RFQ cooler and buncher project for ISOLDE

Present status and off-line test results

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Why an RFQ CB for ISOLDE

- Reduced transverse emittance
- Reduced energy spread
- Beam bunching capability

For a wide range of masses

Relatively fast cooling (< ms)

Examples for applications

- Injection into mass spectrometers
  e.g. ISOLTRAP, MISTRAL, JYFLTRAP
- Laser spectroscopy
  – COLLAPS, JYFL
- Injection into mass separators
  – HRS of ISOLDE, EURISOL

Installation of RFQ

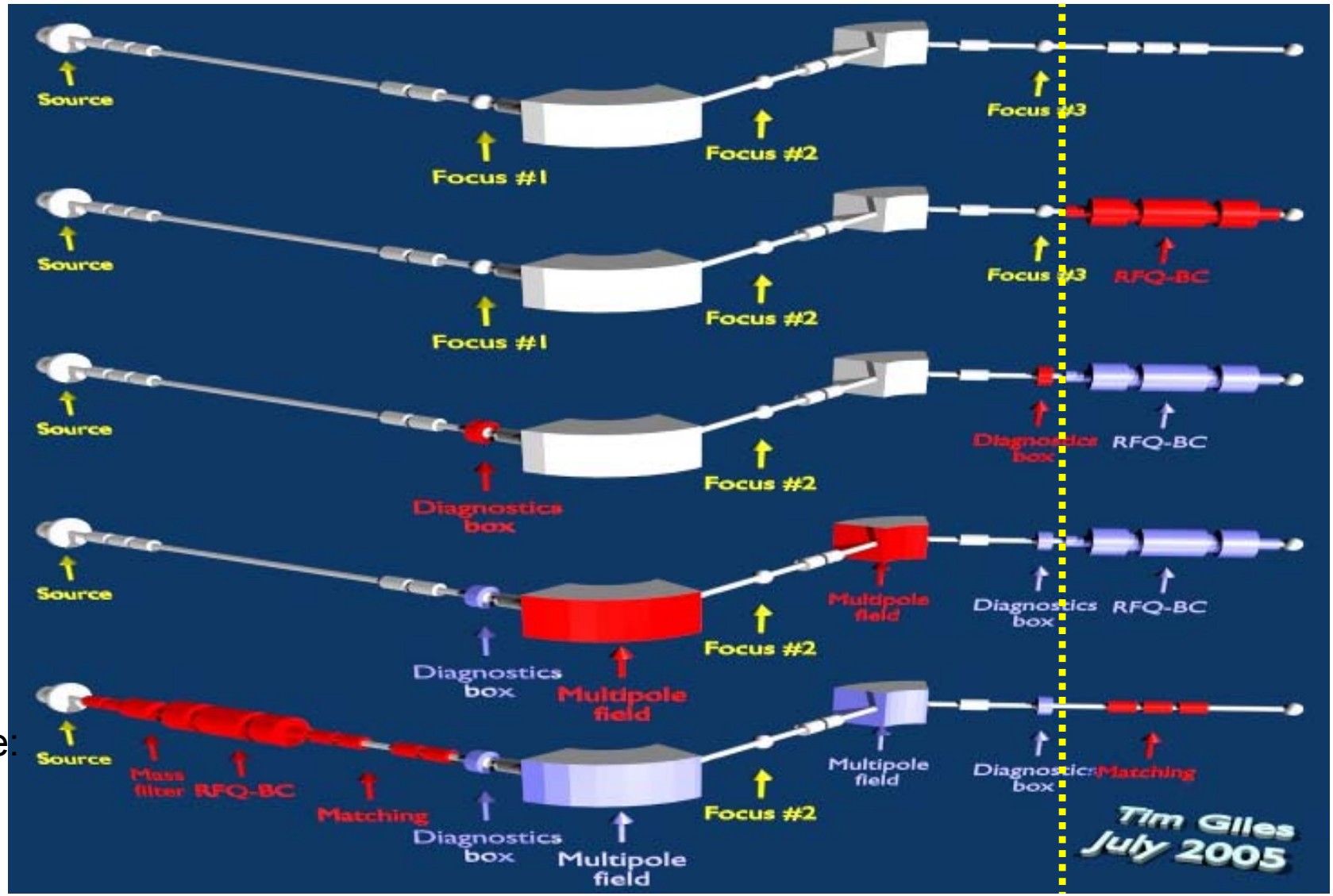
Today:

October 2007:

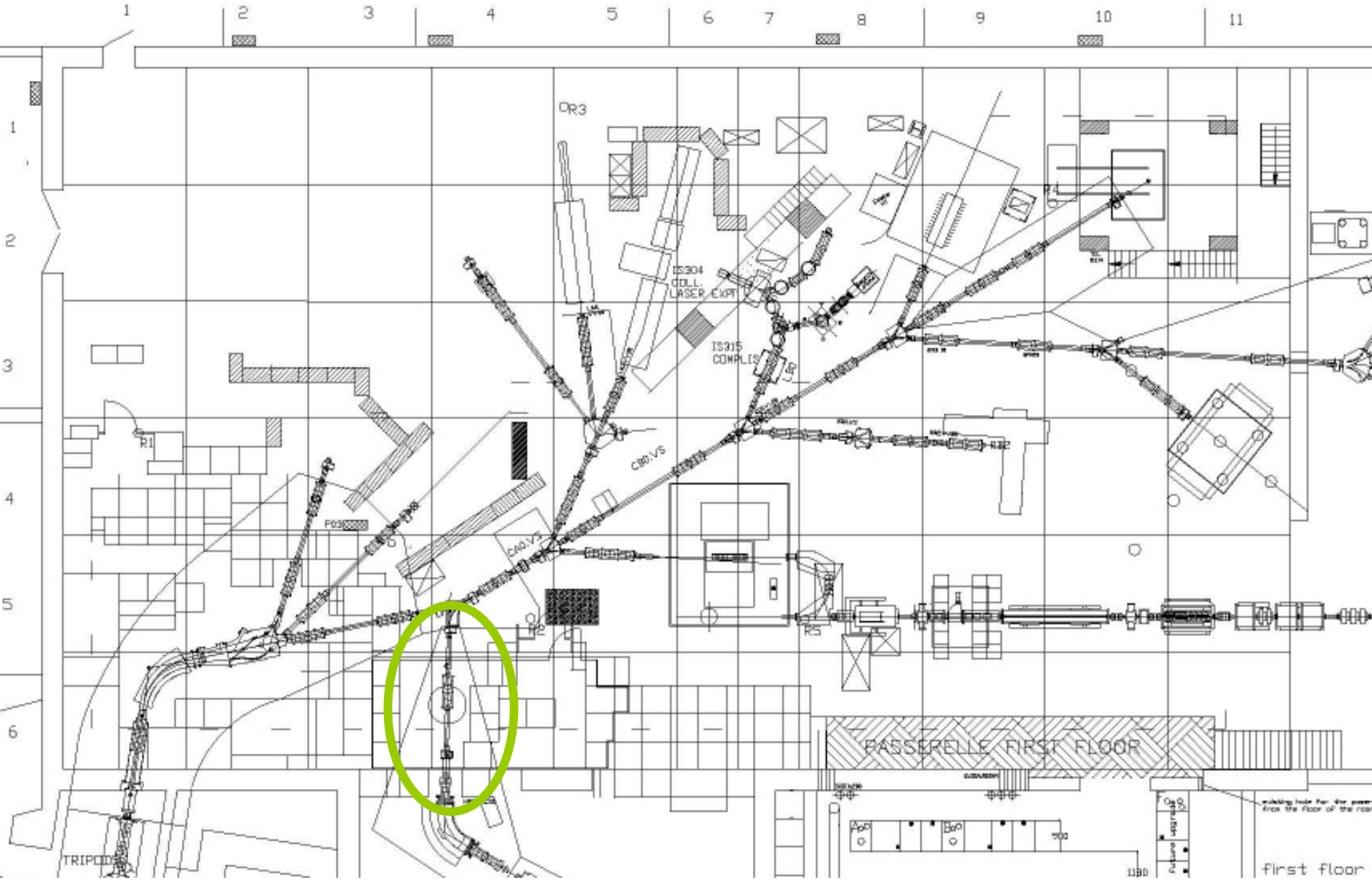
2nd step:

future:

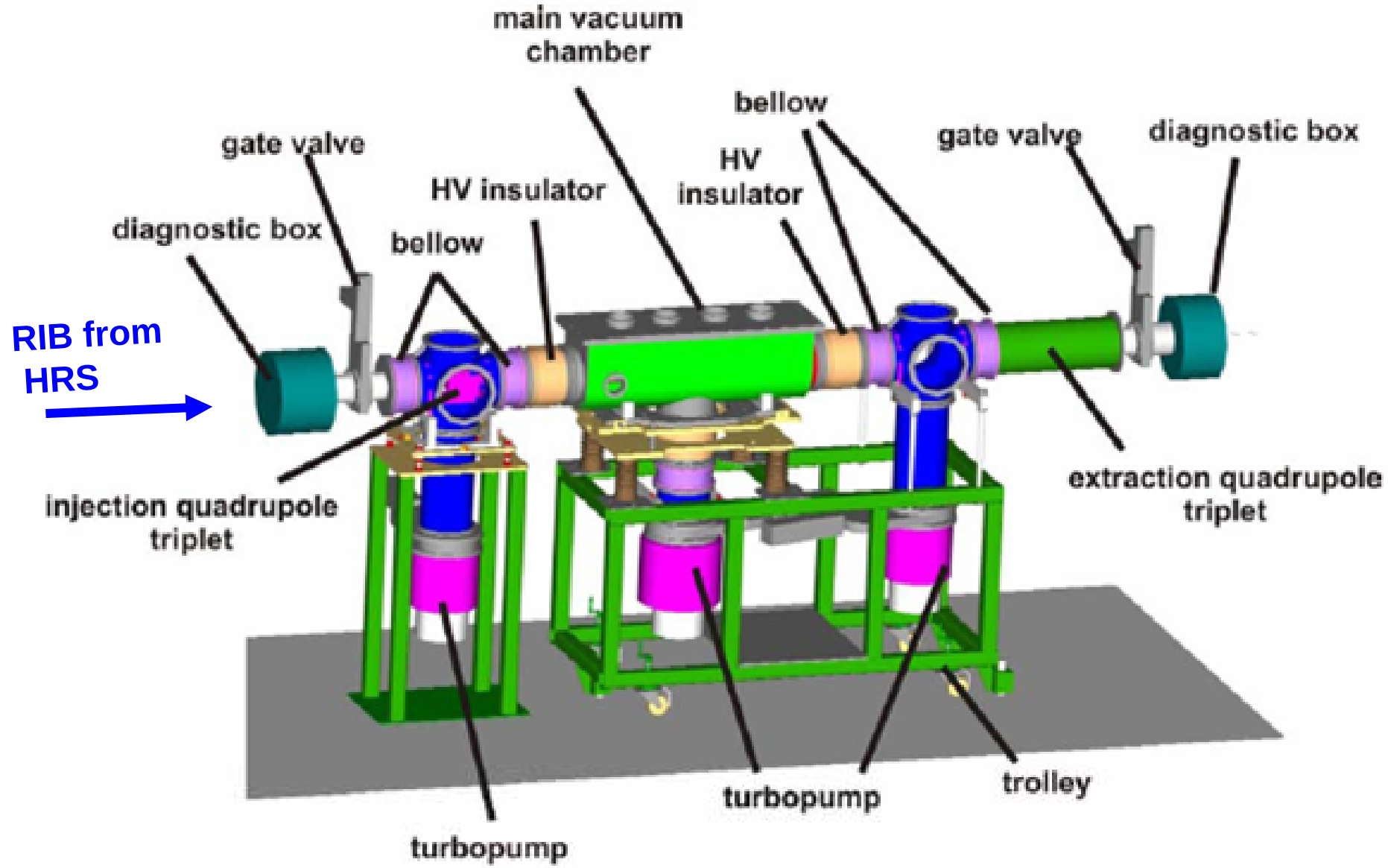
EURISOL HIE Isolde:



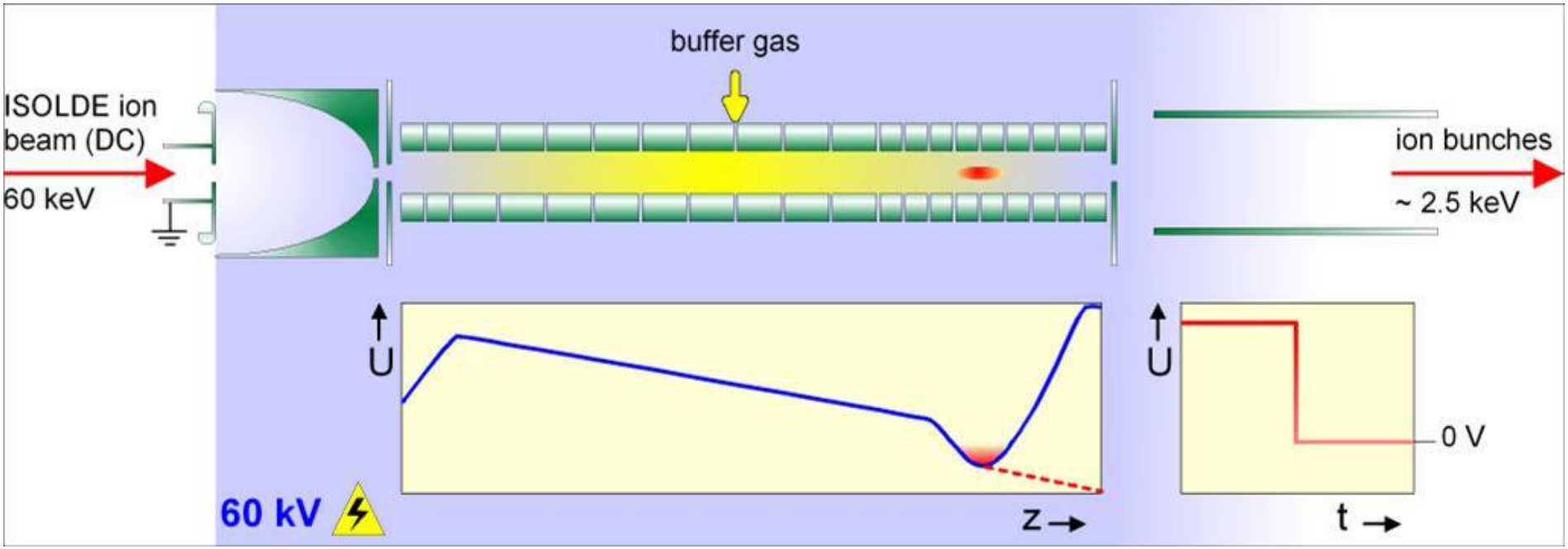
Where at ISOLDE



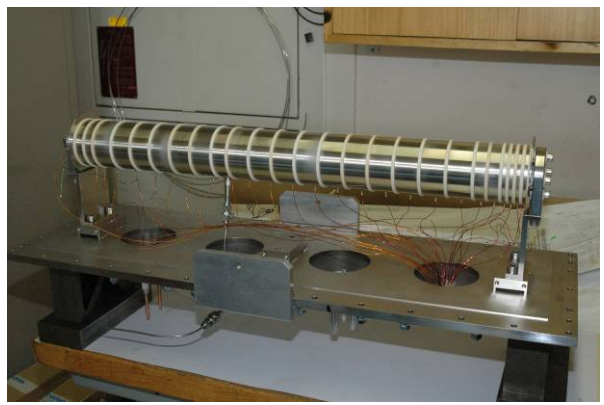
Cartoon of the RFQ installation



