



SuperB: Physics Summary

John Walsh
INFN, Pisa

*XVII SuperB Workshop and Kick Off Meeting
La Biodola, May 28 - June 2, 2011*



A very active and fruitful week

- We had eight separate physics parallel sessions
- Total of 26 presentations
 - of which perhaps 30-40% by our theorist friends
- Some highlights...
 - I apologize in advance for not showing something from each talk
 - Problem of quantity, not **quality**!



Lots of stuff...

Monday, 30 May 2011	
08:00	[168] gg physics at Flavour Factories slides by Fulvio PICCININI (PV) (Sala Ajaccio: 08:30 - 08:50)
09:00	[170] Possible gammagamma physics at SuperB slides by Federico NGUYEN (ROMA3) (Sala Ajaccio: 08:50 - 09:10)
	[173] Spectroscopy and hadronic structure in gamma* gamma and gamma*gamma* reactions slides by Prof. Lech SZYMANOWSKI (Ecole Polytechnique, CphT/SINS Warsaw) (Sala Ajaccio: 09:10 - 09:30)
	[174] Recent news on spectroscopy slides by Chiara SABELLI (ROMA1) (Sala Ajaccio: 09:30 - 09:50)

Tuesday, 31 May 2011	
11:00	[29] Lattice QCD calculations in view of the SuperB slides by Nazario TANTALO (ROMA2) (Sala Ajaccio: 11:00 - 11:30)
	[179] Tau LFV slides by Mr. Alberto CERVELLI (PI) (Sala Ajaccio: 11:30 - 11:45)
	[180] SuperB vs MEG and Mu2E and NP models predicting LFV slides by Dr. Alberto LUSIANI (PI) (Sala Ajaccio: 11:45 - 11:55)
12:00	[181] Status of Vus determination from Kaon and Tau decays slides by Mario ANTONELLI (LNF) (Sala Ajaccio: 11:55 - 12:15)
	[182] Vus and Tau slides by Diogo BOITO (Sala Ajaccio: 12:15 - 12:30)

Wednesday, 01 June 2011	
08:00	[165] NA62 slides by Francesca BUCCI (F1) (Sala Ajaccio: 08:30 - 08:55)
09:00	[166] KLOE 2 slides by Antonio PASSERI (ROMA3) (Sala Ajaccio: 08:55 - 09:20)
	[167] MEG slides by Giovanni SIGNORELLI (PI) (Sala Ajaccio: 09:20 - 09:45)
10:00	[169] BES III slides by Dr. Haibo LI (IHEP, Beijing) (Sala Ajaccio: 09:45 - 10:10)
	[171] PANDA slides by Dr. Paola GIANOTTI (LNF) (Sala Ajaccio: 10:10 - 10:35)

Wednesday, 01 June 2011	
11:00	[196] TDCPV in charm by Dr. Fernando MARTINEZ-VIDAL (IFIC (Universidad de Valencia-CSIC)) (Sala Ajaccio: 11:00 - 11:25)
	[197] TDR Discussion Session paper (Sala Ajaccio: 11:25 - 11:55)
12:00	[198] December Physics Workshop Planning Session slides (Sala Ajaccio: 11:55 - 12:25)

Tuesday, 31 May 2011	
08:00	[184] K* mu mu at LHCb slides by Dr. Will REECE (CERN) (Sala Bonaparte 2: 08:30 - 08:50)
09:00	[185] BaBar/SuperB exclusive and inclusive slides by Prof. Gerald EIGEN (University of Bergen) (Sala Bonaparte 2: 08:50 - 09:10)
	[186] SuperB sensitivity fitting studies slides by Dr. Kevin FLOOD (Caltech) (Sala Bonaparte 2: 09:10 - 09:30)
	[187] Exclusive and inclusive theory: low q2 region slides by Tobias HURTH (Johannes Gutenberg-University, Mainz) (Sala Bonaparte 2: 09:30 - 09:50)
10:00	[188] Exclusive high q2 region slides by Dr. Christoph BOBETH (TU Munich (IAS/Excellence cluster universe)) (Sala Bonaparte 2: 09:50 - 10:10)
	[189] Discussion (Sala Bonaparte 2: 10:10 - 10:30)

Tuesday, 31 May 2011	
08:00	[175] Searching for Dark Forces in Rare Decays slides by matt GRAHAM (Sala Ajaccio: 08:30 - 08:50)
09:00	[176] Searching for Dark Forces in e+e- Interactions slides by Bertrand ECHENARD (California Institute of Technology) (Sala Ajaccio: 08:50 - 09:10)
	[177] Dark Forces at SuperB slides by Luca BARZè (PV) (Sala Ajaccio: 09:10 - 09:30)
	[178] Electroweak measurements slides by Dr. Oscar VIVES (U. Valencia and IFIC) (Sala Ajaccio: 09:30 - 09:50)

Sunday, 29 May 2011	
16:00	[27] Flavour physics and flavour symmetries: an example slides by Riccardo BARBIERI (PI) (Sala Ajaccio: 16:00 - 16:45)
17:00	[28] Flavor Physics in an SO(10) Grand Unified Model slides by Sebastian JAEGER (University of Sussex) (Sala Ajaccio: 16:45 - 17:30)

Monday, 30 May 2011	
08:00	[89] TDCPV at Charm Threshold, etc. slides by Mr. Gianluca INGUGLIA (Queen Mary University of London) (Sala Bonaparte 2: 08:30 - 09:00)
09:00	[90] Time-dependent Decay Correlations slides by Michael SOKOLOFF (University of Cincinnati) (Sala Bonaparte 2: 09:00 - 09:30)
	[91] Resolution Studies at Charm Threshold slides by Mr. Rolf ANDREASSEN (University of Cincinnati); Michael SOKOLOFF (University of Cincinnati) (Sala Bonaparte 2: 09:30 - 09:50)
10:00	[92] CPT and Other Topics for SuperB slides by Prof. Millnd PUROHIT (Univ. of South Carolina) (Sala Bonaparte 2: 09:50 - 10:20)

Interplay session

Some (approximate) flavour symmetry must be operative

$$U(2) \rightarrow U(2)_Q \times U(2)_u \times U(2)_d$$

$$V = (2, 1, 1)$$

$$\Gamma_u = (2, \bar{2}, 1)$$

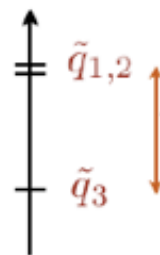
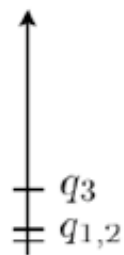
$$\Gamma_d = (2, 1, \bar{2})$$

$$u_i^L \xrightarrow{\xi W} d_j^L$$

$$d_i^{L,R} \xrightarrow{\tilde{g}} \tilde{d}_j^{L,R}$$

A relevant example: supersymmetry

Particle spectrum



TeV's, not controlled by symmetry breaking nor by naturalness

$$V_{CKM} = \begin{pmatrix} 1 - \lambda^2/2 & \lambda & s_u s e^{-i\delta} \\ -\lambda & 1 - \lambda^2/2 & c_u \theta \\ -s_d s e^{i(\phi+\delta)} & -s c_d & 1 \end{pmatrix}$$

$$s_u c_d - c_u s_d e^{-i\phi} = \lambda e^{i\delta}$$

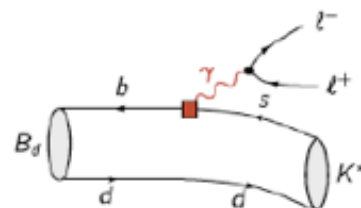
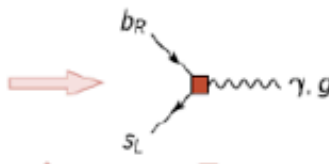
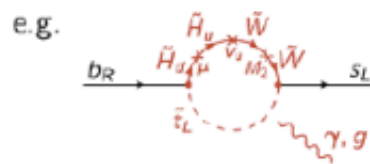
$$W^L = \begin{pmatrix} c_d & s_d e^{-i(\delta+\phi)} & -s_d s_L e^{i\gamma} e^{-i(\delta+\phi)} \\ -s_d e^{i(\delta+\phi)} & c_d & -c_d s_L e^{i\gamma} \\ 0 & s_L e^{-i\gamma} & 1 \end{pmatrix}$$

