STATUS OF THE TEXAS A&M CYCLOTRON INSTITUTE

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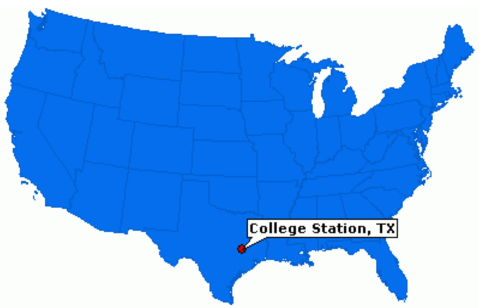
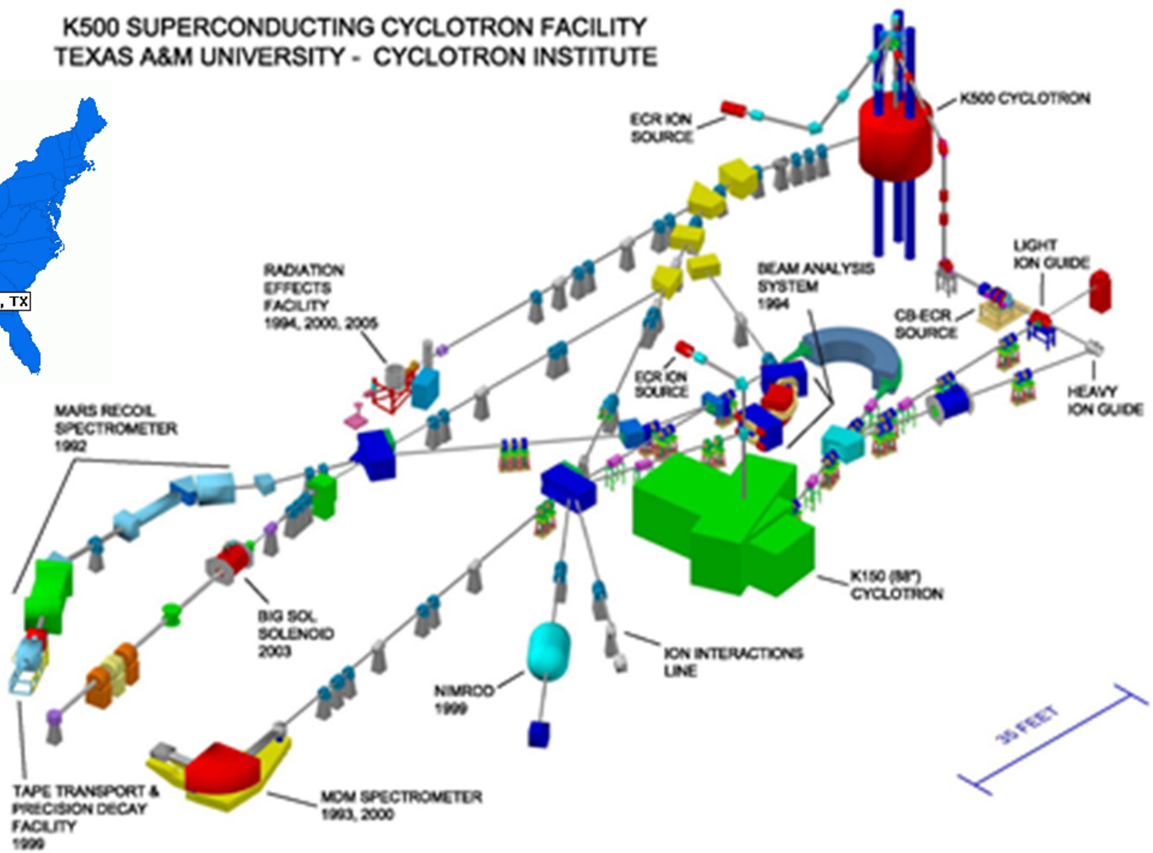
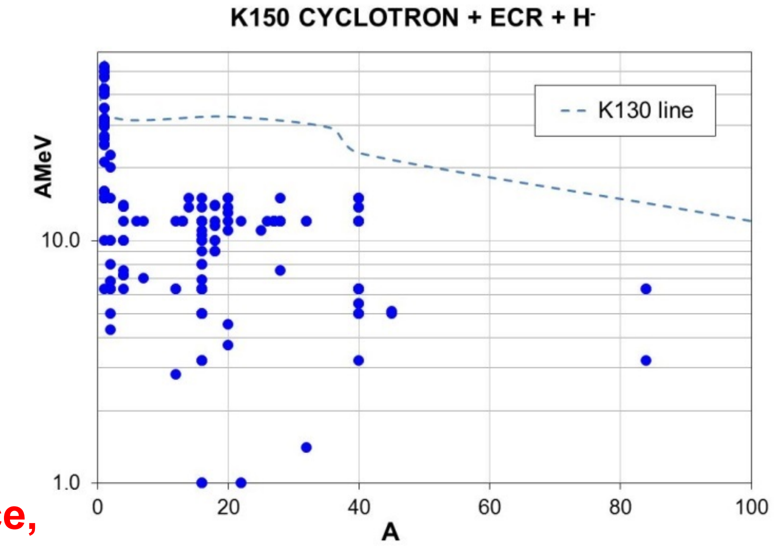


