

Helmut Oeschler and the structure of matter – his early days at TH Darmstadt/GSI

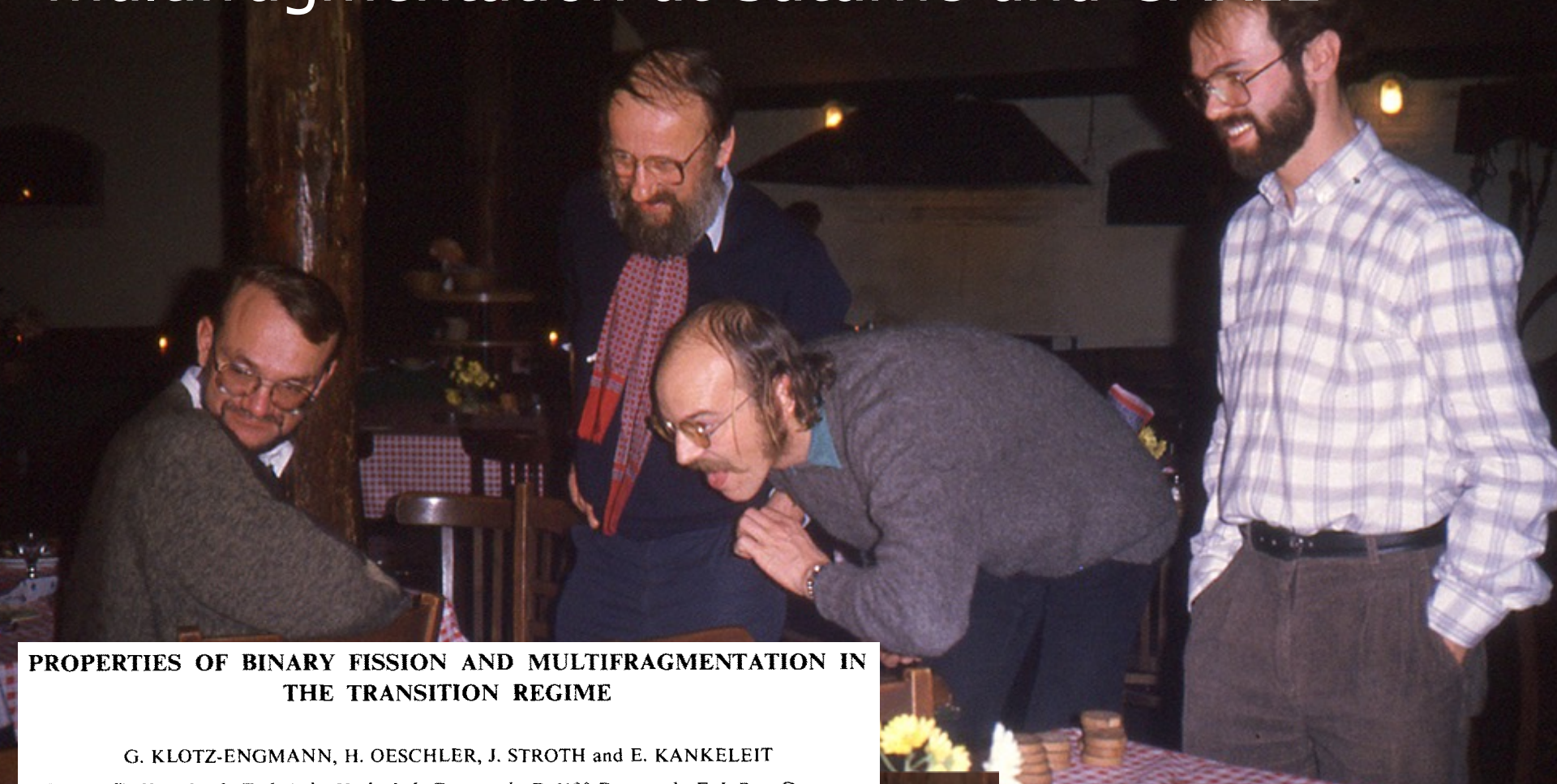


Peter Senger, GSI and Univ. Frankfurt

After years of travel (MPI Heidelberg — NBI Kopenhagen — CNRS Strasbourg — IPNO Paris) Helmut started in 1981 as “Akademischer Rat” at TH Darmstadt in the group of Egbert Kankeleit



Helmut continues his experiments on fission and multifragmentation at Saturne and GANIL



PROPERTIES OF BINARY FISSION AND MULTIFRAGMENTATION IN THE TRANSITION REGIME

G. KLOTZ-ENGMANN, H. OESCHLER, J. STROTH and E. KANKELEIT

Institut für Kernphysik, Technische Hochschule Darmstadt, D-6100 Darmstadt, Fed. Rep. Germany

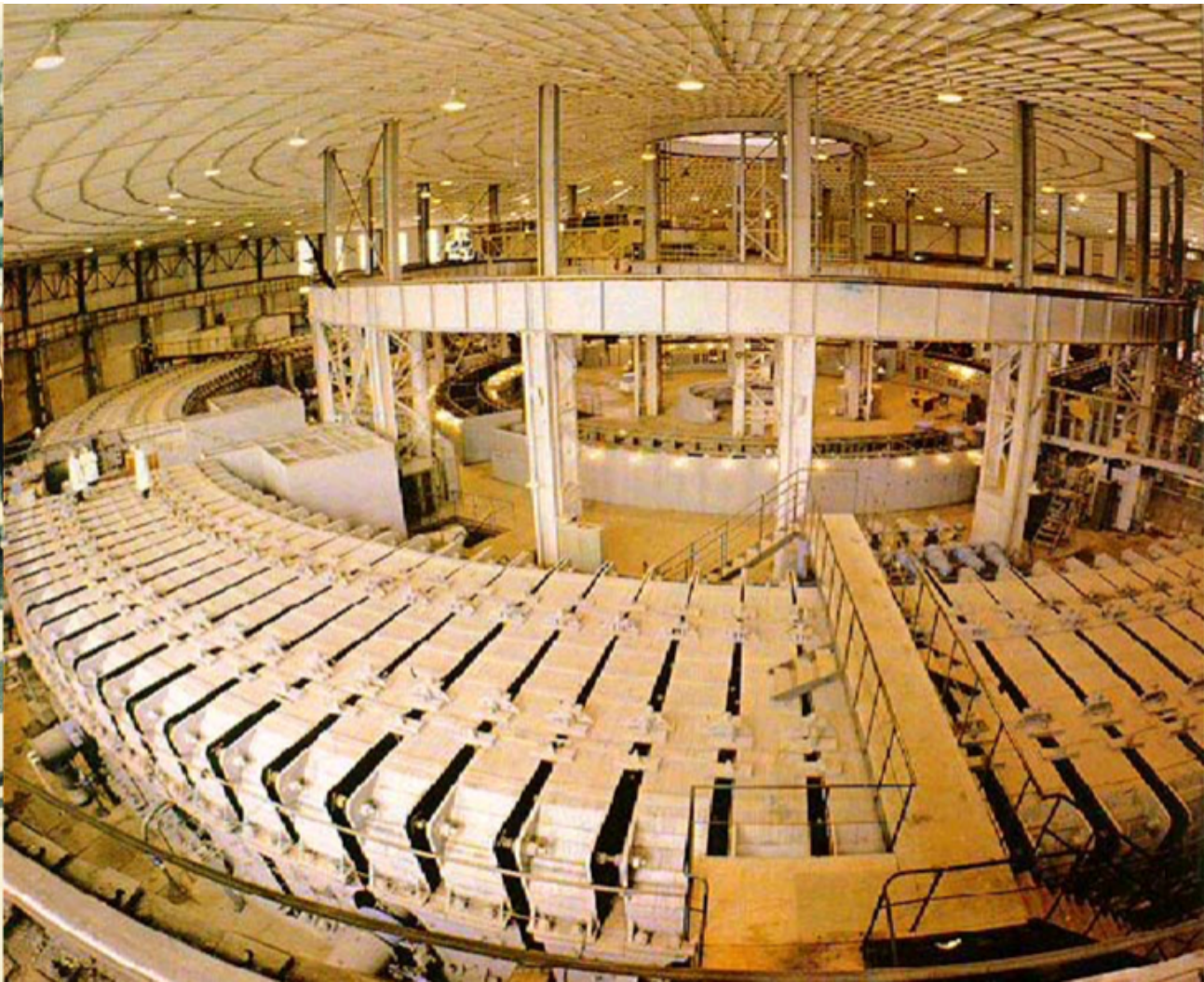
Y. CASSAGNOU, M. CONJEAUD, R. DAYRAS, S. HARAR¹,
R. LEGRAIN, E.C. POLLACCO and C. VOLANT

