First look at new J/Ψ η'[ργ] Ntuples

May 15th 2019, Annecy/Edinburgh meeting, M. Chefdeville

Status

- Little time to work on this lately (attended 2 conferences in last month)
  - Basically: only reproduced Run2 Ntuples of JpsiEtap with more variables
- Just had a look at the data this week
  - PID cuts & mass windows
  - Export JpsiK^{*+} BDT
  - First mass fits & cross-checks

Run2 Ntuples

- Files available at:

  /afs/cern.ch/work/c/chefdevi/public/Stefano/

  (to be moved to /eos upon green light)

- Contains 2016 MC & Run II data Decay Trees Tuples. Data lumi tuples yield:

  0.28 – 1.64 – 1.02 – 1.28 /fb for 2015, 2016, 2016 and 2018 respectively

  to be compared to 0.33 – 1.67 – 1.71 – 2.19 /fb from operation plots (link).

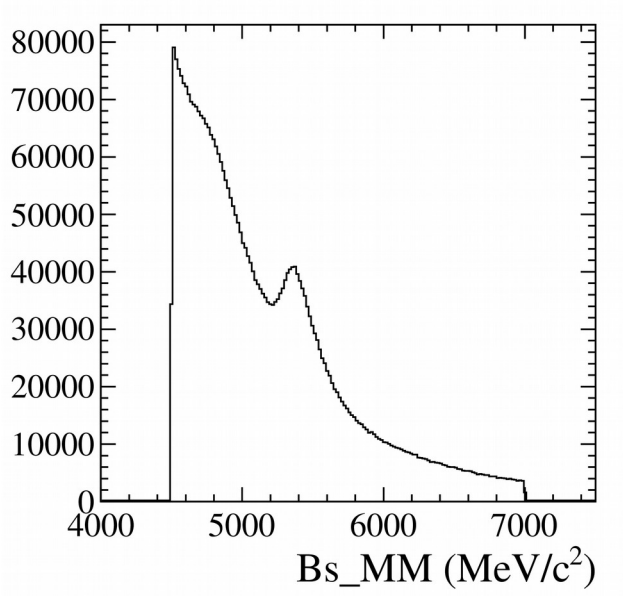
  This can't be explained by rate of failed jobs (<1%).

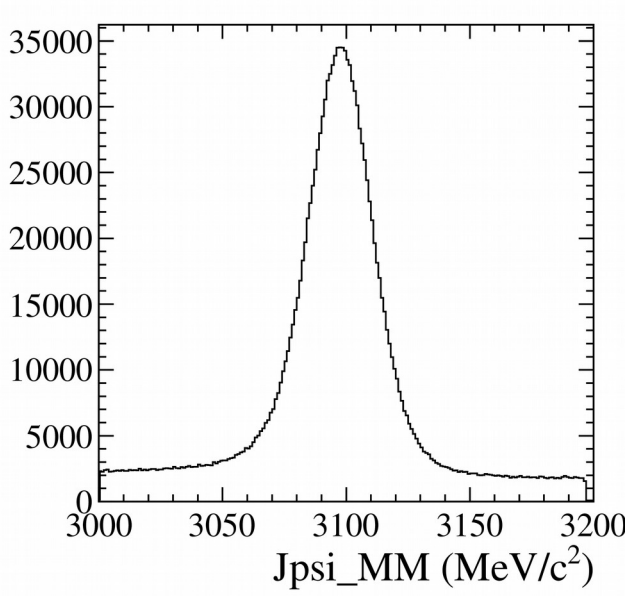
Selections & mass distributions

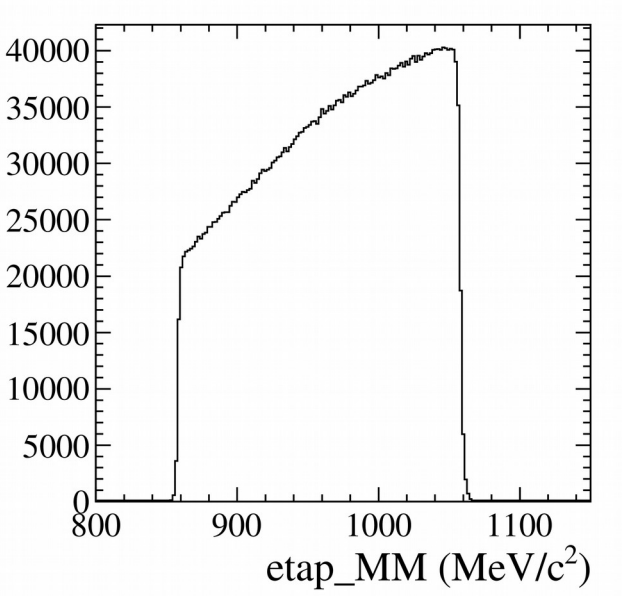
- Rho[pipi]: StdLoosePions (PT> 200 MeV/c)
  (AM>600*MeV) & (AM<900*MeV) & (ADOCACHI2CUT(15, ''))
  (BPVVDZ>0) & (VFASPF(VCHI2)<9) & (BPVDIRA>0.95) & (BPVVDCHI2>25)

- Etap[RhoGamma]: StdLooseAllPhotons (PT > 200 MeV/c)
  (CL>0.05)
  (ADAMASS('eta_prime')< 100*MeV) & (APT>1500*MeV) → *PS: MC has PT>2.25 GeV/c as gen cut*

- Bs[JpsiEtap]: FullDSTDiMuonJpsi2MuMuDetachedLine
  (AM>4500*MeV) & (AM<7000*MeV)
  (BPVDIRA>0.9995) & (BPVIP()<0.2) & (BPVIPCHI2()<20) & (VFASPF(VCHI2PDOF)<10)

