Karlsruhe Institute of Technology

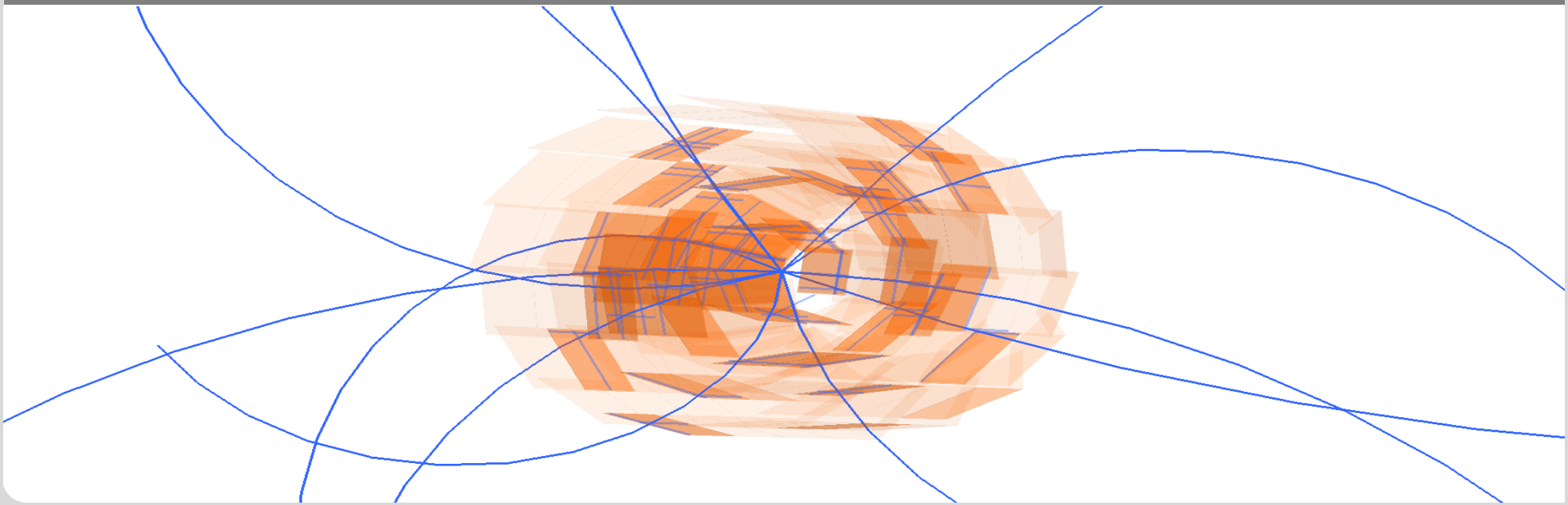
Belle II

Part2 – VXDTF2 MVA QE: Figures of Merit and Helix parameters

Online Tracking Meeting

Sebastian Racs | 3rd April 2018

INSTITUT FÜR EXPERIMENTELLE TEILCHENPHYSIK (ETP)



Part 2 – Re-doing studies

Basics

- Why is there a drop in Hit Efficiency when using the VXDTF2 MVA?
- **On master state 9f24b7cd40a (22.03.18)**
- 20k $\Upsilon(4S)$ events with official phase 3 Bkg overlay 15th Campaign
- SVDonly tracking

What was done?

- Look at figures of merit and 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 Resoultion: **standard deviation** and **68% Quantile Width**

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

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

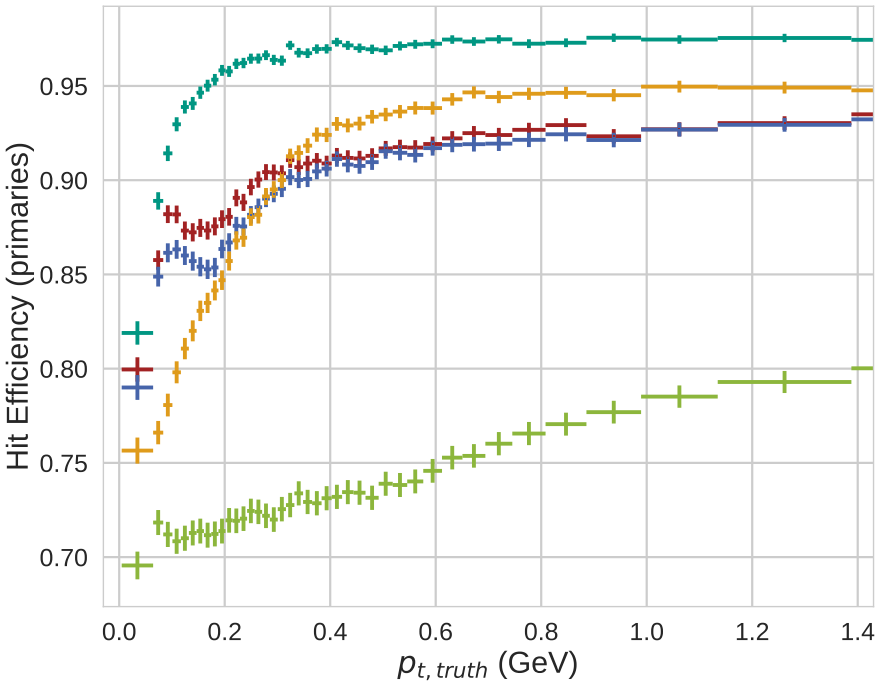
Figures of merit & Helix parameters

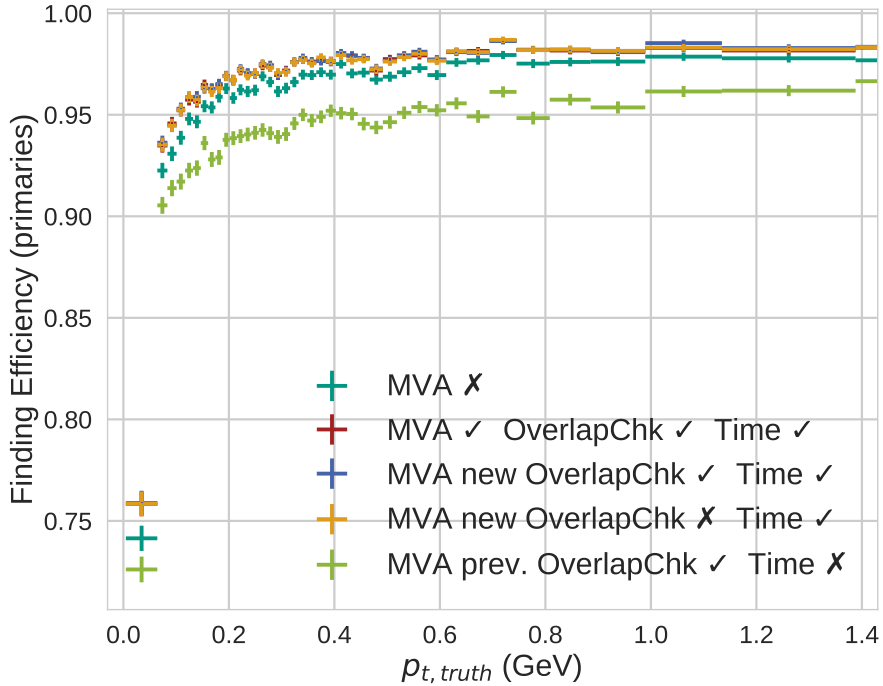
	# Tracks	# Matched	# Fitted	# Mat.&Fit	% Mat.&Fit
MVA ✗	214 413	201 417	206 270	198 035	0.9236
MVA ✓ OverlapChk ✓ Time ✗	215 484	203 266	210 765	201 883	0.9369
MVA ✓ OverlapChk ✓ Time ✓	215 342	203 276	210 566	201 888	**0.9375**
MVA new OverlapChk ✓ Time ✓	215 410	203 348	210 673	201 925	0.9374
MVA new OverlapChk ✗ Time ✓	215 508	203 276	210 432	201 880	0.9368
MVA prev. OverlapChk ✓ Time ✗	215 172	**196 925**	**179 030**	**168 347**	**0.7824**

