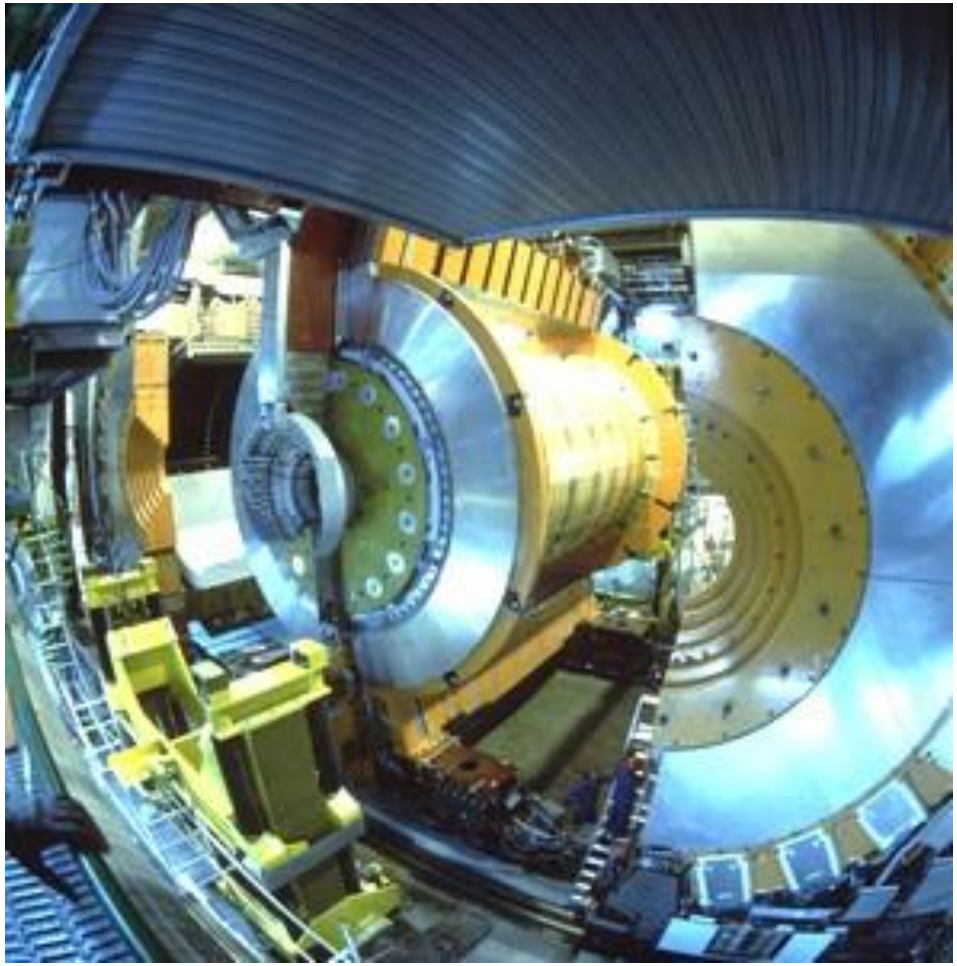
The Early Days of OPAL - from first ideas to approval



10 Years after the

end of data taking

21 October 2010

Once upon a time, 30 years ago…

How and when it all began - 1

1980 Uppsala Conference on Experimentation at LEP:

Physics:	Toponium, Z weak interaction lab
Politics:	first operation in 1986 (if approved in 1981)
Parameters:	30 km, 50 GeV/beam, 4 experiments
Price:	850 MCHF, 50 MCHF for experiments

… and many talks on experimentation

How and when it all began - 2

1980 preparatory discussions (from JADE perspective):

Mainly involved: Japan (Koshiba, Orito, Totsuka)
Heidelberg (Heintze)
Manchester (Murphy)

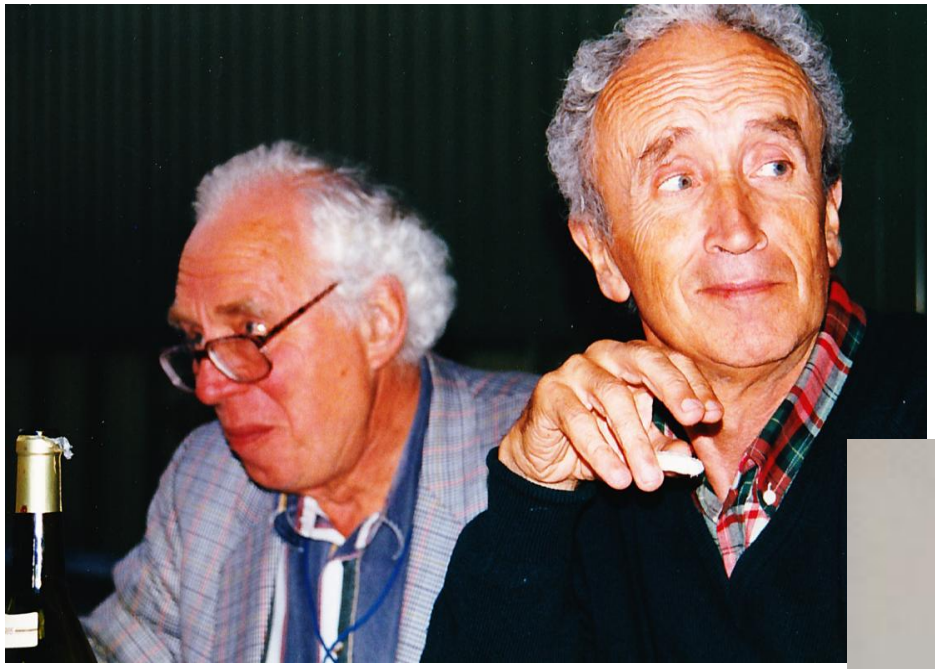
Between September and December 1980 many visits to CERN

