Report from SuperB Workshop VI
(Valencia Physics Retreat)

SuperB Detector Workshop I
SLAC, 14-16 Feb, 2008

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Format the Workshop

	Mo 7th	Tu 8th	We 9th	Tw 10th	Fr 11th	Sa 12th	Su 13th	Mo 14th	Tu 15th
9:00	Registration	Plenary III	Working groups	Working groups	Working groups	Plenary V (Summary WGs)	Excursion to the Albufera lake	Preparation of the document	Preparation of the document
9:30									
10:00									
10:30		Coffee	Coffee	Coffee	Coffee	Coffee		Coffee	Coffee
11:00		Plenary IV	Working groups	Working groups	Working groups	Plenary VI (Summary WGs)		Preparation of the document	Preparation of the document
11:30									
12:00									
12:30									
13:00	Lunch	Lunch	Lunch	Lunch	Lunch	Lunch		Lunch	Lunch
13:30									
14:00									
14:30		Working groups	Working groups	Working groups	Working groups	Plenary VII (Summary WGs)		Preparation of the document	End session
15:00	Welcome								
15:30	Plenary I								
16:00									
16:30	Coffee	Coffee	Coffee	Coffee	Coffee			Coffee	
17:00	Plenary II	Working groups	Working groups	Working groups	Working groups			Preparation of the document	
17:30									
18:00									
18:30									
					Dinner (21:00)				

Goals of the workshop (and beyond)

Goals:
- **Sharpening the discovery potential of the Super Flavour Factory**
- **Simulation studies including detector response and machine parameters**

- Answers to IRC questions
- New ideas not considered in CDR
- Identify benchmark channels whenever possible
- Refine SuperB sensitivity estimates
  - Go beyond what is in the CDR
  - Realistic machine and detector simulation
  - Work closely with tools group
- Few presentations to stimulate interesting discussions
  - Introductory plenary talks on Monday afternoon and Tuesday moorning
  - Reports from WGs on Saturday
  - Few presentations in Parallel sessions
    - Stimulate discussions and "attractions"
- Started discussing and preparing document for IRC and P5 review on Monday and Tuesday of the 2nd week

Organization

WORKING GROUPS

WG 1 Tau Physics: LFV, CPV, EDM	Conveners: G.Isidori gino.isidori@lnf.infn.it A.Lusiani alberto.lusiani@pi.infn.it M.Roney mroney@uvic.ca P.Paradisi paride.paradisi@uv.es
WG 2 Charm Physics: CPV in D^0 mixing	Conveners: D.Asner asner@physics.carleton.ca I.Bigi ibigi@nd.edu F.Martínez-Vidal fernando.martinez@ific.uv.es
WG 3 Spectroscopy: new states and decay modes	Conveners: R.Faccini riccardo.faccini@roma1.infn.it A.Polosa a.polosa@roma1.infn.it
WG 4 B Physics: Observables sensitive to New Physics	Conveners: M.Ciuchini ciuchini@roma3.infn.it T.J.Gershon T.J.Gershon@warwick.ac.uk A.Stocchi stocchi@lal.in2p3.fr
WG 5 Tools	Conveners: M.Rama rama@slac.stanford.edu

Assumptions

- SuperB will accumulate 75/ab on the Υ(4S)
  - Beam energies 7 GeV e^- on 4 GeV e^+
  - 5 years operation @ $L_{peak} \sim 10^{36}/cm^2/s$
  - Data taking starts ~2015 ⇒ 75/ab by ~2020
- SuperB can operate at different energies
  - L_{peak} scales with s
    - $L_{peak} \sim 10^{35}/cm^2/s$ @ ψ''(3770)
- SuperB will be able to work with 80% polarized electron beam
- LHC operation will be successful
  - LHCb will accumulate 10/fb before SuperB starts
  - ATLAS & CMS will have plenty of data

  (no assumption whether or not NP is discovered at LHC
- SuperKEKB will start at ~2012 and will accumulate 10/fb @ Υ(4S)
- BESIII will have accumulate 15/fb at $D\bar{D}$ threshold (100×smaller peak luminosity)

WG I - Tau physics: LFV, CPV, EDM

Tau physics topics, progress since CDR

LFV Decays
- NP model estimates for SM points
- exp. sensitivity re-assessed
- compare with SuperKEKB and MEG