	Find. Eff.	Hit Eff.	Clone Rate	Fake Rate	Hit Purity	avg. # hits	layer 3	layer 4	layer 5	layer 6
MVA ✗	0.9591	**0.9591**	0.0006	0.0601	0.9875	7.87	1.855	2.104	1.980	1.930
MVA ✓ OverlapChk ✓ Time ✗	0.9668	0.8962	0.0008	0.0560	0.9917	7.26	1.644	1.955	1.867	1.798
MVA ✓ OverlapChk ✓ Time ✓	0.9670	0.9019	0.0006	0.0554	0.9923	7.30	1.666	1.963	1.872	1.802
MVA new OverlapChk ✓ Time ✓	**0.9673**	0.8931	0.0007	0.0553	0.9925	7.23	1.637	1.946	1.863	1.788
MVA new OverlapChk ✗ Time ✓	0.9669	0.8940	0.0007	0.0561	0.9929	7.24	1.670	1.947	1.860	1.763
MVA prev. OverlapChk ✓ Time ✗	**0.9379**	**0.7350**	**0.0026**	**0.0824**	**0.9307**	**6.46**	**1.504**	**1.691**	**1.671**	**1.595**

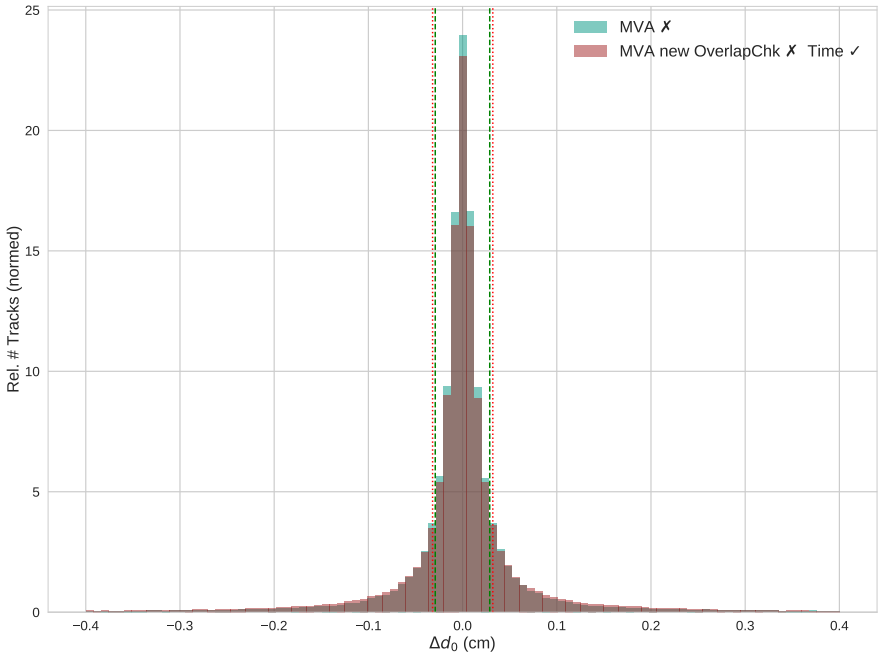
	Δd_0 (cm)		$\Delta \tan\lambda$		$\Delta\omega$ (1/cm)		$\Delta\phi_0$		Δz_0 (cm)		Δp_t (GeV)	
	std	mid 68%	std	mid 68%	std	mid 68%	std	mid 68%	std	mid 68%	std	mid 68%
MVA ✗	0.4162	**0.0578**	**0.1443**	**0.0189**	0.0090	**0.0021**	0.4060	**0.0212**	0.346	**0.0543**	3.163	**0.0500**
MVA ✓ OverlapChk ✓ Time ✗	0.3746	0.0654	0.1446	0.0193	0.0072	0.0022	0.3858	0.0225	0.337	0.0584	1.477	0.0521
MVA ✓ OverlapChk ✓ Time ✓	0.3720	0.0638	0.1445	0.0193	0.0072	0.0022	0.3782	0.0221	0.335	0.0576	1.393	0.0517
MVA new OverlapChk ✓ Time ✓	0.3730	0.0646	0.1444	0.0194	0.0072	0.0022	0.3855	0.0223	0.336	0.0584	1.485	0.0519
MVA new OverlapChk ✗ Time ✓	0.3689	0.0639	0.1451	0.0196	0.0071	0.0022	0.3844	0.0223	0.338	0.0600	1.316	0.0512
MVA prev. OverlapChk ✓ Time ✗	**0.6811**	**0.1355**	**1.0245**	**0.0244**	**0.0168**	**0.0041**	**0.5851**	**0.0410**	**11.031**	**0.0886**	**38.037**	**0.1005**