$$W^R \approx 1$$

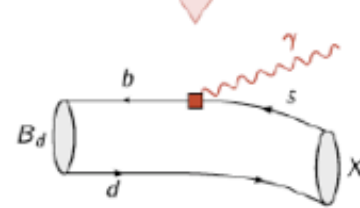
1 new angle s_L and 1 new phase γ

$\Delta F = 1$

Consider flavour-blind phases as illustrative example



A_7, A_8 in $B \rightarrow K^* \ell^+ \ell^-$

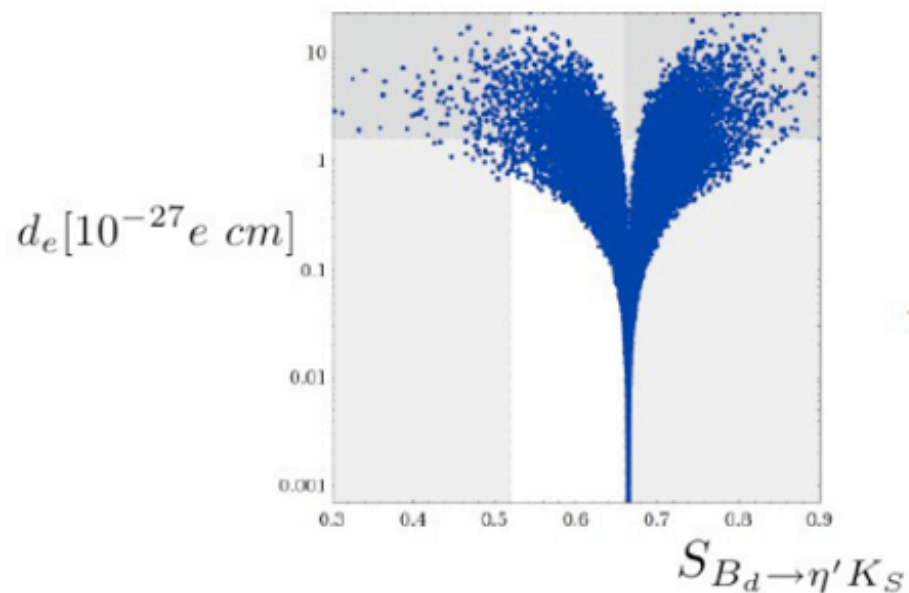


Direct CP asymmetry in $B \rightarrow X_s \gamma$



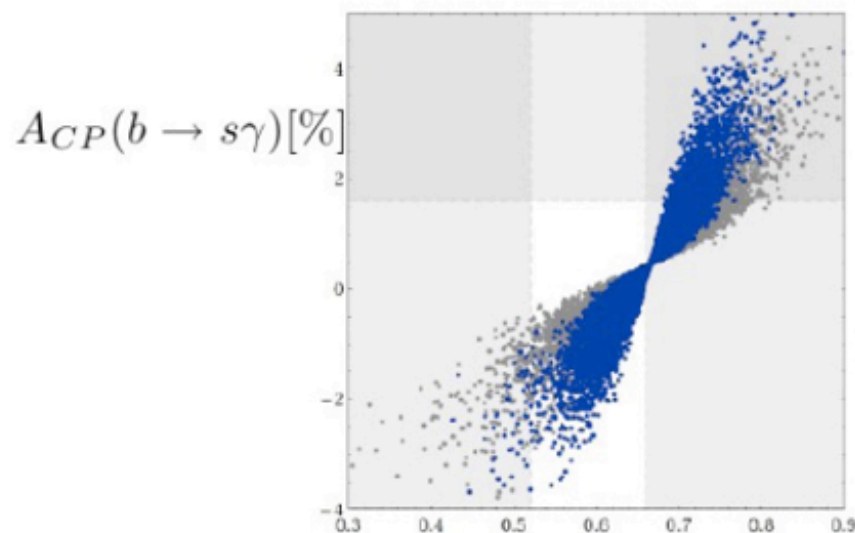
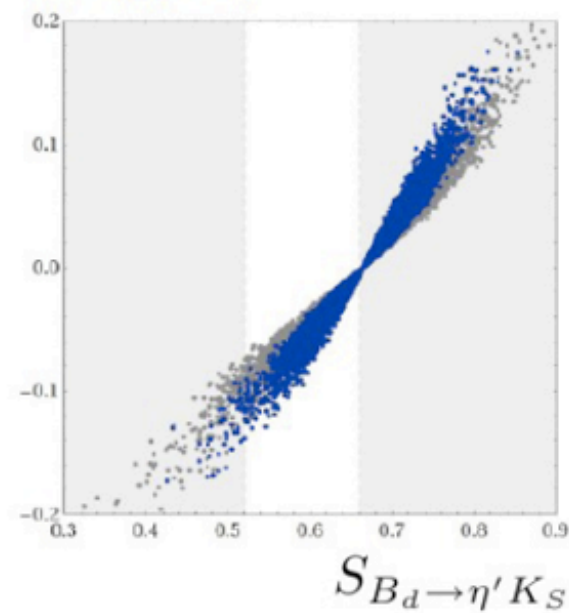
Mixing-induced CP as. in $B \rightarrow (\phi, \eta') K_S$

Barbieri's talk



Flavour blind phases lead to contributions to electric dipole moments

A_7 in $B \rightarrow K^* \ell^+ \ell^-$



Interplay session

[Chang, Masiero, Murayama 03]

Jäger's talk

- SO(10) gauge theory with superpotential

$$W_Y = \frac{1}{2} 16_i Y_1^{ij} 16_j 10_H + 16_i Y_2^{ij} 16_j \frac{45_H 10'_H}{2 M_{Pl}} + 16_i Y_N^{ij} 16_j \frac{\overline{16}_H \overline{16}_H}{2 M_{Pl}}$$

SO(10) spinor

$$16_i = (Q, u^c, d^c, L, e^c, \nu^c)_i, \quad i = 1, 2, 3$$

M_U, M_V^{Dirac}

M_D, M_L

$M_{\nu R}$

$$m_{\overline{16}_i}^2 = m_0^2 \mathbb{1}, \quad m_{10_H}^2 = m_{10'_H}^2 = m_{16_H}^2 = m_{\overline{16}_H}^2 = m_{45_H}^2 = m_0^2$$

$$A_1 = a_0 Y_1, \quad A_2 = a_0 Y_2, \quad A_N = a_0 Y_N,$$

CMM Model

“msugra
GUTs”

Observable/mode	H^+ high $\tan \beta$	MFV	non-MFV	NP Z penguins	Right-handed currents	LTH	SUSY					SUSY GUT CMM
							AC	RVV2	AKM	δLL	FBMSSM	
✓ $\tau \rightarrow \mu \gamma$							***	***	*	***	***	***
✓ $\tau \rightarrow \ell \ell \ell$						***						?
✓ $B \rightarrow \tau \nu, \mu \nu$	*** (CKM)						*	*	*	*	*	-
✓ $B \rightarrow K^{(*)} \nu \bar{\nu}$			*	***			*	*	*	*	*	?
✓ S in $B \rightarrow K_S^0 \pi^0 \gamma$					***							
✓ S in other penguin modes			*** (CKM)		***		***	***	*	***	***	?
✓ $A_{CP}(B \rightarrow X_s \gamma)$			***		***		*	*	*	***	***	?
✓ $BR(B \rightarrow X_s \gamma)$		***	*		*							***
✓ $BR(B \rightarrow X_s \ell \ell)$			*	*	*							?
✓ $B \rightarrow K^{(*)} \ell \ell$ (FB Asym)							*	*	*	***	***	?
$B_s \rightarrow \mu \mu$							***	***	***	***	***	*
β_s from $B_s \rightarrow J/\psi \phi$							***	***	***	*	*	***
✓ a_{sl}						***						***
✓ Charm mixing							***	*	*	*	*	
✓ CPV in Charm	***									***		

