

LCFIPlus

T. Tanabe, T. Suehara

ICEPP, The University of Tokyo

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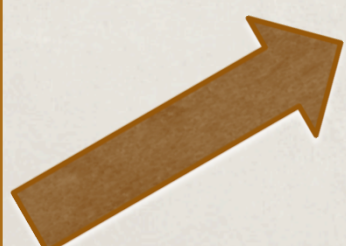
- ✧ introduction
- ✧ event model, algorithms
- ✧ steering, documentation
- ✧ looking ahead
- ✧ conclusions

Introduction

NIM A 610 573 (2009)

- * LCFIVertex
 - * vertex finder & flavor tagger for LOI
 - * **neural net difficult to extend**

- * Jet Finding
 - * needed to be improved for **multi-jet events**
 - * vertex first, jet second approach



- * LCFIPlus
 - * vertex finding, jet finding, flavor tagger in one package
 - * exploit **TMVA** package
 - * flexible algorithm flow & configuration with XML steering files

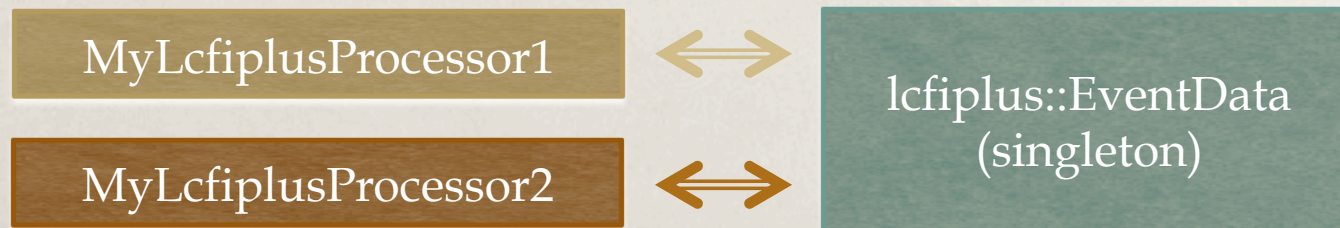
Included in ilcsoft v01-13

Data Types & Event Model

LCIO	LCFIPlus
ReconstructedParticle (PFOs)	Track, Neutral
ReconstructedParticle (Jets)	Jet
Vertex	Vertex
MCParticle	MCParticle (optional)

list of names specified in XML

- * LCFIPlus creates own event model for convenience of algorithms
 - * automatic conversion of data types from/to LCIO
 - * takes advantage of **LCIO persistence** model
 - * caveat: event data at run time is held in a singleton



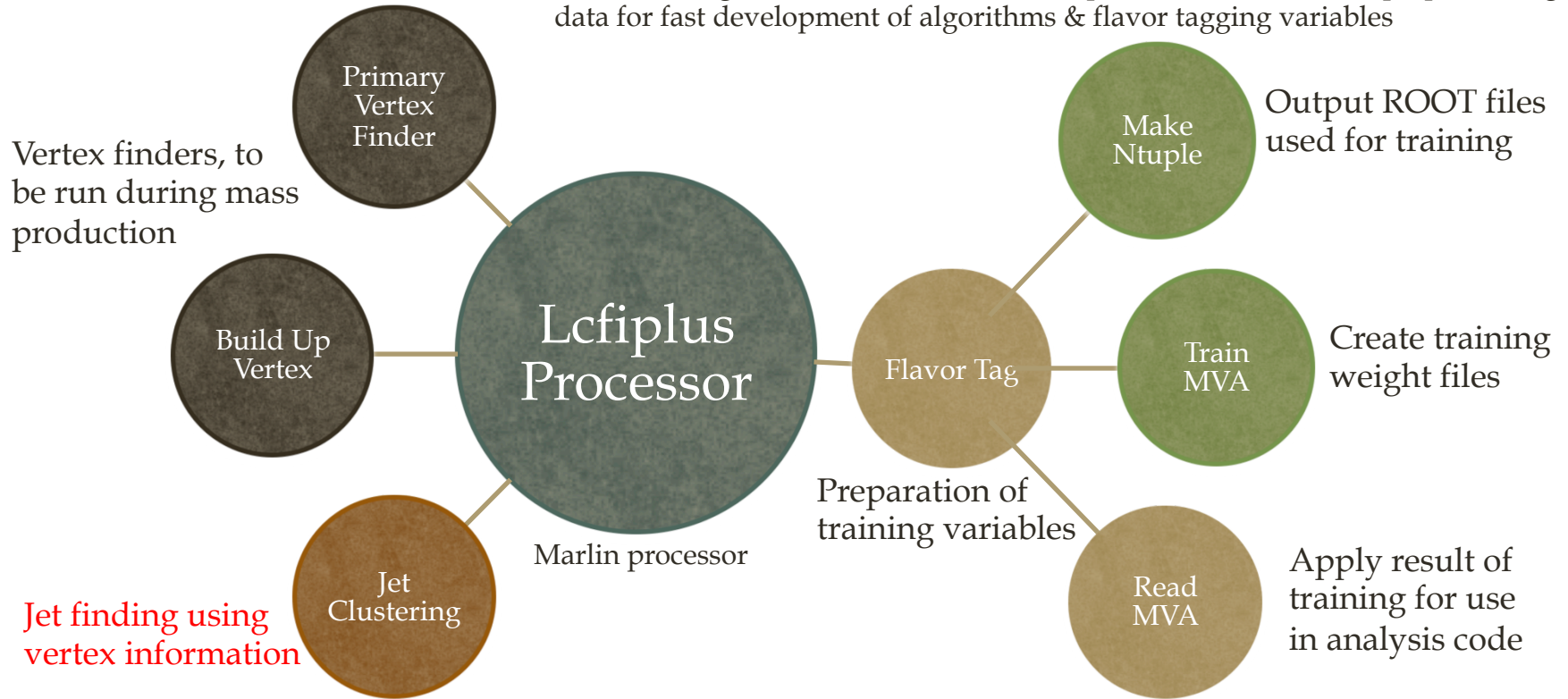
Caution: input/output list names are shared in the same Marlin run!!!
 Possible to support different names; let us know if this should be supported

