CYCLOTRON INSTITUTE
Texas A&M University

Recent Progress on the Facility Upgrade for Accelerated Radioactive Beams at Texas A&M

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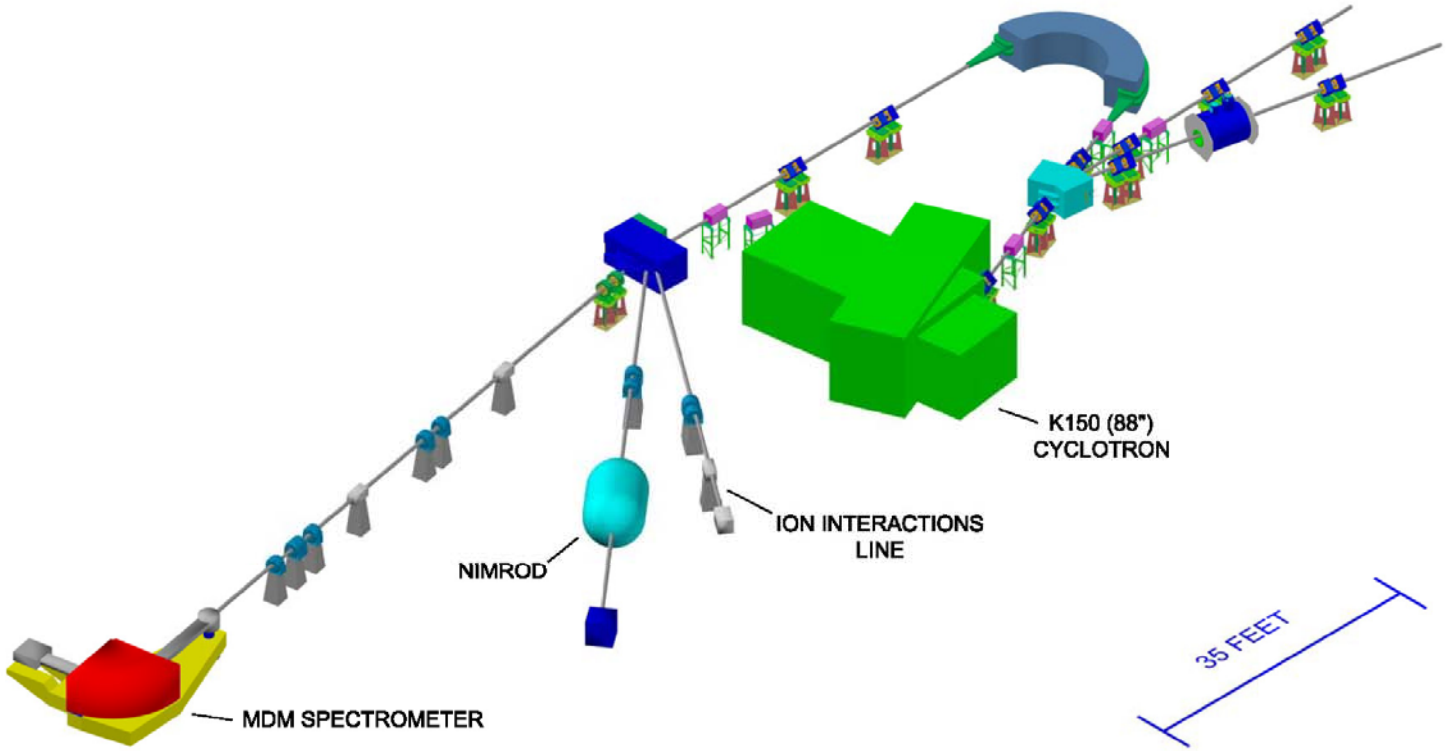
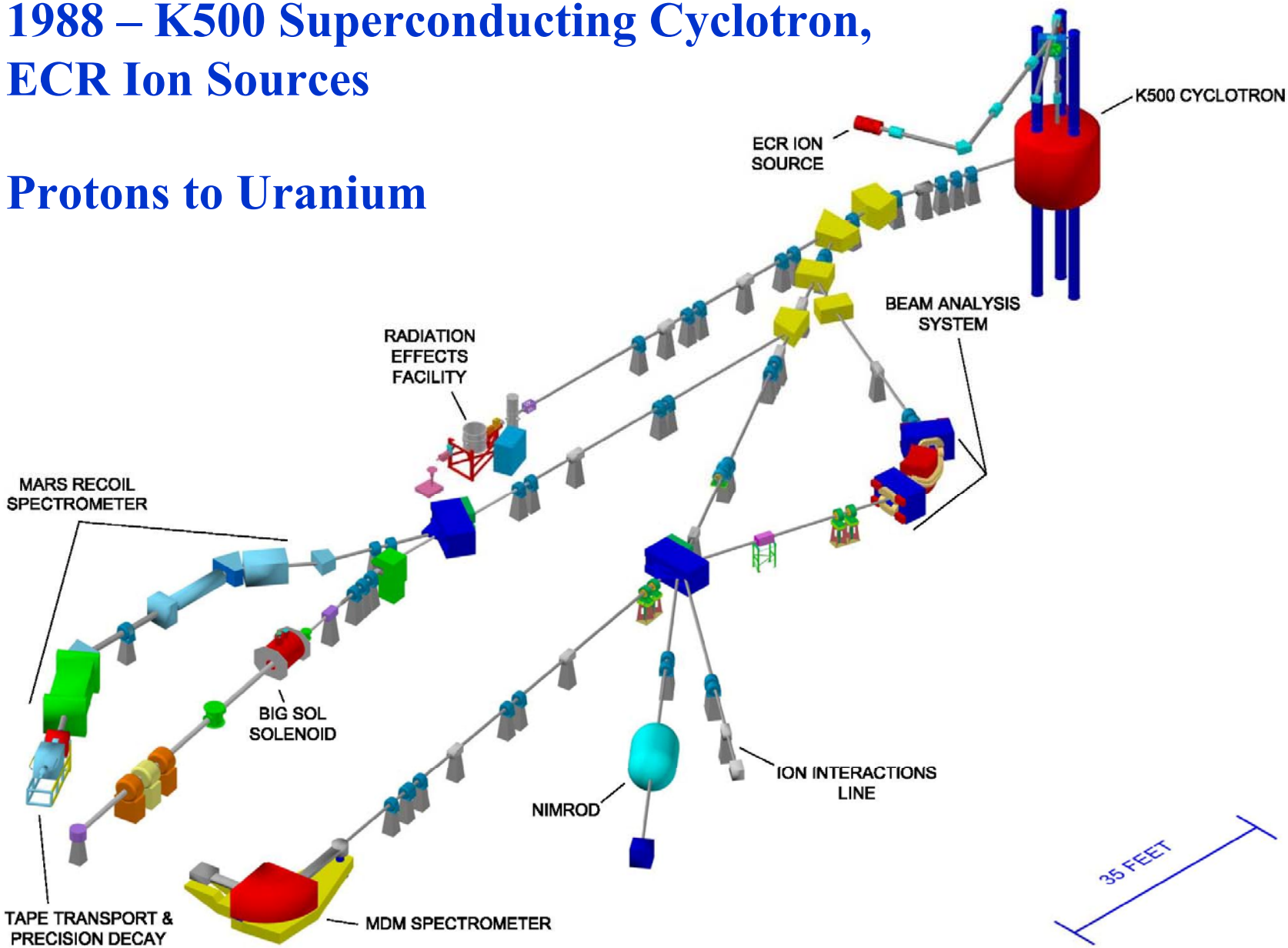
1966 to 1986 – Conventional 88” Cyclotron, Internal Filament and PIG Ion Sources, External Polarized Sources



