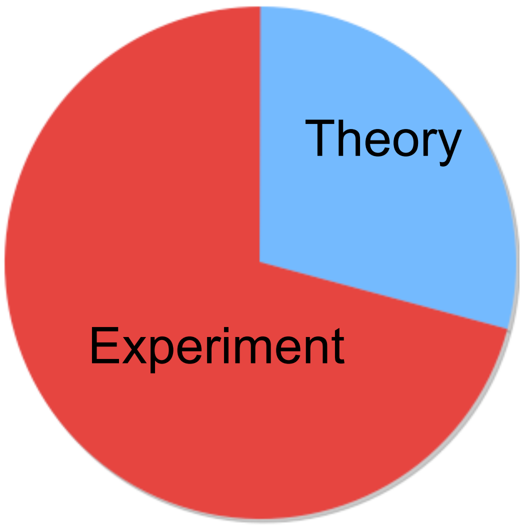
Experimental Summary

Cristinel Diaconu
Centre de Physique des Particules de Marseille and
Deutsches Elektronen Synchrotron Hamburg

Moriond QCD 2010

- Exciting results and excellent talks
- A summary can only be a selection, tried to do my best
- 93 talks



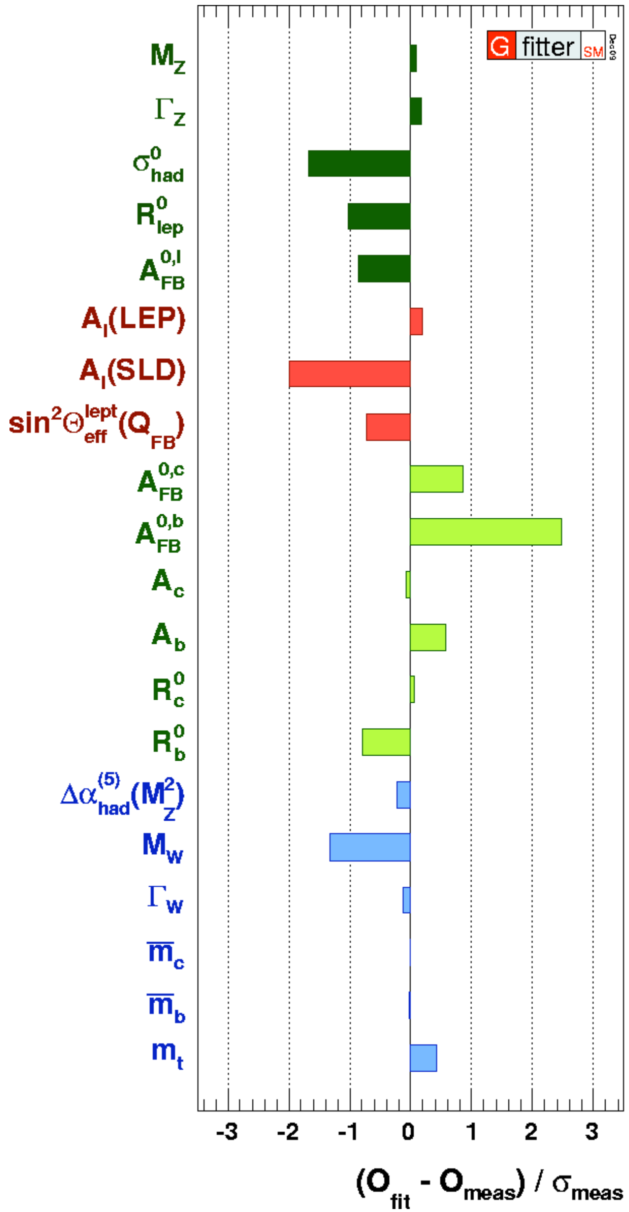
  - Some experimental subjects will be covered by Dmitri

SM (Sci Maestro)

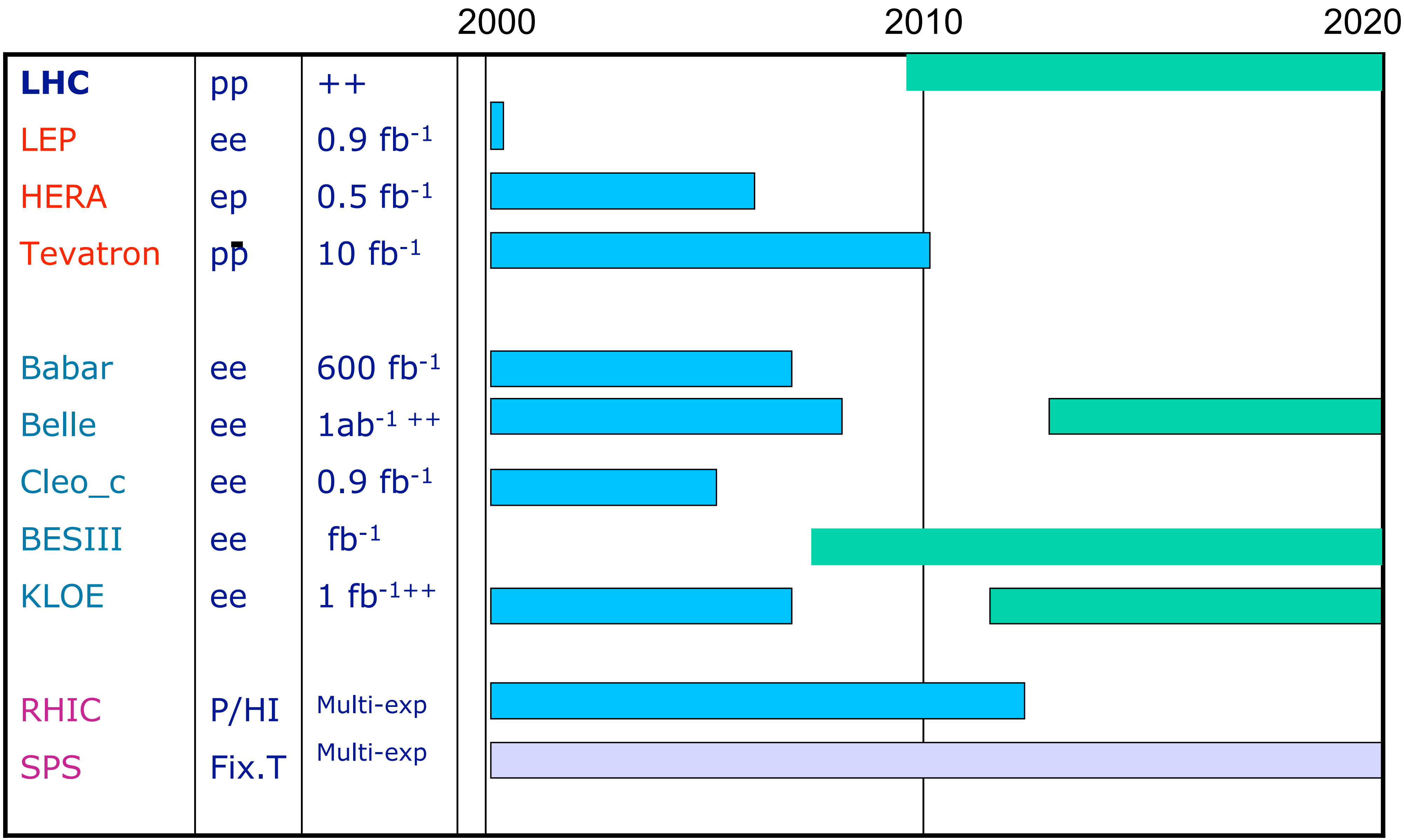
In perfect shape….

Open Questions:
-why 3 generations?
-why (so) different fermion masses?
-why these 4 forces?
…

And btw :
...do we know how QCD really works?



HEP experimental programs in +-10 years

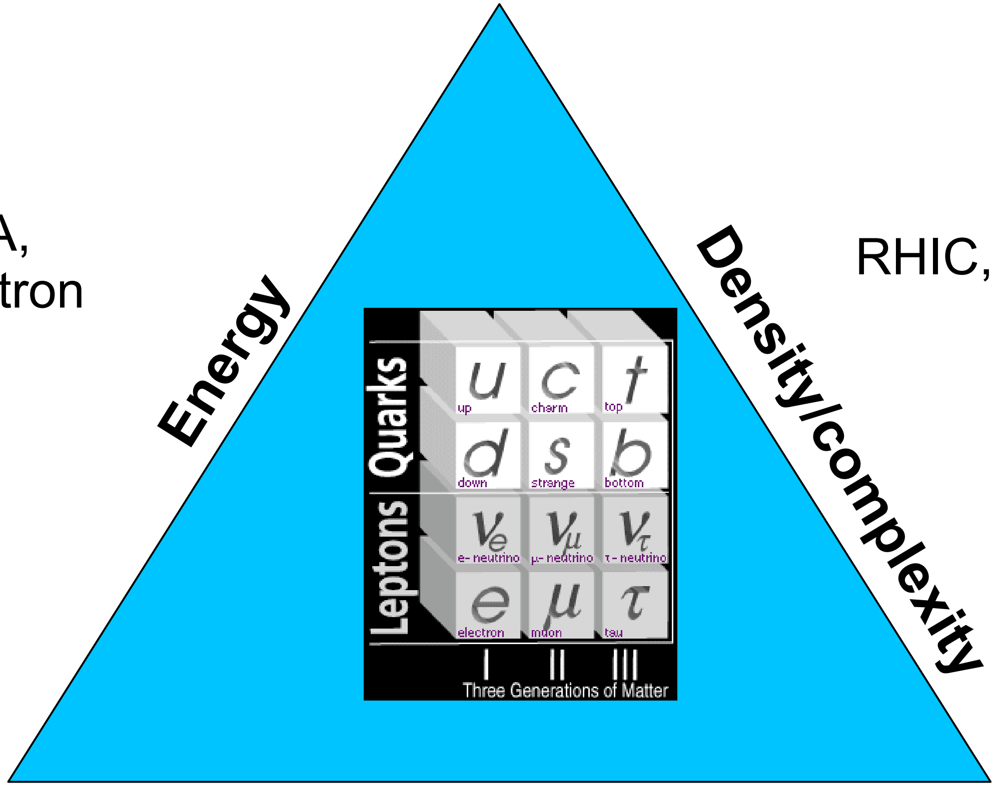


[not all programmes, dates are approximate, just to give the picture]

The experimental frontiers of the high energy physics

LHC,
HERA,
TeVatron
LHC

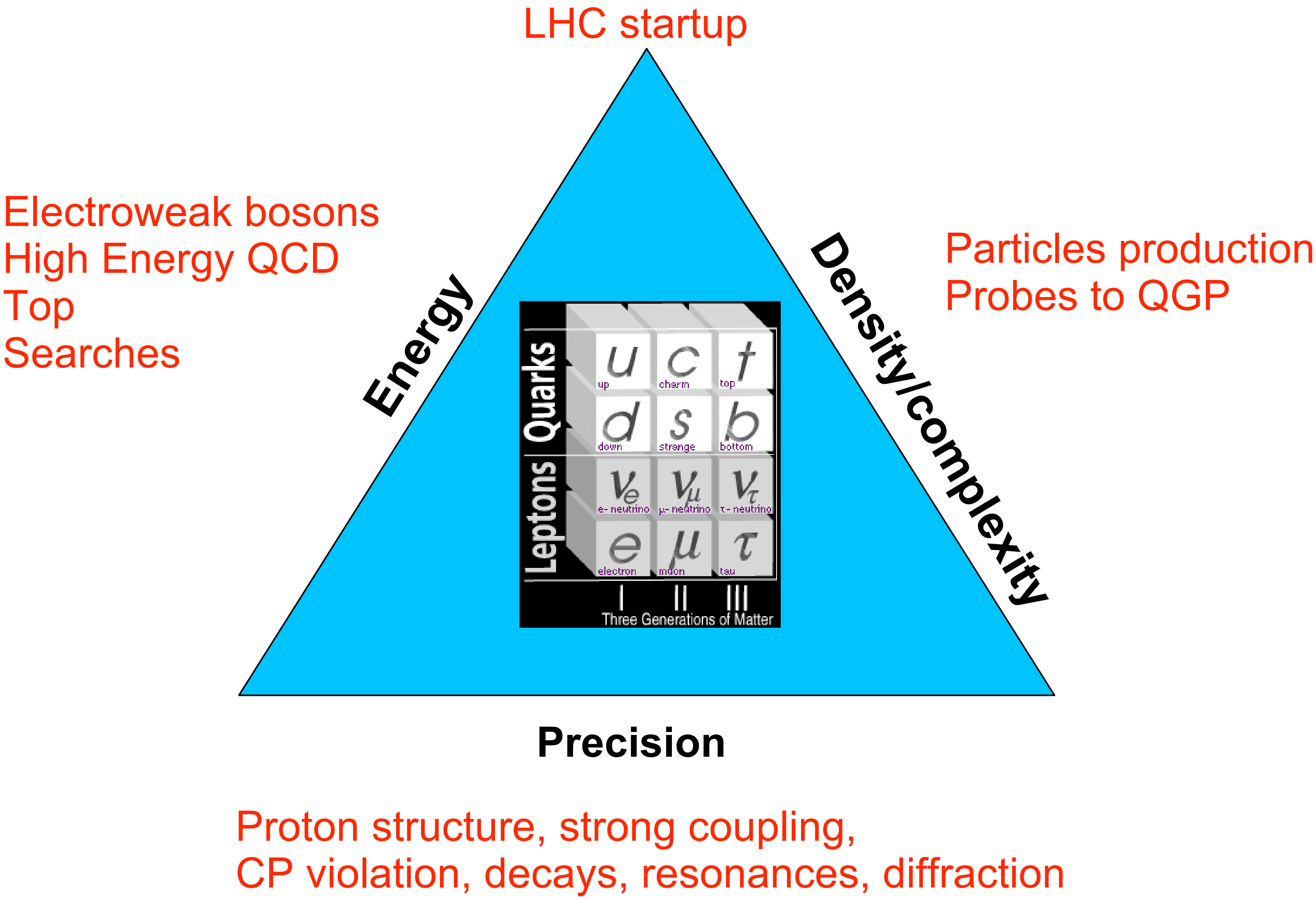
RHIC, SPS



Precision

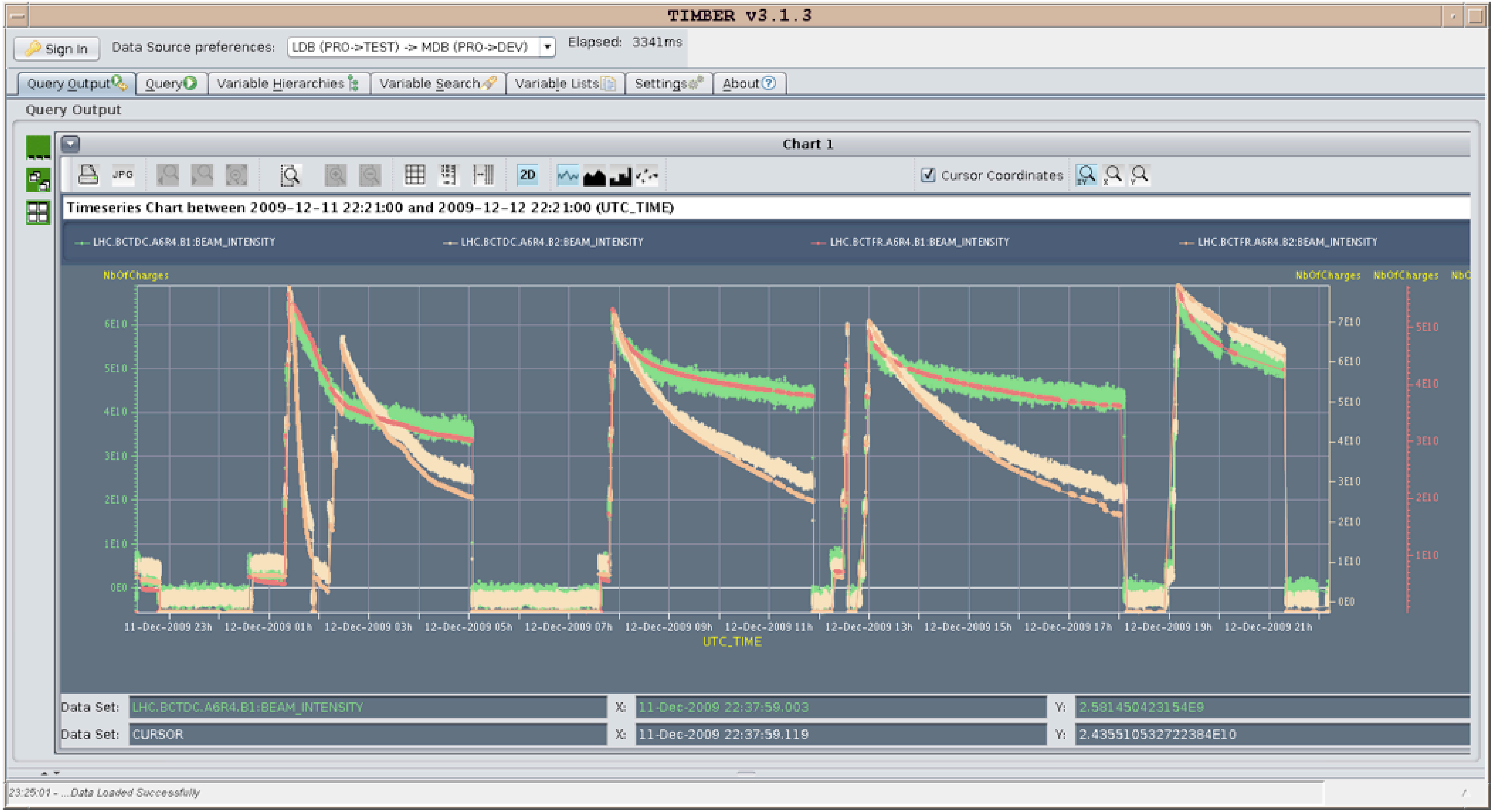
Babar, Belle, Cleo_c,BESIII,
KLOE, NA48, COMPASS, NA61

The experimental frontiers of the high energy physics



LHC startup

R. Bailey



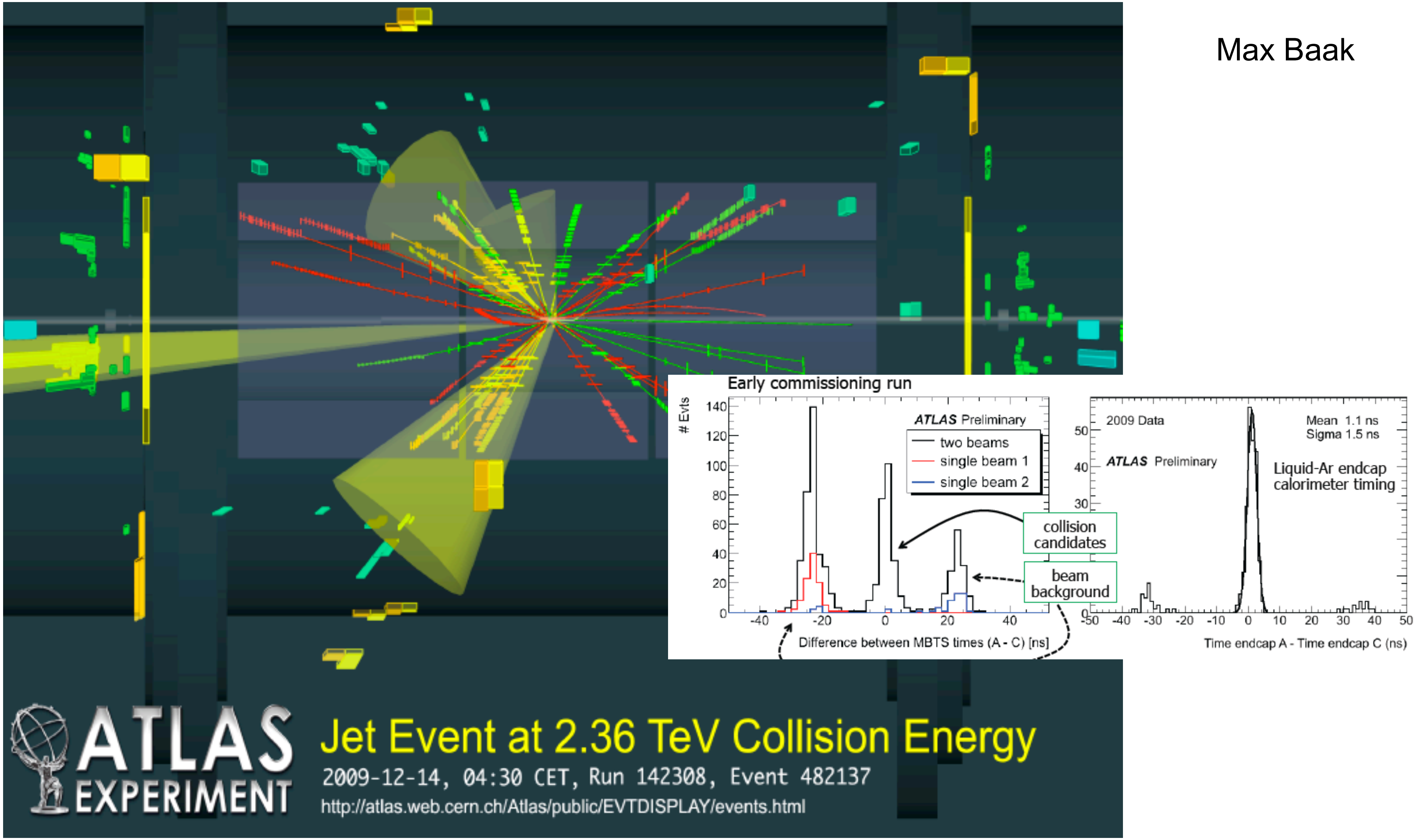
Luminosity Production!

LHC Detectors Readiness

- ALICE, ATLAS, CMS, LHCb have proven ability to reconstruct data and do physics analysis (albeit small data set so far)
  - Fruitful preparation with cosmics
- Calorimeters and tracking in very good shape
  - Subtle studies performed: conversions, dE/dx
- Particle identification demonstrated
  - Electrons and photons
  - Muons
  - Hadronic final state (Ptmiss), energy flow (CMS)
- Simulation in agreement with the data
  - Very good starting point for the first analyses

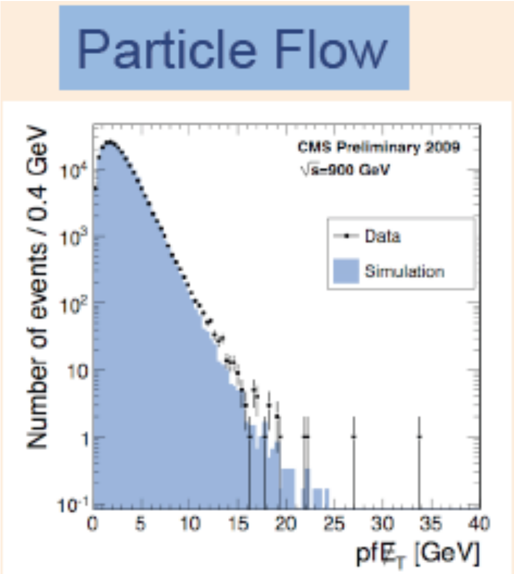
LHC start-up:ATLAS

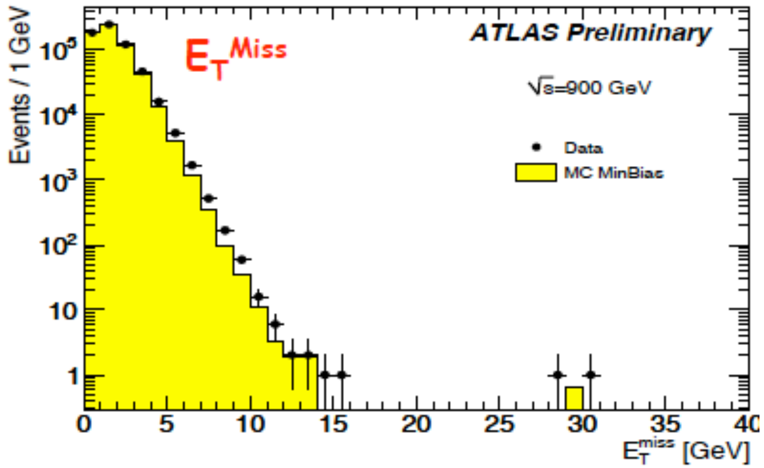
Max Baak

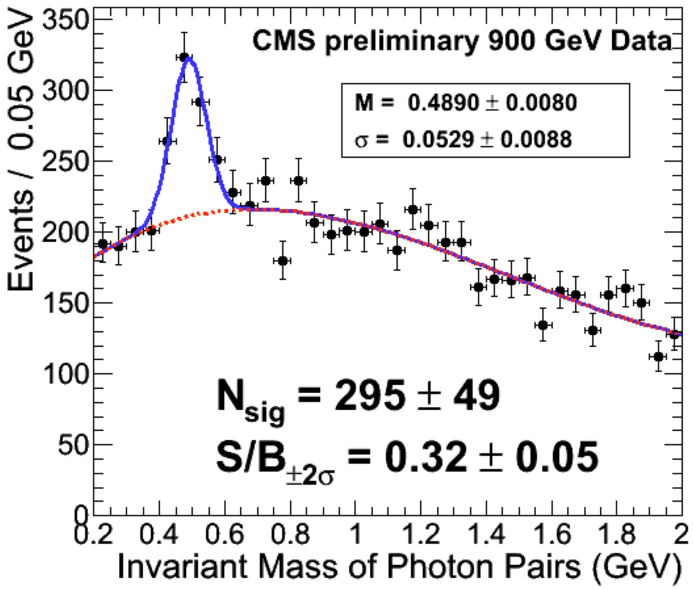


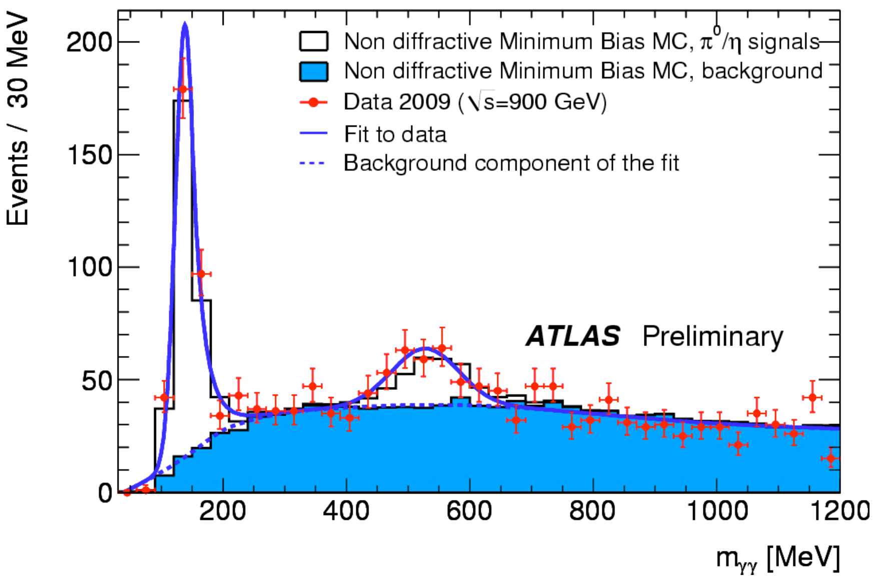
Calorimeters

E.Monnier
S.Rappocio
Chiara Rovelli



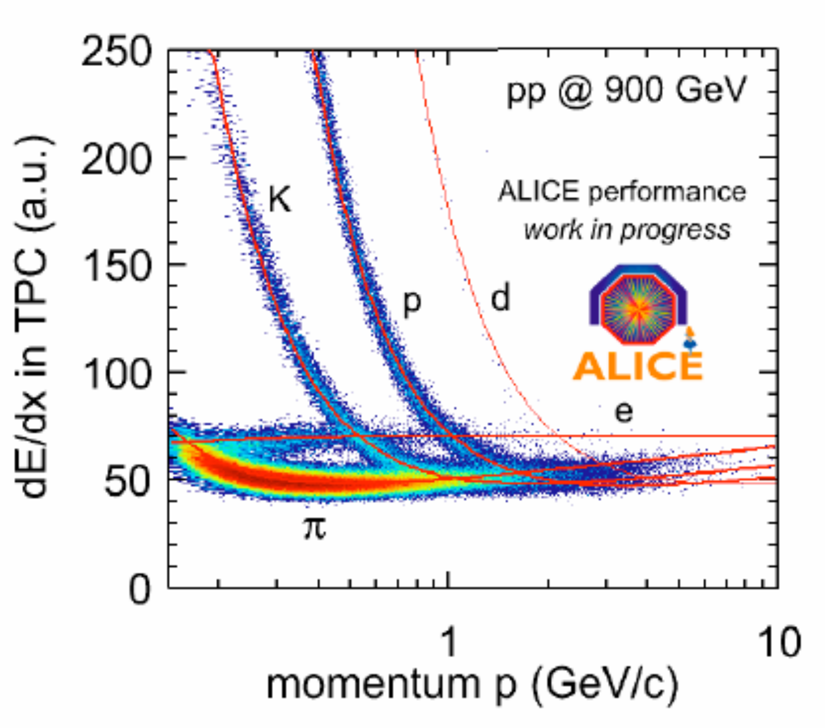




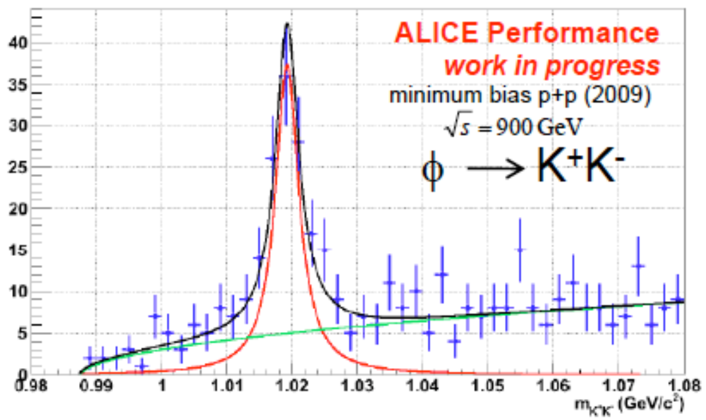


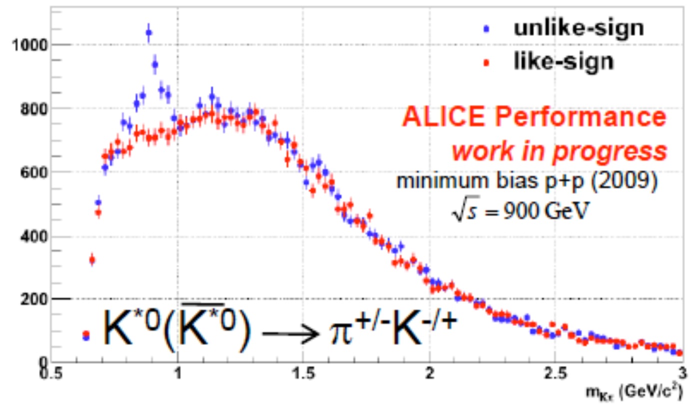
ALICE: identified particles

F.Noferini

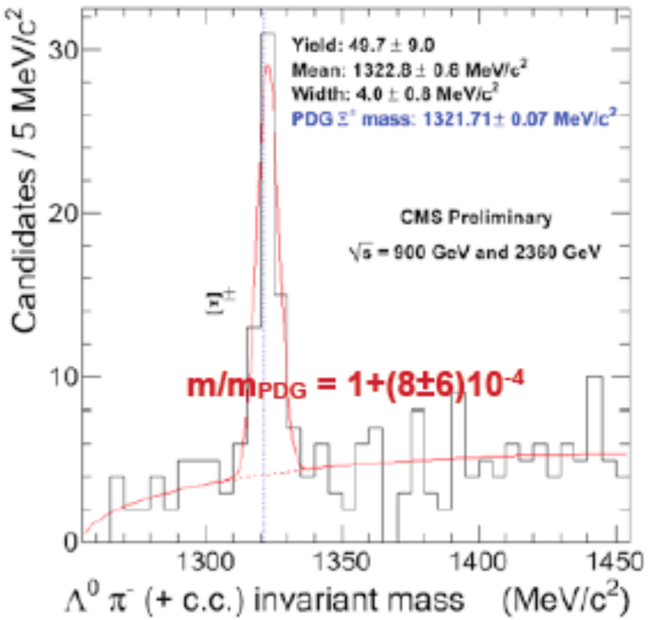


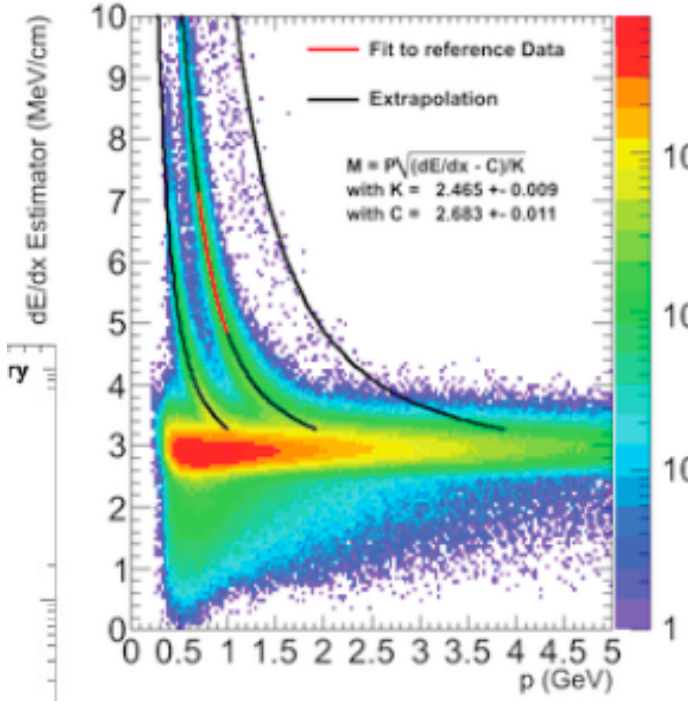
dEdx in the TPC





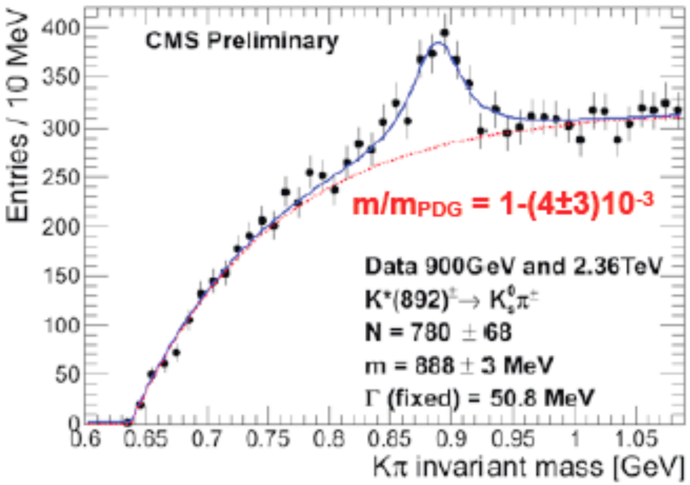
Tracking and muons CMS

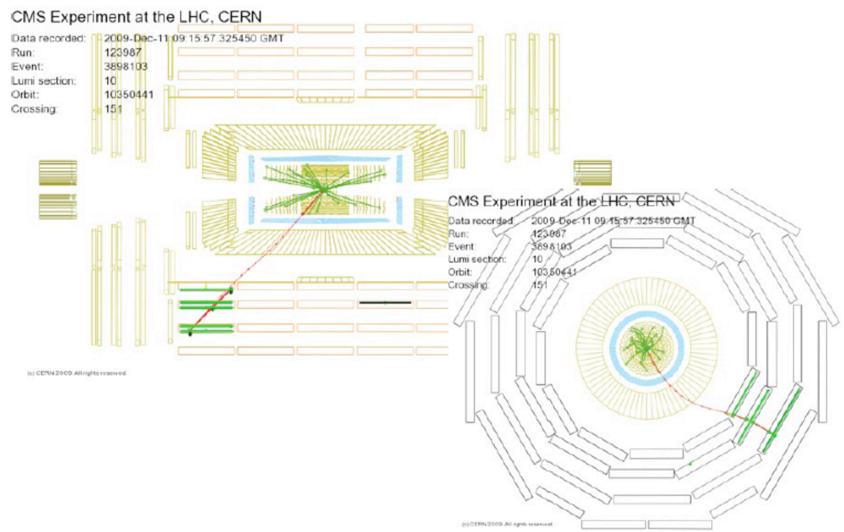




D.Giordano
G.Masetti

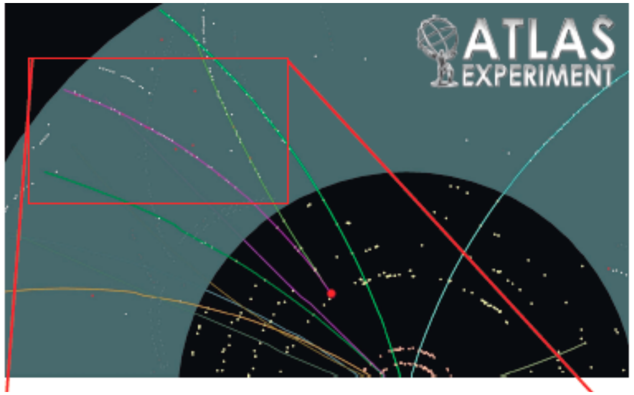
dE/dx in the silicon detector (analog readout)

