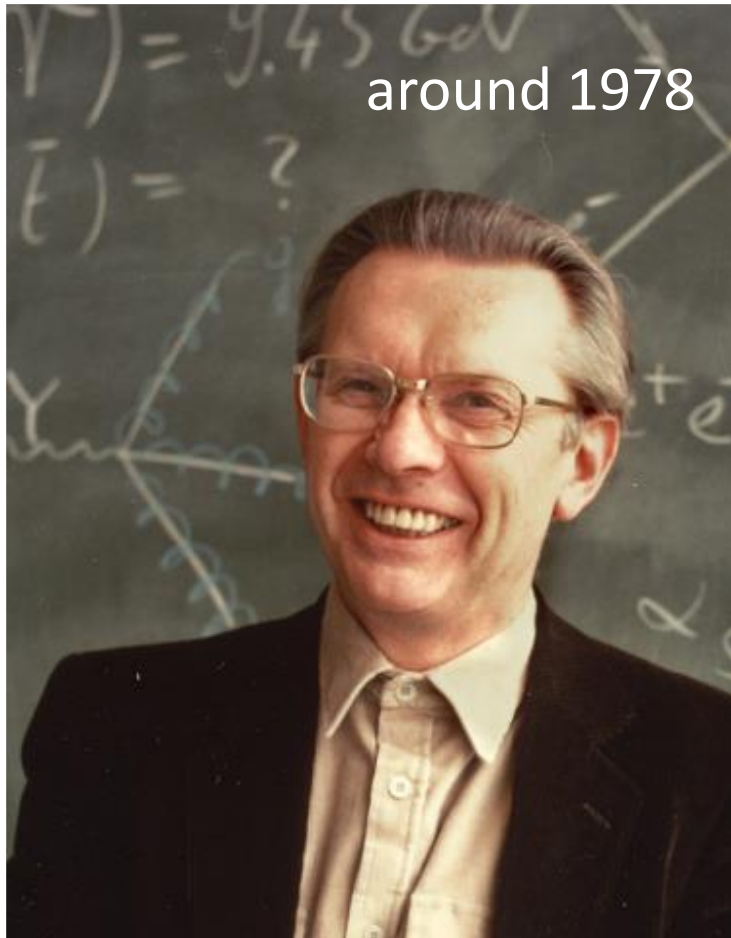


HERWIG SCHOPPER



around 1978

His career in Germany

A few highlights from
an amazing voyage
through
space, time, and
physics



2013

Herwig Schopper in Germany

(and elsewhere)

