News and status report

Oct 29th 2019, Annecy/Edinburgh meeting, M. Chefdeville

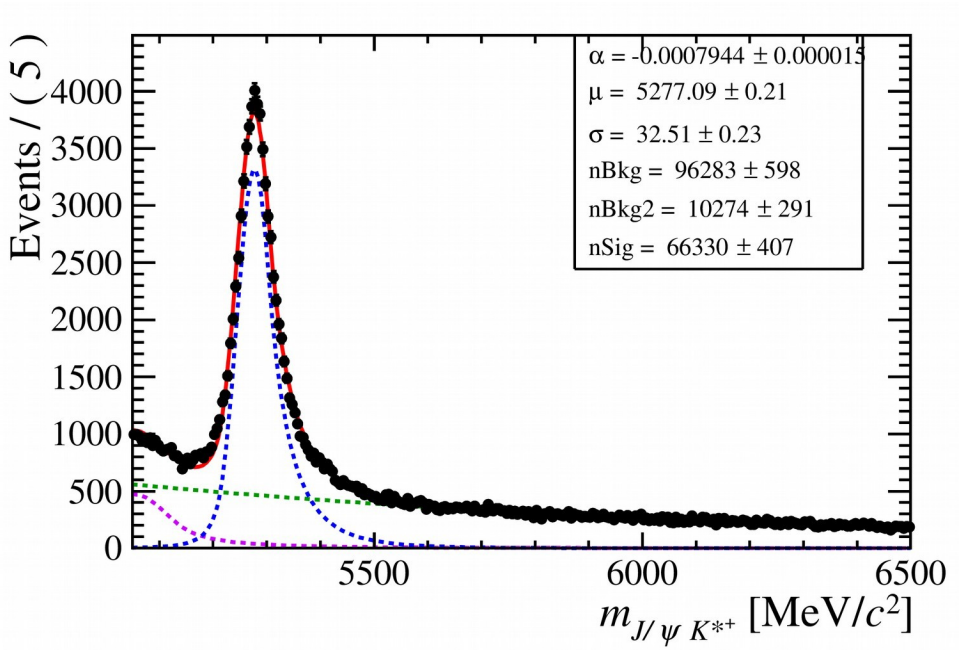
News

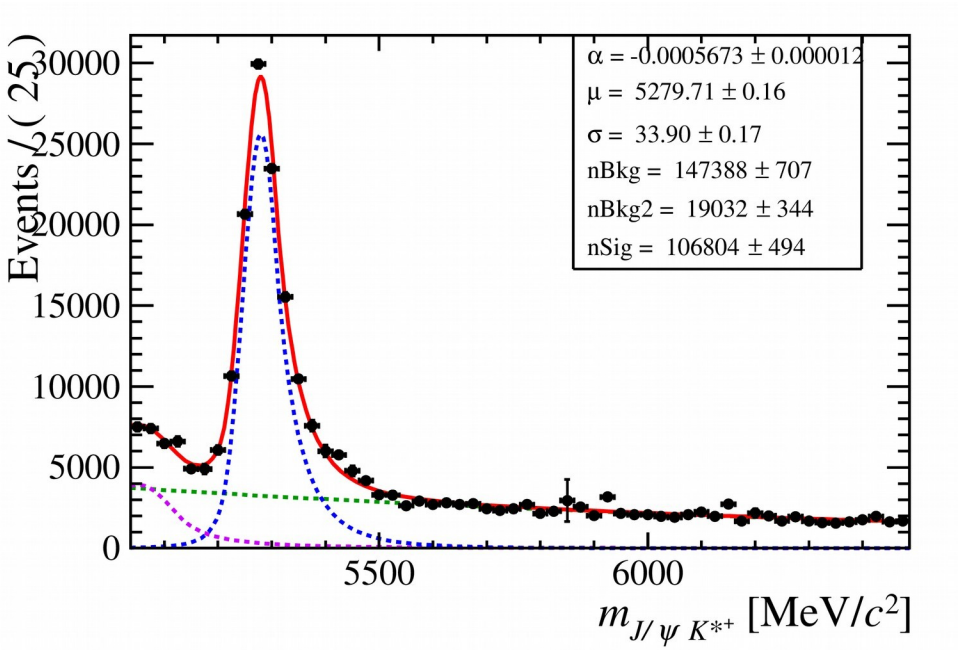
- LAPP phi_s team reinforced
  - Anthony Downes started his PhD on Oct. 1st
    - Branching ratios of Jpsi eta(‘) and TD analysis with Run 1-2 dataset
    - Start with performance study (photon eff.) taking over from Greg Cowan and Marion Lehuraux
  - We found a post-doc with experience on radiative decay, to start in Dec.
    - Will contribute to tagging tools (for Run 3 but also Run 1&2)
    - Will orient his work towards Run 3: adapt photon reco and our lines.

      + will participate to the migration of B2CC lines to the new framework
- Status of Jpsi eta(‘) analysis
  - Selection of normalisation channel (JpsiK^{*+}) finalised
  - MC for Jpsi eta’[rho g]

Selection of JpsiK*

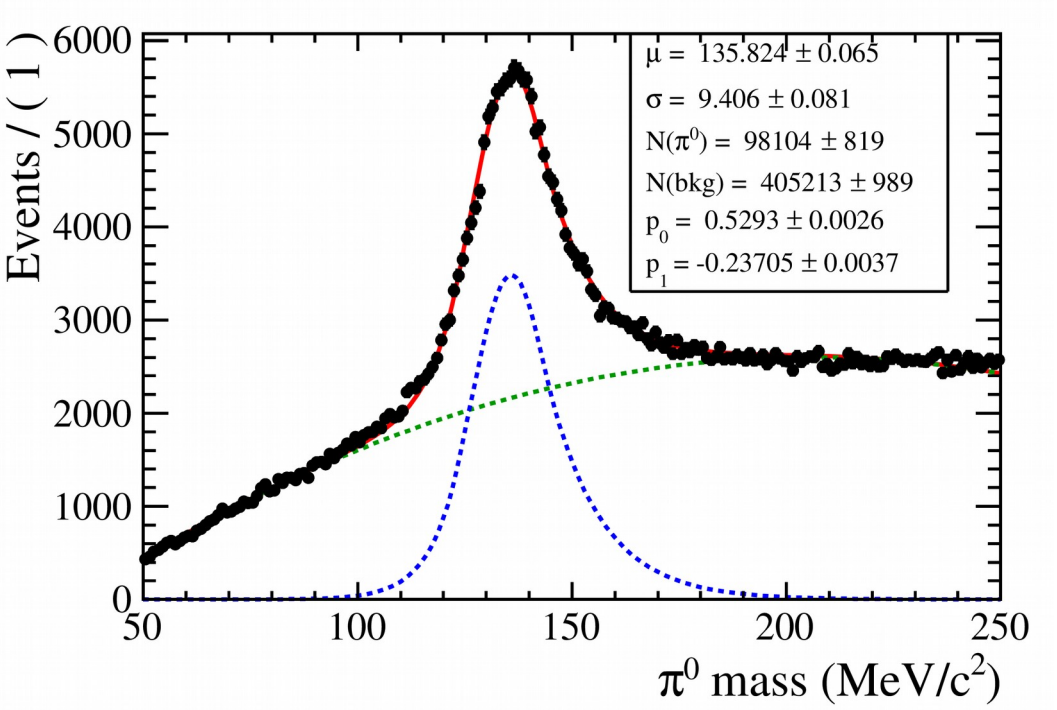
- Meant to control BDT inputs and efficiency
- Previous selections of 2016-17-18 data:
  - using 3σ mass windows on pi0 and K*+ → N = 66.3 k (left)
  - Using wide pi0 and fitting them in bins of m(B+) → N = 106.8 k (right)
- Pros: Quite a gain of signal (large tails, non-resonant Kpi0?)
- Cons: how to project variables? + systematics from pi0 mass shape?



