

First encounters

I had not worked with Lorenzo before ALEPH but we had met before

**At a Dubna meeting in Feb 1967 The full Primakoff team was there:
Lorenzo Foa + C.Bemporad + P.Braccini**

**I remember I was very impressed by the quality of the work
and I remember that we visited St-Petersburg (Leningrad at the
time) after the conference in the same Intourist group.**

**We met again later around 1977, when we were the first occupants
of the North area, Lorenzo was leading the NA1-NA7 experiments
while I was working with Aldo Michelini on the NA3 experiment
not far away.**

The start of Aleph

Jack Steinberger with most of his colleagues of CDHS had gathered a group of physicist for main labs in Europe and Pisa was certainly a key one with many high level physicists. During close to one year we did something like brain storming on many different areas (including a magnet in the shape of a sphere)

This was a very exciting period where we were not cornered on a single part of a detector but tried to help the overall understanding. This is when I learned to appreciate Lorenzo his deep understanding allied to a very open mind. Lorenzo was part of the Sphere group while I was looking with R.Turlay M. Davier H. Videau and others.. on the solenoid solution.

Well the fun of brainstorming had to stop at some time and we had to settle on a rough initial design, share responsibilities and start more detailed studies.

The HCal(1)

In our book “25 years of ALEPH” in an article called “The inception of HCal” Lorenzo’s describe very clearly the main ideas for a good HCal.

It had to be have high granularity

It had to have good hermiticity with the constraint of using the iron for the return flux of the solenoid.

It had to be as cheap as possible.

The idea is stated that the energy resolution was not the most important parameter : this meant that more or less clearly the idea that we could measure energy roughly in HCal because anyhow charged particle are measured by the TPC and photons by ECAL was already there. (the particle flow idea) However granularity was essential to allow to identify neutral hadron interaction in HCal and to track muons in a jet environment

HCAL(II)

The first idea was to use scintillators (the influence of CDF) but the granularity was hard to get.

Then the idea of streamer tubes (similar to tubes used in a proton decay experiment built at Frascati) was explored and adopted.

Of course the granularity meant a huge number of digital channels (one per tube)

Pads with induced cathode readout were forming towers.

So the Italian groups (essentially Pisa, Frascati, and Bari at first) took the responsibility of building this HCAL under the leadership of Lorenzo

Jack was always prodding us to reduce the number of different techniques so it was natural for the muon detector to be built with the same technique as HCAL.

HCAL and muon

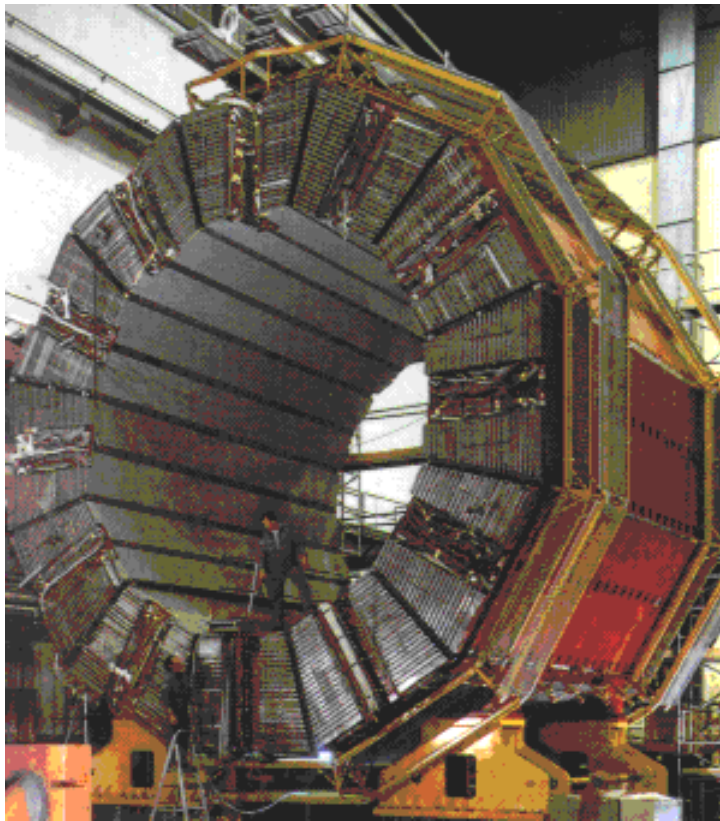
The strength of the Italian group was not sufficient to handle the construction of HCAL and both muon chambers layers with in each muon layer tubes in two orthogonal directions

Luckily Jack succeeded in convincing a Chinese IHEP group to join ALEPH and take responsibility for the second layer of muon chambers. This started a fruitful collaboration to exchange techniques and both parties were very satisfied by the arrangement. Lorenzo visited IHEP 1985 with Jack

Pisa also invested in the design of a silicon strip vertex detector but for lack of funds (and manpower?) this was delayed until 1990-1991 So first we had to admire ALEPH after it had been built and take some data

HCAL construction

It was a huge work because of the many elements and contrary to some other detectors , it required a lot of time to install on site the detector in each of the iron slots.



