B-tagging

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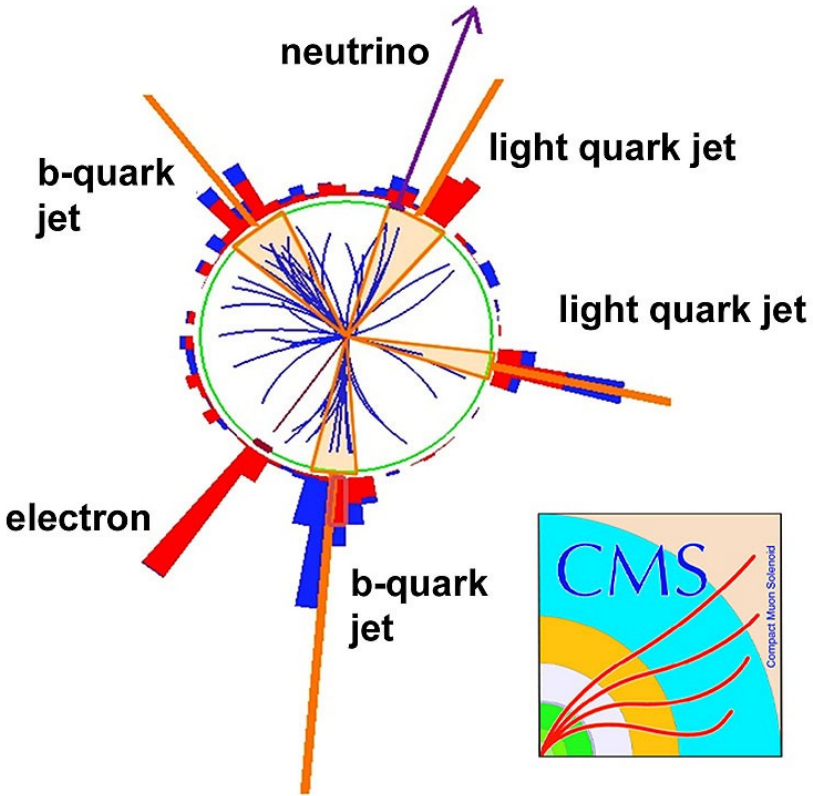
BSMS 2nd Year

Quark and their respective Jets

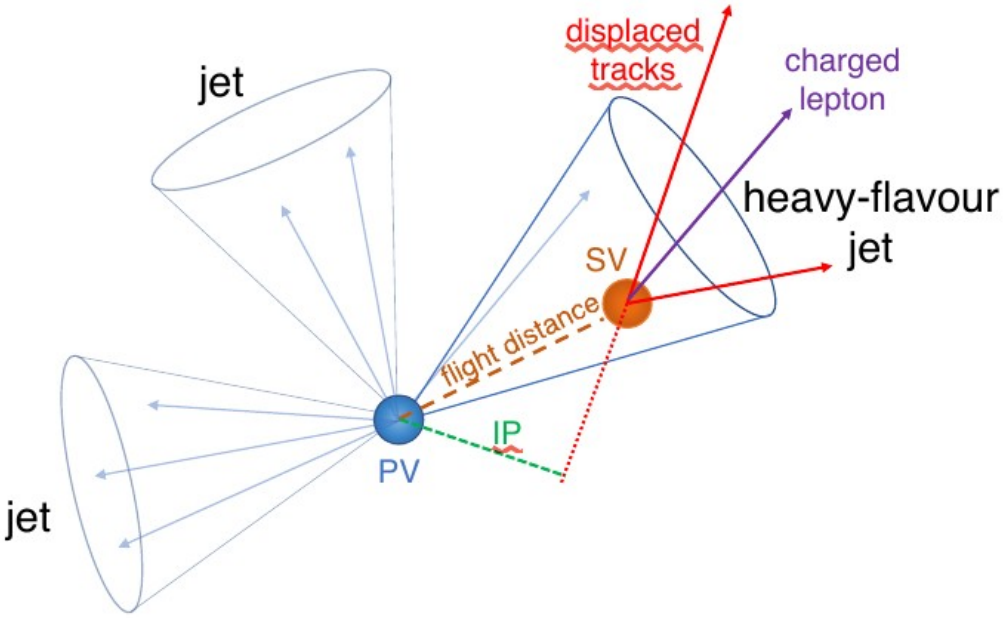


But how does one make sense of this spread of particles detected?
→ Jet reconstruction Algortithms

4 Vector, number and properties of constituents, Secondary vertex properties of each Reconstructed Jet

Secondary Vertex????

