit assuming only D_0^* and D_2^* contributions. This contradicts HQET predictions. However, we do not observe a wide D_1^* in the $D^*\pi$ mode, which should be of the same order. Other possible contributions (D_v^*)?

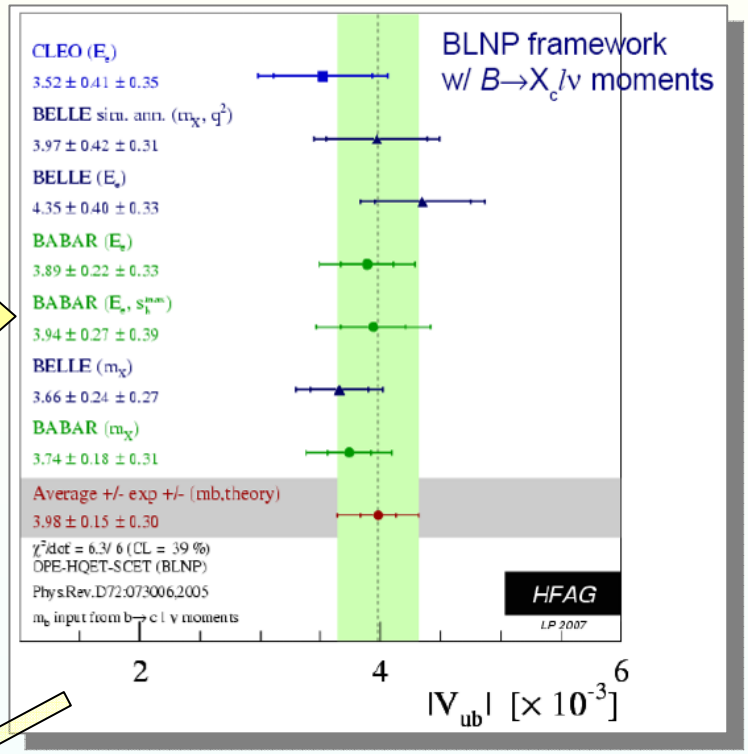
Semi-leptonic B and D decays

Mazur



V_{ub}

Exclusive **Inclusive**



- $|V_{ub}|$ from exclusive decays = $(3.33 \pm 0.21^{+0.58}_{-0.38}) \times 10^{-3}$
- Consistent with global UT fit $(3.44 \pm 0.16) \times 10^{-3}$ **[UTFit Collab]**
- $|V_{ub}|$ from inclusive decays = $(3.98 \pm 0.15 \pm 0.30) \times 10^{-3}$

$$|V_{cb}| = (42.04 \pm 0.34_{\rm fit} \pm 0.59_{\Gamma_{\rm sl}}) \times 10^{-3}$$
$$m_b^{\rm kinetic} = 4.597 \pm 0.034_{\rm fit}\ {\rm GeV}$$
$$m_c = 1.1634 \pm 0.051_{\rm fit}\ {\rm GeV}$$
$$\mu_\pi^2 = 0.4341 \pm 0.033_{\rm fit}\ {\rm GeV}^2$$
$$\rho_D^3 = 0.2927 \pm 0.020_{\rm fit}\ {\rm GeV}^2$$

1.6% precision on $|V_{cb}|$, 0.7% on m_b

Leptonic B decays

Kim

BaBar, CDF, Belle, CLEO

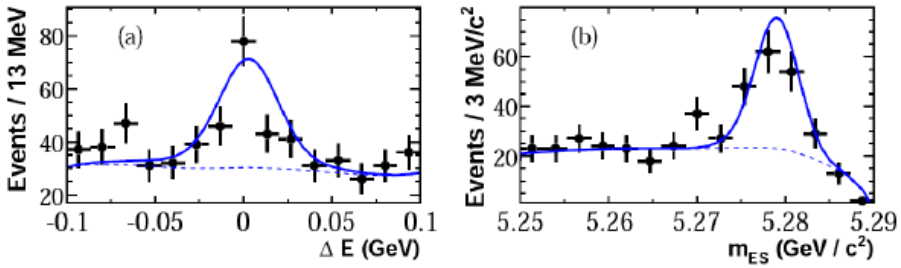
Mode	# $B\bar{B}$ events	UL @ 90% CL	Prev. Best UL
$B^0 \to e^+e^-$	384 M	11.3×10^{-8}	6.1×10^{-8}
$B^0 \to \mu^+\mu^-$		5.2×10^{-8}	1.8×10^{-8}
$B^0 \to e^+\mu^-$		9.2×10^{-8}	18×10^{-8}
$B^+ \to e^+\nu$	378 M	5.2×10^{-6}	9.8×10^{-7}
$B^+ \to \mu^+\nu$		5.6×10^{-6}	1.7×10^{-6}
$B^0 \to e^+\tau^-$		2.8×10^{-5}	1.4×10^{-4}
$B^0 \to \mu^+\tau^-$		2.2×10^{-5}	3.8×10^{-5}
$B^+ \to K^+\nu\bar{\nu}$	351 M	4.2×10^{-5}	1.4×10^{-5}

Penguin B decays

Simi

$B \to a_1 K$: observation

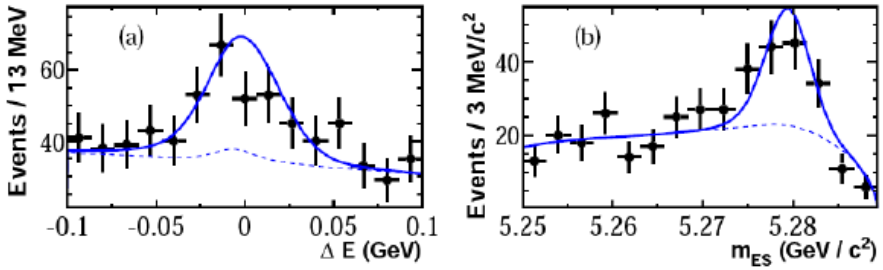
[Phys.Rev.Lett.,100, 51803]`



$BF(B^+ \to a_1^+ K^0_S) = (34.9 \pm 5.0 \pm 4.4)\ 10^{-6}$

First observation of this decay mode

significance 6.2σ



$BF(B^0 \to a_1^- K^+) = (16.3 \pm 2.9 \pm 2.3)\ 10^{-6}$

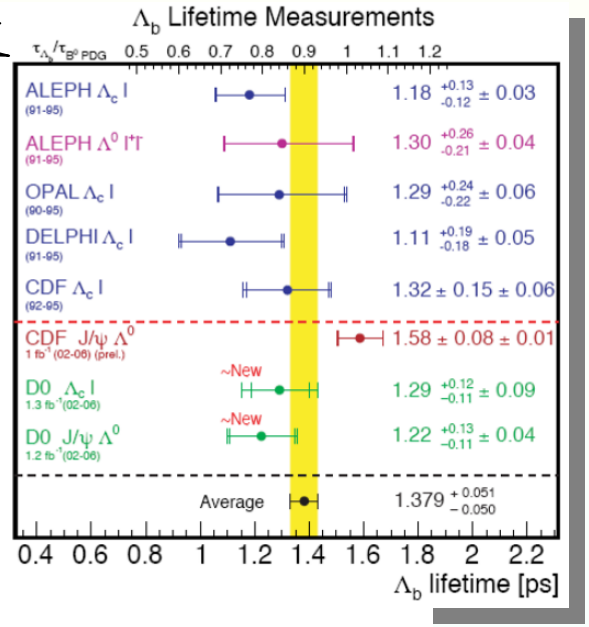
Observation of this decay mode

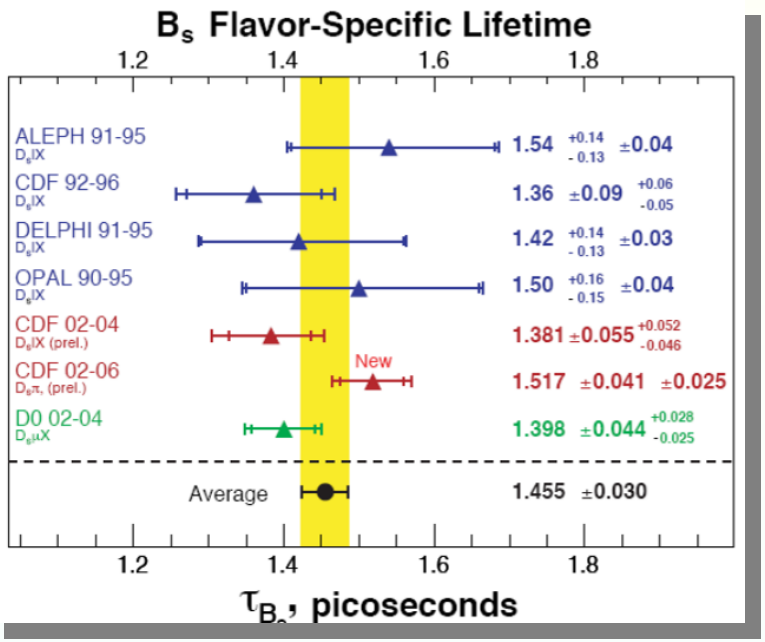
significance 5.1σ

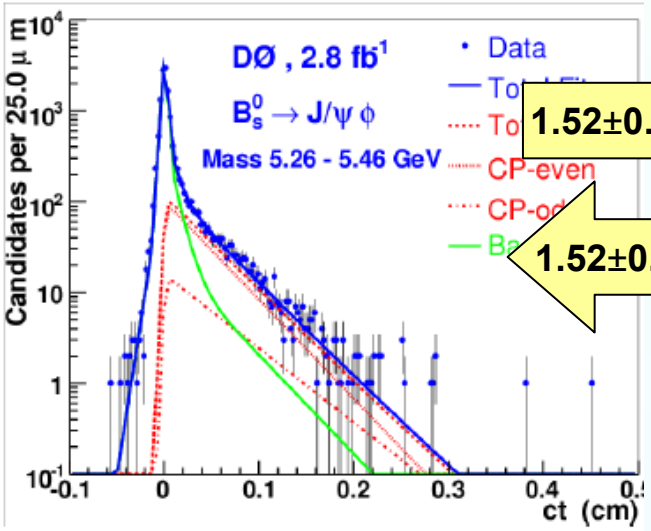
B lifetimes ~@ Tevatron

Parua

New





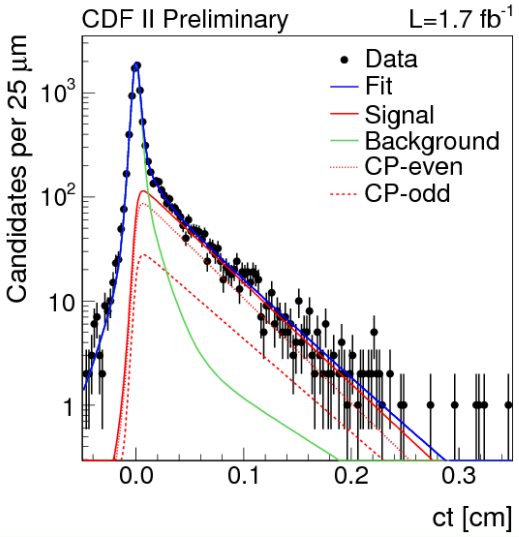


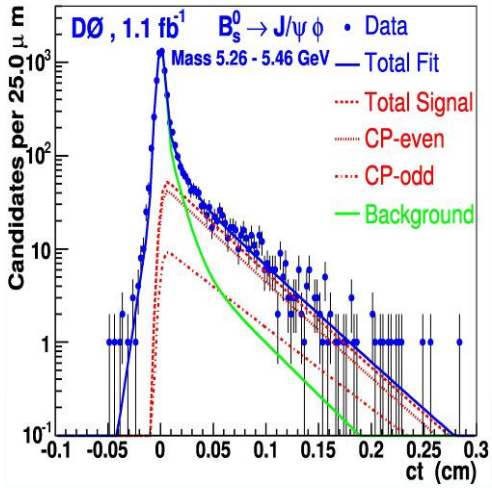
1.52±0.05 ±0.01 ps

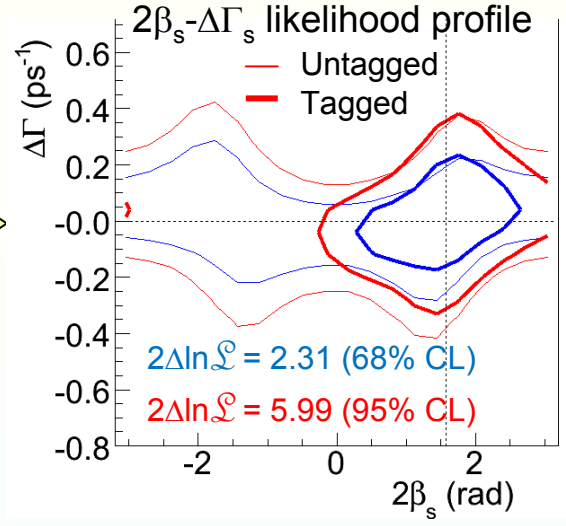
1.52±0.04 ±0.02 ps

B_s at the Tevatron

Di Giovanni





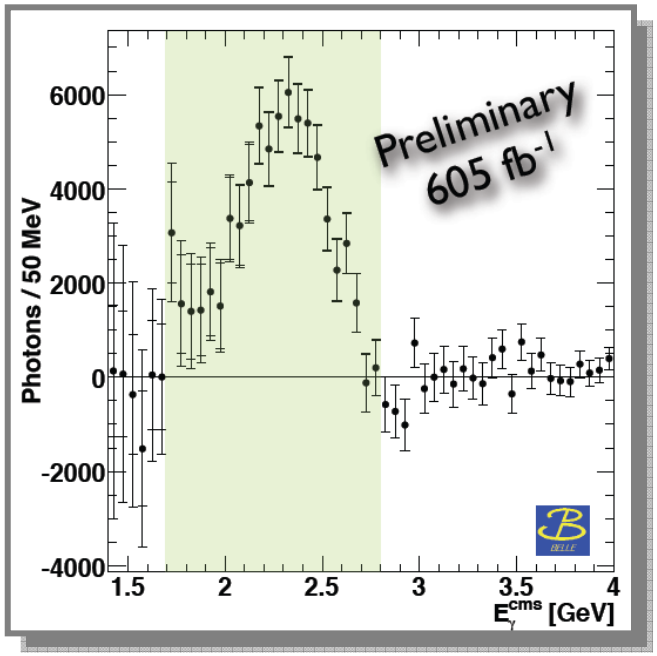


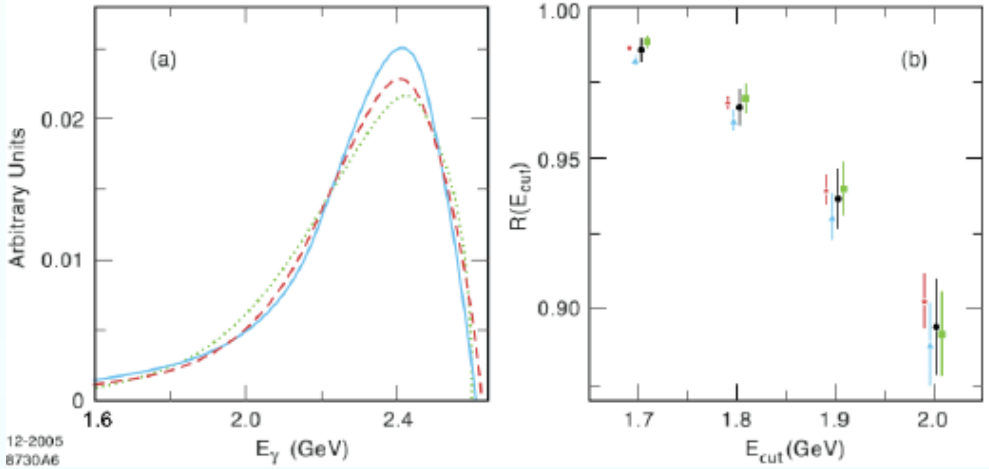
New

- **CDF and DØ search for CP violation effects:**
  - ✓ **Direct CP violation ($B^+ \rightarrow J/\Psi\ K^+$)**
  - ✓ **CP Violation in Mixing: precise measurement**
  - ✓ **CP Violation in the interference between mixing and decay: FIRST $\sin(2\beta_s)$ measurement**
- **Interesting $\sin(2\beta_s)$ fluctuation at Tevatron experiments:**
  - ✓ **Exclude large negative values**
  - ✓ **Both experiments, CDF and DØ**
  - ✓ **In the same direction of A_{SL}**

$B \to X_s \gamma$

Limosani





CLEO [9.1 fb^{-1}] PRL87,251807(2001)

BaBar [81.5 fb^{-1}] PRD72,052004(2005)

BaBar [81.5 fb^{-1}] PRL98,022002(2007)

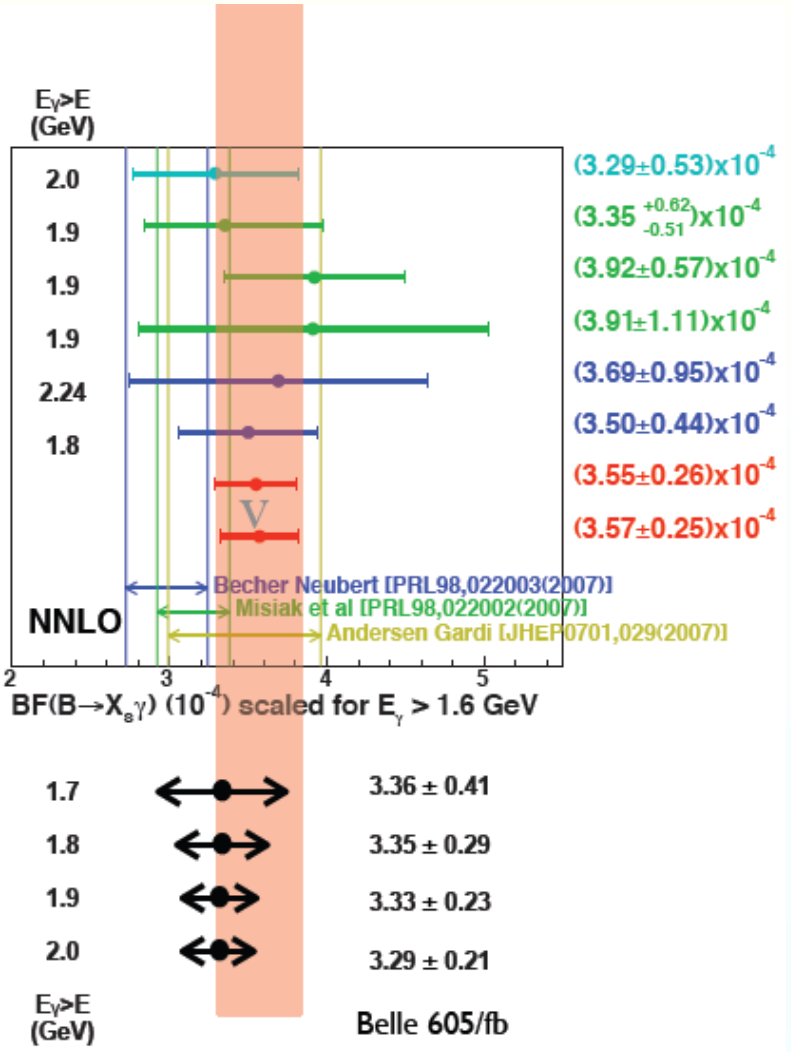
BaBar PRD-RC [210 fb^{-1}] new

Belle [5.8 fb^{-1}] PLB511,151(2001)

Belle [140 fb^{-1}] PRL93,061803(2004)

HFAG 2006 hep-ex/0603003

(* simple minded average)



New

CKM γ angle

Sordini

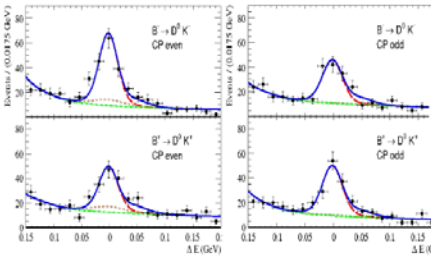
charged B: GLW results

arXiv:0802.4052

UPDATED

Update of the GLW analysis $B^- \to D^0 K^-$, with $D^0 \to K^+K^-$, $\pi^+\pi^-$, $K_S\pi^0$, $K_S\omega$ and $K^-\pi^+$ (for normalization) on **382M** of BB pairs

- cut on m_{ES} and event shape variables
- extended maximum likelihood fit to the ΔE and Cerenkov distribution



$A_{CP+} = 0.27 \pm 0.09(\text{stat}) \pm 0.04(\text{syst})$
$A_{CP-} = -0.09 \pm 0.09(\text{stat}) \pm 0.02(\text{syst})$
$R_{CP+} = 1.06 \pm 0.10(\text{stat}) \pm 0.05(\text{syst})$
$R_{CP-} = 1.03 \pm 0.10(\text{stat}) \pm 0.05(\text{syst})$

also expressed in terms of:

$x_+ = -0.09 \pm 0.05(\text{stat}) \pm 0.02(\text{syst})$,
$x_- = +0.10 \pm 0.05(\text{stat}) \pm 0.03(\text{syst})$,
$r^2 = +0.05 \pm 0.07(\text{stat}) \pm 0.03(\text{syst})$.

$$x_\pm = \frac{R_{CP+}(1 \mp A_{CP+}) - R_{CP-}(1 \mp A_{CP-})}{4}, \quad r^2 = x_\pm^2 + y_\pm^2 = \frac{R_{CP+} + R_{CP-} - 2}{2},$$

Viola Sordini, Moriond EW 2008

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charged B: ADS results

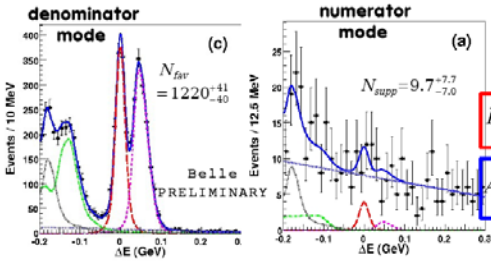
PRELIMINARY

UPDATED

Update of the ADS analysis $B^- \to D^0 K^-$, with $D^0 \to K^-\pi^+$ on **657M** of BB pairs

PRELIMINARY

- cut on M_{bc} and event shape variables
- extended maximum likelihood fit to the ΔE distribution



no significant ADS signal found

$R_{ADS} = (8.0^{+6.3+2.0}_{-5.7-2.8}) \times 10^{-3}$

$A_{ADS} = -0.13^{+0.97}_{-0.88} \pm 0.26$

$r_B < 0.19$ @ 90% C.L.

Viola Sordini, Moriond EW 2008

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charged B: GGSZ results

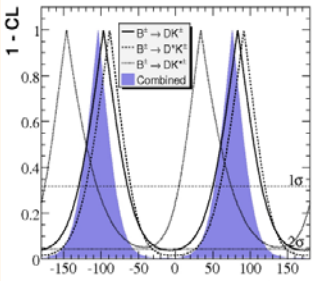
PRELIMINARY

NEW

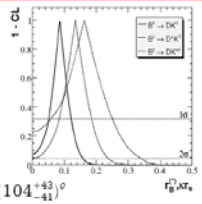
Results for the cartesian coordinates

(statistical, systematic and model errors included)

Parameters	$B^- \to \tilde{D}^0 K^-$	$B^- \to \tilde{D}^{*0} K^-$	$B^- \to \tilde{D}^0 K^{*-}$
x_- , x_-^* , x_{s-}	$0.090 \pm 0.043 \pm 0.013 \pm 0.011$	$-0.111 \pm 0.069 \pm 0.014 \pm 0.004$	$0.115 \pm 0.138 \pm 0.039 \pm 0.014$
y_- , y_-^* , y_{s-}	$0.053 \pm 0.056 \pm 0.007 \pm 0.015$	$-0.051 \pm 0.080 \pm 0.009 \pm 0.010$	$0.226 \pm 0.142 \pm 0.058 \pm 0.011$
x_+ , x_+^* , x_{s+}	$-0.067 \pm 0.043 \pm 0.014 \pm 0.011$	$0.137 \pm 0.068 \pm 0.014 \pm 0.005$	$-0.113 \pm 0.107 \pm 0.028 \pm 0.018$
y_+ , y_+^* , y_{s+}	$-0.015 \pm 0.055 \pm 0.006 \pm 0.008$	$0.080 \pm 0.102 \pm 0.010 \pm 0.012$	$0.125 \pm 0.139 \pm 0.051 \pm 0.010$



$\gamma/\phi_3 = (76^{+23}_{-24})^\circ (mod.\ 180^\circ)$
$r_B(DK) = 0.086 \pm 0.035$
$r_B(D^*K) = 0.135 \pm 0.051$
$r_S(DK^*) = 0.181^{+0.100}_{-0.118}$



$\delta(DK) = (109^{+28}_{-31})^\circ$, $\delta(D^*K) = (-63^{+28}_{-30})^\circ$, $\delta(DK^*) = (104^{+43}_{-41})^\circ$

Viola Sordini, Moriond EW 2008

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charged B: GGSZ results

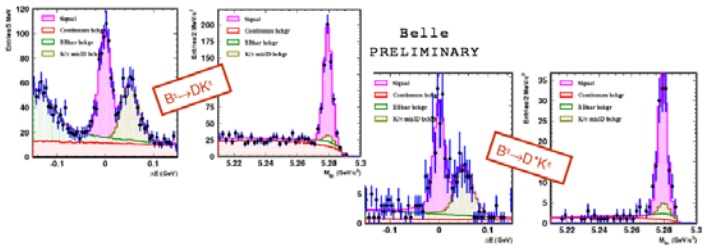
PRELIMINARY

UPDATED

Update of the Dalitz analysis of $B^- \to D^0 K^-$ and $D^{*0} K^-$, with $D^0 \to K_S\pi^+\pi^-$ and $D^{*0} \to D^0\pi^0$.