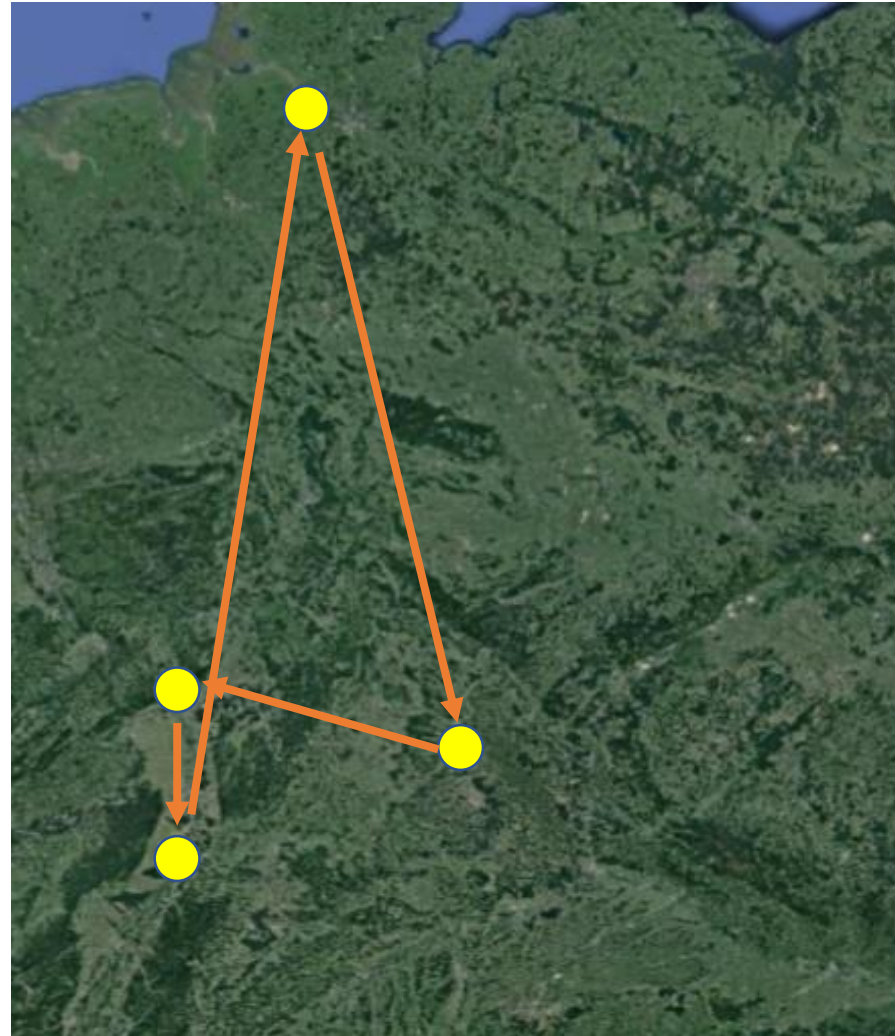
Hamburg, 1973-1980
DESY DG

Mainz, 1957-1961
Professor and Institute Director

Cornell, sabbatical, 1960/1961

Karlsruhe, 1962-1972, Professor
and Director, TH / KfZ

CERN, Research Ass.. 1966/1967
Leader Division of Nuclear Physics,
1970-1972



Hamburg, 1945-1953
Studies, PhD thesis and Postdoc

Stockholm, sabbatical, 1951-1952

Erlangen, 1953-1957
Assistant and lecturer

Cambridge, sabbatical, 1956-1957

Herwig Schopper's 100th Birthday, 1 March 2024

Hamburg 1945-1953

Herwig Schopper began his studies of physics at the University of Hamburg in 1945.

Chair of Experimental Physics at UHH was **Rudolf Fleischmann**, a nuclear physicist

Fleischmann became a role model for Herwig due to his curiosity and wide interest.

RF was a famous lecturer and hired HS as a part time assistant to prepare experiments for the lectures and take care of students in their Lab classes (Praktikum).



https://www.youtube.com/watch?v=KSHh19K2_PI

Nuclear Physics in Germany

- Herwig was very interested in nuclear physics, but nuclear physics research was forbidden in Germany until 1955 (Sovereignty)
- In fall 1955: Federal Ministry for Atomic Affairs
 - promote and advance research and utilisation of nuclear energy by establishing research centres outside universities and
 - by financing projects in industry and universities
- This paved the way for Nuclear Physics (and energy) in Germany and for HS's future activities

Hamburg 1945-1953

For his Diploma and PhD thesis, Herwig worked with Fritz Goos in **optics**

He developed a range of formulae for transmission and reflection of electromagnetic waves from thin single layers, and for multilayers. First method to measure the absolute phase in reflection of light from thin metal surfaces
-> **PhD** in April, 1951

Die Bestimmung der optischen Konstanten und der Schichtdicke absorbierender Schichten mit Hilfe der Messung der absoluten Phasenänderung. In: Z.Physik, 129, 285 (1951)

At the same time: full-time assistant to Rudolph Fleischmann, and starting to work on polarized proton sources

Hamburg 1945-1953

Being aware of Herwig's interest in nuclear physics,
Fleischmann organized a one-year research fellowship for Herwig
(after he had finished his PhD) to go abroad, to learn how to do
nuclear physics
He suggested Stockholm..

Stockholm 1951/1952



In Stockholm Herwig worked with **Lise Meitner**

Herwig's task was to perform a precise measurement of β spectra by measuring the absorption rate of electrons in different materials using radioactive sources and a Geiger-Müller counter.

This was his first experiment in Nuclear Physics in the keV range.

Erlangen 1953-1957

- Fleischmann moved to Erlangen in 1953 and persuaded Herwig to join him with the goal to become „Dozent“ (lecturer).
- Herwig's research focused on:
 - Beta decays, beta-gamma angular correlations
 - Building the world's first polarised proton source (Clausnitzer, Schopper, Fleischmann) -> [Chris Fabjan](#).

