



TOHOKU
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LCFIPlus Performance Tests

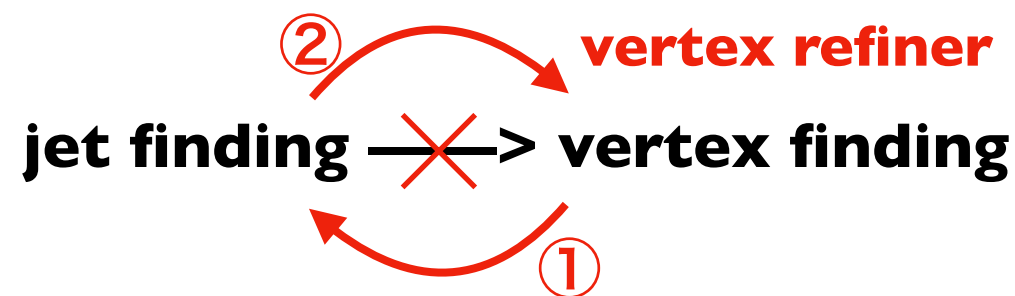
Ryo Yonamine (Tohoku University)

**54th General ILC physics meeting
18th Nov. 2017**

What's LCFIPlus?

It's Jet flavour identification tools!

- **Originated from LCFIVertex**



- Assign vertices to jets if necessary
- Find single track vertices (“pseudo-vtx”)
- Force two vertices

- **Implemented in iLCSoft, but not necessarily.**
- **Now it is becoming the standard in LC physics.**
- **Developpers :**
T. Tanabe, T. Suehara, M. Kurata, J. F. Strube

RY has just joined.

1 D. Bailey, et al., The LCFIVertex package: vertexing, flavour tagging and vertex charge reconstruction with an ILC vertex detector, Nucl.Instrum.Meth. A610 (2009) 573–589.

Urgent matter of LCFIPlus

- ▶ **iLCSoft has been intensively developed for coming MC mass-production (MP).**
- ▶ **Jet clustering part in LCPFPlus can be user option, while vertex finding part is common for most process and thus it is to be performed in the MP.**
- ▶ **It means the performance, especially of vertex finding part, must be checked before the MP.**

LCFIPlus performance tests

How ?

Comparing with the previous results that is already published.

NIM A 808 (2016) 109 - 116

Test samples:

- - **bb~**(~35k), **cc~**(~40k), **qq~** (q= u,d,s) (~40k)
- - $\sqrt{s}=91.2\text{GeV}$,
- **W/O ISR**,
- **ILD_I4_v02** (from DD4hep) (not yet **ILD_s4_v02**)
- **ilcsoft v01-19-04**
- **produced by Miyamoto-san in August 2017**
- **data directory :**

/hsm/ilc/grid/storm/prod/ilc/mc-opt/ild/rec/91-nobeam/
flavortag/ILD_I4_v02/v01-19-04_lcgeo/00008622/000/*

Issues with these samples :

- **Known problem** with detector geometry (v01-19-04)
- **No RecoMCTruthLink collection** (bugs in Marlin).
- **Temporarily MarlinTrkTracksMCTruthLink collection used.**
(For a particle associated more than 2 tracks, the first track entry is always used.)
- **This can affect our results to some extent.**

Vertex finding result (bb~ sample used)

Categorize tracks by their origins using MC info

Reference(Table2)

Track origin	Primary
Total number of tracks	496897
Tracks in secondary vertices	0.6%
... from the same decay chain	—
... from the same parent particle	—
Track origin	Bottom
Total number of tracks	258299
Tracks in secondary vertices	57.5%
... from the same decay chain	56.6%
... from the same parent particle	32.2%
Track origin	Charm
Total number of tracks	247352
Tracks in secondary vertices	64.3%
... from the same decay chain	63.4%
... from the same parent particle	38.9%
Track origin	Others
Total number of tracks	56432
Tracks in secondary vertices	2.5%
... from the same decay chain	1.9%
... from the same parent particle	1.2%