Analysis performed on **635M** of BB pairs

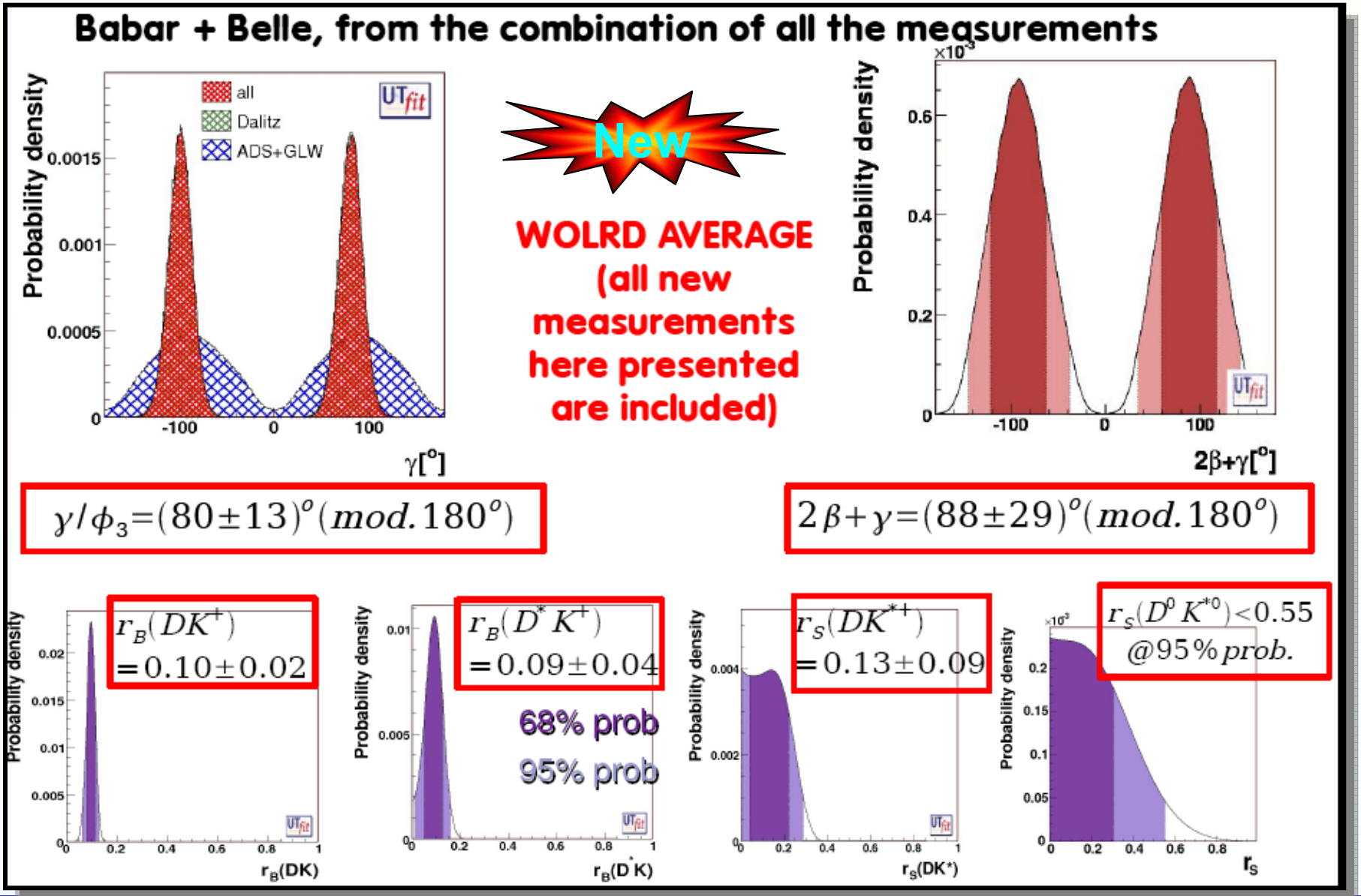
- M_{bc}, ΔE and shape variables are used in a maximum likelihood fit to discriminate between signal and background
- D^0 Dalitz structure used as an external input
- CP fit for extraction of cartesian coordinates for DK and D*K



Viola Sordini, Moriond EW 2008

CKM γ angle

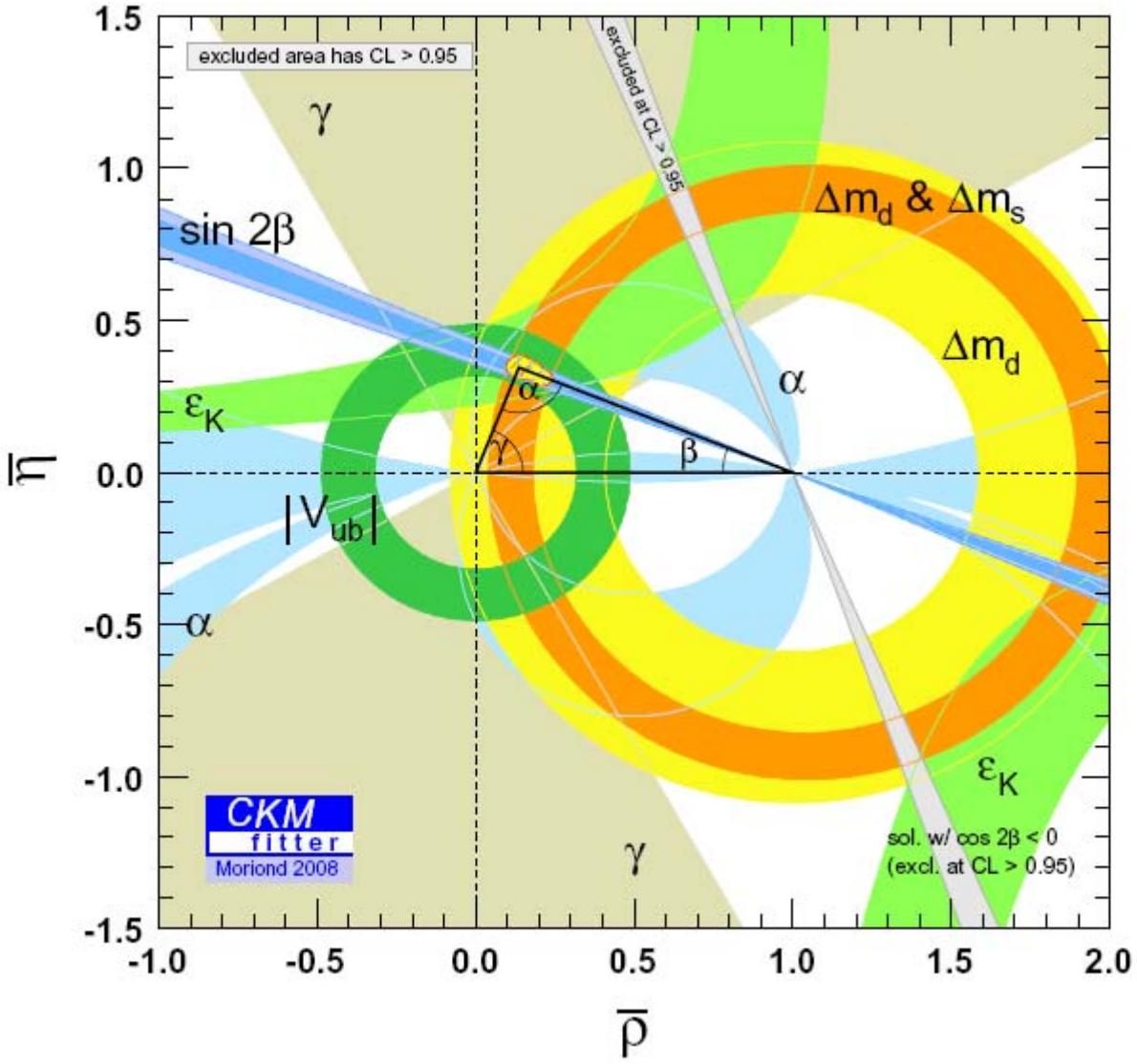
Sordini



CKM Fitter

New

Descotes-Genon



$|V_{ud}|$, $|V_{us}|$

$|V_{cb}|$, $|V_{ub}|$

$B \to \tau\nu$

Δm_d, Δm_s

ϵ_K

$\sin 2\beta$

α

γ

$$A = 0.795^{+0.025}_{-0.015}$$
$$\lambda = 0.2252^{+0.0008}_{-0.0008}$$
$$\bar{\rho} = 0.135^{+0.033}_{-0.016}$$
$$\bar{\eta} = 0.345^{+0.015}_{-0.018}$$

(68% CL)

UT Fit

Very New

FIRST EVIDENCE OF NEW PHYSICS IN b ↔ s TRANSITIONS

arXiv:0803.0659v1 [hep-ph] 5 Mar 2008

(UT*fit* Collaboration)

We combine all the available experimental information on B_s mixing, including the very recent tagged analyses of $B_s \to J/\Psi\phi$ by the CDF and DØ collaborations. We find that the phase of the B_s mixing amplitude deviates more than 3σ from the Standard Model prediction. While no single measurement has a 3σ significance yet, all the constraints show a remarkable agreement with the combined result. This is a first evidence of physics beyond the Standard Model. This result disfavours New Physics models with Minimal Flavour Violation with the same significance.

$$C_{B_s} e^{2i\phi_{B_s}} = \frac{A_s^{\rm SM} e^{-2i\beta_s} + A_s^{\rm NP} e^{2i(\phi_s^{\rm NP} - \beta_s)}}{A_s^{\rm SM} e^{-2i\beta_s}} =$$

Δm_s [ps^{-1}]	17.77 ± 0.12	[15]
$A_{\rm SL}^s \times 10^2$	2.45 ± 1.96	[16]
$A_{\rm SL}^{\mu\mu} \times 10^3$	-4.3 ± 3.0	[17, 18]
$\tau_{B_s}^{\rm FS}$ [ps]	1.461 ± 0.032	[19]
ϕ_s	http://tinyurl.com/2f9rtl	[20]
$\Delta\Gamma_s$	http://tinyurl.com/2f9rtl	[20]
ϕ_s [rad]	0.60 ± 0.27	[21]
$\Delta\Gamma_s$ [ps^{-1}]	0.19 ± 0.07	[21]
τ_{B_s} [ps]	1.52 ± 0.06	[21]
$C_{\phi_s,\Delta\Gamma_s} = -0.042$	$C_{\phi_s,\tau_{B_s}} = -0.571$	$C_{\tau_{B_s},\Delta\Gamma_s} = 0.23$

TABLE I: Input parameters used in the analysis. We also show the correlation coefficients Cs of the measurements of ϕ_s, $\Delta\Gamma_s$ and τ_{B_s} from ref. [21].

Observable	68% Prob.	95% Prob.
ϕ_{B_s}[°]	-19.9 ± 5.6	[-30.45,-9.29]
	-68.2 ± 4.9	[-78.45,-58.2]
C_{B_s}	1.07 ± 0.29	[0.62,1.93]
$\phi_s^{\rm NP}$[°]	-51 ± 11	[-69,-27]
	-79 ± 3	[-84,-71]
$A_s^{\rm NP}/A_s^{\rm SM}$	0.73 ± 0.35	[0.24,1.38]
	1.87 ± 0.06	[1.50,2.47]
Im $A_s^{\rm NP}/A_s^{\rm SM}$	-0.74 ± 0.26	[-1.54,-0.30]
Re $A_s^{\rm NP}/A_s^{\rm SM}$	-0.13 ± 0.31	[-0.61,0.78]
	-1.82 ± 0.28	[-2.68,-1.36]
$A_{\rm SL}^s \times 10^2$	-0.34 ± 0.21	[-0.75,0.03]
$A_{\rm SL}^{\mu\mu} \times 10^3$	-2.1 ± 1.0	[-4.7,-0.3]
$\Delta\Gamma_s/\Gamma_s$	0.105 ± 0.049	[0.02,0.20]
	-0.098 ± 0.044	[-0.19,-0.02]

TABLE II: Fit results for NP parameters, semileptonic asymmetries and width differences. Whenever present, we list the two solutions due to the ambiguity of the measurements. The first line corresponds to the one closer to the SM.

UT Fit

Very New

FIRST EVIDENCE OF NEW PHYSICS IN b ↔ s TRANSITIONS

arXiv:0803.0659v1 [hep-ph] 5 Mar 2008

(UT*fit* Collaboration)

$$C_{B_s} e^{2i\phi_{B_s}} = \frac{A_s^{\rm SM} e^{-2i\beta_s} + A_s^{\rm NP} e^{2i(\phi_s^{\rm NP} - \beta_s)}}{A_s^{\rm SM} e^{-2i\beta_s}} =$$

Observable	68% Prob.	95% Prob.
ϕ_{B_s}[°]	-19.9 ± 5.6	[-30.45,-9.29]
	-68.2 ± 4.9	[-78.45,-58.2]
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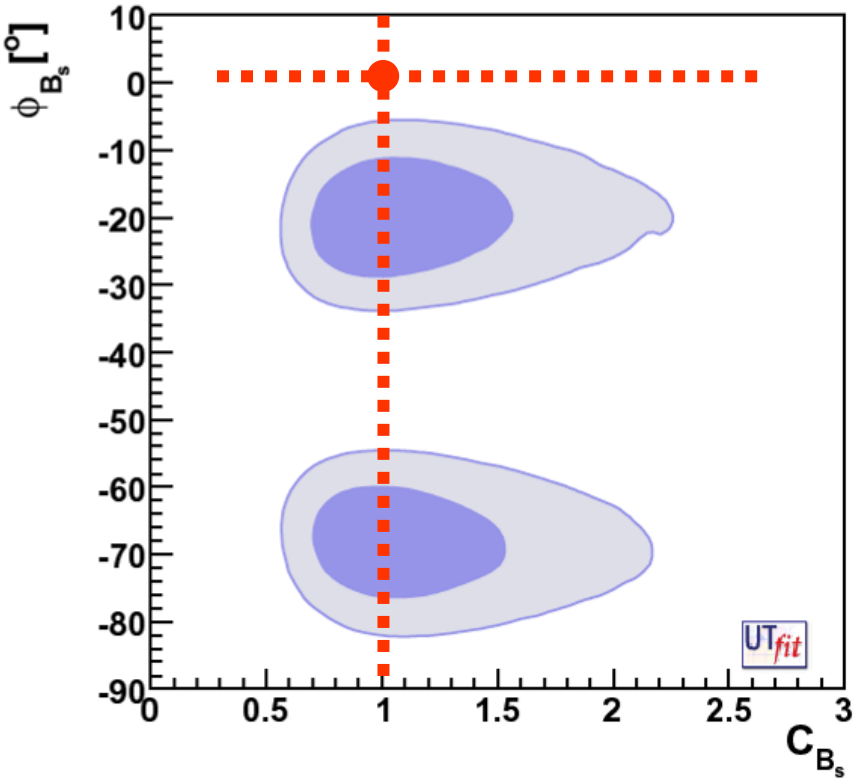
TABLE II: Fit results for NP parameters, semileptonic asymmetries and width differences. Whenever present, we list the two solutions due to the ambiguity of the measurements. The first line corresponds to the one closer to the SM.

- **Standard Model**
  - **– C_{B_s}=1 & ϕ_{B_s}= 0**



Comment

All cows start as calves …

… but not all calves end up as cows

A "hint" rather than "evidence"?

Declaration:

The paper reporting the first NA31 ε'/ε result was entitled

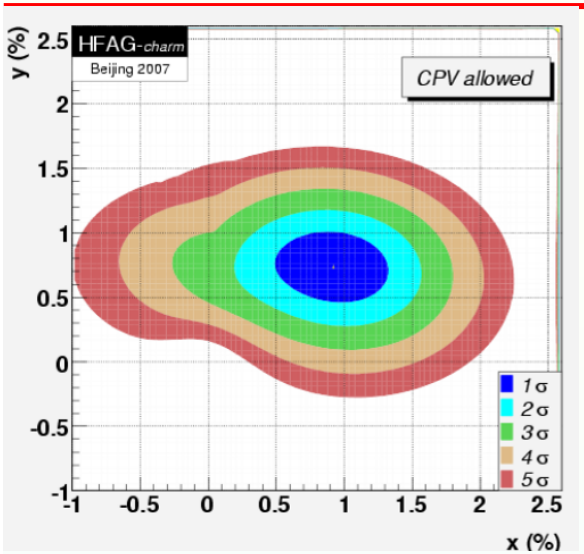
"Evidence for direct CP-violation" when

$\varepsilon'/\varepsilon = 0.0033 \pm 0.0011$ – i.e. 3σ from 0

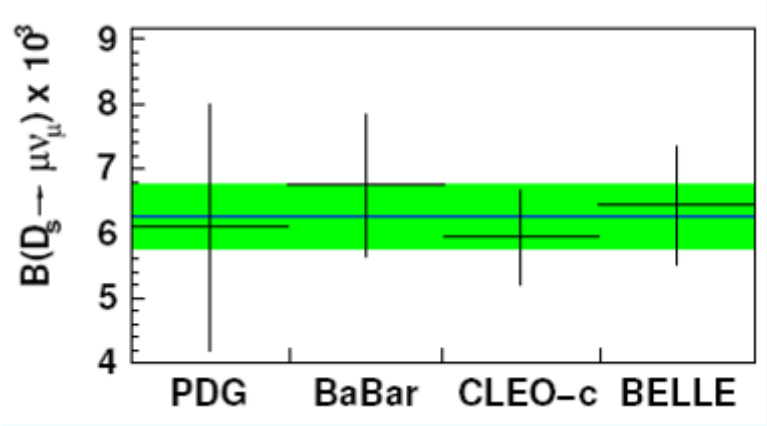
As we shall see, that did become a cow!

Charm and Tau decays

Zupanc



- $\bar{D}^0$-D^0 mixing established
  - At "high end" of SM
- BELLE & BaBar
  - Look for CPV in 2π,3π,KK,KKπ
    - All consistent with 0



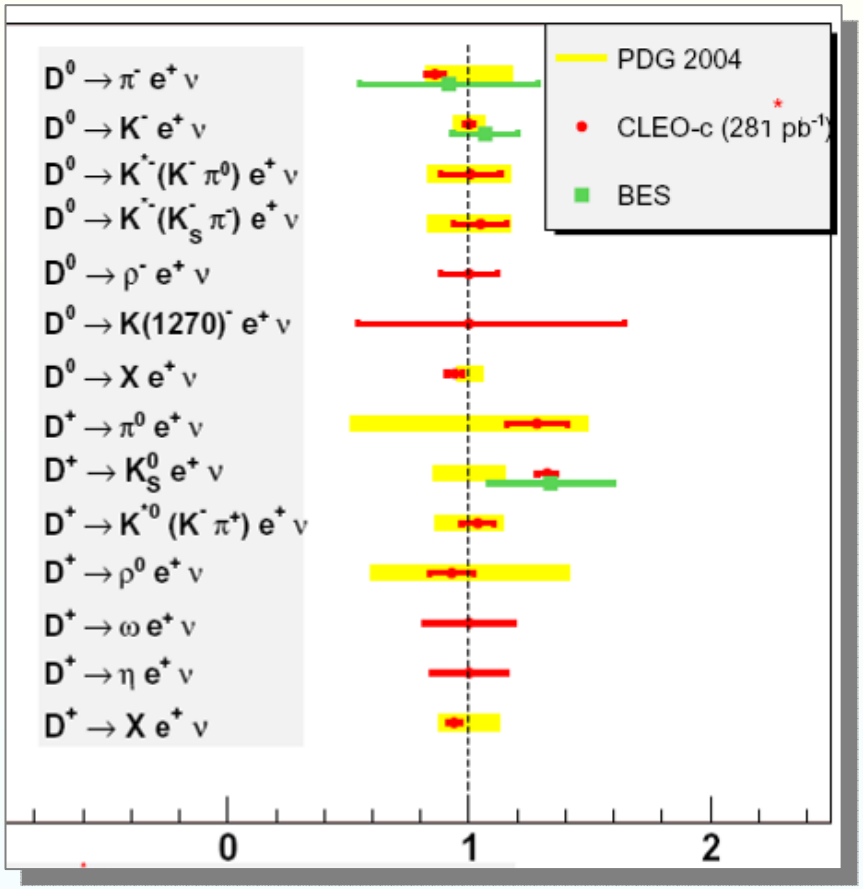
- DS→$\mu\nu$
  - W.A. vs. LQCD prediction:

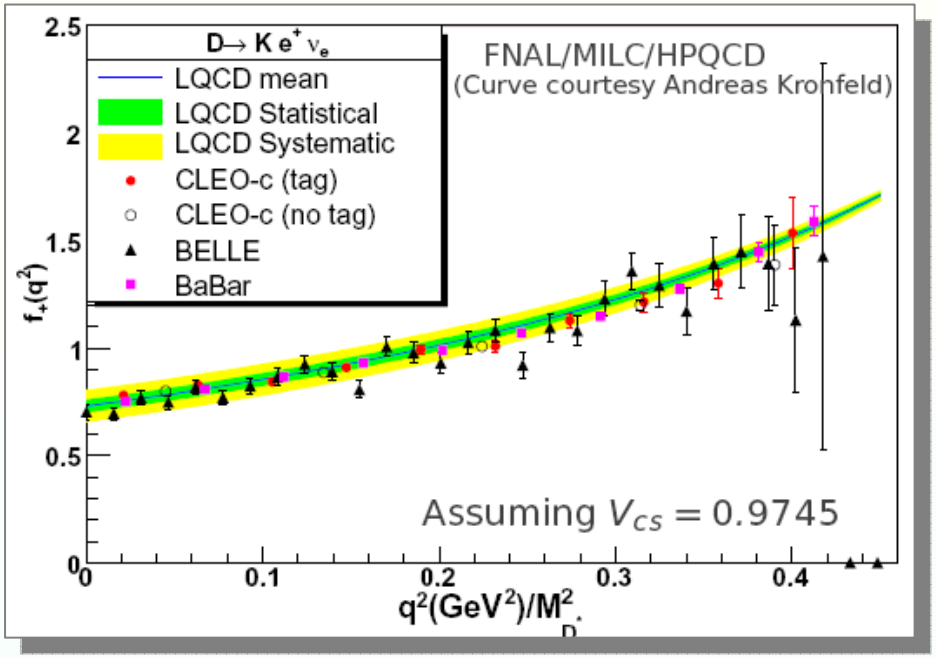
    $f_{exp}(D_s) = 271 \pm 11$ MeV

    $f_{LQCD}(D_s) = 241 \pm 3$ MeV
    - 2.6 σ discrepancy

CLEO

Park





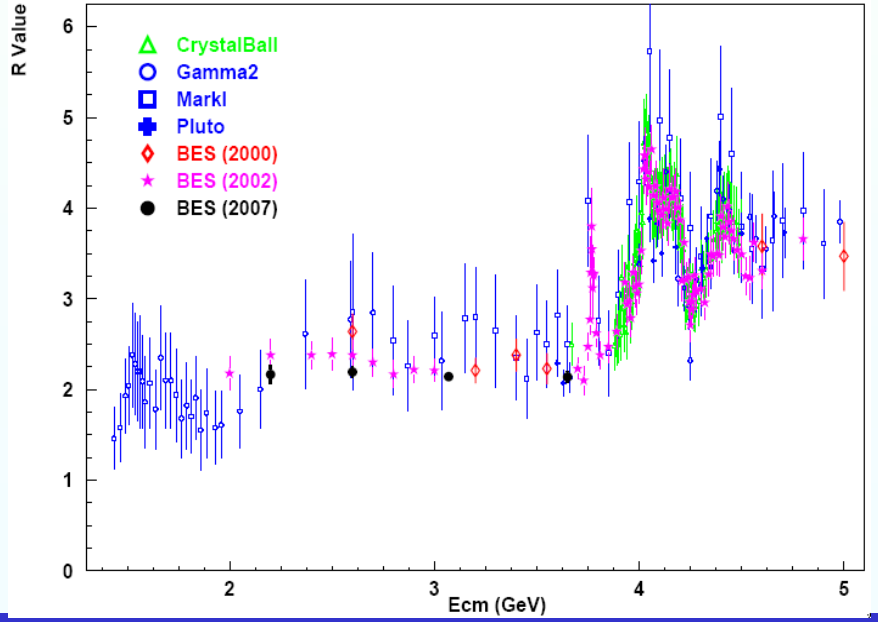
- Modified pole model used for comparison :
  $f_+(q^2) = \frac{f_+(0)}{(1-q^2/m^2_{pole})(1-\alpha q^2/m^2_{pole})}$
- Shape parameter: CLEO-c prefers smaller value
- Normalization:
  experiment (2%) consistent with LQCD (10%)

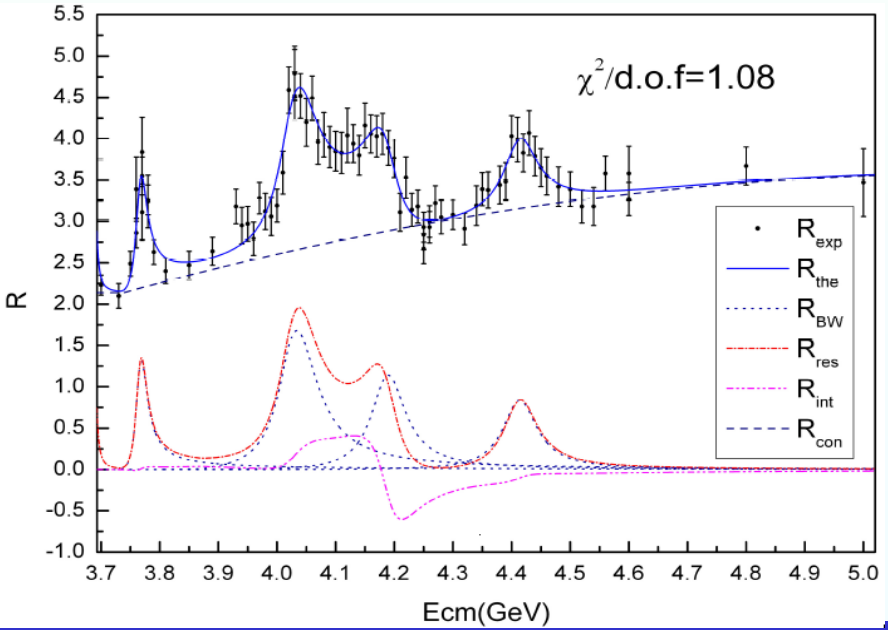
BES – R and J/ψ states

Ho

- R values between 2.20–3.65 GeV are measured with large data samples and improved methods, the errors are decreased. The new measurement agrees with the pQCD prediction within errors.

- Resonance parameters of high mass charmonia are determined considering the phase angles, interference and energy-dependent width. The model dependences are compared. New results will be helpful to understand the properties (states) of excited charmonia.