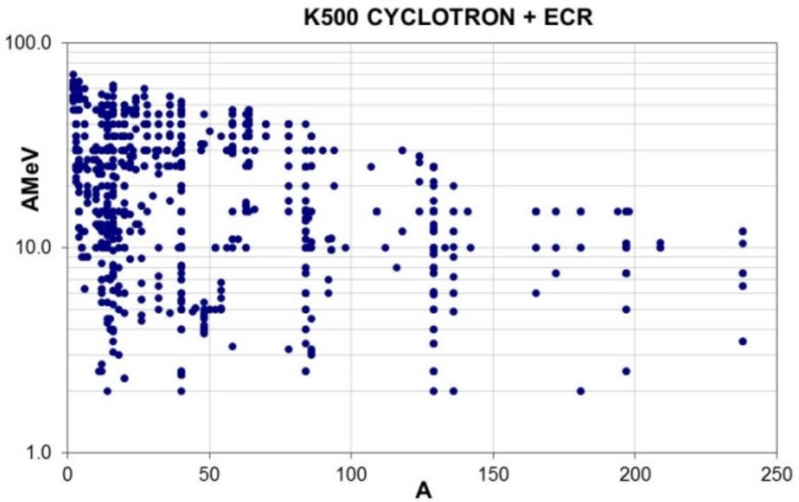


FACILITY CAPABILITY

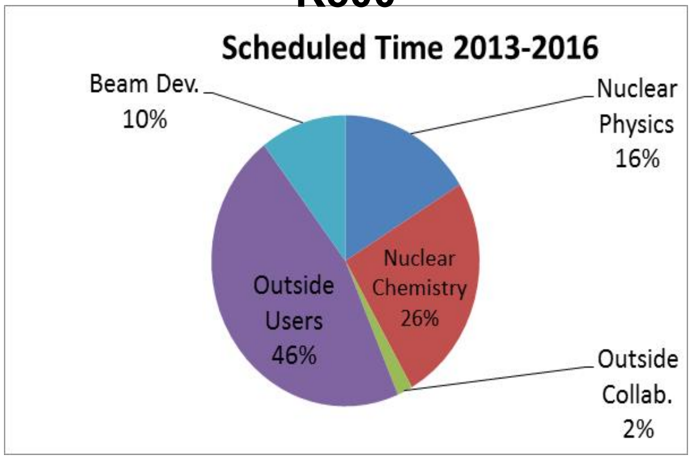


K150 conventional cyclotron (88") injected by a 14.5+11 GHz ECR ion source and a H/D-minus ion source. Still lacking cryopanel operation.

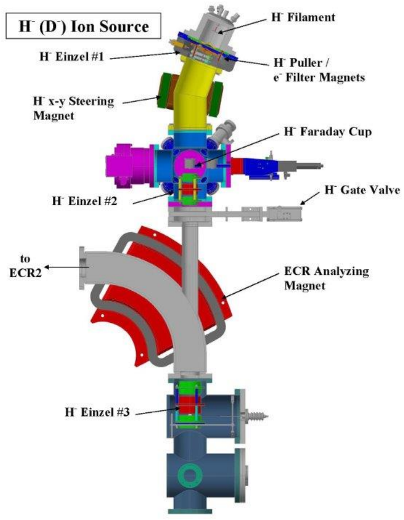
K500 superconducting cyclotron injected by a 6.4 GHz ECR ion source, H2+ to U.