June 12th 2014

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Jacques Lefrancois

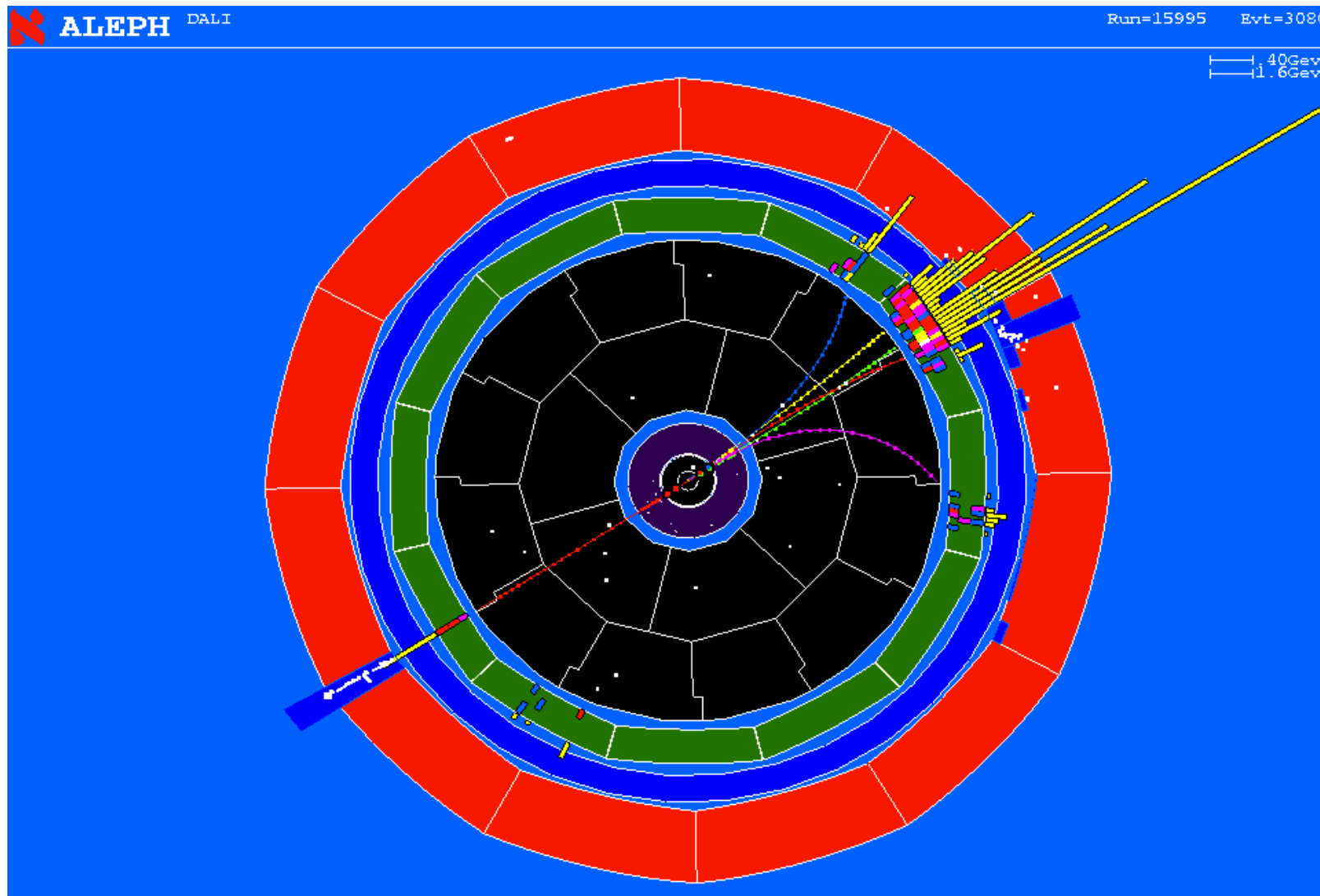


Aleph (before final cabling!)

