Update on same-side tagging for B_s-mixing

A. Rakitin

Lancaster University

October 26, 2006

B-Meeting

http://www-d0.fnal.gov/~rakitin/d0_private/tex/2006.Oct.26.Bmtg/tr.pdf

Outline:

- Use **new unbiased** MC sample:
  - $B_s \to \mu D_s, D_s \to \phi\pi, (x_s = 25)$ (10K events so far)
- Look at tracks in cone $\cos\alpha > 0.8$ around $\vec{p}(B_s)$ (for consistency with OST)
- Use one of the following for same-side tagging:
  - Charge of one track selected with some kinematic algorithm
  - Average charge of all tracks around $\vec{p}(B)$, like "jet-charge"
- Choose best same-side taggers
- Apply chosen SSTs and "Comb. OST" to MC (old and new) and data

Unbiased MC sample

New unbiased MC sample means:

- We generate $B_s \to$ everything (no user.dec file, d0_mess eff. 3.4×10^{-4})
- We select μ
- We select D_s
- We require $D_s \to \phi\pi$
- We require $\phi \to K^+K^-$

As opposed to old one:

- $B_s \to \mu Ds$
- Nothing about $\overline{B_s}$
- Parent of μ^+ must be B_s
- Parent of μ^- must be $\overline{B_s}$
- $D_s \to \phi\pi$
- $\phi \to K^+K^-$

One-track taggers:

The following taggers are used:

☞ Min. p_t^{rel}

☞ Max. p_L^{rel}

☞ Max. p_t

☞ Min. $|\Delta\vec{P}| \equiv |\vec{p}(B_s) - \vec{p}(K)|$

☞ Min. ΔR

☞ Max. $\cos\alpha$

☞ Min. $\cos\theta^*$

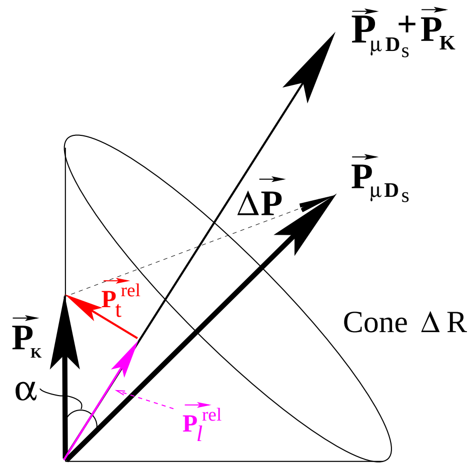
☞ Max. $\cos\theta^*$

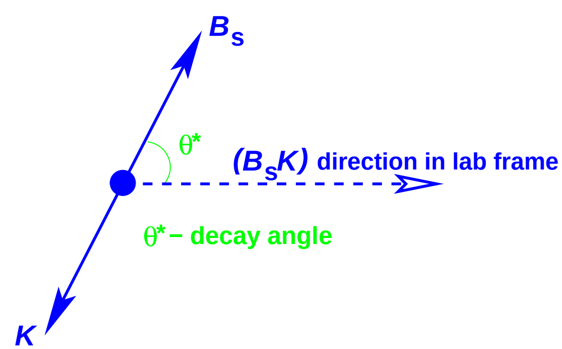
☞ Min. $m(B_sK)$

☞ Random track

☞ (dE/dx - in future)

☞ . . .





– p_t^{rel} and p_L^{rel} are $\perp$ and $||$ components of SST candidate's momentum $\vec{p}(K)$ w.r.t $\vec{p}(B_sK)$

– $\Delta R \equiv \sqrt{\Delta\phi^2 + \Delta\eta^2}$ and angle α are taken between $\vec{p}(B_s)$ and $\vec{p}(K)$

– θ^* – decay angle of B_sK-system, *i.e.* angle between directions of $\vec{p}(B_sK)$ and $\vec{p}(B_s)$ in reference frame of B_sK system

Many-track taggers:

Using weigted-average charge of all the tracks around $\vec{p}(B_s)$

Thirty-one tagger used:

☞ $Q_{jet}(p_t, \kappa) = \frac{\sum q \cdot p_t^\kappa}{\sum p_t^\kappa}$

☞ $Q_{jet}(p_t^{rel}, \kappa) = \frac{\sum q \cdot (p_t^{rel})^\kappa}{\sum (p_t^{rel})^\kappa}$

☞ $Q_{jet}(p_L^{rel}, \kappa) = \frac{\sum q \cdot (p_L^{rel})^\kappa}{\sum (p_L^{rel})^\kappa}$

– $\kappa = 0.0, 0.1, 0.2, ...1.0$
– p_t^{rel} and p_L^{rel} here are $\perp$ and $||$ components of SST candidate's momentum $\vec{p}(K)$ w.r.t $\vec{p}(B_s)$

Obtaining *true* dilution in MC

For each tagger we measure numbers of events in which:

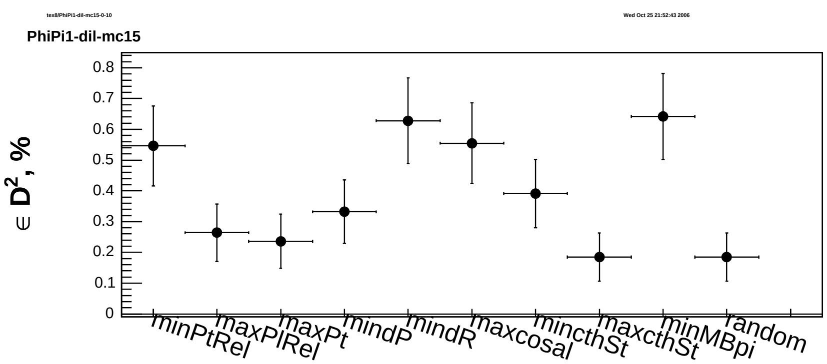
- tag charge corresponds to true B_d-flavor at production ("Right Tag")
- tag charge is opposite to true B_d-flavor at production ("Wrong Tag")
- no tag was found ("No Tag")

