

Status of LCFIVertex

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LCFIVertex

Tracking

Particle Flow
(Pandora)

Jet Clustering
(Durham)

Vertex Finder
(ZVTOP)

Flavor Tagging
with Neural
Net

Vertex Charge
Reconstruction

LCFIVertex Package

status of LCFIVertex

- work on LCFIVertex has been on hold since ~2007
- the work by UK group is now well-documented; NIM paper published
- Asia group will take over responsibilities for maintenance and development

The LCFIVertex package: vertexing, flavour tagging and vertex charge reconstruction with an ILC vertex detector

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and the LCFI Collaboration:

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Z. Zhang¹

NIM A 610 (2009) pp. 573-589 [arXiv:0908.3019]

LCFIVertex tasks

- fundamental improvements
 - jet-clustering, flavor-tagging
- impact on detector optimization
 - parton charge identification
 - performance check using beam background
- maintenance work
 - validation of LCFIVertex results when other code changes
 - more consistent LCIO output, monitoring tools

LCFIVertex task list

details next slides.

completion target: 2010 Q4

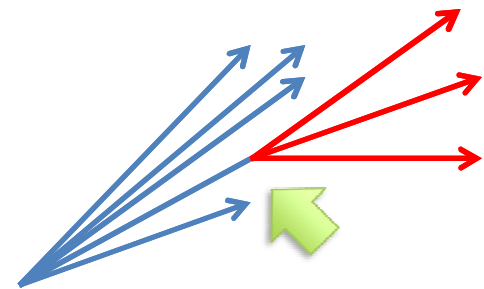
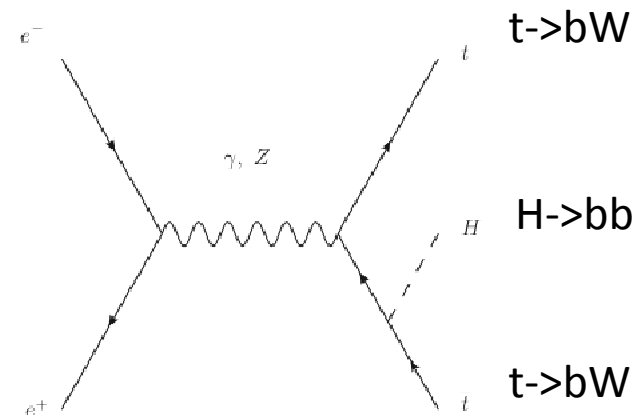
task	assignment
jet clustering / flavor tagging	T. Suehara, T. Tanabe
parton charge identification	T. Saito
validation	Y. Takubo
maintenance/coordination	H. Ono, A. Miyamoto
FPCCD digitizer	K. Yoshida, Y. Takubo

see talk by K. Yoshida after this talk

mew email list for LCFIVertex development
SVN accounts are set up (thanks to Frank)
people with permanent positions are responsible

