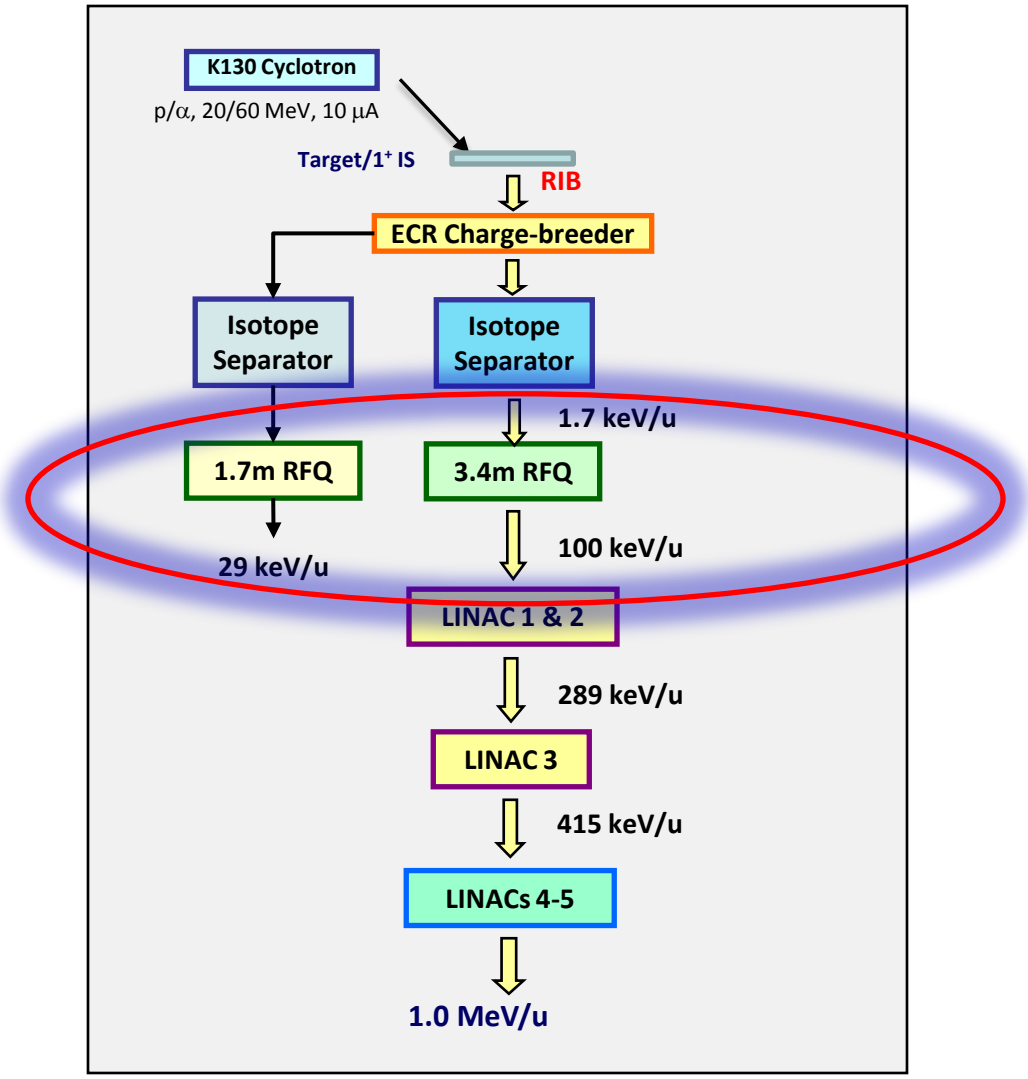
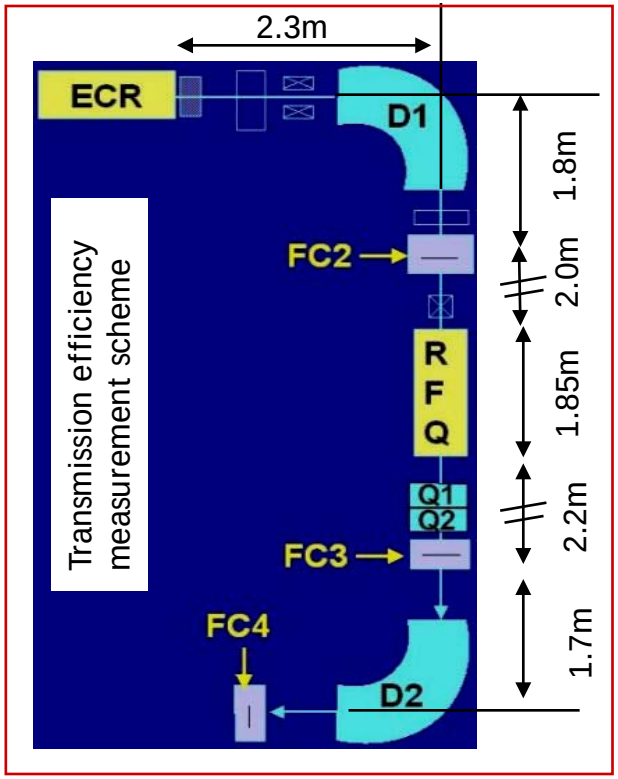
Radio Frequency Quadrupole (RFQ) linac



