ISOLDE 1985 – 1987:

In the Shadow of LEP Construction

H.-Jürgen Kluge

GSI Darmstadt and University of Heidelberg, Germany

Once upon at time....

There are only few documents still available of my time as ISOLDE group leader

30 years ago, personal computers were still extremely rare. At CERN, we used at that time terminals connected to the central computer. Data were stored on magnetic tapes (which you can hardly read any longer if they would exist at all).

Power point did not exist. We used for talks mainly hand written transparencies and an overhead projector.

When Heinz Haas took over as group leader at ISOLDE, I left almost all documents in the office of the group leader or in the office of the ISOLTRAP group.

Communications went on by hand written or typed letters via surface or air mail and, in the case of urgency, by telex. Fax did not yet exist.

Some kind of „email" was just coming up. But only very few printouts of that time are still in my folders at home. For example, the very first one I received .....

My very first „email“ in 1987

FILE: FRANCE NOTEBOOK AO ***** CERN/CMS REL4 LEVEL4.12+ V4 *****

DATE: 4 JUNE 1987, 16:08:18 EST
FROM: AUDI GEORGES 69-41-52-23 AUDI AT FRCPN11
TO: BOLLEN AT CERNVM

ORSAY, JUNE 4, 1987

DEAR JURGEN AND GEORG,
I'VE SENT SOME TIME AGO THE MASS TABLE BY ELECTRONIC MAIL TO CERN. IF IT DIDN'T REACH YOU OR IF THE FORMAT DOES NOT FIT YOU, PLEASE LET ME KNOW.
A SURVEY OF INTERESTING CASES WITH THE PERFORMANCES OF THE APPARATUS AS IT HAS WORKED UP TO KNOW, I.E. PRECISION ON 77RB 25KEV AND LIMIT OF 2*10-7 (FROM 85RB), GIVES A FEW INTERESTING CASES FOR COMING EXPERIMENTS. THE "EXPECTED PRECISION" IS OBTAINED WITH THE SAME RUNNING TIME AND THE SAME TRANSMISSION AS FOR 77RB. OF COURSE, IF THE TRANSMISSION OF THE SET-UP IS TO BE IMPROVED, THE FINAL PRECISION WILL IN MOST CASES BE IMPROVED, AND MANY MORE CASES (NOT REPORTED IN THE TABLE BELOW) MAY BECOME INTERESTING. I HAVE ASSUMED ALSO THAT THE NUMBER OF NUCLEI IN THE APPARATUS FOR BA AND RA IS REDUCED BY A FACTOR 100 COMPARED TO ALCALII DUE TO STOPPING AND REIONIZATION (10 FOR DIFFUSION AND 10 FOR IONIZATION) AND THAT FOR RARE-EARTH THIS FACTOR IS 1000 (100 FOR IONIZATION). FOR THESE TWO CATEGORIES THE IONIZING FOIL SHOULD BE RHENIUM, HEATED AROUND 1500 DEGREES. THE "VALUABLE PRECISION" FIGURES ARE A SORT OF ESTIMATE RANGING FROM WHAT WOULD BE A "VERY INTERESTING RESULT" TO WHAT WOULD BE A "USEFUL RESULT".

NUCLEUS	ACTUAL PRECISION	T	EXPECTED PRECISION	VALUABLE PRECISION	REMARK
76RB	60KEV	39S	58KEV	60-150	DISCUSSION AT CERN
78RB	30	17M	17	20- 30	
120CS	80	57-64S	28	30- 60	ISOMER AT 500(300)KEV
124CS	40	6-31S	25	15- 50	ISOMER AT 462.5(1)KEV
122BA	#	2M	600	200-500	IF OTHER BA ARE OK
123BA	#	3M	280	200-500	
124BA	#	12M	110	200-500	
125BA	250	8-3M	60	80-200	ISOMER?
126BA	#	1.5H	50	100-300	
156HO	#	56M	220	200-400	ISOMERS?
160YB	#	5M	350	100-300	IF OTHER YB ARE OK
161YB	#	4M	320	100-300	IF OTHER YB ARE OK
162YB	#	19M	250	100-300	
164YB	#	1.3H	200	50-200	

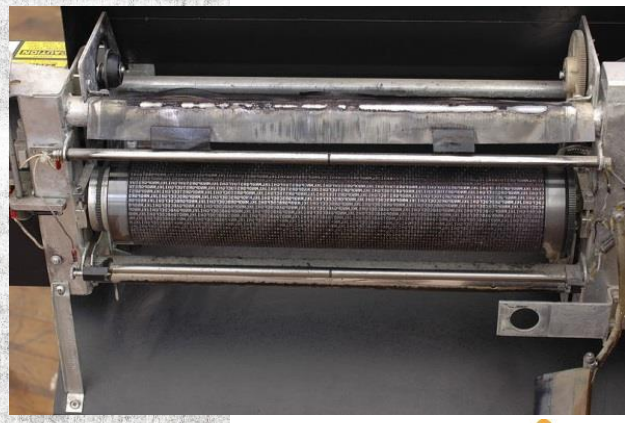
ABOUT REMARKS: I WONDER IF THE ISOMER AT 125BA REALLY EXIST. IF IT DOES IT SHOULD LIE SOMEWHERE AROUND 1 MEV (CF NDS 32) AND THE RESOLVING POWER OF THE PENNING TRAP SHOULD SEPARATE IT EASILY. IN THE RECENT NDS 49, THE 6M AND 2M ISOMERS AT 156HO ARE NO MORE REPORTED, INSTEAD THERE ARE 2 ISOMERS WITH 1 AND 58 NS WHICH ARE TOTALY TRANSPARENT TO US. FOR THE N-DEF CS REGION, I SUGGEST TO GET FIRST 124CS, SINCE THE ISOMER SITUATION IS CLEAR. IF TIME IS AVAILABLE IT WOULD BE VALUABLE TO MEASURE 120CS AND, IF WE ARE LUCKY, ALSO GET AN ESTIMATE OF THE EXCITATION ENERGY OF ITS ISOMER.