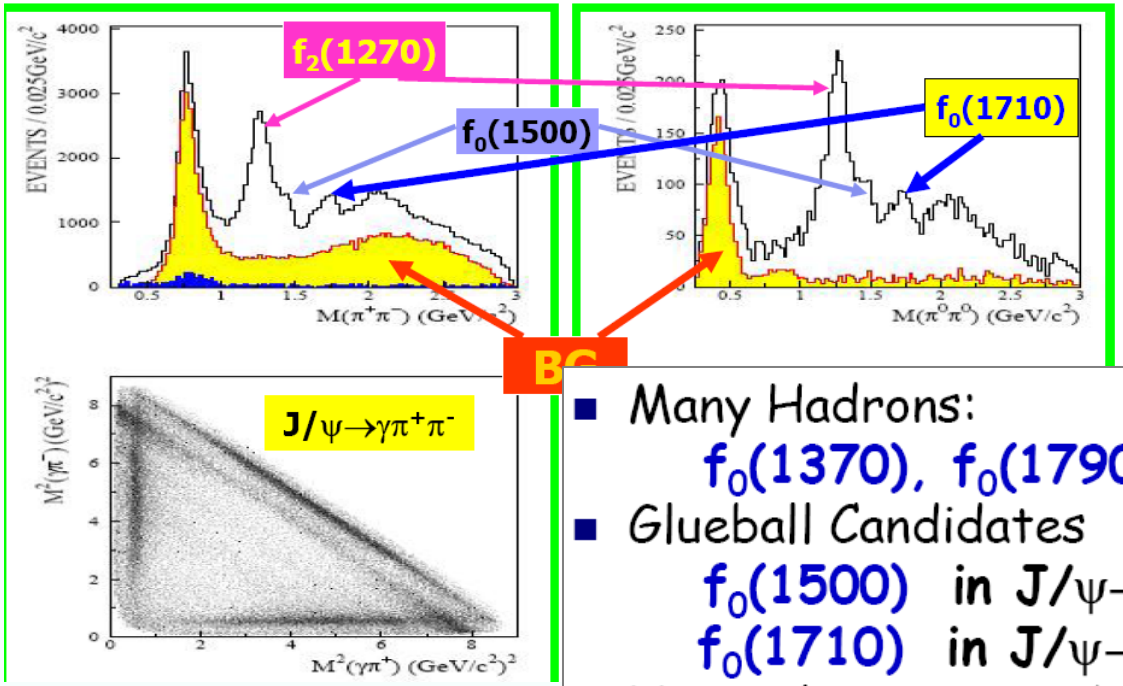




BES – new charm states

Xu

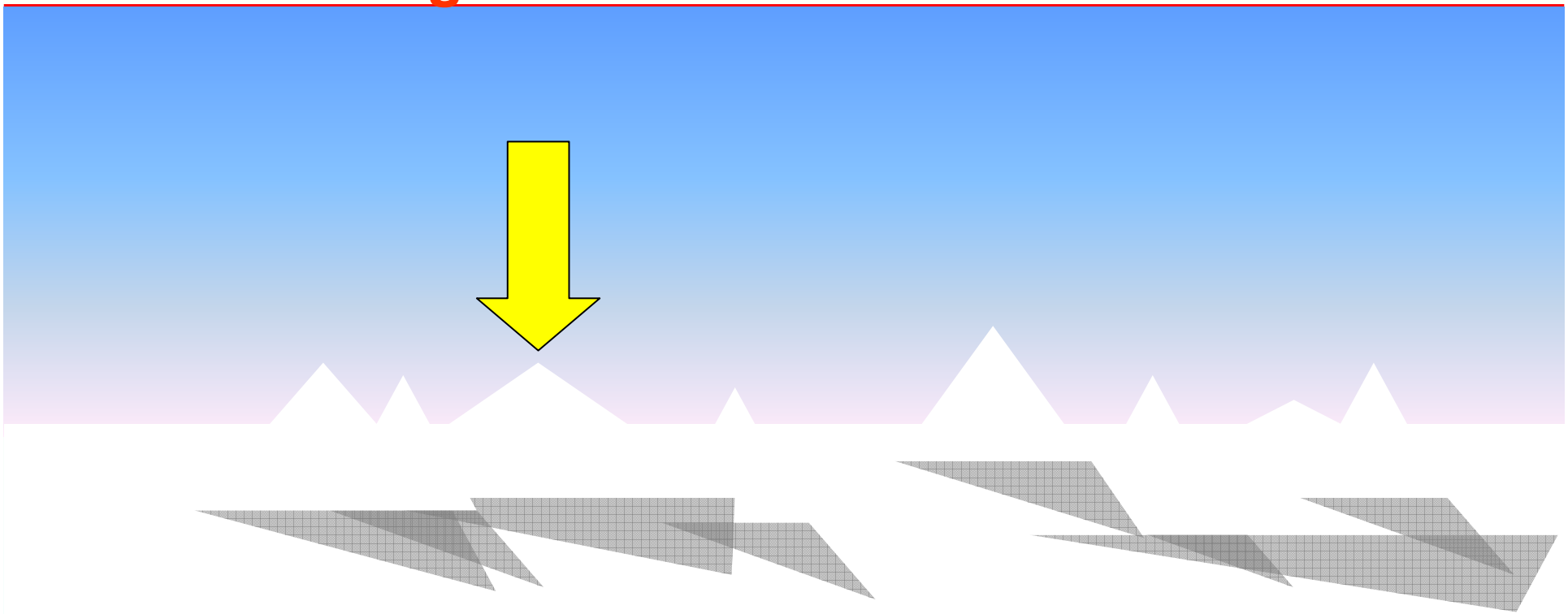
$J/\psi \to \gamma\pi\pi$



- Many Hadrons:
  $f_0(1370)$, $f_0(1790)$, $\eta(1440)(\eta(1405),\eta(1475))$, …
- Glueball Candidates
  $f_0(1500)$ in $J/\psi \to \gamma\pi^+\pi^-$, $\gamma\pi^0\pi^0$
  $f_0(1710)$ in $J/\psi \to \gamma K^+K^-$, $\gamma K_s K_s$, ωK^+K^-
- New enhancements/structures
  $x(1835)(0^{-+})$ in $J/\psi \to \gamma(\pi\pi\eta')$ $(\eta' \to \eta\pi\pi,\ \gamma\rho)$ 7.7σ
  $x(1859)(0^{-+})$ in $J/\psi \to \gamma(p\bar{p})$
  $x(1760)(0^{-+})$ in $J/\psi \to \gamma(\omega\omega)$ $>10\sigma$
  $x(1810)(0^{++})$ in $J/\psi \to \gamma(\omega\phi)$ $>10\sigma$
  $x(1576)(1^{--})$ in $J/\psi \to \pi^0(K^+K^-)$ 7.2σ
  $y(2175)(1^{--})$ in $J/\psi \to \eta(\phi f_0(980))$ 5.0σ

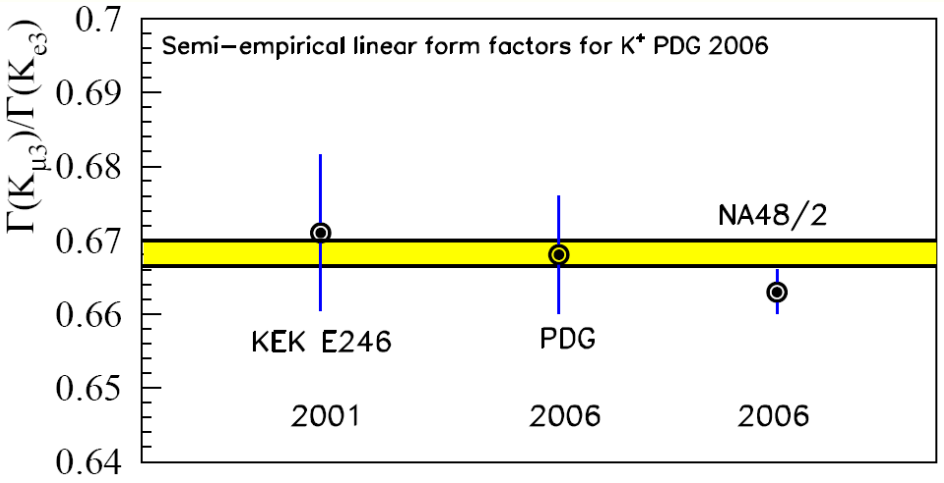
New

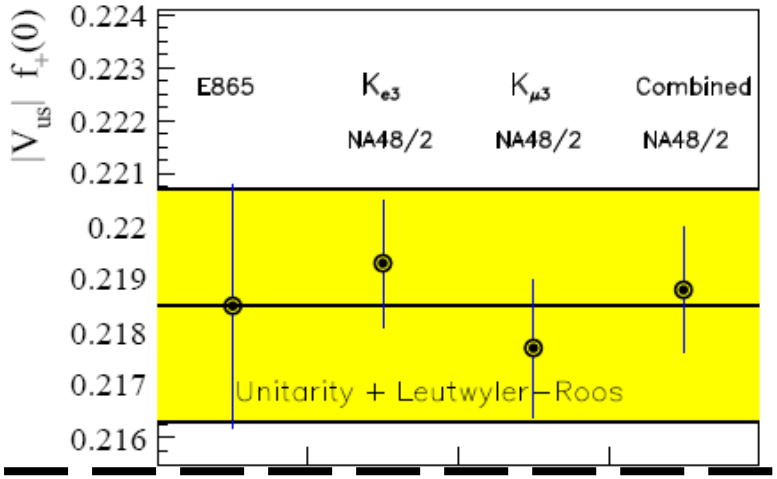
Strange results from Kaons

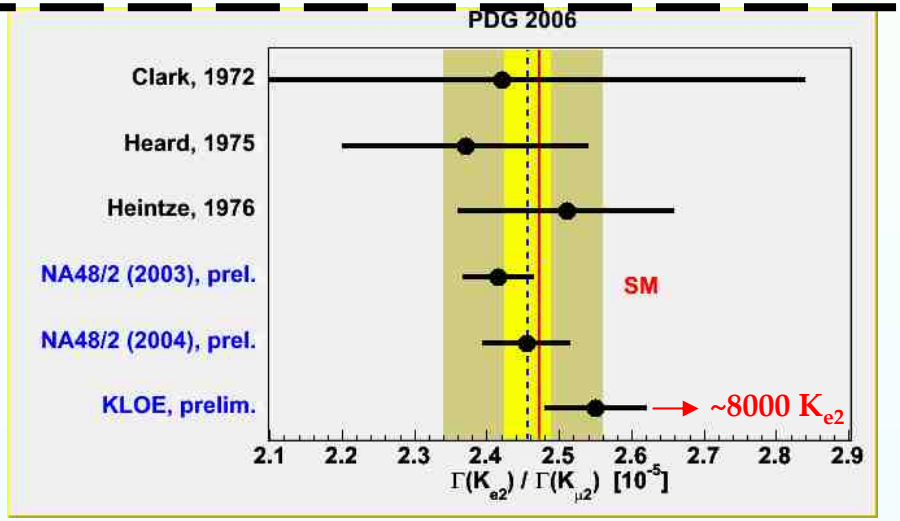


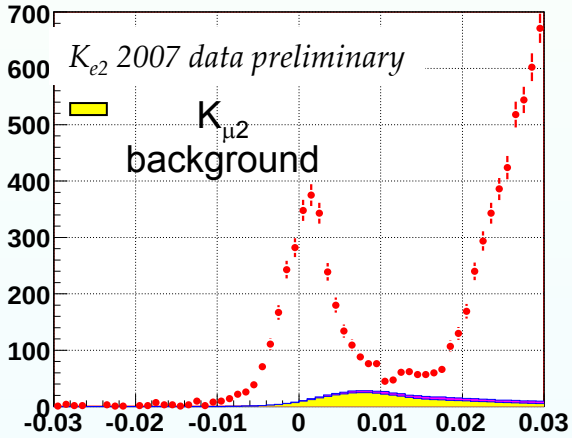
NA48⁺⁺ – $K_{\mu 3}/K_{e3}$, V_{us} & $K_{\ell 2}$

Ruggiero









Goal: total uncertainty ~0.5%

- $R^{+}_{K\mu 3/Ke3} = 0.663 \pm 0.003_{stat} \pm 0.001_{syst}$ (NA48)
- $R^{0}_{K\mu 3/Ke3} = 0.664 \pm 0.002$ (KTeV hep-ex/0406002)
- $R^{0}_{K\mu 3/Ke3} = 0.662 \pm 0.030$ (Evans *et al Phys.Rev.D7 36 (1973)*

KLOE

Testa

V_{us}

From BR (K_L3), FF's , the $\tau(K_L)$ and $\tau(K^\pm)$
$f_+(0)\times|V_{us}|=0.2157\pm0.0006$ with 0.3% accuracy

From K_{L3} and $K_{\mu2}$: $|V_{us}|=0.2237\pm0.0013$ and $|V_{us}/V_{ud}|=0.2326\pm0.0015$ with 0.6% accuracy

first-row CKM unitarity to 0.1% (0.6σ)

Preliminary results on the FF parameters

New

LFV

$r_{\mu e} = g_\mu^2/g_e^2 = 1.000\pm0.008$ from K_L3 decays
Preliminary results on the ratio BR(K→eν)/BR(K→μν)

NP

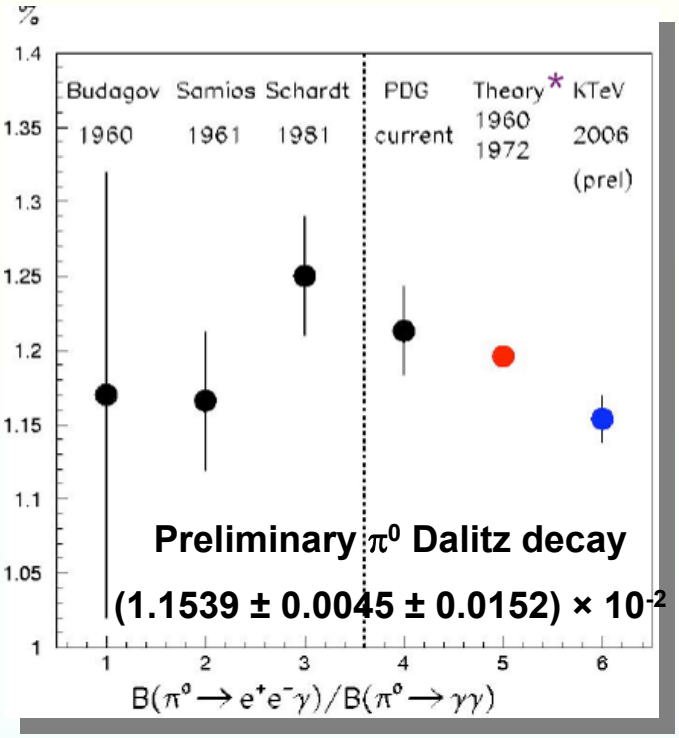
The measurement of BR($K_{\mu2}$) and excludes a large region in the m_{H^+}-tanβ plane.

Preliminary results with higher statistics dataset on CPT, Lorentz symmetry and QM tests

With the analysis of the full data sample (2.2 fb^{-1}) KLOE will further improve all results

KTeV rare decays

Zimmermann



π^0 Double Dalitz decay

(1960: 112 events: B.R. $(3.18 \pm 0.30) \times 10^{-5}$

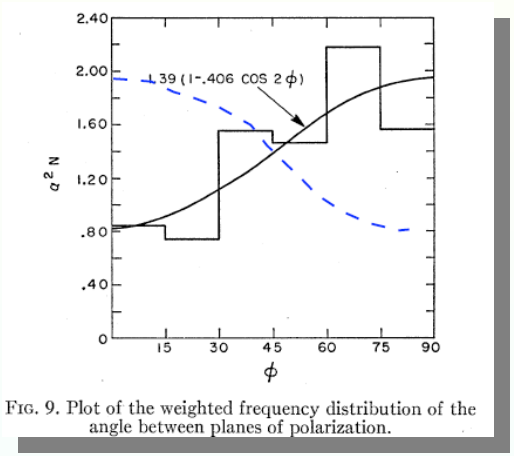
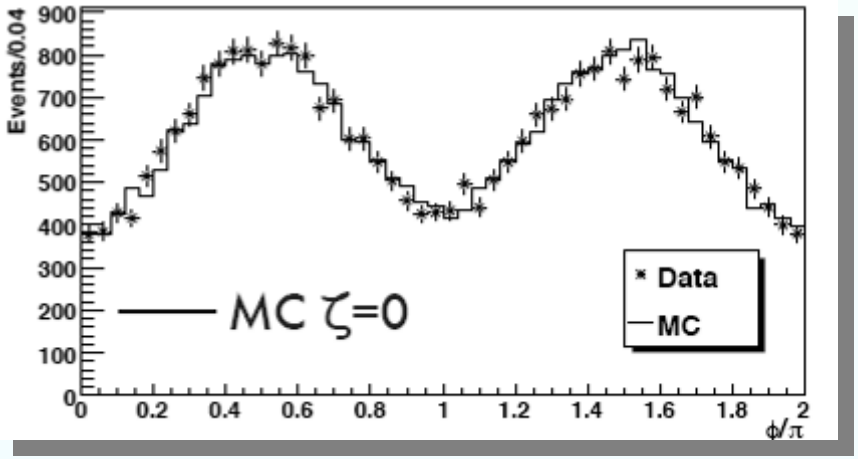


FIG. 9. Plot of the weighted frequency distribution of the angle between planes of polarization.

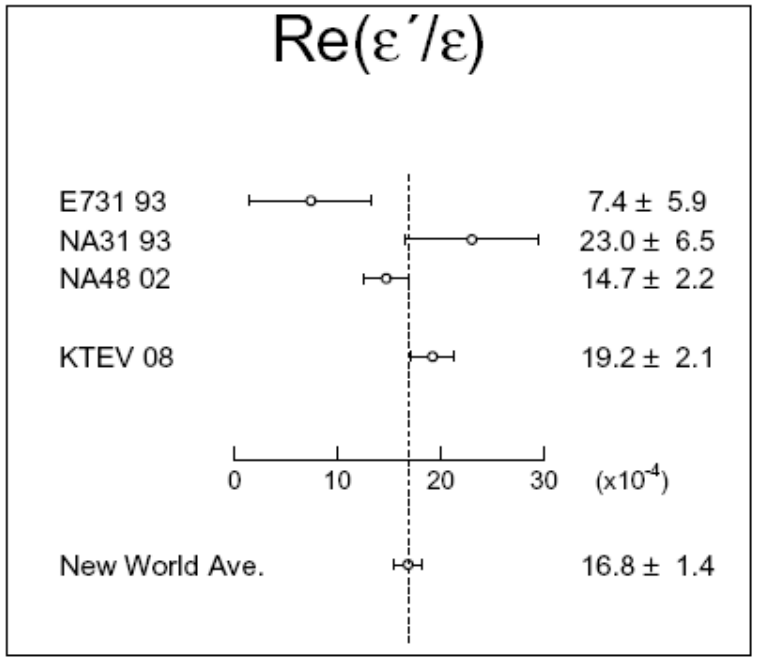
2008: 30.5k events: B.R. $(3.26 \pm 0.18) \times 10^{-5}$

New



KTeV ε'/ε

Glazov



- Final Result from KTeV collaboration on $Re(\epsilon'/\epsilon)$, based on entire data set:
  $Re(\epsilon'/\epsilon) = [19.2 \pm 2.1] \times 10^{-4}$
- NA48 and KTeV results are consistent with each other, precise value of Direct CP violation parameter $\overline{Re(\epsilon'/\epsilon)} = [16.8 \pm 1.4] \times 10^{-4}$ is established.
- KTeV data is consistent with no CPT violation:
  - $\phi_\epsilon - \phi_{SW} = [0.40 \pm 0.56]^\circ$
  - $Im(\epsilon'/\epsilon) = [-17.2 \pm 20.2] \times 10^{-4}$

Search for $K_s \to e^+e^-$

YSF

Archilli

Upper Limit evaluation

New

In data sample we find $N_{obs} = 0$ and 0 events in MC BKG sample.

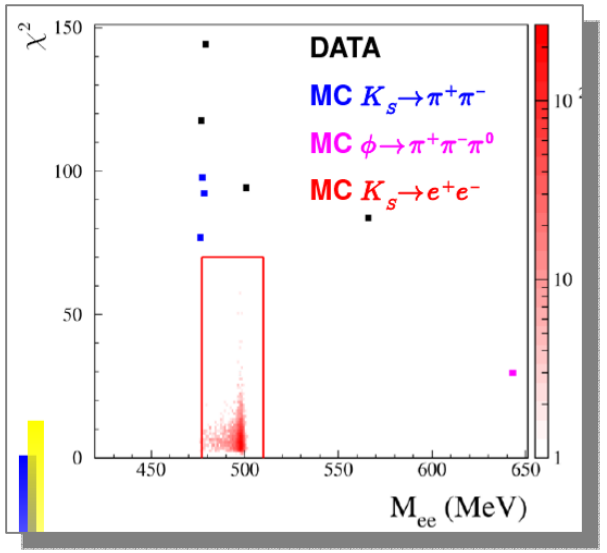
The Upper limit for the number of signal events μ_{sig} is: $UL(\mu_{sig}) = 2.3$ @ 90% CL

Using the following efficiencies:

$$\varepsilon_{sig}(sele|tag) = (0.534 \times 0.871) = 0.465(4)$$
$$\varepsilon_{\pi\pi}(sele|tag) = 0.6102(5)$$

Having normalized to:

$$N_{\pi\pi} = 217\,422\,768$$

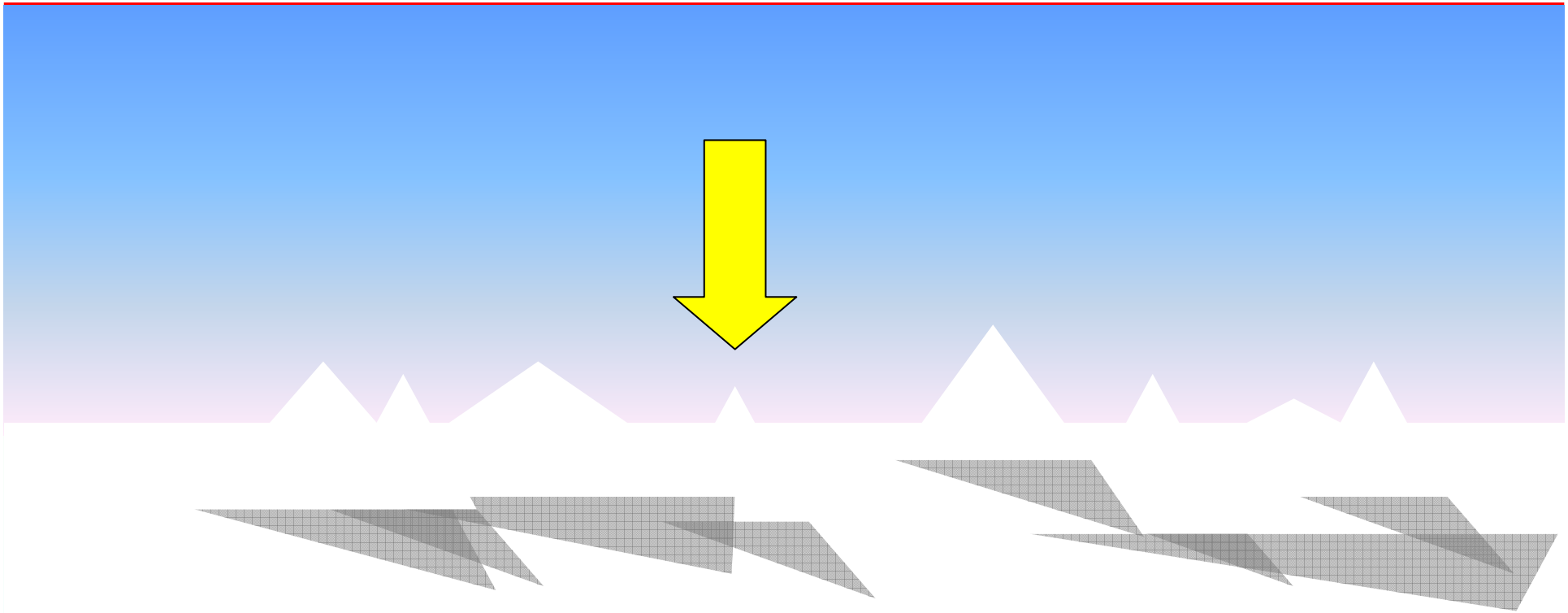


we have:

$$UL(BR) = UL(\mu_{sig}) \times \frac{\epsilon_{\pi\pi}(sele|tag)}{\epsilon_{sig}(sele|tag)} \times \frac{BR_{\pi\pi}}{N_{\pi\pi}} = 9.3 \times 10^{-9}\,@\,90\%\,CL$$

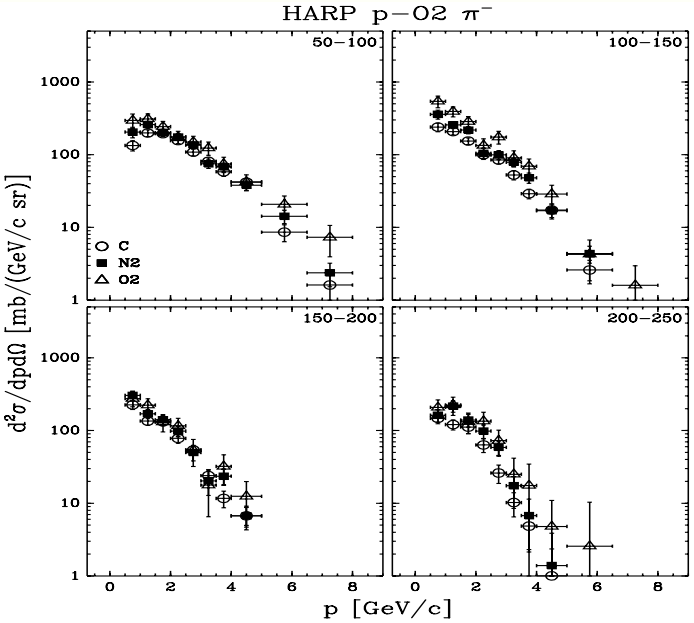
We improve by more than 1 order of magnitude on the present best limit.

