Statusbericht der HEPHY Belle-Gruppe

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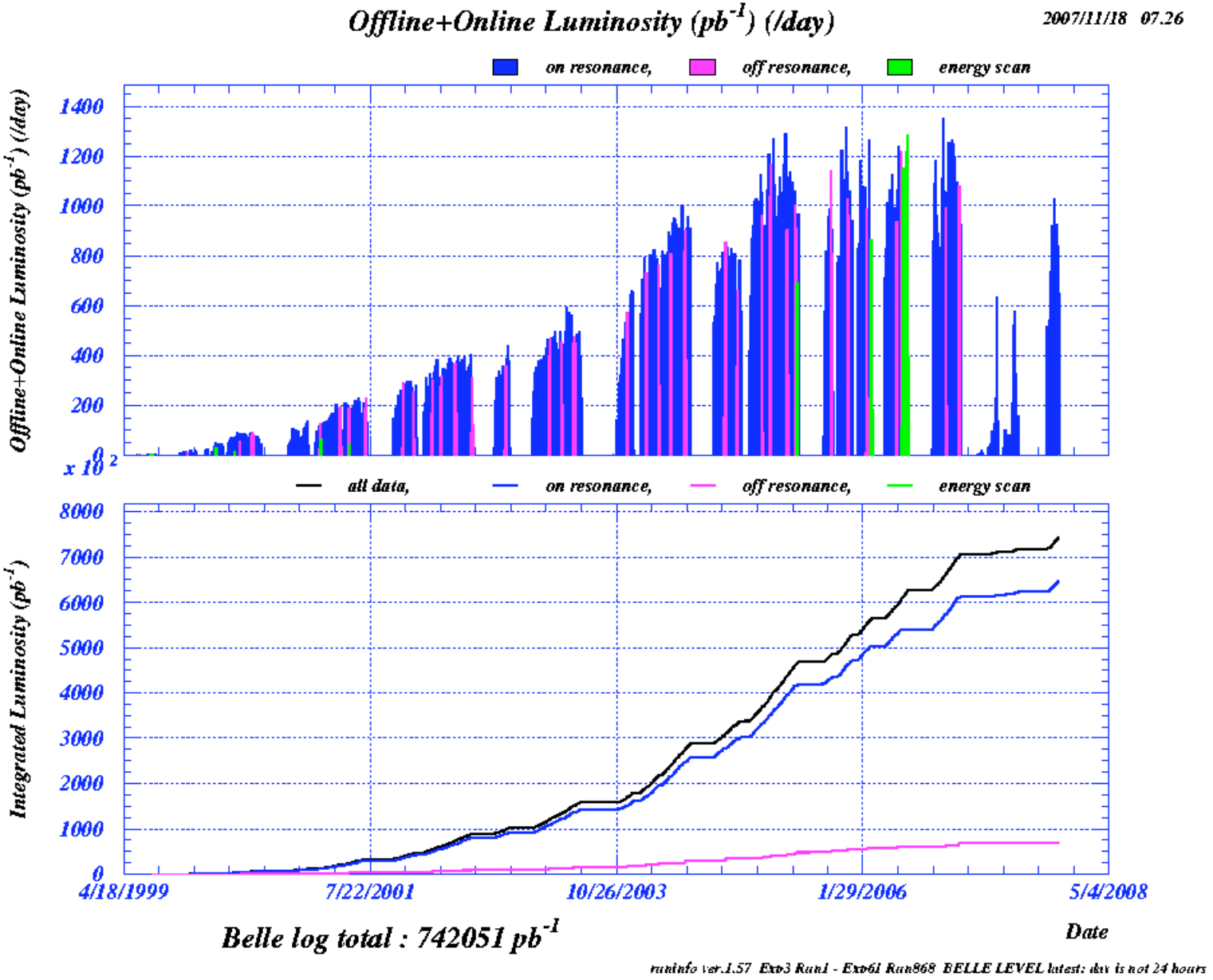
W. Mitaroff, M. Pernicka, G. Richter, C. Schwanda
und L. Widhalm