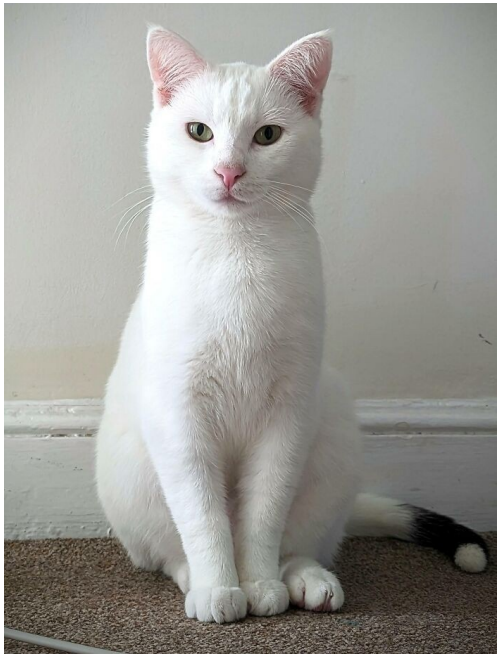
About SVX

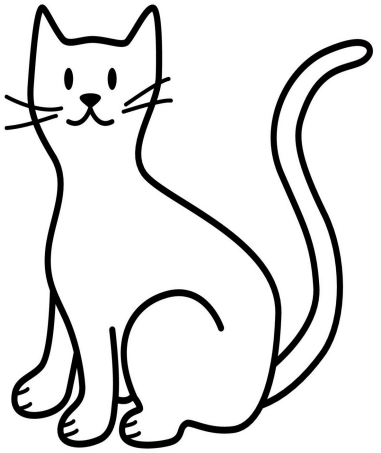


SVX is reconstructed from tracks displaced from the primary vertex

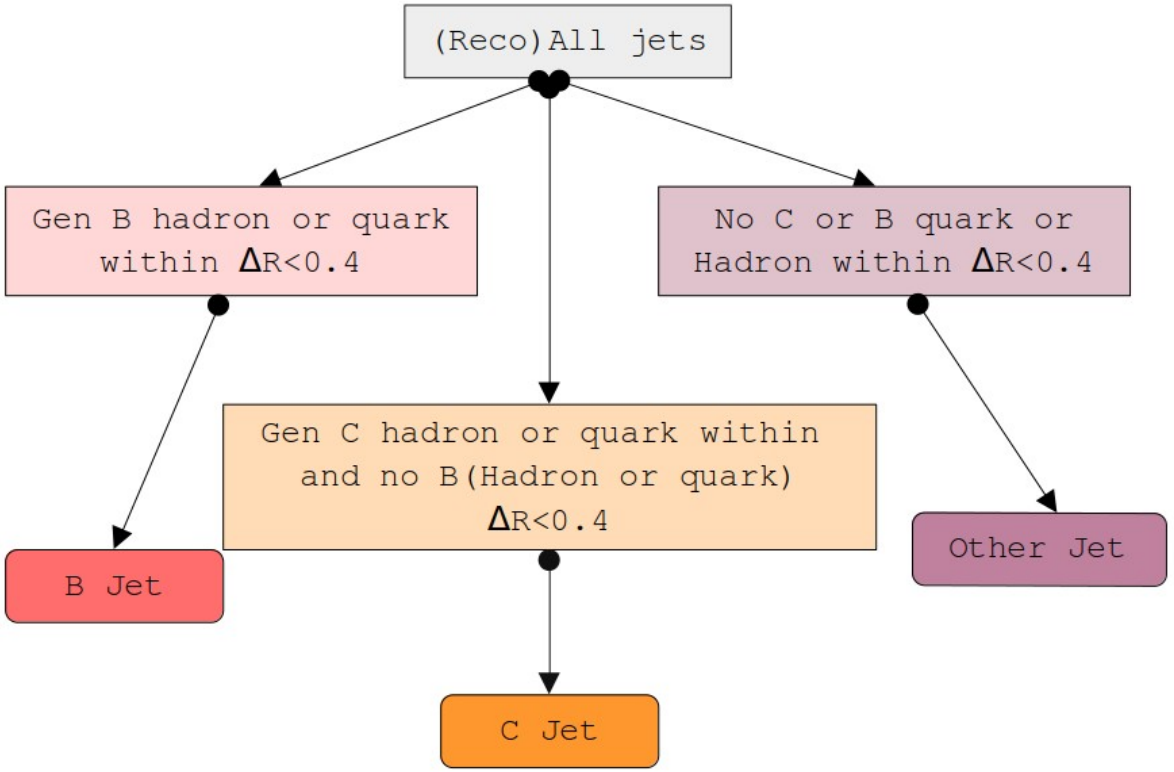
Generated and Reconstructed

- Using simulations , we generate collision events and produce detector signatures as we would for real collisions
- Then we use our usual reconstructing mechanisms to make reconstructed info



