



Combined test for Linear Collider

Imad Laktineh

Goals of a combined test

- **PFA** is an attractive concept which is the corner stone of two principal ILC concepts (ILD, SID) but until now it is **not really tested** in real life. This should be done the sooner the better.
- **Few PFA algorithms exist**. They were **fine tuned for specific sub-detectors**. We need to check them and develop new generation more flexible. **Real data will allow such development**
- We need to **compare different options** for the future ILC experiments. Only combined tests can allow a true comparison at the PFA-related performance
- Previous experience (DHCAL+Eudet Telescope) showed a real need for a **common acquisition system**. Combined test will be the place to realize it

What we can do with a combined test?

Configurations of PFA we can try to test:

- **Charged and neutral particles together**
→ need target and appropriate magnetic field
- **Charged particles with the same energy**
→ need high intensity beam
- **Combine both to come close to jet configurations**
→ need both

Charged particles with the same energy

Simple configurations : Tracker+ECAL+HCAL

Beam intensities available at the SPS

Up to 10^7 particles/spill of 16 seconds

Calorimeters clock = 5 MHz \rightarrow 200 ns window

Probability to have more than 2 tracks in one calo event

=0.08

Beam dimensions : $2 \times 2 \text{ cm}^2$ to $30 \times 30 \text{ cm}^2$

To determine precisely the distance between the tracks we need a tracker in front of the calorimeters

Charged particles with the same energy

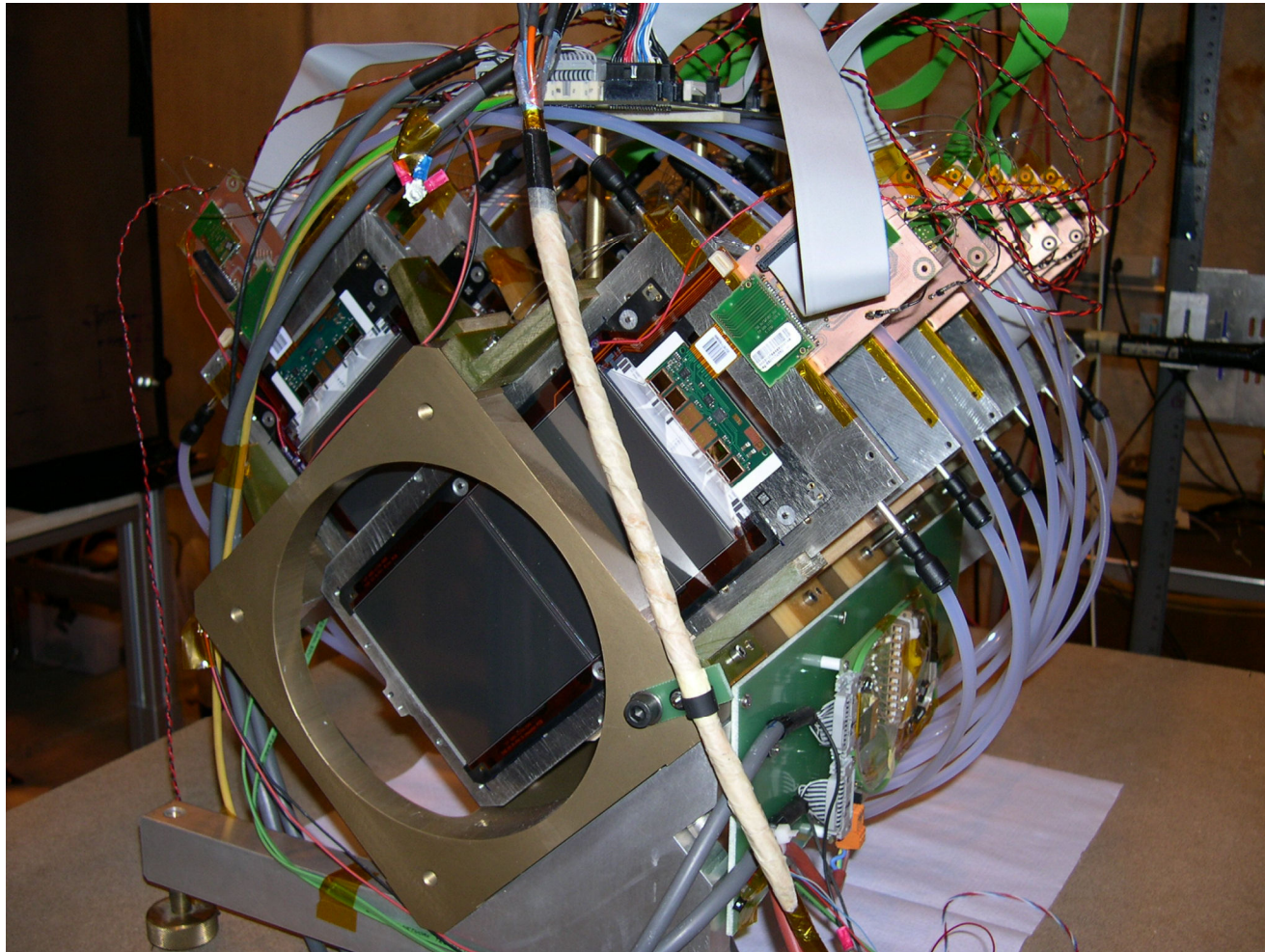
Available trackers

1- CMS Telescope:

- 6 double-layer of silicon strips of $10 \times 10 \text{ cm}^2$ each.
- Resolution of 30 micron for each layer
- 40 MHz clock and integration time $< 100 \text{ ns}$

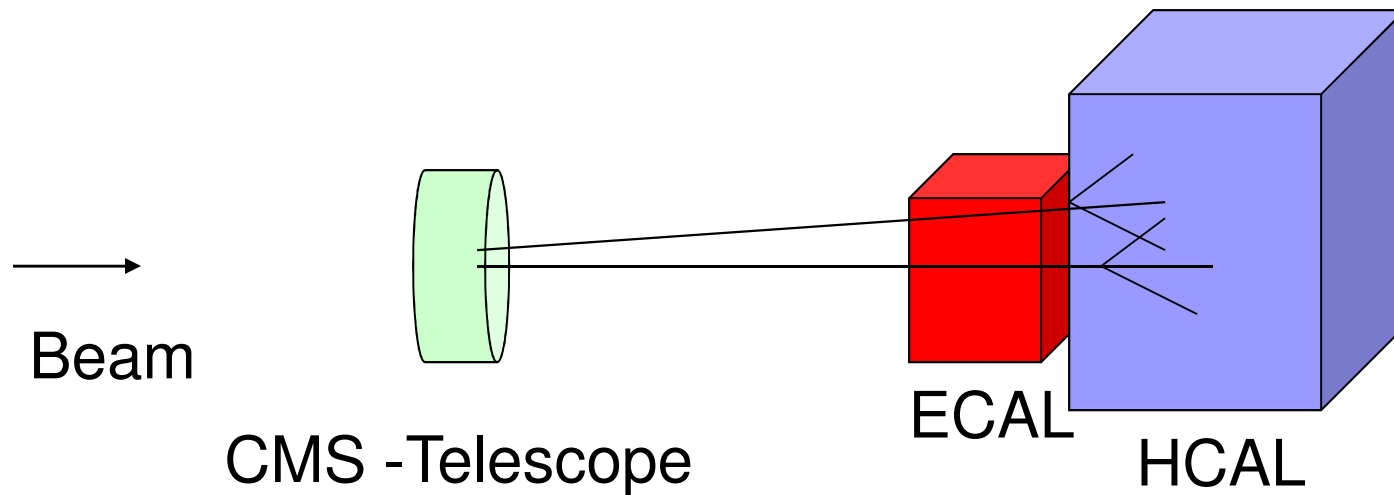
2- Eudet Telescope

- 6 layers of silicon pixels $0.7 \times 0.7 \text{ cm}^2$ each
- Resolution of few microns for each layer
- Integration time # $200 \mu\text{s}$



