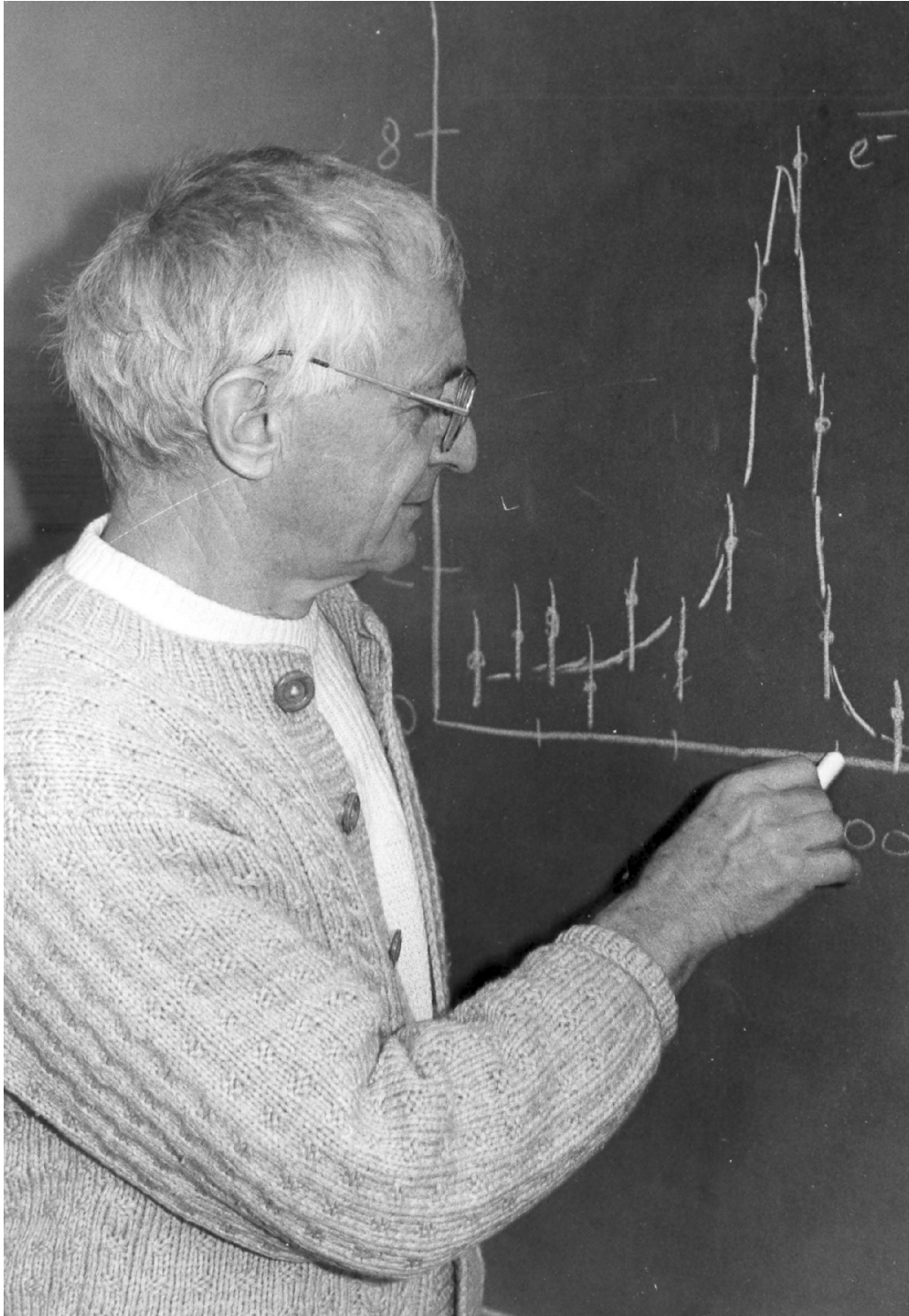
Gabrijel/Elko Kernel

1932 - 2025



Elkotova raziskovalna pot

- IJS: jedrska fizika, meritve z betatronom
- Univerza v Oxfordu
- Eksperiment Omicron v CERNu
- Eksperiment ARGUS v DESY
- Eksperiment DELPHI v CERNu

Magnetni spektrometer Omicron v CERNu

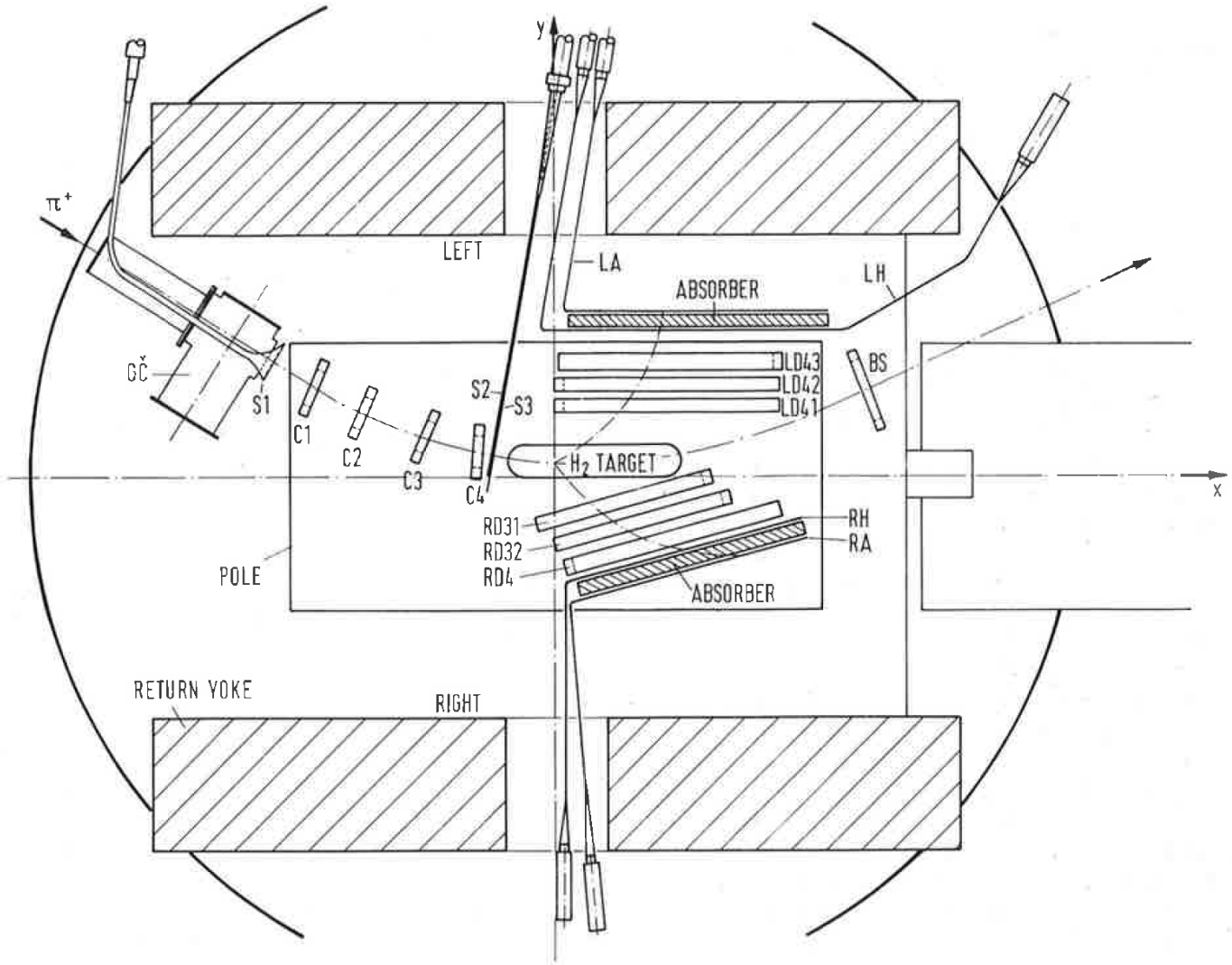


Fig. 2. Layout of detectors and target in the Omicron spectrometer for $\pi^+ p \to \pi\pi N$. C1–C4 are MWPCs, LD41, LD42, LD43, RD31, RD32, RD4 are drift chambers, S1, S2, S3 scintillation counters and LH, LA, RH, RA scintillation hodoscopes.