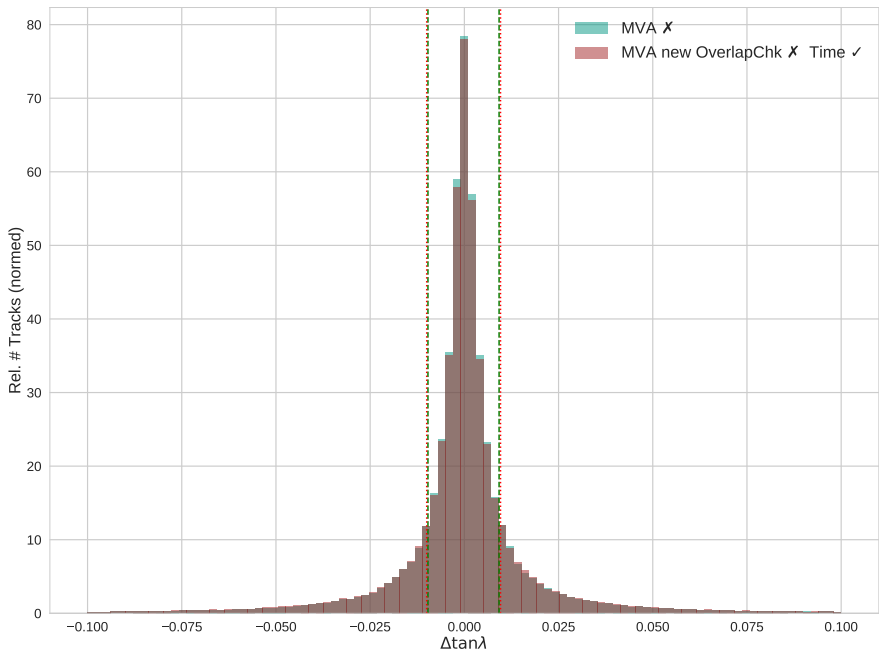
Hit & Finding Efficiency by p_t Profile





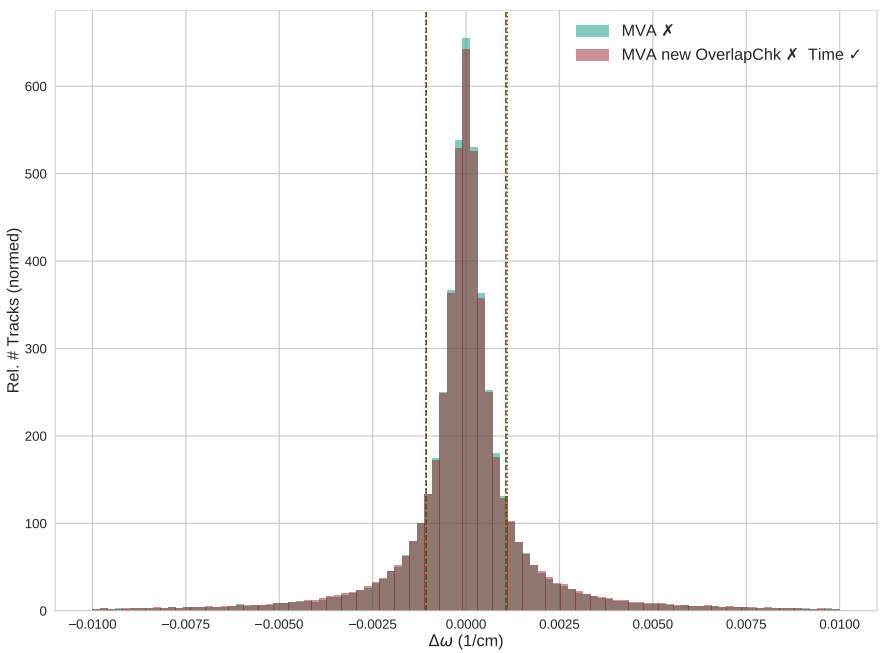
Helix parameter distributions

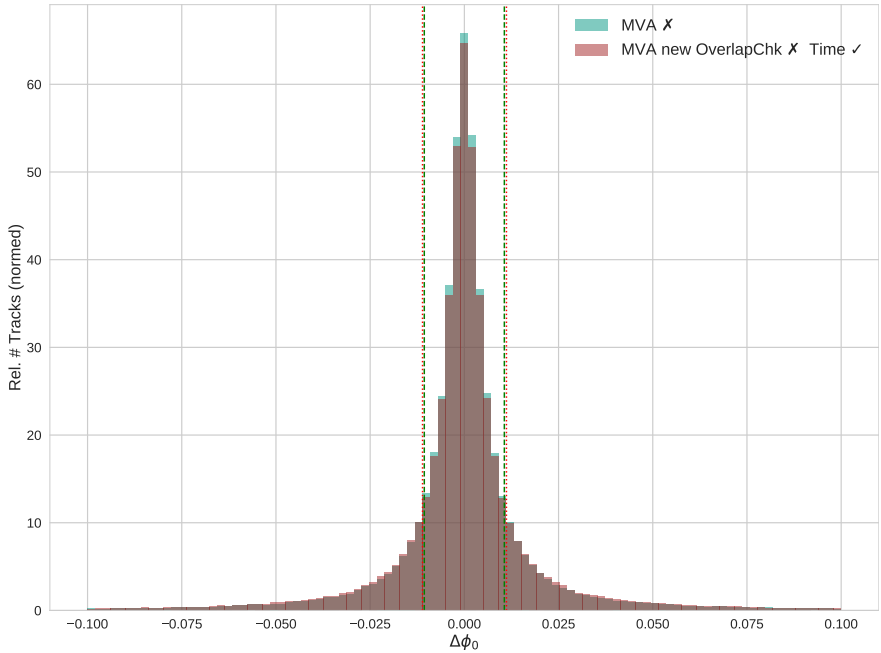




- Markers signify position of 16% and 84% percentiles that enclose middle 68% of total distribution