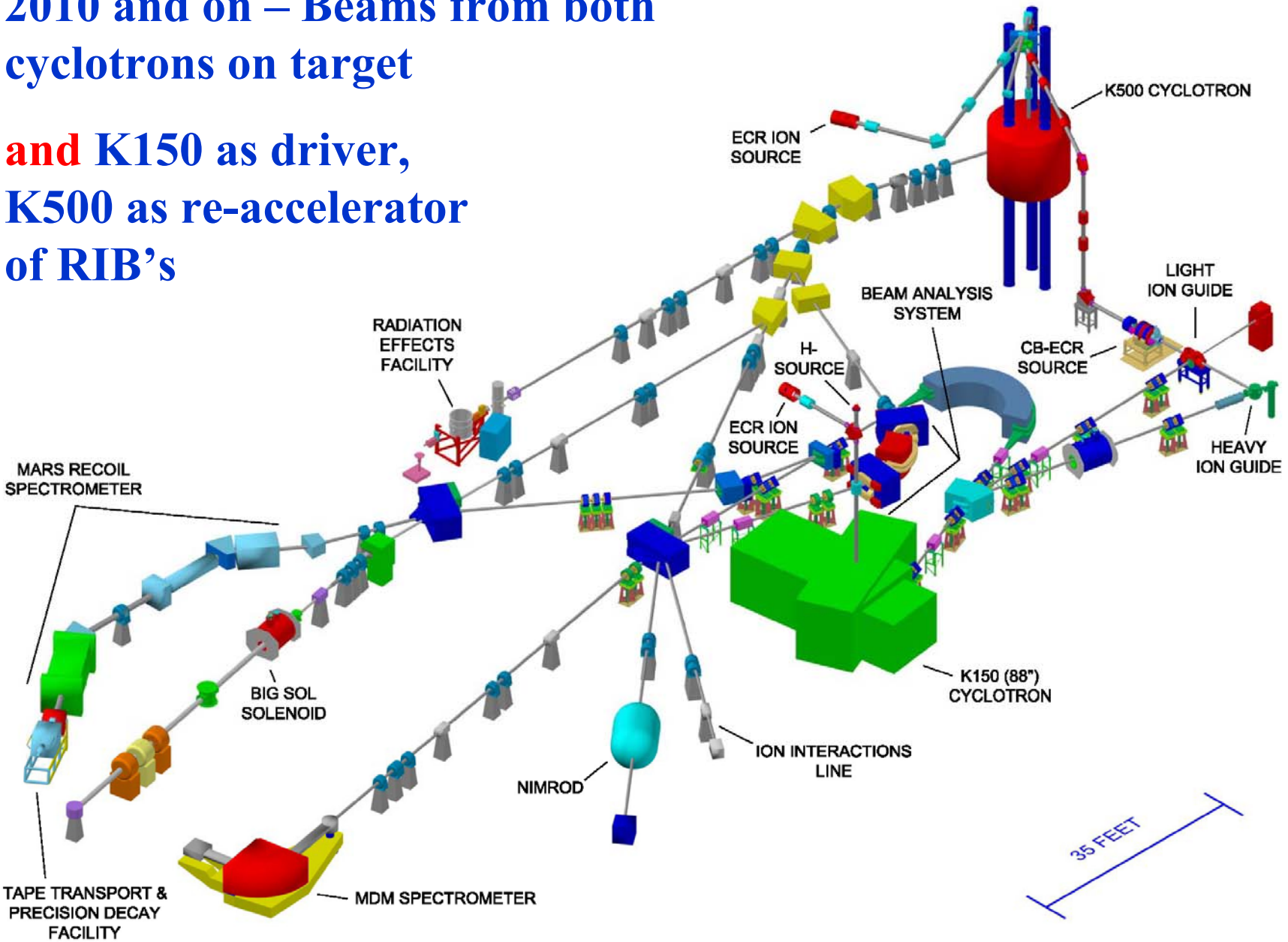
1988 – K500 Superconducting Cyclotron, ECR Ion Sources