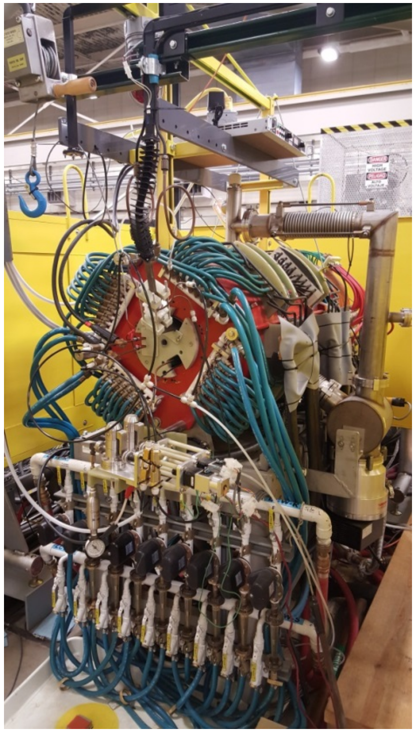
K500



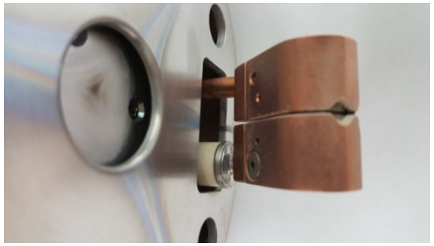
K150 ION SOURCES



ECR2



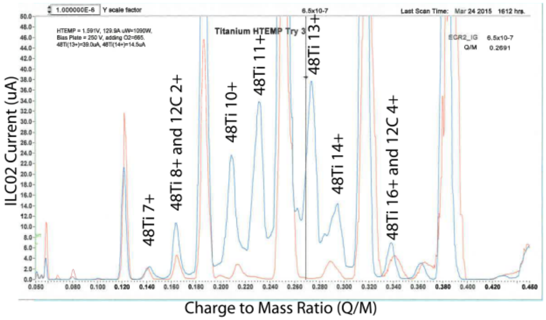
Close-up of oven



Leads and Ta crucible

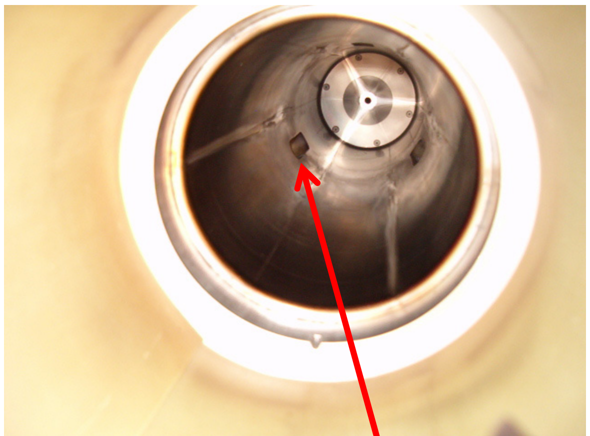
Injection flange for Hi-temp oven, following LBL

Ti Charge-state spectrum



K500 ECR1 ION SOURCE

Toward extraction

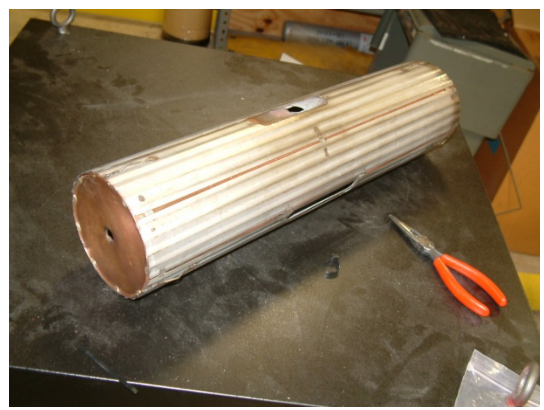


Radial port

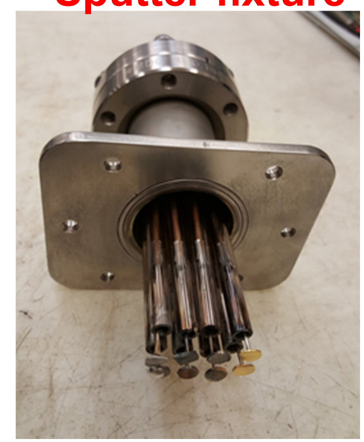
Low-temp oven

Hi-temp oven

Passive liner (Li)



Sputter fixture



Single Event Effects (SEE) Program

Henry Clark

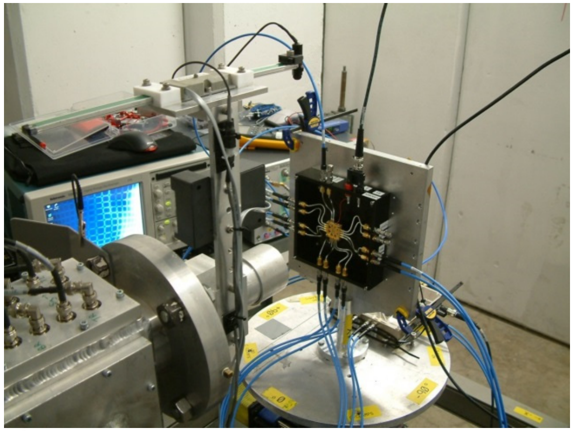
Some definitions:

- A single event upset (SEU) is a change of state caused by one single ionizing particle (ions, electrons, photons...) striking a sensitive node in a micro-electronic device.
- Soft errors are non-destructive and normally appear as transient pulses in logic or support circuitry, or as bit flips in memory cells or registers.
- Hard errors usually result in a high operating current, above device specifications, and must be cleared by a power reset. Burnout errors are so destructive that the device becomes operationally dead.

