Electrostatic Accelerators – Present and Future

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“HIAT” History

- *International Conference on the Technology of Electrostatic Accelerators*
  - Daresbury 1973
- *International Conference on Electrostatic Accelerator Technology*
  - Strasbourg 1977 - Oak Ridge 1981
- *International Conference on Electrostatic Accelerator Technology and Associated Boosters*
  - Buenos Aires 1985 - Strasbourg / Heidelberg 1989
  - Legnaro / Padova – 1992
- *International Conference on Heavy Ion Accelerator Technology*
  - Canberra 1995 - Argonne 1998 - New Delhi 2002
  - Brookhaven 2005 (SNEAP – HIAT) - Venice 2009

Lab	Abbreviation	Respondents	e-mail address
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Argonne	ANL	Richard Pardo	Richard pardo <pardo@phy.anl.gov>
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Survey Responses

Category	Past few years	Next few years	Wish list
Power supplies & Vac Equipment	Yal, MPI, ANS, TIF, BNL, ANU, ORN, FSU, MLL	Yal, ANS	Yal, MPI, ANS
Accel Tubes HVEC VIVIRAD	FSU, IRM, Mic		LNS, LNL
Accel Tubes NEC	JAE, MPI		ORN
Voltage grading	LNL, MPI, TIF, San	USP, IUA	MPI, TIF, IUA
Computer control upg	ANS, MLL, MPI, ANS, TIF	FSU, ANU, IRM, Pur	BNL
Beam pulsing	IUA	TIF, FSU, USP, ANU, Yal	
Positive ion source	ANL, LNL, BNL	ANL, LNL, BNL	
ECR Terminal	JAE	JAE, IRM,	Yal, Mel, HFI
High vlotage deck	HMI, CIA, ANS, MPI	HMI, CIA	
LINAC expand	CIA	CIA	FSU, San, JAE
Replace/Add El Accel		ANS	Mel, Mic, NOS, IRM
Pellet chains	San, Yal		Wei, IUA
RIB accelerator	LNS, ORN, CIA	LNS, ORN, CIA	Yal, JAE
RIB recoil	FSU, Pur	FSU, Pur, ANU	Yal

3 Keys to success

1. excellent technical staff
   - competence, commitment and innovative spirit
2. scientific staff quality
   - status in the international physics
   - productivity built upon the competence of their home accelerator
   - nimble response to changing science priorities
   - clever exploitation of the strengths in local equipment and personnel.
3. close collaboration between the scientific and technical staff.

Consolidation[10]

- Power supplies
- Vacuum gauges and electronics
- Accelerator tubes
- Charging systems – belts => chains
- Corona points => resistors
- Computer control systems
- Beam pulsing
- Terminal ECR

Nuclear Physics %

100%

0%

- FSU, IRM, ORN
- LNL
- LNS, Yal
- ANU
- TIF
- JAE
- BNL, IUA
- MLL
- HPI, Pur, Mic, San, Wei, HFI, NOS

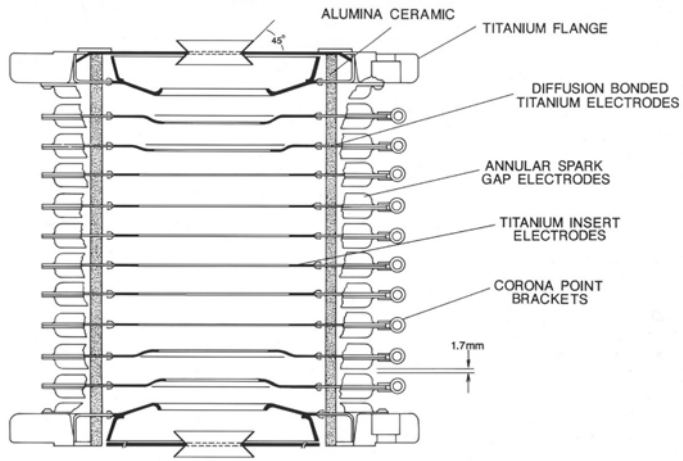
Reliability

- **Tech Staff quality: mentioned by a few**
- **Modernize electrical equipment - everyone**
- **Improve voltage grading – LNL, MPI, TIF, San, USP**
- **Replace/process accelerator tubes – JAERI, MPI**
- **Laser ablated stripper foils - BNL, IUA, ANU**
- **Conservative terminal voltage – Heidelberg**
- **Terminal magnet coils replacement - JAERI**
- **Terminal ion source – no stripper foil limits - JAERI**