Helix parameter distributions





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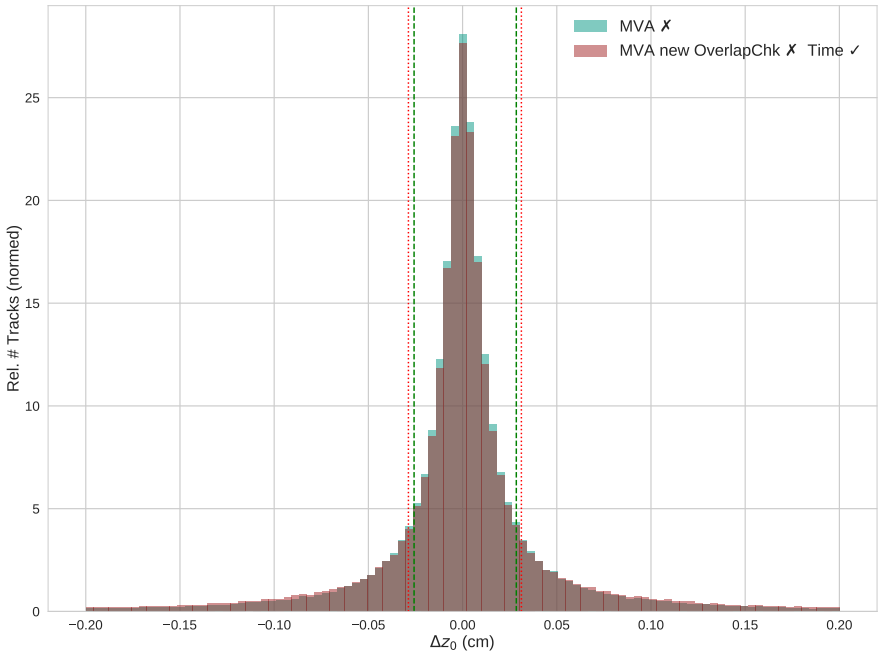
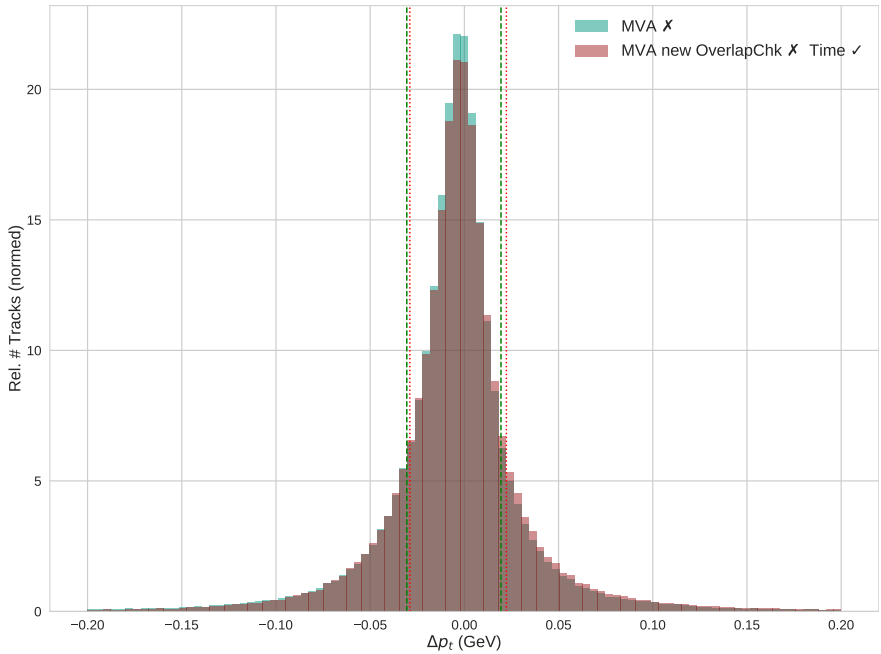
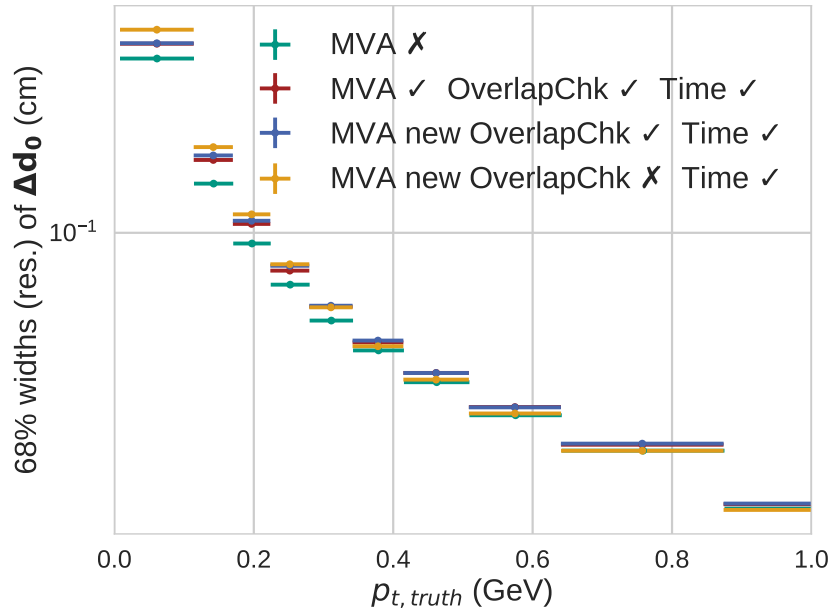
Helix parameter distributions