Jack one day (early 89 if I remember correctly) took Pierre Lazeyras our technical coordinator and the two next spokesmen to be elected in 1990 and 1993 (!) for a picture at the pit.

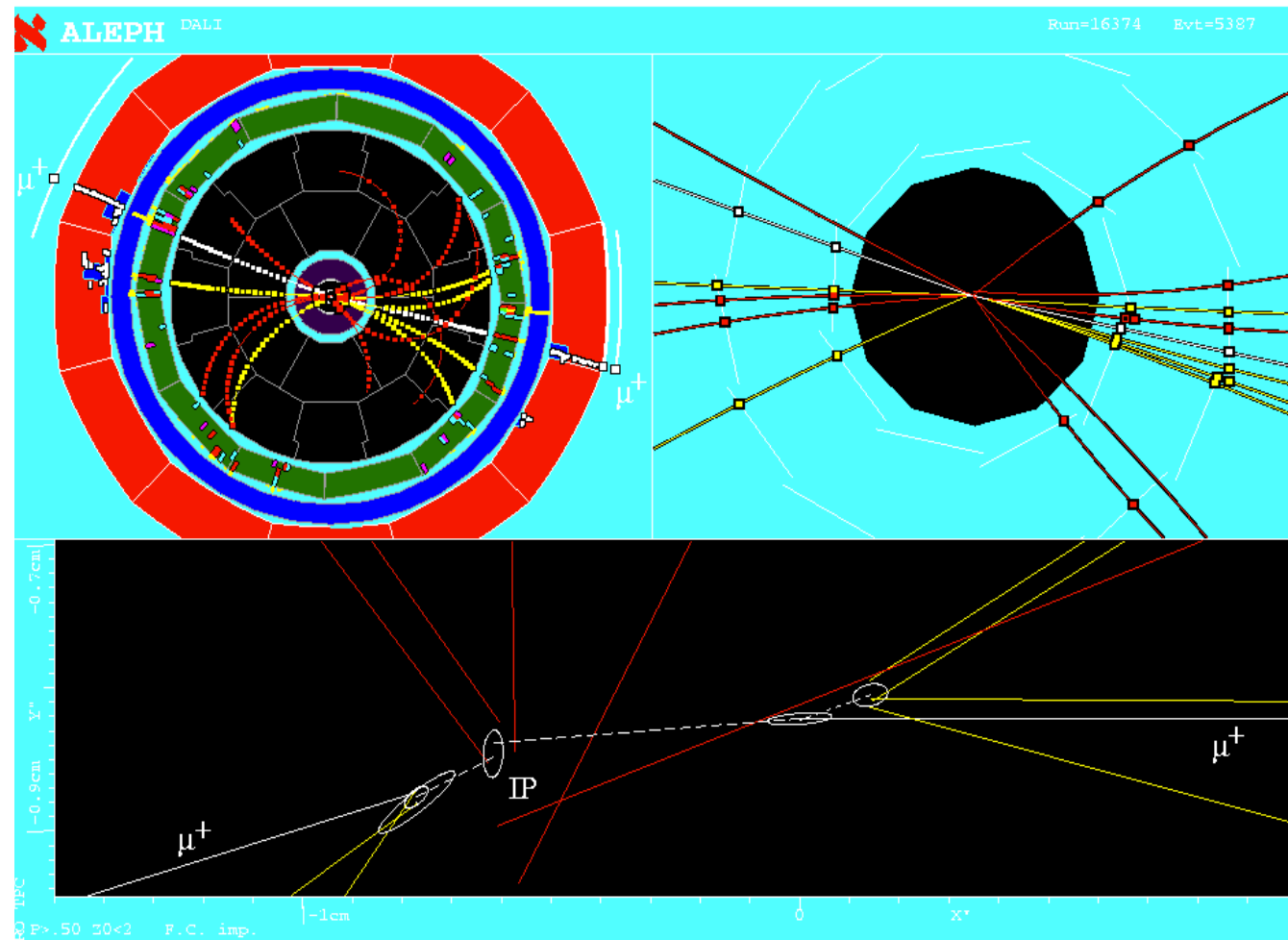


$Z^0 \Rightarrow \tau, \tau$ one $\tau \Rightarrow 5$ pions + ν , the other $\tau \Rightarrow \mu \nu \nu$



Examples of HCAL +muon chamber use

This is an example of a case where both b mesons decay semileptonically to muons and it is an oscillation since both muons are positive. One can see that with the granularity of HCAL the following of the candidate muon track improves greatly the hadron rejection. Below is the vertex of both muons but I will talk about the vertex detector later.