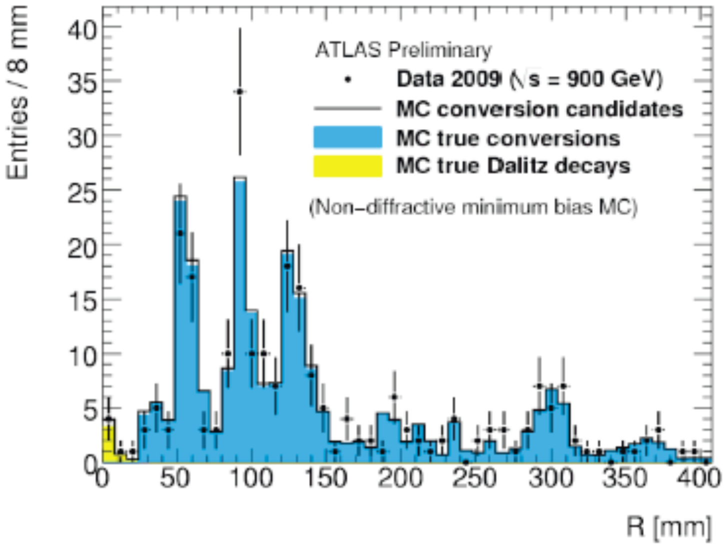


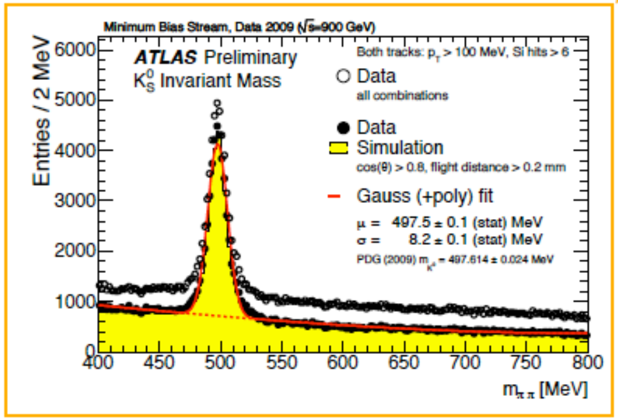


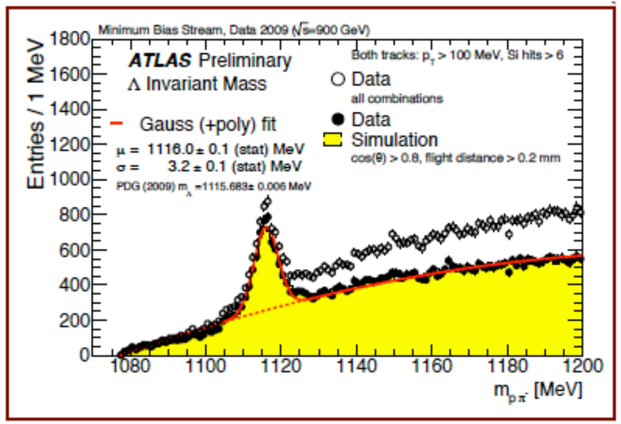
ATLAS Tracking

Andreas Salzburger





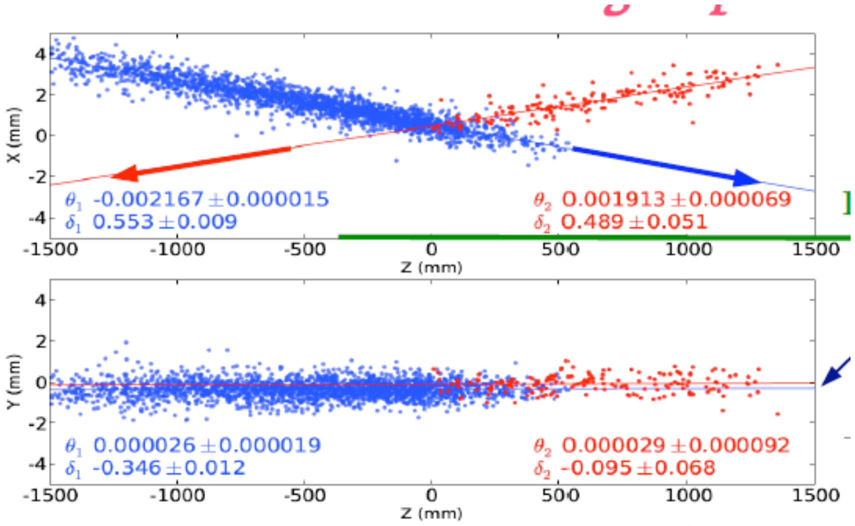


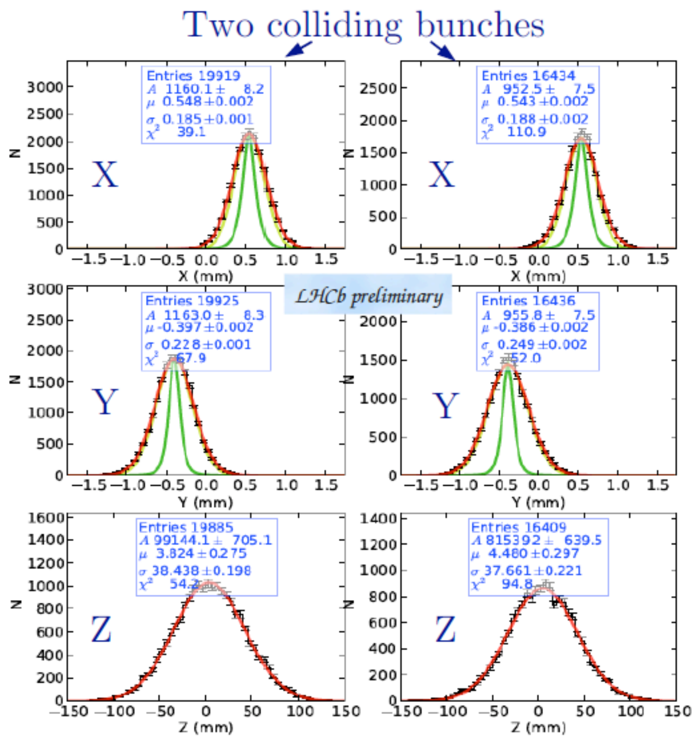


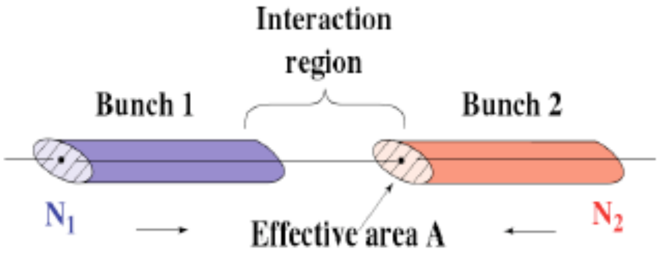
Material buget measured with conversion photons
V0s identified
Very good agreement with the simulation

Luminosity measurement LHCb

Vladislav Balagura







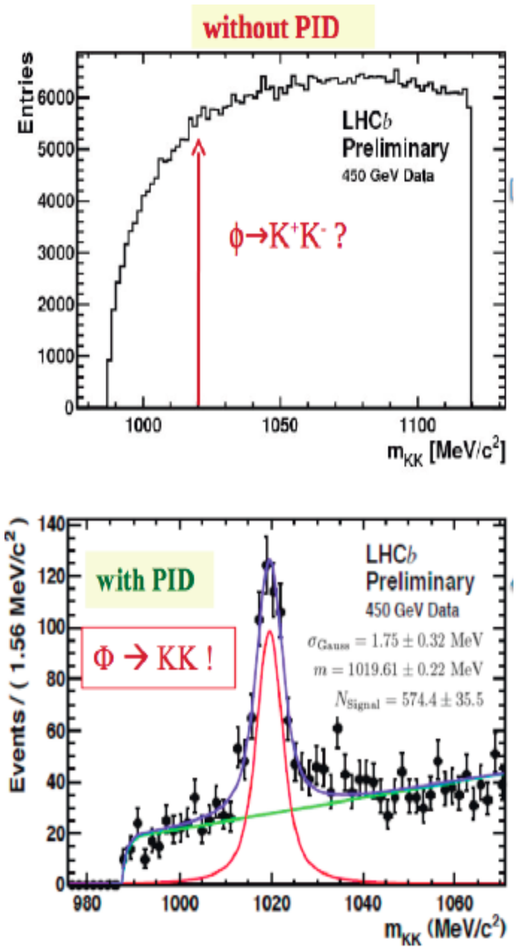
$$\int L\,dt = f \times \int N_1 N_2\,dt \times \sum_{bunches} A^{-1} \times \frac{1}{\epsilon_{crossing}} \times \frac{1}{\epsilon_{phase}} \times \frac{1}{\epsilon_{debunching}}$$

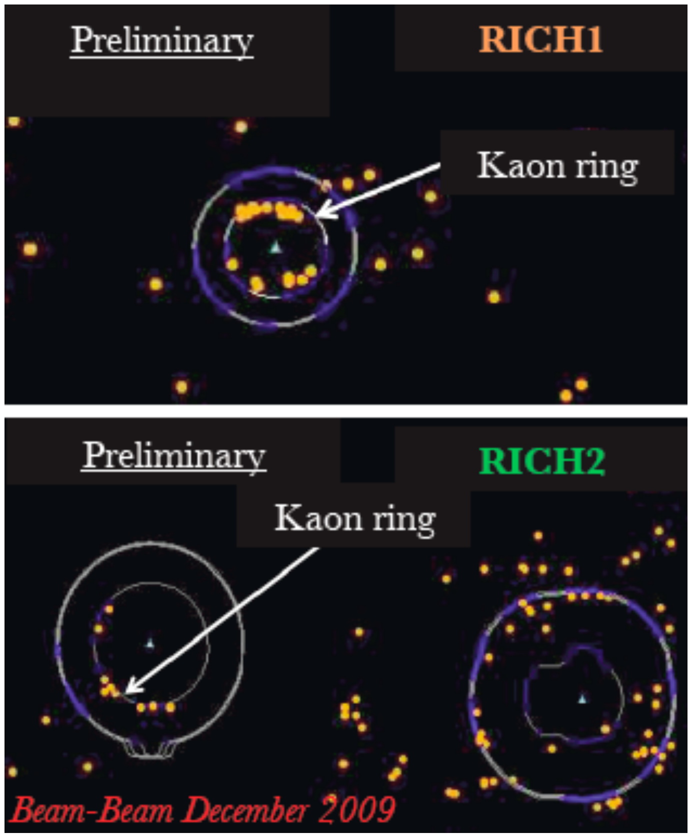
$6.8 \pm 1.0\ \mu b^{-1}$

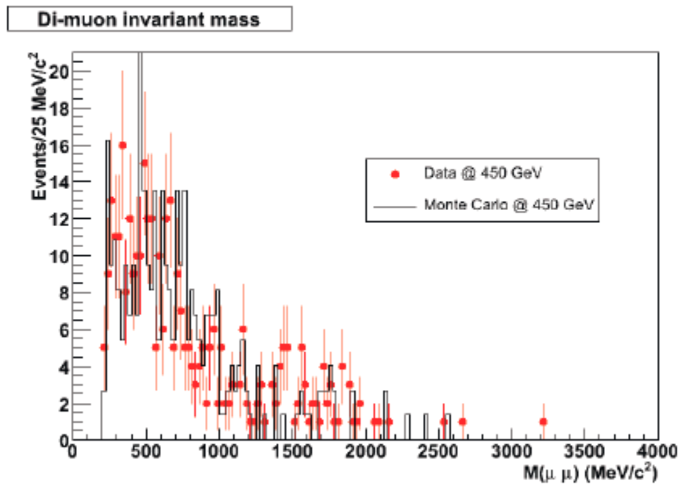
Luminosity measurement, succesful machine monitoring

LHCb: RICH and muons

Caterina Deplano



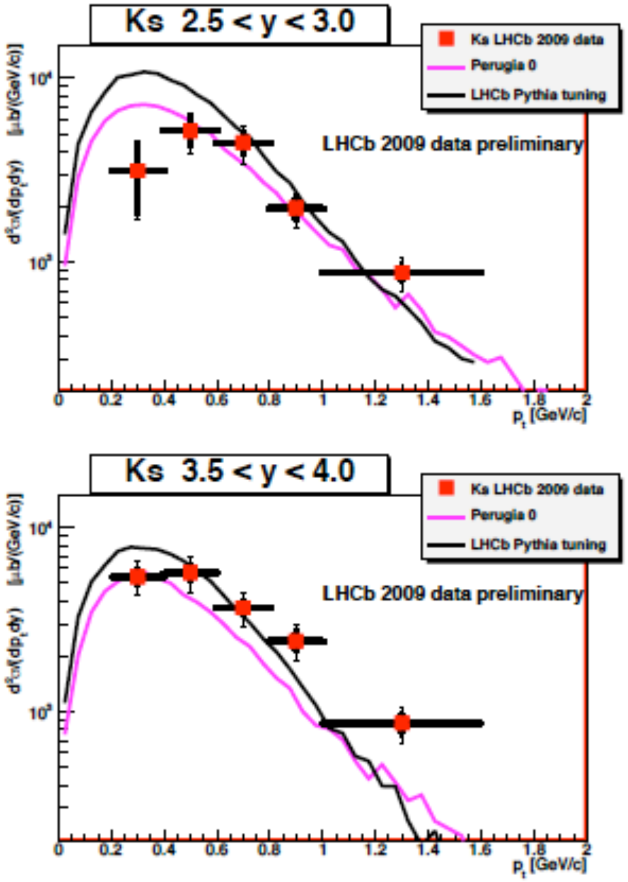




Strange particles production K^0_s

Marc Knecht

- Including L_{int}=6.8±1.0 μb^{-1}



-Crosses: LHCb DATA 2009 Preliminary

-Bold error bars: statistical errors

-Thin error bars: syst. including 15% on lumi

-BLACK curve: LHCb PYTHIA tuning

-PINK curve: Perugia 0 PYTHIA tuning

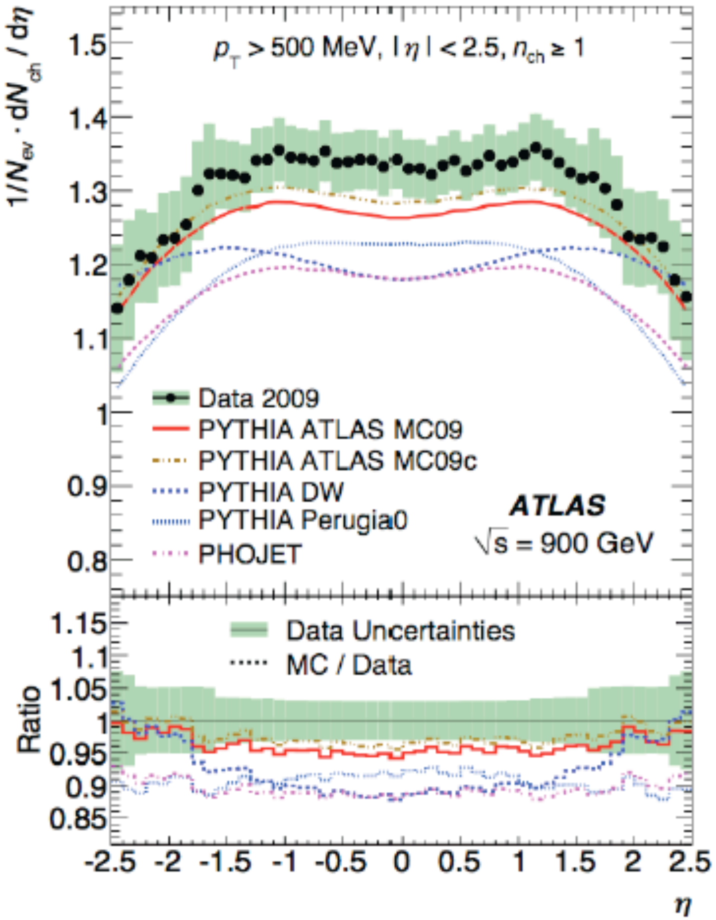
Cross-sections reasonably consistent with PYTHIA predictions

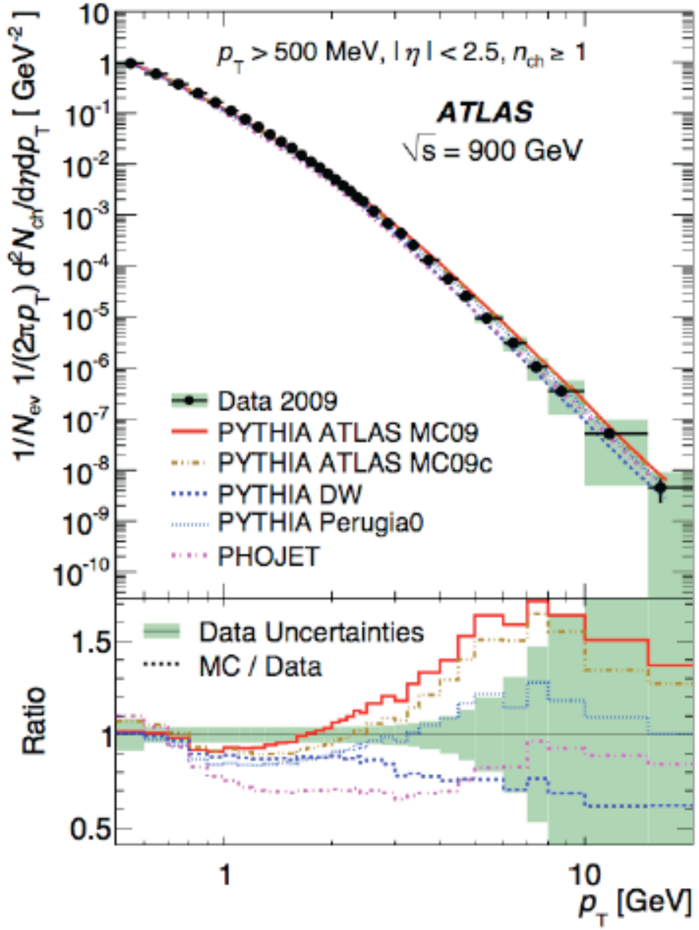
Charged particles multiplicity

$dN_{ch}/d\eta$

$1/p_T \, dN_{ch}/dp_T$

W. H. Bell

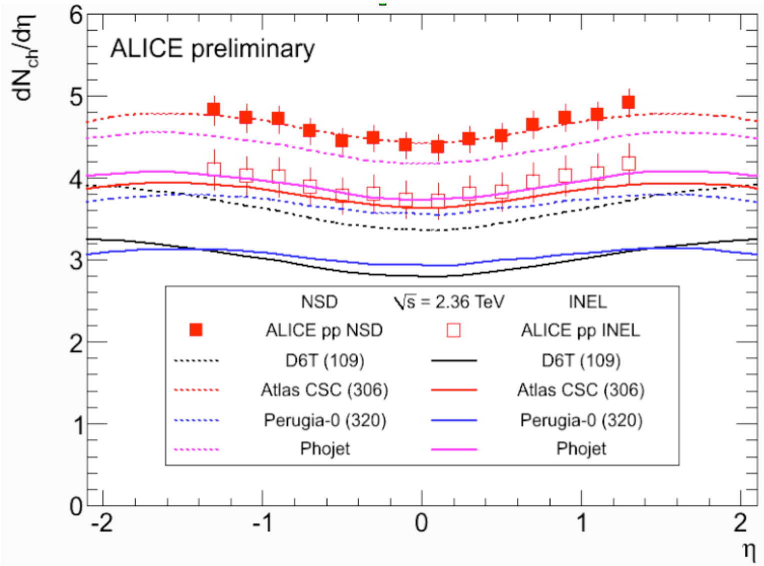


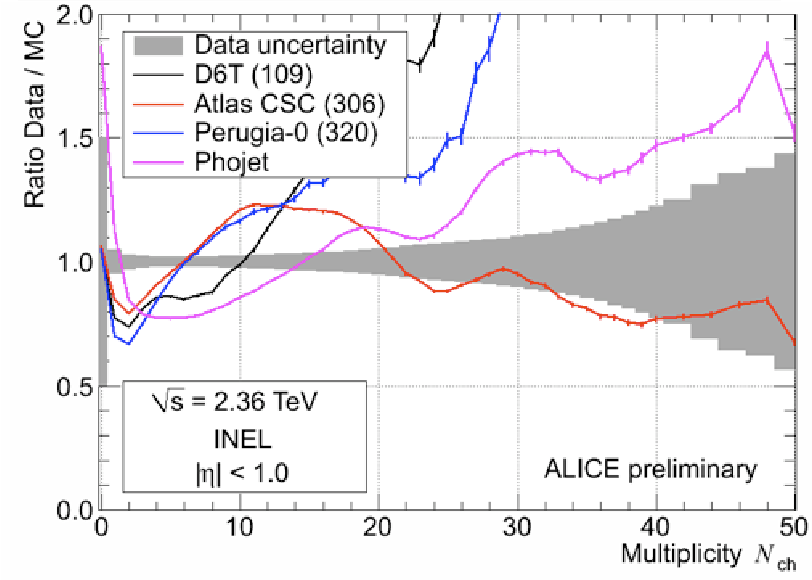


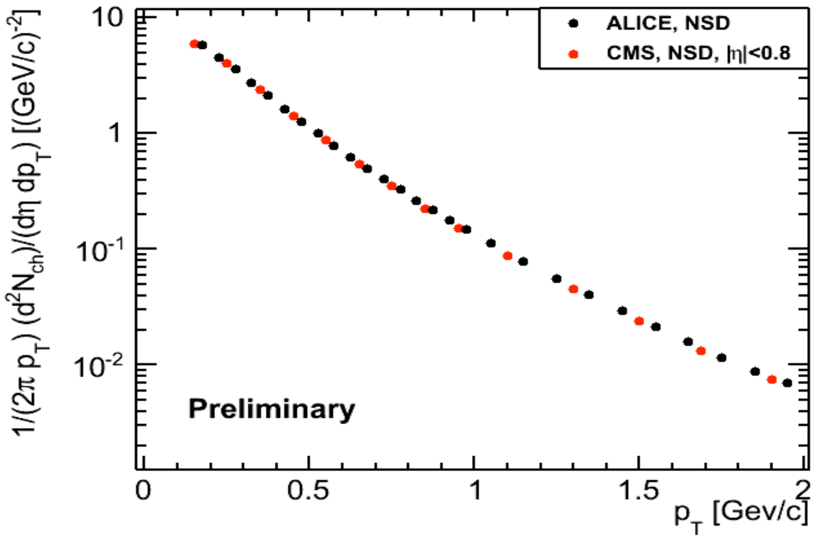
Data precision highlight differences to MC models

Charged particles multiplicity

Jan Fiete Grosse-Oetringhaust
Jacek Otwinowski





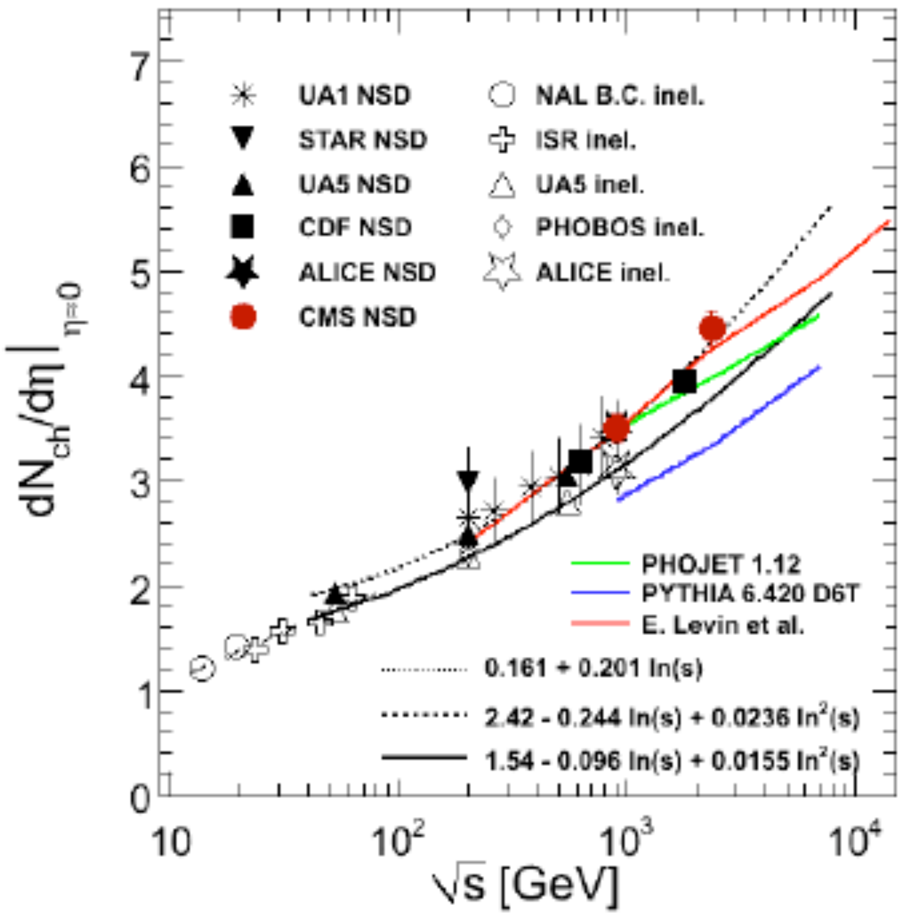


Detailed tracking studies prove a robust identification
dEdx resolution 5.5% (as design)
Discriminate models

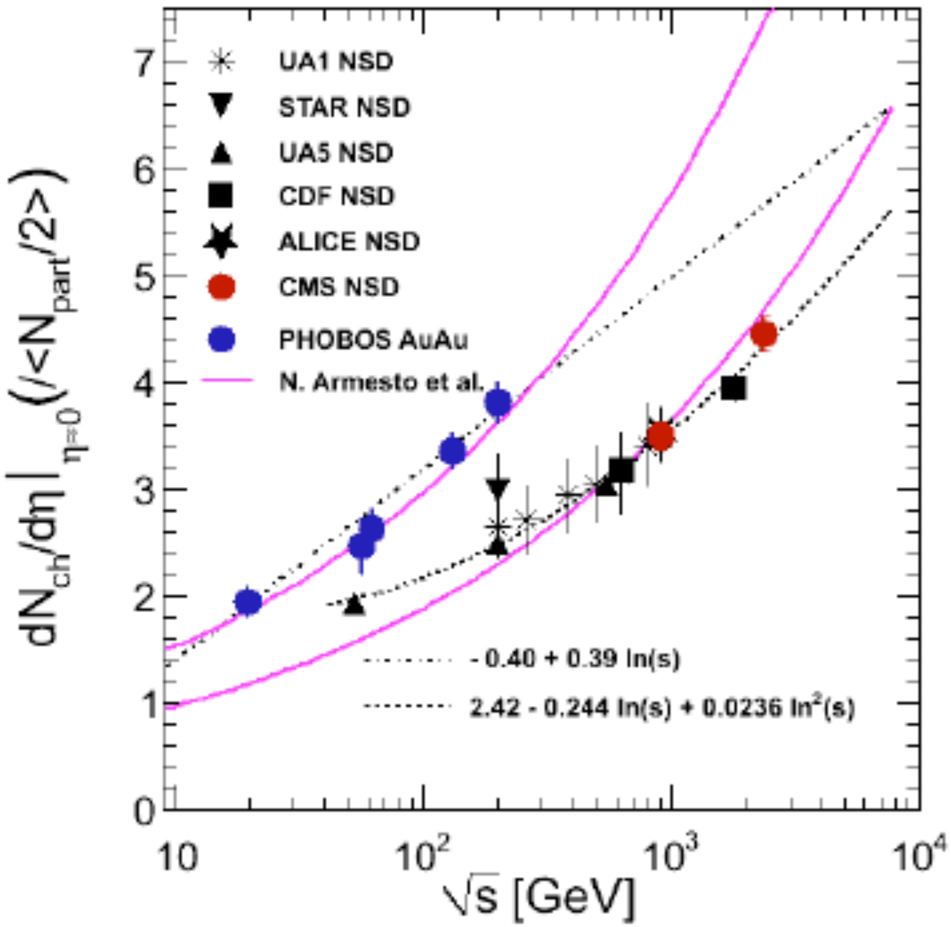
Charged particle multiplicity

Christoph Roland

pp data

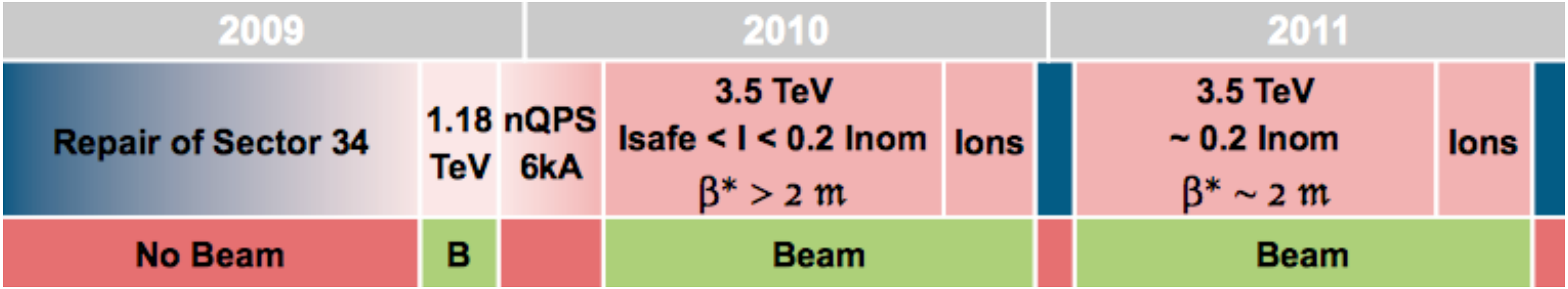


pp compared to AA



LHC is at the energy frontier, look forward for more data

LHC outlook



Plan: **100 pb-1 in 2010 , 1fb-1 by 2011 + Heavy Ions @ 7 TeV**

If this is achieved, a vigourous start of the physics program is expected soon:

- Early B-physics
- W and Z production
- Top
- Higgs
- High mass dilepton resonances
- SUSY
- Universal Extra Dimensions

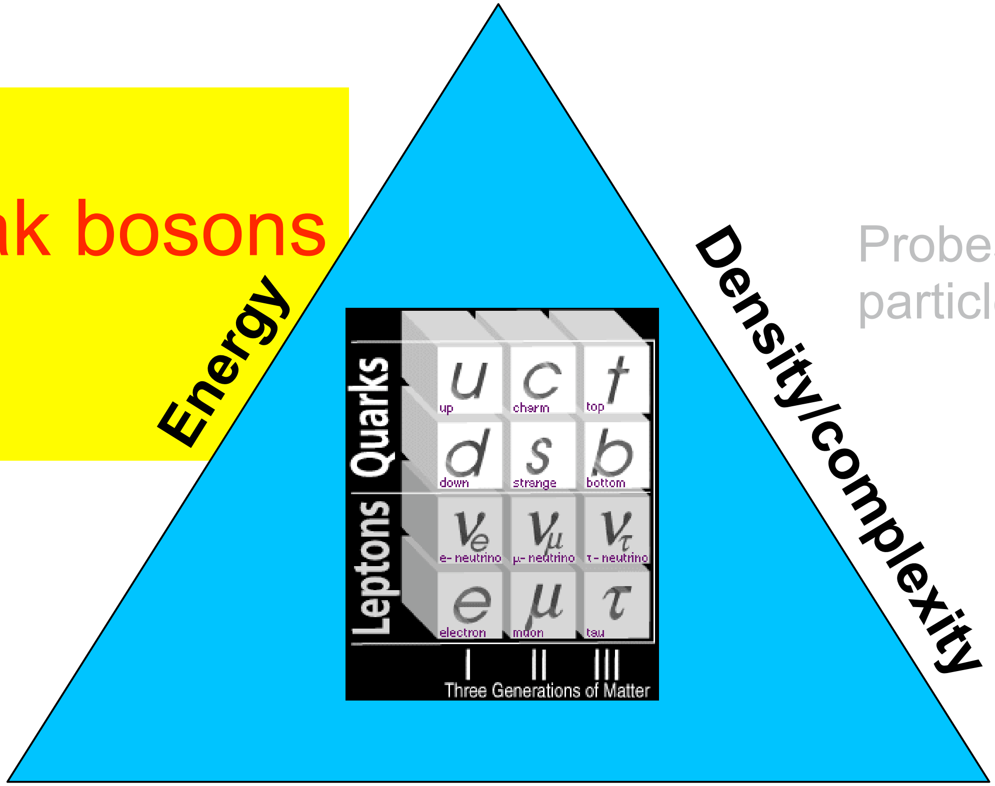
I.Vichou

The experimental frontiers of the high energy physics

LHC startup

Higgs
Electroweak bosons
Top
Searches

Probes to QGP,
particles production



Precision

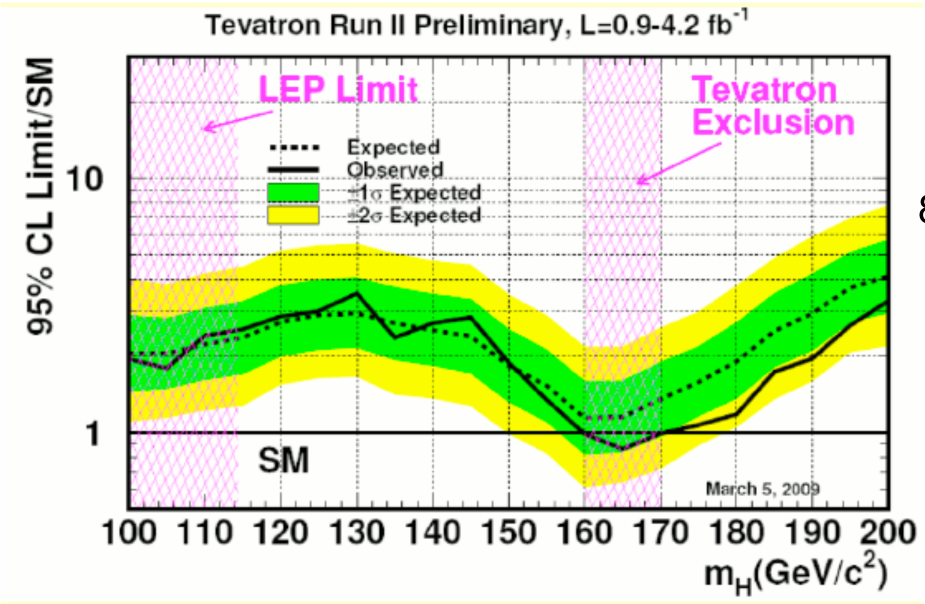
Proton structure, strong coupling,
CP violation, decays, resonances, diffraction

Combined Higgs searches

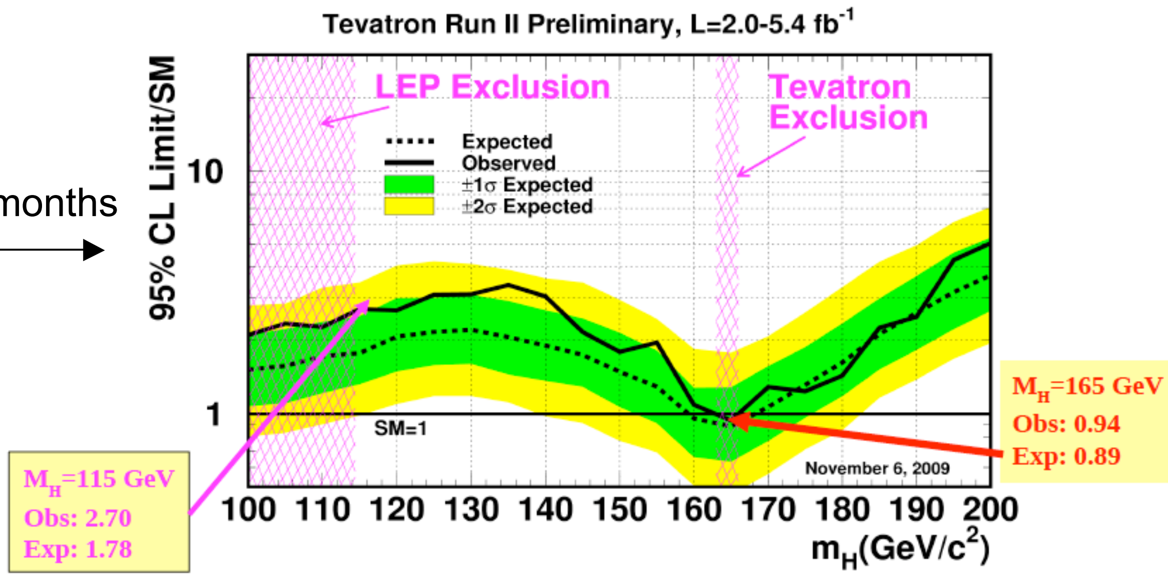
Weiming Yao
Ralf Bernhard
Shalhout Z. Shalhout

First joint CDF&D0 publication on SM Higgs search(PRL 104 061802 2010)

- Set 95% CL mass exclusion: $162<m_H<166$ GeV/c^2 ($159<m_H<169$ expected)

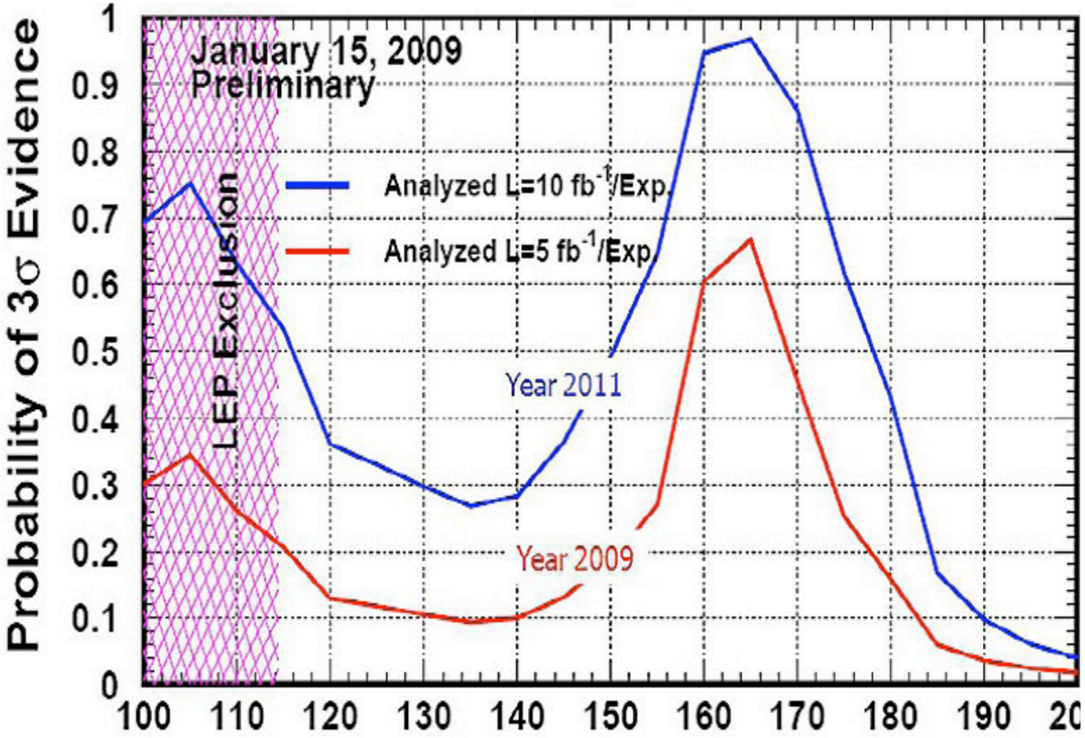


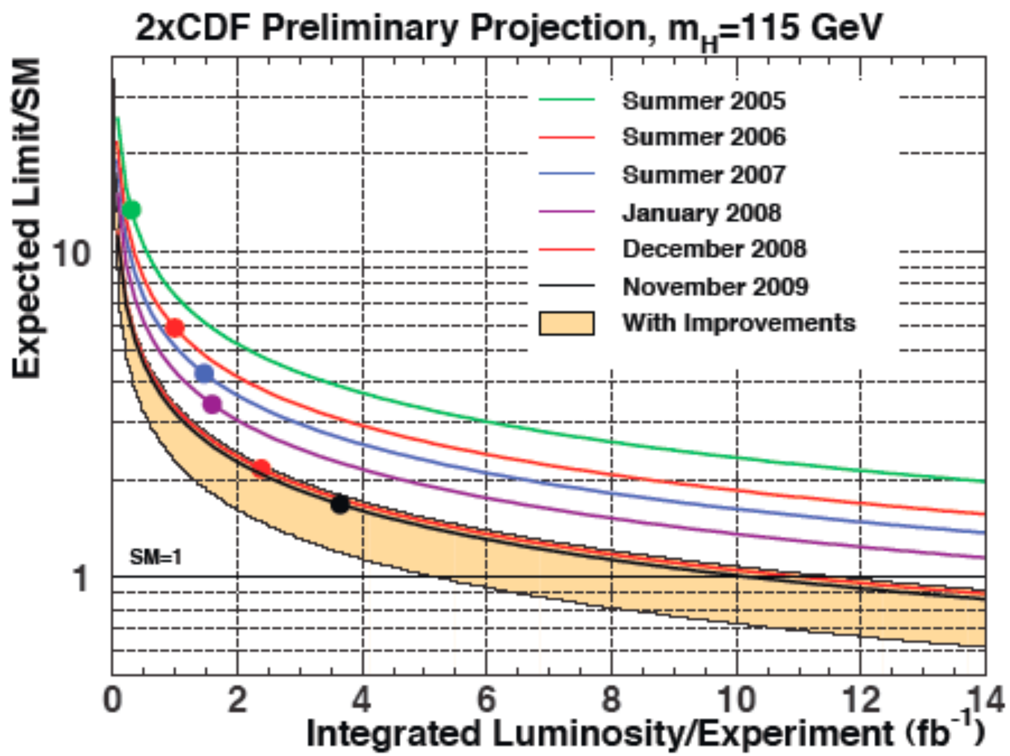
8 months →



Since march 2009:
The sensitivity improved: work on many channels,
Grab as much sensitivity as possible (even 1/100 is useful)
Slight excess, exclusion domain reduced.