BEST REGARDS,
GEORGES AUDI

AUDI FRCPN11 6/04/87

„Email“ information was sent from computer center to computer center.

The „mail“ was printed on perforated fanfold paper by an IBM line printer, an impact printer with a fast rotating drum having only capital letters.



Just to set a first frame: What happened 1985 – 1987 in the world?

- Nelson Mandela rejects an offer of freedom from the South African government.
- The Schengen Agreement is signed between certain member states of the European Economic Community, creating an area with no internal border controls.
- The first smoking ban for restaurants is passed in Aspen, Colorado.
- Space Shuttle Challenger disintegrates 73 seconds after launch.
- Swedish Prime Minister Olof Palme is assassinated on his way home from the cinema.
- The Chernobyl disaster takes place.
- Argentinian football player Diego Maradona scores one handball goal (nicknamed the "Hand of God") against England.
- During a visit to Berlin, Germany, U.S. President Ronald Reagan challenges Soviet Premier Mikhail Gorbachev to tear down the Berlin Wall.
- The first Starbucks Coffee stores outside of Seattle are opened in Vancouver and Chicago.

Just to set a second frame: What happened 1985 – 1987 in science and technology?

- The first commercial Internet domain name is registered in the name symbolics.com by Symbolics Inc., a computer systems firm in Cambridge, Massachusetts.
- Scientists of the British Antarctic Survey announce discovery of the ozone hole.
- The first personal computer virus, Brain, starts to spread.
- Florida rapist Tommy Lee Andrews is the first person to be convicted as a result of DNA fingerprinting.
- Preparations are made to build the largest particle collider ever, the Superconducting Super Collider (SSC) – a circular accelerator with an 87-kilometre circumference.
- Supernova 1987a is observed, the first "naked-eye" supernova since 1604.
- The first heart-lung transplant takes place.

Just to set a third frame: Who won 1985 – 1987 the Nobel Prize in Physics?

1985
Klaus von Klitzing
"for the discovery of the quantized Hall effect"

1986
Ernst Ruska
"for his fundamental work in electron optics, and for the design of the first electron microscope"
Gerd Binnig and Heinrich Rohrer
"for their design of the scanning tunneling microscope"

1987
J. Georg Bednorz and K. Alexander Müller
"for their important break-through in the discovery of superconductivity in ceramic materials"

To set the scene:
What happened 1985 – 1987 at CERN?

Briefly before:

Carlo Rubbia and Simon van der Meer win the Nobel Prize 1984 "for their decisive contributions to ..... the discovery of the W and Z bosons.

The Intersecting Storage Ring (ISR), the first hadronic (p-p and p-anti-p) collider ring is shut down in 1984. It was used to develop stochastic cooling and provided indications that protons contain smaller constituents, ultimately identified as quarks and gluons.

Herwig Schopper is Director General of CERN, Robert Klapisch acts as Research Director, Bernhard Hyams is EP Division Leader and Gregers Hansen (1981 - 1985) and Hans Specht (1986 - 1988) are Chairmen of the Proton Synchrotron and Synchro-Cyclotron Committee (PSCC).

To set the scene: What happened 1985 – 1987 at CERN?

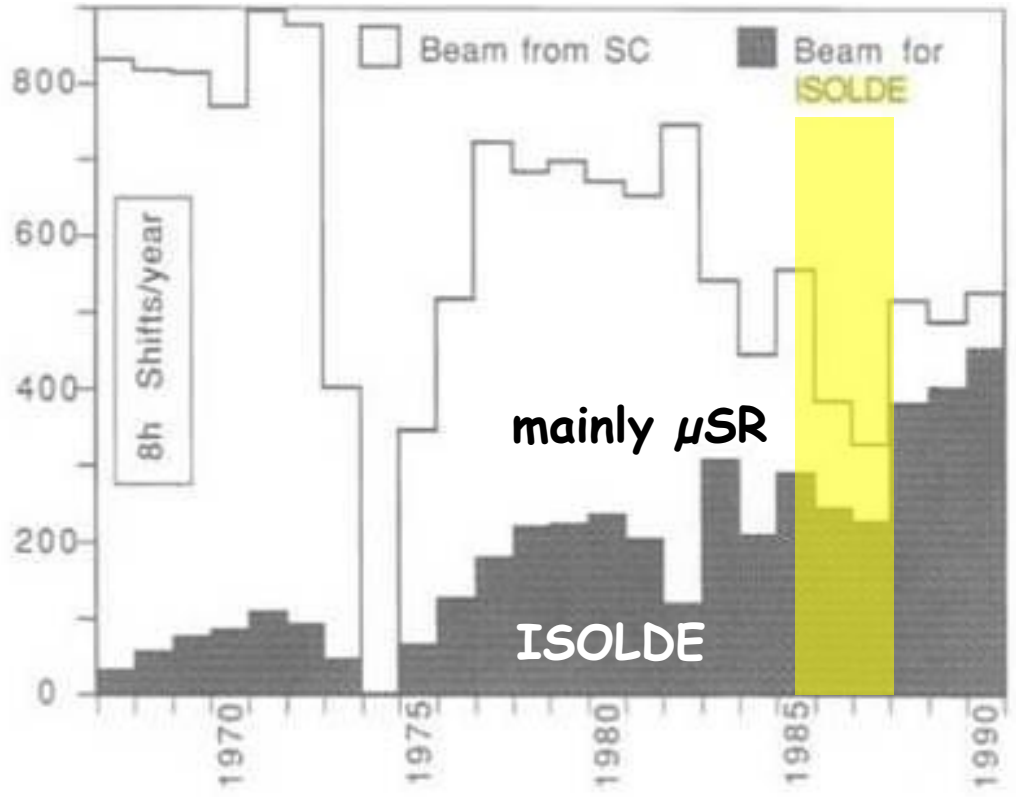
- At the Super Proton Synchrotron (SPS), the UA1 and UA2 experiments carry on investigating the W and Z boson properties.
- Civil engineering work are under way for the future Large Electron-Positron (LEP) collider.
- CERN begins to accelerate heavy ions in the Super Proton Synchrotron (SPS) in order to study the gluon-plasma created in the big bang.
- The Low-Energy Antiproton Ring (LEAR) is coming into operation. Electron cooling is tested at LEAR.
  The ATRAP experiment is proposed for a CPT test by comparing the masses of proton and antiproton. ATRAP and ISOLTRAP, the latter one proposed at the same time for mass spectrometry of radionuclides at ISOLDE, are the very first Penning traps connected to an accelerator. A decelerator ring for antiprotons (ELENA) is proposed but turned down. An antiproton gravity experiment proposed by Michael Holz-scheiter is accepted by the PSCC. This experiment was the precursor of the ATHENA and ALPHA experiments aiming at a CPT test by comparing the 1s – 2s transition frequencies in hydrogen and antihydrogen. Today gravity experiments are again on the agenda at the Antiproton Decelerator at CERN.