This test

329521

0.9%

182606

57.5%

59.3%

33.9%

167334

64.8%

63.6%

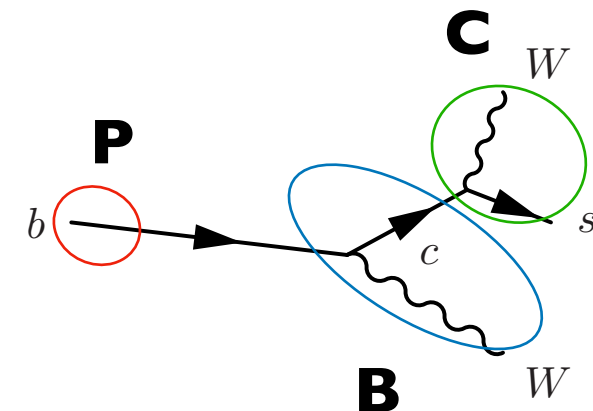
38.9%

36508

6.6%

5.9%

1.6%



Need tighter V0 rejection??
To be checked with new samples.

Vertex refiner results

bb~

Reference(table3)

(#vtx, #pseudo-vtx)	<i>b</i> jet
(0, 0)	21.3%
(0, 1)	1.61%
(1, 0)	39.7%
(1, 1)	13.5%
(2, 0)	23.8%

cc~

(#vtx, #pseudo-vtx)	<i>c</i> jet
(0, 0)	59.3%
(0, 1)	0.17%
(1, 0)	39.8%
(1, 1)	0.54%
(2, 0)	0.19%

qq~

(#vtx, #pseudo-vtx)	<i>uds</i> jet
(0, 0)	98.1%
(0, 1)	0.01%
(1, 0)	1.80%
(1, 1)	0.02%
(2, 0)	0.04%

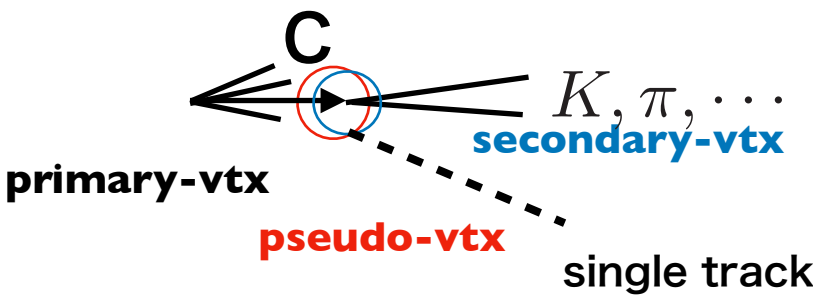
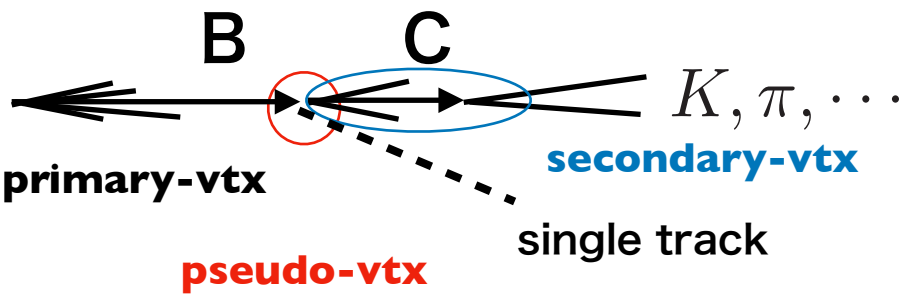
This test