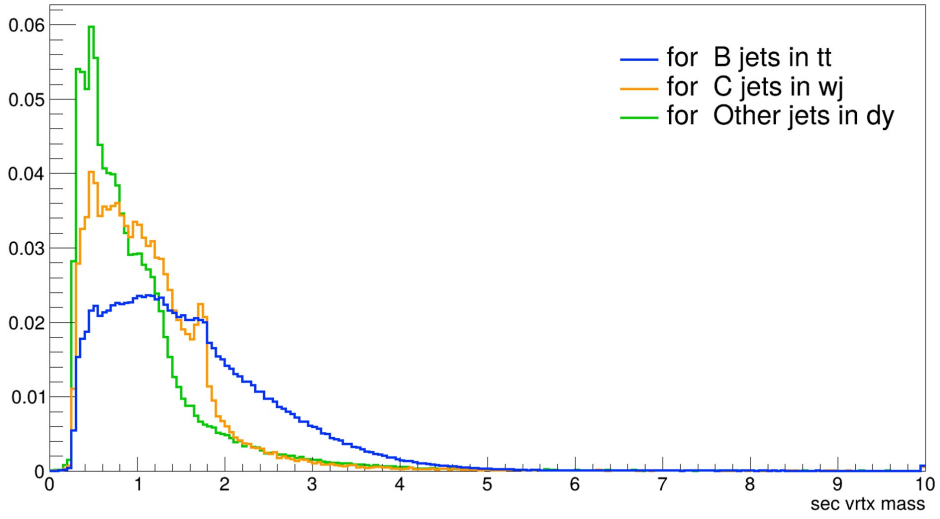


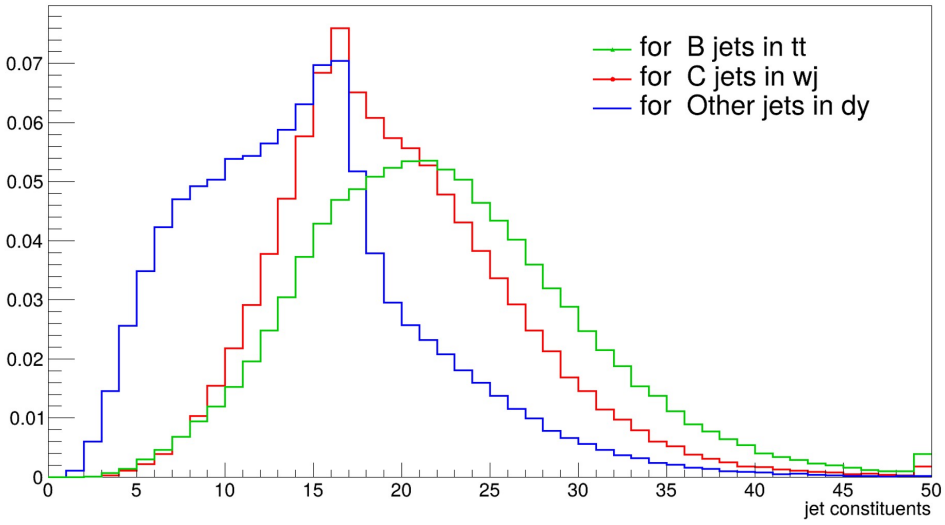
Sorting Jets based on Gen info



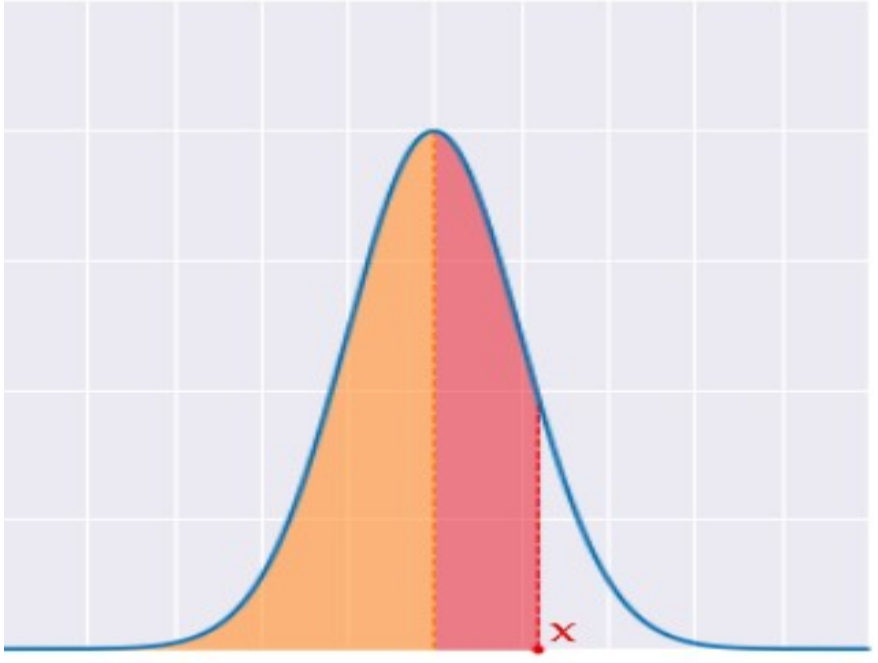
Secondary Vertices are also sorted similarly

A whole slew of propeties were plotted





Objective: find a range of these properties that preserve a “respectable” amount of Bjets while seperating them from others