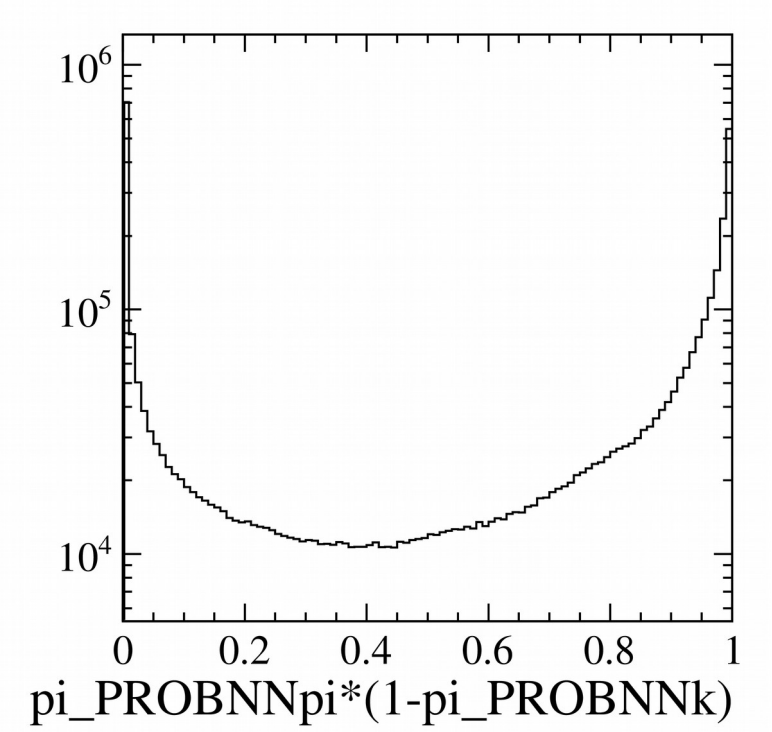


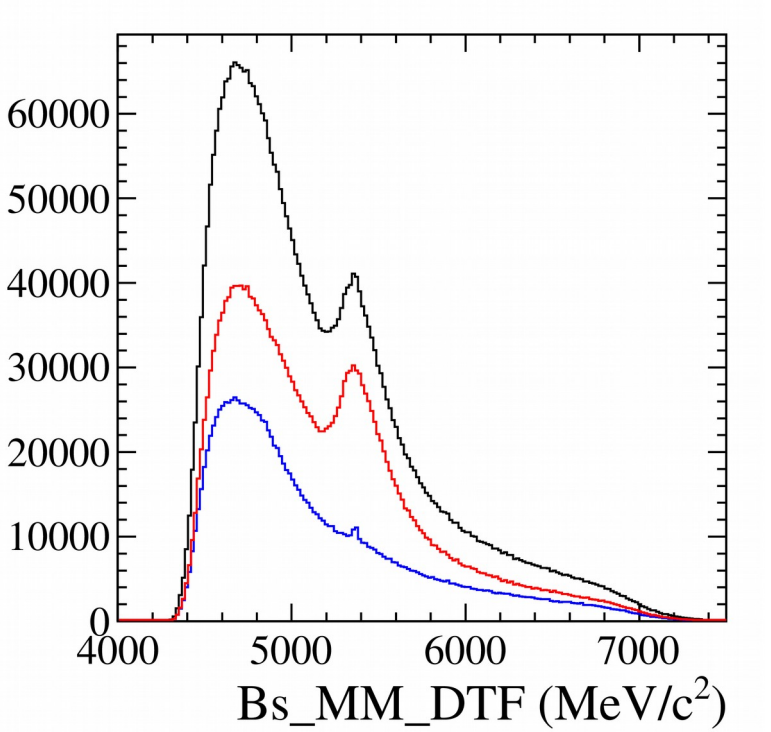




PID cuts

- Large and wide peak around Bs mass
  - Probably originates from high-BR JpsiK*[Kpi], JpsiPhi[KK]
  - Strongly suppressed by PID cut on pions (ProbNNpi*(1-ProbNNk) > 0.4)
- From now on, use Bmass from DTF with PV and (Jpsi, etap) mass constrains

