SNEAP 05 HIAT

SNEAP
Symposium of Northeastern Accelerator Personnel

HIAT
Heavy Ion Accelerator Technology

Symposium at Danford's Inn

October 16-20, 2005

BROOKHAVEN NATIONAL LABORATORY

Co-hosted by Brookhaven National Laboratory and Yale University

A.W. Wright Nuclear Structure Laboratory

SNEAP/HIAT Agenda

Sunday October 16, 2005

19:00 – 22:00	**Brookhaven Ballroom** Opening Reception and Conference Registration

Monday October 17, 2005

8:30 – 9:15	Registration – **Diplomatic Room**
9:15 – 10:00	**Session 1 – Diplomatic Room** **Chair: Jim Alessi**
Derek Lowenstein	Welcome
Thomas Roser	Relativistic Heavy Ion Collider
10:00 – 10:30	Break
10:30 – 12:00	**Session 2 – Diplomatic Room** **Chair: Martha Meigs**
Jeff Ashenfelter	Status of Yale ESTU
Chuck Carlson	Brookhaven Tandem Operation
Manu Poletti	The GNS 6MeV Tandem Accelerator Control and Automation System
12:00-13:30	Lunch
13:30 – 15:00	**Session 3 HIAT Parallel – Bayles Room** **Chair: Jeff Ashenfelter**
Subhendu Ghosh	A Novel Technique of Reduction of Microphonics in Superconducting Resonators
David Weisser	A Novel Rotational Tuner for Multi-Stub Resonators
Greg Harper	Radioactive Ion Beams and Deflector Power Supplies at the University of Washington Nuclear Physics Lab
13:30 – 15:00	**Session 3 SNEAP Parallel - Diplomatic Room** **Chair: Chuck Carlson**
Bernard Waast	Status Report of Orsay MP9
Ludwig Beck	Status of the Munich Tandem Accelerator
Victor H Rotberg	A History of a Repair of a Unique Sparking Problem
15:00 – 15:30	Break

15:30 – 17:00	**Session 4 - Diplomatic Room** **Chair: Greg Norton**
Graham F Peaslee	Installation of the Hope College Ion Beam Analysis Laboratory
Kevin Carnes	Picosecond Ion Pulses from an EN Tandem Created by a Femtosecond Ti:Sapphire Laser
David Weisser	A Gas Cathode for the ANU Version of a SNICSII Progress Report
17:00- 19:00	Dinner
19:00- 22:00	Tour of Stony Brook Nuclear Structure Lab

Tuesday October 18, 2005

9:00 – 10:00	**Session 5 - Diplomatic Room** **Chair: Stephen Ferguson**
Michel Letournel	Industrial Electrostatic Accelerators. Potentialities for Research
Andreas Heinz	Nuclear Structure at Yale
10:00 – 10:30	Break
10:30 – 12:00	**Session 6 HIAT Parallel - Bayles Room** **Chair: David Weisser**
Giovanni Bisoffi	First beams through PIAVE - the Positive Ion Injector of ALPI
Gary Zinkann	Atlas Energy Upgrade
Oliver K Kester	The HITRAP Decelerator at GSI
10:30 – 12:00	**Session 6 SNEAP Parallel - Diplomatic Room** **Chair: John McKay**
Greg Norton	Resistor Problems
	Open Discussion
12:00-13:30	Lunch
13:30 – 15:00	**Session 7 HIAT Parallel - Bayles Room** **Chair: Richard Lefferts**
Giovanni Bisoffi	ALPI Upgrading
Richard C Pardo	Radioactive Beams from ^{252}Cf fission using a Gas Catcher and an ECR Charge Breeder at ATLAS

David Weisser	Far-Field Electrodes for a 3 Frequency Gridded Buncher
13:30 – 15:00	**Session 7 SNEAP Parallel - Diplomatic Room** **Chair: Greg Harper**
Fred Johnson	ANU EME Lab Report
Mark Roberts	Ion Optics Calculations for a Continuous-Flow Accelerator Mass Spectrometry System
David Garton	A Modification to the ANSTO HVEE 846B Ion Source, High Voltage Platform
15:00 – 15:30	Break
15:30 – 17:00	**Session 8 - Diplomatic Room** **Chair: Arthur Haberl**
Ke Han	Search for Strangelets in Lunar Soil Using the Tandem Van-de-Graaff Accelerator at WNSL, Yale
Sunil Ojha	Development of AMS program at Nuclear Science Centre New Delhi, India
David Garton, Roland Szymanski David Weisser	SNEAP-ATF 2006
17:00-19:00	Dinner
19:00-22:00	Tour of BNL Tandem Van de Graaff

Wednesday October 19, 2005

9:00 – 10:00	**Session 9 - Diplomatic Room** **Chair: Mark Roberts**
Manfred Friedrich	A Modified RF Ion Source with a Ceramic Bottle
Roland Szymanski	RF Ion Source Coupling/Decoupling Problems.
10:00 – 10:30	Break
10:30 – 12:30	**Session 10 HIAT Parallel - Bayles Room** **Chair: Richard Pardo**
Jim Alessi	Electron Beam Ion Source
Tim Winkelmann	Status of the Ion Sources at the ISL and their Application for Eye Tumor Therapy
Subhendu Ghosh	A Large Acceptance Analysing Magnet for ECR sources

10:30 – 12:30	**Session 10 SNEAP Parallel - Diplomatic Room** **Chair: Chris Westerfeldt**
Allan Kern	Rebuild Your Magnet Power Supply
	Open discussion about belts and charging systems
12:30-14:00	Lunch
14:00-23:00	Winery Tour and Banquet at Atlantis

Thursday October 20, 2005

9:00 – 10:00	**Session 11 - Diplomatic Room** **Chair: John McKay**
John McKay	SNEAP Business Meeting
	HIAT Business Meeting
	Open Discussion
10:00 – 10:30	Break
10:30 – 12:00	**Session 12 - Diplomatic Room** **Chair: Scott McMaster**
Tom Barker	Yale Accelerator Labor Eliminator "YALE"
	Open Discussion
12:00	Meeting end
12:00	Leave Port Jefferson for Yale Tour
19:15	Arrive back in Port Jefferson

ATTENDEES

39th Intl Symposium of Northeastern Accelerator Personnel
10th Intl Conference on Heavy Ion Accelerator Technology

Port Jefferson, New York
October 16-20, 2005

Hans Abendroth
Affiliation: BNL
Email: hansa@bnl.gov
Phone Number: 631-344-4581
Fax Number: 631-344-4583

Office Address:
Brookhaven National Laboratory
Tandem Van de Graaff Facility
59 Cornell Avenue
Upton, New York 11973

James Alessi
Affiliation: BNL
Email: Alessi@bnl.gov
Phone Number: 631-344-7563
Fax Number: 631-344-4583

Office Address:
Brookhaven National Laboratory
Tandem Van de Graaff Facility
59 Cornell Avenue
Upton, New York 11973

Jeffrey Ashenfelter
Affiliation: Yale University
Email: ash@riviera.physics.yale.edu
Phone Number: 203-432-5790
Fax Number:

Office Address:
Wright Nuclear Structure Laboratory
Yale University
PO Box 208124
272WhitneyAvenue
New Haven, CT 06520-8124

Isabelle Bailly
Affiliation: CEA
Email: isabelle-bailly@cea.fr
Phone Number:33 169 264829
Fax Number: 33 169 267024

Office Address:
BP 12 91680 Bruyeres le Chatel
France

Dr. Ludwig Beck
Affiliation: Maier-Leibnitz-Labor, Munich
Email: Ludwig.Beck@LMU.de
Phone Number: 0049 89 8914271
Fax Number: 0049 89 28914280