Discussions with Amaldi, Winter, Steinberger, Michelini

November: a first concept (HD, Japan)

4.12.1980 Orito and Heintze meet with Aldo Michelini and W. Kienzle (first time I noted Mette's phone number)

Some of the Founding Fathers



… and many more

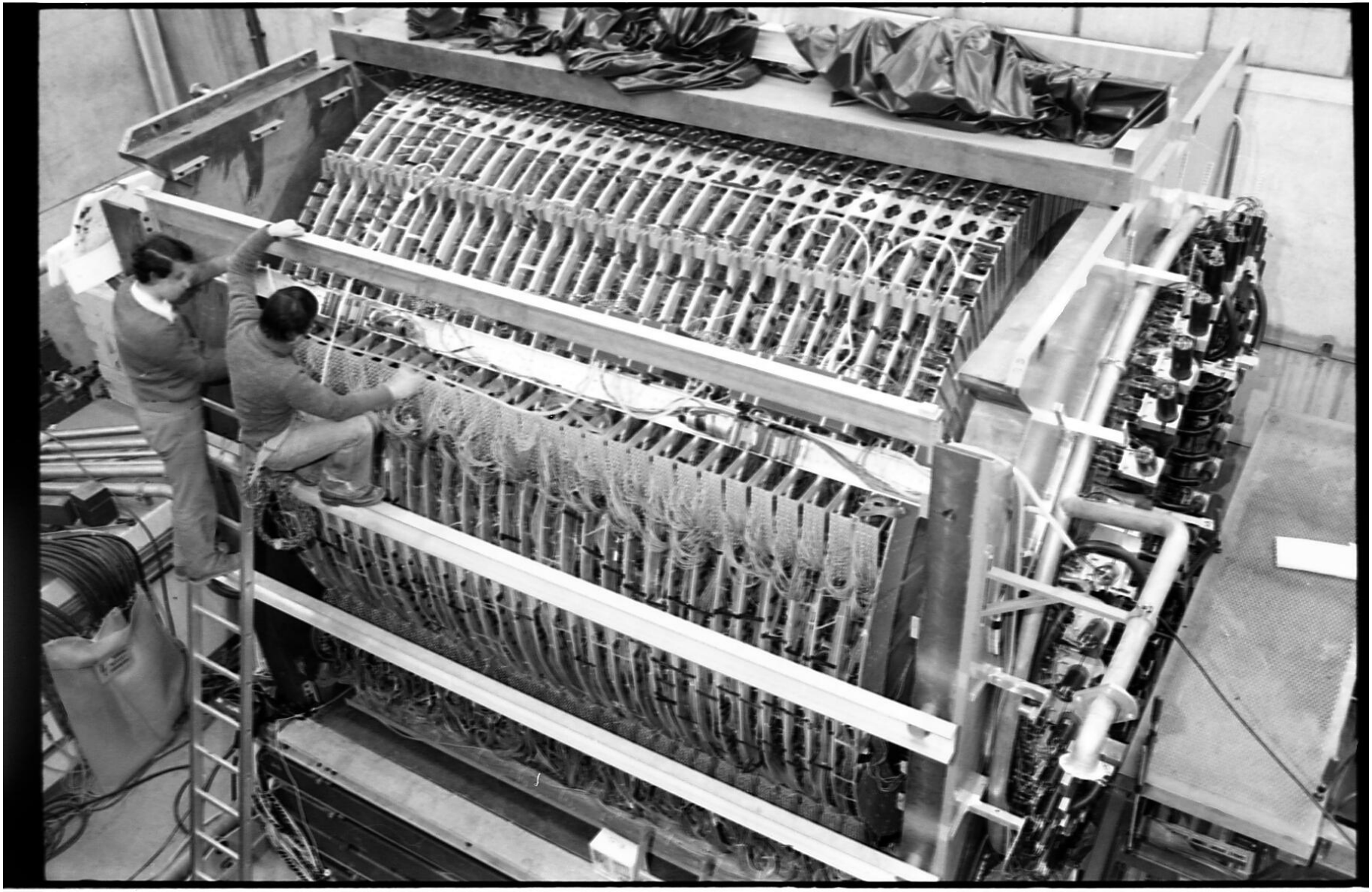
… and Mother

How and when it all began - 3

Still December 1980:

- prepare preliminary detector design as discussion basis (JADE + CERN)
- Keep contact with potential collaborators
- First discussion about thin SC coil 5-10 kG
- First discussions with Morpurgo and Wenninger

JADE Lead Glass Detector



January/February 1981

Decisive meeting of NA3 (spokesman A.M.) with the following decisions:

- interested in principle, no parameters fixed
- Would like new discussion of all parameters, on basis of physics discussion
- Should start from fundamental concept as previously presented
- Want meeting on 4./5. February 1981