Protons to Uranium



2010 and on – Beams from both cyclotrons on target

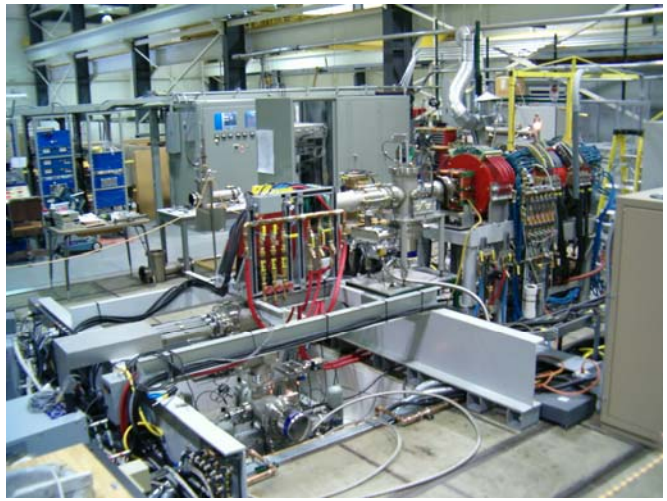
and K150 as driver, K500 as re-accelerator of RIB's



October 2007

88” Cyclotron Vault

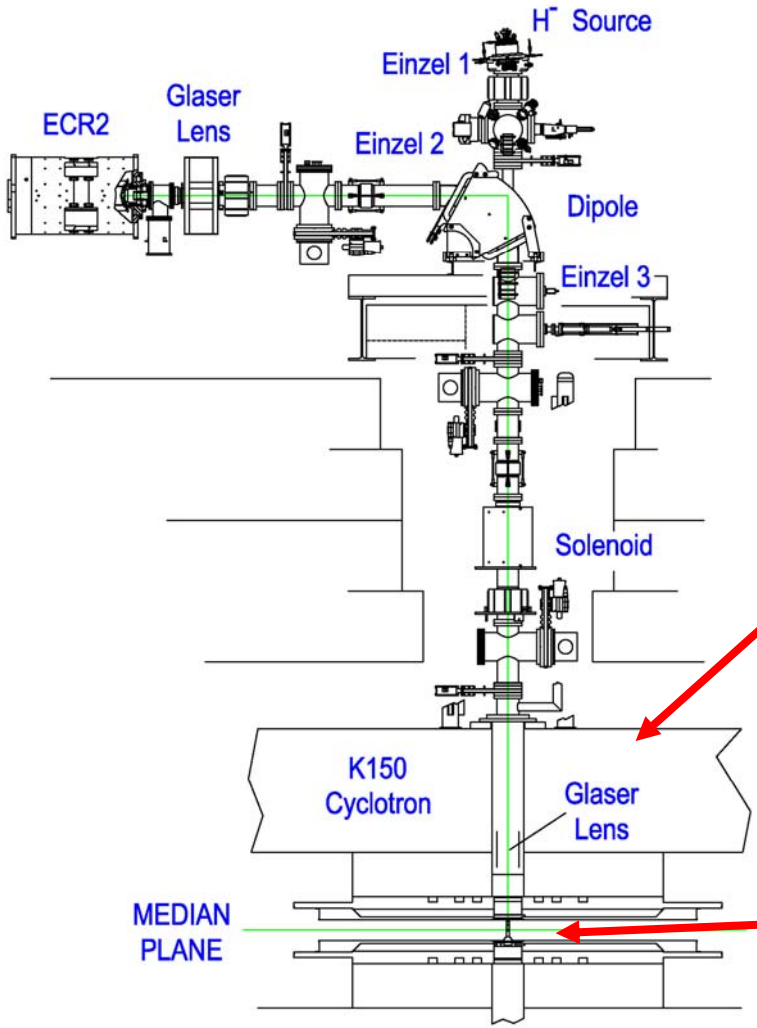
ECRIS Injection



Proton beam run – 0.65 µA at 10”, 0.22 µA 38”, 0.02 µA extracted