Office Address:
Maier-Leibnitz-Laboratorium
Am Coulombwall 6
D-85748 Garching
GERMANY

Dr. Giovanni Bisoffi
Affiliation: INFN - Laboratori Nazionali di Legnaro
Email: bisoffi@lnl.infn.it
Phone Number: +39 049 068311
Fax Number: +39 049 641925

Office Address:
Istituto Nazionale di Fisica Nucleare
Laboratori Nazionali di Legnaro
viale dell Università 2
I 35020 Legnaro
Italy

Bret P. Carlin
Affiliation: Duke University - TUNL
Email: carlin@tunl.duke.edu
Phone Number: (919) 660-2544
Fax Number: (919) 660-2540

Office Address:
Duke University - TUNL
Box 90308
Durham, NC 27708

Charles W. Carlson
Affiliation: BNL
Email: ccarlson@bnl.gov
Phone Number: 631-344-5261
Fax Number: 631-344-4583

Office Address:
Brookhaven National Laboratory
Tandem Van de Graaff Facility
59 Cornell Avenue
Upton, New York 11973

Dr. Kevin D. Carnes
Affiliation: Kansas State Univeristy
Email: kdc@phys.ksu.edu
Phone Number: 785 532 2662
Fax Number:

Office Address:
Department of Physics/Cardwell Hall
Kansas State University
Manhattan, KS 66506

W. Scott Daniel
Affiliation: Brigham Young University
Email: wsd@byu.edu
Phone Number: 801-378-3160
Fax Number:

Office Address:
Physics Department
C-151 Eyring Science Center
Provo, UT 84602

Joel Eder
Affiliation: SenTech Corporation
Email: jeder@sentechcorp.com
Phone Number: 317-248-1988
Fax Number: 317-248-2014

Office Address: SenTech Corporation
Attn: Joel Eder
5745 Progress Rd
Indianapolis, IN 46241

Olga Enguita
Affiliation: C.M.A.M. Universidad Autónoma de Madrid
Email: olga.enguita@uam.es
Phone Number: 34-914973619
Fax Number: 34-914973623

Office Address:
Centro de micro-Análisis de Materiales (edif 22)
Universidad Autónoma de Madrid
E-28049 Madrid
España

David Enyeart
Affiliation: U.C. Santa Barbara
Email: David@iqcd.ucsb.edu
Phone Number: 805-893-3390
Fax Number:

Office Address:
U.C. Santa Barbara
iQCD
Santa Barbara, CA 93106

Dr. Stephen M. Ferguson
Affiliation: Western Michigan University
Email: steve.ferguson@wmich.edu
Phone Number: 269 3874 963
Fax Number: 269 387 4939

Office Address:
Dept of Physics - MS 5252
Western Michigan University
Kalamazoo, MI 49008-5252

Dr. Manfred Friedrich
Affiliation: Forschungszentrum Rossendorf
Email: m.friedrich@fz-rossendorf.de
Phone Number: 49-51-260 3284
Fax Number: 49-351-260 3285

Office Address:
Forschungszentrum Rossendorf
Institute of Ion Beam Physics and Materials Research
P.O. Box 51 01 19
D-01314 Dresden
Germany

David Garton
Affiliation: ANSTO
Email: dbg@ansto.gov.au
Phone Number: +61 2 9717 3665
Fax Number: +61 2 9717 3257

Office Address:
ANSTO Building 53
Private Mail Bag 1
Menai, NSW, 2234
Australia

Subhendu Ghosh
Affiliation: Inter University Accelerator Center
Email: ghosh@nsc.ernet.in
Phone Number: 011-26893955
Fax Number: 011-86893955

Office Address:
Inter University Accelerator Center
Aruna Asaf Ali Marg
New Delhi - 110067
India

Mr. Paul Giebels
Affiliation: High Voltage Engineering Europa B.V.
Email: info@highvolteng.com
Phone Number: +31 33 4619741
Fax Number: +31 33 4615291

Office Address:
High Voltage Engineering Europa
B.V.P.O. Box 99
3800 AB Amersfoort
Netherlands

Arthur W. Haberl
Affiliation: University at Albany
Email: ahaberl@albany.edu
Phone Number: 518-442-4480
Fax Number :518-442-4486

Office Address:
Ion Beam Laboratory
University at Albany
Albany, NY 12222

Ke Han
Affiliation: Yale University
Email: hehehan@msn.com
Phone Number: 203-432-3387
Fax Number:

Office Address:
508 J. W. Gibbs Laboratory
260 Whitney Ave.
New Haven, CT 06520

Gregory C. Harper
Affiliation: University of Washington
Email: gharper@u.washington.edu
Phone Number: 206.543.4084
Fax Number: 206.685.4634

Office Address:
Research Engineer/Scientist IV
University of Washington
CENPA NPL Bldg.
Box 354290
Seattle, WA 98195-4290
USA

Fred Johnson
Affiliation: Australian National University
Email: fred.johnson@anu.edu.au
Phone Number: +6126 125 9746
Fax Number:

Office Address:
Electronic Materials Engineering Research
School of Physical Sciences
The Australian National University
Acton ACT 0200
Australia

Raymond Juras
Affiliation: Oak Ridge National Laboratory
Email: jurasrc@ornl.gov
Phone Number: 865 574-4764
Fax Number: 865 574-1268

Office Address:
Oak Ridge National Laboratory
Building 6000 MS 6368
Bethel Valley Rd
Oak Ridge, TN 37831

Allan W. Kern
Affiliation: Western Michigan University
Email: allan.kern@wmich.edu
Phone Number: 269-387-4958
Fax Number: 296-387-4939

Office Address:
Western Michigan University
Physics Dept. Mail Stop 5252
Kalamazoo, MI 49008-5252

Dr. Oliver K. Kester
Affiliation: GSI Darmstadt
Email: o.kester@gsi.de
Phone Number: +49 6159 712047
Fax Number: +49 6159 712901

Office Address:
GSI Darmstadt
Planckstraße 1
D-64291 Darmstadt
Germany .

Jan N. Klug
Affiliation: RUBION / DTL
Email: klug@ep3.rub.de
Phone Number: +49-234-32-23597
Fax Number:

Office Address:
Ruhr-Universität Bochum
RUBION / DTL NT 06/253
Universitätsstr. 150
D-4780 Bochum
Germany

Robert D. Krause
Affiliation: Kansas State University
Email: Krause@phys.ksu.edu
Phone Number: 785-532-2660
Fax Number: 785-532-6806

Office Address:
Kansas State University
James R. Macdonald Lab
Dept. of Physics
Cardwell Hall
Manhattan, Kansas 66506

Robert B. Krawchuk
Affiliation: Rutgers University
Email: krawchukrb@earthlink.net
Phone Number: 609-921-7062

Prof. Larry O. Lamm
Affiliation: University of Notre Dame
Email: Larry.O.Lamm.1@nd.edu
Phone Number: 574-631-7716
Fax Number: 574-631-5952

Office Address:
124 Nieuwland Science Hall
Department of Physics
University of Notre Dame
Notre Dame, IN 46565

Richard S. Lefferts
Affiliation: Stony Brook Nuclear Structure Lab
Email: richard.lefferts@stonybrook.edu
Phone umber: 31 632 8169
Fax Number: 631 632 8573

Office Address:
Department of Physics and Astronomy
Stony Brook University
Stony Brook, New York 11794-3800

Michel Letournel
Affiliation: Vivirad
Email: vivirad@fr.oleane.com
Phone Number: 33 388 691325
Fax Number: 33 388 691618