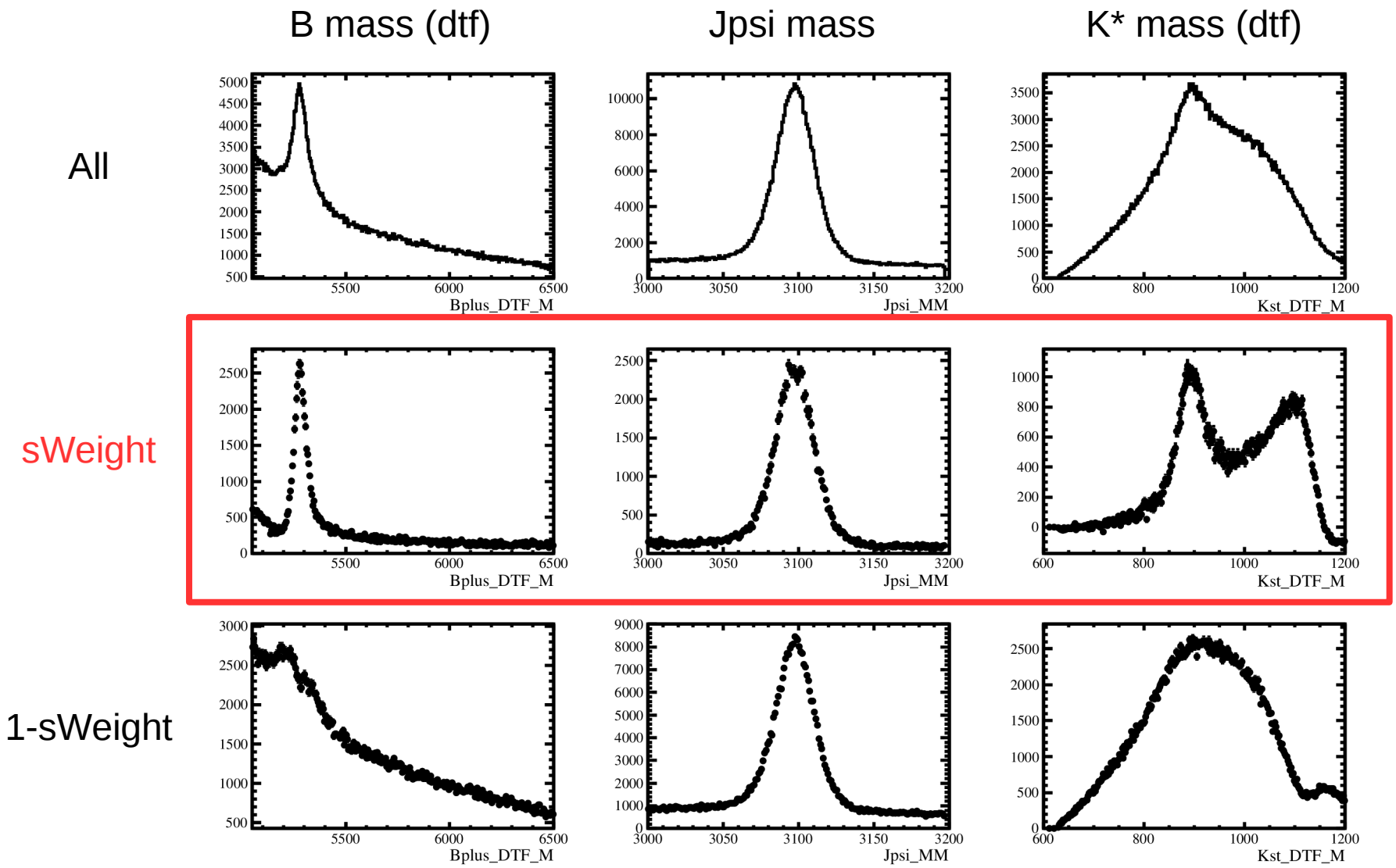


Pi0 mass fit

- Now: use sPlot to fit the pi0 mass and weight the B+ mass
- For now use the model used to fit in bins of B+ mass
  - Fit bkg (Chebychev o(2)) on sidebands only
  - Fix bkg and fit a gaussian with expo. tails as signal
  - Fix tails and fit bkg+signal to all bins

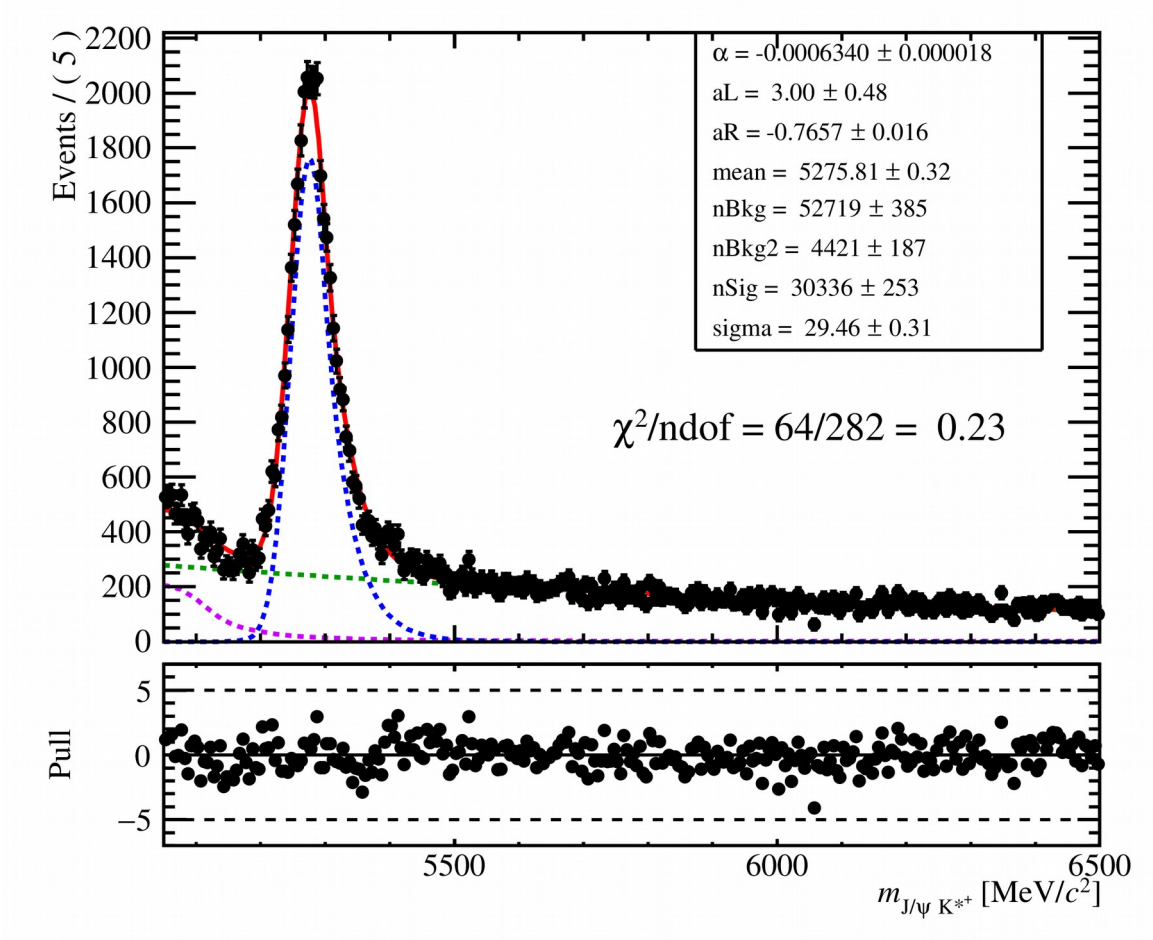


sPlot projections (2018)



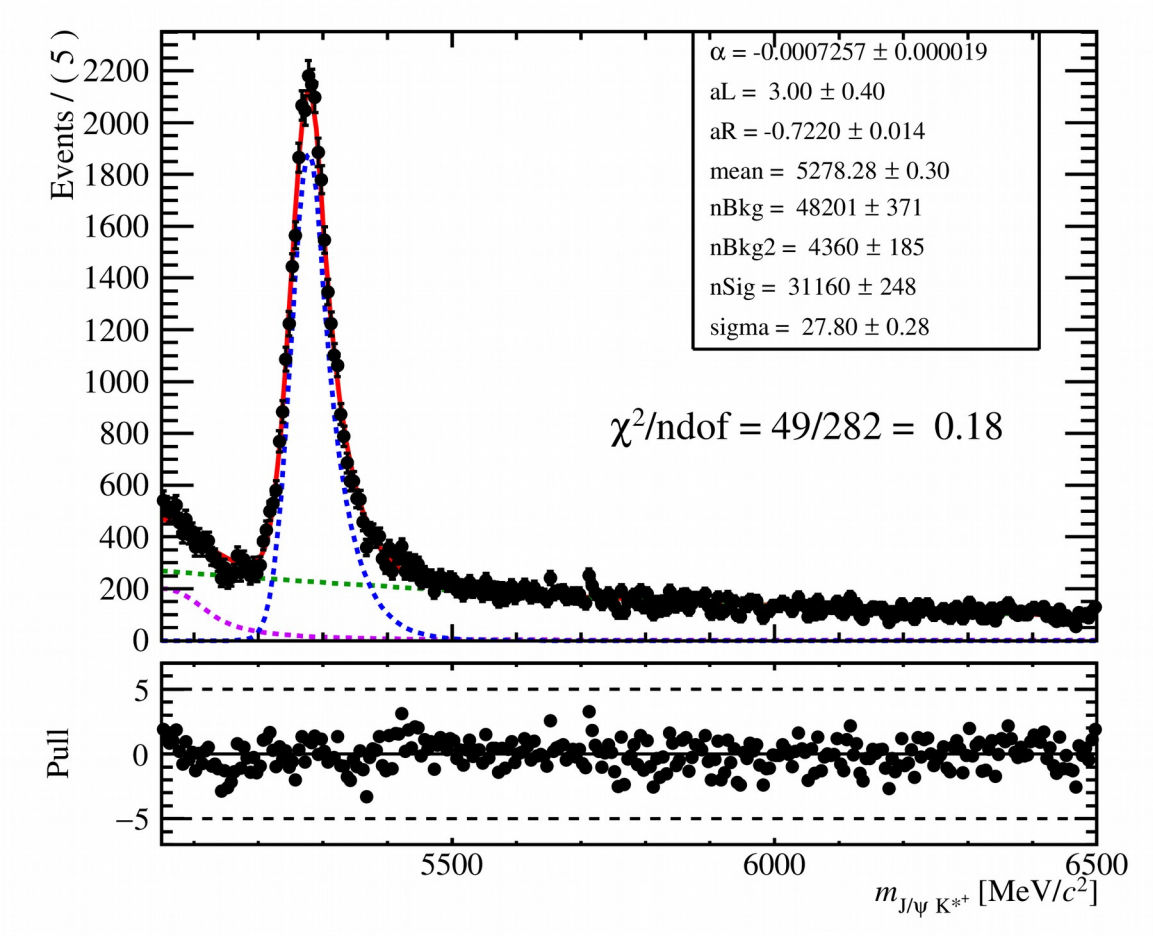
sWeighted B^+ mass fit (2016)