CPV in tau decay
- extrapolation from CLEO search

Tau EDM
- NP predictions updated
- exp. sensitivity estimate improved with
  - phenomenology paper
  - generator level simulations (tau production with polarized electrons)

Charged Current Universality Measurements
- no advancement (syst. limited)

CPT test on tau lifetime
- no dedicated work
- 2nd priority vs. golden channels

CPT test on tau mass
- no dedicated work (syst. limited)

Tau g-2
- NP predictions updated
- related to $(g-2)$ via SUSY
- exp. sensitivity estimate improved with
  - phenomenology paper
  - generator level simulations (tau production with polarized electrons)

Tau physics: LFV

New physics predictions for tau LFV decays

- new work by M.Herrero, E.Arganda, J.Portoles
- work in parallel by G.Isidori and P.Paradisi
- predictions at Snowmass points for $\mu \to e\gamma$, $\mu \to 3\ell$, $\tau \to \ell\gamma$, $\tau \to 3\ell$, $\tau \to \ell hh, \ell P^0, \ell V^0$
- $\tau \to \mu\gamma$ generally most powerful probe
- sensitivity of 10^{-9} probes significant portion of NP parameter space
- Tau LFV decays confirmed as Super*B* golden channels for NP discovery

Super*B* sensitivity for LFV decays

- experimental sensitivity re-assessed by
  - mentioning conservative extrapolations of known results
  - estimating possible Super*B* improvements, also with simulations
  - investigating the advantages of polarized beams

Tau physics: LFV in $\tau \to \mu\gamma$

Conservative SuperB sensitivity for $\tau \to \mu\gamma$

Conservative estimate of exp. sensitivity

- start from last published B-Factories paper (BABAR, 232 fb^{-1})
- $UL^{90}_{EXP} = \frac{\max(2.4, 1.6\sqrt{N_{BGK}})}{2 \cdot \mathcal{L} \cdot \sigma(e^+e^- \to \tau^+\tau^-) \cdot \epsilon}$ $N_{BGK} = 6.2 \cdot (\mathcal{L}/232\,\text{fb}^{-1})$ $\epsilon = 7.42\%$
- $\mathcal{L} = 75\,\text{ab}^{-1}$ → $UL^{90}_{EXP} = 7 \cdot 10^{-9}$ conservative   guaranteed scaling with $\sqrt{\mathcal{L}}$

Improvements on SuperB sensitivity for $\tau \to \mu\gamma$

- kinematic $\mu\mu\gamma$ rejection: in progress
- BABAR analysys re-optimization: in progress
- Super*B* lower asymmetry, better geom. coverage: estimate *UL* better by 5%
- improved detector hermeticity, to be studied
- smaller beam-pipe, more precise d_0 reconstruction: to be investigated
- electron beam polarization
  - done generator level simulations KK & Tauola
  - re-optimized for Super*B* at 75 ab^{-1} the *mu*. γ angular cuts
- veto muons in tag-side (modest gain)
- remove muon ID to increase efficiency, in progress

• LFV with SuperB is a clean and powerful probe for New Physics
• SuperB less powerful than $\mu \to e\gamma$ but highly complementary

Tau physics: CPV and EDM

T/CP-odd observables in tau decay

- no exp. sensitivity for most common NP scenarios
- effects with R-parity viol. SUSY or non-SUSY multi-Higgs up to the current UL from CLEO
- extrapolating from CLEO limit, Super*B* can improve by a factor 130

Tau EDM

- no exp. sensitivity for most common NP scenarios given the electron limit
- enhancements up to 10^{-22} *e*cm in multi-Higgs models
- polarized beams improve Super*B* sensitivity (arXiv:0707.1658 [hep-ph])
- exp. sensitivity estimated in above reference
- estimate refined with simulation, first estimate of syst. limitations
- Super*B* sensitivity now estimated at $\approx 10^{-19}$ *e*cm

- CPV in tau decay and EDM can be measured precisely
- However only some specific NP models predict measurable effects

Tau physics: g-2

Tau (g-2)