Office Address:
Vivirad SA
23 Rue Principale
67117 Handschuheim
France

Patricia Long
Affiliation: Woods Hole Oceanographic Institution
Email: plong@whoi.edu
Phone Number: 508-289-3548
Fax Number: 508-457-2183

Office Address:
Woods Hole Oceanographic Institution
MS#8
Woods Hole, 02543 MA

Jean-Gabriel Marmouget
Affiliation: CEA
Email: jean-gabriel.marmouget@cea.fr
Phone Number: 33 169-265050
Fax Number: 33 169-267024

Office Address:
BP12 91680 Bruyeres le Chatel
France

John McKay
Affiliation: Chalk River (Retired)
Email: mckay@magma.ca
Phone Number: 613-584-4975
Fax Number:

Office Address:
Box 463
Deep River, Ontario
Canada K0J 1P0

Scott A. McMaster
Affiliation: McMaster University
Email: scott@mcmaster.ca
Phone Number: (905) 525-9140, x23640
Fax Number: (905) 524-3994

Office Address:
McMaster University
Tandem Accelerator Building,
Room 206, 1280 Main Street West
Hamilton, Ontario, Canada L8S 4K1

Martha J. Meigs
Affiliation:
Oak Ridge National Lab
Email: meigsmj@ornl.gov
Phone Number: 865-574-4950
Fax Number: 865-574-1268

Office Address:
Oak Ridge National Lab
Building 6000, MS 6368
P. O. Box 2008
Oak Ridge, TN 37831-6368

Dr. Greg Norton
Affiliation: National Electrostatics Corp
Email: nec@pelletron.com
Phone Number: 608 831 7600
Fax Number: 608 831 9591

Office Address:
National Electrostatics Corp
P.O. Box 620310
Middleton,W I 3562

Sunil Ojha
Affiliation: Inter University Accelerator Center
Email: ojha@nsc.ernet.in
Phone Number: 91-11-26893955
Fax Number: 91-11-26893666

Office Address:
Inter University Accelerator Center
Aruna Asaf Ali Marg
New Delhi - 110067
India

Louis C. Onwuliri
Affiliation: KAJI AND COMPANY NIGERIA LTD
Email: louischinedu@yahoo.com
Phone Number: 2348035309232
Fax Number: 2348035309232

Office Address:
10 modupeola st egbe idumu lga lagos
Nigeria

Dr. Richard C. Pardo
Affiliation: Argonne National Laboratory
Email: pardo@phy.anl.gov
Phone Number: 630 252 4029
Fax Number: 630 252 9647

Office Address:
9700 S. Cass Avenue
Bldg #203
Argonne, IL 60439

Prof. Graham F. Peaslee
Affiliation: Hope College
Email: peaslee@hope.edu
Phone Number: 616-395-7117
Fax Number: 616-395-7118

Office Address:
Chemistry Dept.
Hope College
35 E. 12th St.
Holland MI 49423

Manu Poletti
Affiliation: Inst. of Geological & Nuclear Sci. Ltd
Email: m.poletti@gns.cri.nz
Phone Number: +64 4 570 667
Fax Number: +64 4 570 4657

Office Address:
Geological & Nuclear Sciences
PO Box 31 312
Lower Hutt 6315
New Zealand

Chris Purcell
Affiliation: Inst. of Geological & Nuclear Sci. Ltd
Email: c.purcell@gns.cri.nz
Phone Number: +64 4 570 4779
Fax Number: +64 4 570 4657

Office Address:
Institute of Geological & Nuclear Sciences Ltd
Rafter Research Centre
30 Gracefield Road, PO Box 31312
Lower Hutt 6315, New Zealand

Dr. Roland Repnow
Affiliation: Max-Planck-Institute for Nuclear Physics, Heidelberg
Email: repnow@mpi-k.de
Phone Number: +49 6221 516277
Fax Number: +49 6221 516234

Office Address:
Max-Planck-Institut fuer Kernphysik
P.O.Box 103980
D-69029 Heidelberg
Germany

Brian J. Richter
Affiliation: GMW Associates
Email: brian@gmw.com
Phone Number: 650-802-8292
Fax Number: 650-802-8298

Office Address:
GMW Associates
955 Industrial Rd
San Carlos, CA 94070

Dr. Mark Roberts
Affiliation: Woods Hole Oceanographic Institution
Email: mroberts@whoi.edu
Phone Number: 508 289 3654
Fax Number:

Office Address:
National Ocean Sciences AMS Facility
Department of Geology and Geophysics
Mail Stop #8, McLean Laboratory
Woods Hole Oceanographic Institution
Woods Hole, MA 02543-1539 USA

Dr. Victor H. Rotberg
Affiliation: University of Michigan
Email: vhr@umich.edu
Phone Number: 734-936-0166
Fax Number:

Office Address:
University of Michigan
2600 Draper Rd
Ann Arbor, MI 48109-2145

Yigal Shachar
Affiliation: Weizmann Institute of Science
Email: flshachr@wisemail.weizmann.ac.il
Phone Number: 972-8-9342526
Fax Number:

Office Address:
Weizmann Institute of Science
POB 26
Rehovot 76100, Israel

Henrik Skov
Affiliation: Danfysik A/S
Email: hef@danfysik.dk
Phone Number: +45 4679 0000
Fax Number: +45 4679 0001

Office Address:
Mollehaven 31
DK-4040 Jyllinge
Denmark

Dave Spingler
Affiliation: Florida State University
Email: spingler@nucmar.physics.fsu.edu
Phone Number: 850-644-1191
Fax Number: 850-644-4478

Office Address:
Physics Department
212 Keen Building
Tallahassee, Fl 32306-4350

Dannie Steski
Affiliation: BNL
Email: Steski@bnl.gov
Phone Number: 631-344-7851
Fax Number: 631-344-4583

Office Address:
Brookhaven National Laboratory
Tandem Van de Graaff Facility
59 Cornell Avenue
Upton, New York 1973

Roland Szymanski
Affiliation: University of Melbourne
Email: ras@physics.unimelb.edu.au
Phone Number: 61 3 83447405
Fax Number: 61 3 93474783

Office Address:
School of Physics
University of Melbourne
Victoria 3010, Australia

Dr. Karl F. von Reden
Affiliation: Woods Hole Oceanographic Institution
Email: kvonreden@whoi.edu
Phone Number: 508-289-3384
Fax Number:
Office Address:

Woods Hole Oceanographic Institution
Mailstop #8
Woods Hole, A 02543

Dr. Bernard Waast
Affiliation:
Institut de Physique Nucléaire
Email: waast@ipno.in2p3.fr
Phone Number: (33) 1 69 15 52 91
Fax Number: (33)1 69 15 51 08

Office Address:
Institut de Physique Nucléaire
Bat. 109 91406 ORSAY Cedex
FRANCE

Dr. David Weisser
Affiliation: Australian National University
Email: david.weisser@anu.edu.au
Phone Number: +61 2 6125 2080
Fax Number: + 61 2 6125 0748

Office Address:
Nuclear Physics Department
Research School of Physical Sciences &
Engineering
Australian National University
Canberra, ACT 0200
AUSTRALIA

Chris R. Westerfeldt
Affiliation: Duke University & T.U.N.L.
Email: cwest@tunl.duke.edu
Phone Number: 919-660-2545
Fax Number: 919-660-2634

Office Address:
Duke University Physics Department
Box 90308
Science Drive
Durham, NC 27708-0308

Tim Winkelmann
Affiliation: Hahn Meitner Institut
Email: windelmann@hmi.de
Phone Number: 030 8062 2427
Fax Number: 030 8062 2293