- sPlot data from each year separately (low χ^2 to be understood)
- In 2016: N = 30.3 k



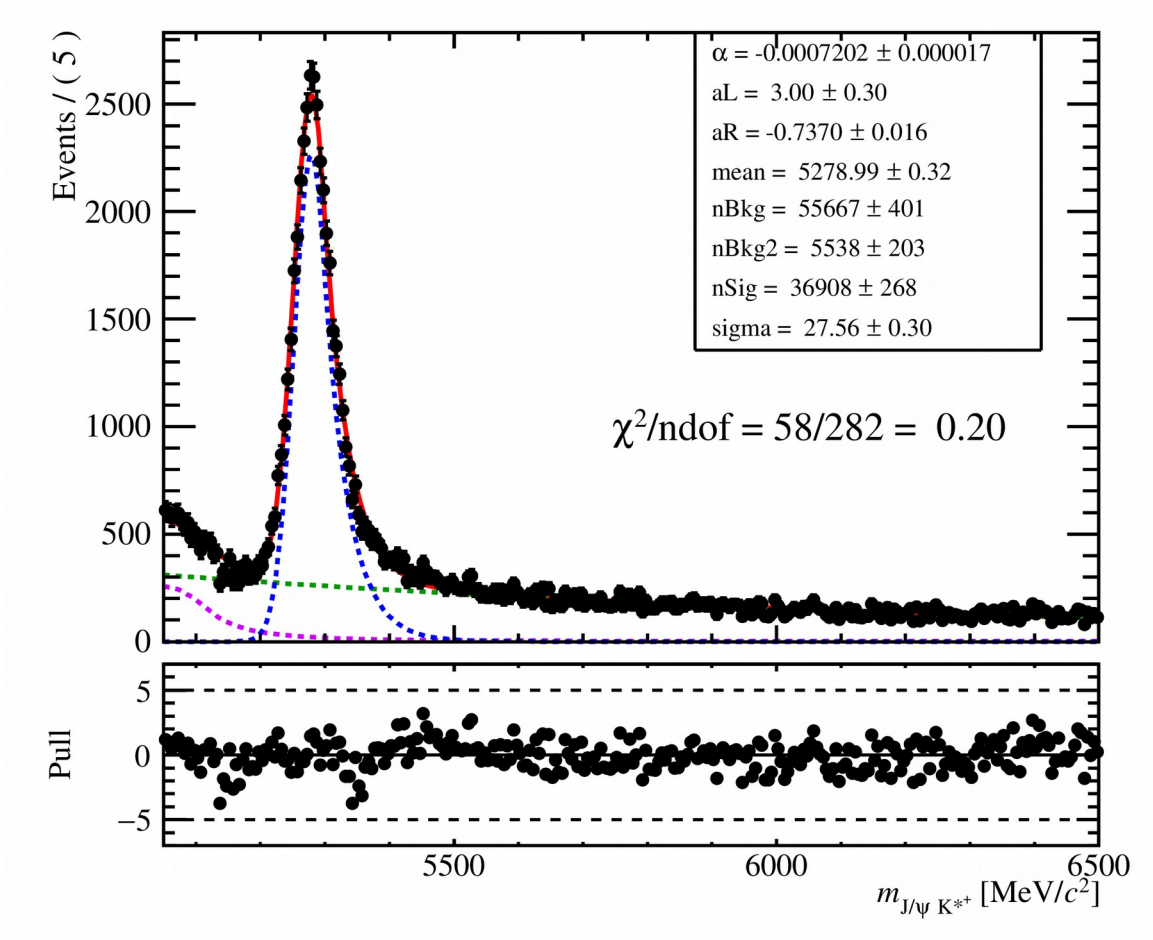
sWeighted B^+ mass fit (2017)

- sPlot data from each year separately
- In 2017: N = 31.1 k



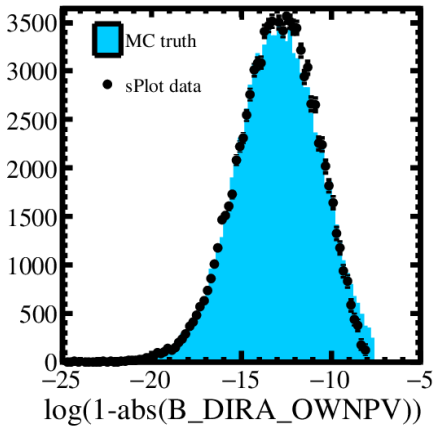
sWeighted B^+ mass fit (2018)

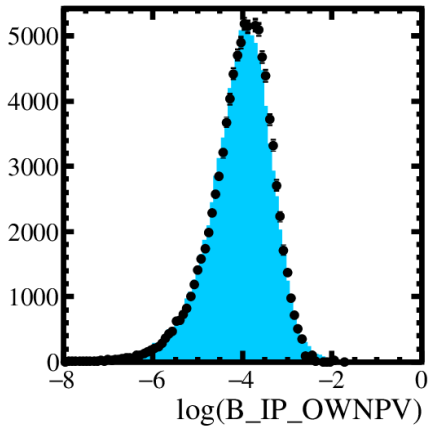
- sPlot data from each year separately
- In 2016: N = 36.9 k
- Total of 98.3 k VS 64.9 k with mass windows, and 106.8 k with per Bmass bin

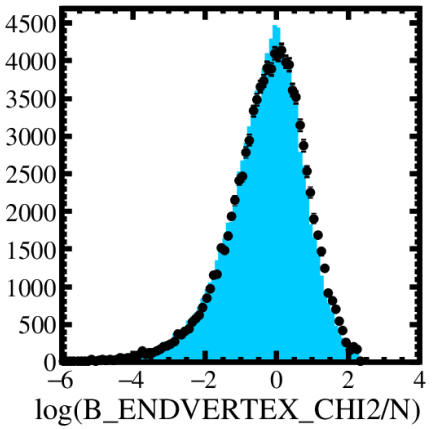


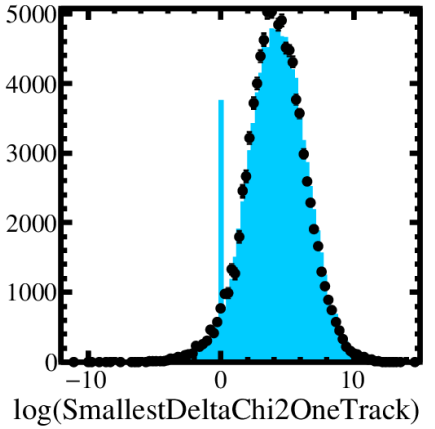
Vertex variables

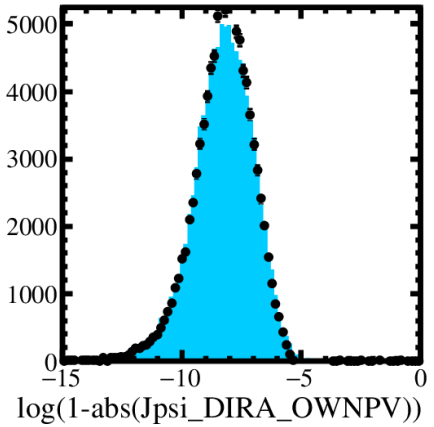
- Run sPlot again to calculate sWeights from B^+ mass fit
- Project variables using product of weights: w(pi0 fit) * w (B fit)