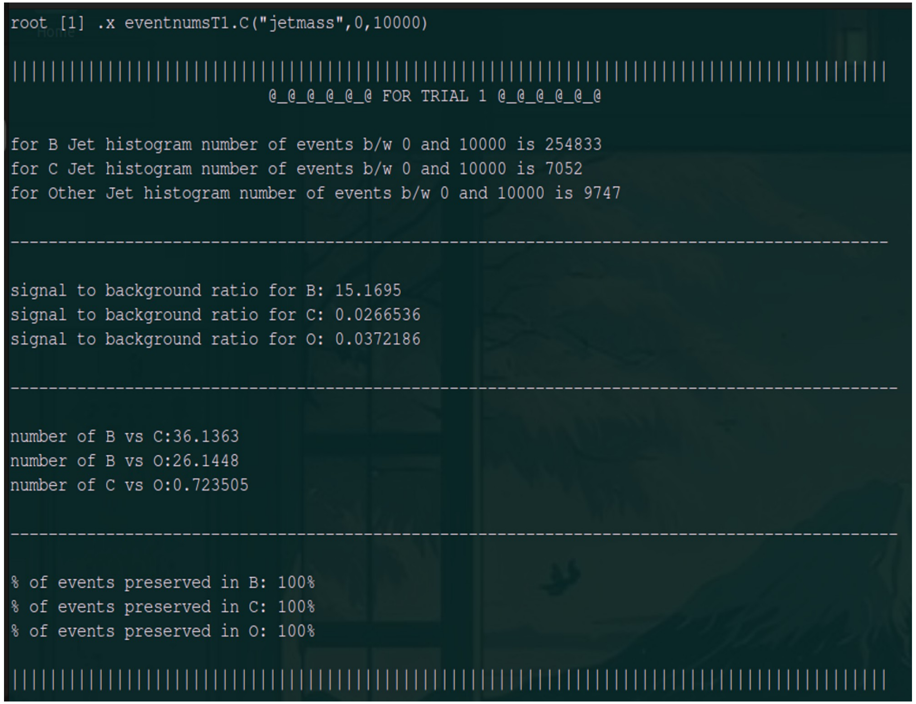


Respectable??

How much seperation??