D.Ph.N./B.E., CEN Saclay, F-91191 Gif-sur-Yvette Cedex, France

Received 28 December 1988
(Revised 20 February 1989)



Experiments on multifragmentation at the Synchrophasotron with the FASA Detector





27 October 1994

PHYSICS LETTERS B

Physics Letters B 338 (1994) 141–146

Evidence for simultaneous breakup in reactions with relativistic α -projectiles

V. Lips^a, R. Barth^a, H. Oeschler^a, S.P. Avdeyev^b, V.A. Karnaukhov^b, W.D. Kuznetsov^b,
L.A. Petrov^b, O.V. Bochkarev^c, L.V. Chulkov^c, E.A. Kuzmin^c, W. Karcz^d, W. Neubert^e,
E. Norbeck^f, D.H.E. Gross^g

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^e Forschungszentrum Rossendorf, 01314 Dresden, Germany

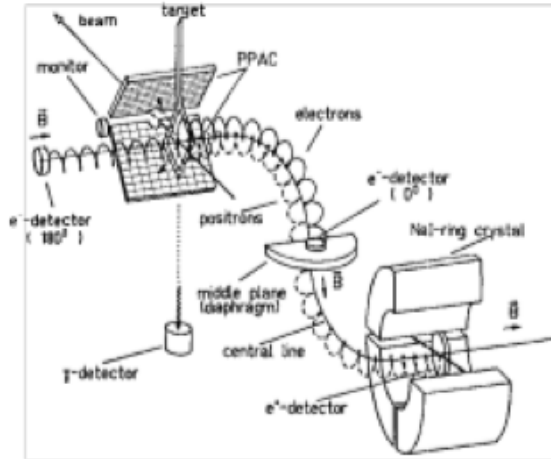
^f University of Iowa, Iowa City, IA 52242, USA

^g Hahn-Meitner-Institut, Bereich Theorie, D-14109 Berlin, Germany

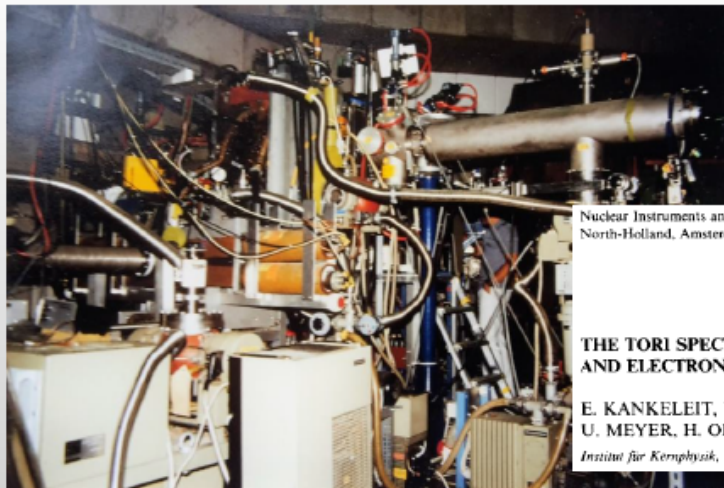
Received 2 May 1994; revised manuscript received 1 August 1994

Editor: R.H. Siemssen

Helmuts activity at GSI: Experiments with the Toroid (electron-positron) spectrometer



1986...88

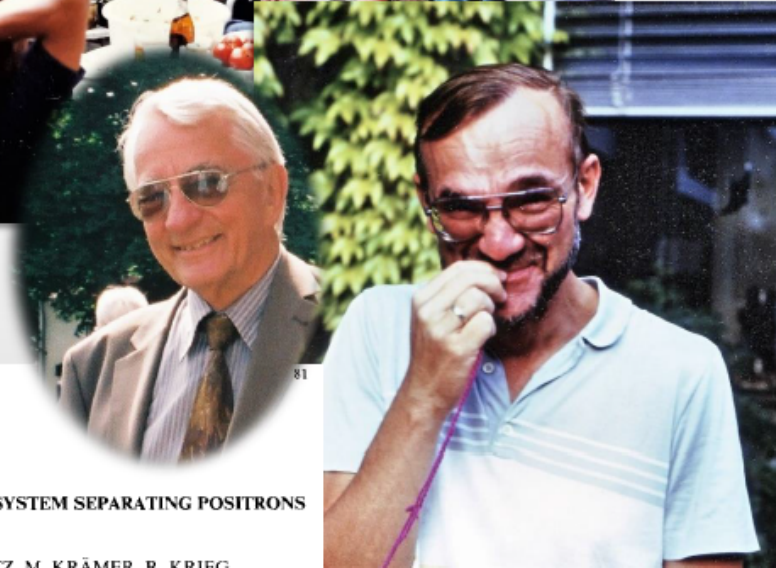


Nuclear Instruments and Methods in Physics Research A234 (1985) 81-90
North-Holland, Amsterdam

THE TORI SPECTROMETER, A MAGNETIC TRANSPORT SYSTEM SEPARATING POSITRONS AND ELECTRONS EMITTED IN HEAVY ION COLLISIONS

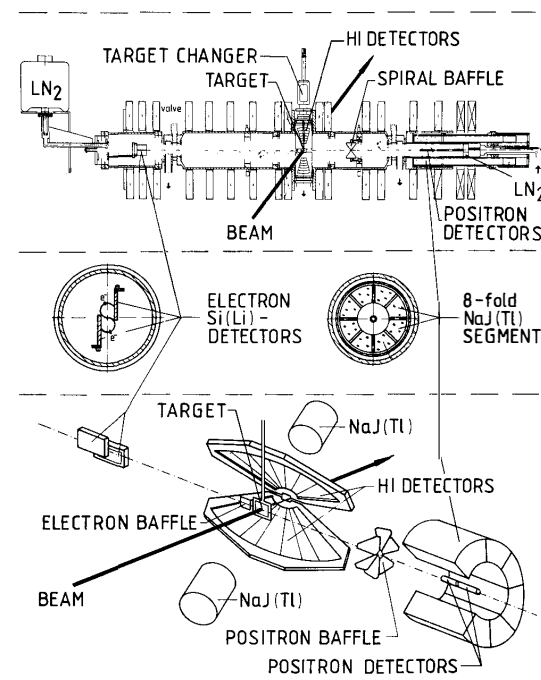
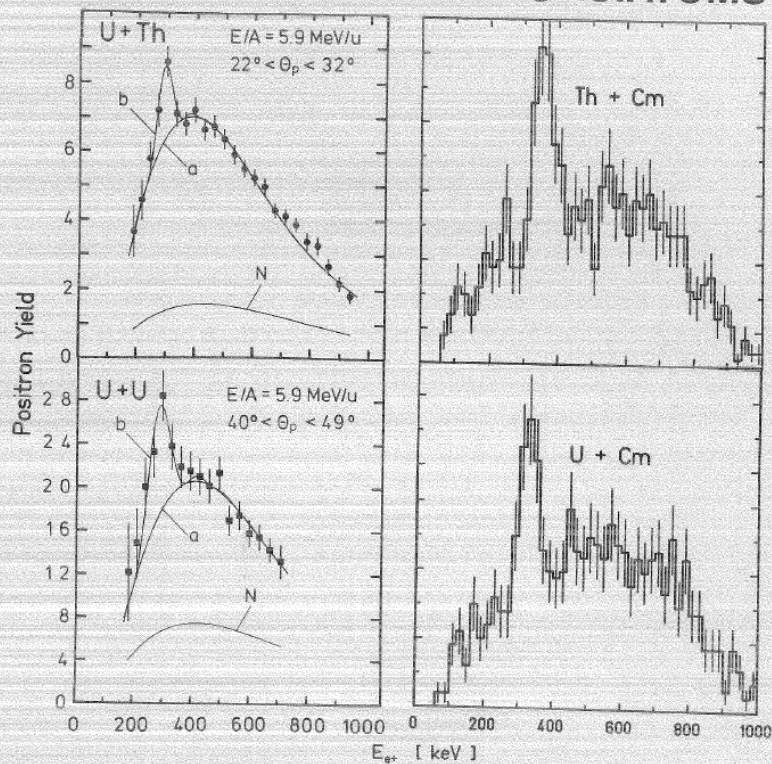
E. KANKELEIT, U. GOLLERTHAN, G. KLOTZ, M. KOLLATZ, M. KRÄMER, R. KRIEG,
U. MEYER, H. OESCHLER and P. SENGER

