Particle Physics & The Launch of The Daresbury Nuclear Physics Laboratory

Robin Marshall

Daresbury Celebrates 50 Years of Outstanding Science
29 October 2012

The title of my talk differs from the advertised one, simply because the laboratory was created as Daresbury Nuclear Physics Laboratory and only became Daresbury Laboratory later.

FORVO

All the words in the world. Pronounced.

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Word: **Daresbury**

in: place names, England, Village, Cheshire, science, University

Pronunciation in English [en] Back to English

Pronunciation by **TopQuark** (Male from United Kingdom)

0 votes ★ Good ⊖ Bad Add to favorites Download MP3 Share

Pronunciation by **Man_of_Kent** (Male from United Kingdom)

0 votes ★ Good ⊖ Bad Add to favorites Download MP3 Share

Could you do it better? different accent? **Pronounce Daresbury in English**

Accents & languages on maps

Returning to Daresbury after so many years, I thought it perhaps wise to use modern technology and determine once and for all how to pronounce Daresbury and to resolve the dichotomy. I found this site which offered definitive advice on the pronunciation. Plus ça change!

1 April 1977

For Further Reading

22 December 1977

There are several people in the audience today more worthy of giving this talk than I am, although perhaps a factor is that I might draw attention to their contributions more glowingly than they would themselves. In the meantime I can advise you to obtain a copy of the Nina scrapbook which you can download from here: and read the talks by John Holt, Jim Cassels, Alec Merrison, Sandy Donnachie & Alec Ashmore, which they gave at the Nina wake on 22nd December 1977. I also advise those tempted to grin as manically as those did in the picture here, as Nina was switched off, that although they may temporarily inherit the Earth, their day will also come.

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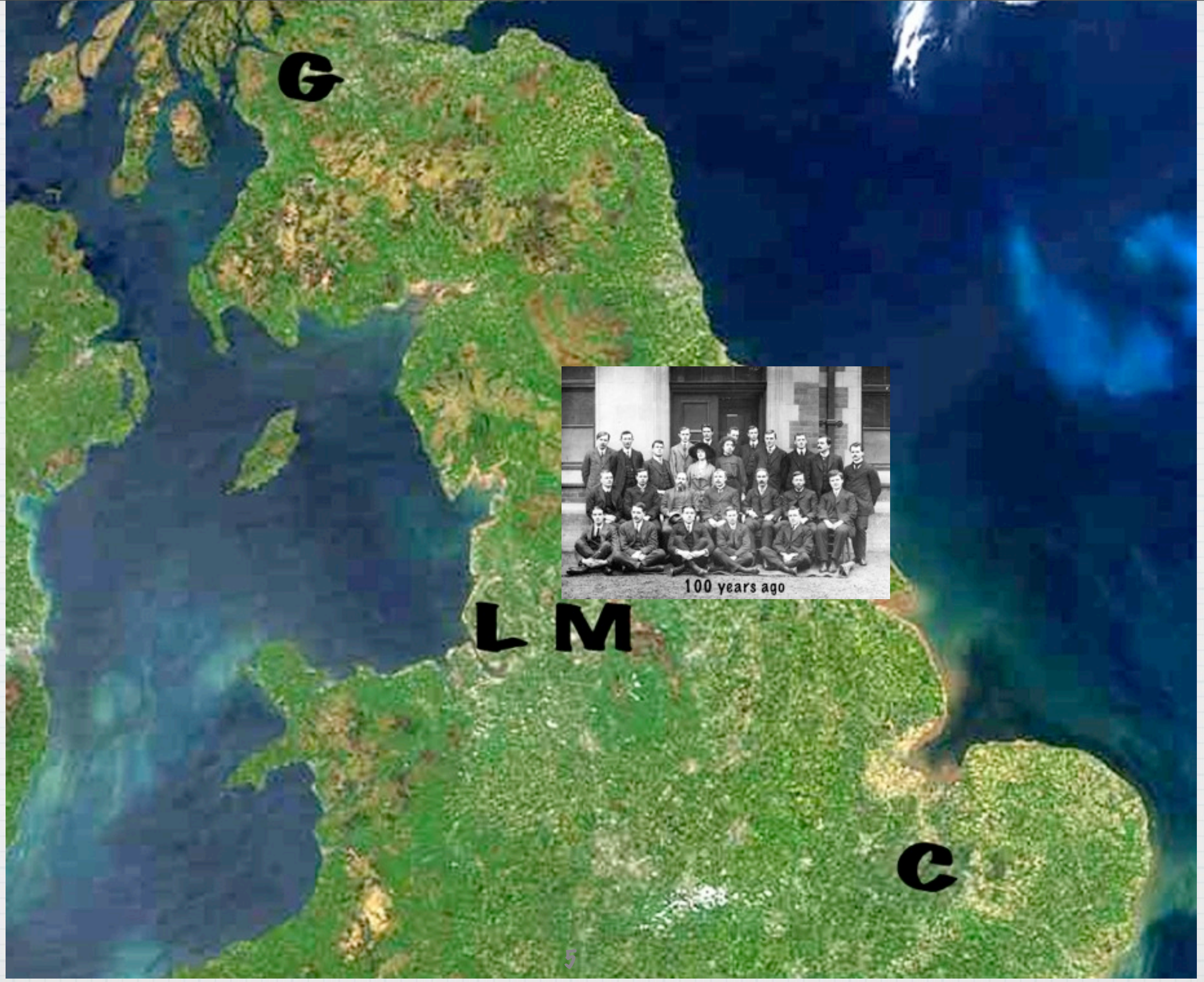
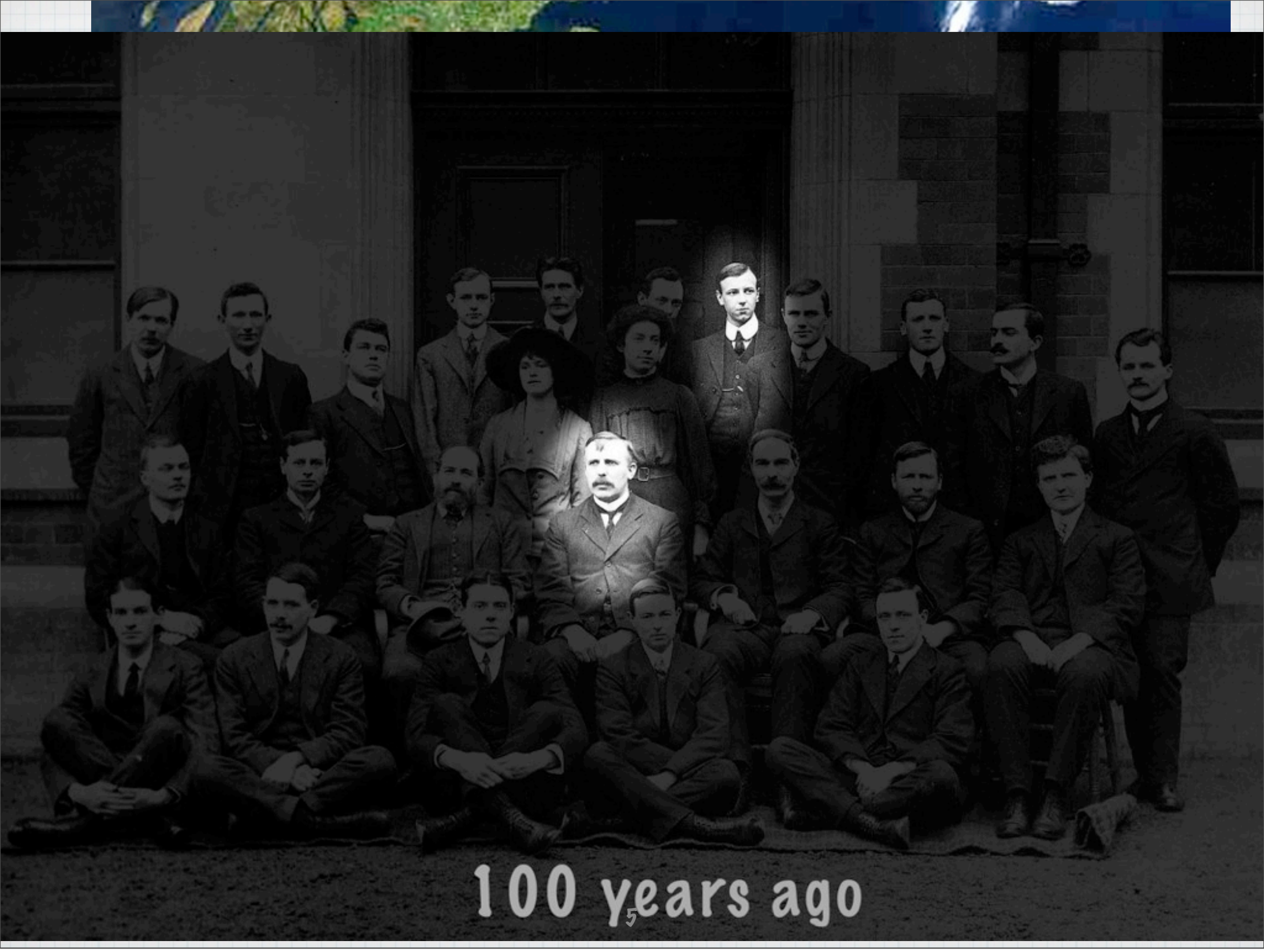
My agenda.

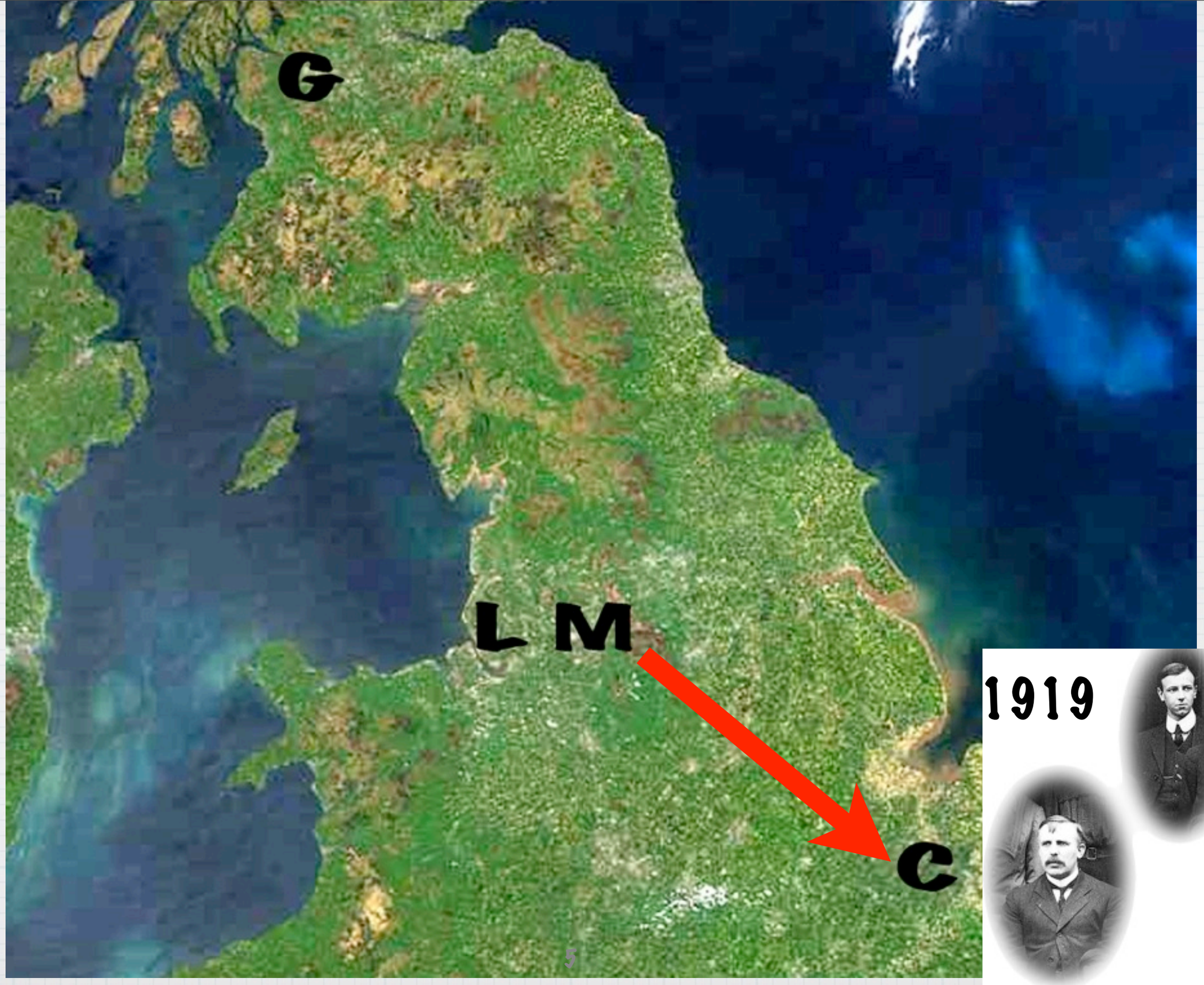


The story of DNPL and Nina begins in Manchester almost exactly 100 years ago. Chadwick, who had entered physics by accident, joining university to study maths, but sitting on the wrong bench and studying physics, followed his undergraduate degree with an MSc in Rutherford's department. Here are the members of the Manchester physics department in 1919.

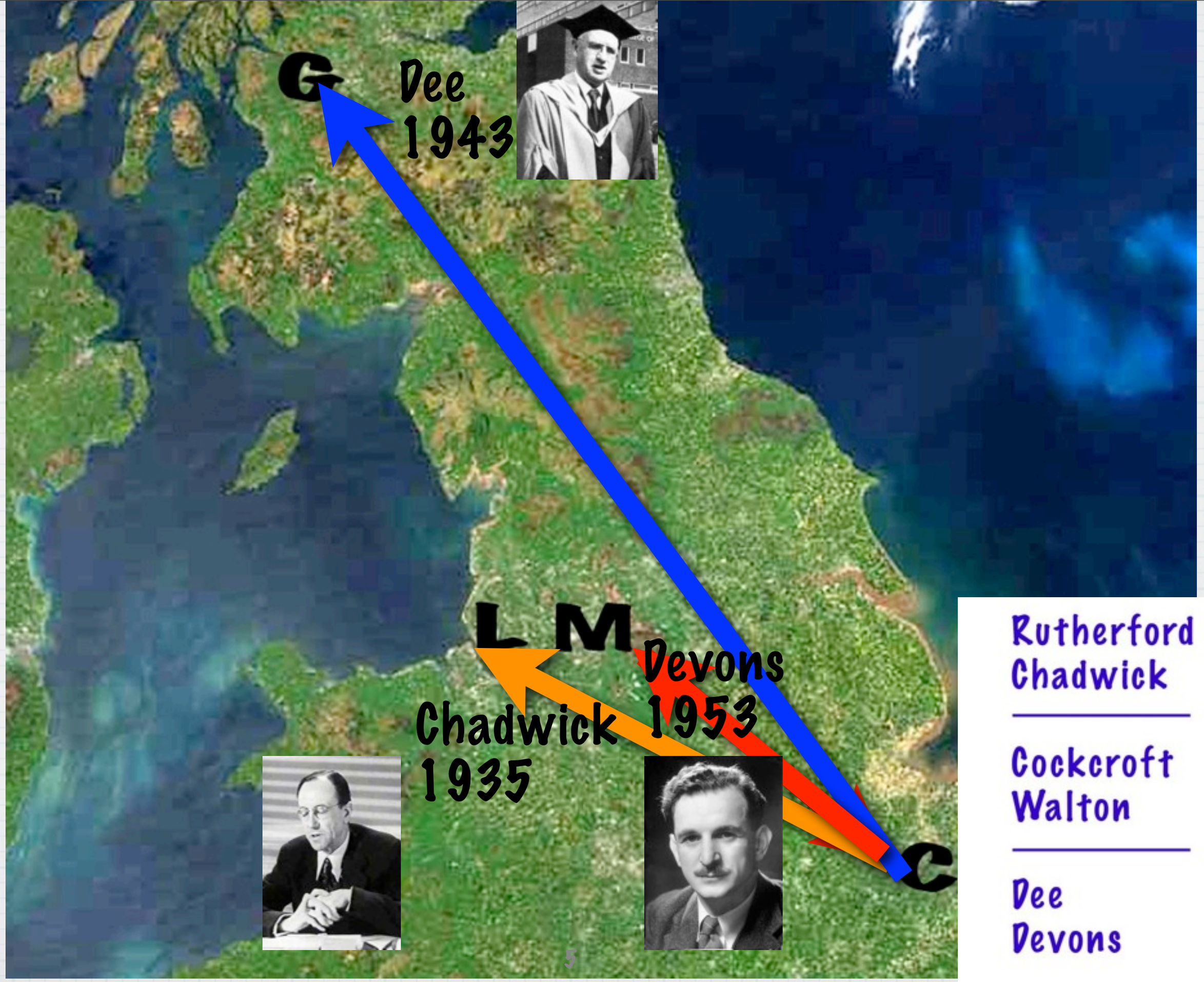
On the magnified version of the group photo, we can recognise many famous names: Charles Darwin, Jimmy Nuttall, Hans Geiger, Arthur Schuster, Earnest Rutherford, Henry Moseley and Ernest Marsden. The callow young MSc student standing in the doorway now eneters the story.



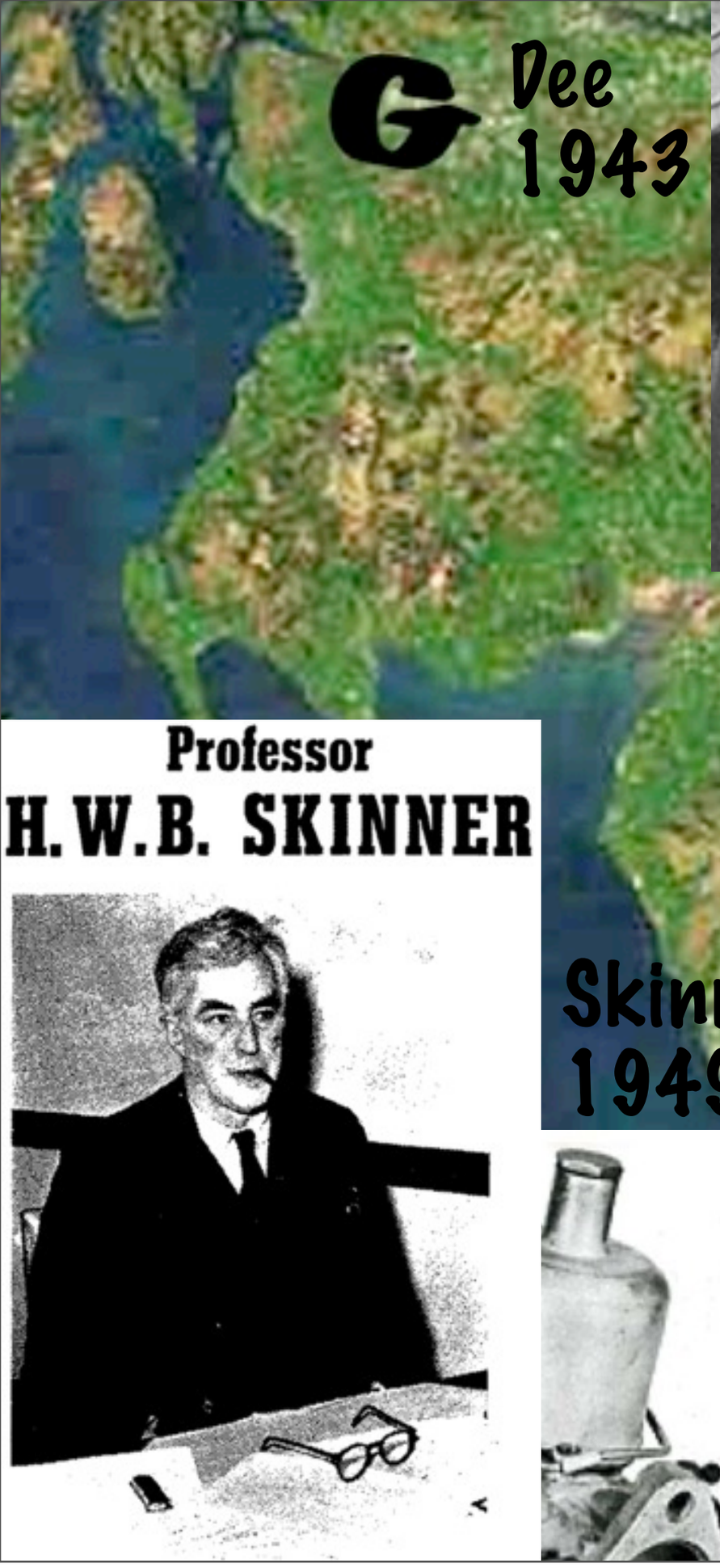
The two we are most interested in are highlighted here; Earnest Rutherford & James Chadwick.

