Radio Frequency Quadrupole (RFQ) linac

K130 Cyclotron
p/α, 20/60 MeV, 10 μA

Target/1° IS

RIB

ECR Charge-breeder

Isotope Separator

1.7m RFQ

29 keV/u

Isotope Separator

3.4m RFQ

100 keV/u

LINAC 1 & 2

289 keV/u

LINAC 3

415 keV/u

LINACs 4-5

1.0 MeV/u
29 keV/u ; 1.7 m long RFQ commissioned in Sept. 2005

India’s first RFQ

<table>
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<tr>
<th>Measured Parameters</th>
<th>Value</th>
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<tbody>
<tr>
<td>Frequency</td>
<td>33.7 MHz</td>
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<tr>
<td>Q- value</td>
<td>5200</td>
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<tr>
<td>RF power for $^{16}$O$^{4+}$ (V$_{vane}$=11.45 kV)</td>
<td>670 W</td>
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<td>RF power for $^{16}$O$^{3+}$ (V$_{vane}$=15.27 kV)</td>
<td>1.2 kW</td>
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<td>RF power for $^{16}$O$^{1+}$ (V$_{vane}$=45.9 kV)</td>
<td>*10.8 kW</td>
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<td>Typical transmission at RFQ exit (FC3/FC2)</td>
<td>#85 %</td>
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<td>Typical transmission of analyzed beam (FC4/FC2)</td>
<td>#80 %</td>
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<td>* Duty factor 20%</td>
<td></td>
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<td># Electron suppressed FC</td>
<td></td>
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</tbody>
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- RFQ constructed with complete indigenous technology
- Machining of Vane, post & other components at Central Mechanical Engineering Research Institute (CMERI), Durgapur (200 km from Calcutta)
- RF transmitters made by SAMEER, Mumbai; RIKEN’s (Japan) help in physics design

Parameters of 1.7m RFQ

- Frequency: 33.7 MHz
- q/A ≥ 1/16
- Energy: 1.38 → 29 keV/u
- Vane Length: 1.552 m
- Vane Voltage: ± 45.9 kV
- Characteristic radius $r_0$: 7.1 mm
- Max. modulation: 1.935
- Focusing strength: 4.83
- Q: 9830
- $R_p$: 174 kΩ
3.4m RFQ: commissioned in July 2008


- q/A=1/14; input = 1.75 keV/u; output = 100 keV/u, 3.4m long, vane length ~ 3.12m, resonating at 37.83 MHz

- RFQ made at CMERI Durgapur, Cavity, Cu plating at GSI, Darmstadt via Danfysik

- Measured transmission efficiency at RFQ exit for O^{5+} ~ 90 %
Parameters of 3.4m Long RFQ

- Frequency: 37.8 MHz
- q/A ≥ 1/14
- Energy: 1.73 → 98.8 keV/u
- No. of gaps: 9
- Vane Length: 3.12 m
- ϕ_s: -21.5°
- Vane Voltage: ±53.7 kV
- Accln. grad.: 2.13 MV/m
- R_p: 65 kΩ
- Q: 8026
RFQ linac: press coverage

Cosmos and cancer

Biplab Das

A big indigenously-built machine sits in the campus of the Variable Energy Cyclotron Centre (VECC) in Kolkata. It hums into action occasionally prying open many secrets of the universe with its energetic radioactive ion beams (RIB).

Alongside cracking puzzles like how chemical elements were born in the fiery cauldron of stars, the RIB technology also generates energetic particles to selectively kill tumor cancer cells.

Researchers at VECC have designed the radio frequency quadrupole (RFQ) accelerator that accelerates low energy heavy ions. "It is a three-in-one accelerator — it accelerates, bunches and focuses the ion beams," says Alok Chakrabarti of VECC.

The VECC team has created the facility in collaboration with

Particle physics

Explosive Potential: 7 Keys Of Quantum Physics & Mind Creation

LightBrightPencil.com

India joins select club in particle technology

Special Correspondent

KOLKATA: India's first heavy ion Radio Frequency Quadrupole (RFQ) accelerator has been commissioned at the Department of Atomic Energy's Variable Energy Cyclotron Centre (VECC) here.

Scientists from across the world have acknowledged the achievement as a hallmark development in particle accelerator technology in the country, VECC officials told the Hindu on Tuesday.

Japan is the only other Asian country to have successfully commissioned such an accelerator which was tried out on a "proof-of-principle" basis for the first time in the United States of America in 1986.

*RFQ is a radio frequency [88.7MHz] cavity of very pure copper that houses four precisely machined vanes which takes care of the acceleration, bunching and focusing of ion beams*, according to the VECC.

Nature India

Welcome back: Vishal

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