Institut für Kernphysik, Technische Hochschule Darmstadt, Germany

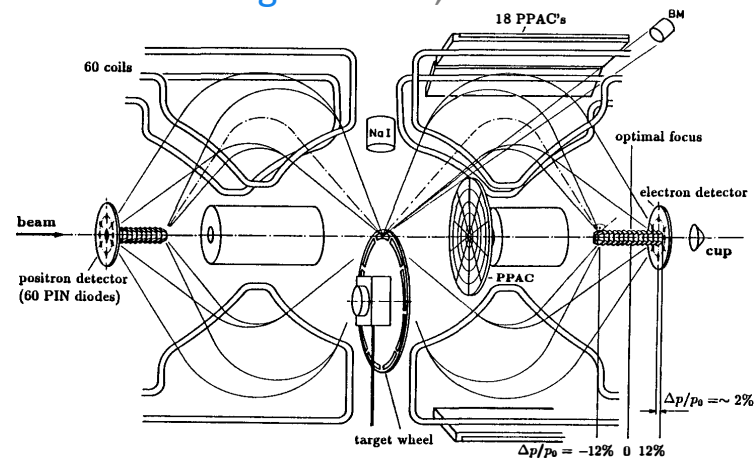


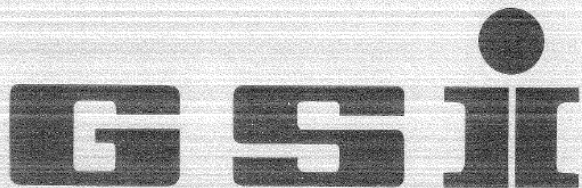
SCIENTIFIC REPORT 1983

POSITRONS FROM QUASIATOMS



Double Orange Kienle, Bosch

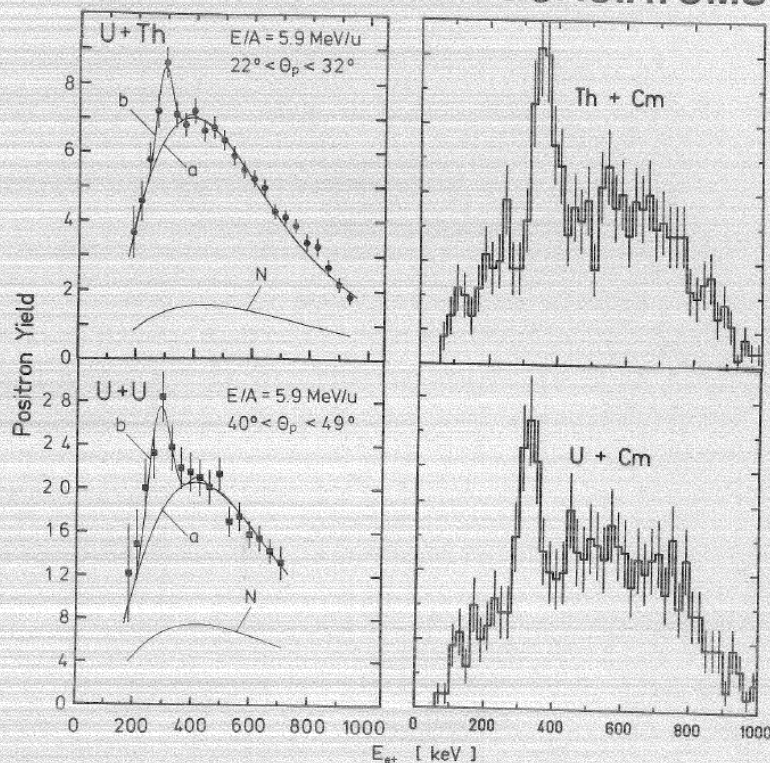




GSI 84-1
MARCH 1984
ISSN 0174-0814

SCIENTIFIC REPORT 1983

POSITRONS FROM QUASIATOMS



GSI GESELLSCHAFT FÜR SCHWERIONENFORSCHUNG
DARMSTADT MITGLIED DER AGF

10.00 Eröffnung der Konferenz (Plenarsaal P)

10.15 Plenarvortrag (Plenarsaal P)

PL.1 Positronen aus Riesenkernen
P. Kienle (TU München)

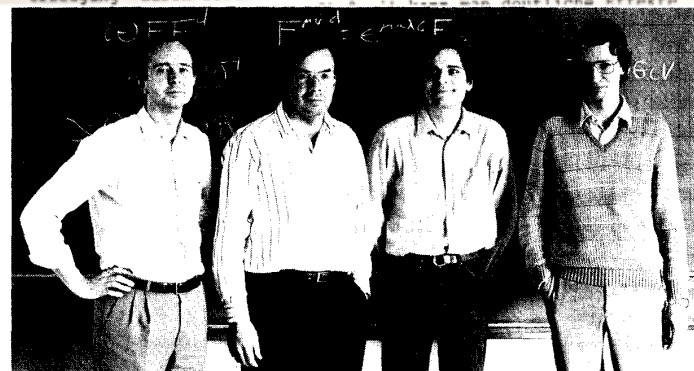
11.00 Pause

11.30 Gruppenbericht (Plenarsaal P)

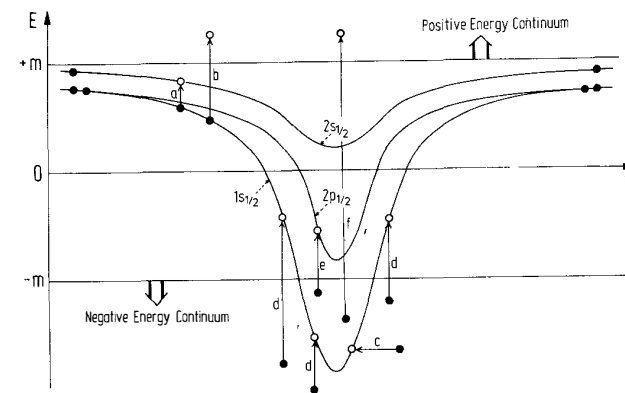
PL.2 Positronenemission und die Zeitverzögerung in Schwerionenstößen*

J. REINHARDT, T. DE REUS, U. HEINZ, B. MÜLLER, W. GREINER (Inst. f. Theoret. Physik, Univ. Frankfurt/M.) und U. MÜLLER, G. SOFF (GSI Darmstadt)

Schwerionenstöße mit hoher Gesamtladung $Z=Z_1+Z_2$ der beteiligten Kerne ermöglichen es, das Verhalten des Elektron-Positron-Feldes unter dem Einfluß starker elektromagnetischer Felder durch Messung der Erzeugung von δ -Elektronen, Positronen und Löchern in inneren Schalen zu untersuchen. Insbesondere wird ein Schrumpfen der Wellenfunktionen und ein drastischer Anstieg der elektronischen Bindungsenergie vorhergesagt, die für das 1s-Niveau im Fall $Z > Z_{\text{cr}} = 173$ die doppelte Ruhemasse $2m_{\text{ec}}^2$ überschreiten sollte. Dies eröffnet die Möglichkeit zur "spontanen Positronenerzeugung" durch Zerfall eines K-Loches.