Algorithms

Explicit Dependencies:

* small circle = LCFIPlus algorithm

Individual algorithms can be run with output to LCIO; useful for preprocessing data for fast development of algorithms & flavor tagging variables



Data Flow:



Steering

- * Typical user experience:
 - * obtain DST files (with vertices)
 - * select weight files from ILDConfig (tentative!! what about SiD??)
 - * run analysis with JetClustering + FlavorTag + ReadMVA
- * For training:
 - * prepare training samples in DST format (with vertices)
 - * ntuple preparation step:
 - * JetClustering + FlavorTag + MakeNtuple
 - * (concatenate the ROOT files with “hadd” if necessary)
 - * training step:
 - * FlavorTag + TrainMVA
 - * run analysis with the weight files

Documentation & Feedback

- * User feedback + documentation system (thanks J. Strube)
 - * Documentation **wiki** hosted at SLAC (thanks N. Graf)
 - * also issue tracking with JIRA
 - * <https://confluence.slac.stanford.edu/display/ilc/LCFIPlus>
 - * skeletal at the moment... need to be filled in
- * Checking memory leaks with coverity @ CERN (thanks A. Sailer)
- * Early bug reports (thanks J. Engels, F. Gaede, J. Strube, A. Sailer)
- * Doxygen class reference (partially complete)

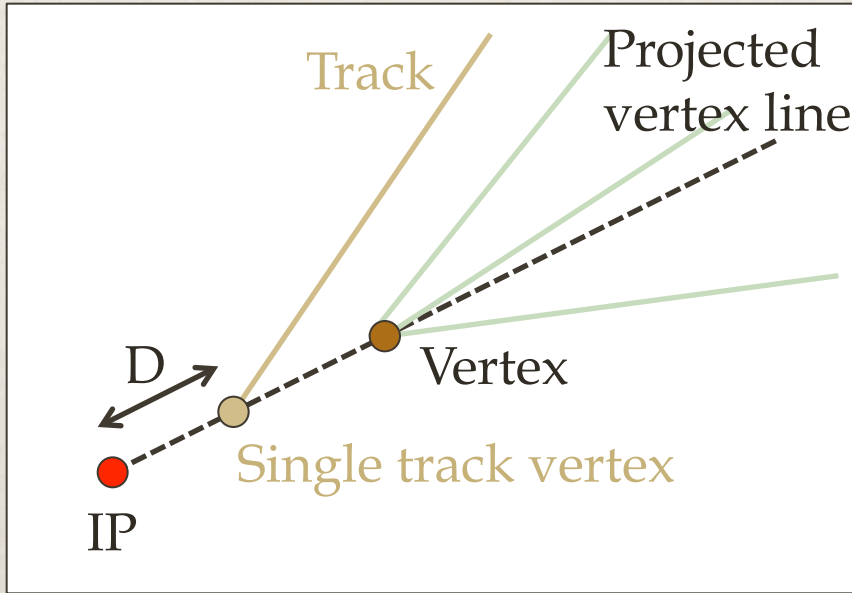
Looking Ahead

- * Two contexts for improvements, bug fixes, solving issues: **short-term** (for mass production) & **long-term** (user analysis)
 - * Short-term goals
 - * **validation!**
 - * vertex, jets, flavor... (we'll do them but **extra eyes** would help)
 - * **vertex finders** are **slow**
 - * fast enough?
 - * if not, need to rewrite kernel (e.g. Kalman filter)
 - * distribution of **weight files** from training
 - * included in **ILDConfig package?**
 - * what about **SiD & CLIC?**
 - * related: need to raise **experts** capable of making own training files
 - * Long-term goals
 - * continued improvement in vertex/jet finding, flavor tagging
 - * e.g. calibration of output variables for different categories
 - * effect of **backgrounds**: on jet clustering in particular

MyLcFiplusProcessor	1.472000e+02 s
MyClupatraProcessor	1.078700e+02 s
MyFullLLDCTracking_MarlinTrk	9.256000e+01 s
MyMarlinPandora	1.558000e+01 s
MySiliconTracking_MarlinTrk	5.690000e+00 s

100 evts
zpole bb

Single track vertices



* Single-track vertex finding: **ZVKIN** algorithm exists but was **never used** in production (to our knowledge)

* Instead, a simple geometrical approach:

- * given a secondary vertex, look for a nearby track, compatible with an additional vertex
- * Cut-based selections found to give **promising results**; to be included as a variable in flavor tagging

* Procedure (preliminary)

- * Find a track whose distance to the projected vertex line is $< 0.1 D$
- * Angle between track (at vertex) and the projected vertex line must be < 0.5 rad
- * $0.3 \text{ mm} < D < 30 \text{ mm}$
- * d_0 or z_0 significance of $T > 5$

(bbhh 100 events)	b	c	o
# MC hadrons	486	585	
# single track vertex (reco)	113	102	18
→ # MC matched (1 trk)	59	19	
→ # MC matched (2 trks)	21	16	

Conclusions

- * LCFIPlus released and included in iLCSoft
 - * use of TMVA, flexible configuration via XML steering files
- * Documentation framework ready, content to be provided soon
- * Looking ahead:
 - * validation!
 - * slow vertex finders
 - * need to raise experts from SiD & CLIC