Office Address:
Hahn Meinter Institut
Glienickerstr 100
14109 Berlin
Germany

Gary P. Zinkann
Affiliation: ANL
Email: zinkann@anl.gov
Phone Number: 630 252 4892
Fax Number: 630 252 4118

Office Address:
Argonne National Laboratory
Physics - Bldg. 203
Argonne, IL 60439

SPONSORS

The Organizing Committee for SNEAP/HIAT 2005 would like to gratefully acknowledge the support of the following sponsors:

National Electrostatics Corp.
Greg Norton
7540 Graber Road
P.O. Box 620310
Middleton, WI 53562-0310
Telephone: (608) 831-7600
Fax: (608) 831-9591
http://www.pelletron.com/
nec@pelletron.com

GMW Associates
Brian Richter
955 Industrial Road
San Carlos, CA 94070
Tel: (650) 802-8292
Fax: (650) 802-8298
http://www.gmw.com/
sales@gmw.com

Pfeiffer Vacuum, Inc.
Frank Federico
150 Old Willimantic Road
06237 Columbia, CT
Tel: (860) 228 4508
http://www.pfeiffer-vacuum.com/
Frank.Federico@pfeiffer-vacuum.com

SenTech Corporation
Joel Eder
5745 Progress Road
Indianapolis, IN 46241
Tel: (317) 248-1988
Toll Free (888) 248-1988
Fax: (317) 248-2014
http://www.sentechcorp.com/
jeder@sentechcorp.com

AUSTRALIAN NATIONAL UNIVERSITY
NUCLEAR PHYSICS DEPARTMENT
CANBERRA, AUSTRALIA

D C Weisser, N R Lobanov, A K Cooper, A G Muirhead, H J Wallace and J K Heighway, T Kibedi, R B Turkentine

14UD

The 14UD continues to operate at around 4,400 hours per year. There were 5 tank openings this year due to problems with anomalous wear of chain pulleys. In the low energy mid-section, a 60 l/s triode ion pump replaced the titanium sublimer pump and 10 l/s ion pump. This allowed the removal of the remaining Lucite rods since computers, via optical fibres, control all functions.

Chains

The huge particulate production associated with chain #1reported last year was wrongly ascribed to SF6 breakdown products. The extensive deposits turned out to be ground up nylon from the chain pulleys. It is still not clear why this chain, with only 6,000 hours of use, generates so much pulley wear. More details are on our web site and will be discussed in the charging system session.

Ion Sources

McSNICS

The two 30-year-old pre-acceleration tubes have been replaced with 3 new NEC general-purpose tubes. This has cured the sparking problem and has enabled operation at 150 kV resulting in improved beam transmission through the 14UD. We next intend to increase operation voltage to 200 kV, the limit of the Glassman power supply.

Gas Cathode SNICSII

The Gas Cathode SNICSII has been installed and is under test. Although its output of > 4 μA on CaH^- more than satisfies experimenters' needs it is not clear why it has not scaled with ammonia pressure at the Ca sample surface. More detail appears elsewhere in the proceedings. This source is also being used for non-gas beams of Sulphur in order to avoid contamination of the McSNICS source, when it is used for ^{36}Cl AMS. S^{33} beam of ~ 0.1 μA for 5 days were provided from a natural sulphur FeS cathode. The cathode sample was produced using a 5 tonne press with the resulting slug machine and press-fit into a standard copper holder. There was negligible wear of the FeS after 5 days use.

Gridded Buncher

The improved electrodes for the gridded buncher have been installed and delivered the anticipated 50% bunching efficiency. The new electrodes and larger vacuum housing combine to spread out the RF field that the beam experiences as it approaches the bunching gap. Previously, carbon coated Teflon cylinders spread the field but out-gassed when RF was applied. Details are covered elsewhere in the proceedings.

LINAC

LINAC Performance

An experiment was performed with 327 MeV ^{58}Ni beam that was returned to the gamma ray beam line in the old 14UD target area.

Operations were hampered this year by repeated failures of the water-cooling system for the helium compressor. Because of the extended drought in the Canberra region and much of Australia, the use of potable water for cooling was not a continuing option. The water chillers are now being replaced.

Resonator Control Cards

The resonator control cards have been replaced with ones manufactured by BARC, Mumbai, India. These have greatly simplified operations due to their easy control and superb phase stability. The RF amplifiers have also been replaced with ones from Dressler, Germany, which allow 200 W CW operation in addition to > 500 W pulse power for conditioning.

Multi-stub Resonator tuners

A novel two-stub accelerating structure, optimised for ion velocity of 4.5% the speed of light, has been designed. The main electromagnetic and mechanical parameters are derived using Micro-Wave-Studio solver. In the two-stub cavity, the opposite going currents in the tuner plate need not to return through the RF joint. It is this feature of the two-stub concept that allows implementation of a rotary tuner instead of the conventional deflection plate. The small driving force required for a rotary tuner only requires a simple drive mechanism and so provides low-backlash tuning. The design of the two-stub cavity has been finalised allowing the building the first working prototype. It is described elsewhere in the proceedings.

Work is underway on understanding and improving the demountable joints necessary in our multi-stub resonators. This is in spite of the extremely low currents that the multi-stub design imposes on the joints.

AUSTRALIAN NATIONAL UNIVERSITY
NUCLEAR PHYSICS DEPARTMENT
CANBERRA, AUSTRALIA

D C Weisser, N R Lobanov, A K Cooper, A G Muirhead,
H J Wallace and J K Heighway, T Kibedi, R B Turkentine

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The 14UD continues to operate at around 4,400 hours per year. There were 5 tank openings this year due to problems with anomalous wear of chain pulleys. In the low energy mid-section, a 60 l/s triode ion pump replaced the titanium sublimer pump and 10 l/s ion pump. This allowed the removal of the remaining Lucite rods since computers, via optical fibres, control all functions.

Chains

The huge particulate production associated with chain #1reported last year was wrongly ascribed to SF6 breakdown products. The extensive deposits turned out to be ground up nylon from the chain pulleys. It is still not clear why this chain, with only 6,000 hours of use, generates so much pulley wear. More details are on our web site and will be discussed in the charging system session.

Ion Sources

McSNICS

The two 30-year-old pre-acceleration tubes have been replaced with 3 new NEC general-purpose tubes. This has cured the sparking problem and has enabled operation at 150 kV resulting in improved beam transmission through the 14UD. We next intend to increase operation voltage to 200 kV, the limit of the Glassman power supply.

Gas Cathode SNICSII

The Gas Cathode SNICSII has been installed and is under test. Although its output of > 4 μA on CaH^- more than satisfies experimenters' needs it is not clear why it has not scaled with ammonia pressure at the Ca sample surface. More detail appears elsewhere in the proceedings. This source is also being used for non-gas beams of Sulphur in order to avoid contamination of the McSNICS source, when it is used for ^{36}Cl AMS. S^{33} beam of ~ 0.1 μA for 5 days were provided from a natural sulphur FeS cathode. The cathode sample was produced using a 5 tonne press with the resulting slug machine and press-fit into a standard copper holder. There was negligible wear of the FeS after 5 days use.

Gridded Buncher

The improved electrodes for the gridded buncher have been installed and delivered the anticipated 50% bunching efficiency. The new electrodes and larger vacuum housing combine to spread out the RF field that the beam experiences as it approaches the bunching gap. Previously, carbon coated Teflon cylinders spread the field but out-gassed when RF was applied. Details are covered elsewhere in the proceedings.

LINAC

LINAC Performance

An experiment was performed with 327 MeV ^{58}Ni beam that was returned to the gamma ray beam line in the old 14UD target area.