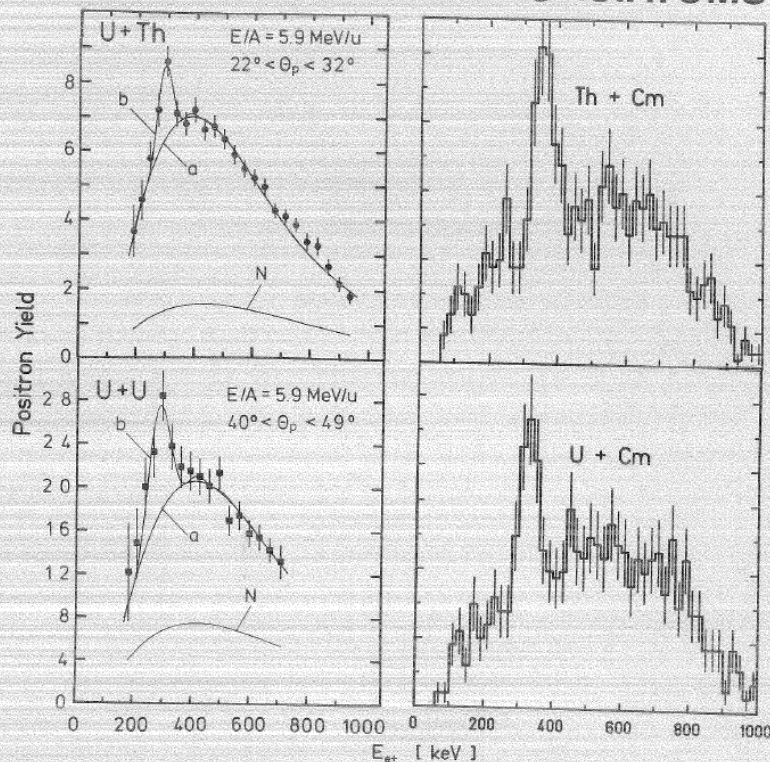


Frankfurt QED Theory Group



SCIENTIFIC REPORT 1983

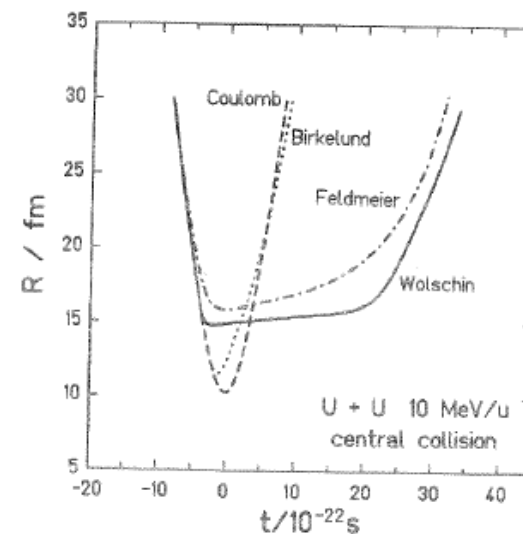
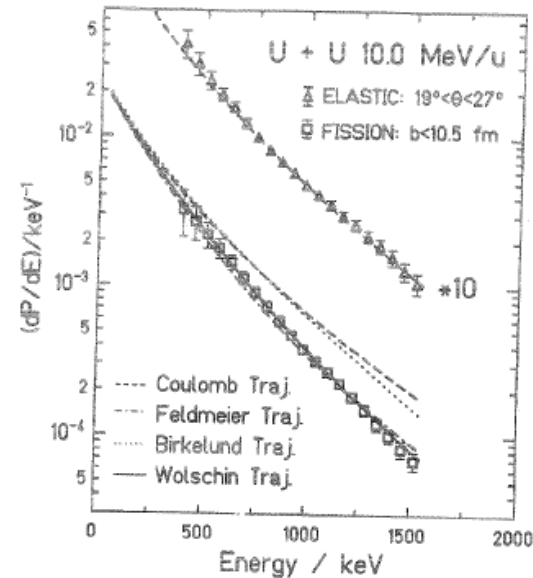
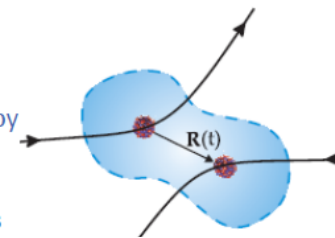
POSITRONS FROM QUASIATOMS



Dissipative HIC

Tool: e^-/e^+ spectroscopy

- Fast stopping
- Long contact times



Helmuts strange period at GSI

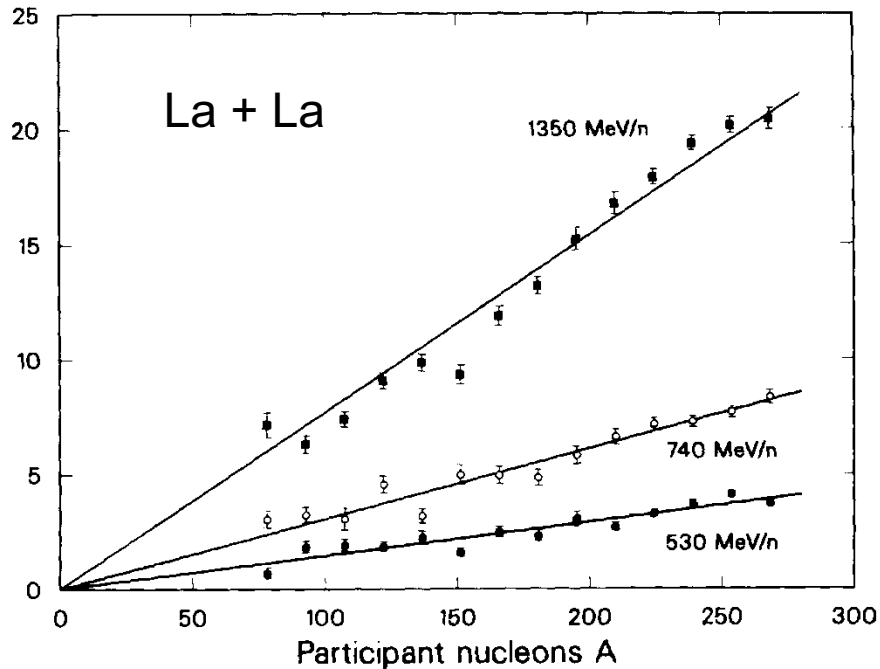
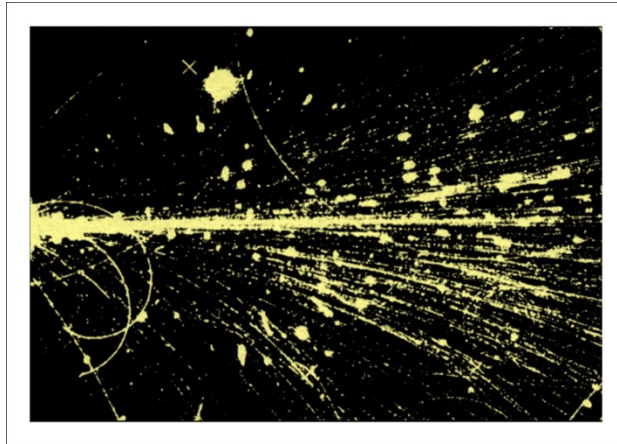


1989 - 2004

Pioneering experiments at the Bevalac

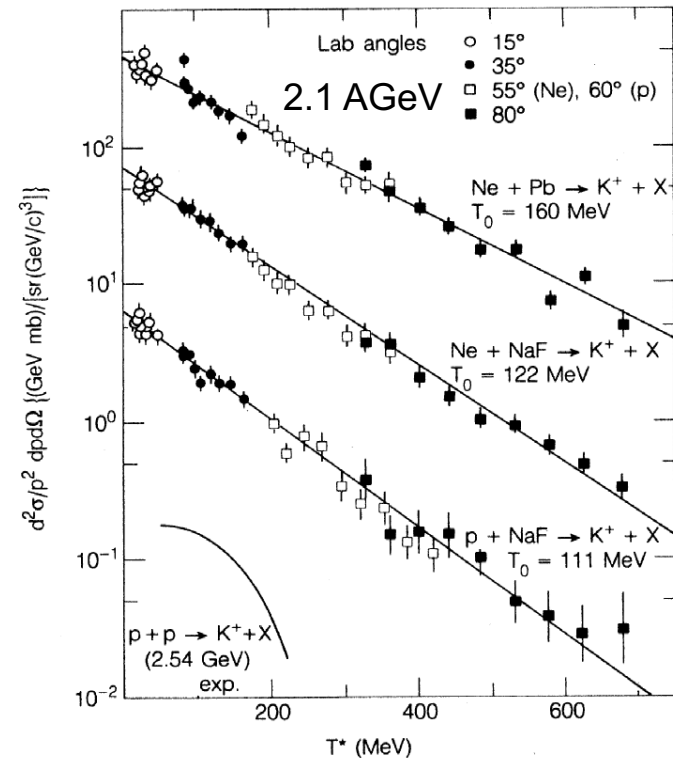
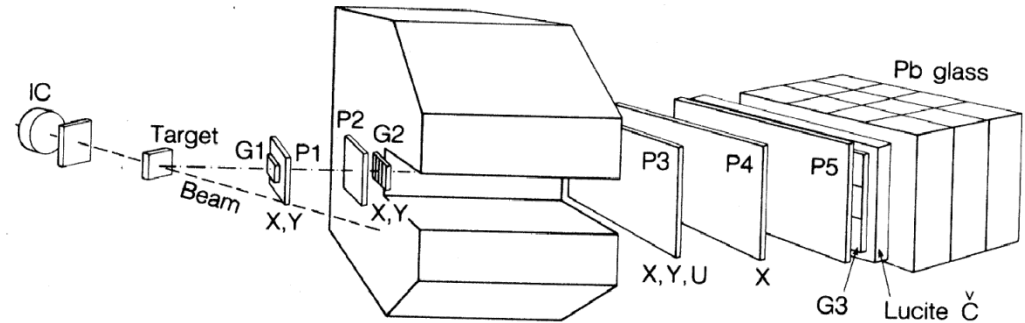
Pion Production