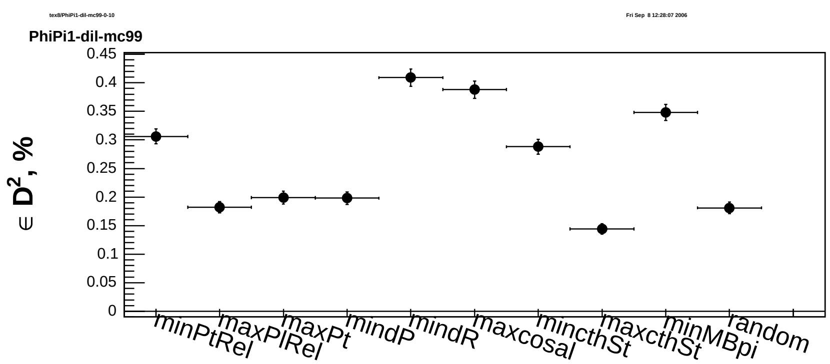
Mistag rate $p = \frac{N_{WT}}{N_{RT}+N_{WT}}$

True dilution D $= 1 - 2p = \frac{N_{RT}-N_{WT}}{N_{RT}+N_{WT}}$

True dilutions in MC - one-track taggers

Tagger	RT	WT	NT	$\varepsilon, \%$	D, %	εD^2, %
Min. p_t^{rel}	4273 $\pm$ 65	3584 $\pm$ 60	3211 $\pm$ 57	71.0 $\pm$ 0.4	8.8 $\pm$ 1.1	0.546 $\pm$ 0.130
Max. p_L^{rel}	4168 $\pm$ 65	3689 $\pm$ 61	3211 $\pm$ 57	71.0 $\pm$ 0.4	6.1 $\pm$ 1.1	0.264 $\pm$ 0.093
Max. p_t	4155 $\pm$ 64	3702 $\pm$ 61	3211 $\pm$ 57	71.0 $\pm$ 0.4	5.8 $\pm$ 1.1	0.236 $\pm$ 0.088
Min. ΔR	4298 $\pm$ 66	3559 $\pm$ 60	3211 $\pm$ 57	71.0 $\pm$ 0.4	9.4 $\pm$ 1.1	0.628 $\pm$ 0.139
Max. $\cos\alpha$	4276 $\pm$ 65	3581 $\pm$ 60	3211 $\pm$ 57	71.0 $\pm$ 0.4	8.8 $\pm$ 1.1	0.555 $\pm$ 0.131
Min. $\lvert\Delta\vec{P}\rvert$	4197 $\pm$ 65	3660 $\pm$ 60	3211 $\pm$ 57	71.0 $\pm$ 0.4	6.8 $\pm$ 1.1	0.332 $\pm$ 0.103
Min. $m(B_sK)$	4302 $\pm$ 66	3555 $\pm$ 60	3211 $\pm$ 57	71.0 $\pm$ 0.4	9.5 $\pm$ 1.1	0.642 $\pm$ 0.140
Min. $\cos\theta^*$	4220 $\pm$ 65	3637 $\pm$ 60	3211 $\pm$ 57	71.0 $\pm$ 0.4	7.4 $\pm$ 1.1	0.391 $\pm$ 0.111
Max. $\cos\theta^*$	4129 $\pm$ 64	3728 $\pm$ 61	3211 $\pm$ 57	71.0 $\pm$ 0.4	5.1 $\pm$ 1.1	0.185 $\pm$ 0.078
Random track	4129 $\pm$ 64	3728 $\pm$ 61	3211 $\pm$ 57	71.0 $\pm$ 0.4	5.1 $\pm$ 1.1	0.185 $\pm$ 0.078

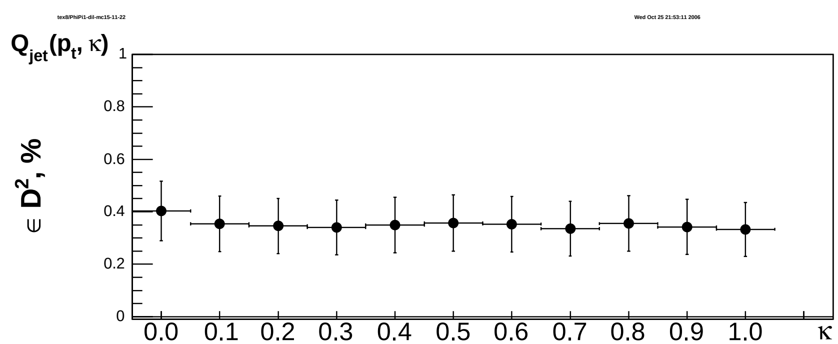


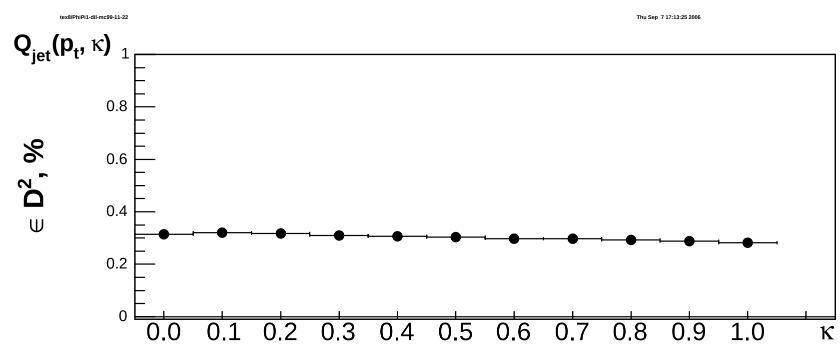


True dilutions for many-track taggers

Weighted with p_t:

Tagger	RT	WT	NT	ε, %	D, %	εD^2, %
Aver. Q	3848 ± 62	3284 ± 57	3936 ± 63	64.4 ± 0.5	7.9 ± 1.2	0.403 ± 0.113
$Q_{jet}(p_t, \kappa = 0.1)$	4755 ± 69	4164 ± 65	2149 ± 46	80.6 ± 0.4	6.6 ± 1.1	0.354 ± 0.106
$Q_{jet}(p_t, \kappa = 0.2)$	4751 ± 69	4167 ± 65	2150 ± 46	80.6 ± 0.4	6.5 ± 1.1	0.346 ± 0.105
$Q_{jet}(p_t, \kappa = 0.3)$	4749 ± 69	4170 ± 65	2149 ± 46	80.6 ± 0.4	6.5 ± 1.1	0.340 ± 0.104
$Q_{jet}(p_t, \kappa = 0.4)$	4753 ± 69	4166 ± 65	2149 ± 46	80.6 ± 0.4	6.6 ± 1.1	0.349 ± 0.106
$Q_{jet}(p_t, \kappa = 0.5)$	4756 ± 69	4162 ± 65	2150 ± 46	80.6 ± 0.4	6.7 ± 1.1	0.357 ± 0.107
$Q_{jet}(p_t, \kappa = 0.6)$	4754 ± 69	4164 ± 65	2150 ± 46	80.6 ± 0.4	6.6 ± 1.1	0.353 ± 0.106
$Q_{jet}(p_t, \kappa = 0.7)$	4747 ± 69	4171 ± 65	2150 ± 46	80.6 ± 0.4	6.5 ± 1.1	0.336 ± 0.104
$Q_{jet}(p_t, \kappa = 0.8)$	4755 ± 69	4163 ± 65	2150 ± 46	80.6 ± 0.4	6.6 ± 1.1	0.355 ± 0.106
$Q_{jet}(p_t, \kappa = 0.9)$	4750 ± 69	4169 ± 65	2149 ± 46	80.6 ± 0.4	6.5 ± 1.1	0.342 ± 0.105
$Q_{jet}(p_t, \kappa = 1.0)$	4746 ± 69	4173 ± 65	2149 ± 46	80.6 ± 0.4	6.4 ± 1.1	0.333 ± 0.103



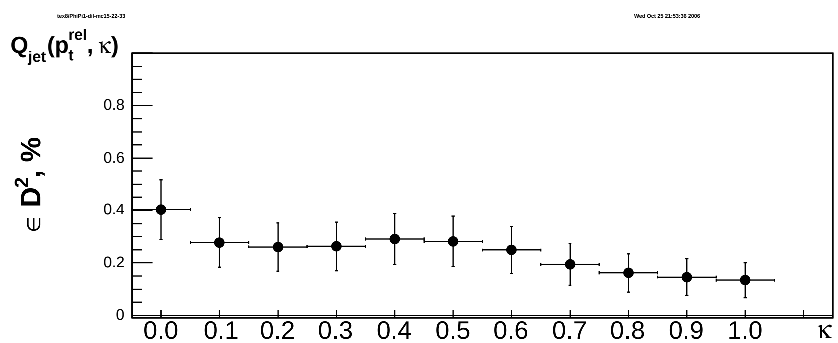


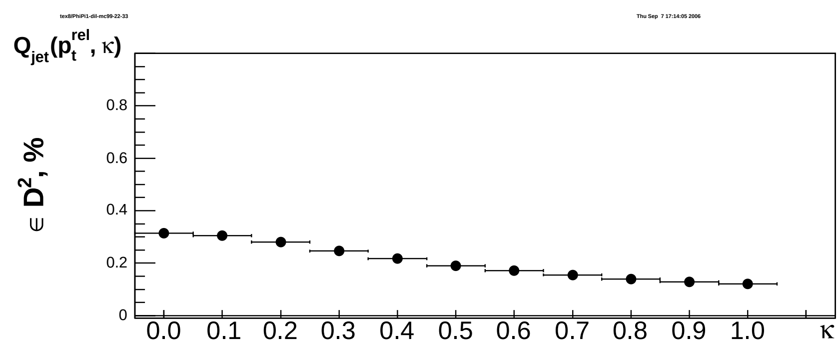
Horizontal line within errors

True dilutions for many-track taggers

Weighted with p_t^{rel}:

Tagger	RT	WT	NT	ε, %	D, %	εD^2, %
Aver. Q	3848 ± 62	3284 ± 57	3936 ± 63	64.4 ± 0.5	7.9 ± 1.2	0.403 ± 0.113
$Q_{jet}(p_t^{rel}, \kappa = 0.1)$	4722 ± 69	4198 ± 65	2148 ± 46	80.6 ± 0.4	5.9 ± 1.1	0.278 ± 0.095
$Q_{jet}(p_t^{rel}, \kappa = 0.2)$	4714 ± 69	4206 ± 65	2148 ± 46	80.6 ± 0.4	5.7 ± 1.1	0.261 ± 0.092
$Q_{jet}(p_t^{rel}, \kappa = 0.3)$	4715 ± 69	4205 ± 65	2148 ± 46	80.6 ± 0.4	5.7 ± 1.1	0.263 ± 0.093
$Q_{jet}(p_t^{rel}, \kappa = 0.4)$	4728 ± 69	4192 ± 65	2148 ± 46	80.6 ± 0.4	6.0 ± 1.1	0.291 ± 0.097
$Q_{jet}(p_t^{rel}, \kappa = 0.5)$	4724 ± 69	4196 ± 65	2148 ± 46	80.6 ± 0.4	5.9 ± 1.1	0.282 ± 0.096
$Q_{jet}(p_t^{rel}, \kappa = 0.6)$	4708 ± 69	4212 ± 65	2148 ± 46	80.6 ± 0.4	5.6 ± 1.1	0.249 ± 0.090
$Q_{jet}(p_t^{rel}, \kappa = 0.7)$	4679 ± 68	4241 ± 65	2148 ± 46	80.6 ± 0.4	4.9 ± 1.1	0.194 ± 0.080
$Q_{jet}(p_t^{rel}, \kappa = 0.8)$	4660 ± 68	4260 ± 65	2148 ± 46	80.6 ± 0.4	4.5 ± 1.1	0.162 ± 0.073
$Q_{jet}(p_t^{rel}, \kappa = 0.9)$	4650 ± 68	4270 ± 65	2148 ± 46	80.6 ± 0.4	4.3 ± 1.1	0.146 ± 0.070
$Q_{jet}(p_t^{rel}, \kappa = 1.0)$	4642 ± 68	4278 ± 65	2148 ± 46	80.6 ± 0.4	4.1 ± 1.1	0.134 ± 0.067