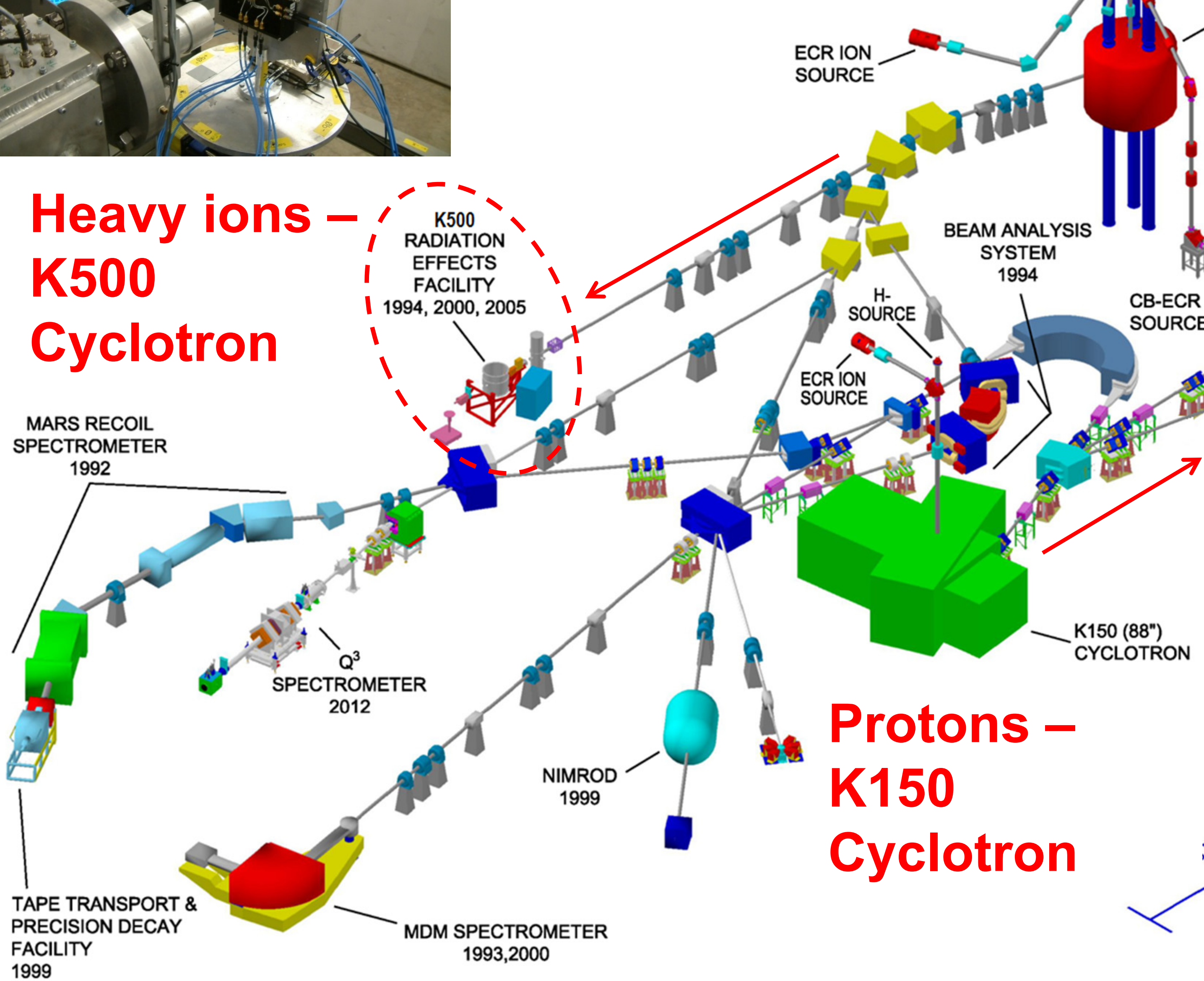
Aerospace computer equipment receives radiation from cosmic rays, solar flares and the Earth's Van Allen radiation Belts - **causing SEUs**.