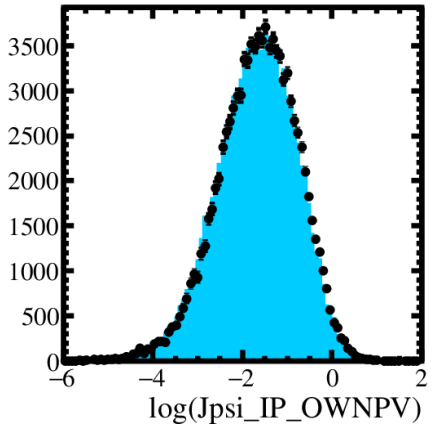


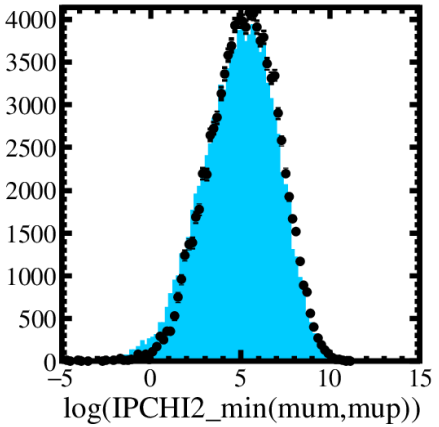


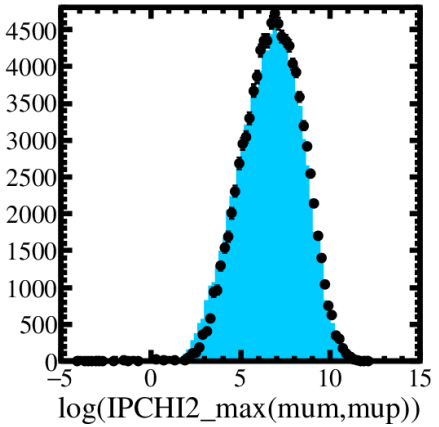






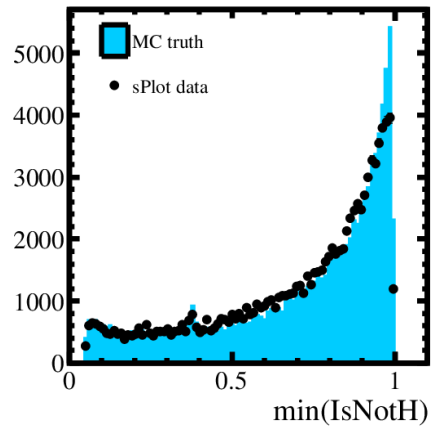


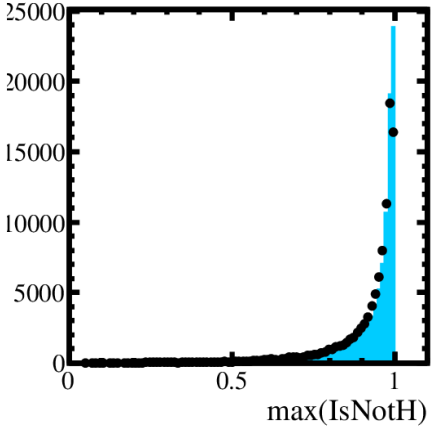


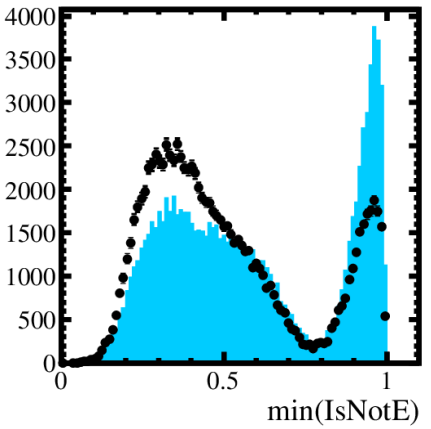


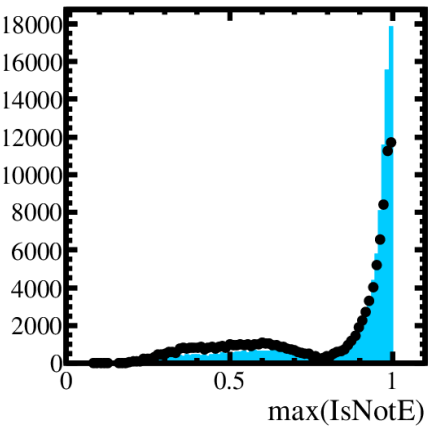
Kinematics and neutral PID

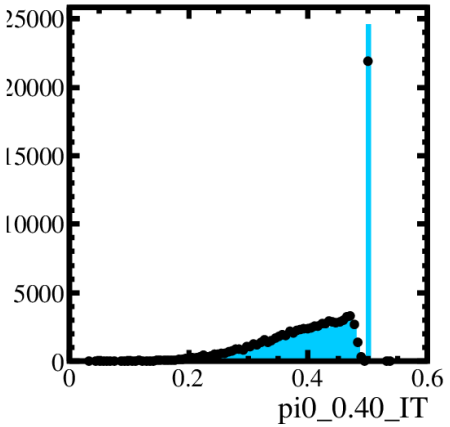
- Run sPlot again to calculate sWeights from B^+ mass fit
- Project variables using product of weights: w(pi0 fit) * w (B fit)

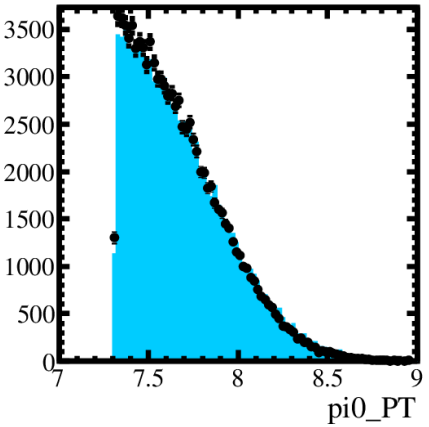


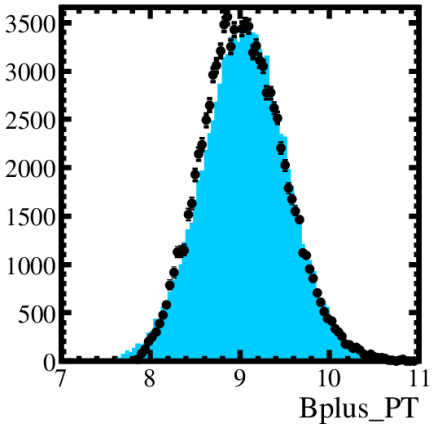






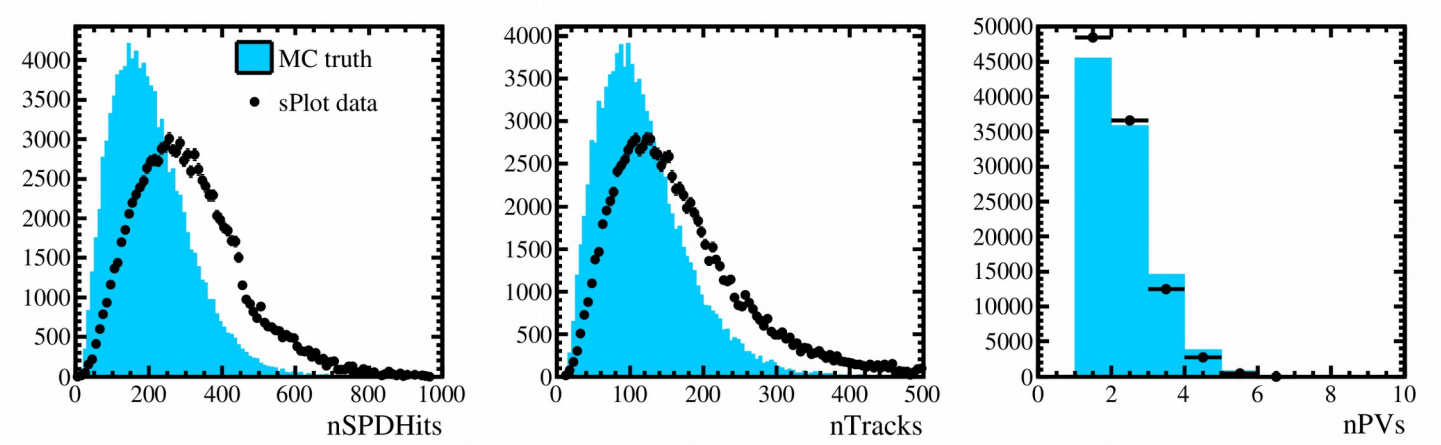






Global event variables

- Run sPlot again to calculate sWeights from B^+ mass fit
- Project variables using product of weights: w(pi0 fit) * w (B fit)
- Well-known discrepancies in occupancy variables