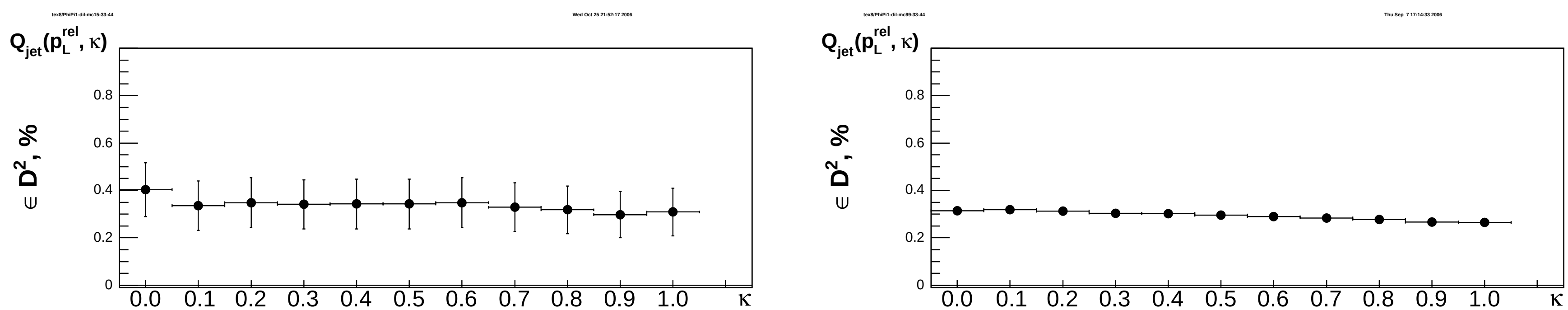


Best $\kappa = 0.0$

True dilutions for many-track taggers

Weighted with p_L^{rel}:

Tagger	RT	WT	NT	ε, %	D, %	εD^2, %
Aver. Q	3848 ± 62	3284 ± 57	3936 ± 63	64.4 ± 0.5	7.9 ± 1.2	0.403 ± 0.113
$Q_{jet}(p_L^{rel}, \kappa = 0.1)$	4748 ± 69	4172 ± 65	2148 ± 46	80.6 ± 0.4	6.5 ± 1.1	0.336 ± 0.104
$Q_{jet}(p_L^{rel}, \kappa = 0.2)$	4753 ± 69	4167 ± 65	2148 ± 46	80.6 ± 0.4	6.6 ± 1.1	0.348 ± 0.105
$Q_{jet}(p_L^{rel}, \kappa = 0.3)$	4750 ± 69	4170 ± 65	2148 ± 46	80.6 ± 0.4	6.5 ± 1.1	0.341 ± 0.104
$Q_{jet}(p_L^{rel}, \kappa = 0.4)$	4751 ± 69	4169 ± 65	2148 ± 46	80.6 ± 0.4	6.5 ± 1.1	0.343 ± 0.105
$Q_{jet}(p_L^{rel}, \kappa = 0.5)$	4751 ± 69	4169 ± 65	2148 ± 46	80.6 ± 0.4	6.5 ± 1.1	0.343 ± 0.105
$Q_{jet}(p_L^{rel}, \kappa = 0.6)$	4753 ± 69	4167 ± 65	2148 ± 46	80.6 ± 0.4	6.6 ± 1.1	0.348 ± 0.105
$Q_{jet}(p_L^{rel}, \kappa = 0.7)$	4745 ± 69	4175 ± 65	2148 ± 46	80.6 ± 0.4	6.4 ± 1.1	0.329 ± 0.103
$Q_{jet}(p_L^{rel}, \kappa = 0.8)$	4740 ± 69	4180 ± 65	2148 ± 46	80.6 ± 0.4	6.3 ± 1.1	0.318 ± 0.101
$Q_{jet}(p_L^{rel}, \kappa = 0.9)$	4731 ± 69	4189 ± 65	2148 ± 46	80.6 ± 0.4	6.1 ± 1.1	0.298 ± 0.098
$Q_{jet}(p_L^{rel}, \kappa = 1.0)$	4736 ± 69	4184 ± 65	2148 ± 46	80.6 ± 0.4	6.2 ± 1.1	0.309 ± 0.100



Horizontal line within errors

Best many-track tagger

- The best tagger is $Q_{jet}(p_t, \kappa = 0.6)$ – for consistency with OST
- We will use this tagger only, skipping the remaining 30

Measuring SST dilution in data:

- Divide sample of N events into five subsamples:
  - N_1 events tagged only by first tagger with *true* dilution D_1
  - N_2 events tagged only by second tagger with *true* dilution D_2
  - N_{12} events tagged by both taggers identically with *true* dilution $\mathsf{D}_{12} = \frac{\mathsf{D}_1+\mathsf{D}_2}{1+\mathsf{D}_1\mathsf{D}_2}$
  - $\bar{N}_{12}$ events tagged by both taggers differently with *true* dilution $\bar{\mathsf{D}}_{12} = \frac{|\mathsf{D}_1-\mathsf{D}_2|}{1-\mathsf{D}_1\mathsf{D}_2}$
  - N_{NT} events not tagged by both taggers
- A simple formula holds: $\mathsf{D}_1\mathsf{D}_2 = \frac{N_{12}-\bar{N}_{12}}{N_{12}+\bar{N}_{12}}$
- Use one (more trustworthy) *true* dilution from other sources and measure another (D0 Note 4991:$D_{OST} = 44.3 \pm 2.2$)
- Calculate $\epsilon D^2 = \frac{1}{N}(N_1\mathsf{D}_1^2 + N_2\mathsf{D}_2^2 + N_{12}\mathsf{D}_{12}^2 + \bar{N}_{12}\,\bar{\mathsf{D}}_{12}^2)$