RFQ Cooler technique



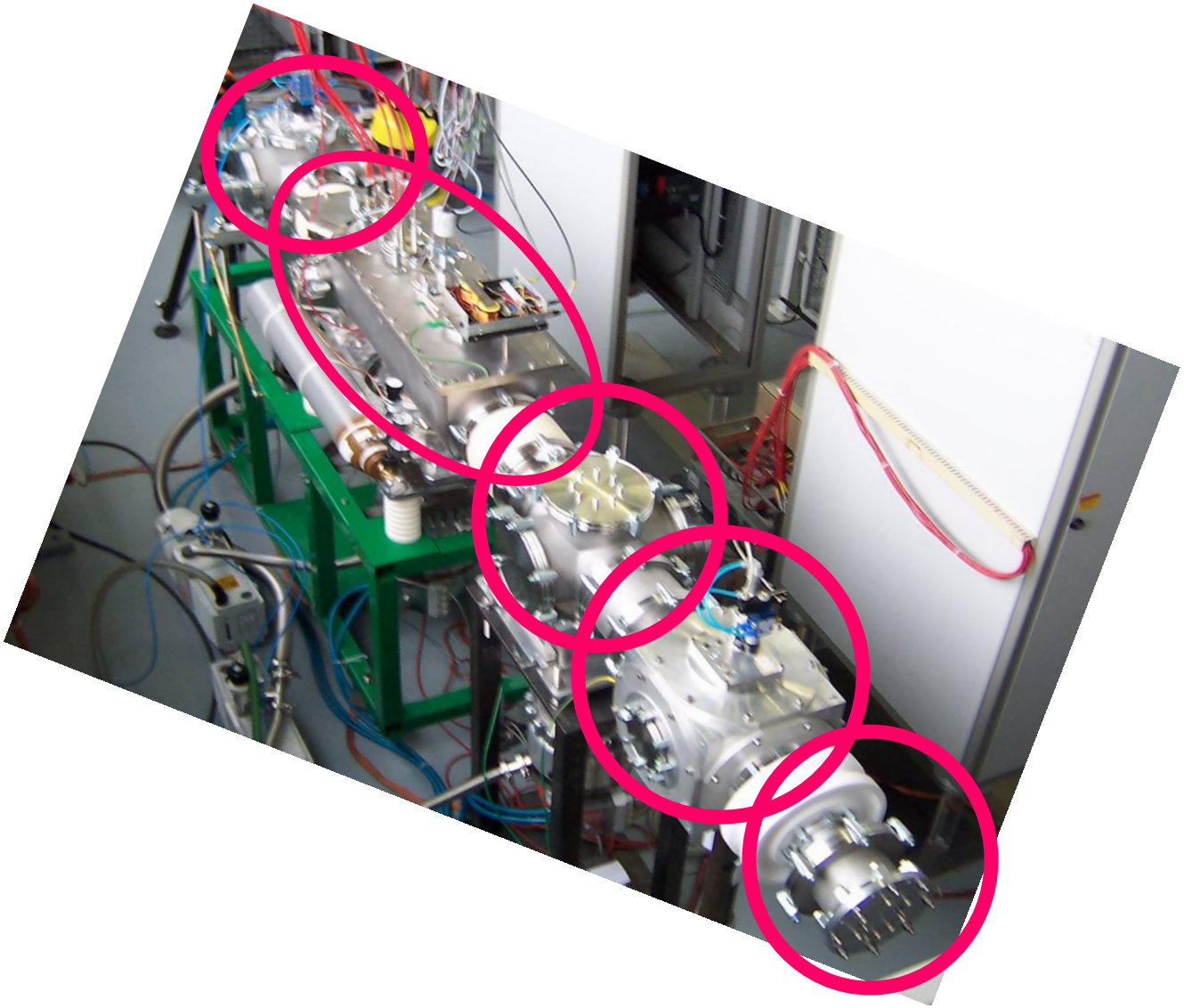
- RF for radial confinement
- DC Segments for axial trapping
- Gas for cooling