Efficiency→how much of the Bjets were tagged as B Jets

MisId Rate→ how much of non B Jets were tagged as BJets



```
root [1] .x eventnumsT1.C("jetmass",0,10000)

||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||
                          @_@_@_@_@_@ FOR TRIAL 1 @_@_@_@_@_@

for B Jet histogram number of events b/w 0 and 10000 is 254833
for C Jet histogram number of events b/w 0 and 10000 is 7052
for Other Jet histogram number of events b/w 0 and 10000 is 9747

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signal to background ratio for B: 15.1695
signal to background ratio for C: 0.0266536
signal to background ratio for O: 0.0372186

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number of B vs C:36.1363
number of B vs O:26.1448
number of C vs O:0.723505

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% of events preserved in B: 100%
% of events preserved in C: 100%
% of events preserved in O: 100%

||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||
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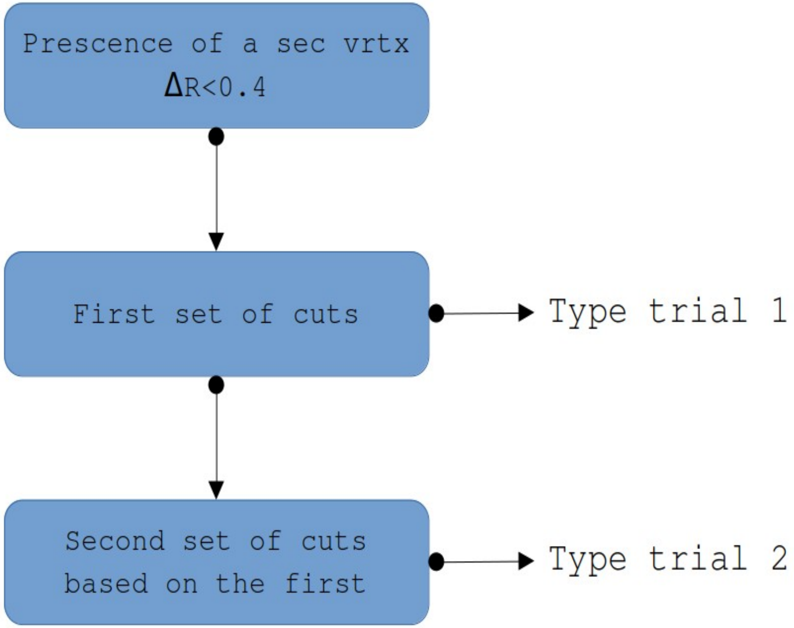


B-tagger trial 1

