$h \rightarrow \tau^+\tau^-$ BR Study
kT clustering & tau finder
for 500 GeV $\nu\bar{\nu}h$

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kT clustering & tau finder

- I need proper R-value of kT clustering to get good performance.

- Now using R = 1.0 case at 500 GeV $\nu\bar{\nu}h$, but not optimized.

- Besides, I did not checked the matching of the tau finder.

- I checked the tau finder performance as the function of R-value.

kT clustering

# of PFOs	come from Higgs	come from not Higgs
All PFO	96641	153216
$R = 0.5$	89190 (92.3 %)	7824 (5.11 %)
$R = 0.6$	90011 (93.1 %)	10702 (6.98 %)
$R = 0.7$	90651 (93.8 %)	13851 (9.04 %)
$R = 0.8$	91180 (94.3 %)	17313 (11.3 %)
$R = 0.9$	91590 (94.8 %)	21260 (13.9 %)
$R = 1.0$	92033 (95.2 %)	25428 (16.5 %)
$R = 1.1$	92368 (95.6 %)	29833 (19.5 %)
$R = 1.2$	92700 (95.9 %)	34473 (22.5 %)
$R = 1.3$	92999 (96.2 %)	39544 (25.8 %)
$R = 1.4$	93286 (96.5 %)	44776 (29.2 %)
$R = 1.5$	93562 (96.8 %)	50256 (32.8 %)

← now using

Check the tau finder performance

- I updated my code to get the MC information of the PFOs in the reconstructed tau candidate, and get the parent of that particles.

- (Parent == Higgs) is OK. (Parent != Higgs) is NOT OK, it means that the overlay PFOs are combined in the reconstructed tau candidate.

- I combined most energetic τ^+ and τ^- as the Higgs boson candidate, so I checked the matching in the energetic tau candidates, as the function of R-value.

Matching results

OK = come from Higgs
not = not come from Higgs

# of PFOs	R = 0.5 OK	not	R = 0.6 OK	not	R = 0.7 OK	not	R = 0.8 OK	not	R = 0.9 OK	not
τ^- charged	18296	501	18278	654	18245	753	18221	863	18195	992
τ^- neutral	20935	1099	21031	1415	21078	1645	21089	1897	21075	2082
τ^+ charged	18449	479	18418	616	18387	714	18332	823	18290	906
τ^+ neutral	20989	1210	21073	1538	21093	1791	21080	2011	21078	2183

# of PFOs	R = 1.0 OK	not	R = 1.1 OK	not	R = 1.2 OK	not	R = 1.3 OK	not	R = 1.4 OK	not
τ^- charged	18164	1083	18098	1157	17980	1213	17861	1257	17742	1256
τ^- neutral	21066	2258	21020	2415	20926	2506	20786	2633	20687	2687
τ^+ charged	18257	978	18172	1044	18072	1083	17972	1109	17870	1131
τ^+ neutral	21063	2337	20998	2448	20938	2536	20843	2644	20719	2711

now using

Matching results
as the function of R-value

- For charged PFOs: 3 - 8% of charged PFOs are mis-combined

- For neutral PFOs: 5 - 13% of neutral PFOs are mis-combined

- Now using R = 1.0: ~5% charged PFOs and ~10% neutral PFOs are mis-combined to tau candidates.

- If I use R = 0.5, ~3% charged PFOs and ~5% neutral PFOs are mis-combined. It looks better than R = 1.0.

Summary & Plans

- I checked the tau finder performance as the function of R-value.

- R = 1.0 case: ~5% charged PFOs and ~10% neutral PFOs are mis-combined.

- Performance of R = 0.5 looks better than R = 1.0… ---> Now I'm analyzing R = 0.5 case.

- JPS Meeting in next September @ Saga: not registered yet, but I will register and give a talk