4./5. February 1981

TENTATIVE AGENDA

4th and 5th February 1981., Conf. Room 4 (892); 1-D20, CERN II
(For organizational questions contact : Mme. Decamp CERN ext. 6433/

Wednesday 4th February :

9^{30} - 11^{00}	- Introductory remarks
	- General LEP situation (resumé of public LEP meeting 26 Jan., etc.)
	- LEP experimental areas
11^{00} - 12^{30}	- Physics discussion
	- Lunch
14^{00} - 15^{00}	- Physics discussion continued
15^{00} - 16^{30}	- Central Detector
16^{30} - 17^{30}	- Possible magnet configurations (resumé of discussions with M. Morpurgo)
19^{30}	- Dinner at "La Rotonde" (Maconnex)*)

Thursday 5th February :

9^{30} - 11^{00}	- Electron-Photon Detector
11^{00} - 12^{00}	- Hadron Calorimeter
	- Muon Detector
12^{00} - 13^{00}	- Computer and Data handling
	- Lunch
14^{00} - 16^{00}	- Questions of procedure and organization
16^{00} - 17^{00}	- Meeting of "Study Groups"

This is the first (OPAL) meeting

In a way: the birth of OPAL

In the Swiss Mountains in Summer 1981

Villar sur Olon Meeting on LEP (1-7 June 81)

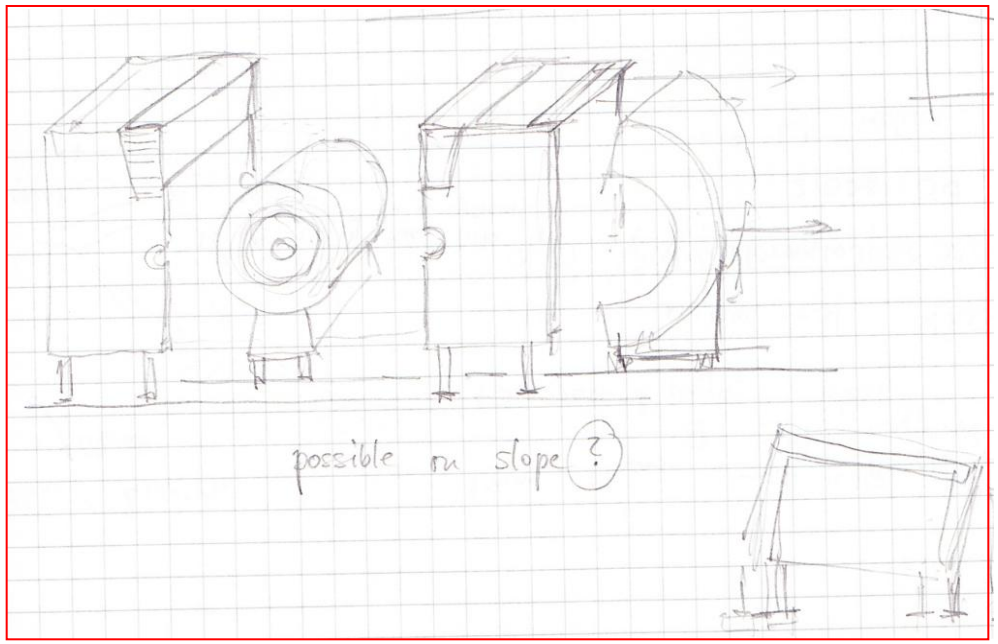
Brought scientists together, played key role in growth of collaboration (marriage market)

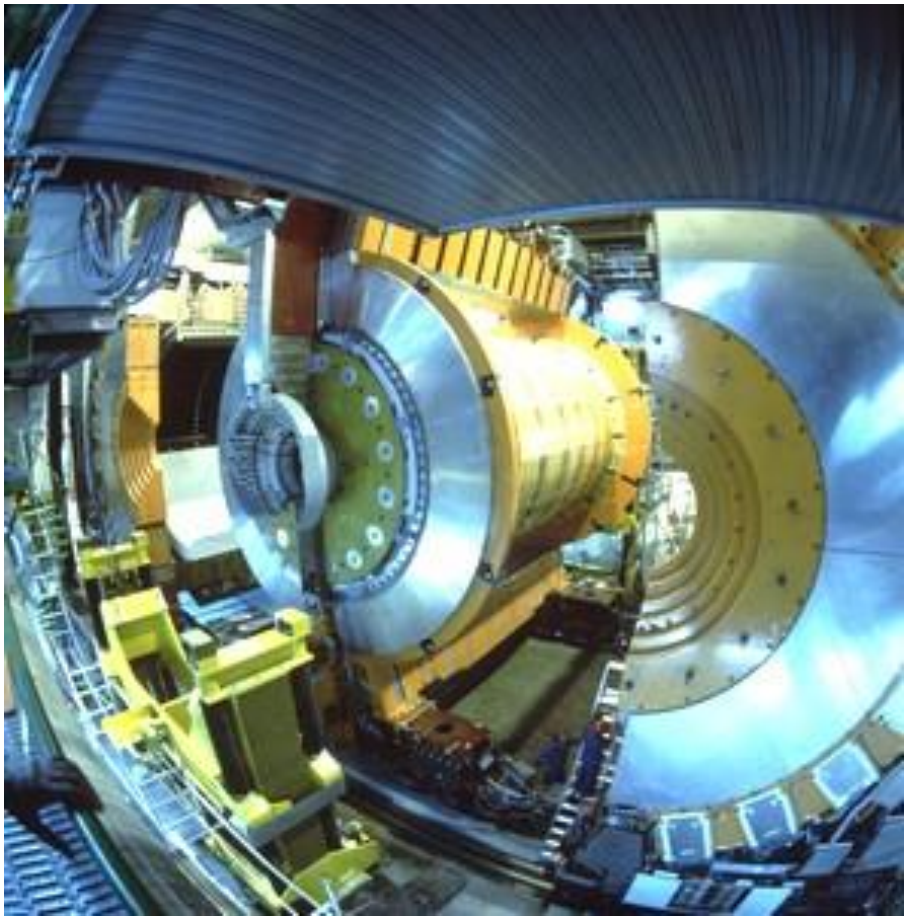
There once was a place called Villards
A palace with more than one star,
They talked about LEP,
The future of HEP,
But decisions were made at the bar.