But first let's demonstrate that this technique works in MC

"Min. ΔR" SST + Comb. OST

	SST-only	OST-only	SST		SST + OST	
			with OST	w/o OST		
N_{RT}	4298±66	1733±42	918±30	3380±58	3380±58	554±24
N_{WT}	3559±60	718±27	782±28	2777±53	2777±53	197±14
N_{NT}	3211±57	8617±93	751±27	2460±50	2460±50	
ε, %	71.0±0.4	22.1±0.4	69.4±0.9	71.5±0.5	–	
D, %	**9.4±1.1**	**41.4±1.8**	**8.0±2.4**	**9.8±1.3**	**9.8±1.3**	**47.5±3.2**
N_{12}^{RT}	–	–	–	–	643±25	
N_{12}^{WT}	–	–	–	–	246±16	
D_{12}^{meas}	–	–	–	–	44.7±3.0	
D_{12}^{calc}	–	–	–	–	48.9±1.9	
$\bar{N}_{12}^{RT}$	–	–	–	–	536±23	
$\bar{N}_{12}^{WT}$	–	–	–	–	275±17	
$\bar{D}_{12}^{meas}$	–	–	–	–	32.2±3.3	
$\bar{D}_{12}^{calc}$	–	–	–	–	33.3±2.2	
εD^2(meas), %	0.628±0.139	3.798±0.279	0.444±0.251	0.685±0.163	3.253±0.304	
εD^2(calc), %	–	–	–	–	3.920±0.500	
N_{12}	–	–	–	–	889±30	
$\bar{N}_{12}$	–	–	–	–	811±28	
$\frac{N_{12}-\bar{N}_{12}}{N_{12}+\bar{N}_{12}}$	–	–	–	–	0.046±0.024	
$D_{SST} \cdot D_{OST}$	–	–	–	–	0.039±0.005	
Diff.	–	–	–	–	0.007±0.025 (0.3 σ)	

"$Q_{jet}(p_t, \kappa = 0.6)$" SST + Comb. OST

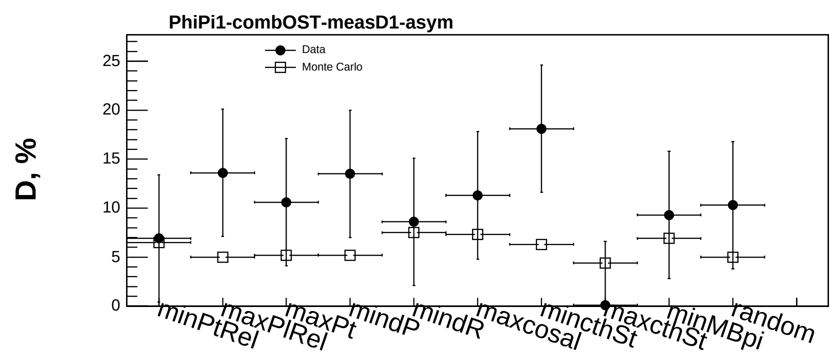
	SST-only	OST-only	SST with OST	SST w/o OST	SST + OST	
N_{RT}	4754±69	1733±42	1051±32	3703±61	3703±61	359±19
N_{WT}	4164±65	718±27	913±30	3251±57	3251±57	128±11
N_{NT}	2150±46	8617±93	487±22	1663±41	1663±41	
ε, %	80.6±0.4	22.1±0.4	80.1±0.8	80.7±0.4	–	
D, %	**6.6±1.1**	**41.4±1.8**	**7.0±2.3**	**6.5±1.2**	**6.5±1.2**	**47.4±4.0**
N_{12}^{RT}	–	–	–	–	740±27	
N_{12}^{WT}	–	–	–	–	279±17	
D_{12}^{meas}	–	–	–	–	45.2±2.8	
D_{12}^{calc}	–	–	–	–	46.7±1.9	
$\bar{N}_{12}^{RT}$	–	–	–	–	634±25	
$\bar{N}_{12}^{WT}$	–	–	–	–	311±18	
$\bar{D}_{12}^{meas}$	–	–	–	–	34.2±3.1	
$\bar{D}_{12}^{calc}$	–	–	–	–	35.8±2.1	
εD^2(meas), %	0.353±0.106	3.798±0.279	0.396±0.238	0.341±0.118	3.335±0.311	
εD^2(calc), %	–	–	–	–	3.785±0.564	
N_{12}	–	–	–	–	1019±32	
$\bar{N}_{12}$	–	–	–	–	945±31	
$\frac{N_{12}-\bar{N}_{12}}{N_{12}+\bar{N}_{12}}$	–	–	–	–	0.038±0.023	
$D_{SST} \cdot D_{OST}$	–	–	–	–	0.027±0.005	
Diff.	–	–	–	–	0.010±0.023 (0.4 σ)	

“Min $m(B_sK)$” SST + Comb. OST

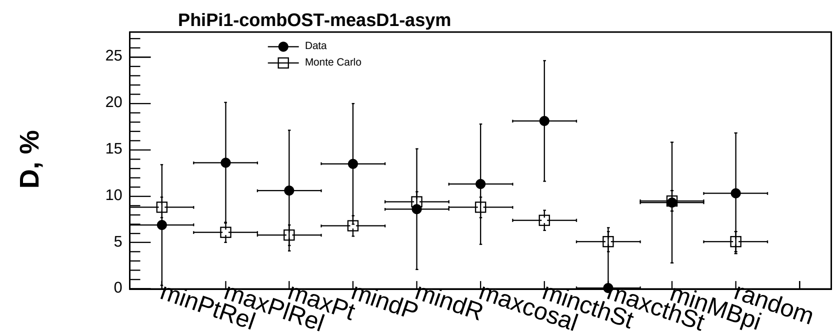
	SST-only	OST-only	SST with OST	SST w/o OST	SST + OST	
N_{RT}	4302±66	1733±42	923±30	3379±58	3379±58	554±24
N_{WT}	3555±60	718±27	777±28	2778±53	2778±53	197±14
N_{NT}	3211±57	8617±93	751±27	2460±50	2460±50	
ε, %	71.0±0.4	22.1±0.4	69.4±0.9	71.5±0.5	–	
D, %	**9.5±1.1**	**41.4±1.8**	**8.6±2.4**	**9.8±1.3**	**9.8±1.3**	**47.5±3.2**
N_{12}^{RT}	–	–	–	–	642±25	
N_{12}^{WT}	–	–	–	–	240±15	
D_{12}^{meas}	–	–	–	–	45.6±3.0	
D_{12}^{calc}	–	–	–	–	49.0±1.9	
$\bar{N}_{12}^{RT}$	–	–	–	–	537±23	
$\bar{N}_{12}^{WT}$	–	–	–	–	281±17	
$\bar{D}_{12}^{meas}$	–	–	–	–	31.3±3.3	
$\bar{D}_{12}^{calc}$	–	–	–	–	33.2±2.2	
εD^2(meas), %	0.642±0.140	3.798±0.279	0.512±0.268	0.681±0.163	3.264±0.304	
εD^2(calc), %	–	–	–	–	3.912±0.499	
N_{12}	–	–	–	–	882±30	
$\bar{N}_{12}$	–	–	–	–	818±29	
$\frac{N_{12}-\bar{N}_{12}}{N_{12}+\bar{N}_{12}}$	–	–	–	–	0.038±0.024	
$D_{SST} \cdot D_{OST}$	–	–	–	–	0.039±0.005	
Diff.			–	–	-0.002±0.025 (-0.1 σ)	