- assuming SUSY explains $(g-2)_\mu$ exp. vs. theory discrepancy
  → $\Delta_{SUSY}[a_\tau] \approx 10^{-6}$ and enhancements up to 10^{-5} are possible
- polarized beams improve Super*B* sensitivity (arXiv:0707.2496v1 [hep-ph])
- exp. sensitivity estimated in above reference
- estimate refined with simulation, first estimate of syst. limitations
- Super*B* sensitivity now estimated at $\Delta a_\tau = 2.4{\cdot}10^{-6}$

• SuperB can test whether SUSY is a viable explanation for muon g-2 discrepancy

Tau physics: Beam polarization

Beam polarization in Super*B*

- Super*B* will be able to work with 80% polarized electron beam
- improved exp. sensitivity for tau EDM and $g-2$
- possibly, adgantages also for LFV searches

Beam polarization simulations

- checked that KK and Tauola properly simulate
  - polarized colliding beams
  - outgoing tau polarization, with effects on decay products angular distributions
  - also longitudinal and transverse tau spin correlations are simulated
- millions of events in specific decay modes have been simulated and studied

Polarization of the electron beam gives SuperB an additional advantage w.r.t. SuperKEKB, particularly for the tau EDM and g-2 measurement, possibly also for LFV

SuperB statistics is always an advantage wrt SuperKEKB

WG II – Charm physics: Mixing and CPV

Prologue: New Physics Scenarios & Uniqueness of Charm

- New Physics in general induces FCNC
  - their couplings could be substantially stronger for Up-type than for Down-type quarks

(actually happens in some models which `brush the dirt of FCNC in the down-type sector under rug of the up-type sector)

- SM `background' much smaller for FCNC of *Up*-type quarks
  - ➥ cleaner -- albeit smaller -- signal!

- CPV, either in decay or in mixing or interference, is the way to Search for New Physics
- At SuperB precision measurements of mixing should be considered as a tool for searches for CPV and as validation of SuperB charm CP studies
  - Ambiguous probe for New Physics (long distance QCD effects…)

New physics via charm CPV

Finding $\not{CP}$ somewhere in $\Delta C \neq 0$ is a seminal discovery -- yet not a program, `merely' its first step!

Program (exp)

Study $\not{CP}$ & $\not{T}$ in

- $\Delta C = 1$ vs. $\Delta C = 2$; i.e., direct vs. indirect $\not{CP}$ via t dependance
- CF vs. CS vs. DCS
- partial rates vs. Final State Distributions (FSD)
- down to 10^{-3} - 10^{-4} levels

using runs at ~ 10 GeV & ~ 4 GeV

Program (th)

- Develop phenomenology for $\not{CP}$ & $\not{T}$ in FSD
- Derive reliable SM predictions
- Analyze NP scenarios -- in particular Little Higgs Models

Charm physics: indirect CPV (in mixing)

- Observable sensitive to |q/p| (ΔC=2)

$$A_{sl} = \frac{N^{++} - N^{--}}{N^{++} + N^{--}} = \frac{|q|^4 - |p|^4}{|q|^4 + |p|^4} \qquad R_M = \frac{1}{2}(x^2 + y^2)$$

$$N^{++} = \bar{D}^0 \to l^+ \nu K^-, \quad N^{--} = D^0 \to l^- \bar{\nu} K^+ \qquad D^0 = -, \bar{D}^0 = +, \quad l^{\pm} = \pm$$

$$D^0 \to l^- \nu X$$

$$D^0 \to K^+ \pi^-$$

  - At threshold –ψ''(3770)-, time dependent asymmetry can reveal a new source of WS leptons (violation of SM selection rules)
  - Use sum of several exclusive channels

$D^0 \to K^-\pi^+$, $K^-\pi^+\pi^0$, $K^-\pi^+\pi^0$, $K^-\pi^+\pi^+\pi^-$, $K^-e^+\nu$, $K^{*-}e^+\nu$, $K^-\mu^+\nu$, $K^{*-}\mu^+\nu$, K^+K^-, $\pi^+\pi^-$
(Σ ($\varepsilon \times \mathcal{B}$) ~ 22.7%)

- Measurement can be performed
  - At threshold with D double-tagging
    - Clean environment (closed kinematics), smaller systematics
    - Sensitivities: **δA ~ 2.5%/month** (Only sl $D^0 \to K^- \ell^+ \nu$ **δA ~ 9.5%/month**)