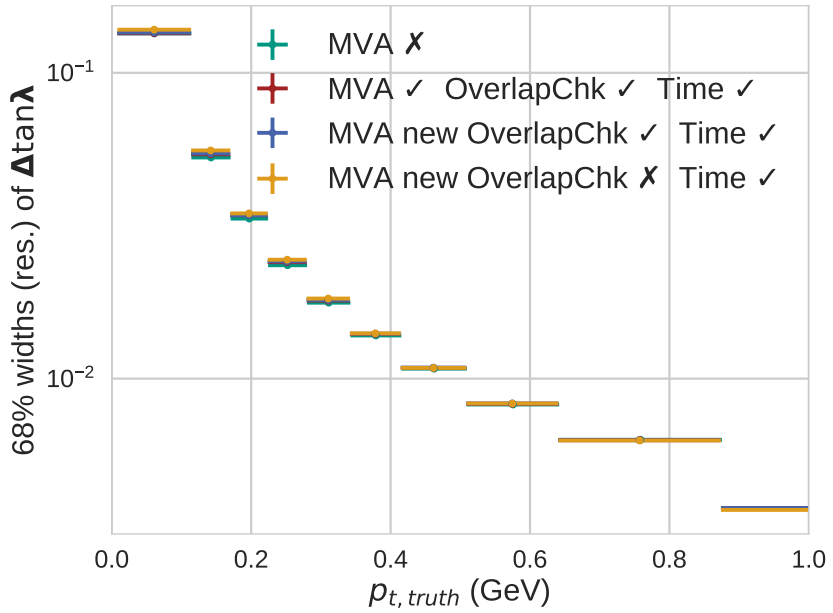


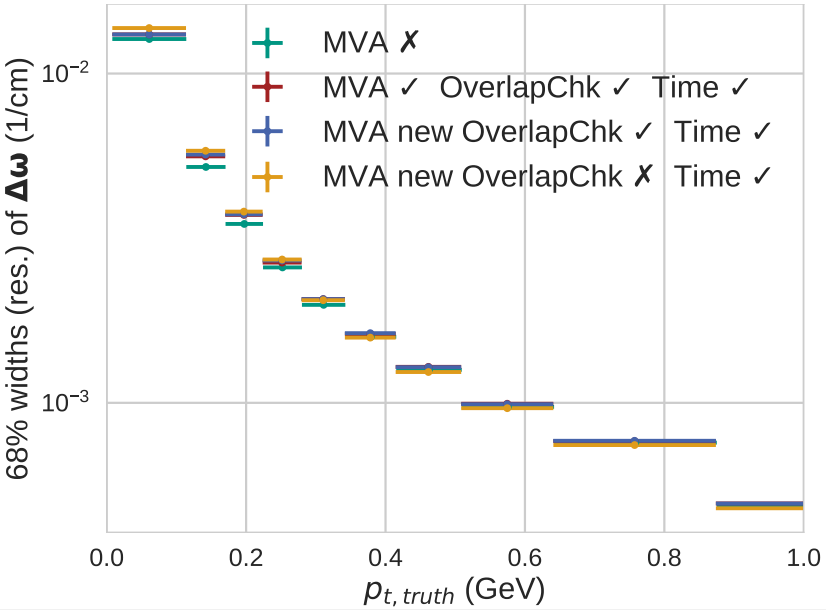


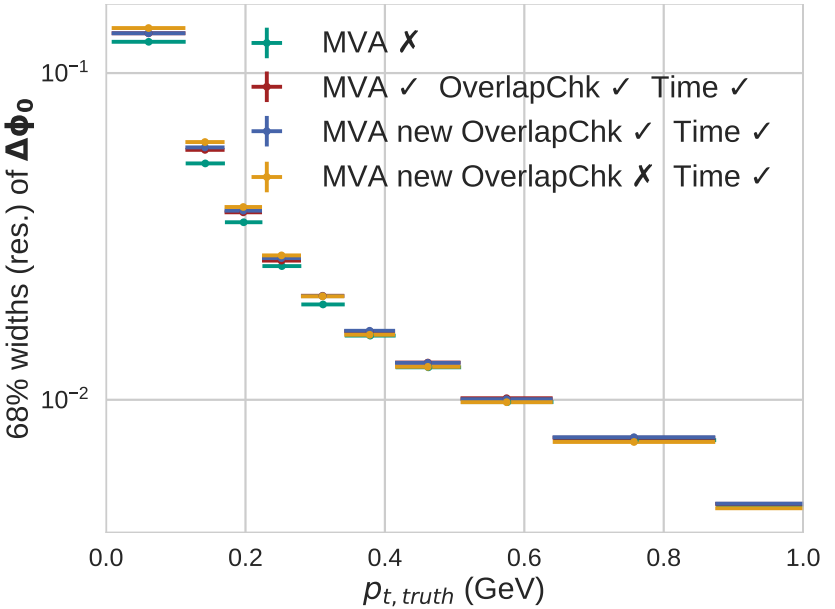
- Markers signify position of 16% and 84% percentiles that enclose middle 68% of total distribution