Engineers must test the resilience of their computer chips in accelerated beams here on Earth to simulate the effects that will happen in space.

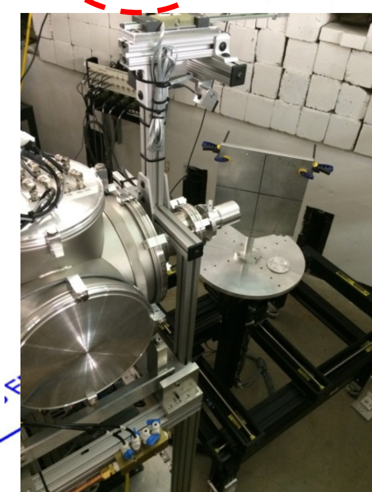
The Two SEU Testing Stations



Heavy ions – K500 Cyclotron



Protons – K150 Cyclotron



TEXAS A&M UNIVERSITY

SEE CAPABILITY

K500 Cyclotron
- 15 AMeV – α, N, Ne, Ar, Cu, Kr, Ag, Xe, Ho, Ta, Au
- 25 AMeV – α, N, Ne, Ar, Cu, Kr, Ag, Xe
- 40 AMeV- α, N, Ne, Ar, Cu, Kr-78
- Flux adjustable between 1E1-1E7 p/s-cm2
- Uniform beam spots – 1” and 1.5” diam. (reduced with collimators)
- In-air testing station – 10”X10” frame (x, y, z, θ roll angle)
- Climate controlled data room + staging area
- Cable length ~20 ft minimum

K150 Cyclotron
- Protons – 6, 10, 15, 20, 25, 30, 35, 40, 45, 49 MeV
- Degrader wheel for fast energy changes
- Flux adjustable between 1E1 – 1E10 p/s-cm2
- Uniform beam spots – 1” and 1.5” diam. (reduced with collimators)
- In-air testing station – 10”X10” frame (x, y, z, θ roll angle)
- Cable length ~60 ft minimum