      → 4 months of running @ threshold (0.6 ab) → **δA ~ 1%**
  - At Y(4S) with D* tagging
    - More background, possible to tag the other c quark
    - Sensitivities: **δA ~ 2.7%/year**

      → 5 years of running (75 ab) → **δA ~ 1%**

Charm physics: CPV in interference of mixing and decay

$$D^0 \to CP$$

- Observable sensitivity to $\phi = \arg\left(\frac{q}{p}\frac{\bar{A}_f}{A_f}\right)$ (interference between ΔC=1 and ΔC=2)

- Lifetime measurements in CP eigenstates: time distribution is exponential only approximately. Good approximation since mixing and CPV are small

$$y_{CP} = \frac{\tau_{K\pi}}{\langle \tau_{hh} \rangle} - 1 \quad , \quad \Delta Y = \frac{\tau_{K\pi}}{\langle \tau_{hh} \rangle} A_\tau$$

$$2y_{CP} = \left(\left|\frac{q}{p}\right| + \left|\frac{p}{q}\right|\right)(\pm y)\cos(\phi) - \left(\left|\frac{q}{p}\right| - \left|\frac{p}{q}\right|\right)(\pm x)\sin(\phi)$$

$$2A_\Gamma = \left(\left|\frac{q}{p}\right| - \left|\frac{p}{q}\right|\right)(\pm y)\cos(\phi) - \left(\left|\frac{q}{p}\right| + \left|\frac{p}{q}\right|\right)(\pm x)\sin(\phi)$$

$$A_\Gamma = \frac{\tau(\bar{D}^0 \to CP) - \tau(D^0 \to CP)}{\tau(\bar{D}^0 \to CP) + \tau(D^0 \to CP)}$$

  – May require full time-dependent analysis with SuperB statistics

- Sensitivities with 75/ab:

$$\sigma(\cos\phi) \approx \sigma(y_{CP})/y \approx 3\times10^{-4}/y$$

$$\sigma(\sin\phi) \approx \sigma(\Delta Y)/x \approx 3\times10^{-4}/x$$

Charm physics: direct CP

- Estimates from BaBar analysis to 75/ab from 2-body decays
  - $D^0 \to K^+\pi^-$ in time dependent analysis

$$D^0 \to K^+\pi^-$$

$$A_D = \frac{R(D^0 \to K^+\pi^-) - R(\bar{D}^0 \to K^-\pi^+)}{R(D^0 \to K^+\pi^-) + R(\bar{D}^0 \to K^-\pi^+)}$$

$\sigma(A_D) \sim 0.4\%$

  - $D^0 \to K^+K^-, \pi^+\pi^-$ in time independent analysis (in this case, direct CPV effect mixed with indirect)

$$D^0 \to CP$$

$$A_{CP} = \frac{R(D^0 \to K^+K^-) - R(\bar{D}^0 \to K^-K^+)}{R(D^0 \to K^+K^-) + R(\bar{D}^0 \to K^-K^+)}$$

$\sigma(A_{CP}) \sim 0.03\%$

- Dalitz plot analysis, time integrated (e.g. Kshh)
  - Strong phase variation over resonances of the Dalitz plot can improve the sensitivity to the asymmetry
    - Asymmetry on regions of phase spaces can have different signs which could averaged out when integrating over the DP
  - Comparison of time-integrated CP conjugate DPs (model indep.) vs model dep.
  - From $D^0 \to \pi^+\pi^-\pi^0$, expect sensitivity at 3×10^{-4} at SuperB
- T odd correlations in Cabibbo Suppressed decays $D^0 \to K^+K^-\pi^+\pi^-$

Sensitivity to T violation ~ 0.04% with 75 ab^{-1}

Charm physics: 3-body decays and running energies

- Time-dependent Dalitz plot analyses are the golden modes for mixing, CPV in interference from mixing and decay, and perhaps too direct CP
  - Requires to keep under control Dalitz model systematics
    - Improved models with larger statistics
    - Full PWA analyses
    - Make use of threshold data
  - Very hard to estimate w/o performing analysis, but extremely promising
- Running at $\psi(3770)$ is important
  - Quantum coherence provides unique oportunity to directly measure and/or validate from other (mostly model dependent) measurements D-$\overline{\mathrm{D}}$ strong phase
    - (x',y') $\rightarrow$ (x,y) $$\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} \cos\delta & \sin\delta \\ -\sin\delta & \cos\delta \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix}$$
    - Dalitz model systematics in 3-body (e.g. $K_S\pi\pi$) analyses
  - Time-dependent measurements possible, but poor time resolution ($\sigma_t \sim \tau$) and poor statistical reach (cross-section 3×wrt 10GeB but luminosity 10×smaller)
  - 0.6/ab (~4 months) would give ~1% (very clean) CPV in mixing