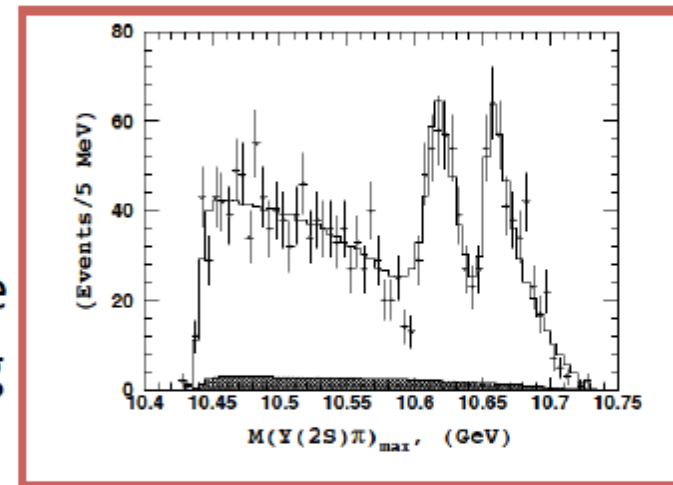
✓ = SuperB can measure these modes



C. Sabelli

Spectroscopy

- Recent news: discovery of two charged four quarks states with b content (Z_b):
 - Further confirmation of the importance of investigating exotic spectroscopy
 - Additional stress on the need of sitting at the $Y(5S)$ for a significant time

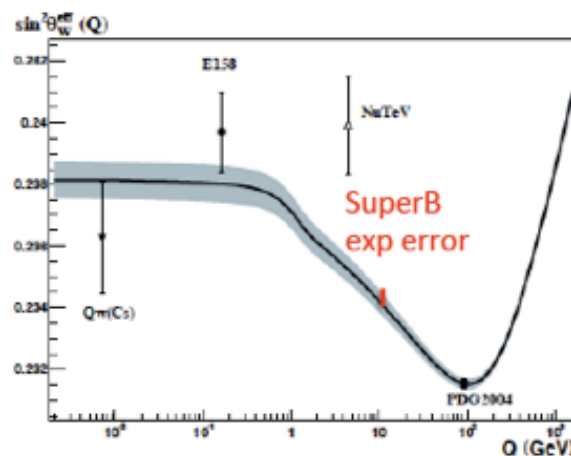


No significant change in strategy:

- High luminosity at $Y(4S)$
- Scan in the charmonium and bottomonium region

Electroweak

- Inconsistencies among $\sin^2\theta_w$ measurements at LEP could be further investigated with precise $A_{LR}(f)$, $A_{pol}(\tau)$ measurements at SuperB



Note:
 $\sin^2\theta_w(b) = 0.281 \pm 0.016$
(3.1 σ apart)

- Without polarization measurement dominated by measurements of $g_A (= -0.5$ in SM). Second order sensitivity to $\sin^2\theta_w \rightarrow$ polarization is critical

By-product: tau polarization can be used to measure beam polarization

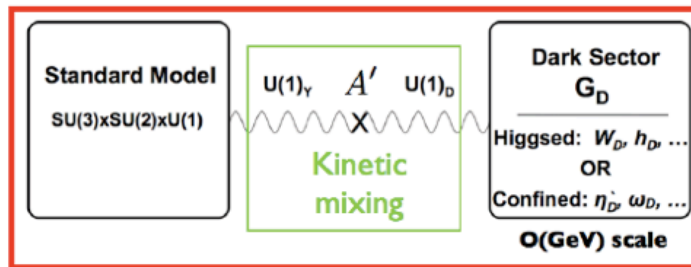
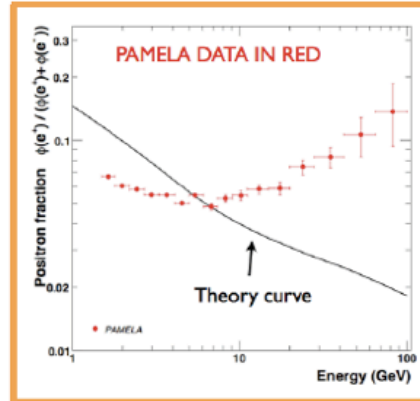
Search for Dark Forces

M. Graham
B. Echenard
L. Barze'

Results from **Pamela**/Fermi:
excess of positrons of
astrophysical origin

→ Due to particles decaying
into e^+e^- with $m < 2m_p$?

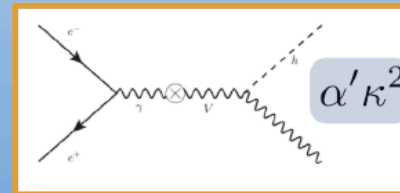
→ "Dark" gauge sector



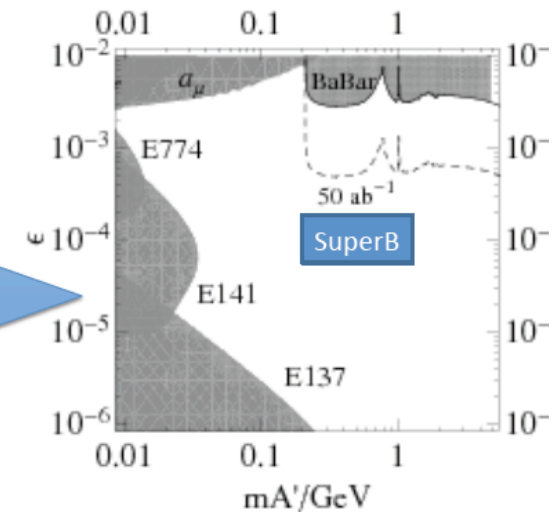
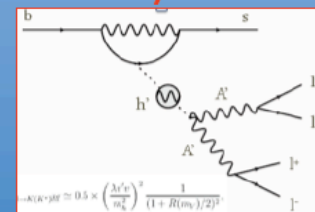
SuperB Sensitivity to dark forces

Discovery modes:

- Direct production



- B decays



Major experimental issue:
trigger for low multiplicity states

Threshold Running Scenario

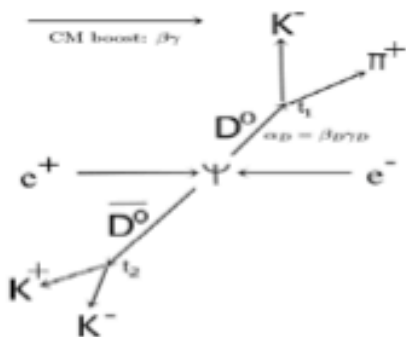
- The run envisaged here is a 500 fb^{-1} exposure at $\psi(3770)$
 - About 600 \times CLEO- \cancel{c} and (50-100) \times BES III
 - Just above $D\bar{D}$ threshold
 - At one-tenth nominal luminosity, Super B can complete this in a few months
 - Set up and tuning of final focus may take another few months
→ Perhaps a year altogether ?
- Since Elba 2011 and the White Paper new possibilities exist
 - Perhaps the boost can be raised from $\beta\gamma=0.23$ to 0.91 (P. Raimondi)
 - Maybe other thresholds or even larger runs can be made.