Pionski žarek s protoni iz sinhrociklotrona

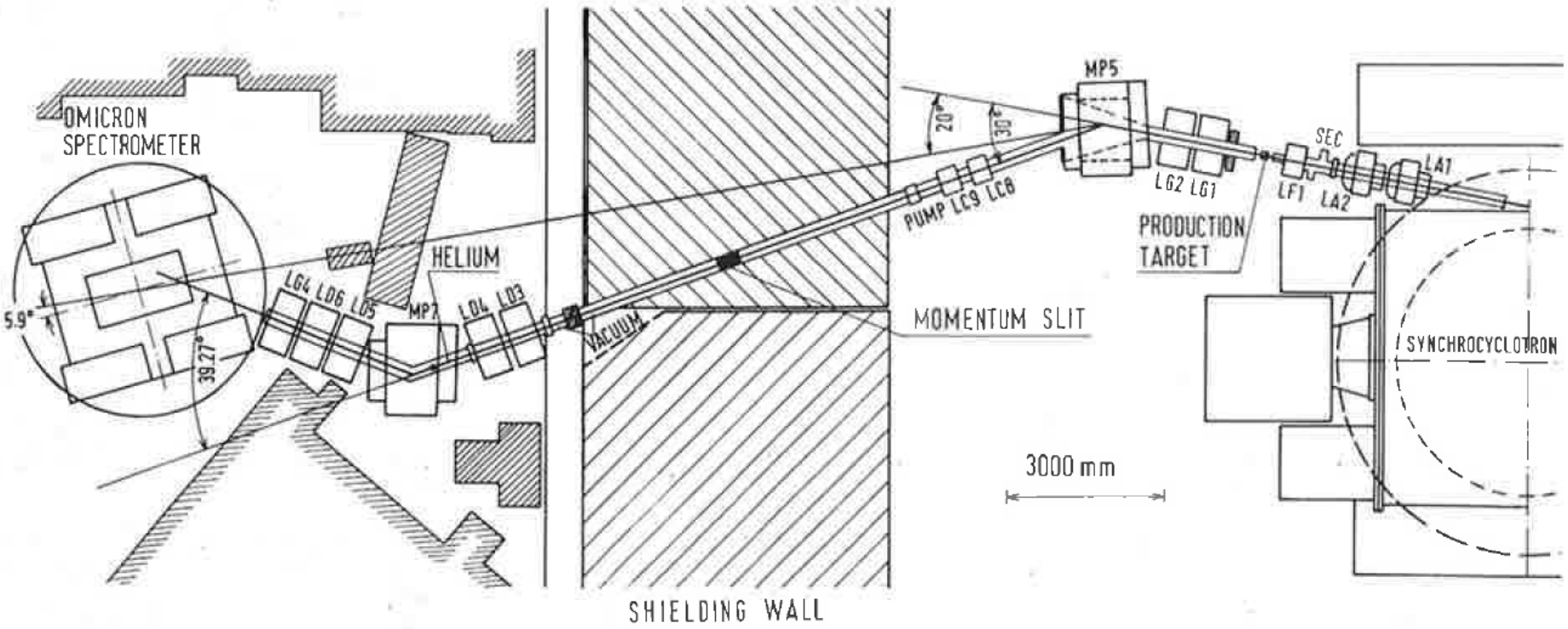
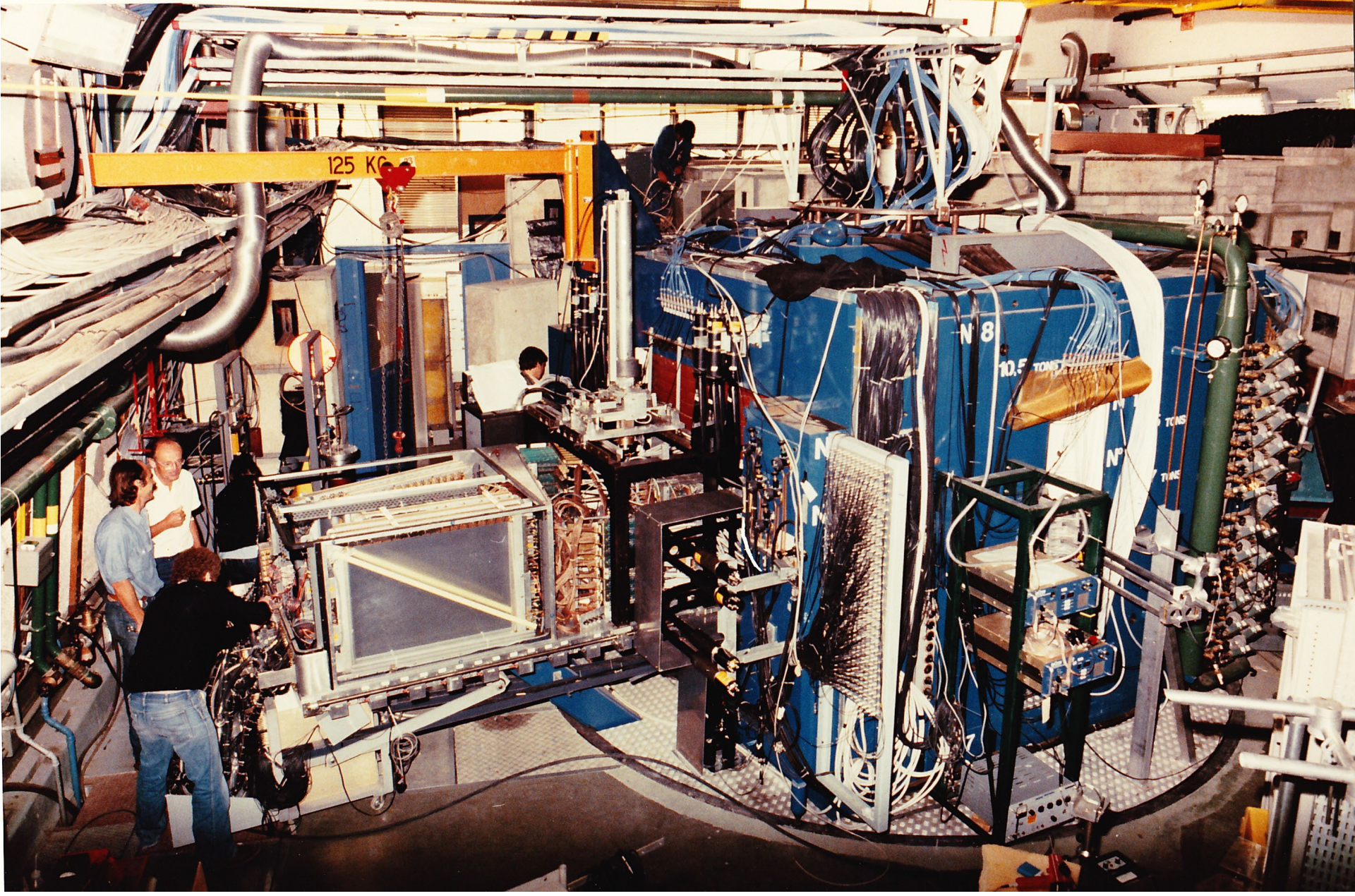
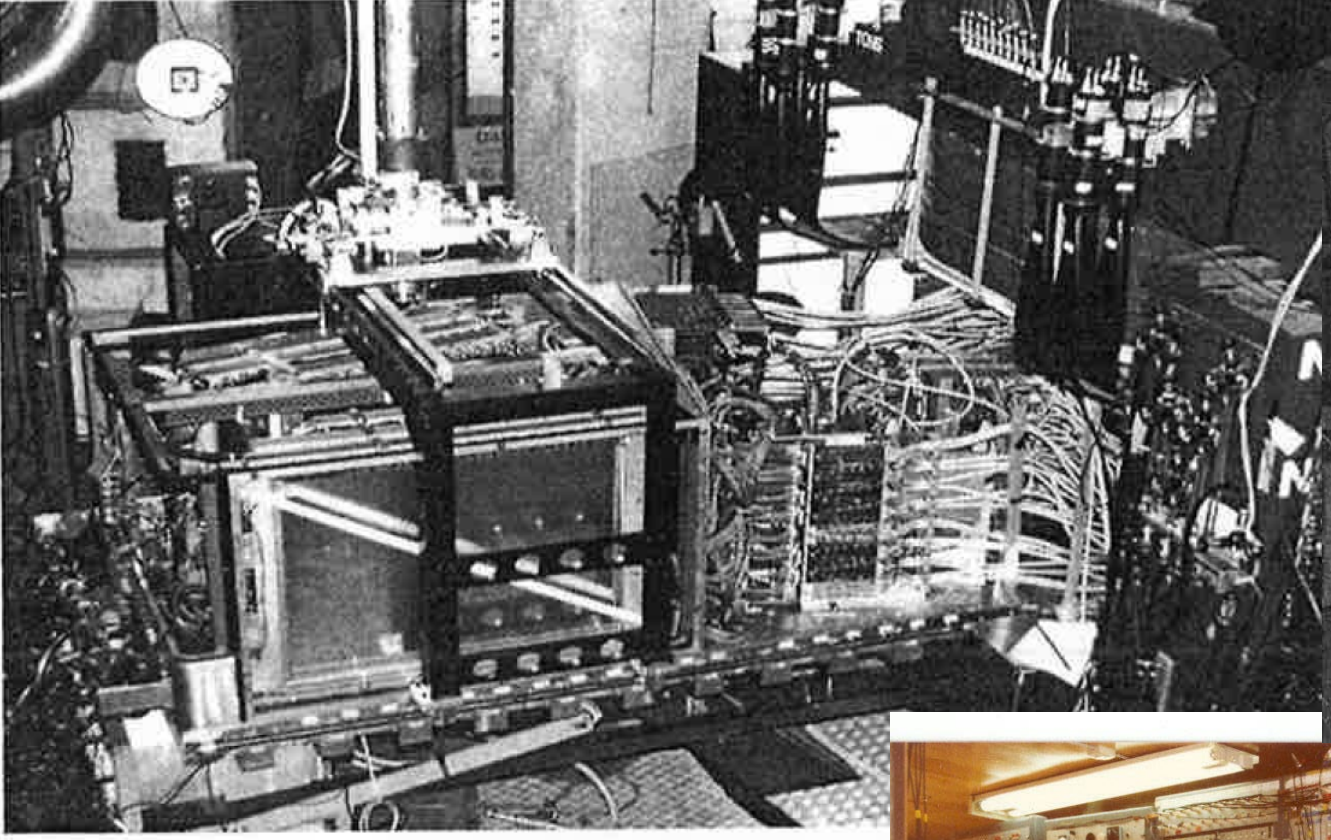
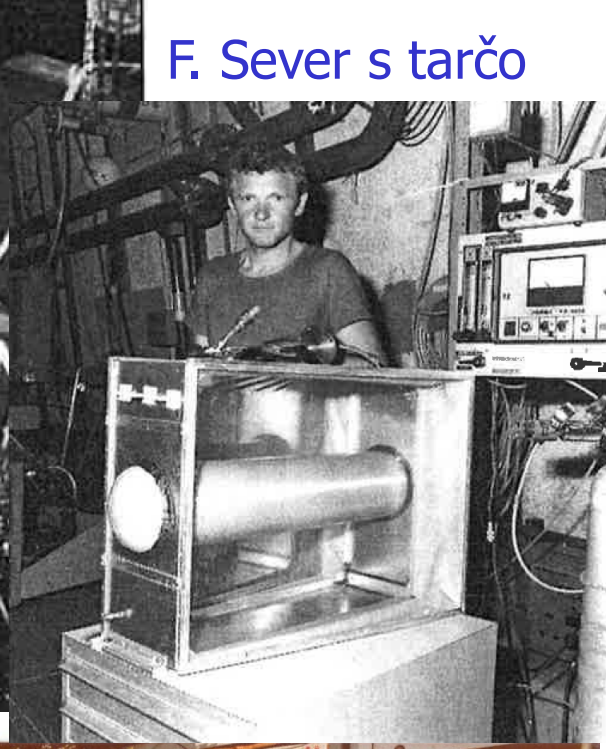