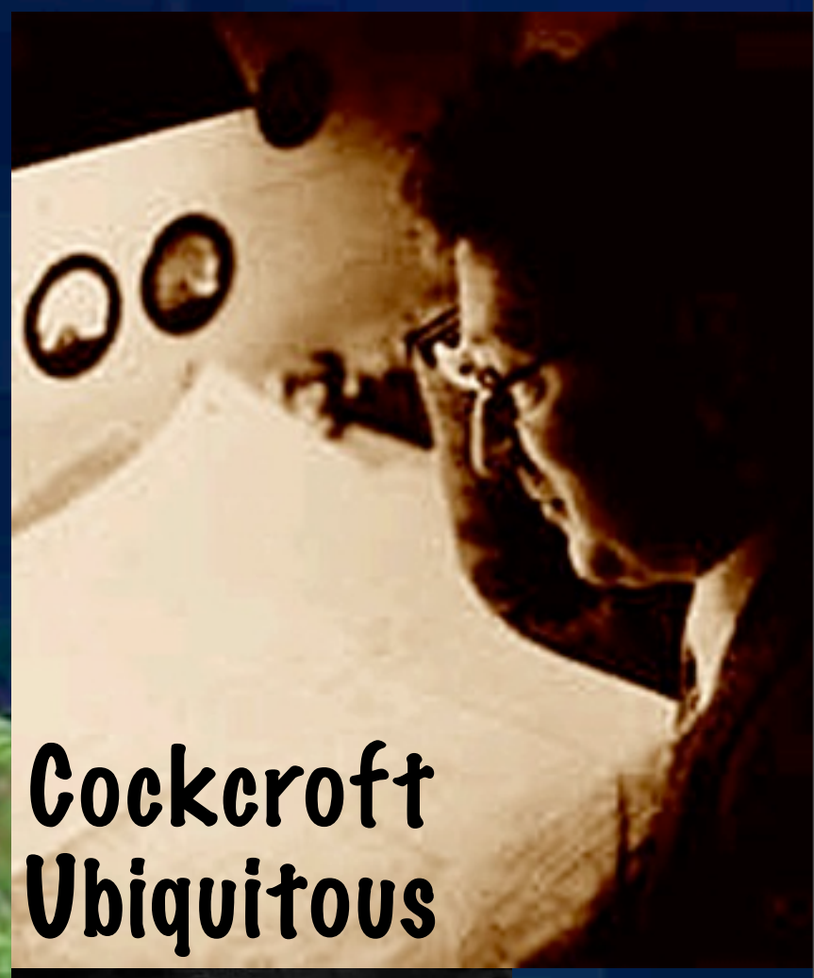


By 1919, Rutherford & Chadwick were both at Cambridge, which was about to take over the pre-eminance in UK for nuclear physics, before throwing it all away 18 years later.



Of the many illustrious names that adorned Cambridge between 1919 and 1937, I have picked out 6. The glory days were short lived. Chadwick left for Liverpool in 1935, Rutherford died in 1937, Walton faded from the scene, Dee was hired by Glasgow in 1943 and Devons left for Manchester in 1953 when Blackett went to Imperial College.



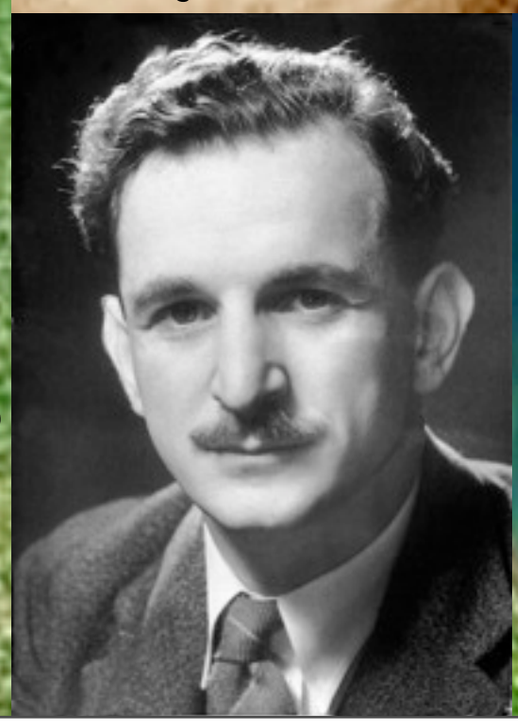


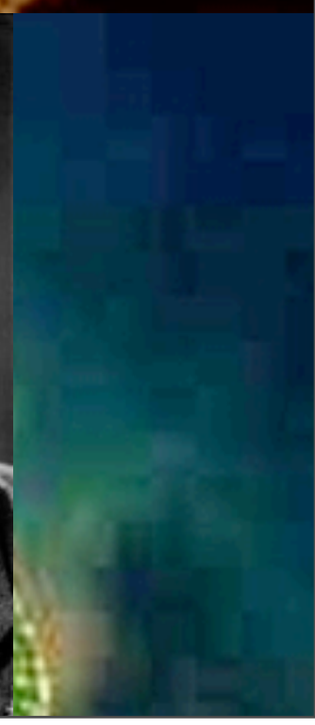
Skinner
1949

2nd NIRNS
accelerator
in North

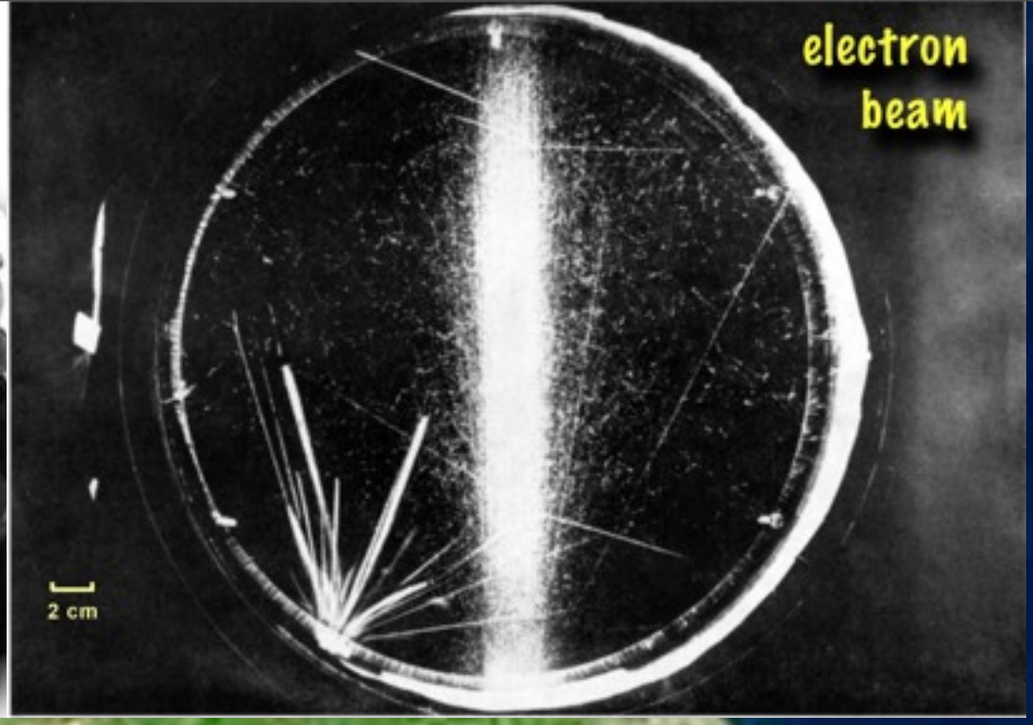
L M

Devons
1953

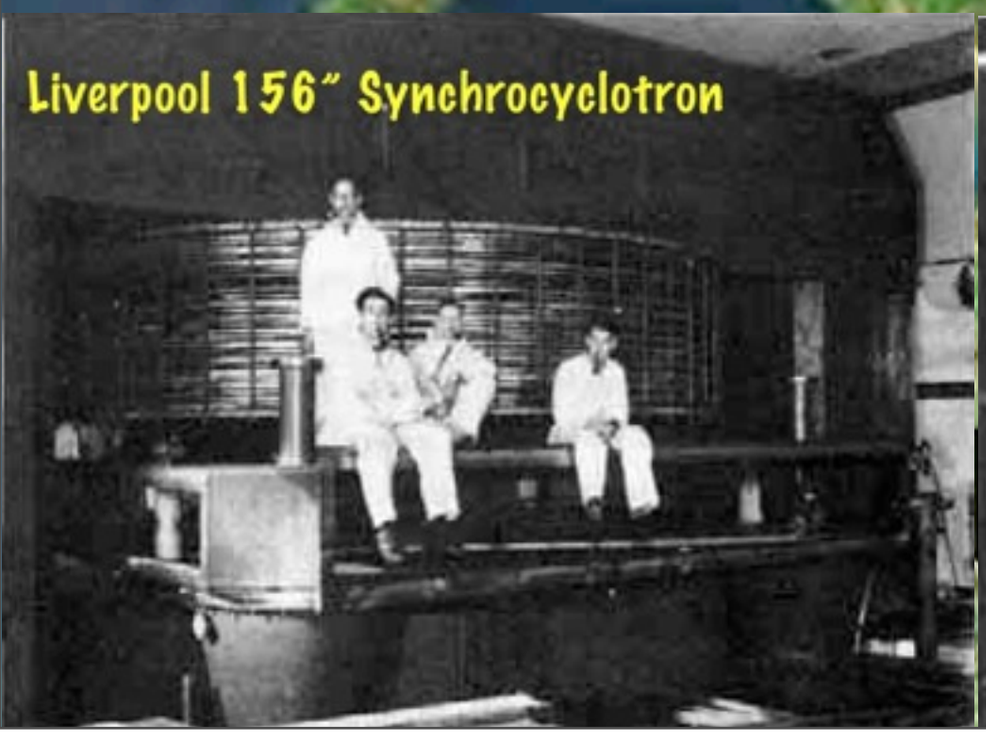


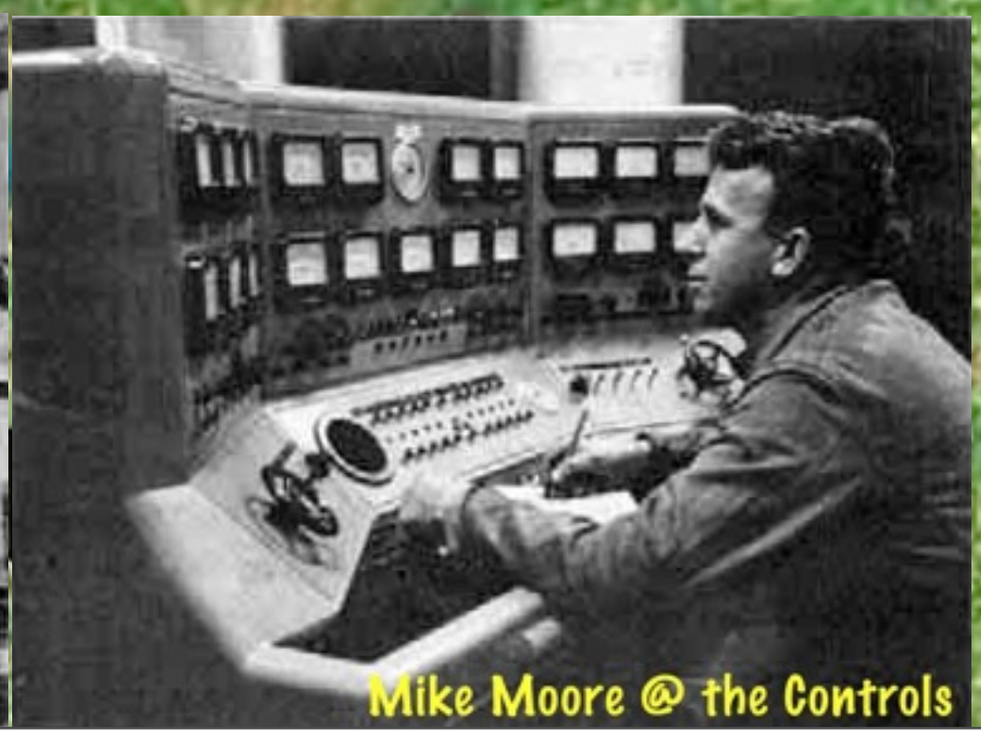


So that is the end of Cambridge as far as Daresbury is concerned. There now grew up an accelerator culture in Glasgow, Liverpool and Manchester, free from the suppressions of Rutherford, who thought them a waste of money. Cockcroft became ubiquitous and powerful after WW2 and a consensus emerged in the 1950s, that the 2nd accelerator to be built under the auspices of NIRNS (the National Institute for Research into Nuclear Science) should be in the North. By now Chadwick had returned to Cambridge and given way to Herbert Skinner. Devons essentially just gave way, building a little Van de Graaf, irritating his own Vice Chancellor at one end of the East Lancs Road and Skinner at the other. Dee ensured that Glasgow built an electron synchrotron.

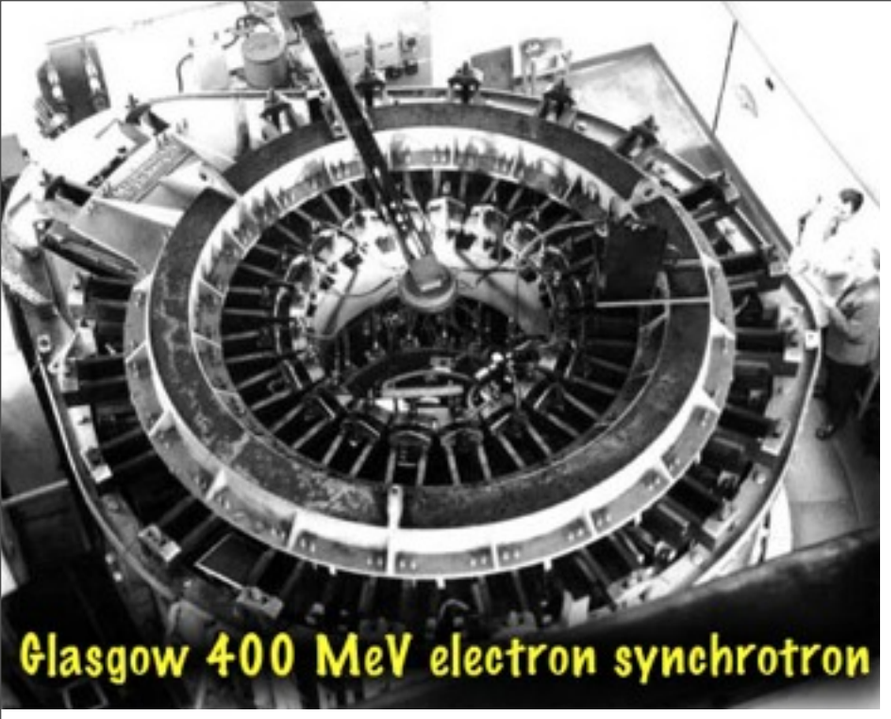


2nd NIRNS accelerator in North





Liverpool built cyclotrons inspired by Chadwick; a 37 inch machine before WW2, which did research on nuclear bomb preparation and a 156 inch post war machine which did much nuclear physics research. Glasgow built a beautiful 400 MeV electron synchrotron, essentially a prototype for Nina.



Philip Ivor Dee, John Rutherglen, John Gunn

---

postgraduates:

Sandy Donnachie, Erwin Gabathuler, Bruno Touschek, Graham Brookes

Herbert Skinner,
Alec Ashmore, Alec Merrison,
Gerald Pickavance, Jim Cassels

Mike Moore, Harry Newns

John Holt =>

---

postgraduates:

Brian Couchman, Vince Hatton,
Neil Marks, Robin Tait &
Ian Rabinowitz. (accelerator)

Dave Edwards,Bill Range, Paul Booth,
Don Braben, Roger Clifft,
John Thompson (nucl/particle physics)

After the early, tragic death of Skinner during a visit to CERN in 1960, it was rapidly decided that the Northern machine would be an electron accelerator and government approval was quickly sought, whilst the design was already begun. These university accelerators produced a generation of names that impacted not only on Daresbury in subsequent years, but everywhere in particle physics. In particular, John Holt gave up pure nuclear and particle physics research to supervising many PhD students, as well as doing his own research and design on various subjects concerning the Nina Accelerator design.

Government Approval for Laboratory & Accelerator

- On Friday 13th July 1962, approval was announced for the construction of DNPL & Nina.
- Burying the "bad" news for the South, on the same day, Macmillan sacked 7 members of the cabinet, including his Chancellor of Exchequer, Selwyn Lloyd.
- Construction was so rapid, that there was only time for one attempt to close it down.
- NIRNS chairman Lord Bridges advised "No Minister, if you close it down now, so soon, you will have to go before the House and admit you have made a mistake."

LABORATORY FOR 4 GeV ELECTRON SYNCHROTRON

HL Deb 25 July 1962 vol 242 cc1007–8 1007

2.31 p.m. §

THE MARQUESS OF SALISBURY My Lords, I beg leave to ask the Question which stands in my name on the Order Paper. §

To ask Her Majesty's Government whether a decision has yet been reached on the provision of a new laboratory to house a 4GeV electron synchrotron, as recommended by the National Institute for Research in Nuclear Science.] §

THE LORD PRESIDENT OF THE COUNCIL AND MINISTER FOR SCIENCE (VISCOUNT HAILSHAM) My Lords, I am happy to tell my noble friend that approval has now been given for this project. The capital cost is expected to be about £3½ million. The new laboratory will be set up in the North of England and will be particularly associated with the Universities of Liverpool, Manchester and Glasgow. A number of sites in the Liverpool–Manchester area are being investigated. The first Director of the laboratory will be Professor A. W. Merrison, and he 1008
is to be seconded from Liverpool University for a period of five years to take up the post. §

THE MARQUESS OF SALISBURY My Lords, may I welcome most warmly the statement of the noble Viscount, and say how much satisfaction it will give to all those who are interested in maintaining the supremacy—or pre-eminence, at any rate—of this country in this particular branch of science? §

With the country distracted by the Knights of the Long Knaves, it was left to the Marquess of Salisbury, acting on a tip-off, to get the approval of DNPL back into the news and to express his personal view that DNPL would maintain the pre-eminence of this country in this particularly branch of science. Who are we to argue with that?

Progress of the Site

October 1963
Green field

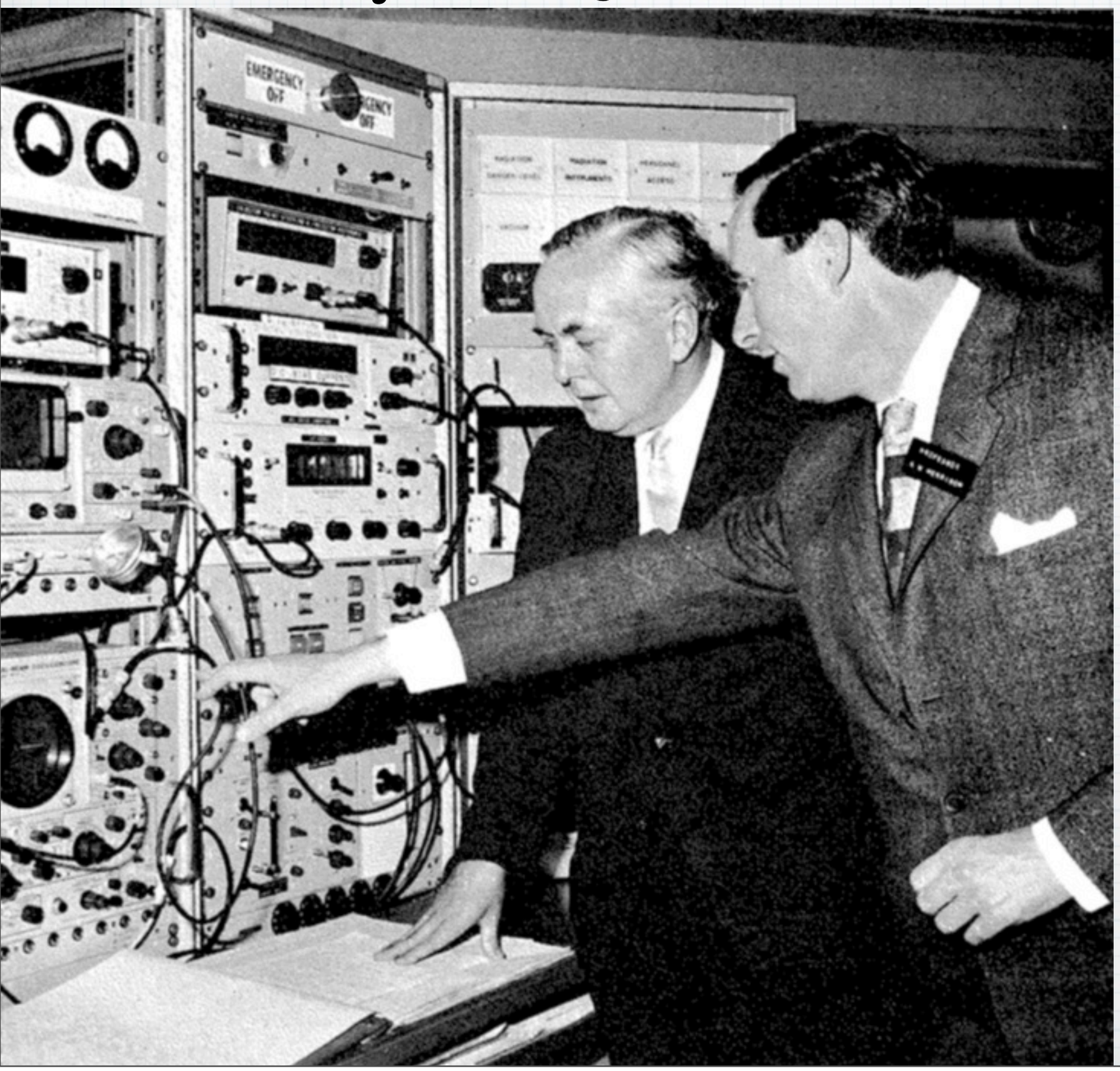
In October 1963, the final chosen site was still a green field. Two lone figures can be spotted in the middle of the field although history has not recorded who they are.

Progress of the Site

April 1965
Laboratory

By April 1965, astonishing progress had been made, with large areas of the new laboratory already in the form we can recognise today.

Official Opening: 16 June 1967



1st beam
2nd Dec
1966

Design
energy
reached
3rd Dec
1966

The first beam was successfully accelerated on the 2nd December 1966 and the full design energy already reached a day later, an achievement almost unparalleled in accelerator history, present or probably the future, unless Daresbury builds it. Nina worked. The Prime Minister of the day, Harold Wilson, officially opened the laboratory on 16th June 1967.

Highly visible & approachable SMT

Alec Merrison

Basil Zacharov

Harold Rothwell

Michael Crowley-Milling

Mike Moore

Tony Eggington

Bob Voss

18

The senior management team of the laboratory, headed by Professor Alec Merrison will be remembered by anyone on site as highly visible and approachable. You could have a row with any one of them anywhere, even on the canal towpath. Merrison was my PhD external examiner and I remember vividly how he took away my mortal fear and made me realise that the viva would be a physics discussion and not the inquisition I had imagined.