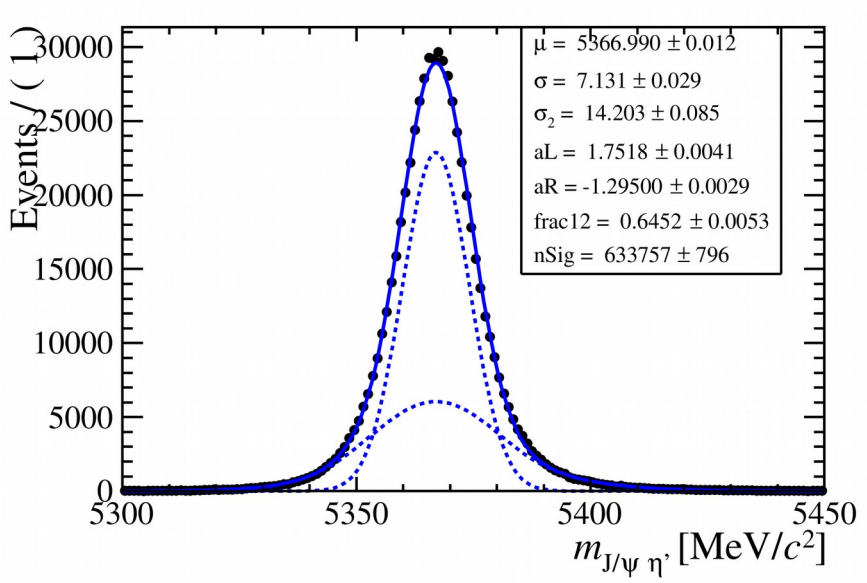




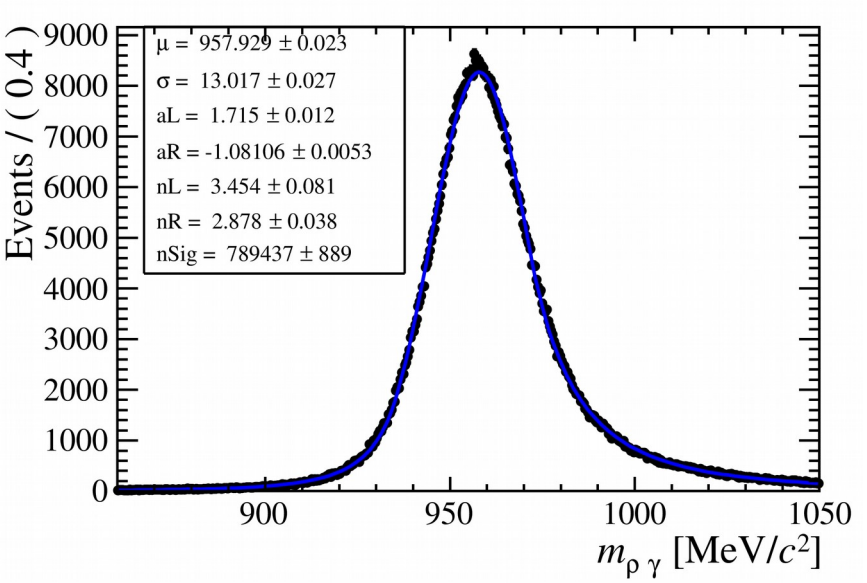
Mass windows & line shapes

- Use Sim09e-Pythia8, Stripping28r1NoPrescalingFlagged, 2016 signal MC (13144203)
  - About 8M events… truth-matched in Ntuples: about 11% (quite high)
- Sum of gaussian + gaussian with expo. tails for signal (common mean)

  σ_1 = 7.1 MeV/c^2 and σ_2 = 14.2 MeV/c^2
- For etap, using dCB: μ = 957.9 MeV/c^2 and σ = 13.0 MeV/c^2



Includes PID & mass window & soft BDT cut (see later)



PID cut only

BDT from JpsiK*+

- Still working on best BDT with JpsiK*+

  (single BDT VS double BDT)

- For now, use single BDT with set of variables as similar as possible

- Train MC signal VS data sideband (50k each):