nSPDHits reweighting

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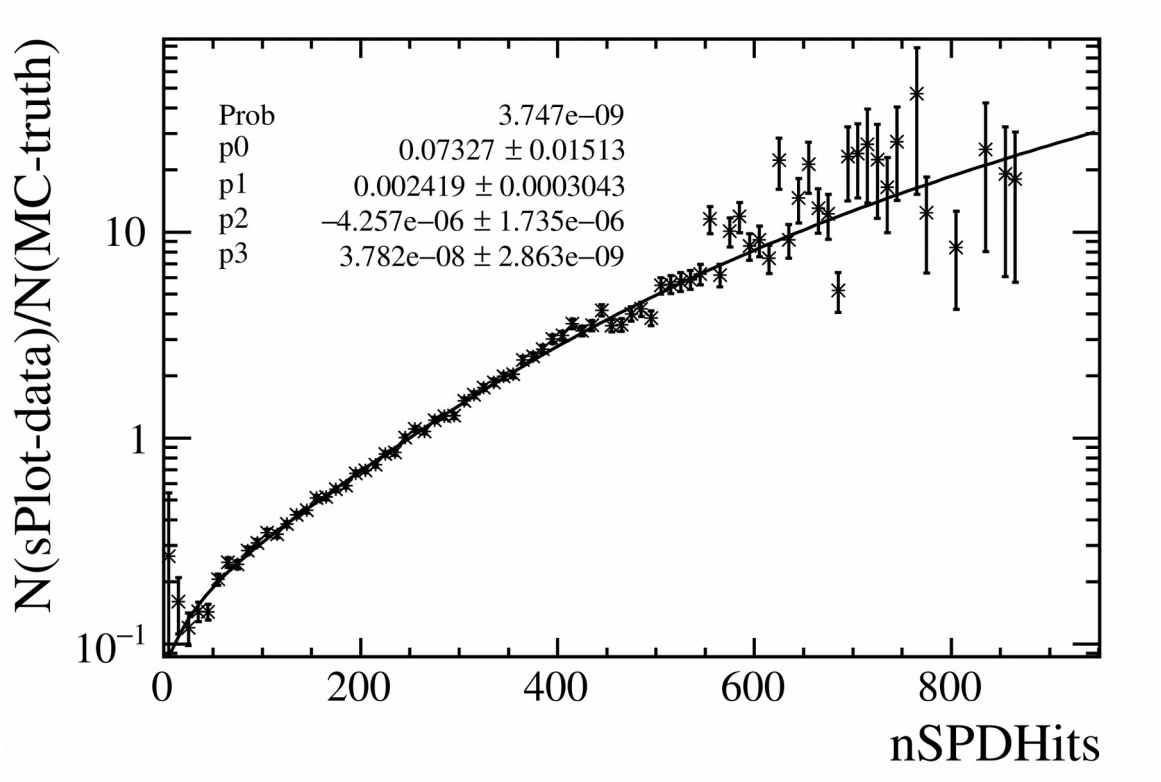
- Simple MC reweighting based on nSPDHits



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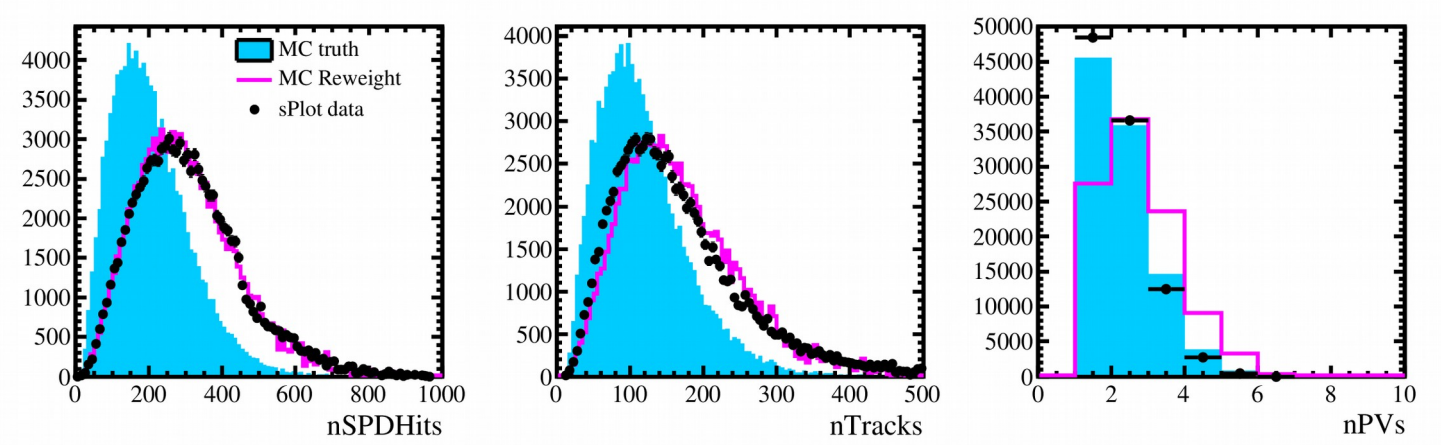
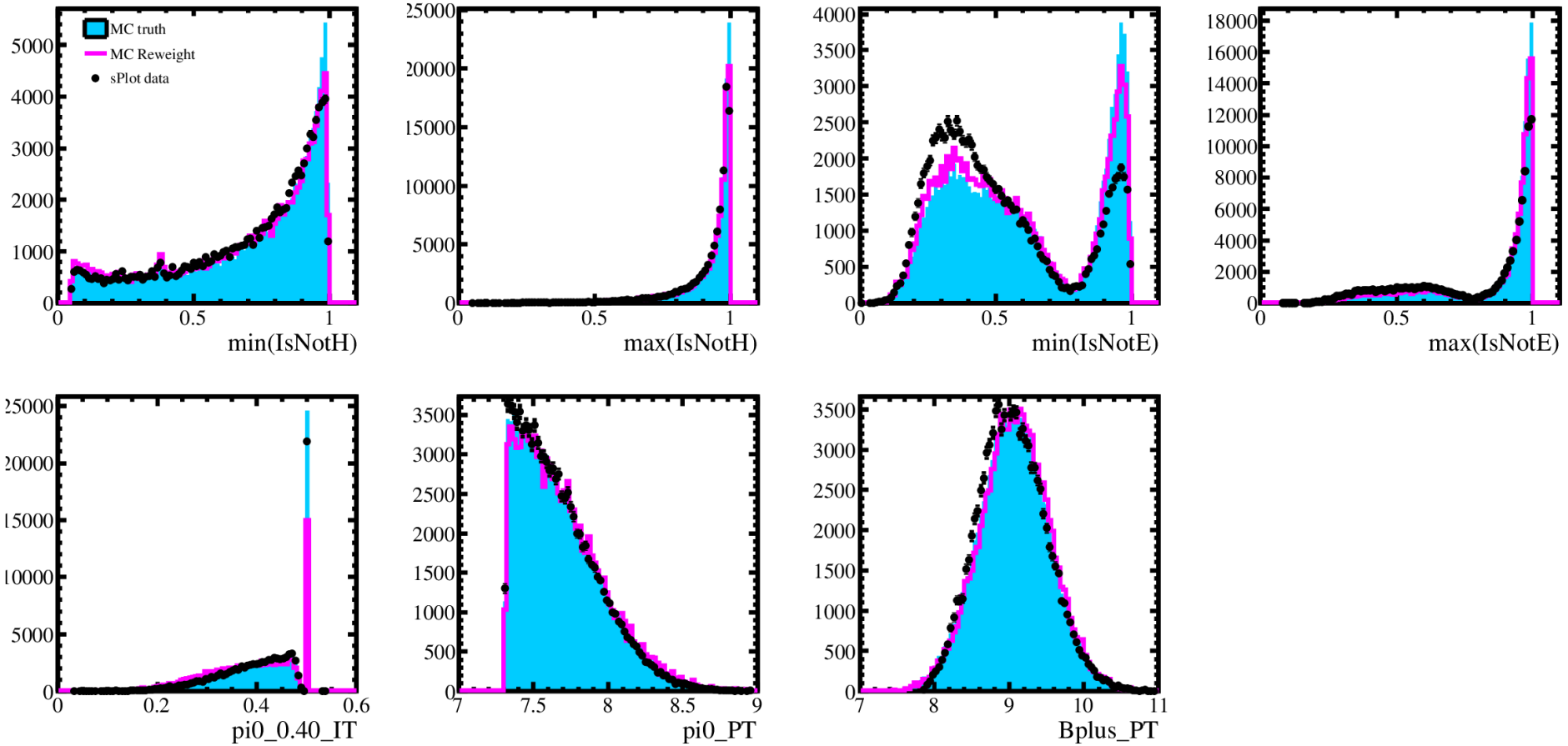


nSPDHits reweighting

- Simple MC reweighting based on nSPDHits
- Improves PID but isolation gets worse (vertex var. almost unaffacted)