WG III – Spectroscopy: New states and decay modes

The Physics Case

- There are indications that strong interactions do not only form mesons and baryons, but also other forms of aggregation
  - A major step forward in the understanding of nature (strong interactions)
  - Converting these indications into a solid set of measurements is within the reach of SuperB
  - Twofold task:
    - Discriminate among possible interpretations (regular mesons, molecules, tetraquarks, hybrids,…)
    - Complete the picture
      - Very large number of missing states
  - Operatively we will assume the tetraquark model is correct and explore the observables that are unique to SuperB
- There are new physics models that predict Higgs bosons at masses below $2m_b$ to have escaped LEP searches.
  - We will explore which are the search channels that require SuperB statistics

Search for resonances:

With non-quarkonium J^{PC}

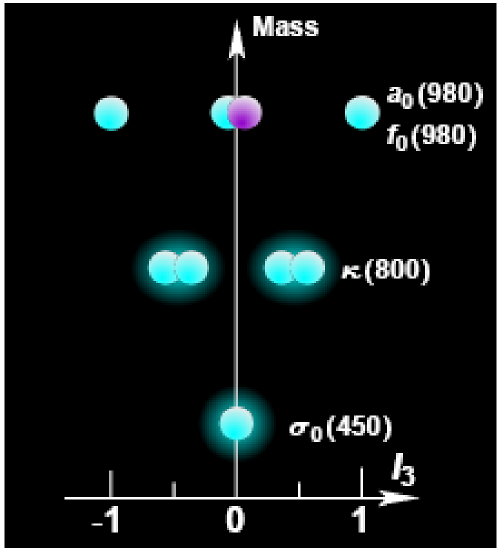
Unnaturally small widths

Not null charge: would be clear indication of something new going on

Spectroscopy: light quark mesons and charmonium

Light meson spectroscopy

- Possibility that the scalar none is a tetraquark



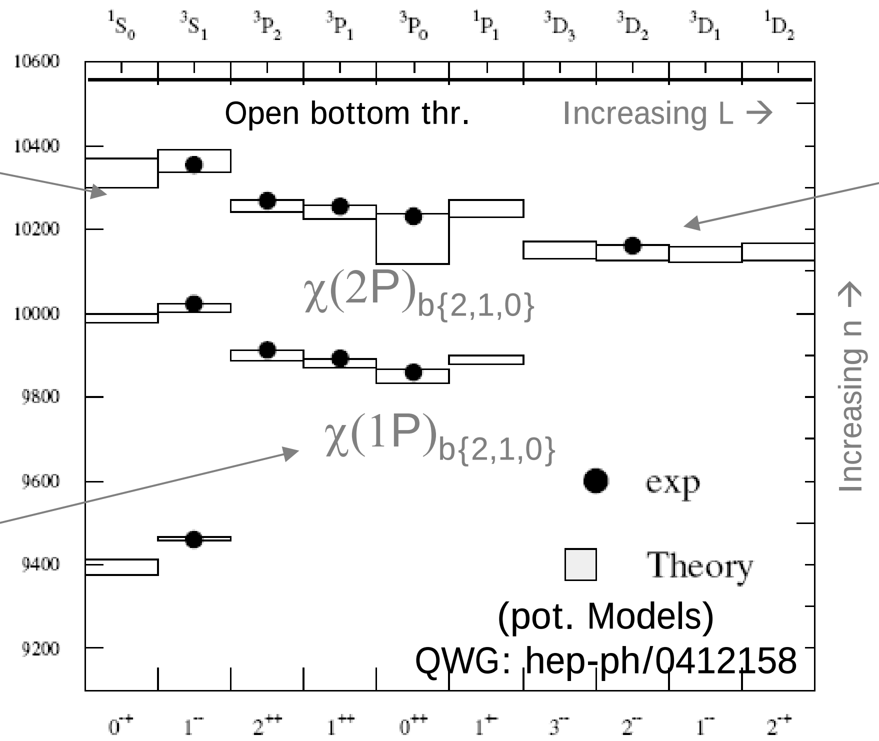
- Stengthened by recent dispersion relation studies of BaBar+KLOE data
- BaBar candidate for a 1^- excitation Y(2175), in ϕf_0
  - Very low stat
- Room for investigating whether $f_0(1500)$ is a glueball, search for additional states,…