Measured SST dilutions in data

	N_1	N_2	N_{NT}	N_{12}	$\bar{N}_{12}$	$\frac{N_{12}-\bar{N}_{12}}{N_{12}+\bar{N}_{12}}$	D_{OST}	D_{SST}^{meas}	D_{12}^{calc}	$\bar{D}_{12}^{calc}$	εD^2(calc), %
Min. p_t^{rel}	18498±186	577±27	4865±82	1050±42	987±41	0.031±0.029	44.3 ± 2.2	6.9±6.5	49.7±5.3	38.6±6.0	2.339±0.701
Max. p_L^{rel}	18498±186	577±27	4865±82	1076±42	954±40	0.060±0.029	44.3 ± 2.2	13.6±6.5	54.6±5.0	32.7±6.4	3.381±1.294
Max. p_t	18498±186	577±27	4865±82	1063±42	968±40	0.047±0.029	44.3 ± 2.2	10.6±6.5	52.4±5.2	35.4±6.2	2.823±1.018
Min. $\lvert\Delta\vec{P}\rvert$	18498±186	577±27	4865±82	1076±42	954±40	0.060±0.029	44.3 ± 2.2	13.5±6.5	54.5±5.0	32.8±6.4	3.358±1.284
Min. ΔR	19403±191	618±28	5115±85	1103±43	1018±41	0.040±0.028	44.3 ± 2.2	9.1±6.4	51.3±5.2	36.7±6.1	2.599±0.871
Max. $\cos\alpha$	18498±186	577±27	4865±82	1064±42	963±40	0.050±0.029	44.3 ± 2.2	11.3±6.5	52.9±5.1	34.8±6.3	2.939±1.085
Min. $\cos\theta^*$	18498±186	577±27	4865±82	1097±42	934±40	0.080±0.029	44.3 ± 2.2	18.1±6.5	57.8±4.9	28.5±6.7	4.480±1.714
Max. $\cos\theta^*$	18498±186	577±27	4865±82	1017±42	1016±41	0.001±0.029	44.3 ± 2.2	0.1±6.5	44.4±5.7	44.2±5.7	1.972±0.285
Min. $m(B_s K)$	18498±186	577±27	4865±82	1060±42	976±41	0.041±0.029	44.3 ± 2.2	9.3±6.5	51.4±5.2	36.5±6.1	2.627±0.901
Random	18498±186	577±27	4865±82	1063±42	970±40	0.046±0.029	44.3 ± 2.2	10.3±6.5	52.3±5.2	35.6±6.2	2.788±1.001