Fig. 1. Beam transport layout for $\pi p \to \pi\pi N$ measurement.

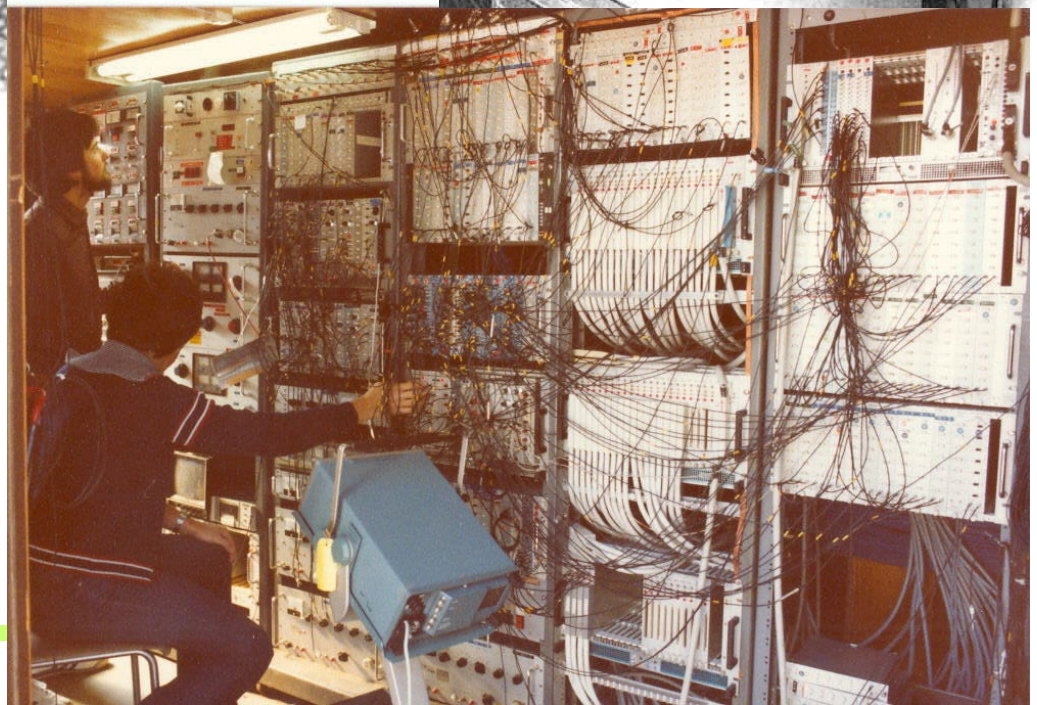

125 KG
N 8





F. Sever s tarčo

Detektor v izvlečenem položaju za montažo, popravila in meritve položaja detektorskih komponent



Kontrolna soba: vse v enem, triger, DAQ, diagnostika, doktoranti ☺

Instrumentacija v fiziki delcev

Elkova vizija je bila, da moramo za vsak mednarodni projekt prispevati tudi inovativne rešitve v instrumentaciji.

Za spektrometer Omicron

- Večžična proporcionalna komora za meritev vpadnega žarka
- Čerenkov detektor za meritev sestave vpadnega žarka
- Prožilni sistem, ki uporablja signale na žičnih komorah
- Metode za rekonstrukcijo sledi
- ….

Odskočna deska za kasnejši razvoj detektorjev na F9 in za njihovo uporabo v medicinskem slikanju.

VOLUME 17, NUMBER 11 PHYSICAL REVIEW LETTERS 12 SEPTEMBER 1966

PION SCATTERING LENGTHS*

Steven Weinberg
Department of Physics, University of California, Berkeley, California
(Received 20 June 1966)

The current commutation relations[1] and partially conserved axial-vector current (PCAC) assumption[2,3] allow the calculation of the matrix elements for emission and absorption of any number of soft pions[4] and, therefore, in particular, determine the scattering length of a pion on any target particle. In this note we give a simple formula for pion scattering on any particle but a pion,[5] and then extend this result to the more difficult case of pion-pion scattering.

Motivacija: meritev pionsko-pionske sipalne dolžine preko procesov tipa π p → π π N v bližini praga za reakcijo

→ Elko predlagatelj in 'spokesperson'
zaporedja eksperimentov SC94

Omicron @ CERN

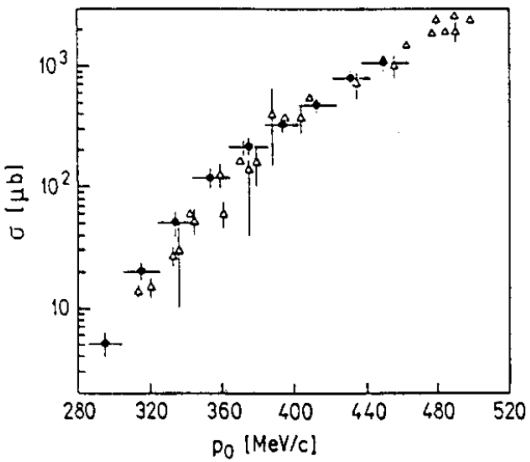
Omicron @ CERN

Omicron @ CERN : izlet na Juro

V CERNovi kantini

Omicron, analiza podatkov po končanem eksperimentu: sestanek na IJS, druženje na Vrhu