News from Neutrinos

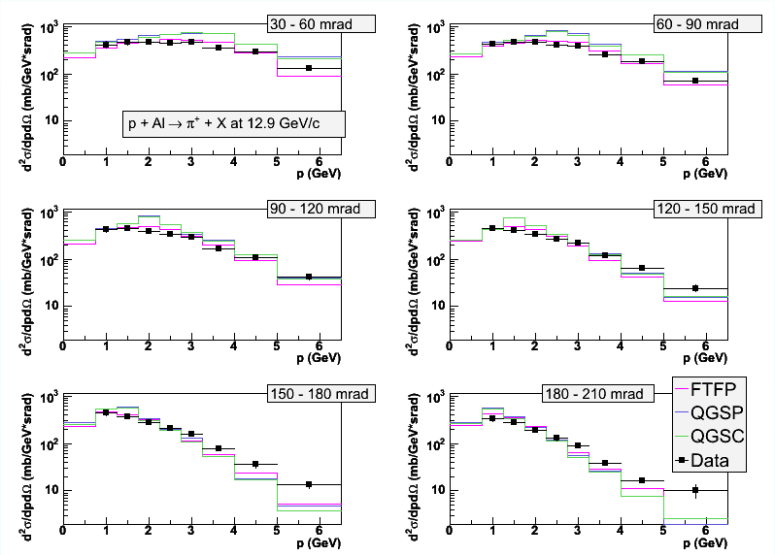


HARP

Tsenov



p+C, N2,O2 @ 12 GeV/c



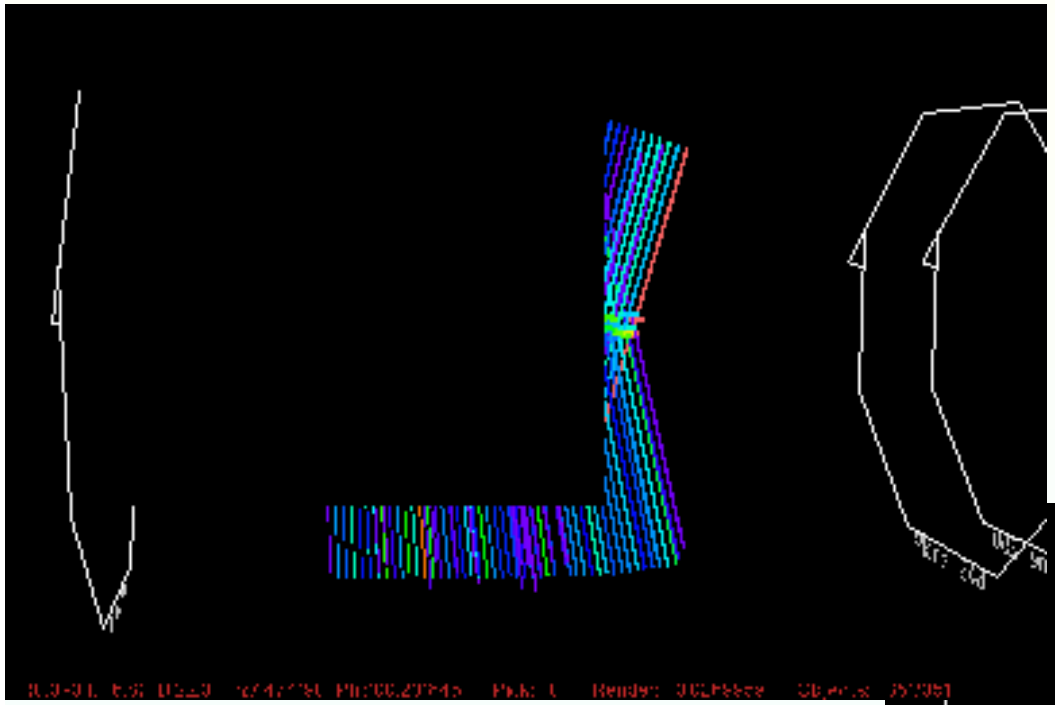
p+Al versus GEANT4

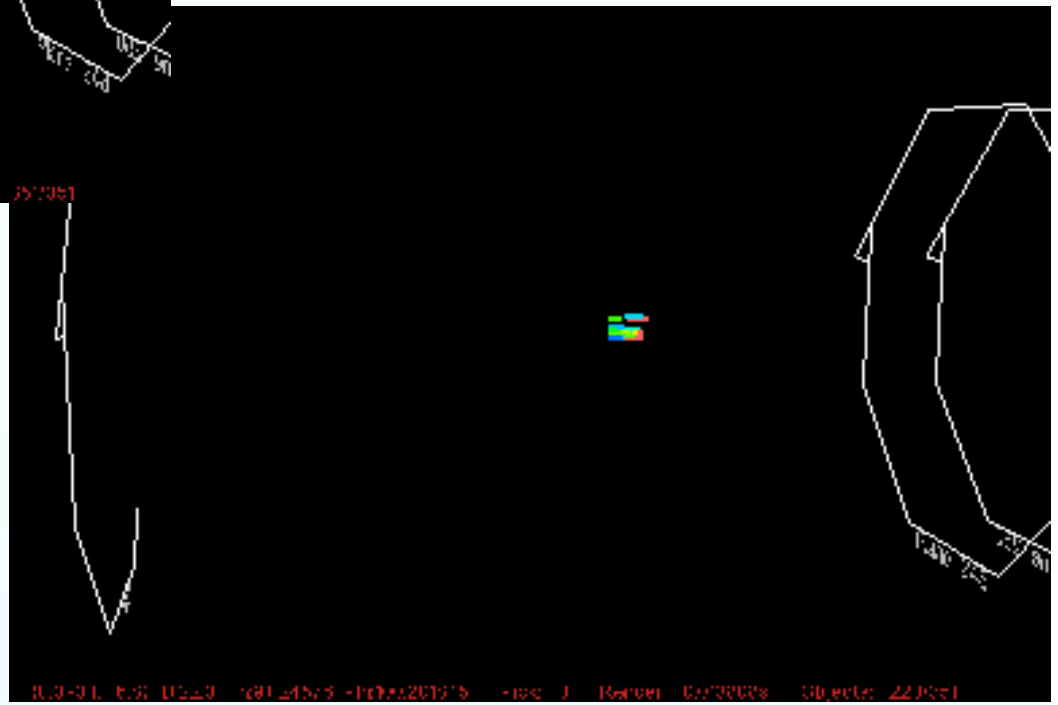
- Many targets
- Many momenta
- Important for many experiments
  - K2K
  - MINOS
  - MiniBooNE
  - T2K
  - …

New

MINOS

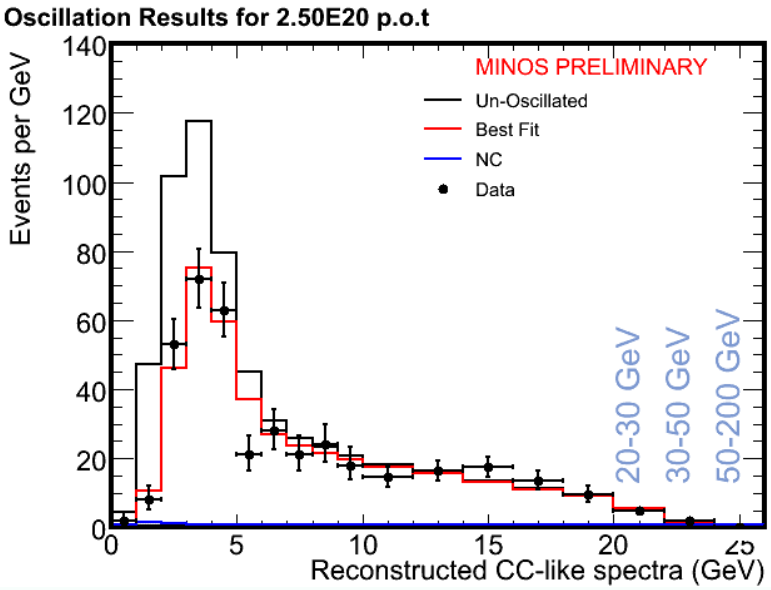
Habig

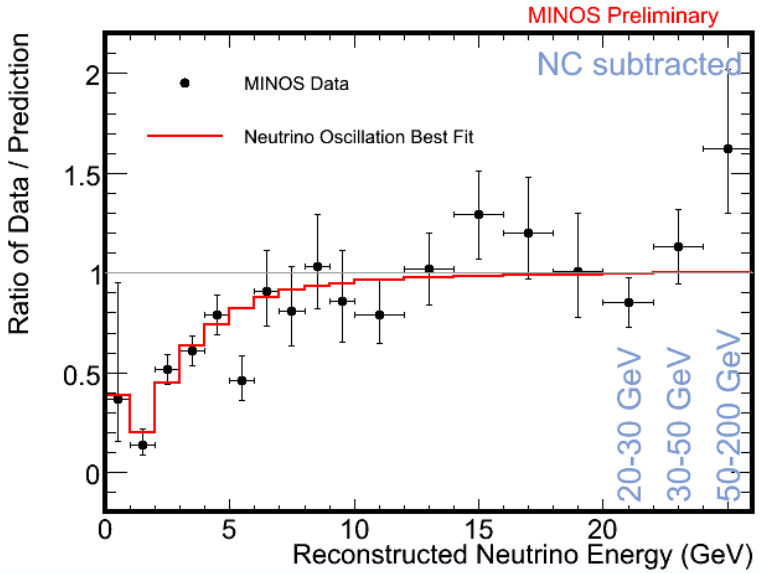




MINOS

Habig





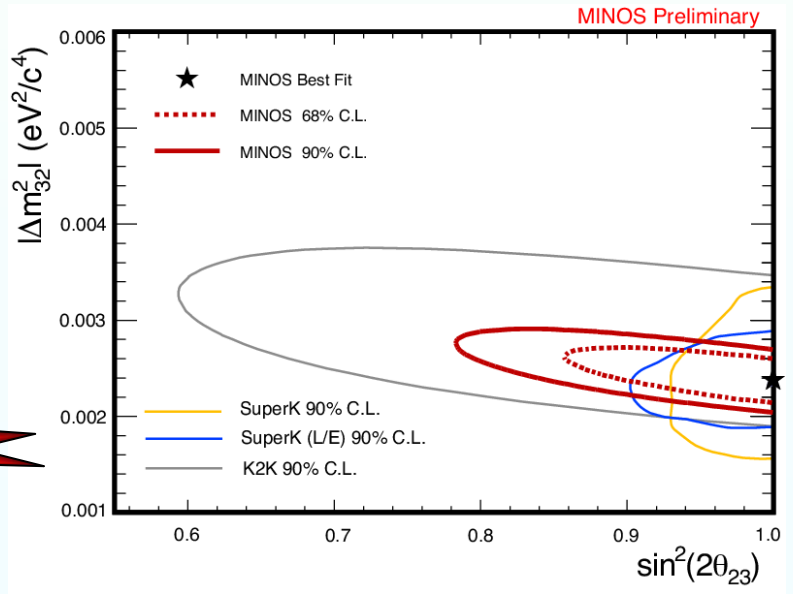
Consistent with previous experiments
Already best measurement of $|\Delta m^2_{32}|$

$|\Delta m^2_{32}| = 2.38\ ^{+0.20}_{-0.16}$ (stat + syst) x 10^{-3} eV^2

$\sin^2 2\theta_{23} = 1.00\ _{-0.08}$ (stat + syst)

χ^2/ndf=41.2/34

New

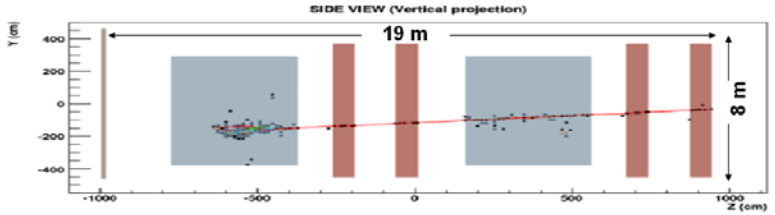


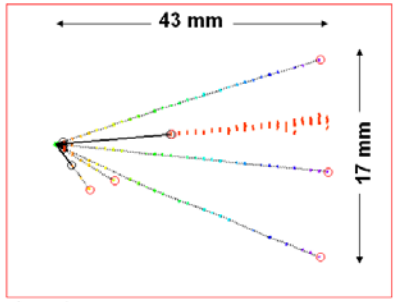
ν_e appearance → new sensitivities!

OPERA

Pistillo

Event 178969961: ν_μCC interaction





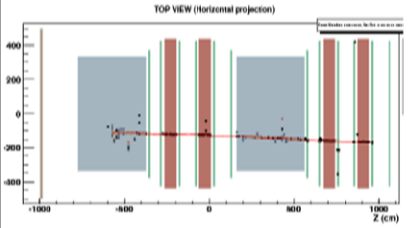
5 prongs associated to the neutrino interaction

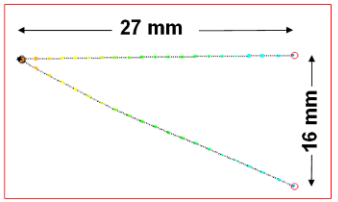
<IP> = 9 μm

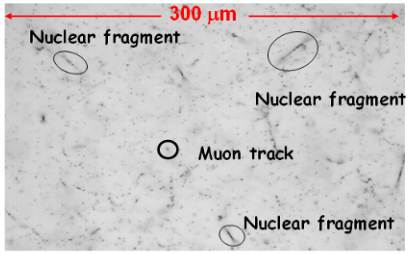
Electromagnetic shower pointing to the vertex (γ conversion)

38 Events So far

Event 179673325 QE-like topology

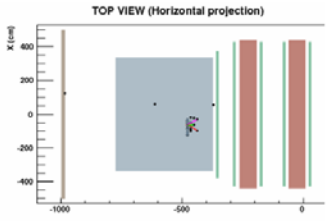


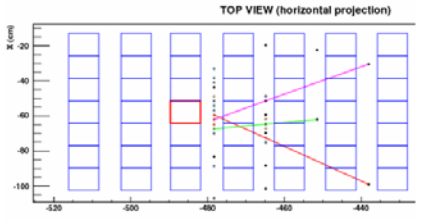




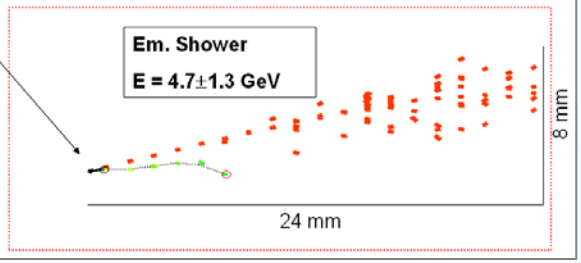
The visual inspection allow the observation of nuclear fragments and the classification of the event as DIS

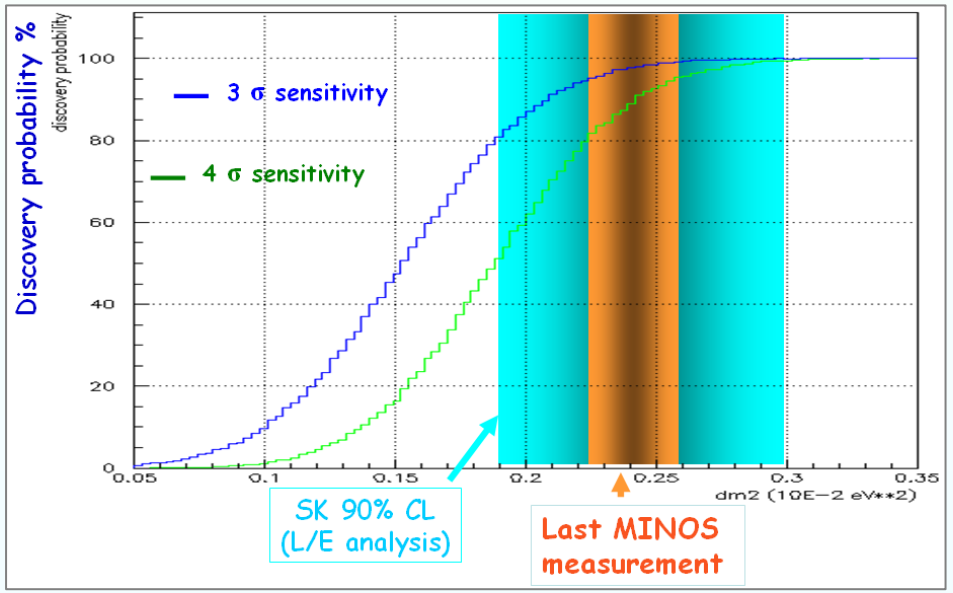
Event 183545620 located in Bern





Neutrino vertex
IP = ~3μm

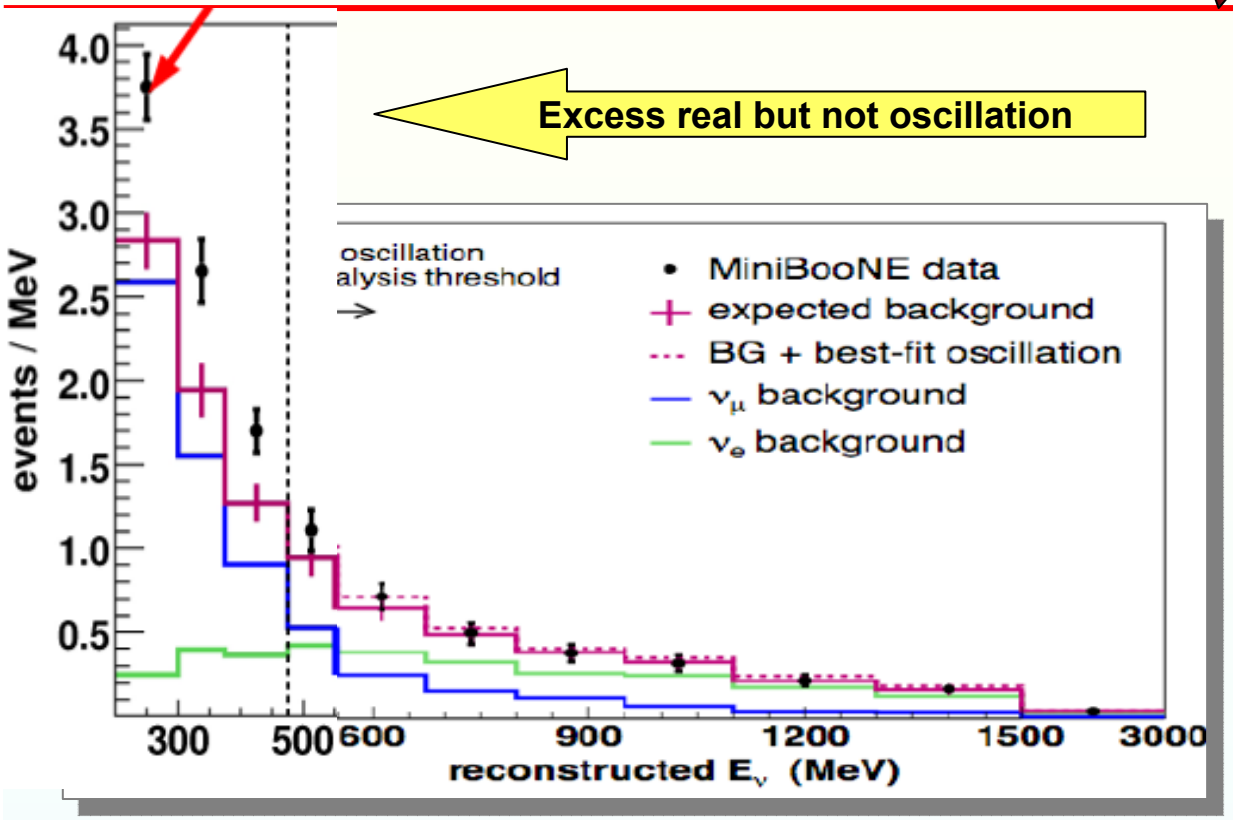


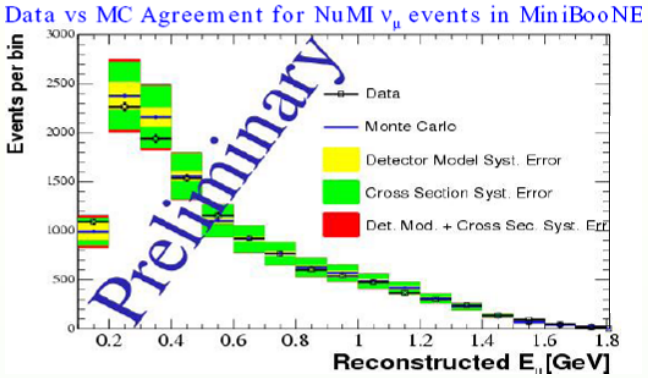


MiniBooNE

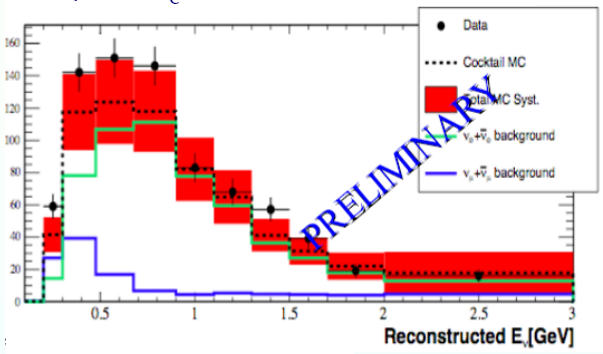
New

Polly





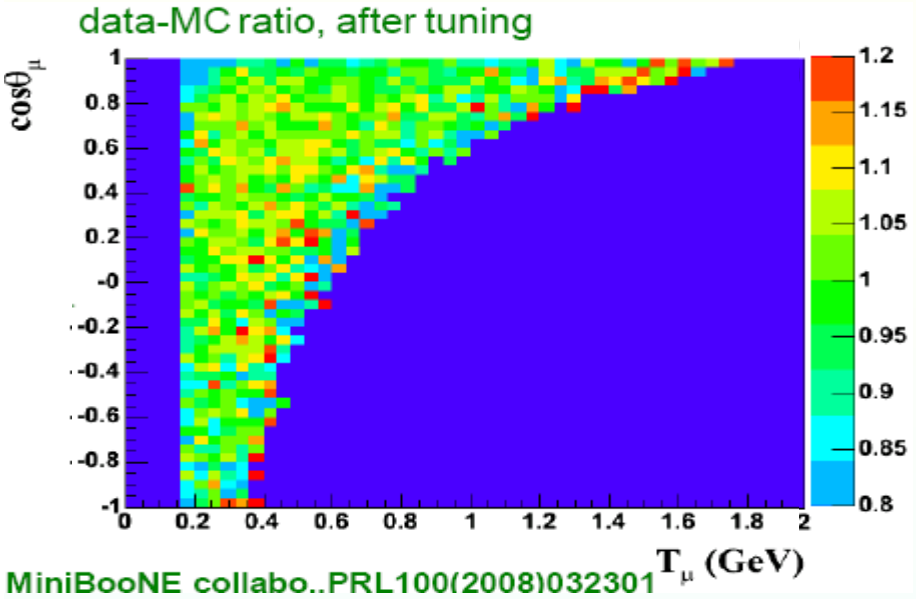
Analysis of ν_e-like events from NuMI beam



- MiniBooNE is approved to run 2 more years of anti-ν running in the BNB
  - Unique cross-section measurements
  - Partial coverage of the LSND signal region with an anti-neutrino beam
  - SciBooNE near detector
  - ν/anti-ν xsecs for T2K/NOVA

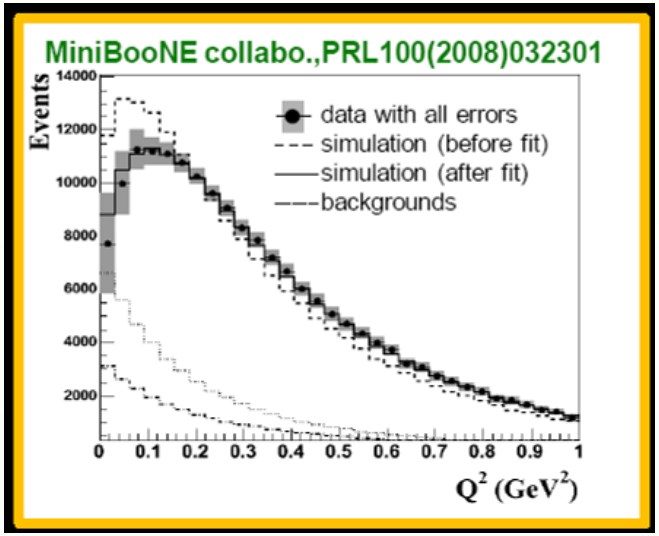
Low Energy Neutrino Cross-sections

Katori



CC-QE

NC-π^0

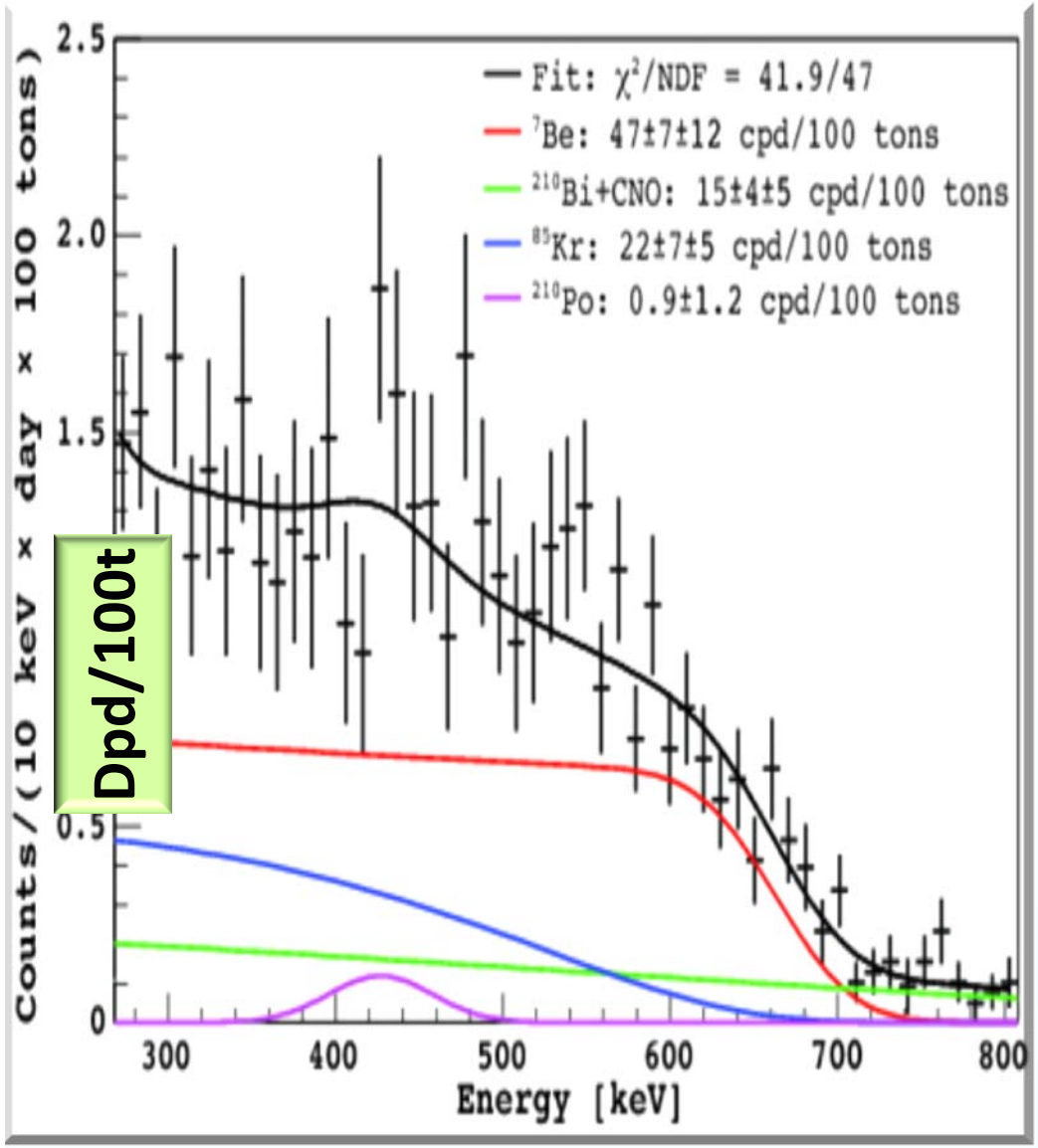


- **MiniBooNE, K2K, MINOS, T2K**
  - **Minerva, SciBooNE**
- **Low energy neutrino cross-sections**
  - **not so well known**
  - **Shape and normalisation distortions to oscillation searches …**