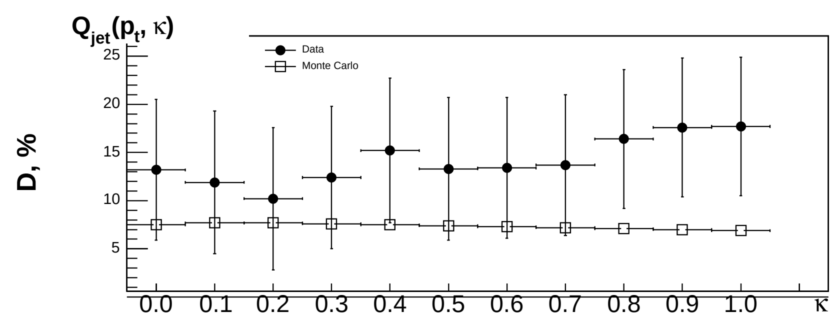
.   Old MC

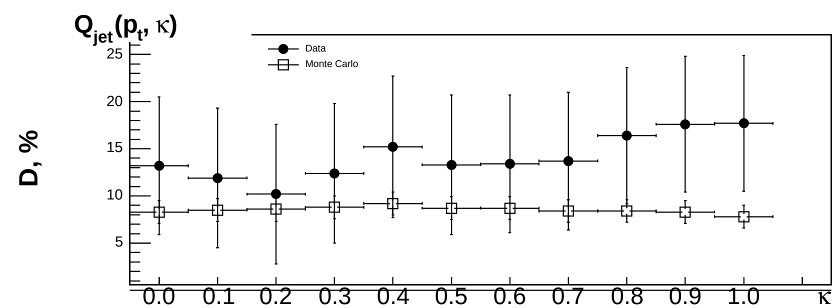


New MC

Measured SST dilutions in data

	N_1	N_2	N_{NT}	N_{12}	$\bar{N}_{12}$	$\frac{N_{12}-\bar{N}_{12}}{N_{12}+\bar{N}_{12}}$	D_{OST}	D_{SST}^{meas}	D_{12}^{calc}	$\bar{D}_{12}^{calc}$	εD^2(calc), %
Aver. Q	13893±159	1066±41	9484±128	815±36	725±34	0.058±0.032	44.3 ± 2.2	13.2±7.3	54.3±5.6	33.0±7.1	2.966±1.066
$Q_{jet}(p_t, \kappa = 0.1)$	13391±155	1140±43	9987±133	773±35	696±33	0.053±0.033	44.3 ± 2.2	11.9±7.4	53.4±5.7	34.2±7.1	2.752±0.943
$Q_{jet}(p_t, \kappa = 0.2)$	13330±155	1143±43	10048±133	766±35	700±33	0.045±0.033	44.3 ± 2.2	10.2±7.4	52.1±5.8	35.7±7.0	2.539±0.814
$Q_{jet}(p_t, \kappa = 0.3)$	13371±155	1138±43	10007±133	776±36	696±33	0.055±0.033	44.3 ± 2.2	12.4±7.4	53.7±5.7	33.8±7.1	2.814±0.979
$Q_{jet}(p_t, \kappa = 0.4)$	13492±156	1128±42	9889±132	788±36	689±33	0.067±0.033	44.3 ± 2.2	15.2±7.5	55.8±5.6	31.2±7.3	3.255±1.203
$Q_{jet}(p_t, \kappa = 0.5)$	13649±157	1094±42	9733±130	799±36	710±33	0.059±0.032	44.3 ± 2.2	13.3±7.4	54.4±5.6	33.0±7.1	2.956±1.055
$Q_{jet}(p_t, \kappa = 0.6)$	13932±159	1071±41	9448±128	810±36	719±34	0.059±0.032	44.3 ± 2.2	13.4±7.3	54.4±5.6	32.9±7.1	2.992±1.081
$Q_{jet}(p_t, \kappa = 0.7)$	14150±160	1038±40	9230±127	829±37	734±35	0.061±0.032	44.3 ± 2.2	13.7±7.3	54.7±5.6	32.5±7.1	3.068±1.124
$Q_{jet}(p_t, \kappa = 0.8)$	14387±162	997±39	8996±125	860±37	744±35	0.073±0.032	44.3 ± 2.2	16.4±7.2	56.6±5.4	30.1±7.2	3.556±1.332
$Q_{jet}(p_t, \kappa = 0.9)$	14628±163	983±39	8754±123	875±38	749±35	0.078±0.032	44.3 ± 2.2	17.6±7.2	57.4±5.3	28.9±7.2	3.845±1.449
$Q_{jet}(p_t, \kappa = 1.0)$	14813±164	971±39	8568±121	884±38	755±35	0.079±0.032	44.3 ± 2.2	17.7±7.2	57.5±5.3	28.8±7.2	3.892±1.471

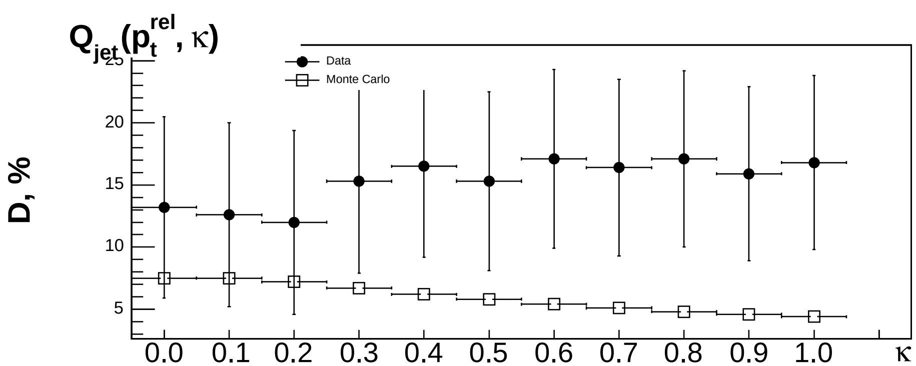




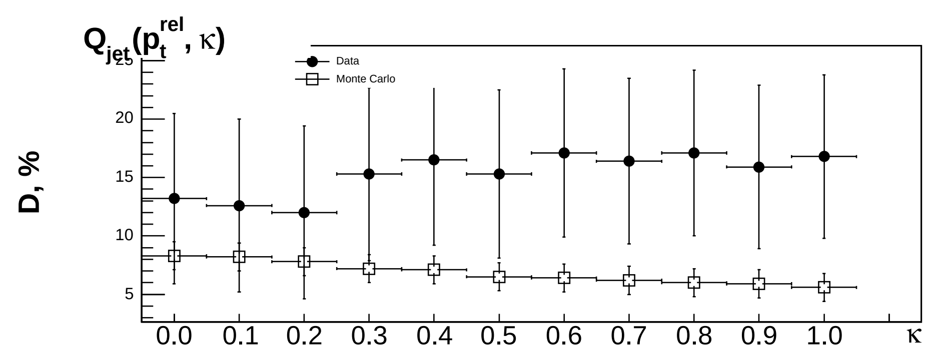
. Old MC New MC

Measured SST dilutions in data

	N_1	N_2	N_{NT}	N_{12}	$\bar{N}_{12}$	$\frac{N_{12}-\bar{N}_{12}}{N_{12}+\bar{N}_{12}}$	D_{OST}	D_{SST}^{meas}	D_{12}^{calc}	$\bar{D}_{12}^{calc}$	εD^2(calc), %
$Q_{jet}(p_t^{rel}, 0.1)$	13407±155	1134±43	9971±133	778±35	696±33	0.056±0.033	44.3 ± 2.2	12.6±7.4	53.9±5.7	33.5±7.1	2.852±0.999
$Q_{jet}(p_t^{rel}, 0.2)$	13471±156	1115±42	9908±132	784±36	705±33	0.053±0.033	44.3 ± 2.2	12.0±7.4	53.5±5.7	34.1±7.1	2.768±0.954
$Q_{jet}(p_t^{rel}, 0.3)$	13701±157	1087±42	9680±130	810±36	707±33	0.068±0.032	44.3 ± 2.2	15.3±7.4	55.8±5.5	31.1±7.2	3.292±1.212
$Q_{jet}(p_t^{rel}, 0.4)$	14030±159	1047±41	9354±128	836±37	722±34	0.073±0.032	44.3 ± 2.2	16.5±7.3	56.7±5.4	29.9±7.3	3.552±1.333
$Q_{jet}(p_t^{rel}, 0.5)$	14282±161	1002±40	9100±126	860±37	750±35	0.068±0.032	44.3 ± 2.2	15.3±7.2	55.8±5.4	31.1±7.1	3.357±1.237
$Q_{jet}(p_t^{rel}, 0.6)$	14554±162	1003±40	8828±124	864±37	742±35	0.076±0.032	44.3 ± 2.2	17.1±7.2	57.1±5.4	29.4±7.3	3.727±1.412
$Q_{jet}(p_t^{rel}, 0.7)$	14781±164	964±39	8602±122	881±38	762±35	0.073±0.031	44.3 ± 2.2	16.4±7.1	56.6±5.3	30.1±7.1	3.608±1.358
$Q_{jet}(p_t^{rel}, 0.8)$	15016±165	932±38	8366±120	900±38	773±36	0.076±0.031	44.3 ± 2.2	17.1±7.1	57.1±5.3	29.4±7.1	3.779±1.422
$Q_{jet}(p_t^{rel}, 0.9)$	15275±167	897±37	8106±118	915±38	794±36	0.070±0.031	44.3 ± 2.2	15.9±7.0	56.2±5.3	30.5±7.0	3.563±1.333
$Q_{jet}(p_t^{rel}, 1.0)$	15450±168	869±36	7927±116	931±39	802±36	0.074±0.031	44.3 ± 2.2	16.8±7.0	56.9±5.2	29.7±7.0	3.765±1.416