Time Resolution Study

Rolf Andreassen, U. Cincinnati

$$\alpha_D \sim 0.147$$

$$\alpha_B \sim 0.062$$



$$\Delta t = \frac{\Delta z}{\beta\gamma} + \frac{\alpha_D}{\beta} \Sigma t \cos \theta$$

LOW BOOST

$$\beta\gamma = 0.23$$

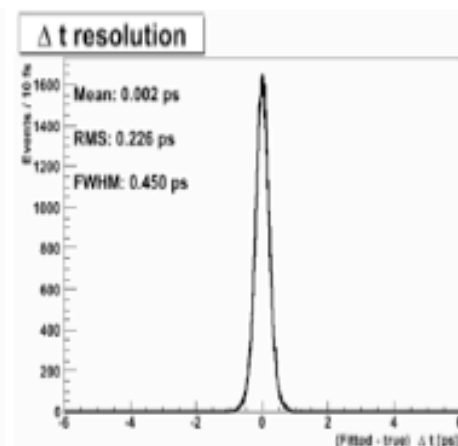
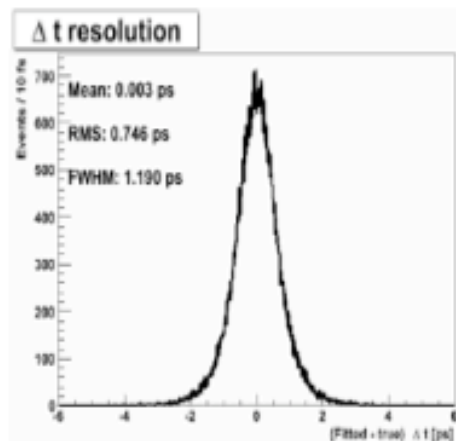
$$\sigma_{\Delta t} \sim 1.5\tau_{D^0}$$

HIGH BOOST

$$\beta\gamma = 0.91$$

$$\sigma_{\Delta t} \sim 0.5\tau_{D^0}$$

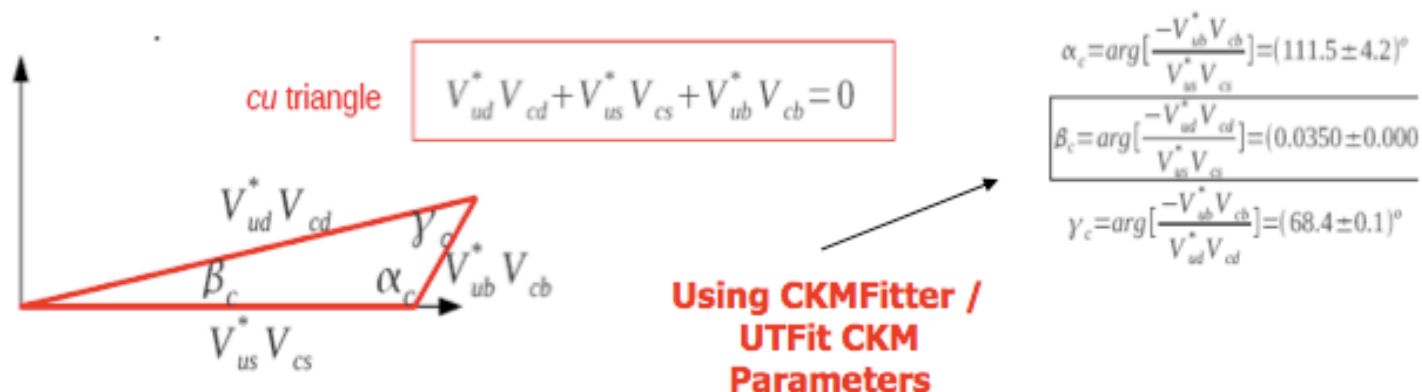
- Look at decay chain $\psi(3770) \rightarrow D^0\bar{D}^0$, with $D^0 \rightarrow K^-\pi^+$, $\bar{D}^0 \rightarrow K^+K^-$.
- Require all four tracks to be truth matched.
- Fit full decay tree and extract decay vertices; require probability of fit greater than 1% and that error on t be less than 0.3 ps (high boost) or 1.2 ps (low boost).



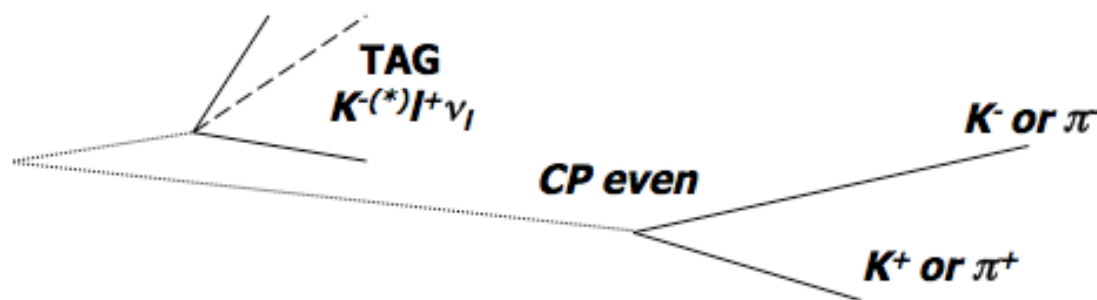
TD CPV ?

Gianluca Inguglia, A. Bevan, B. Meadows

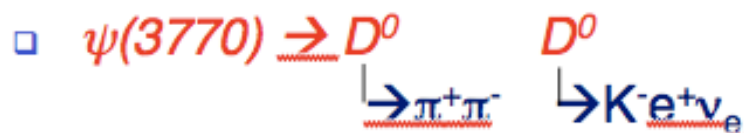
- Could we look into the “Charm (cu) Triangle” for 1st time?



- Measure β_c and ϕ_{Mix} from two main channels:



Toy Simulation of TDCPV at $\psi(3770)$



$500 \text{ fb}^{-1} \rightarrow 160K$ events
 projected from CLEO-c

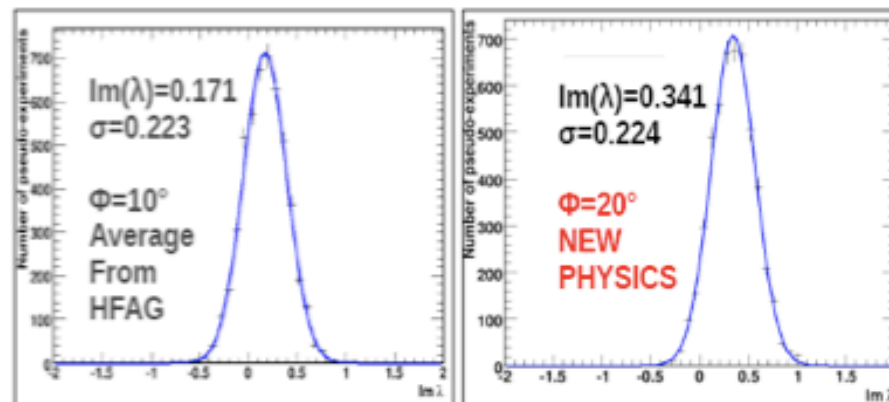
□ Possible to add

- μ and K^* channels ($\times 3$)
- Other CP channels ($\times 2$)

$\rightarrow \sigma(\phi_M) \sim 3^\circ$

□ Competitive with measurement
 of ϕ_M using 75 fb^{-1} at $Y(4S)$

BUT get there in ~ 1 year !!



*Include constraint from
 other ϕ_M measurements
 \rightarrow Begin to measure β_c*

*Only toy studies so far
 Comparison with similar
 analyses at $Y(4S)$ and at LHCb
 to be made.*



Charm

- Fernando...