What happened 1985 – 1987 at ISOLDE?

Construction of ISOLDE-3

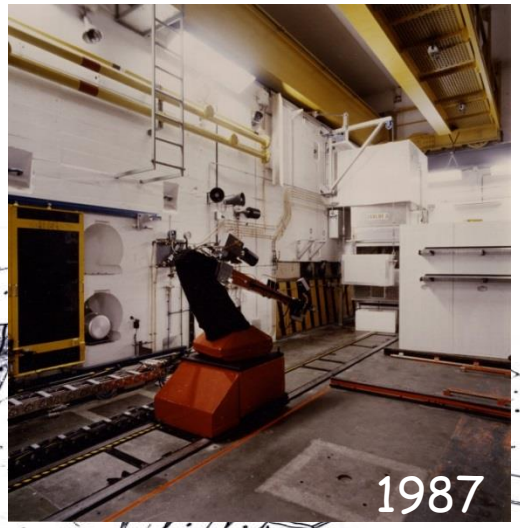
The 600 MeV Synchrocyclotron (SC) is more and more used as injector for ISOLDE.

A second isotope separator (ISOLDE-3) with high resolving power is being built. It uses two magnets which serve today as High-Resolution Separator (HRS) at the PS Booster ISOLDE.



Brian Allardyce of the Synchrocyclotron Group is in charge of building ISOLDE-3. The target is placed in the SC vault and the proton hall serves as the new experimental area.

December 1987: First beam at ISOLDE-3



IS-3

$\left(\frac{M}{\Delta M}\right)_{max} = 3 \cdot 10^4$

enhancement factor $= 10^8$

ISOLDE / CERN

600 MeV protons, 3 μA

910 MeV ^{3}He, 1 μA

IS-2

$\left(\frac{M}{\Delta M}\right)_{max} = 1500$

enhancement factor $= 10^4$

What happened 1985 – 1987 at ISOLDE?
A tough time for ISOLDE at CERN

The LEP construction period 1981–88 was a lesson for those at ISOLDE and SIN who still felt that an opportunity had been missed. CERN's economy was stretched to the limit. The laboratory took large loans, cut services to physics users to a minimum, stopped maintaining buildings and equipment, and took risks on the operational safety of all machines so that it was no longer uncommon for an outside team to loose important parts of its machine time because stand-by duty for a CERN accelerator technician, who could have fixed a technical mishap, was no longer paid for. ISOLDE managed to scrape through.....

P.G. Hansen in History of CERN (1996)

- I act in one person as ISOLDE group leader, coordinator for the synchrocyclotron, and as responsible person for the ISOLDE Technical Group.
- No financial or manpower support for installing ISOLTRAP.
- No access to the EP Pool for Electronics.
- My proposal for building up a laser ion source based on resonance ionization spectroscopy (now called "RILIS") is turned down by the CERN management. Letters to the Director General (Herwig Schopper) get no answer.

First step to a laser ion source at ISOLDE

USSR ACADEMY OF SCIENCES

INSTITUTE OF SPECTROSCOPY

142092 Moscow Region
Troitzk
Tel. 334-55-79

Professor H.-J.Kluge
CERN EP Division
CERN
CH-1211 Geneve 23
Switzerland

April 22, 1985

Dear Professor Kluge,

It gave me much pleasure to hear from your letter of 26.03.85 that you have been freshly appointed a head of ISOLDE in CERN. In September 1984 during my stay at Mainz we observed your very interesting experiments on laser ionization detection of Pu. I would be very glad to receive from you the preprints on this problem so that I could include your data into my book "Laser Photoionization Spectroscopy" which is on the point of being finished by myself for Academic Press. No doubt, your plans to advance this technique, especially in the part of pulsed laser source looks a natural logical step. We would gladly cooperate with you on this problem. In what sense could we be useful to you? The principal difficulty on our part in a such a cooperation is a deficiency of currency funds at the Academy of Sciences to pay local expenses during our scientists'stay in Geneve. As for funds to deliver Soviet-made laser technology and other devices, these tasks can be resolved much easier.