Higgs Prospects

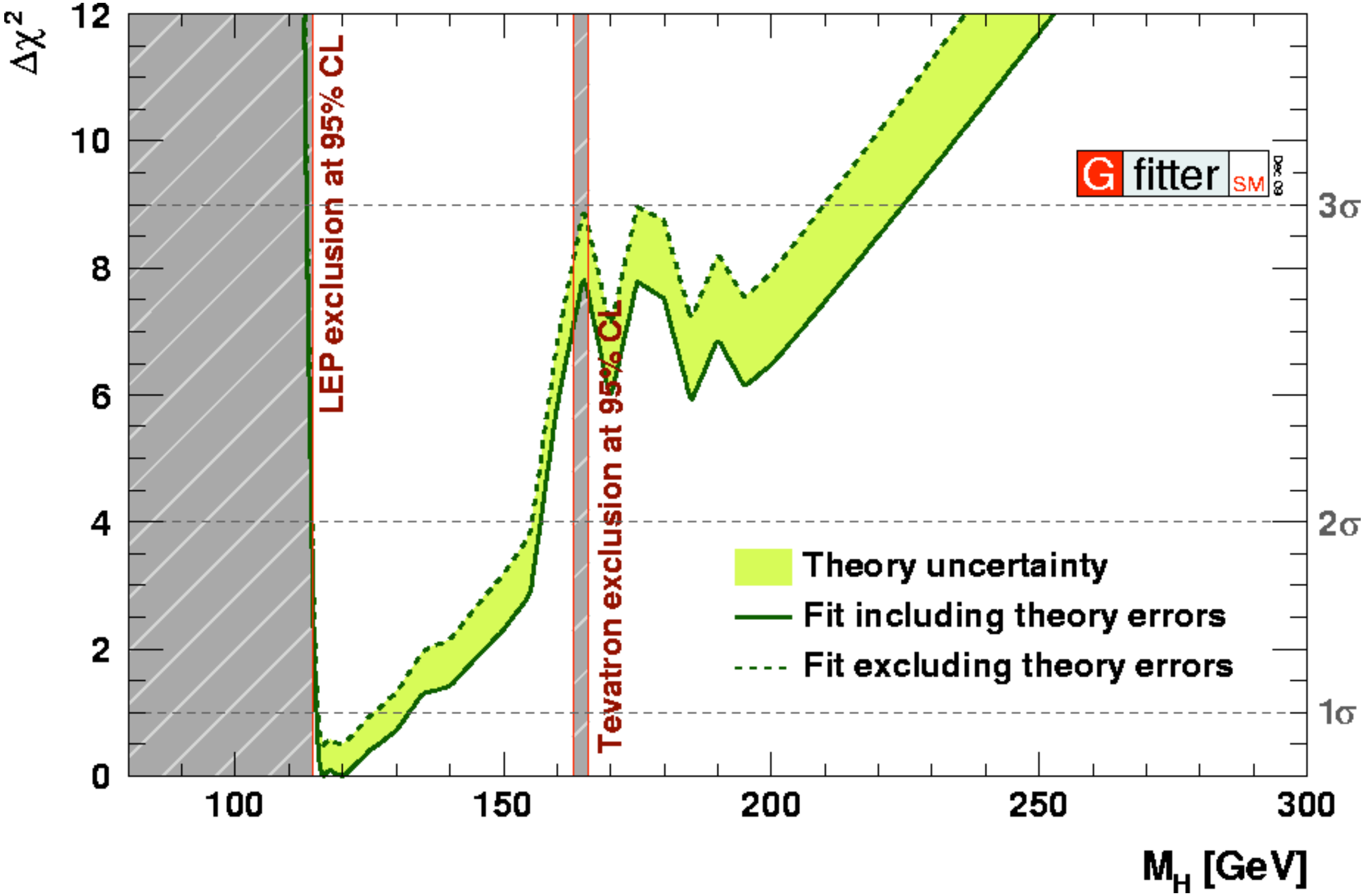




Large data sets accumulated in the last/next 18 months may lead to another “step”
Exciting times ahead!

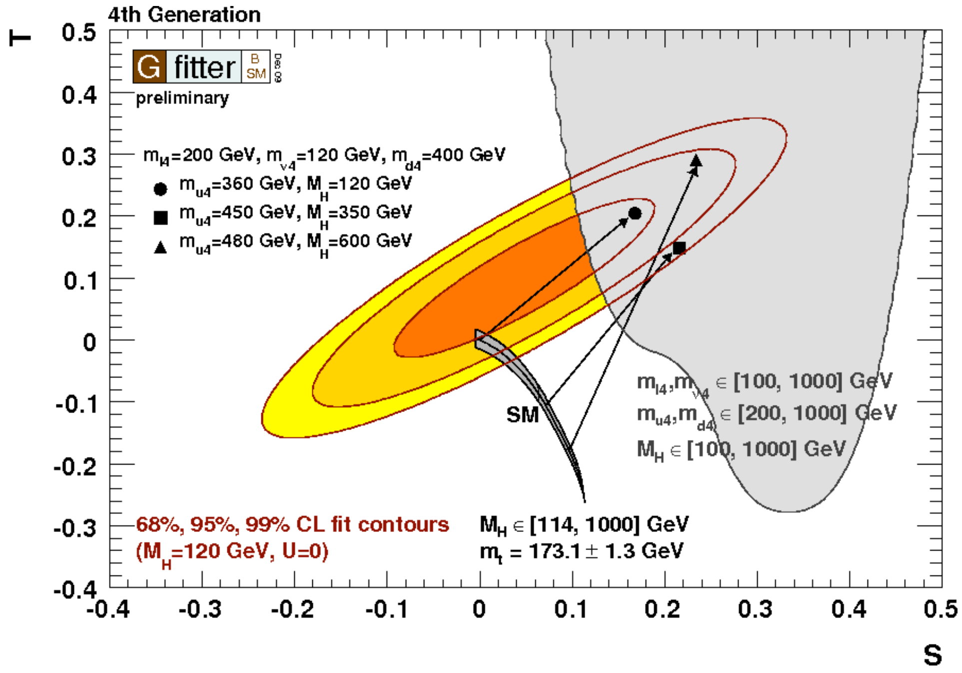
Higgs from precision

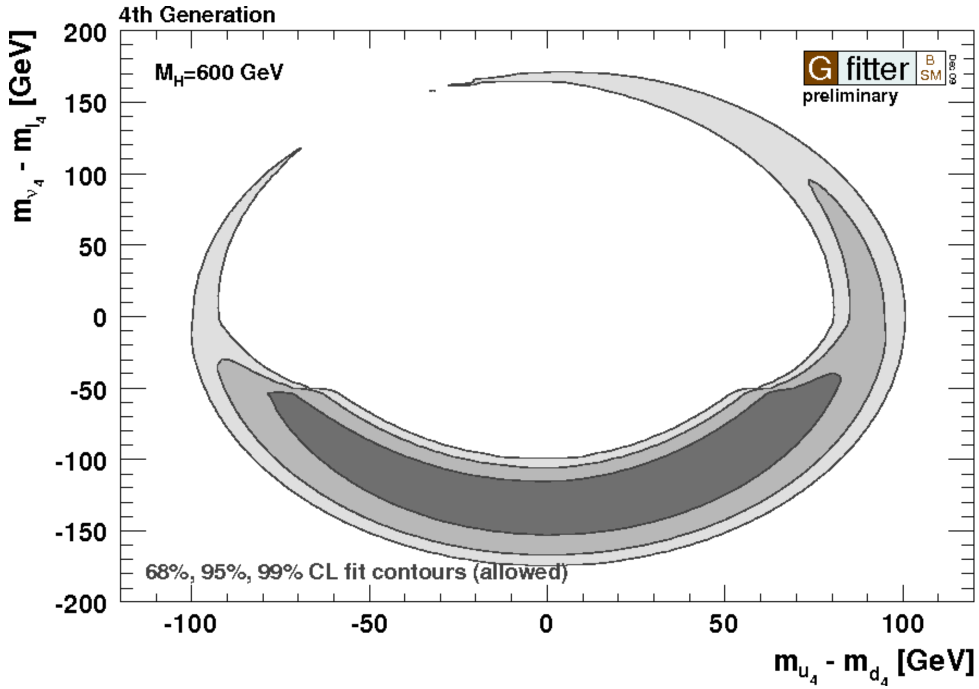
Johannes Haller



Room for new physics from precision

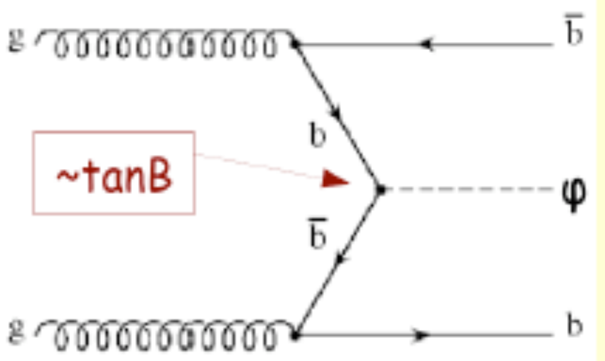
Johannes Haller

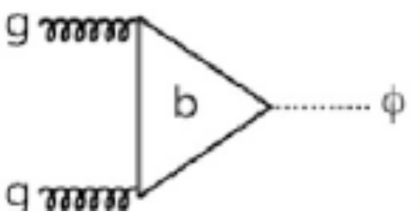




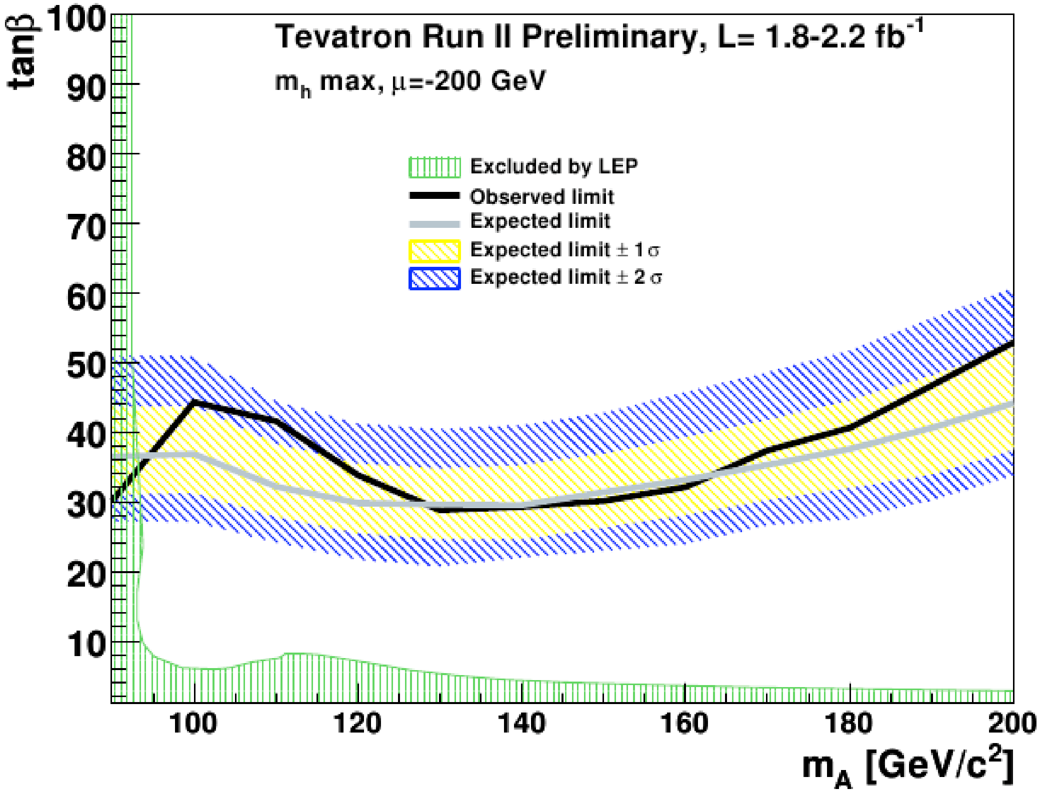
Non-standard Higgs

Sébastien Greder





Decay to bb and ττ
Associated production mechanism studied
Performant b and τ ID
Combined CDF and D0 data

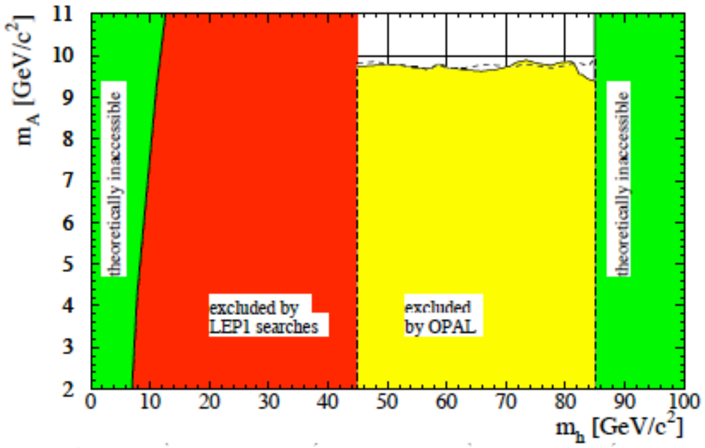


tan β< 30-50
excluded for m_A up to
200 GeV/c^2

ALEPH:

James Beacham

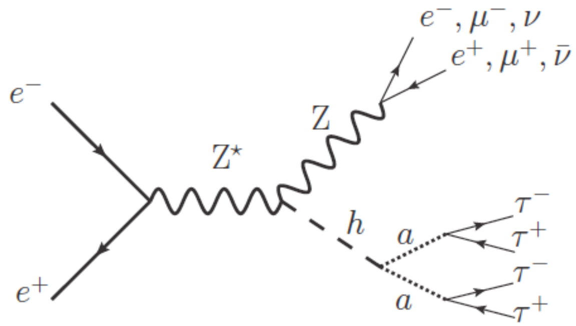
Eur. Phys. J. C37 (2004) 49–78, [hep-ex/0406057].



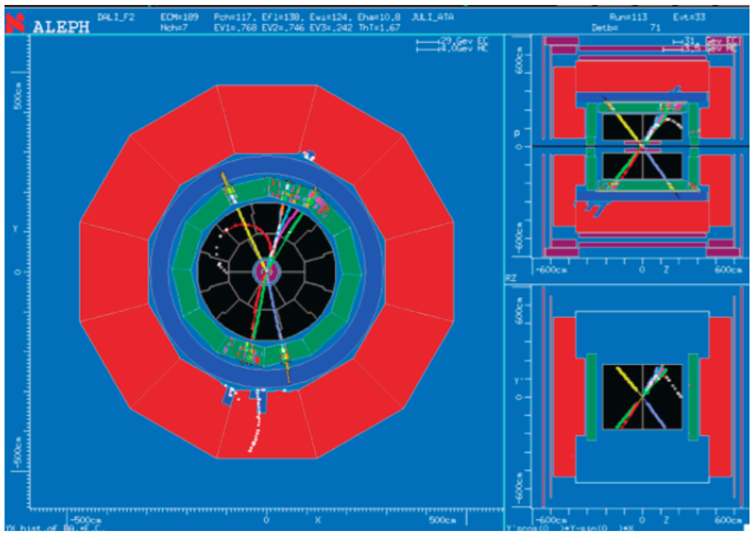
95% CL in the m_A versus m_h plane for the MSSM no-mixing benchmark

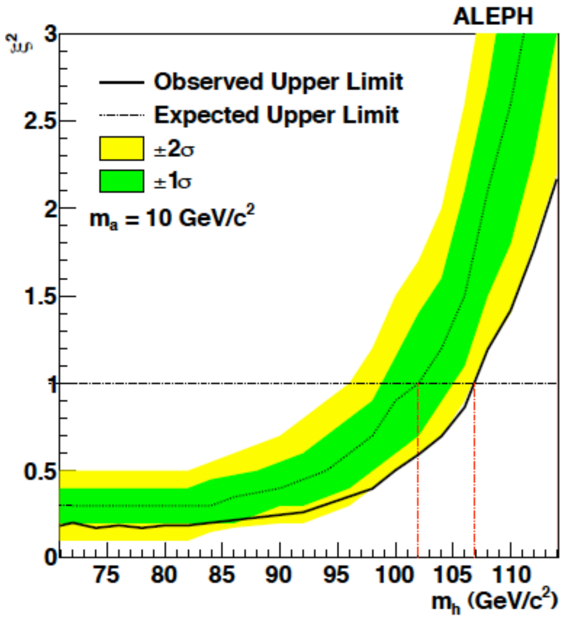
In NMSSM a (mixture of A from MSSM) is naturally light

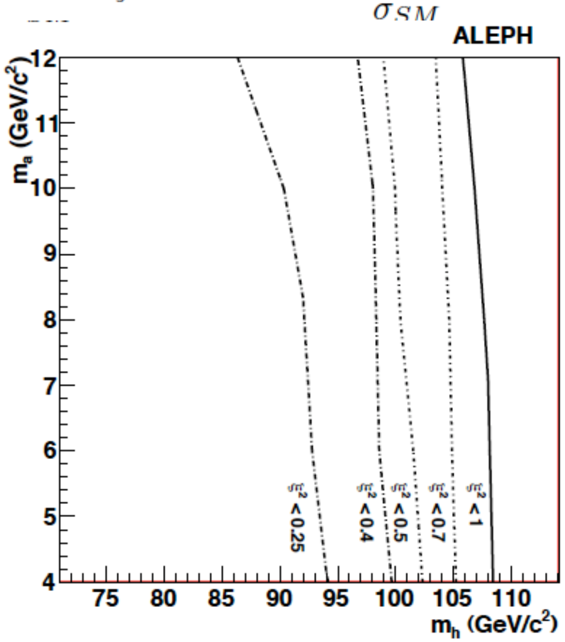
- if $m_a < 2m_b$, h evades *4b* searches and expect a $\longrightarrow \tau^+\tau^-$



$$\xi^2 = \frac{\sigma\,\mathrm{BR}(h \to aa)\,\mathrm{BR}(a \to \tau\tau)^2}{\sigma_{SM}}$$



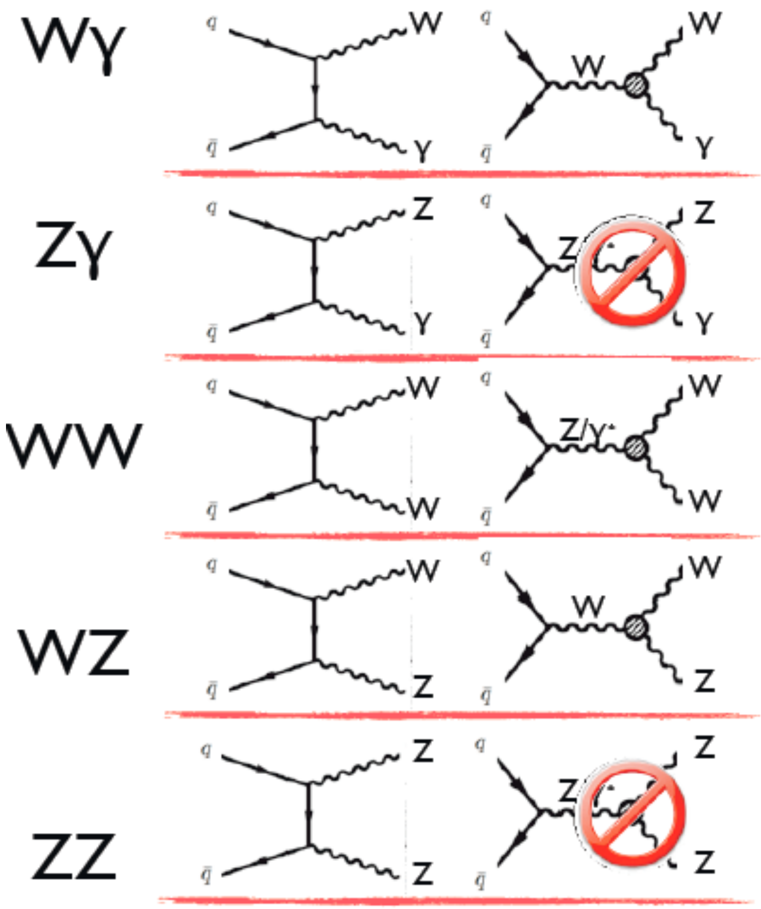


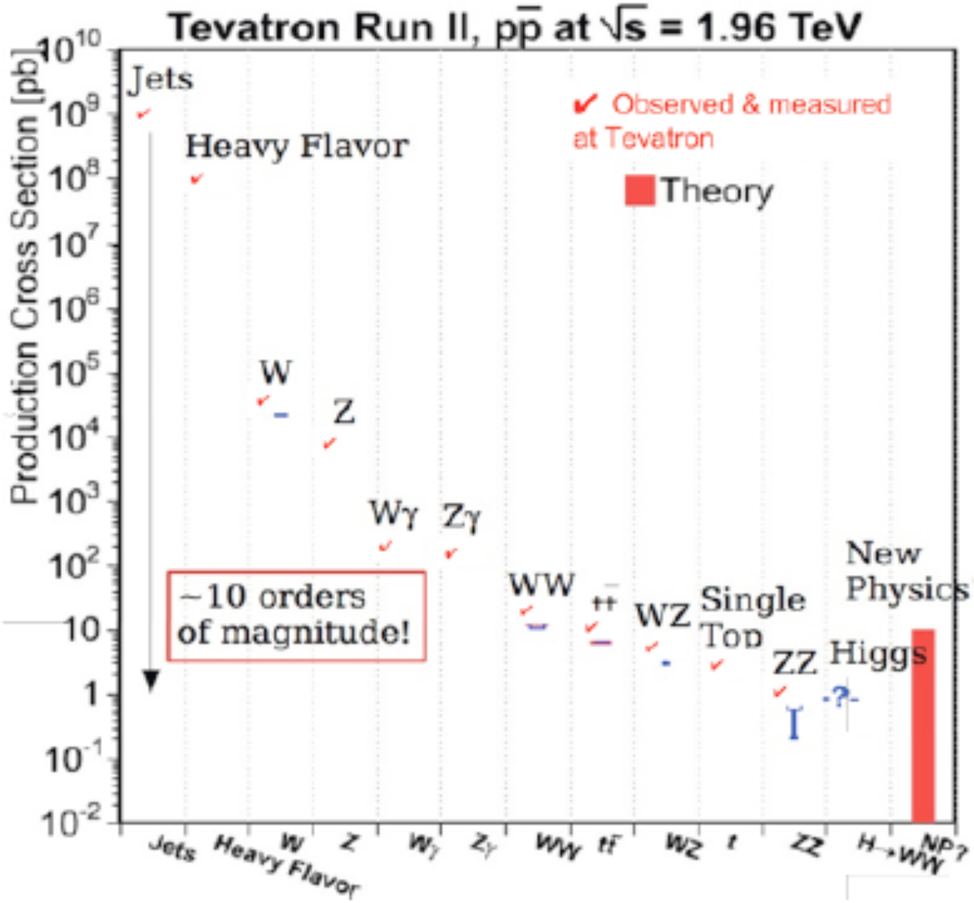


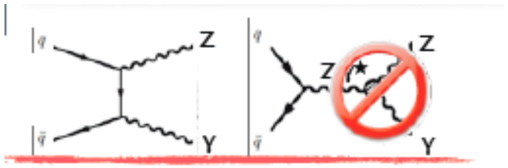
Di-Bosons at Tevatron

Direct probe into the gauge structure of the SM
Benchmark for experimental capabilities (Higgs)
New Physics effects

Vadim Rusu



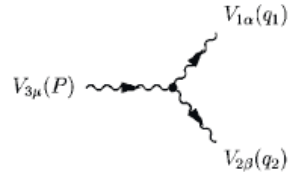




Z+gamma

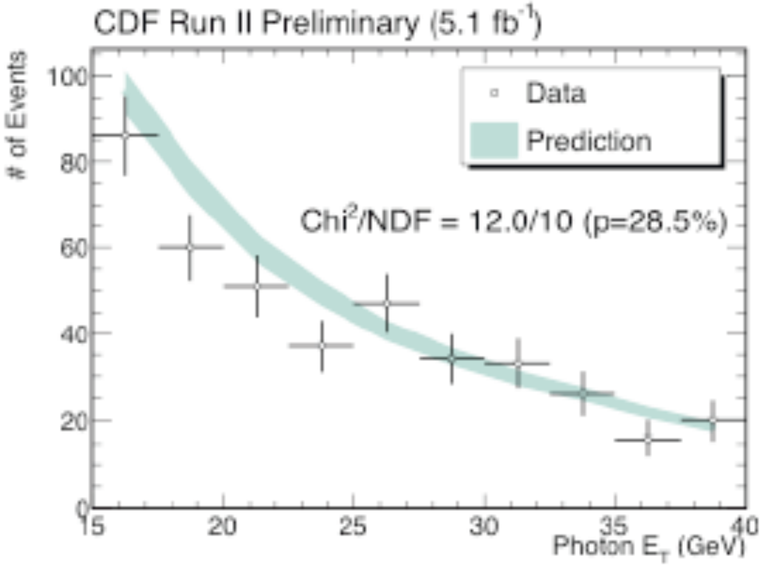
- σ=4.6±0.2(stat)±0.3(syst)±0.3(lumi)pb
- NLO = 4.5±0.4pb

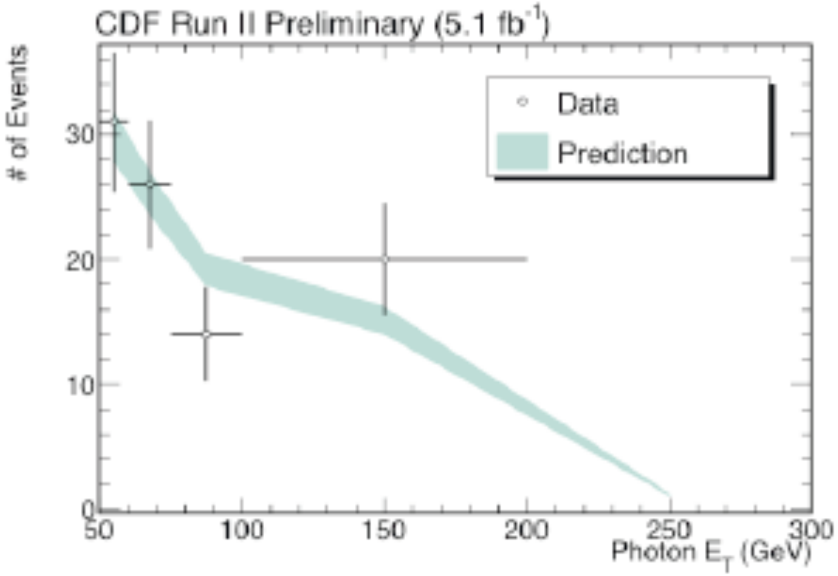
- C̸P: h_1, h_2
- CP: h_3, h_4



Experiment Luminosity(fb^{-1})	LEP II 0.7	D0 1.1	CDF (+MET) 1.5	D0(+MET) 3.6	
h_3^Z	-0.20, 0.07	-0.083, 0.082	-0.05, 0.05	-0.033, 0.033	-0.037,0.038
h_4^Z	-0.05, 0.12	-0.005, 0.005	-0.0034, 0.0034	-0.0017, 0.0017	-0.0017,0.0017
h_3^γ	-0.049, 0.008	-0.085, 0.084	-0.051,0.051	-0.033, 0.033	-0.038,0.040
h_4^γ	-0.02, 0.034	-0.005, 0.005	-0.0034, 0.0034	-0.0017, 0.0017	-0.0017,0.0017

New CDF analysis optimized threshold

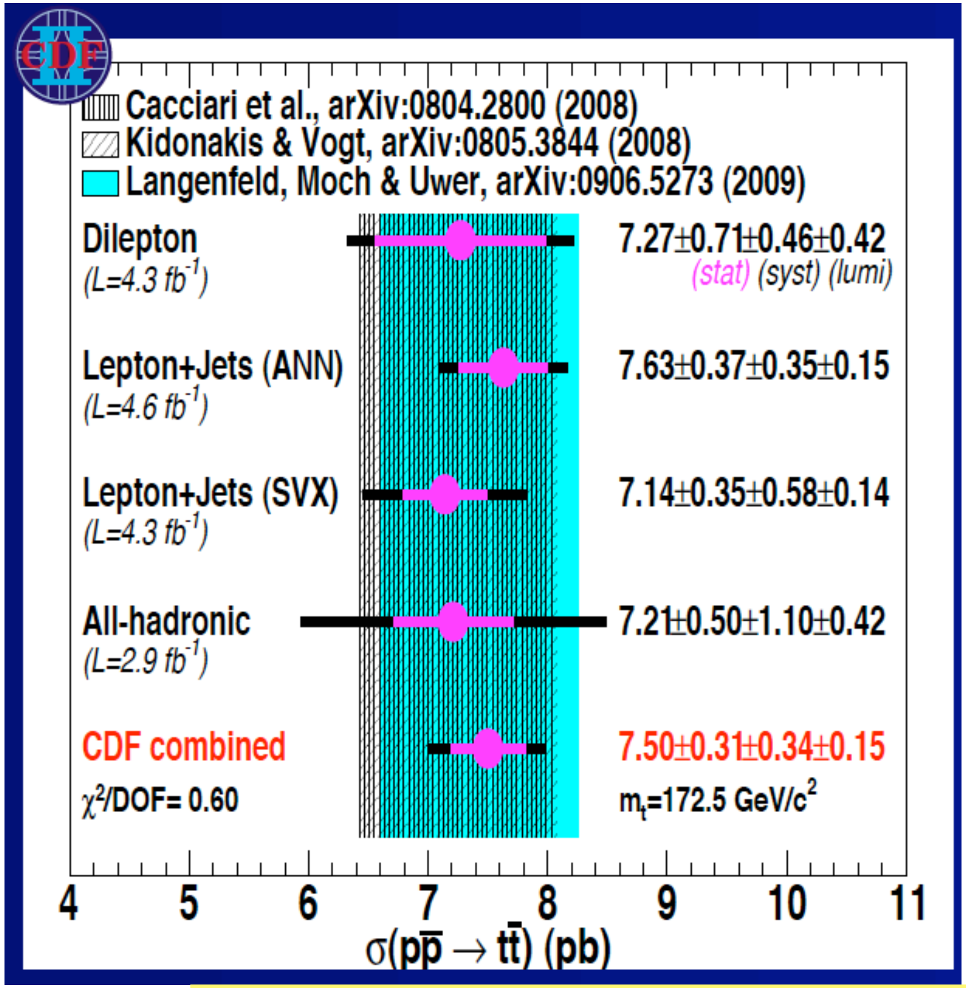


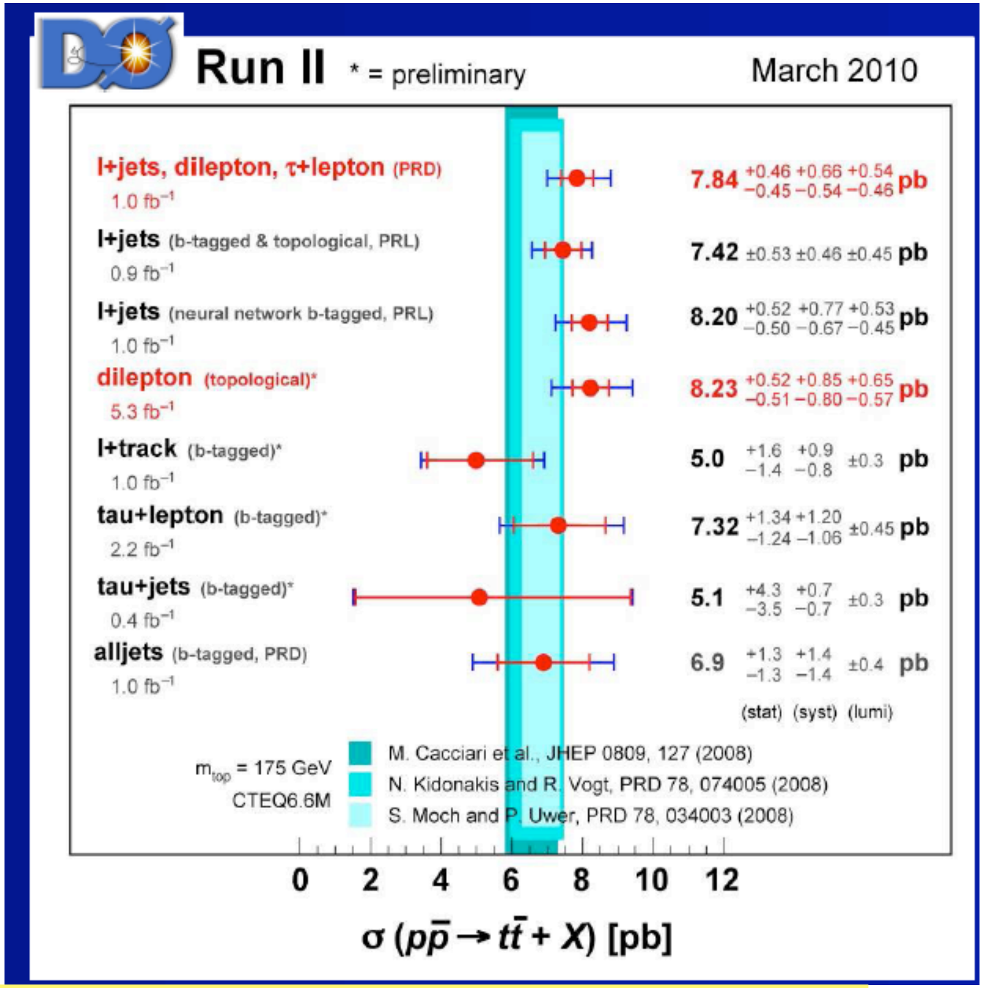


Top production

Michael Begel

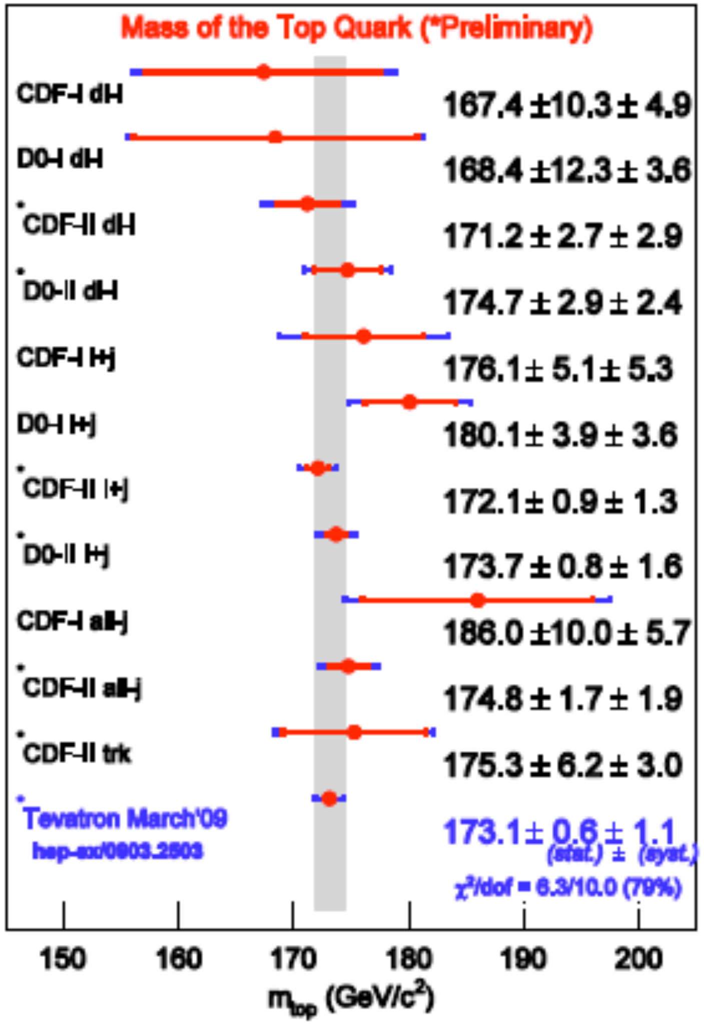
12 new measurements (1-5 fb^{-1}) released in the last year





Inclusive $t\bar{t}$ production cross section known to $\sim$ 6.5%

Top mass measurements



$$m_{top} = 173.1 \pm 1.3\ GeV/c^2$$

Hyunsu Lee

New measurements

CDF LJ (ME) $= 172.8 \pm 1.3\ GeV/c^2$

CDF LJ (TM) $= 172.1 \pm 1.5\ GeV/c^2$

CDF DIL(TM) $= 170.6 \pm 3.8\ GeV/c^2$

Precision to 1.3 GeV (0.75%)
from single measurements

Top properties

Veronica Sorin

M_t = 172.8 ± 1.3 GeV/c^2

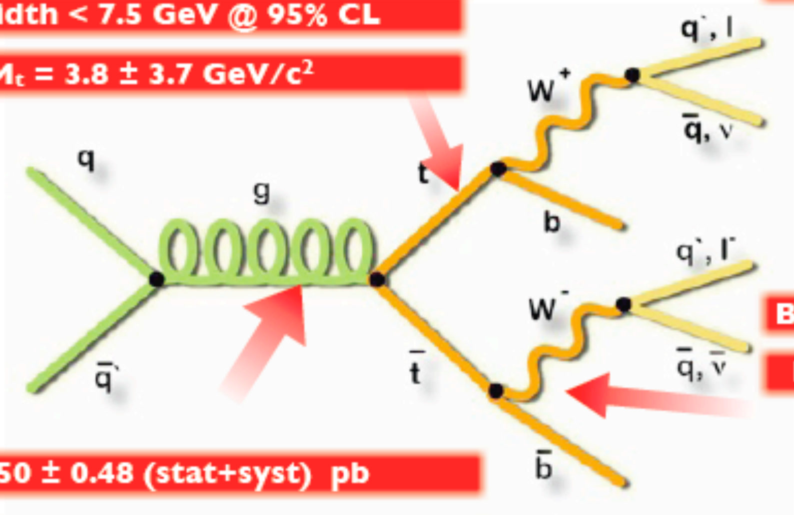
Top charge : not 4/3 @ 95% CL

Top width < 7.5 GeV @ 95% CL

ΔM_t = 3.8 ± 3.7 GeV/c^2

anom coupl : no evidence found

f_+ = 0.110 ± 0.059 (stat) ± 0.052 (syst)



B(t→Wb)/B(t→Wq)=0.97 ± 0.09

BR(t → Zq) < 3.7% at 95% C.L.