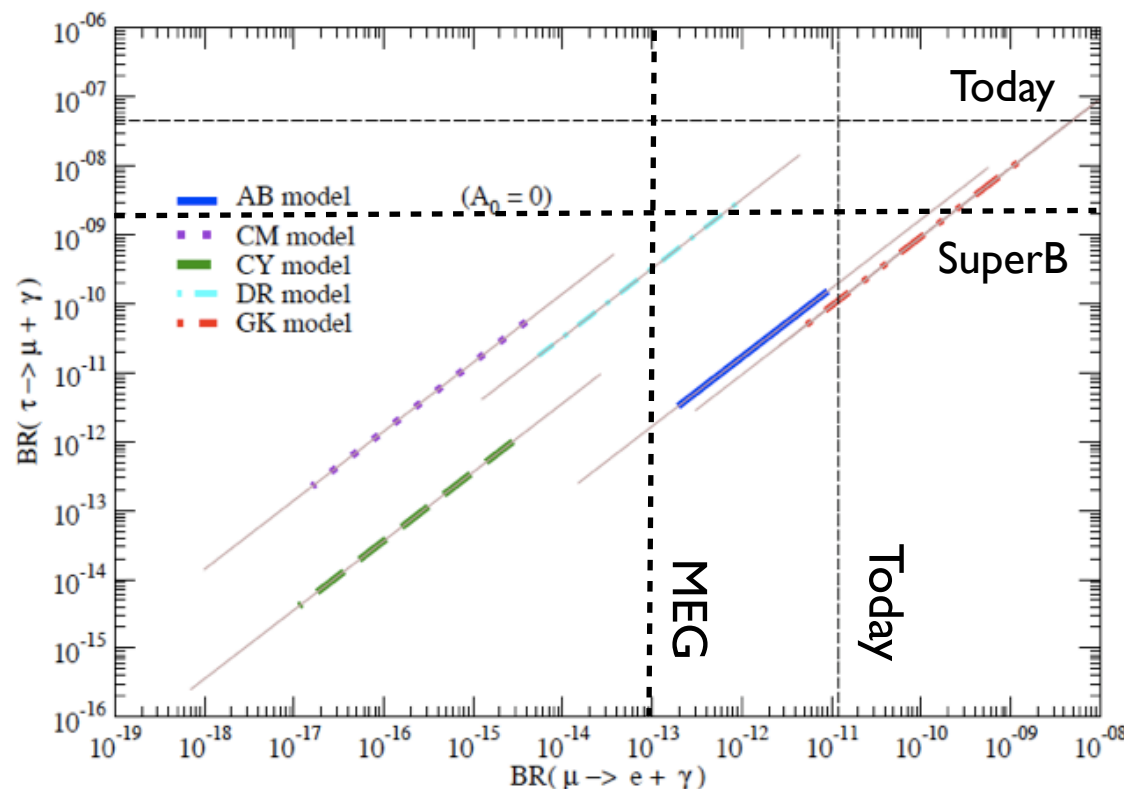


tau physics

SuperB vs MEG and Mu2E and NP models predicting LFV

A. Lusiani

C.H.Albright, Mu-Chun Chen, LFV in Predictive Susy GUT Models



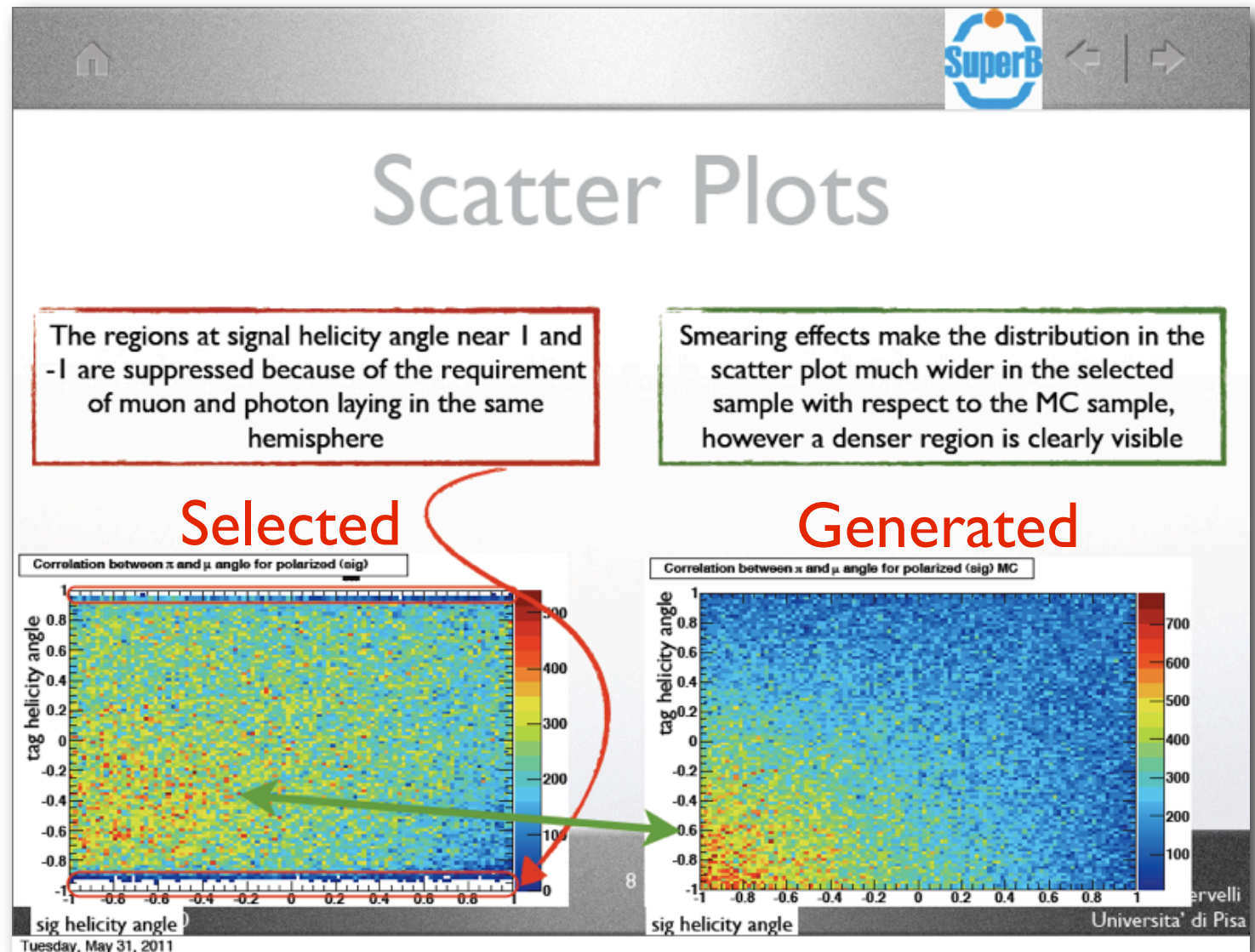
Conclusions

- ◆ published NP models LFV predictions: Mu2e more sensitive than MEG more sensitive than SuperB
- ◆ **correlations** between muon and tau LFV come
 - ▶ partly from experimental constraints on NP parameters
 - ▶ but also from **assumptions** driven by elegance, simplicity, similarity with low energy physics (flavour symmetries, mixing & mass hierarchies)
- ◆ muon and tau LFV measurements are **both necessary** to probe the most general NP structure that is allowed by today's measurements

tau physics

- Helicity angle correlations between sig and tag taus with beam polarization – A. Cervelli

Correlation persists, but is diluted by selection.





$b \rightarrow s$ dedicated session

- Get theorists & experimentalists in the same room and discuss:
 - capabilities of LHCb/SuperB/Belle
 - theoretical uncertainties in observables
 - exclusive vs. inclusive measurements, etc.