We are readily inclined to discuss ways of cooperation in the development of laser ion sources either when you are in USSR (please let us know when it is convenient for you to come, certainly we shall pay your local expenses in Moscow), or during a visit of some of my co-workers to CERN (Dr.V.Mishin or me). I was glad to know Dr.H.Ravn and Prof.W.Wölfli are interested in this cooperation.

With very best wishes,

Sincerely yours,

Professor V.S.Letokhov

M E M O 25/11/86

To : JURGEN KLUGE

From : CERN Scientific Secretary

Subject: 28th meeting of the CERN-USSR Scientific Committee

9.2 ISOLDE LASER ION SOURCE

The ISOLDE Coordinator, H.-J. Kluge, informed the Committee that it was proposed to develop a laser ion source for ISOLDE, which would have the advantage compared to other sources of being highly selective, very efficient, and would permit pulsed ion beams. This project concerned groups from CERN, Mainz, and Troitzk, and was a technical development, not an experiment (an experiment with the same collaborators was already in progress). The Troitzk group (an institute of the Academy of Sciences) was prominent in the development of lasers, and their technical and material contribution was essential to this project. He outlined the timescale and extent of the expected Troitzk participation.

The Committee supported this proposal.

W. Blair

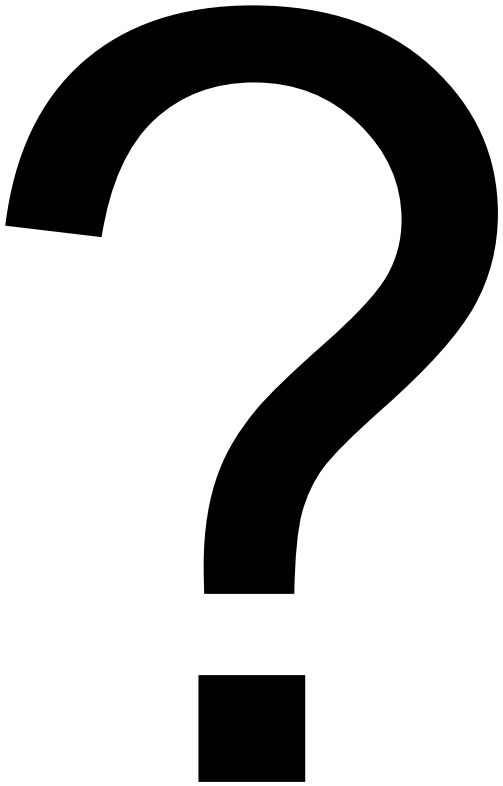
11.11.86/09:07

GENEVE

PROF VS LETOKHOV
INSTITUTE SPECTROSCOPY
ACADEMY SCIENCES
142092/TROITZK/MOSKOW/REGION/ISSR

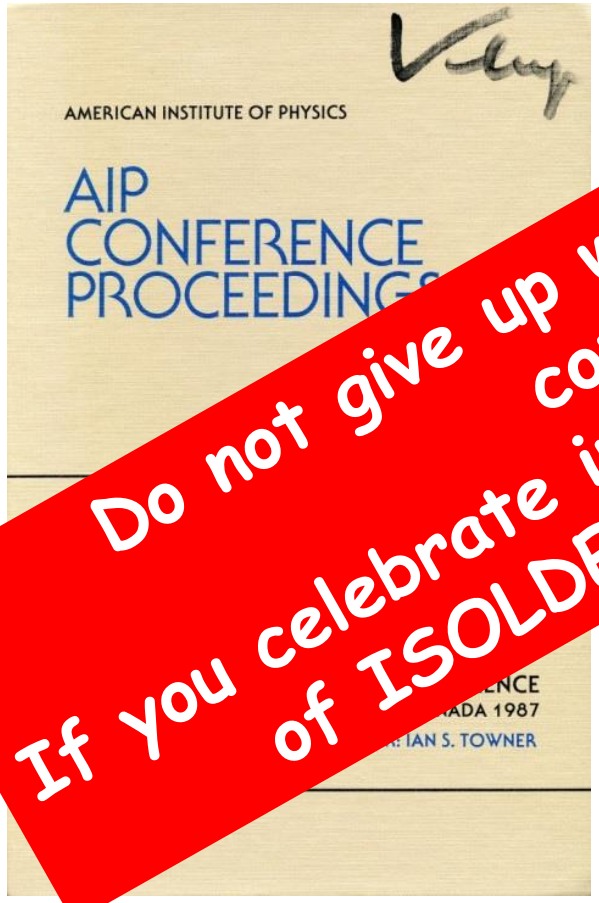
WOULD LIKE TO INVITE YOU TO VISIT CERN AND ISOLDE IN FEBRUARY 1987 STOP CERN WILL PAY LOCALEXPENSES FOR THREE WEEKS STOP DID NOT GET YOUR LETTER CONCERNING THE LASER ION SOURCE STOP PROPOSE TO POSTPONE OUR PROPOSAL TO THE NEXT IC MEETING STOP PLERASE TELL ME AS SOON AS POSSIBLE WHEN YOU COULD COME TO CERN RETGARDS
JUERGEN KLUGE CERNLAB