H. Bogild

October 1981: CERN Council approves LEP

From First Ideas to a Design





Very hard work in the fall and winter of 1981

Guidelines

General purpose detector for LEP

Homogeneous coverage of large solid angle with

- high resolution track chamber in solenoid
- high resolution electromagnetic calorimeter
- hadron calorimeter
- muon detector

Emphasis also on

- techniques where the collaboration has specific experience

-> achieve anticipated resolution

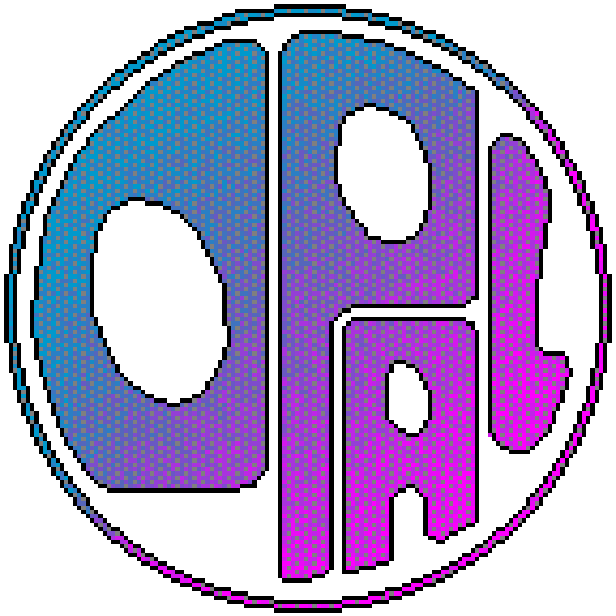
-> be ready for first operation

Name Search

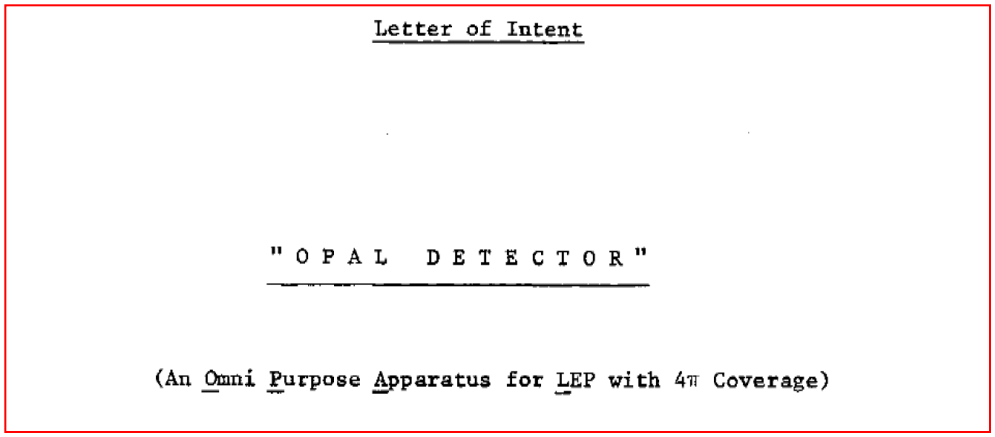
Collaboration meeting, the child gets baptised

18.11.1981

Lotus
Jace
Jason
Glass
Apple
Gem
Aldo



The Letter of Intent



Letter of Intent

"O P A L D E T E C T O R"

(An Omni Purpose Apparatus for LEP with 4π Coverage)

The collaboration:

Birmingham - Bologna - Bonn - Carleton - CERN - Freiburg - Geneva - Heidelberg - U.C. London - McGill - Manchester - Maryland - NRCC-Canada - Rutherford - CEN Saclay - Tokyo.