Helix parameter resolutions by p_t Profile

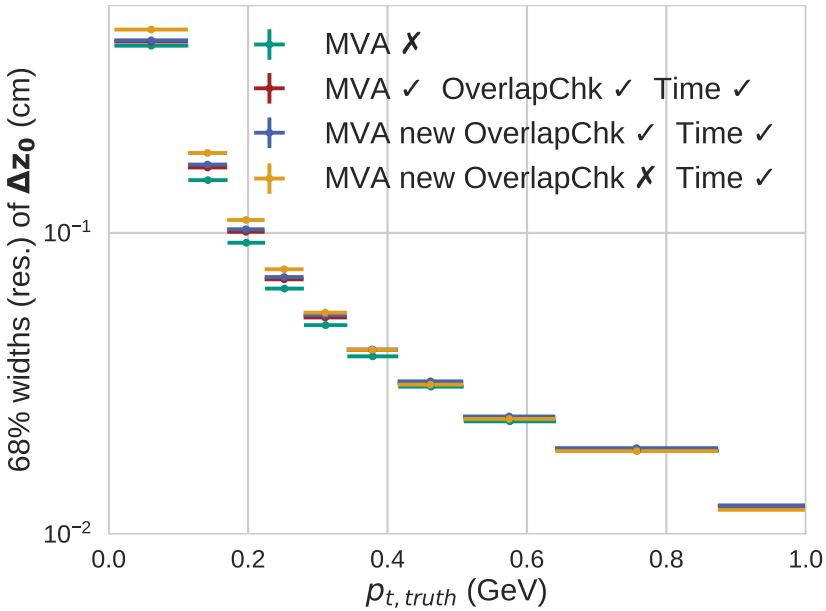


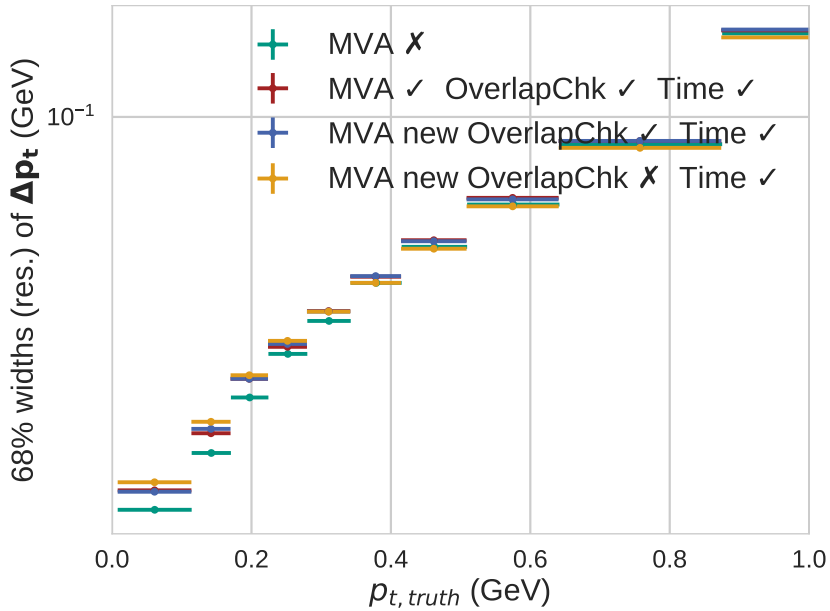




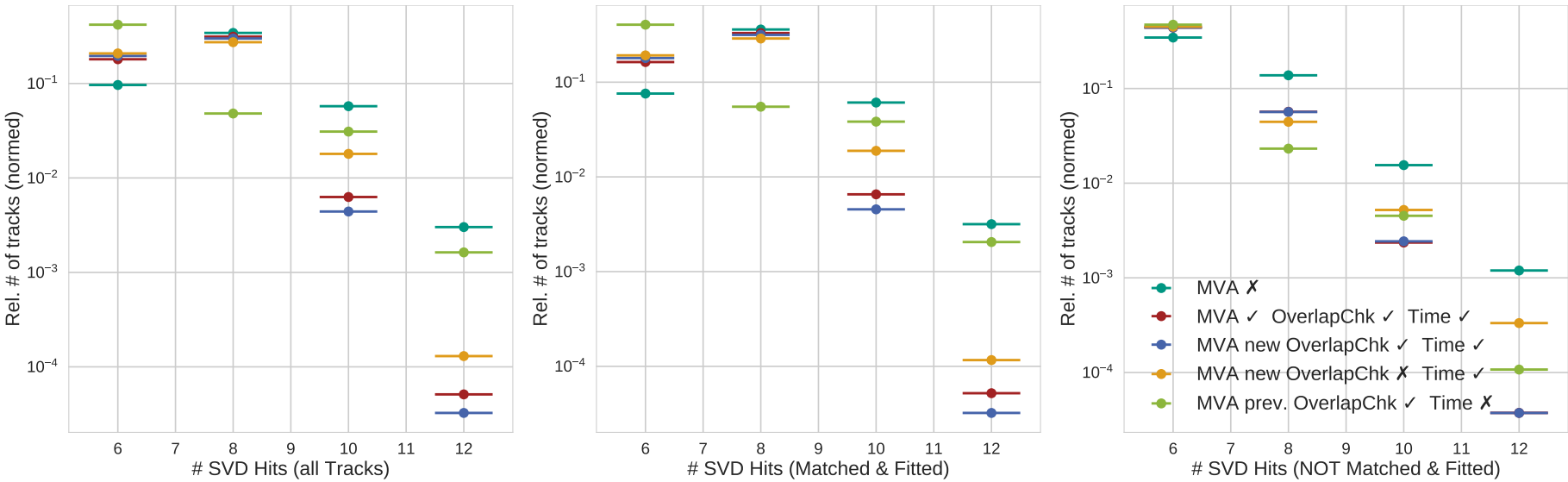


Helix parameter resolutions by p_t Profile

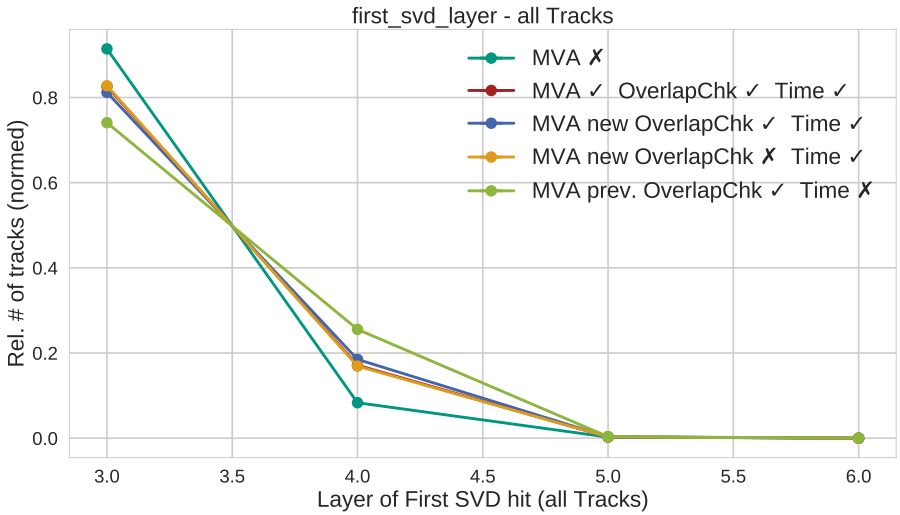


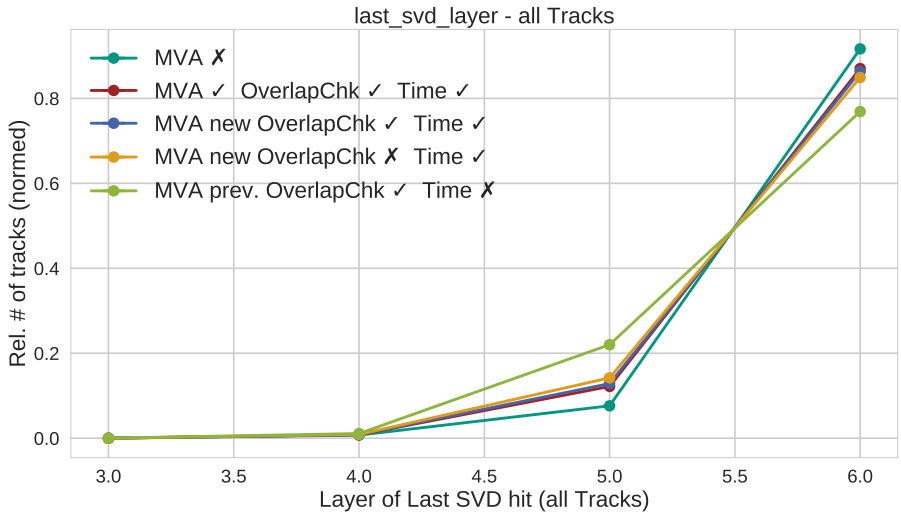


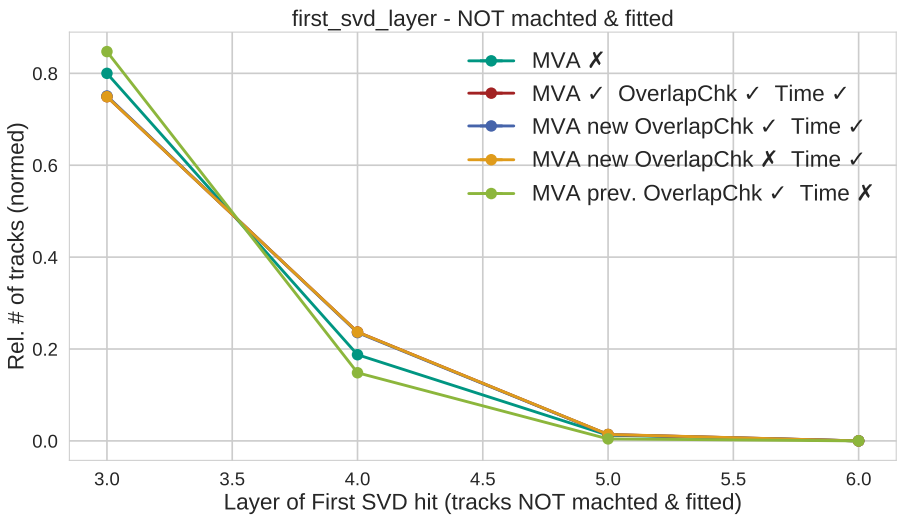
of SVD Hits (per Track)