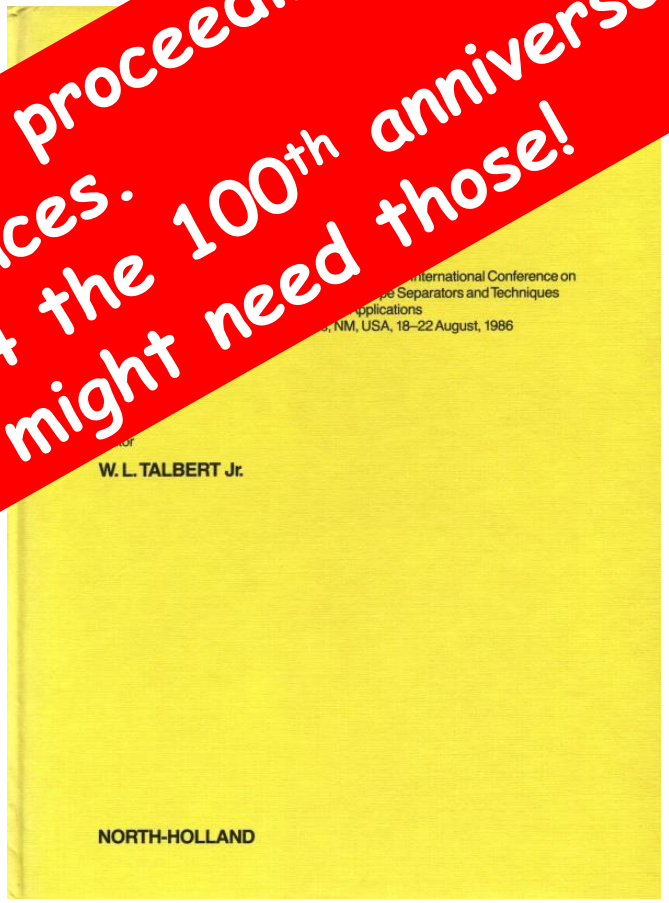
What happened 1985 – 1987 scientifically at ISOLDE?



What happened 1985 – 1987 scientifically at ISOLDE?

Proc. of the 5th Intern. Conf. on „Nuclei far from stability", Lake Rousse… …da, 1987
and
Proc. of the 11th Intern. Conference on „Electromagnetic Isotope S… …hniques related to their applications", Los Alamos …



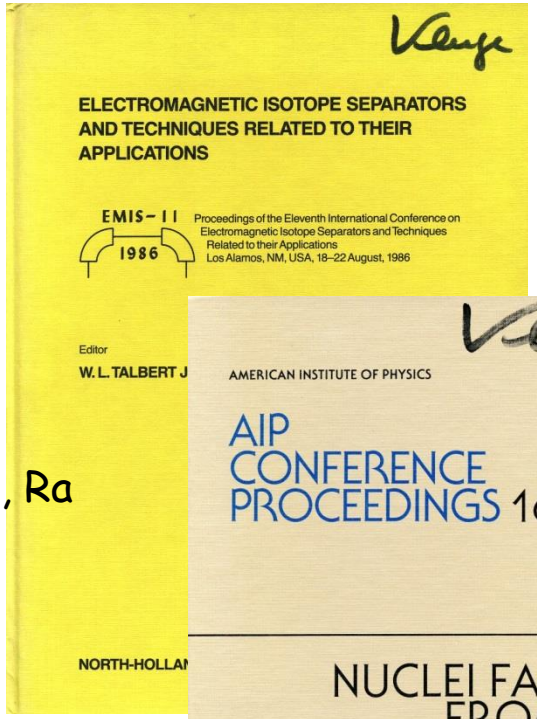


Do not give up writing proceedings of conferences. If you celebrate in 2064 the 100th anniversary of ISOLDE, you might need those!

What happened 1985 – 1987 at ISOLDE?
Scientifically a very fruitful time for ISOLDE

Proc. of the 5th Intern. Conf. on „Nuclei far from stability", Lake Rousseau, Canada, 1987
and
Proc. of the 11th Intern. Conference on „Electromagnetic Isotope Separators and Techniques related to their applications", Los Alamos, USA, 1986

Topics and (some) Names



Mass Measurements

First ISOLTRAP measurements: Cs-124, 122
Audi, Bollen, Kluge, Schweikhard, ...

Q-beta measurements: K-49,50, Cl-40,42
Miehe, Dessagne, Huck, Klotz, Knipper, Walter, ...

Moments and Radii

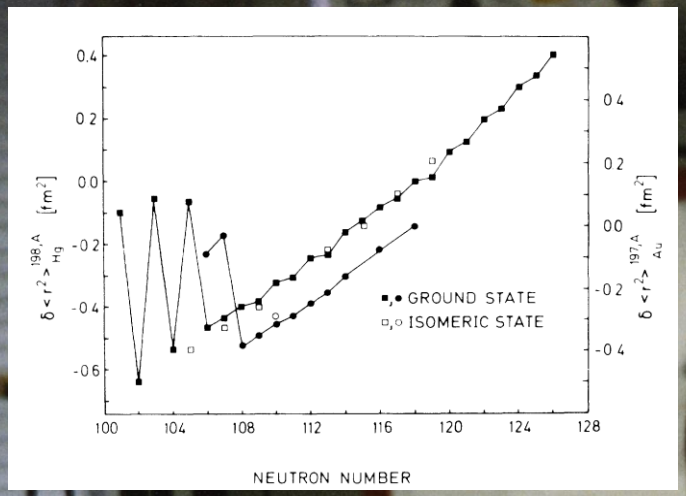
Collinear spectroscopy: Li, Sr, Ag, Cd, In, Sn, Xe, Ba, Hg, Tl, Rn, Ra
Huber, Lievens, Neugart, Otten, Wendt,...

