

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 - 2011 first radioactive beams

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”: (³He,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**

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

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	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

ROOTS1: 1×10³mb to 7×10²mb

ROOTS2: 1×10²mb to 7×10¹mb

Plasma chamber: ~4×10¹mb

TMP1: ~1×10⁰mb

Sextupole: 2.43 m

²²⁸Th open source

CB-ECRIS - Injection

Alkali 1+ source from HeatWave

Injection end of ECR source

CB - ECRIS

- Design and built by Scientific Solutions, San Diego California
- 14.5 GHz
- Coils ~ 1.1 T
- Hexapole Nd-Fe-B ~ 1.1 T

Argon spectrum

ILIG11 off line 0.5285

Feb 12 2010 1646 hrs.

SIMION calculations for the injection into CB-ECRIS

Ion gun: Na-1⁺, Accel=7 kV+30 V

Einzel lens

Grounded shield

Plasma chamber (7 kV)

- Solenoidal magnetic field considered for the two coils
- No hexapole magnetic field