LoI sent to CERN on 26.1.1982

Open presentation on 24.3.1982

Competitors were

ALEPH

Delphi

L3

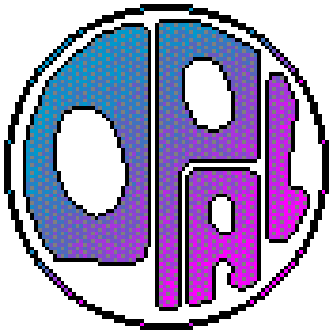
Electra

Logic

(BSF)

LoI Presentation

OPAL – Main Physics Aims (from LoI 1982)



- Observation of Z^0 (mass, BR, width …)
- Measure number of generations
- Test of SM
  - Precise study of electroweak interference
  - Weak decays of heavy quarks
  - Search for the Higgs
- Search for new physics
  - New flavours
  - New heavy leptons
  - Supersymmetry
  - Technicolour
- Study of QCD

LEPC

LEPC chair: G. Wolf

Many interactions after submission and presentation of LoI
Even more questions: physics performance, technical, finances, size, coil

June 82: OPAL is only experiment not offering a 10-15% saving
LEPC: „we have not done our job properly"

At most 4 experiments -> 2 not accepted
At most 3 solenoids
Schopper does not want shoot out

July 82: Prepare cost reduced design (model C) for LEPC

Coil story

LoI had 1 Tesla SC coil

Morpurgo: only SC is technically sound

Schopper and LEPC: OPAL should use warm coil (be safe)
exchange coil later

Koshiba: difficult to defend a first generation experiment

Morpurgo: will nevertheless study thin warm coil

In the end we ran all the years with a warm coil

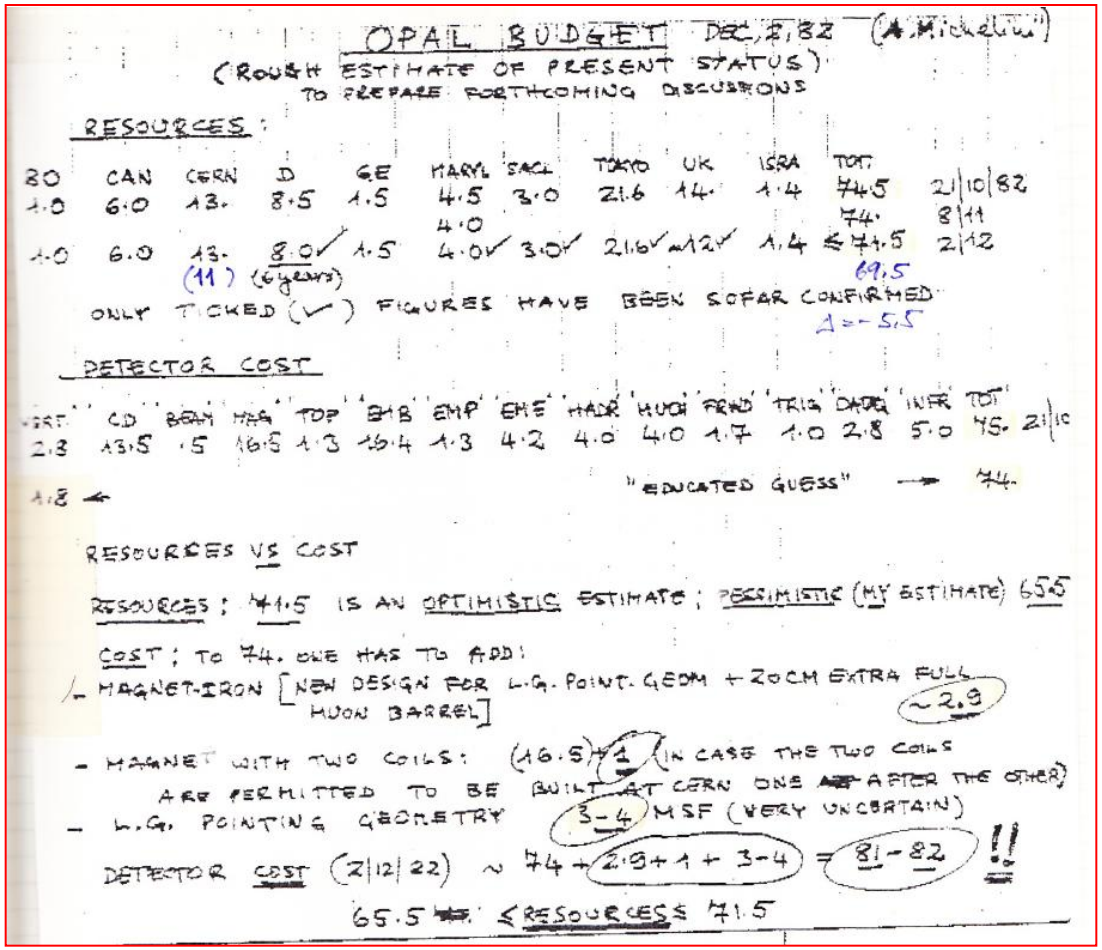
Finances

OPAL cost estimate considered by LEPC as the most realistic

The Matrix (2 Dec 82)

Cost: 81 -82 MCHF

Recources: 66-72



OPAL BUDGET DEC 2, 82 (A. Michelini)

(ROUGH ESTIMATE OF PRESENT STATUS)
TO PREPARE FORTHCOMING DISCUSSIONS

RESOURCES:

BO	CAN	CERN	D	GE	MARY	SACL	TOKYO	UK	ISRA	TOT	
1.0	6.0	13.	8.5	1.5	4.5	3.0	21.6	14.	1.4	74.5	21/10/82
					4.0					74.	8/11
1.0	6.0	13. (11)	8.0 ✓ (6 years)	1.5	4.0 ✓	3.0 ✓	21.6 ✓	12 ✓	1.4	≤ 71.5	2/12
										69.5	

ONLY TICKED (✓) FIGURES HAVE BEEN SOFAR CONFIRMED
1 = 5.5

DETECTOR COST

VERT	CD	BEAM	HAD	TOF	EMB	EMP	EME	HADR	MUOI	FRND	TRIG	DAQ	INFR	TOT	
2.3	43.5	.5	16.5	1.3	16.4	1.3	4.2	4.0	4.0	1.7	1.0	2.8	5.0	45.	21/10

1.8 ← "EDUCATED GUESS" → 74.