σ = 7.50 ± 0.48 (stat+syst) pb

Afb= 19.3 ± 6.5 (stat) ± 2.4 (syst) %

dσ/dMtt no discrepancy with SM

dσ/dpt no discrepancy with SM

fraction via gg fusion : $0.07^{+0.15}_{-0.07}$

Single Top Observation !!

Many Searches

Garcia-Bellido and Goldschmidt's talks

Experiment's web pages:

CDF: http://www-cdf.fnal.gov/physics/new/top/top.htm

D0: http://www-d0.fnal.gov/Run2Physics/top/top_public_web_pages/top_public.html

Top properties

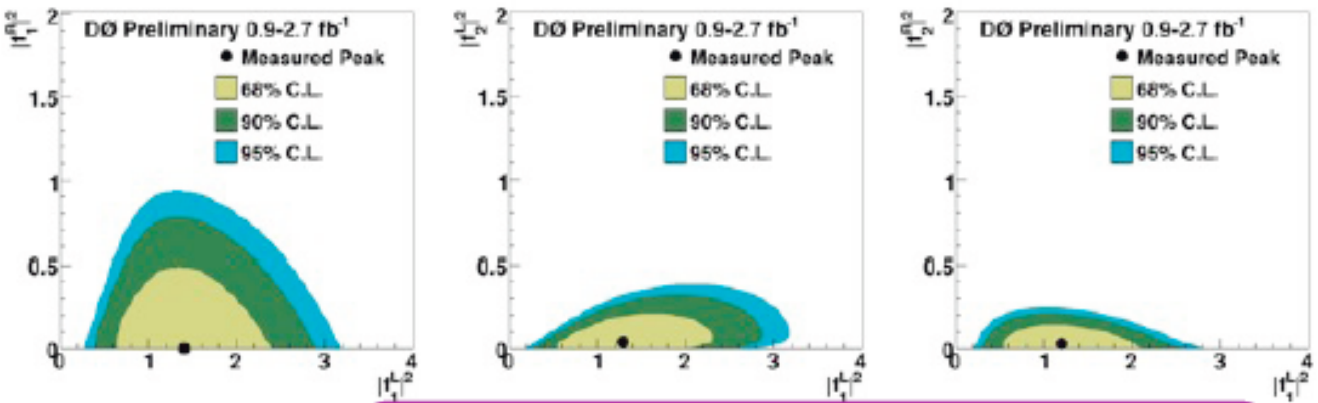
Veronica Sorin

A general investigation of the top quark couplings

$$L_{tWb} = \frac{g}{\sqrt{2}} W_{\mu}^{-} \bar{b} \gamma^{\mu} \left(f_1^L P_L + f_1^R P_R \right) t - \frac{g}{\sqrt{2} M} \partial_{\nu} W_{\mu}^{-} \bar{b} \sigma^{\mu\nu} \left(f_2^L P_L + f_2^R P_R \right) t + h.c.$$

2.7 fb^{-1}

In SM: expect $f_1^L = 1$, all others cancel



Consistent with SM

find 95%CL if $f_1^L = 1$

$|f_1^R|^2 < 0.72$

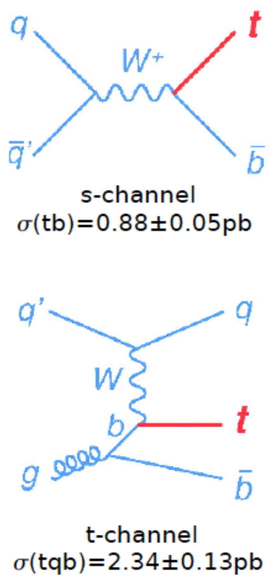
$|f_2^L|^2 < 0.19$

$|f_2^R|^2 < 0.20$

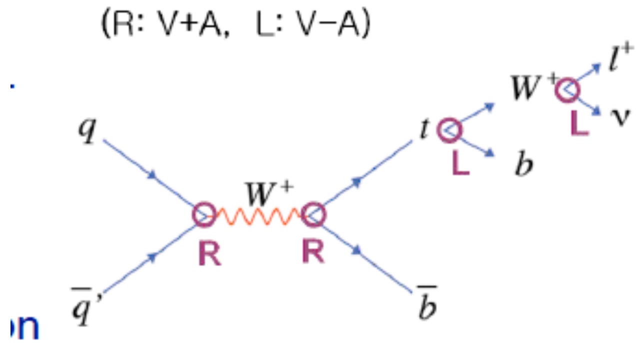
1 fb^{-1} Reference:
D0 PRL 102 092002 (2009)

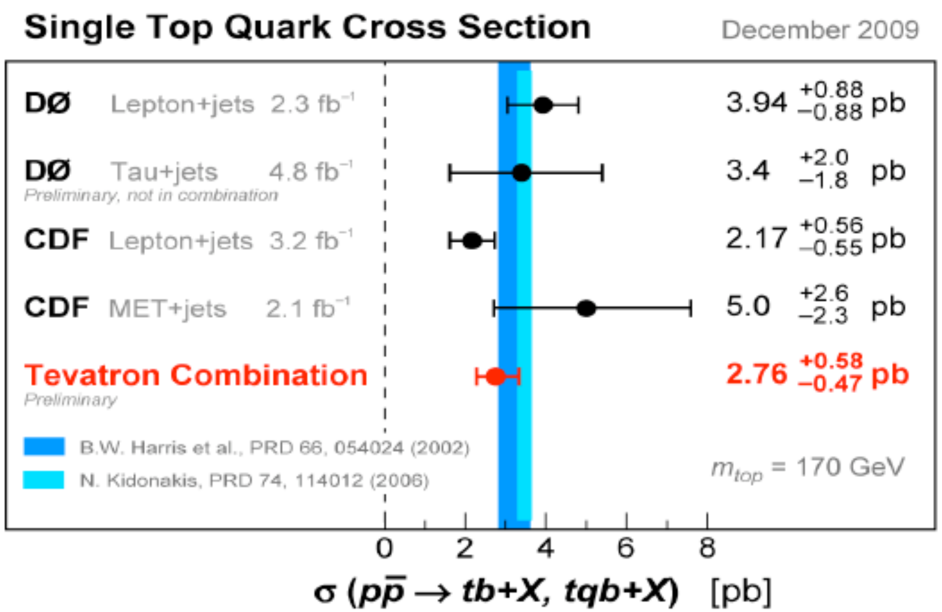
Single top

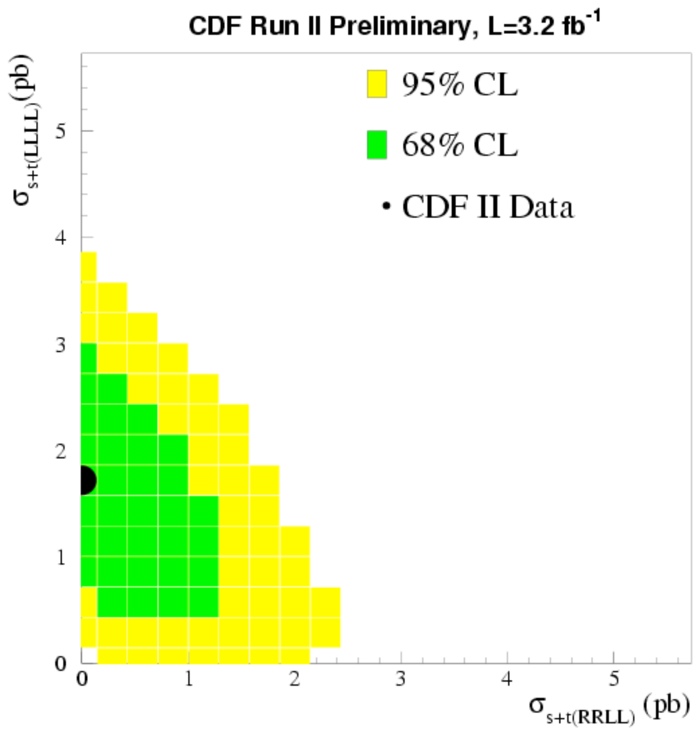
Arán García-Bellido
Nathan Goldschmidt



Surgery of the single top production:
s/t cross sections, polarisation, width, searches
Amazing program!



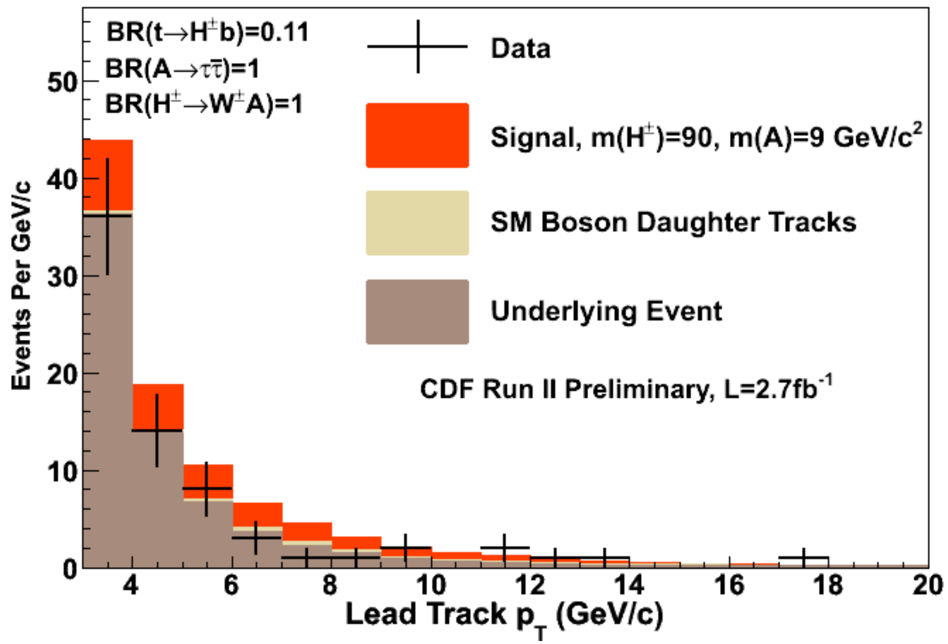


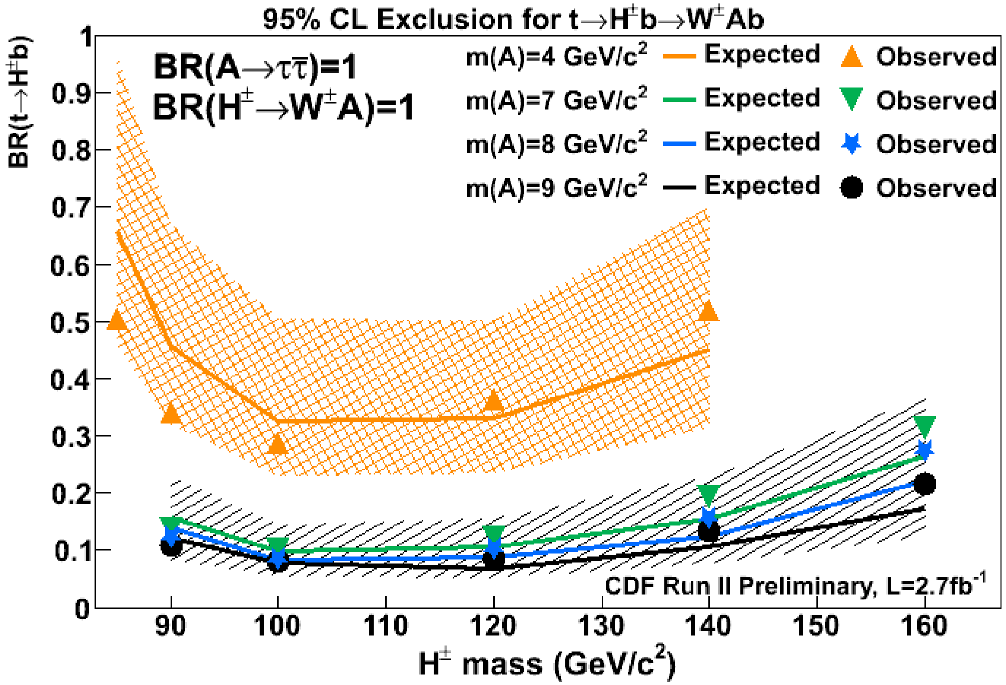


...and searches

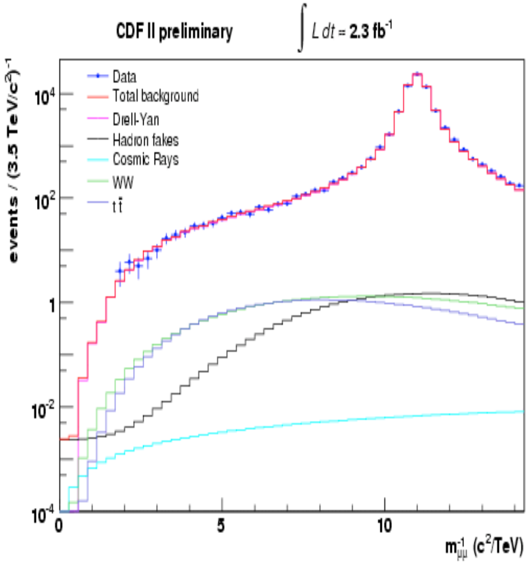
Nathan Goldschmidt

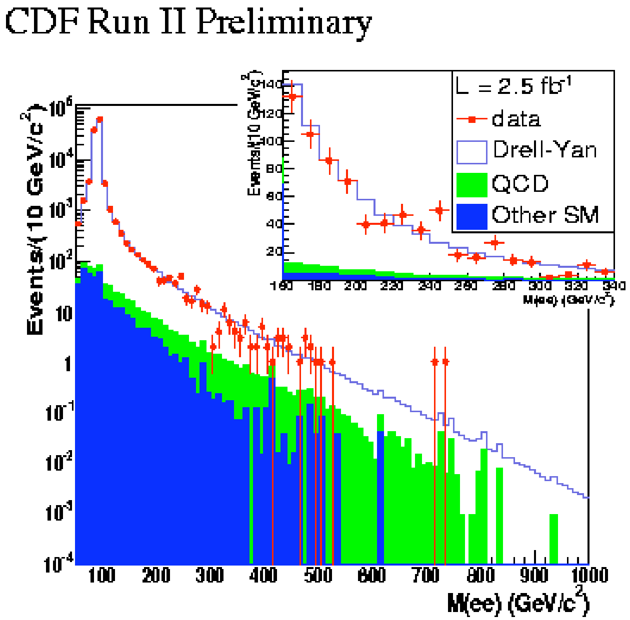
- Search for $t \to H^+ b$, where $H^+ \to W^+ A$
- If $m_A < 2m_b$, $A \to \tau^+\tau^-$ will dominate

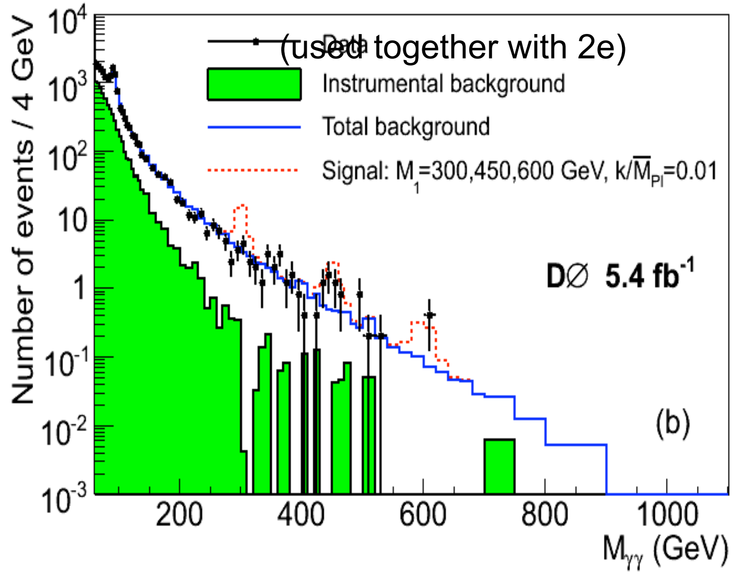




Searches for new physics with high scales







(used together with 2e)

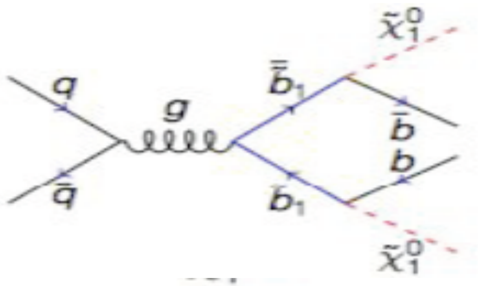
Lidija Živković

Model	Mass [GeV]
Z'(SM)	961
Z'(η)	873
Z'(χ)	857
Z'(ψ)	846
Z'(N)	831
Z'(sec)	788
Z'(I)	755

Lower limits on the mass of Kaluza-Klein excitation of the graviton of 560 GeV - 1040 GeV for $0.01 \le k/M_{Pl} \le 0.1$.

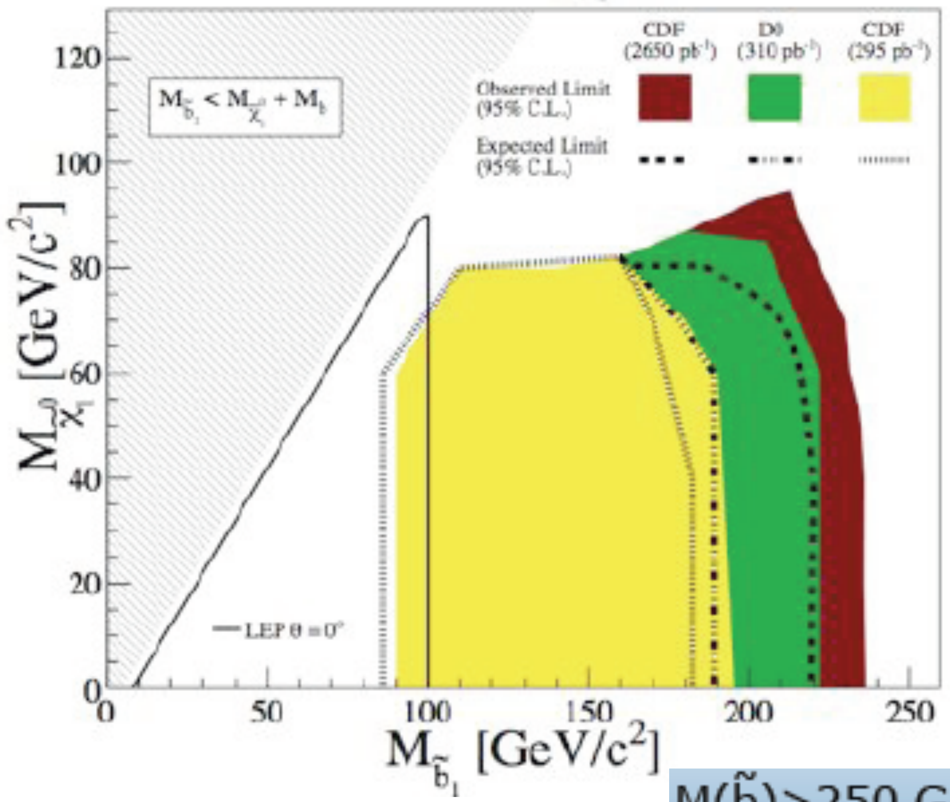
SUSY Searches: steady progress

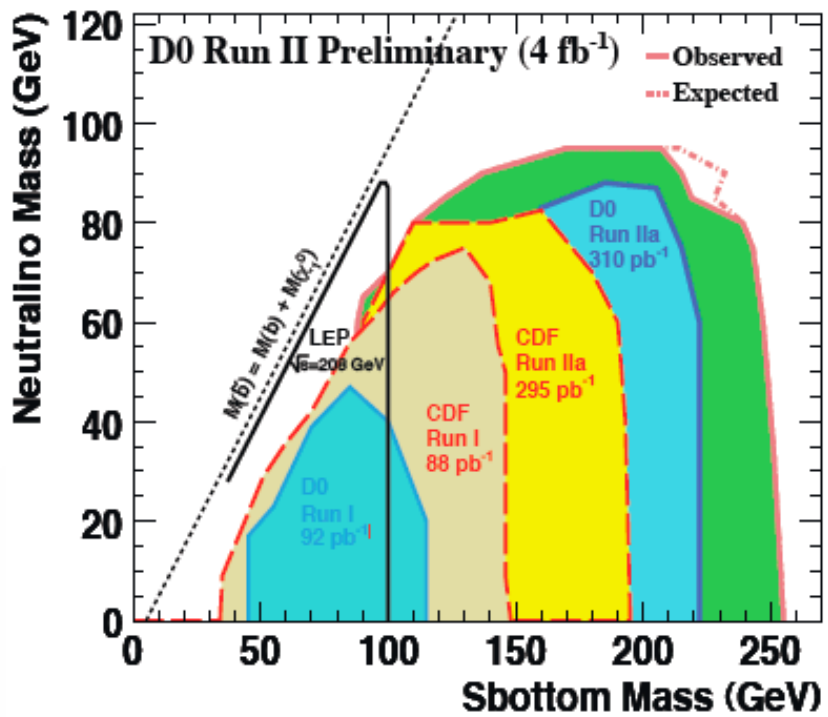
MSSM



Signature:
2 b-jets and
MET
($\tilde{\chi}_1^0$=LSP)

Gianluca de Lorenzo

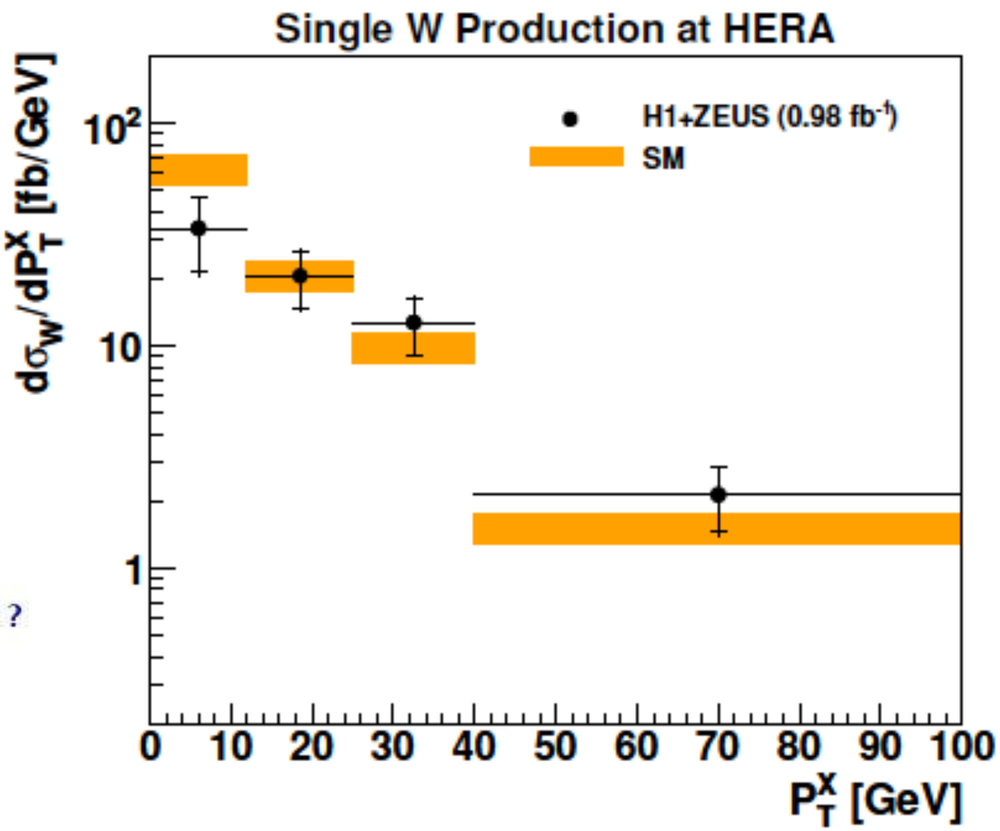




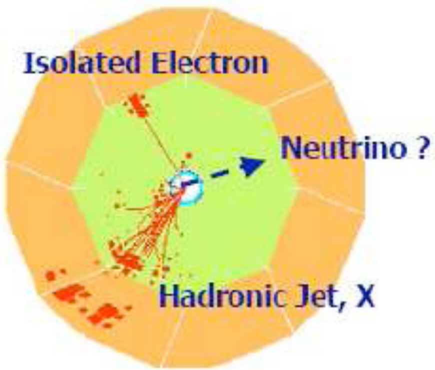
M($\tilde{b}$)>250 GeV/c² when M($\tilde{\chi}$)<70 GeV/c²

Will the new physics appear at the end of the data taking?

W production in ep collisions

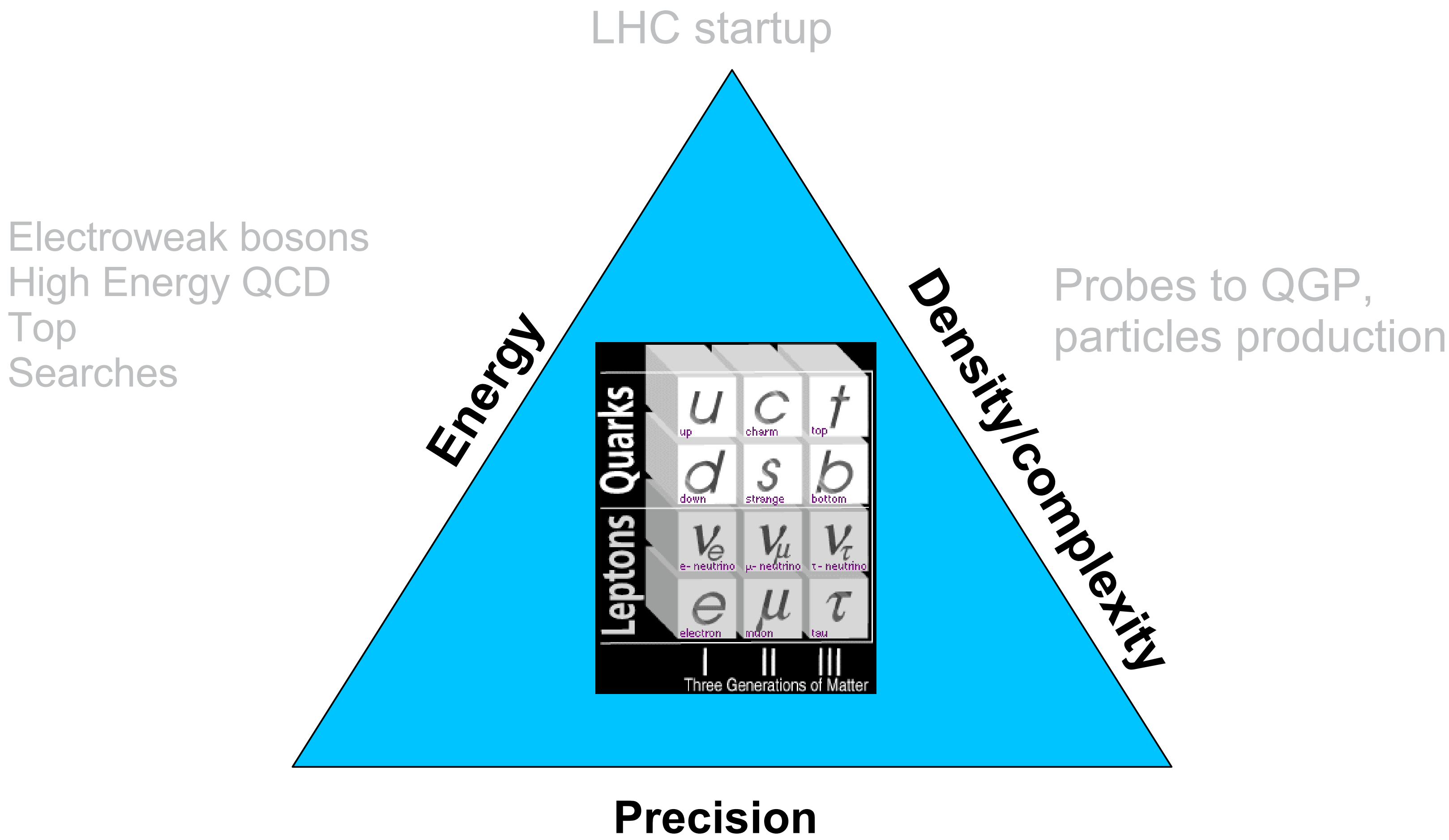


Combined
H1+ZEUS Data



The total single W cross section (at $\sqrt{s} = 317$ GeV) $= 1.06 \pm 0.16(\mathrm{stat.}) \pm 0.07(\mathrm{sys.})$ pb
in good agreement with SM prediction 1.26 ± 0.19 pb (from EPVEC at NLO)

The experimental frontiers of the high energy physics

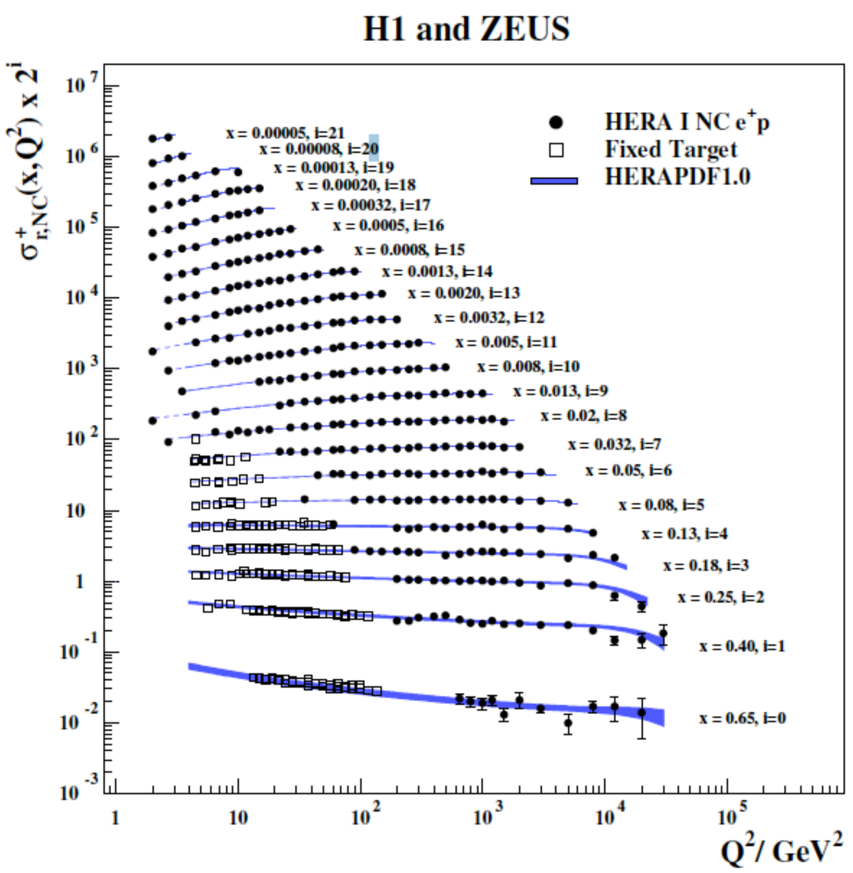


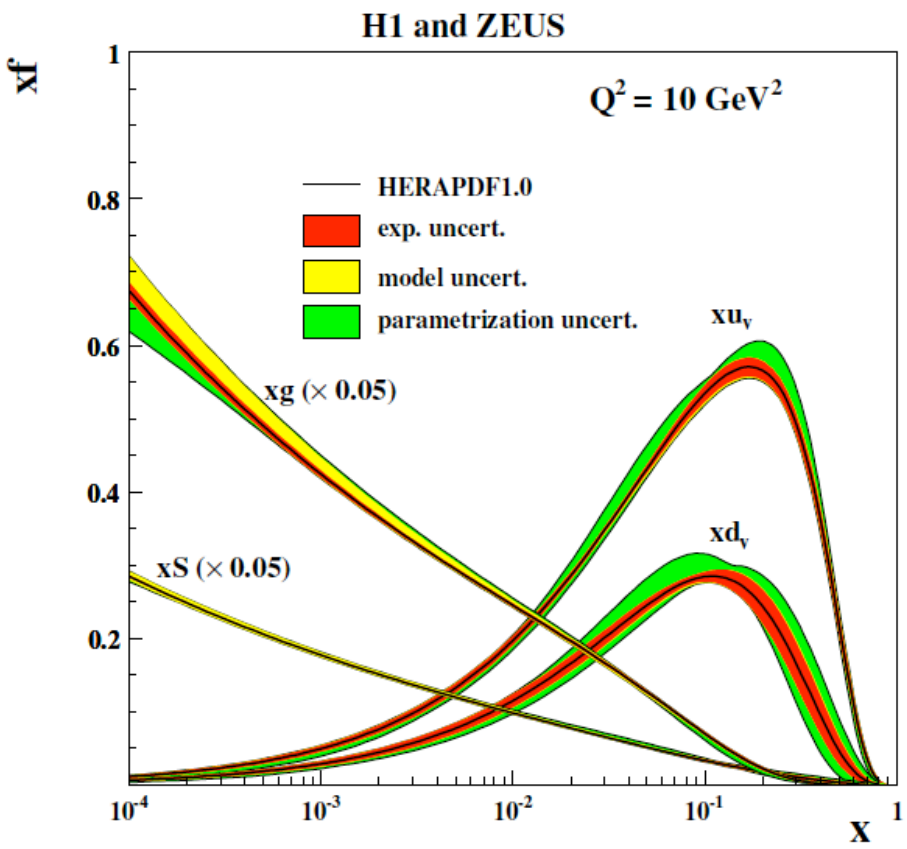
Proton structure, jets, strong coupling, Hadrons, Heavy flavours