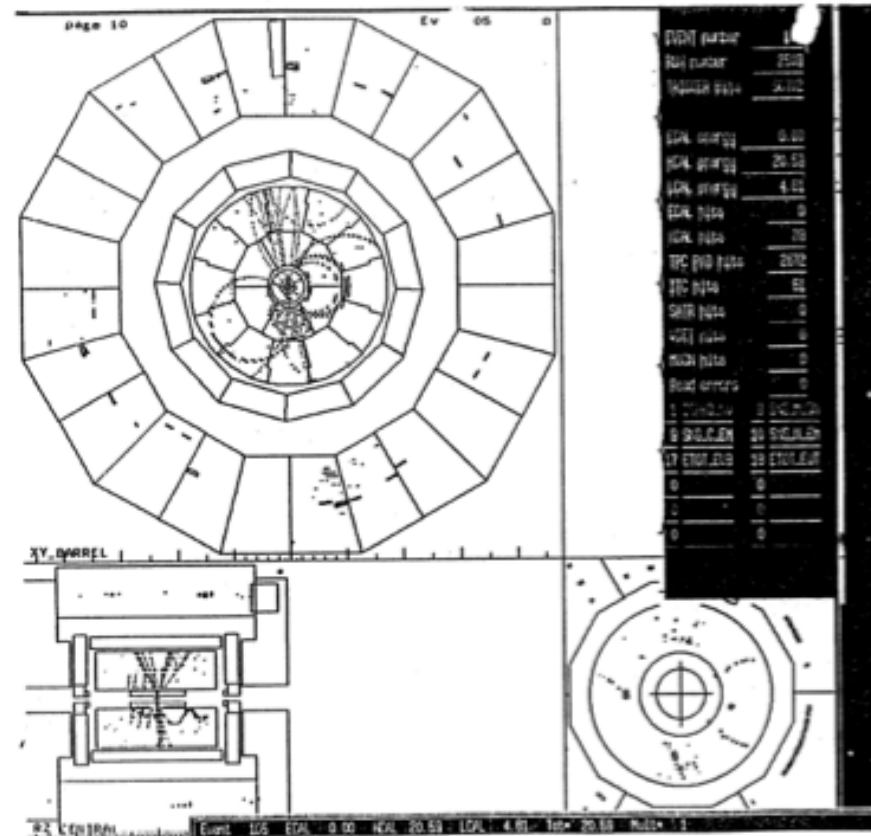
ALEPH start-up and our collective worries at the pit

We got our first event on August 14th in the Pilot run and I remember our shared excitement with Lorenzo

But more important I remember that the initial running revealed some difficulties in pit organisation..

A certain number of us then met at the pit and discussed how to change things. I remember the role of Lorenzo with his experience, his calm and dedication. We finally all agreed on some changes in organisation which were implemented before the end of 89. And things when smoothly after.

However there was a price to pay Senior physicist “who had pushed for these solutions” should in 2 weeks rotation be fully available at the pit to be “run coordinator” Lorenzo did a lot of those and I found recently his reports. The number of run coordinators was gradually enlarged.



Run coordinator report

ALEPH PERFORMANCE

- SOME FRAGILITY AT THE BEGINNING: (53 mb^{-1})

DAQ (MESSAGE SYSTEM, VAX REBOOTED....)

HCAL (D.R. OF HALF A PETAL DEAD)

TPC (1 TPD CHANGED)

ITC SLOWCONTROL

- HUMIDITY IN ECAL BARRACKS (SOLVED)
- NOISE IN VDET (50+50 HITS , DATA ARE GOOD)

THEN WELL FOR SOME DAYS

FIRST STORM : OK

SECOND STORM : CAUSED SOME PROBLEMS TO ECAL
LOW VOLTAGES

RUNS AFTER THE STORM (SATURDAY) WITHOUT AN ADE
(MAYBE)

LUMINOSITY : DO WE GET OUR SHARE?
(PROBABLY YES, BUT CHECK)