RESOURCES VS COST

RESOURCES: 71.5 IS AN OPTIMISTIC ESTIMATE; PESSIMISTIC (MY ESTIMATE) 65.5

COST: TO 74. ONE HAS TO ADD:

- MAGNET-IRON [NEW DESIGN FOR L.G. POINT. GEOM + 20CM EXTRA FULL HUON BARREL] ~2.9
- MAGNET WITH TWO COILS: (16.5) +1 (IN CASE THE TWO COILS ARE PERMITTED TO BE BUILT AT CERN ONE AFTER THE OTHER)
- L.G. POINTING GEOMETRY 3-4 MSF (VERY UNCERTAIN)

DETECTOR COST (2/12/22) ~ 74 + 2.9 + 1 + 3-4 = 81-82 !!

65.5 ≤ RESOURCES ≤ 71.5

Towards an Approval

13 July 82: Results of LEPC meeting

- ALEPH is most liked universal detector
- Integral differences between OPAL and Electra in favour of OPAL
- OPAL preliminary recommendation with warm coil
- 1 detector with good hadron resolution wanted (Delphi)
- L3 only accepted if 4 experiments are to be built
- Logic not accepted

Consequences: Electra dissolving
OPAL to get more collaborators

November 82: Recommendation of OPAL by LEPC under two conditions:

- warm magnet
- pointing LG geometry
- Milestone: successful test of FSP

Full Technical Proposal in April 1983

16 June 1983: Final approval by Research Board

Organisation

OPAL organisation did not follow the text books

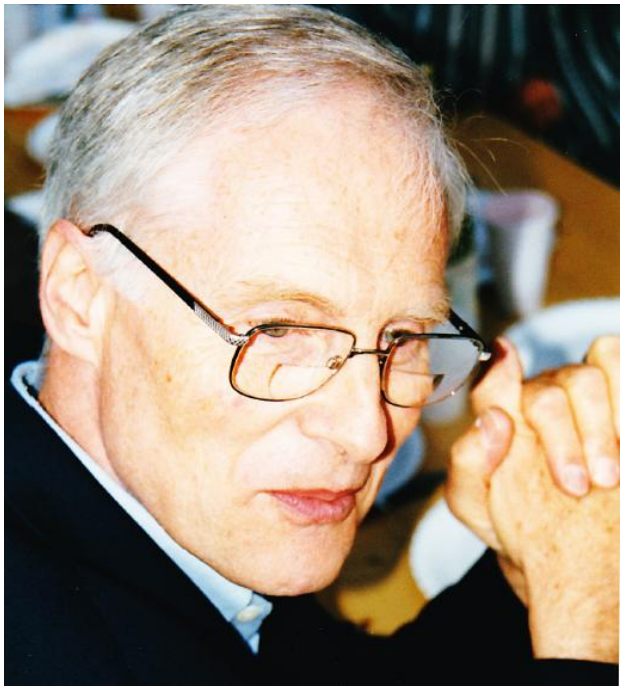
Key elements were (they were generated as time passed and complexity increased):

- Collaboration meetings
- Editorial boards
- Parameter group
- Group of 6 (to become 9)
- Coordinators (financial, technical, GLIMOS, physics etc.)
- Sub-detector groups (e.g. DSG of jet chamber)