nTracks reweighting

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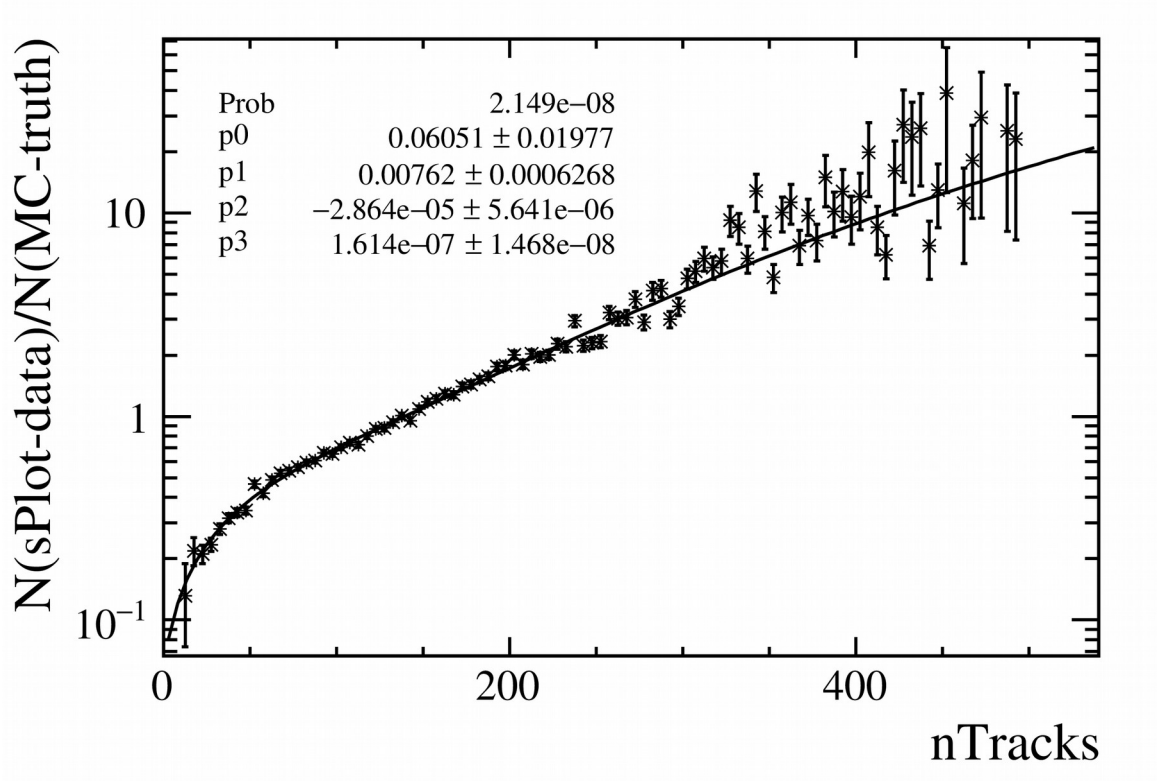
- Project variables using product of weights: w(pi0 fit) * w (B fit)
- Simple MC reweighting based on nTracks



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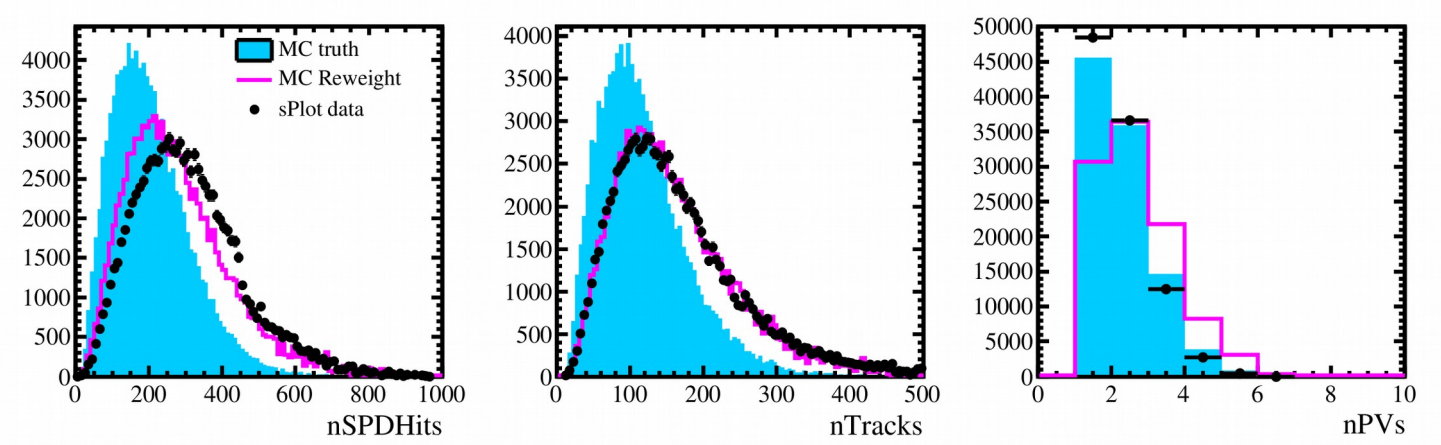

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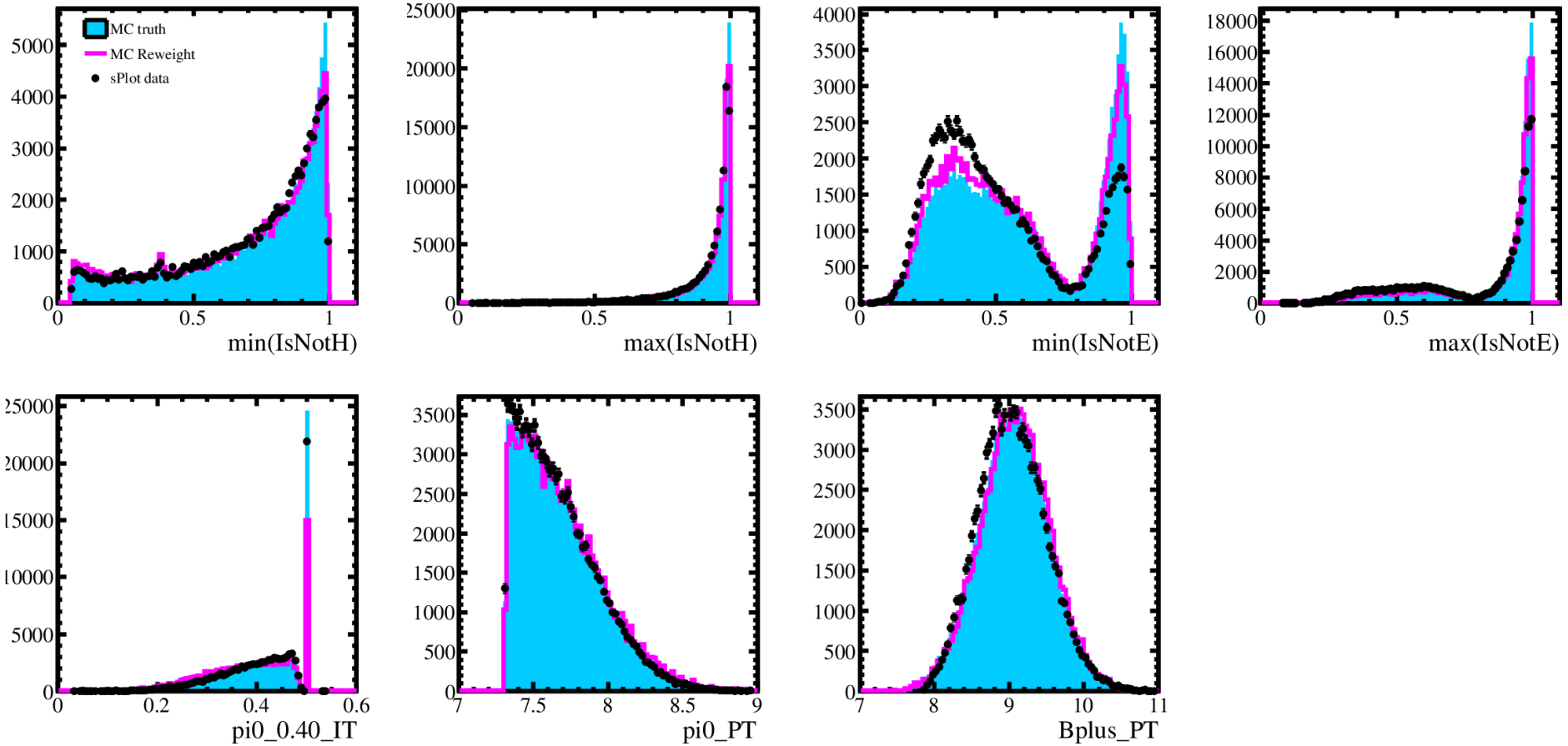
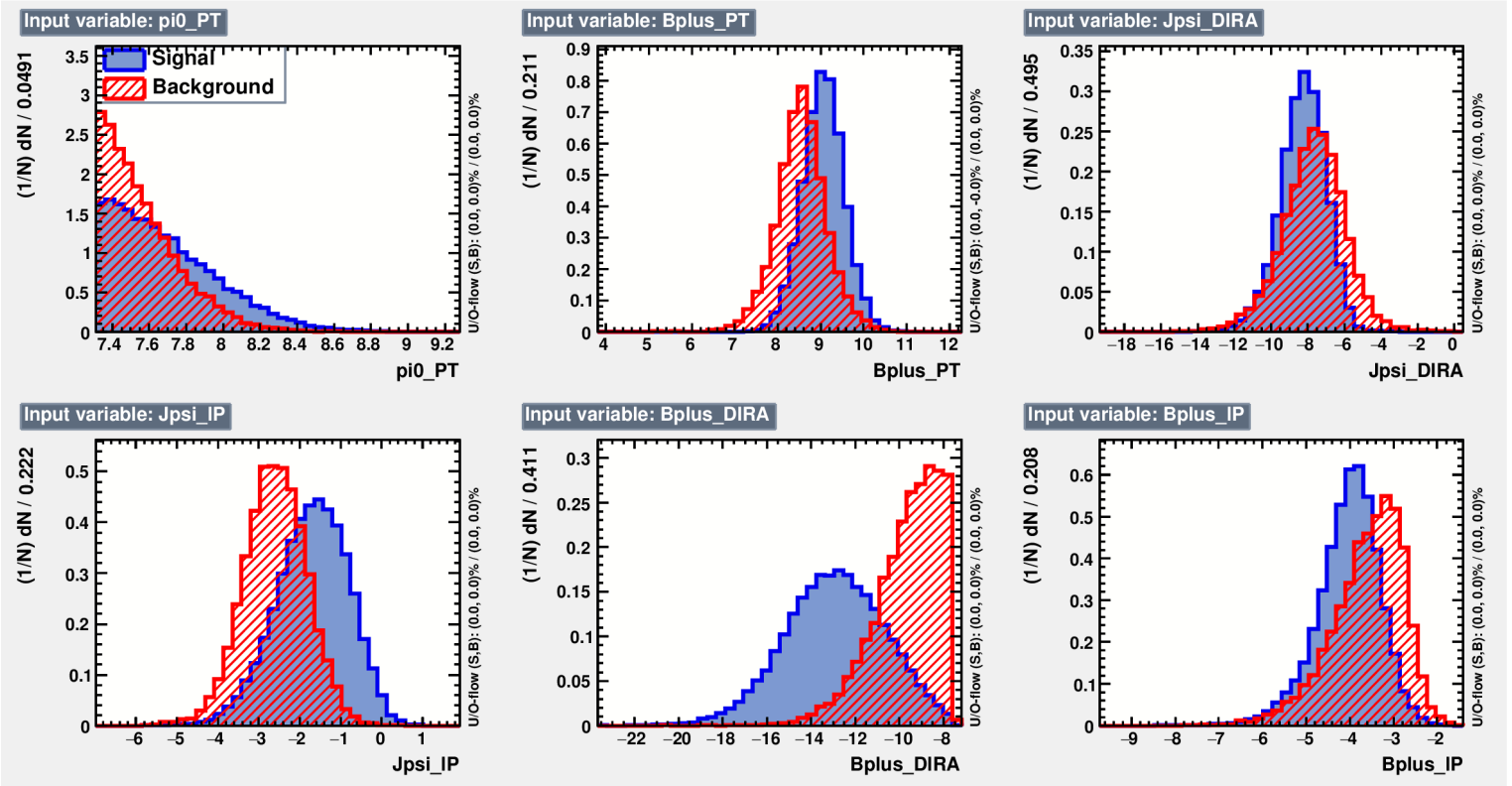