Highly visible & approachable SMT

And before the science, I would like to pay a tribute to
Shirley Lowndes and the library,
without whom, few papers would have been published.

Mention clowns & SPRU

Ah, the men from Spru of Sussex . .

- They sent in the buffoons to check out the boffins.
- They "assessed" the work of the lab and the result wasn't even "not wrong", it was risible.
- They said the accelerator was too late and too expensive compared to others.
- They said the results were not interesting.
- They said the results had no impact.
- All this is to be expected if you send in the clowns.
- Their fallacious conclusions will be shredded in what follows.

Despite the loud assertions of Irvine and Martin of Spru/Sussex, the laboratory and Nina cost half what is cost to build the DESY synchrotron and it cost half to run. The experimental teams on Nina were typically half the size of those at other similar laboratories and yet produced competitive physics. Results from the CEA electron synchrotron were cited more often because they were wrong and had to be disproved. Both CEA and DESY suffered serious fires which destroyed apparatus and led to a suspension of the programme. In the case of CEA, there were fatalities. No such mishaps afflicted the Nina programme.

The Physics Programme
as reported in DNPL03 for the period Nov '65 to April '66

1. Liverpool: Photoproduction of neutral π (& η)
2. Manchester: Photoproduction of neutral K
3. Glasgow: Polarisation of p in ep scattering
4. Daresbury: Tests of QED via Wide Angle Pair Prod.
5. No collaborations (yet), but they followed soon.

The Physics Programme as it evolved

- Glasgow-Liverpool-Sheffield: Polarisation etc
- Manchester: K^0 production and decay
- Manchester-Lancaster (Mancaster) ep->eX
- Glasgow-Sheffield-Daresbury Hadronic σ_T for γp
- Daresbury-Frascati-Pisa (PEP) electroproduction
- Daresbury-Lancaster-Sheffield (LAMP) Multi
- Theory: collaborating with everyone*
- Dynamic inter-flowing collaborations

This slide does not show the regular re-distribution of collaborations as people shifted dynamically to carry out the specific physics that interested them.

Theory - Experiment

1.B:7.A

Nuclear Physics **37** (1962) 594—623; © *North-Holland Publishing Co., Amsterdam*

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DISPERSION RELATIONS FOR THE PHOTODISINTEGRATION OF THE DEUTERON

A. DONNACHIE

The University, Glasgow †

Received 6 January 1962

Abstract: The calculation of the matrix element for deuteron photodisintegration is considered. There are twelve invariant amplitudes. The covariant form of the transition amplitude is related to the non-covariant (Pauli-matrix) form, which is further related to the individual multipole transition amplitudes. The Born terms of the covariant amplitudes are derived, and the dispersion relations written down in energy for a fixed difference in the photon-proton and photon-neutron momentum transfers. It is necessary to use this rather than a fixed momentum transfer, in order to exhibit explicitly all the poles in the dispersion relations.

Jan 1962, Glasgow again, Sandy Donnachie published his thesis (sole author) in Nucl Phys - on Peierls' diplon.

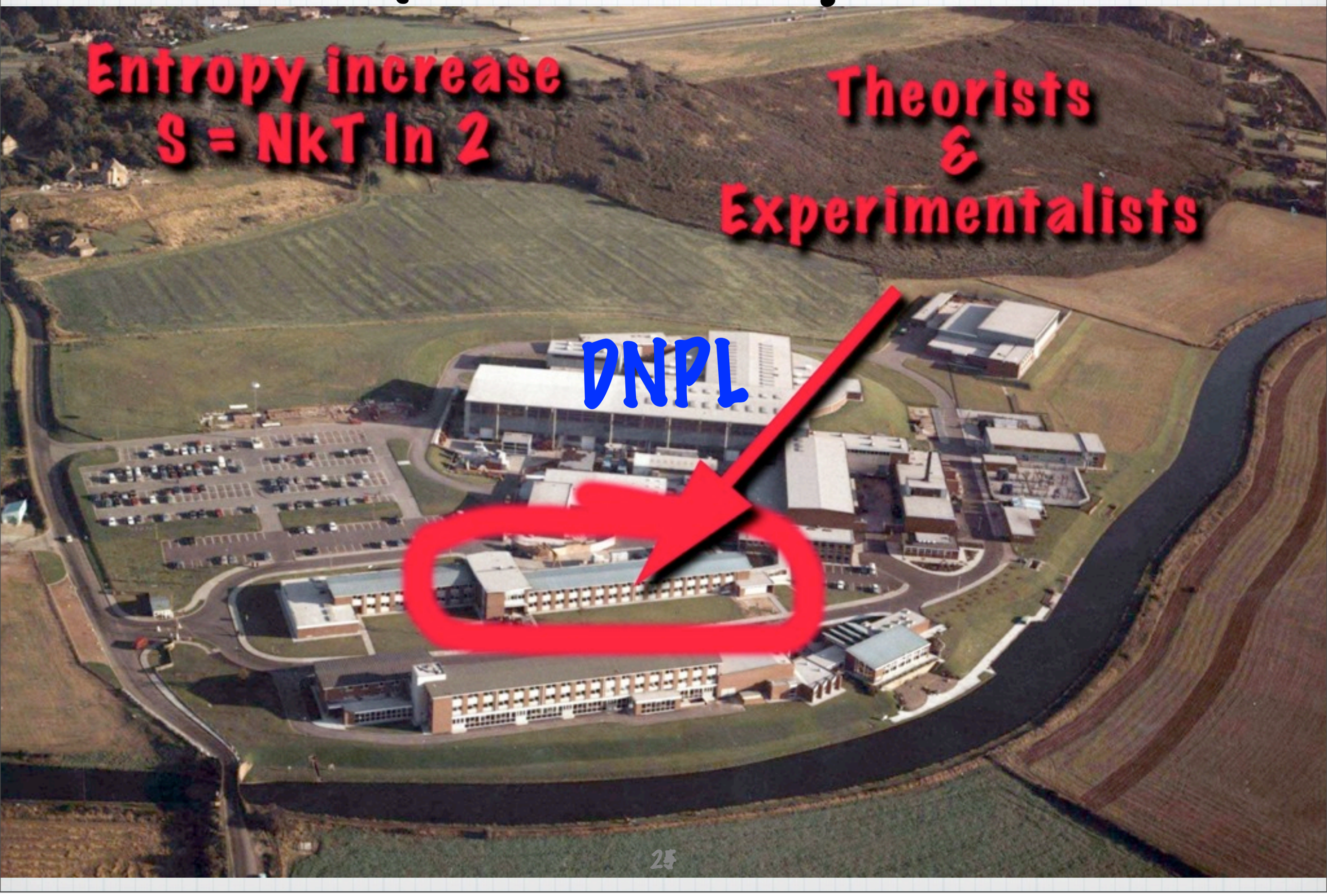
Jul 1970, Theory group stablished at DNPL with Prof Donnachie, Manchester Uni as its Head

The influence of Glasgow on the physics at Daresbury was extended when Professor Donnachie, who obtained his PhD there in 1962, became head of the theory group in 1970.

Theory - Experiment

Having worked at both DESY & Daresbury, I can say that both were terrific places to do physics research. One striking difference was that at DESY, the theorists were all on the top floor of a skyscraper and the experimentalists were all in a low building. I knew the names of the DESY theorists, read their papers but did not know what most of them looked like.

Theory - Experiment



Sandy Donnachie and Erwin Gabathuler ensured that physicists, experimental and theoretical, had offices next to each other and would all gather for coffee every Friday morning, when someone would talk about their latest work, no matter what.

The GLS sequence: π^0/η & polarisation

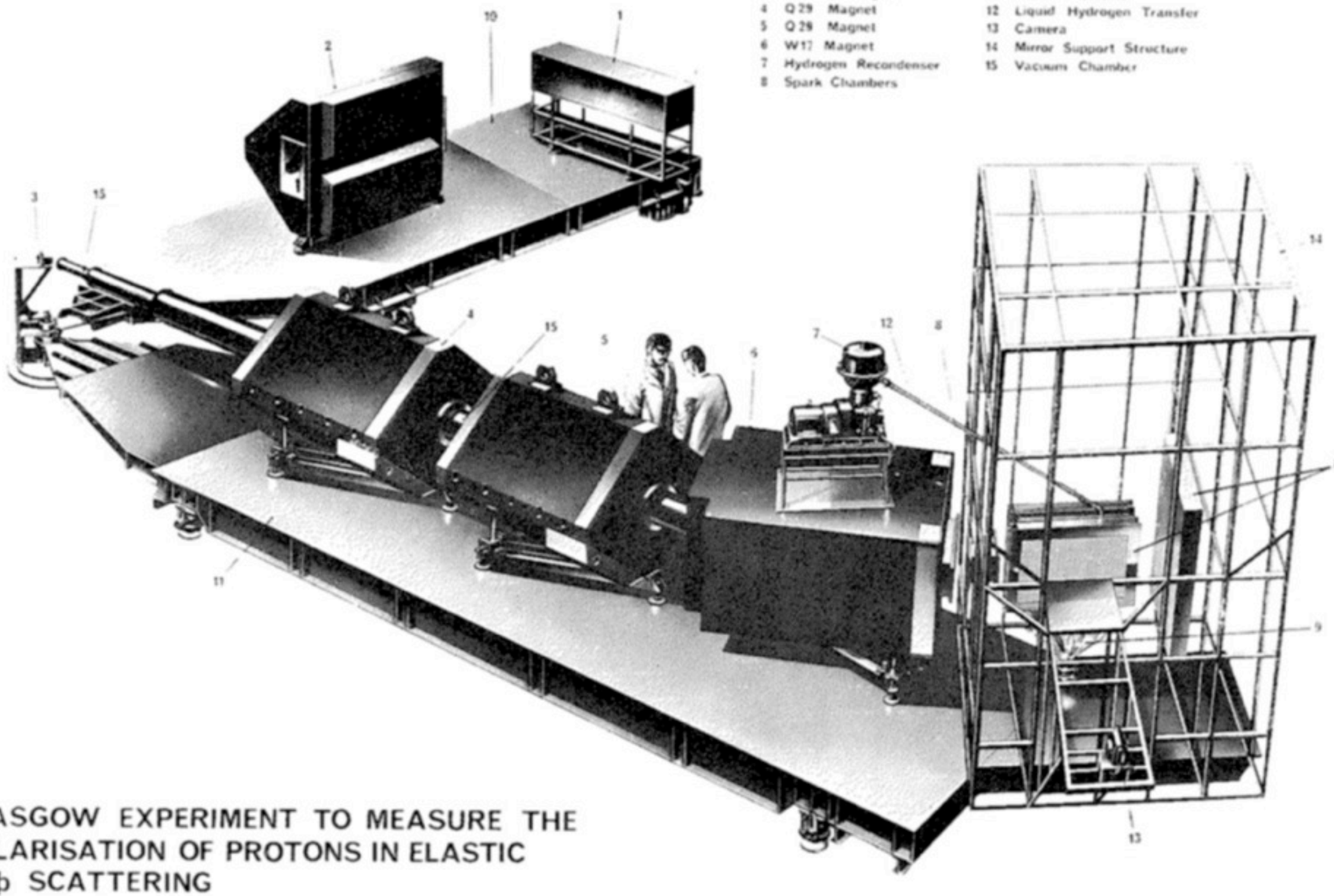


FIG. 6 — ILLUSTRATION OF THE GLASGOW/SHEFFIELD EXPERIMENT

The GLS sequence: π^0/η & polarisation

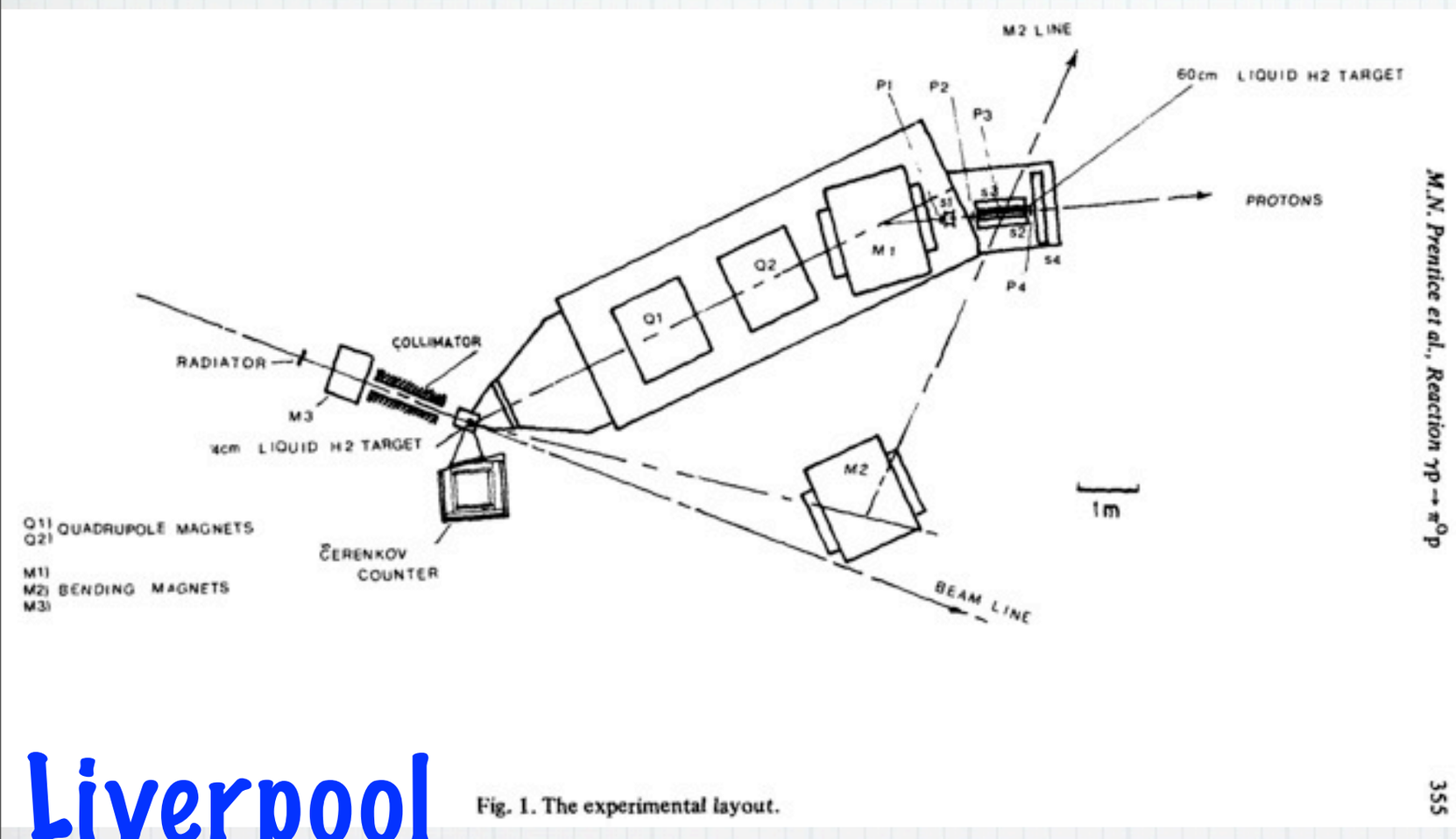


Fig. 1. The experimental layout.

355

Glasgow 1965 plan

actualised

Liverpool similar kit

-> GLS

The GLS sequence: π^0/η & polarisation

Nuclear Physics B154 (1979) 492–502
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Nuclear Physics B159 (1979) 383–396
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MEASUREMENTS OF THE DOUBLE POLARI
G AND *H* IN NEUTRAL PION PHOTOPRODU

P.J. BUSSEY and J.G. RUTHERGLEN
University of Glasgow, Scotland

P.S.L. BOOTH, L.J. CARROLL, G.R. COURT,
R. GAMET, P.J. HAYMAN, J.R. HOLT, J.N. JA
W.H. RANGE and C. WOOFF
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University of Sheffield, England

Received 16 July 1979

Nuclear Physics B169 (1980) 403–414
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MEASUREMENTS OF THE POLARISATION PARAMET
G AND *H* IN POSITIVE PION PHOTOPRODUCTIO

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University of Sheffield, England

Received 12 March 1979

Nuclear Physics B84 (1975) 437–448. Nort

Volume 61B, number 5

THE POLARISED BEAM
OF ETA MESONS FROM PROTONS AT

P.J. BUSSEY, C. RAINE and J.G. R
University of Glasgow, Glasgo

P.S.L. BOOTH, L.J. CARROLL, P.R. DANIEL, A.W
J.R. HOLT, J.N. JACKSON, J. NOREM
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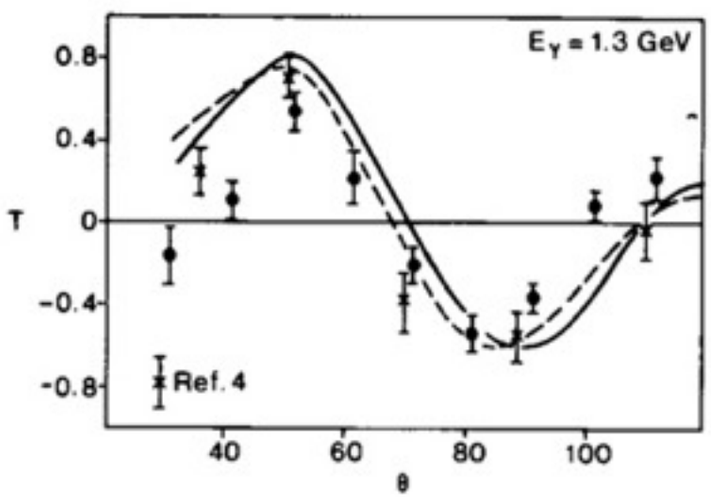
W. GALBRAITH, V.H. RAJARATNAM, C. SUTTON, M.C. THORNE and P. WALLER
University of Sheffield, Sheffield, UK

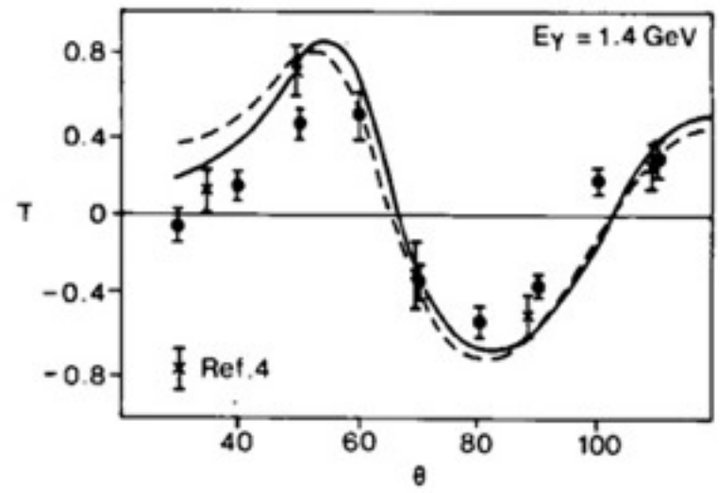
Received 13 December 1976
(Revised 24 January 1977)

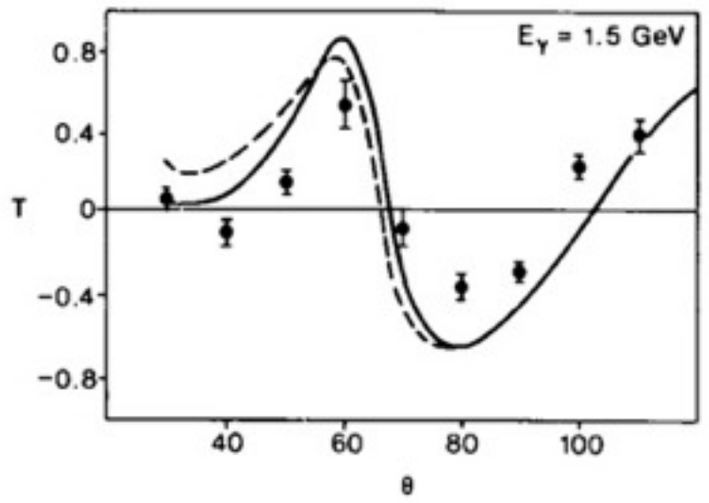
Measurements have been made of the target asymmetry parameter for photoproduction of π^0 mesons from protons, using a butanol polarised target with a ^{3}He cryostat. Results were obtained at 14 incident photon energies between 0.7 GeV and 1.45 GeV over an angular range ~40° to 145° c.m. The recent analysis of Barbour and Crawford provides a very good fit to the data.

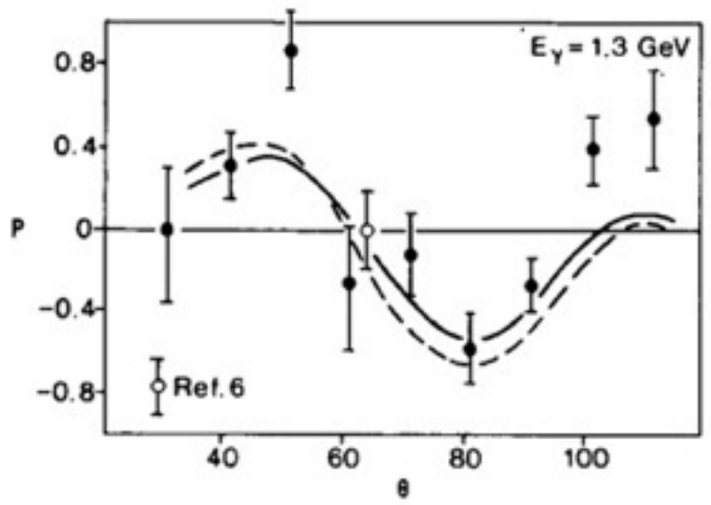
A plethora of publications.