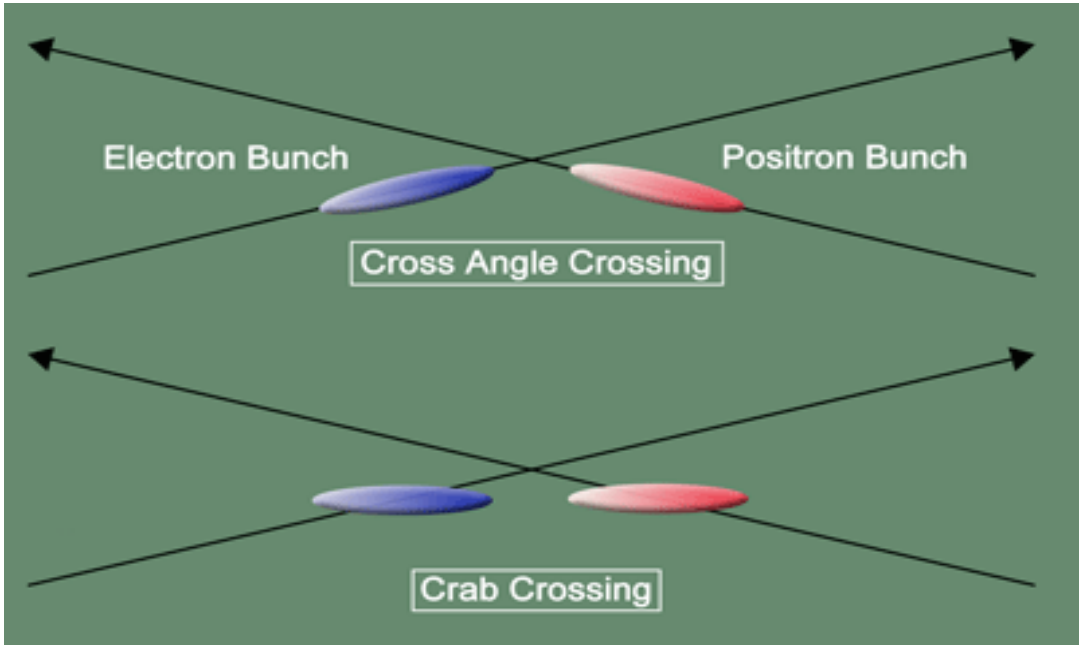
Neuigkeiten vom Experiment und vom KEKB-Beschleuniger



Zum Vergleich: BaBar hat dzt. 477/fb auf Band

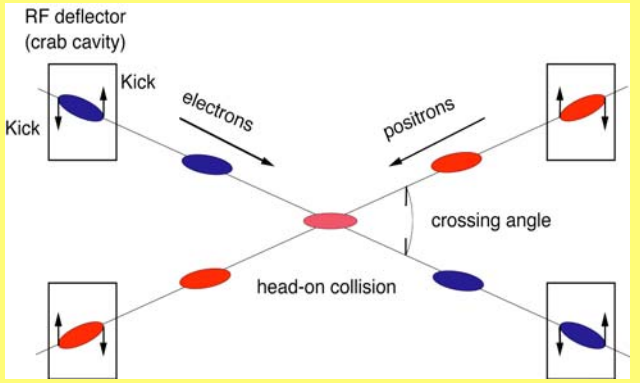
KEKB-Beschleuniger

- Jänner 2007: Einbau der crab cavities
- Februar - Juni 2007: Test bei niederen Strömen
- Seit Oktober 2007: Betrieb mit crab cavities, bei höheren Strömen (Luminosität dzt. ~12/nb/s)