New

Borexino

Dalnoki-Veress



^{7}Be rate
$= 47 \pm 7_{stat} \pm 12_{sys}$

LMA MSW
$= 49 \pm 4$

No FC
$= 75 \pm 4$

doi:10.1016/j.physletb.2007.09.054 Cite or Link

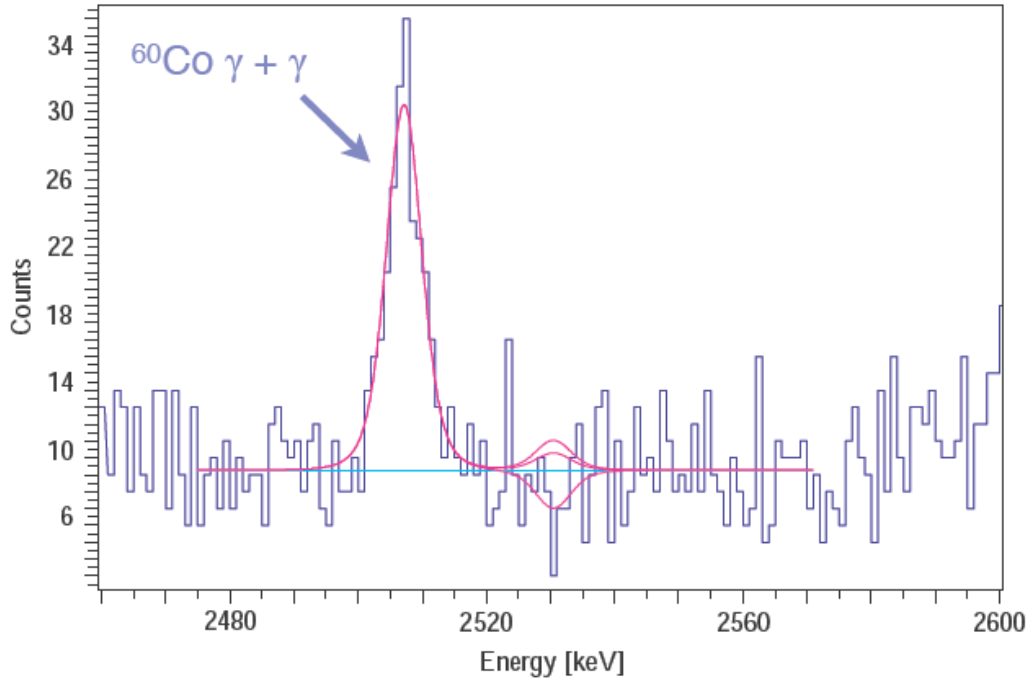
First real time detection of ^{7}Be solar neutrinos by Borexino

Borexino Collaboration, C. Arpesella[a], G. Bellini[b], J. Benziger[c], S. Bonetti[b], B. Caccianiga[b], F. Calapri, M. Deutsch[h], A. Etenko[e], K. Fomenko[i], R.

Cuoricino Results (preliminary)

- Collected Statistics: $M \cdot t = 15.53\ \mathrm{Kg}\ ^{130}\mathrm{Te} \cdot \mathrm{y}$
- Background level: $b = 0.18 \pm 0.01\ (\mathrm{c/KeV/Kg/y})$
- 0νDBD Half-life limit (90% C.L): $\tau^{0\nu}_{1/2} > 3.1 \cdot 10^{24}\ \mathrm{y}$
- Effective neutrino mass limit: $m_{\beta\beta} < 0.20 \div 0.68\ \mathrm{eV}$

New



Cuoricino

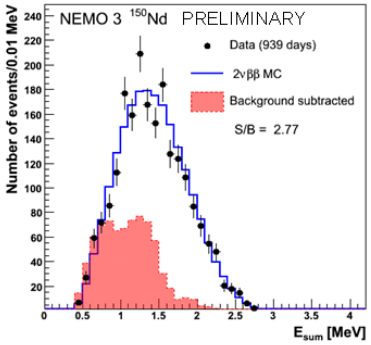
▼

Cuore

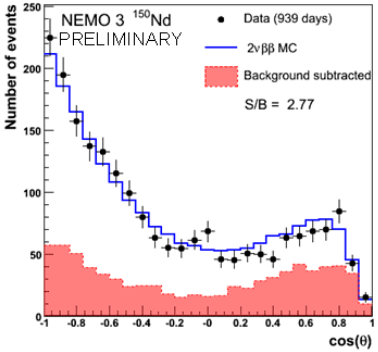
ββ2ν results for ^{150}Nd

$Q_{\beta\beta}$ = 3.367 MeV 46.6 g of Nd_2O_3 enriched to 91%, equivalent to 37 g of ^{150}Nd
Feb 2003 – Dec 2006 : 939 days of data collection
2828 events observed

Energy sum of the electrons



Angular distribution



$T_{1/2}$ (ββ2ν) = (9.20 $^{+0.25}_{-0.22}$ (*stat*) ± 0.73 (*syst*)). 10^{18} y

$$T_{\frac{1}{2}}(\beta\beta 2\nu) = (1.88^{+0.66}_{-0.39}(\text{stat}) \pm 0.19(\text{syst})).10^{19}\ \text{y}$$

(*V. Artemiev et al.,Phys. Let. B., 345, (1995) 564*)

$$T_{\frac{1}{2}}(\beta\beta 2\nu) = (6.75^{+0.37}_{-0.42}(\text{stat}) \pm 0.68(\text{syst})).10^{18}\ \text{y}$$

(A. De Silva et al., Phys. Rev. C 56 (1997) 2451)

NEMO-3

New

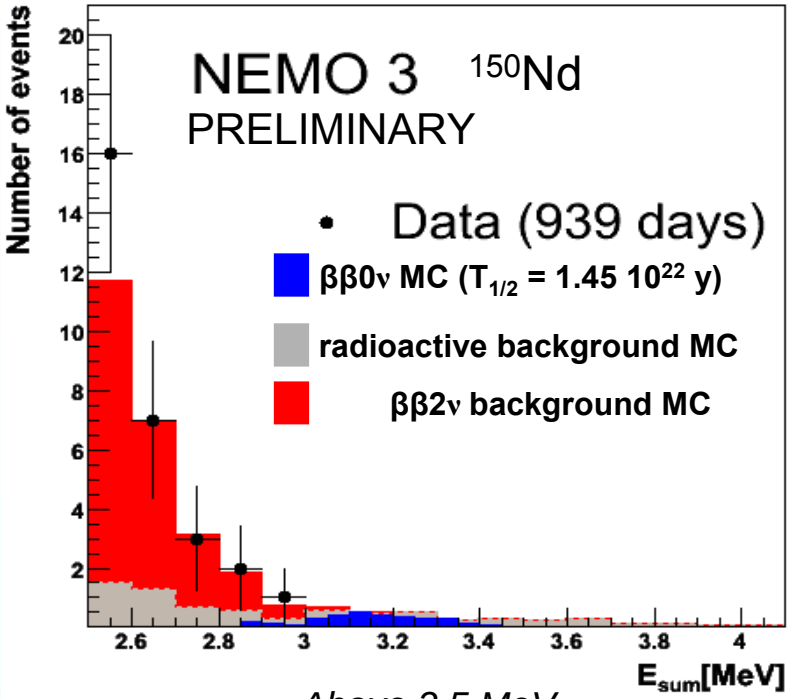
$T_{1/2}$ (ββ0ν) > 1.45 10^{22} y 90 % CL

$\langle m_\nu \rangle$ < 3.7 – 5.1 eV

V.A. Rodin et al., Nucl. Phys. A 766 (2006) 107

Previous result: $T_{1/2}$ > 1.7 10^{21} y 90 % CL

A.A. Klimenko et al., Nucl. Instr. Meth. B 17 (1986) 445

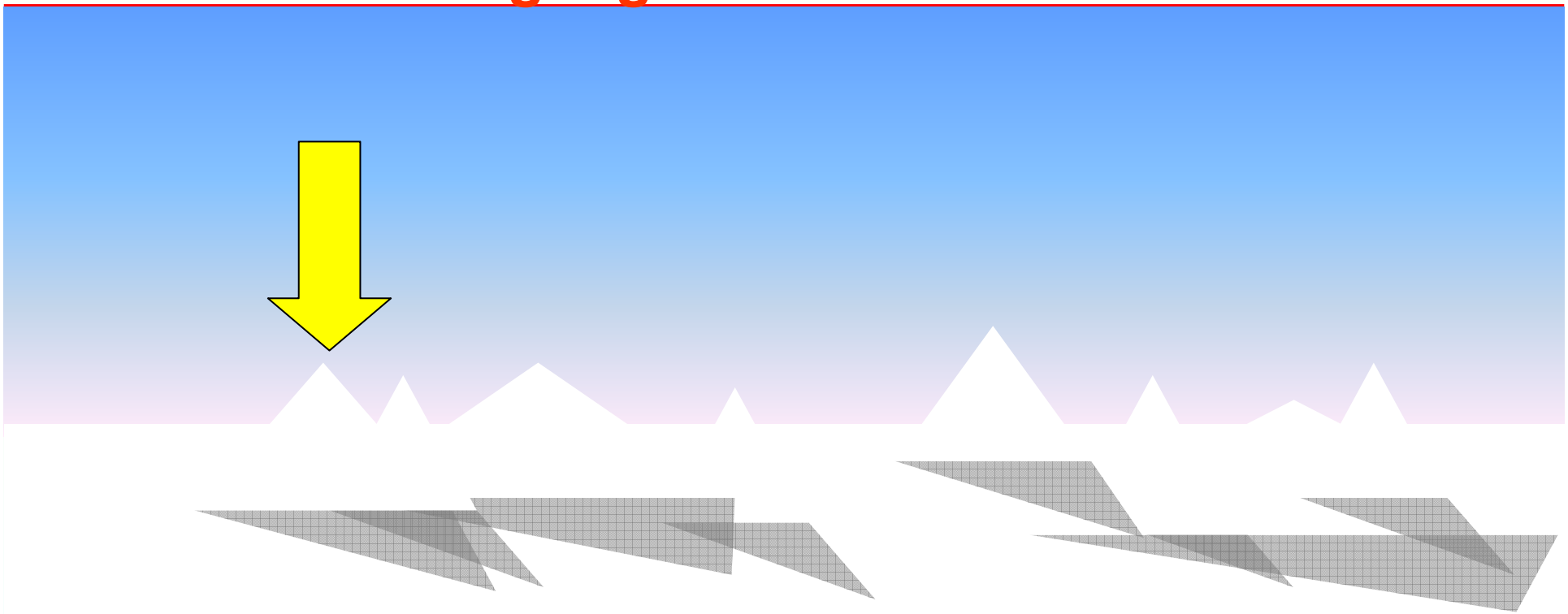


Above 2.5 MeV

28.6 ± 2.7 events expected from background

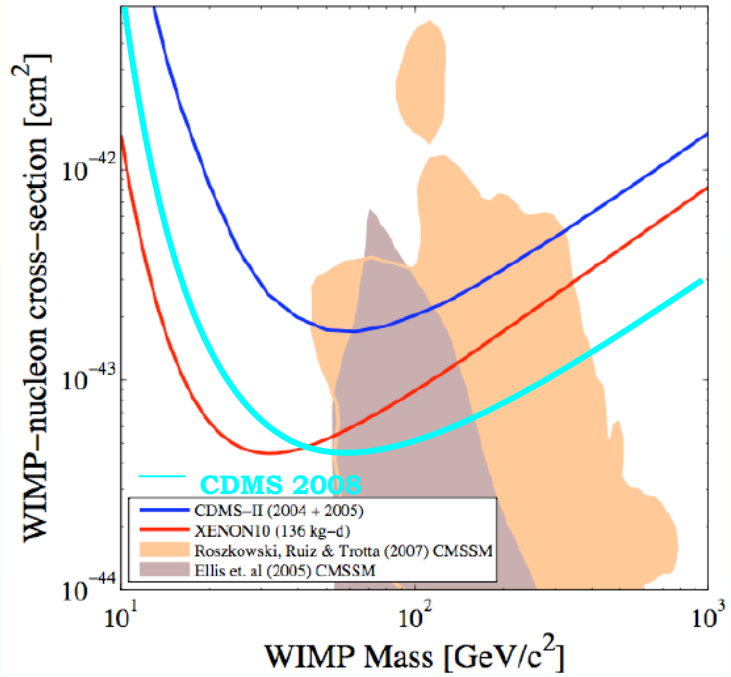
29 events observed

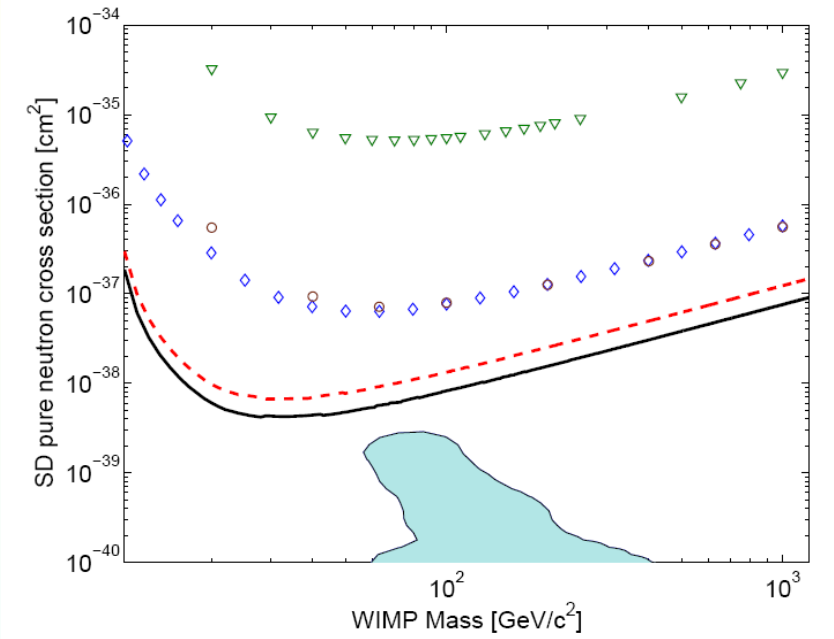
Throwing Light on Dark Matter

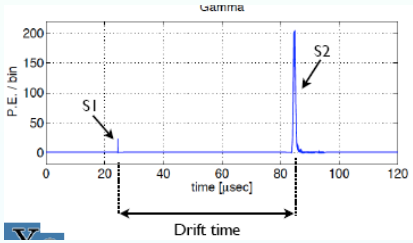


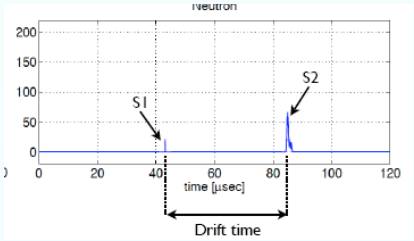
XENON

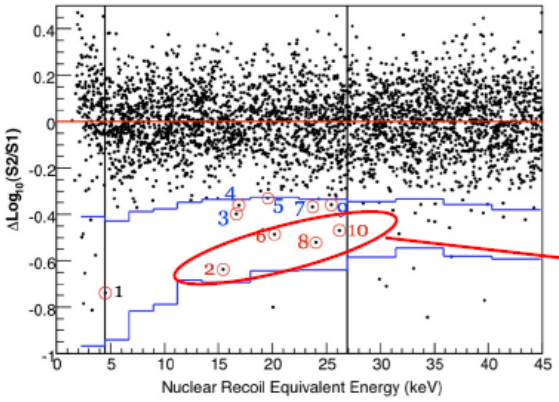
Santorelli

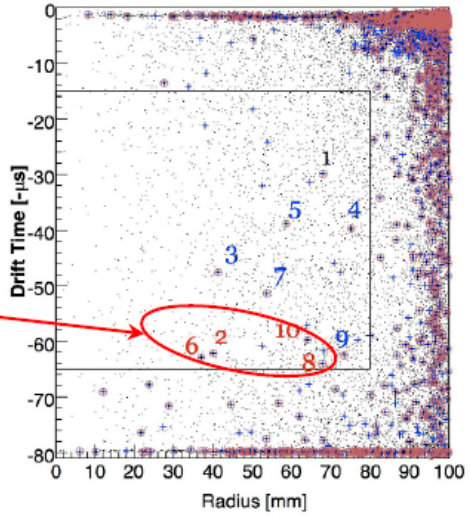






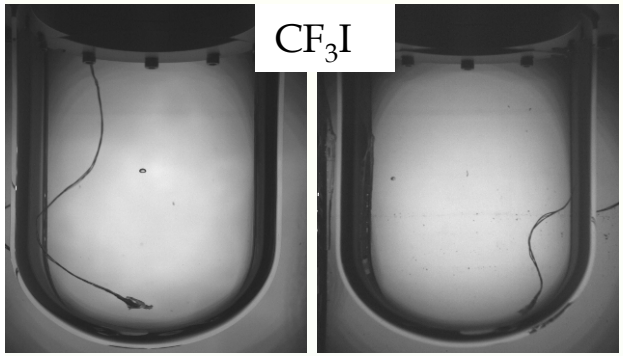




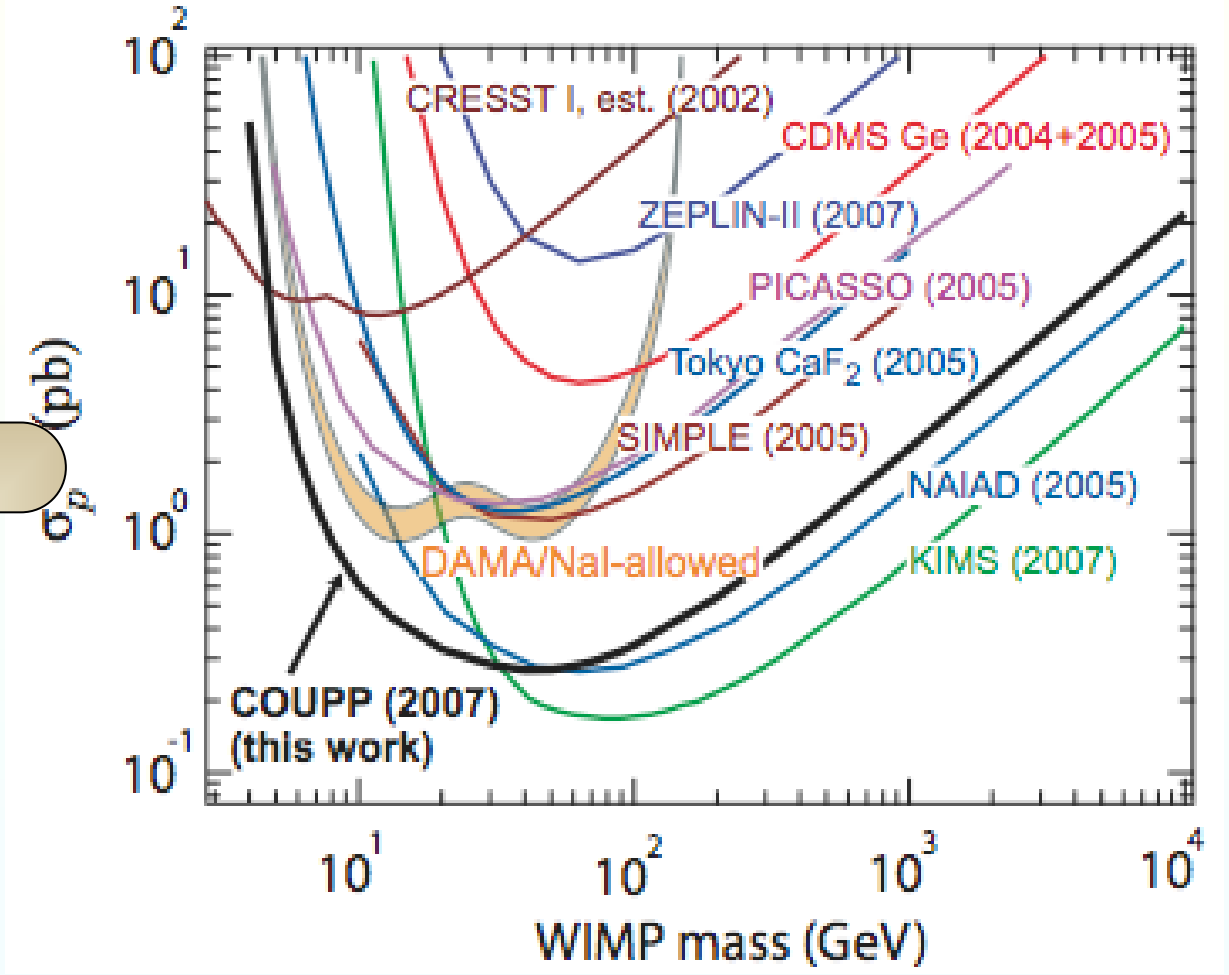


COUPP

Szydagis

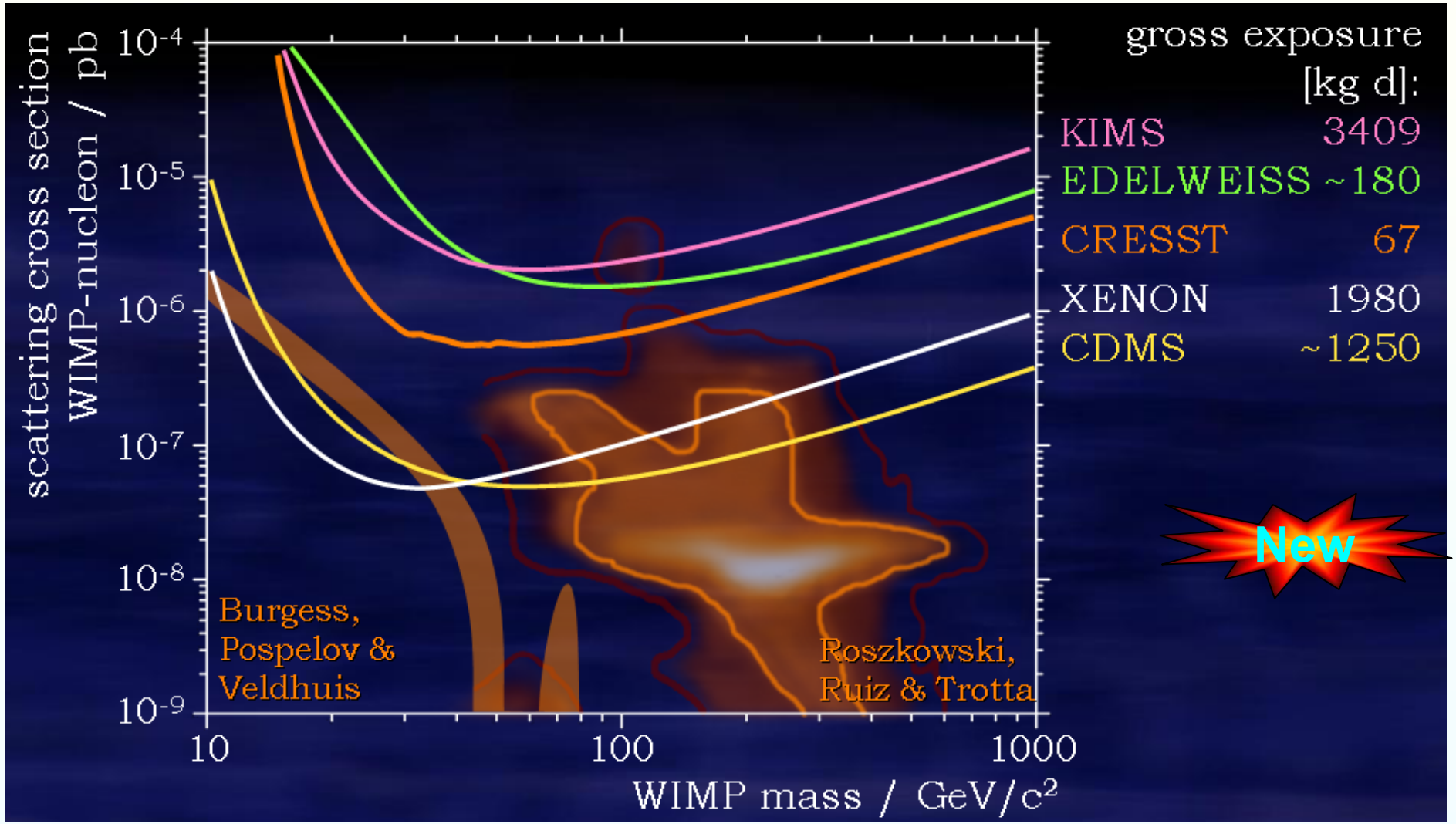


SCROLL
of
HONOUR
for the
Imaginative use of Old Technology



CRESST

Lang

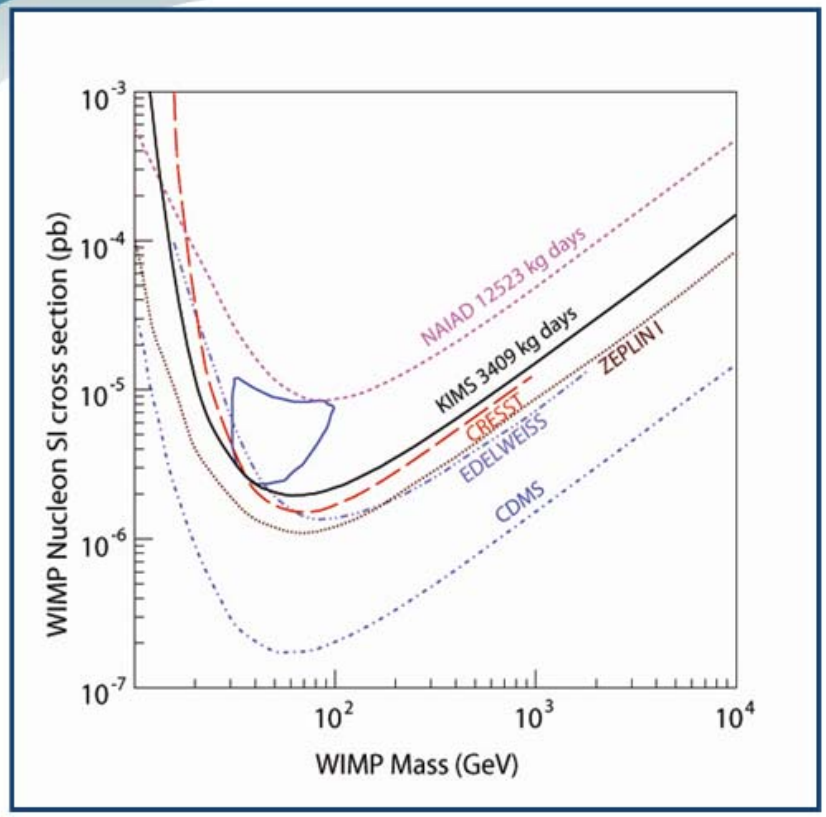

scattering cross section WIMP-nucleon / pb
10^{-4}
10^{-5}
10^{-6}
10^{-7}
10^{-8}
10^{-9}
10
100
1000
WIMP mass / GeV/c²
gross exposure [kg d]:
KIMS 3409
EDELWEISS ~180
CRESST 67
XENON 1980
CDMS ~1250
Burgess, Pospelov & Veldhuis
Roszkowski, Ruiz & Trotta
New

KIMS

Kim

Spin independent limit

PRL 99, 091301 (2007)

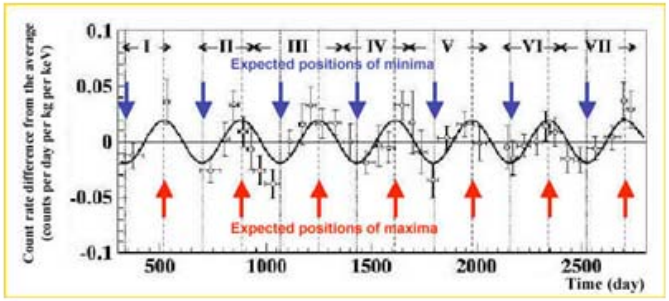


$\rho_D = 0.3\ GeV/c^2/cm^3$

$v_0 = 220 km/s$

$v_{esc} = 650 km/s$

Systematic uncertainty
Fitting, Quenching factor
energy resolution...
~ 15% higher than w/o syst.