*GC, HS, RF: Erzeugung eines Wasserstoffatomstrahles mit gleichgerichteten Kernspins. In: Z.Physik, 144, 336 (1956) **

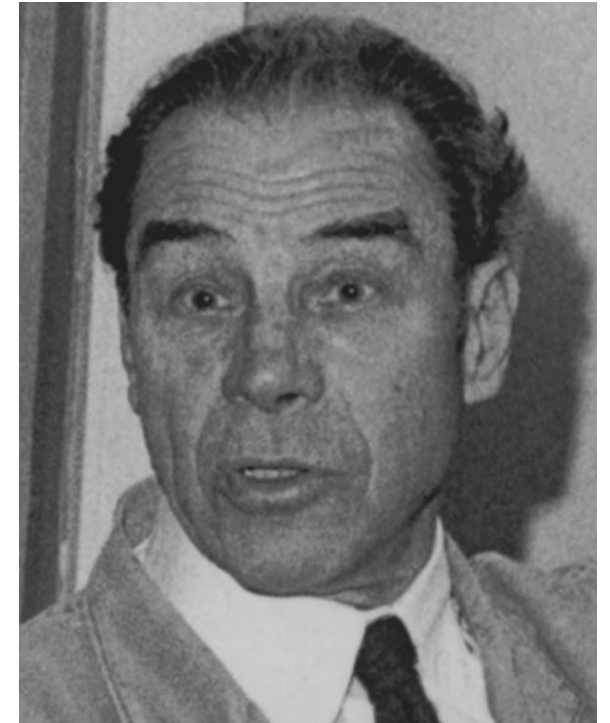
Cambridge 1956/1957

- Sabbatical, at Cambridge with Otto Frisch, to learn how to do nuclear physics with an accelerator, arriving in Summer 1956
- Cambridge had a Van de Graaff accelerator operating at 3 MeV
- Herwig investigated the splitting of the deuteron using energetic photons

- He then moved on to do an experiment to provide a further proof parity violation by measuring circular polarisation of γ -rays in the β -decay of ^{60}Co and ^{22}Na -> [Sam Ting](#)

Mainz (1957-1961)

- In 1957 professorship in Mainz
- To set up an institute for research in experimental nuclear physics.
- His partner: Swiss nuclear physicist, Hermann Wäffler, who had experience in accelerator physics (MPI für Chemie, Mainz)
- Proposal for a linear accelerator, which later developed into the Mainz Microtron Laboratory
- Before the linac was complete, Herwig moved on, **in two directions**



Hermann Wäffler

Cornell (1960/1961)

- Willibald Jentschke needed people for DESY who knew how to do experiments at an electron accelerator. He asked Herwig to work at **Cornell** which had the highest energy electron accelerator at that time (1.4 GeV).
- Herwig accepted the challenge
- At the same time, he was offered a position as professor at the TH **Karlsruhe** and Director of two Institutes for Nuclear Physics, at the TH and the Forschungszentrum Karlsruhe (FZK, Center for Nuclear Research).

Cornell (1960/1961)

- Robert Wilson suggested the construction of a spectrometer, Herwig used a quadrupole magnet instead of a dipole to measure electron scattering from an internal target.
- Determined the electric and magnetic form factors of the proton and the neutron
- Running both the experiment and the accelerator at the same time
- 1961 was also the year when the Wall was built dividing Germany.... Return to Germany or not??



Karlsruhe (1961-1972)

- TH Karlsruhe and FZK appointed Schopper as Director of their Institutes of Experimental Nuclear Physics
- His condition was the **unification of both institutes:**
 - University: self-defined, open research, students
 - Center: infrastructure needed for big experiments, center profits from open research
- While in Karlsruhe, Herwig spent 3 years at CERN, 1 year as research Associate and 2 years as Head of the NP division

Karlsruhe (1961-1972)

- Research directions at the IEKP:

1. Nuclear physics (parity violation, nuclear physics with cyclotron, polarised protons,..)
2. Particle Physics:
 - a. [Electron Nucleon scattering at DESY](#) -> electromagnetic form factors
 - b. [Neutron scattering at CERN](#) and Serpuchov (some work as Research Associate)
 - c. [Invention of Hadron Calorimetry \(1967\)](#) -> see [Chris Fabjan](#)
3. Mesonic atoms and meson spectroscopy
4. European development of [superconducting RF cavities](#) -> see [Chris Fabjan](#)
5. Proposal for a 300 GeV proton accelerator

DESY (1973-1980)