Charmonium spectroscopy

- X(3872/6), Y(4360), Y(4660), Z(4330) are most likely tetraquark candidates
  - Low stat
- The best way to discriminate between tetraquark and other models are the semileptonic decays
  - E.g. $X(3872) \rightarrow D_s \pi^0 l \nu$ allowed only by tetraquark, $D^{*0}D^0$ molecule could only go to $D^{*0}K l \nu$
  - Cabibbo suppressed + ν (experimental challenge)
- BFs to two $D_{(s)}$ mesons $\Rightarrow$ need high statistics

Spectroscopy: Bottomonium

η_b (x3) completely missing



2 h_b and 3 D wave states are narrow but not observed

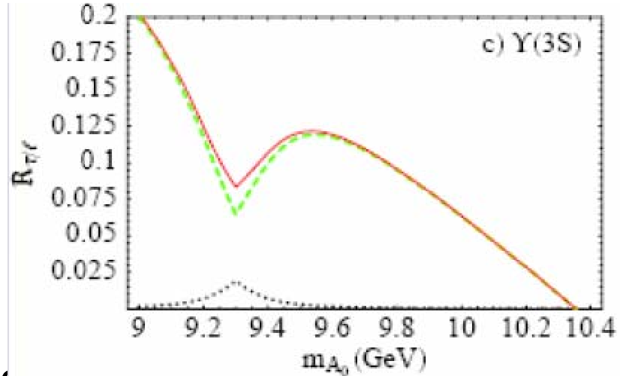
Unconfirmed J assignments of all the χ_b s

8 narrow resonances still missing !

The large number of missing states is due to low individual BFs and large background

Spectroscopy: Exotica Searches in bottomonium

- Light Higgs (lightest CP-odd Higgs in NMSSM):
  - $\Upsilon(nS) \rightarrow \gamma A_1$ (n=1,2,3) [$\Upsilon(mS) \rightarrow \Upsilon(nS)\pi\pi$]
    - $A_1 \rightarrow \tau\tau$
  - Two possible experimental approaches:
    - Measure $R = BF(\Upsilon \rightarrow \tau\tau\gamma)/BF(\Upsilon \rightarrow ll\gamma)$
    - Tag explicitely the monochromatic photon and the τ-pair



  - Might be systematics limited
- Extra dimensions
  - Direct searches for gravitons: $e^+e^- \rightarrow G\,\gamma$ (single photon)
- SUSY & Light Dark Matter
  - Direct searches: $\Upsilon \rightarrow$ invisible (particles which are not observed, typically LSPs)

Do B-Factories already saturate the discovery potential?

Spectroscopy: running at different energies

- Identified energies of interest:
  - Υ(3S) run
    - 0.3 ab-1 (~2 months) would already decuplicate the BF sample
  - Energy scan in 4-5 GeV range?
    - Produce the plot of $R_c = \sigma(c)/\sigma(ll)$, with c = several channels of interest (e.g. $J/\psi\ \pi\pi$,…)
    - BES does not reach these energies

WG IV – B Physics

- Many B physics observables sensitive to New Physics

Δm_d $A_{SL}(B_d)$ $S(B_d \to J/\psi K_S)$ $S(B_d \to \phi K_S)$

$\alpha(B \to \pi\pi, \rho\pi, \rho\rho)$ $\gamma(B \to DK)$ CKM fits

Δm_s $A_{SL}(B_s)$ $S(B_s \to J/\psi \phi)$ $S(B_s \to \phi\phi)$

$B(b \to s\gamma)$ $A_{CP}(b \to s\gamma)$ $S(B^0 \to K_S \pi^0 \gamma)$ $S(B_s \to \phi\gamma)$