R. Stock, H. Ströbele, J. Harris, ...



Kaon Production

S. Nagamiya, S. Schnetzer,



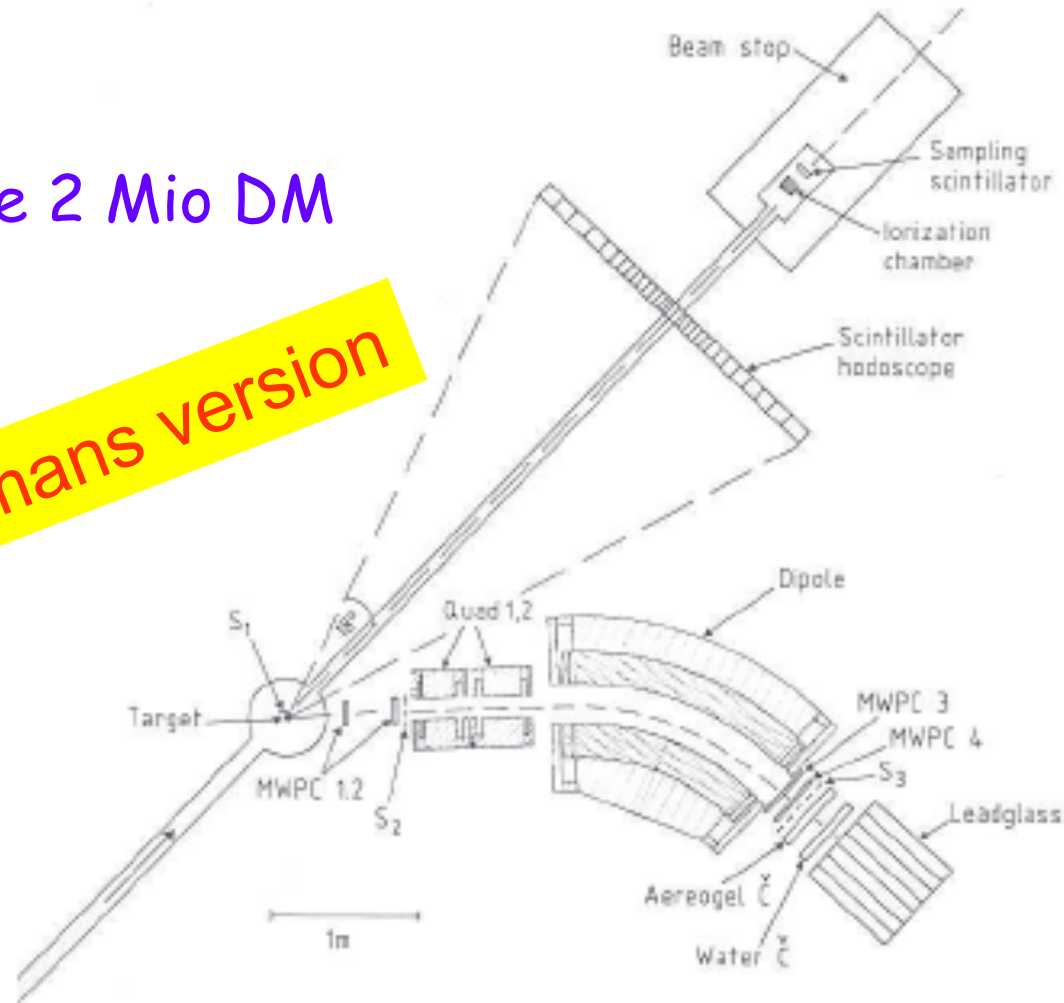
GSI SIS18: Proposal of the "recycle" team: Z1 Magnet + Berkeley hodoscope

R. Bock, J. Harris, B. Kohlmeyer, H. Oeschler, F. Pühlhofer,
A. Sandoval, D. Schüll, R. Stock, H. Ströbele, ... (1987)

$\Omega = 5 \text{ msr}$

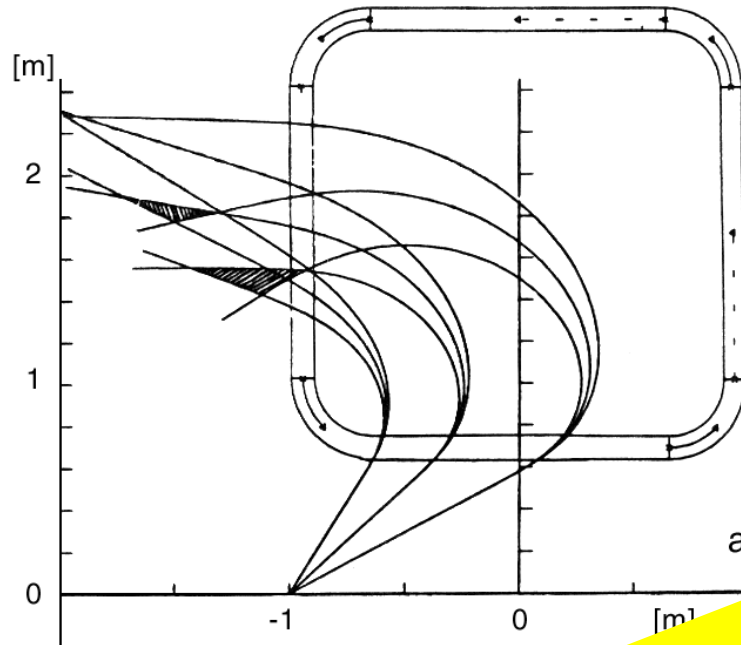
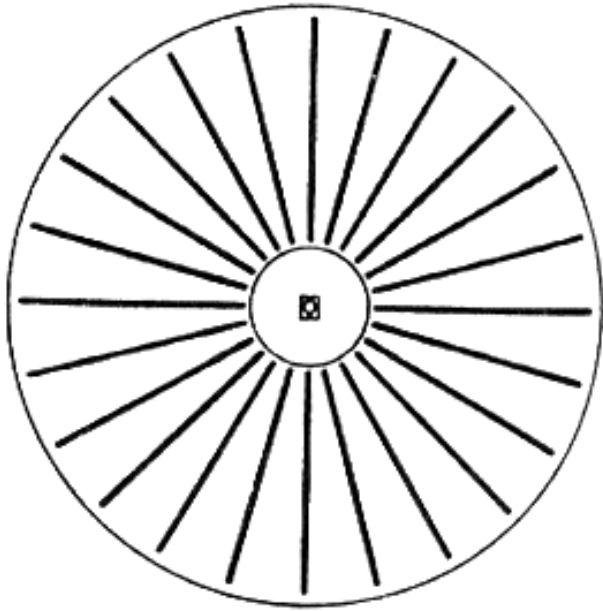
cost estimate 2 Mio DM

Poor mans version



GSI SIS18: Proposal of the "daring" team: A superconducting Orange-Type Spectrometer

