

Window-less Operation of the JYFL Gas-filled Recoil Separator RITU

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Other contributions:

Matti Leino: Transmission of the
JYFL Gas-filled Recoil Separator
RITU

T. Engvist: About the Design of
a Gas-filled Separator

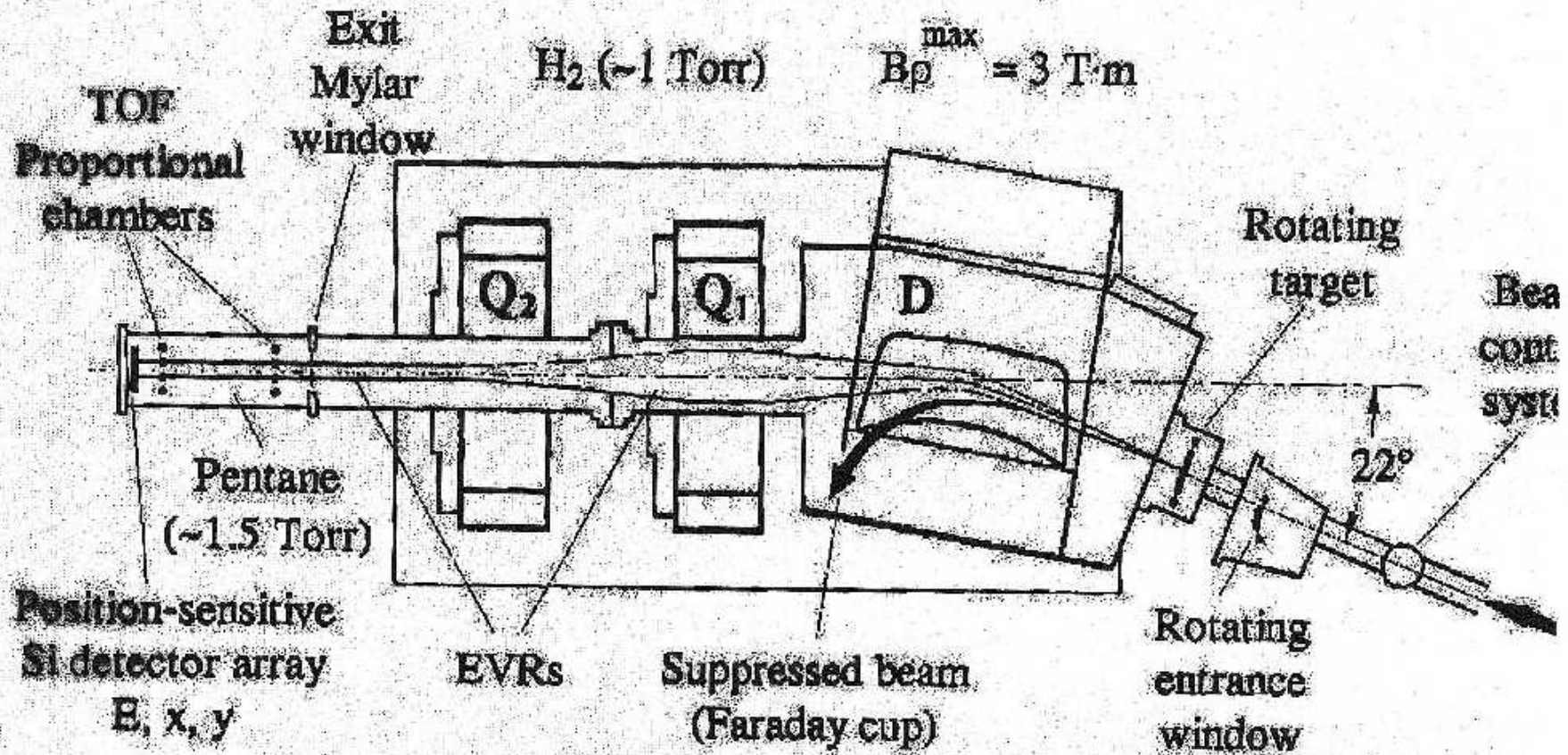
Differential pumping at RITV

Why?