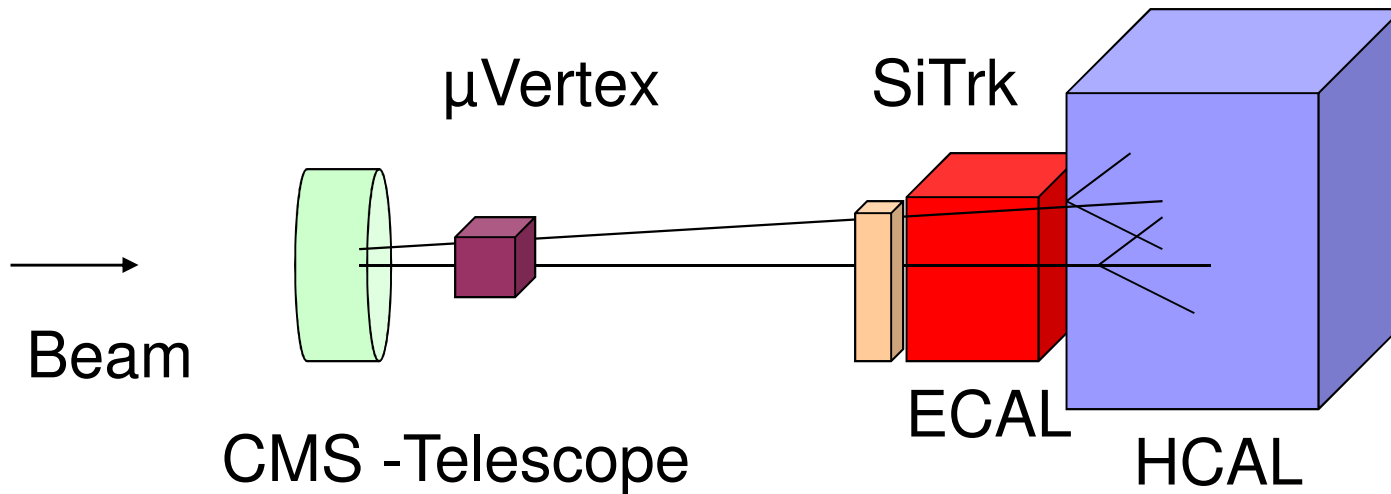
CMS telescope

Charged particles with the same energy



- Variable distance to accommodate divergent beams
- Acquisition based on **Xdaq** system
- Mechanical structure to be developed

Charged particles with the same energy



Additional tracking system can be also used but....

Charged and neutral particles

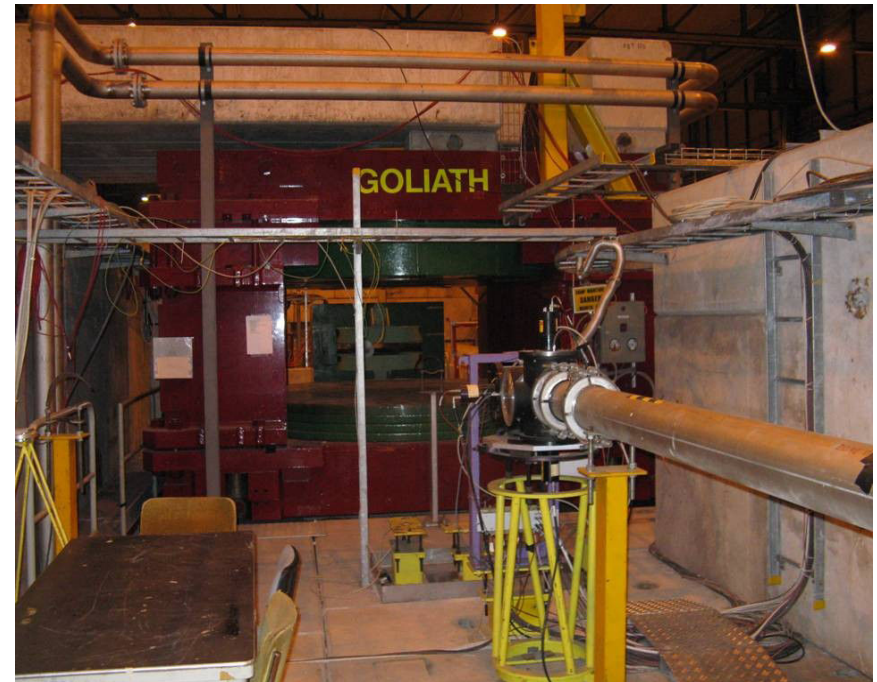
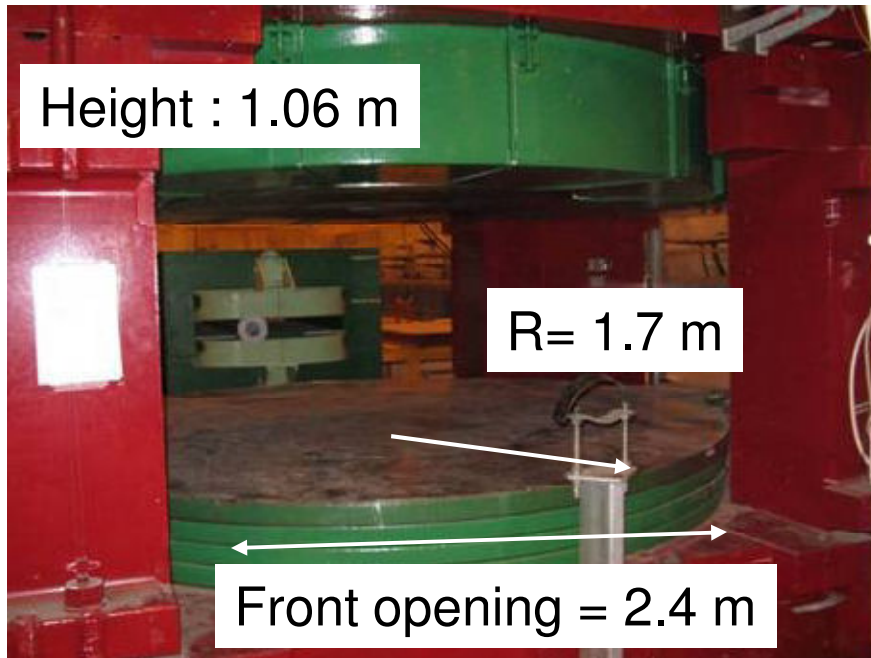
Complicated configurations :