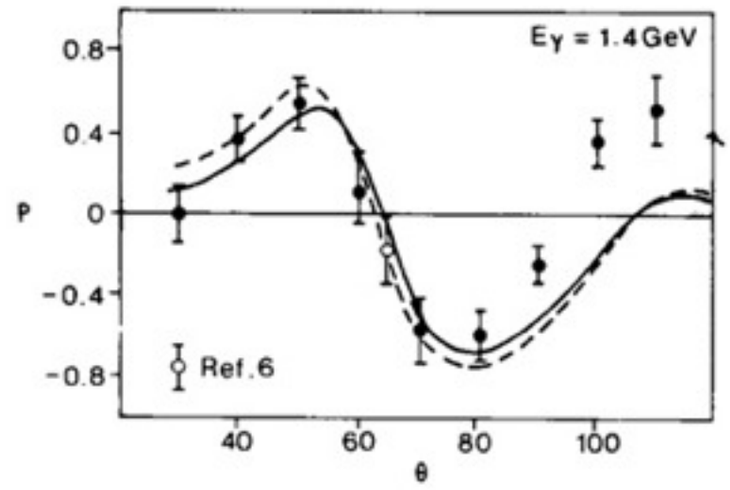
The GLS sequence: π^0/η & polarisation

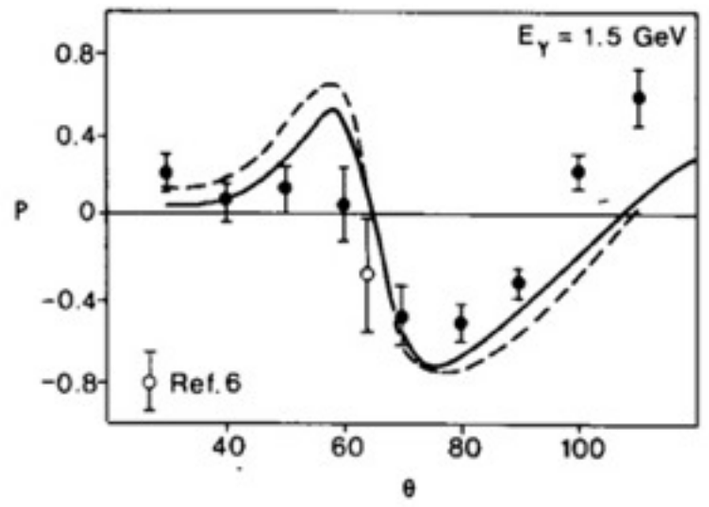












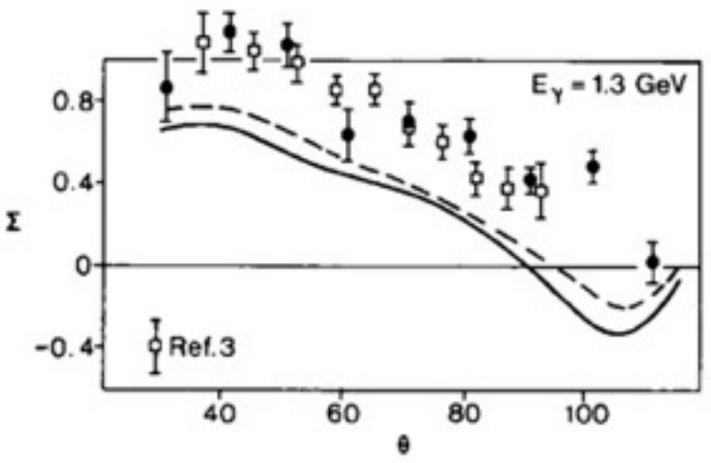


Fig. 2(a).

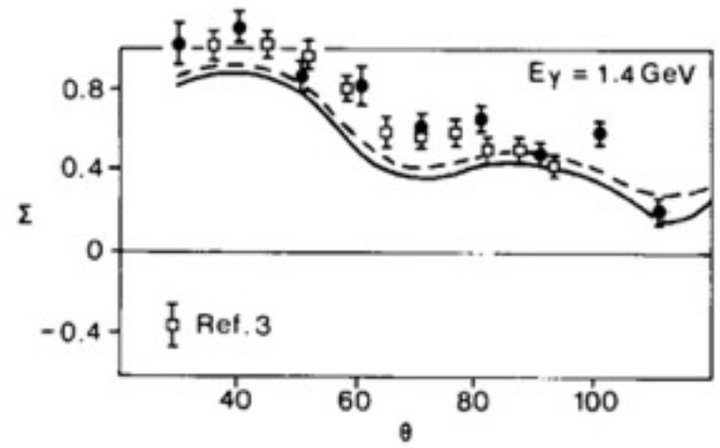


Fig. 2(b).

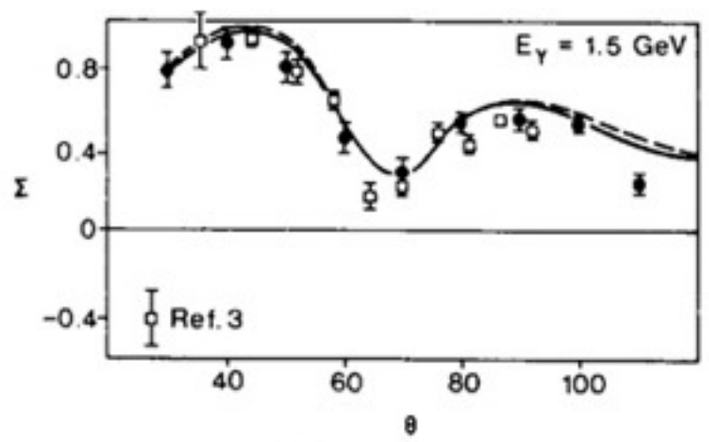


Fig. 2(c).

By a subtle combination of polarised beams, polarised targets and the measurement of the polarisation of the final state proton, the complete total scattering amplitude could be broken down into its various constituents and the full picture of the scattering process built up.

The GLS sequence: π^0/η & polarisation

John Holt

Physics @ Liverpool cyclotrons

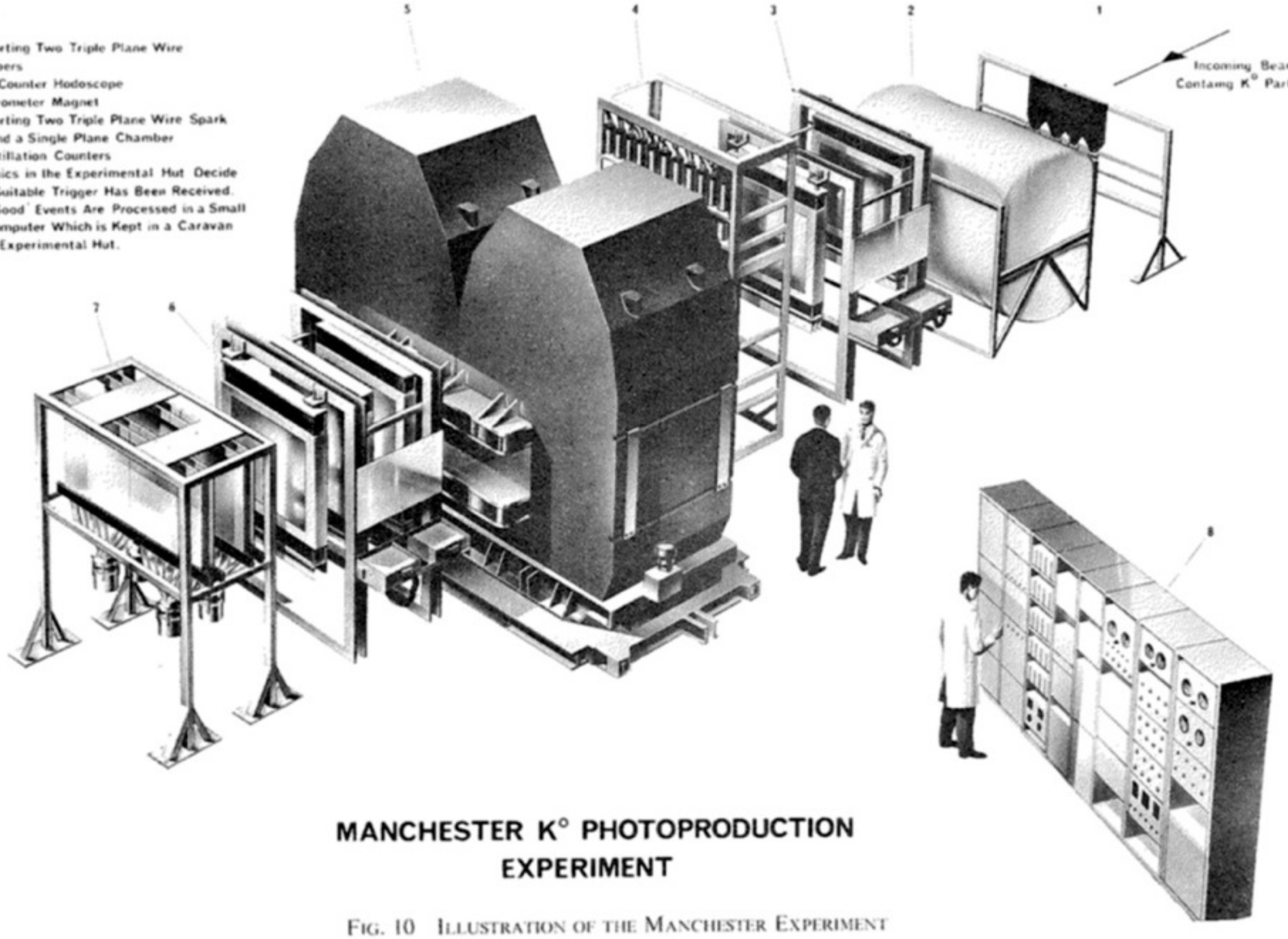
Designer and accomplisher of the NINA magnet lattice and the rest

Supervisor of Liverpool PhDs who helped to create NINA

Physics @ NINA and SPS

The Apparatus: Manchester K^0

1 Anticounters
2 Helium Bag
3 Frame Supporting Two Triple Plane Wire Spark Chambers
4 Scintillation Counter Hodoscope
5 Large Spectrometer Magnet
6 Frame Supporting Two Triple Plane Wire Spark Chambers and a Single Plane Chamber
7 Further Scintillation Counters
8 Fast Electronics in the Experimental Hut Decide Whether a Suitable Trigger Has Been Received. Data From 'Good' Events Are Processed in a Small 'On-Line' Computer Which is Kept in a Caravan Outside the Experimental Hut.



MANCHESTER K° PHOTOPRODUCTION EXPERIMENT

FIG. 10 ILLUSTRATION OF THE MANCHESTER EXPERIMENT

This isometric view of the Manchester K^0 experiment is taken from the 6 monthly progress report DNPL05, which covered the period November 1966 to May 1967.

This 35mm Kodachrome slide shows the double C Lintott spectrometer magnet for the Manchester K^0 experiment. The smaller grey magnet on the left was used as a sweeper, to remove charged particles from the K^0 beam. This “little” magnet has a history.

Magnet That May Aid In Solving Riddle Of Space

PROFESSOR BLACKETT.

"Daily Express" Special Representative.

PROFESSOR BLACKETT, professor of physics at London University, came to Manchester yesterday engaged in work more thrilling than Sherlock Holmes could ever boast of.

Professor Blackett is attempting to solve one of the greatest riddles of the universe—what are cosmic rays?

They come from interstellar space, thousands of millions of miles away, to bombard the earth night and day. They have been called "The waste energy of creation." But nobody knows what they are, where, exactly, they come from, nor why.

Professor Blackett has clues. He has enlisted the engineering industry of Manchester to help him.

They presented him yesterday with the most powerful magnet ever made in this country. It was only a nominal presentation, because the magnet weighs eleven tons.

He saw it in action in the vast workshops of Metro-Vick's, Trafford Park. It was an uninspiring sight—two metal casings eighteen inches apart. Just projecting from the casings were the two points of the magnet. Ventilating pipes pour air at pressure on the encased coils to prevent the whole thing overheating and going up in flames.

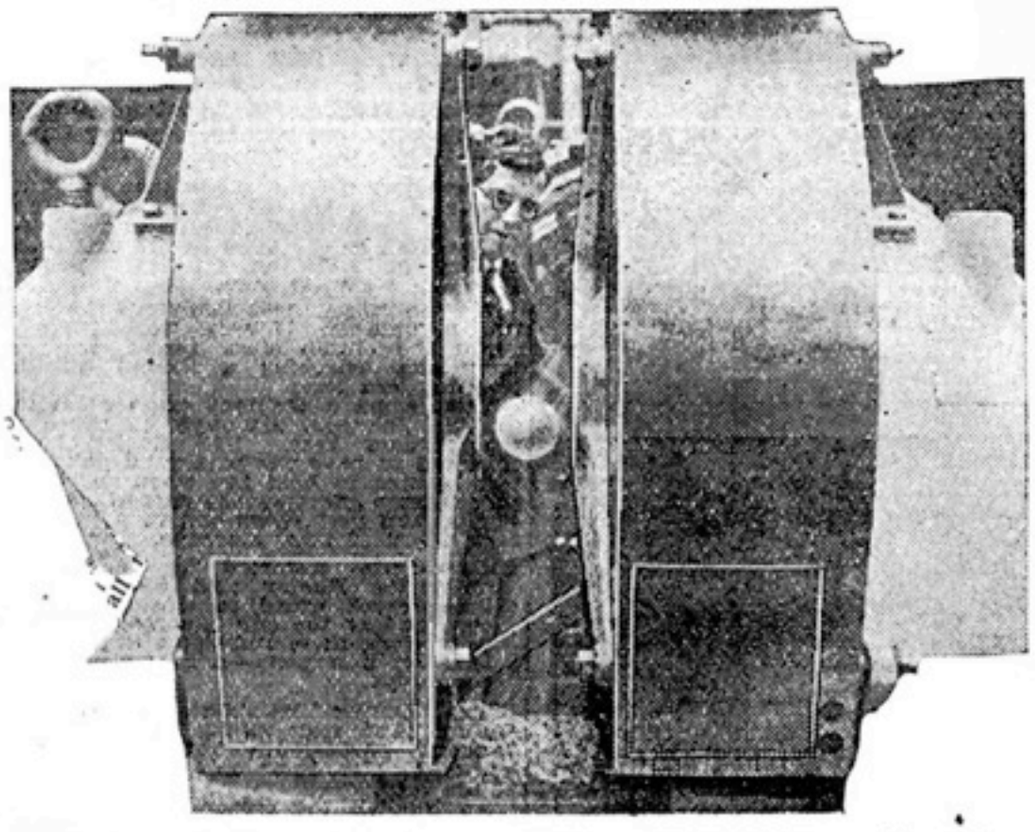
Engineers demonstrated the strength of the magnetic field. An aluminium globe was dropped between the two points.

It fell, bounced—on nothing—remained momentarily suspended in mid-air, began to sink almost imperceptibly between the two points, and finally came to rest on the ground, like a child's balloon.

I tried another test. I was told to strike between the two points with a copper rod. I struck. The rod hit something that felt like thick treacle, and stopped. It had to be forced through. A ball on the end of a wooden stick was placed between the points. It was as difficult to turn as a rusty screw.

That is the immense magnetic force Professor Blackett has been wanting. It will enable him to measure the energy of the cosmic rays. The whole machine will be transported to the Birkbeck College of the London University. A camera will photograph the electrons, which constitute the rays, and betray the extent to which they are deflected by the magnet. The more powerful they are, the less they will be deflected.

That is all he will admit. The "space sleuth" is secretive. Even scientists have been known to steal each others thunder. Professor Blackett is taking no risk.

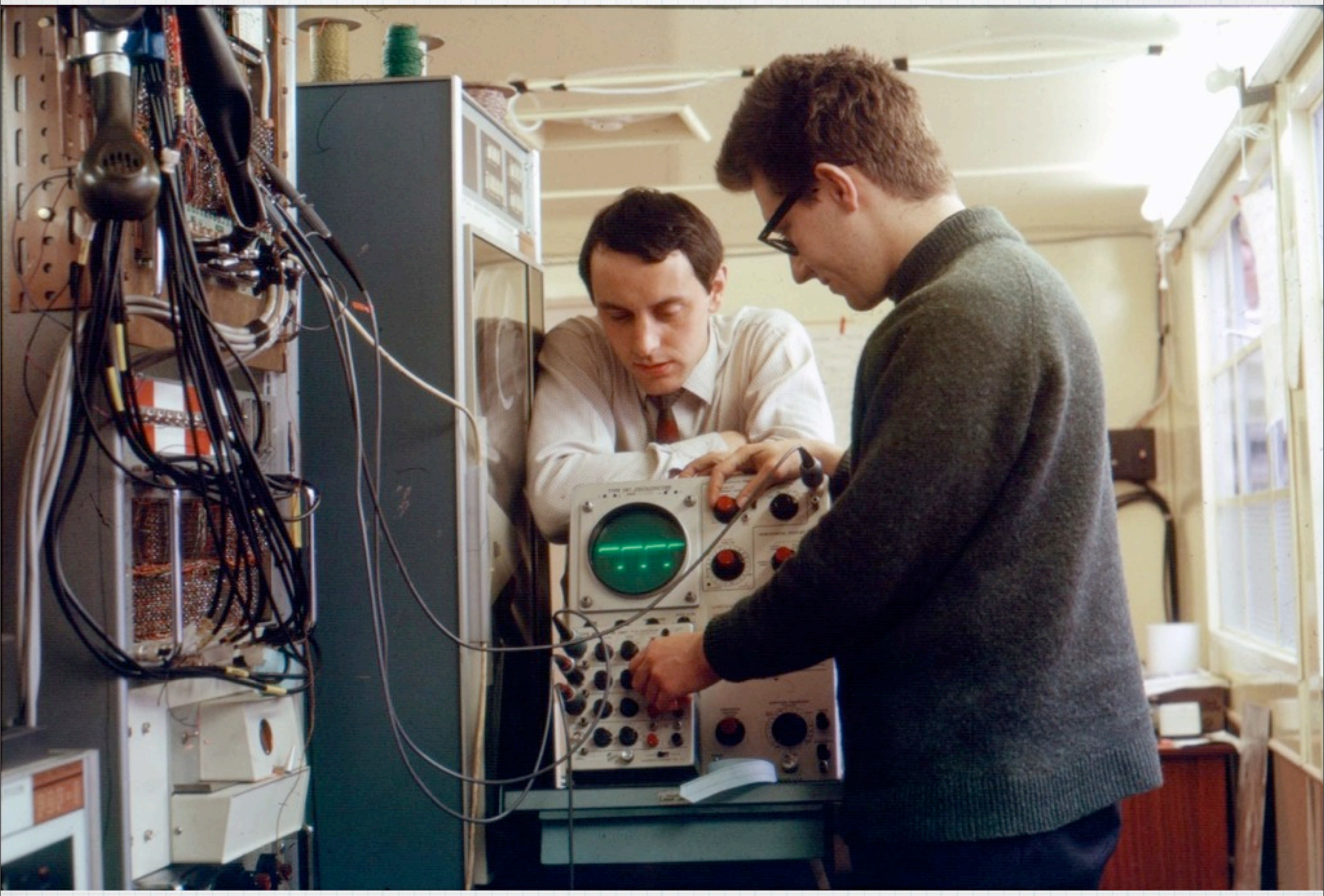


THE ALUMINIUM GLOBE suspended in mid-air between the poles of the giant magnet.

3 June 1934
(Daily Herald)

Blackett's magnet, appearing in the previous slide, appeared in the Daily Express of 3 June 1934. It was by Metro-Vick of Trafford Park, Manchester for Blackett, then at Birkbeck College. Even in 1934, particle physicists were already solving the riddle of the Universe, as they have a habit of doing.

Blackett brought his magnet to Manchester and here the cloud chamber that was used to discover the V particles (K mesons) and hence the s quark, is about to enter its jaws. The V particle discovery paper was published in 1947. 40 years later, K^0 particles once again streamed through its aperture.



In his 35mm colour slide, Robin Marshall & Roger Templeman check out the tunnel diode beam RF timing on a Tektronix in the Manchester K^0 electronics cabin.

Paul Murphy and Les Bird in the Manchester K^0 control room.