Tuesday, 31 May 2011		
08:00	[184] $K^* \mu \mu$ at LHCb by Dr. Will REECE (CERN) (Sala Bonaparte 2: 08:30 - 08:50)	slides
09:00	[185] BaBar/SuperB exclusive and inclusive by Prof. Gerald EIGEN (University of Bergen) (Sala Bonaparte 2: 08:50 - 09:10)	slides
	[186] SuperB sensitivity fitting studies by Dr. Kevin FLOOD (Caltech) (Sala Bonaparte 2: 09:10 - 09:30)	slides
	[187] Exclusive and inclusive theory: low q^2 region by Tobias HURTH (Johannes Gutenberg-University, Mainz) (Sala Bonaparte 2: 09:30 - 09:50)	slides
10:00	[188] Exclusive high q^2 region by Dr. Christoph BOBETH (TU Munich (IAS/Excellence cluster universe)) (Sala Bonaparte 2: 09:50 - 10:10)	slides
	[189] Discussion (Sala Bonaparte 2: 10:10 - 10:30)	

$b \rightarrow sl$: LHCb analysis of $B \rightarrow K^* \mu \mu$

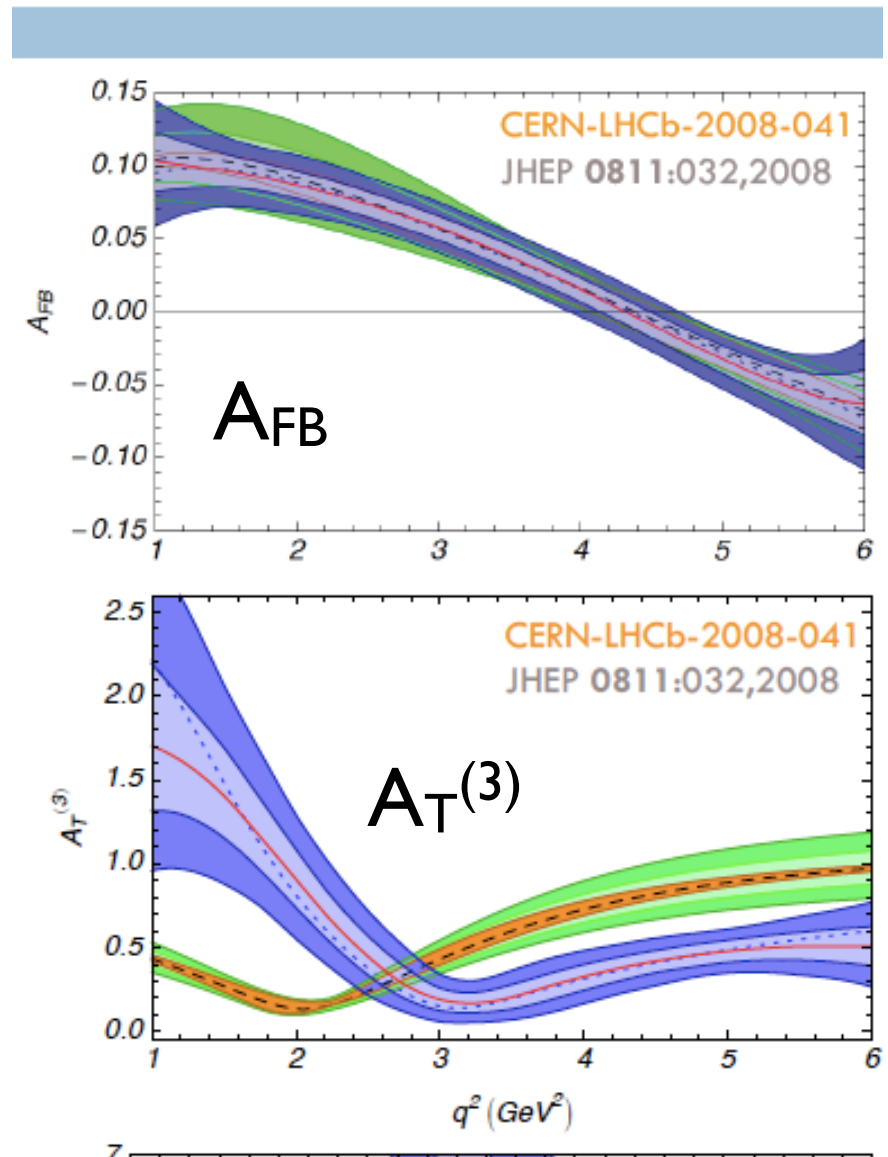
from Will Reece

10 fb^{-1}

SM Theory Distribution

Toy fits to SUSY model b ($C_7' \neq 0$) $1, 2\sigma$

- Traditional observables such as F_L (K^* polarization fraction) and A_{FB} (lepton F-B asymmetry) not necessarily sensitive to all NP models, e.g. right-handed currents
- “New” asymmetries, measured with **high-statistics full angular analysis**, can be more sensitive in some cases



$b \rightarrow sl$: Inclusive vs. Exclusive: q_0^2 (A_{FB} zero) from Tobias Hurth

Exclusive versus Inclusive

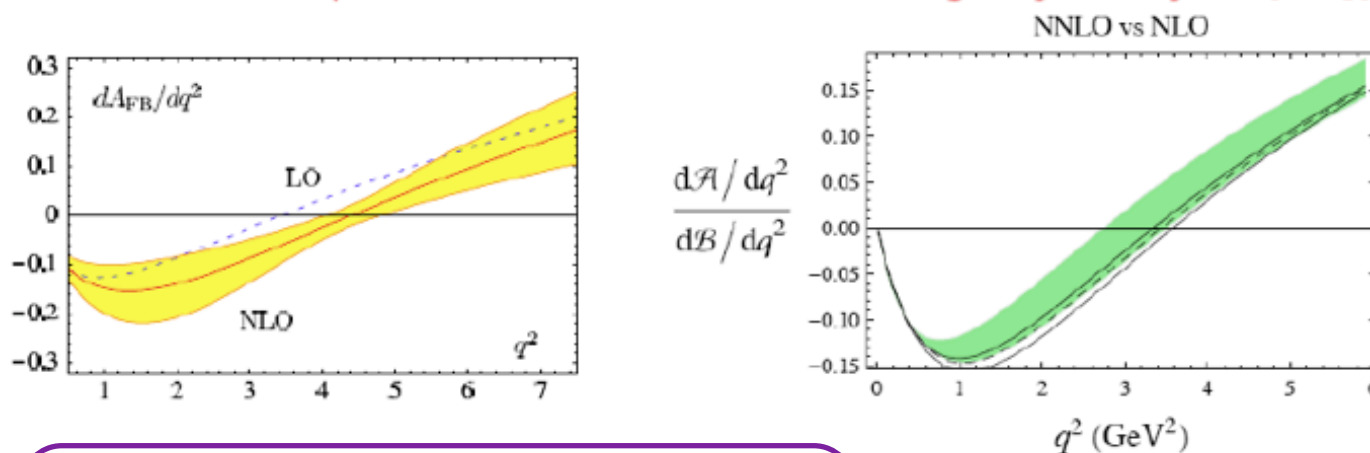
SLHCb versus SFF

Important role of Λ/m_b corrections

Measurement of inclusive modes restricted to e^+e^- machines.

(S)LHC experiments: Focus on theoretically clean exclusive modes necessary.