μ Vertex+TPC?+Tracker+ECAL+HCAL and still modular

- We need a target to obtain interactions
at least this is useful for μ Vertex study
- We need a magnet to measure momentum of at least
part of the particles (need to be carefully evaluated)
and use constraint from the total available energy

Charged and neutral particles

Any available magnet? Yes Goliath



SPS/H4 line

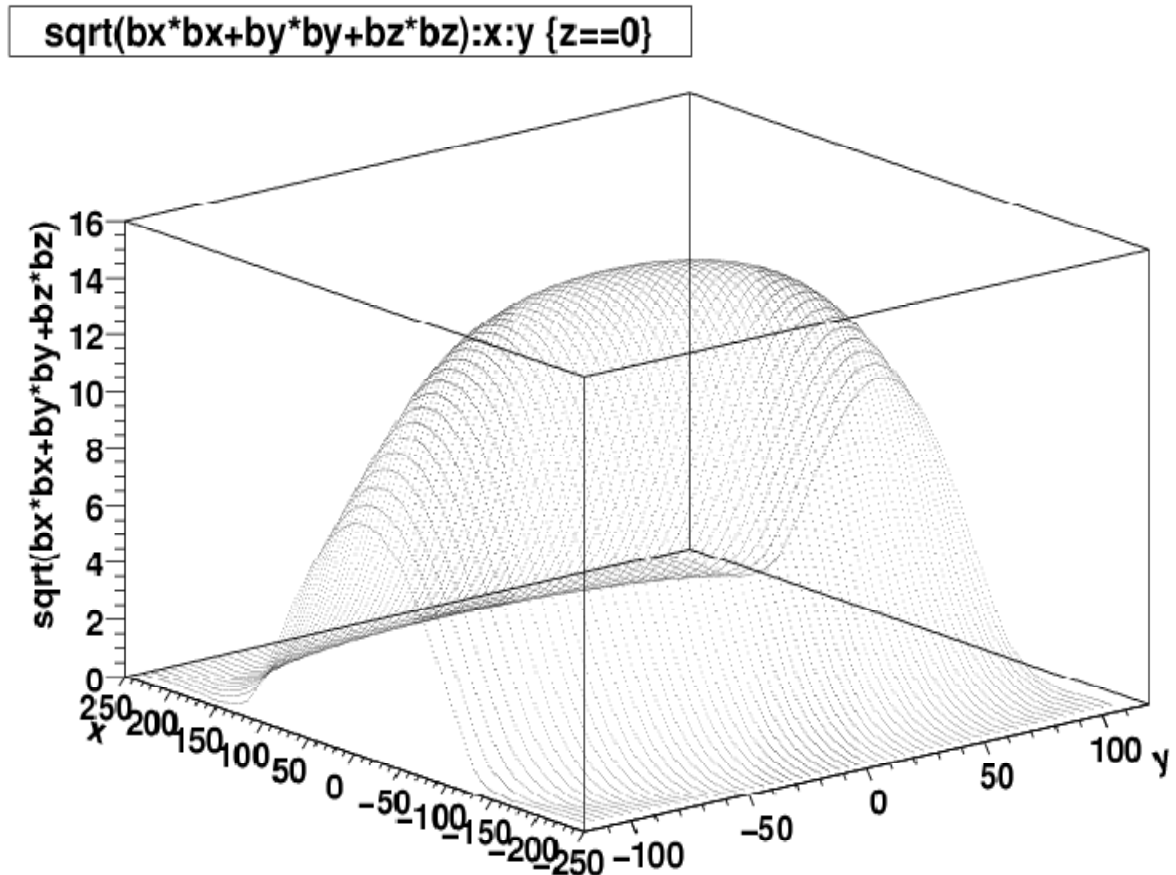
Courtesy M. Alfonsi

Charged and neutral particles

→ 1.4 T is it enough?

→ TPC could be included easily?

→ Calorimeters inside Goliath?



Map realized by NA57 experime



Conclusion

- Simple case of FPA study can be achieved at low cost by combining existing/future calorimeters with existing tracker telescope
- More advanced PFA study needs more sophisticated setup. Some elements exist already and need to be evaluated correctly.
- A combined, modular test is not a new idea but it becomes now necessary to validate concepts and options.