Proton structure measurements at HERA

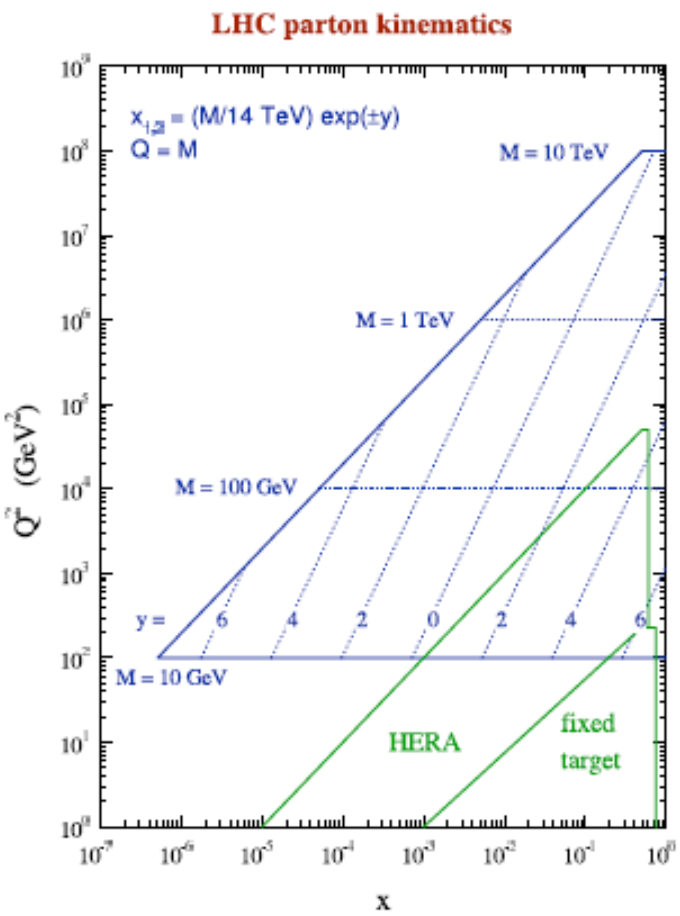
Precision to 1% at low x

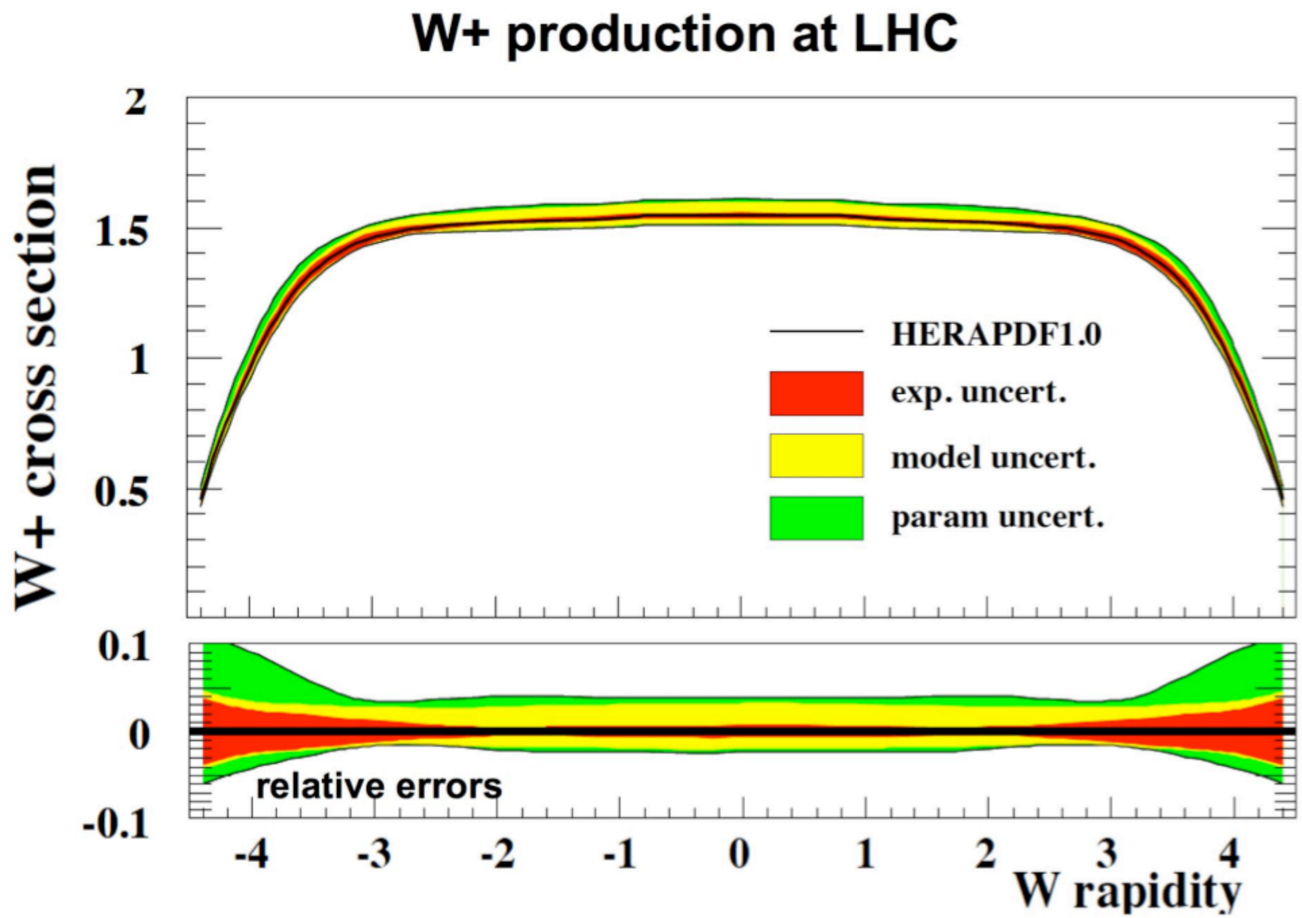
Katie Oliver





Predictions for LHC

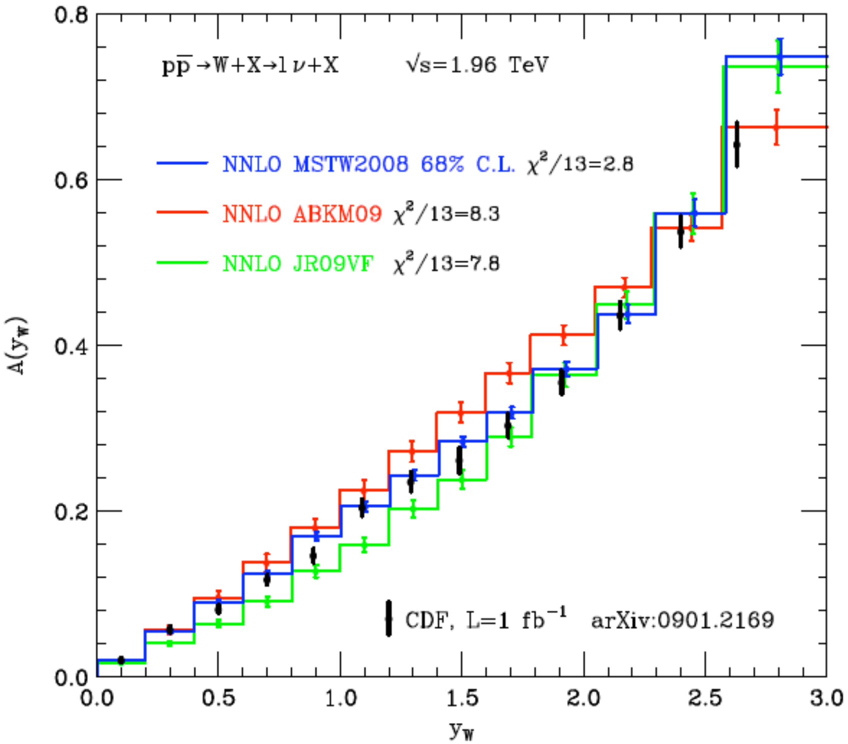




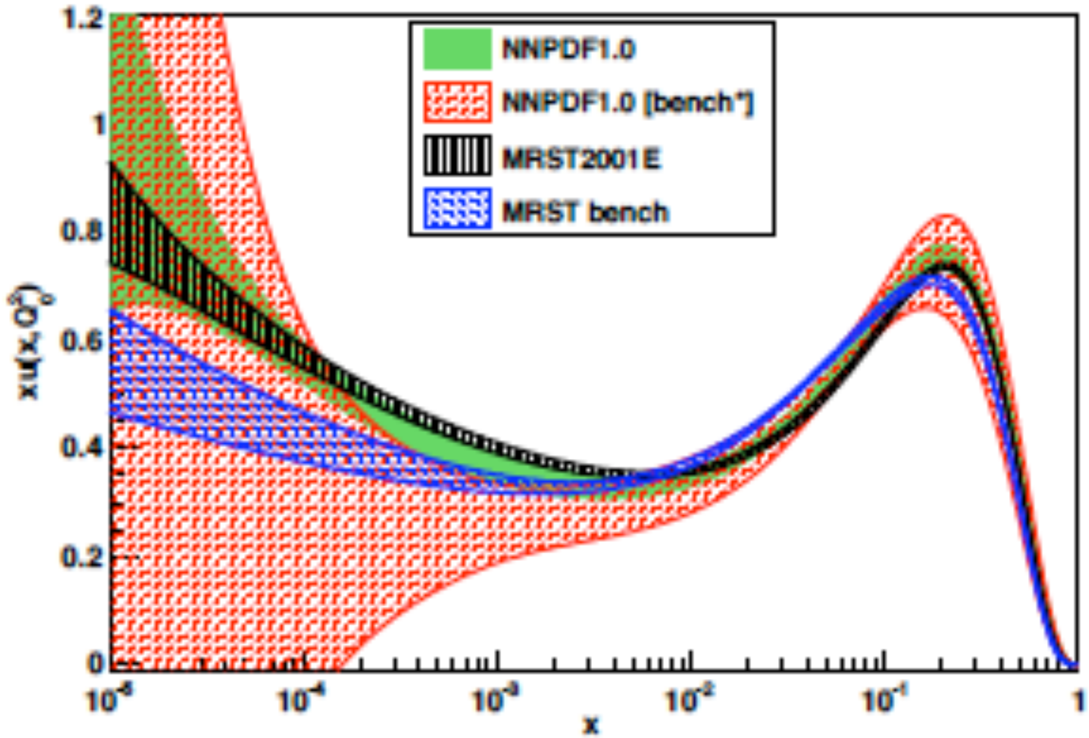
Combined data is extremely precise at low x
Systematic errors in PDF determination become dominant

PDF's and their erros

Giancarlo Ferrera



Maria Ubiali

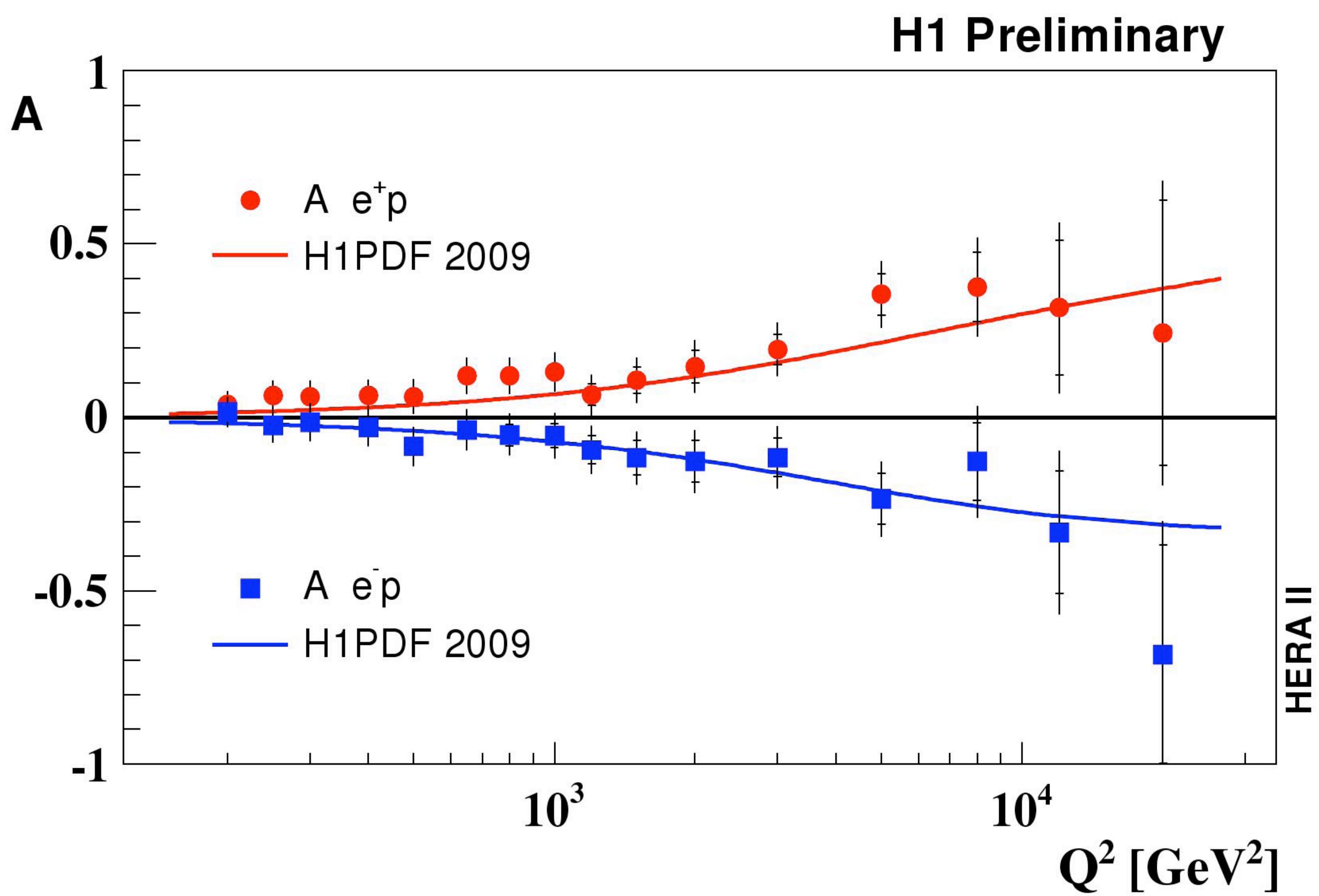


Most fine analyses (NNLO): different results
Work ongoing to refine the theoretical treatment

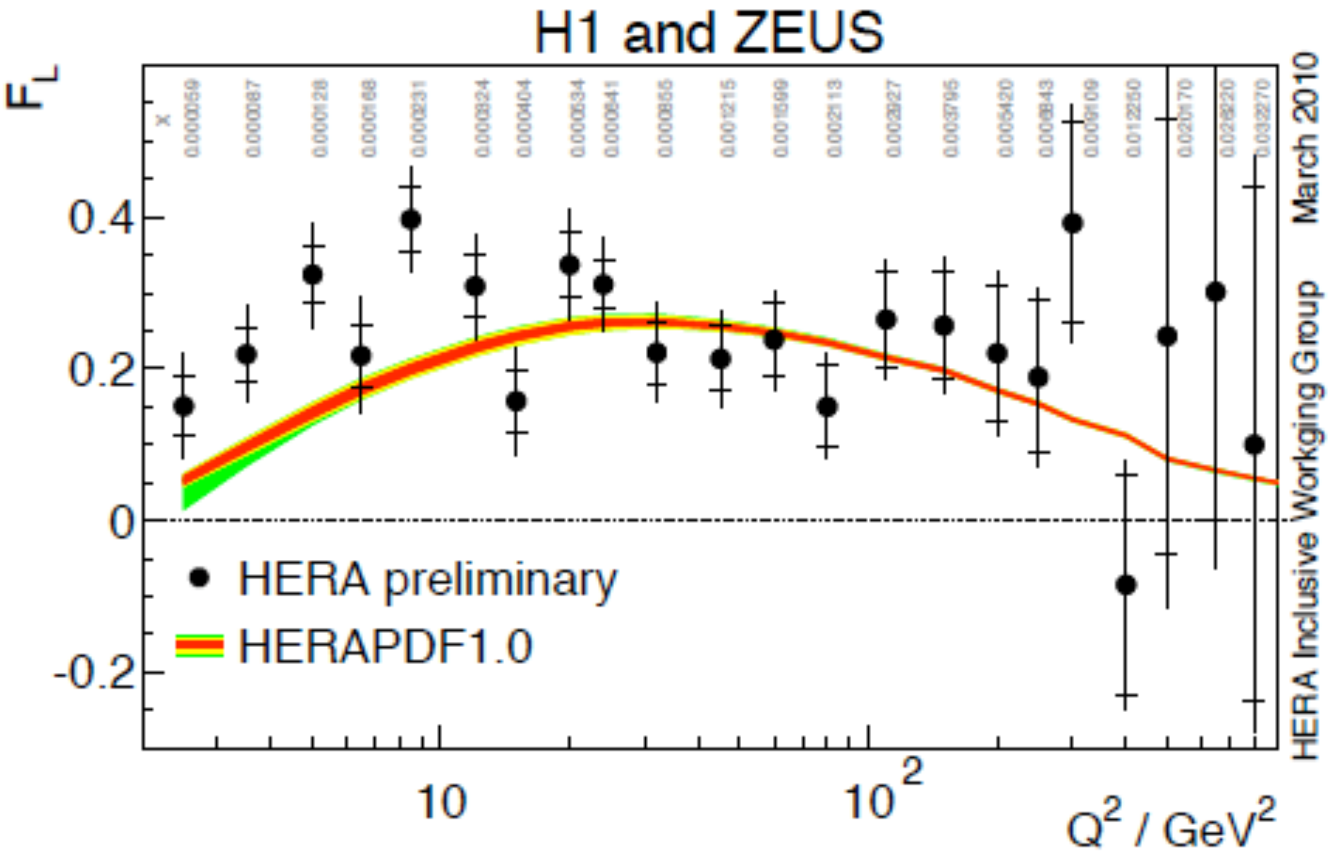
Benchmarks different
NNPDF: unbiased neural net
PDF parameterisation
Global fit released NNPDF2.0

Next step at HERA: high Q2 data

$$A^{\pm} = \frac{2}{P_e^+ - P_e^-}\left(\frac{\sigma^{\pm}(P_e^+) - \sigma^{\pm}(P_e^-)}{\sigma^{\pm}(P_e^+) + \sigma^{\pm}(P_e^-)}\right)$$

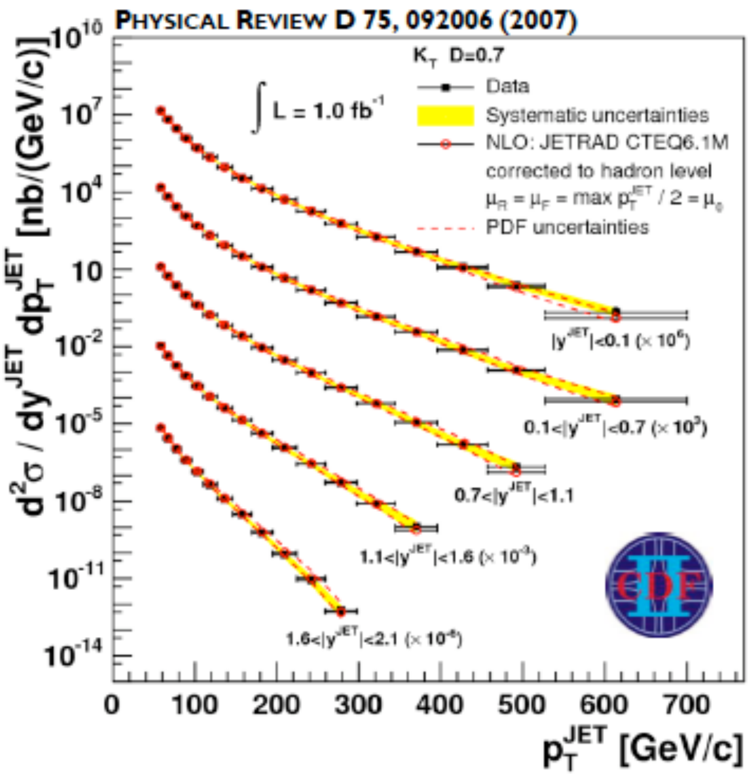


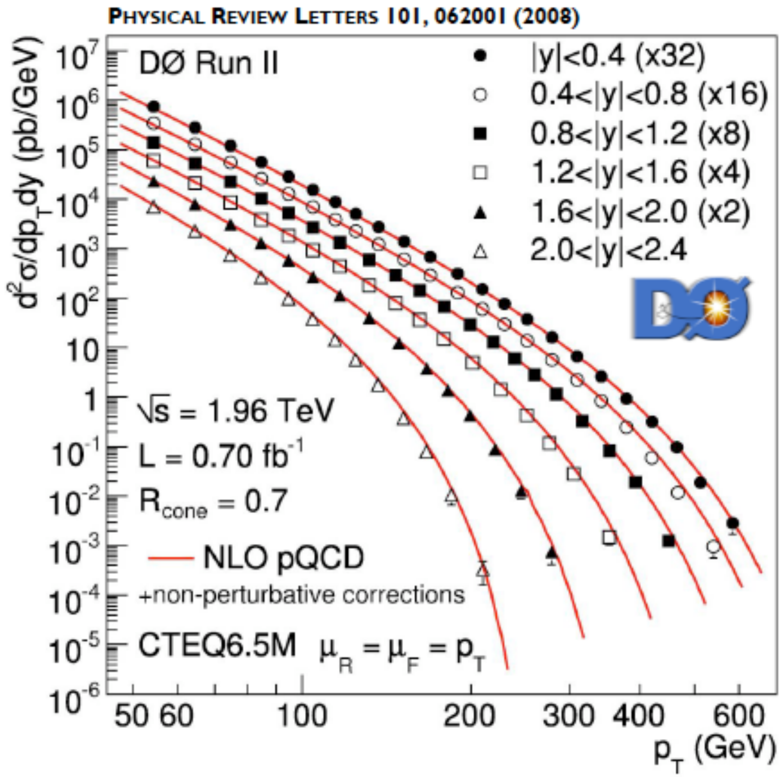
Longitudinal structure function

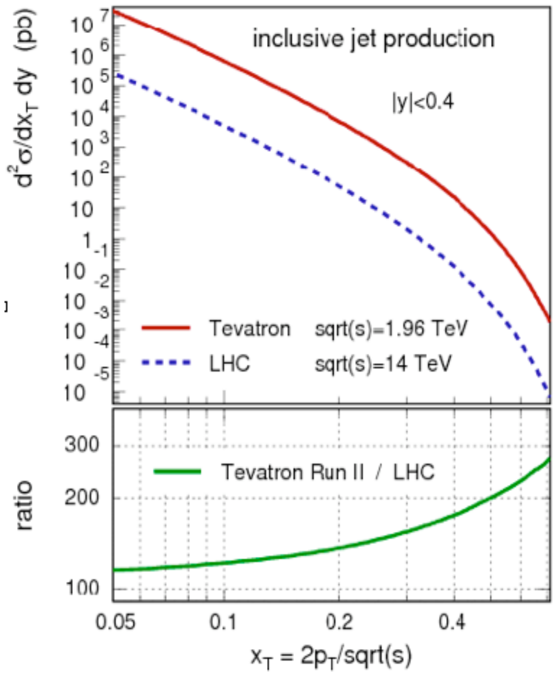


Combination of H1 and ZEUS data
Towards new constraints and interesting advances at low x

Inclusive jet measurements at Tevatron



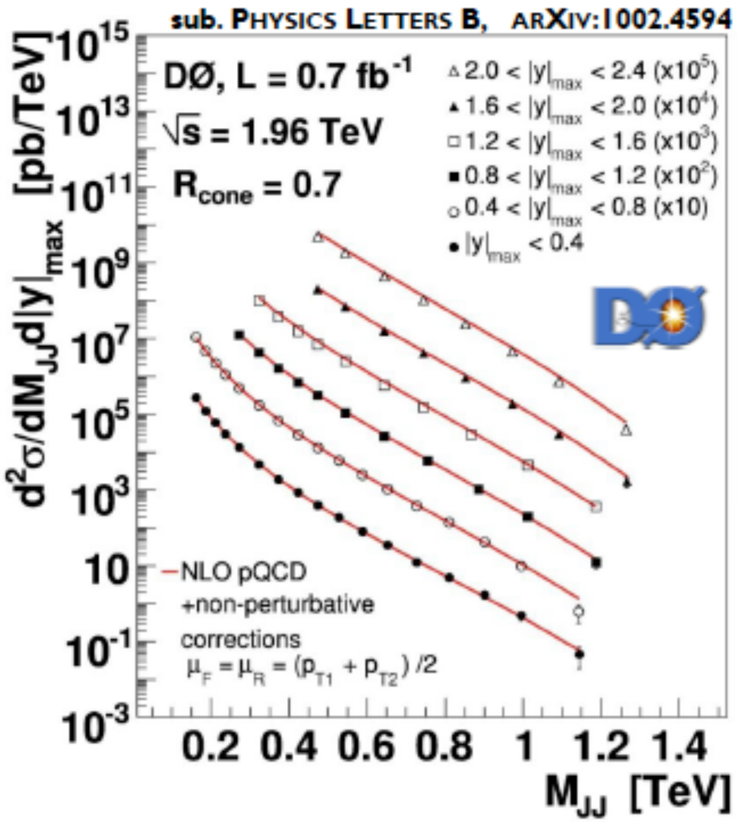


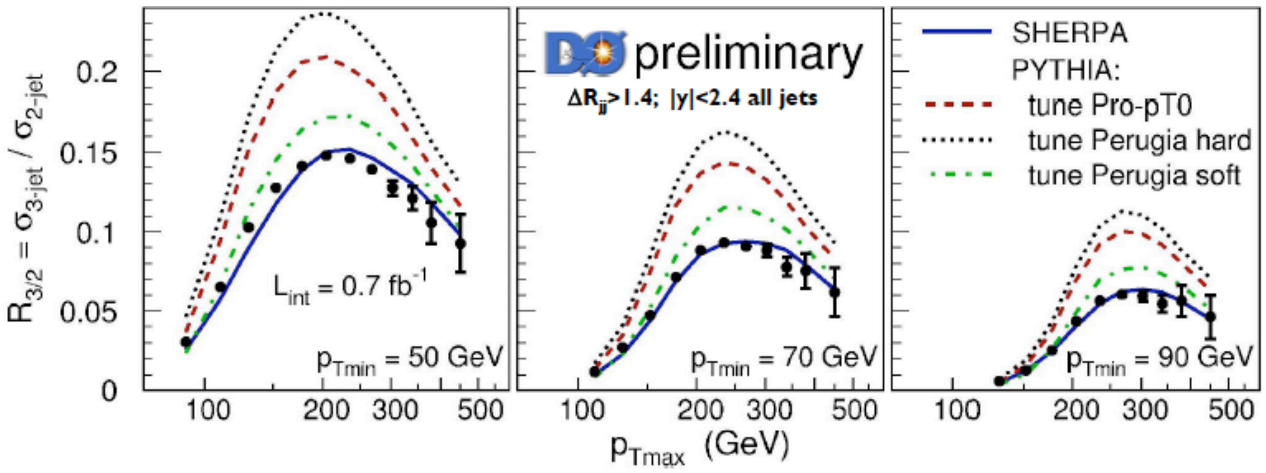


Check QCD at very large PT
Constrain PDF's at large x
Unique sensitivity (not superceded by LHC)

Jets at Tevatron : dijet mass

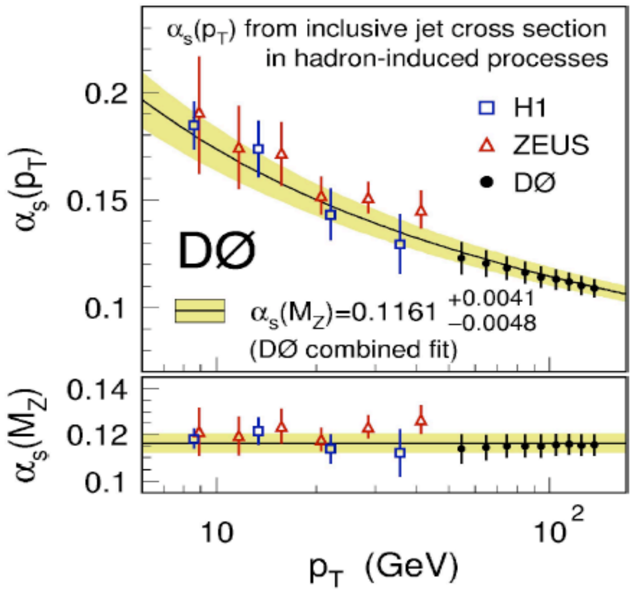
Darren Price

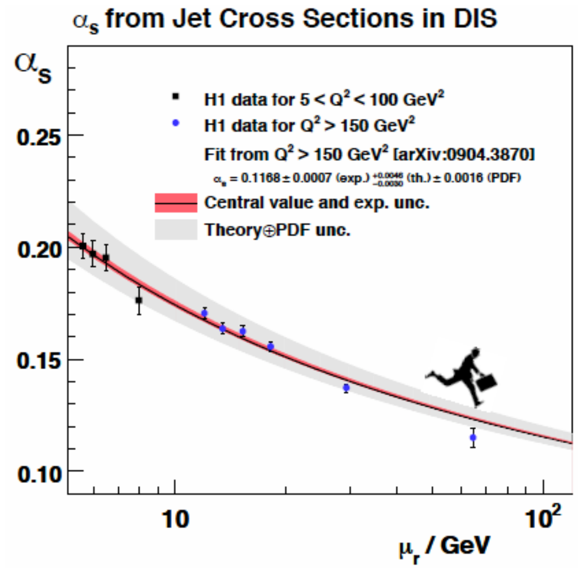




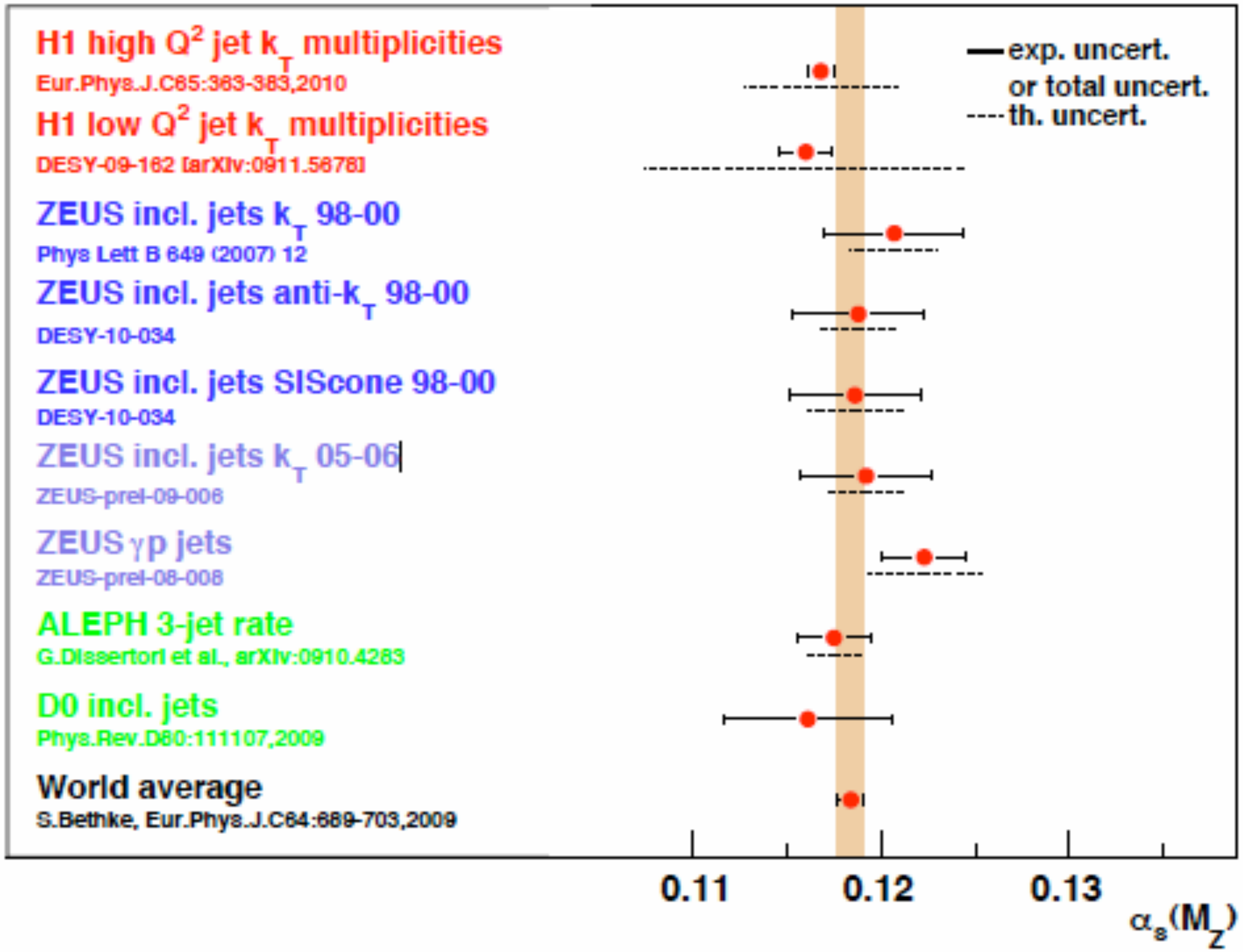
Independent QCD observables
No deviation of M_{JJ} observed
$R_{3/2}$ sensitive to MC tuning

Strong coupling measurements from jets





B.Hiroski
G.Grindhammer

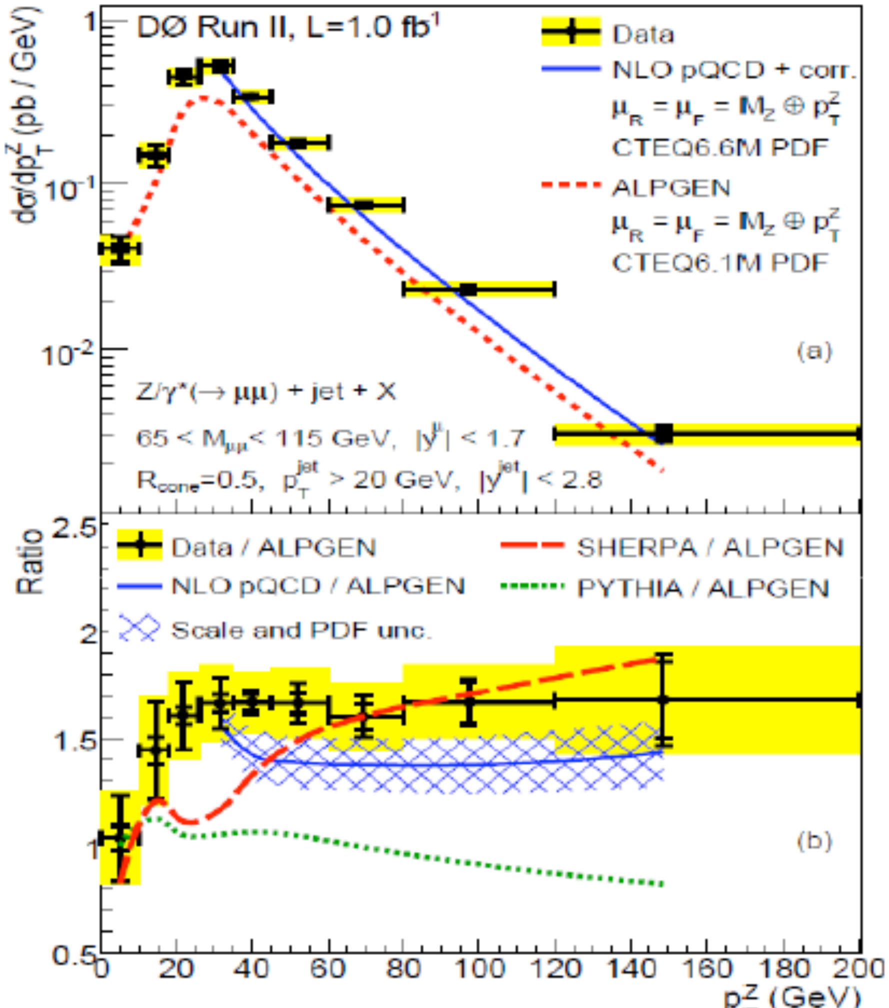


More theory (NNLO) needed for DIS

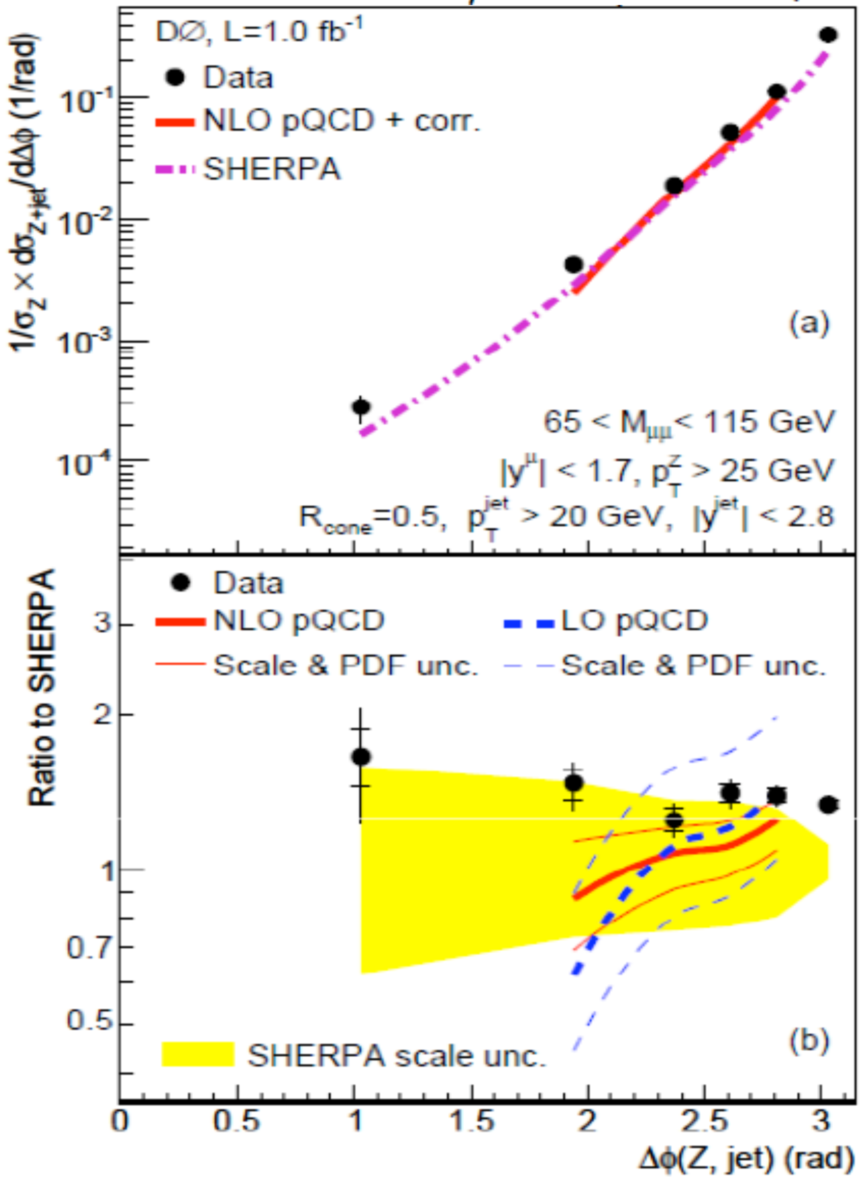
EW bosons as QCD workers

S. Grinstein

Phys.Lett.B682:370 (2010)

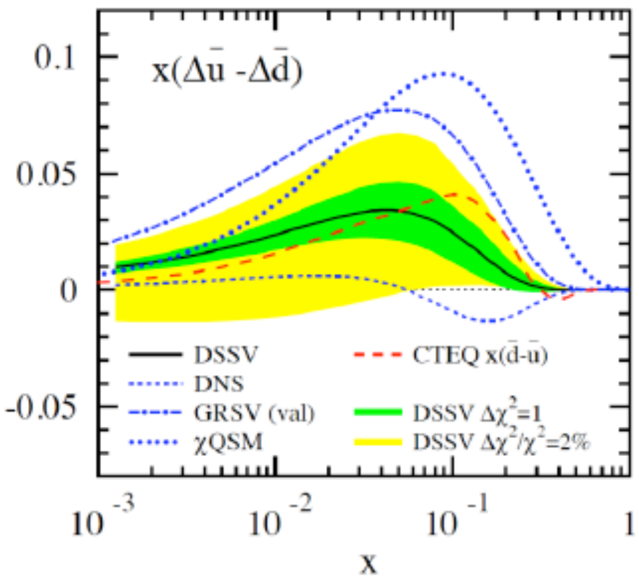


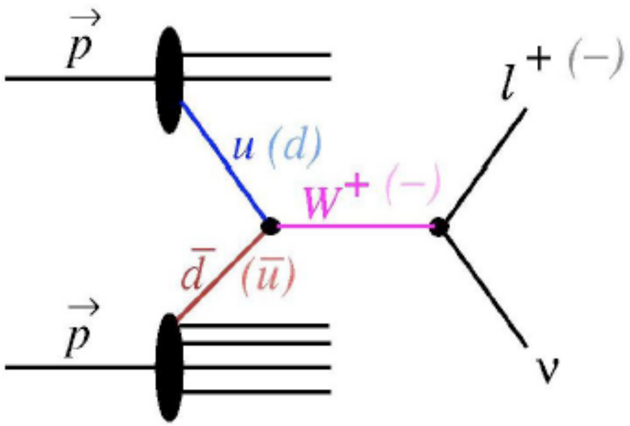
Phys.Lett.B669:278 (2008)

