



The Light Ion Guide CB- ECRIS Project at Texas A&M University Cyclotron Institute

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Project overview

Cyclotron Institute Texas A&M:

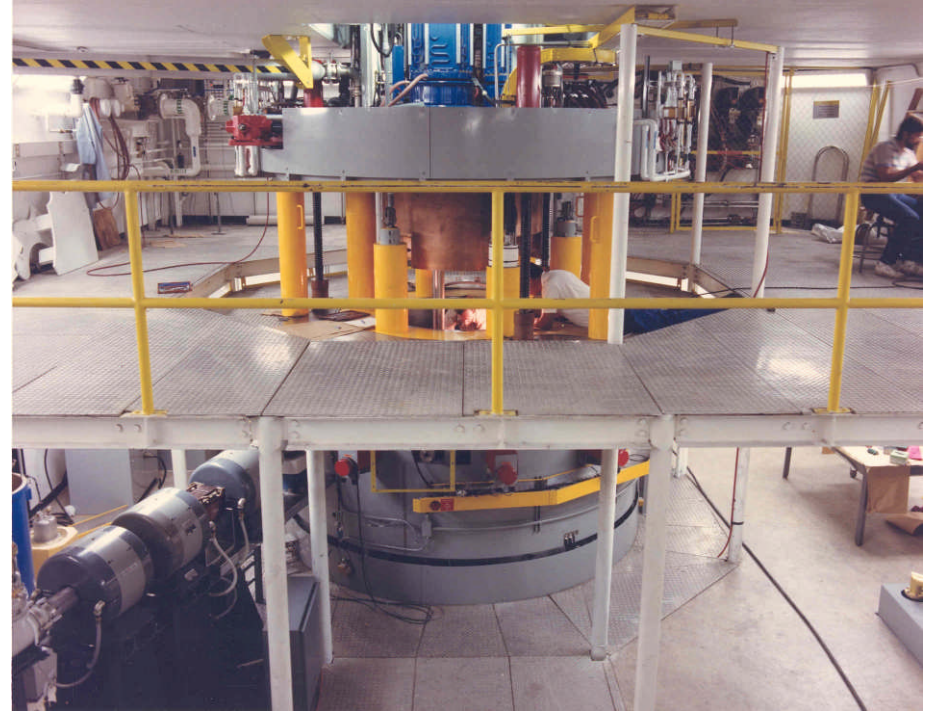
- 88" Cyclotron (decommissioned 1986)

- K500 Superconducting Cyclotron

Upgrade started 2004 → full speed 2005

Re-activation of 88" Cyclotron – deliver high intensity light particle and heavy ion beams.

Production of rare isotopes for acceleration in K500 Superconducting Cyclotron and higher intensity stripping and fragmentation beams.





Scientific program

1. Nuclear Astrophysics:

- a. Radioactive beams from K500: Asymptotic Normalization Coefficients method
- b. Stable beams from 88": ($^3\text{He}, d$) reactions and MDM spectrometer