$\pi^- p \rightarrow \pi^- \pi^+ n$



$\pi^- p \rightarrow \pi^- \pi^0 p$

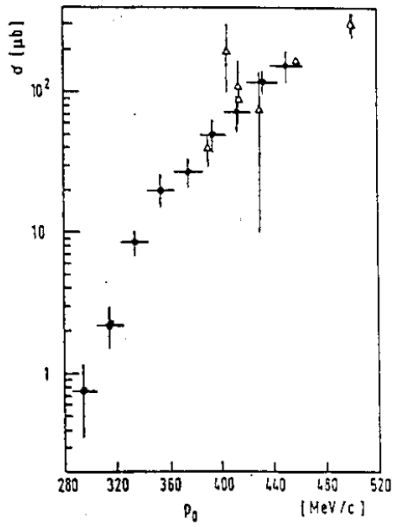
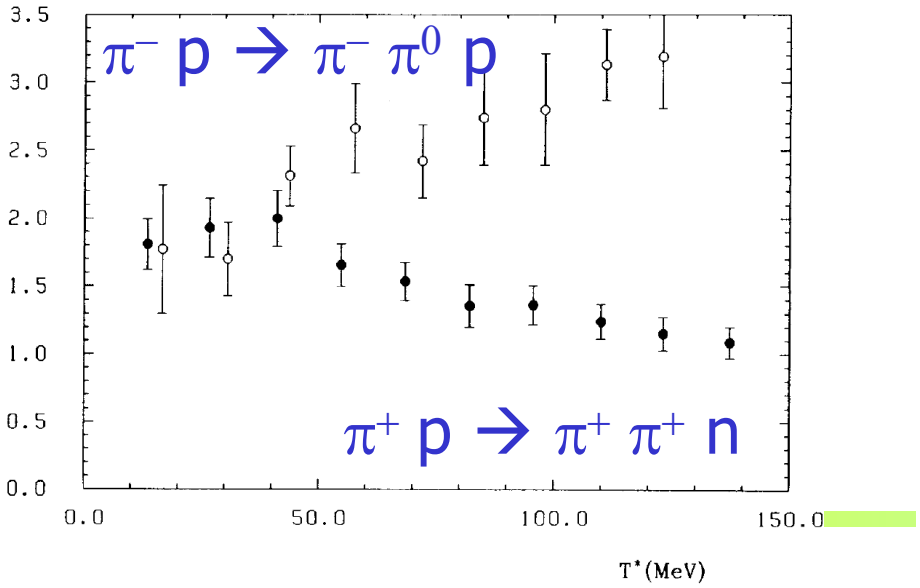
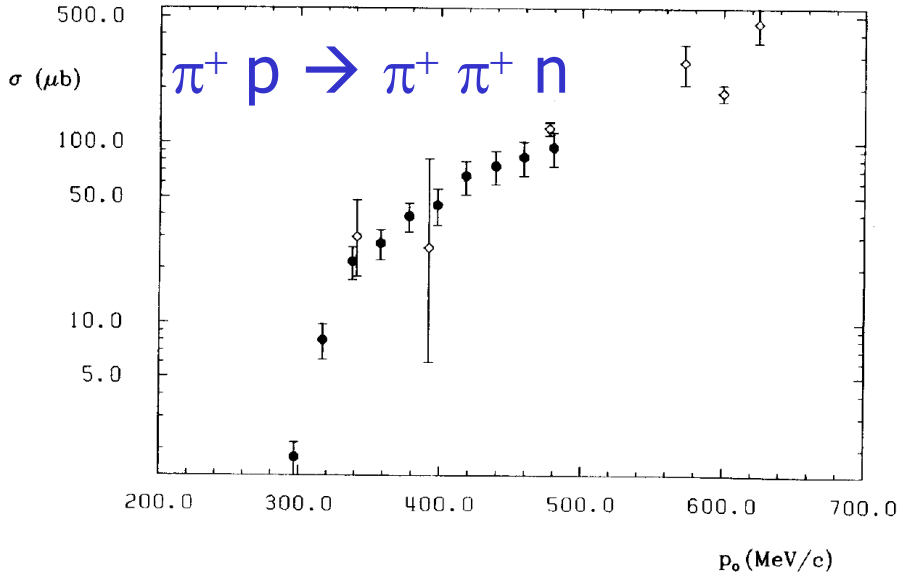


Figure 2: Integrated cross sections for $\pi^- p \rightarrow \pi^+ \pi^- n$ (left) and $\pi^- p \rightarrow \pi^- p \pi^0$ (right) as measured in this experiment (full circles) compared to previous experimental studies. Statistical and systematic errors have been summed in quadrature.

Omicron: nekaj rezultatov – sipalni preseki in reducirane amplitude





Pustolovci v svetu neskončno majhnega

Skupina slovenskih fizikov skupaj z vrhunskimi znanstveniki z vsega sveta v slovitih laboratorijih CERN in DESY razvozlava uganke vesolja

Tedenski sestanek
v Elkovem kabinetu
na FMF

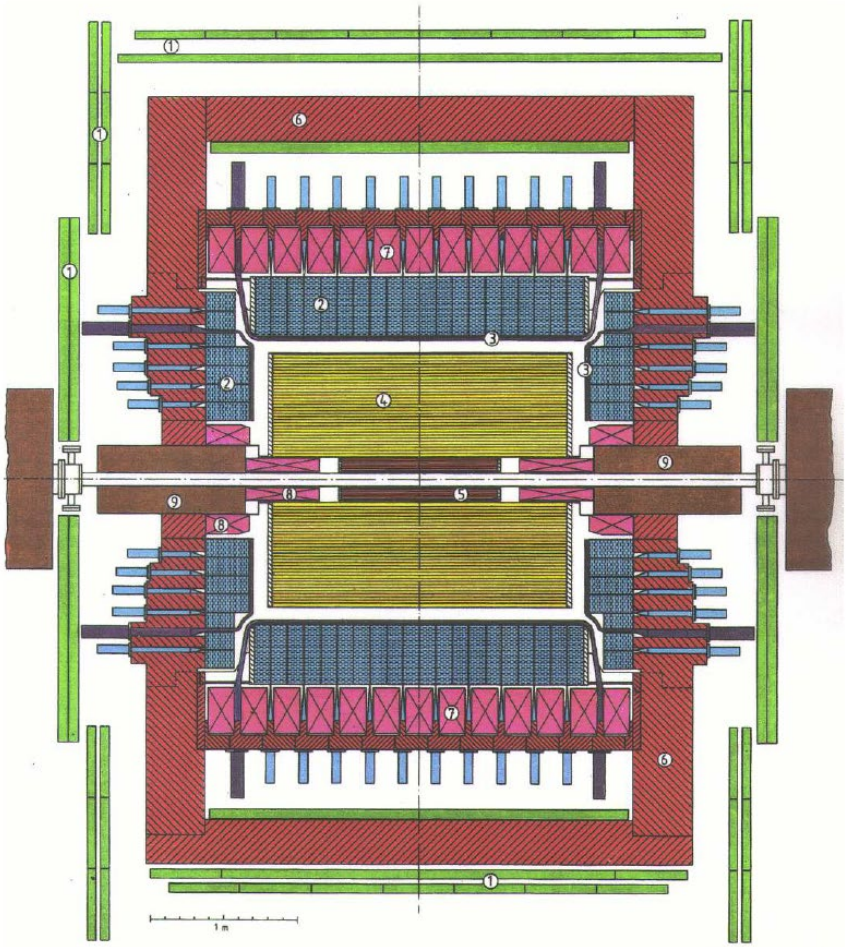
Foto: Janez Zrnec

Naslednja Elkova postaja: eksperiment ARGUS ob trkalniku e^+e^- DORIS v DESY (Hamburg)

ARGUS: magnetni spektrometer z žarki energij 5.3 GeV + 5.3 GeV

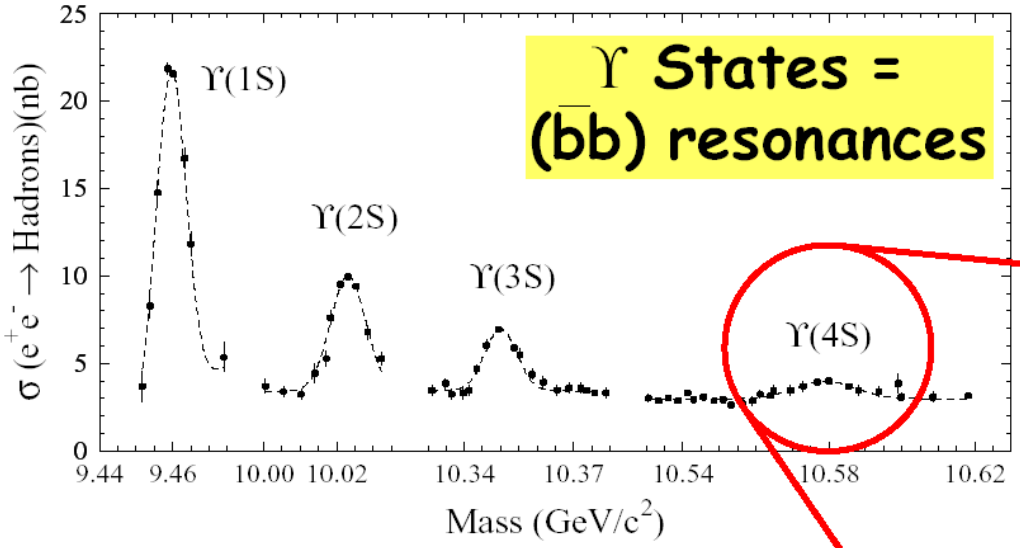
Velik prostorski kot, odličen sledilni sistem, identifikacija delcev (TOF, dE/dx, EM kalorimeter, mionske komore).