jet clustering & flavor tagging

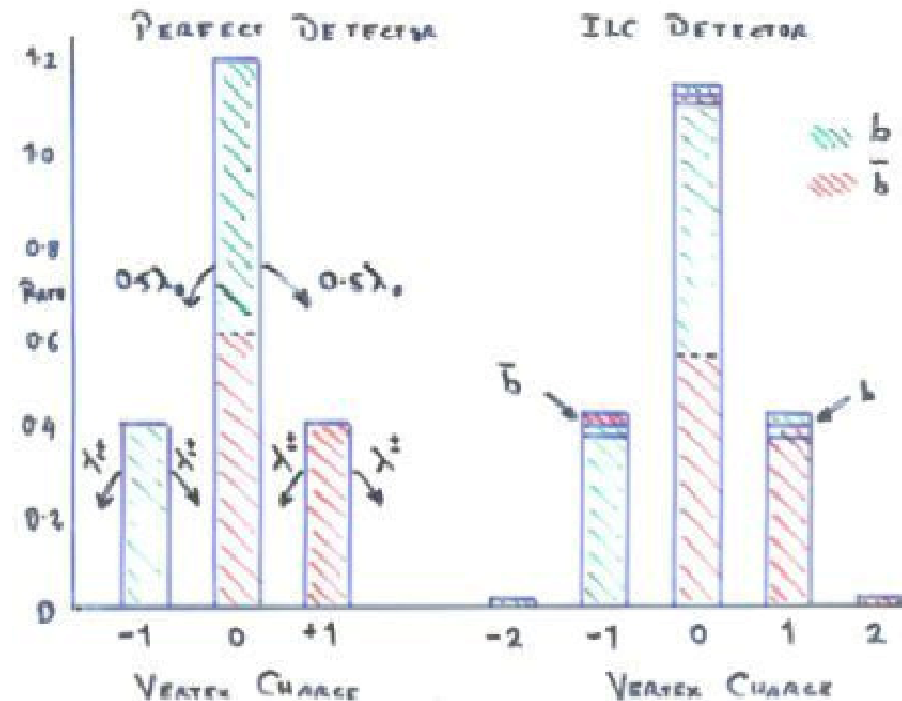
- many important analysis targets have multi-jet final states (ZHH, ttH, etc)
 - improvement in jet-clustering/flavor-tagging is essential
- jet-clustering could be improved by:
 - use of vertex information
 - physics-motivated jet finding (mass-like constraint)
- flavor-tagging could be improved in principle by:
 - using jet substructure information (sub-jets, multiplicity)
 - considering more discriminating variables (especially those which are not currently included in the neural net)
- current implementation: Marlin processor which invokes SatoruJetFinder (Fortran code)
 - C++ code has been written for various algorithms
 - Jade, Durham, Cambridge, (Cheated)
 - provides a playing ground for new ideas in jet clustering



parton charge ID

- motivated e.g. by measurement of A_{LR} in $Z \rightarrow b\bar{b}/c\bar{c}$
- provides quantitative tools to optimize the detector
 - basically the track momentum cut should be as low as possible and the beam pipe as thin as possible
- performance check for two-jet events is available; will check for many-jet events.