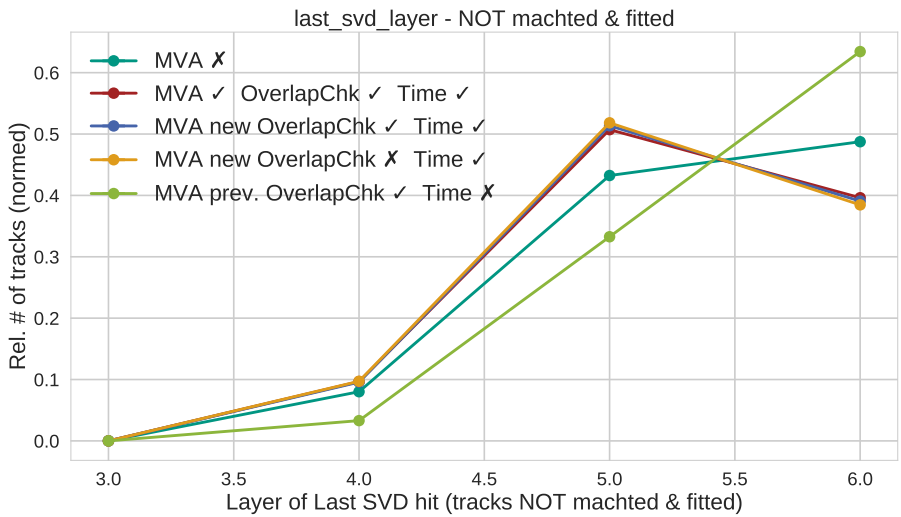


Layer of First & Last SVD Hit

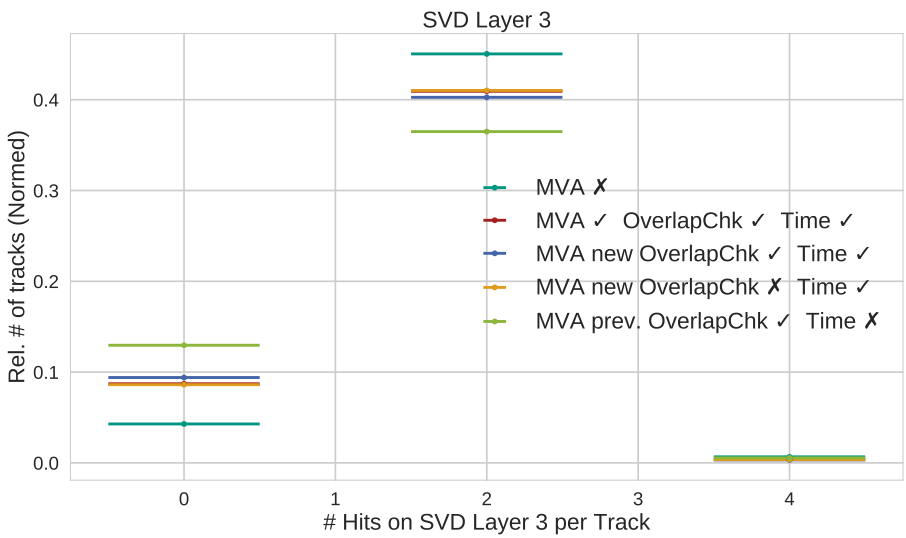


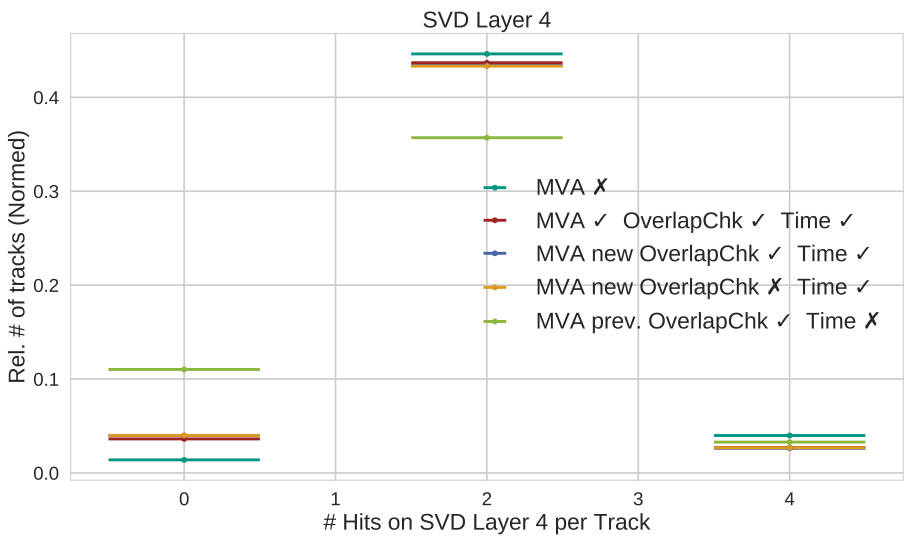


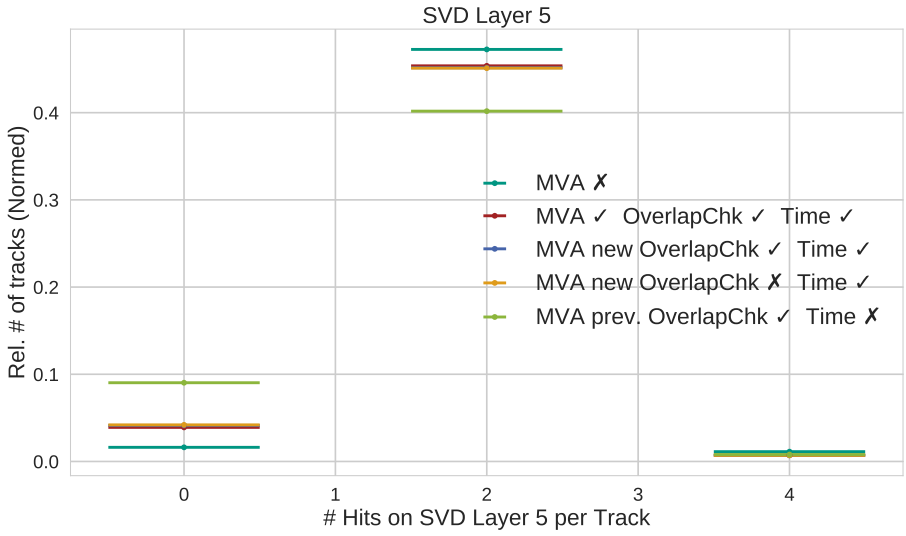


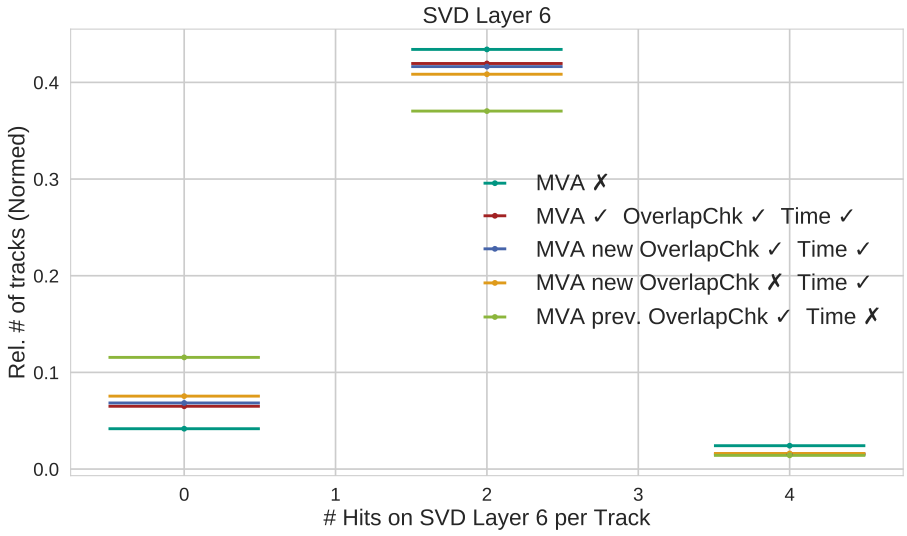


of SVD Hits on Layer (per Track)