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

India's first RFQ

1.7 m RFQ during installation

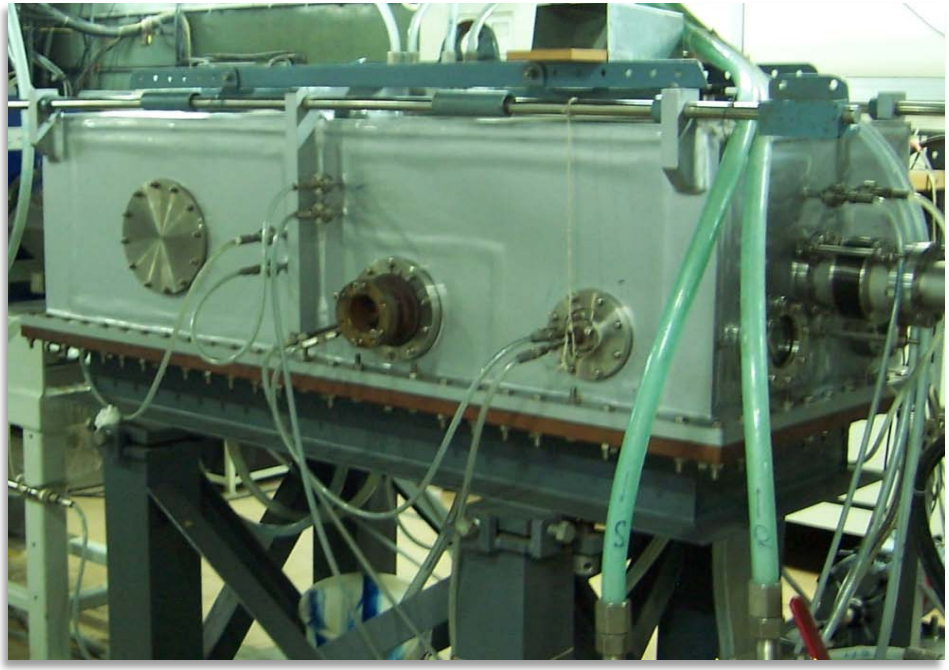


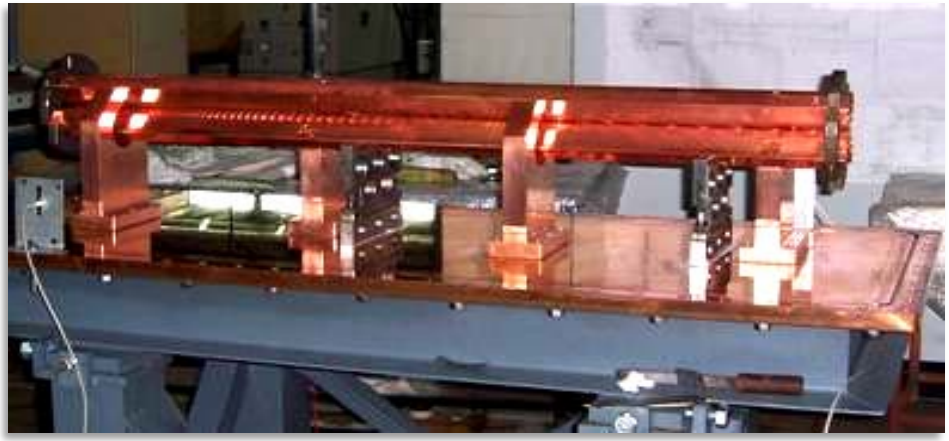
Measured Parameters	*Value*
Frequency	33.7 MHz
Q- value	5200
RF power for $^{16}O^{4+}$ (V_{vane}=11.45 kV)	670 W
RF power for $^{16}O^{3+}$ (V_{vane}=15.27 kV)	1.2 kW
RF power for $^{16}O^{1+}$ (V_{vane}=45.9 kV)	*10.8 kW
Typical transmission at RFQ exit (FC3/FC2)	#85 %
Typical transmission of analyzed beam (FC4/FC2)	#80 %
** Duty factor 20%* *# Electron suppressed FC*	