imperfections e.g.
due to missed tracks



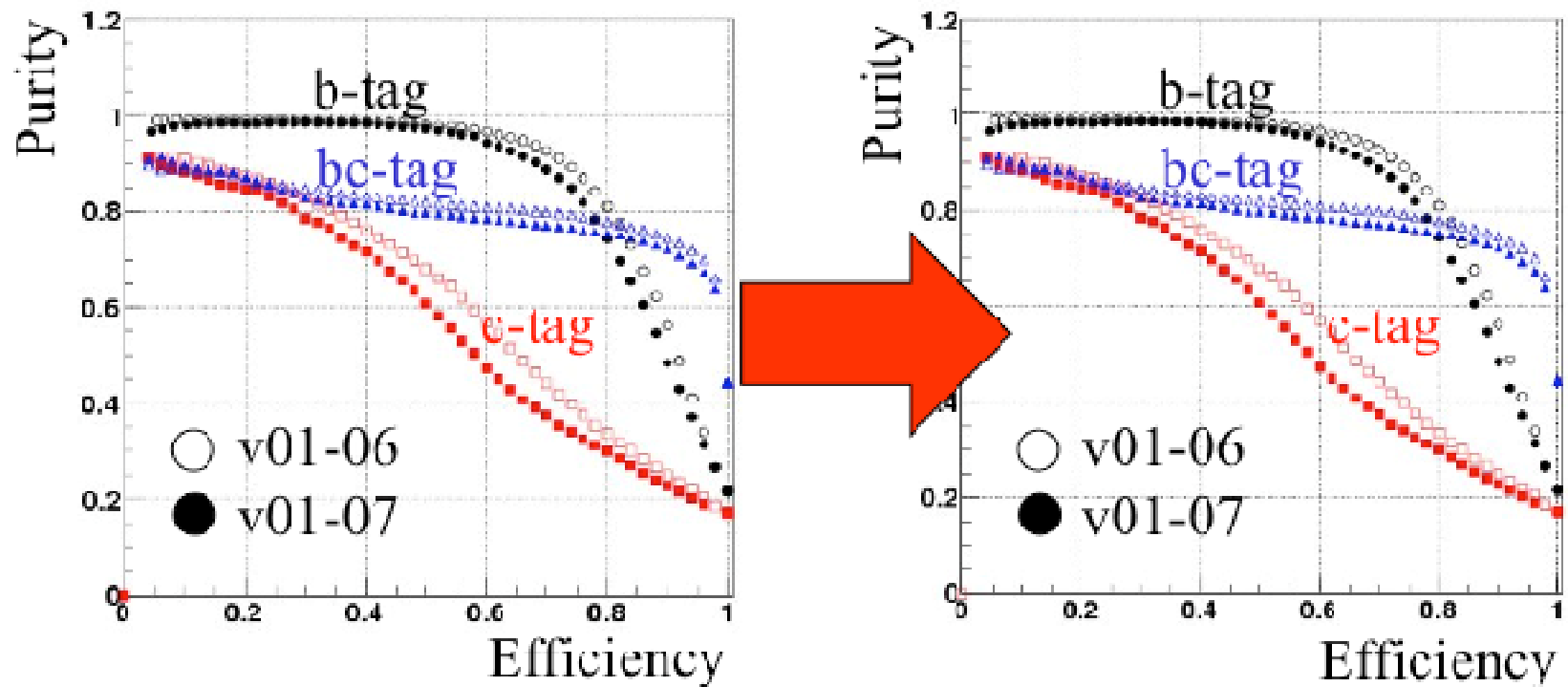
Chris Damerell

comparison of ilcsoft v01-06 vs. v01-07

The performance of ilcsoft v07 was compared with ilcsoft v06.

- v06: 20,000 events
- v07: 3000 events \rightarrow 10,000 events

The performance is still worse than v06.



summary

- after a short hiatus, the development and maintenance of LCFIVertex will now continue
- ongoing and planned studies
 - jet-clustering
 - flavor-tagging
 - parton charge
 - validation/maintenance
- first round of updates 2010 Q3-Q4

backup

neural net variables

(only the primary vertex is found)

1 vertex found

c-tag

- d₀ significance most significant track
- z₀ significance most significant track
- d₀ significance 2nd most significant track
- z₀ significance 2nd most significant track b-tag
- momentum most significant track
- momentum 2nd most significant track
- joint probability in r-φ b-tag
- joint probability in z c-tag

2+ vertices found

b/c tag for N_{vtx}=3

c-tag for N_{vtx}=2

- decay length
- decay length significance
- raw momentum
- p_T-corrected mass b/c tag b-tag for N_{vtx}=2
- number of secondary vertex tracks
- secondary vertex probability
- joint probability in r-φ
- joint probability in z