Ruled out the interpretation of DAMA signal as recoil of ^{127}I (dominant target for SI WIMP interaction).

DAMA annual modulation still needs to be checked !

DM-TPC

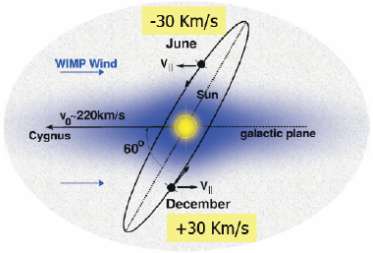
Ahlen

Drukier, Freese, Spergel (1987)
...

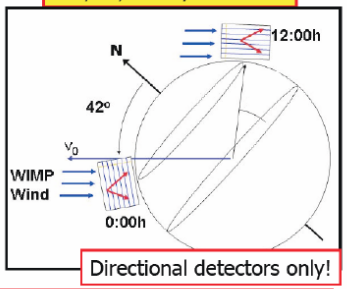
Why a directional DM detector

In presence of backgrounds, unambiguous observation of DM requires correlation with astrophysical phenomena

Yearly asymmetry~2-10%



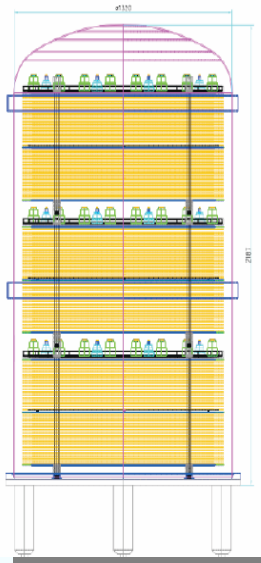
Daily asymmetry~30-100%!

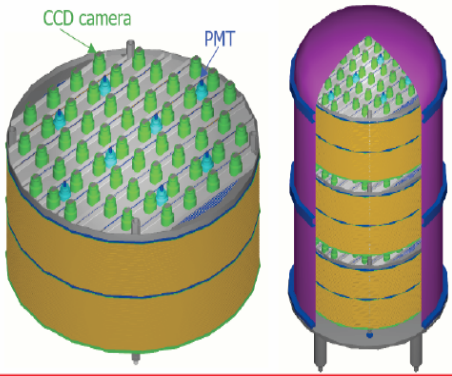


Directional detectors only!

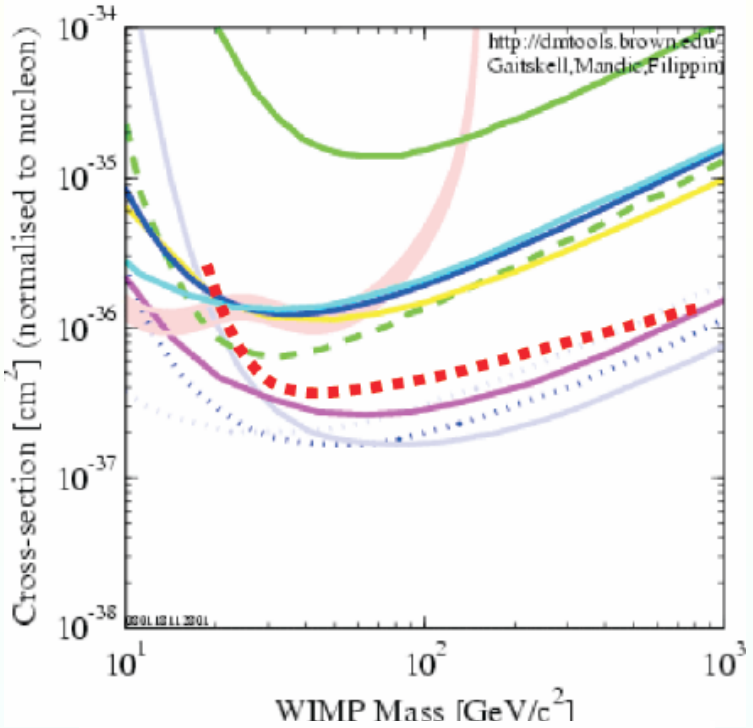
Directional detection provides:
1) Unambiguous positive observation of DM in presence of backgrounds
2) Test our understanding of DM model (a DM observatory)

Example: 1.5 m^3 detector





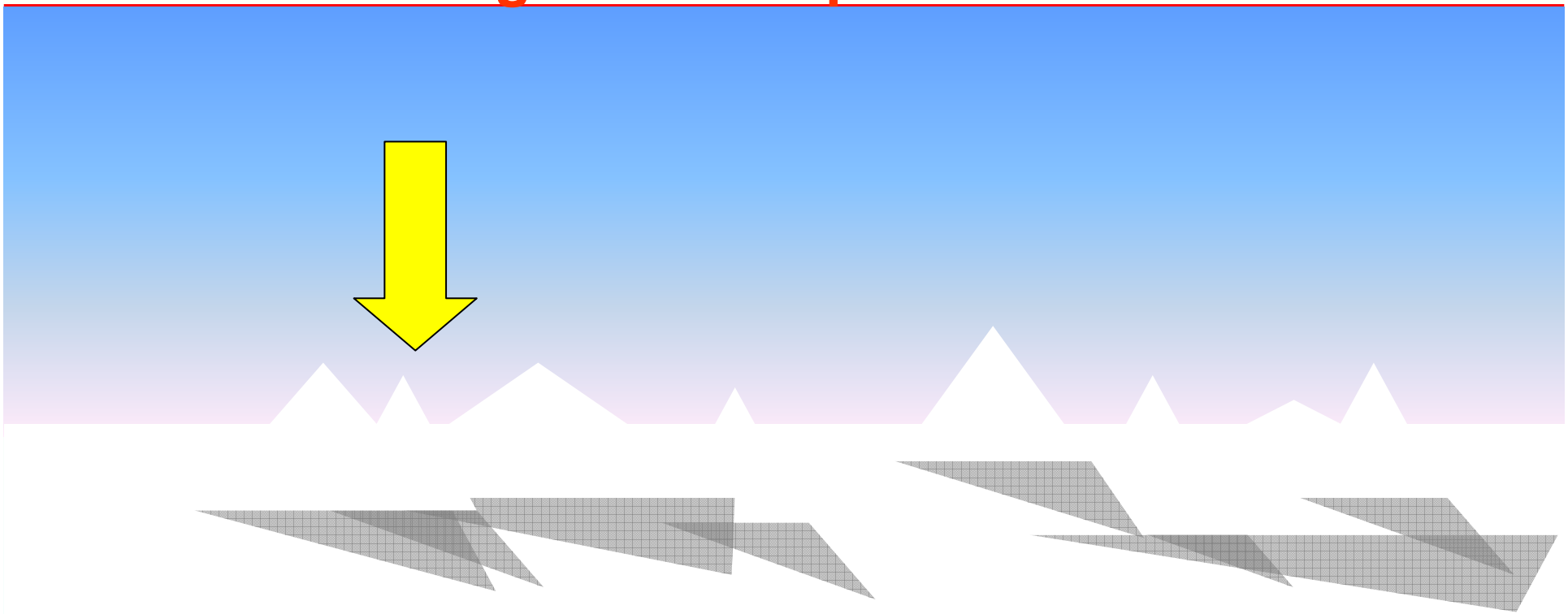
- 3 units --> 3 x (2 x 25) cm drift regions
  - 1m^2 triple mesh circular frames; V_{active}~ 1.5 m^3
- Low-cost CCD cameras inside active volume (20°C)
- 25-50 cameras/plane; KAI220 chip & 0.95/25 lens



DM-TPC (very preliminary)

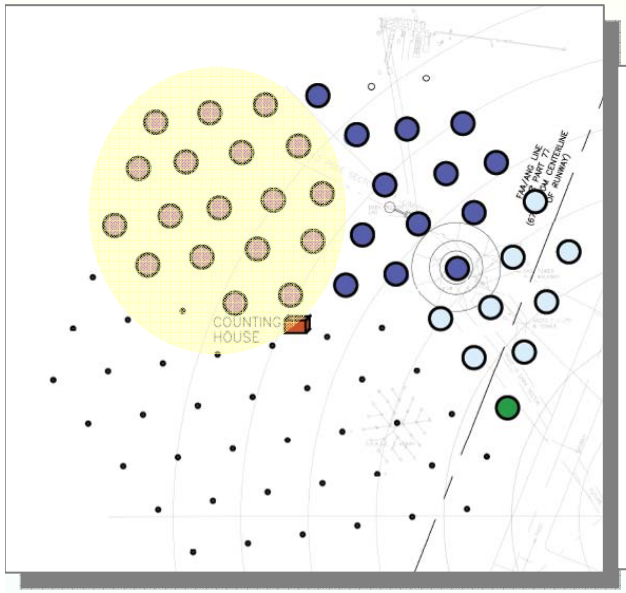
DATA listed top to bottom on plot
ZEPLIN II SD-proton
PICASSO SD-proton (2005)
Tokyo 2005 CaF2, SD-proton
SIMPLE SD-proton (2005)
DAMA 2003 NaI SD-proton (est.)
XENON10 SD-proton (preliminary)
NAIAD 2005 Final SD-proton
COUPP 2007 (5 keV threshold, 40 C) SD-pro
KIMS 2007 - 3409 kg-days CsI SD-proton
COUPP 2007 (19 keV threshold, 30 C) SD-pr

Messengers from space

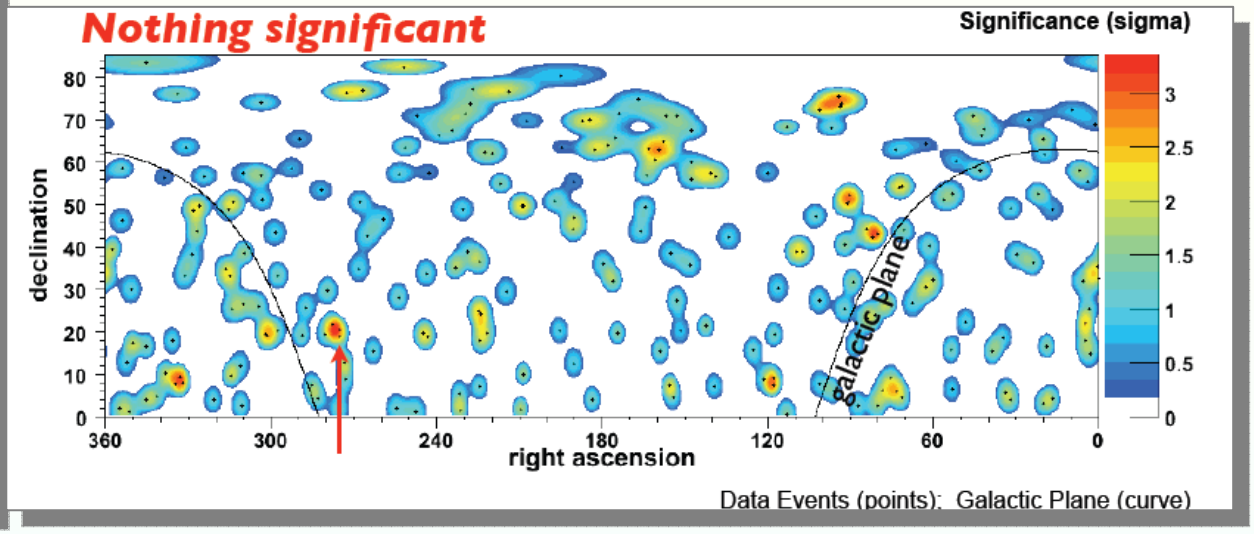


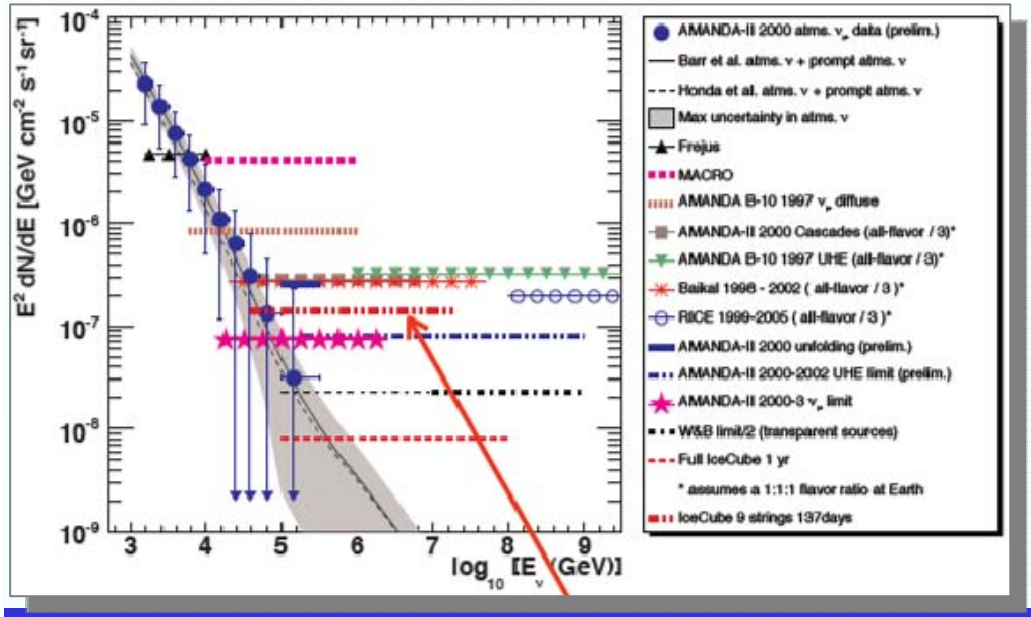
AMANDA-ICECUBE

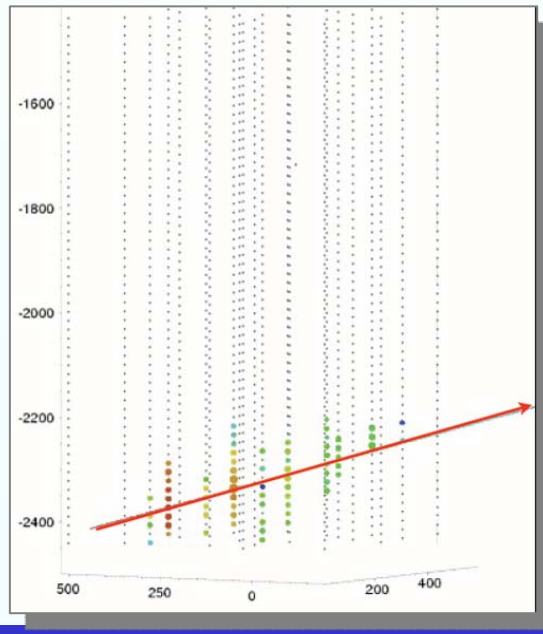
Roucelle



Point sources of neutrinos?



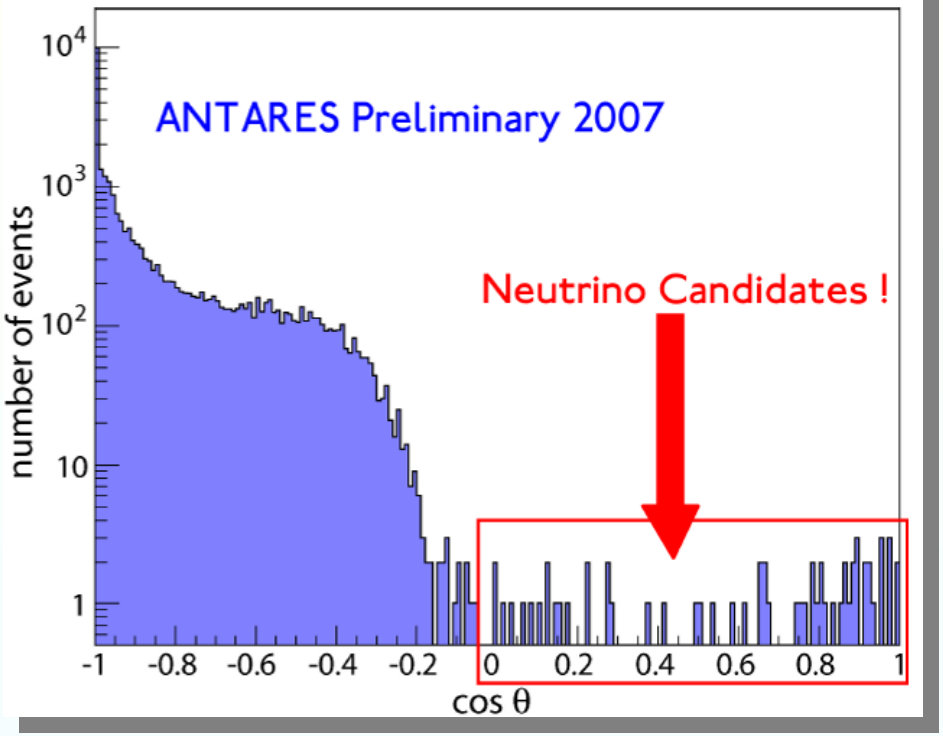




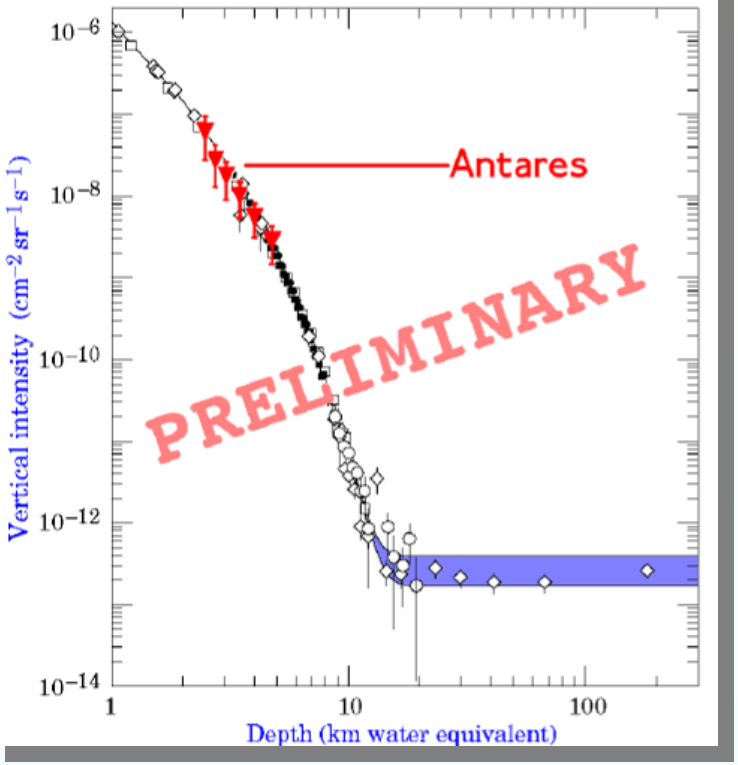
ANTARES

Pradier

Zenith Angle Distribution



Atmospheric muons flux



New

Borghi

CAST results: ^{4}He phase II

- Improvement by a factor of 7 wrt previous experimental searches.
- It goes beyond astrophysical limit of globular clusters for coherence masses

Article published: JCAP04(2007)010

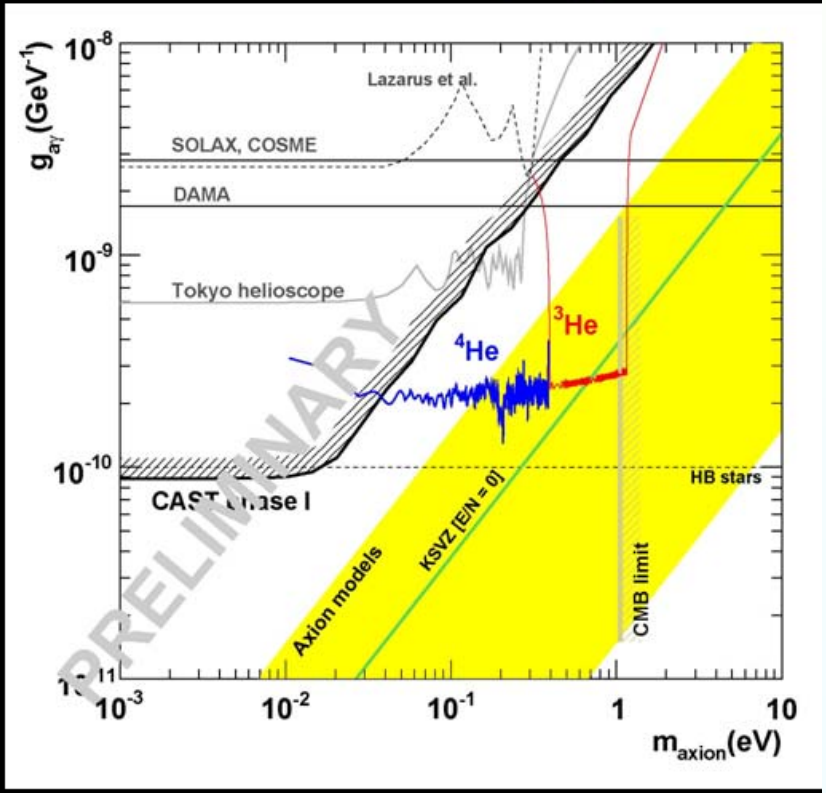
- Data taking with ^{4}He performed all along 2006
- ~160 density steps performed, reaching ~13 mbar (~0.4 eV)
- QCD theoretically axion models region is entered!!.
- **Finalizing Analysis. Publication under preparation**

- ^{3}He phase will start in few weeks entering deeper into the QCD theoretically axion models region

Phase I vacuum: $m_a \leq 0.02$ eV

Phase II ^{4}He: $0.02\ eV \leq m_a \leq 0.4$ eV

Phase II ^{3}He: $0.4\ eV \leq m_a \leq 1.15$ eV



High Energy Gamma Rays from Space

Glicenstein

- Surveying capabilities (HESS)⇒ new sources found on a regular basis

- Galactic Center: signal from Sgr A East excluded (HESS)

- Indirect dark matter search:
  new results from HESS (Sgr dwarf),MAGIC (Draco), Whipple
  still lacking 2-3 orders of magnitude

- interesting bounds on quantum gravity scale (MAGIC)

- new instruments coming very soon:
  ground-based: MAGIC-II (2008)
  HESS-II (2009)
  satellite: GLAST (2008)