- 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

Rev Sci Instrum. 78 (2007) 043303 ; Rev. Sci. Instrum. 80, (2009) 103303

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

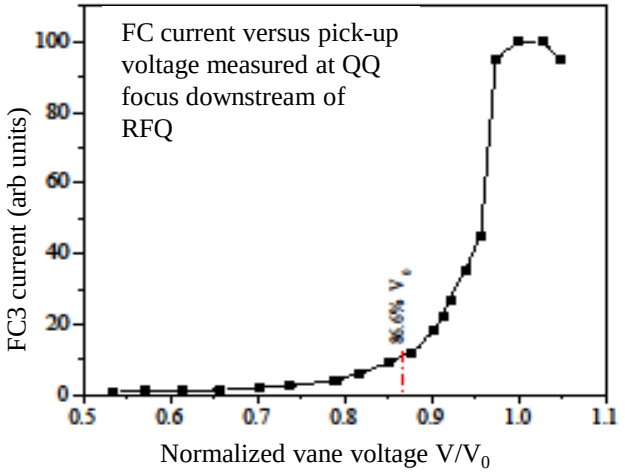
3.4m RFQ: commissioned in July 2008

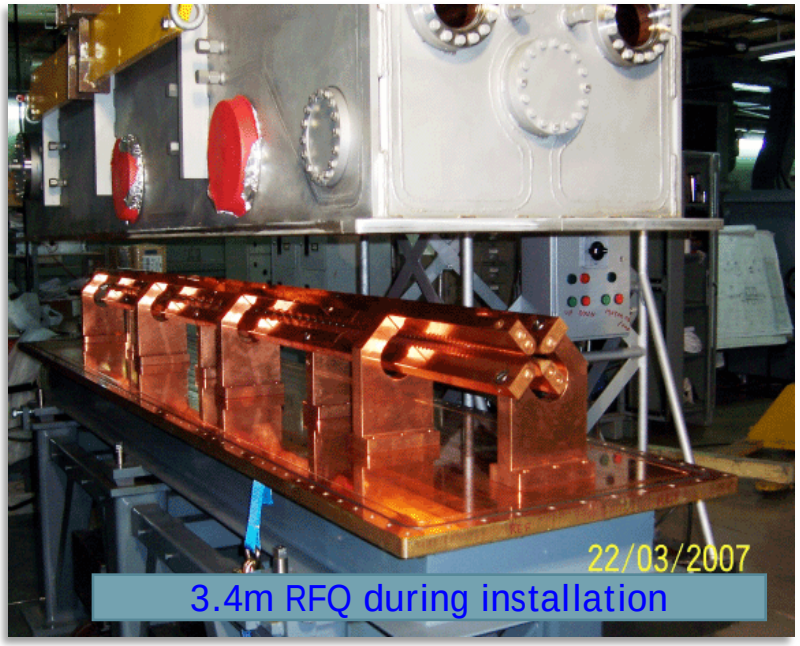
Rev Sci Instrum. 81 (2010) 023301

- 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

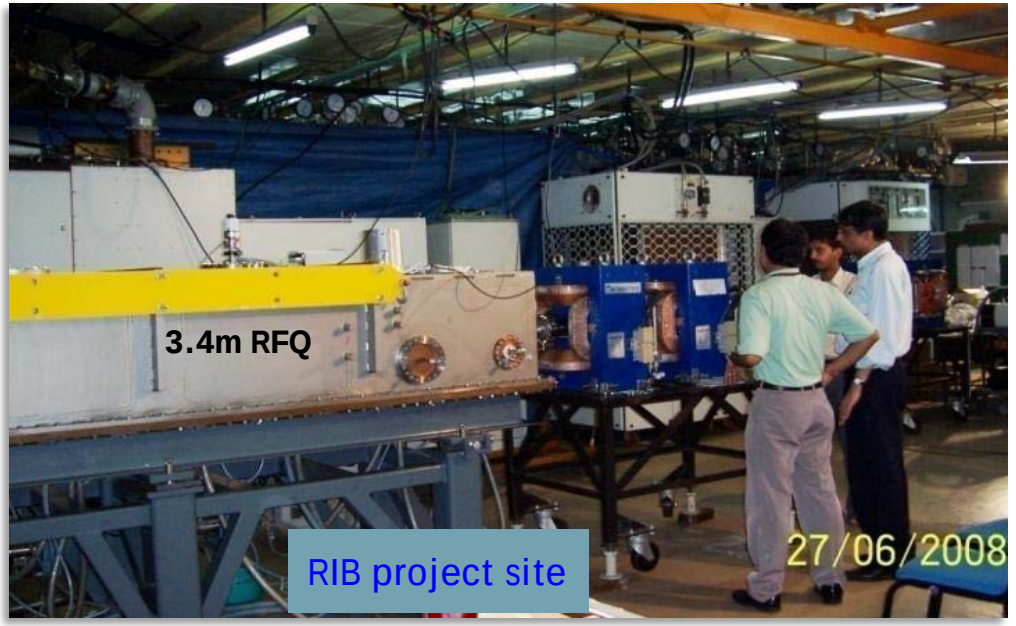
- RFQ made at CMERI Durgapur, Cavity,
Cu plating at GSI, Darmsadt via Danfysik

