Lb production correction workflow (M. Ferrillo 01/04/25)

Preselection: [code] post DaVinci

MC cuts

- **L0 Trigger**

```
((J_psi_1S_L0MuonDecision_TOS == 1
&& muplus_P > 2000
&& muplus_PT > 2000)

|| (J_psi_1S_L0MuonDecision_TOS == 1
&& muminus_P > 2000
&& muminus_PT > 2000))
```

- **HLT1 Trigger**

```
(J_psi_1S_Hlt1DiMuonHighMassDecision_TOS == 1
|| J_psi_1S_Hlt1TrackMuonDecision_TOS == 1
|| Lb_Hlt1TwoTrackMVADecision_TOS == 1
|| Lb_Hlt1TrackMVADecision_TOS == 1)
```

- **HLT2 Trigger**

```
(J_psi_1S_Hlt2DiMuonDetachedJPsiDecision_TOS == 1)
```

- **PID cuts** (matching data-level selection [here])

```
(
 ((p_PIDp_pidcorr > 5 && (p_PIDp_pidcorr - K_PIDK_pidcorr) > 0)
|| (p_ProbNNp_pidcorr > 0.1)) && (p_TRACK_GhostProb < 0.5)
```

```
)
&& (
((K_PIDK_pidcorr > 0 && (K_PIDK_pidcorr - p_PIDp_pidcorr) > -6)
|| (K_ProbNNk_pidcorr > 0.1)) && (K_TRACK_GhostProb < 0.5)
  )
```

- **Truth matching**

```
(abs(Lb_TRUEID) == 5122
 && abs(J_psi_1S_TRUEID) == 443
 && abs(p_TRUEID) == 2212
 && abs(K_TRUEID) == 321
 && muplus_TRUEID == -13
 && muminus_TRUEID == 13)
```

- **Mass window** (for BDT training)

```
(Lb_M > Lb_mass_pdg - Delta && Lb_M < Lb_mass_pdg + Delta)

Lb_mass_pdg = 5619.60    # from PDG, units : MeV/c^2
Delta = 5 * 8            # Units MeV, units : MeV/c^2
```

Data cuts

- **L0 Trigger**

```
((J_psi_1S_L0MuonDecision_TOS == 1
&& muplus_P > 2000
&& muplus_PT > 2000)

|| (J_psi_1S_L0MuonDecision_TOS == 1
&& muminus_P > 2000
&& muminus_PT > 2000))
```

- **HLT1 Trigger**

```
(J_psi_1S_Hlt1DiMuonHighMassDecision_TOS == 1
|| J_psi_1S_Hlt1TrackMuonDecision_TOS == 1
|| Lb_Hlt1TwoTrackMVADecision_TOS == 1
|| Lb_Hlt1TrackMVADecision_TOS == 1)
```

- **HLT2 Trigger**

```
(J_psi_1S_Hlt2DiMuonDetachedJPsiDecision_TOS == 1)
```

- **Mass sidebands**

```
(Lb_M < Lb_mass_pdg - Delta || Lb_M > Lb_mass_pdg + Delta)

Lb_mass_pdg = 5619.60    # from PDG, units : MeV/c^2
Delta = 5 * 8            # Units MeV, units : MeV/c^2
```

MVA training: [code]

- Optimise MVA, train it and then apply: MVA $>$ 0.5.

- Optimise the MisID cut and enforce a: 2* 20 MeV cut around Lb mass in replaced mass hypotheses (see also slides for plots).

Lb mass fit: [code]

Fit Lb mass to extract data sWeights (see slides).

Lb production correction: [code]

Retrieve Lb production correction with different binning schemes (rectangular one chosen in Lb angular).
Phase space limits:

```
range_p  = (0, 5e5)
range_pt = (0, 3.5e4)
```