$B(b \to d\gamma)$ $A_{CP}(b \to d\gamma)$ $A_{CP}(b \to (d+s)\gamma)$ $S(B^0 \to \rho^0 \gamma)$

$B(b \to s l^+ l^-)$ $B(b \to d l^+ l^-)$ $A_{FB}(b \to s l^+ l^-)$ $B(b \to s \nu \bar{\nu})$

$B(B_s \to l^+ l^-)$ $B(B_d \to l^+ l^-)$ $B(B^+ \to l^+ \nu)$

  - Maximize sensitivity by combining information
  - Correlations between results to distinguish models
  - Need very precise measurements

- Identify benchmark and “golden” (publicity) channels

B Physics: items discussed at workshop

- Some theoretically clean channels
  - Unitarity Triangle angles (α, β, γ)
    - Not discussed during the meeting, work required
  - Unitariry Triangle sides (Vub, Vcb)
    - Talks of Viaud, Gambino
    - How to reach 1-2% precision?
  - $b \to s\gamma$ (Walsh, Hurth)
  - $b \to sll$ (Renga Hurth)
  - $b \to s\nu\nu$ (Renga)

Inclusive channels:
- need detailed study of sensitivity for realistic Super*B* accelerator & detector
- effect of hermeticity on recoil analyses
- Important to work with tools group

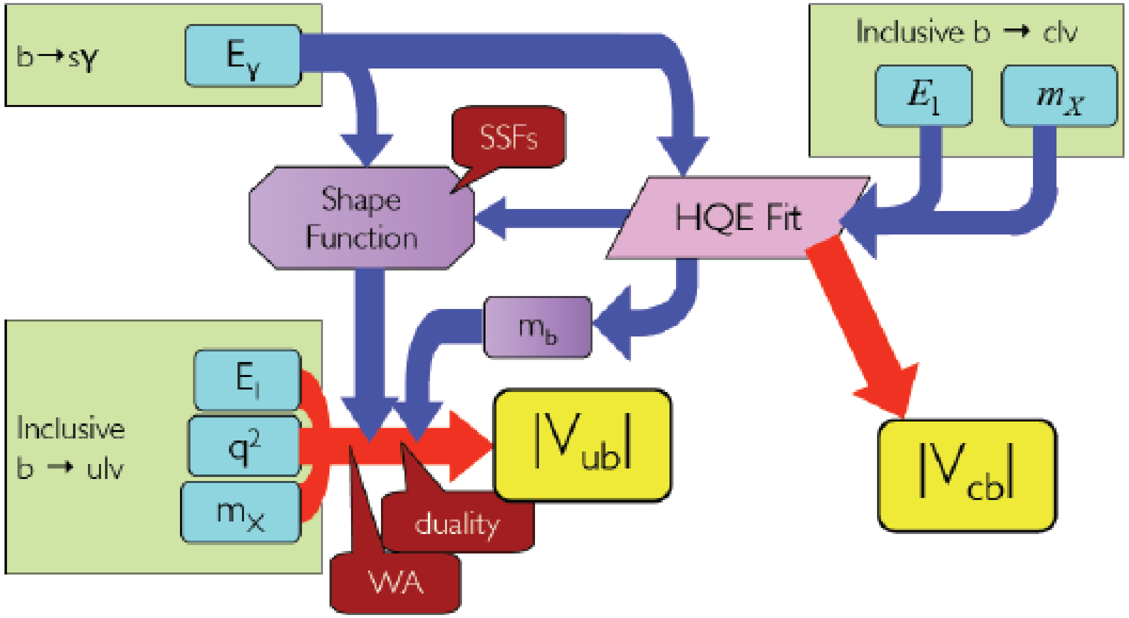
  - $b \to \tau\nu(\gamma)$ (Bevan)
  - $b \to sll$, $b \to l\nu$ (Robertson)

Some modes not discussed in CDR
- Assess interest and feasibility of measurements at Super*B*

- Interplay of Collider and Flavor Physics (highly relevant to the SuperB physics case). Emphasis on theoretical side for now
  - Tools HEP/Flavor interplay (Ronga)
  - SUSY breaking scenario (Shindou)
  - MFV + Snowmass points (Ciuchini + Silvestrini)

B Physics: V_{ub}

- Is 2% error on Vub feasible?