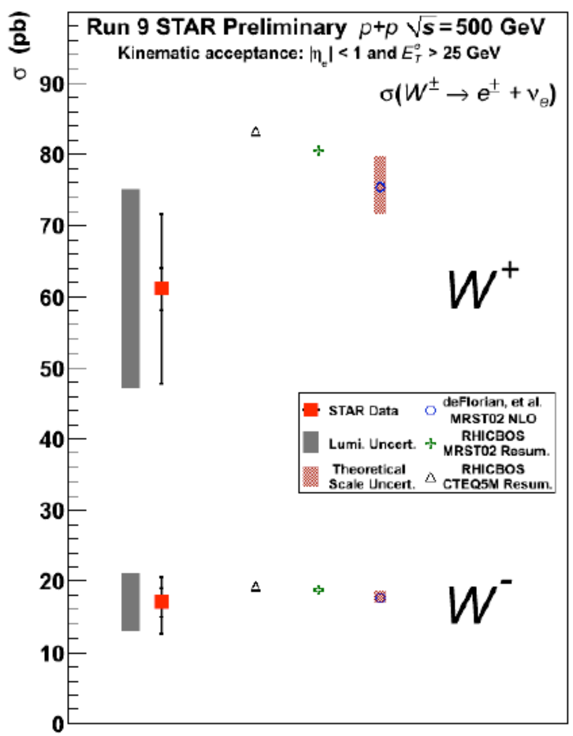


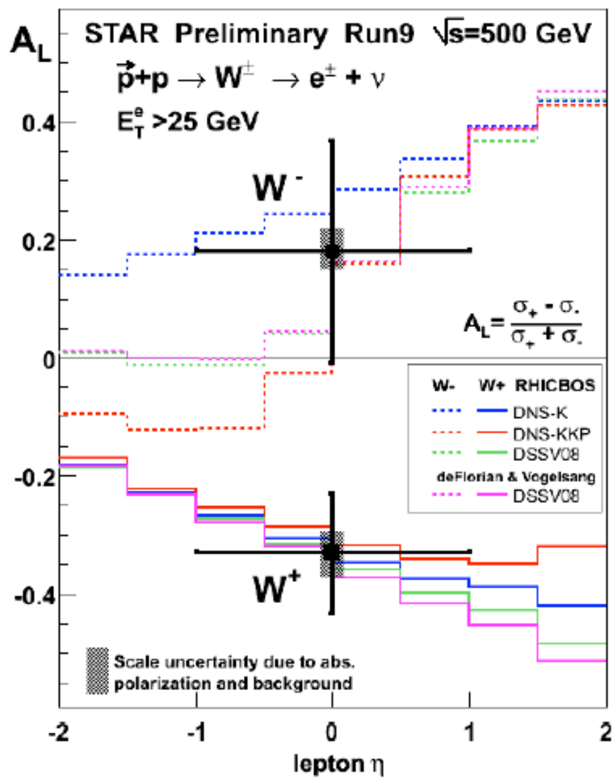
W at RHIC

Justin Stevens







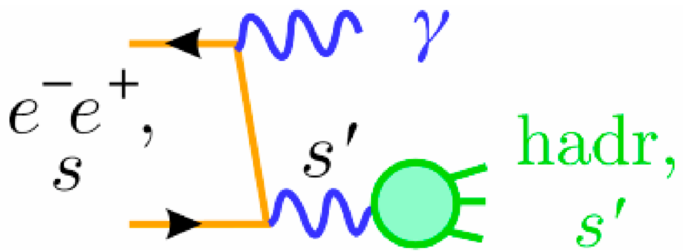


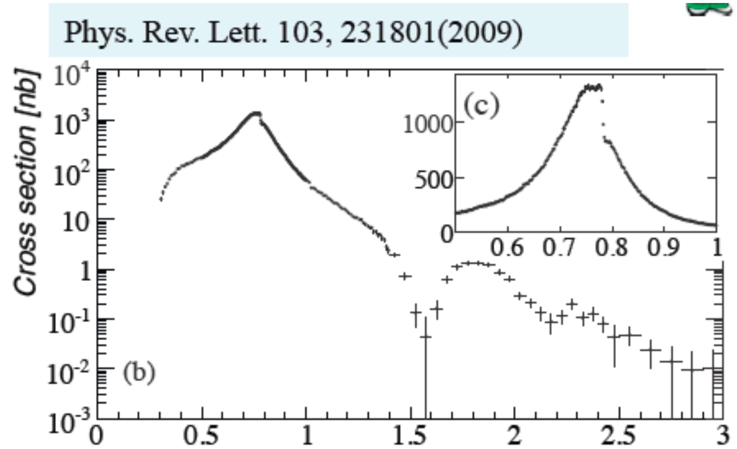
$$A_L^{W-} \propto -\Delta d(x_1)\bar{u}(x_2) + \Delta\bar{u}(x_1)d(x_2)$$

$$A_L^{W^+} \propto -\Delta u(x_1)\bar{d}(x_2) + \Delta\bar{d}(x_1)u(x_2)$$

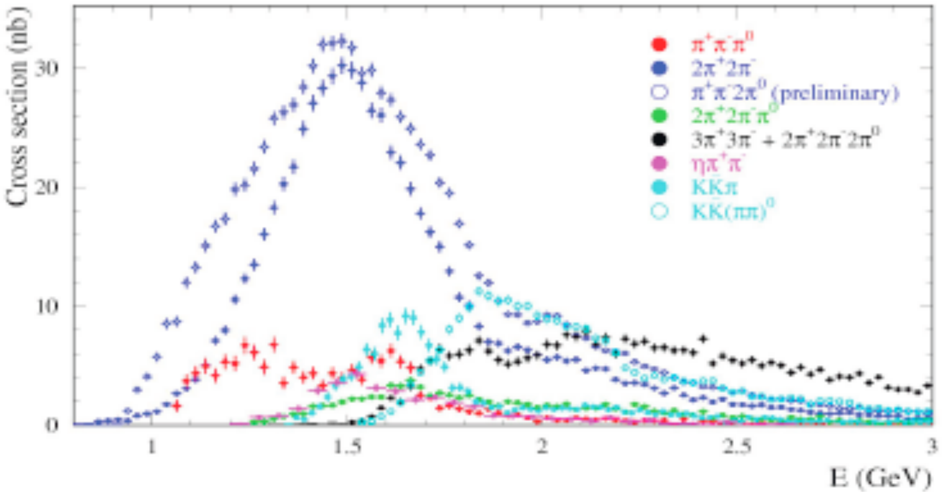
Statistics need improvement, foreseen in the next run

ISR measurements at b-factories





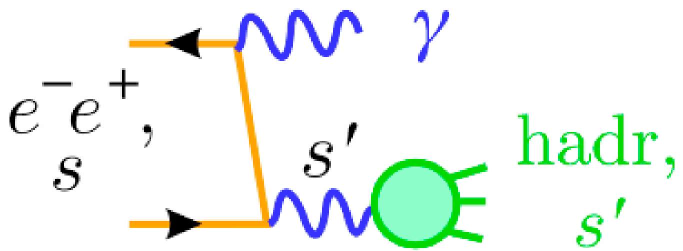
unprecedented accuracy! a factor 2-3 improvement on determination of contributions to a_μ^{had} ($\times 10^{-10}$)



	without *BABAR*	with *BABAR*
$\pi^+\pi^-\pi^0$	2.45 ± 0.26	3.25 ± 0.09
$2(\pi^+\pi^-)$	14.20 ± 0.90	13.09 ± 0.44
$3(\pi^+\pi^-)$	0.10 ± 0.10	0.11 ± 0.02
$2(\pi^+\pi^-\pi^0)$	1.42 ± 0.30	0.89 ± 0.09

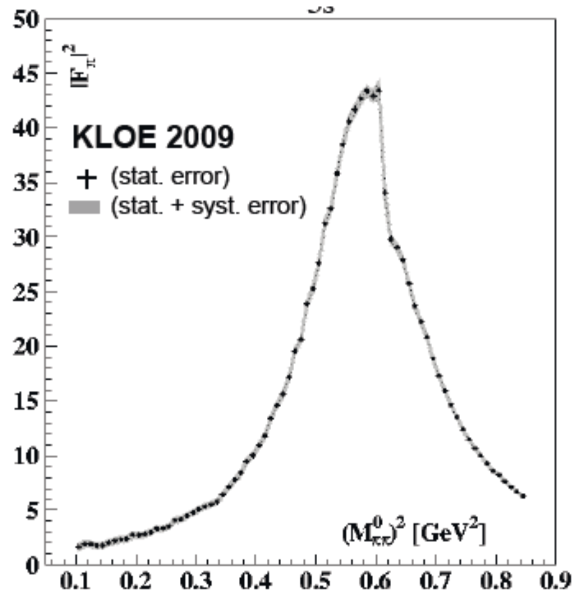
a_μ^{had} (10^{-10})	$695.5 \pm 4.0_{exp} \pm 0.7_{QCD}$
$a_\mu^{exp} - a_\mu^{SM}$ (10^{-10})	25.5 ± 8.0
Deviation	$3.2\,\sigma$

KLOE measurement hadronic cross section



$$a_\mu^{\mathrm{had}} = \frac{1}{4\pi^3}\int_{x_1}^{x_2}\sigma^{\mathrm{had}}(s)\mathrm{K}(s)\mathrm{d}s$$

$$\sigma_{\pi\pi}(s_\pi) = \frac{\pi\alpha^2\beta_\pi^3}{3s}\left|F_\pi(s_\pi)\right|^2$$



$a_\mu^{\pi\pi}$(0.35-0.85GeV^2):

KLOE08 (small angle)	$a_\mu^{\pi\pi} = (379.6 \pm 0.4_{stat} \pm 2.4_{sys} \pm 2.2_{theo}) \cdot 10^{-10}$
KLOE09 (large angle)	$a_\mu^{\pi\pi} = (376.6 \pm 0.9_{stat} \pm 2.4_{sys} \pm 2.1_{theo}) \cdot 10^{-10}$
	0.2% 0.6% 0.6%

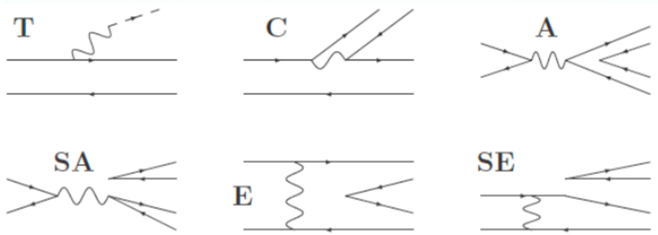
$a_\mu^{\pi\pi}$(0.152-0.270 GeV^2):

KLOE09 (large angle)	$a_\mu^{\pi\pi} = (48.1 \pm 1.2_{stat} \pm 1.2_{sys} \pm 0.4_{theo}) \cdot 10^{-10}$
CMD-2	$a_\mu^{\pi\pi} = (46.2 \pm 1.0_{stat} \pm 0.3_{sys}) \cdot 10^{-10}$

Competitive precision
Shift in a_μ remains in the 3 sigma region

CLEO-c: the nature of hadronic decays Ds->PP

Marina Artuso



818 pb^{-1}

Understanding of the strong interaction mechanisms in hadronic decays

Prediction based here on SU(3) and a subset of discrete symmetries

$$R(D^+) \equiv \frac{(\Gamma(D^+) \to K_s^0\pi^+) - (\Gamma(D^+) \to K_L^0\pi^+)}{(\Gamma(D^+) \to K_s^0\pi^+) + (\Gamma(D^+) \to K_L^0\pi^+)}$$

Cabibbo favored

Meson	Decay Mode	B(%)(CLEO-c)	Rep.	Predicted B (%)
D^0	$K^-\pi^+$	3.9058±0.077	T+E	3.905
	$\bar{K}^0\pi^0$	2.38±0.085	(C-E)/√2	2.347
	$\bar{K}^0\eta$	0.962±0.060	C/√3	1.002
	$\bar{K}^0\eta'$	1.900±0.108	-(C+E)/√6	1.920
D^+	$\bar{K}^0\pi^+$	3.074±0.097	C+T	3.090
D_s	$\bar{K}^0K^+$	2.98±0.17	C+A	2.939
	$\pi^+\eta$	1.84±0.15	(T-2A)/√3	1.810
	$\pi^+\eta'$	3.95±0.34	2(T+A)/√6	3.693

Cabibbo single supressed

Meson	Decay mode	$\mathcal{B}$[1] (10^{-3})	p^* (MeV)	$\lvert A\rvert$ ($10^{-7}GeV$)	Rep.	Predicted $\mathcal{B}$ (10^{-3}) $\lvert T\rvert < \lvert C\rvert$	Predicted $\mathcal{B}$ (10^{-3}) $\lvert T\rvert > \lvert C\rvert$
D^0	$\pi^+\pi^-$	1.45 ± 0.05	921.9	4.70 ± 0.08	$-(T' + E')$	2.24	2.24
	$\pi^0\pi^0$	0.81 ± 0.05	922.6	3.51 ± 0.11	$-(C' - E')/\sqrt{2}$	1.36	1.35
	K^+K^-	4.07 ± 0.10	791.0	8.49 ± 0.10	$(T' + E')$	1.92	1.93
	$K^0\overline{K}^0$	0.32 ± 0.02	788.5	2.39 ± 0.14	0	0	0
D^+	$\pi^+\pi^0$	1.18 ± 0.06	924.7	2.66 ± 0.07	$-(T' + C')/\sqrt{2}$	0.88	0.89
	$K^+\overline{K}^0$	6.12 ± 0.22	792.6	6.55 ± 0.12	$(T' - A')$	0.73	6.15
D_s^+	π^+K^0	2.52 ± 0.27	915.7	5.94 ± 0.32	$-(T' - A')$	0.37	3.08
	π^0K^+	0.62 ± 0.23	917.1	2.94 ± 0.55	$-(C' + A')/\sqrt{2}$	0.86	0.85

Cabibbo doubly supressed

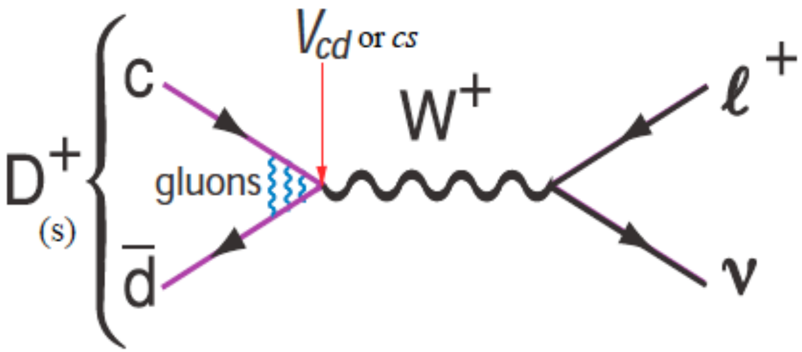
$s \leftrightarrow d$ exchange

$$\frac{\Gamma(D^0 \to K_s\pi^0) - \Gamma(D^0 \to K_L\pi^0)}{\Gamma(D^0 \to K_s\pi^0) + \Gamma(D^0 \to K_L\pi^0)} = 0.108 \pm 0.025 \pm 0.024$$

Prediction $R(D^0) = 2\tan^2\theta_c = 0.107$

Ds->tau nu

Sheldon Stone
Jochen Dingfelder



$$\Gamma(P^+ \to \ell^+ \nu) = \frac{1}{8\pi} G_F^2 f_P^2 m_\ell^2 M_P \left(1 - \frac{m_\ell^2}{M_P^2}\right)^2 |V_{Qq}|^2$$

Calculate, or measure if V_{Qq} is known, here take $V_{cd}=V_{us}= 0.2256$, $V_{cs}=V_{ud}-V_{cb}/4= 0.9734$

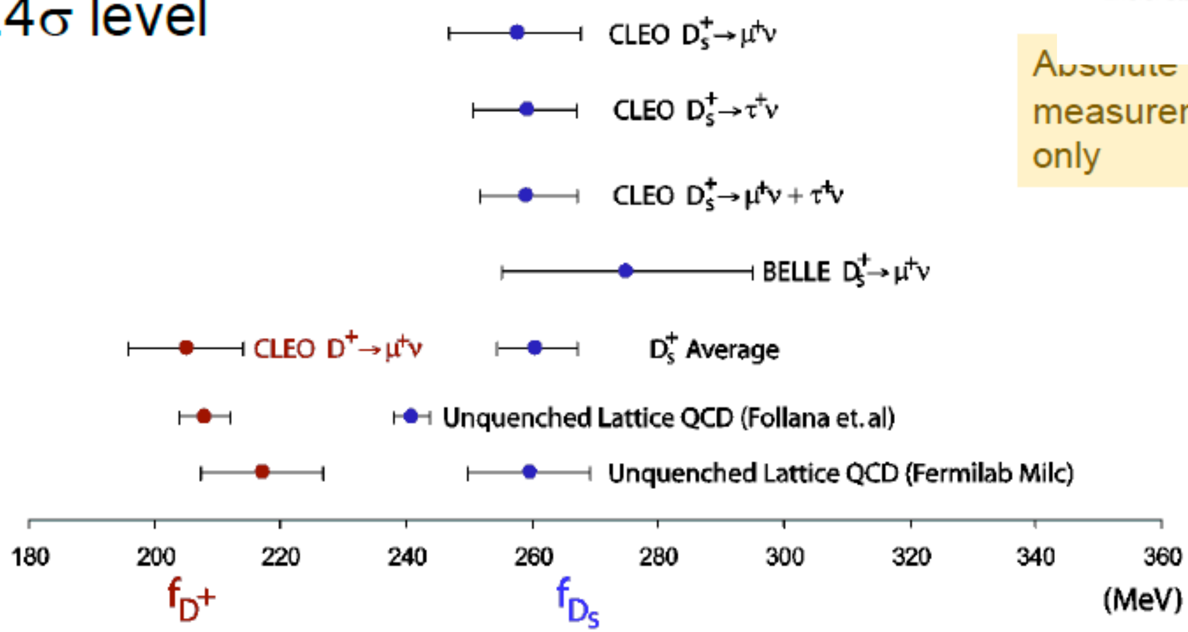
$f_{D_s} = (233.6 \pm 13.6 \pm 10.4 \pm 7.1)$ MeV
(Tot. Error = 7.9%)

Errors: Statistical ± BaBar Systematic ± PDG Systematic

BABAR preliminary

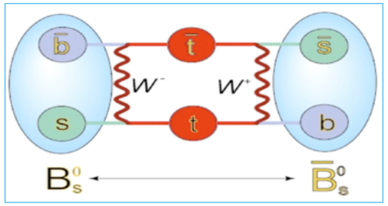
2.4σ level

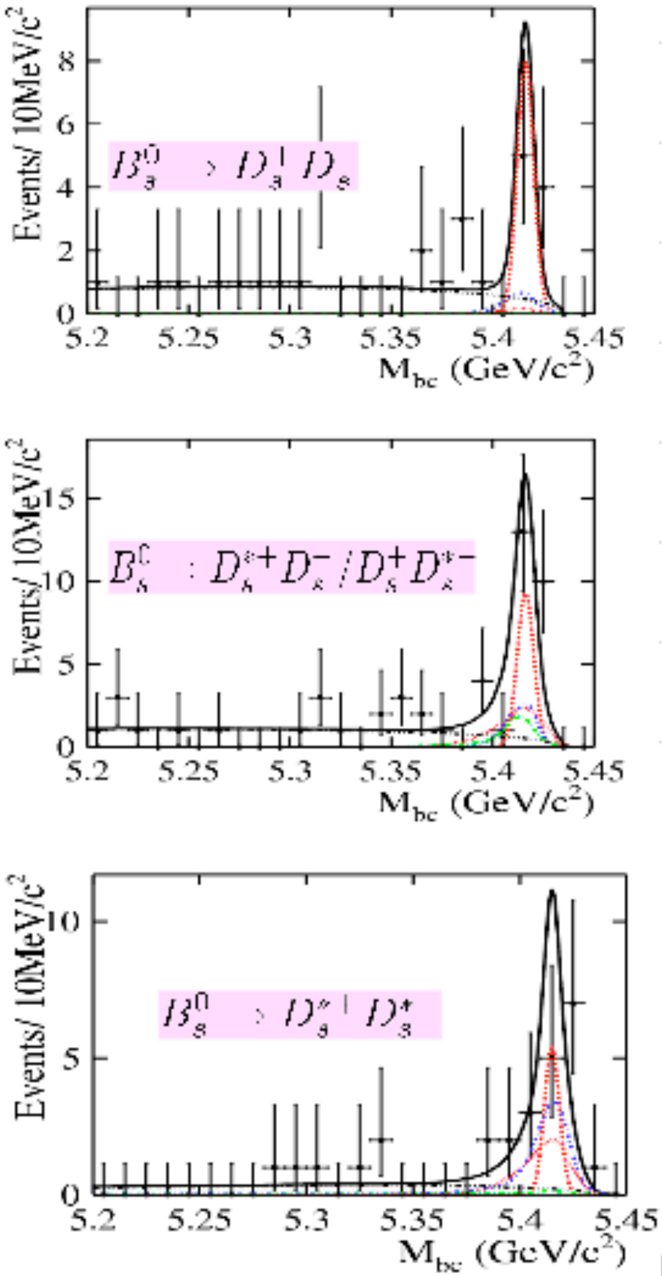
Absolute B measurements only



Belle Bs->DsDs

Tariq Aziz





(23.6 fb^{-1})

$$\frac{\Delta\Gamma_s}{\Gamma_s} = \frac{2\mathcal{B}(B_s \to D_s^{(*)+} D_s^{(*)-})}{1 - \mathcal{B}(B_s \to D_s^{(*)+} D_s^{(*)-})}$$

$$\mathcal{B}(B_s^0 \to D_s^{(*)+} D_s^{(*)-}) = (6.9^{+1.5}_{-1.3} \pm 1.9)\%$$

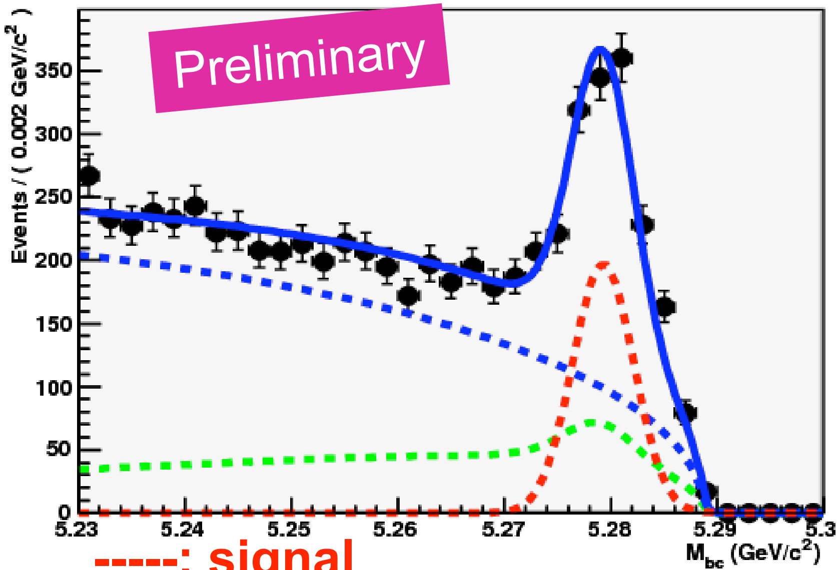
$$\frac{\Delta\Gamma_s}{\Gamma_s} = \frac{2\mathcal{B}}{(1-\mathcal{B})} = (0.147^{+0.036+0.044}_{-0.030-0.042} \pm 0.004)\%$$

$PDG: \quad 0.092^{+0.051}_{-0.054}$

Belle: hadronic penguins

Jeri M.C. Chang

657M BB Sum of exclusive modes $B \to X_s \eta$



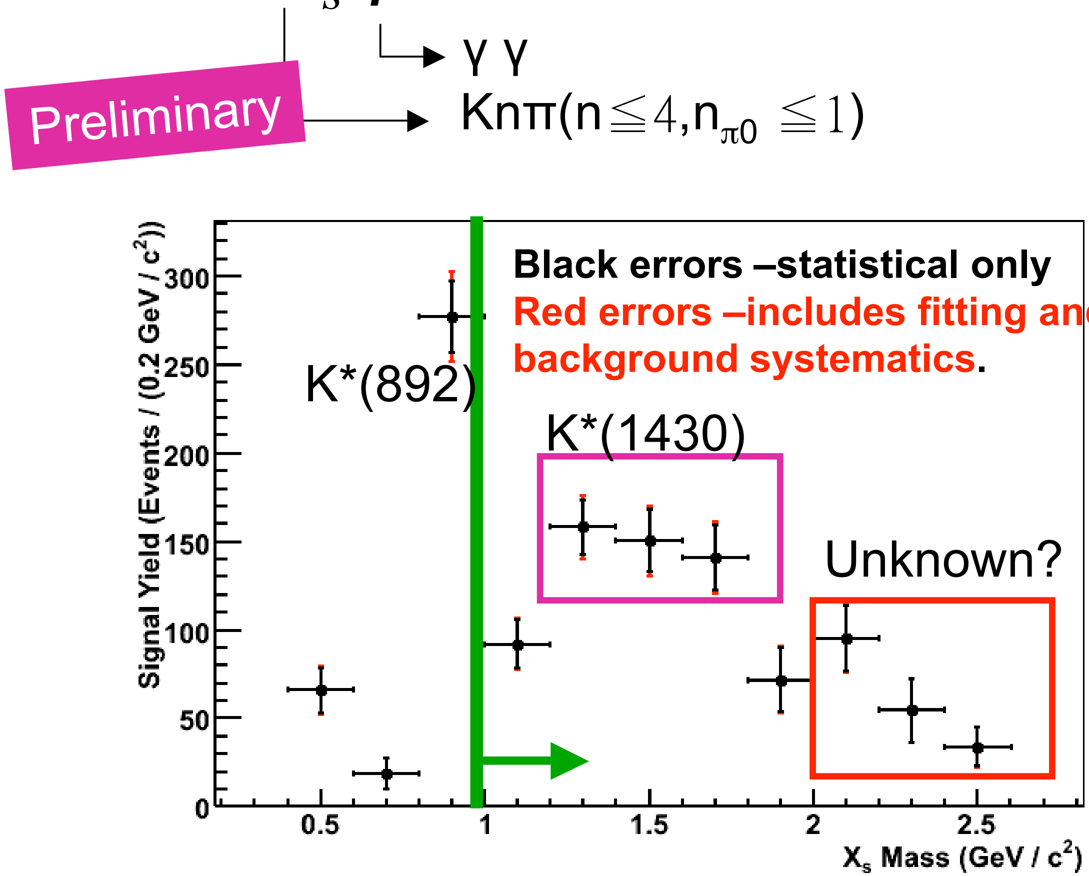
-----: signal

-----: BB background

-----: combinatorial background

Signal yield (M_{Xs}> 1.0 GeV/c^2) =

17.6σ statistical significance



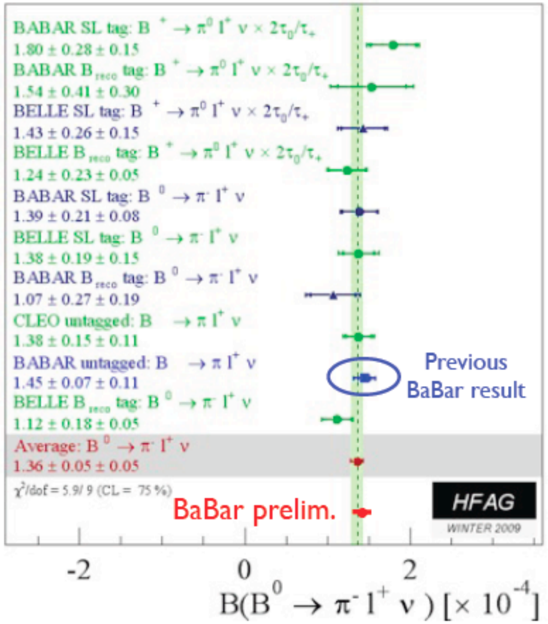
M_{bc} is fitted in bins of Xs mass.

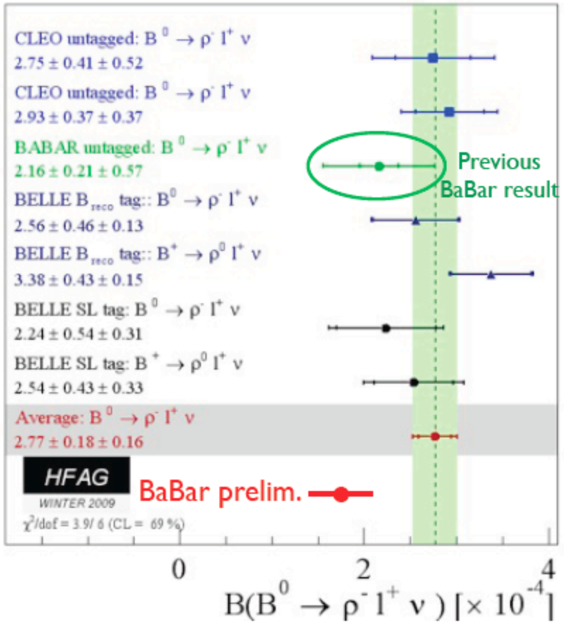
Vub form factors

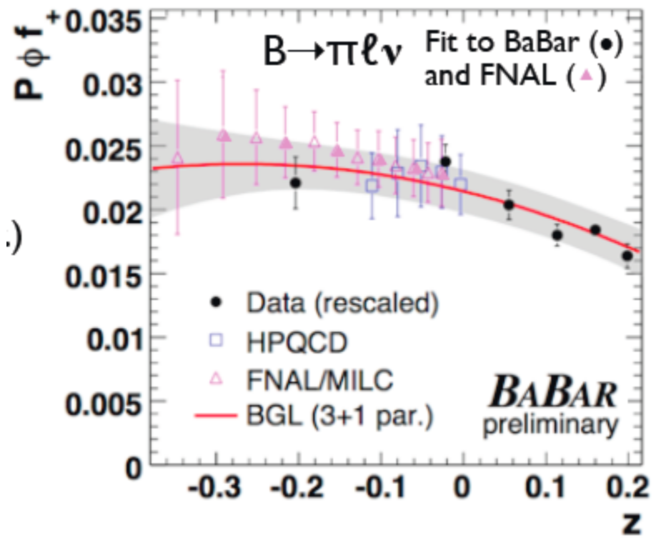
$$\mathcal{B}(B^0 \to \pi^- \ell^+ \nu) = (1.41 \pm 0.05 \pm 0.07) \times 10^{-4}$$
$$\mathcal{B}(B^0 \to \rho^- \ell^+ \nu) = (1.75 \pm 0.15 \pm 0.27) \times 10^{-4}$$

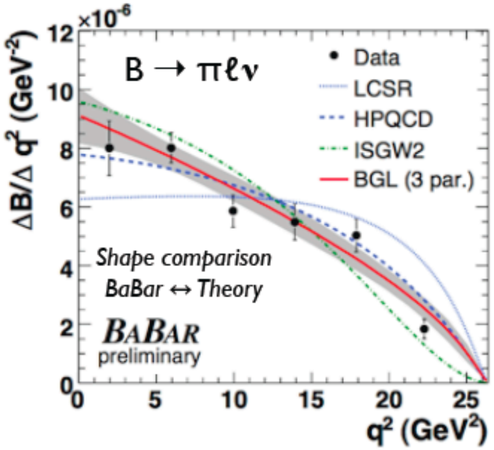
BABAR preliminary

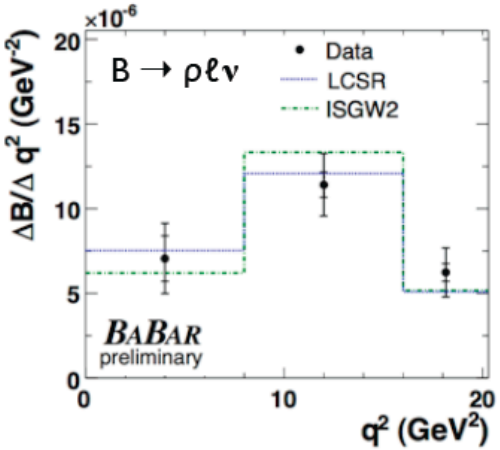
Jochen Dingfelder











$$|V_{ub}| = (3.05 \pm 0.29) \times 10^{-3} \quad \text{FNAL/MILC (6 points)}$$
$$|V_{ub}| = (3.01 \pm 0.35) \times 10^{-3} \quad \text{HPQCD (1 point)}$$

BABAR preliminary

⇒ Most precise $|V_{ub}|$ result from exclusive decays: error ~ 9-10%

Tevatron: b-baryons

Mirco Dorigo
Marek Karliner

D0

- $L = 1.3\ fb^{-1}$
- built on Ξ_b^- discovery
  $m(\Xi_b^-) = 5774 \pm 11 \pm 15$ MeV/c^2
- $N(\Omega_b^-) = 17.8 \pm 4.9 \pm 0.8$
- significance 5.4σ
- $m(\Omega_b^-) = 6165 \pm 10 \pm 13$ MeV/c^2

World's First

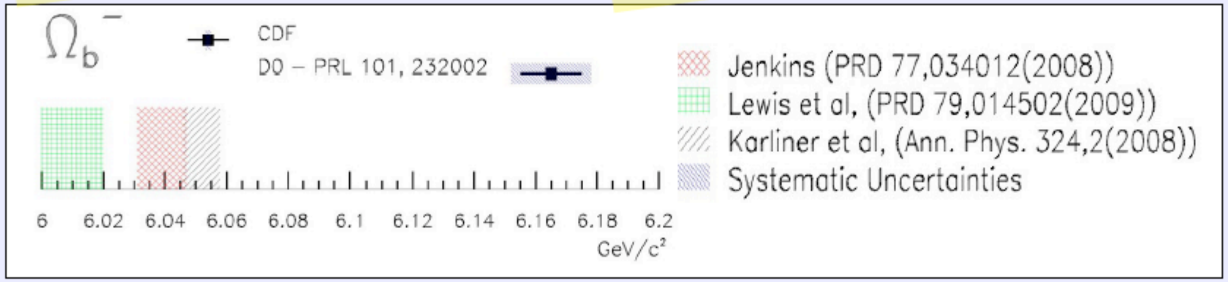
CDFII

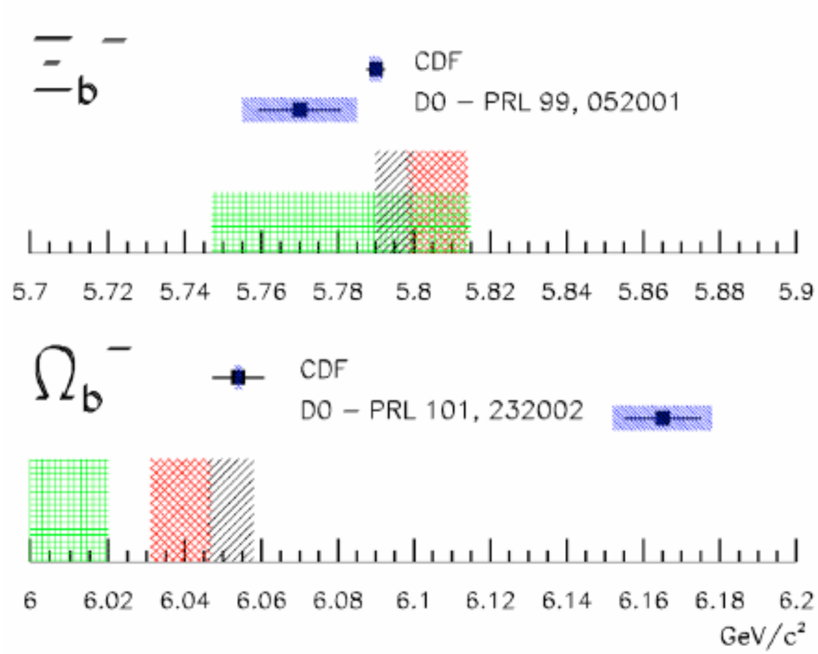
- $L = 4.2\ fb^{-1}$
- Ξ_b^- update (from 1.9 fb^{-1}):
  $m(\Xi_b^-) = 5790.9 \pm 2.6 \pm 0.8$ MeV/c^2
  $\tau(\Xi_b^-) = 1.56^{+0.27}_{-0.25} \pm 0.2$ ps

World's Best

- $N(\Omega_b^-) = 16^{+6}_{-4}$
- significance 5.5σ
- $m(\Omega_b^-) = 6054.4 \pm 6.8 \pm 0.9$ MeV/c^2
- $\tau(\Omega_b^-) = 1.13^{+0.53}_{-0.40} \pm 0.02$ ps

World's First





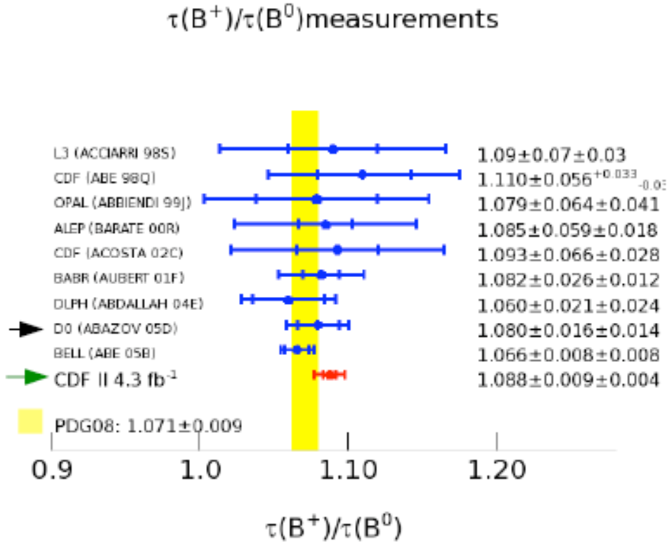
Measurements complete the heavy baryons knowledge
Discrepancy in Omega_b needs further investigation

