study of new jet-clustering

Junping Tian (KEK)

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status

original

$$J_\beta(P_\alpha) \equiv E_\alpha - \beta \frac{P_\alpha^2}{E_\alpha} = E_\alpha \left[(1-\beta) + \beta v_\alpha^2\right]$$

my variant

$$J(P_\alpha) = E_\alpha(1 - \frac{M_\alpha}{\Lambda})$$

Λ is kind of virtuality scale, can be tuned

- original version implemented; one variant invented
- a first look at jet purities, going to take a look at Higgs mass
- tuning of either β or Λ is similar tuning of y cut
- for some jets it works same as durham, which seems promising that at least similar performance would be expected
- feature of global clustering might be helpful to incorporate likelihood of color-singlet system
- next step is to figure out what's the possible best likelihood for color-singlet system, and how to combine with jet function

new clustering code: kekcc:~tianjp/analysis/PostDBD/GeorgiClustering

a first look at new GeorgiClustering

jet purity check: energy fractions from color-singlet systems

Jet function:

$$J_\beta(P_\alpha) \equiv E_\alpha - \beta \frac{P_\alpha^2}{E_\alpha} = E_\alpha \left[(1-\beta) + \beta v_\alpha^2\right] ,$$

original, β=1

event #1

------------ Jets from Georgi Clustering (original, beta = 1)-----------

Jet	Mass	Energy	Func	Norm	CS	E1(%)	E2(%)	E3(%)	E4(%)	Np
0	115.436	184.199	111.856	0.607258	1	63.0903	36.9097	0	0	34
1	7.81184	97.4018	96.7753	0.993568	1	100	0	0	0	12
2	11.0048	44.2489	41.512	0.938147	2	0	100	0	0	21
3	0.251736	1.05797	0.998075	0.943384	2	0	100	0	0	2

------------ Jets from Durham Clustering-----------

Jet	Mass	Energy	Func	Norm	CS	E1(%)	E2(%)	E3(%)	E4(%)	Np
0	34.766	117.681	-18.6956	-0.158867	2	42.6426	57.3574	0	0	32
1	7.81187	97.4018	72.0388	0.739604	1	100	0	0	0	12
2	3.68404	67.5756	59.2773	0.877199	1	97.7118	2.28824	0	0	4
3	11.0048	44.2489	28.0172	0.633173	2	0	100	0	0	21

benchmark code: kekcc:~tianjp/analysis/PostDBD/JetBenchmark

a first look at new GeorgiClustering

Jet function: original

$$J_\beta(P_\alpha) \equiv E_\alpha - \beta \frac{P_\alpha^2}{E_\alpha} = E_\alpha \left[(1-\beta) + \beta v_\alpha^2\right] ,$$

my variant

$$J(P_\alpha) = E_\alpha(1 - \frac{M_\alpha}{\Lambda})$$

Λ is kind of virtuality scale, can be tuned

event #1

------------ Jets from Georgi Clustering (my variant, scale = 60)------------

Jet	Mass	Energy	Func	Norm	CS	E1(%)	E2(%)	E3(%)	E4(%)	Np
0	7.81184	97.4018	72.0389	0.739605	1	100	0	0	0	12
1	11.5319	95.189	58.5986	0.615603	2	44.2007	55.7993	0	0	17
2	3.68404	67.5756	59.2773	0.877199	1	97.7118	2.28824	0	0	4
3	11.0048	44.2489	28.0173	0.633174	2	0	100	0	0	21
4	12.1619	22.4922	13.374	0.594605	2	36.0481	63.9519	0	0	15

------------ Jets from Durham Clustering-----------

Jet	Mass	Energy	Func	Norm	CS	E1(%)	E2(%)	E3(%)	E4(%)	Np
0	34.766	117.681	-18.6956	-0.158867	2	42.6426	57.3574	0	0	32
1	7.81187	97.4018	72.0388	0.739604	1	100	0	0	0	12
2	3.68404	67.5756	59.2773	0.877199	1	97.7118	2.28824	0	0	4
3	11.0048	44.2489	28.0172	0.633173	2	0	100	0	0	21

a first look at new GeorgiClustering

my variant

$$J(P_\alpha) = E_\alpha(1 - \frac{M_\alpha}{\Lambda})$$

event #2

------------ Jets from Georgi Clustering (my variant, scale = 60)-----------

Jet	Mass	Energy	Func	Norm	CS	E1(%)	E2(%)	E3(%)	E4(%)	Np
0	16.1515	116.933	53.9781	0.461617	2	23.2905	76.7095	0	0	24
1	11.2229	55.8273	34.9426	0.625905	2	0	100	0	0	25
2	15.801	61.2749	29.0014	0.473301	1	91.2497	8.75035	0	0	32
3	7.93389	41.463	30.4975	0.735537	1	98.495	1.50504	0	0	14
4	22.9611	27.6794	6.4944	0.234629	2	29.9444	70.0556	0	0	36

------------ Jets from Durham Clustering-----------

Jet	Mass	Energy	Func	Norm	CS	E1(%)	E2(%)	E3(%)	E4(%)	Np
0	43.9904	150.39	-70.1338	-0.466346	2	27.4482	72.5518	0	0	57
1	17.0479	61.9552	26.7483	0.431736	2	5.02137	94.9786	0	0	35
2	7.8502	47.4272	35.0168	0.738327	1	97.6037	2.39633	0	0	22
3	11.2406	43.4048	27.1416	0.625313	1	95.8272	4.17277	0	0	17

back up

implementation of Georgi Jet-Clustering

- a test version of GeorgiClustering has been implemented, with #mini-jet = 25. (kekcc:~tianjp/analysis/PostDBD/GeorgiClustering)
- number of combinations = 2^{25} ~ 32M, CPU time ~ 10s /event.
- several bugs in SatoruJetFinder have been found and fixed when we need more then 20 mini-jets. (kekcc:~tianjp/soft/MarlinReco/v01-10)
- surprisingly found that FastJetClustering(Processor) in current ilcsoft only supports kt type clustering; need a few efforts to support Durham (some one interested welcome to go ahead).

Jet function:

$$J_\beta(P_\alpha) \equiv E_\alpha - \beta \frac{P_\alpha^2}{E_\alpha} = E_\alpha \left[(1-\beta) + \beta v_\alpha^2\right] ,$$

a first look at new GeorgiClustering

original

$$J_\beta(P_\alpha) \equiv E_\alpha - \beta\frac{P_\alpha^2}{E_\alpha} = E_\alpha\left[(1-\beta) + \beta v_\alpha^2\right]$$

generalized

$$J_\beta^{(n)}(P_\alpha) \equiv E_\alpha^n\left[(1-\beta) + \beta v_\alpha^2\right]$$

- a practical issue is to decide value of β, which is essentially a degree of penalty to jet virtuality.
- I started with constant β from 1 to N…, found 1 may be too small, would be somewhere between 3~4, still working on that.
- I found most probably the β needs be tuned, to reflect different jet sub-structure; one variant is being investigated.
- I'm now looking at some benchmark, purity of jet, color singlet, etc…

see following slides