Accelerator Tubes

- High Pressure water cleaning
  - S. Takeuchi, T. Nakanoya,, H. Kabumoto, T. Yoshida, Nucl. Instr. and Meth. A 513(2003)429-438.
- Superconducting RF
  - Clean rooms

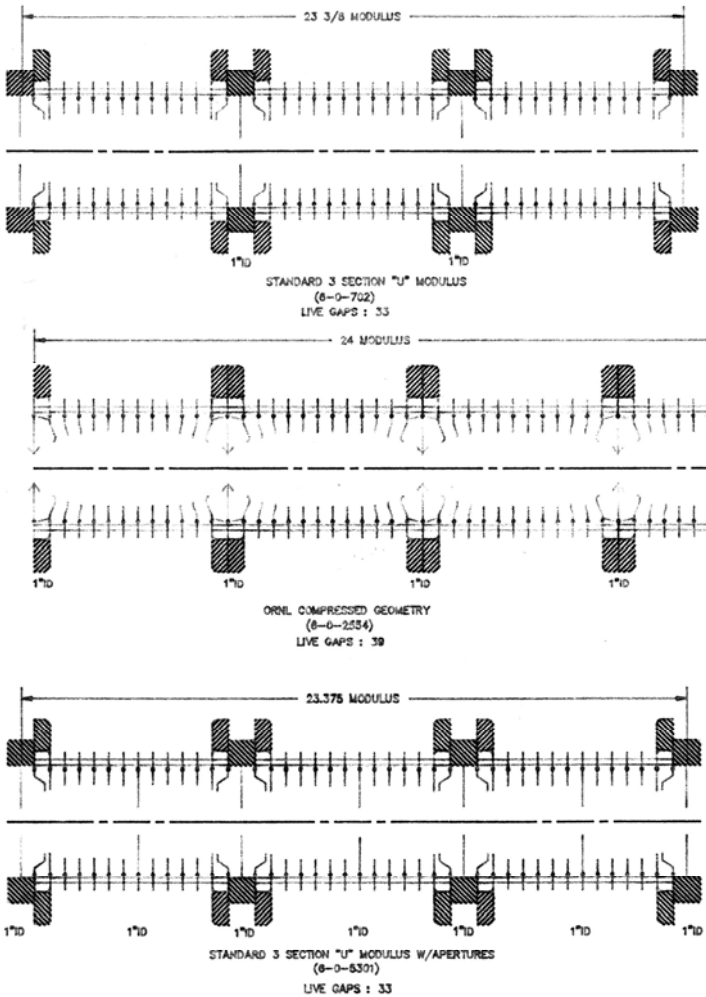
National Electrostatics Corp.



Accelerator Tubes 2

- NEC adopted in manufacture
  - Installation and maintenance: weak point
- Compressed Geometry =
- Extended tubes
- 30 kV/2.5cm

NEC Accelerator Tubes – “always a work in progress”