20.3 %
1.68 %
37.9 %
18.6 %
21.5 %

59.1 %
0.19 %
39.9 %
0.72 %
0.11 %

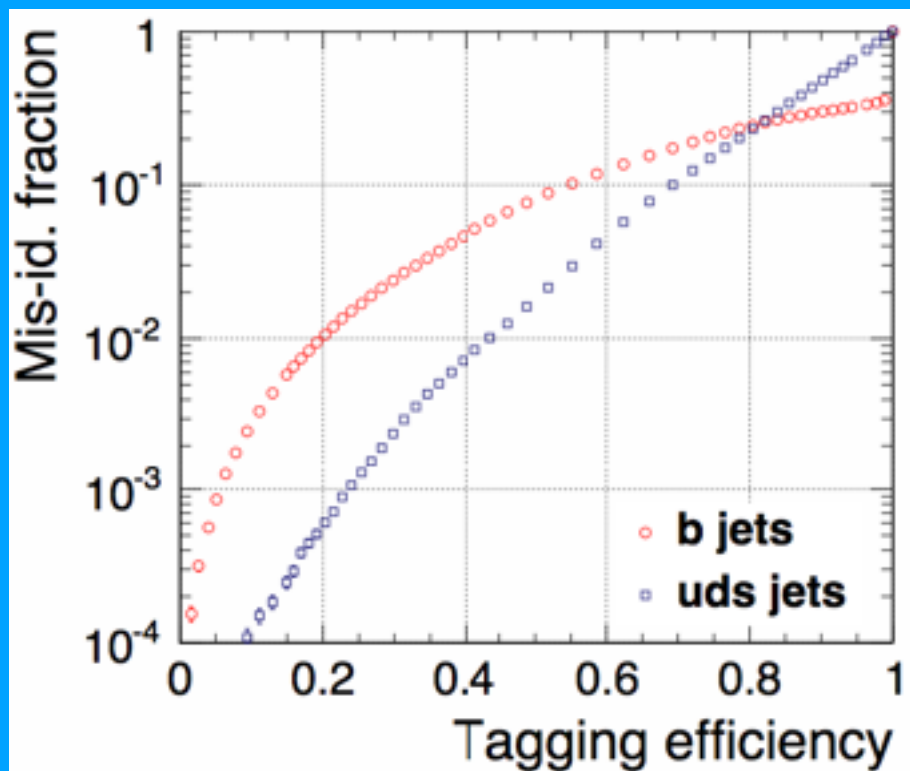
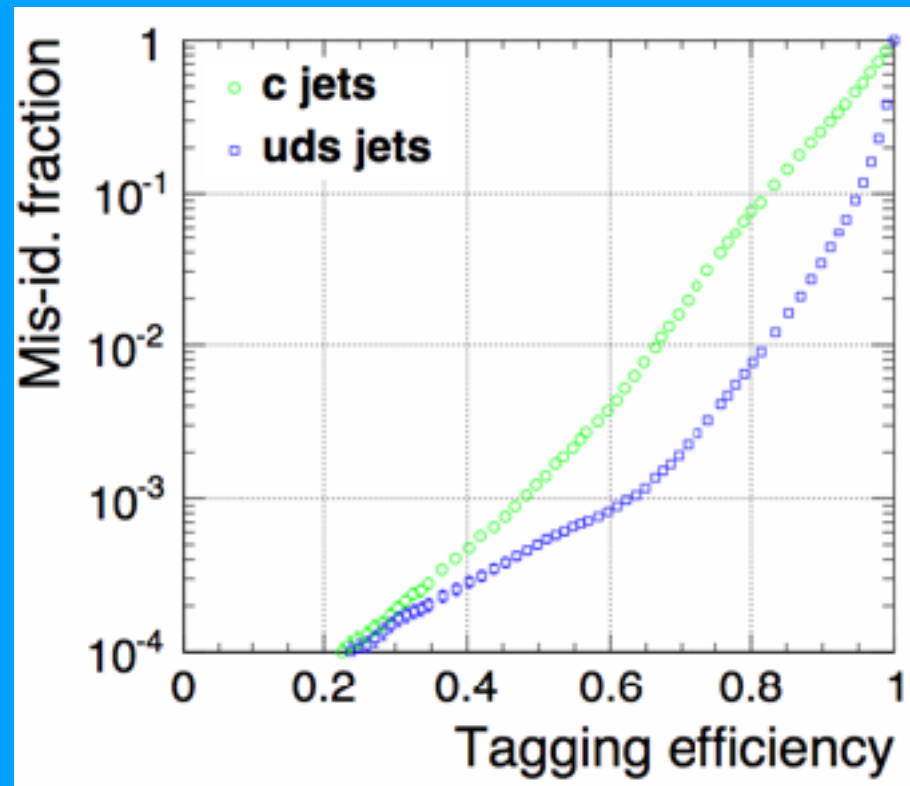
99.0 %
0.02 %
0.93 %
0.03 %
0.03 %