Operations were hampered this year by repeated failures of the water-cooling system for the helium compressor. Because of the extended drought in the Canberra region and much of Australia, the use of potable water for cooling was not a continuing option. The water chillers are now being replaced.

Resonator Control Cards

The resonator control cards have been replaced with ones manufactured by BARC, Mumbai, India. These have greatly simplified operations due to their easy control and superb phase stability. The RF amplifiers have also been replaced with ones from Dressler, Germany, which allow 200 W CW operation in addition to > 500 W pulse power for conditioning.

Multi-stub Resonator tuners

A novel two-stub accelerating structure, optimised for ion velocity of 4.5% the speed of light, has been designed. The main electromagnetic and mechanical parameters are derived using Micro-Wave-Studio solver. In the two-stub cavity, the opposite going currents in the tuner plate need not to return through the RF joint. It is this feature of the two-stub concept that allows implementation of a rotary tuner instead of the conventional deflection plate. The small driving force required for a rotary tuner only requires a simple drive mechanism and so provides low-backlash tuning. The design of the two-stub cavity has been finalised allowing the building the first working prototype. It is described elsewhere in the proceedings.

Work is underway on understanding and improving the demountable joints necessary in our multi-stub resonators. This is in spite of the extremely low currents that the multi-stub design imposes on the joints.

Status of the Yale ESTU

J. ASHENFELTER, J. BARIS, T. BARKER and C. MILLER
Yale University
Wright Nuclear Structure Laboratory

Abstract. The ESTU Accelerator was constructed between 1985 and 1988 with experimental runs beginning at the end of 1988. The designed voltage of 20 MV was achieved in 1990. Over the past three years, problems associated with aging equipment have hampered operations. The present condition of the ESTU and associated systems will be discussed.

The GNS 6MeV Tandem Accelerator

Control and Automation System

Manu Poletti

Institute of Geological and Nuclear Science

New Zealand

Abstract

The G3Net is the name given to the control and automation system that manages most beam line components and services of the 6MeV tandem accelerator. The system is designed to assist the operator in running the accelerator by providing remote control of its equipment. G3Net works in parallel to a real-time data acquisition system that collects experiment data.

Data acquisition for the system is provided by Group3 Technology in the form of many compact control nodes linked by fiberoptics. These units are embedded in custom enclosures that provide a standardised platform which supports the various instruments and devices of the beam line. A number of standardised hardware interfaces have been developed for this platform. These connect to simple/generic devices like electromechanical valves and also more complex/specific systems like the Fischer slits interface.

Software for the G3Net is written in LabVIEW using the Endevo GOOP toolkit for object oriented development in LabVIEW. The configurable structure of this code ensures that the hardware changes or additions can be easily accommodated. G3Net consists of two main applications, First the server application that interfaces with the Group3 controllers, and second the remote user interface which operates across a TCP/IP network. Auxiliary functions like data logging, fault detection and vacuum interlocks are also provided by the server application.

G3Net has proven to be flexible and robust due to its modular design. We continue to develop software and hardware to expand its capabilities.

A Novel Technique of Reduction of Microphonics in Superconducting Resonators

S.Ghosh, R.Mehta, B.K.Sahu, A.Rai, P.N.Patra, G.K.Chowdhury, D.S.Mathuria, A.Pandey, D.Kanjilal and A.Roy

Inter University Accelerator Centre, Aruna Asaf Ali Marg, New Delhi 110067, India

During on-line beam tests of niobium superconducting quarter wave resonators (QWR), it has been observed that due to presence of microphonics in the ambiance of Linac, RF power of about 300 watts is required to lock the resonators in overcoupled mode. The high RF power causes several operational problems like melting of insulation of RF power cable; excessive heating of drive coupler leading to other associated problems and increased cryogenic loss. To reduce the requirement of RF power, a novel technique of damping the mechanical mode of the resonator by inserting stainless steel balls of suitable diameter inside the central conductor of the QWR cavity has been adopted. Due to dynamic friction between the balls and the niobium surface, the amplitude of vibration of the central conductor excited by the mechanical mode has been reduced drastically. Measurement of the microphonic vibrations of QWR at superconducting temperature has been performed with and without SS balls with the help of cavity resonance monitor in phase lock loop. We observe a reduction of the amplitude of the vibrations by a factor of 3 with the steel balls inserted in the central conductor of the QWR. The cavity could be phase and amplitude locked, with about 50% of the RF input power compared to that in the case without the SS balls. This remarkable reduction of microphonic vibrations and input RF power has been checked by repeated measurements during many cold tests on a number of resonators. Details of the on-line beam tests of the linac booster and the damping mechanism for drastic reduction of microphonics will be presented.

A Novel Rotational Tuner for Multi-Stub Resonators

D Weisser, N Lobanov, A Muirhead and A Cooper

Nuclear Physics Department
Research School of Physical Sciences and Engineering
Australian National University
Canberra, AUSTRALIA

Frequency tuning of RF resonators for LINACs usually involve strenuous distortion of substantial metal plates in the electric field of the accelerating electrodes. The distortion is often beyond the elastic limit and has large backlash and hysteresis. A new tuner has been developed for multi-stub resonators featuring a metal bar rotating on an axis between and above the electrodes. It requires minimal force to tune the resonator frequency over the required range. Room temperature prototypes have proved the principle and an assembly suitable for use in a superconducting two-stub resonator is under construction.

Radioactive Ion Beams and Deflector Power Supplies at the University of Washington Nuclear Physics Lab

Greg Harper

We have recently performed experiments with two radioactive ion beams. The first is approximately15 MeV $^{8}B^{5+}$ produced by $^{6}Li^{3+}(^{3}He,n)^{8}B^{+5}$. The incident $^{6}Li^{3+}$ is a 24 MeV ion beam. The $^{8}B^{5+}$ b^{+} decays to ^{8}Be which then undergoes a double-a decay. The second is approximately 27.5 MeV $^{12}N^{7+}$ produced by $^{10}B^{5+}(^{3}He,n)$ $^{12}N^{7+}$. The incident $^{10}B^{5+}$ is a 35-MeV ion beam. The $^{12}N^{7+}$ b^{+} decays to one of two excited states of ^{12}C which then a decay to ^{8}Be. The ^{8}Be then double-a decays. In each case the radioactive ion product is imbedded in a silicon detector. The b^{+} is tagged by a scintillator as a coincidence signal. The low-energy a particles are observed in the silicon detector. The detector dead layer is measured using the terminal ion source and the tandem in single ended mode producing 80-keV to 475-keV a particles incident on the detector. The response is observed while rotating the detector.

We are now using potted, miniature power supplies for the electrostatic deflectors in the terminal ion source. The supplies are rugged, compact, and the electrolytic capacitors within are already protected for use in a high pressure environment. Using the electrostatic deflectors instead of a permanent magnet allows us to change ion species using a gas manifold.

STATUS REPORT OF ORSAY MP 9

B. Waast, for Accelerator Division of IPN, Orsay

The MP Tandem is used for experiments in Nuclear Physics, Ion-Matter interaction, and Instrumentation development, with a steady demand from year to year. For them, the accelerator is operated in a wide range of terminal voltages (0.9 MV up to 14.7 MV), and delivers atomic beams and clusters beams. The last ones (mainly C_n, C_{60} and Au_n) are issued either from the external negative injector, or from the ORION source in the terminal.

To preserve reliability, a continuous effort is done to rejuvenate the equipments, by replacing power supplies (negative injector, magnetic HE elements) and some components of the accelerator, and renewing the power electrical distribution and the refrigerating units.