Well-known example: Zero of forward-backward-charge asymmetry in $b \rightarrow sl^+\ell^-$



Exclusive Zero:

Theoretical error: 9% + $O(\Lambda/m_b)$ uncertainty

Experimental error at SLHC: 2.1% Libby

Egede, Hurth, Matias, Ramon, Reece
arXiv:0807.2589

Inclusive Zero:

Theoretical error: $O(5\%)$ Huber, Hurth, Lunghi, arXiv:0712.3009

Experimental error at SFF: 4 – 6% Browder, Cluchini, Gershon, Hazumi, Hurth, Okada, Stocchi
arXiv:0710.3799

“Other Experiments” session

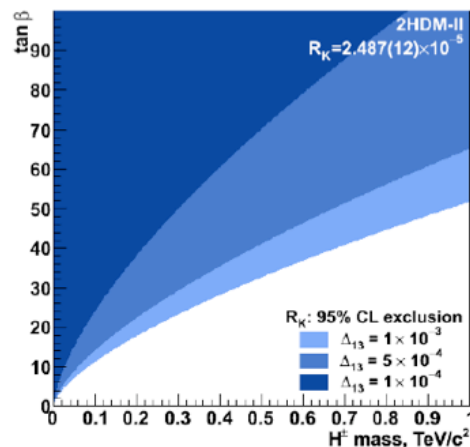
- Presentations from a series of flavour experiments

Wednesday, 01 June 2011	
08:00	[165] NA62 by Francesca BUCCI (FI) (Sala Ajaccio: 08:30 - 08:55)
09:00	[166] KLOE 2 by Antonio PASSERI (ROMA3) (Sala Ajaccio: 08:55 - 09:20)
	[167] MEG by Giovanni SIGNORELLI (PI) (Sala Ajaccio: 09:20 - 09:45)
10:00	[169] BES III by Dr. Halbo LI (IHEP, Beijing) (Sala Ajaccio: 09:45 - 10:10)
	[171] PANDA by Dr. Paola GIANOTTI (LNF) (Sala Ajaccio: 10:10 - 10:35)

$$R_K = \Gamma(K^+ \rightarrow e^+ \nu) / \Gamma(K^+ \rightarrow \mu^+ \nu)$$

R_K : Sensitivity to NP

For non-tiny values of the LFV s-lepton mixing Δ_{13}
the sensitivity to H^\pm in R_K is strong



XVII SuperB Workshop and
Kick Off Meeting, June 1 2011

Francesca Bucci

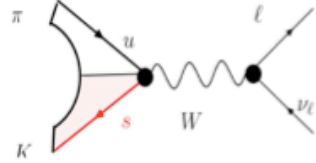
15

$$K^+ \rightarrow \pi^+ \nu \bar{\nu}$$

Decay Mode	Events
Signal: $K^+ \rightarrow \pi^+ \nu \bar{\nu}$ [flux = 4.8×10^{12} decay/year]	55 evt/year
$K^+ \rightarrow \pi^+ \pi^0$ [$\eta_{\pi^0} = 2 \times 10^{-8}$ (3.5×10^{-8})]	4.3% (7.5%)
$K^+ \rightarrow \mu^+ \nu$	2.2%
$K^+ \rightarrow e^+ \pi^+ \pi^- \nu$	$\leq 3\%$
Other 3 – track decays	$\leq 1.5\%$
$K^+ \rightarrow \pi^+ \pi^0 \gamma$	$\sim 2\%$
$K^+ \rightarrow \mu^+ \nu \gamma$	$\sim 0.7\%$
$K^+ \rightarrow e^+ (\mu^+) \pi^0 \nu$, others	negligible
Expected background	$\leq 13.5\%$ ($\leq 17\%$)

KLOE-1 core business : V_{us}

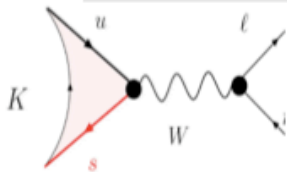
$$\Gamma(K_{l3}(\gamma)) = \frac{C_K^2 G_F^2 M_K^5}{192\pi^3} S_{EW} |V_{us}|^2 |f_+^{K^0\pi^-}(0)|^2 I_{Kl}(\lambda_{+,0}) (1 + \delta_{SU(2)}^K + \delta_{\text{adm}}^{Kl})^2$$



K_{l3} : $K \rightarrow \pi \ell \nu$

- ❖ Precise determination of V_{us}
- ❖ Test of Lepton universality K_{e3} vs $K_{\mu 3}$
- ❖ Most precise test of CKM unitarity
- ❖ Lepton-Quark universality of weak int.

$$\frac{\Gamma(K_{\mu 2}(\gamma))}{\Gamma(\pi_{\mu 2}(\gamma))} = \frac{|V_{us}|^2}{|V_{ud}|^2} \times \frac{f_K}{f_\pi} \times \frac{M_K(1-m_\mu^2/M_K^2)^2}{m_\pi(1-m_\mu^2/m_\pi^2)^2} \times (1 + \alpha(C_K - C_\pi))$$



K_{l2} : $K \rightarrow \ell \nu$

- ❖ Precise determination of V_{us}/V_{ud}
- ❖ Test of Physics beyond the SM
 - right-handed contributions to charged weak currents
 - charged Higgs exchange (2 Higgs doublet scenarios)
- ❖ Lepton Flavor Violation test with $\Gamma(K_{e2})/\Gamma(K_{\mu 2})$

$\Gamma(K_{\mu 2})/\Gamma(\pi_{\mu 2})$

Helicity suppressed: enhanced sensitivity to NP

A. Passeri

Physics @KLOE-2

Sensitivity @ KLOE-2

		% err	BR	τ	δ	I_{ke}
K_{l3}	0.2155(4)	0.20	0.09	0.13	0.11	0.06
$K_{l\mu 3}$	0.2167(4)	0.21	0.10	0.13	0.11	0.08
$K_{se 3}$	0.2153(7)	0.32	0.30	0.03	0.11	0.06
$K^{\pm}e 3$	0.2152(10)	0.47	0.25	0.05	0.40	0.06
$K^{\pm}\mu 3$	0.2132(10)	0.48	0.27	0.05	0.39	0.08

Upper limit

- From the analysis of the 2009 data our limit on the BR is the following:

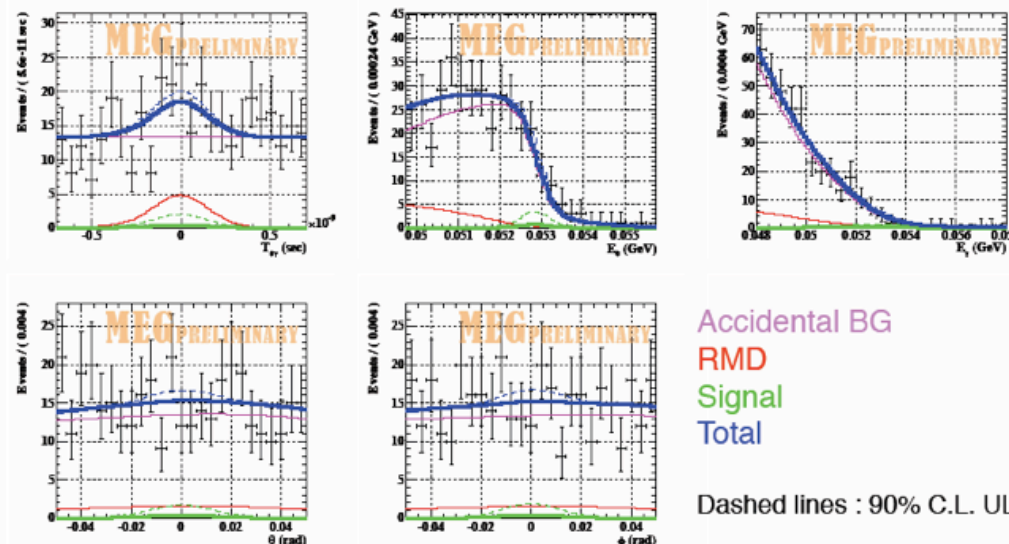
$$\frac{\mathcal{B}(\mu^+ \rightarrow e^+ \gamma)}{\mathcal{B}(\mu^+ \rightarrow e^+ \nu \bar{\nu})} < 1.5 \times 10^{-11} \quad \text{Preliminary MEG PRELIMINARY}$$

at 90% C.L.

- cfr. MEGA limit $\text{BR} < 1.2 \times 10^{-11}$ @ 90% C.L.