E. Grosse, W. Henning, T. Matulewicz, U. Trinks (1987)



Acceptance 2π
cost estimate 12 Mio DM

Rich mans version

The compromise

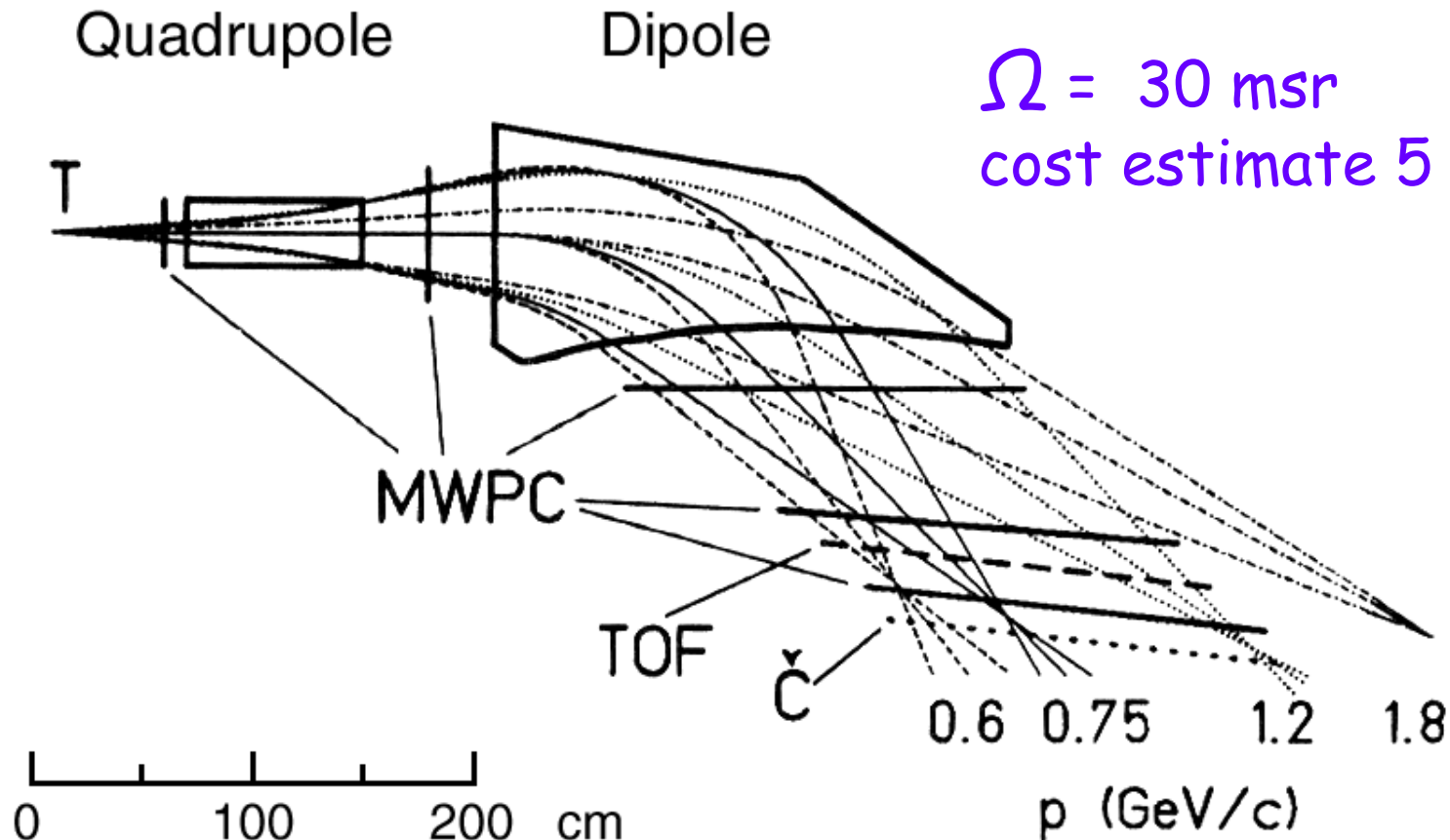
Univ. Frankfurt: R. Stock, H. Ströbele, ...

Univ. Marburg: B. Kohlmeyer, F. Pühlhofer, ...

TU Darmstadt: H. Oeschler,

Jag. Univ. Krakow: W. Walus, ...

GSI: H. Grosse, W. Henning, P. Kozcon, P. Senger, ...





Helmut (TU Darmstadt) contribution to KaoS: MWPC & R/O, DAQ



The Transputer-Based Data Acquisition System for Multiwire Proportional Chambers^{B,G}

P. Baltes, J. Foh, E. Kankeleit, Ch. Müntz, H. Oeschler, S. Sartorius, A. Wagner (TH Darmstadt) and the KaoS Collaboration GSI 1991

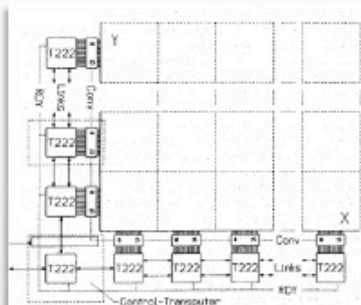


Figure 1: MWPC transputer network of one MWPC.

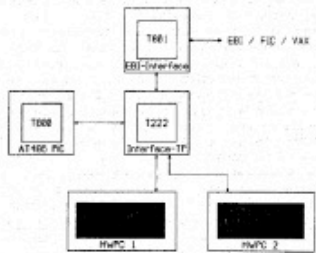


Figure 2: Link connections between two MWPC's, the host computer and the EBI interface.



Properties of large MWPC's at the Kaon Spectrometer^{B,G}

GSI 1988

P. Baltes, Ch. Müntz, H. Oeschler, S. Sartorius, A. Wagner (TH Darmstadt), H. Stelzer (GSI) and the KaoS Collaboration

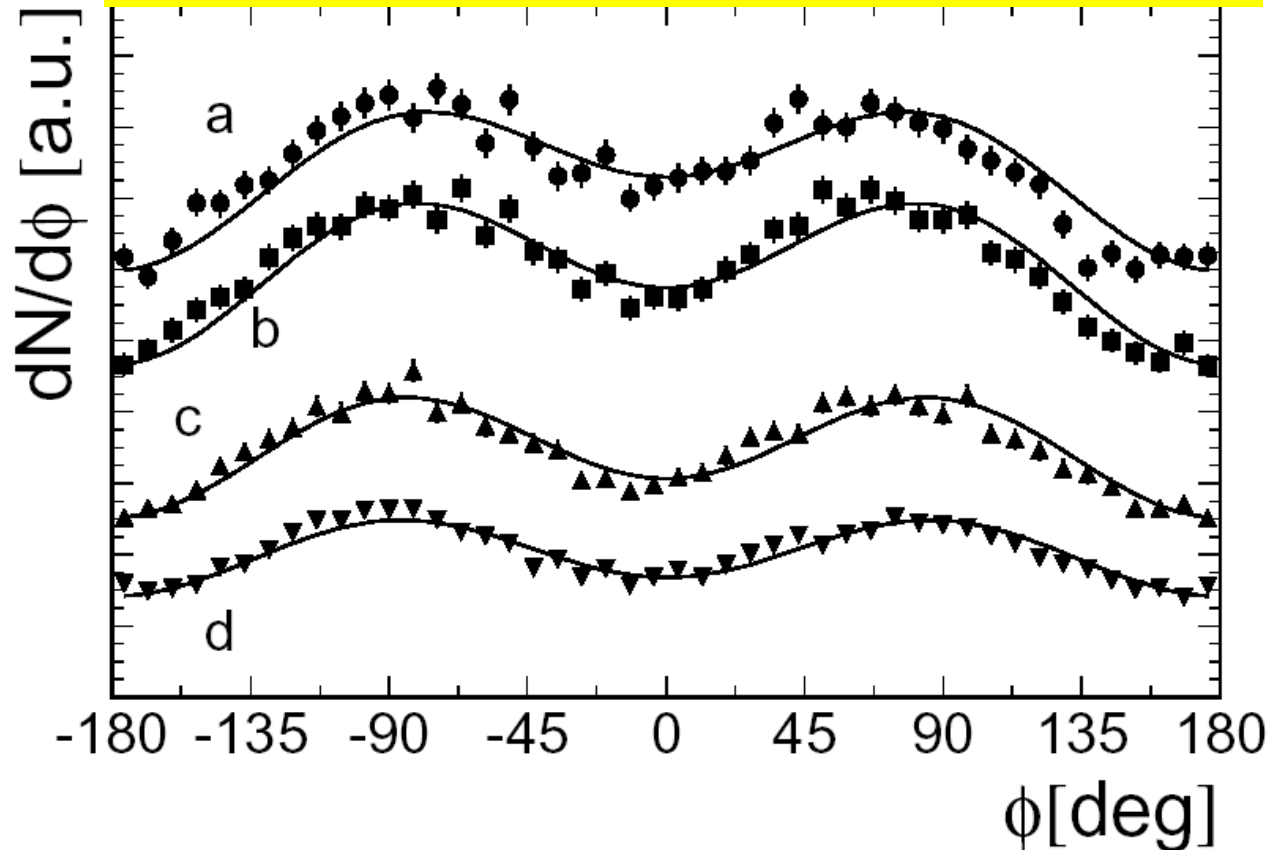




Azimuthally Anisotropic Emission of Pions in Symmetric Heavy-Ion Collisions

D. Brill,¹ W. Ahner,² P. Baltes,³ R. Barth,² C. Bormann,¹ M. Cieřlak,² M. Dębowski,² E. Grosse,² W. Henning,^{2,*} P. Koczoń,² B. Kohlmeier,⁴ D. Miřkowiec,² C. Müntz,³ H. Oeschler,³ H. Pöpl,⁴ F. Pühlhofer,⁴ S. Sartorius,³ R. Schicker,² P. Senger,² Y. Shin,¹ J. Speer,⁴ J. Stein,¹ K. Stiebing,¹ R. Stock,¹ H. Ströbele,¹ K. Völkel,⁴ A. Wagner,³ and W. Waluř⁵

Discovery of "elliptic flow" of pions !