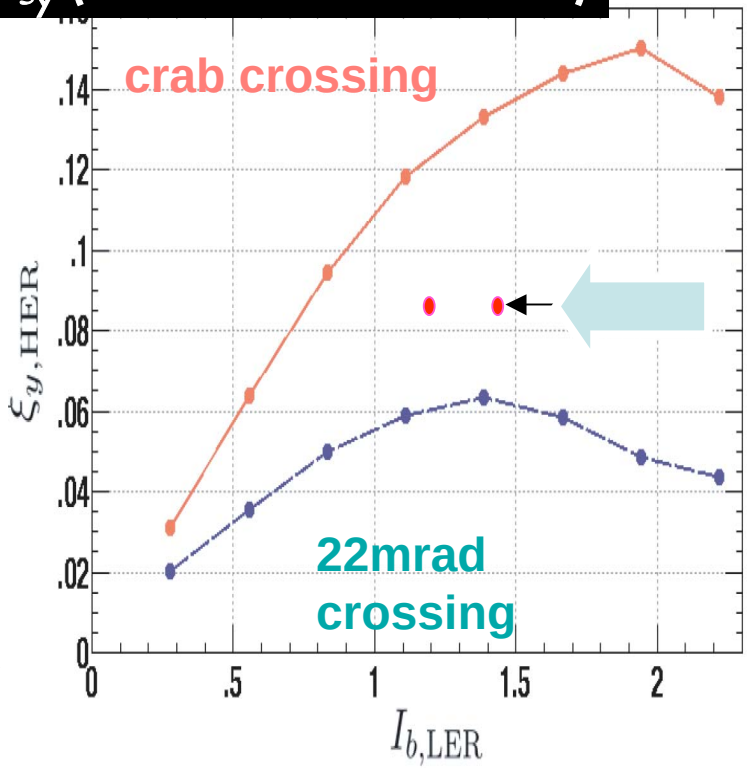
Crab cavities

$$L \approx \frac{\gamma_\pm}{2er_e}\frac{I_\pm \xi_{\pm y}}{\beta_y^*}$$



- Jeweils eine superleitende crab cavity im LER- und HER-Ring
- Ergebnis des 4,5-monatigen Beamtests
  - Spezifische Luminosität konnte um ~30% gesteigert werden
  - Beam-beam-Simulation würde aber eine Verdopplung erwarten lassen
  - Ein Erfolg?

ξ_y (beam-beam simulation)



Zukunft von Belle/KEKB

M. Yamauchi [belle_ml:8040] vom 26. September 2007

Dear colleagues,

This mail is to inform you of the recent status of our proposal on the KEKB upgrade.

…

"A partial upgrade of KEKB and Belle will be carried out in 2009-2011 within our annual operation budget. Installation of additional RF and so on will continue after resuming operation in 2012. The target luminosity is 2x10^35/cm^2/sec.”

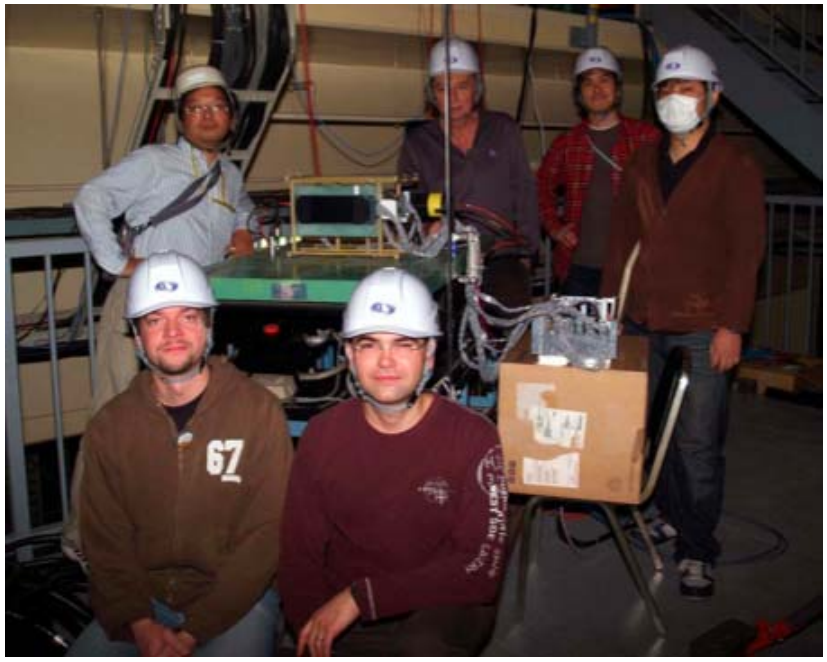
…

We believe some official statement will be issued by the KEK management soon referring to the KEKB upgrade. In addition, the roadmap recommended by the working group was shown to the Japanese HEP community by Takasaki at the J-HEP general meeting a few days ago.