Aims of the off-line tests

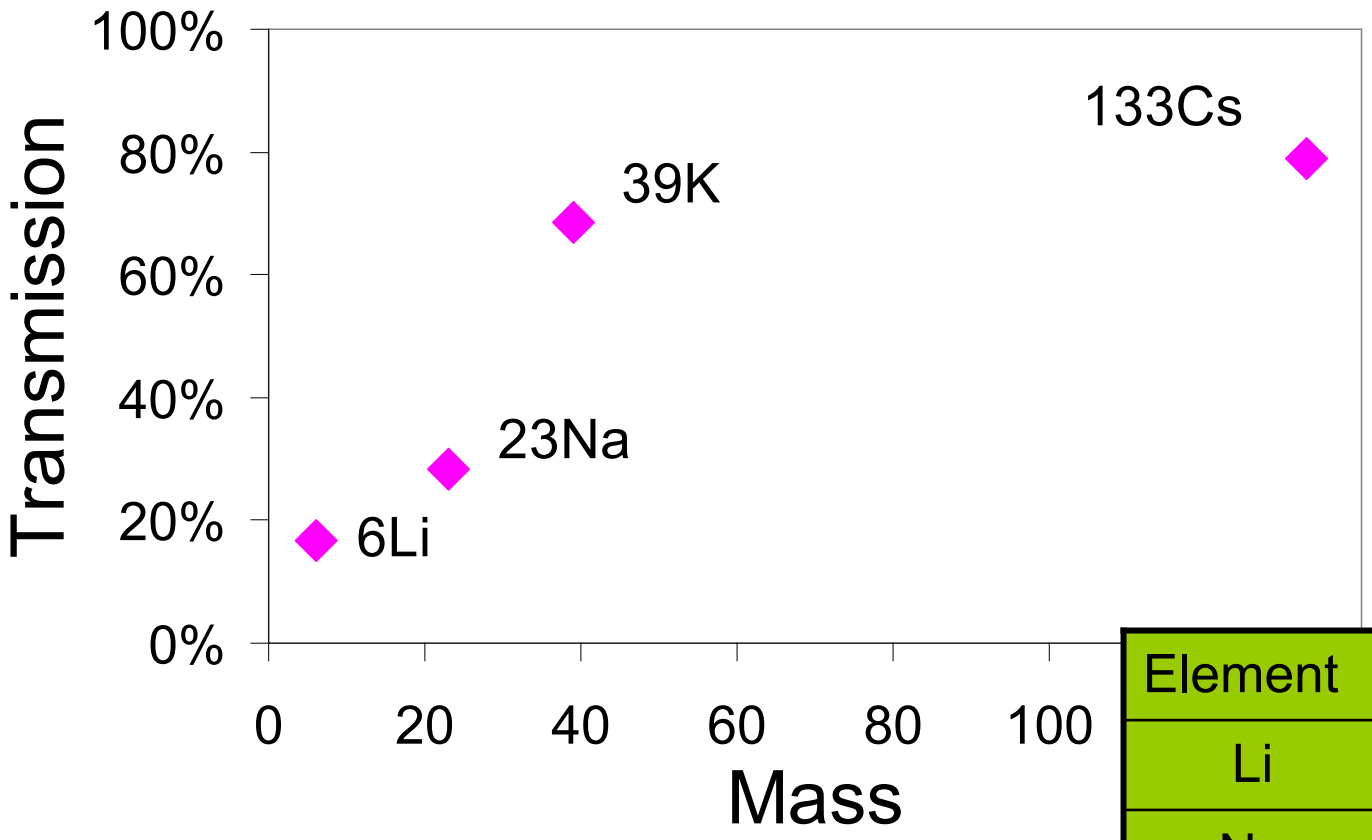
- Transmission efficiency
  - As a function of the mass
    - Alkali ions Li,Na, K, Cs
    - Ar / noble gases from a FEBIAD source
  - CW and pulsed mode
- Beam quality improvements
  - Emittance measurements
  - Time and energy spread of the bunches
- Specific issues
  - Space charge limit with bunched beams
  - Recombination of noble gases with impurities

ISCOOL off-line tests



- RFQ
- RF Oscillator
- Test ion source
- 2 FCs for diagnostics
- Quadrupole Triplet

