Karlsruhe Institute of Technology

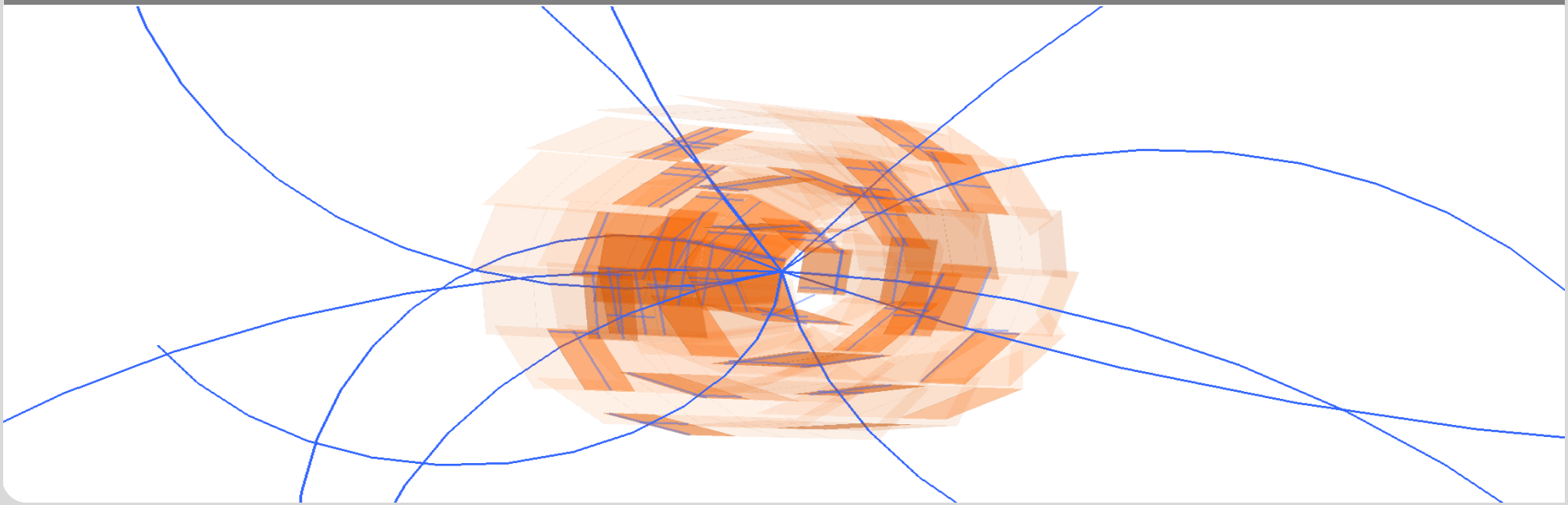
Belle II

VXDTF2 MVA QE: Figures of Merit and Helix parameters

Online Tracking Meeting

Sebastian Racs | 2nd March 2018

INSTITUT FÜR EXPERIMENTELLE TEILCHENPHYSIK (ETP)



Follow-up on last tracking meeting

Reminder

- Why is there a drop in Hit Efficiency when using the VXDTF2 MVA?
- On master state bbe0a3b1 (13.02.18)
- 15k $\Upsilon(4S)$ events with official phase 3 Bkg overlay 15th Campaign
- SVDonly tracking
- MVA with default weight (without timing) from master

New

- In addition to the figures of merit also look at helix parameters
- Compare Fit values with MC values for RecoTracks:
  - $\Delta\text{param}_i = \text{param}_{i,PR} - \text{param}_{i,True}$

  $\Rightarrow$ Table with Offset: **mean** and Resoultion: **68% Quantile Width**

68% Quantile Width (or $\pm 1\sigma$ equivalent range)

$$68\%\ \text{wd} = \text{percentile}_{84\%}(\Delta\text{param}) - \text{percentile}_{16\%}(\Delta\text{param})$$