Diagnosis: Poor matching from injection into the central region

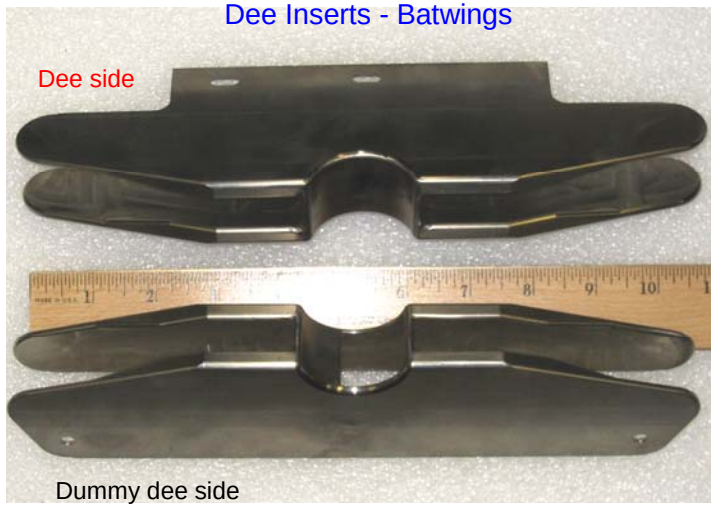
Axial Injection Line



Glaser mounted

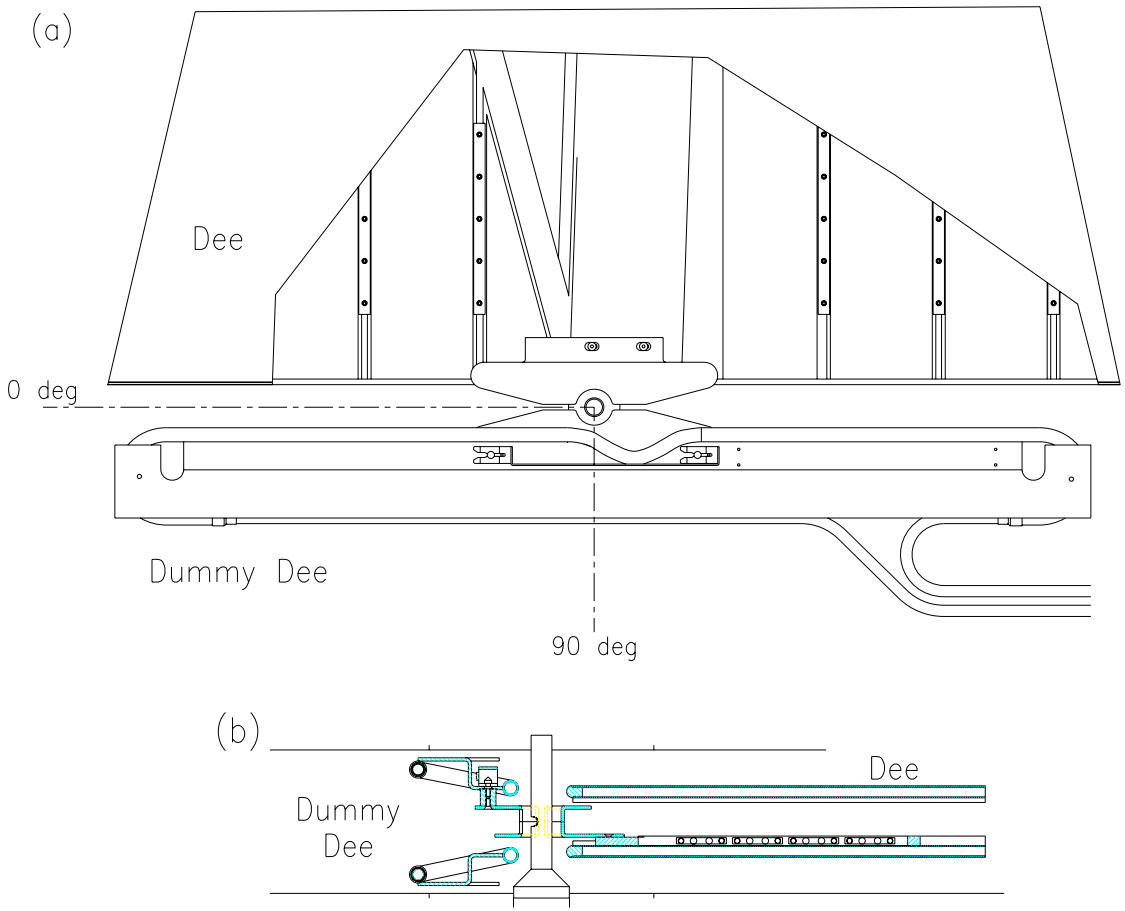
Central Region Modification

Modification = Titanium Dee Inserts (Berkeley Batwings)