Willibald Jentschke:
Director of DESY until 1970
DG of CERN from 1971-1976



Wolfgang Paul:
Director of DESY from 1971-1972



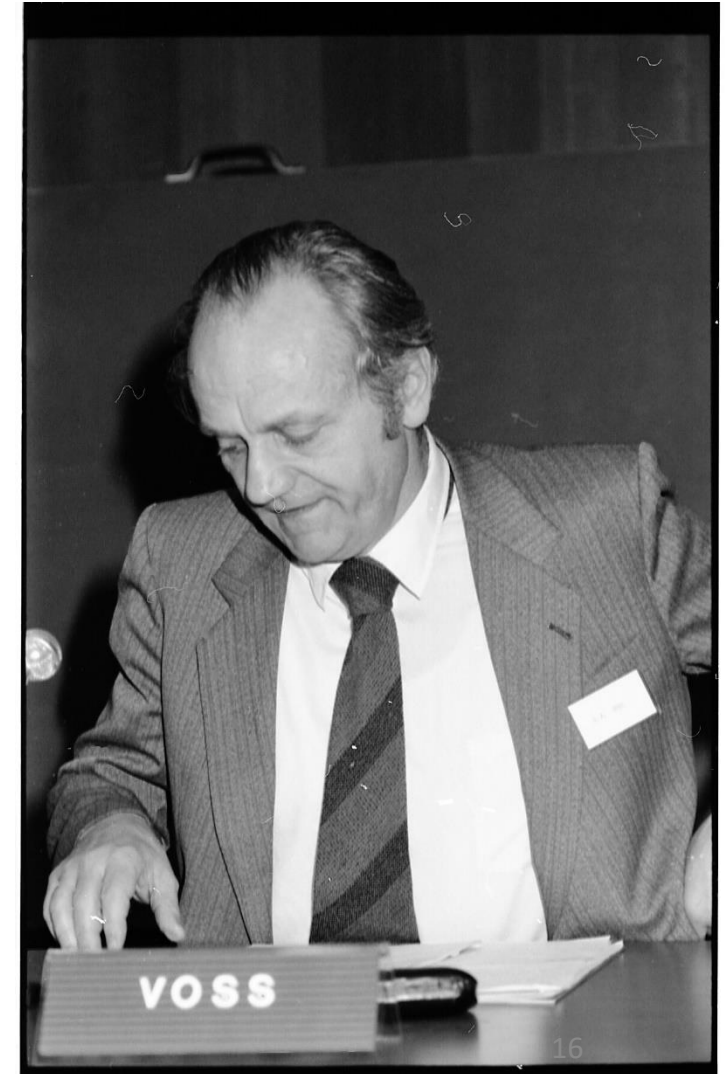
Herwig Schopper:
Director of DESY from 1973-1980
DG of CERN from 1981-1988

DESY in 1973

A good time to arrive

- DESY had gained reputation
- The DORIS e+e- storage ring (3.5 GeV):
completed and ready to take data (summer 1974)
- Stable funding

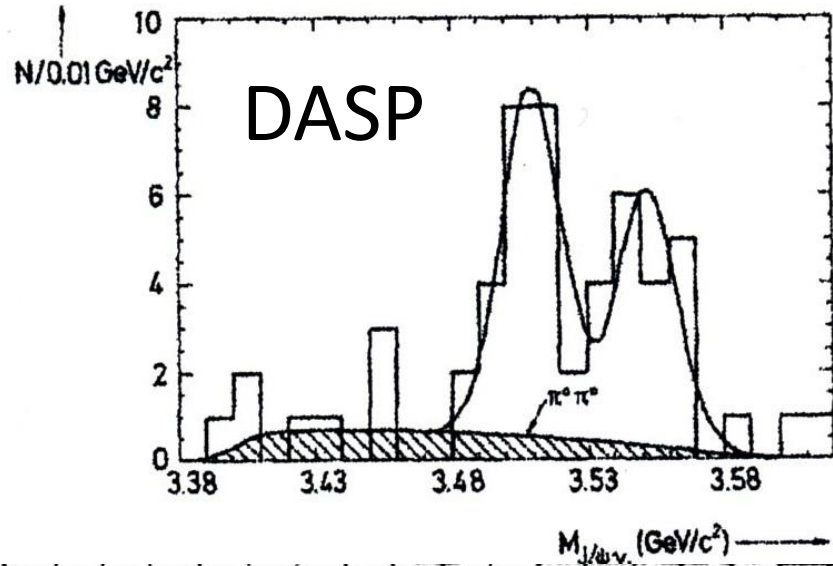
- A brilliant team: Voss (arrived in Jan 1973),
Teucher, Weber, Berghaus as directors
- Intriguing hints from R measurement from
Frascati and CEA



DESY: No time to rest

- November revolution 1974
- European future plans under ECFA
- adapting of DORIS scientific program
- Prepare to compete
 - > Proposal of PETRA
- Make PETRA a reality
- International use of PETRA
- Upgrade DORIS, build ARGUS
- HERA planning
- Foundation of HASYLab
- New SR beam lines
- Ypsilon discovery (1977)
- DESY long term future
- Synchrotron radiation at DORIS
- Serving a larger community