2. Nuclear Structure:

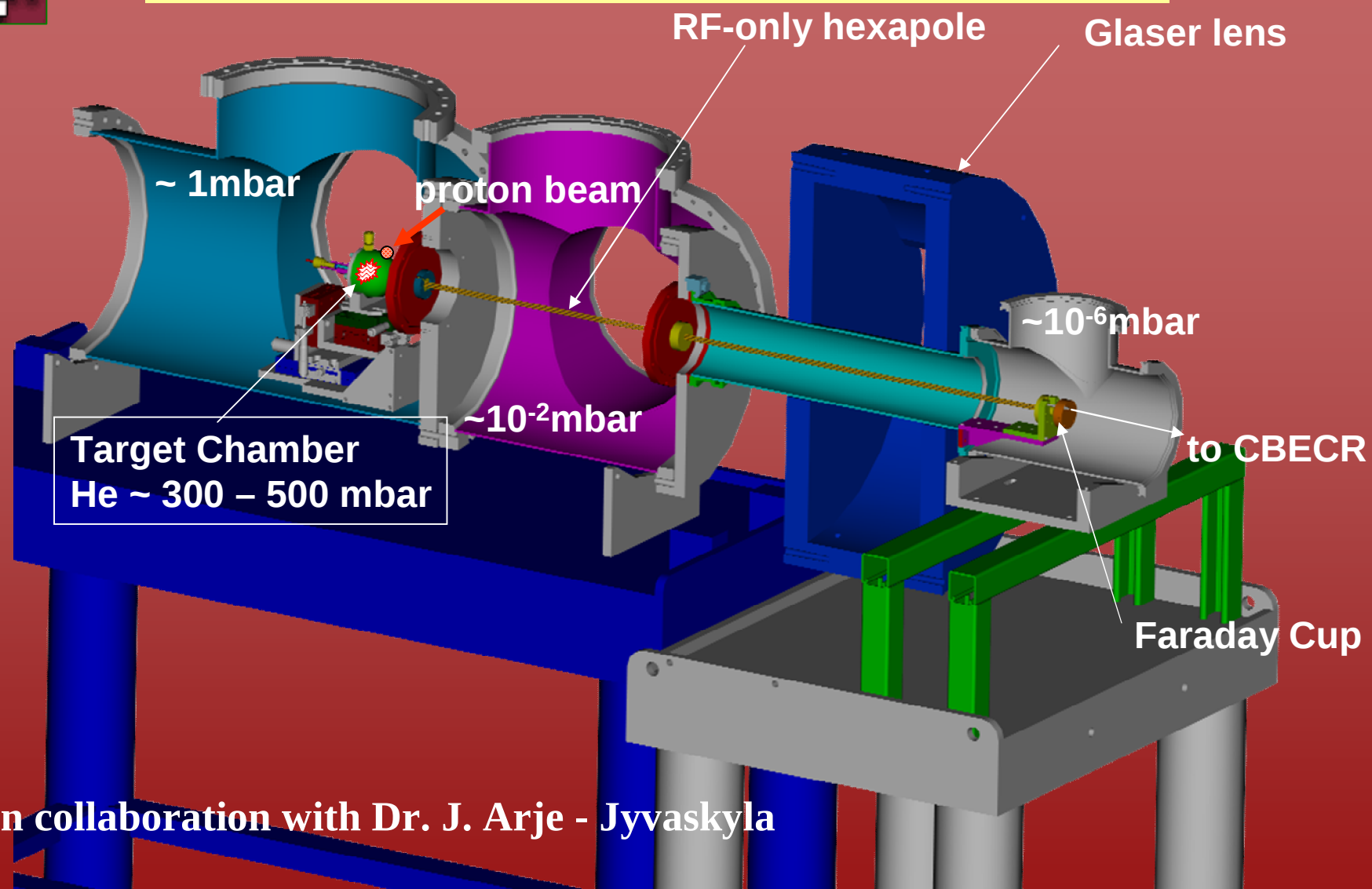
- a. Giant Monopole Resonance and Compressibility: GMR as a nuclear structure effect and compressibility in nuclei with much higher asymmetry
- b. Cluster Structure: radioactive beams and thick target inverse kinematics technique