- Measured transmission efficiency at
RFQ exit for O^{5+} ~ 90 %



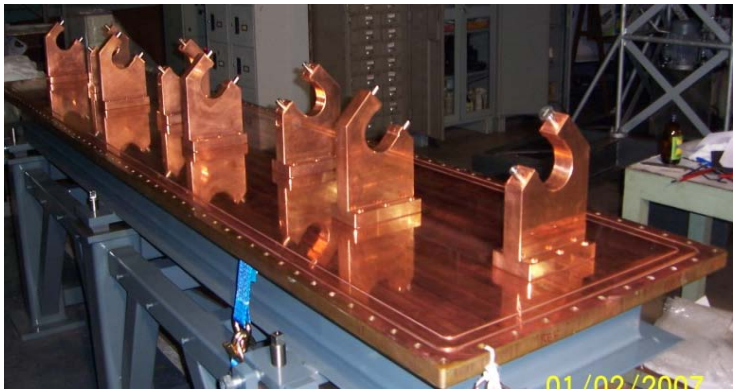


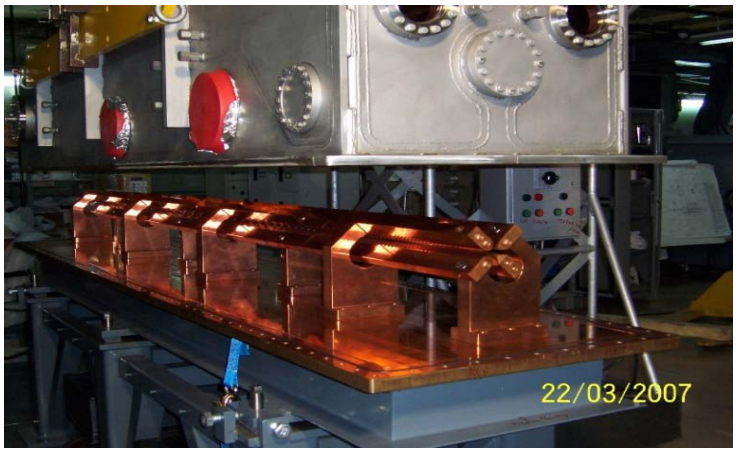
3.4m RFQ during installation

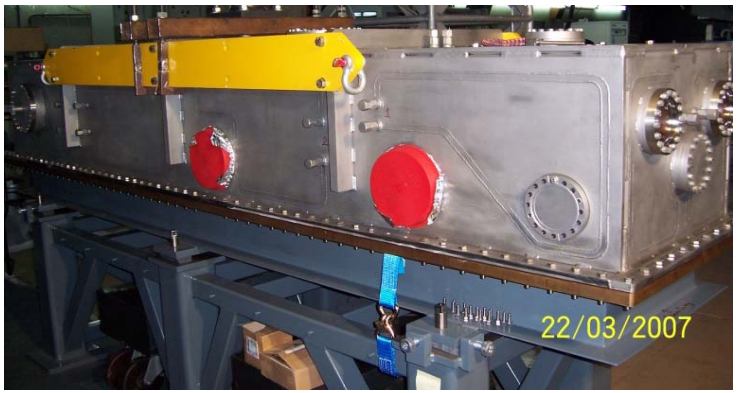


RIB project site

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

THE HINDU

Online edition of India's National Newspaper

Wednesday, Oct 05, 2005

National

National

India joins select club in particle technology

Special Correspondent

KOLKATA: India's first heavy ion Radio Frequency Quadruple [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 hall-mark 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 1980.

"RFQ is a radio frequency [33.7MHz] cavity of very pure copper that houses four precisely machined vanes which takes care of the acceleration, bunching and focusing of ion beams", according

nature INDIA

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doi:10.1038/nindia.2010.77; Published online 14 June 2010

Science news

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).