Resonance Ionization Mass Spectrometry: Au, Pt
Bollen, Borge, Kluge, ...

1985: Searching for gold in the Allondon

1985: Searching for gold in the Allondon

Resonance ionization spectroscopy of ^{185}Au – ^{189}Au



What happened 1985 – 1987 at ISOLDE?
Scientifically a very fruitful time for ISOLDE

as documented in the Proc. of the 5th Intern. Conf. on „Nuclei far from stability", Lake Rousseau, Canada, 1987
and
Proc. of the 11th Intern. Conference on „Electromagnetic Isotope Separators and Techniques related to their applications", Los Alamos, USA, 1986

Topics and (some) Names

Mass Measurements

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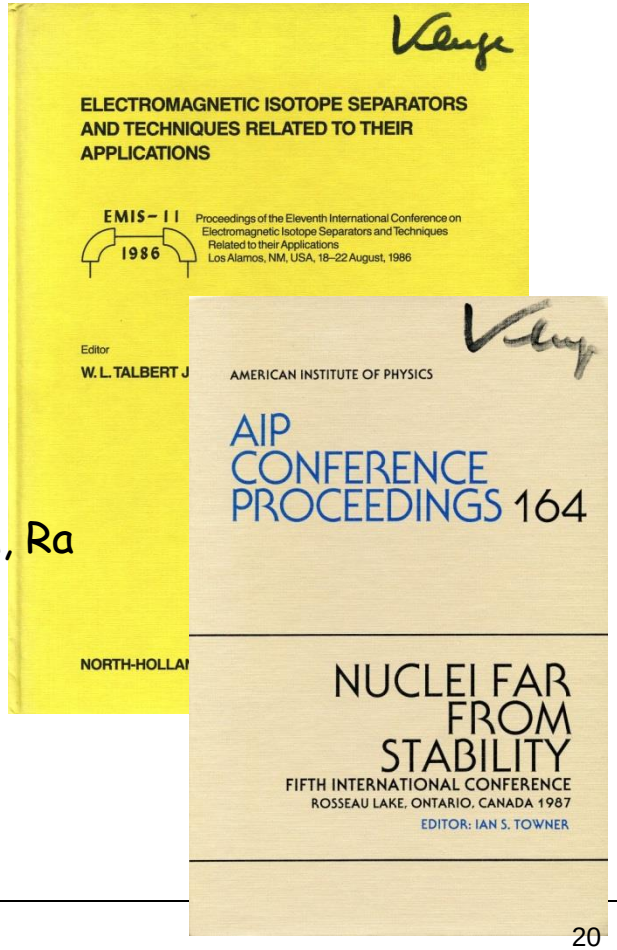
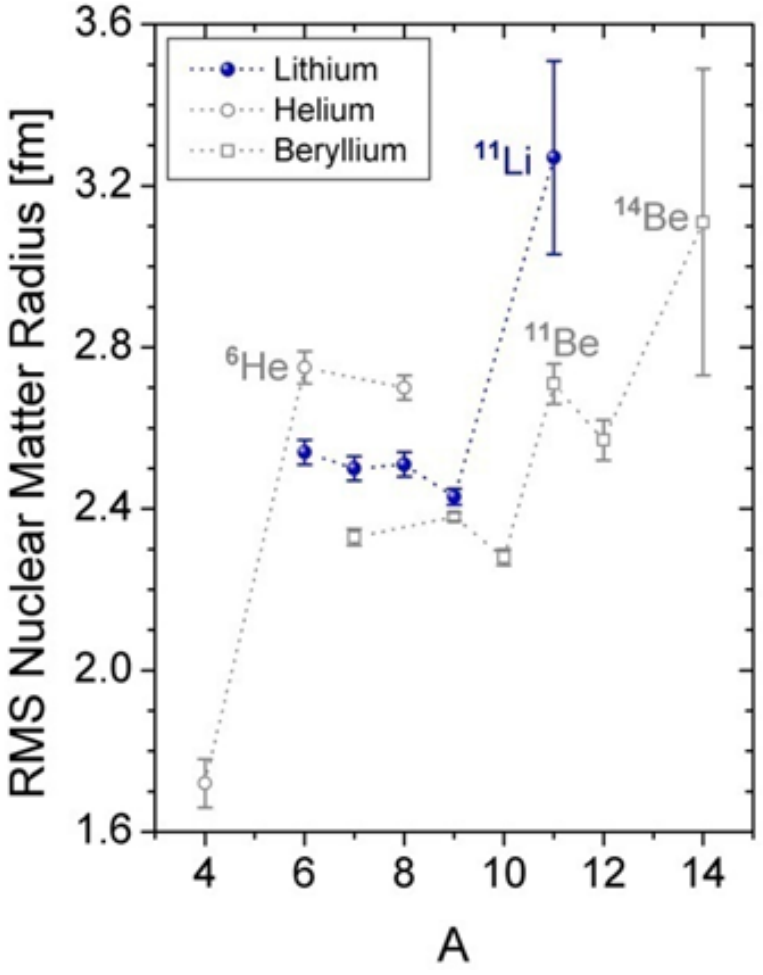
Huber, Lievens, Neugart, Otten, Wendt,...

Resonance Ionization Mass Spectrometry: Au, Pt
Bollen, Borge, Kluge, ...

The neutron halo of nuclei at the neutron drip line: Li-9,11
Borge, Hansen, Jonson, Tengblad, Riisager, ...