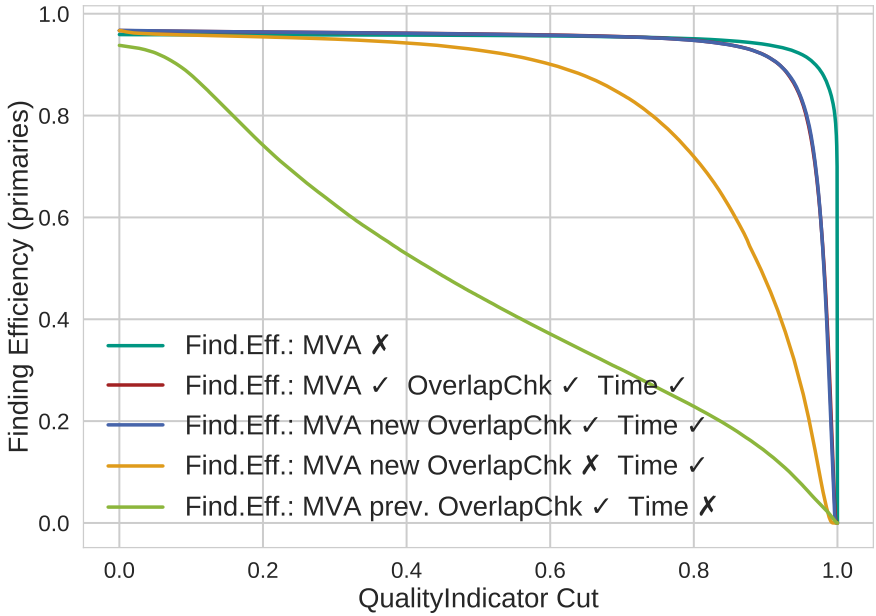


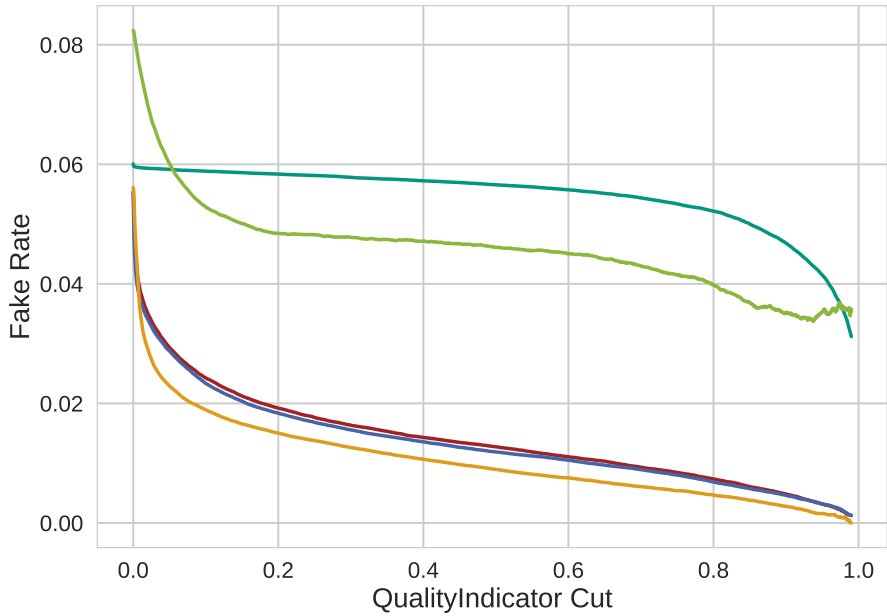


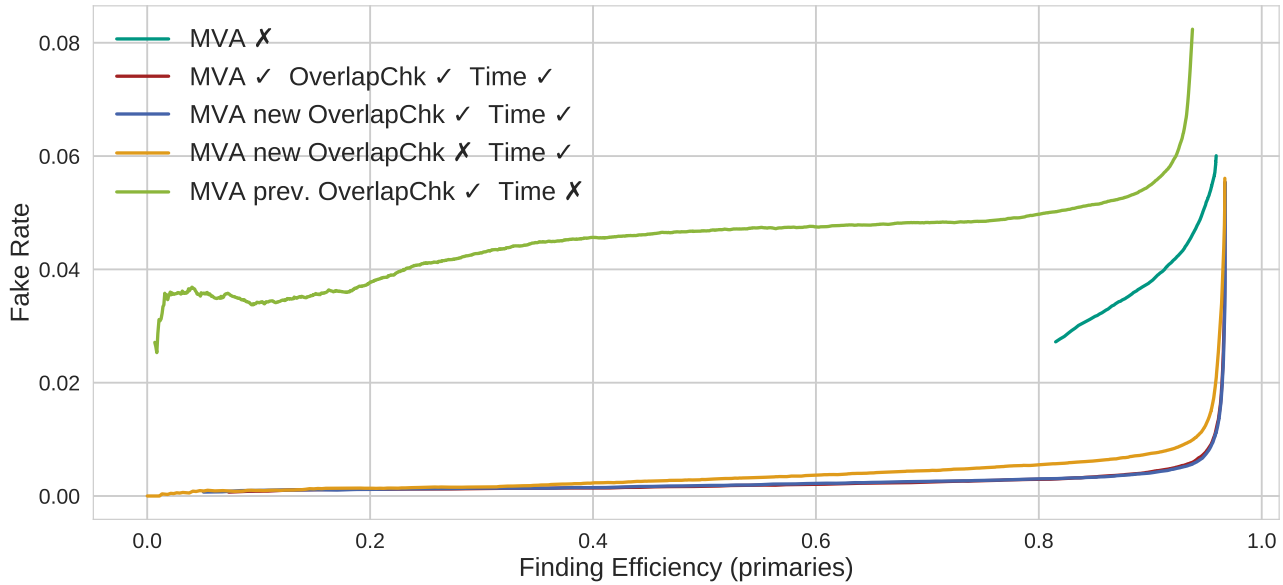




QI Cutting


Finding Efficiency (primaries)
QualityIndicator Cut
Find.Eff.: MVA ✗
Find.Eff.: MVA ✓ OverlapChk ✓ Time ✓
Find.Eff.: MVA new OverlapChk ✓ Time ✓
Find.Eff.: MVA new OverlapChk ✗ Time ✓
Find.Eff.: MVA prev. OverlapChk ✓ Time ✗


Fake Rate
QualityIndicator Cut


Fake Rate
Finding Efficiency (primaries)
MVA ✗
MVA ✓ OverlapChk ✓ Time ✓
MVA new OverlapChk ✓ Time ✓
MVA new OverlapChk ✗ Time ✓
MVA prev. OverlapChk ✓ Time ✗

Discussion

- The **previously** ”new” weightfile seems to be faulty
- No MVA (OverlapCheck with TripletFit QI) produces best vertex resolutions when considering 68% quantile, not when considering standard deviation