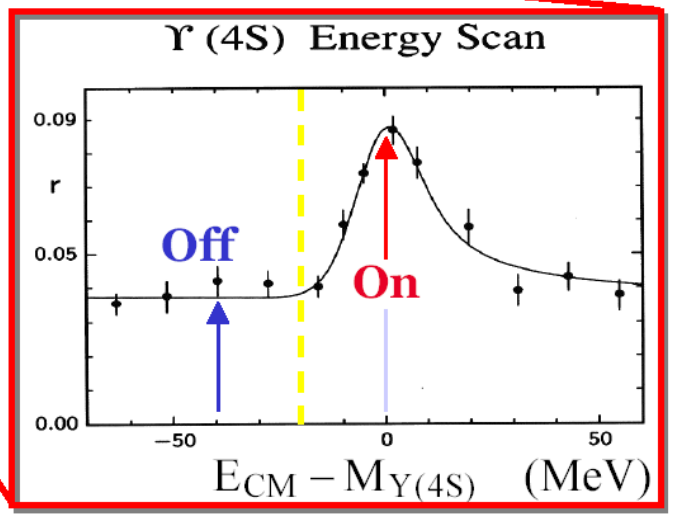
Zadetek v polno – eden najbolj uspešnih eksperimentov vseh časov v fiziki delcev.



Detektor ARGUS

Sistematske študije mezonov B na območju resonance $\Upsilon(4s)$





Cross Sections at $\Upsilon(4S)$:

$b\bar{b} \sim 1.1$ nb

$c\bar{c} \sim 1.3$ nb

$d\bar{d}$, $s\bar{s} \sim 0.3$ nb

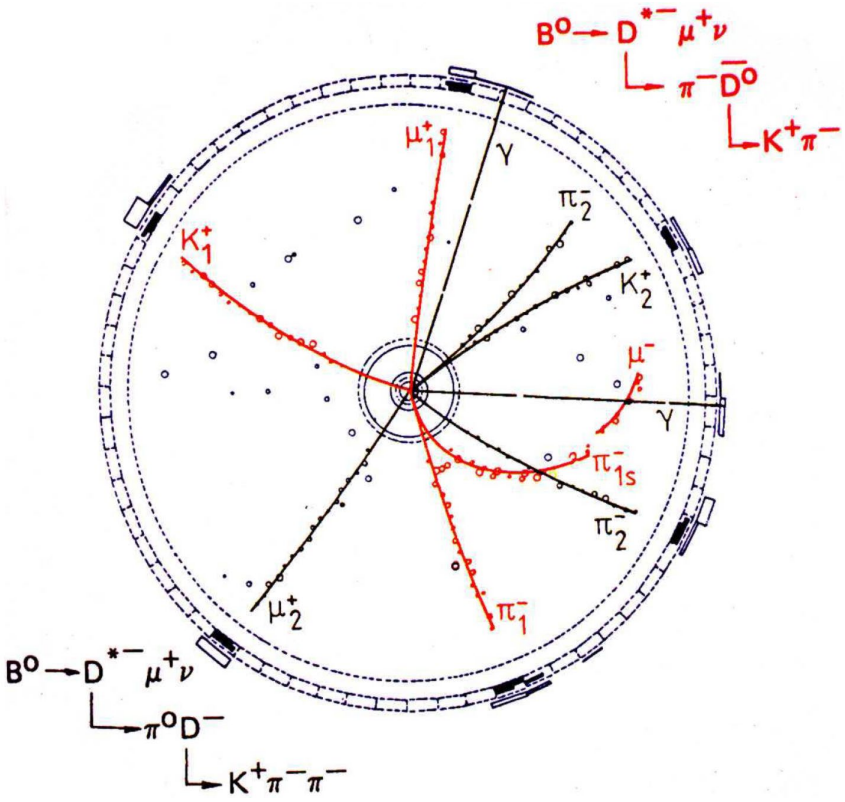
$u\bar{u} \sim 1.4$ nb

$$e^+e^- \to \Upsilon(4S) \to B\bar{B}$$

$$L = 1 \text{ state}$$

Najvažnejše odkritje: mešanje v sistemu mezonov B^0

1987: ARGUS odkrije mešanje pri nevtralnih mezonih BB:
B^0 se pretvori v anti-B^0 in obratno



Rekonstruiran redek dogodek: v končnem stanju so razpadnih produkti dveh mezonov B^0, medtem, ko sta nastala B^0 in anti-B^0 → anti-B^0 se je pretvoril v B^0

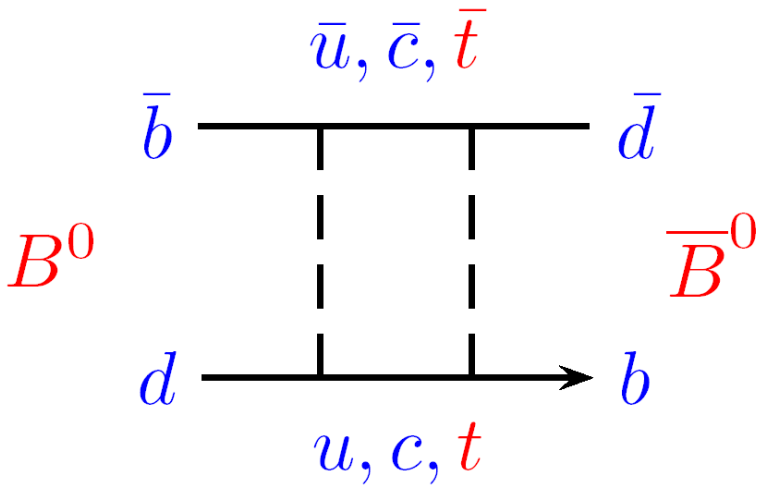
Parameter mešanja

$$\chi_d = 0.17 \pm 0.05$$

ARGUS, PL B **192**, 245 (1987)

citatov >1500

Mešanje pri mezonih B^0



$$\Delta m \propto$$

$$|V_{tb}^* V_{td}|^2 m_t^2 \propto \lambda^6 m_t^2$$

$$|V_{cb}^* V_{cd}|^2 m_c^2 \propto \lambda^6 m_c^2$$

Velika pogostost mešanja → velika masa kvarka t

Kvark t so odkrili šele sedem let kasneje!

ARGUS 1987 Bled Meeting

ARGUS: Meritev sklopitvene konstante močne interakcije α_s

Pri meritvah razpadov resonance $\Upsilon(1S)$

Razmerje verjetnosti za razpad v končno stanje s tremi gluoni in v končno stanje z dvema gluonoma in žarkom gama je proporcionalno razmerju med sklopitvenima konstantama močne in elektromagnetne interakcije.

Meritev je bila highlight na osrednji konferenci fizike delcev leta 1988 v Muenchenu.