June 12th 2014

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Jacques Lefrancois



1990-1993

I became spokesman in February 1990

Lorenzo was enjoying the physics with his brilliant young physicists of Pisa

For example

B physics with Roberto Tenchini and colleagues

Tau lifetime with Francesco Fidecaro and colleagues

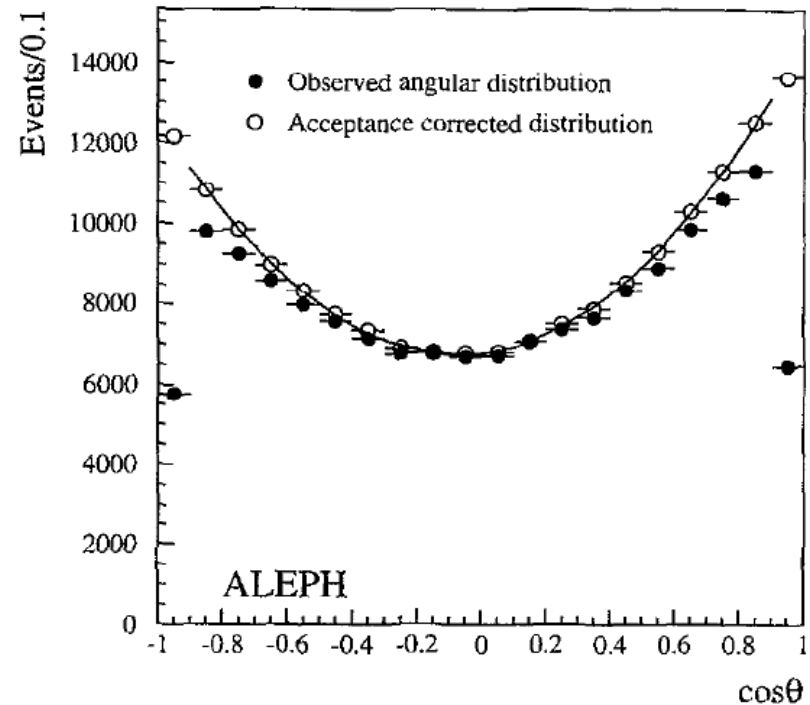
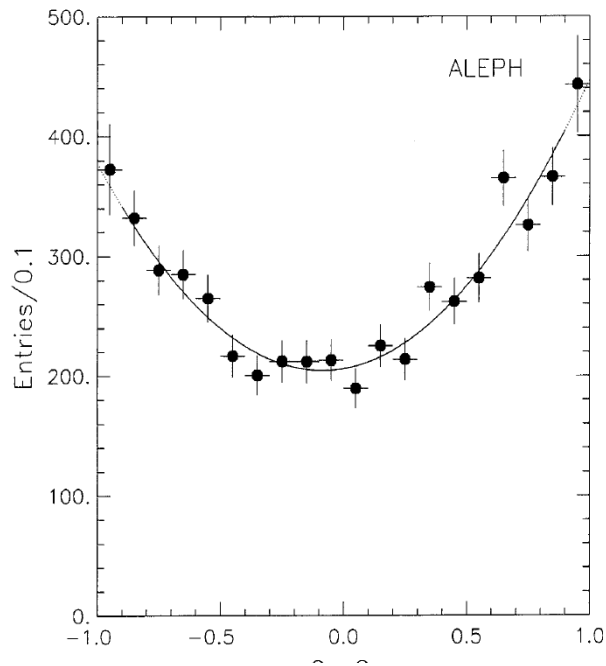
However hardware investment was not over. Pisa had shown some years ago interest in a vertex detector whose construction had been staged

Physics with HCAL: B quark asymmetry at the Z0

The B quark asymmetry was measured using the e and muon leptonic decays

In 91 A_{FB} was $= .126 \pm .028 \pm .12 \Rightarrow \sin^2 \theta_{\text{eff}} = .2256 \pm .0055$

Later in 95-96 A_{FB} was $.1008 \pm .0043 \pm .0028$ and $\Rightarrow \sin^2 \theta_{\text{eff}} = .23198 \pm .00092$



The Vertex detector(I)