Cuts-all max sig w/ specified min preservation w/ no prev cuts

Preservation of B jets	**SV nTracks**	**SV mass**	**Jet mass**	**Jet nCons**	**ε_b**	**ε_c**	**ε_o**	**$\varepsilon_{b/\varepsilon o}$**	**$\varepsilon_{b/\varepsilon c}$**
>25%	(4,15)	(2,10)	>13	>29	1.693%	0.142%	0.055%	30.78	***11.92***
>50%	>3	(1,10)	>10	>2	8.332%	0.901%	0.230%	***36.22***	9.24
>75%	(2,5)	(0,10)	(8,1000)	>19	21.530%	3.463%	0.685%	31.43	6.21

B-tagger trial 2.1

Cuts- max sig w/ preservation specified for SV nTracks>3

Preservation of B jets	SV nTracks	SV mass	Jet mass	Jet nCons	ε_b	ε_c	ε_o	$\varepsilon_{b/\varepsilon o}$	$\varepsilon_{b/\varepsilon c}$
>25%	>3	>2.5	>15	(31,45)	0.995%	0.115%	0.045%	22.11	***8.65***
>50%	>3	>2	>12	(26,45)	0.245%	0.037%	0.012%	20.41	6.62
>75%	>3	>1	>9	(20,45)	0.368%	0.053%	0.016%	23.00	6.94
No other parameter	>3	--	--	--	15.954%	2.988%	0.655%	***24.35***	5.33

B-tagger trial 2.2

Cuts- max sig w/ preservation specified for Jetmass>10

Preservation of B jets	SV nTracks	SV mass	Jet mass	Jet nCons	ε_b	ε_c	ε_o	$\varepsilon_{b/\varepsilon o}$	$\varepsilon_{b/\varepsilon c}$