On the experimental areas, PARRNe 2 is currently operated to study neutron-rich elements. This on-line separator is fed by the fission fragments desorbed from a thick uranium carbide target, under irradiation by the neutron flux generated by the deuteron beam of the Tandem. The installation of ALTO is nearly completed: this HF accelerator will deliver electron beams up to 50 MeV, and allow direct comparison with photo-fission production.

Maier-Leibnitz-Laboratorium der LMU und TU München
-Beschleunigerlabor-

Ludwig.Beck@LMU
Am Coulombwall 6
85748 Garching
GERMANY

The Tandem accelerator of the Maier-Leibnitz-Laboratorium (MLL), the former „Beschleunigerlabor der LMU und TU München“ was running very reliable during the last year. The accelerator was running 7200 hours for experiments in the fields of nuclear and applied physics. In the last maintenance in August we replaced the charging chains at the low energy side after some 75,000 h of operation (since Dec. 1993). The high energy chains are running since Sept. 1990 (95,000 h). We are planning to replace them next year.
The new research reactor FRM-II is now producing neutrons in routine operation. This is very important for the MAFF (Munich Accelerator for Fission Fragments) project. The MAFF will be the successor of the Tandem accelerator. MAFF is at present still in a design and planning stage. The official authorization procedure for MAFF will start soon. The development of important components e.g. the ion source, cryosystem and vacuum system is going on. At least until MAFF is operational the well performing Tandem will not be shutdown.

A History of a Repair of a Unique Sparking Problem

V.H.Rotberg and O.Toader
The University of Michigan, Nuclear Engineering and Radiological Sciences.
Ann Arbor, MI 48109 USA

For 6 months in 2004 our accelerator was unavailable due to intermittent sparking. After many laborious tank openings, unsuccessful attempts to identify the problem and pressure from many research projects under deadline, a consultant was hired. However, when this also proved fruitless and having realized that there was no perspective of a solution by the conventional approach, a change of paradigm led our staff to abandon all previous procedures and the problem was found. The accelerator has been operating faultlessly since then. We will describe the evolution of our ideas and the atmosphere in the laboratory during this period.

Installation of the Hope College Ion Beam Analysis Laboratory

Graham F. Peaslee
Hope College

We have purchased and installed a NEC 5SDH tandem pelletron (1.7 MV) with an alphatross ion source and a microprobe end-station. Funded mostly by NSF-MRI, the new laboratory replaces our AN-2000 machine that operated for over 30 years. The facility was proposed to facilitate research in several disciplines: solid state physics, electrochemistry, environmental chemistry, biochemistry, paleontology with standard techniques such as RBS, PIXE and PESA. In addition, industrial collaborations were proposed and the facility was part of an institutional plan to train undergraduates with interdisciplinary research projects on sophisticated instrumentation. The HIBAL facility was dedicated in October, 2004 and has run a variety of experiments in its inaugural year. We have publications pending or in process for an RBS study on electrochemical films, PIXE studies on lake sediments, and PESA and PIXE studies on gel electrophoresis gels. Seven faculty, four industrial users, one technician, one graduate student and 18 undergraduates have run experiments and/or received operator training on the instrument, and since August 2004 we have over 100 runs successfully performed, including more than 86 for research and the rest for development and training. Some insights into our proposal process, machine configuration criteria, installation and machine performance will be presented, along with examples of some of our initial research results.

Picosecond Ion Pulses from an EN Tandem Created by a Femtosecond Ti:Sapphire Laser

K.D. Carnes, C.L. Cocke, Z. Chang, H.V. Needham, and A. Rankin

As the James R. Macdonald Laboratory at Kansas State University continues its transformation from an ion collisions facility to an ultrafast laser/ion collisions facility, we are looking for novel ways to combine our traditional accelerator expertise with our new laser capabilities. One such combination is to produce picosecond pulses of stripping gas ions in the high energy accelerating tube of our EN tandem by directing ~100 femtosecond, sub-milliJoule laser pulses up the high energy end of the tandem toward a focusing mirror at the terminal. Potential ion pulse broadening effects, such as tandem terminal ripple, thermal motion of the gas, and space charge will be discussed. SIMION calculations showing the effect of Dowlish titanium spiral inclined field tubes on the pulses will be presented, along with a report on the current status of the project.

A Gas Cathode for the ANU Version of a SNICSII
Progress Report

D Weisser, N Lobanov, H Wallace and A Cooper

Nuclear Physics Department
Research School of Physical Sciences and Engineering
Australian National University
Canberra, AUSTRALIA

Abstract SNEAP – HIAT 2005

A gas cathode has been installed in a differentially pumped SNICSII ion source with the goal of producing reliable hydride beams of Calcium, Beryllium, Nitrogen and Magnesium as well as enhanced atomic Lithium. The gas cathode performance has previously been reported at SNEAP 2004 but without differential pumping. The current series of tests is not yet complete but indicate CaH^- current of 4.2 μA – a factor of 2 higher than without differential pumping. The setting of the gas pressure is much more controlled than for the previous arrangement and the output more stable. A new cathode contact device has been devised that is much more reliable than the usual spring contact.

Industrial Electrostatic Accelerators. Potentialities for Research

Michel Letournel – VIVIRAD SA (France)
e-mail : vivirad@aol.com

Abstract :

Many different particle accelerators have been used in the laboratories for Nuclear Physics but also for some applications. But generally, in laboratories, we are not familiar with the applications of direct electrons or X-Rays, neither with the industrial accelerators themselves.

There is now quite a large range of machines for industrial applications of course, but it opens also potentialities for other applications or Research.

Actually, over 70% of the industrial electron accelerators in the world are electrostatic machines, due mainly to their power, their simplicity and reliability. In industry, some 800 electrostatic accelerators ranging from 0,5 MeV up to 5 MeV are in operating along various requirements. They essentially differ from each other through their associated power supply. Cascade accelerators of various types, asymmetric or symmetric (Cockroft-Walton), parallel (Dynamitron®) and Insulated Core Transformers (ICT®) are commonly in use for radiation processing.

Through direct electrons or X-Ray conversion, numerous fields of industry benefit from the electron treatment at various energies and powers. A quick survey of some applications will be presented in the cross-linking field for pollution control. Particularly, it would remove SO_x and NO_x from the emissions of the thermal power plants, due to the possible Megawatt power of the adequate electron accelerators.

The ICT power allows to find new possible applications in Research or nowadays concerns. For example, associated with an ECR proton ion source in the range of 2 MeV up to MeV – some mA protons ; or with a new generator in the range of 10 MV – 5 mA protons single stage or a 20 MeV tandem with a negative proton ion source of 2 mA to reach a neutron flux of 10^{14} n / sec.

First beams through PIAVE – the Positive Ion Injector of ALPI

Giovanni Bisoffi

At INFN-Legnaro the heavy ion injector PIAVE, based on superconducting RFQ resonators, is at an advanced stage of beam commissioning. The RFQs (SRFQ1 and SRFQ2), built in full Nb within a stiffening Ti jacket, are 0.8 m in diameter and 1.4 and 0.8 m long, respectively (the resonant frequency is 80 MHz). Beam bunching is separate. They are followed by 8 QW Resonators, matching the optimum beta to the lower beta section of the ALPI booster. Phase and amplitude locking, versus both microphonics and pressure variations of the liquid helium bath in which the cavities are immersed, is the main rf issue. Since November 2004, beam acceleration tests were carried out in PIAVE with a 16^O^3+ pilot beam. The typical ion beam current was a few hundreds nA, received from an ECR ion source on a high voltage platform. The ion beam current could be raised up to a few electrical uA without any inconveniences. The most recent results will be reported.