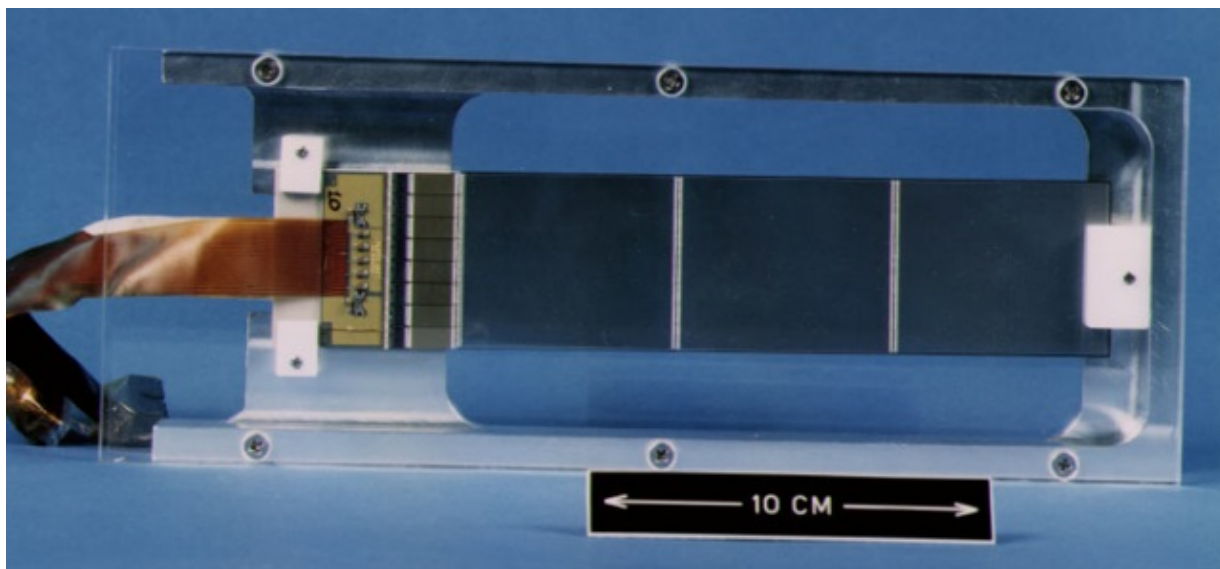
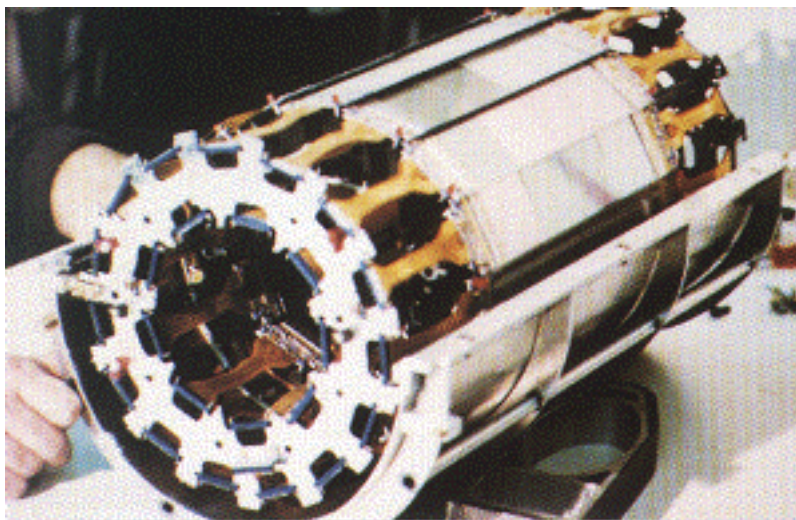
The idea of a vertex detector was suggested early in 82 by M. Giorgi but postponed (“staged”).

Then 1984 there was a suggestion from Ron Settles (Munich) to Lorenzo that MPI-Munich could join the effort of building the vertex detector. Lorenzo accepted warmly and the effort started.

In 89 and 90 part of a detector with two side readout was installed but with a lot of difficulties and hardware failures, as happen sometimes with a new technique. As often, when there are difficulties, there were then tensions between the two collaborating institutes and the spokesman at the time had to try to calm things.

I have to say that at all time Lorenzo was extremely helpful, since his fairness was never doubted by anybody at any time he could greatly help calm the situation and focus on solving hardware problems. => the 1991 data taking with the Vertex Detector was excellent.

The Vertex Detector (II)



Example of Physics with VDET: tau-lifetime

After the year 91 of data taking, 6621 tau decays were accumulated. One can measure in 3prongs-3prongs the distance between the 2 vertices (left plot) Or in one prong one-prong the impact parameter difference or sum (right plot) the lifetime is measured to be $291\text{fs} \pm 13 \pm 6$ at the end of the Z0 the lifetime was $290.1 \pm 1.5 \pm 1.1$ The VDET was also essential for B tagging