- intensive beams → problems with gas windows

Solutions

- rotating window system
 - technically possible but difficult
 - need for big C foils
 - bad experience about using metallic foils
- differential pumping
 - needs collimation
- from 1-5 mbar down to 10^{-6} mbar level in short distance
- has to be realized in two stages (at minimum)
- costs has to be kept low
 - helium consumption?



The Dubna Gas-Filled Recoil Separator: a Facility for Heavy Element Research

Viscous flow :

$$C = \frac{\pi d^4}{256 \eta L} (P_1 + P_2)$$

Molecular flow :

$$C = \frac{1}{6} \left(\frac{2 \pi k T}{m} \right)^{1/2} \frac{d^3}{L}$$

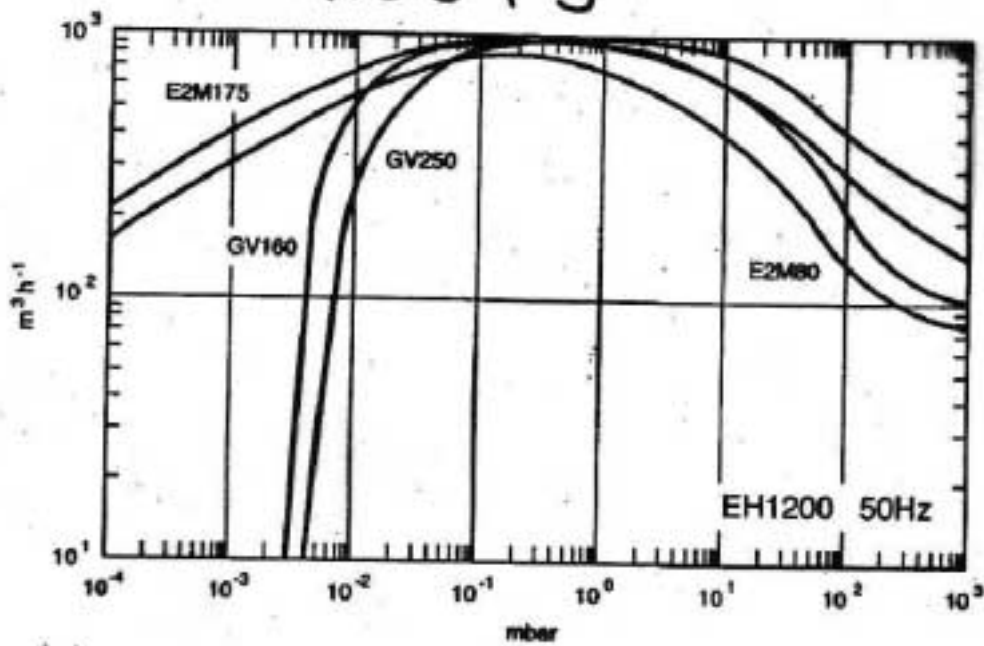
Example : $d = 12 \text{ mm}$ } collimator
 $L = 50 \text{ mm}$
 $P = 1 \text{ mbar}$

flow $\sim 100 \text{ m}^3/\text{h}$ (1 mbar)