The Apparatus: Wide Angle Pair Production

DARESBURY GROUP EXPERIMENT
TO STUDY THE PHOTOPRODUCTION
OF ELECTRON AND MUON PAIRS

Big Apparatus
The smallest team

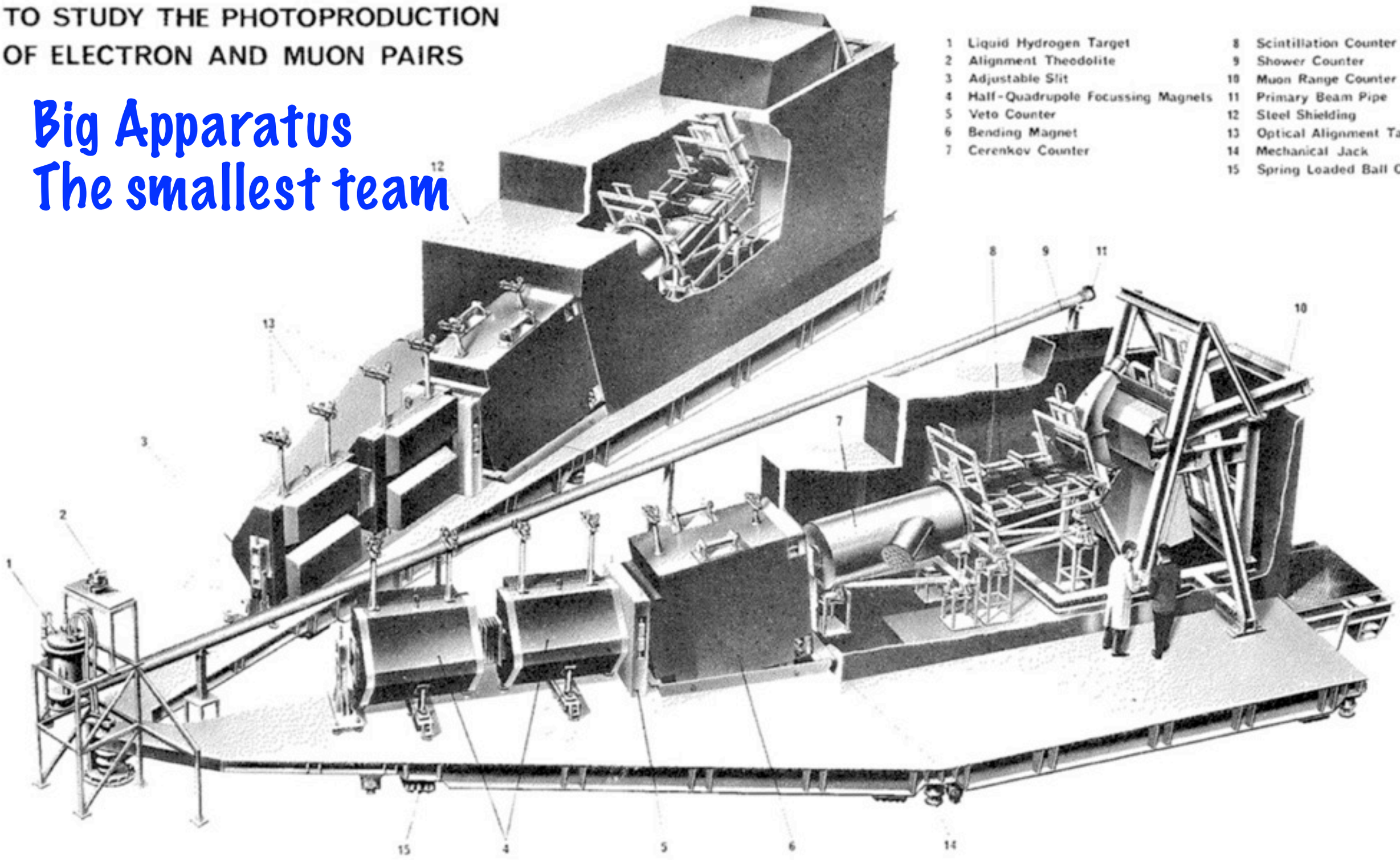


FIG. 9 ILLUSTRATION OF THE DARESBURY EXPERIMENT

The Apparatus: Wide Angle Pair Production WAPP

- Helping to clear of the mess of wrong experiments (by CEA)
- CEA (Cambridge Electron Accelerator) was one of the SPRU darlings. "Earlier", "Cheaper", "more cited".
- CEA got cited more, because it got things wrong, and even shut down for 2 years as Nina started.
- CEA said: "QED violated = Crab apples fall upwards."
- PS DNPL cost half of similar DESY to build and run.

Wide Angle Pair Production WAPP

VOLUME 24, NUMBER 21 PHYSICAL REVIEW LETTERS

OBSERVATION

MBER 17

ermination of the Real Part of the ρ-Nucleon Forward Scattering Amplitude and the Relative ρ-ω Production Phase

P. J. Biggs,* D. W. Braben, R. W. Clifft, E. Gabathuler, and R. E. Randt†
Daresbury Nuclear Physics Laboratory, Warrington, England
(Received 26 April 1971)

on forward scattering amplitude has been obtained by
of asymmetric electron-positron pairs from a
ω production phase is also made. A
real to the imaginary part o

YSICAL REVIEW LETTERS

MAGNITUDE AND PHASE OF ρ-ω INTERFERENCE
FROM CARBON

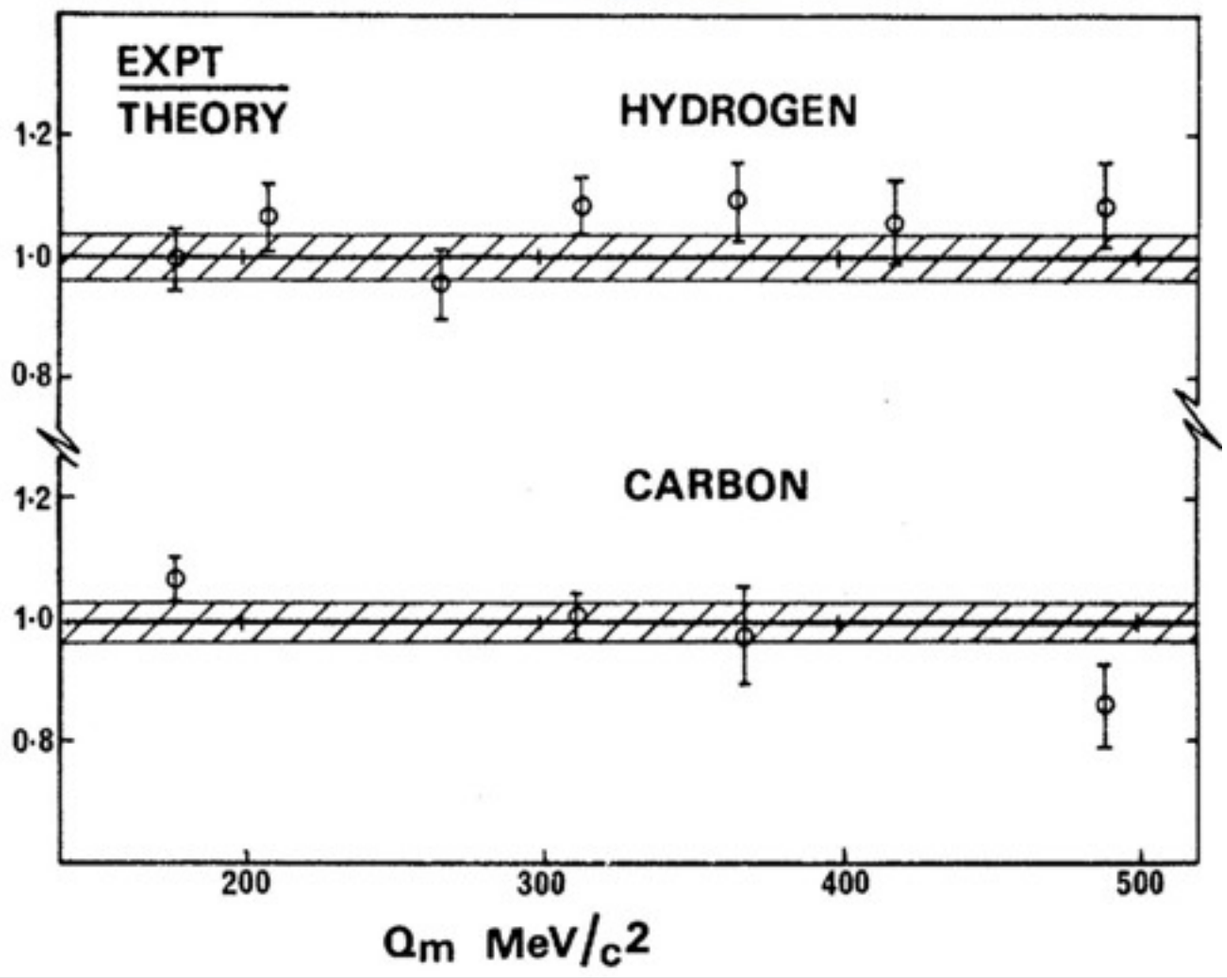
ω-ρ interference 1970.
Still baffling theorists in 2010

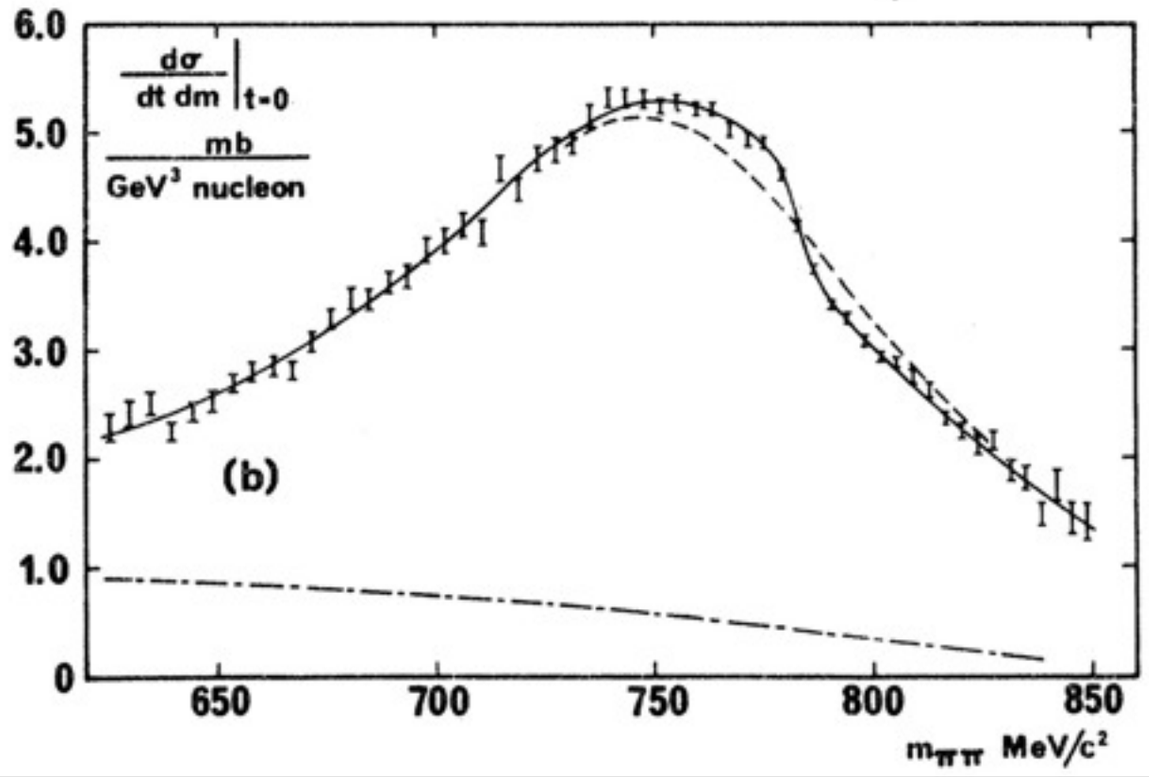
A Study of Interference Effects
in Photoproduced ρ, ω and ϕ Vector Mesons
by
Valeria Frisullo

A thesis submitted to the Faculty of the Graduate School of the University of Colorado in partial fulfillment of the requirements for the degree Doctor of Philosophy

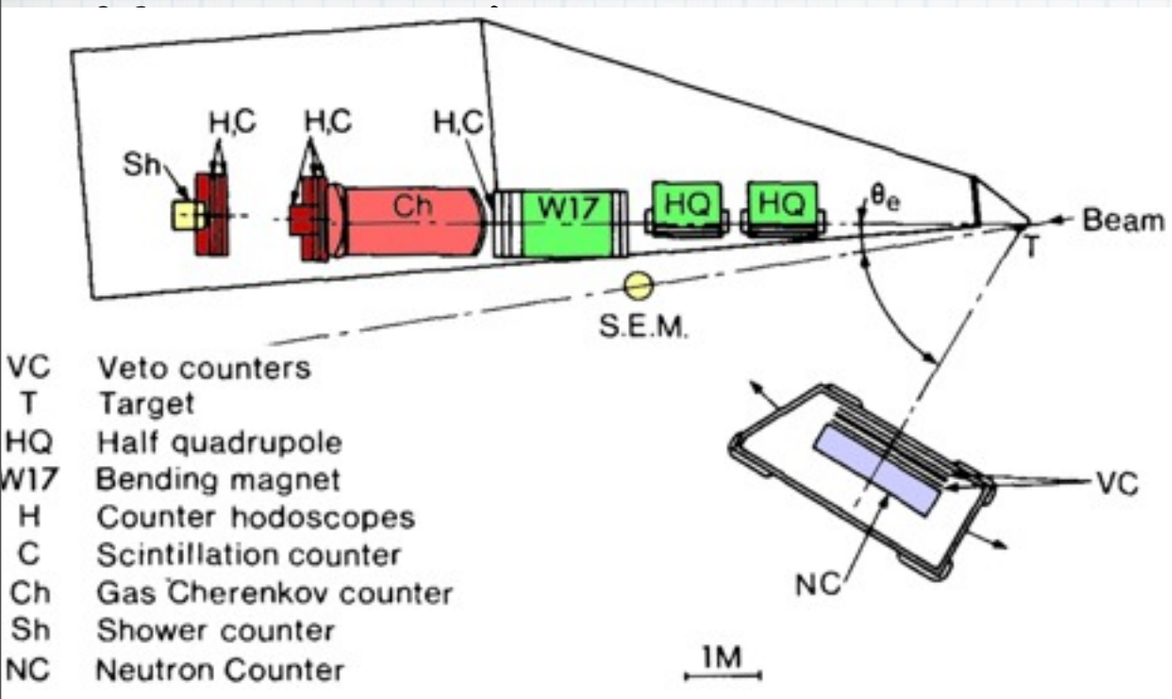
Department of Physics
2010

Quantum Electrodynamics saved





PEP: Daresbury-Frascati-Pisa: Electroproduction



VC	Veto counters
T	Target
HQ	Half quadrupole
W17	Bending magnet
H	Counter hodoscopes
C	Scintillation counter
Ch	Gas Cherenkov counter
Sh	Shower counter
NC	Neutron Counter

4 PHYSICS LETTERS 24 Jun

N FORM FACTOR AT A TIMELIKE MOMENTUM TRANSFER
ATELY 1 fm^{-2} FROM π^+ ELECTROPRODUCTION AT THRESHOL

. DEL GUERRA, A. GIAZOTTO, M.A. GIORGI, A. STEFANINI
Instituto di Fisica dell'Università, Pisa, Italy
and Instit

Nuclear Physics B106 (1976) 385–412
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Received 9 January 1976

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and Institu

INCLUSIVE NEUTRON SPECTRA IN ELECTROPRODUCTION ABOVE THE RESONANCE REGION

J. BAILEY, D.R. BOTTERILL, D.W. BRABEN *, D. CLARKE, H.E. MONTGOMERY and P.R. NORTON
Daresbury Laboratory, Daresbury, Warrington WA4 4AD, England

G. MATONE
Laboratori Nazionali di Frascati I-00044, Frascati, Rome, Italy

A. DEL GUERRA, A. GIAZOTTO, M.A. GIORGI and A. STEFANINI
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Istituto Nazionale di Fisica Nucleare, Sezione di Pisa, Via Livornese, S. Piero a Grado I-56010 Pisa, Italy

In electroproduction on hydrogen at momentum transfers −0.3, −0.6, −0.9 (GeV/c and W = 2.3 GeV we have measured, over a range of backward centre-of-mass angles, th yield of neutrons with momenta between 0.4 and 1.2 GeV/c, and in addition, protons over a limited range with momenta greater than 0.8 GeV/c. We compare the neutron yields with those of the protons and also with previous experiments. We find that the yield of neutrons is significantly greater than that of protons.

Volume 45B, number 4 PH

THE TOTAL CROSS SECTI
ON HYDROG

From an extrapolation of thresh
sical point, we derive the value of th
sult is $F_\pi(k_\pi^2) = 1.19 \pm 0.1$. From thi

D.R. BOTTERILL, D.W. BRABEN , K. KIKUCHI and P.I
Da

Volume 45B, number 4

A Del GUERRA,
I

A MEASUREMENT OF TH
OF THE PROCESS ep → enπ$^+$ NEAR THRESHOLD*

A. Del GUERRA, A. GIAZOTTO, M.A. GIORGI and A. STEFANINI
Istituto di Fisica dell' Universita, Pisa, Italy
and INFN Sezione di Pisa, Italy

and

D.R. BOTTERILL, D.W. BRABEN* and P.R. NORTON

The total cross section for the reac
and for centre of mass energies betwee
tecting the electron and neutron in coi
lation theoretical models.

Lots of papers. Italian collaboration.

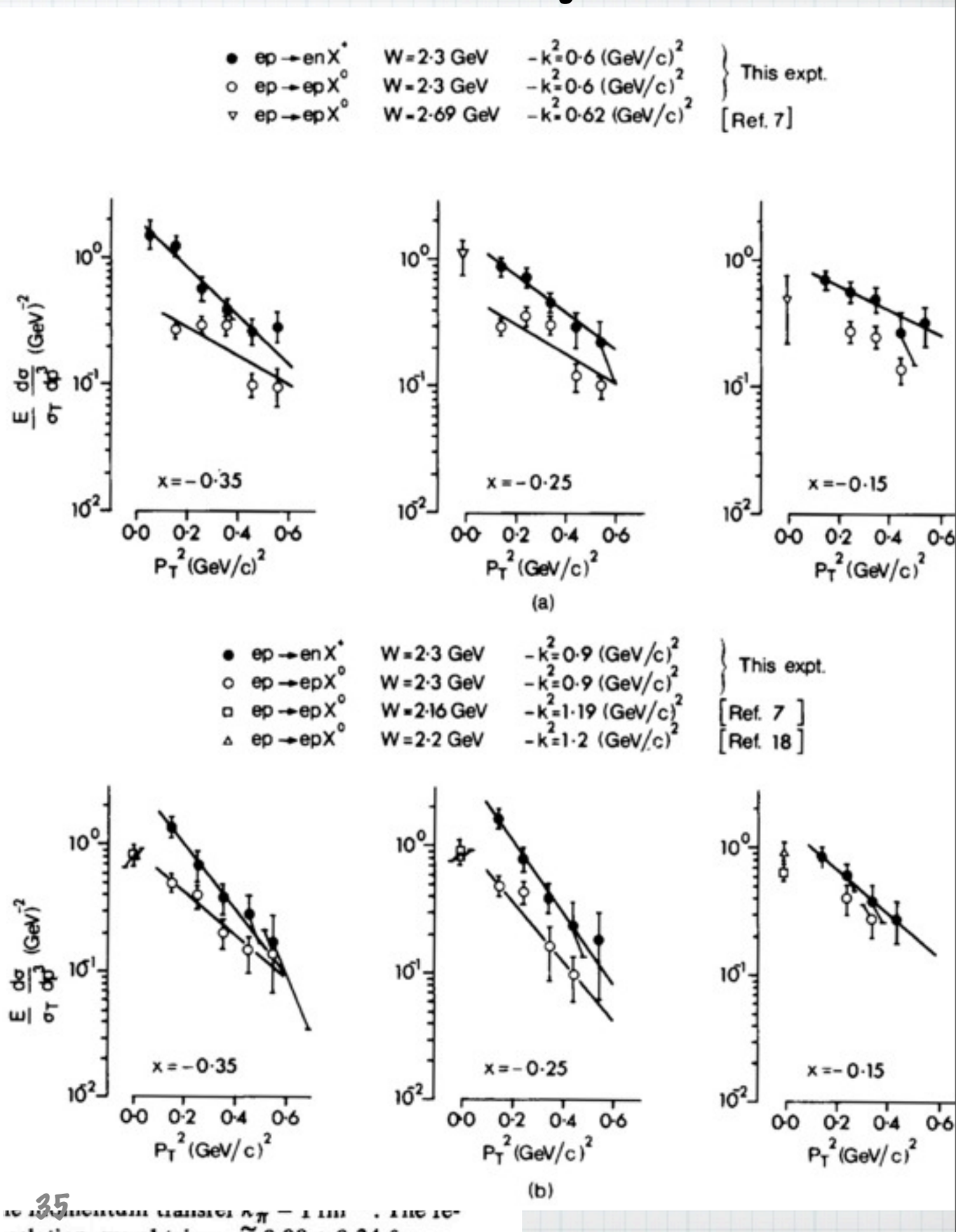
PEP: Daresbury-Frascati-Pisa: Electroproduction

+ Glasgow + Trieste

Jefferson

Director

The 2 Dons



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INCLUSIVE NEUTRON SPECTRA IN ELECTROPRODUCTION ABOVE THE RESONANCE REGION

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In electroproduction on hydrogen at momentum transfers −0.3, −0.6, −0.9 (GeV/c) and W = 2.3 GeV we have measured, over a range of backward centre-of-mass angles, the yield of neutrons with momenta between 0.4 and 1.2 GeV/c, and in addition, protons over a limited range with momenta greater than 0.8 GeV/c. We compare the neutron yields with those of the protons and also with previous experiments. We find that the yield of neutrons is significantly greater than that of protons.

relation, we obtain $r_\pi \gtrsim 0.98 \pm 0.24$ fm.

Lancaster Spark Chamber: ω,ρ photoproduction

Lancaster University, 1964, younger than DNPL!
Yet, among the first physics outputs from Nina!

Nuclear Physics B95 (1975) 249–268
North-Holland Publishing Company

NUCLEAR PHOTOPRODUCTION OF RHO MESONS

P. CODDINGTON, M. ATKISS, T.J. BRODBECK, D.H. LOCKE, J.V. MORRIS
D. NEWTON and T. SLOAN
University of Lancaster

Received 31 July 1974
(Revised 9 May 1975)

Targets of Be, C, Al, Cu, Ag and Au were exposed to a tagged photon beam in the 2.75 to 4.35 GeV energy range and cross sections are presented for the reaction $\gamma A \to A\rho^0$. Optical spark chambers were used to examine charged particles and γ rays from the targets, so that the data are believed to be free from inelastic contamination. The results are analysed both in terms of total cross sections $\sigma(A\gamma \to \rho A)$, and in terms of forward differential cross sections $(d\sigma/dt)_{\theta=0}(\gamma A \to \rho A)$. From the A dependence of these cross sections we determine the total rho-nucleon cross section, $\sigma_{\rho N}$, to be (22.5 ± 2.7) mb, and the absolute values of the cross sections determine the forward photoproduction cross section from a nucleon $(d\sigma/dt)_{\theta=0}(\gamma p \to \rho p) = (72.7 \pm 8)\,\mu b/GeV^2$. These values correspond to an assumed value $\alpha_{\rho N} = -0.2$ for the ratio of the real to imaginary part of the ρ nucleon forward scattering amplitude. The corresponding value of the photon-rho coupling constant $\gamma_\rho^2/4\pi = 0.65 \pm 0.16$.