Flexibility

BNL - RHIC injection

Heidelberg – Storage ring

Experimental Equipment Development

Heidelberg – EBIT, Ion Trap, Cryo-Storage Ring

FSU – RIB SLR energy homogenizer

Notre Dame & São Paulo – RIB - Dual SC solenoids

ANU – RIB – SC solenoid

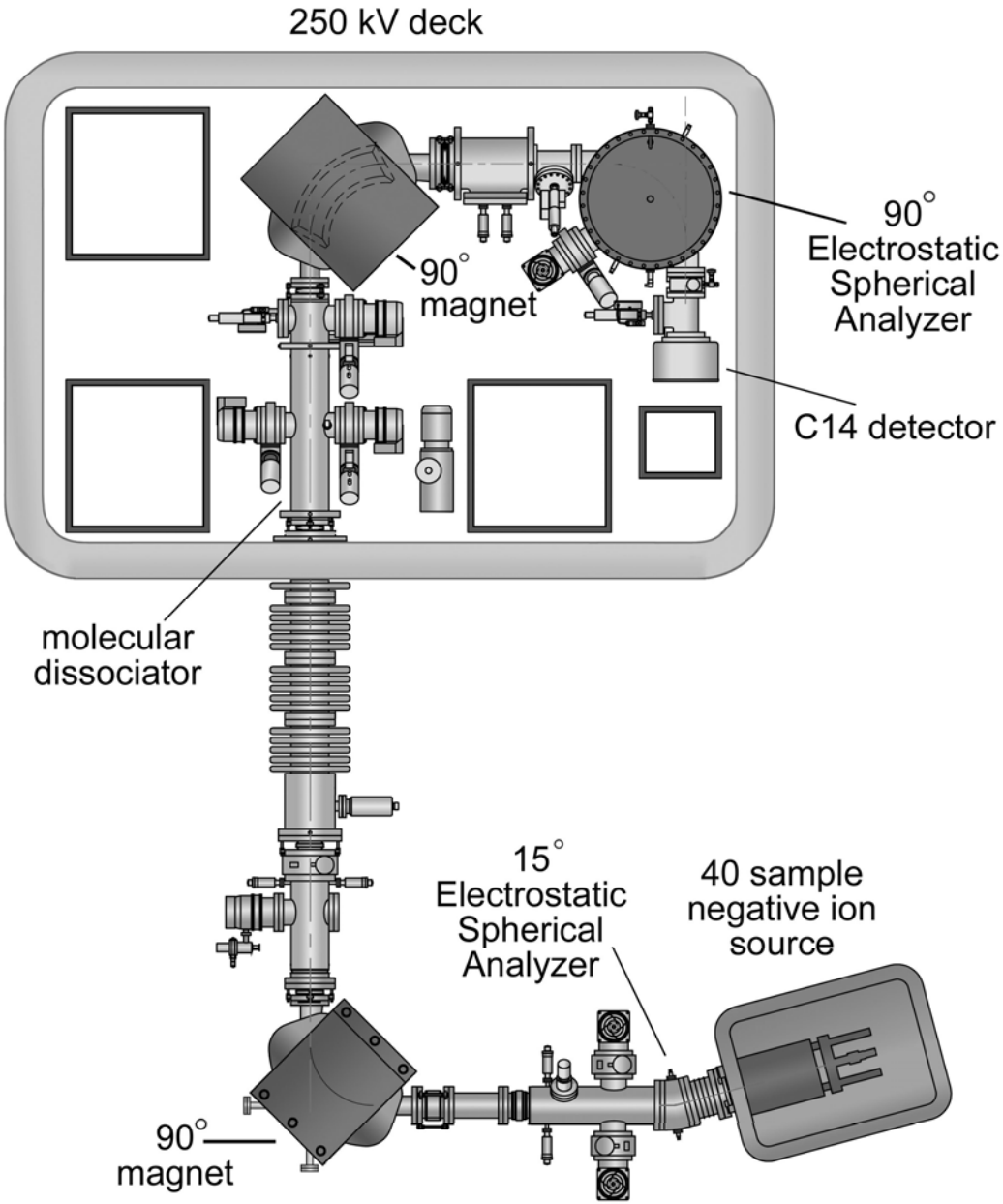
Wish List

- LINAC expansion
- Accelerator replacement
- Recoil RIB
- Accelerator RIB

AMS - Innovations

- Molecules
  - $^{12}CH_2$ and ^{13}CH interfere with ^{14}C detection
  - dissociated in stripper gas 250 keV

- SSAMS NEC
- MICADAS Zurich



Courtesy of National Electrostatics Corp.

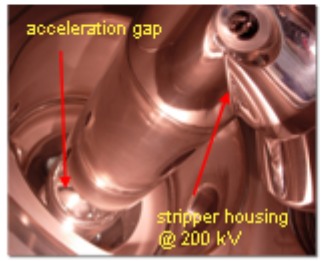
J. B. Schroeder, T. M. Hauser, G. M. Klody, G. A. Norton, R. L. Loger, R. L. Kitchen and M. L. Sundquist, Nucl. Instr. and Meth. B240 (2005) 463-467

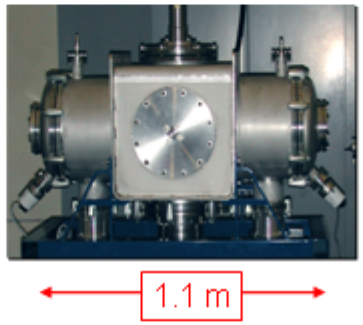
Mini Carbon Dating System (MICADAS)

Laboratory of Ion Beam Physics ETH

Source

Tandem Accelerator Unit





Special features

- *Vacuum insulated high voltage platform*
- *Two gap lenses*
- *Commercial 200 kV power supply*

Destruction of molecules

- *Gas stripper density ≈ 2 μg/cm2 N_2*
- *Multiple ion gas collisions*
- *Charge state 1+*

H. Synal, M.Stocker, M. Suter, Nucl. Instr. and Meth B 259 (2007) 7–13.

Summary

- Reliable flexible injectors
- Evolution of science areas
- Return of terminal ion sources
- AMS – 200 to 500 kV