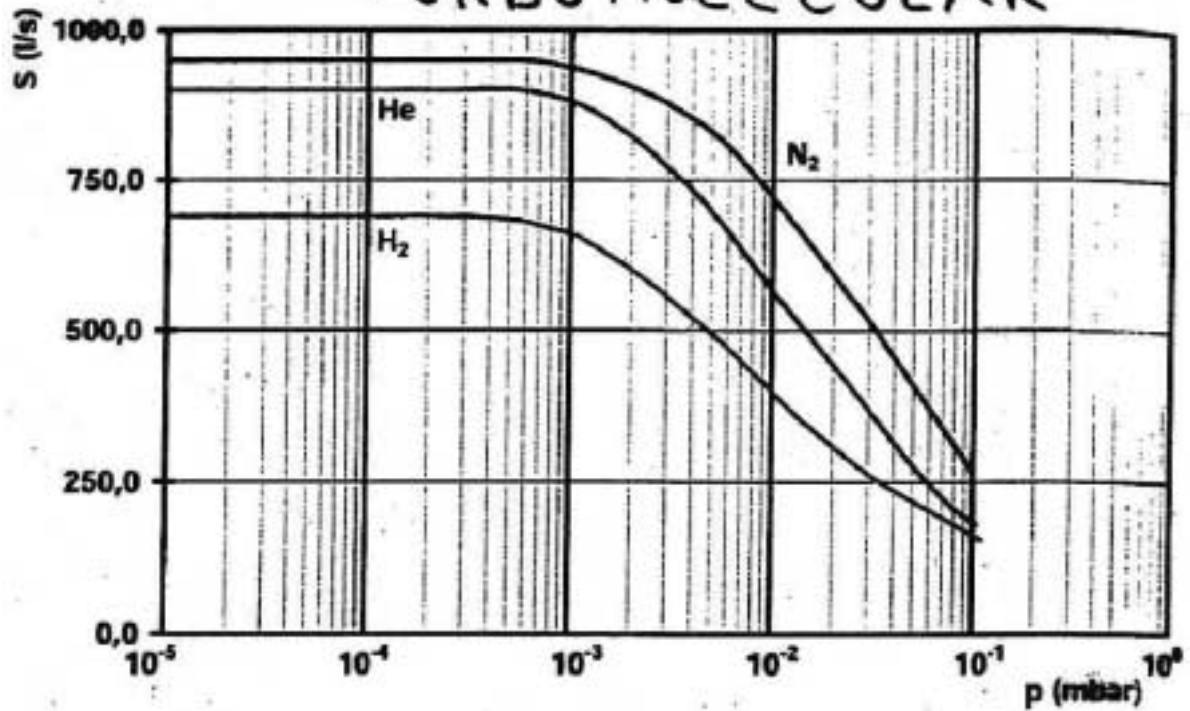
typical bottle size 10000 bar \cdot l

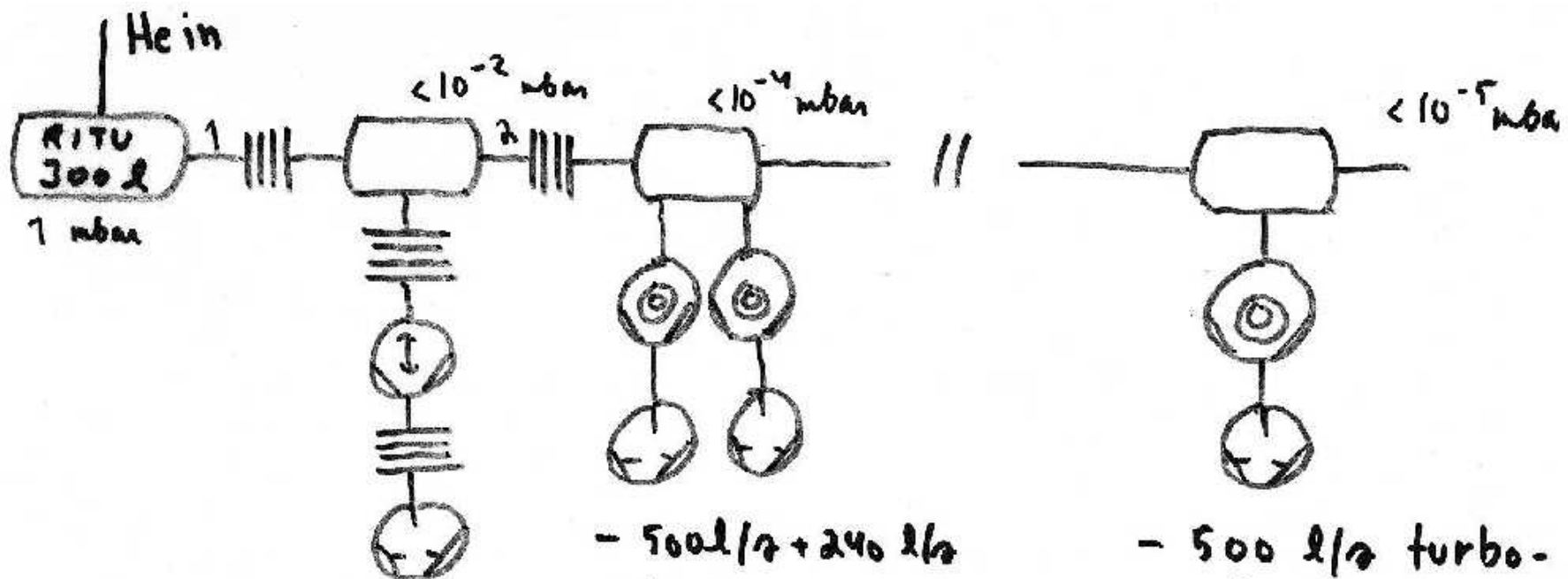
\rightarrow bottle change every 100 h