…

SVD3

- Belle/KEKB-Upgrade hat auch wesentliche Auswirkungen auf das für 2008 geplante SVD-Upgrade (“SVD3”)
- Siehe Bericht der Elektronik 2-Gruppe



Erfolgreicher Test des SVD3-Auslesesystems am KEK im Nov. 2007

Comparison between SuperB and SuperKEKB

		SuperB (Upgrade)	SuperKEKB (Low Emittance)	
Emittance	ε_x	0.8	9	nm
Horizontal beta	β_x^*	20	200	mm
Vertical beta	β_y^*	0.2	3	mm
Horizontal beam size	σ_x^*	4	42	μm
Vertical beam size	σ_y^*	20	367	nm
Bunch length	σ_z	6	3	mm
Half crossing angle	ϕ_x	17	15	mrad
Piwinski angle	φ	25.5	1	rad
Current(LER/HER)	I_b	3.95/2.17	10.4/4.4	A
Luminosity (x10^{35})	L	24	8.25	$cm^{-2}s^{-1}$
AC Plug Power	P	35	83	MW

One order magnitude smaller than SuperKEKB

T. Gershon, EPS07 Manchester

Two Approaches to New Physics

R. Cahn, EPP2010, Jänner 2005

B physics:

shake the Box, listen

virtual particles

LHC: open the Box

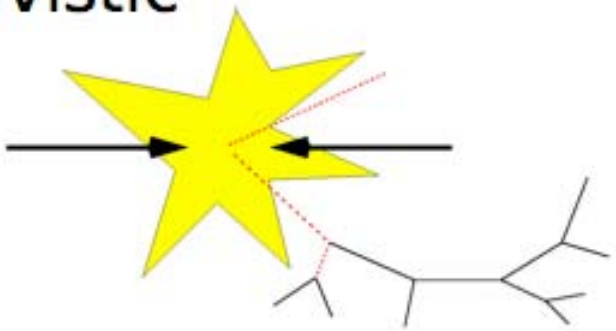
real particles

T. Gershon, EPS07
Manchester

Motivation

- Major challenge for particle physics in the next decade is to go beyond the Standard Model

"relativistic"

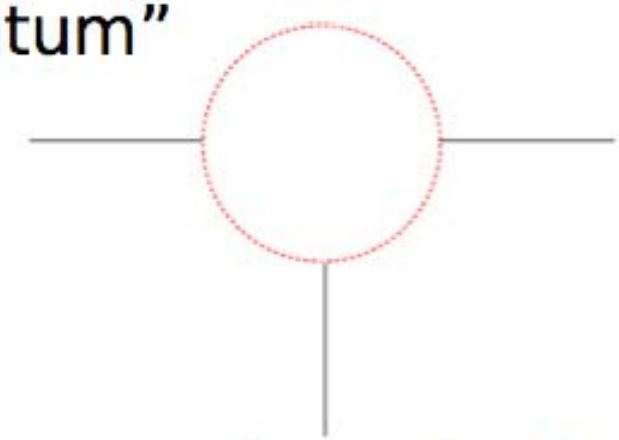


New heavy particles produced on mass shell

Sensitivity depends on:

- available centre-of-mass energy
- knowledge of Standard Model backgrounds

"quantum"



New heavy particles produced off mass shell ("virtual")