The ATLAS Energy Upgrade

G. P. Zinkann*, Z. Conway, J. D. Fuerst, M. P. Kelly, M. Kedzie, S. MacDonald, K. W. Shepard

Physics Division, Argonne National Laboratory, 9700 S. Cass Avenue, Argonne Illinois. 60439

Abstract

The Argonne Tandem-Linac Accelerator System (ATLAS) at Argonne National Laboratory is being upgraded with eight new superconducting (SC) cavities and a new cryomodule. The new cryomodule will replace an existing ATLAS cryomodule at the high energy end of the accelerator. By utilizing advances made by the TESLA group in cavity processing and assembly techniques, along with the new ANL SC cavity design, this single cryomodule will provide an additional 15 - 20MV of accelerating gradient to the ATLAS accelerator. This paper will discuss the new cavity design and performance, the processing techniques and features of the new cryomodule design.

The HITRAP Decelerator Project at GSI

O. Kester, L. Dahl, S. Eliseev, F. Herfurth, S. Heinz, H.-J. Kluge, C. Kozhuharov, G. Maero, W. Quint, Gesellschaft für Schwerionenforschung, Planckstr. 1, 64291 Darmstadt, Germany

U. Ratzinger, A. Schempp, B. Hofmann, A. Sauer, Institut für Angewandte Physik, J.W. Goethe-Universität, Frankfurt, Germany
for the HITRAP collaboration

The heavy ion trap (HITRAP) linac will decelerate highly charged ions up to U^{92+}, provided by the GSI accelerator facility at 4 MeV/u, down to 6 keV/u. The highly charged ions will be subsequently injected into a large Penning trap for beam cooling purpose. Therefore the HITRAP facility will provide unique beams of approximately 10^5 highly charged ions at very low energies for atomic physics experiments. The HITRAP decelerator LINAC employs a double drift buncher (DDB) for phase focusing, an interdigital H-type (IH) structure and a 4-rod RFQ. A subsequent de-buncher will reduce the final energy spread in order to improve the injection efficiency into the cooler trap. The lay-out of the decelerator, beam dynamics calculations and the present status will be reported.

ALPI Upgrading

Giovanni Bisoffi

Abstract
In the last years all the 44 medium beta ALPI cavities had their Pb superconducting layer replaced by Nb, thus increasing the average accelerating field from 2.4 to 4.4 MV/m. Moreover the refurbishing of the ALPI cryogenic lines feeding the low energy section, allows now to maintain reliably cool its low beta, bulk Nb cavities. ALPI is now full operational and it is ready to accelerate the PIAVE beams, its new positive injector, which successfully started to deliver the first beams in December 1994.

RADIOACTIVE BEAMS FROM ^{252}CF FISSION USING A GAS CATCHER AND AN ECR CHARGE BREEDER AT ATLAS

Richard C. Pardo

for

Guy Savard, E. Frank Moore, Adam A. Hecht, and Sam Baker

Argonne National Laboratory, 9700 S. Cass Avenue, Argonne, IL 60439

An upgrade to the radioactive beam capability of the ATLAS facility has been proposed using ^{252}Cf fission fragments thermalized and collected into a low-energy particle beam using a helium gas catcher. In order to reaccelerate these beams an existing ATLAS ECR ion source will be reconfigured as a charge breeder source. A 1Ci ^{252}Cf source is expected to provide sufficient yield to deliver beams of up to ~10^6 far from stability ions per second on target. A facility description, the expected performance and the expected performance will be presented in this paper. This work is supported by the U.S. Department of Energy, Office of Nuclear Physics, under contract W-31-109-ENG-38.

Far-Field Electrodes for a 3 Frequency Gridded Buncher

D Weisser, N Lobanov and A Rawlinson

Nuclear Physics Department
Research School of Physical Sciences and Engineering
Australian National University
Canberra, AUSTRALIA

RF fields imposed between a pair of grids that the beam traversed can bunch heavy ion beams. The RF experienced by the beam as it approaches the first grid will also modulate the beam energy and can disrupt the desired energy modulation. In this far-field region, the disruption can be minimised if the beam experiences several RF cycles during its approach so that the average modulation is near zero. Specially designed electrodes can achieve this. The design must balance the extension of the field with minimising the added capacitive loading

ANU EME Lab Report

Fred Johnson
Electronic Materials Engineering
The Australian National University,
Canberra, Australia

The Electronic Materials Engineering (EME) Department conducts interdisciplinary research in the areas of condensed matter physics, materials science and device engineering. The Ion-Beam Modification and Analysis of Materials research subgroup carries out fundamental studies of ion-solid interaction processes, materials science studies employing ion-irradiation and/or ion-beam analysis. These studies employ the Department's accelerator facilities that include, a high-energy, high current ion-implanter (1.7 MV terminal potential), a low energy (150 kV) ion implanter, and a separate tandem accelerator (1.7 MV terminal potential) for ion beam analysis.

This report will outline the equipment and technical issues arising at the implanter laboratories of the EME Department.

Ion Optics Calculations for a Continuous-Flow Accelerator Mass Spectrometry System

M.L. Roberts, B.X. Han, and K.F. von Reden,

National Ocean Sciences AMS Facility
Woods Hole Oceanographic Institution
Woods Hole, MA 02543, USA.

E-mail address of main author: mroberts@whoi.edu

The National Ocean Sciences Accelerator Mass Spectrometry (NOSAMS) facility at Woods Hole Oceanographic Institution is constructing a system for the analysis of ^{14}C in a continuously flowing stream of carrier gas. A key component of the system is a gas-accepting microwave-plasma source coupled to a magnesium vapor charge exchange canal. The gas ion source/charge exchange canal combination is capable of producing up to 80 μA of C^- ions from 250 μl/m of CO_2 gas. However, when compared to a beam from a typical cesium sputter source, the beam from the gas source/charge exchange canal combination is characterized by large emittance (80 to 140 π mm mrad at 30 keV) and large energy spread (+/- 300 eV at 30 keV). For high efficiency transmission, a large-acceptance, energy-achromatic Accelerator Mass Spectrometry (AMS) system has been designed and is in the process of being constructed. Details of the ion optics of the system will be presented.

A Modification to the ANSTO HVEE 846B Ion Source, High Voltage Platform

David Garton, Kevin Ansary and Peter Drewer

Institute of Nuclear Geophysiology
Australian Nuclear Science and Technology Organisation (ANSTO)
Sydney, Australia

Stable ion beams from the ANTARES HVEE 846B ion source are dependent on the electrical and mechanical stability of the high voltage platform. The ion source is required to maintain acceleration voltages of up to 90 kV but in recent times the high voltage platform has begun to show significant electrical breakdown. The breakdown has directly influenced beam stability and effective repairs and preventative maintenance to reduce this have become unsustainable due to the age and design of the platform. In order to maintain the long term high performance of the ion source, a new high voltage platform is being developed. Based on conventional air insulation techniques, the new platform incorporates some innovative engineering design features that will reduce the potential difference between the various biasing voltages and significantly reduce the onset of corona and spark discharges. An overview of the problems faced and solved with the original design and details of the new design are discussed.

Search for Strangelets in Lunar Soil Using the Tandem Van-de-Graaff Accelerator at WNSL, Yale

Alexei Chikanian[1], Evan Finch[1], Ke Han[1], Richard Majka[1], Jack Sandweiss[1]
Jeffery Ashenfelter[2], Andreas Heinz[2], Peter Parker[2]
Peter Fisher[3], Benjamin Monreal[3]
Jes Madsen[4]

[1]High Energy Physics Group, Yale University
[2]Wright Nuclear Structure Lab, Yale University
[3]Physics Department, MIT
[4]University of Aarhus, Denmark

A wide range of experimental searches for strangelets (Strange Quark Matter with the baryon number A less than 10^6) have been conducted since Witten[1] postulated the existence of Strange Quark Matter. However, none of these experiments, including terrestrial searches, accelerator searches, and the Alpha Magnetic Spectrometer 01 experiment (AMS-01) could give a definite answer to its existence. Our experiment aims to search for strangelets in lunar soil, whose expected strangelet concentration, 8×10^{-17}, is much higher than that on earth. The lunar soil sample is analyzed through the tandem Van-de-Graaff accelerator at Wright Nuclear Structure Laboratory (WNSL), Yale University. The accelerator together with our own designed detection system enables us to identify strangelets at a level of less than 1 per 10^{17} atoms.