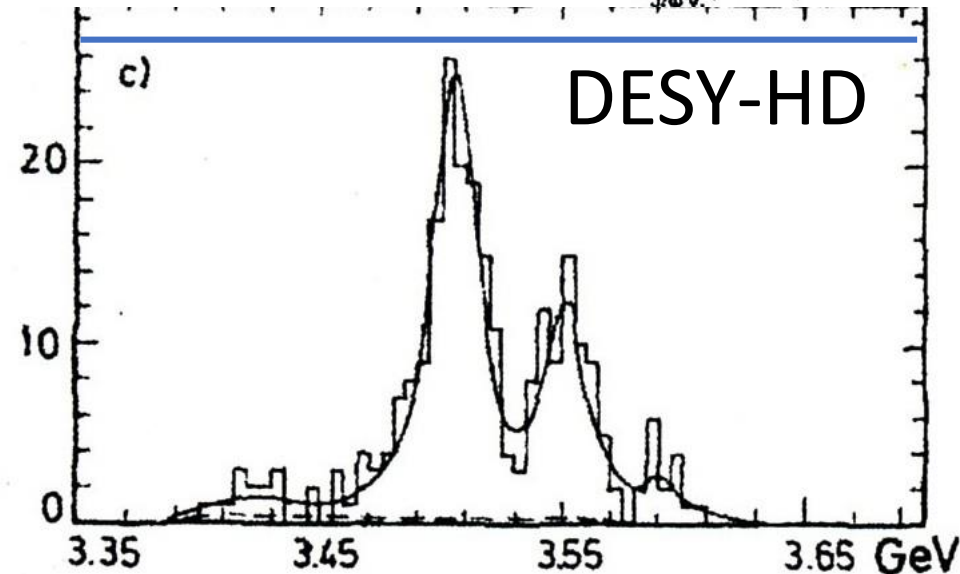
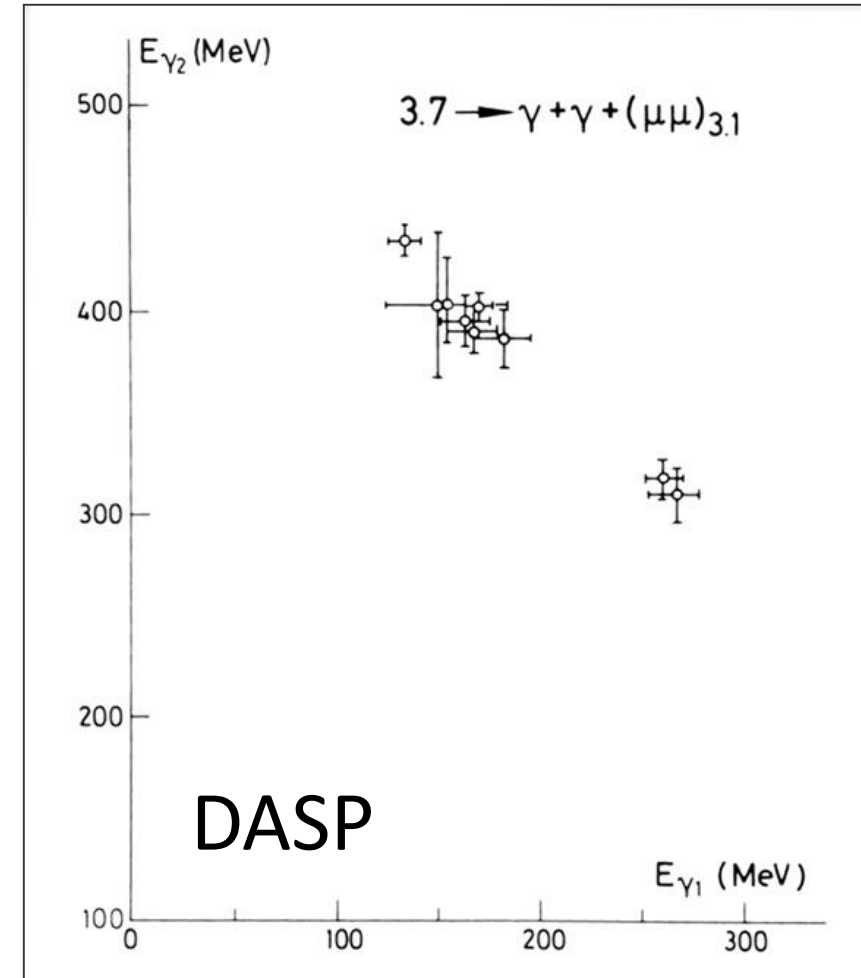
DORIS – The era of the charm quark – 1975 ff