ROOTS



TURBOMOLECULAR






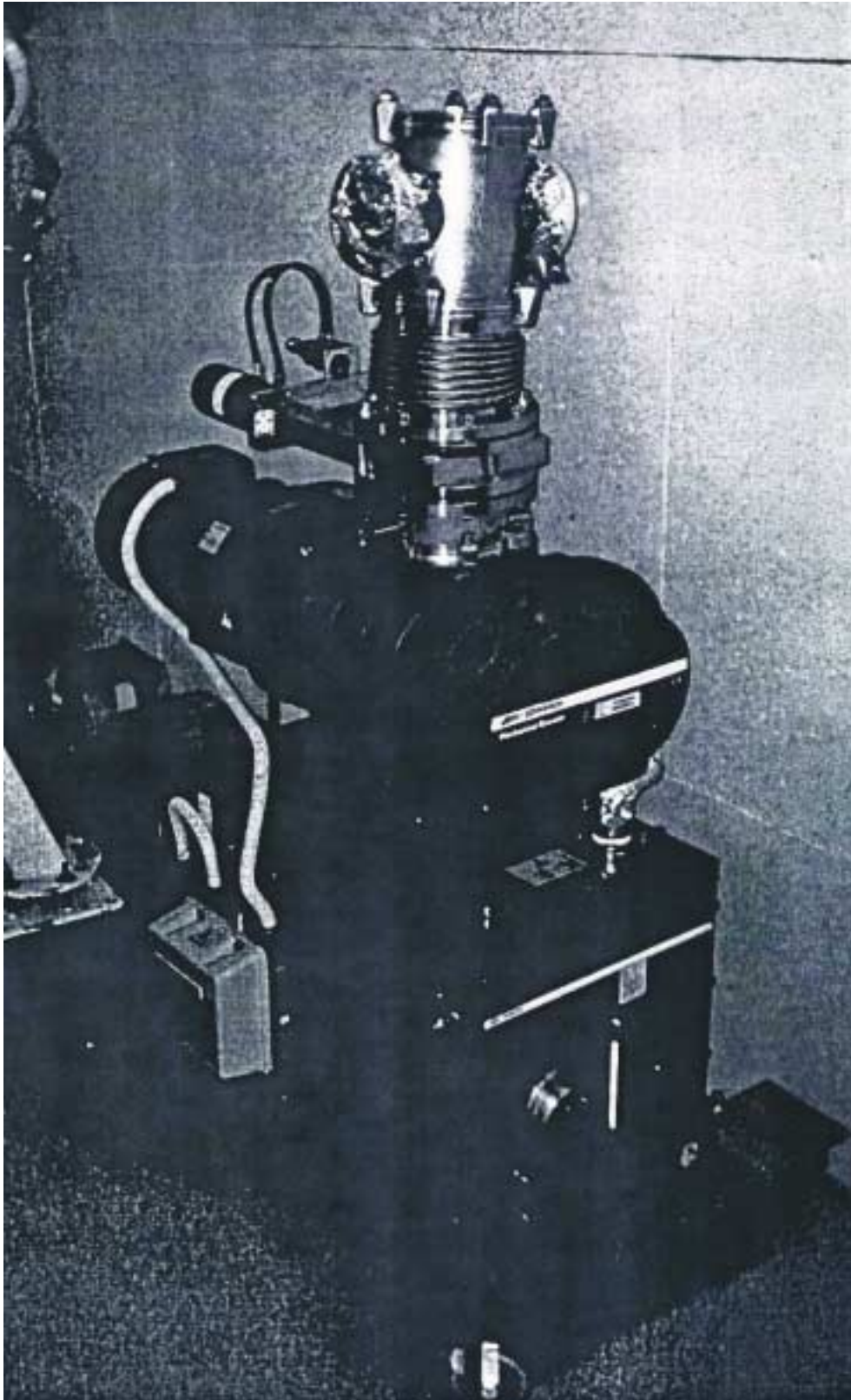
- 1020 m³/h
mechanical
Booster pump +
two stage rotary pump