3. Fundamental Interactions: superallowed β -decay measurements

4. Nuclear Dynamics and Nuclear Thermodynamics



The Light Ion Guide

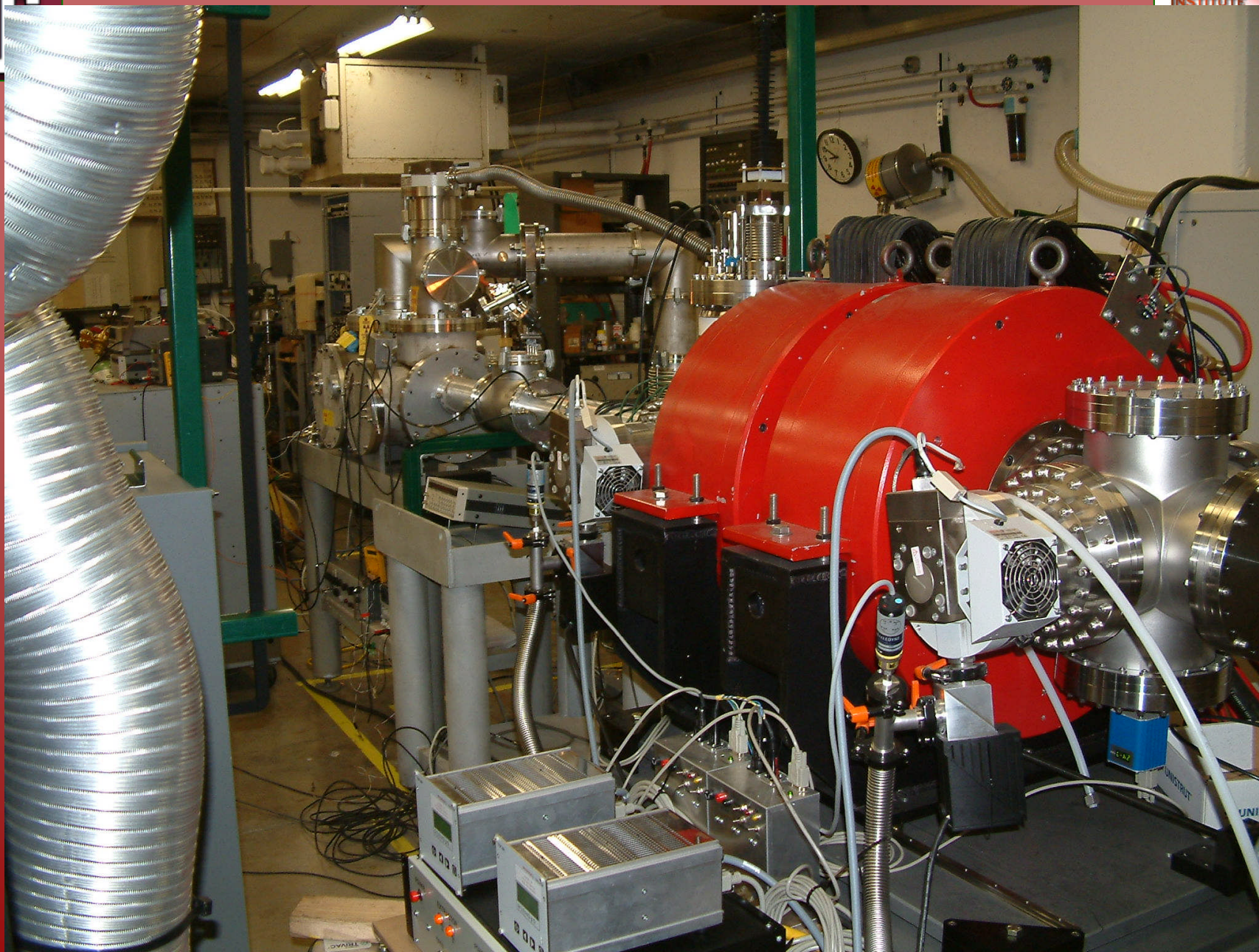


In collaboration with Dr. J. Arje - Jyvaskyla

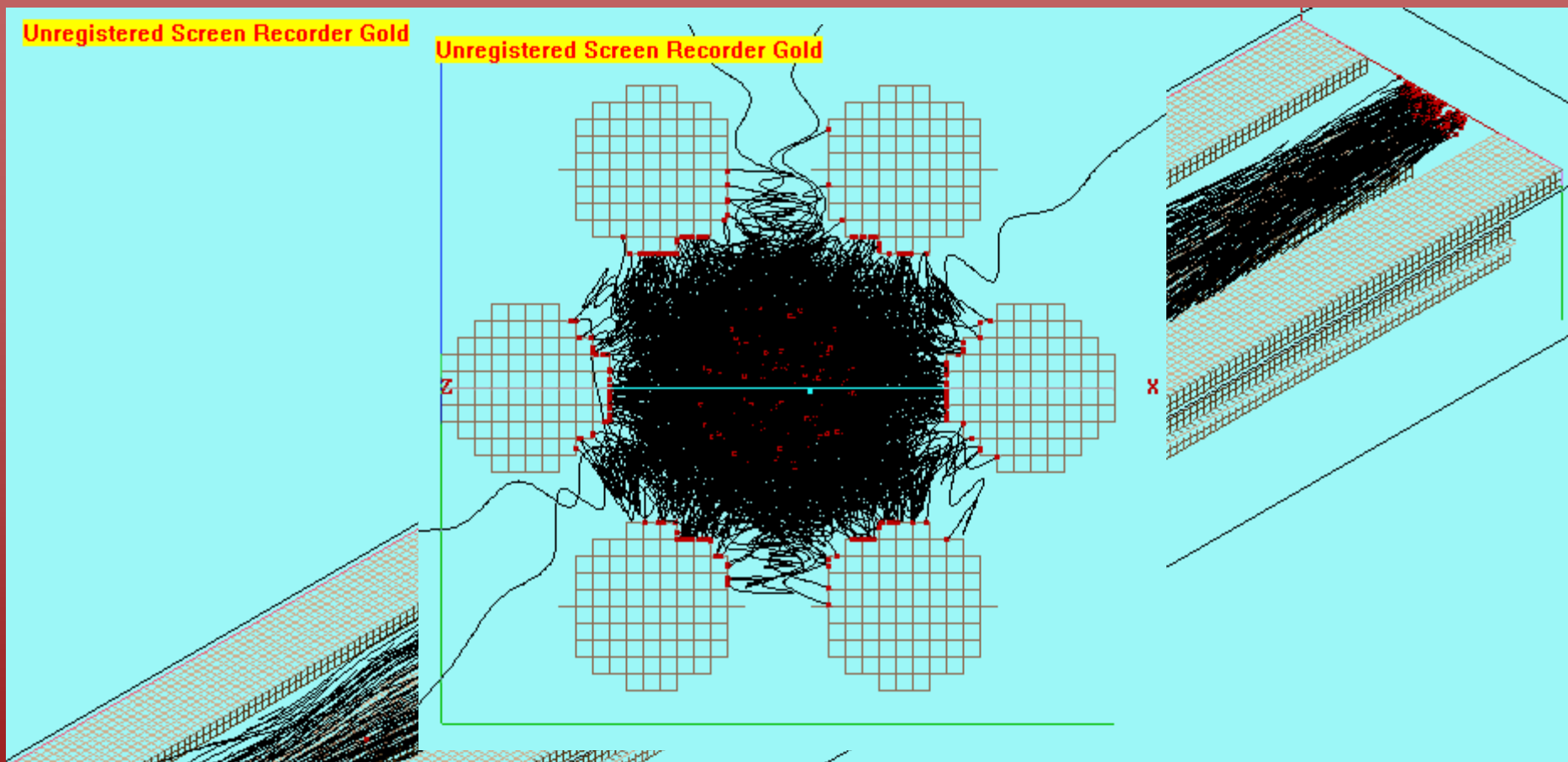


Projected beam intensities from LIG after K500

(p,n)	Max Energy	Intensity
Product ($T_{1/2}$)	MeV/A	particles/s
^{27}Si (4.16s)	57	4×10^4
^{50}Mn (0.28s)	45	1×10^5
^{54}Co (0.19s)	45	4×10^4
^{64}Ga (2.63m)	45	2×10^5
^{92}Tc (4.25m)	35	2×10^5
^{106}In (6.20m)	28	4×10^5
^{108}In (58.0m)	28	2×10^5
^{110}In (4.9h)	26	4×10^5



The RF-only hexapole



SIMION calculations ~ 80% efficiency for 250 cm long sextupole



Details – Light Ion Guide

Parameters: exit hole diameter (1 mm and 2 mm), pressure, DC-fields, distance between the exit hole and the sextupole, etc ...

Pumping system (Pfeiffer):

- **ROOTS blower 1:** 2000 m³/h (+ 6000 m³/h – online condition)
- **ROOTS blower 2:** 1000 m³/h
- **Turbo pumps:** 520 l/s + 2× 520 l/s (CB-ECRIS)