Cascade decay of Ψ' (3684)

via intermediate state into

$J/\Psi(3095)$



$J/\Psi(3095)$ is a positronium-like bound state of charm-anticharm quarks

PETRA 1976 - 1986



Construction started in 1976

The project advanced very fast

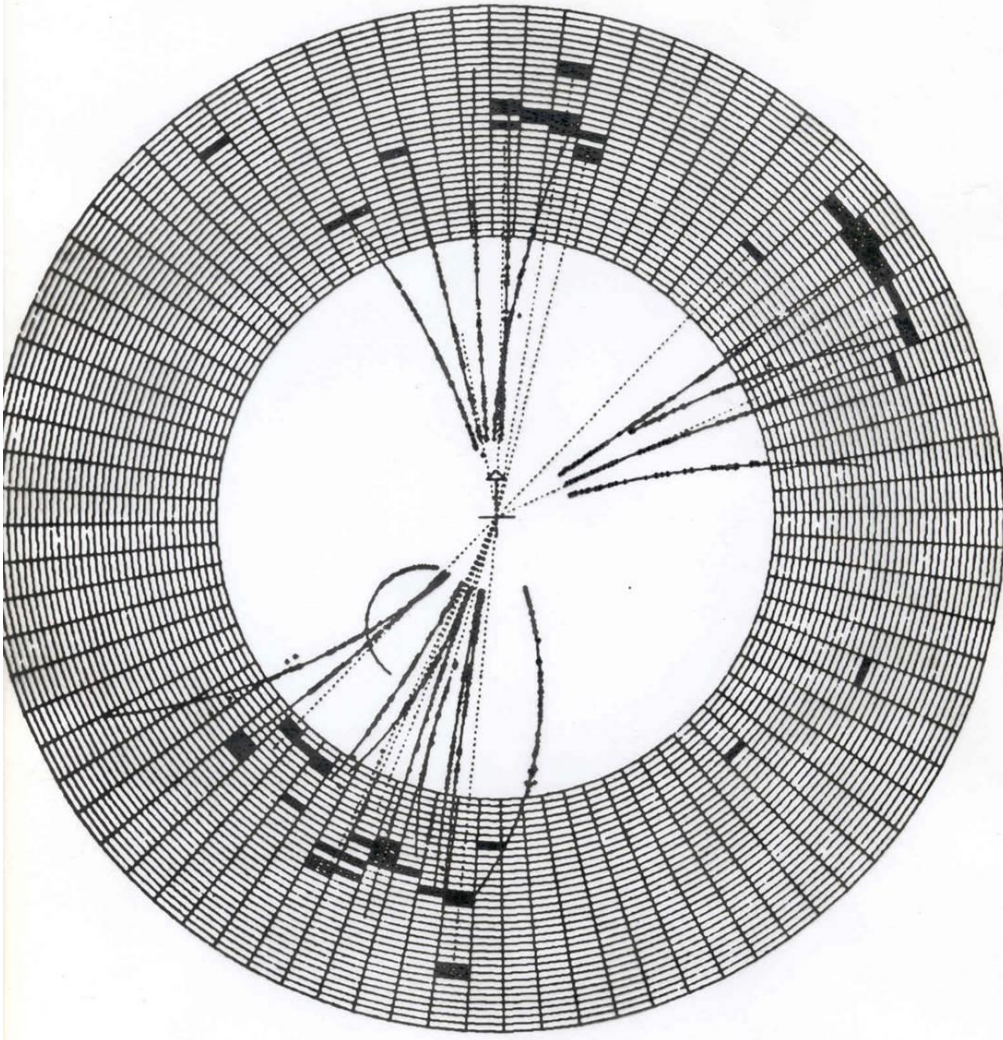
Construction completed in 1978, > 12 months **ahead of schedule** (and 20 M under budget of 100 MDM)

First **stored beam** in July 1978

Five experiments approved - CELLO, JADE, Mark J, PLUTO, TASSO

With PETRA DESY became international

Discovery of the Gluon



PETRA as test bed of QCD:
quarks radiate gluons -> 3 jet events
planar events with 3-jet structure
one sided **jet broadening**

B. Wiik, Bergen, 18 June 1979

Paul Soeding, EPS Geneva
conference, 27 June – 4 July 1979

Lepton Photon Symposium 1979

Fermilab 23– 29 August 1979

The conclusion of all four PETRA experiments (JADE, Mark J, PLUTO and TASSO) was very similar.

To cite Haim Harari from his summary talk in 1979:

5.3. Gluons Exist

(a) Have we really seen three-jet events in e^+e^- collisions?

(b) If we did, does that confirm the existence of the gluon?

- Our answer to both questions is a cautious, qualified yes.