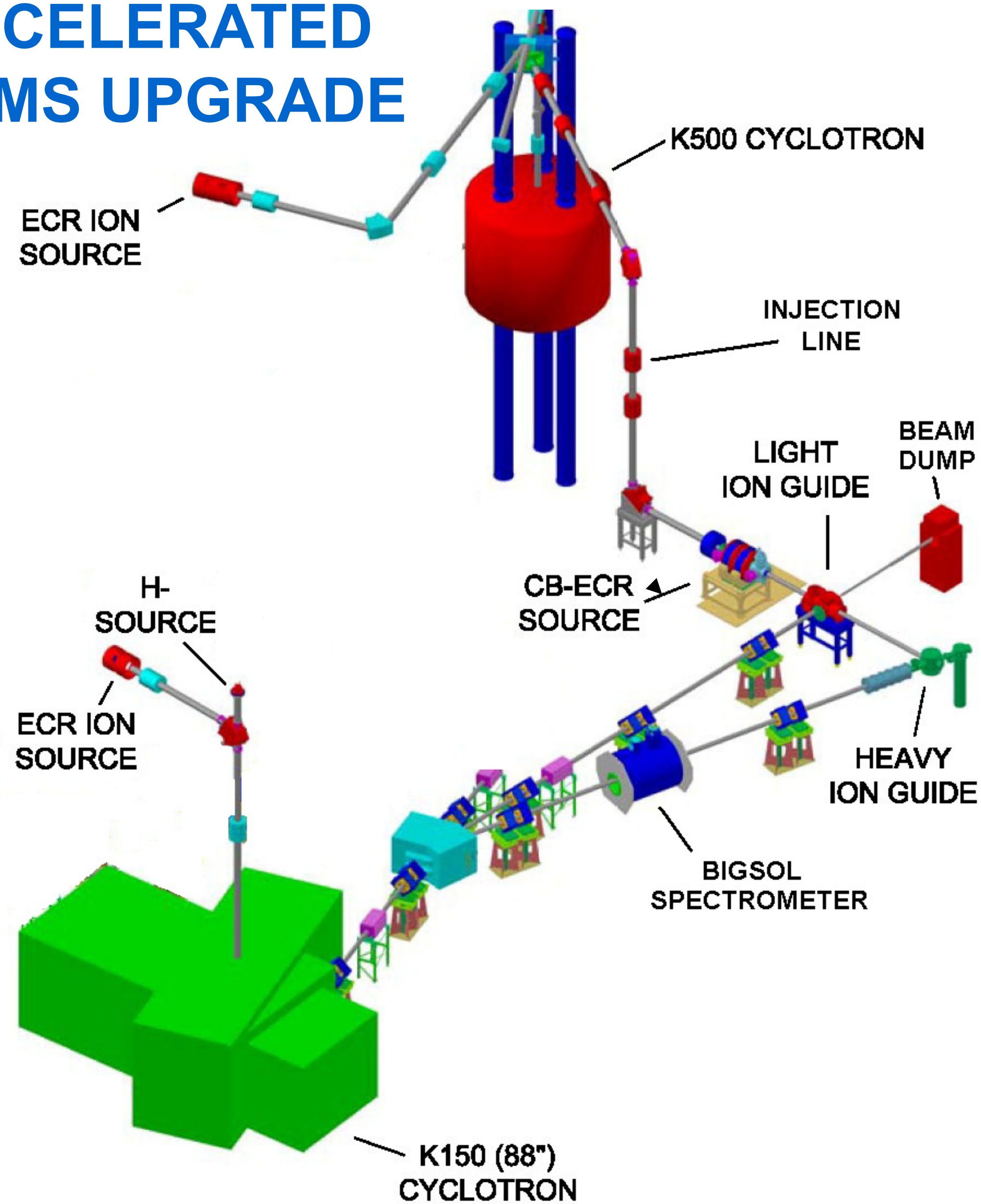
TUNING THE K500 FOR SEE

- Charge-states for ions in each suite are chosen so that the Q/M's are close so that only small changes in the magnetic field need to be made between the various beams while the cyclotron frequency is left fixed. (Q/M = ~0.20 for the 15 AMeV suite.)
- To save time between beam changes within each suite the injection line which uses only magnetic components is left fixed, and the extraction-voltage of ECRIS is varied.
- All the beams from solid materials in these suites are provided by sputtering into the ECRIS. To switch between solids requires just applying the sputtering voltage to the lead to that solid.
- Beam changes within each suite less than ½ hour. No "cocktails".

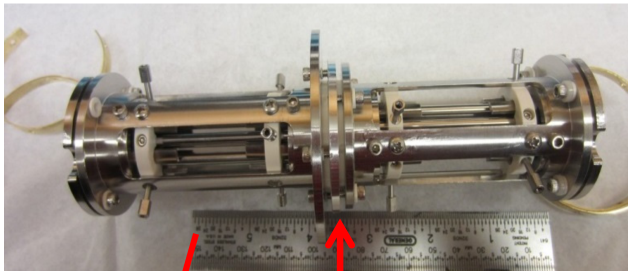
STATUS OF THE ACCELERATED RADIOACTIVE BEAMS UPGRADE

Light-Ion Guide – Gabriel Tabacaru and Juha Ärje

Heavy-Ion Guide – Greg Chubaryan



LIGHT-ION GUIDE

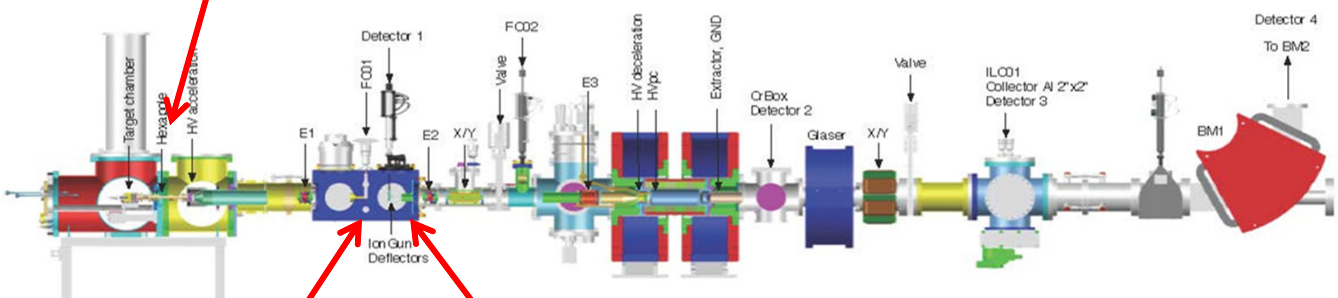


RF-only Sextupole Guide following JYFL design

Above shielding charge-bred beam of Ga-64 12+ at 23 pps

Smaller flux of Rn-220 29+ (from thorium)