  $\Delta m(\eta') > 30$ MeV/c^2 and $m(Bs) > 6500$ MeV/c^2

```
: ---------------------------------------------------------------------------
: Rank : Variable                                    : Variable Importance
: ---------------------------------------------------------------------------
:    1 : Bs_PT                                       : 9.633e-02
:    2 : Bs_DIRA                                     : 9.576e-02
:    3 : Bs_VTXCHI2                                  : 9.478e-02
:    4 : log(Bs_SmallestDeltaChi2OneTrack)           : 9.068e-02
:    5 : min_MIPCHI2DV                               : 8.331e-02
:    6 : max_MIPCHI2DV                               : 7.208e-02
:    7 : Bs_IP                                       : 7.000e-02
:    8 : Jpsi_IP                                     : 6.657e-02
:    9 : gamma_PT                                    : 6.333e-02
:   10 : gamma_0.40_IT                               : 6.164e-02
:   11 : Jpsi_DIRA                                   : 5.998e-02
:   12 : IsNotH                                      : 5.903e-02
:   13 : Bs_NumVtxWithinChi2WindowOneTrack           : 4.436e-02
:   14 : gamma_0.40_nc_mult-1+gamma_0.40_cc_mult     : 4.218e-02
: ---------------------------------------------------------------------------
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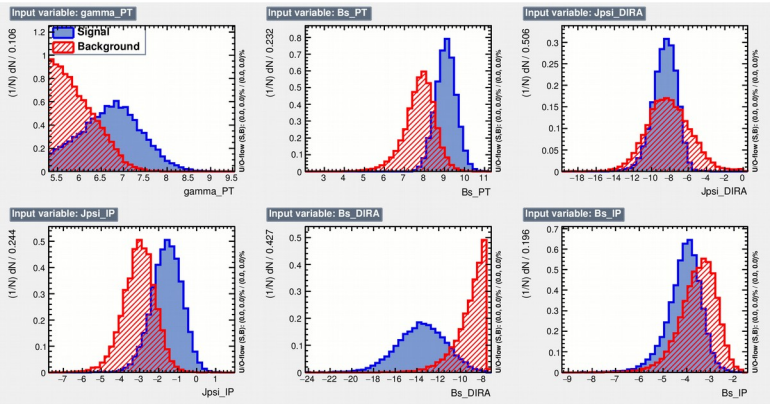
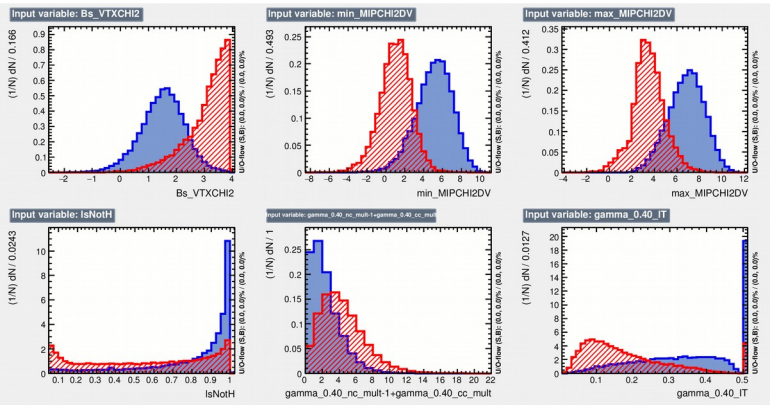
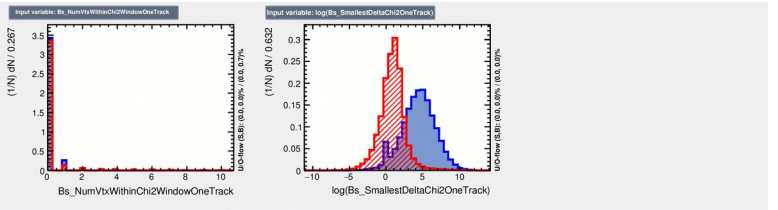