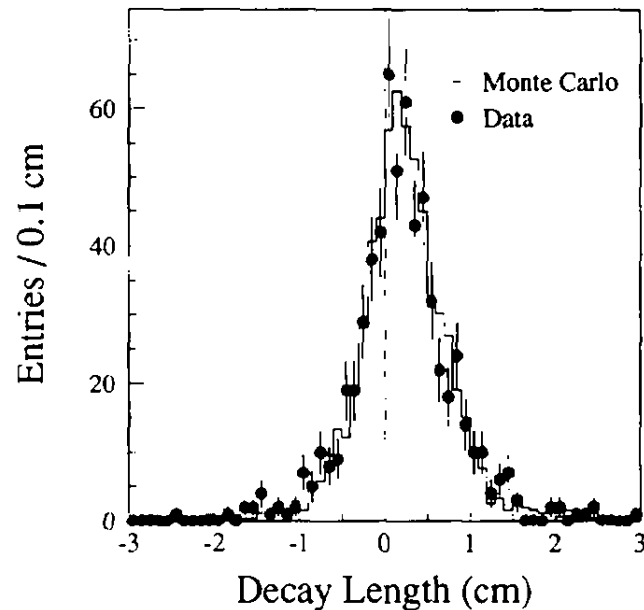
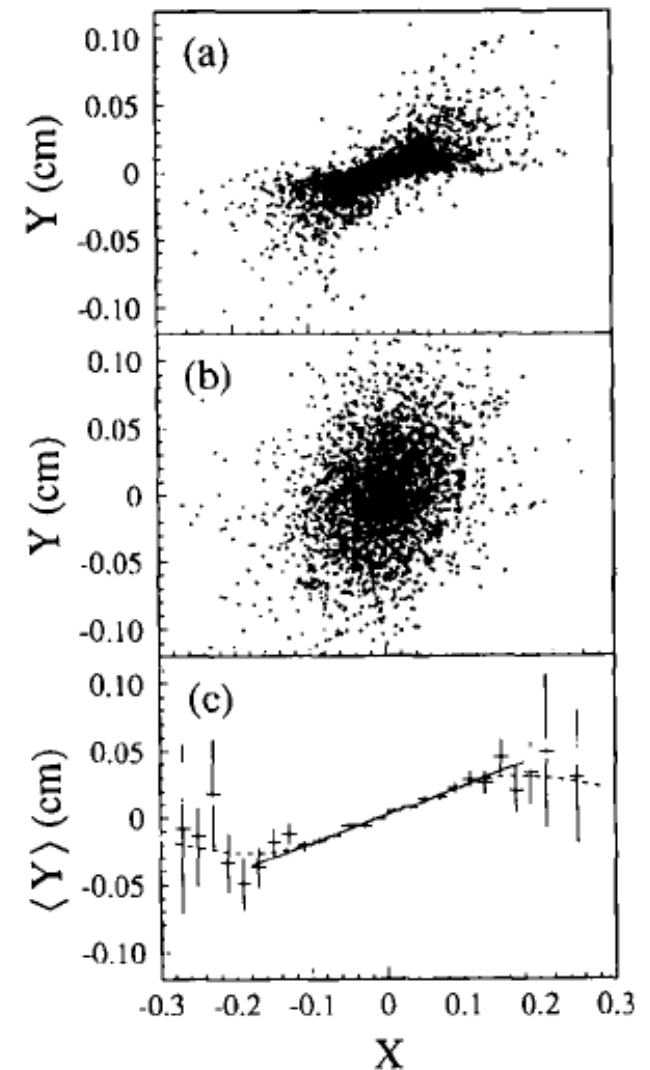


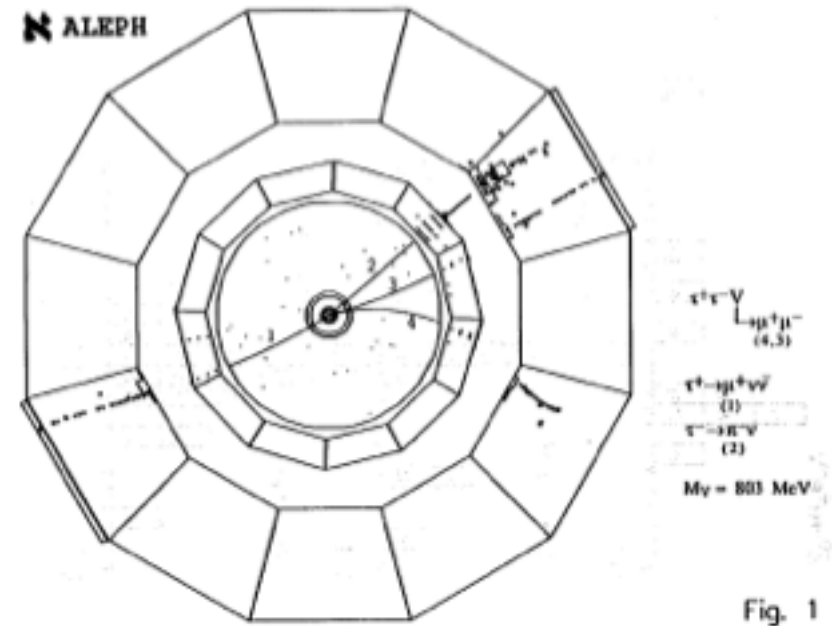
Fig. 5. Decay length distribution for the accepted three-prong decays. The Monte Carlo has a lifetime of 304 fs.