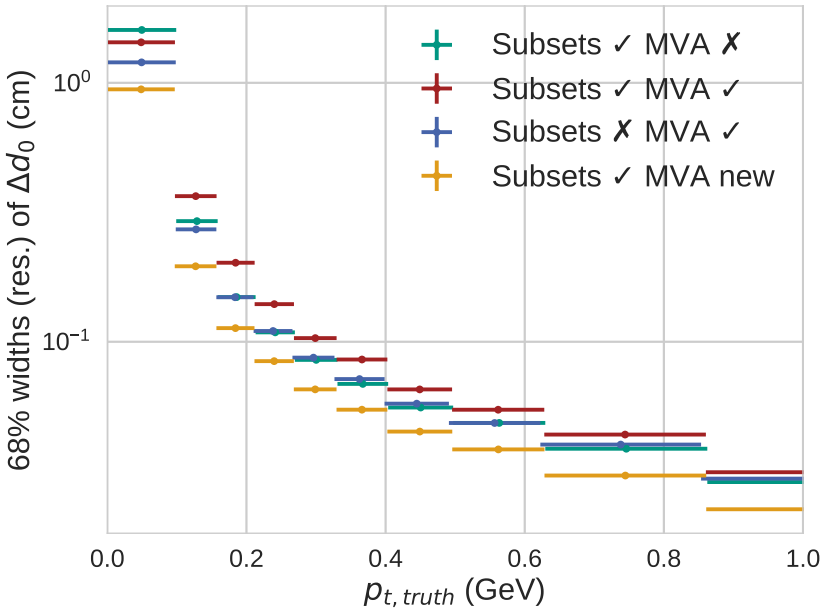
Figures of merit & Helix parameters

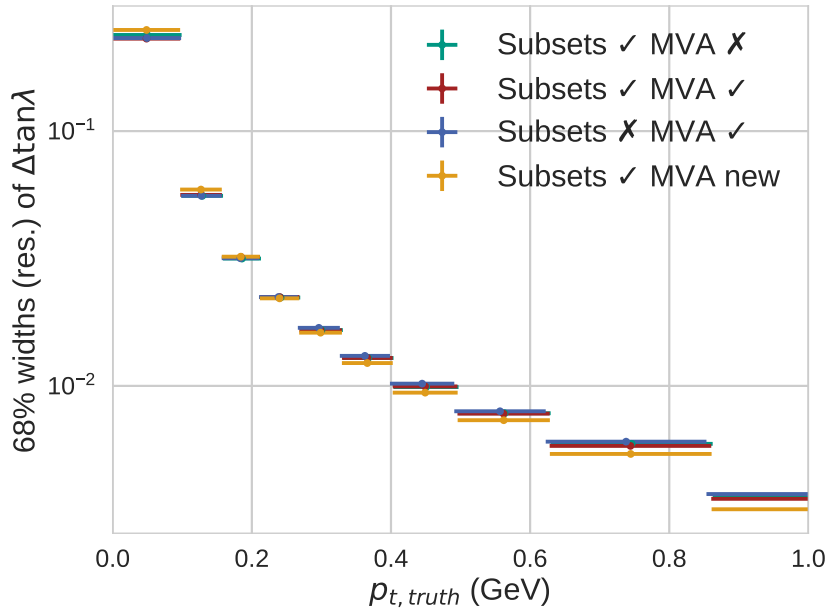
Subs	MVA	Find. Eff.	Hit Eff.	Hit Purity	Fake Rate
✓	✗	0.9199	0.8990	0.9674	0.0656
✓	✓	0.9314	0.8611	0.9684	0.0593
✗	✗	0.8783	0.9046	0.9661	0.0679
✗	✓	0.8811	0.9045	0.9691	0.0624
✓	new	**0.9345**	**0.7712**	**0.9899**	0.0605

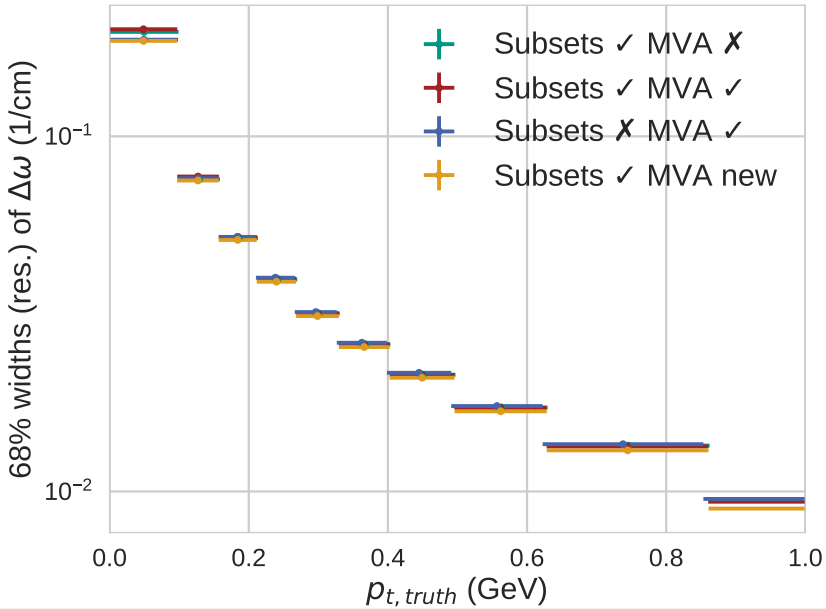
Subs	MVA	Δd_0 (cm)		$\Delta \tan\lambda$		$\Delta\omega$ (1/cm)		$\Delta\phi_0$		Δz_0 (cm)	
		mean	68% wd	mean	68% wd	mean	68% wd	mean	68% wd	mean	68% wd
✓	✗	0.0210	0.111	-0.0125	0.0166	0.0019	0.0399	-0.0076	0.0371	0.0615	0.0851
✓	✓	0.0088	0.141	-0.0105	0.0167	0.0020	0.0380	-0.0043	0.0449	**0.0333**	0.0835
✗	✗	0.0129	0.111	-0.0097	0.0170	**0.0014**	0.0405	-0.0079	0.0379	0.0433	0.0869
✗	✓	**0.0063**	0.114	-0.0113	0.0168	0.0016	0.0386	-0.0037	0.0386	0.0623	0.0799
✓	new	0.0064	**0.064**	**-0.0089**	**0.0139**	0.0016	**0.0328**	**-0.0005**	**0.0189**	0.0472	**0.0627**