$$M_{P_T} = \sqrt{M_{vtx}^2 + |p_{T,vtx}|^2 + |p_{T,vtx}|}$$

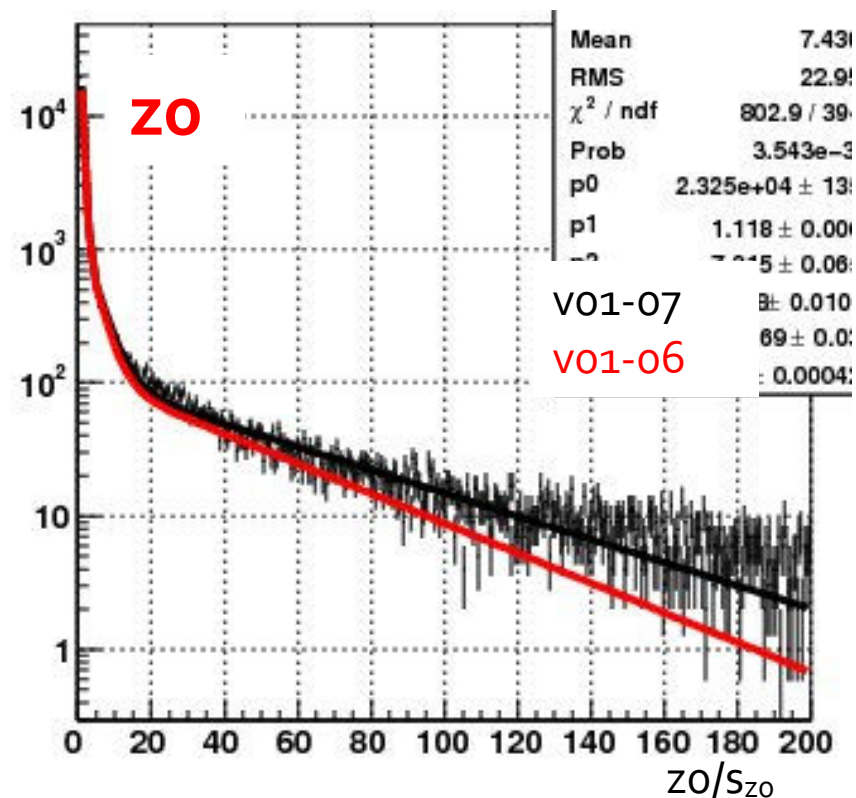
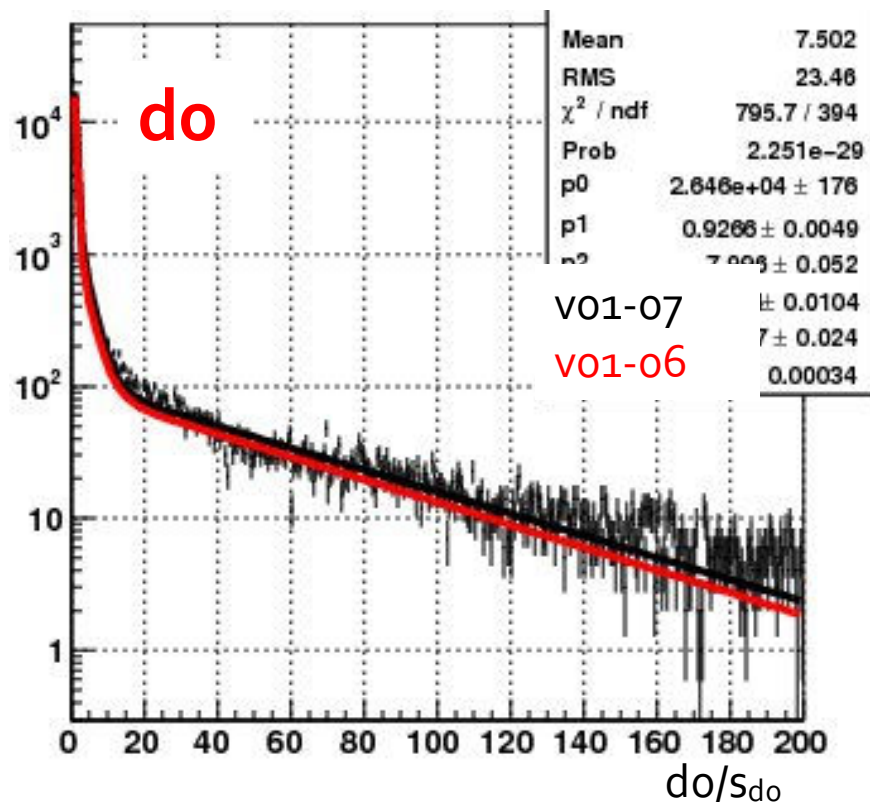
Most important variable for 2 jet samples at E_{cm}=91.2 GeV

Most important variable for 2 jet samples at E_{cm}=500 GeV

Impact Parameter Significance

The fit to the significance was performed using $Z \rightarrow qq$ samples.

- The fit result is similar to vo1-o6.



Neural-net retraining was done using the new fit results.

efficiency vs. purity

The efficiency vs. purity was checked with $Z \rightarrow bb/cc/uds$ samples.

- $bb/cc/uds$ events are normalized to the BR of Z decays.

- BR(bb): 15.12%
- BR(cc): 12.03%
- BR(uds): 42.76%

- Background is defined as:

- b-tag: cc/uds
- c-tag: bb/uds
- bc-tag: bb

Purity-efficiency in vo1-07 is worse compared to vo1-06.