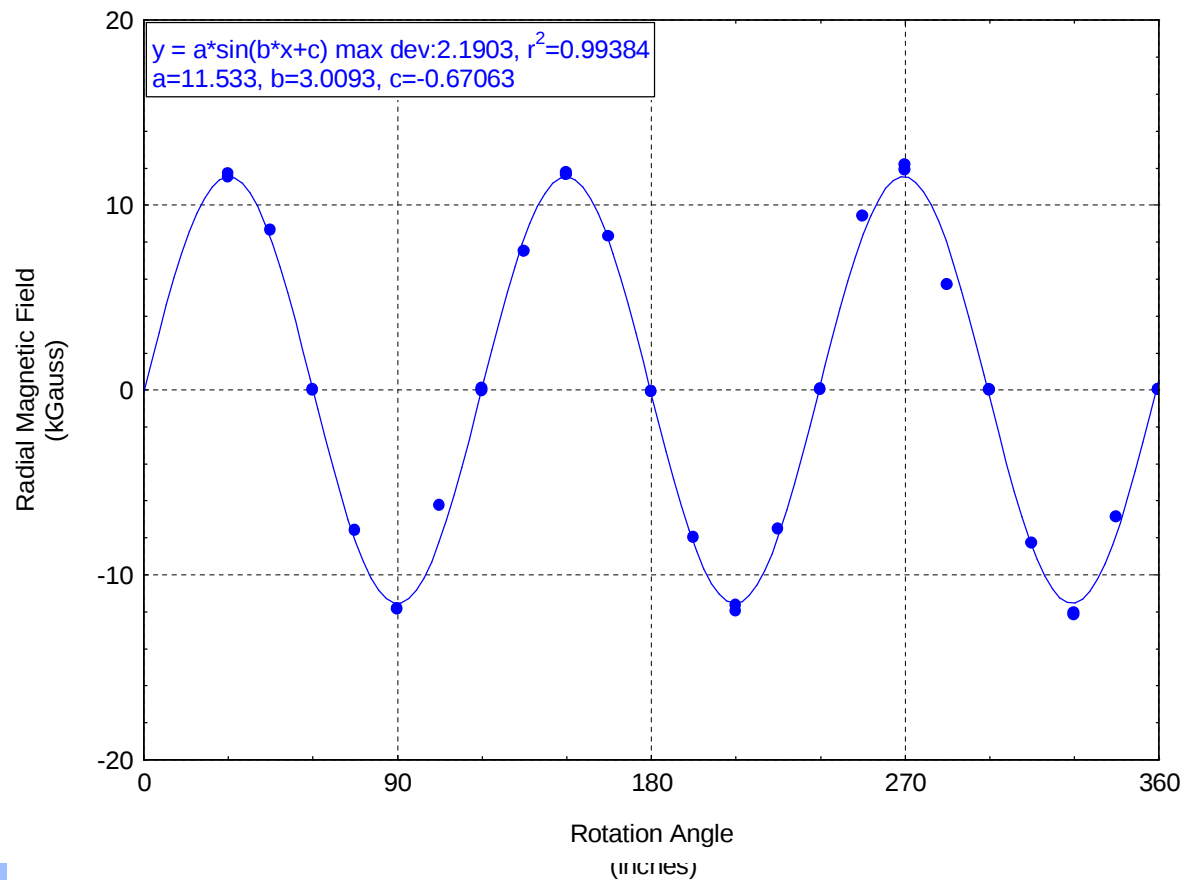
Initial developments:

- **spark chamber** (ionization of impurities, He) → current
- **²²⁸Th open source** (daughters) → alpha particles from ²¹⁶Po