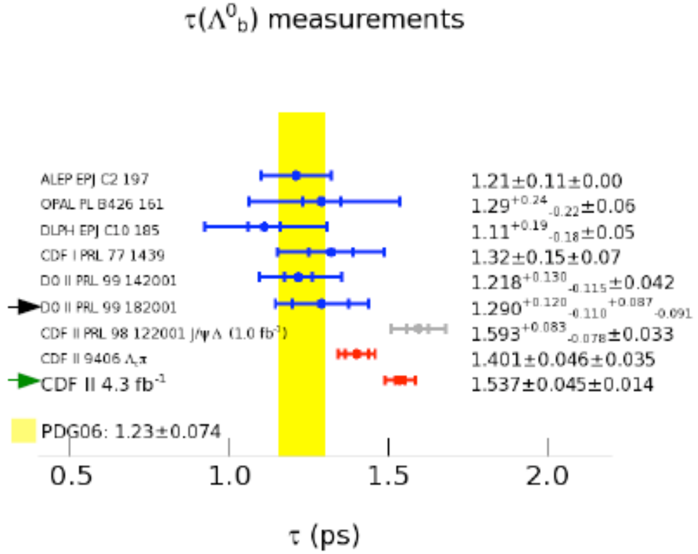
Advances in lifetimes measurements

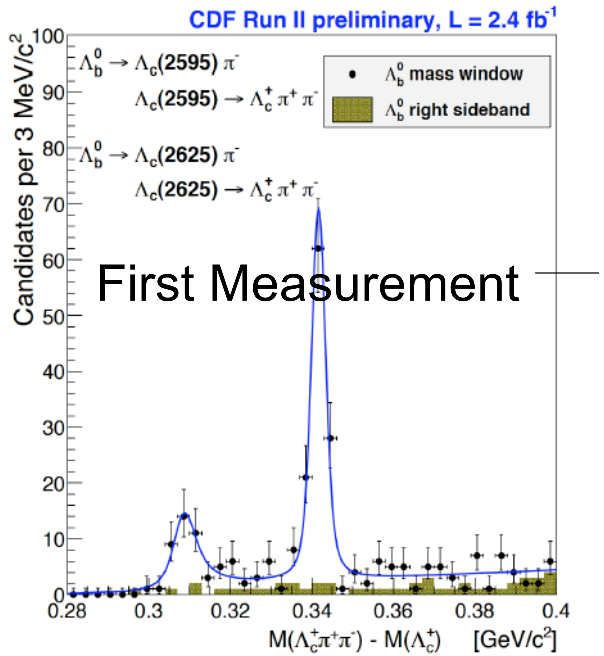
$$B^+ \to J/\psi\, K^+,\ B^0 \to J/\psi\, K^{*0},\ B^0 \to J/\psi\, K^0_s,\ \text{and}\ \Lambda^0_b \to J/\psi\, \Lambda^0$$

Results — World's Best

$$c\tau(B^+) = 491.4 \pm 2.6\ (stat.)\ \pm\ 2.6\ (syst.)\ \mu m,$$
$$c\tau(B^0) = 451.7 \pm 3.0\ (stat.)\ \pm\ 2.5\ (syst.)\ \mu m,$$
$$c\tau(\Lambda^0_b) = 460.8 \pm 13.4\ (stat.)\ \pm\ 4.1\ (syst.)\ \mu m.$$
$$\tau(B^+)/\tau(B^0) = 1.088 \pm 0.009\ (\text{stat.}) \pm 0.004\ (\text{syst.})$$
$$\tau(\Lambda^0_b)/\tau(B^0) = 1.020 \pm 0.030\ (\text{stat.}) \pm 0.008\ (\text{syst.})$$

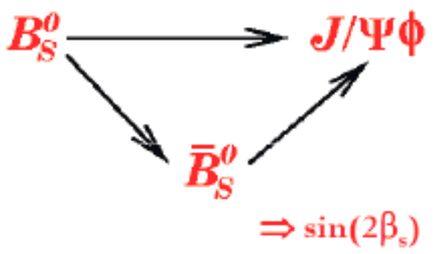




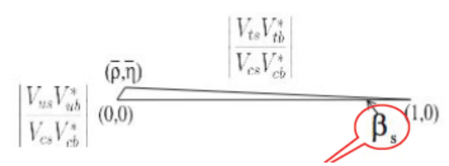


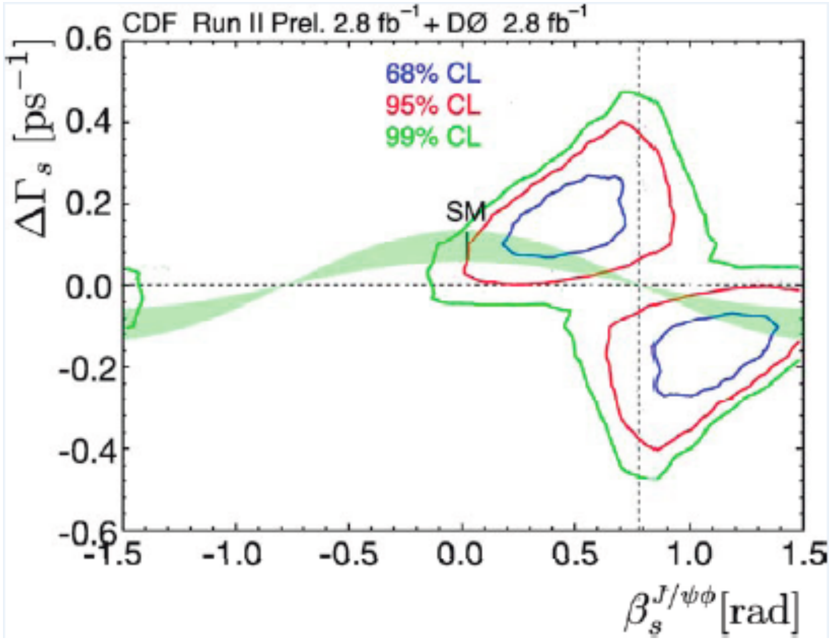
Bs mixing at Tevatron

Louise Oakes



$$\mathcal{A}_{CP}(t) \equiv \frac{\bar{B}^0_s(t) - B^0_s(t)}{\bar{B}^0_s(t) + B^0_s(t)} = \sin(2\beta_s) \cdot \sin \Delta m_s t$$





Tevatron combination: probability of observed deviation from SM = 3.4% (2.12 σ)

Rare Decays at Tevatron

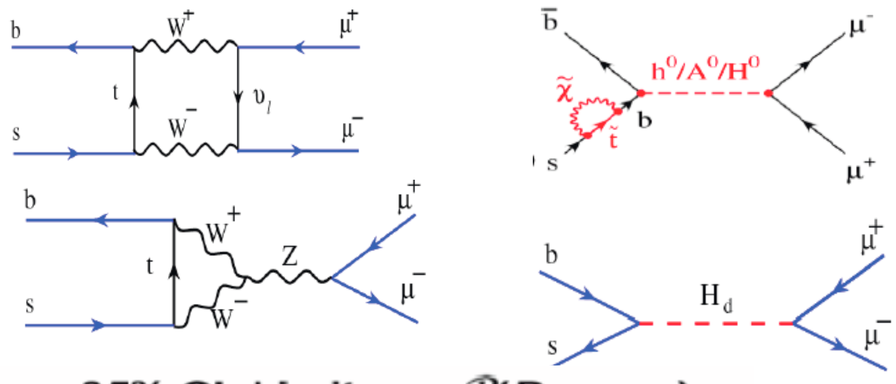
Dmitri Tsybychev

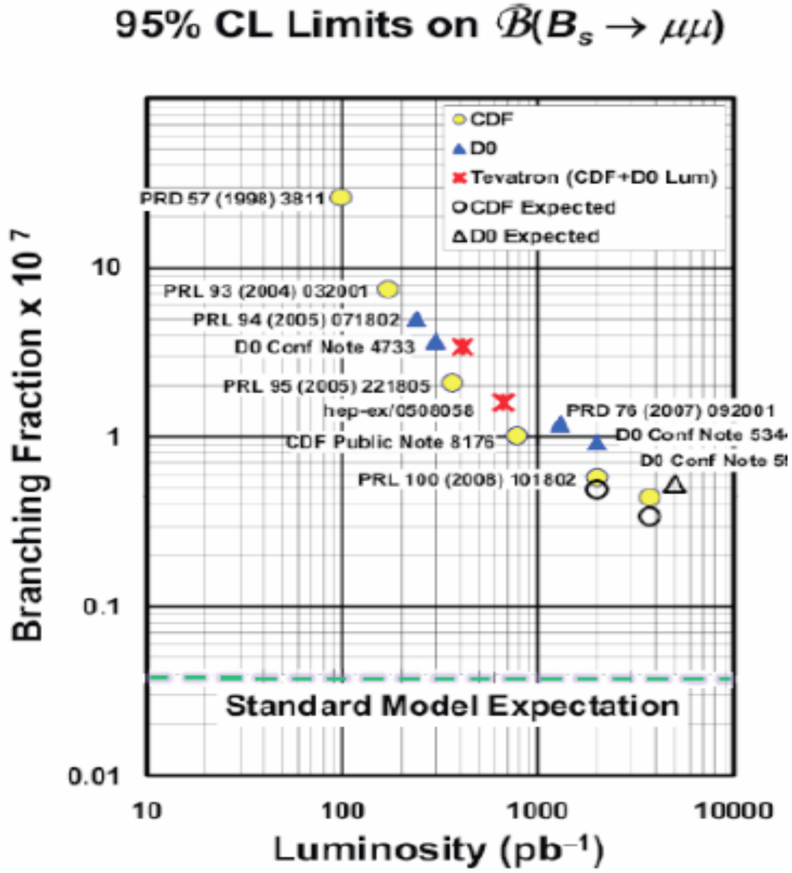
$Br(B^0_s \to \mu^+\mu^-) = (3.42 \pm 0.54) \times 10^{-9}$

$Br(B^0_d \to \mu^+\mu^-) = (1.00 \pm 0.14) \times 10^{-9}$ s

	$B^0_s \to \mu^+\mu^-$	$B^0_d \to \mu^+\mu^-$
CDF	$< 4.3 \times 10^{-8}$	$< 7.6 \times 10^{-9}$

$3.7\ fb^{-1}$





- 90% C.L.
- $BR(B^0 \to e^+e^-) = 8.3 \times 10^{-8}$
- $BR(B^0_s \to e^+e^-) = 2.8 \times 10^{-7}$

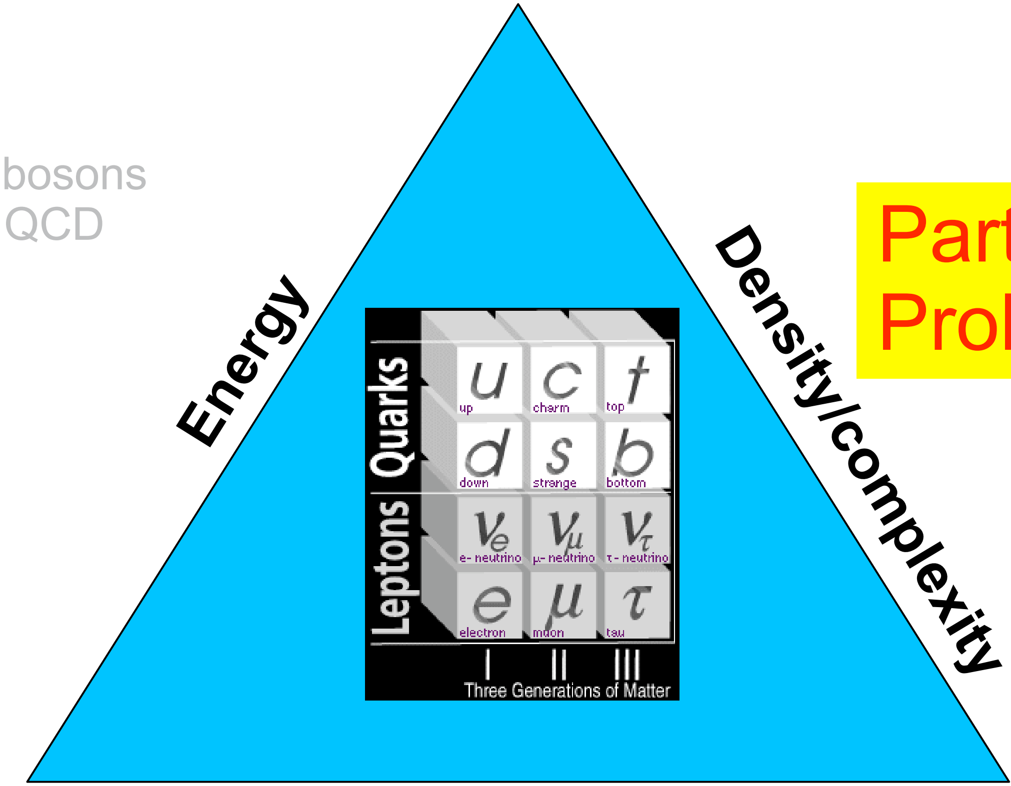
- 90% C.L.
- $BR(B^0 \to e^+\mu^-) = 6.4 \times 10^{-8}$
- $BR(B^0_s \to e^+\mu^-) = 2.0 \times 10^{-7}$

Constrains on new phyiscs from rare decays

LHCb can discover signal down to $<2 \times 10^{-8}$ in 2010-11.
(G.Wlikinson)

The experimental frontiers of the high energy physics

Electroweak bosons
High Energy QCD
Top
Searches



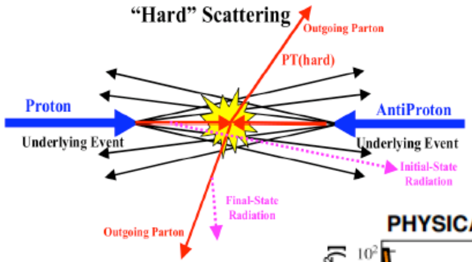
Particles production
Probes to QGP

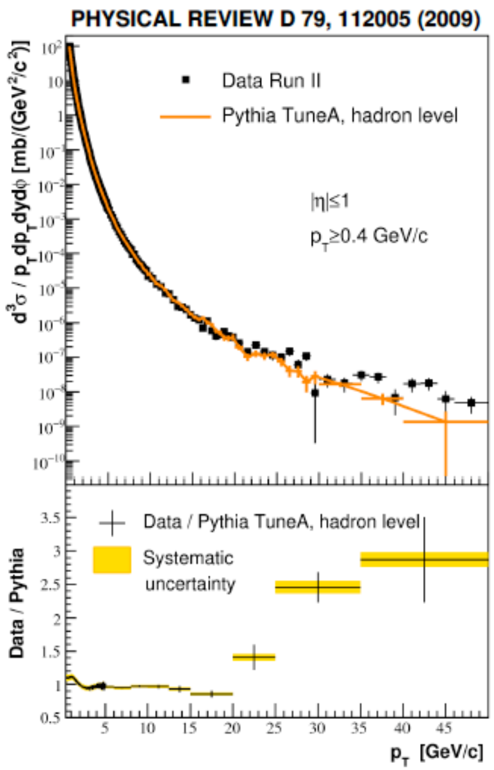
Precision

Proton structure, strong coupling,
CP violation, decays, resonances, diffraction

Particles cross sections

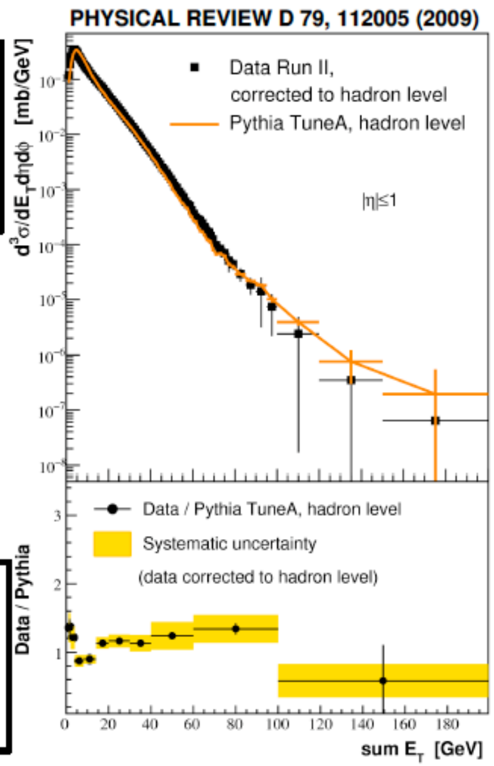
Murilo Rangel



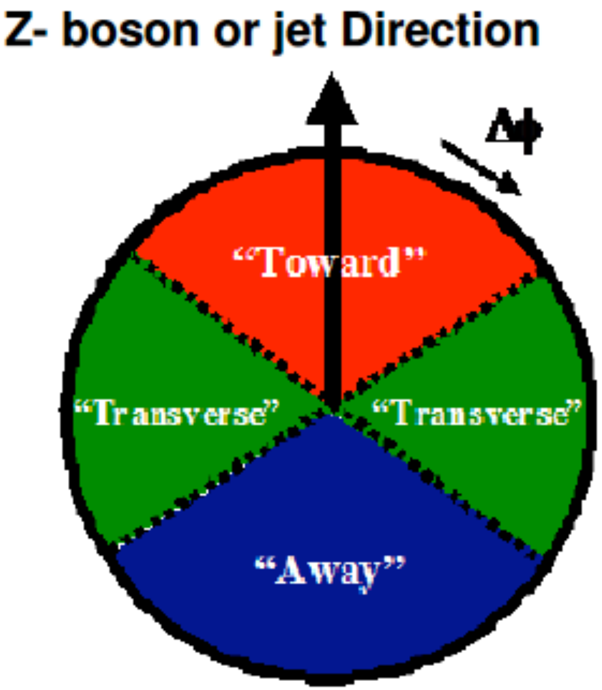


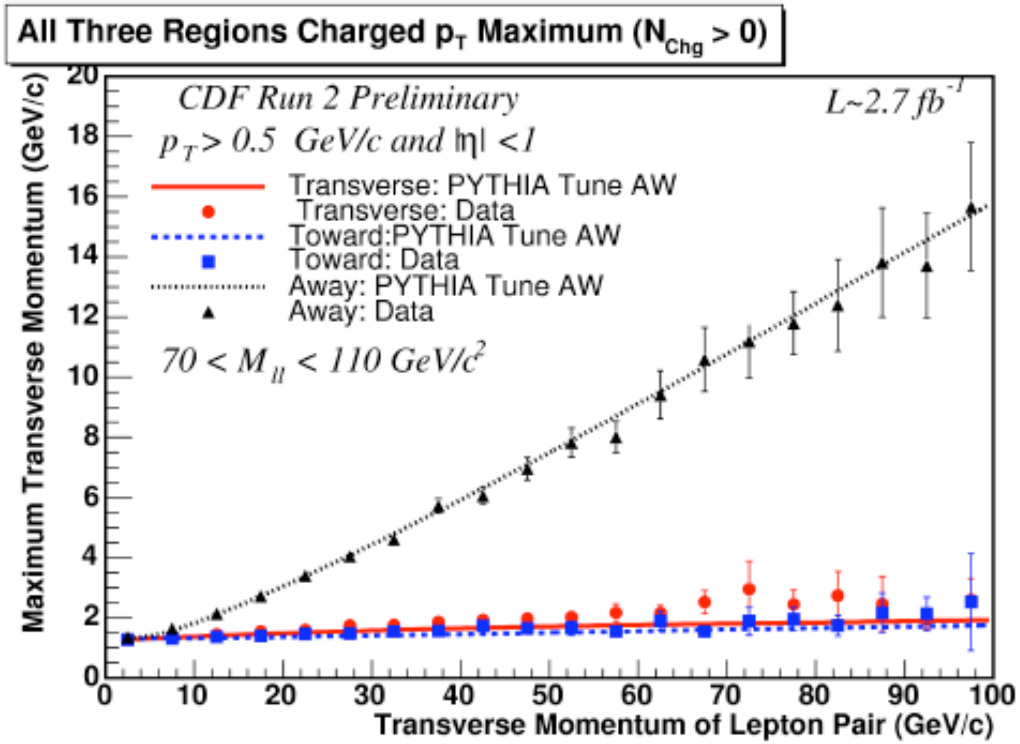
→ Charged particles tracks.
→ 11 orders of magnitude probed.

→ Measurement of neutral particle activity.
→ Pythia prediction is shifted.



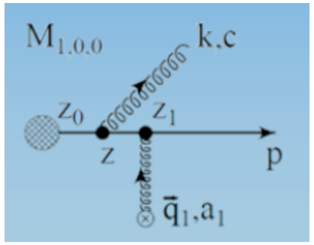
Multiple interactions tested at Tevatron

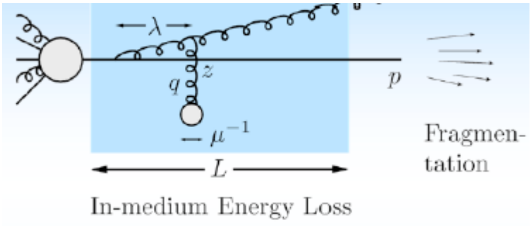




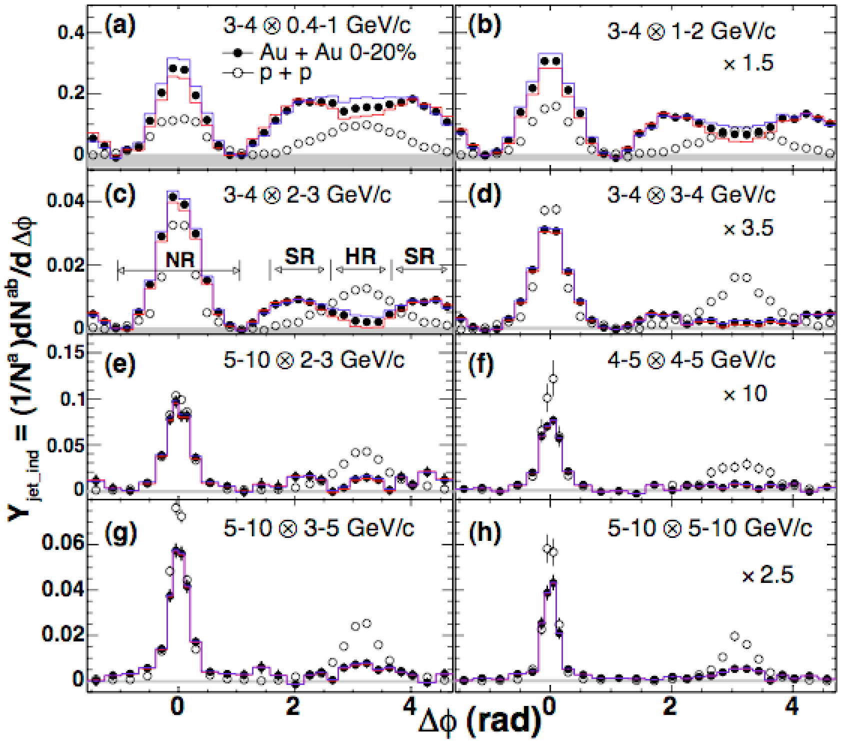
Precise tests for MI phenomenology, improve LHC analyses (hopefully)

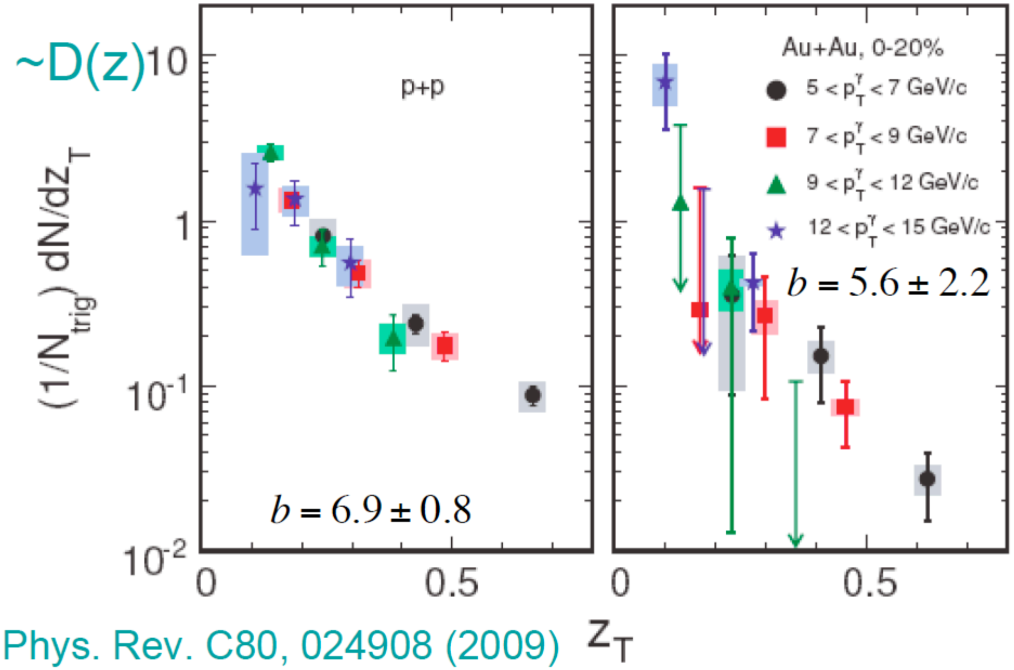
Jet energy loss at RHIC





- Direct γ-hadron correlations
- At LO Ejet=Eγ
- Look at hadrons at Δφ~π from γ
- Evidence D(z) softer in Au+Au



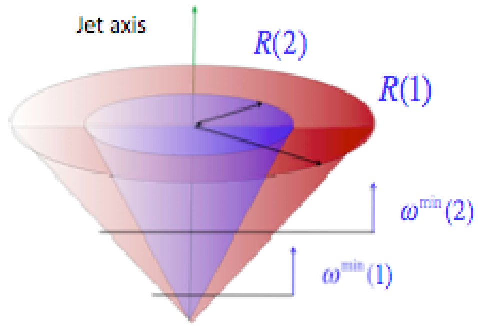


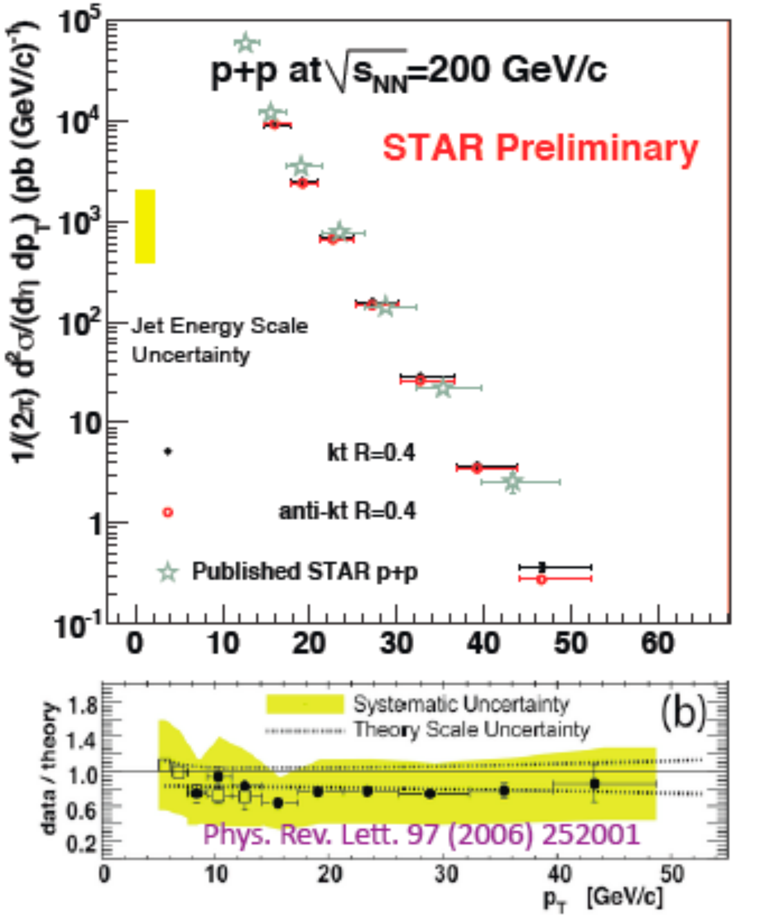
Phys. Rev. C80, 024908 (2009)

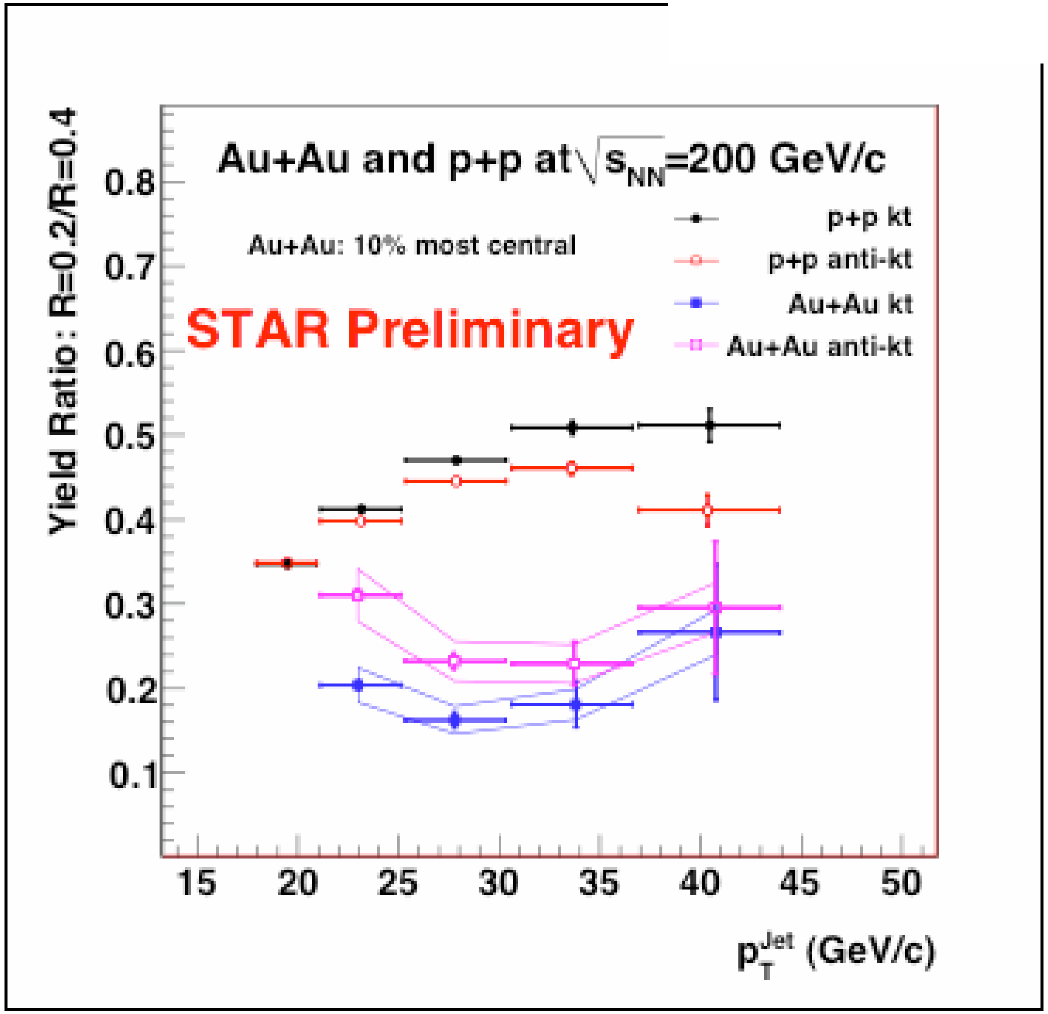
Nathan Grau

Jet reconstruction at RHIC

Sevil Salur



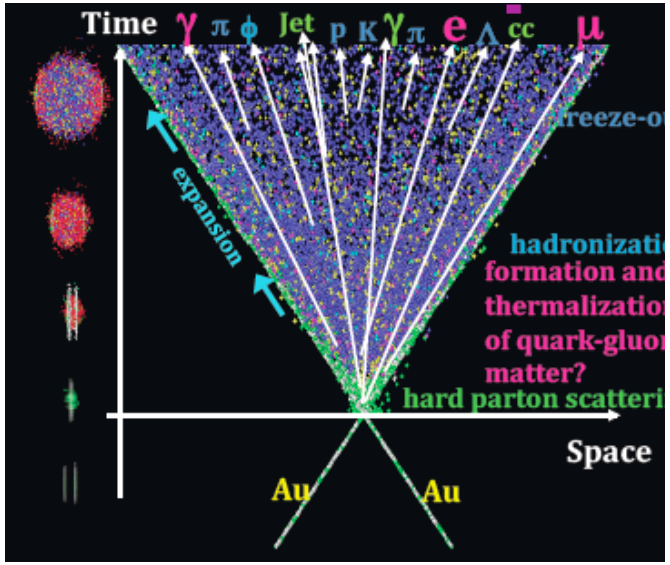


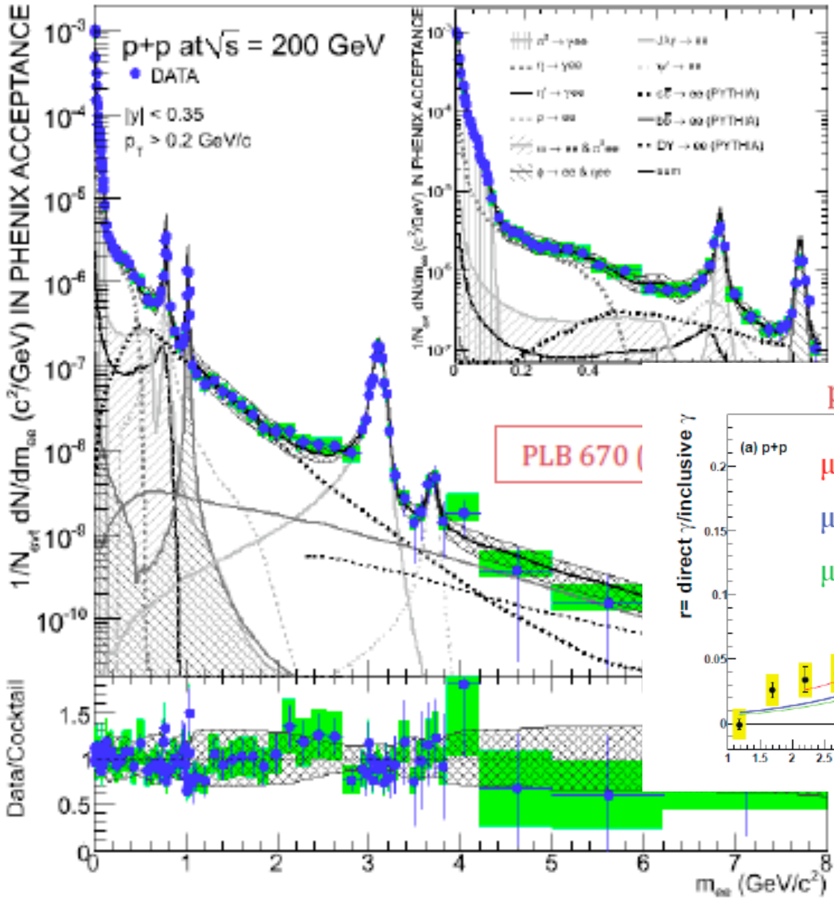


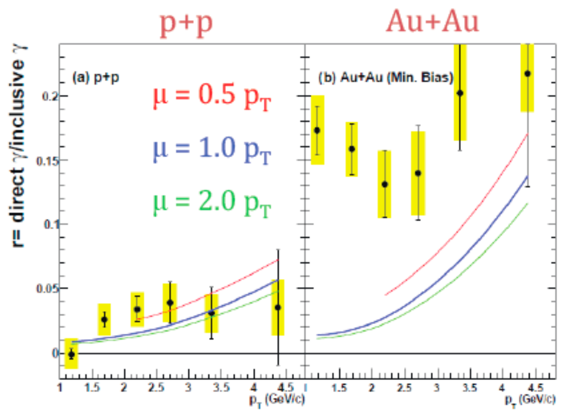
Probes of complexity

Torsten Dahms

Dielectron continuum in p+p and Au+Au Collisions at RHIC







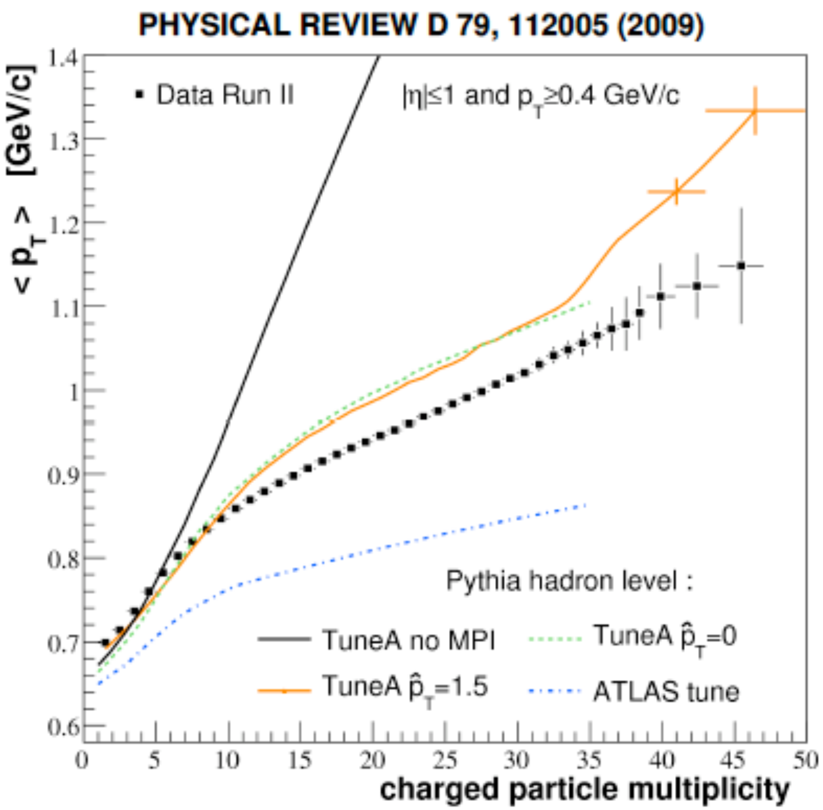
Ending ("experimental") remarks

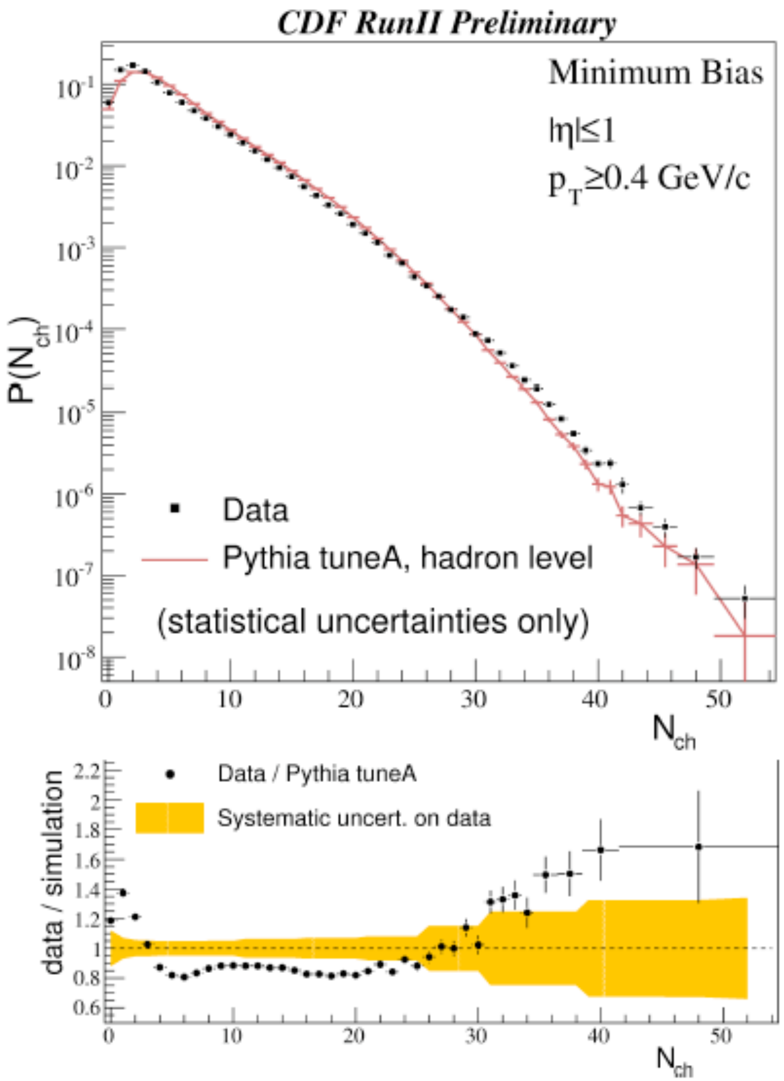
- Combination
  - Independence versus combination
  - Experimental discrepancies should be solved as much as possible
- Precision
  - match precision in calculations and experiment
- Completion
  - Unique HEP programs arrive to an end, person power
  - Data preservation (dphep.org)
- Diversity
  - HEP (and QCD) is experiment driven, maintain capability to cover all areas