Observation of Enhanced Subthreshold K^+ Production in Central Collisions between Heavy Nuclei

D. Miśkowiec, W. Ahner, R. Barth, M. Cieślak, M. Dębowski, E. Grosse, W. Henning,* P. Koczoń,
R. Schicker, E. Schwab, and P. Senger

Gesellschaft für Schwerionenforschung, D-64220 Darmstadt, Germany

P. Baltes, Ch. Müntz, H. Oeschler, S. Sartorius, Ch. Sturm, and A. Wagner

Technische Hochschule Darmstadt, D-64289 Darmstadt, Germany

P. Beckerle, Ch. Bormann, D. Brill, Y. Shin, J. Stein, R. Stock, and H. Ströbele

Johann Wolfgang Goethe Universität, D-60486 Frankfurt, Germany

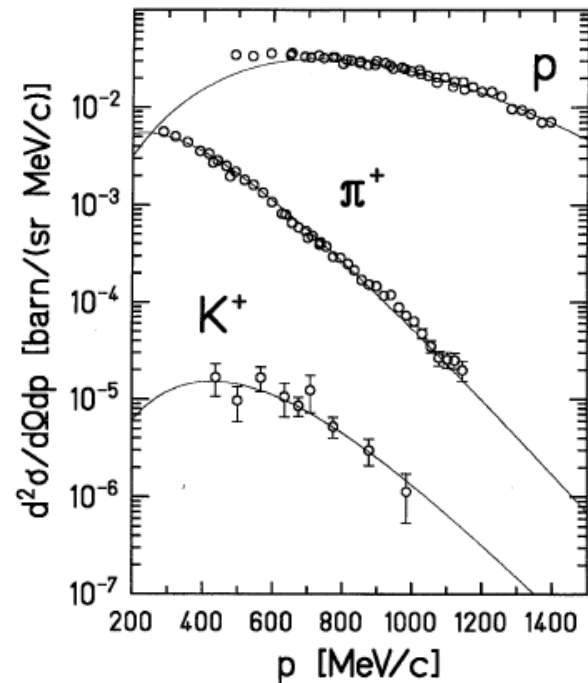
B. Kohlmeyer, H. Pöpl, F. Pühlhofer, J. Speer, and K. Völkel

Philipps Universität, D-35037 Marburg, Germany

W. Waluś

Jagiellonian University, PL-30-059 Kraków, Poland

(Received 4 February 1994)



First measurement of kaons in
collisions between heavy nuclei!

Observation of Enhanced Subthreshold K^+ Production in Central Collisions between Heavy Nuclei

VOLUME 78, NUMBER 21

PHYSICAL REVIEW LETTERS

26 MAY 1997

Subthreshold Production of Kaons and Antikaons in Nucleus-Nucleus Collisions at Equivalent Beam Energies

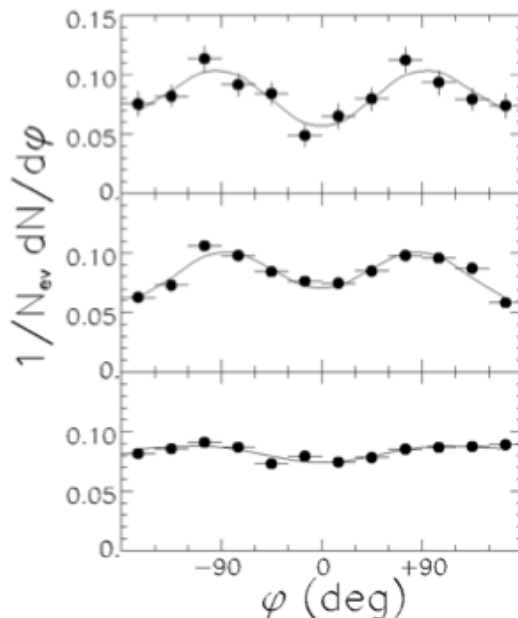
VOLUME 81, NUMBER 8

PHYSICAL REVIEW LETTERS

24 AUGUST 1998

Enhanced Out-of-Plane Emission of K^+ Mesons Observed in Au + Au Collisions at 1A GeV

Y. Shin,³ W. Ahner,¹ R. Barth,¹ P. Beckerle,³ D. Brill,³ M. Cieřlak,⁵ M. Dębowski,⁵ E. Grosse,⁶ P. Koczoń,¹
B. Kohlmeier,⁴ M. Mang,¹ D. Miřkowiec,¹ C. Müntz,² H. Oeschler,² F. Pühlhofer,⁴ E. Schwab,¹ R. Schicker,¹
le,³ C. Sturm,² K. Völkel,⁴ A. Wagner,^{2,*} and W. Waluř⁵
(KaoS Collaboration)



Discovery of "elliptic flow"
of K^+ mesons !

Observation of Enhanced Subthreshold K^+ Production in Central Collisions between Heavy Nuclei

VOLUME 78, NUMBER 21

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Enhanced Out-of-Plane Emission of K^+ Mesons Observed in Au + Au Collisions at 1A GeV

VOLUME 82, NUMBER 8

PHYSICAL REVIEW LETTERS

22 FEBRUARY 1999

Medium Effects in Kaon and Antikaon Production in Nuclear Collisions at Subthreshold Beam Energies

VOLUME 85, NUMBER 1

PHYSICAL REVIEW LETTERS

3 JULY 2000

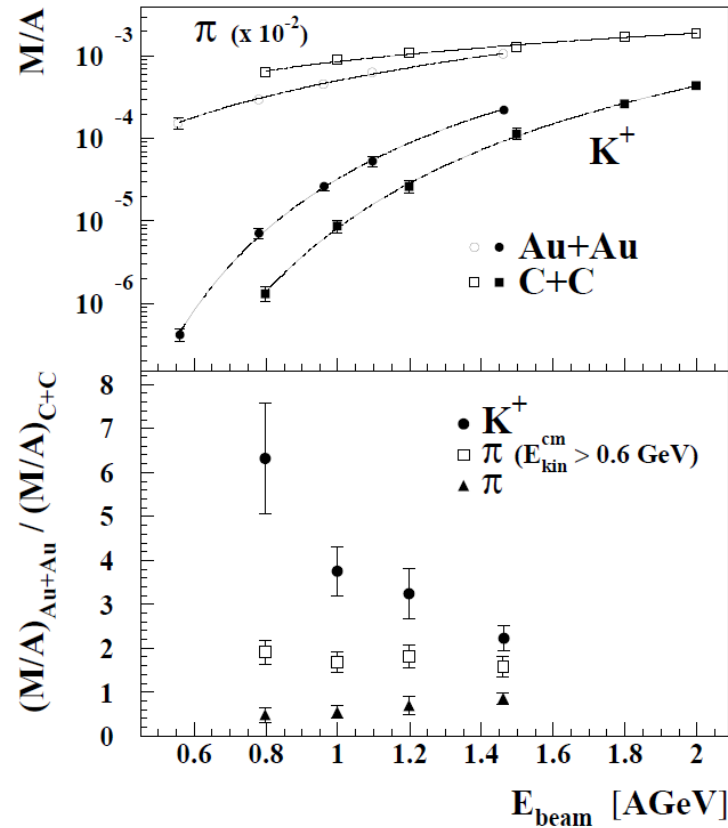
Emission Pattern of High-Energy Pions: A New Probe for the Early Phase of Heavy-Ion CollisionsA. Wagner,* C. Müntz,[†] H. Oeschler, and C. Sturm*Technische Universität Darmstadt, D-64289 Darmstadt, Germany*R. Barth, M. Cieřlak, M. Dębowski,* E. Grosse,* P. Koczoń, F. Laue,[‡] M. Mang, D. Mićkowiec,
E. Schwab, and P. Senger*Gesellschaft für Schwerionenforschung, D-64291 Darmstadt, Germany*

P. Beckerle, D. Brill, Y. Shin, and H. Ströbele

Lehrstuhl für Experimentelle Kernphysik, Universität Bonn, D-53115 Bonn, Germany

Evidence for a Soft Nuclear Equation-of-State from Kaon Production in Heavy-Ion Collisions

C. Sturm,¹ I. Böttcher,⁴ M. Dębowski,⁵ A. Förster,¹ E. Grosse,^{6,7} P. Koczoń,² B. Köhlmeier,⁴ F. Laue,^{2,*} M. Mang,² L. Naumann,⁶ H. Oeschler,¹ F. Pühlhofer,⁴ E. Schwab,² P. Senger,² Y. Shin,³ J. Speer,⁴ H. Ströbele,³ G. Surówka,^{2,5} F. Uhlig,¹ A. Wagner,^{8,6} and W. Waluś⁵