Details – CB-ECRIS

TAMU Sextupole
Initial QA Checkout
5-JAN-07



Artificial Solutions

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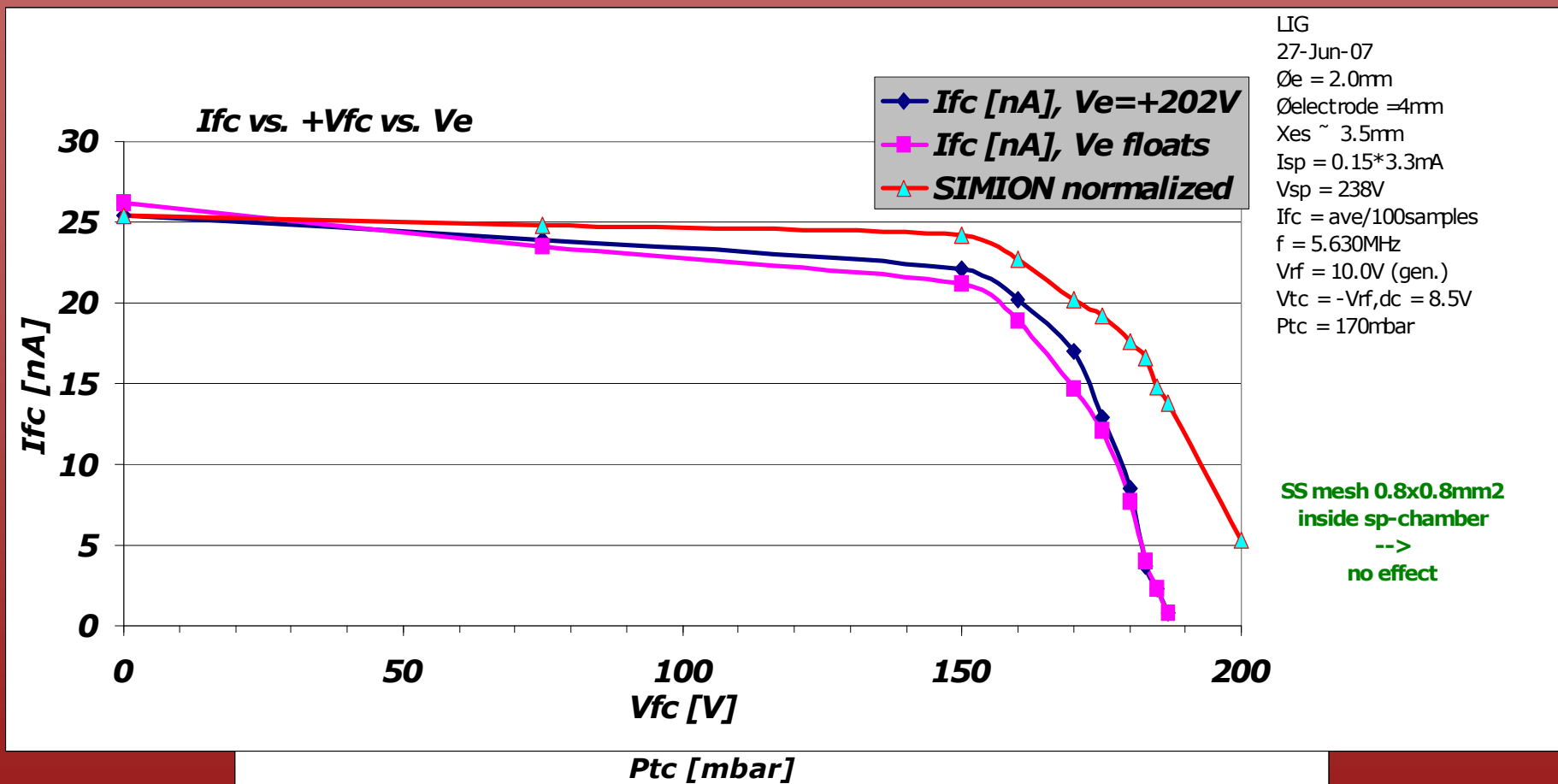
SS !!!