Optimized transmissions

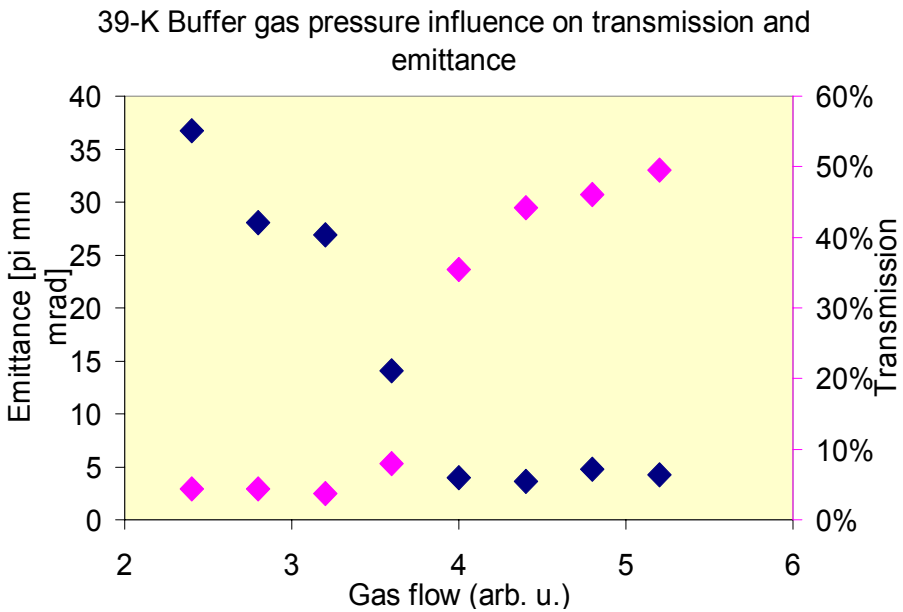


CW mode

Element	Transmission
Li	17 %
Na	28 %
K	68 %
Cs	79 %

Ion cooling

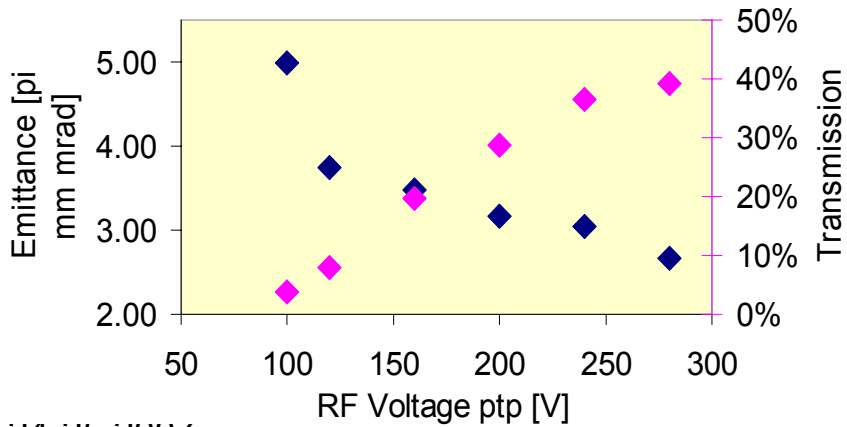
CW mode



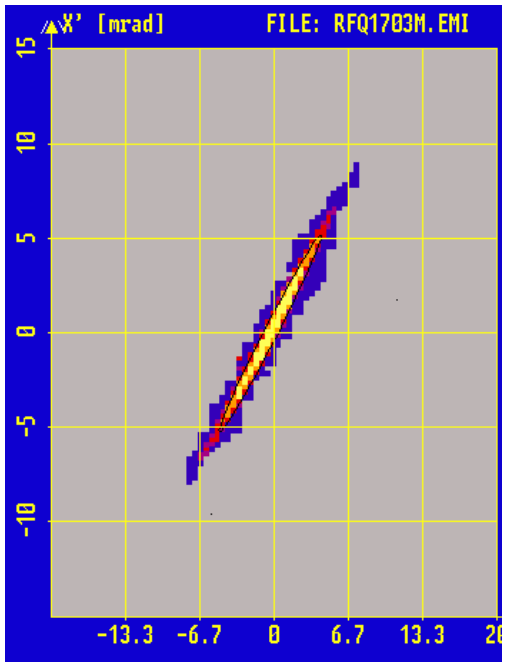
Element	Emittance
Ion source	>35 π•mm•mrad
Without cooling	>35 π•mm•mrad
With cooling Cs	ε_{95}= 2.2 π•mm•mrad 60% transmission
Na	ε_{95}=2.95 π•mm•mrad 23 % transmission