  - Experimentally: yes (Viaud), but hard to evaluate precisely the SuperB factory's potential w/o a rigorous study (i.e. simulation, as accurate as possible)
    - Too many things to know, from many th. or exp. Sources, having a complicated behavior (w.r.t. the backgrounds, for example) to obtain reliable results otherwise…
  - Theoretically: maybe (Gambino)
    - Very positive answer at this stage, need to discuss with other expert

B Physics: $b \to s\gamma$

- Sensitivity to inclusive $B(b \to s\gamma)$ will be more likely limited by systematics (and theory error)
- Clean environment, hermiticity, vertexing and very high statistics give SuperB huge advantage for recoil analysis (hadronic tags)
  - Need detailed simulations to have precise estimates of improvements
  - Would allow reduction of photon energy cut
- Main source of theoretical uncertainty in $B(b \to s\gamma)$ due to higher order corrections of $O(\alpha_s \Lambda / m_b)$
  - Non-perturbative physics due to necessary cuts in the photon energy spectrum to suppress $B\bar{B}$ background
  - If this can be reduced, theory error could be 3% (Hurth) (or better with reduction of photon energy cut)

WG V – Tools for simulation

- The main goal is to setup tools to do fast (and full) simulation aimed to the preparation of the Technical Design Report of the SuperB project
- The tools should
  - simulate the SuperB environment reasonably well
  - generate very large samples of the main physics processes

- A working group was formed at the end of December.
- The meeting in Valencia was very useful to establish contact between tools and physics groups and plan the future activity

Tools: Interaction with subsystems and physics groups

- Good interaction with subsystems during the last month to understand
  - what are the needs for the optimization of the detector using a fast simulation
  - what is the best way to develop a more realistic simulation
- Interplay with physics groups has also started (example: use of $\tau^+\tau^-$ generator in simulation)
- Regular meetings every second week

Tools: Plans

- very short term: provide the SuperB community with a working and well-documented fast simulation tool (PravdaMC)
  - to do optimization studies of the detector
  - to begin a few preliminary physics studies
- short and medium term: improve the fast simulation by both enhancing PravdaMC and exploring other solutions
- medium and long term: explore possible ways to integrate the fast simulation in the same framework of the full simulation (Geant4)

Conclusion

- Fruitful (and long) workshop, even if organized too quickly (with Xmas break in between)
  - Few presentations, lots of interesting discussions, time for attractions
  - It has been fundamental to prepare the report for IRC and P5
  - It has been a good opportunity to start and prepare the work on benchmark channels for TDR studies
- Tau WG
  - LFV with SuperB is a clean and powerful probe for New Physics. tau $\rightarrow\mu\gamma$ is the golden channel, highly complementary with $\mu\rightarrow e\gamma$ from MEG
  - CPV in tau decay and EDM can be measured precisely but only some specific NP models predict measurable effects
  - SuperB can test whether SUSY is a viable explanation for muon g-2 discrepancy
  - Polarization of the electron beam gives SuperB an additional advantage w.r.t. SuperKEKB, particularly for the tau EDM and g-2 measurement, possibly also LFV
- Charm WG
  - SuperB is “the” unique facility within the reach for New Physics from CPV in charm
  - Mixing measurements will significantly improve results from previous experiments
  - Running ~4 month at $\psi''(3770)$ will give access to 1% sensitivity on CPV in mixing and will prove unique tool for several other key measurements (e.g. 3-body decays)

Conclusion (cont)

- Spectroscopy WG
  - A branch of physics where there is evidence that something "new" is going on
  - A long way before the panorama is clarified
    - High statistics in clean environment is key to find/establish new states and discriminate between models (tetraquarks, hybrids, molecules,…)
  - Room for exotica searches (light Higss, Extra-dimensions, SUSY, dark matter)
  - Running <2 month at $\Psi(3S)$ would decuplicate the sample
  - Benefits from running at 4-5 GeV?
- B-Physics WG
  - A lot of activity at the workshop, on both theory and experimental sides
  - Quantitative comparison between SuperB and SuperKEKB in progress
    - Emphasis in qualitative differences
  - "Golden processes" as benchmark channels and publicity plots
- Tools WG
  - Started interplay with physics groups as well as some activities (e.g. tau generator)
- Working on the report:
  - material being collected and starting to edit the whole thing
  - First version will be available for P5 review the 20th Feb