Nuclear Physics B136 (1978) 95–114
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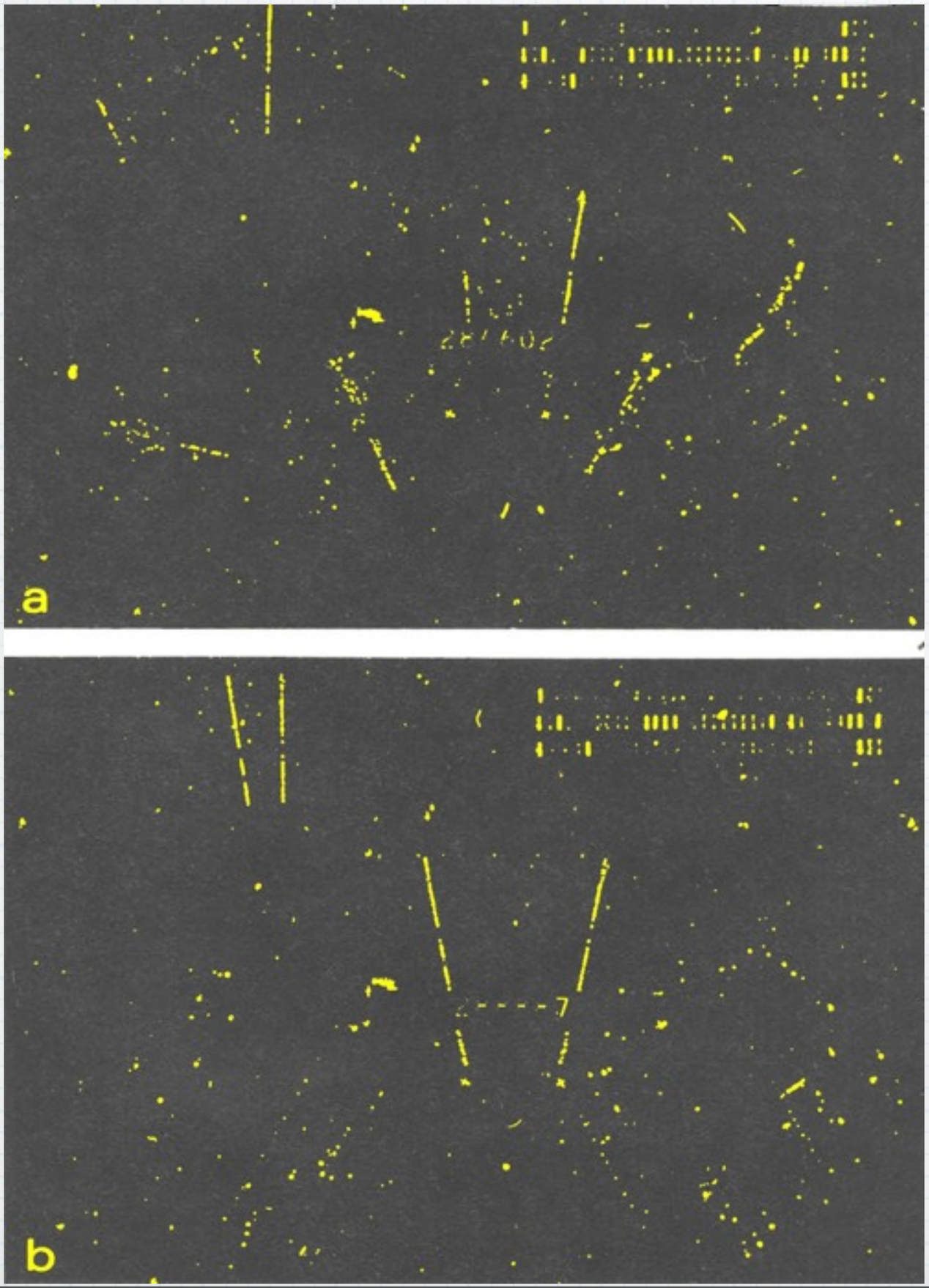
PHOTOPRODUCTION OF ω MESONS FROM COMPLEX NUCLEI TARGETS

T.J. BRODBECK, P. CODDINGTON, J.V. MORRIS, D. NEWTON and T. SLOAN
Department of Physics, University of Lancaster, UK

Received 9th January 1978

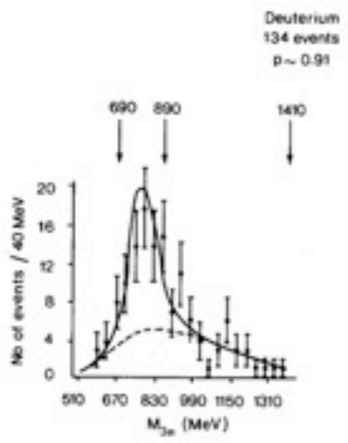
Measurements are presented of the cross sections for omega meson photoproduction at a mean energy of 3.9 GeV from nuclear tagrets of D, Be, C, Al, Cu, Ag, Au. An optical and Glauber model analysis of the coherent cross sections has been performed to obtain the ω-nucleon cross section, $\sigma_{\omega N}$, and the photon-omega coupling constant $\gamma_\omega^2/4\pi$. Our results are summarised in table 4. We find good agreement with the quark model prediction that $\sigma_{\omega N} = \sigma_{\rho N}$, and with the value of $\gamma_\omega^2/4\pi$ determined from the storage ring experiments and from an earlier complex nuclei measurement. However, we disagree with more recent complex nuclei measurements which found a high value of $\gamma_\omega^2/4\pi$.

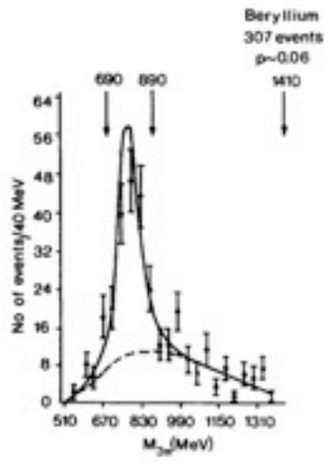
Lancaster Spark Chamber: ω,ρ photoproduction

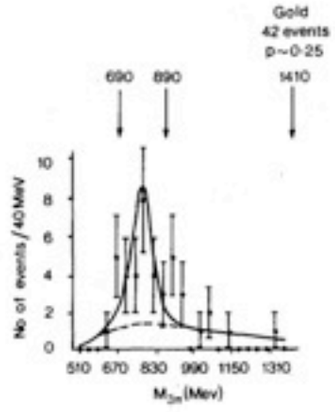


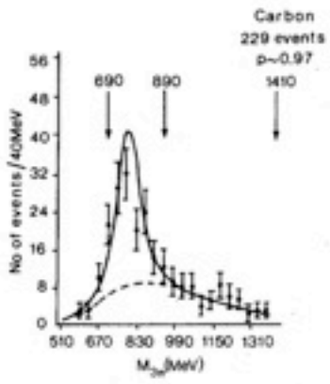
Nice spark chamber experiment

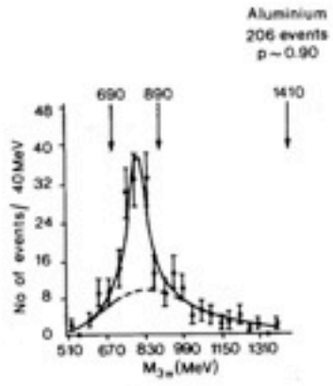
Lancaster Spark Chamber: ω,ρ photoproduction

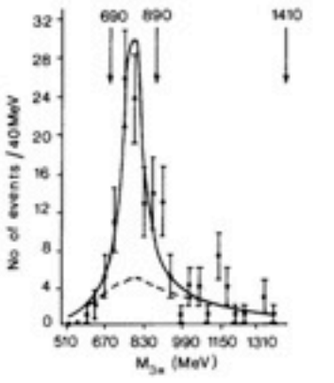


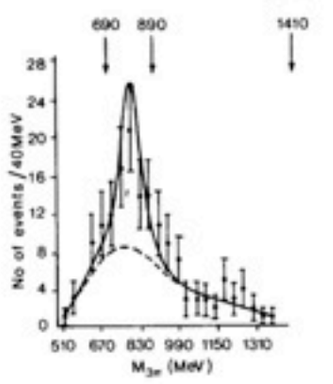


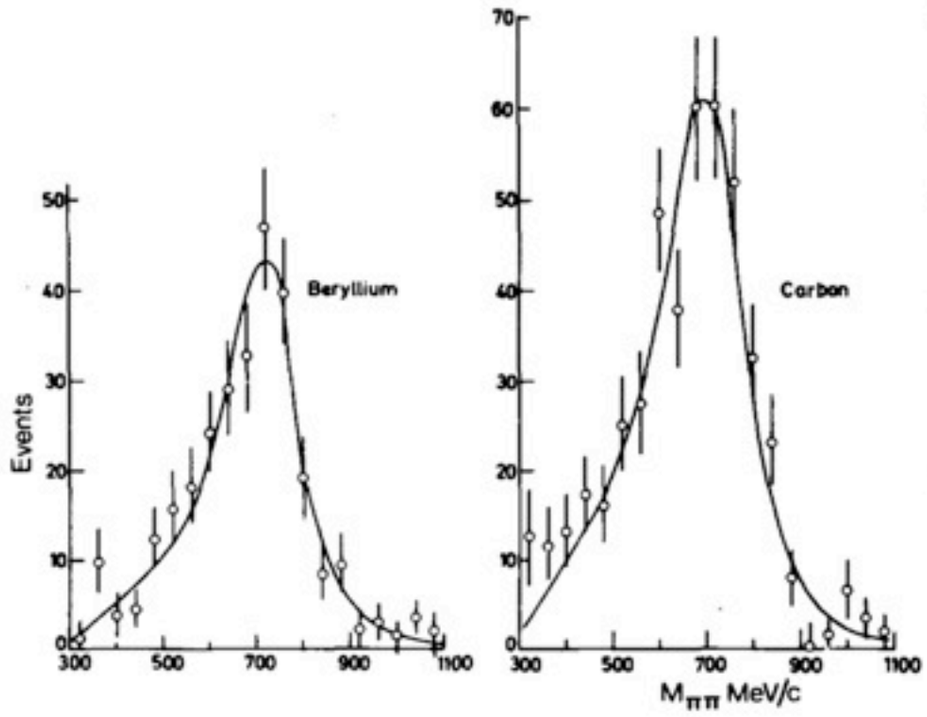


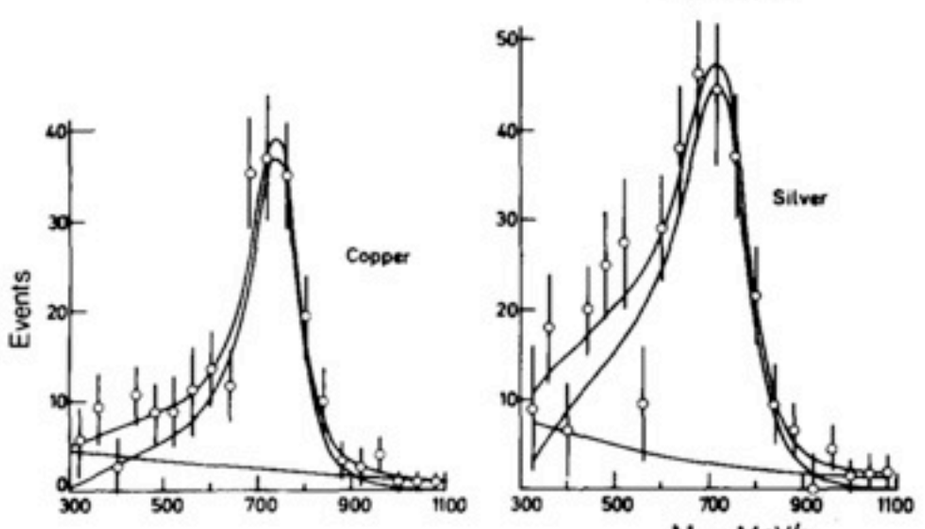






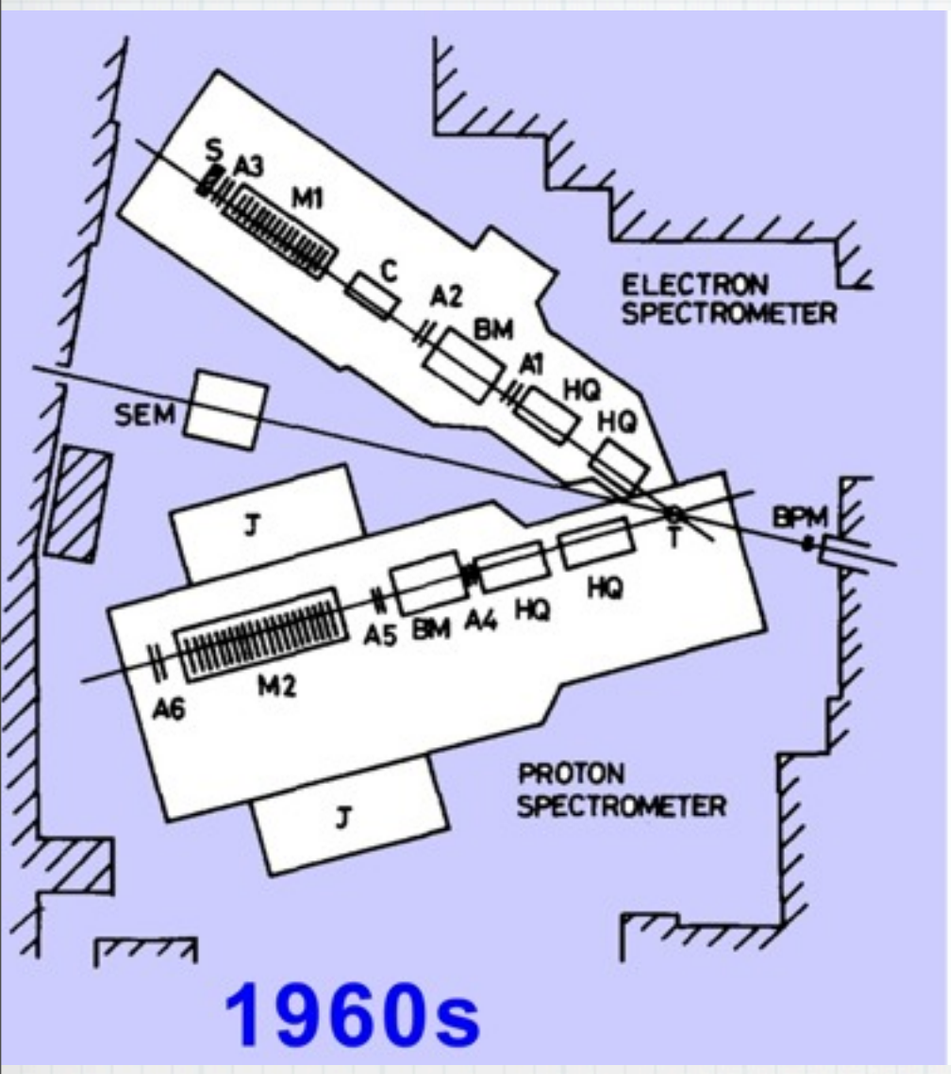




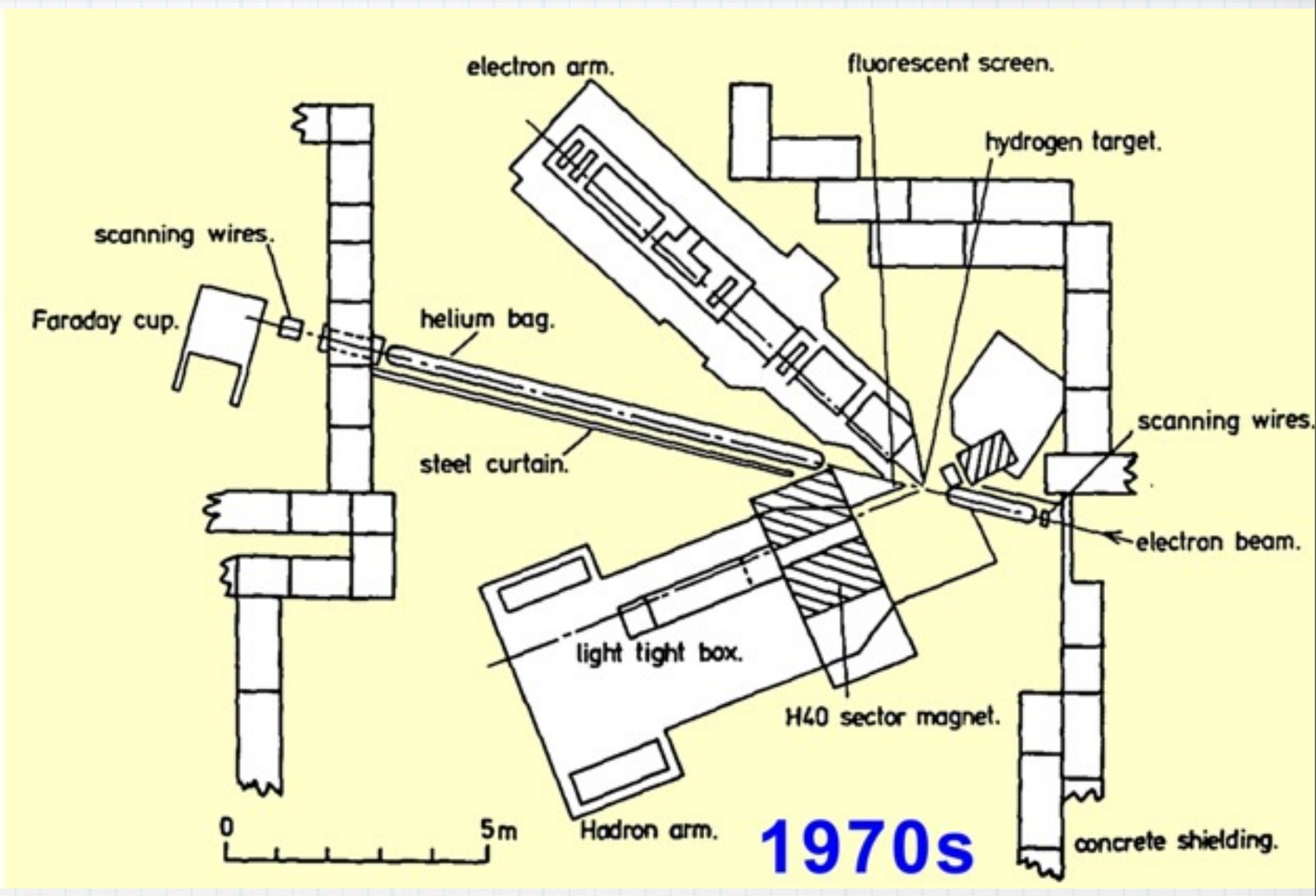


Thorough measurements of nuclear shadowing and the ω and ρ photon couplings.

Mancaster + UCL & DNPL: Electroproduction



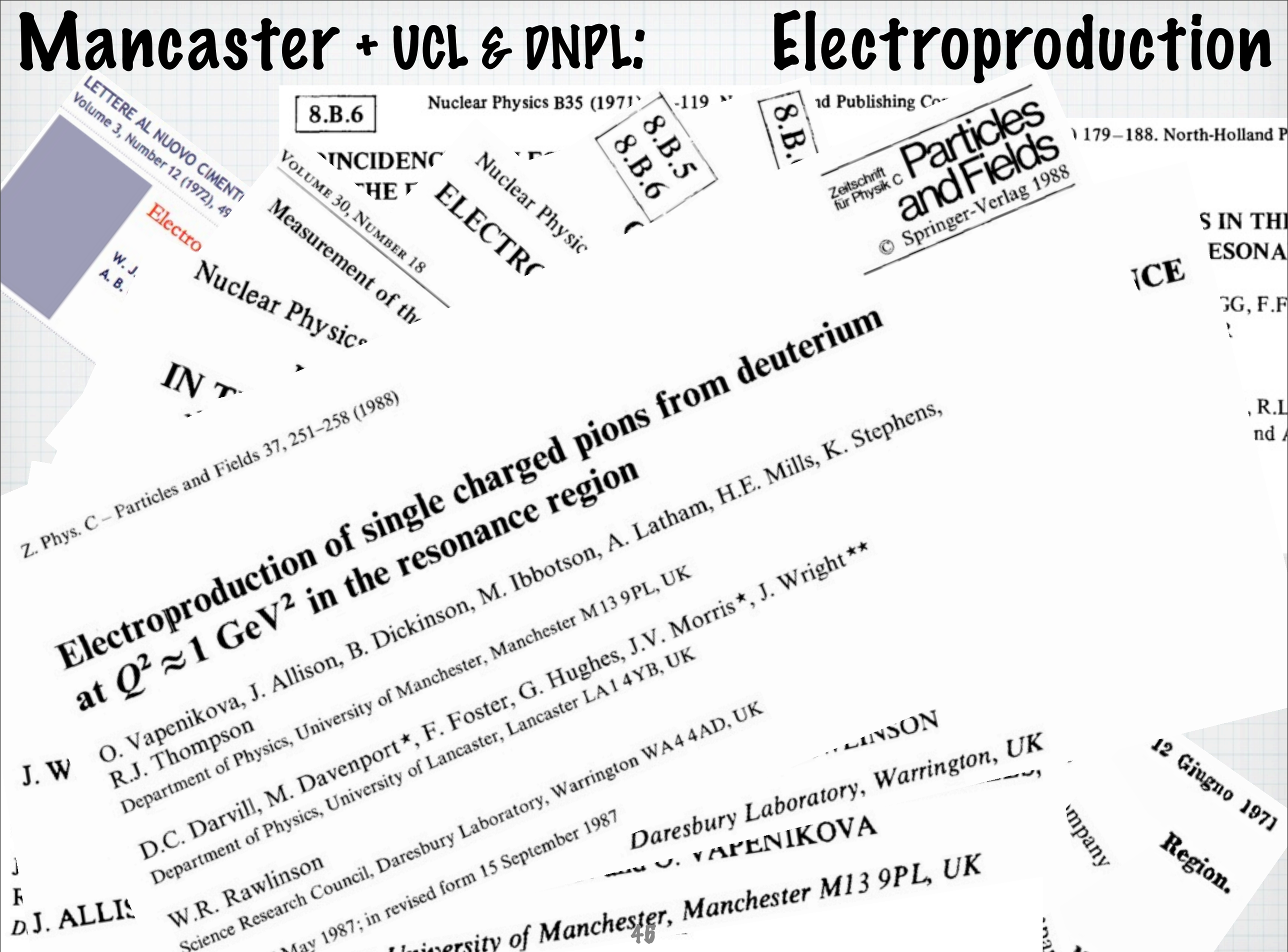
1960s



1970s

The Lancaster-Manchester collaboration, known as Mancaster, carried out an extended programme, adding sophistications to their apparatus as they went along.