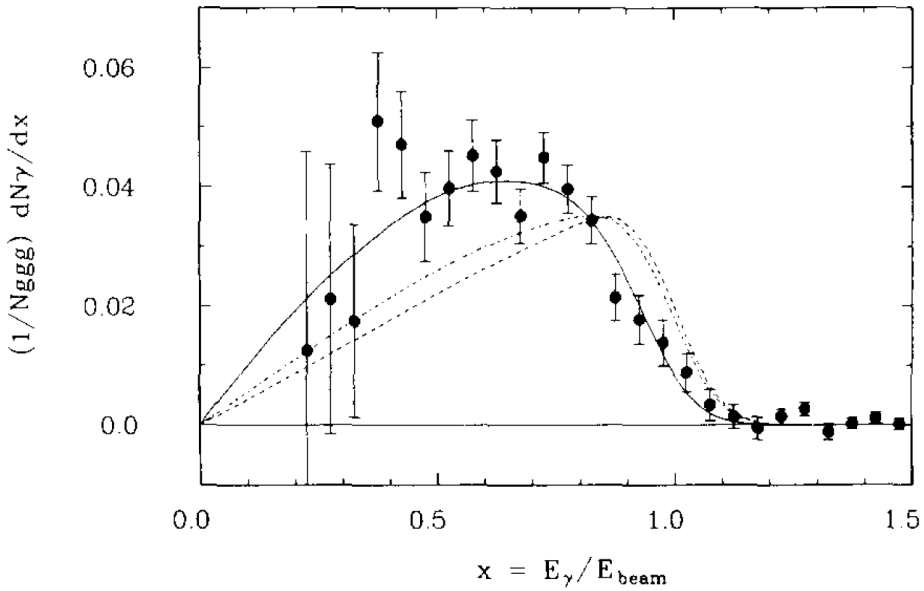
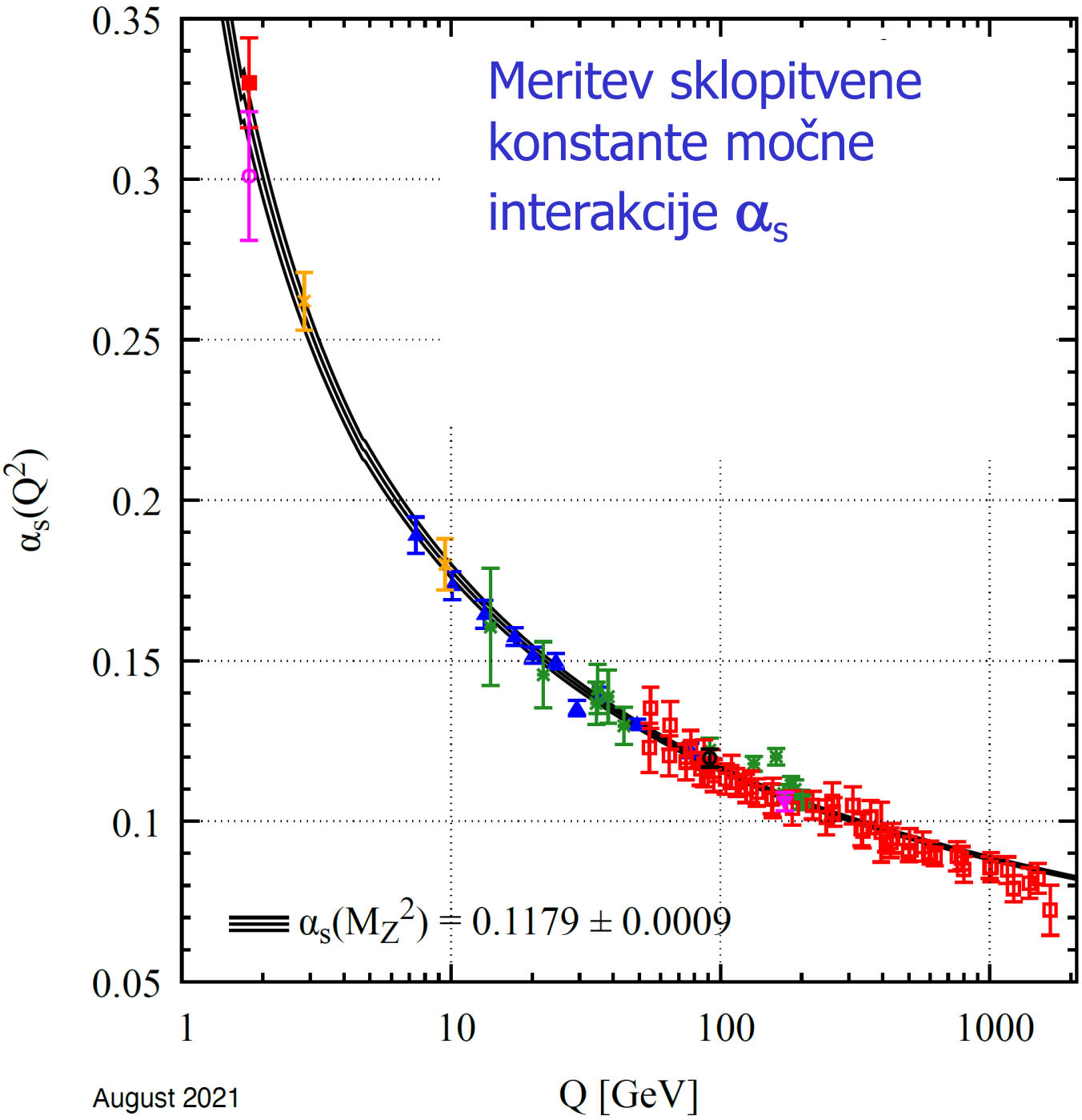
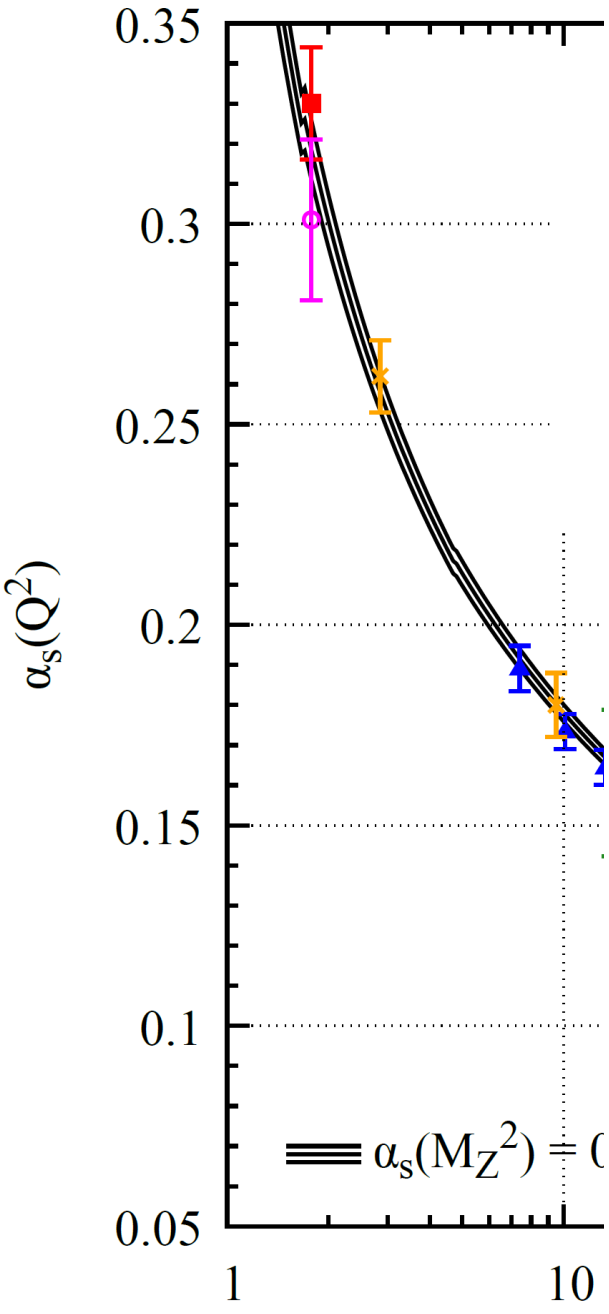


Fig. 3. Acceptance-corrected direct photon spectrum compared to the theoretical spectra of ref. [3] (dashed curve), ref. [4] (dot-dashed curve) and ref. [5] (solid curve). The error bars represent statistical errors only.


Meritev sklopitvene konstante močne interakcije α_s
$\alpha_s(M_Z^2) = 0.1179 \pm 0.0009$
$\alpha_s(Q^2)$
Q [GeV]
0.35
0.3
0.25
0.2
0.15
0.1
0.05
1
10
100
1000



August 2021

DETERMINATION OF α_s FROM A MEASUREMENT OF THE DIRECT PHOTON SPECTRUM IN Υ(1S) DECAYS

ARGUS Collaboration

H. ALBRECHT, A.A. ANDAM [1], U. BINDER, P. BÖCKMANN, R. GLÄSER, G. HARDER, A. NIPPE, M. SCHÄFER, W. SCHMIDT-PARZEFALL, H. SCHRÖDER, H.D. SCHULZ, R. WURTH, A. YAGIL [2,3]
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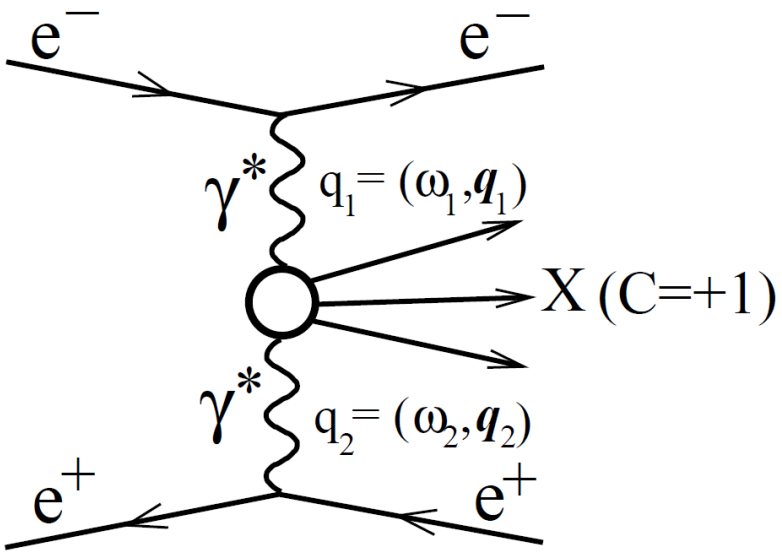
Institute of Theoretical and Experimental Physics, 117259 Moscow, USSR

