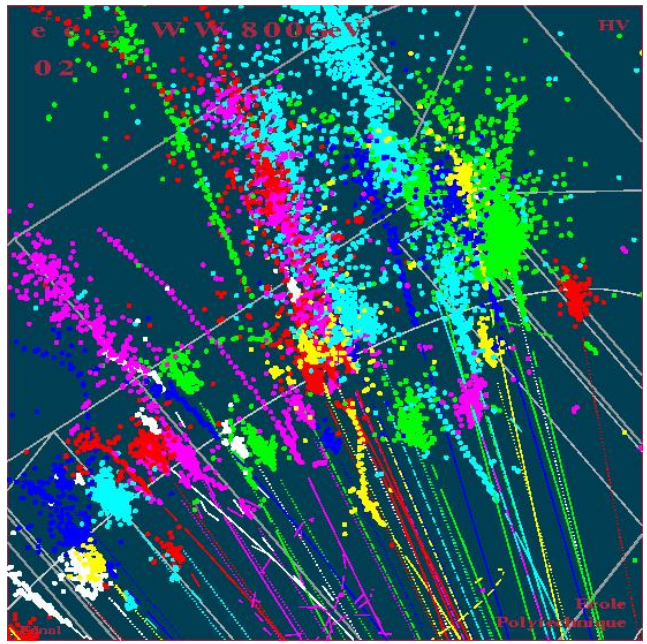
PFA Progress and Priorities

Mark Thomson
(for Steve Magill, Felix Sefkow, Mark Thomson and Graham Wilson)



This talk:

- ★ Progress at Snowmass (Alexei)
- ★ Some personal perspectives
- ★ Summary of discussions of priorities
- ★ Suggestion for short-term LDC priorities
  - looking towards Vienna ECFA meeting
- ★ Getting slightly more organised... another suggestion

Personal Perspective

- Until recently we did not have the software tools to optimise the detector from the point of view of **Particle Flow**
- This has changed !
- **The basic tools are mostly there:**
  - **Mokka :** now has scalable geometry for the LDC detector
  - **MARLIN:** provides a nice (and simple) reconstruction framework
  - **LCIO:** provides a common format for worldwide PFA studies
  - **SLIC:** provides a G4 simulation framework to investigate other detector concepts (not just GLD, LDC and SiD)
  - **Algorithms:** in MARLIN framework already have ALGORITHMS for TPC tracking, clustering + PFA

We are now in the position to start to learn how to optimise the detector for PFA

Some Caution:

- This optimisation needs care: can't reach strong conclusions on the basis of a single algorithm
- A lot of work to be done on algorithms + PFA studies
- Not much time : aim to provide input to the detector outline

Need to get a little more organised + get more people involved

Prioritised PFA list

(from discussions + LDC, GLD, SiD joint meeting)

The A-List (in some order of priority)

1) B-field : is BR^2 the correct performance measure (probably not)
2) ECAL radius
3) TPC length
4) Tracking efficiency
5) How much HCAL – how many interactions lengths 4, 5, 6…
6) Longitudinal segmentation – pattern recognition vs sampling frequency for calorimetric performance
7) Transverse segmentation
8) Compactness / gap size
9) HCAL absorber : Steel vs. W, Pb, U…
10) Circular vs. Octagonal TPC (are the gaps important)
11) HCAL outside coil – probably makes no sense but worth demonstrating this (or otherwise)
12) TPC endplate thickness and distance to ECAL
13) Material in VTX – how does this impact PFA

The B-List

1) Impact of dead material
2) Impact (positive and negative) of particle ID - (e.g. DIRC)
3) How important are conversions, V^0s and kinks
4) Ability to reconstruct primary vertex in z

Goals for Vienna

(OPEN FOR DISCUSSION)

Longer-term goals:

- ★ Understand B, R and L dependence
- ★ Understand impact of transverse granularity and longitudinal segmentation

BUT:

- ★ Vienna is only 2.5 months away
- ★ Be realistic – main thing is to get this effort underway

General points:

- ★ performance metric : jet-energy resolution
  - ★ Z at 91 GeV
  - ★ W^+W^- at 1 TeV
- ★ Try and attach names to goals…

Vienna goals …..

Goals for Vienna:

- ★ B-field dependence:
  - ✦ Requires realistic forward tracking (HIGH PRIORITY) – **Who ?**

- ★ Radial and length dependence:
  - ✦ Ideally with > 1 algorithm

- ★ Complete study of “perfect particle flow”

- ★ Try to better understand confusion term
  - ✦ Breakdown into matrix of charged-photon-neutral hadron

- ★ Study HCAL granularity vs depth
  - ✦ already started (AR)
  - ✦ how many interaction lengths really needed ?

- ★ ECAL granularity
  - ✦ how much ultra-high granularity really helps ?
  - ✦ granularity vs depth

Getting (a little) more organised

Proposal:

- ★Arrange monthly PFA phone conferences
- ★Forum for people form to present/discuss recent progress
- ★Goal : realistic PFA optimisation studies for Bangalore (and beyond)
- ★Try and involve all regions : need to study EACH detector performance with multiple algorithms
- ★First xday of each month **1600-1800 (CET)**
  - •not ideal for all regions but probably the best compromise
- ★If people are in agreement – will set up an email list immediately after Snowmass

- ✦ We can make real and rapid progress on understanding what really drives PFA
- ✦ Provide significant input into the overall optimisation of the ILC detector concepts