When optimizing the buffer gas pressure or the RF voltage the emittance decreases as transmission efficiency increases

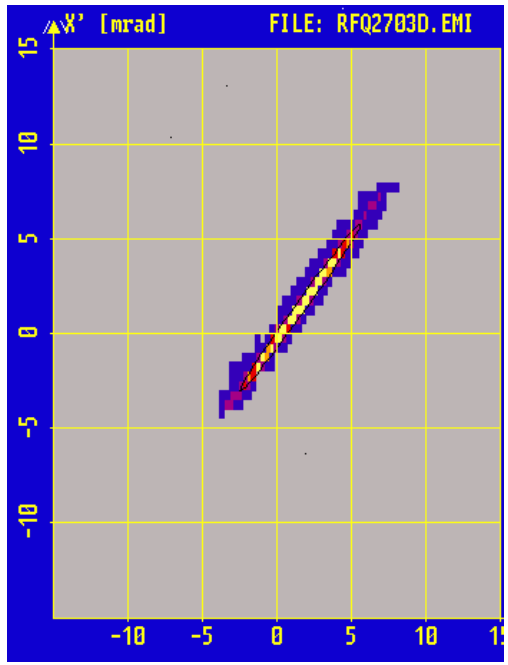
39-K RF ptp voltage influence on transmission and emittance



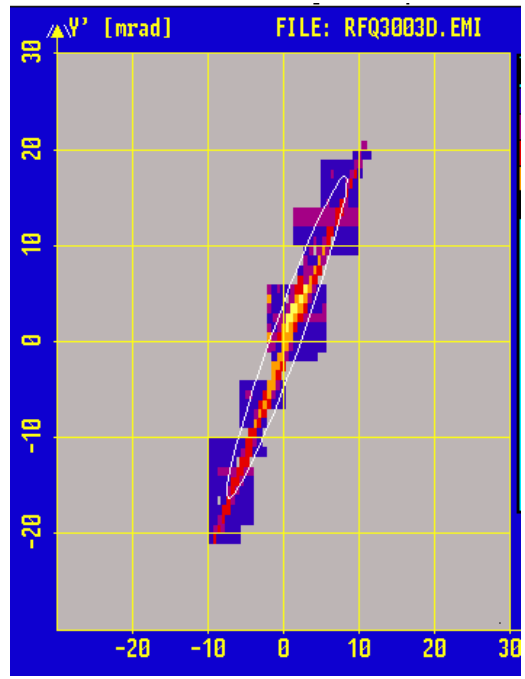
Emittance measurements



KV-plane 4 mm mrad emittance after the RFQ with 50 % transmission



2 mm mrad in emittance in the KV-plane after the RFQ with 60 % transmission



33 mm mrad emittance in the KV plane directly from the ion source

Bunched beams

- Preliminary tests with Na ions
  - Transmission close to CW operation (>20%)
  - Space charge limits in transmission efficiency not seen up to 10^6-10^7 ions/bunch
  - BUT: long bunches >50μs
    - may be due to the (too) simple extraction scheme adopted up to now – pulsing of the extraction plate only

Next steps

- Off-line commissioning
  - Tests with a FEBIAD ion source (Ar)
    - ISOLDE-like ion source
    - Charge recombination in the buffer gas?
  - Tests of the bunching mode with a better extraction scheme
    - Pulsing the extraction plate and the last segments of the buncher
- Installation
  - HV platform - next June
  - Installation of the RFQ - October