R. CHILDERS, C.W. DARDEN and Y. OKU
University of South Carolina [15], Columbia, SC 29208, USA

Received 13 August 1987

ARGUS: Dvofotonska fizika



Študij hadronskih sistemov s C=+1

Končna stanja ($\gamma\gamma \rightarrow X$):

- $\pi^- \pi^+ \pi^0$
- $\rho^0 \rho^0$ (prevlada $J^P = 2^+$)
- $\rho^0 \omega$
- $\omega \omega$
- K* K*

ARGUS: Dvofotonska fizika

Študij hadronskih sistemov s C=+1

Končna stanja ($\gamma\gamma \rightarrow X$):

- $\pi^- \pi^+ \pi^0$
- $\rho^0 \rho^0$ (prevlada $J^P = 2^+$)
- $\rho^0 \omega$
- $\omega \omega$
- K* K*

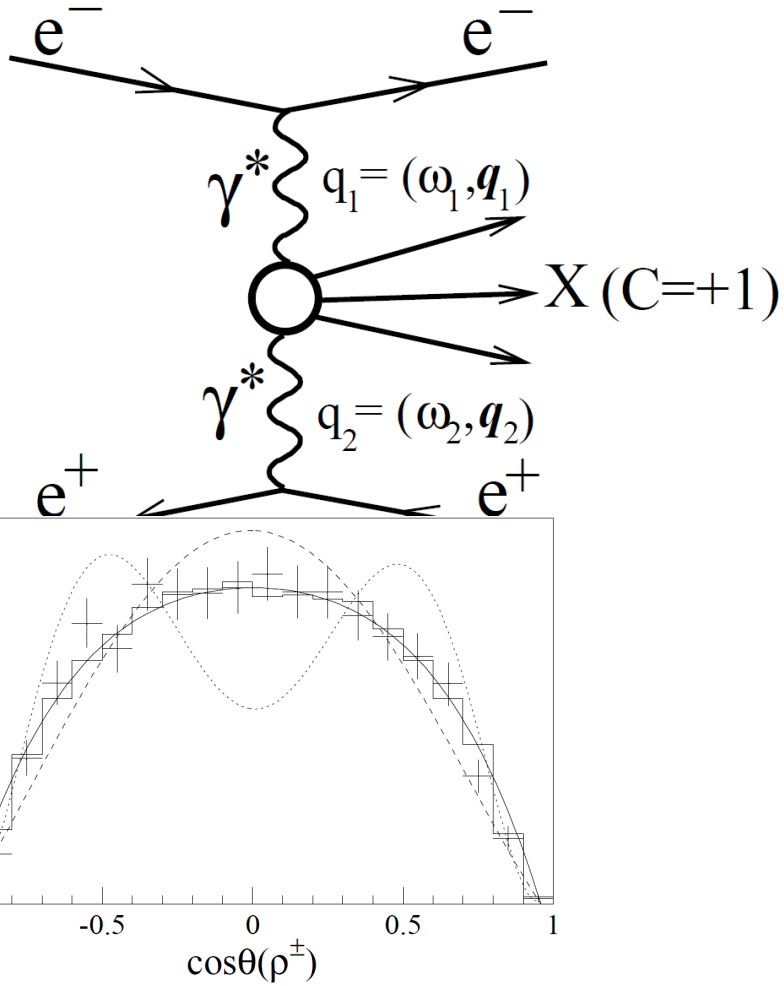


Fig. 7. Polar angle distribution of the $\pi^{\pm}\pi^0$ pairs for the part of the selected sample with $1.05\,\mathrm{GeV/c^2} < m(3\pi) < 1.45\,\mathrm{GeV/c^2}$ (see Fig. 2 for the definition of the angle). The data (*crosses*) are compared to the distribution of the simulated sample (*histogram*), containing fractions of particular partial waves in proportions, obtained by the maximum likelihood method. Also shown are expected distributions for the $(2^+, 2) \rightarrow \rho\pi$ (*full line*) and $(2^+, 0) \rightarrow \rho\pi$ (*dotted line*) channels as well as for the $\pi^+\pi^-\pi^0$, distributed isotropically in the phase space (*dashed line*)

ARGUS: Dvofotonska fizika

Študij hadronskih sistemov s C=+1

Končna stanja ($\gamma\gamma \rightarrow X$):

- $\pi^- \pi^+ \pi^0$
- $\rho^0 \rho^0$ (prevlada $J^P = 2^+$)
- $\rho^0 \omega$
- $\omega \omega$
- K* K*

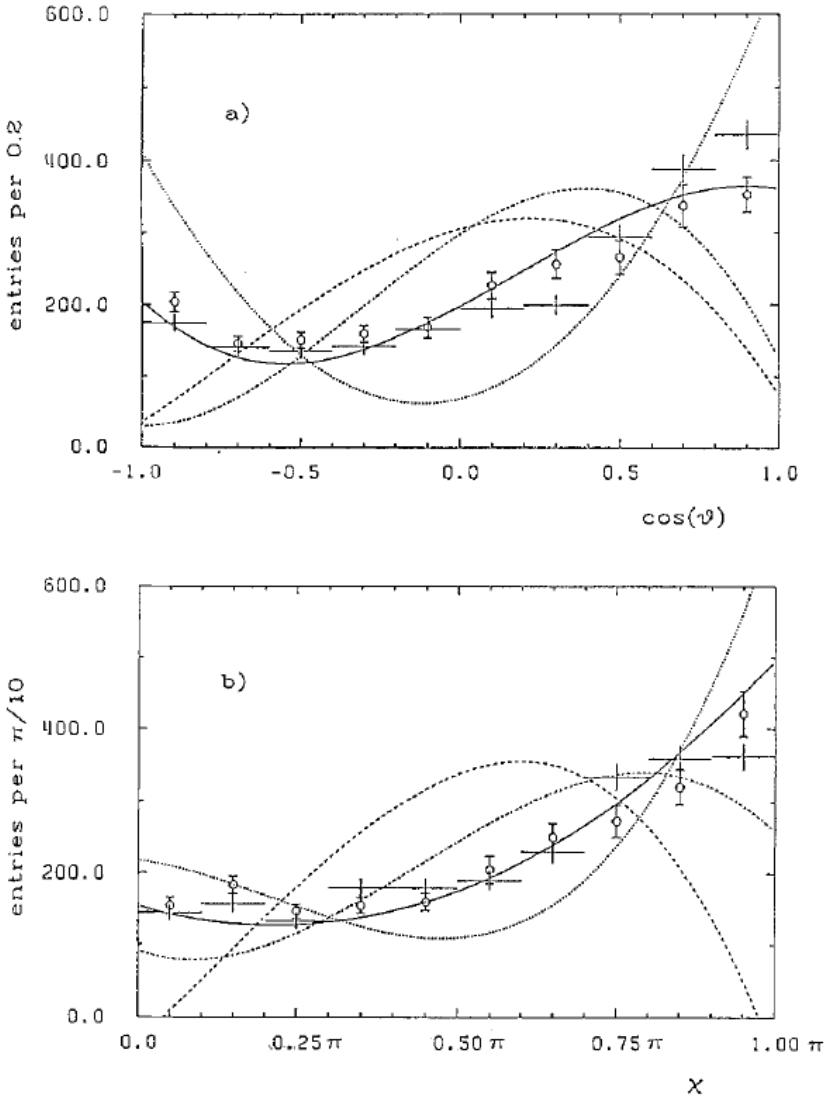


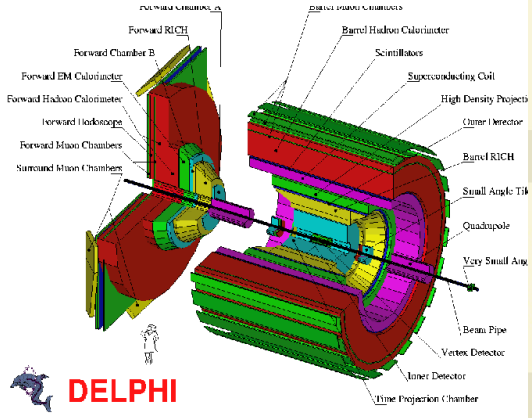
Fig. 4. One-dimensional angular distributions (the definition of the angles is given in the text) for $1.6 < W_{\gamma\gamma} < 1.8$ GeV/c^2. The result of a 7 parameter fit (circles) is compared to the data (crosses). Also shown are the simulated distributions for various $\rho^0 \rho^0$ spin-parity states: $J^P = 0^+$ (dotted line), $J^P = 0^-$ (dashed line), $J^P = 2^+$ with helicity 2 (solid line) and $J^P = 2^-$ (dash-dotted line)

