Photon reconstruction & lineshapes

June 5th 2019, Annecy/Edinburgh meeting, M. Chefdeville

Status

- JpsiEtap
 - DTF-Ntuples (JpsiPiPi mass plot) to better constrain part. reco'ed bkg.
 - New production with StdVeryLooseAllPhotons (PT>75 MeV/c VS 200 MeV/c) still to be analysed
- JpsiPi0
 - Aim at reporting in B2CC next week
 - Nasty bkg is JpsiK0sh: few discriminating variables & moderate calo resolution
 - Investigated mass shapes & resolution



JpsiPi0 & JpsiK0sh

- Relative yields
 - $BR(JpsiPi0) = 1.79 \times 10^{-5}$
 - BR $(JpsiK0sh[Pi0Pi0]) = 1.45 \times 10^{-4}$
- Get mass shapes from Run2 MC for JpsiPi0 and Run1 MC for JpsiK0sh
 - All truth matched photons: shift of pi0 mass from K0sh due to decay after flight



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 - At least 1 truth-matched photon: increased overlap between Bmass distributions
 Should be mitigated with narrowing the pi0 mass window



Effect of DTF

- Constrain mass of diphoton to pi0 mass
 - Small improvement for JpsiPi0 (not sure why...)
 - Brings the JpsiK0sh mass closer to the B mass!

 \rightarrow better use non-DTF mass and improve resolution by other means (isolation, CL...)



Photon energy reconstruction

• Master formulae:

 $E = [\alpha(E_ecal - E_pu) + \beta E_prs] * global + \gamma$

 E_{ecal} and E_{prs} are measured in clusters of 3x3 cells

E_pu taken from 6016 values in CondB (Ecal/Calibration/PileUpOffset.xml) Values scaled according to event multiplicity (default is nSPDHits)

 α factorises position-dependent leakage corrections & possible ECAL calibration

PRS factor β is depends on ECAL section & conv/uncv photon type (SPD_{3x3}=0/!0)

constant γ represents loss before the calo (also section-type dependent)

factor global helps to stabilise converted photon calibration (=1 for uncv)

- 6 (β, γ) & global: tuned on events without pile-up (low-multiplicity photon)
 - These are larger for converted photons than for unconverted photons
 - In MC, $\gamma=0$

PU and photon type

- Ratio of Uncv/Conv keeps increasing with occupancy (expect ~ flat)
- In reconstruction: photon classified as converted if 1 SPD hit in 3x3 cluster
 - This definition is quite sensitive to $\text{PU} \rightarrow \text{uncv'ed}$ photon reco'ed as converted
 - Including converted photon with no hit in front of seed as uncv'ed \rightarrow ratio ~ flat



Exercise on JpsiK* (Run2)

- Re-calculate E_photon and M_pi0 if Spd hit not in front of ECAL seed
- 2 cases of interest: 2 pi0 photons in this category or only one
 - In both cases: mass aligns with mass in other categories



2 converted: Spd1 Seed1

2 unconverted: Spd0

1 or 2 mis-classified with Spd1 Seed0: no correction & with correction

Exercise on JpsiK* (Run2)

- Effect seen as a global shift of B peak
- Marginal gain on resolution (maybe right-hand tail)



Outlook

- Photon misclassification
 - Almost no effect on JpsiK* (pi0_PT>1.5 GeV/c)
 - To be checked for low energy photons (more sensitive to PRS energy) of JpsiEtap
- Focus on JpsiPi0 selections:
 - High-resolution photons
 - Will serve other JpsiX⁰ modes