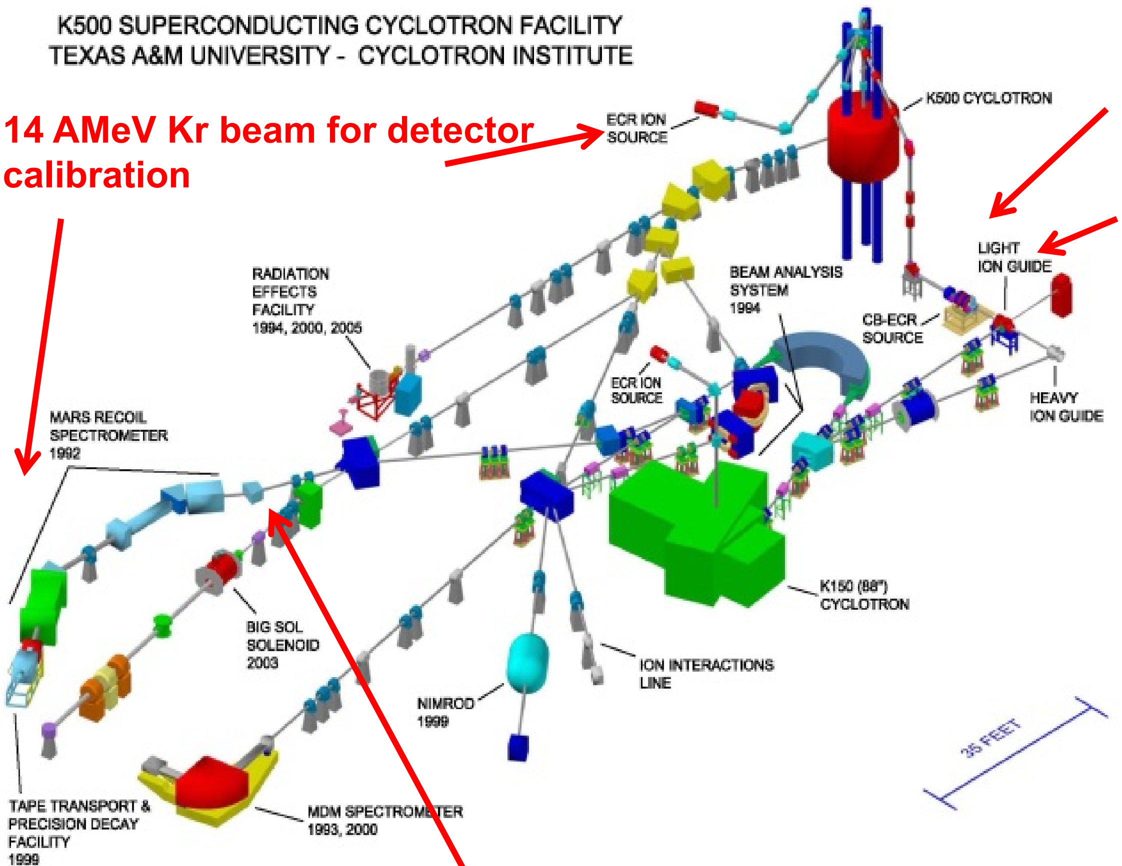
aperture



2X1E4 pps of Ga-64 with a 4μA proton beam

1+ alkali ion source + ES 90° deflector

TUNING THE K500 AND ITS BEAM-LINE FOR RIBS



14 AMeV Kr beam for detector calibration

14 AMeV O 3+ (.1876)

14 AMeV Rb 16+ (.1885) with shift in RF of 56 kHz

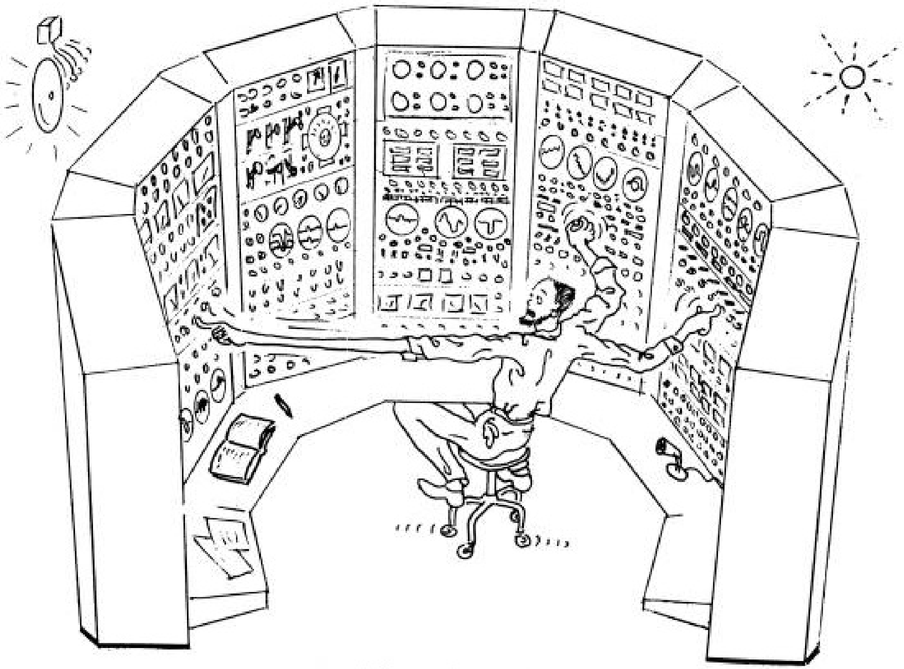
12 kHz to make the oxygen completely disappear from the detector. (RF = 12.24 MHz)