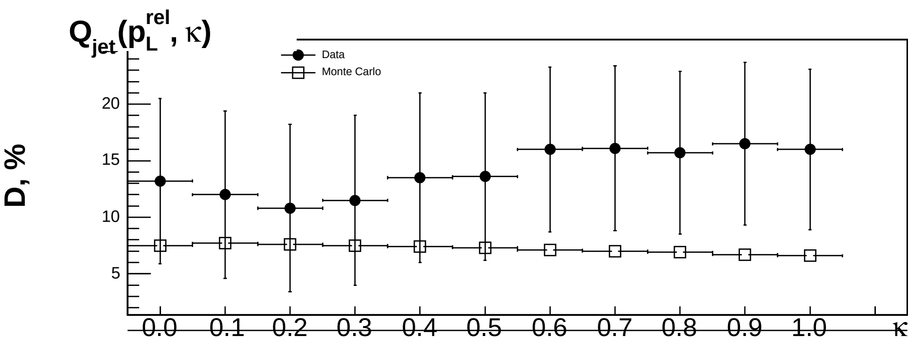
. Old MC

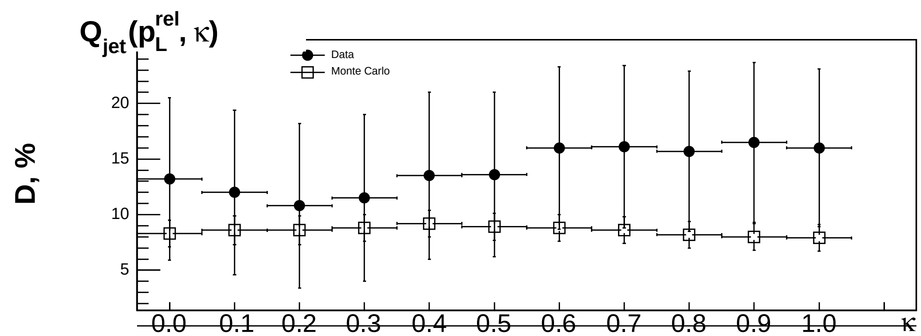


New MC

Measured SST dilutions in data

	N_1	N_2	N_{NT}	N_{12}	$\bar{N}_{12}$	$\frac{N_{12}-\bar{N}_{12}}{N_{12}+\bar{N}_{12}}$	D_{OST}	D_{SST}^{meas}	D_{12}^{calc}	$\bar{D}_{12}^{calc}$	εD^2(calc), %
$Q_{jet}(p_L^{rel}, 0.1)$	13391±155	1138±43	9987±133	776±35	697±33	0.053±0.033	44.3 ± 2.2	12.0±7.4	53.4±5.7	34.1±7.1	2.764±0.948
$Q_{jet}(p_L^{rel}, 0.2)$	13321±155	1141±43	10055±133	768±35	697±33	0.048±0.033	44.3 ± 2.2	10.8±7.4	52.6±5.8	35.1±7.0	2.615±0.863
$Q_{jet}(p_L^{rel}, 0.3)$	13376±155	1130±43	10005±133	776±36	701±34	0.051±0.033	44.3 ± 2.2	11.5±7.5	53.1±5.8	34.6±7.1	2.696±0.919
$Q_{jet}(p_L^{rel}, 0.4)$	13603±157	1106±42	9778±131	793±36	703±34	0.060±0.033	44.3 ± 2.2	13.5±7.5	54.6±5.7	32.7±7.2	2.991±1.087
$Q_{jet}(p_L^{rel}, 0.5)$	13846±158	1078±41	9533±129	804±36	713±34	0.060±0.033	44.3 ± 2.2	13.6±7.4	54.6±5.7	32.7±7.2	3.014±1.104
$Q_{jet}(p_L^{rel}, 0.6)$	14069±160	1051±41	9307±127	830±37	720±34	0.071±0.032	44.3 ± 2.2	16.0±7.3	56.3±5.5	30.5±7.3	3.450±1.298
$Q_{jet}(p_L^{rel}, 0.7)$	14345±161	1020±40	9032±125	847±37	734±35	0.071±0.032	44.3 ± 2.2	16.1±7.3	56.4±5.4	30.3±7.2	3.505±1.321
$Q_{jet}(p_L^{rel}, 0.8)$	14595±163	989±39	8780±123	861±37	749±35	0.070±0.032	44.3 ± 2.2	15.7±7.2	56.1±5.4	30.7±7.1	3.449±1.298
$Q_{jet}(p_L^{rel}, 0.9)$	14838±164	975±39	8535±121	872±38	753±35	0.073±0.032	44.3 ± 2.2	16.5±7.2	56.7±5.4	30.0±7.2	3.631±1.379
$Q_{jet}(p_L^{rel}, 1.0)$	15042±166	934±38	8331±120	893±38	775±36	0.071±0.031	44.3 ± 2.2	16.0±7.1	56.3±5.3	30.5±7.0	3.545±1.334





. Old MC

New MC

Summary

- Investigated 44 different SST algorithms with new unbiased Monte Carlo samples
  - 10 one-track taggers
  - 3 two-track taggers
  - 31 many-track tagger
- Taggers in groups are correlated to each other
- Selected best taggers from each group:
  - "Min. ΔR"
  - "$Q_{jet}(p_t, \kappa = 0.6)$"
- Used double-tagged events to measure SST dilution directly from data
  - Checked this technique on MC - seems to be OK
  - Dilutions in new Monte Carlo are higher than in old one $\Longrightarrow$ closer to the data