BDT

- Vertex & kinematic variables: very good data/MC agreement. Train BDT:
  - Signal MC-truth
  - High-mass sideband of sWeighted (w pi0 fit) B^+ mass



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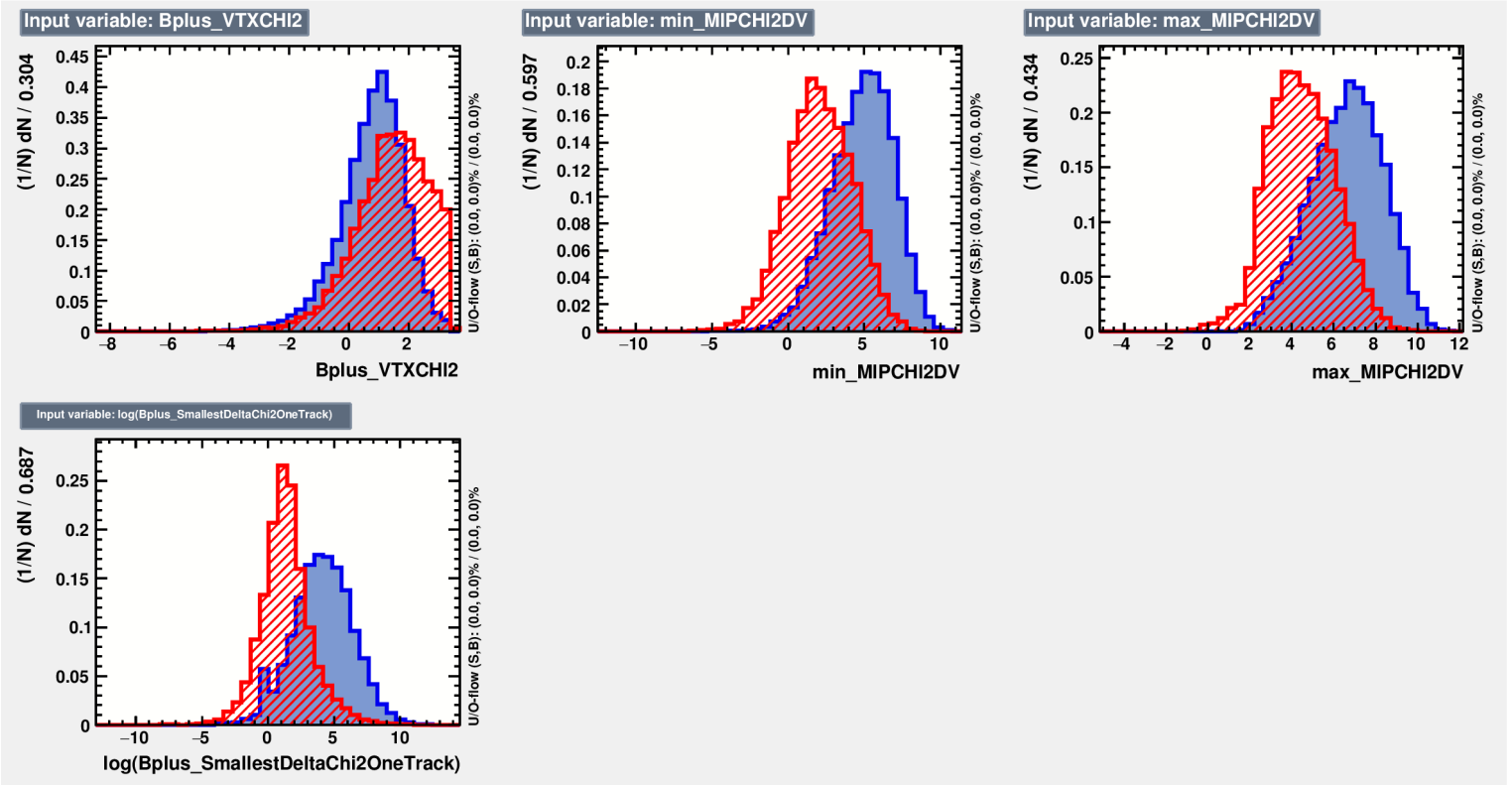
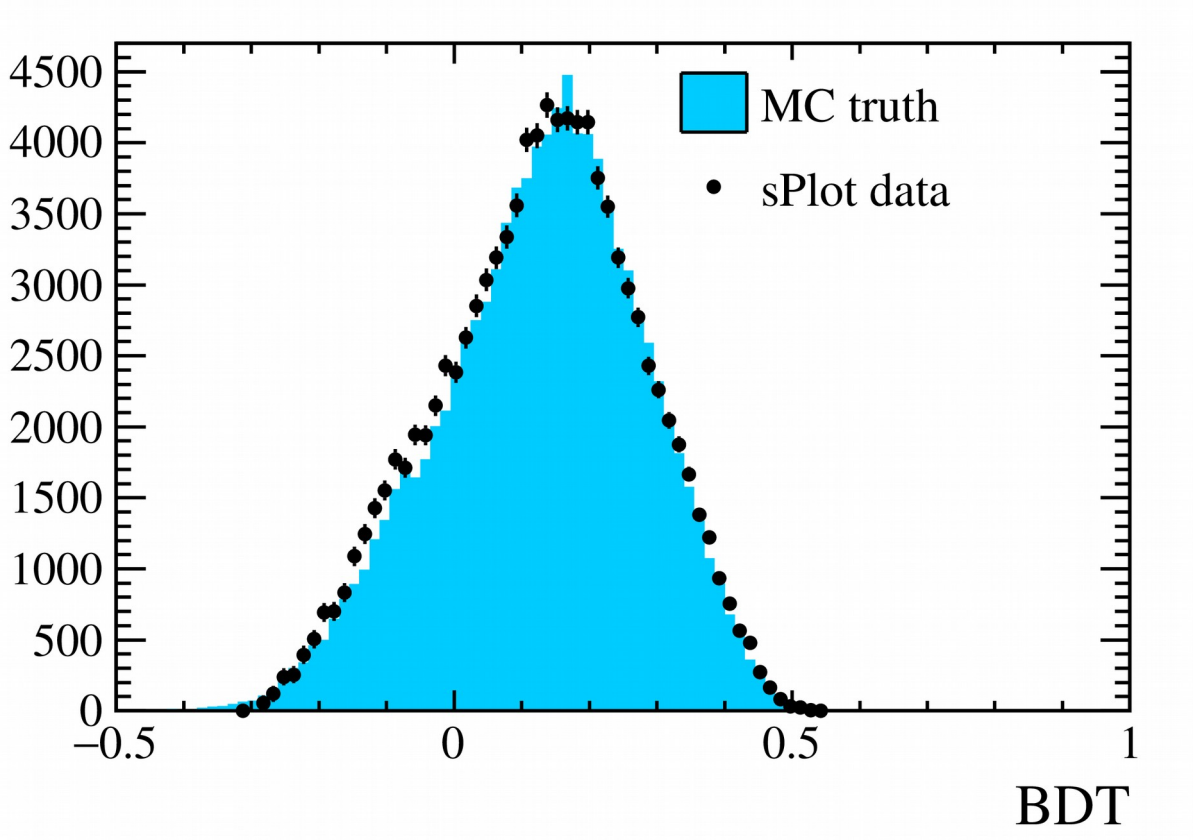