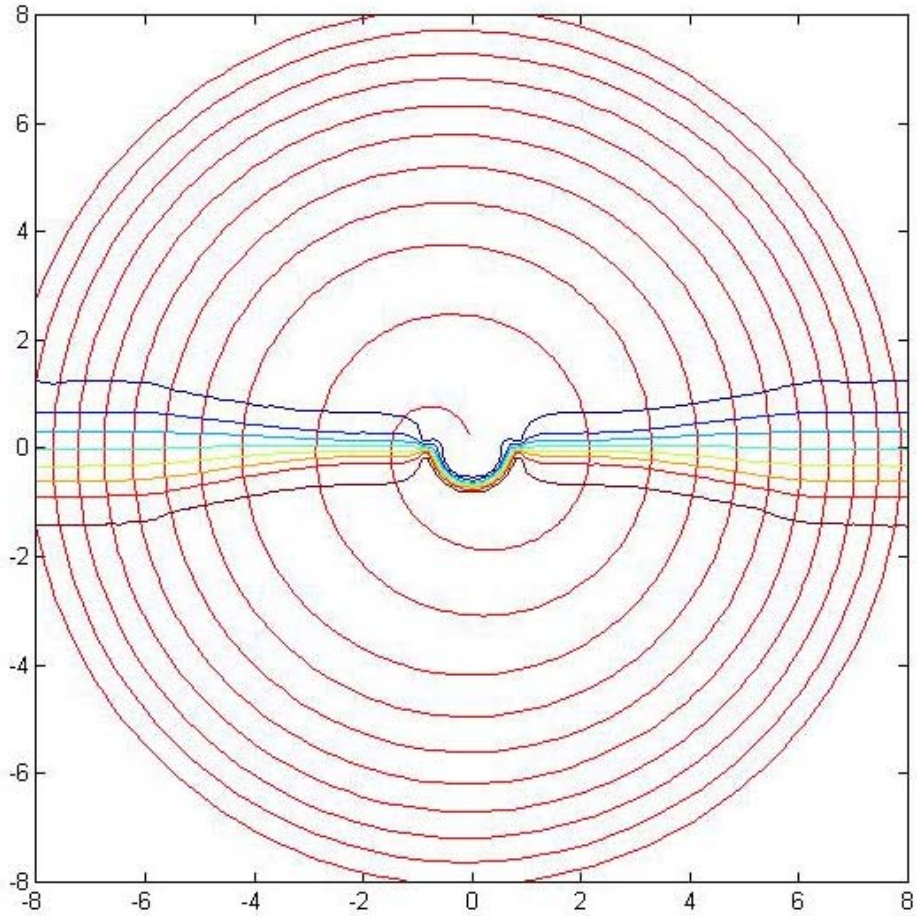
Inserts mounted on the dee and dummy dee

Dee was pulled back into dee tank, but dummy dee insert was installed through gap



Centered orbits calculated with Z3CYCLONE

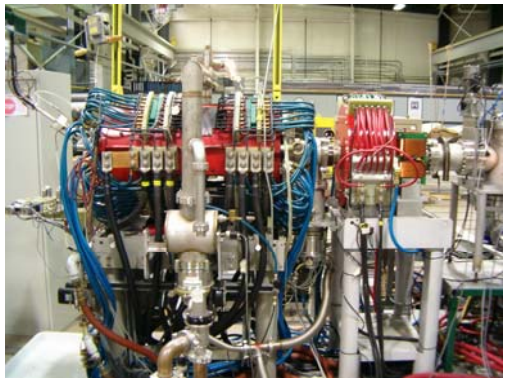
Y(inches)



X(inches)

Beams run after modifications

14.5 GHz ECR2



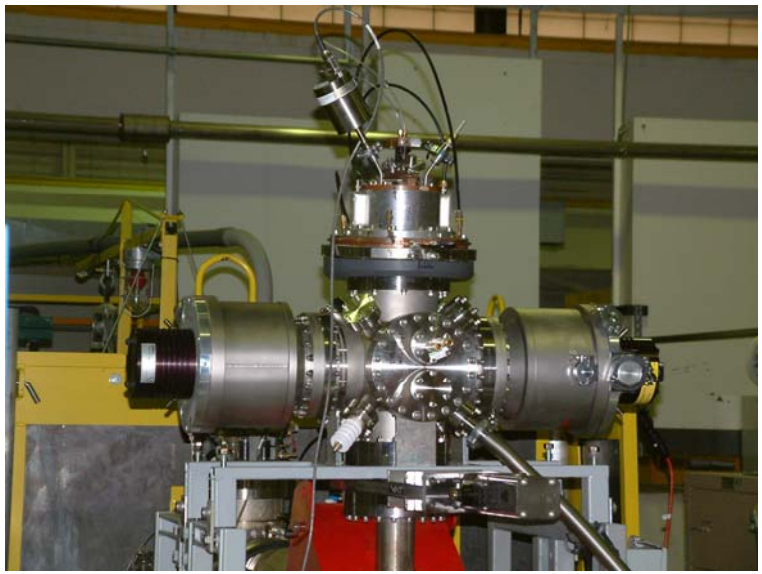
T/A (MeV/u)	Ion	Main Mag (A)	Vdee (kV)	ILC02* (μA)	Inflector (μA)	BP=10" (μA)	35" (μA)
20	protons (Oct./07)	612	73 (w/o batwings)			0.65	0.22
20	protons	613	45	29	10	0.33	0.32
25	protons	669	46	23	8	0.56	0.54
30	protons	742	52	25	9	0.40	0.37
7.5	16 O 5+	1262	53	89	35	3.1	1.9
10	16 O 6+	1186	56	132	62	3.9	3.5
12	16 O 6+	1367	65	130		5.0	4.7
14	16 O 6+	1606	65	110		3.4	2.9
14	16 O 7+	1199	65	22	12	0.74	0.67