Electrodes
for
injection

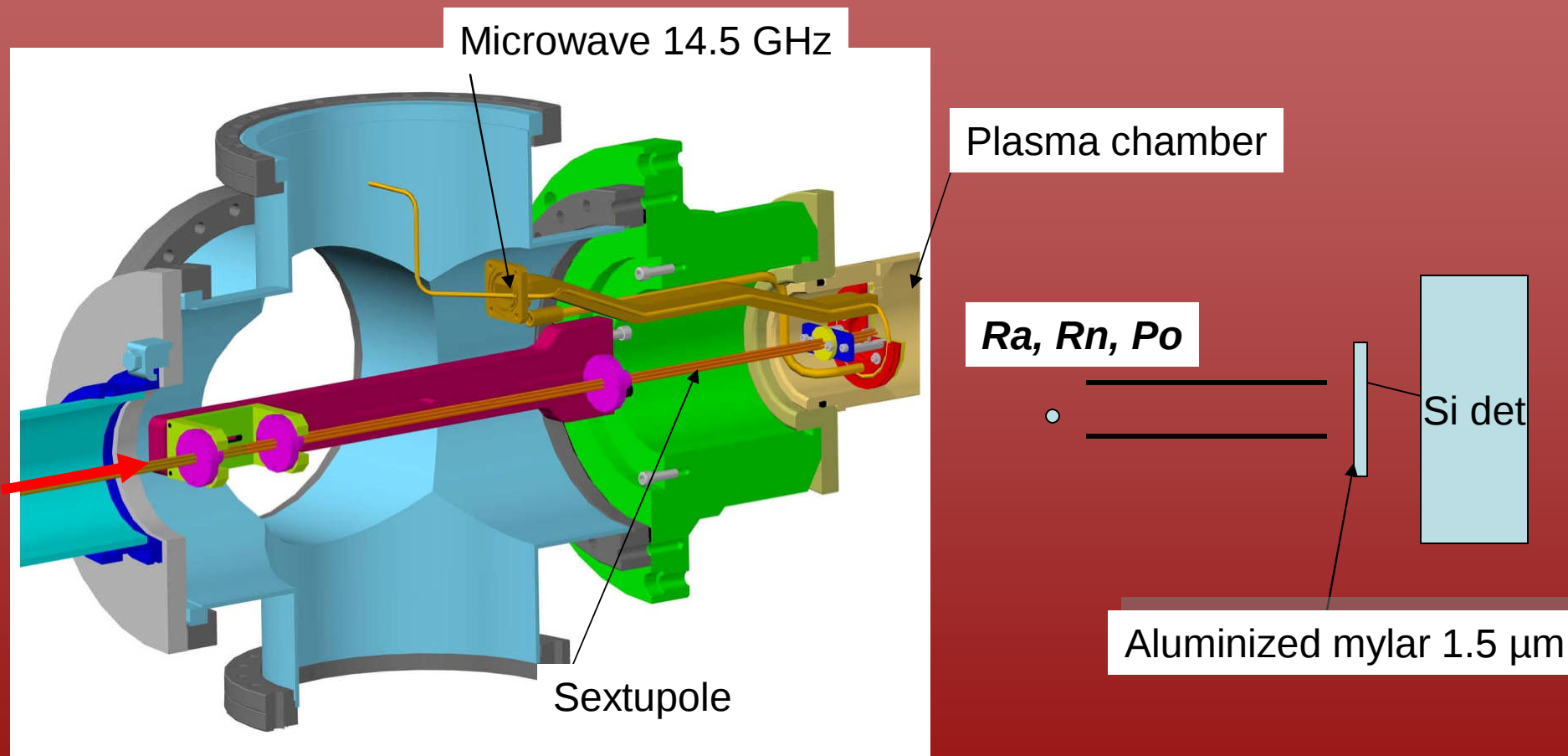
hexapole



Tests – spark chamber

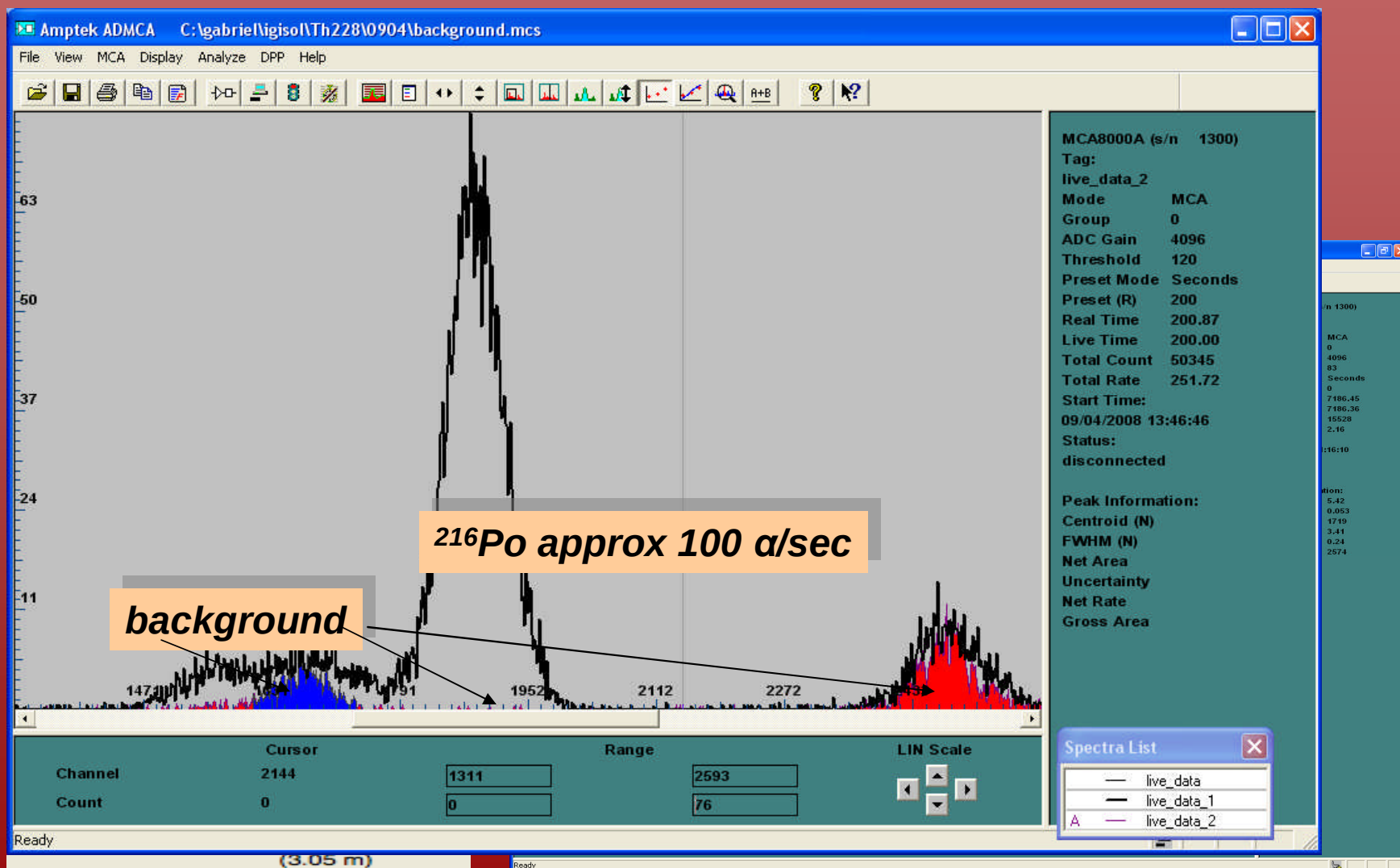


Tests – ^{228}Th open source



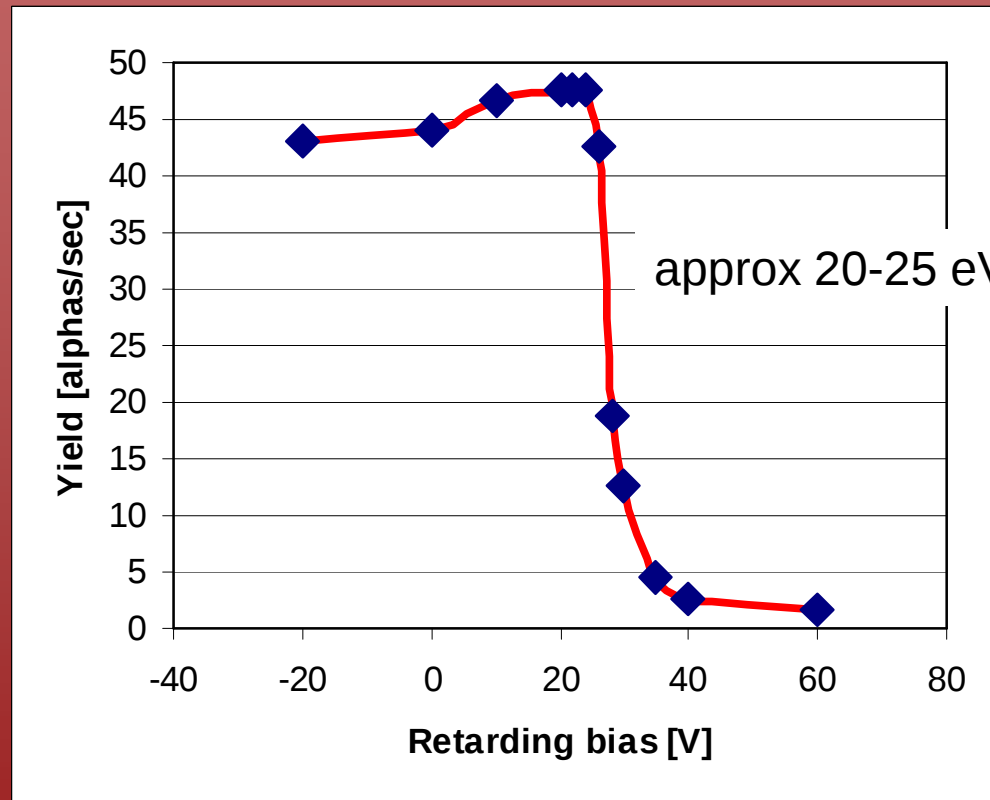


Tests – ^{228}Th open source





Velocity of the ions



Q: Is this velocity appropriate for an efficient injection in the CB-ECRIS?



Future plans

- ☐ CB-ECRIS to be turned on in the next weeks
 - TWT – max 400 W
 - coils at 250 A
 - plasma?!
- ☐ Inject Ra, Rn, Po
- ☐ Detect alphas at the extraction

- ☐ IF *success* GOTO *Improve_Efficiency*
ELSE
Find Stable Conditions for CB-ECRIS

- ☐ Measure the overall efficiency of the device



Upgrade Team

Dr. R.E. Tribble - director



Dr. H. Clark – Project Manager



Managers



K150 – Re-commission

*F. Abegglen – Operation Chief
H. Peeler – Research
Instrumentation*



*Light Ion Guide &
Heavy Ion Guide*

*Dr. G. Tabacaru
Dr. G. Chubaryan
Dr. G. Souliotis*

*Radiation issues &
Beam dump*

Dr. G. Tabacaru



*CBECR &
New beam lines*

*Dr. D. May
Dr. G. Kim*

Thank you!