1. E. Witten, Phys. Rev. D, **30**, 272 (1984).

Development of AMS program at Nuclear Science Centre*, New Delhi, India

(*Presently known as Inter University Accelerator Centre)

Pankaj Kumar[1], J K Pattnaik[2], K S Golda[1], K Devarani[1], S Ojha[1], S Gargari[1], R Joshi[1], T Nandi[1], A Mandal[1], S Chopra[1] and S K Datta[1]

(1) Inter University Accelerator Centre, Aruna Asaf Ali Marg, P.O. Box 10502, New Delhi, India

(2) Department of Earth Sciences, Pondicherry University, Pondicherry, India

The 15UD Pelletron accelerator at NSC, New Delhi is being developed for Accelerator Mass Spectroscopic studies in addition to usage in basic Nuclear Physics, Material Science, Atomic Physics, Radiation Biology etc. The new additions to the facility, for AMS studies, include multi cathode ion source remotely controlled by software, recirculating turbos at the terminal for gas stripper, an offset Faraday cup after analyzer magnet, and dedicated AMS beam line. AMS beam line is equipped with Wien filter, a quadrupole doublet, double slit and multi-anode gas ionization detector. A maximum transmission of 19% has been achieved with gas + foil stripper with injected $^{9}Be^{16}O^{-}$, and $^{9}Be^{3+}$ current measured after analyzer magnet at a terminal potential of 11MV. The measurement of ^{10}Be was performed using simultaneous injection method by injecting mass 26 ($^{10}Be^{16}O^{-}$ & $^{9}Be^{17}O^{-}$) and by indirectly measuring ^{9}Be through $^{17}O^{5+}$ measurement at the offset Faraday cup. A gas cell absorber is used before detector to stop ^{10}B. Results obtained in our lab agree within 5% to known measured values for SRM 4325, with which cathodes were prepared. A description of the facility, experimental technique and the results obtained will be presented.

A Modified RF Ion Source with a Ceramic Bottle

M. Friedrich, Forschungszentrum Rossendorf, Institute of Ion Beam Physics and Materials Research, P.O. Box 510119, D-01314 Dresden, Germany

The generation of negative He ions for acceleration at a tandem accelerator requires an ion source with alkali vapor charge exchange canal. The diffusion of the Li or Rb vapor into the surrounding vacuum chamber limits the operation time of the ion source and increases the necessary maintenance. On the other hand, the modified rf ion source at the Rossendorf single ended 2 MV Van de Graaff accelerator has a life time of some thousands hours. The installation of this ion source inside the terminal of the Rossendorf 5 MV tandem accelerator would allow high-energy implantation of He ions in the energy range of 1-5 MeV without the difficulties of the charge-exchange canal. To reduce the risk for breaking of the ion source glass bottle under the pressure of the insulating gas a ceramic source bottle has been tested. First results of its operation at the 2 MV VdG are presented.

Rf Ion Source Coupling/Decoupling Problems

Roland Szymanski

Abstract

Since the upgrade of our 5U pelletron accelerator we have also been aiming to improve the brightness of our Rf ion source. We have managed to make some improvement but in doing so have come across a rf coupling problem that is hindering real brightness measurements.

Status of the Ion Sources at the ISL and their Application for Eye Tumor Therapy

P. Arndt, H. Homeyer, H. Kluge, J. Röhrich, T. Winkelmann
Hahn-Meitner-Institute Berlin
Glienicker Str. 100
Berlin, Germany 14109

Over the last year, operations of the injectors were very stable and reliable without unscheduled shutdowns, in particular for the proton beam necessary for the eye tumor therapy.

Before I go into detail of the eye tumor therapy and their successful development, I talk about the installation of the new 150kV High-Voltage Platform and their first results.

A Large Acceptance Analysing Magnet for ECR sources

A.Mandal[1], G.Rodrigues[1], D.Kanjilal[1], Peter Brodt[2] and Franz Bodker[2]

[1]Inter University Accelerator Centre, New Delhi, India
[2]Danfysik, Jyllinge, Denmark

Abstract

A large acceptance analysing magnet has been designed to analyse highly charged ions from a HTS ECR ion source called PKDELIS [1] at the Inter University Accelerator Centre (formerly Nuclear Science Centre), New Delhi. The large emittance (~ a few hundred p.mm.mrad) as well as the space charge forces present in the mutli-charged beam extracted from ECR poses a challenge in the design of Low Energy Beam Transport System. A combined function magnet has been designed to incorporate multipole correction in both horizontal and vertical planes to minimise higher order aberrations.For double focussing, the entrance and exit shim angles have been optimised including the gap effect. The special cylindrical shape of the entrance and exit faces and proper multipole field components in the horizontal plane helps to minimise higher order aberrations in both planes. Standard simulation programs like GIOS,TRANSPORT and COSY INFINITY have been used to optimise the optical design parameters.Hardware design and fabrication have been done in collaboration with DANFYSIK, Denmark.Vector Fields simulation program Opera 3D was used in the hardware design of the magnet.Since the analysing magnet will be operated on a high voltage platform, the magnet and associated power supply are designed to be air-cooled. Special care has been taken in the design of the magnet to have minimum weight, good acceptance and moderate mass resolution. The details of the design and fabrication will be discussed in the paper. The magnet has been tested with a Hall probe placed on a precision 3 D position scanner and the test results agree well with the design values.

[1] C.Bieth et al., Nuclear Instruments and Methods in Physics Research B, Vol.235, p.498;D.Kanjilal et al.,Proceedings of 16th International Workshop on ECR Ion Sources, Berkeley, 2004

Rebuild Your Magnet Power Supply

A Kern
Dept. of Physics – MS 5252
Western Michigan University
Kalamazoo MI 49008-5252

Abstract: At last year's SNEAP meeting, I presented a talk about my efforts to rebuild the output transistor bank of our Switching Magnet power supply. My talk will provide specific details about the rebuilding project as well as other improvements incorporated into the final design. Additionally, I will make available schematics, circuit board artwork, drawings and photos.

Yale Accelerator Labor Eliminator "YALE"

Jeff Ashenfelter, Tom Barker, Craig Miller, Dick Wagner

Since the installation of the ESTU at the Wright Nuclear Structure Laboratory we have had to go into the ESTU to pick up a spark gap, piece of string from a drive belt, a bit of Lucite, and other debris that has settled on the tank floor causing the accelerator to spark and run in an unstable condition. Most of this debris was harmless but prevented the accelerator from running at its highest potential. The entry to remove this debris caused a two day delay in operations. We at WNSL have developed a 4-wheel drive platform to which a rotating brush and pan have been attached. Also on the platform is a camera in which the accelerator floor and the debris can be observed. The four wheel motors, brush motor and camera are controlled from outside the accelerator, thus eliminating any electronics that could be damaged during a discharge within the accelerator. The YALE is attached via a multi-conductor cable to a spool that holds 100 feet of cable; this allows the platform to check the entire length of the accelerator floor. When the YALE is not in use it will reside in an Aluminum house located in the low energy end.