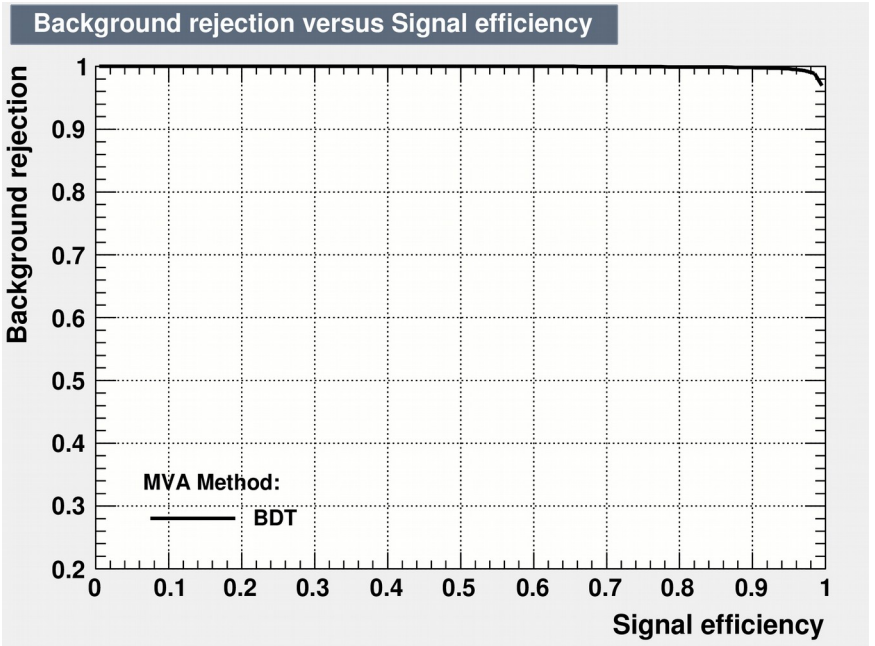


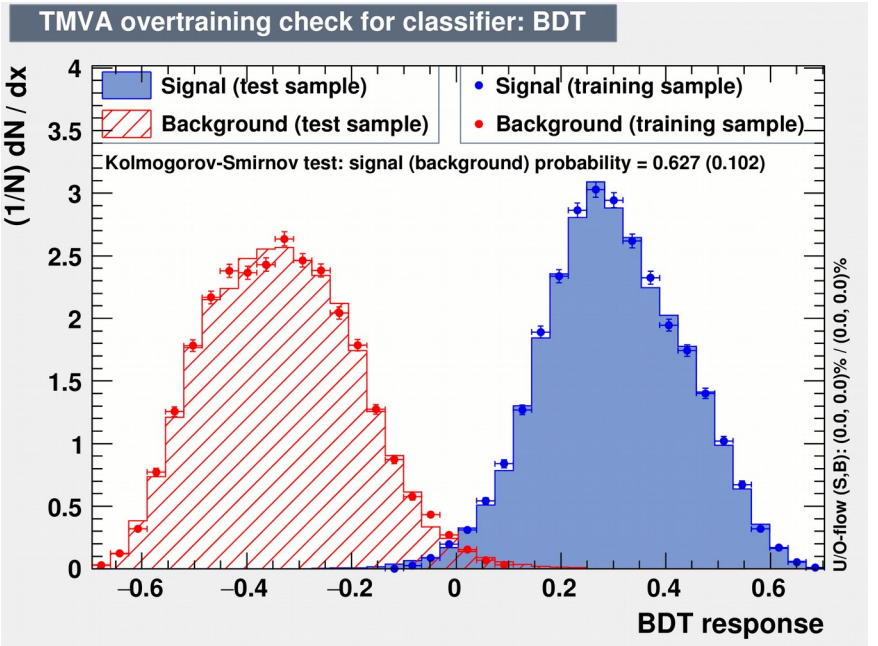




Performance

- With vertex, kinematic, isolation and calo PID variables

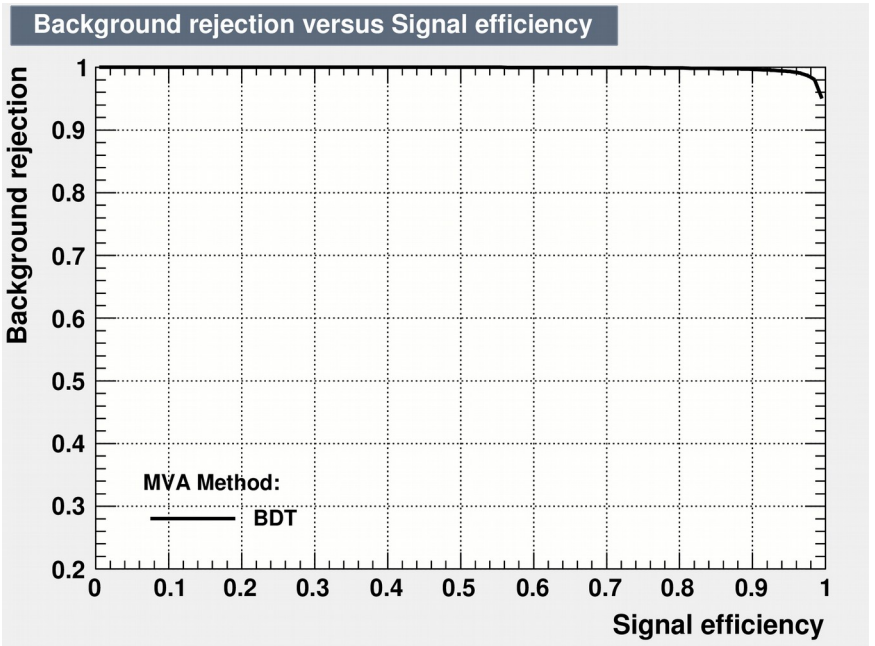


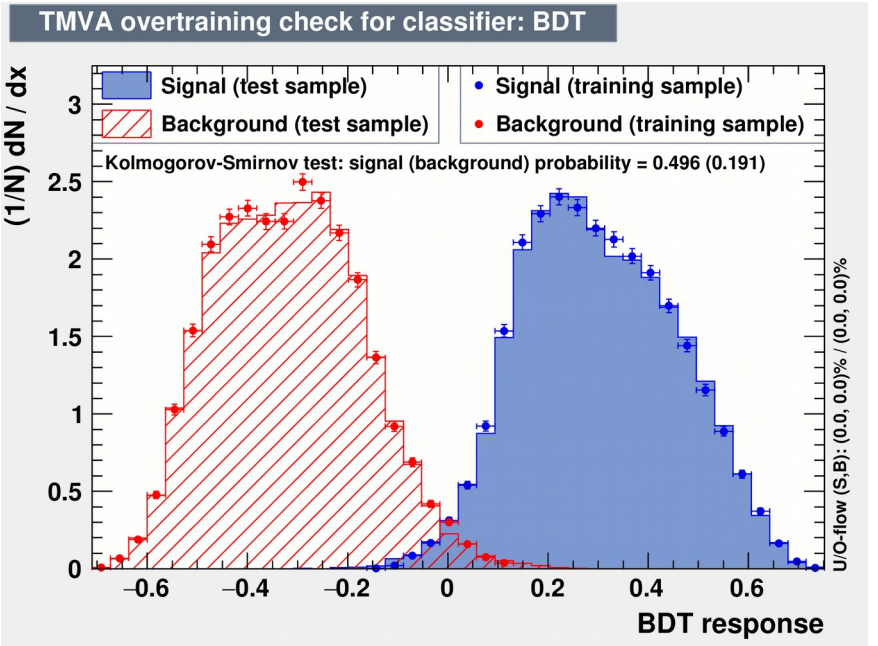


Performance

- BDT also trained without isolation and calo PID variables

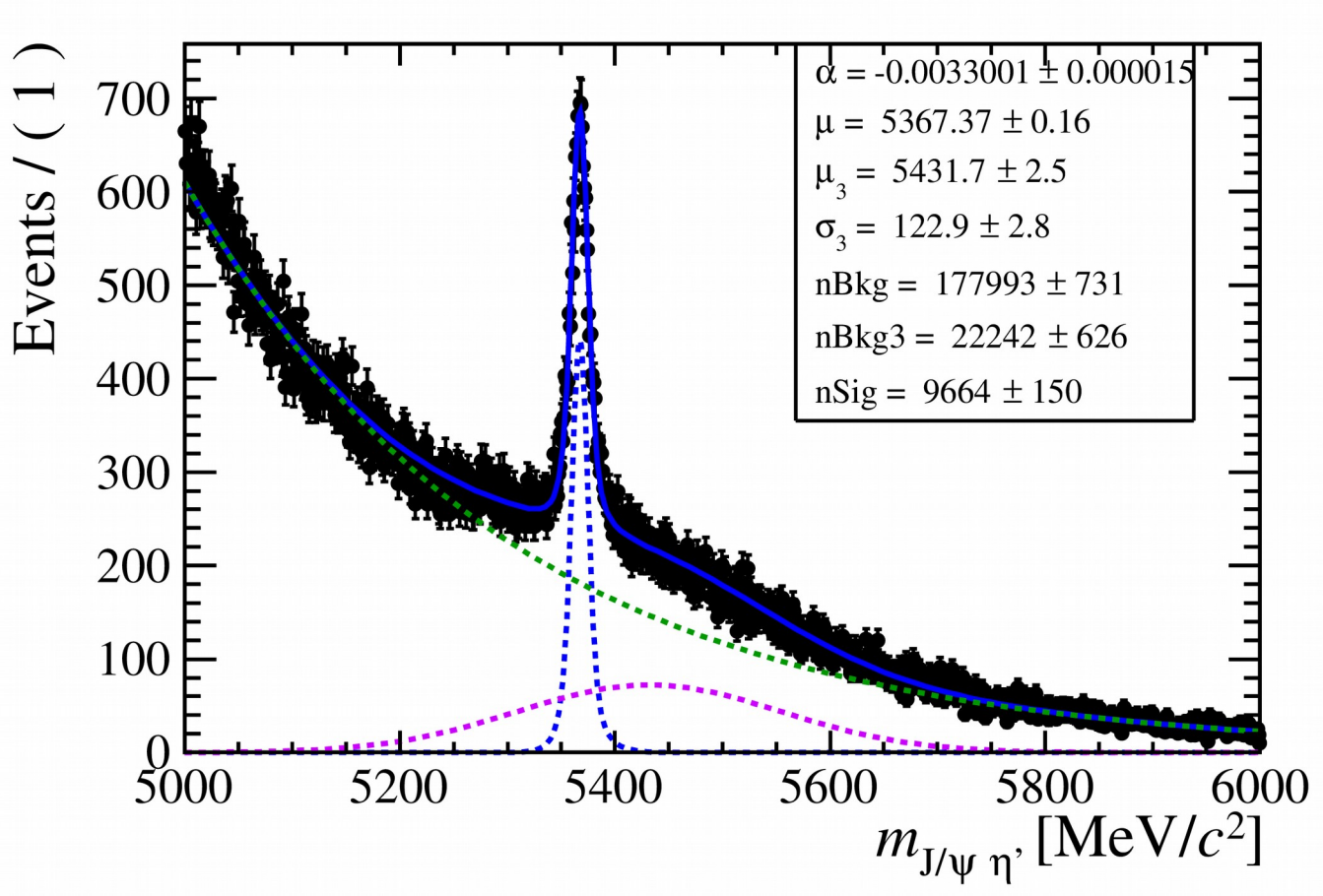
  Very little impact… vertex-kin. variables are doing most of the job (4-track vertex)





First mass fits

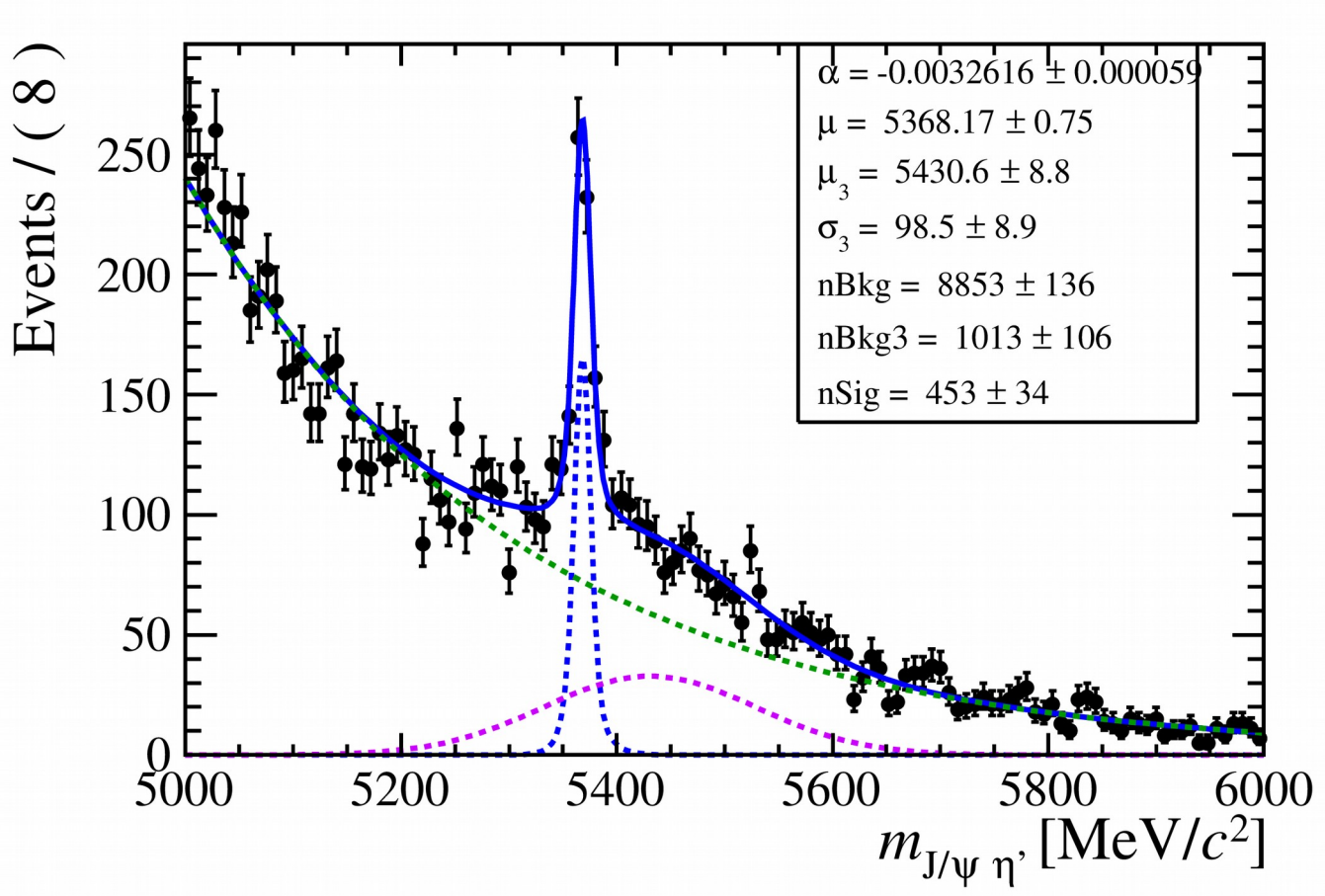
- PID (0.4) & BDT cut (0), 2.5-σ m-window for etap (30 MeV/c^2), 30 MeV/c^2 for Jpsi
- Model: signal (μ) + combi. bkg (expo, α) + bump below Bs mass (gaussian, μ_3, σ_3)
  Later could be some Lambdab0 → Jpsi Lambda[ppi] with p+ reco'ed as a pion...