- Our tentative conclusion is that the experimental evidence for three jets is quite good

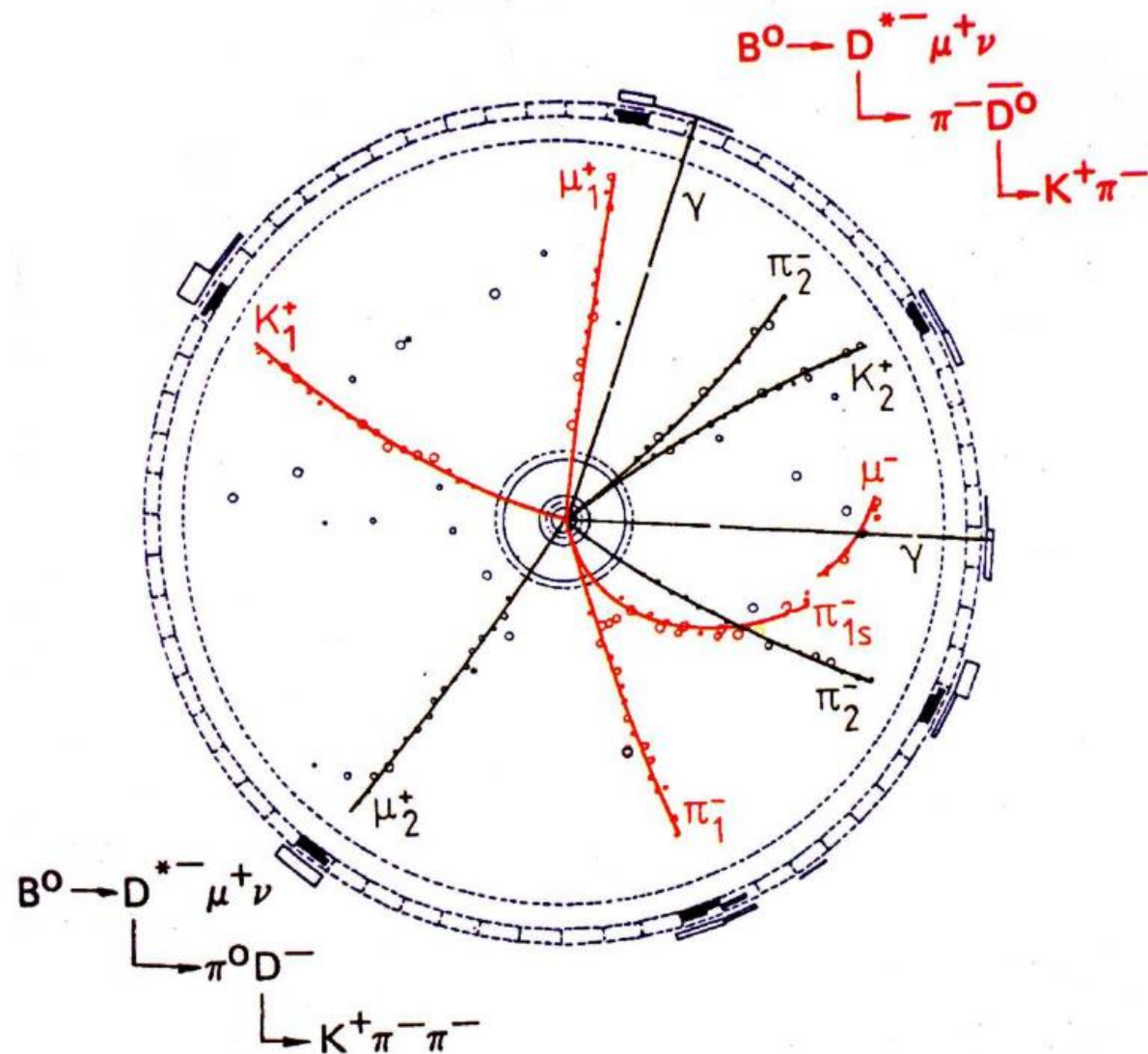
- The most likely explanation is the gluon.

- It is absolutely crucial to confirm the spin of the gluon.

“We believe, however, that five years from now, when we look back, we will all agree that the gluon was discovered in the summer of 1979.”