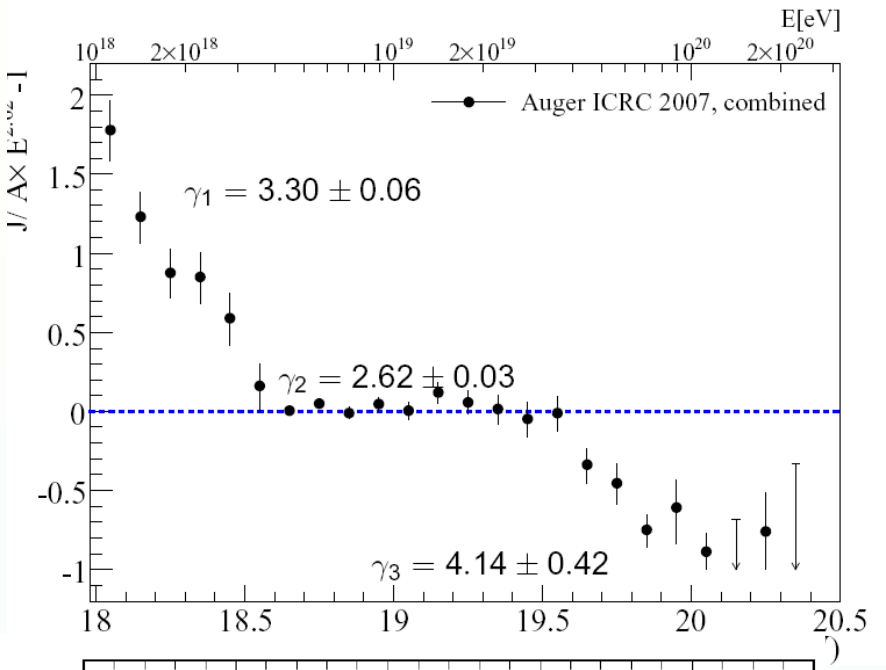
Air Fluorescence Yield

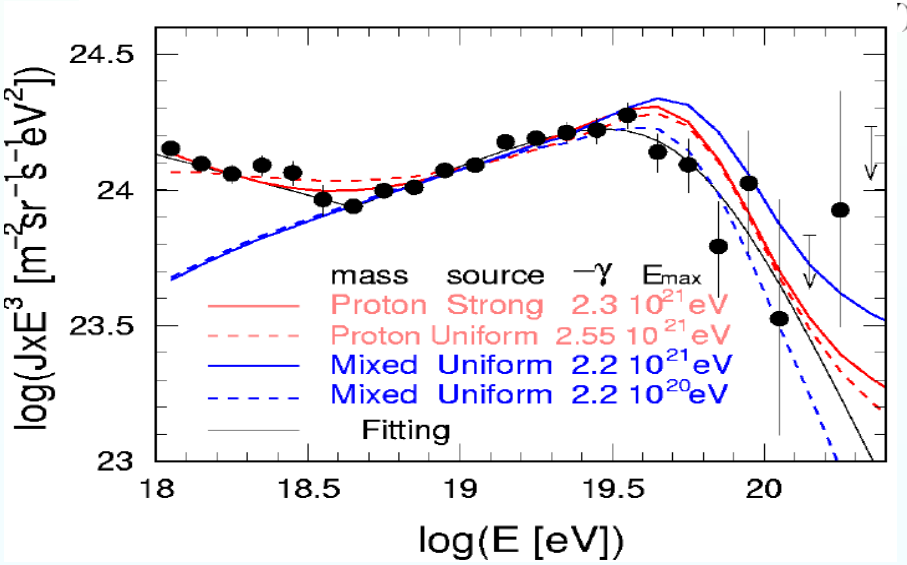
Arqueros

- Calculating the absolute FY is a challenge
- Needed by many experiments
- Laboratory studies by several groups
- New results over the last 3 years
  - General agreement
    - But still some large discrepancies and some model uncertainties
- Absolute values have uncertainty ~10%

Auger Energy Spectrum

Mariş

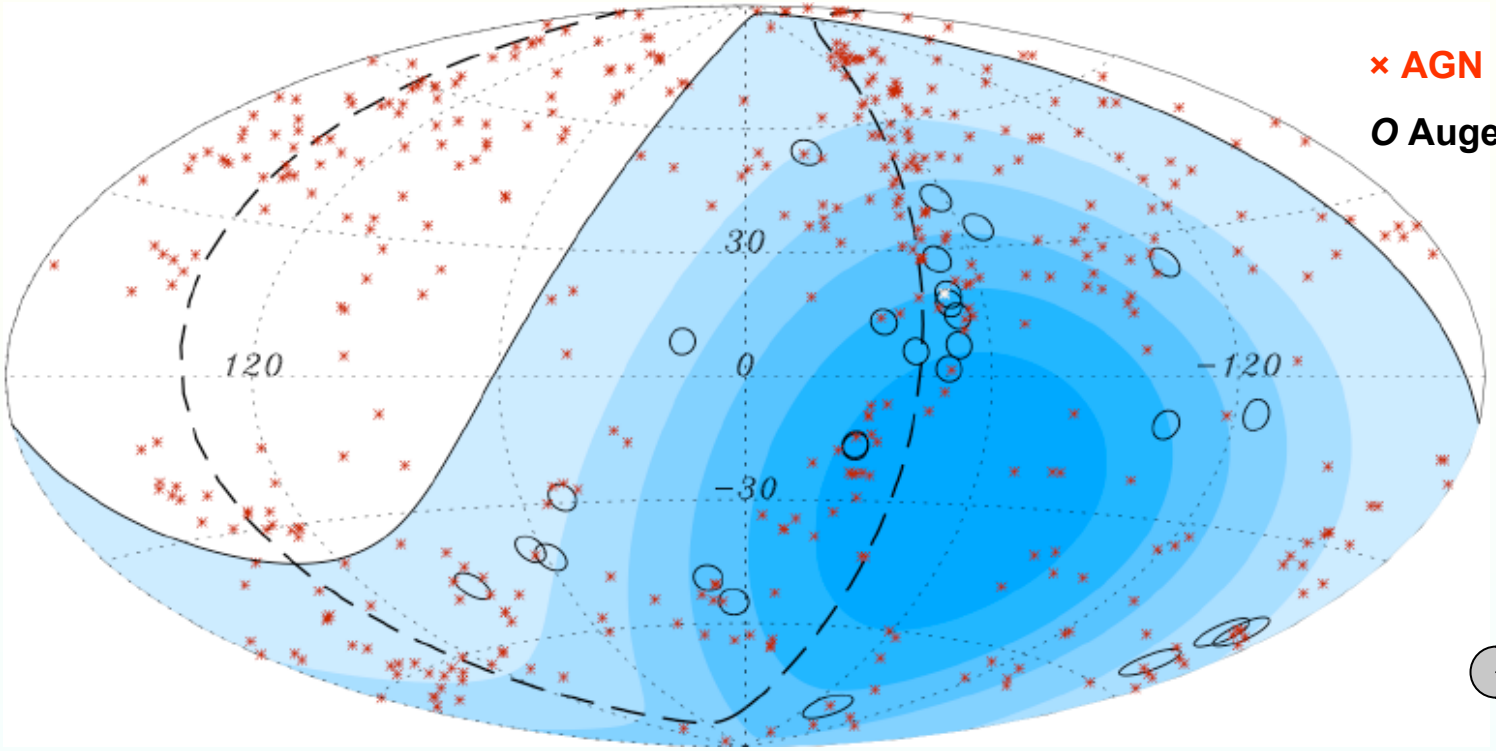


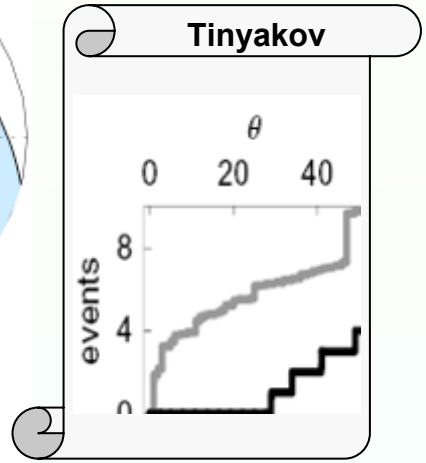


- **Energy Spectrum**
  - 6 σ evidence for suppression at high energies – GZK effect
- **Composition**
  - Mixed composition
    - Photons excluded
    - Neutrino limits

Anisotropies & correlations in UHECR

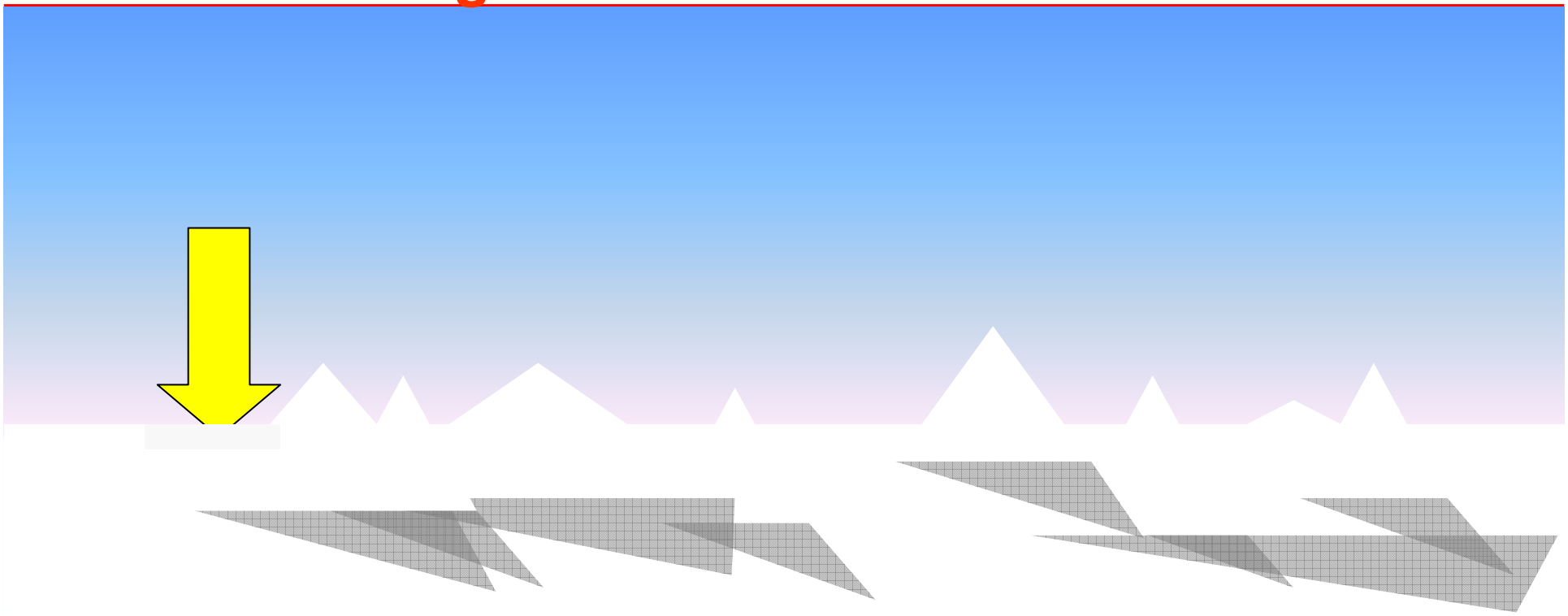
Bonino





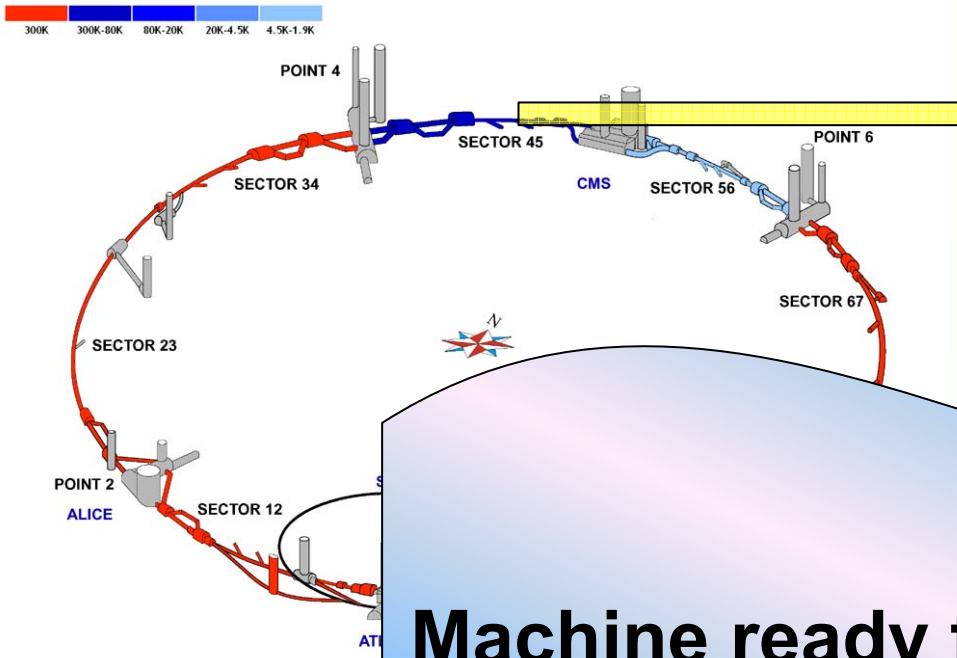
- Anisotropy confirmed at 99% CL
- Compatible with origin in extragalactic sources within GZK horizon
- Small angular scale suggests predominantly light composition
- Not identify unambiguously AGN as the sources

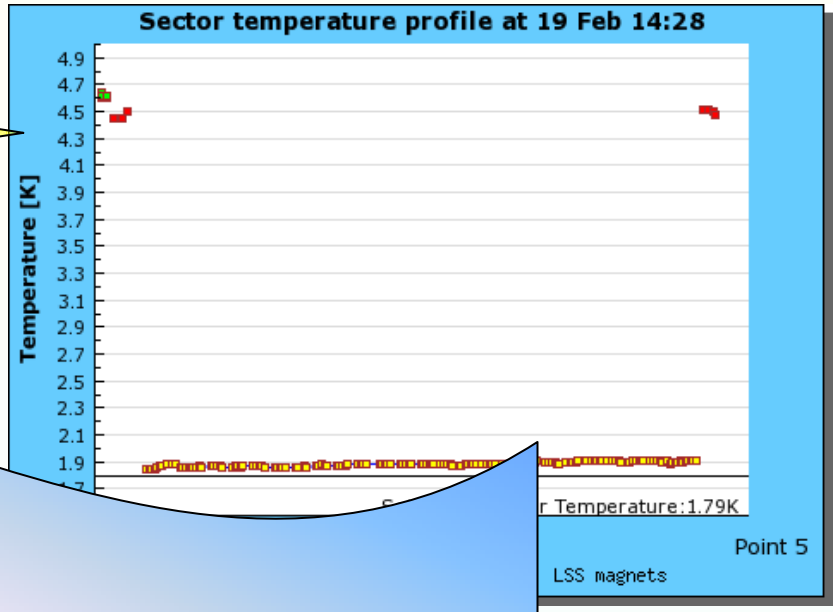
Waiting for the LHC



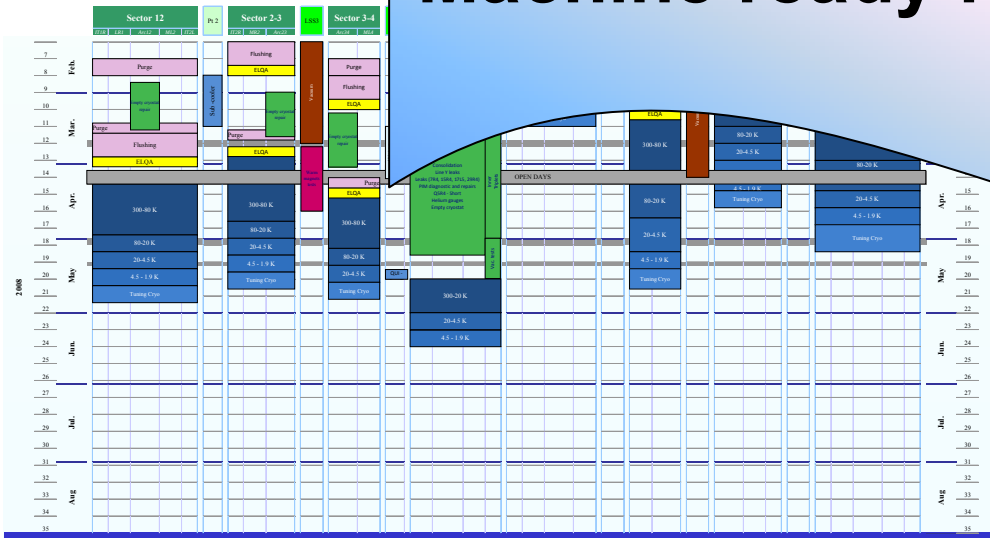
LHC Machine Status

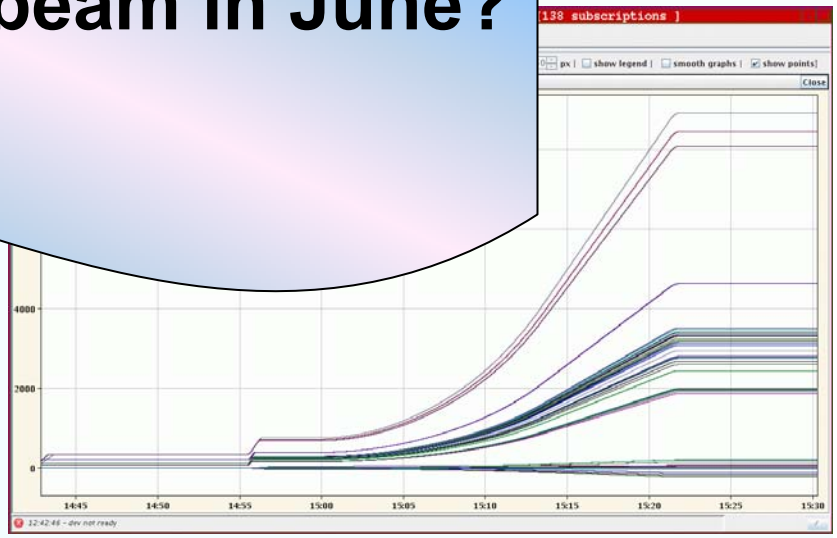
Evans





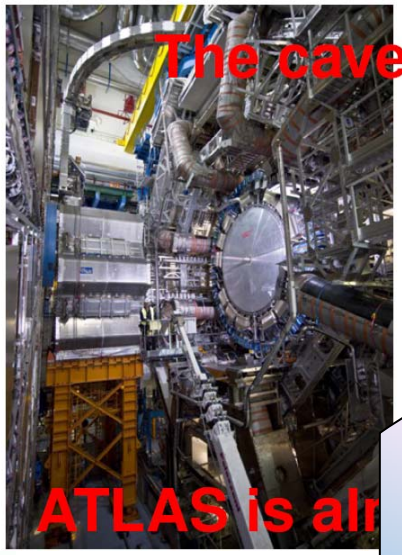
Machine ready for beam in June?

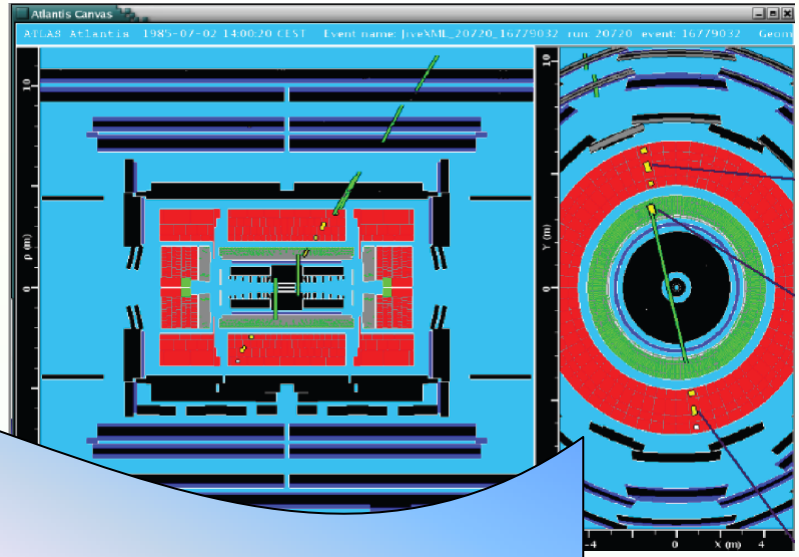




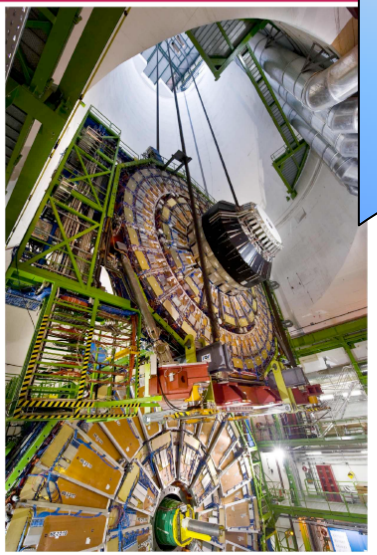
Experiments

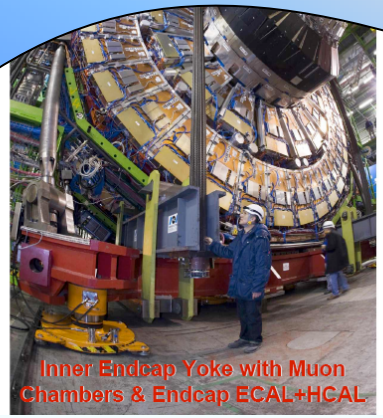
Plamondon, Christiansen



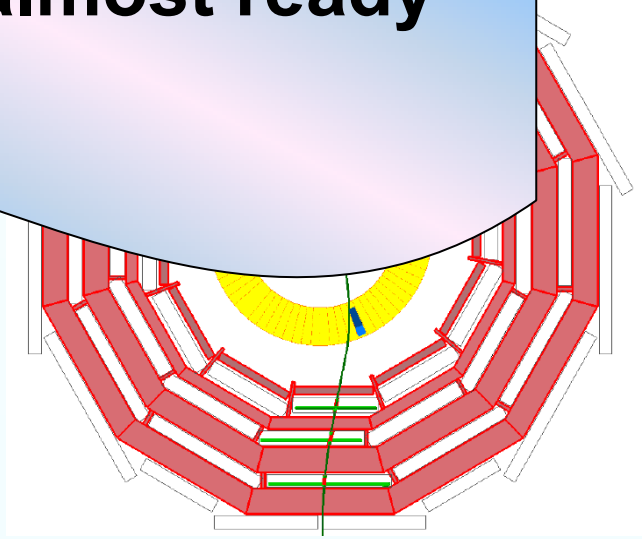


Touch-down for t
Structure of CMS





Experiments almost ready



First physics ready

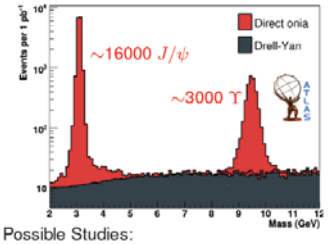
Plamondon, Christiansen

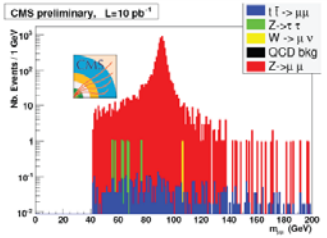
Calibration Early measurements Early discoveries

First peaks: $(J/\psi, \Upsilon, Z) \rightarrow \mu\mu$

Statistics for 1pb^{-1} (3.85days) @ 10^{31} assuming a 30% detector+machine efficiency

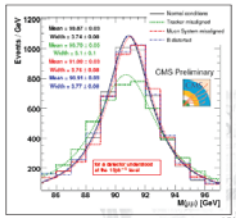
After all cuts: ~600 $Z \rightarrow \mu\mu$ events per pb^{-1}





Possible Studies:

- with J/ψ: sanity checks, tracker alignment and momentum scale
- with Z: detector efficiencies, trigger performance, detector momentum scale, alignment



- use the Z boson mass candle to assess:
  - misalignments of tracker and spectrometer
  - uncertainties on the magnetic field (distorded B field)

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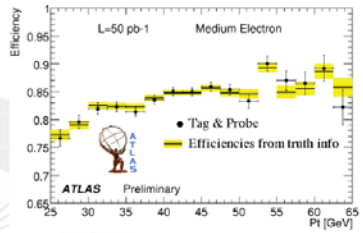
Calibration Early measurements Early discoveries

Z and W cross-sections

for 100pb^{-1}

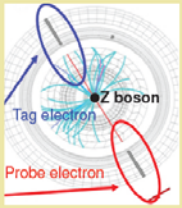
	$\frac{\Delta\sigma}{\sigma}(pp \rightarrow Z/\gamma^* + X \rightarrow \mu\mu)$
ATLAS	$0.004(stat) \pm 0.008(sys) \pm 0.02(th) \pm 0.1(lumi)$
CMS	$0.004(stat) \pm 0.011(sys) \pm 0.02(th) \pm 0.1(lumi)$

- not statistically limited
- systematics at the 1% level (efficiencies,background,. . .)
- Tag&Probe method used to determine efficiencies
  - single lepton trigger to allow unbiased probes
  - agrees well with truth matching (<1% in average)
- theoretical error at 2%, rel. acceptance determination and PDFs
- **limited by luminosity uncertainty: 10%**



Tag&Probe method

- well identified electron on one side: **tag** electron
- simple object on the other side (track or EM cluster): **probe** electron
- determine the efficiency with the number of events in the mass window: M_{inv}=$M_Z \pm$20GeV



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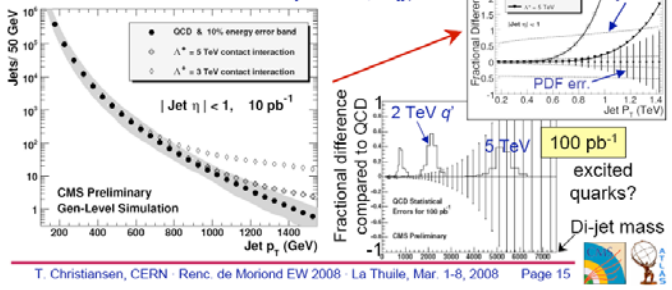
QCD High-E_T Jets

- Jet-*E* scale will dominate error:
  - ~ 10% JES uncertainty for 10 pb^{-1}
  - Measure QCD jet-p_T spectra up to 1 TeV and beyond
  - Contact interactions: large rate at high-p_T, with 10pb^{-1} sensitive to 3 TeV scale C.I. …further use di-jet ratios, $m(jj)$ …



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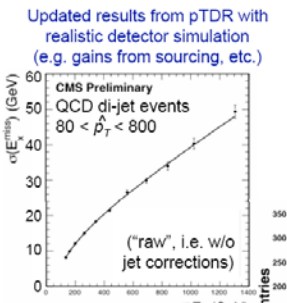
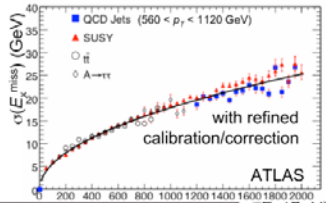
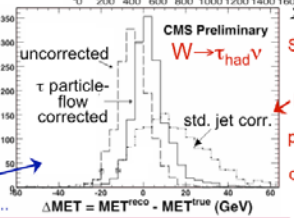
Missing Transverse Energy

Updated results from pTDR with realistic detector simulation (e.g. gains from sourcing, etc.)