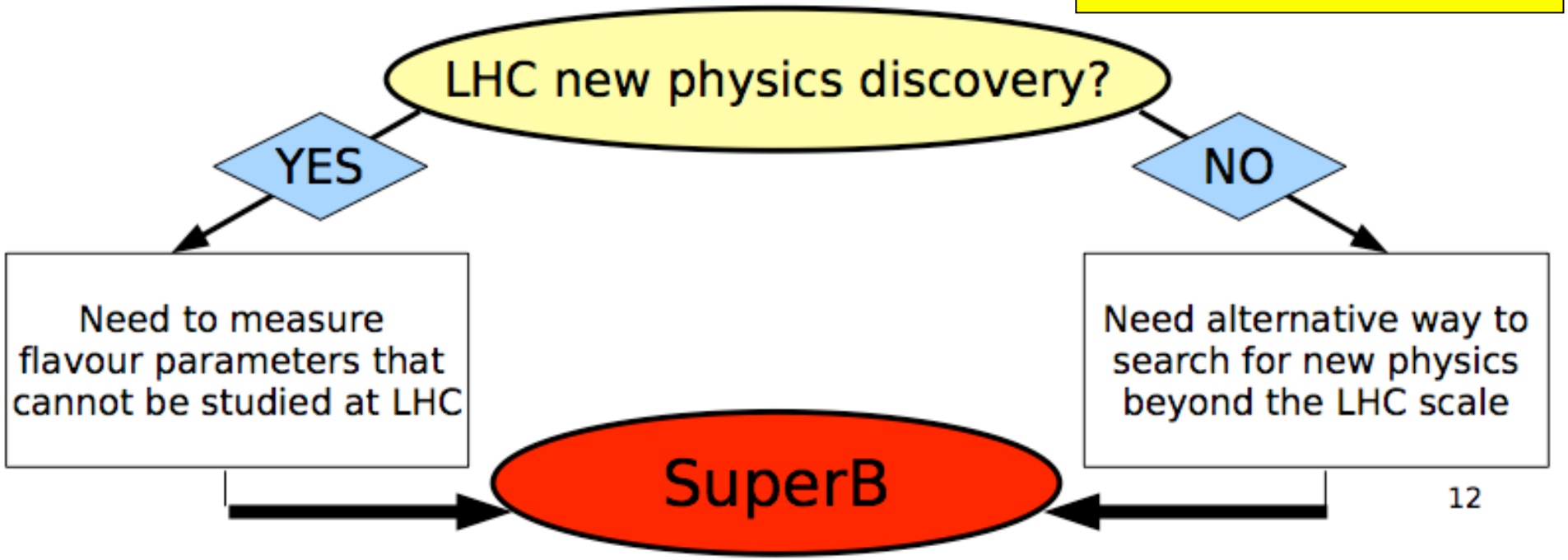
Sensitivity depends on:

- luminosity
- knowledge of Standard Model backgrounds

Interplay of Energy and Luminosity Frontiers

- Important to note that flavour observables are complementary to those at the energy frontier
  - measure different new physics parameters
  - powerful to distinguish models

T. Gershon, EPS07 Manchester



Physik-Highlights Belle

‘hot topics’ 2007

- Überprüfung der quantenmechanischen Verschränkung im Zerfall $\Upsilon(4S) \rightarrow B^0 \bar{B}^0$

  [Phys.Rev.Lett. 99, 131802 (2007)]

- Beobachtung von D^0-$\bar{D}^0$ Mixing

  [Phys.Rev.Lett. 98, 211803 (2007)]

- Erstmalige Beobachtung von $B^0 \rightarrow D^{*-} \tau^+ \nu$

  [Phys.Rev.Lett. 99, 191807 (2007)]

$B^0 \rightarrow D^{*-} \tau^+ \nu$

535 MBB

- Komplizierte Analyse, da bis zu drei (!) Neutrinos im Endzustand
- Nachweis kann nur durch vollständige Rekonstruktion des gesamten Ereignisses gelingen