BDT output

- As for the projection of input variables, we use the product of sWeights to extract the BDT distribution of signal candidates
  - Very good agreement, as expected



BDT output

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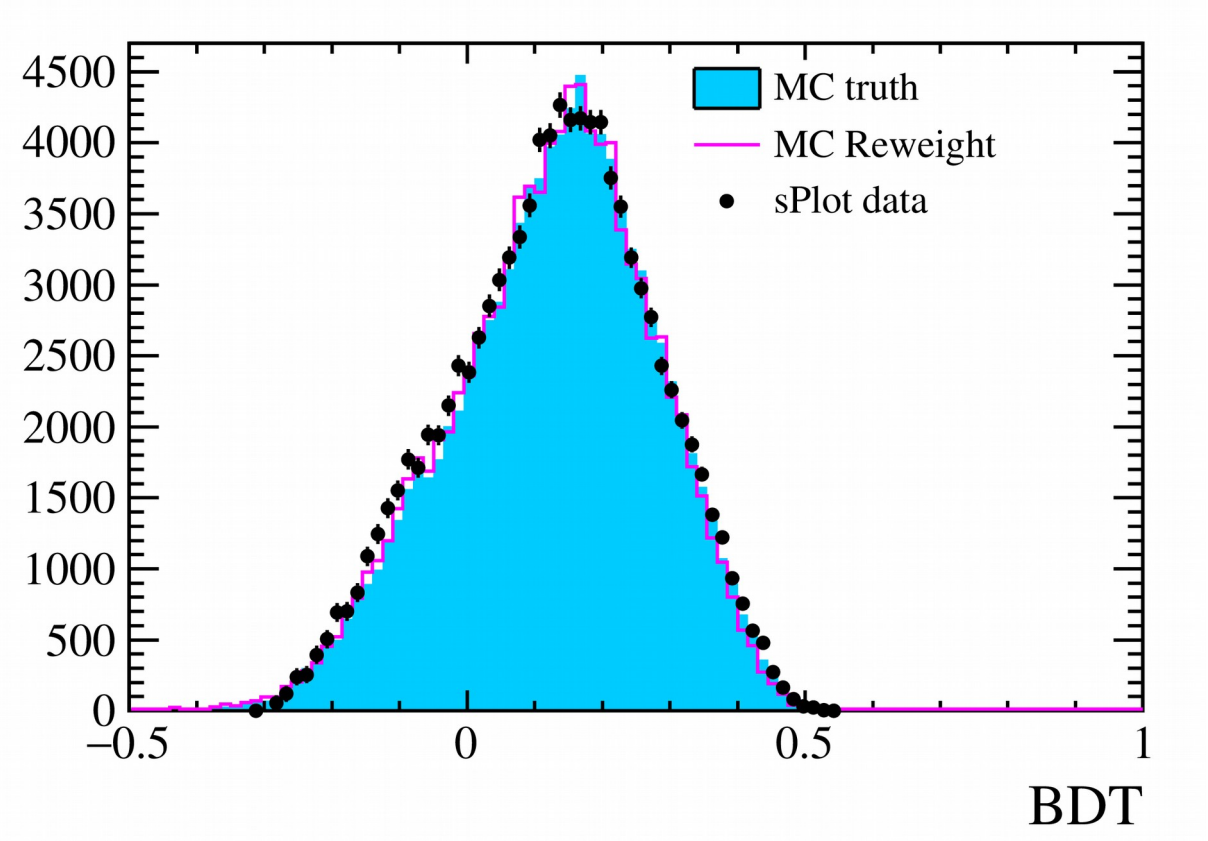
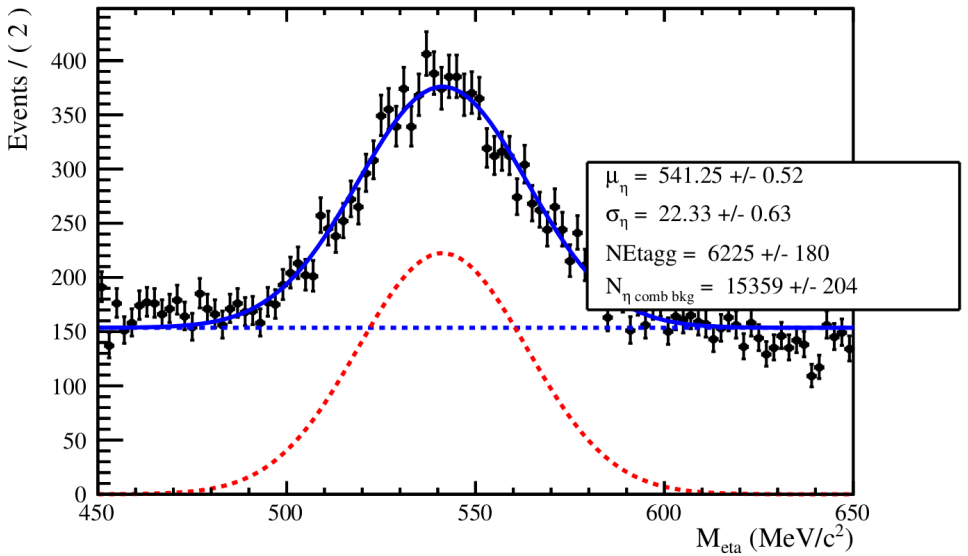
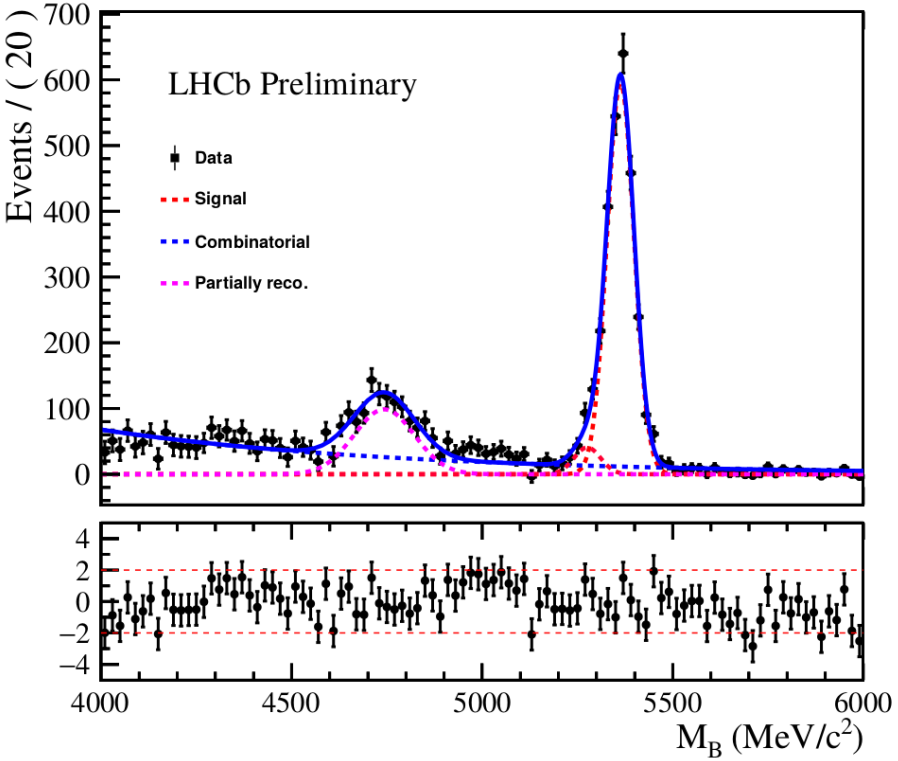
  - Seem to improve with simple reweighting based on nSPDHits



Prospects

- Multiple sPlot approach seems promising to remove combinatorics
- Already tried on Jpsi eta[gg] by Meril Reboud (LAPTH). Done after BDT cut so a eta peak is visible. Other modes to be investigated (currently trying JpsiPi0 with Jpsi and pi0 projections)
- What to do with calo variables? Just a cut?
- Now, solid BDT for BR measurement
- Investigate resampling tools.
  Do this together?





On Jpsi eta'[rho g]

- New Run 2 MC available
  - No tight generator-level cut, full-DST:

    /MC/2016/Beam6500GeV-2016-MagUp-Nu1.6-25ns-Pythia8/Sim09h/Trig0x6139160F/Reco16/Turbo03/Stripping28r1NoPrescalingFlagged/13144201/ALLSTREAMS.DST

    2M full-Sim + 4M Re-Decay
- B2JpsiPiPiK PHSP Run 2 MC also produced (same stat as above)
  - Better constrain mass shape
- Next:
  - Process MC
  - Finalise the vetos and fit model
  - Train BDT and find optimal cut (max. significance)
  - Measure branching against JpsiK^{*+}