Status at LAPP

April 24th 2020, Annecy/Edinburgh meeting M. Chefdeville, A. Downes, B. Quintana

News

- Everybody at home since March 17th in France
 - Possibility of progressive deconfinement after May $11^{\mbox{\tiny th}}$
- LAPP team:
 - Anthony back in UK, work from home
 - Boris offline at his parents
 - I work from home
- Current work
 - JpsiEta on hold (ordered missing Run1 MC, had a look at time acc.)
 - Ant and I: photon/pi0 reco efficiency studies using JpsiKX^o modes
 - \rightarrow some ideas for JpsiEta

Analysis goals in 2020 (B2CC Jan.)

- Effective lifetime of B_s light mass eigenstate in decay to $J/\psi~\eta'[\rho\gamma]$
- Improve absolute branching ratios of B_s decays to J/ ψ $\eta(\eta')$ using different $\eta(\eta')$ modes ($\gamma\gamma$, $\pi\pi\pi^0$, $\pi\pi\gamma$, $\pi\pi\eta$)
- Improve run-1 measurement of η/η' mixing angle
- Combine $J/\psi~\eta(\eta^{\prime})$ modes for a measurement of Φ_s

Janv Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Photon efficiency		Review								
		Selections and mass fit $(J/\psi X^0)$								
		Absolute BRs (Anthony)						-		
			η/η' mixin				ng			
		Decay time acceptance and resolution								
						Effectiv	ve lifetin	ne (Ste	fano)	
Tagging studies & developments (Boris)										
				CKM phase (Φ_s , β_d ?), penguin pollution?						

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Neutral reco efficiency study

- Use JpsiK/Chic1[JpsiG]K/JpsiKst[Kpi0]
- Good mass fits using 2012 data
- Currently testing effect of MC weights on BDT eff.
 - Easy to do on JpsiK, difficult on X⁰ modes \rightarrow still looking for more discriminating variables
- MC requests to use uniform Sim09 versions (g or h) for Run1-Run2
- Anthony report in Run1&2 perf meeting
- New ideas:
 - pi0-Veto with float ouput
 - Bkg-Veto with full reco
 - Control of random X^o bkg & MC reweighting techniques
 - Cone isolation for B
 - TMVA with negative weights





Pi0 veto

- TupleToolVeto checks for overlap in reco'ed objects and returns a boolean
 - Can be applied to single photons or pi0s
 - Discriminate against combinatorial bkg
- M. Reboud PhD @ LAPTh ($B_s \to \mu \mu \gamma)$ modified the tool to make a BDT
 - Saves the actual mass, for pi0 and eta combinations. And the number of combi.
 - Provides better discriminating power than pi0 veto only (his photons have PT>1GeV)



Peaking background veto

- Veto events for which a bkg mode is fully reco'ed
- Case #1: need additional particles (thus DST) (right plot)
 - e.g JpsiPhi[PiPi0] and JpsiEtap[RhoG], or JpsiKst0 and JpsiK
 - Needs to add a neutral (or a track) \rightarrow some efficiency penalty but more powerful than pi0 veto
- Case #2: bkg mode built from signal particles (left plot)
 - e.g JpsiRho[PiPi] and JpsiEtap[RhoG], or JpsiK and Chic1[JpsiG]K/JpsiKst[Kpi0]
 - Veto on DTF-bkg-mass sub-optimal due to tails. Better reconstruct bkg mode independently using another DV sequence at Tupling level. This also avoids signal mass distribution distorsion.



Peaking background control

- Signal/bkg tracks + random photon/pi0
 - Impact virtually any mass fit
 - Can be constrained to signal using MC
 - Expected to be sensitive to the event multiplicity
- Plan to compare nTracks VS nX0
 - Baseline is to reweight in bins of [nPV;nTracks] (instead of nTracks only)
 - Now save size of StdLoose X0 containers to Ntuple





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Peaking background control



MC data

B isolation

- We previously saved photon/pi0 isolation variables
 - In radiative decays, the B isolation proves quite useful. Can be calibrated on modes w/o neutrals (e.g. JpsiK)
 - Needs to check bkg dsitributions (\rightarrow JpsiKst[KPi0] Ntuples)



MVA training

- Usually done with signal MC VS data high-mass SB
 - With neutrals: significant physics bkg in HMSD (random $\gamma/\pi^{_0})$
 - Similarities in some variable distributions \rightarrow MVA less discriminating
- For BDT, possible to inject MC events with a negative weight in the bkg sample
- Example for BDT(JpsiKst[KPi0]): add JpsiKst[KPi] events.
 - Weight (=-0.5) calculated from N(HMSB) and expected contribution relative to signal.



Signal MC VS HMSB data

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Signal MC VS (HMSB data – JpsiKst0 MC)

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Outlook

- Photon efficiency
 - On a good track but still quite to do
 - Target end of May to complete the analysis
 - Update numbers when new MC available
- JpsiEta modes

. . .

- Stripping campaign over
- Prepare a WGP of Ntuples
 - \rightarrow finalise list of relevant variables and bkg decay to be veto'ed