$\tau \rightarrow e\nu\nu$ or $\pi\nu$

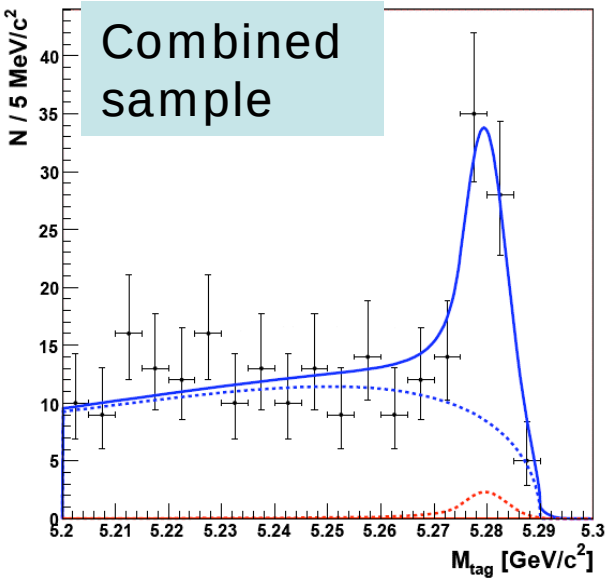
Simultaneous fit

$N_s = 60\ ^{+12}_{-11}$ **6.7σ (5.2σ w/syst.)**

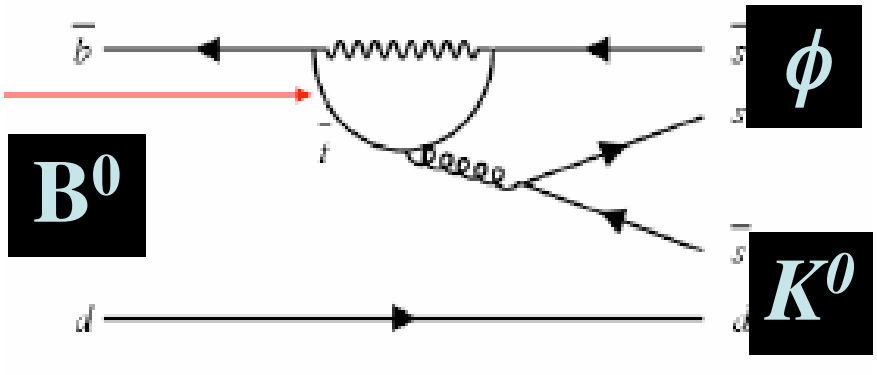
$$Bf(B^0 \rightarrow D^{*-}\tau^+\nu) = (2.02\ ^{+0.40}_{-0.37} \pm 0.37)\ \%$$

SM~1.4 %

First observation !