Thanks

- J. Tran Thanh Van for the Moriond Experience
- Organizing Committee: great set-up, nice whether (fixed during my plenary talk)
  - Thanks for the invitation!
- Program committee: best cocktail of talks I ever seen!
- Speakers for excellent talks

Particles multiplicities





$\gamma\gamma^* \to \eta_c$ Transition Form Factor

- reconstruct $\eta_c \to K_S K^{+-} \pi^{-+}$
- no-tag mode:
  - measure η_c parameters
  - determine F(0)

mass	$2982.2 \pm 0.4 \pm 1.6$ MeV/c^2
Width	$31.7 \pm 1.2 \pm 0.8$ MeV
$\Gamma_{\gamma\gamma} \times BF(\eta_c \to K_S K\pi)$	$0.374 \pm 0.009 \pm 0.031$ keV

- single-tag mode:
  - *$d\sigma/dQ^2 \to F(Q^2)$ normalized to F(0)*

- fit to the FF distribution with

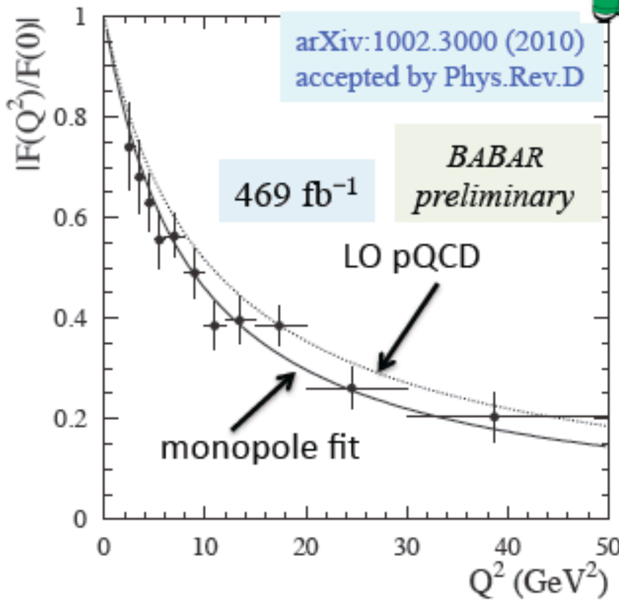
$$F(Q^2) = \frac{F(0)}{1 + Q^2/\Lambda} \Rightarrow \Lambda = 8.5 \pm 0.6 \pm 0.7 \text{ GeV}^2$$

consistent with both

-VMD: $\Lambda = m_{J/\psi}^2 = 9.6$ GeV^2

- Lattice QCD: $\Lambda = 8.4 \pm 0.4$ GeV^2

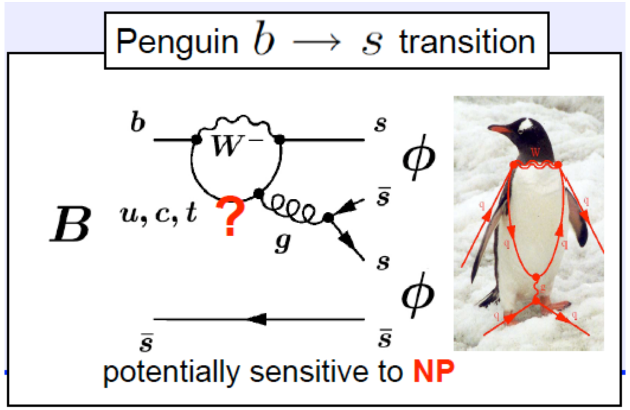
Dudek, Edwards PRL97, 172001 (2006)

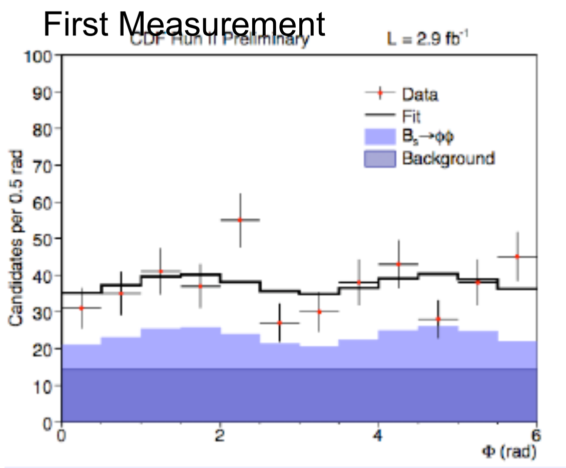


systematic uncertainties independent of Q^2 sum up to ~4.3%

- *BABAR* data lie systematically below a leading-order pQCD calculation (but within the large errors) Feldmann, Kroll PLB413, 410 (1997)

CDF: Bs->ΦΦ and polarisation measurements

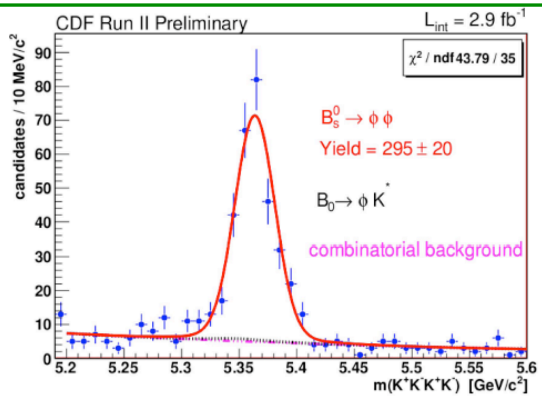




Fit three angles (only show one)

2009, CDFII **BR** update (2.9 fb^{-1})

$$\mathcal{B}(B_s^0 \to \phi\phi) = [2.40 \pm 0.21(\mathrm{stat}) \pm 0.86(\mathrm{syst})] \times 10^{-5}$$



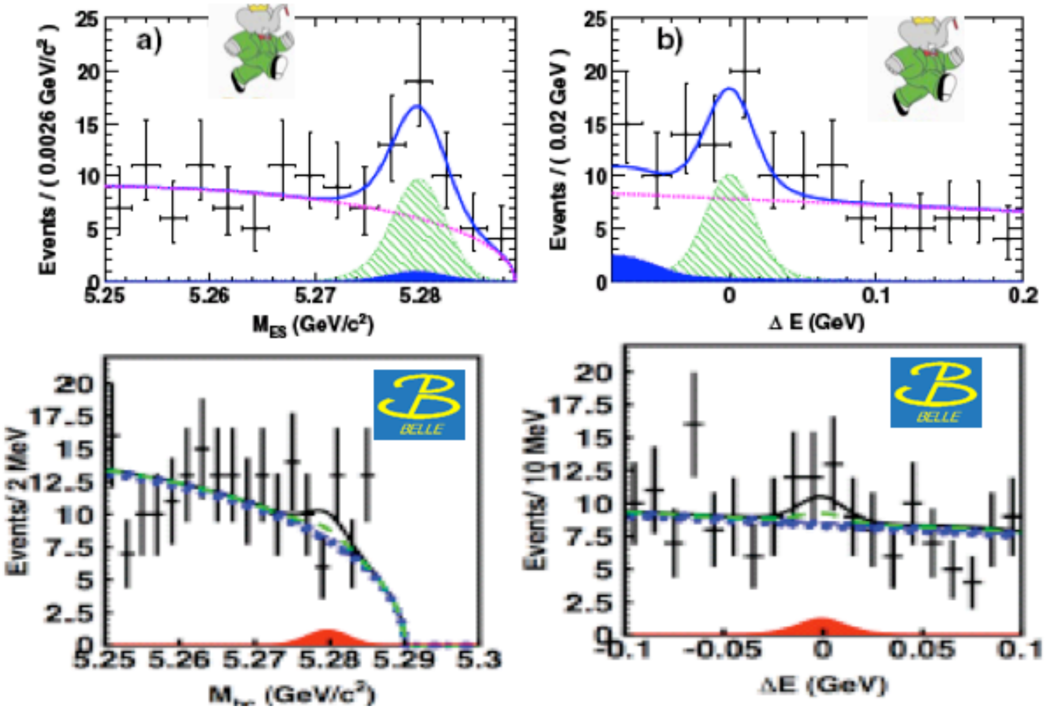
$|A_0|^2 \simeq |A_\parallel|^2 \simeq |A_\perp|^2$ instead of $|A_0|^2 \gg |A_\parallel|^2 \simeq |A_\perp|^2$

	$\lvert A_0\rvert^2$ [%]	$1 - \lvert A_0\rvert^2$ [%]
→ CDF Run II	$34.8 \pm 4.1(\mathrm{stat}) \pm 2.1(\mathrm{syst})$	$65.2 \pm 4.1(\mathrm{stat}) \pm 2.1(\mathrm{syst})$
QCD factorization (2007) [a]	48^{+0+26}_{-0-27}	52^{+0+26}_{-0-27}
QCD factorization (2008) [b]	34 ± 28	66 ± 28
Naive factorization [c]	88.3	11.7
NLO EWP [d]	86.3	13.7
→ perturbative QCD [e]	$61.9^{+3.6+2.5+0.0}_{-3.2-3.3-0.0}$	$38.1^{+3.6+2.5+0.0}_{-3.2-3.3-0.0}$

More luminosity will refine data/theory comparisons

B->VV

$$B^0 \rightarrow K^{*0}\overline{K^{*0}}$$

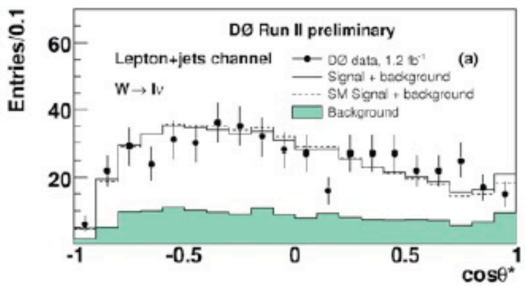


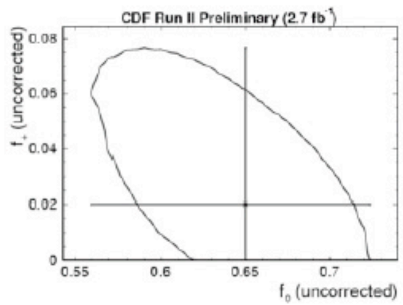
	Y (events)	ε (%)	S (σ) ?	Br (10^{-6})
BaBar	$33.5 \pm^{9.1}_{8.1}$	6.8	6	$1.28 \pm^{0.35}_{0.30} \pm 0.11$
Belle	$7.7 \pm^{9.7}_{8.5} \pm^{2.8}_{2.2}$	4.43	0.9	<0.8

Different observations

Top properties

Veronica Sorin





$f_0 = 0.490 \pm 0.106$ (stat) ± 0.085 (syst)

$f_+ = 0.110 \pm 0.059$ (stat) ± 0.052 (syst)

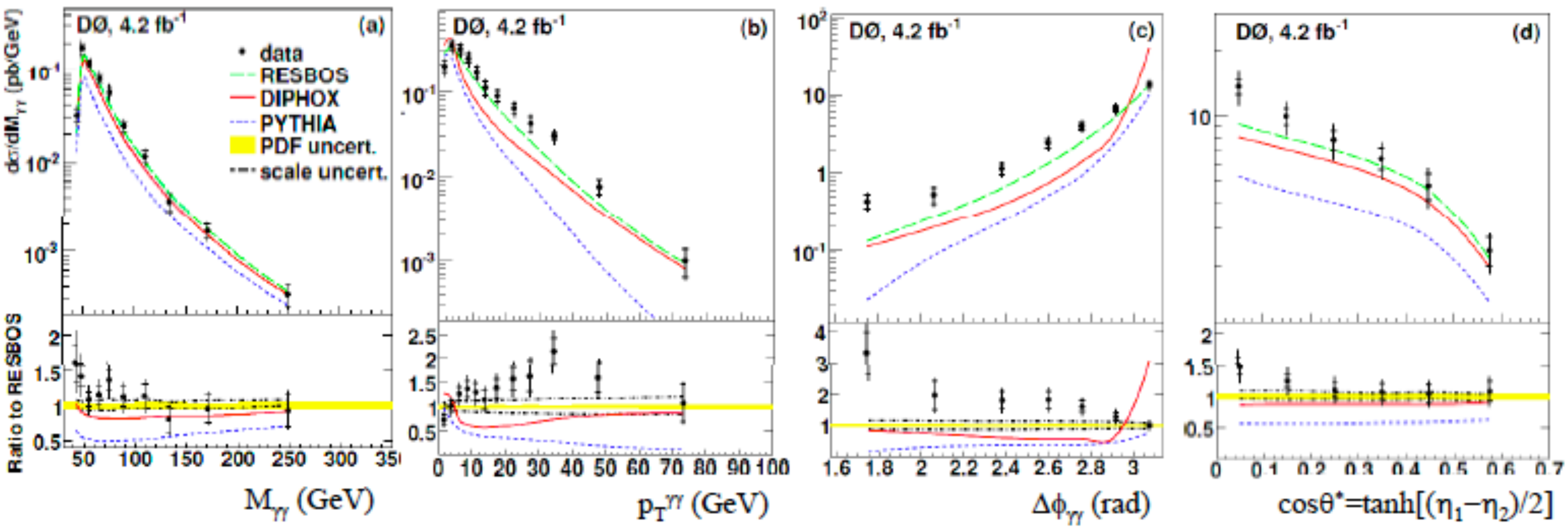
$f_0 = 0.88 \pm 0.11$ (stat) ± 0.06 (syst)

$f_+ = -0.15 \pm 0.07$ (stat) ± 0.06 (syst)

SM expectation F0=0.7 F+=0

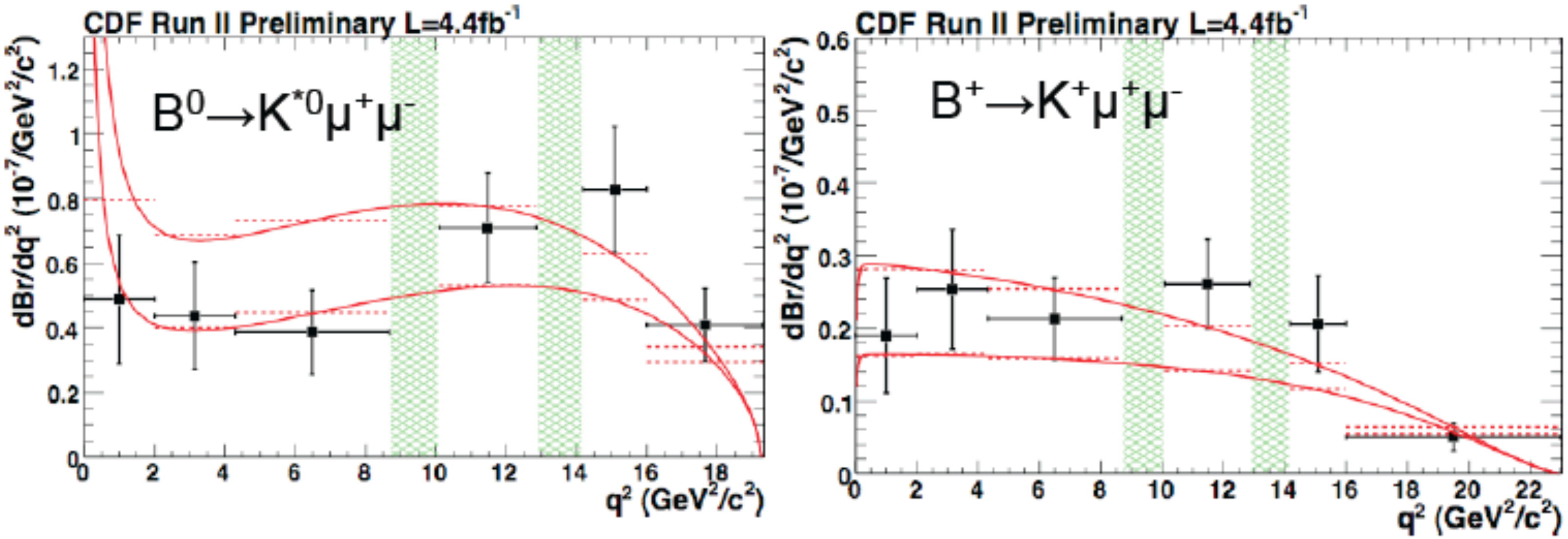
Di-Photon Measurements at Tevatron

L. Han



RESBOS with resummation demonstrates better agreement with data
Test-bed for QCD with “clean” probes

Rare Decays at Tevatron



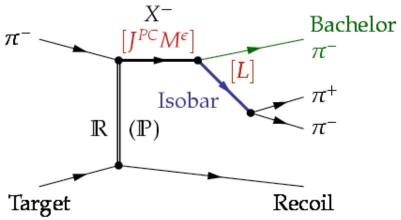
- Absolute Branching Ratios
- $B(B^0 \to K^{*0} \mu^+ \mu^-) = [1.06 \pm 0.14(\text{stat}) \pm 0.09(\text{syst})] \times 10^{-6}$
- $B(B^+ \to K^+ \mu^+ \mu^-) = [0.38 \pm 0.05(\text{stat}) \pm 0.03(\text{syst})] \times 10^{-6}$
- $B(B_s^0 \to \phi \mu^+ \mu^-) = [1.44 \pm 0.33(\text{stat}) \pm 0.46(\text{syst})] \times 10^{-6}$

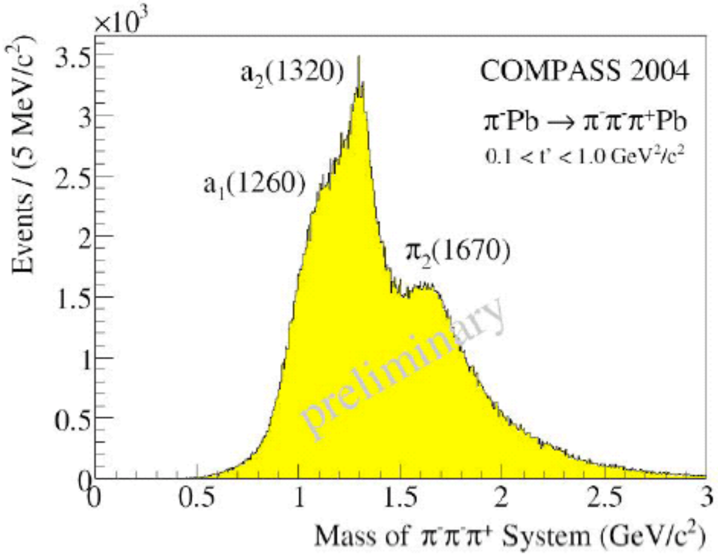
First observation of $B^0_s \to \phi\mu^+\mu^-$ decay!

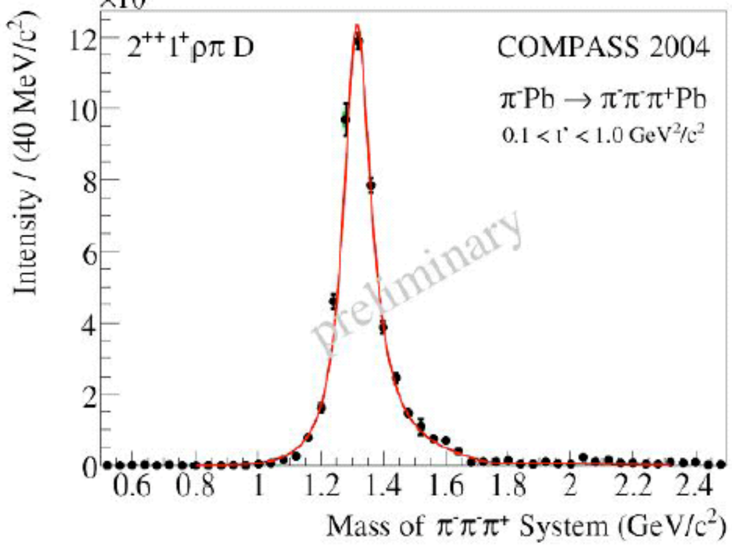
And measurements of the polarization components….

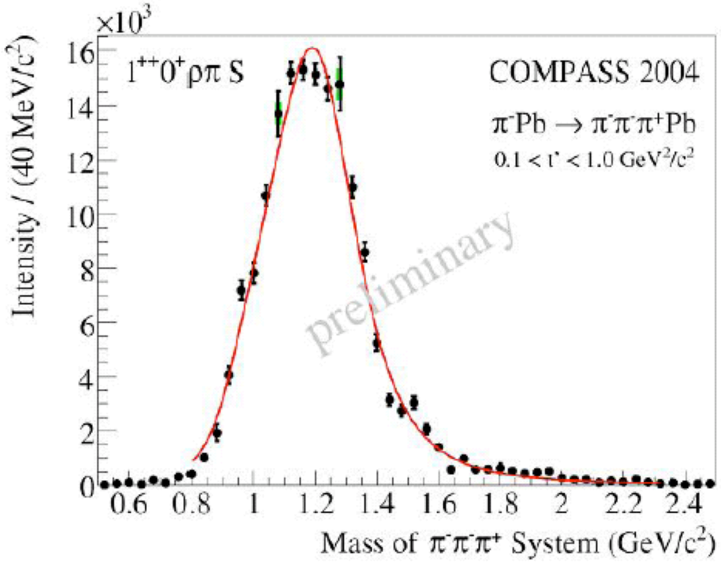
Compass: diffractive dissociation in 3 pions

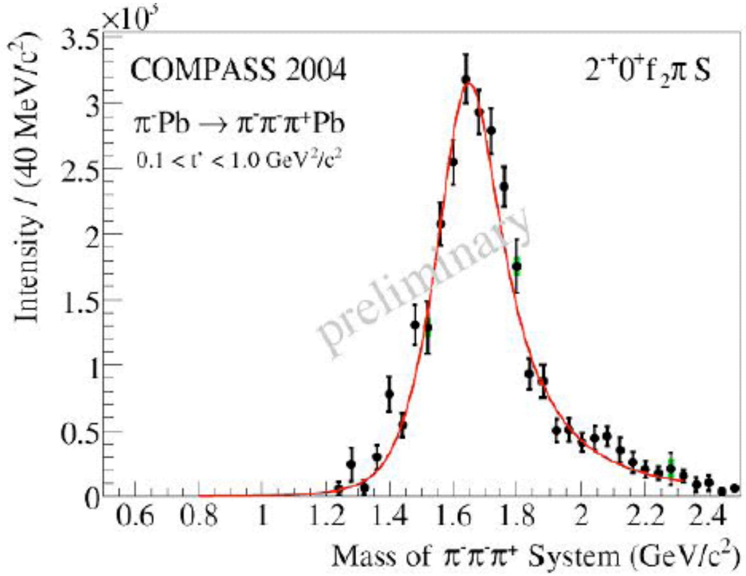
Franck Nerling





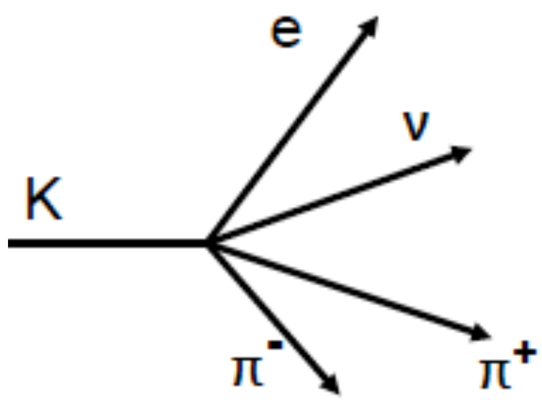


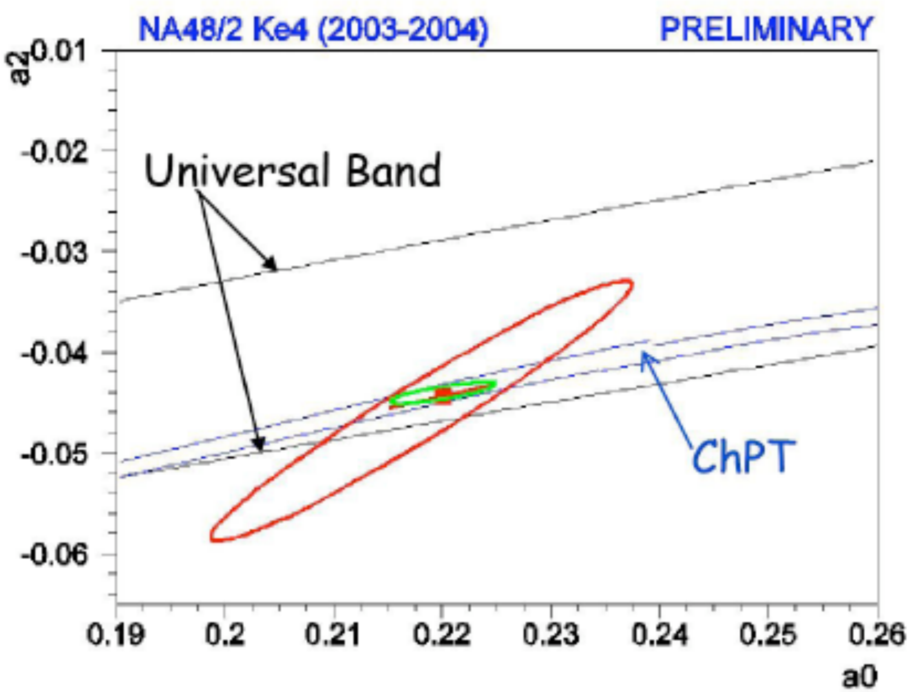




Hadronic interaction studies ith NA48/2

Stefano Venditi



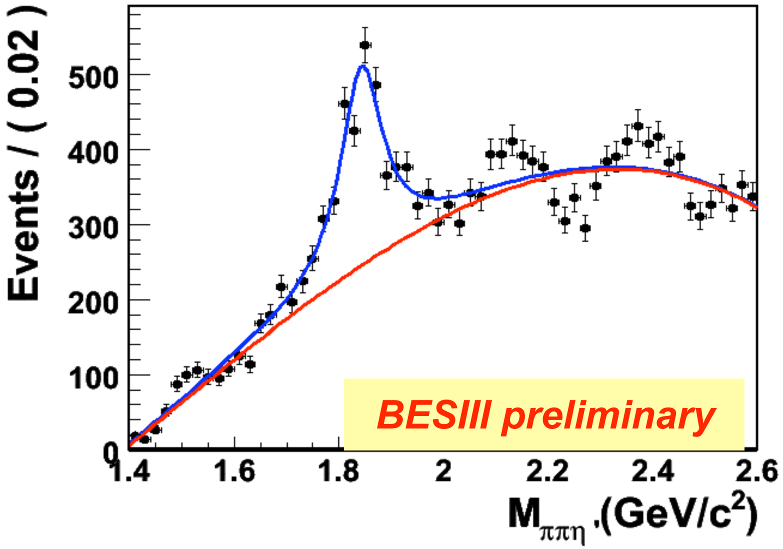


Accurate study of low-energy hadronic
Interactions thanks to the unprecedented
Ke4 statistics available in NA48/2

Mass spectrum of $\eta'\pi^+\pi^-$ in $J/\psi \to \gamma\eta'\pi^+\pi^-$, $\eta' \to \eta\pi^+\pi^-$

H. Yang

The resonance X(1843) confirmed with BESIII data
Structure in the mass spectrum above the resonance

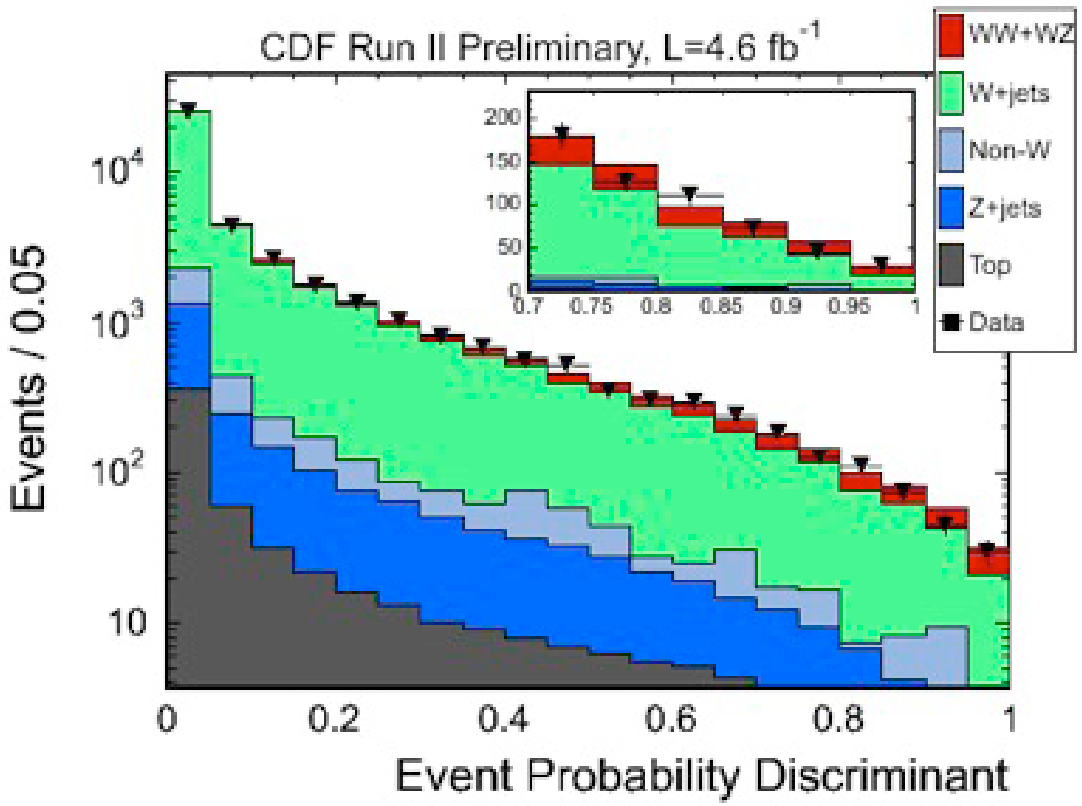


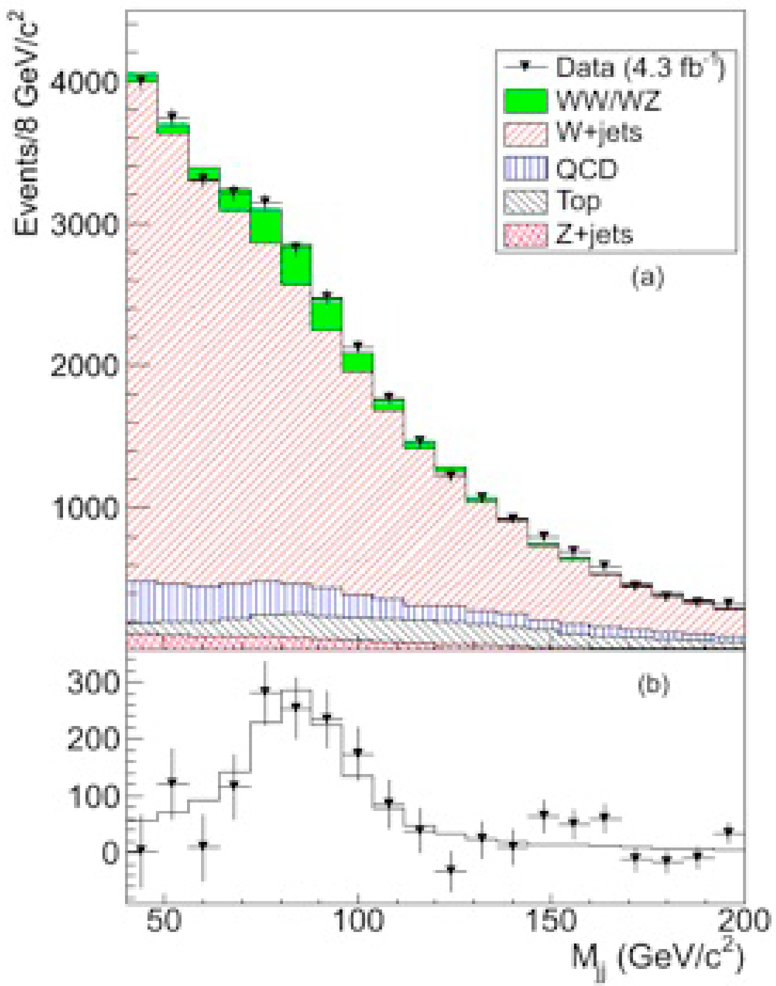
Fit result (Statistic significance ~ 21σ):

$M = 1842.4 \pm 2.8(stat)MeV$

$\Gamma = 99.2 \pm 9.2(stat)MeV$

WW/WZ





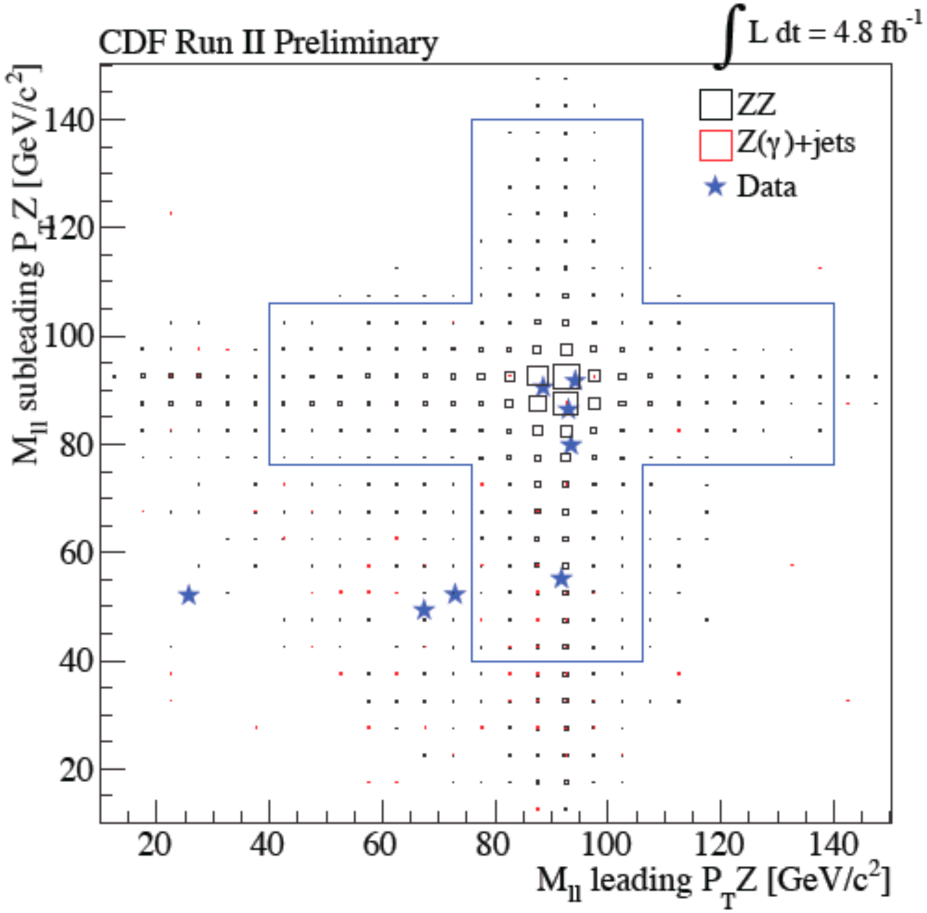
σ = 18.0±2.8(stat)±2.4(syst)±1.1(lumi) pb

◆ **NLO=16.8±0.5 pb**

1fb^{-1} at 7TeV ~ 3.5-5.5fb^{-1} at 2TeV

Tevatron still the place for SM dibosons in the coming years

ZZ -> four leptons



$$\sigma_{ZZ} = 1.56^{+0.80}_{-0.63}(stat.) \pm 0.25(syst.)$$

NLO: 1.4±0.1pb

Top pairs as QCD laboratory: tt+jets

$\sigma_{t\bar{t}j} = 1.6 \pm 0.2\,(\text{stat.}) \pm 0.5\,(\text{sys.})$ pb
at $m_t = 172.5$ GeV

NLO pQCD: $\sigma_{t\bar{t}j} = 1.79^{+0.16}_{-0.31}$ pb
arXiv:0810.0452v2 [hep-ph]