The Three Chiefs

… and their management styles

With first Physics Coordinator



The Collaboration

OPAL Communication – Aldo's notes

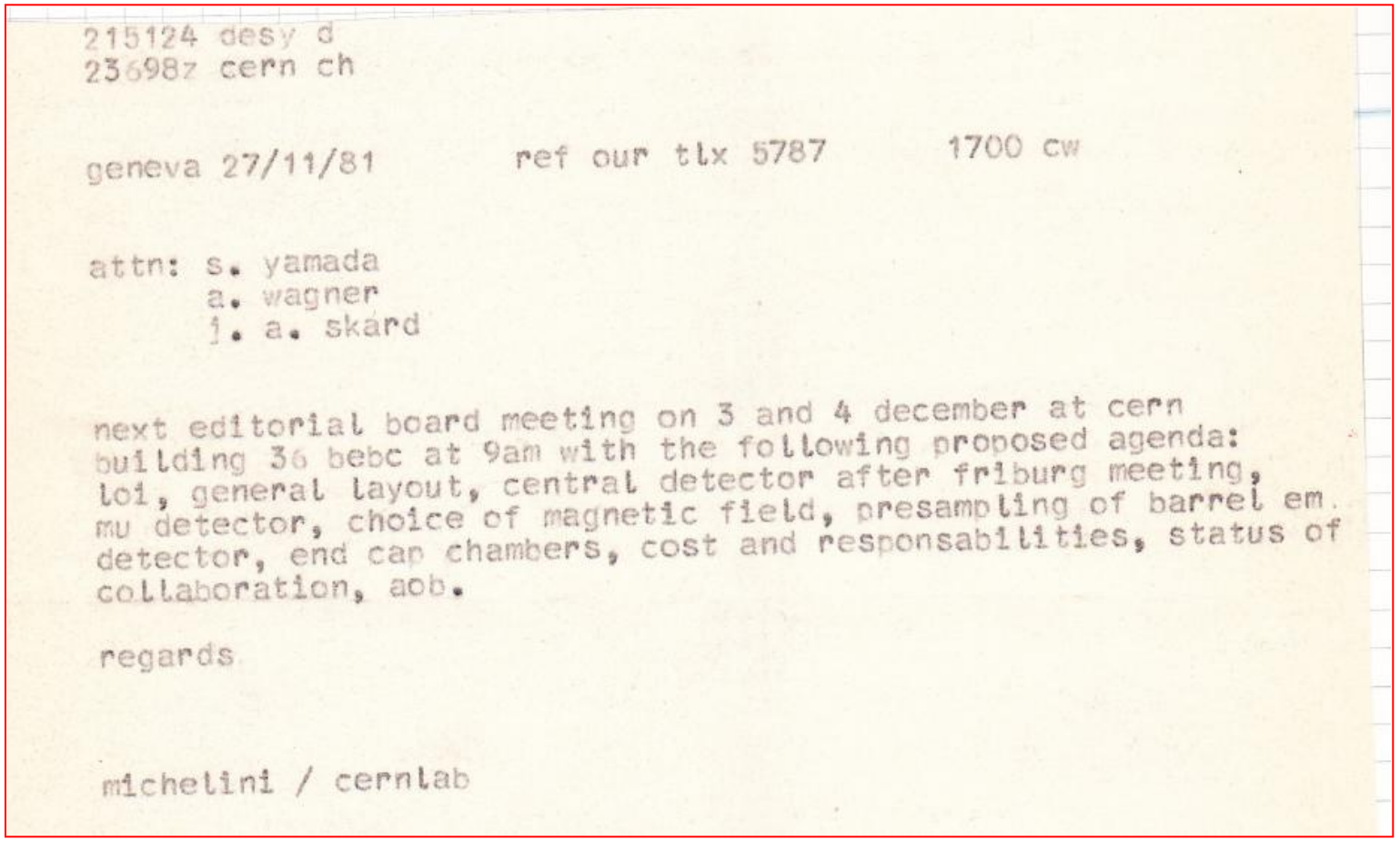
CONFIDENTIAL (not for computer file!) 23/11/81

DEAR COLLEAGUE.

I WOULD LIKE TO MAKE SOME REMARKS ON THE PRESENT COST ESTIMATE OF OPAL (PAGE 14 OF LOI)

1. MAGNET: THE ORIGINAL ESTIMATE BY MORPURGO BASED ON THE SO FAR-AVAILABLE DESIGN, AMOUNTS TO 13.5 MSF (2.5 FOR THE COIL, .75 POWER + CONTROLS, 6.0 FOR IRON, 2. FOR CHARRIOTS, .75 FOR CONTINGENCIES AND 1.5 FOR REFRIGERATION). THE ESTIMATE LISTED ON PAGE 14 OF L.O.I ~~is~~ ASSUMES THAT THE REFRIGERATOR CAN BE FOUND AMONG THE EXISTINGS AT CERN (NORTH AREA ?. WHICH, ALTHOUGH POSSIBLE, CANNOT BE USED AS AN ARGUMENT TO REDUCE THE PRESENT COST ESTIMATE. AS YOU REMEMBER, THE MAGNET IS BEING REDI-SEGNED BY MORPURGO AND AN INCREASE IN PRICE IS TO BE ~~EX~~PECTED. (HOPE TO KNOW THAT BY NEXT EB MEETING).
↳ (LONGER COIL + SEGMENTED END CAPS).