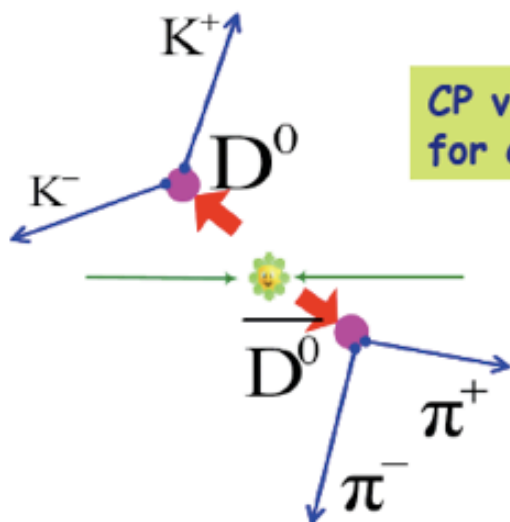
Likelihood fit result

- $N_{\text{sig}} < 14.5$ @ 90% C.L., N_{sig} best-fit value = 3.0
- $N_{\text{sig}} = 0$ is in 90% confidence region
 - C.L @0: 40÷60% depending on the statistical approach



Fitting was done by three groups with different parametrization, analysis window and statistical approaches, and confirmed to be consistent (N_{sig} best fit = 3.0-4.5, UL = $1.2-1.5 \times 10^{-11}$)

CP violation near threshold



CP violating asymmetries can be measured by searching for events with two CP odd or two CP even final states:

$\pi^+\pi^-, K^+K^-, \pi^0\pi^0, K_S\pi^0$,

for the decay of $\psi'' \rightarrow D^0\bar{D}^0 \rightarrow f_1f_2$

$$CP(f_1f_2) = CP(f_1) \cdot CP(f_2) \cdot (-1)^L = -$$

$$CP(\psi'') = +$$

A_{CP} sensitivity : $\Delta A \sim 10^{-3}$

CP violation in mixing can be measured with:

$$A_{SL} = \frac{\Gamma_{l+l+} - \Gamma_{l-l-}}{\Gamma_{l+l+} + \Gamma_{l-l-}} = \frac{1 - |q/p|^4}{1 + |q/p|^4}$$

With 10^8 D pairs in $(K^+e^- \nu)(K^+e^- \nu)$ mode, $|q/p|$ can be measured with (20-30)% accuracy. Current world averaged value is 0.86 ± 0.16 .

Future p - \bar{p} experiment to study mass range 2-6 GeV

The X(3872) state

A charmonium(-like) state found in $e^+ e^-$

$X(3872) \rightarrow J/\psi \pi^+ \pi^-$

Not found in formation in $e^+ e^-$ collision

→ Not $J^{PC} = 1^{--}$

Observation of decay into $J/\psi \gamma$

→ $C=+1$

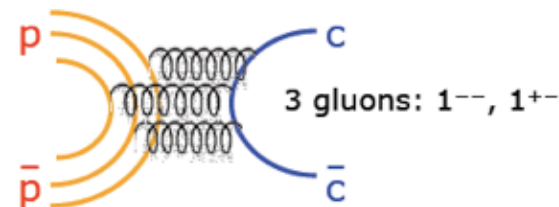
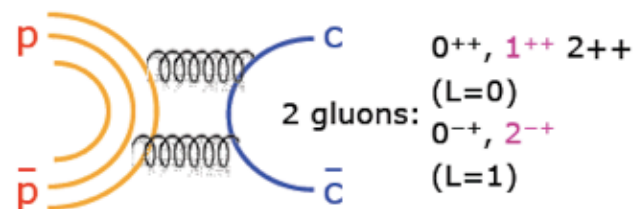
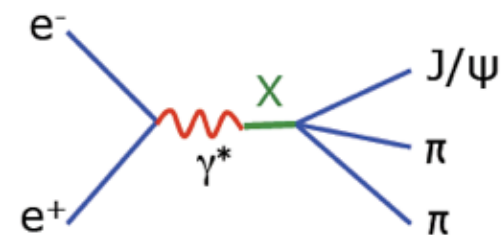
Mass of $X(3872) \rightarrow D^0 \bar{D}^{*0}$ shifted by $\sim 3 \text{ MeV}/c^2$

→ S-wave molecular state?

Width is unknown lower limit $\Gamma < 2.3 \text{ MeV}/c^2$ (Belle)

Helicity amplitude analysis from CDF

→ E.g. $J^{PC} = 1^{++}$ or 2^{--}



Quantum numbers can be determined by studying angular distributions

Organization

Conveners: Adrian Bevan, Marco Ciuchini, David Brown,
John Walsh

- $B_{u,d}$ physics (Bevan)
 - mixing and CPV (Bevan, ?)
 - rare/radiative/semileptonic decays (Walsh, Hurth)
- Tau (Roney)
 - LFV (Lusiani, ?)
 - tau properties (?, Vives)
 - V_{us} (Antonelli, ?)
- Charm (Meadows)
 - mixing and CPV (Meadows, Bigi)
 - direct CPV (Neri, Purohit)
 - FCNC
- B_s (Drutskoy)
 - still thinking about sub-groups
- Other Physics (WG5) (Faccini)
 - spectroscopy (Faccini, Polosa)
 - electroweak physics (Roney, ?)
 - dark forces (Echenard, Polosa)

Organization II

Theory and Tools

- Phenomenology (Ciuchini)
 - model independent/CKM/EFT (Ciuchini)
 - MSSM (Silvestrini)
 - SUSY-GUT (Kou)
 - extra dimensions (Blanke)
 - Little higgs (Tarantino)
 - SM4 (?)
- Non-perturbative methods (?)
 - lattice QCD (Lubicz)
 - HQE (?)
 - QCD sum rules (?)
- Tools (Rama)
 - ?

***Many thanks to Dave Brown for his work as
Tools Coordinator!***



Comparison document

- Short (< 20 pages) document to compare and contrast the SuperB physics program with other flavour experiments:
 - LHCb + SLHCb
 - Belle II
 - BES III
 - NA62, KOTO
 - MEG, COMET, Mu2e
- Very even-handed and fair; soliciting feedback from LHCb and Belle II physics conveners
- Regular bi-weekly meetings → converging rapidly, first complete draft almost ready, will be **finalized by July 1**
- Participants: **Adrian Bevan** (primary editor), Ciuchini, Walsh, Giorgi, Meadows, Lusiani, Drutskoy, Silvestrini, Tarantino, Cervelli, Perez, Stocchi, Brown

TDR Planning

- Plan on producing the Physics TDR on the time scale of early next year
- A working outline has been posted on the wiki: http://mailman.fe.infn.it/superbwiki/index.php/SuperB_Physics_TDR
- We have a good starting point: the Physics White Paper (arXiv:1008.1541), an 85-page document completed last year.
 - evaluating areas of the VVP that need additional work
 - WG's have been asked to provide full wish-list of channels/studies to perform
 - Prioritize and identify channels that need additional work prior to TDR – perhaps 2-3 channels per working group
- Next Physics Meeting: June 14 – would like a first pass of the physics list at that time



Workshop at Frascati in December 2011

- 2-day Physics Workshop to precede General Meeting: 11-12 December
- Expect significant contribution from theorists – hence early planning needed
- Obviously, many things can change, but we've starting to form ideas

Proposal for sessions

subjects we would like to see discussed: these are some suggestions, please add to them

- Day 1
 - Welcome: Aims/intro
 - DESY sll workshop summary
 - WG5 session
 - progress on α_s
 - $b \rightarrow sv$ session
 - Theory + Expt overview, esp A_{CP}
 - B_{uds} session(s)
 - $B_s \rightarrow gg$ &/or ASL Fast Sim progress
 - $b \rightarrow sll$ inclusive/exclusive FastSim progress
- Day 2
 - charm
 - TDCPV progress
 - tau
 - CPV
 - Lattice
 - 2011 Comparison with CDR predictions
 - Planning Session
 - Discuss tools required, and what FastSim mode studies we need for TDR/Book
 - TDR / Elba planning session

New areas of interest

- Time-dependent CP violation at charm threshold
 - B_s physics
 - CP violation in τ decays
 - Measurement of α_s
 - and probably others...
-
- People interested in working on these (or other) topics are encouraged to contact the physics conveners
 - Reminder: regular physics meetings held every other Tuesday at 5 pm European time.