The LLV episode

The LLV is a second order process: a low energy pair of particles (the Vee) is emitted together with the high energy lepton pair (the LL) from $Z^0 \Rightarrow LL$

One physicist group in ALEPH found (from 1989-1990 data) that these events were more frequent when the LL was a $\tau\tau$ compared to $\mu\mu$ or ee , 15 events were found in $\tau\tau$ group with about 4 expected. The problem was to evaluate the significance and include the possibility of systematical error. Debate go heated!



The collaboration started to split until I asked Lorenzo and Ioana Videau (who also passed away very recently) to act as referees. They did a very careful job, the collaboration unanimously agreed to publish their careful suggested version. And Lorenzo gave the CERN seminar presenting the Aleph results. As you know it turned out to be a statistical fluctuation.

Lorenzo's understanding, diplomacy and firmness was very important at that time.

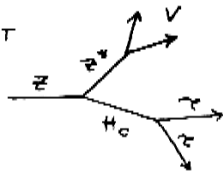
LLV(Lorenzo's conclusion slides)

- IF THE EXCESS IS A STATISTICAL FLUCTUATION:

I AM SORRY!

- IF IT IS SOMETHING NEW:

- ① IT IS NOT

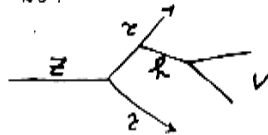


WITH $M_{H_0} \sim 80 \text{ GeV}$

BECAUSE IN THE ZZ R.F.
 $\theta_{e\nu}$ ISOTROPIC

DATA: $E_{2\nu}$ PEAKS
FORWARD

- ② IT IS NOT



(KALINOWSKI, MILLER)

WITH M_R SMALL

BECAUSE NO EVIDENCE OF A NARROW PEAK

BECAUSE E_ν DISTRIBUTION PEAKS AT SMALL E_ν

TO CONCLUDE:

- 1) WE HAVE OBSERVED AN EXCESS OF $Z\nu$
W.R. TO $e\nu$ AND $\mu\nu$
- 2) IT MAY BE A FLUCTUATION WITH
PROBABILITIES $\leq 1\%$
- 3) THE OTHER LEP COLLABORATIONS AND THE
ALEPH DATA OF '91 WILL HELP TO
SOLVE THE QUESTION

1993 the change over

After my 3 years a spokesman, Lorenzo was elected as spokesman and we had a party at Echenevex for the change over where the next two pictures come from. At least 3 Aleph physicist seem not to be unhappy about the change. This picture has often been shown but is not the only one!



1993 the change over

Some time before the picture of the previous slide we had also discussed very seriously, listening with attention to Lorenzo.

When I remember our moments together in ALEPH I like to have these two pictures in my mind: the good relax times, but more often the intense exchanges.



The superconducting solenoid problem

On April 1993 on cooling down of the solenoid a leak developed between the liquid helium circuit and the vacuum isolation; but mysteriously the problem disappeared. It came back again after data taking in January 94 . Luckily it turned out to be accessible (well if you accept to use a lathe about 7m above ground!!!) The problem was at a junction of aluminium and brass pipes. The repair was done thanks to the dedication of our technical coordinator P. Lazeyras and CERN and Saclay personel, and we lost no data taking time.

A spokesman role is difficult, in such cases, because technically you cannot help... but your stomach hurts! The best you can do is have good people and give them your confidence which his what Lorenzo did, but it must have been a hard time for him.



3 years of Lorenzo's spokespersonship?

Lorenzo, after only one year of spokesman job, is then taken away from us by Chris to form his DG team.

It shows the altruistic nature of Lorenzo: I cannot imagine it can be more fun to be Research Director rather than an Aleph spokesperson so it must have been his sense of duty.

Anyhow Aleph decided that if they could not have Lorenzo Foa then they should choose his former thesis student, so L. Rolandi was elected and took over as spokesman from 1994 to 1997.

In 2001 the collaboration chose as spokesman R.Tenchini who happened to be also a former thesis student of Lorenzo. I think it is amazing that a collaboration elects a physicist and later two of his PhD students, probably never happened before. It does not decrease the merits of Gigi and Roberto to note it certainly shows the capacity of Lorenzo to attract good physicist and train them in an excellent way.

It was a privilege to have known Lorenzo.

**I focused on physics but there were also many good times at home
with a meal and drink talking on many other things than physics.**

Thank you Lorenzo.