The RIB project site at VECC.

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 unruly cancer cells.

Researchers at VECC have designed the radio frequency quadrupole (RFQ) accelerator that accelerates low energy heavy ions[1]. "It is a three-in-one accelerator — it accelerates, bunches and focuses the ion beam," says Alok Chakrabarti of VECC.

The VECC team has created the facility in collaboration with

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আনন্দবাজার পত্রিকা

১৫ আশ্বিন ১৪১২ শনিবার ১ অক্টোবর ২০০৫

সংক্ষেপে ...

পরমাণু বিজ্ঞানে নয়া সাফল্য ভারতের

স্টাফ রিপোর্টার ✧ কলকাতা

জাপানের পরে এ বার ভারতেও রেডিও ফ্রিকোয়েন্সি কোয়াড্রুপল চালু হল। এশিয়ার মধ্যে ভারতই হল দ্বিতীয় দেশ, যেখানে এই 'অ্যাক্সিলারেটর' বা ত্বারক চালু করা হয়েছে। শুক্রবার ভেরিয়েবল এনার্জি সাইক্লোট্রন সেন্টারের অধিকর্তা বিকাশ সিংহ এক লিখিত বিবৃতিতে এ কথা জানান। এটি একটি জটিল এবং অত্যাধুনিক ত্বারক। এর মাধ্যমে পরমাণু কণাকে প্রচণ্ড গতিশীল করে তোলা যাবে। ১৯৮০ সালেই প্রথম মার্কিন যুক্তরাষ্ট্র এই ত্বারক চালু করে। তার পর থেকে খুব বেশি দেশ এই ত্বারক চালু করতে পারেনি।