>25%	>4	>1	>10	>23	1.724%	0.139%	0.050%	34.48	***12.40***
>50%	>3	>0.5	>10	>28	5.510%	0.572%	0.155%	***35.54***	9.63
>75%	>2	>0	>10	>33	13.685%	2.190%	0.482%	33.22	6.24
No other parameter	--	--	>10	--	26.432%	6.639%	1.967%	13.43	3.98

B-tagger trial 2.3

Cuts- max sig w/ preservation specified for SV mass $\varepsilon(1,10)$

Preservation of B jets	SV nTracks	SV mass	Jet mass	Jet nCons	ε_b	ε_c	ε_o	$\varepsilon_{b/\varepsilon o}$	$\varepsilon_{b/\varepsilon c}$
>25%	>5	(1,10)	>15	>30	0.876%	0.065%	0.028%	31.28	***13.47***
>50%	>4	(1,10)	>12	>25	3.506%	0.282%	0.089%	***39.39***	12.43
>75%	>3	(1,10)	>9	>20	10.564%	1.285%	0.031%	34.07	8.22
No other parameter	--	(1,10)	--	--	28.587%	8.888%	2.405%	11.86	3.21

B-tagger trial 2.4

Cuts- max sig w/ preservation specified for Jet cons>23

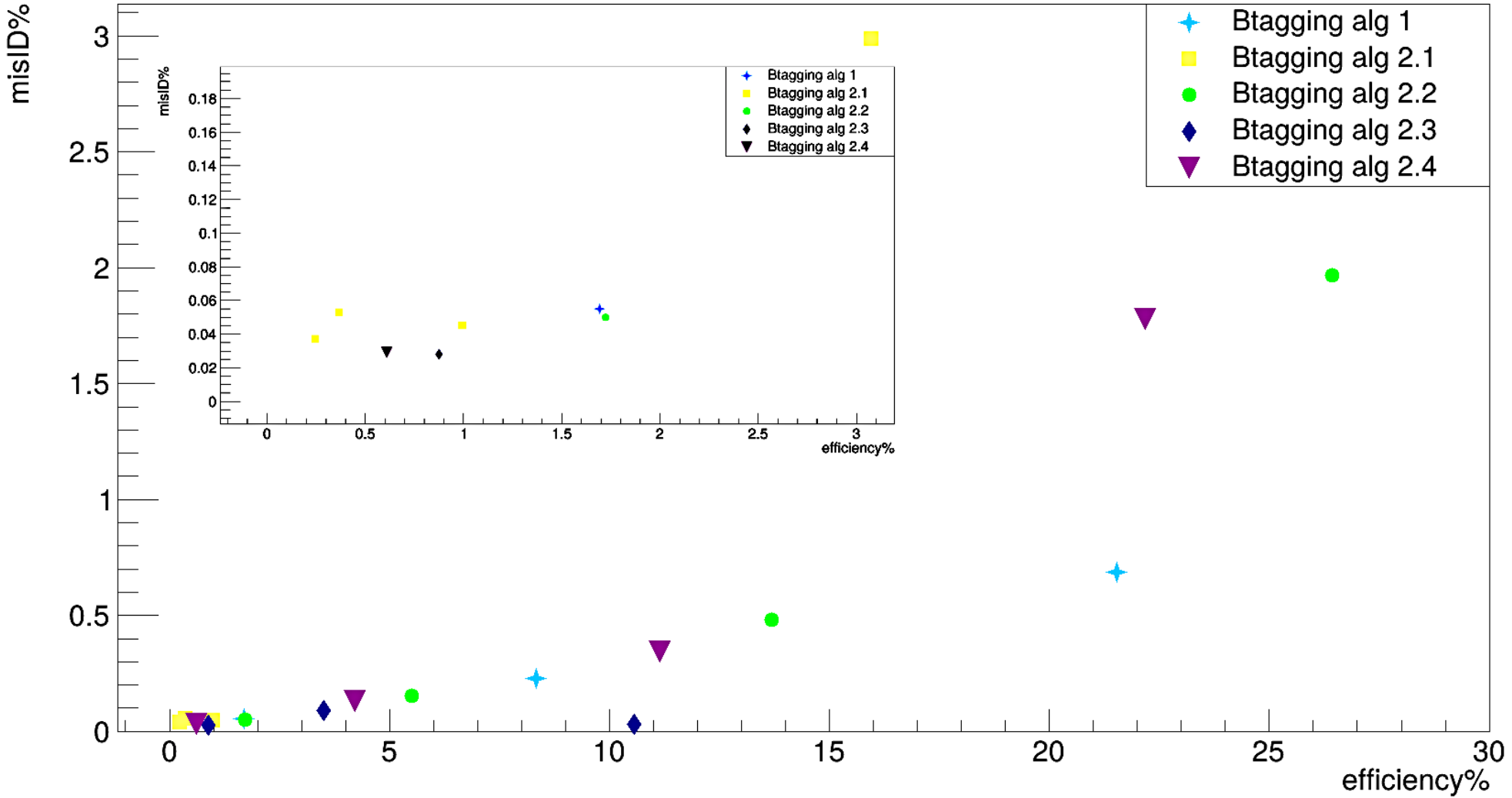
Preservation of B jets	SV nTracks	SV mass	Jet mass	Jet nCons	ε_b	ε_c	ε_o	$\varepsilon_{b/\varepsilon o}$	$\varepsilon_{b/\varepsilon c}$
>25%	>5	>2	>18	>23	0.610%	0.072%	0.029%	21.03	8.47
>50%	>3	>1.5	>14	>23	4.213%	0.418%	0.129%	***32.65***	***10.07***
>75%	>2	>1	>11	>23	11.150%	1.541%	0.344%	32.41	7.23