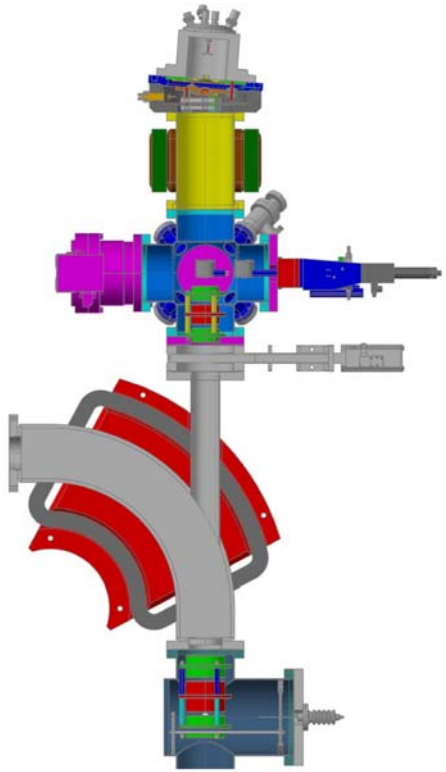
*ILC02 was not biased

Vacuum near extraction – $2X10^{-6}$ torr, no buncher

Radioactivation from light ions, particularly of the deflector, had always been a problem.

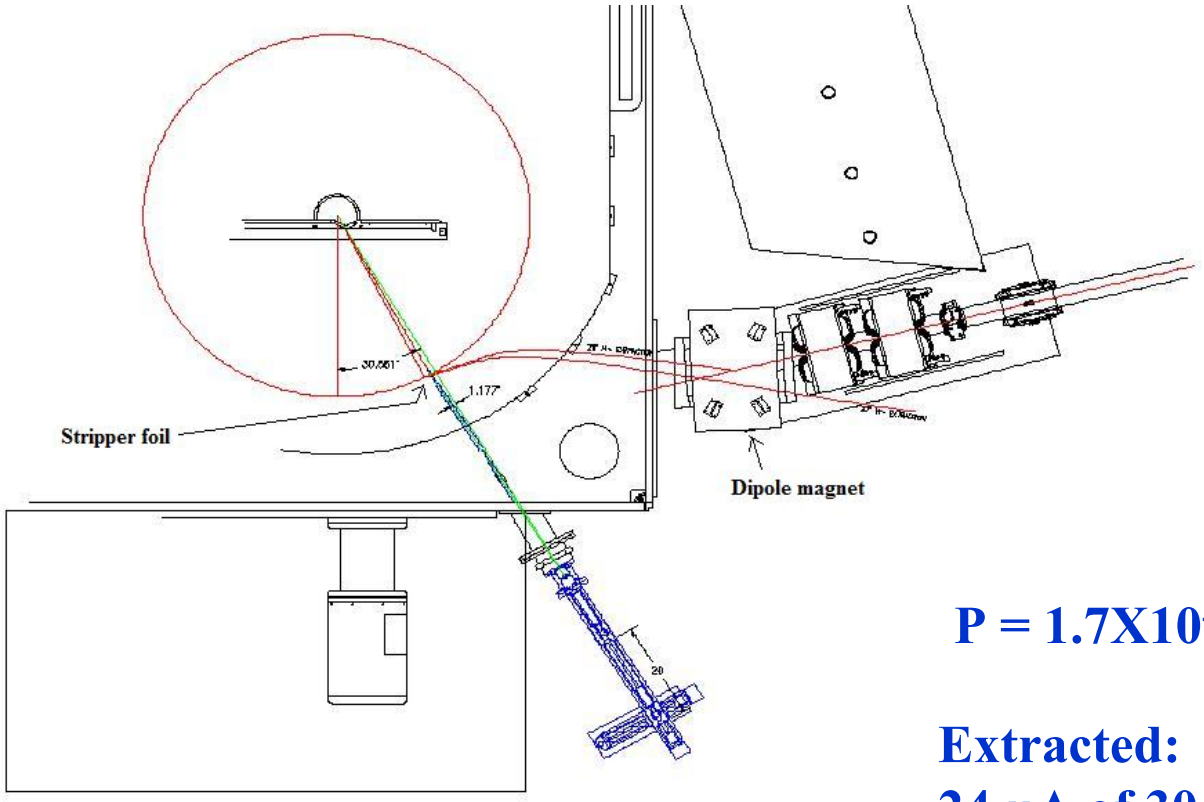
Solution: multi-cusp H^- ion source, modified from a proton source belonging to JYFL, in a collaboration between TAMU and JYFL.