Beam Spot

SUMMARY

- The Texas A&M Cyclotron Institute will continue to flourish with extra support from the SEE program.
- Intensities from the K150 and from the light-ion guide are improving, but need to be much better for the plans of the laboratory.
- We anticipate beginning to accelerate radioactive beams in the near future.

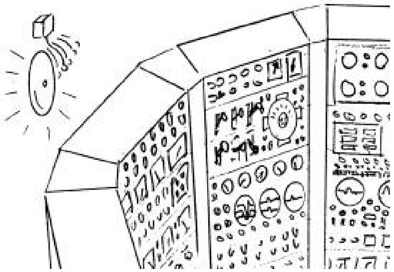
Possible scenario for RIB acceleration



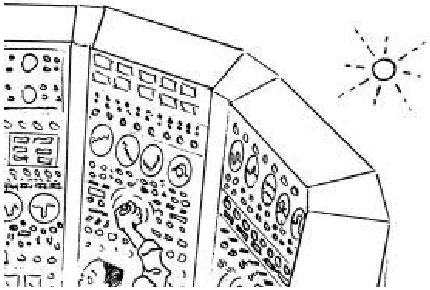
. . . the operator

Courtesy Dave Judd and Ronn MacKenzie

Updated Possible Scenario

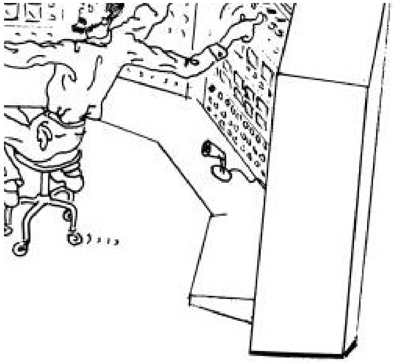


High Bay

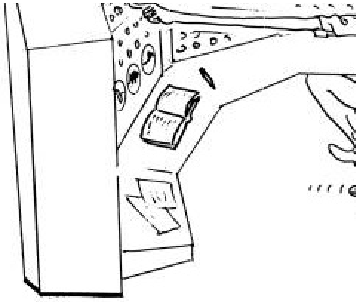


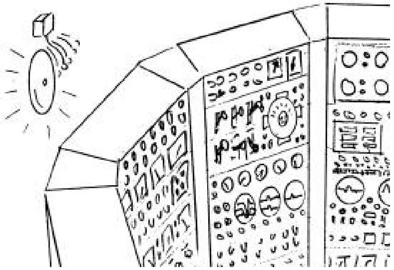
Mezzanine

Basement

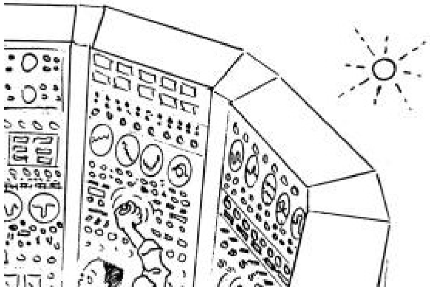


Control Room



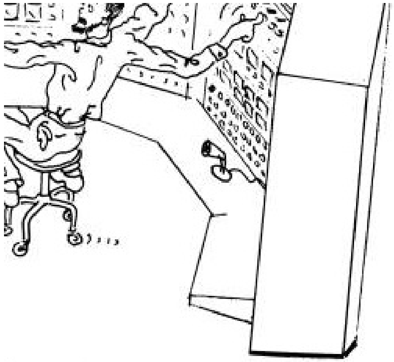


High Bay

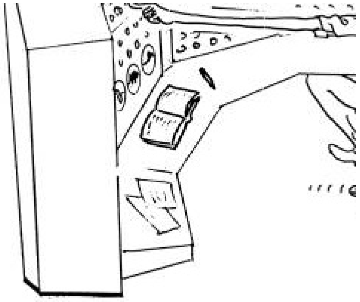


Mezzanine

Basement



Control Room



Thanks