- For all of Run2, we find 9664 +/- 150 events



2015

- For 2015, we find 453 +/- 34 events
- Ratio nSig/L(tuple) = 453 / 280 = 1.62 event / pb^{-1}

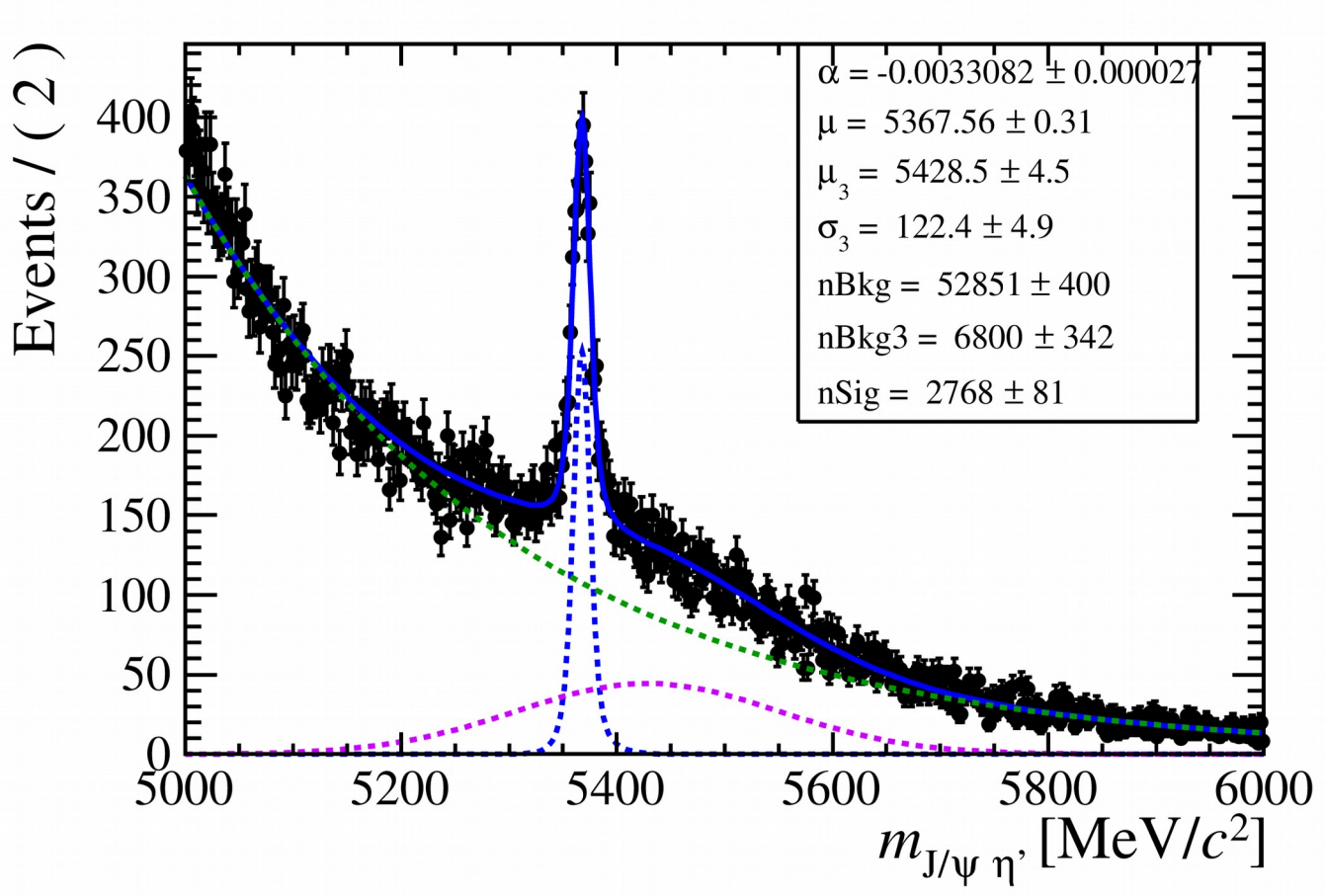
  using L(Operation page): Ratio = 1.37 event / pb^{-1}



2016

- For 2015, we find 2768 +/- 81 events
- Ratio nSig/L(tuple) = 2768 / 1640 = 1.69 event / pb^{-1}

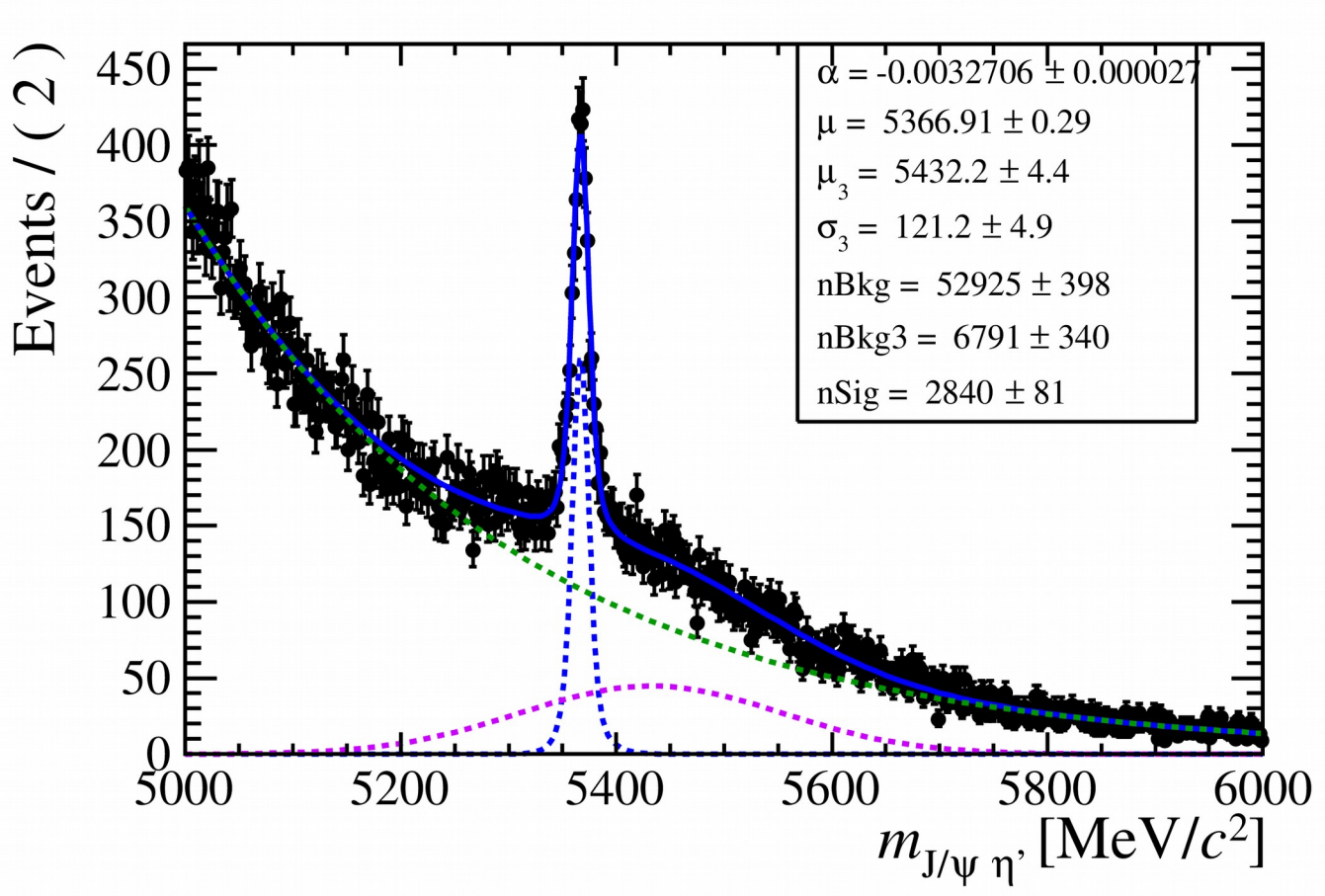
  using L(Operation page): Ratio = 1.66 event / pb^{-1}



2017

- For 2015, we find 2840 +/- 81 events
- Ratio nSig/L(tuple) = 2840 / 1020 = 2.78 event / pb^{-1}

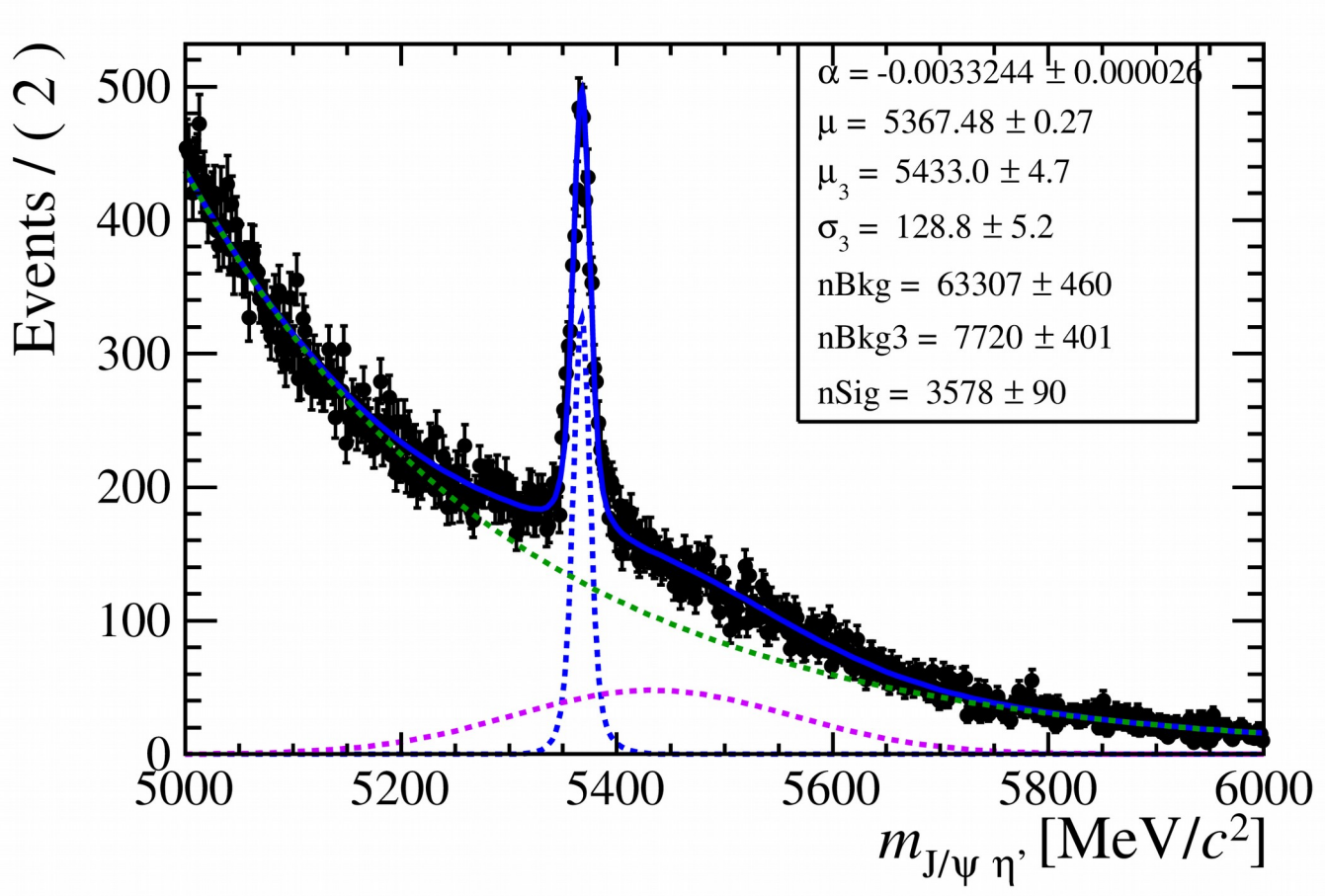
  using L(Operation page): Ratio = 1.66 event / pb^{-1}



2018

- For 2015, we find 3578 +/- 90 events
- Ratio nSig/L(tuple) = 3578 / 1280 = 2.79 event / pb^{-1}

  using L(Operation page): Ratio = 1.63 event / pb^{-1}



Outlook

- First look at new Ntuples:
  - With soft cuts: about 10^4 JpsiEtap[RhoGamma] events in Run2
  - Clean signal with StdAllLoosePhotons (PT>200 MeV/c), any gain for lower PT?

    $\rightarrow$ could try StdVeryLooseAllPhotons (PT>75 MeV/c)
- Cross-checks:
  - Lumi from LumiTuple not reliable for 2017 & 2018 (issue with database?)
  - MC efficiency * CS * BR to be compared with measured yield
- Fit model:
  - MC available for JpsiK* and JpsiPhi, will have a look
  - Lambdab0, or Bs $\rightarrow$ JpsiPiPi... MC requests for B2CC meeting?
- My analysis
  - Besides cross-checks and bkg Ntupling, will have to focus back on JpsiPi0