1.0 mA

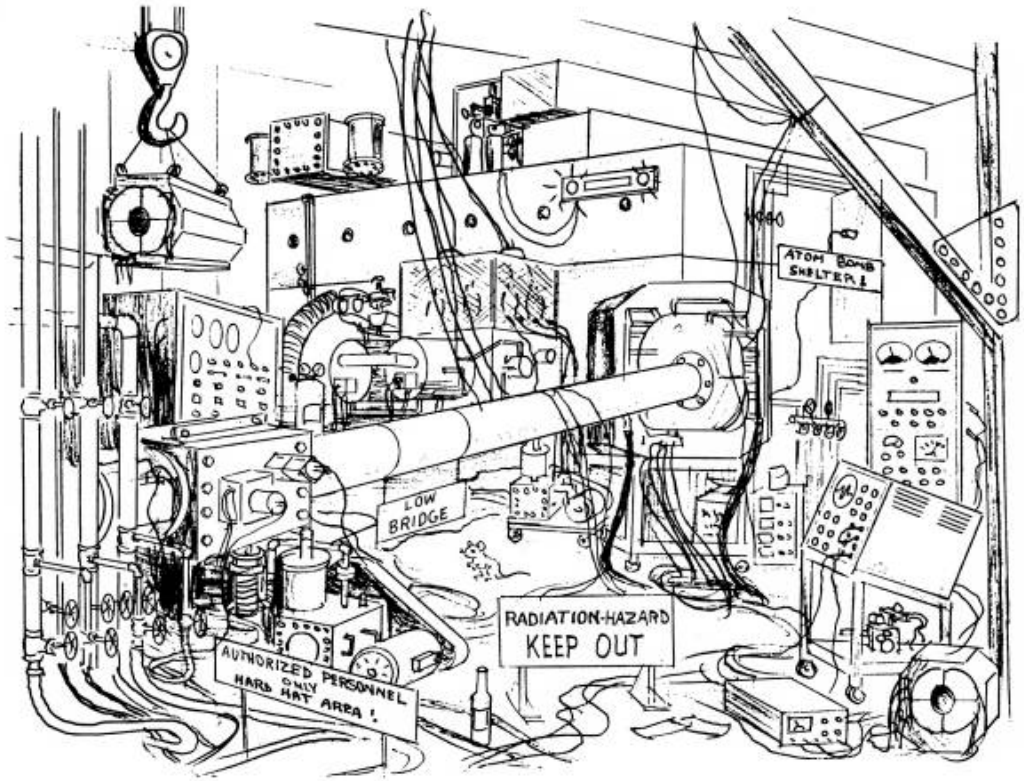
Extraction of Protons and Deuterons



P = 1.7X10^{-6} torr

Extracted:
24 μA of 30 MeV protons
1.2 μA of 20 MeV deuterons

What is our current status?



. . . the visitor

Courtesy Dave Judd and
Ronn MacKenzie

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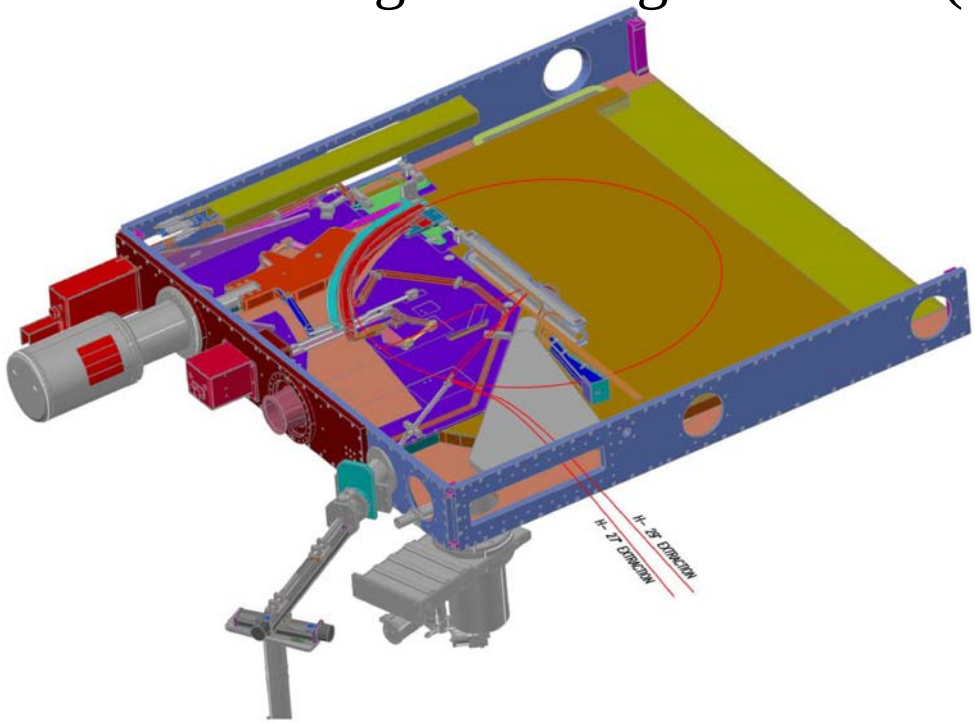
88” Vault Now