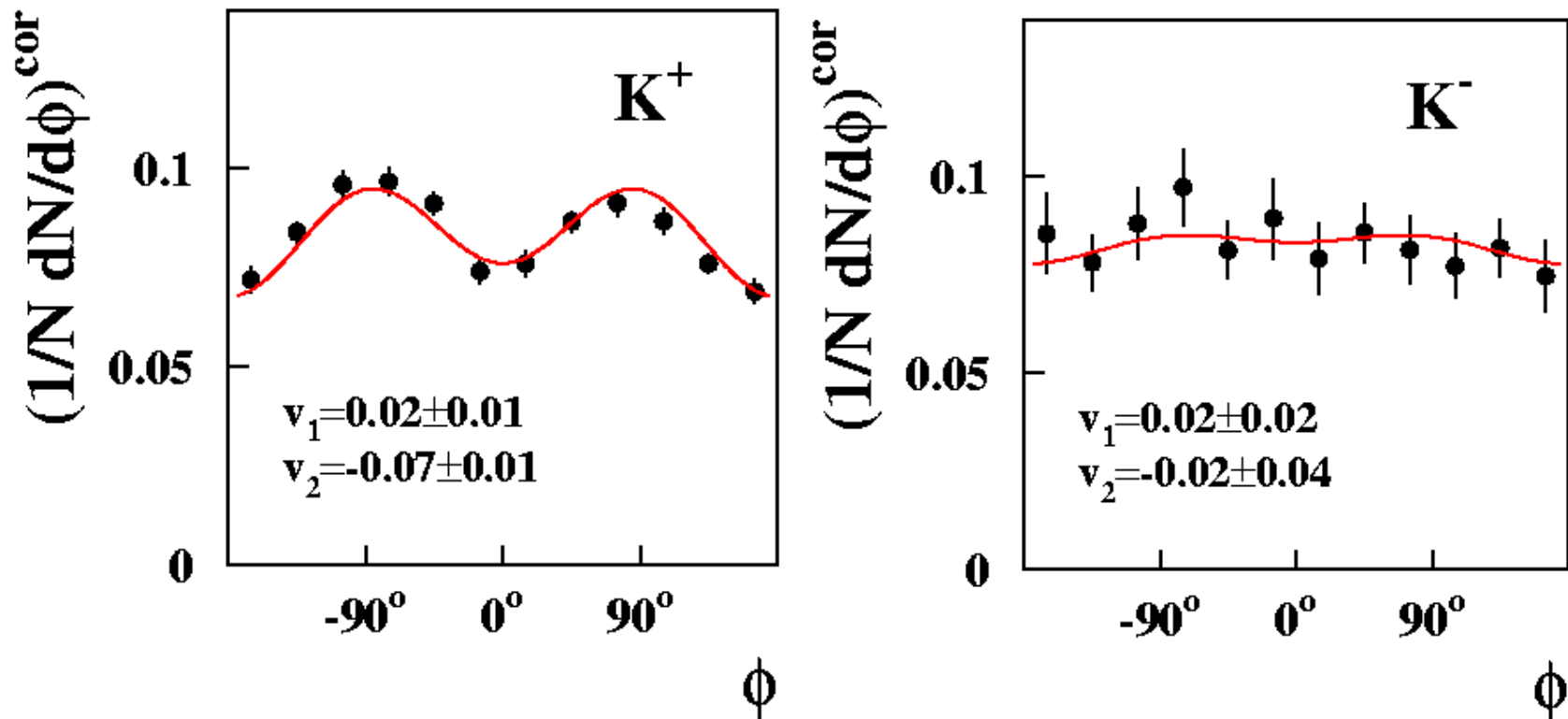


First Evidence for Different Freeze-Out Conditions for Kaons and Antikaons Observed in Heavy-Ion Collisions

A. Förster,² F. Uhlig,² I. Böttcher,⁴ M. Dębowski,^{5,6} F. Dohrmann,⁶ E. Grosse,^{6,7} P. Koczoń,¹ B. Köhlmeier,⁴ F. Laue,^{1,*} M. Menzel,⁴ L. Naumann,⁶ H. Oeschler,² W. Scheinast,⁶ E. Schwab,¹ P. Senger,¹ Y. Shin,³ H. Ströbele,³ C. Sturm,^{2,1} G. Surówka,^{1,5} A. Wagner,⁶ and W. Waluś⁵

(KaoS Collaboration)

Au + Au 1.5 AGeV



KAONS BEHAVE! Mesons at the GSI lab collisions (1 GeV/nucleon, the nuclear matter for a very short time—mesons—mostly positive and pions emerge preferentially. They accompany expected finding could in extreme nuclear environment for the astrophysics of 81, 1576, 1998.)

The case of the missing neutron stars

Certain heavy stars at the end of their lives collapse in the most violent explosions known in the universe—supernovae. What is left after they have blasted most of their bulk into space is a dense ball of neutrons, a neutron star, or occasionally a Black Hole.

Simulations in the 1980s by Gerry Brown at Stony Brook, New York, suggested that neutron stars of up to two solar masses should be found in supernova remnants, but the heaviest seem to be just 1.5 solar masses. According to Brown's calculations, there should be a two-solar-mass neutron star in the remnants of SN1987A, but so far none has been found. Working with Hans Bethe, Brown has come up with a possible reason



GSI Darmstadt's kaon spectrometer, KAOS, looks at the kaons emerging from heavy-ion collisions. (Photo Achim Zschau/GSI.)

The negative charge of large numbers of kaons allows many more protons to exist in the matter. Bethe and Brown estimate that,

in matter, a large number of kaons precipitate the collapse. If they were in SN1987A's

remnant, it would settle itself well. Neutrons are easily produced, and the simulations indicate exactly what GSI Darmstadt

production in the collisions of high-energy nickel ions with a nickel target. In such collisions nuclear matter is compressed to about three times its normal density.

The GSI team found that the number of positive kaons emerging from collisions was as expected, but the number of negative kaons was far higher. One possible explanation, put forward by Gerry Brown among others, is that the effective mass of negative kaons is strongly reduced in the dense nuclear medium compared to that of positive kaons—just the effect needed by Bethe and Brown's proposal. That means that negative kaons become easier to produce, and more of them emerge from the collision.

According to Bethe and Brown's calculations, an effective negative kaon mass at three times normal nuclear density, which would account for the GSI result, could also provoke the gravitational collapse of neutron stars of 1.5 to two solar masses. GSI's result helps turn Bethe and Brown's idea into a firm prediction. All that remains now is to identify the Black Hole in the middle of SN1987A.

● Further reading:
H Bethe 1990 *Supernova Mechanisms Rev. Mod. Phys.* **62** 801.
R Barth et al. 1997 *Phys. Rev. Lett.* **78** 4007.

Research Highlight 1998

The American Physical Society has cited the KaoS results to be among the ten "top physics stories" in particle, nuclear and plasma physics

Success of KaoS experiments was based on the enthusiasm of the young people

17 Diploma

Darmstadt

C. Müntz
A. Wagner
A. Sartorius
P. Baltes
C. Sturm
A. Förster
F. Uhlig
S. Lang
A. Schmäh

Frankfurt

D. Brill
Y. Shin
P. Beckerle
C. Baumann
J. Stein

Marburg

H. Pöppel
B. Schlei
I. Yoo



20 PhD

Darmstadt

C. Müntz
A. Wagner
C. Sturm
A. Förster
F. Uhlig

Frankfurt

D. Brill
Y. Shin
M. Mang
F. Laue

Heidelberg

W. Ahner

Krakow:

D. Miskowiec
M. Cieslak
M. Debowski
G. Surowka
M. Ploskon

Marburg

H. Pöppel
K. Völkel
M. Menzel
I. Böttcher

Dresden

W. Scheinast

Awarded to Helmut Oeschler in 2006

Hohe Ehre aus Paris

Das französische Ministerium für Bildung und Forschung hat den Privatdozenten Dr. Helmut Oeschler mit dem Gay-Lussac-Humboldt-Preis 2006 ausgezeichnet. Der am Fachbereich Physik lehrende Wissenschaftler wurde für seine Arbeiten auf dem Gebiet der Kernphysik und für seine Beiträge zur deutsch-französischen wissenschaftlichen Zusammenarbeit geehrt.

hoch³, November 2006



- In 2000 Helmut joined ALICE
- Team leader of the ALICE group TU Darmstadt
- Chair of the ALICE Editorial Board and member of the Management Board
- One of the leading senior scientists in the Light Flavor Physics Working Group