No other parameter	--	--	--	>23	22.182%	5.907%	1.776%	12.48	3.75

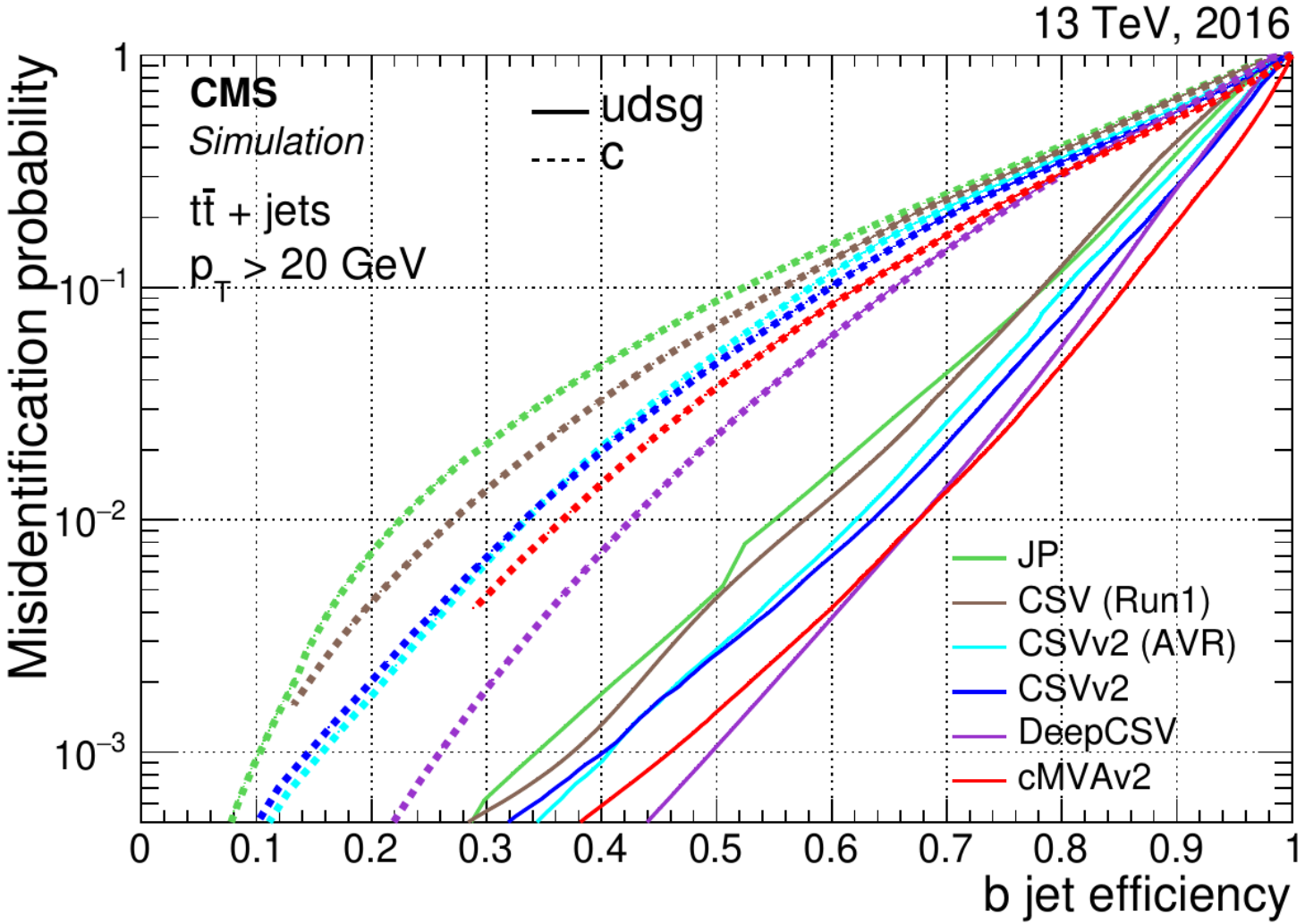
- – Best performance in $\varepsilon_b/\varepsilon_o$
- – Worst performance in $\varepsilon_b/\varepsilon_o$
- – Best performance in $\varepsilon_b/\varepsilon_c$
- – Worst performance in $\varepsilon_b/\varepsilon_c$
- – Highest ε_b
- – Lowest ε_b

Trial	SV nTrack	SV mass	Jet mass	Jet nCons	ε_b	ε_c	ε_o	$\varepsilon_{b/\varepsilon o}$	$\varepsilon_{b/\varepsilon c}$
2.3	--	(1,10)	--	--	28.587%	8.888%	2.405%	11.86	3.21
2.3	>5	(1,10)	>15	>30	0.876%	0.065%	0.028%	31.28	***13.47***
2.3	>4	(1,10)	>12	>25	3.506%	0.282%	0.089%	***39.39***	12.43
2.1	>3	>2	>12	(26,45)	0.245%	0.037%	0.012%	20.41	6.62

- Best performance in $\varepsilon_b/\varepsilon_o$
- Worst performance in $\varepsilon_b/\varepsilon_o$
- Best performance in $\varepsilon_b/\varepsilon_c$
- Worst performance in $\varepsilon_b/\varepsilon_c$
- Highest ε_b
- Lowest ε_b

Efficiency vs misID





Plot from CMS ID of heavy flavour jets using different NN

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Acknowledgements

Thank You!