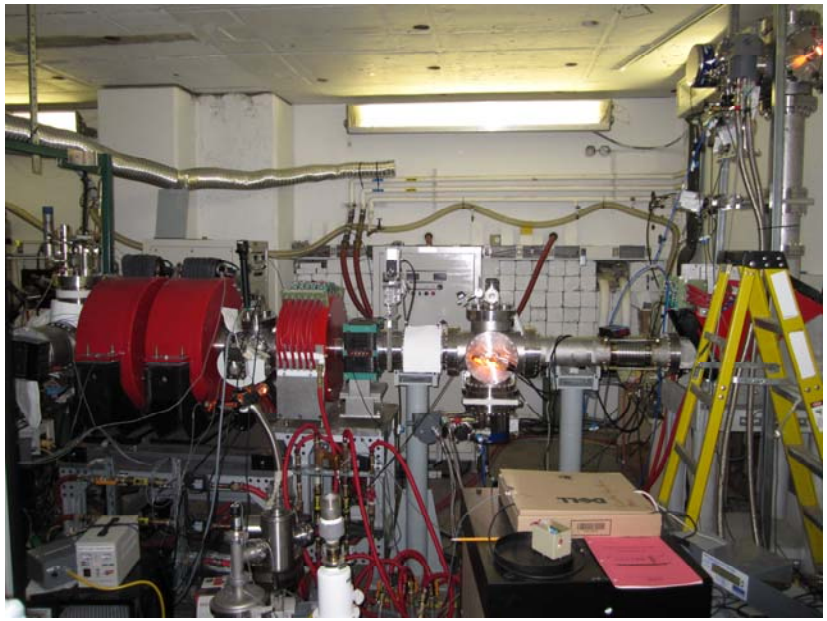
A few of our future strategies

- Install LHe cryopanels for better vacuum
- Extract positive ions with electrostatic deflector
- Test ability to predict main- and trim-coil currents
- Test limits of rf voltage and magnetic field (K150?)



Radioactive beams late next year

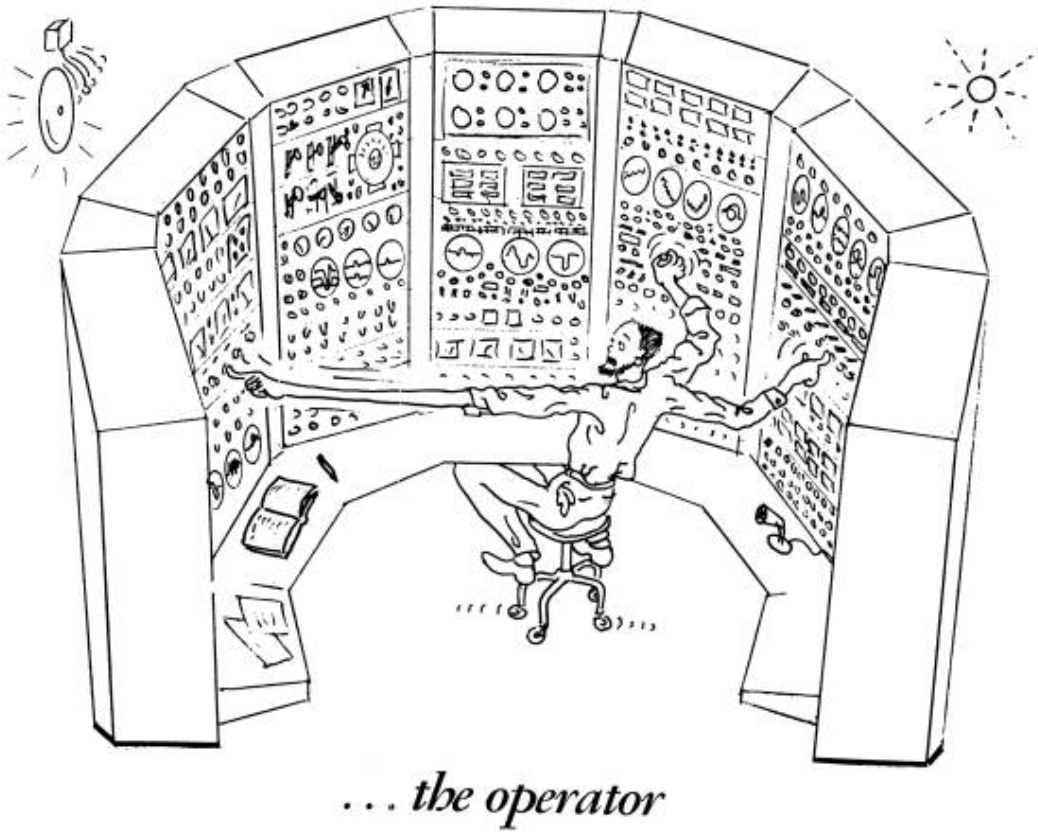
CB-ECRIS and Analysis Line



Possible RIBs from LIG + K500

(p,n) reaction Product $T_{1/2}$	Max Energy [MeV/A]	Intensity [particles/sec]
^{27}Si (4.16s)	57	5.4×10^{3}
^{50}Mn (0.28s)	45	2.1×10^{4}
^{54}Co (0.19s)	45	5.4×10^{3}
^{64}Ga (2.63m)	45	3.5×10^{4}
^{92}Tc (4.25m)	35	3.5×10^{4}
^{106}In (6.20m)	28	5.4×10^{4}
^{108}In (58.0m)	28	2.7×10^{4}
^{110}In (4.9h)	26	5.4×10^{4}

Possible scenario



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Ronn MacKenzie

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