Standard jet correction not optimal here due to different jet properties & flavor composition

Corrections from particle-flow are promising to improve resolution, see here for τ-jets; further P.F. studies in preparation…

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If it is there …

Tsuno

Inclusive analysis with MET+Jets

At topology level,

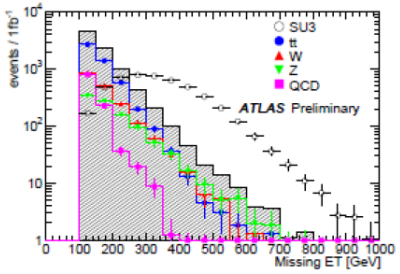
ATLAS baseline selection :

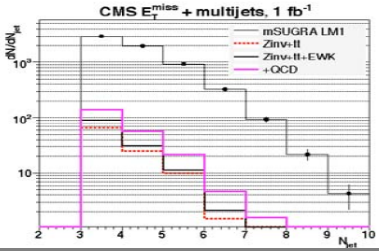
- no lepton

SUSY Cut
- MET > 100 GeV
- leading jet pT > 100 GeV
- at least 4-jets pT>50 GeV
- MET > 0.2 Meff

CMS :
- MET > 200 GeV
- 1st jet pT>180 GeV, 2nd pT>110GeV
- at least 3-jets pT > 30 GeV
- HT > 500 GeV

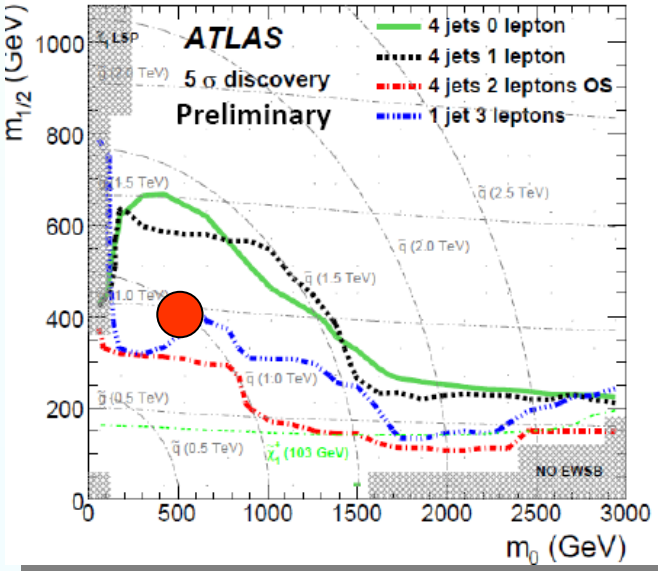
Main backgrounds : QCD jets / W/Z/top



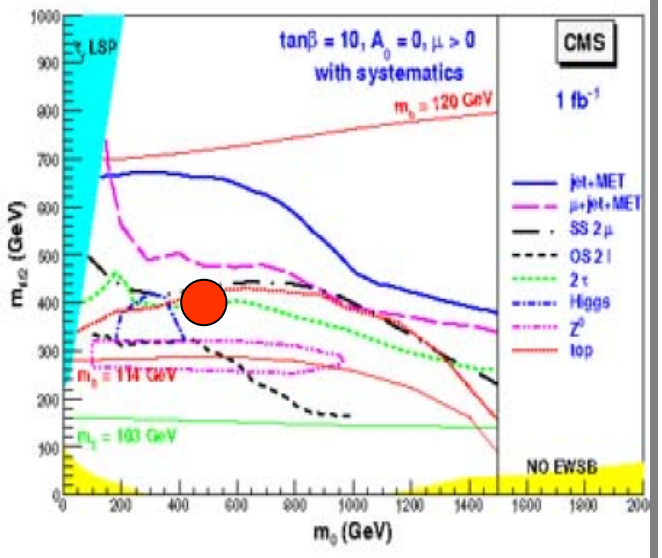


… the experiments will see it

ATLAS CSC 2008



CMS Physics TDR 2006



… and any available (Brout-Englert) Higgs

Tsuno

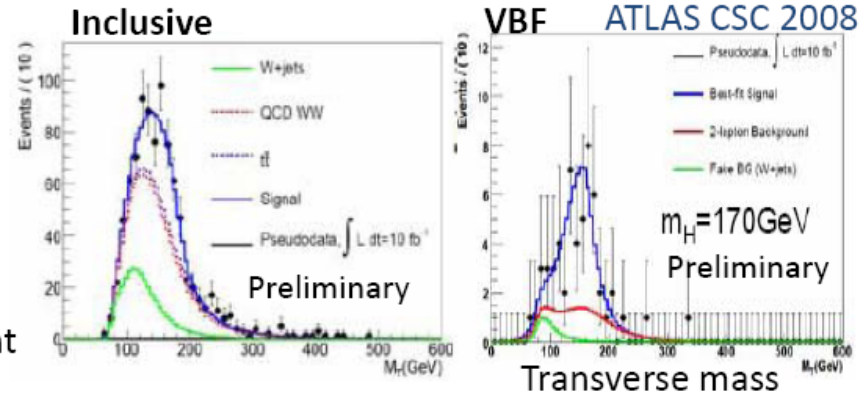
H → WW → 2leptons

Expects large excess of events.

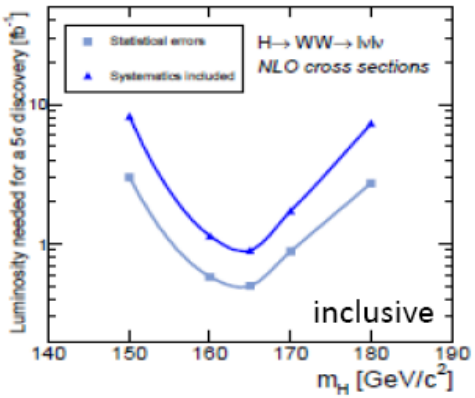
The VBF analysis is also promising channel.

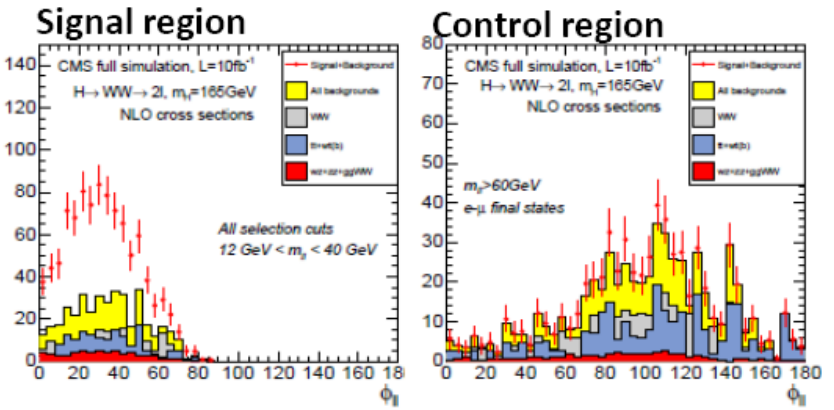
Background normalization by data.

Control region (Normalize WW) (CMS):
all selection except di-lepton invariant mass cut (mll<60GeV).



CMS Physics TDR 2006



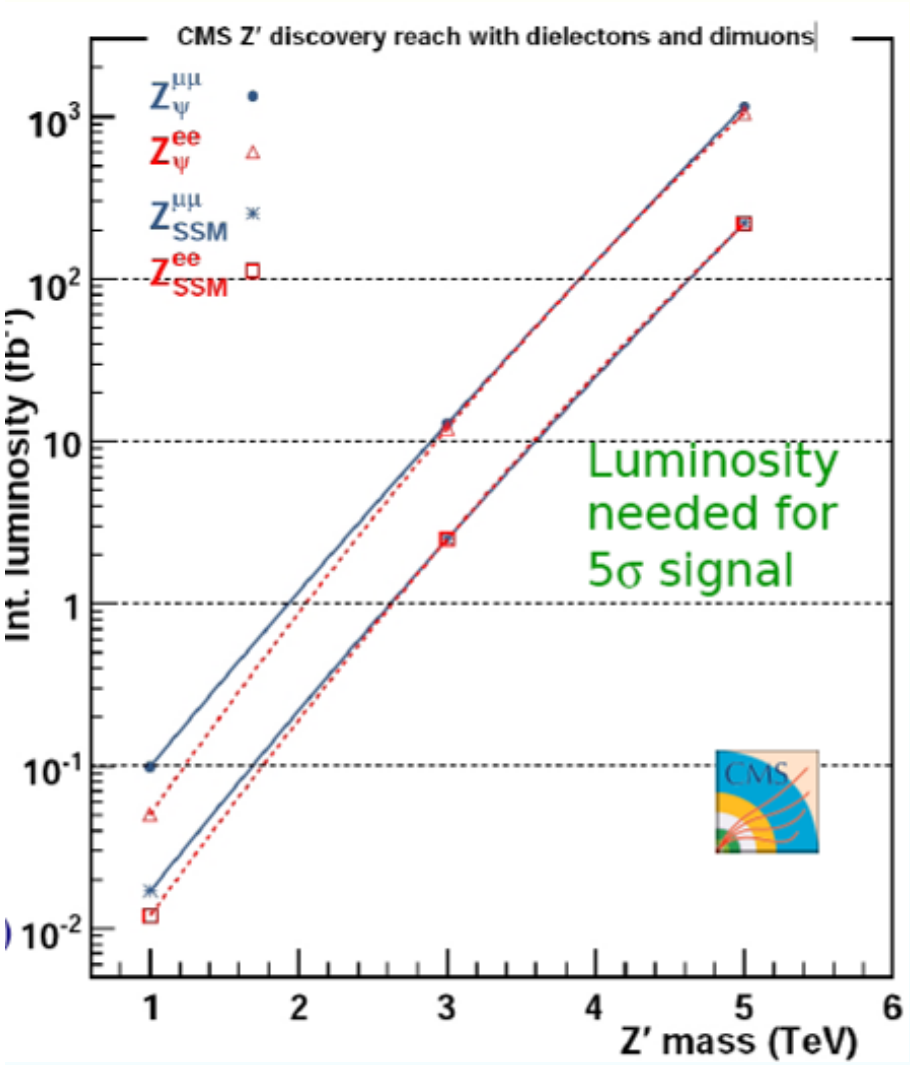


Will observe 5σ excess (160GeV) at 1fb^{-1}.

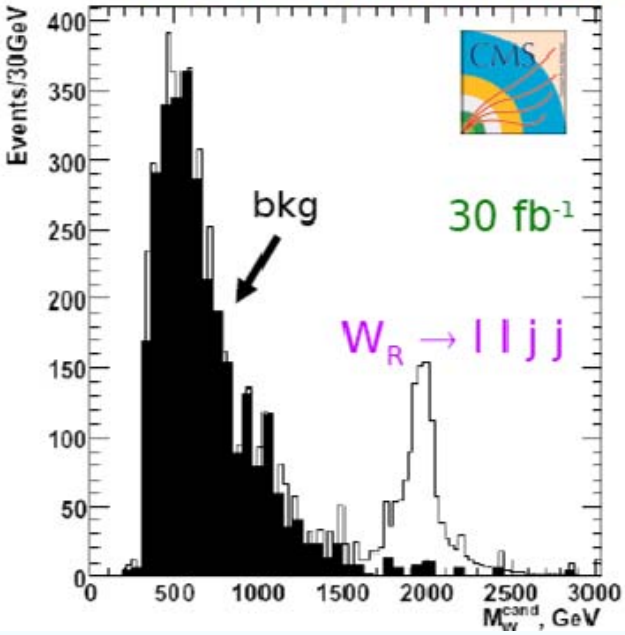
CMS Physics TDR 2006

… and exotica

Bellan

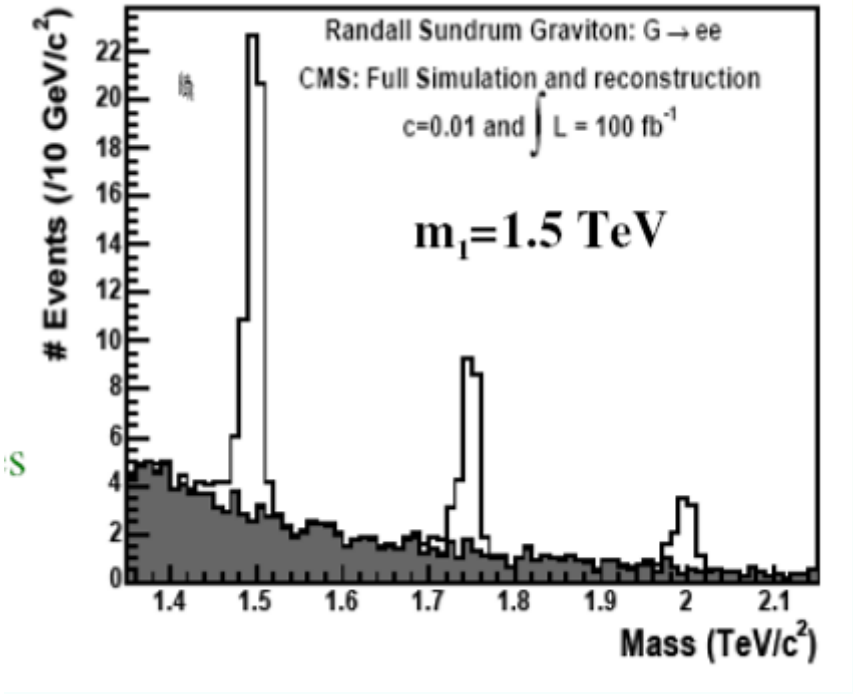


- Symmetry between **Left and Right**
  - $SU_C(3) \otimes SU_R(2) \otimes SU_L(2) \otimes U_Y(1)$
- Signature:
  - di-lepton + 2 jets for W_R
  - 1 lepton + 2 jets for heavy neutrino N_l

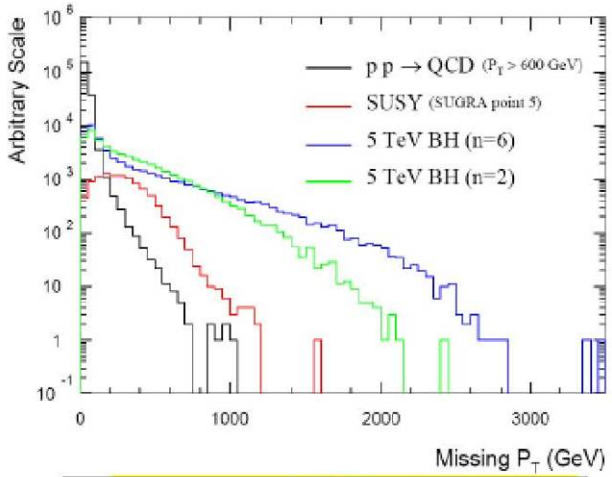


… and even more exotica

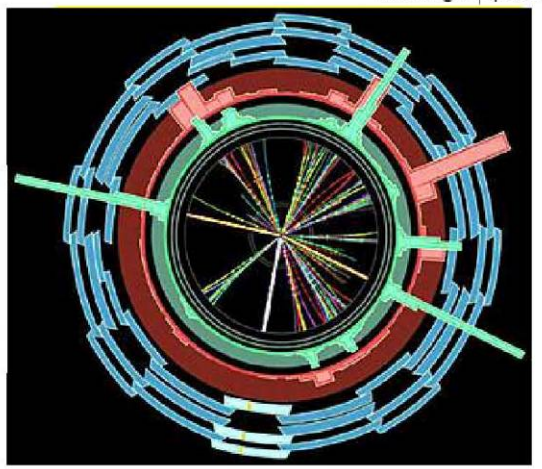
Bellan



Could be discovered with
$1\ fb^{-1}$ if $M_D < 5$ TeV

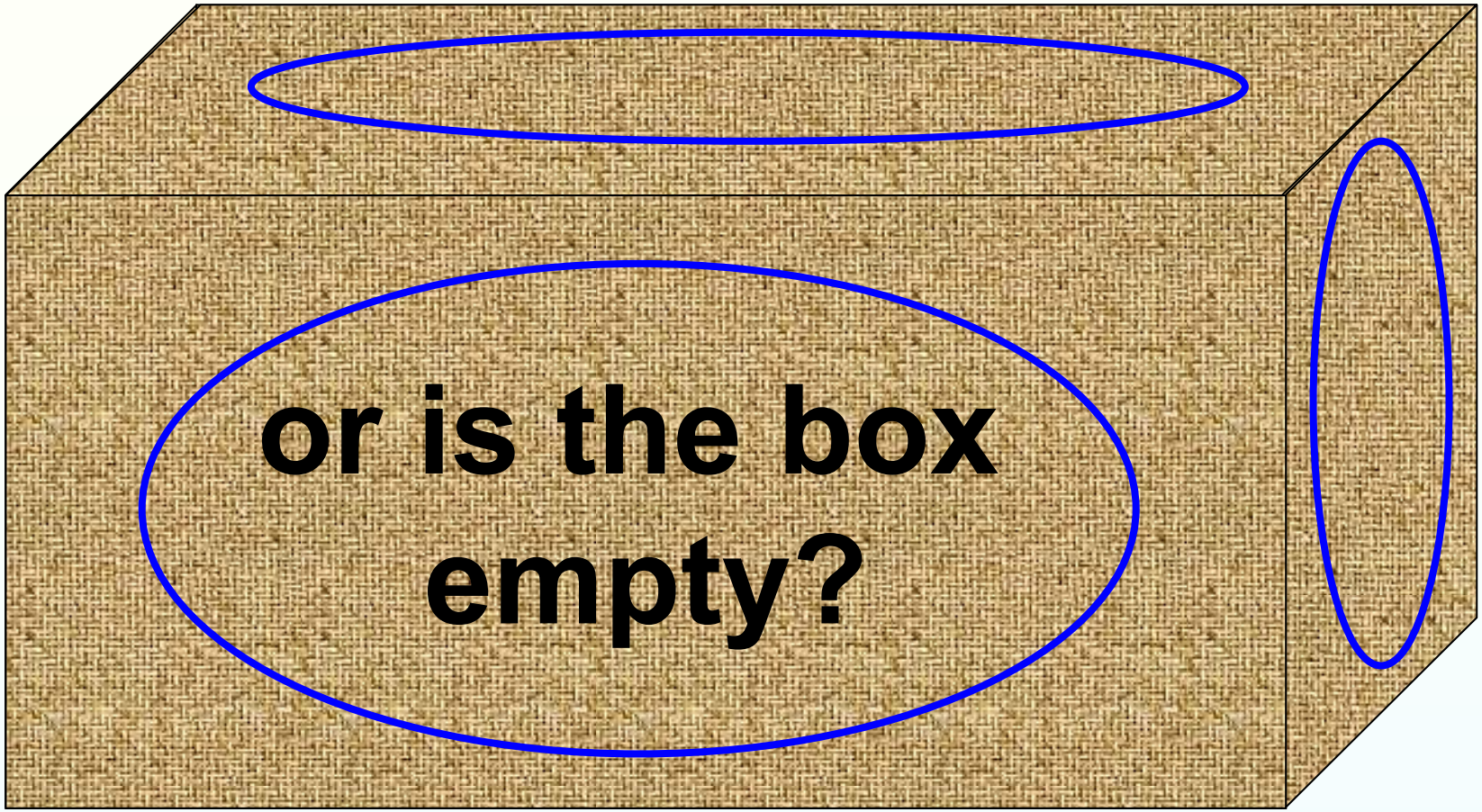


But Lisa Randall's comments



BH → (q and g : leptons : Z and W : ν and G : H : γ)
= (72% : 11% : 8% : 6% : 2% : 1%)

What will the LHC reveal?



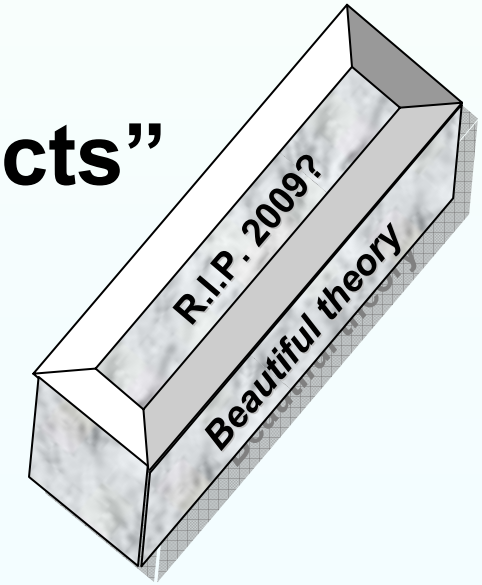
Where to find the new physics?

- ***When*** **we find the new physics**
  - **its effects will be seen in many places**
    - **where it is now hidden**
- **But where to look now?**
  - **Tevatron (CDF/D0) → LHC (ATLAS/CMS)**
  - **BELLE, BaBar & CLEO → LHCb**
  - **Neutrinos**
  - **Rare K, μ decays**
  - **Precision measurements**
  - **Astroparticle physics**
  - **Cosmology**

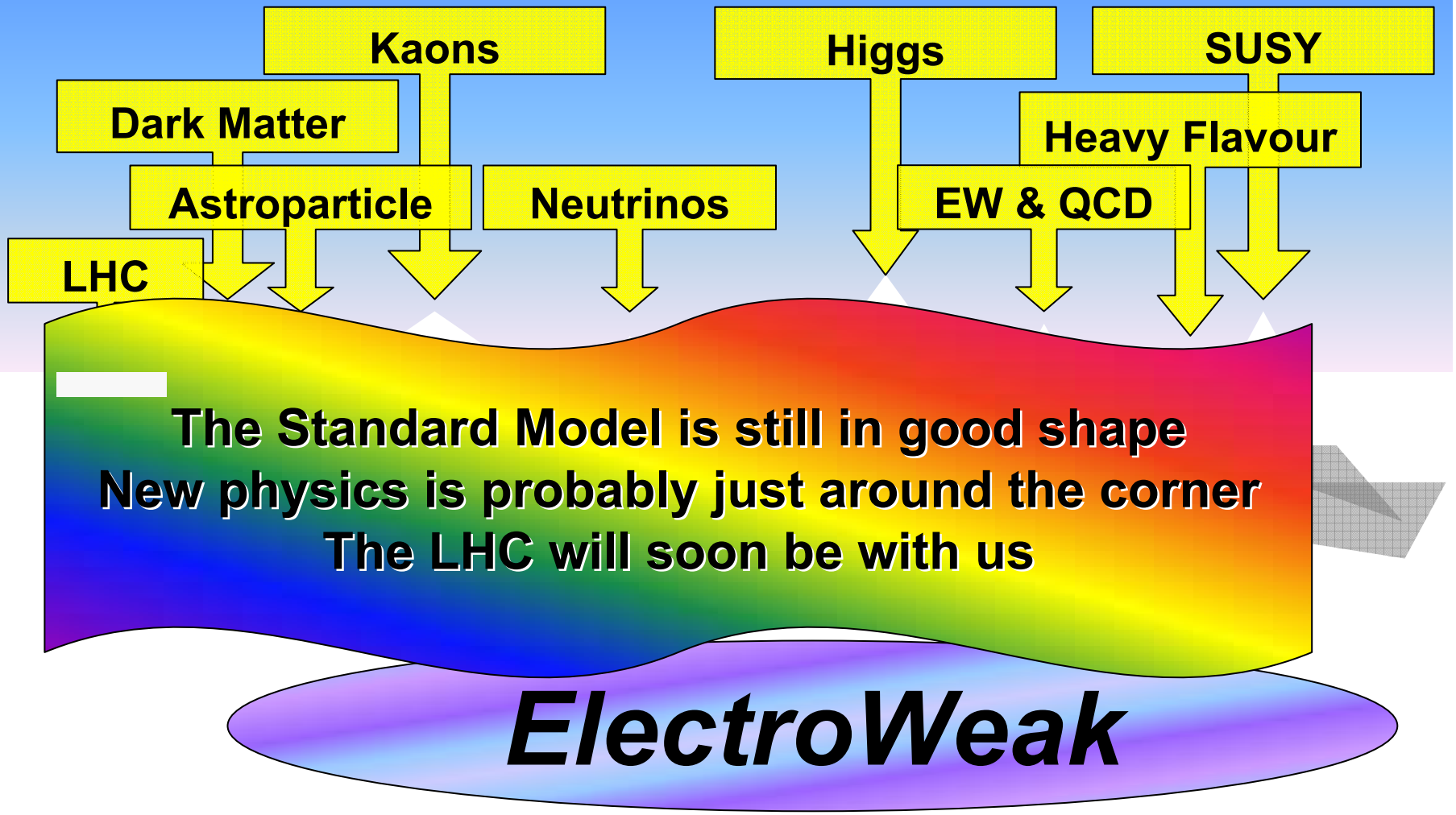
"The great tragedy of Science – the slaying of a beautiful hypothesis by an ugly fact"

T.H. Huxley

- **We have many "beautiful hypotheses"**
- **We need a few more "ugly facts"**
  - **from the LHC?**



Summary


Kaons
Higgs
SUSY
Dark Matter
Heavy Flavour
Astroparticle
Neutrinos
EW & QCD
LHC
The Standard Model is still in good shape
New physics is probably just around the corner
The LHC will soon be with us
ElectroWeak


… and finally …
SCROLL OF HONOUR
to
Tran Thanh Van,
Lydia Iconomidou-Fayard
&
Jean-Marie Frère
and all of the organisers
& hotel staff
for a wonderful "Moriond"