Discovery of extreme matter radii and its explanation



VOLUME 55, NUMBER 24 PHYSICAL REVIEW LETTERS 9 DECEMBER 1985

Measurements of Interaction Cross Sections and Nuclear Radii in the Light *p*-Shell Region

I. Tanihata,[(a)] H. Hamagaki, O. Hashimoto, Y. Shida, and N. Yoshikawa
Institute for Nuclear Study, University of Tokyo, Tanashi, Tokyo 188, Japan

K. Sugimoto,[(b)] O. Yamakawa, and T. Kobayashi
Nuclear Science Division, Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720

and

N. Takahashi
College of General Education, Osaka University, Toyonaka, Osaka 560, Japan
(Received 11 July 1985; revised manuscript received 17 September 1985)

EUROPHYSICS LETTERS 15 August 1987

Europhys. Lett., 4 (4), pp. 409-414 (1987)

The Neutron Halo of Extremely Neutron-Rich Nuclei.

P. G. HANSEN (*) (§) and B. JONSON (**)
(*) *EP-Division, CERN, Geneva, Switzerland*
(**) *Department of Physics, Chalmers University of Technology, Göteborg, Sweden*

(received 17 February 1987; accepted in final form 20 May 1987)

What happened 1985 – 1987 at ISOLDE?
Scientifically a very fruitful time for ISOLDE

Spectroscopy

β-delayed proton emission: Dy-147, β-decay of 27/2 isomers: Er-151, Dy-149
Blomqvist, Huck, Kleinheinz, Nyman, Roeckl, Rubio, Walter, ...

Search for octupole deformation: Fr-225
Borge, Nyman, Kurcewicz, ...

Gamov Teller Strength

Gamov-Teller β-decay: Na-29-31
Huck, Knipper, Miehe, Walter, ...

β-strength in proton-rich isotopes: Ar-32-35
Borge, Hansen, Jonson, Nyman, Riisager, Richter, ...

Gamov-Teller β-decay: Cd-98, 100
Dobaczewski, Nazarewicz, Nyman, Roeckl, Rykaczewski, Zylicz, ...

On-line Separator Systems and Target Techniques

Radioactive ion beams & The ISODE-3 project
Allardyce, Kugler, Ravn, Wollnik, ...

High-temperature metal targets and refractory oxides, carbides and borides as targets for on-line isotope separation &
Bornstadt, Hagebo, Hoff, Jonsson, Kugler, Sundell, Ravn, Vosicki, ...

What happened 1985 – 1987 at ISOLDE?
New directions and completed experiments

Solid state physics becomes a strong research line at ISOLDE
Mössbauer spectroscopy & channeling
Deicher, Hofsäss, Recknagel, Wahl, Weyer, ...

Diffusion studies with implanted radionuclides
Weyer, Mehrer, ...

Perturbed angular correlation studies & surface studies
Haas, Soares, ...

Coming-up experiments:
Nuclear Implantation into Cold On-Line Equipment at ISOLDE-3 (NICOLE)
Berkers, Hagn, Herzog, Knipper, Severijns, Stone, Vanneste, Zech, ...

Radionuclei for medical diagnosis and therapy
Beyer

Completed experiments:
Atomic beam magnetic resonance
Ekström, Lindgren, ...

Optical pumping and radiofrequency magnetic resonance of Fr
Duong, Klapisch, Liberman, Mueller, Pinard,Thibault, ...
continued 1987 by using collinear spectroscopy + Neugart, Otten, Stroke, Wendt, ..

The ISOLTRAP experiment in the 1987 CERN Book on the Experimental Programme

PART II EXPERIMENTAL PROGRAMME IS130

Beam US1
Approved 06/JUN/1985
Status Data-taking

High – Precision Direct Mass Determination of Unstable Isotopes

CERN, Mainz Univ., Montreal McGill Univ., Isolde Collaboration

CERN
Focker G.J Kluge H.J. Kugler E. Ulm G.
Mainz Univ.
Bollen G. Egelhof P. Kalinowski H. Kern F. Schnatz H. Schweikhard L. Stolzenberg H.
Montreal McGill Univ.
Moore R.B.

Spokesman: Kluge, H.–J. Contactman: Kluge, H.–J.

The extension of systematic high–precision measurements of the nuclear mass to nuclei far away from the valley of β stability is demanded for by nuclear physics and astrophysics: the mass or binding energy represent as a fundamental gross property a key input parameter for nuclear matter calculations. It is a sensitive probe for collective and single–particle effects in nuclear structure.

In order to measure nuclear masses with a resolution and accuracy of better than 10^{-6} (i.e. $\Delta M \leq 100$ keV for A = 100), the ions delivered by the on–line mass separator ISOLDE are confined in a Penning quadrupole trap. This trap is placed in the very homogeneous and stable magnetic field of a superconducting magnet. Here, the cyclotron frequency and hence the mass are determined.

The first on–line experiments with the help of this new technique will concern mass measurements in long chains of alkaline earth isotopes.

PUBLICATIONS

P. Dabkiewicz et al., High-precision direct mass determination of short-lived isotopes confined in a Penning trap, Proc. 7th Int. Conf. on Atomic Masses and Fundamental Constants, AMCO–7, Darmstadt–Seeheim, 1984, ed. O. Klepper (THD Schriftenreihe Wissenschaft und Technik, Vol. 26, Technische Hochschule, Darmstadt, 1984; available from GSI, Darmstadt, FRG), p. 684.