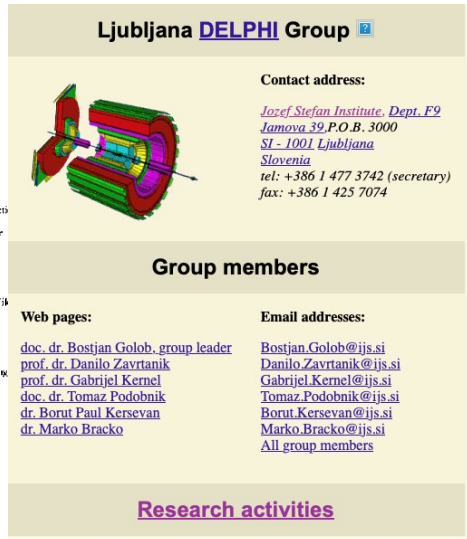
Kandidat za tetrakvarkovsko stanje iz lahkih kvarkov

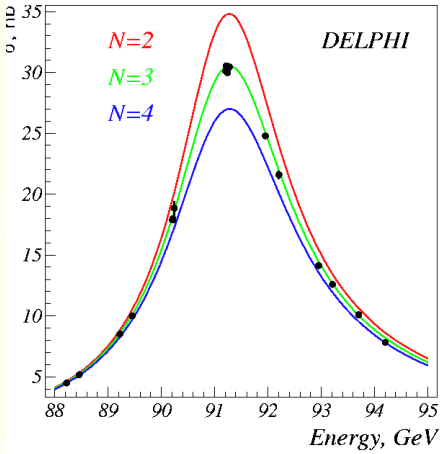
Elko pri eksperimentu DELPHI: 1997-2001

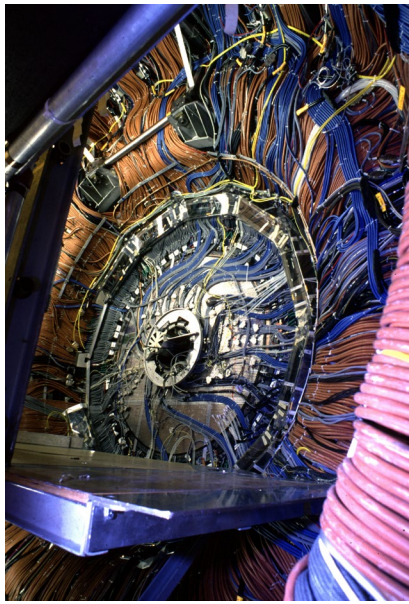
V letu 1997 se vrne v CERN kot član slovenske skupine pri eksperimentu DELPHI in mentor mladim raziskovalcem.

- V skupini takrat tudi D. Zavrtanik, B. Golob, T. Podobnik, B. Eržen, S. Stanič, M. Bračko, B. P. Kerševan ...









Elko pri eksperimentu DELPHI: 1997-2001

Takratne analize:

- Meritev V_{CS} v CKM matriki
- Iskanje nabitih Higgsovih bozonov
- Meritev asimetrije naprej-nazaj
- Meritev trilinearnih sklopitev šibkih bozonov

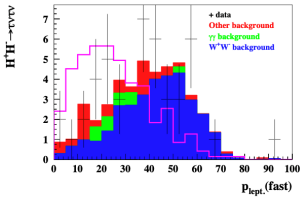
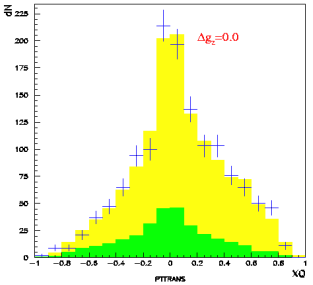
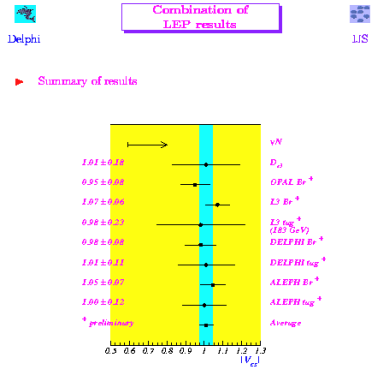


Figure 3.13: Distribution of the momentum of the fastest lepton in the leptonic channel. Si W^+W^- background is blue, $\gamma\gamma$ green and the remaining background reactions red. For easie comparison, signal (purple) is rescaled to the number of events in total background.

Distribution of charge weighted $\cos\theta_W$:
$XQ = P_{W^-}(\Delta Q)\cos\theta_W - (1 - P_{W^-}(\Delta Q))\cos\theta_W$



Best data-MC match for $\Delta g_Z^1 = 0.0$.



$|V_{cs}| = 1.01 \pm 0.03\,(\text{stat.}) \pm 0.02\,(\text{syst.})$

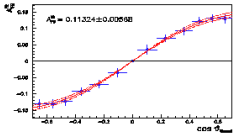
SILAFAE '98, S. Juan, Puerto Rico — B. Golob, April 1998

- Fitted asymmetry: Double tag coefficient is now plugged in directly bin by bin

$$A_{FC}^{fit}(\vartheta) = \frac{A_{FC}^{true}(\vartheta)}{\sqrt{\eta^2(\vartheta)}}$$

$$\eta^2(\vartheta) = \left(\frac{c-w}{c+w}\right)^2 = \frac{(N^{qq}(\vartheta)+N^{qq}(\vartheta+\pi)) - (N^{bkg}(\vartheta)+N^{bkg}(\vartheta+\pi))}{(N^{qq}(\vartheta)+N^{qq}(\vartheta+\pi)) + (N^{bkg}(\vartheta)+N^{bkg}(\vartheta+\pi))}$$

- 1994 MC:



- MC test:

Year	Type of data	$A_{FB}^{b\bar{b}}$
1992	Z^0peak	0.1094 ± 0.0082
1993	Z^0peak	0.1017 ± 0.0088
1994	Z^0peak	0.1132 ± 0.0057
1995	Z^0peak	0.1207 ± 0.0139

A_{FB} measurement — M. Bračko, April 1999

Ljubljana DELPHI Group Work Pages

Current activities:

- Measurements of V_{cs} in W hadronic decays (connected to W and 4 fermions Research Line of Delphi)
- Search for charged Higgs bosons at LEP 2 (connected to Higgs Research Line of Delphi)
- Study of A_{fb} in Z to bb decays using Kaons (connected to B/C Team of Delphi)
- Study of TGC in fully hadronic decays of W's (connected to W and 4 fermions Research Line of Delphi)

Peter Križan, Ljubljana

Elko's 75
Programme

Navigation:

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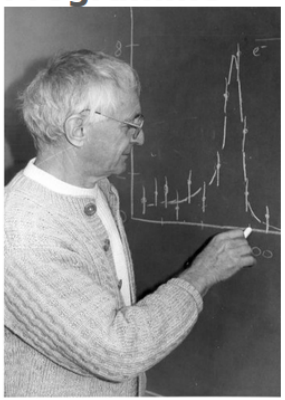
Programme



10:00 Prof. B. Žekš
10:10 Prof. J. Lenarčič
10:20 Prof. S. Žumer
10:30 Prof. B. Povh
OMICRON and Chiral Symmetr
11:00 Prof. A. Stanovnik
The OMICRON Spectrometer
11:30 Prof. W. Schmidt-Parzefall
ARGUS

12:00 Lunch

13:30 Prof. M. Mikuž
Large Hadron Collider and Beyond
14:00 Prof. P. Križan
Flavour Physics, Status and Outlook
14:30 Prof. D. Zavrtanik
Cosmic Rays at Extreme Energies
15:00 Prof. V. Soergel
Linear Collider
15:30 Prof. G. Kernel

Elkofest 2012

Slavnostna akademija ob 80-letnici akad. prof. dr. Gabijela Kernela

Program

9.15 J. Lenarčič (IJS, direktor): Welcome address

9.30 D. Zavrtanik (UNG in IJS): Cosmic rays at extreme energies

10.00 M. Mikuž (FMF UL in IJS): Hunting for the Higgs Boson

10.30 P. Križan (FMF UL in IJS): Where did anti-matter go?

11.00 C.W.E. van Eijk (TU Delft): Inorganic scintillator R&D

12.00 Sprejem v avli instituta

Akademija bo potekala v četrtek, 13.9., v Veliki predavalnici IJS.
Vljudno vabljeni!

Elkofest 2012

nting for the Higgs Boson

Gabrijel/Elko Kernel

1932 - 2025