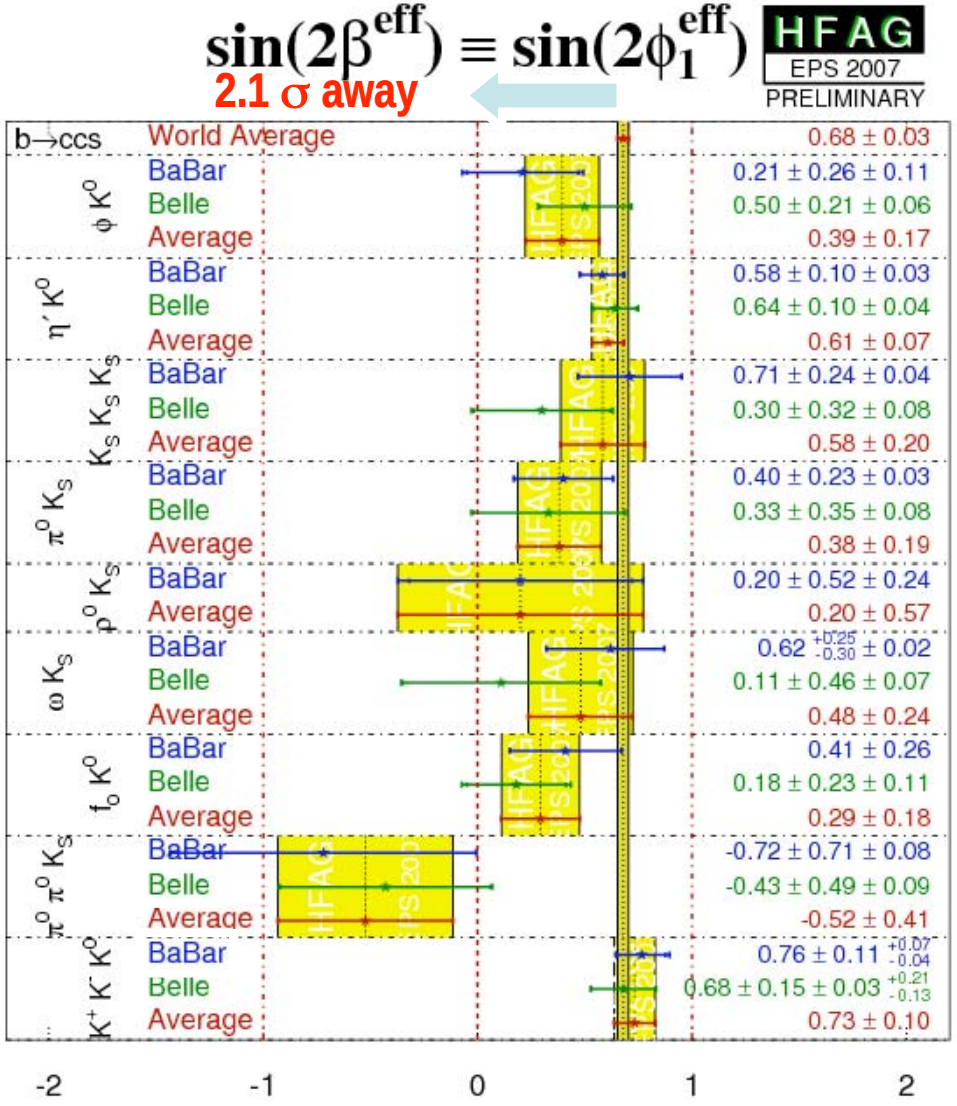


b → sq̄q Pinguin



Extra CPV phase
"sin2φ$_1$"≠sin2φ$_1$
Hint of New Physics

"sin2φ$_1$"=0.56 ± 0.05
2.1σ away from SM
(reduced slightly)



Physikanalyse in Wien

HEPHY Belle-Analysen

- $|V_{cb}|$ inklusiv

  CS + Melbourne

- $D_s \rightarrow \mu\nu$

  L. Widhalm

- Inklusive D^0-Zerfälle

  F. Mandl und G. Leder

- Suche nach spontaner Dekohärenz in $Y(4S) \rightarrow B^0 B^0$

  Dissertation G. Richter

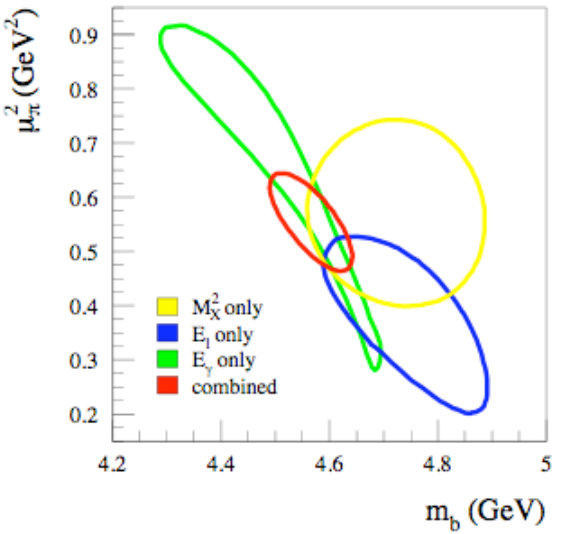
- $B^0 \rightarrow D^{*-} l^+ \nu$ (Formfaktoren und $|V_{cb}|$)

  Dissertation W. Dungel

$|V_{cb}|$ inklusiv

Kinetic scheme ($X_c l\nu + X_s\gamma$ data)

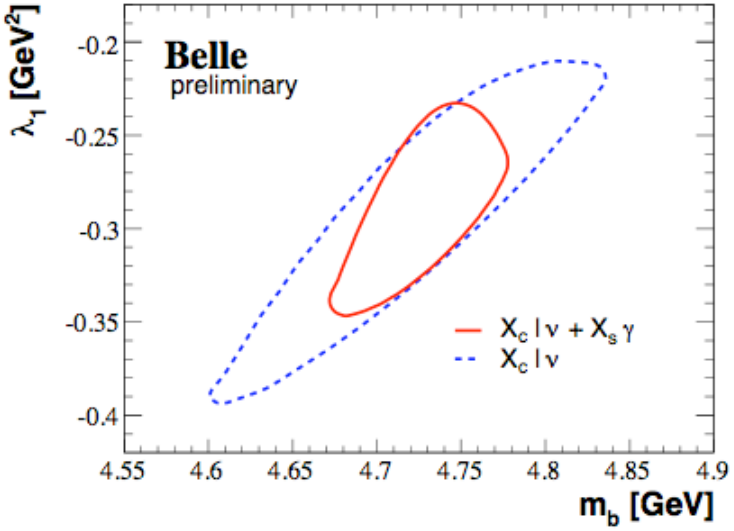
$|V_{cb}| = (41.93 \pm 0.65_{fit} \pm 0.07_{\alpha s} \pm 0.63_{th}) \times 10^{-3}$
$m_b = 4.564 \pm 0.076$ GeV
$m_c = 1.105 \pm 0.116$ GeV $\quad \chi^2/dof. = 17.8/24$