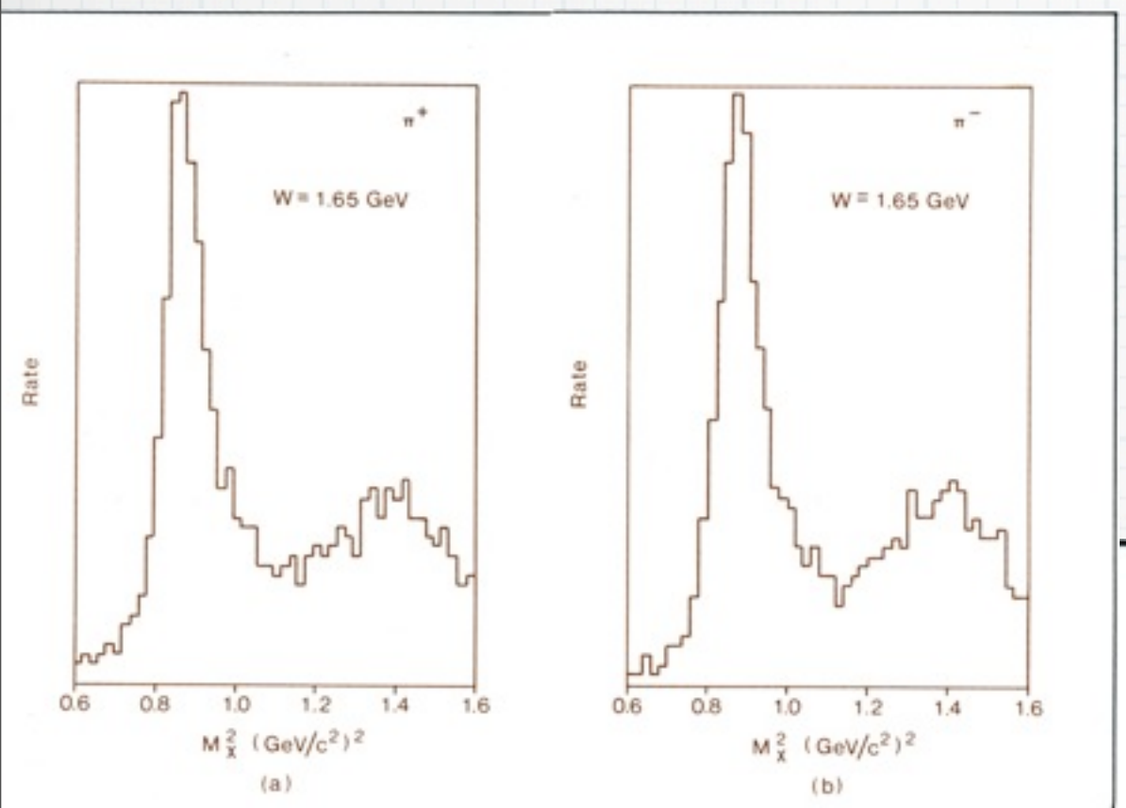
Mancaster + UCL & DNPL: Electroproduction

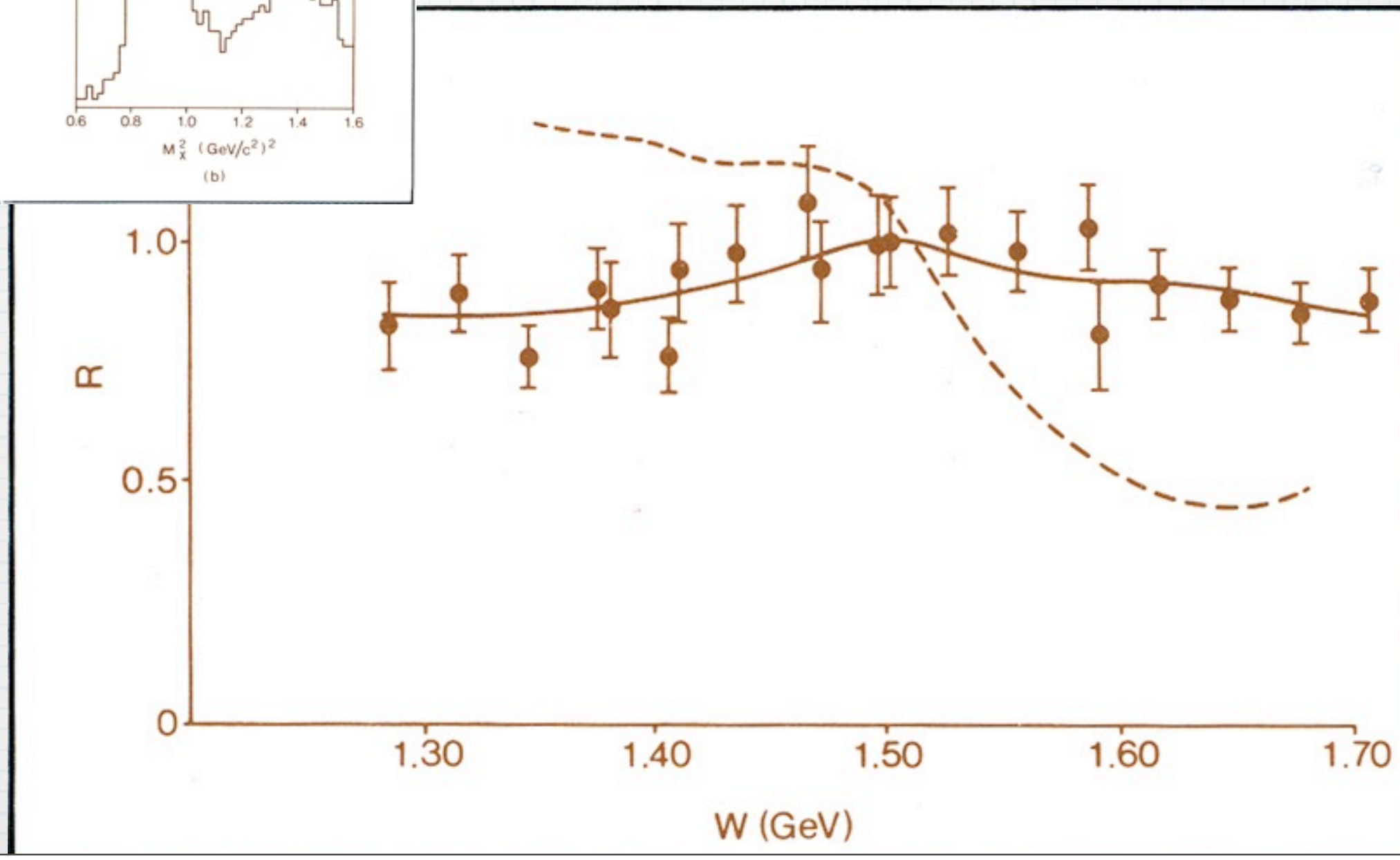


It was a highly productive experiment - the Montgomery effect again.

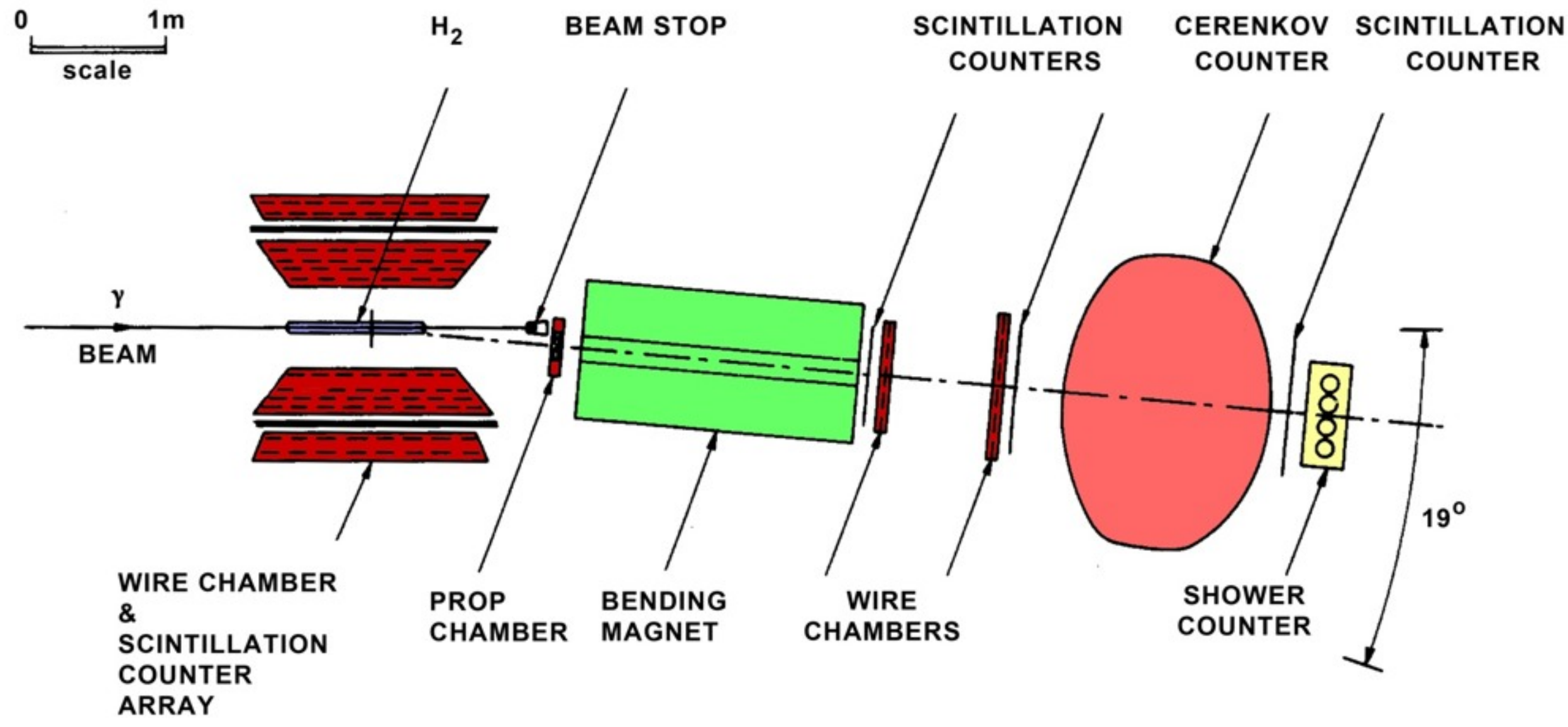
Mancaster + UCL & DNPL: Electroproduction

neutron proton ratios
measured off
deuterium



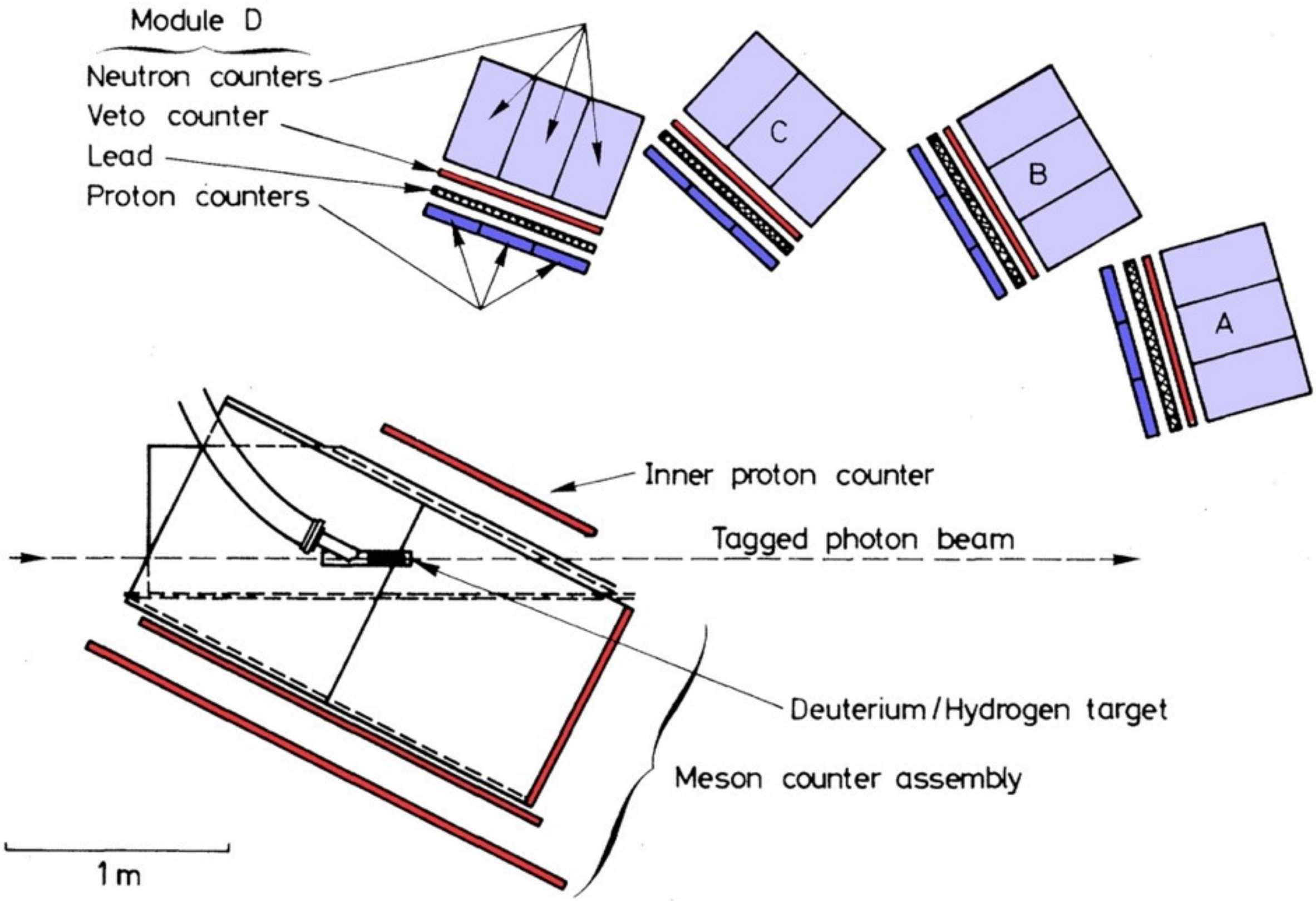


LAMP Experiments: LAMP1 Multi states



The LAMP group, which was headed initially by Erwin, went through 3 lots of apparatus in 6 years.

LAMP Experiments: LAMP1.5 Multi states



This experiment, LAMP1.5, was conceived, built, operated and dismantled within a period of months to check a theoretical muse that the photon might have the ability to induce an isotensor changing current. It didn't.

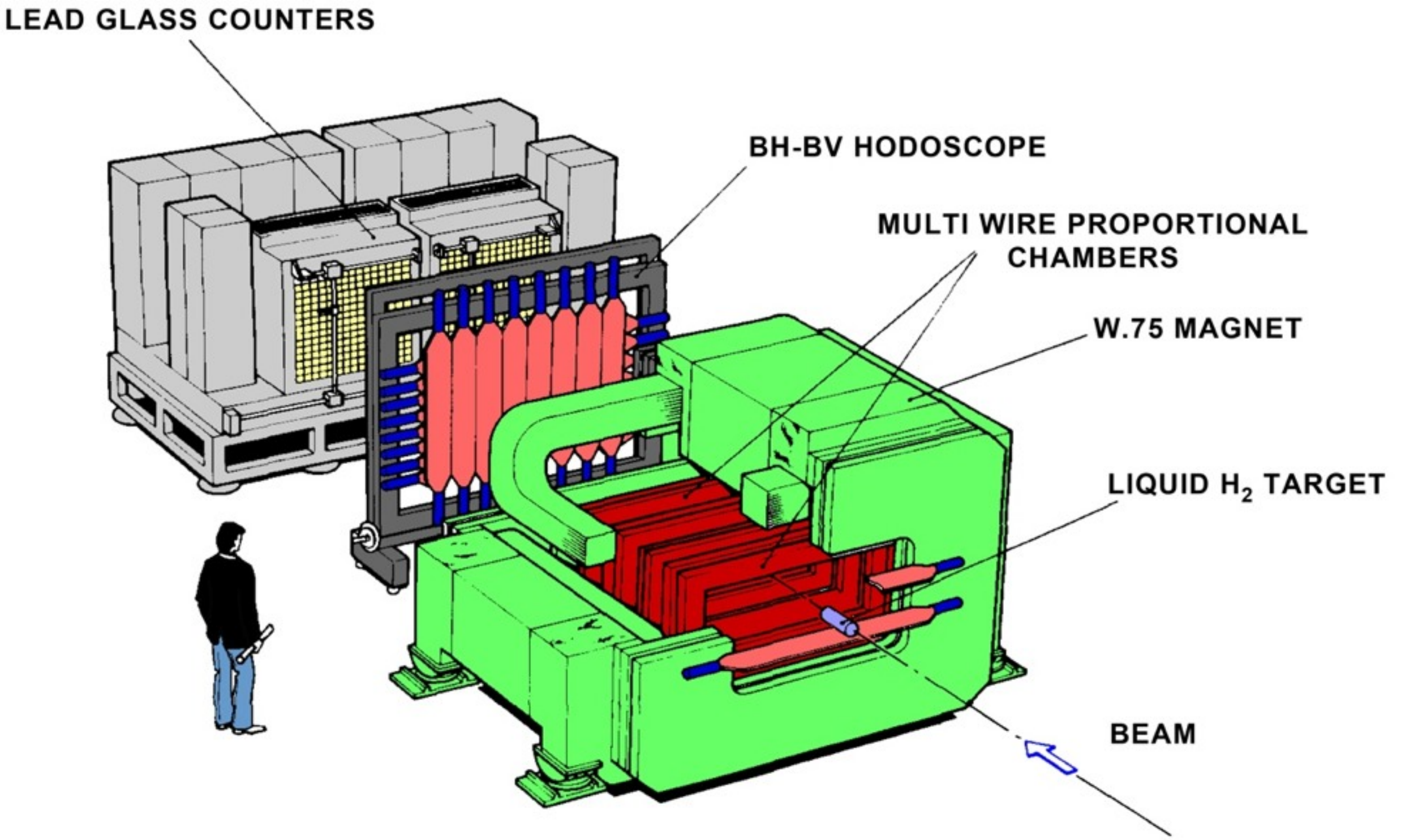
LAMP Experiments: LAMP1.5 Multi states

Some members of the LAMP1.5 group, shortly after they demonstrated that the photon does not have an isotensor changing component to its current. From left to right: **** ****, Dave Tolfree, Erwin Gabathuler, Steve Rock (with beard) and David Ward.

LAMP Experiments: LAMP1.5 Multi states

The LAMP1.5 group official photograph, shortly after they demonstrated that the photon does not have an isotensor current changing ability. From left to right: John Thompson, David Ward, Roger Clifft, Steve Rock, Laurie Littenberg, Erwin Gabathuler, Dave Tolfree, Robin Marshall and Graham Brookes.

LAMP Experiments: LAMP2 Multi states



LAMP2 was a Large Aperture Magnet experiment, designed to detect a range of multi body final states in photoproduction. It recorded over 15 million interactions in its 2 years of operation.