Forced two vertices at maximum

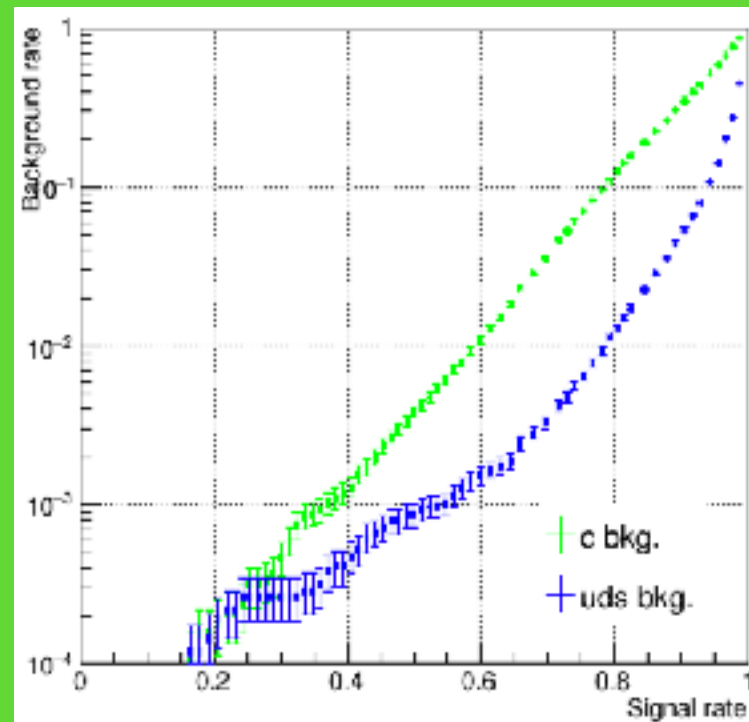


flavour tagging results (TMVA outputs)

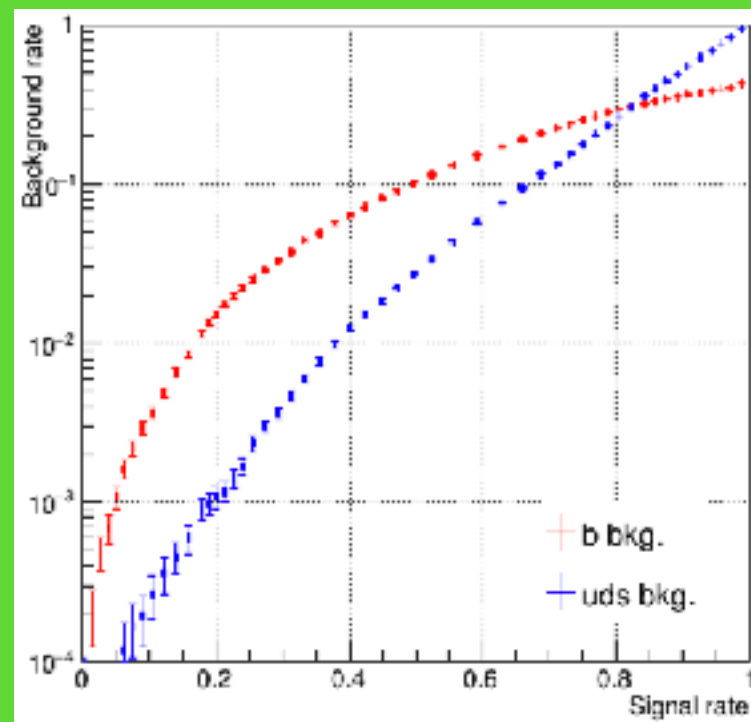
reference (Fig.1)



This test



**b-tagging
performance
(Mis-id probability)**



**c-tagging
performance
(Mis-id probability)**

Conclusion

- ▶ **We checked LCFIPlus performances with relatively new samples (ilcsoft v01-19-04).**
- ▶ **The results shows there is no disaster.
Some differences are to be understood (after checking with new samples?).**
- ▶ **We are ready to test LCFIPlus with next samples produced with ilcsoft v01-19-05.**