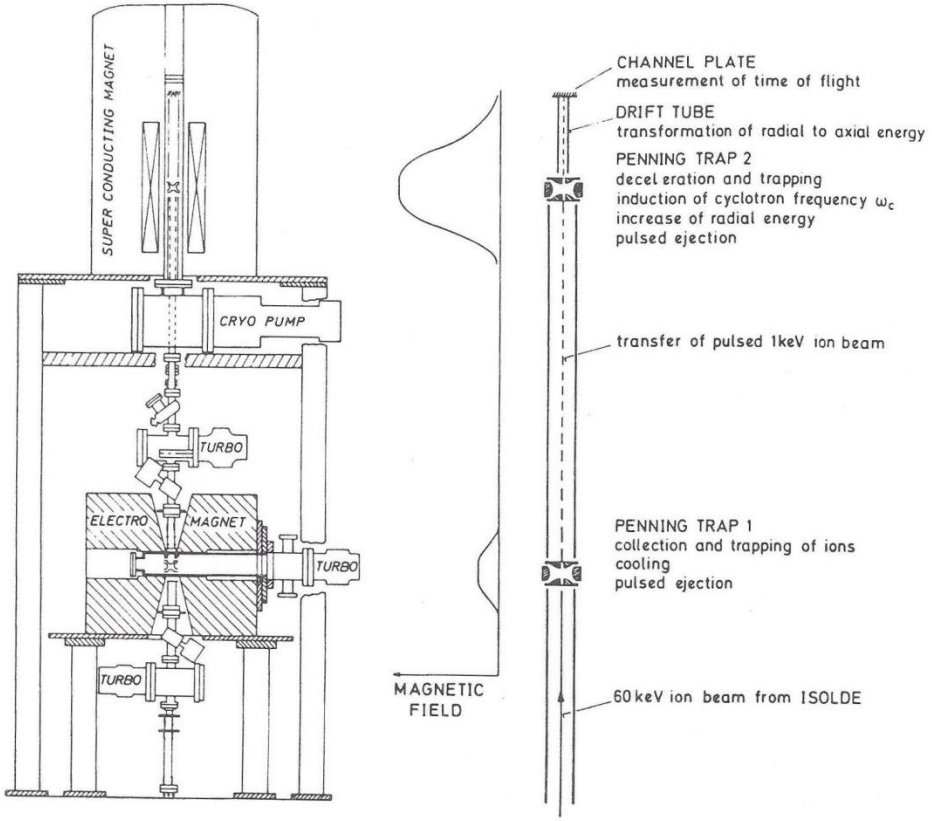
P. Dabkiewicz et al., A Penning-trap mass spectrometer for high-precision mass measurement on short-lived isotopes, Proc. TRIUMF–ISOL Workshop, Mont Gabriel (Quebec), 1984, eds. J. Crawford and J.M. D'Auria (TRIUMF report, TRI–84–1, Vancouver, BC, 1984), p. 81.

H.-J. Kluge, Ground state studies at ISOLDE, preprint CERN–EP/85–151 (1985) to appear in Proc. Int. Symp. on Recent Advances in the Study of Nuclei off the Line of Stability, Chicago, 1985, eds. R.A. Meyer and D.S. Brenner, in press.

H. Schnatz et al., In-flight capture of ions into a Penning trap, Nucl. Instrum. Methods **A251** (1986) 17.

H.-J. Kluge, H. Schnatz and L. Schweikhard, A Penning trap for studying cluster ions, Z. Phys. **D3** (1986) 189.

G. Bollen et al., First absolute mass measurements of short-lived isotopes, preprint CERN–EP/87–33 (1987), Hyperfine Interactions (in press).



The very first ISOLTRAP runs

August 1986

EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH

PHENOMENON OF SITE-CHANGING COLLISIONS

G. Bollen[1], H.-J. Kluge[1-2], L. Schweikhard[1]

[1]Institut für Physik, Universität Mainz, D-6500 Mainz, Fed. Rep. Germany
[2]CERN/ISOLDE, CH-1211 Geneva 23, Switzerland

Abstract. We have observed the phenomenon of site-changing collissions by bombarding Re and Pt foils with 60 keV Ba ions. The foil was heated after implantation to temperatures sometimes higher than the melting point of Pt and the evaporating ions were detected and mass-separated by time of flight. Only potassium was observed irrespective of the Ba^+ beam intensity. This phenomenon might be explained by site-changing collissions or by a new Barium-Snapper model.

Submitted to Physics Tonight
Section: Non-reproducible Results
28 August 1986

June 1987

Timeline of ISOLTRAP members

(only those are listed who registered for the ISOLDE Workshop 2014)

1980 Letter of intent to the ISOLDE Coll. Committee by G. Gräff, H. Kalinowsky and H.-K. Kluge
1985 Proposal to the PSCC by G. Bollen, G.J.Kokker, H. Kalinowsky, F. Kern, H.-J. Kluge, E. Kugler, R.B. Moore, H. Schnatz, and G. Ulm

TIME

BOLLEN, Georg	Michigan State University	East Lansing	United States
SCHWEIKHARD, Lutz	Univerity of Greifswald	Greifswald	Germany
SAVARD, Guy	Argonne National Laboratory	Argonne	United States
DILLING, Jens	TRIUMF		
HERFURTH, Frank	GSI		
LUNNEY, David	CSNSM		
BLAUM, Klaus	MPI Heidelberg		
DELAHAYE, Pierre	GANIL		
HERLERT, Alexander	FAIR		
BREITENFELDT, Martin	Ernst-Moritz-Arndt-Universi		
KOWALSKA, Magdalena	CERN		
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