LAMP Experiments: Multi states

Volume 72B, number 1 PHYSICS LETTERS 5 December 1977

OBSERVATION OF A BARYON EXCHANGE DIP AND PARTON EFFECTS IN BACKWARD PHOTOPRODUCTION OF ω

R.W. CLIFFT*, J.B. DAINTON, E. GABATHULER*, L.S. LITTENBERG☆, R. MARSHALL, S.E. ROCK**, J.C. THOMPSON, D.L. WARD☆☆

Daresbury Laboratory, Science Research Council, Daresbury, Warrington WA4 4AD, UK

and

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University of Sheffield, Sheffield S3 7RH, UK

9 authors 1977

Received 7 October 1977

VOLUME 90, NUMBER 2 PHYSICAL REVIEW LETTERS week ending 17 JANUARY 2003

Photoproduction of the ω Meson on the Proton at Large Momentum Transfer

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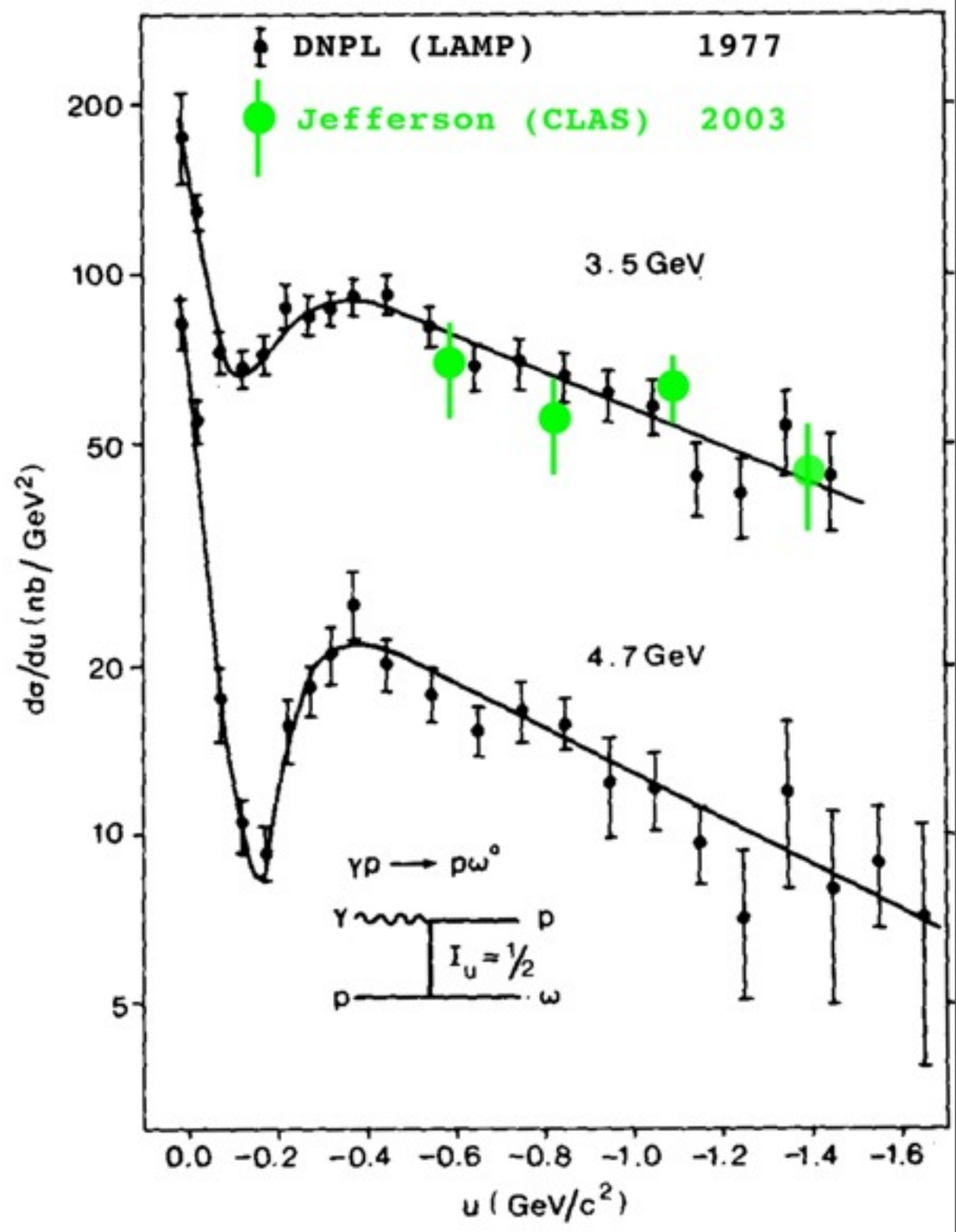
(CLAS Collaboration)

188 authors! 2003



The Irvine and Martin Spru duo of Sussex, erroneously said that Nina experiments were late, unnoticed by others and expensive. The precision measurement of backward ω photoproduction by the 9 members of the LAMP team in 1977 is now being revisited by the Thomas Jefferson Laboratory in Virginia with a team of 188. The Jefferson team is trying to unravel the underlying dynamics, with poorer accuracy, dynamics that were already clearly stated in LAMP's 1977 paper. Laurel & Hardy were wrong again (deliberately?.

The power of Glasgow-Sheffield-DNPL: Total hadronic σ_T for γp

PHYSICAL REVIEW VOLUME 125, NUMBER 1 JANUARY 1, 1962

Photoproduction of Positive Pions from Hydrogen near Threshold

G. M. Lewis, R. E. Azuma,* E. Gabathuler,† D. W. G. S. Leith, and W. R. Hogg‡
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(Received August 31, 1961)

8.B.1 Nuclear Physics B2 (1967) 424–432. North-Holland Publ. Comp., Amsterdam

TOTAL ABSORPTION MEASUREMENTS OF 100-250 MeV PHOTONS IN HYDROGEN

G. R. BROOKES, R. RAILTON, J. G. RUTHERGLEN and I. L. SMITH
Department of Natural Philosophy, Glasgow, Scotland

Received 23 May 1967

PHYSICAL REVIEW D VOLUME 5, NUMBER 7 1 APRIL 1972

Total Hadronic Cross Section of γ Rays in Hydrogen in the Energy Range 0.265–4.215 GeV

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and
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Department of Physics, The University, Sheffield, Yorkshire, England
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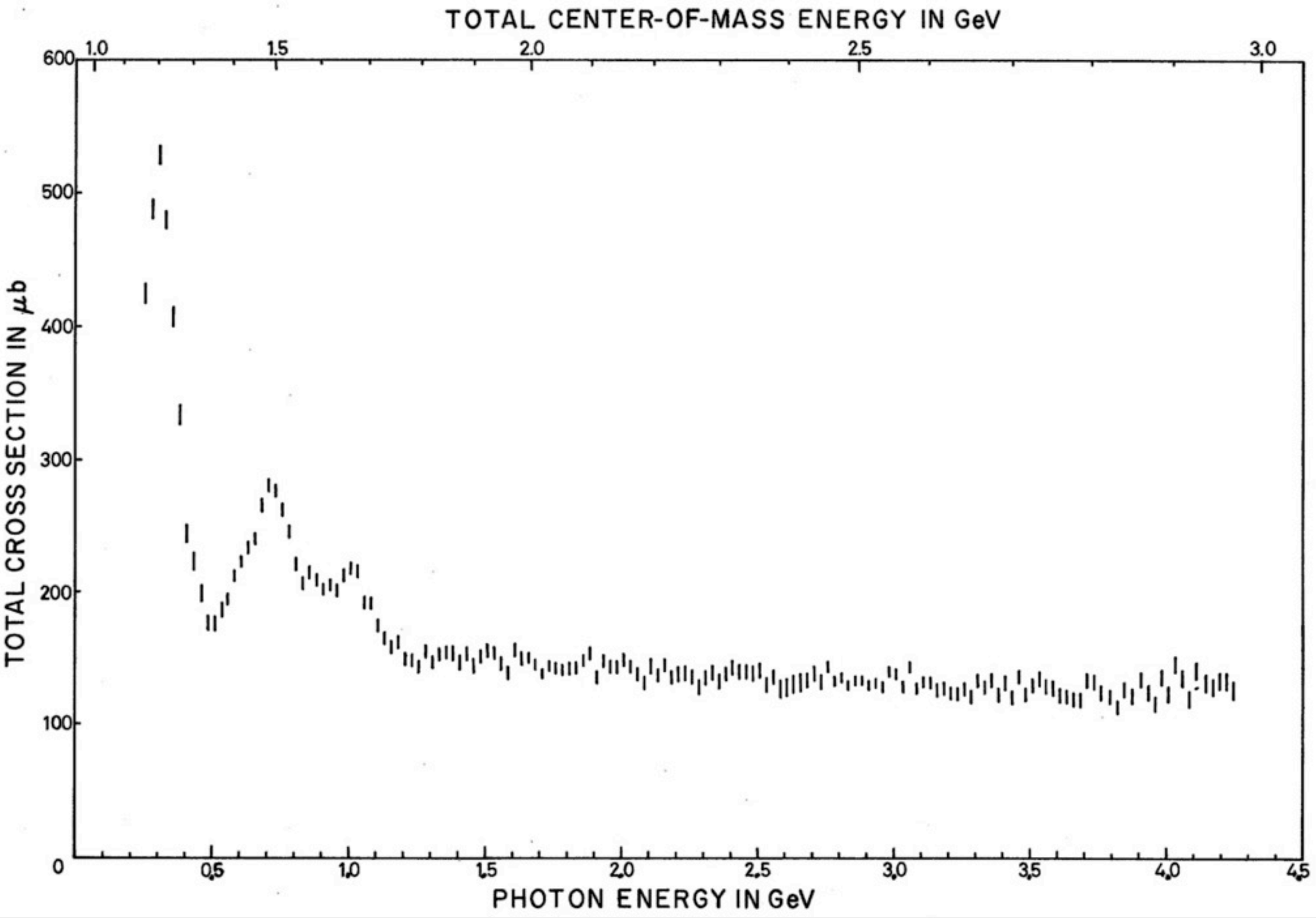
Daresbury Nuclear Physics Laboratory, Daresbury, Cheshire, England
(Received 30 November 1971)

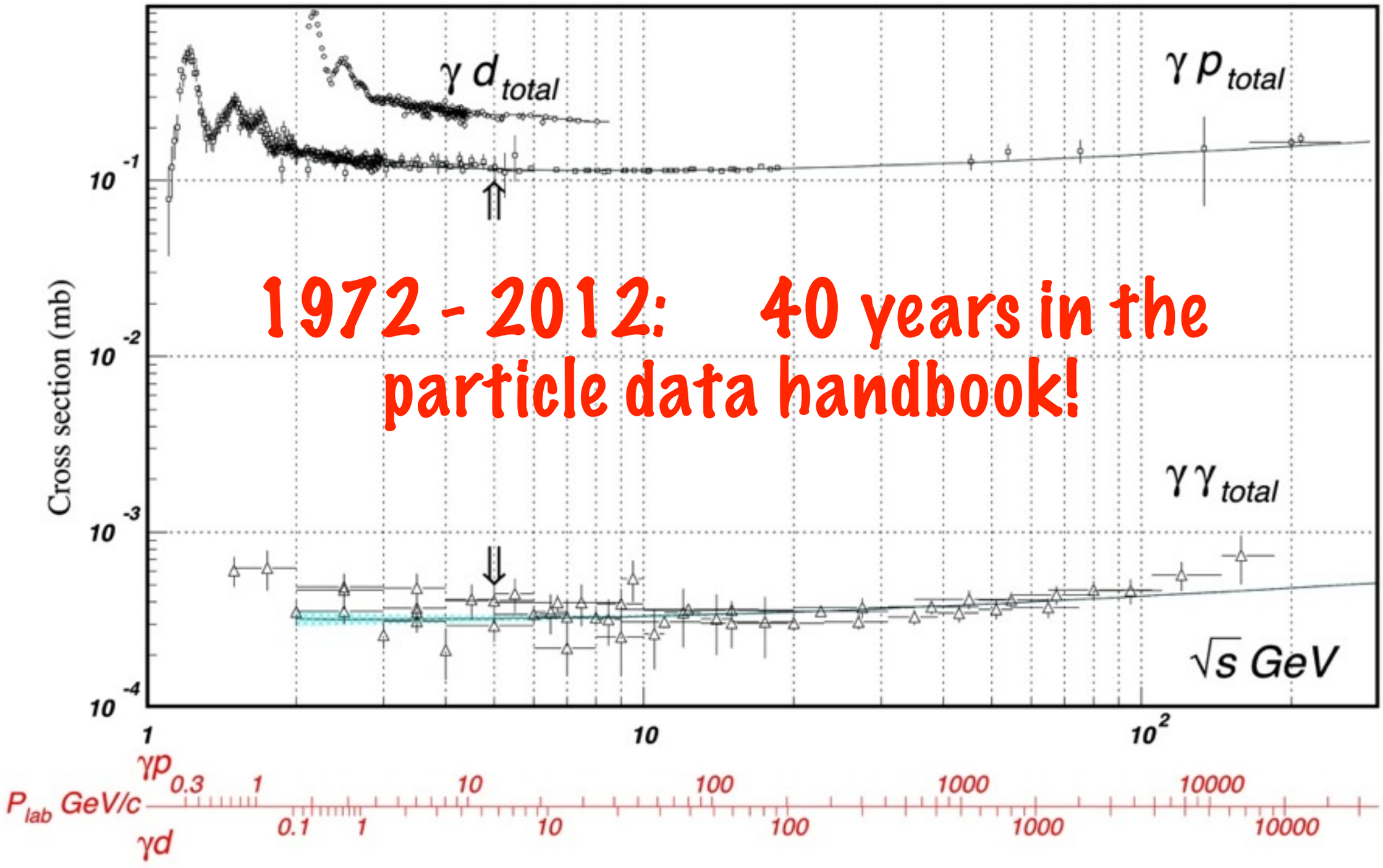
The top two papers here show the origins of some of the Nina physics programme already evident at the Glasgow 400 MeV synchrotron. The third paper at the bottom is the spectacular measurement of the total cross section by the Glasgow-Sheffield-Daresbury collaboration.

The power of Glasgow-Sheffield-DNPL:



The precise measurements were made through the resonance region and well into the continuum.

The power of Glasgow-Sheffield-DNPL: Total hadronic σ_T for γp



1972 - 2012: 40 years in the particle data handbook!

Figure 46.15: Total hadronic cross sections for γd and γp collisions as a function of laboratory beam momentum and the total center-of-mass energy.

The data form the backbone of the total hadronic cross section for γp interactions which have appeared in every issue of the “Review of Particle Properties”, the particle physicists bible, for the last 40 years.

The power of Glasgow-Sheffield-DNPL:

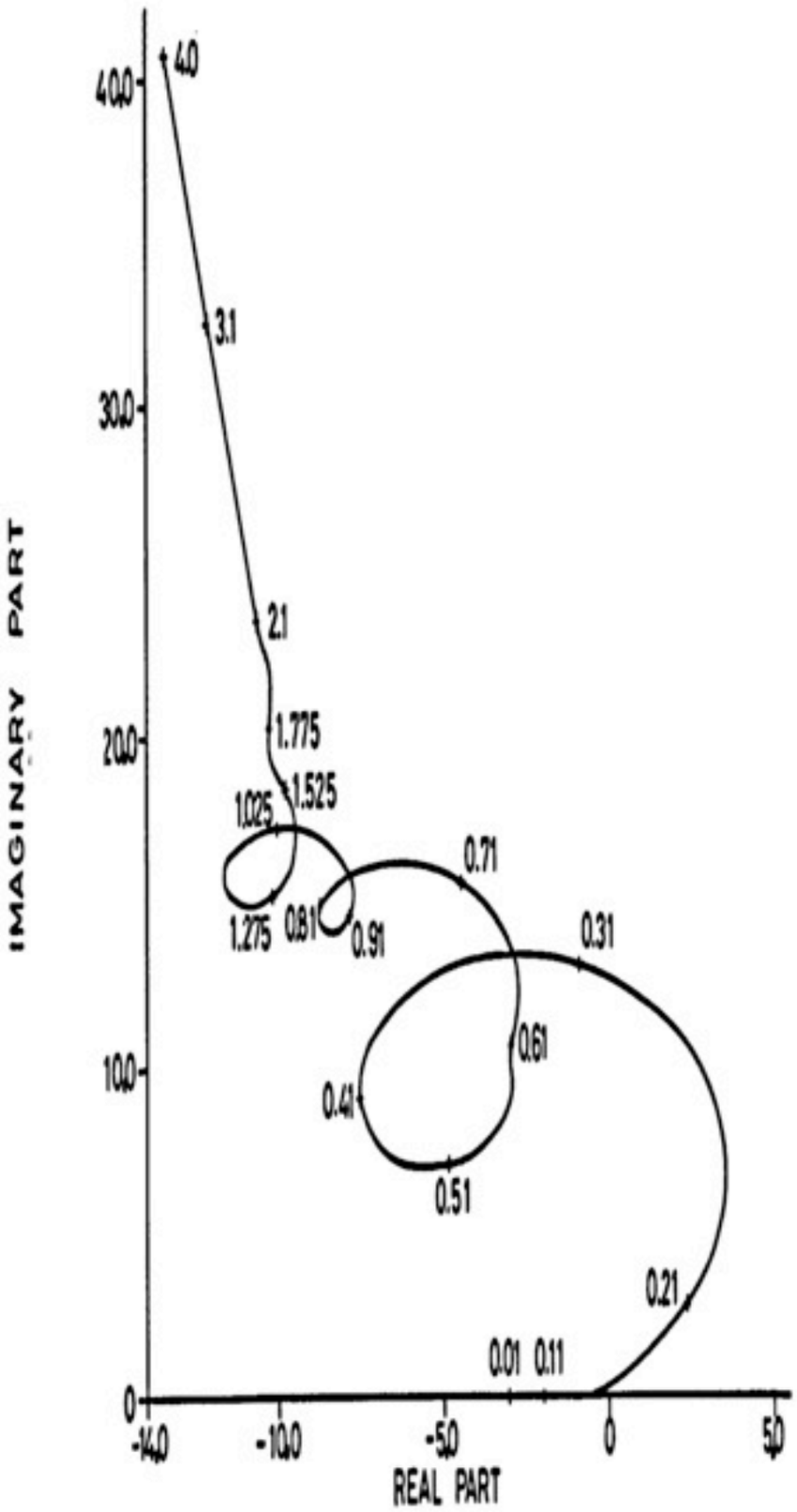
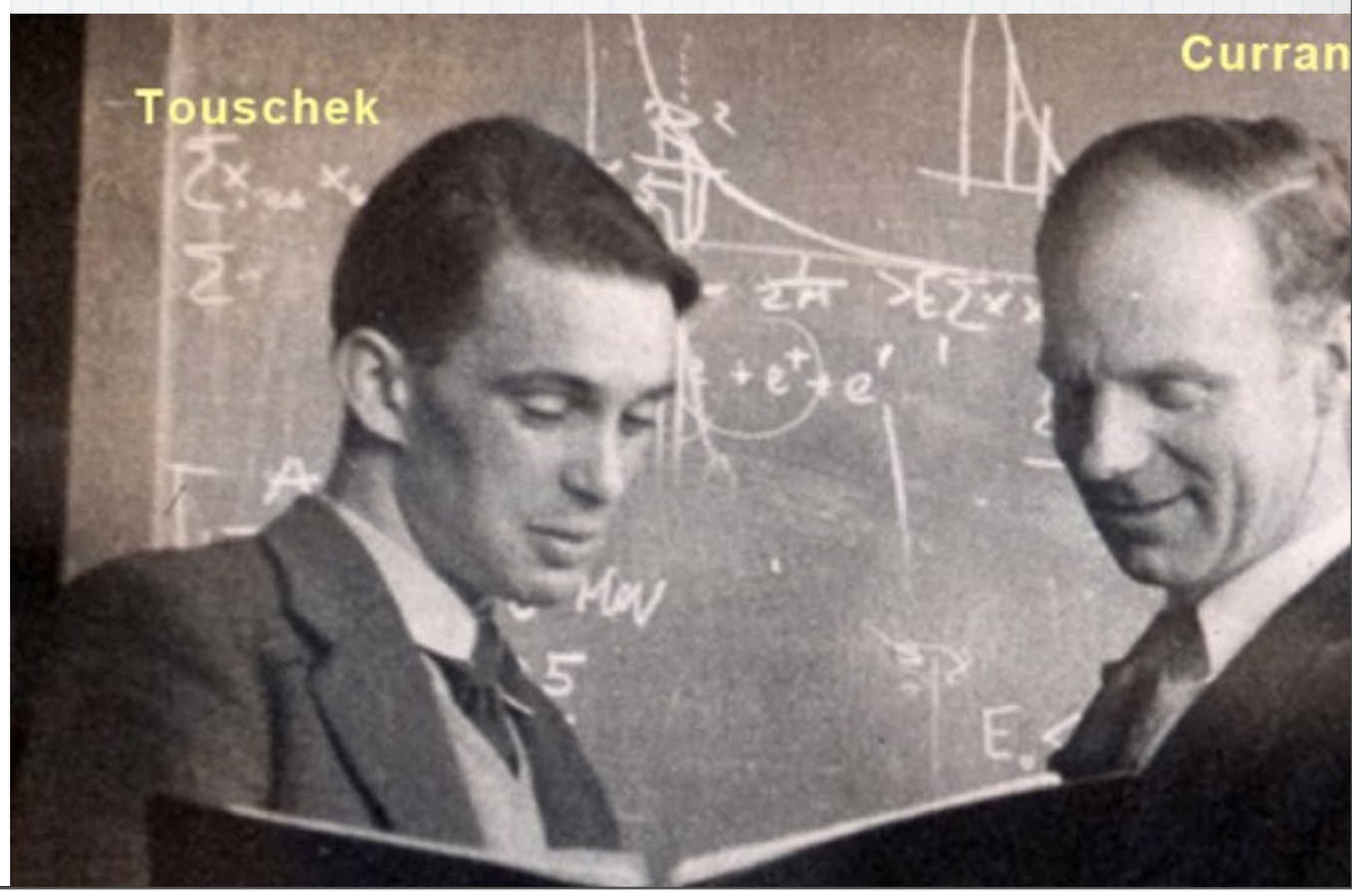


FIG. 10. Argand diagram for the forward scattering amplitude $f_1(\nu)$, plotted as ν goes from 0 to 4.0 GeV.

A 7 GeV Nina would not have done extra physics!

4 GeV was sweet point energy or else . .

Nor would a 15 GeV Frederick!



With further theoretical input, the total cross section can be analysed to produce the (complex) forward scattering amplitude. When plotted on an Argand diagram, the characteristic loops of the first three resonances can clearly be seen. From 2 GeV upwards, the plot is a straight line, as the continuum is entered. The interesting thing is that if Nina had been designed and built as a 6 GeV machine, it would have cost twice as much and produced no extra physics. It would have just confirmed that the line is straight. The choice of 4 GeV turned out to be a retrospective wise one and the extra 2 GeV, at double the cost, would have been no more than “go faster stripes”. This is the sort of scientific subtlety that the Spru duo, Irvine and Martin were incapable of grasping, being untrained and unfamiliar with particle physics, and hence incapable of making rational judgements about it. In the spirit of Ecclesiasticus, we can say that they represent those which have no memorial; who are perished, as though they had never been and are become as though they had never been born; and their children after them. Today, as we celebrate what the Daresbury Laboratory is, was and ever shall be, let us with grim satisfaction imagine what it must feel like to wake up in the morning, realise that you are Irvine and Martin, the men from the Spru and that you wrote that untrue report on Daresbury.

But let me finish by forgetting Spru and then outdoing them. The Northern Universities and Cockcroft could actually have done better. Glasgow was fortunate enough to have as an undergraduate and PhD student, Bruno Touschek, whom I show here together with Irish physicist Sir Samuel Crowe Curran. If Glasgow had not let Touschek go, Nina might have been a 4 GeV e+ e- storage ring, perhaps 3 GeV to keep within the available budget to be built and operational by 1966. In this case, we would have known something. Particle physics Nobel Prizes would have gushed out of Daresbury. In his book “The Quark Machines”, Gordon Fraser says in the context of CERN, “Slowly, the Europeans learned how to be bold, to discard preconceptions and to go for long shots instead.” Alas, this never happened in England. Even with hindsight, if English particle physics were offered the chance to build today, a machine that might do things, they would go for the safe option and build the one that couldn’t. Had Touschek stayed, we might have known something, but English history suggests we wouldn’t.

The End
Of The Beginning

1970-ish


Now-ish