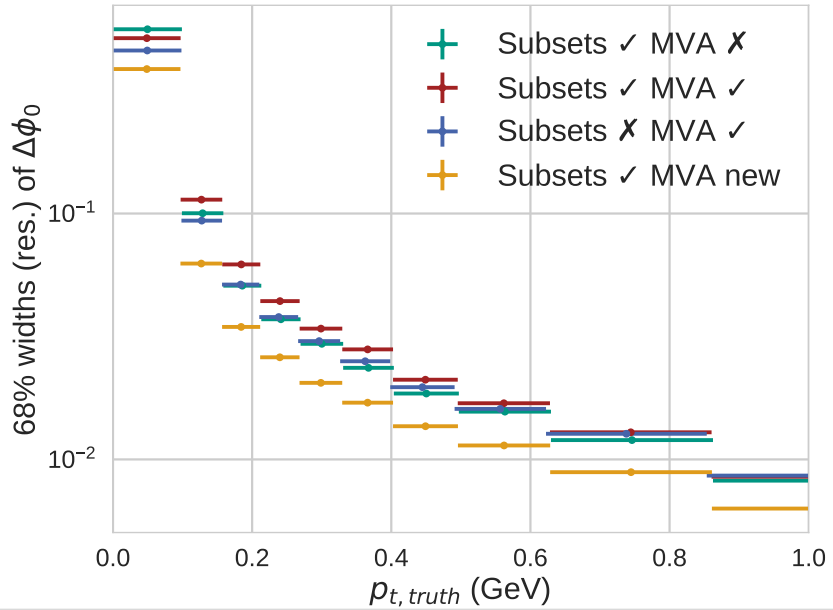
- With current default weight file MVA is NOT better for all parameters
- MVA with new weight has small offsets and better resolutions

Helix parameter resolutions by p_t Profile

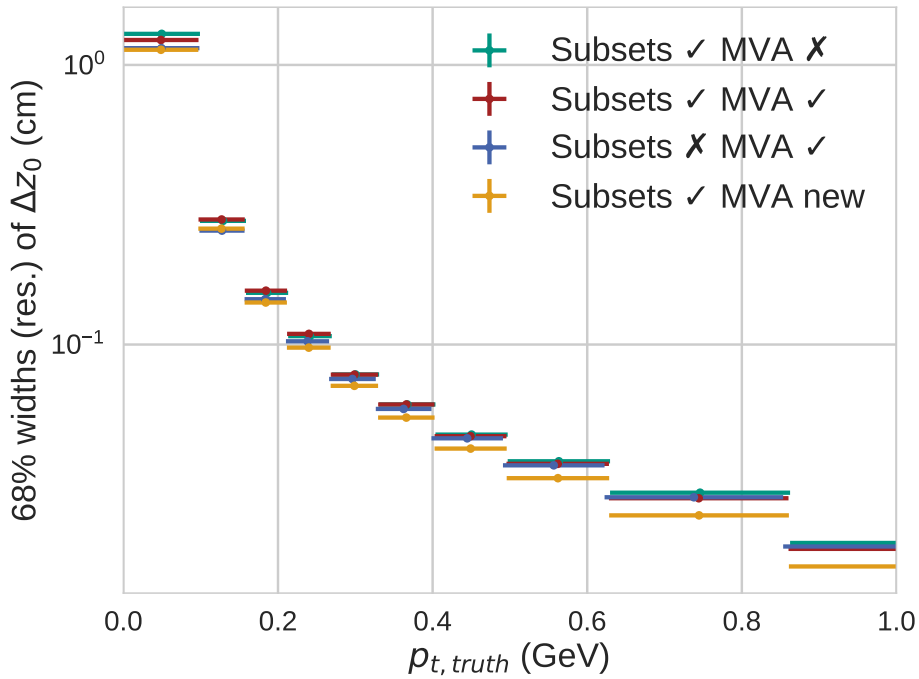








Helix parameter resolutions by p_t Profile



Results for $p_t < 1$ GeV range

- MVA with current weight file worse for some parameters than without MVA
- MVA with new weight file always better (or at least equal)

Discussion

- Do we want 13% loss in Hit Efficiency but very good Hit Purity and increase in Helix parameter resolutions?
- Might be improved further with timing information
- Still has to be checked when Full CKF setup is available

- Still some issues with the fit results:
  Δp_t is very large because for some reason most $p_{t,PR}^{i} \gg p_{t,True}^{i}$?