The result for m_b compatible after scheme translation

1S scheme ($X_c l\nu + X_s\gamma$ data)

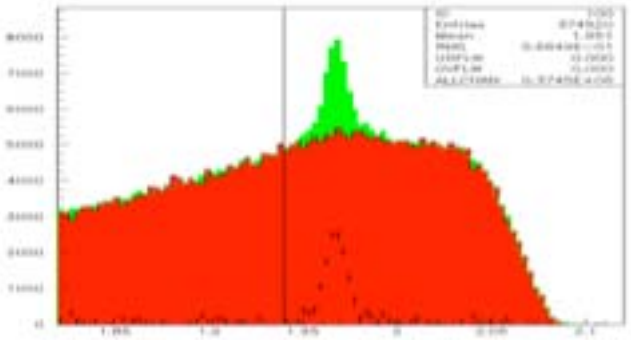
$|V_{cb}| = (41.49 \pm 0.52_{fit} \pm 0.20_{\tau}) \times 10^{-3}$
$m_b = 4.729 \pm 0.048$ GeV
$\lambda_1 = -0.30 \pm 0.04$ GeV^2 $\quad \chi^2/dof. = 5.7/17$

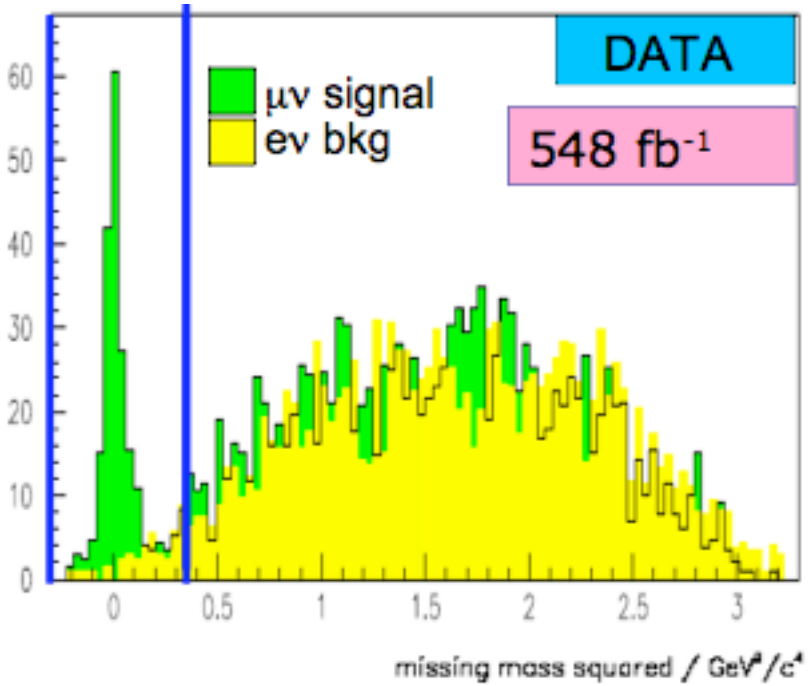


Teilweise bereits publiziert [Phys.Rev. D75, 032001 (2007) und Phys.Rev. D75, 032005 (2007)]; letztes paper kommt demnächst in collaboration-wide review

$D_s \rightarrow \mu\nu$

"inklusives D_s"





$N(D_s \rightarrow \mu\nu) =$

$169 \pm 16_{stat} \pm 8_{syst}$

bkg: 30 ± 4

BR= (6.44 ± 0.76 ± 0.52)×10^{-3}

conference paper; Publikation in Phys. Rev. Lett. ist dzt. in Vorbereitung

preliminary result

G. Richter, FAKT07, Langenlois

- no systematics included yet
- purely statistical error

$$\lambda = -0.1503\ ^{+0.0457}_{-0.0389}$$

- corresponds to a confidence level limit:

$$\lambda < 0.0147 \qquad (CL = 90\%)$$

- in comparison to a study by Apollo Go:

$$\lambda = 0.029 \pm 0.057$$
$$\lambda < 0.0866 \qquad (CL = 90\%)$$

Abschluß des Dissertation erwartet für Mitte 2008