ARGUS at DORIS

Built at the initiative of H. Schopper, led by W. Schmidt-Parzefall



Neutral B mesons show surprisingly large flavour mixing

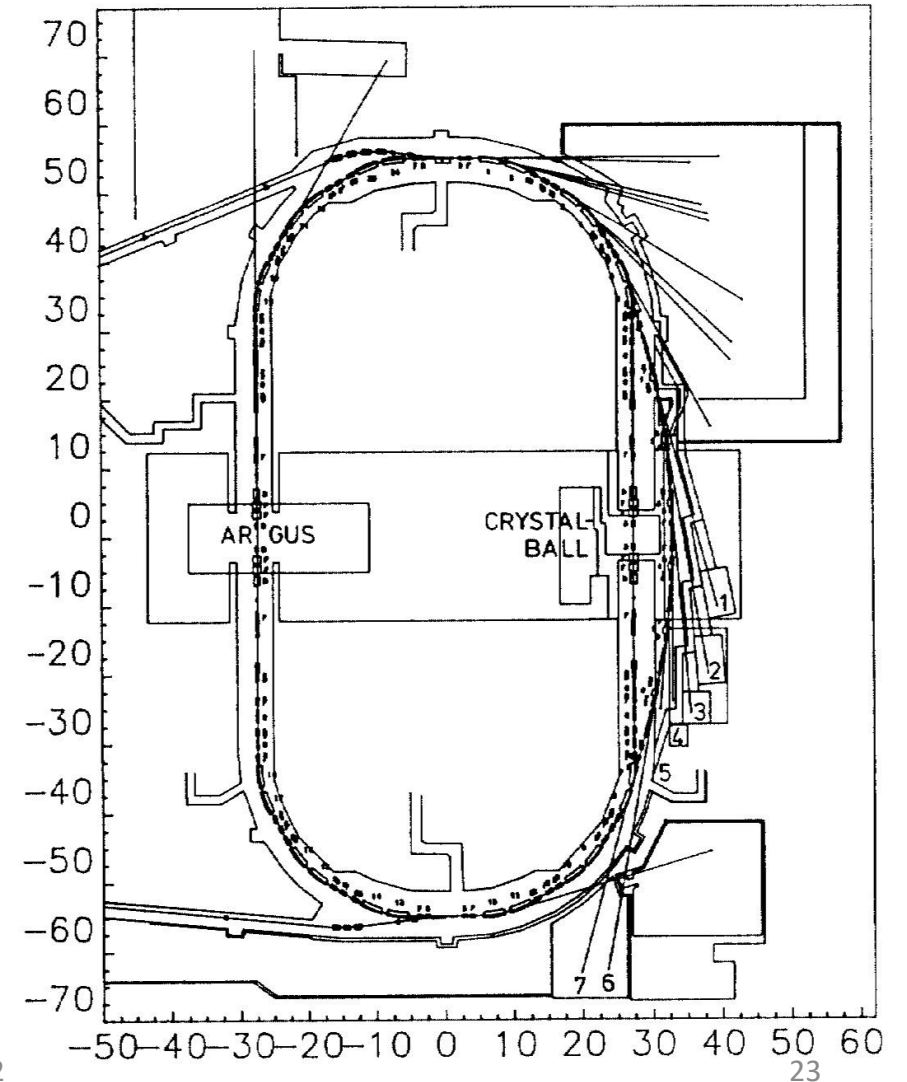


Impact:

- Top mass is heavy ($m > 50$ GeV)
- No top at LEP1 and SLC, no toponium
- CP violation of B mesons is observable
- B factories & LHCb required
- No new physics just around the corner

Hamburger Synchrotronstrahlungslabor HASYLAB

- Storage rings changed the use of synchrotron radiation for science
- HS instituted HASYLAB in 1977, built in 79-80
 - to support the growing user community
 - to extend the facilities
- The reconstruction of DORIS bypass started in 1990
- End of ARGUS in 1993
- DORIS III became a dedicated synchrotron source.



From DESY to CERN (1981-1988)

This talk covers only a small sample of Herwig's activities in Germany and at DESY.



Taking Stock: Scientist and Science Facilitator

- Deep love for science with all its facets,
- Strong sense for where science is going and what can be done
- Clear leadership
- capacity to listen attentively, to analyze, to decide, to explain and convince,
- sincere interest in people,
- Idealism.

You paved the way for many of us.

Taking Stock: Science Policy

Examples from his time in Germany:

- Physics Committee of the German Atomic Commission
- Close contacts to HH and to Bonn
- Close contacts to other labs
- 1977 China
- AGF (Helmholtz Association)
-



Vital other Aspects

1. Very good health
... with the occasional exception

Why you should never retire

(Economist):

Excitement, even in significantly lower doses than are typical earlier in a career, can act as an **anti-ageing serum**.

2. Friends and family



Music



If music be the food of life, play on!

Ad Multos Annos



With our deep
gratitude for all you
have done for
science and, through
science, for the
world!