OPAL Communication – the age of telex



215124 desy d
23698z cern ch

geneva 27/11/81 ref our tlx 5787 1700 cw

attn: s. yamada
a. wagner
j. a. skard

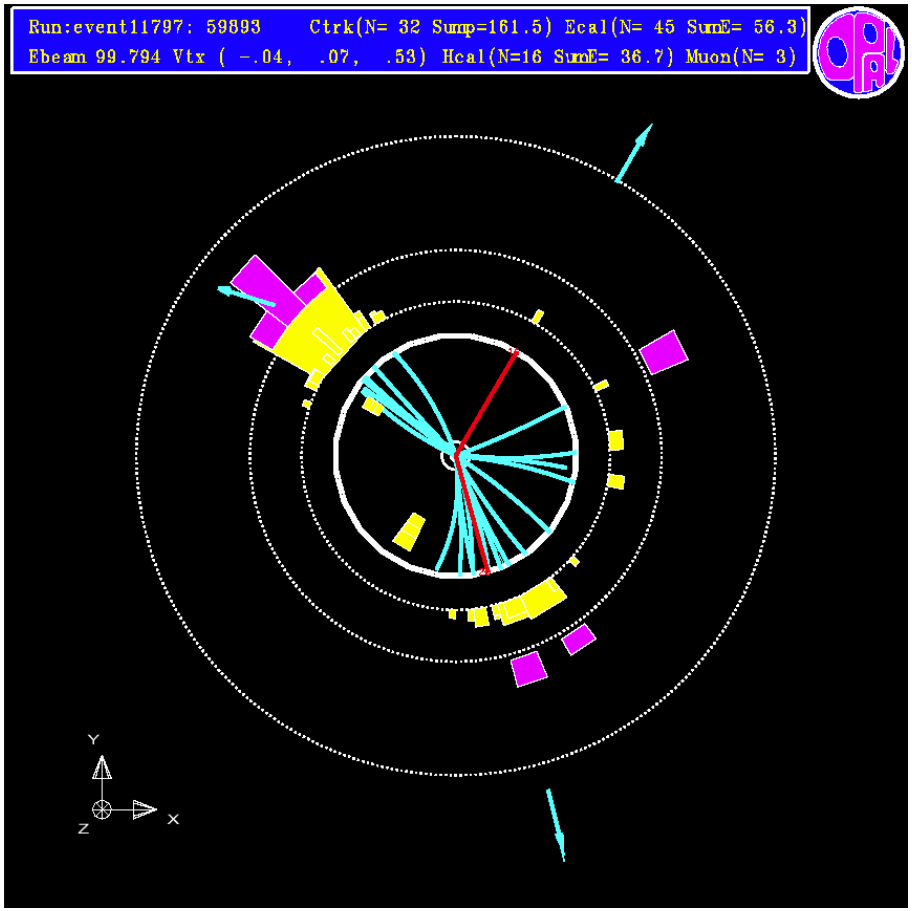
next editorial board meeting on 3 and 4 december at cern building 36 bebc at 9am with the following proposed agenda: loi, general layout, central detector after friburg meeting, mu detector, choice of magnetic field, presampling of barrel em. detector, end cap chambers, cost and responsabilities, status of collaboration, aob.

regards

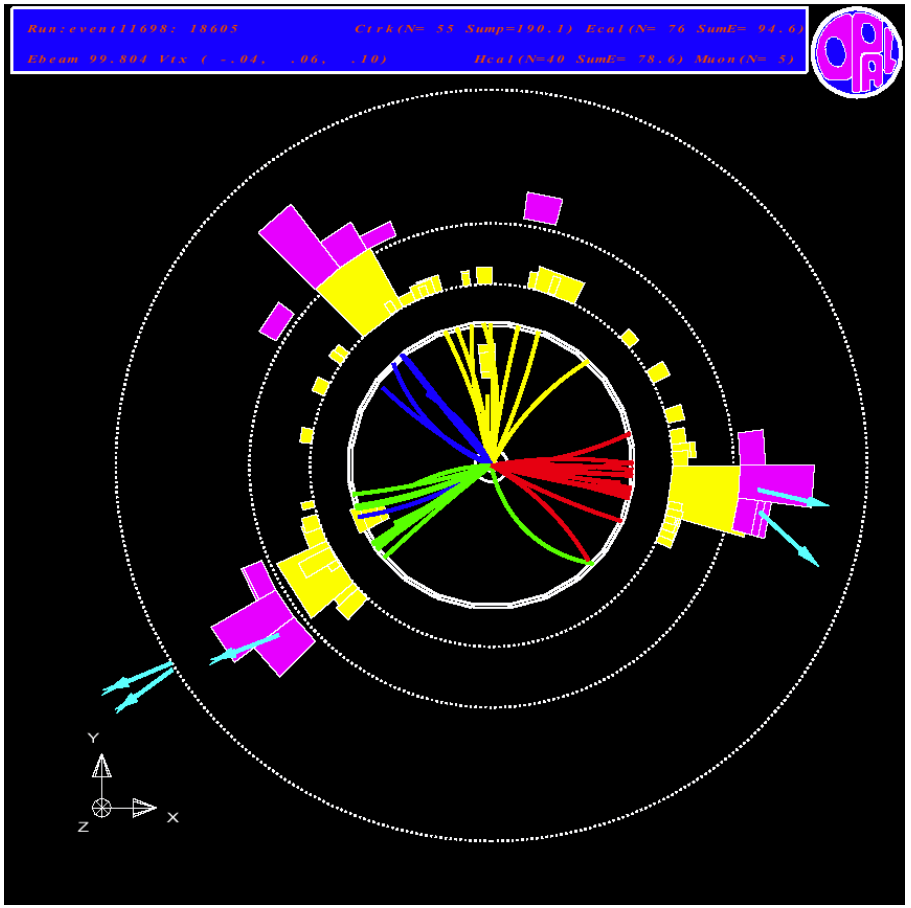
michelini / cernlab

The www was a by-product of LEP

And later (1989) … first results



q q μ μ



q q q q

First Results - CERN 13.10.1989

Conclusion

OPAL measurements of the parameters of the intermediate Vector Bosons Z^0:

based on 4359 events $Z \to q\bar{q}$

$M_Z = 91.010 \pm 0.051 \pm 0.046$ GeV

(machine energy uncertainty)

$\Gamma_Z = 2.60 \pm 0.13$ GeV

$N_\nu = 3.12 \pm 0.42$

Thank you all