- 500 l/s + 240 l/s
turbomolecular
pump stations

- 500 l/s turbo-
molecular pump
station

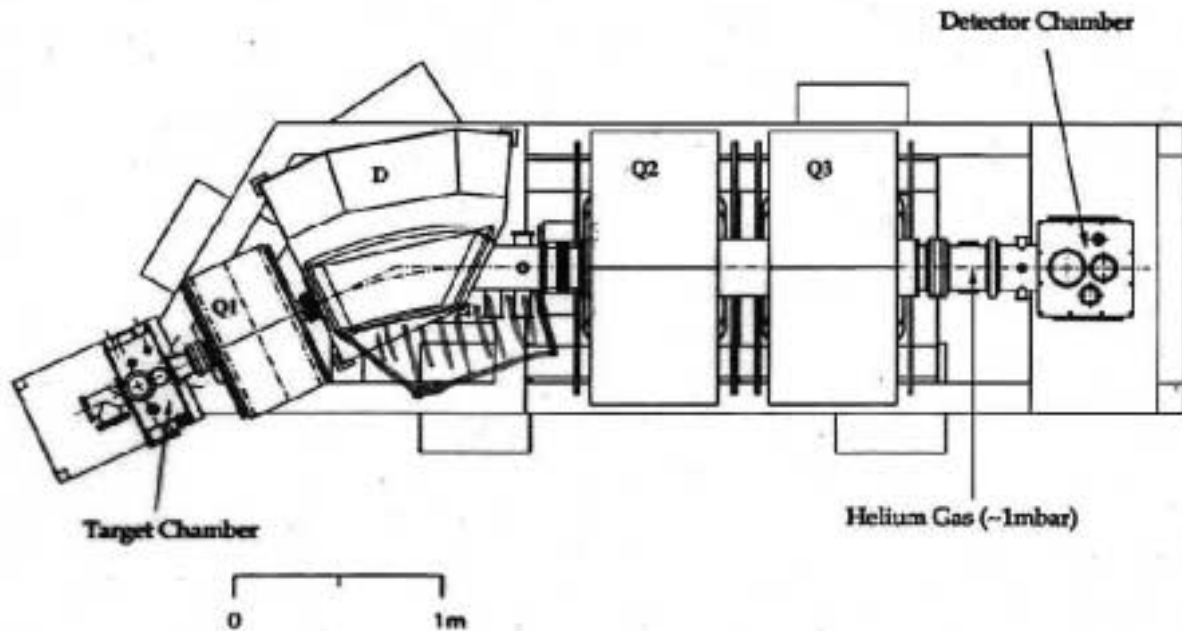
→
1000 l/s station
with ~ 100 times
better compression for He

- 1 collimation \varnothing 10 mm, L = 70 mm
2 -  \varnothing 24 mm, L = 200 mm





Decay Spectroscopy at RITU



Recent Development:

New Dipole Chamber

Improved suppression of scattered beam

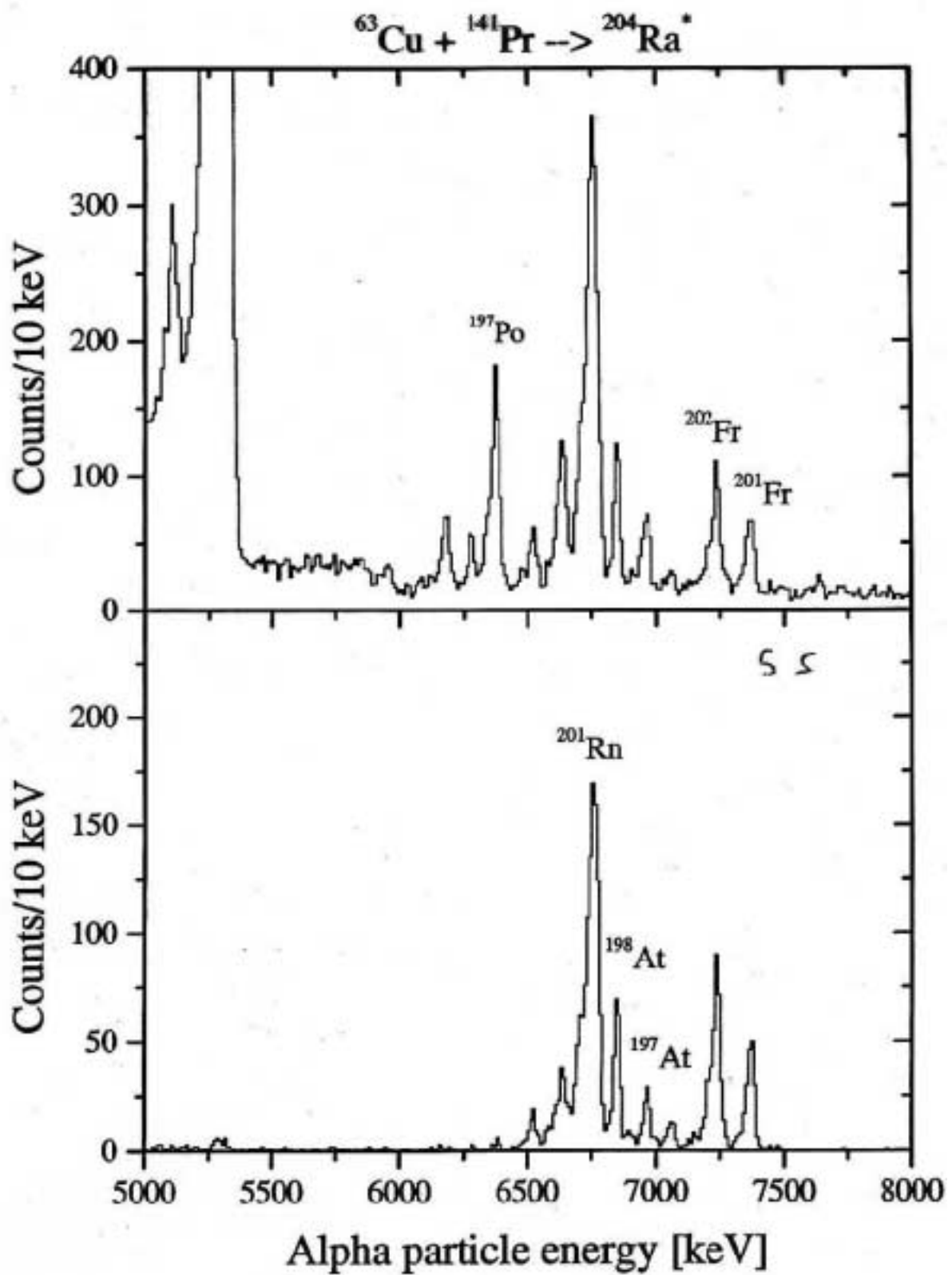
Introduction of Differential Pumping System

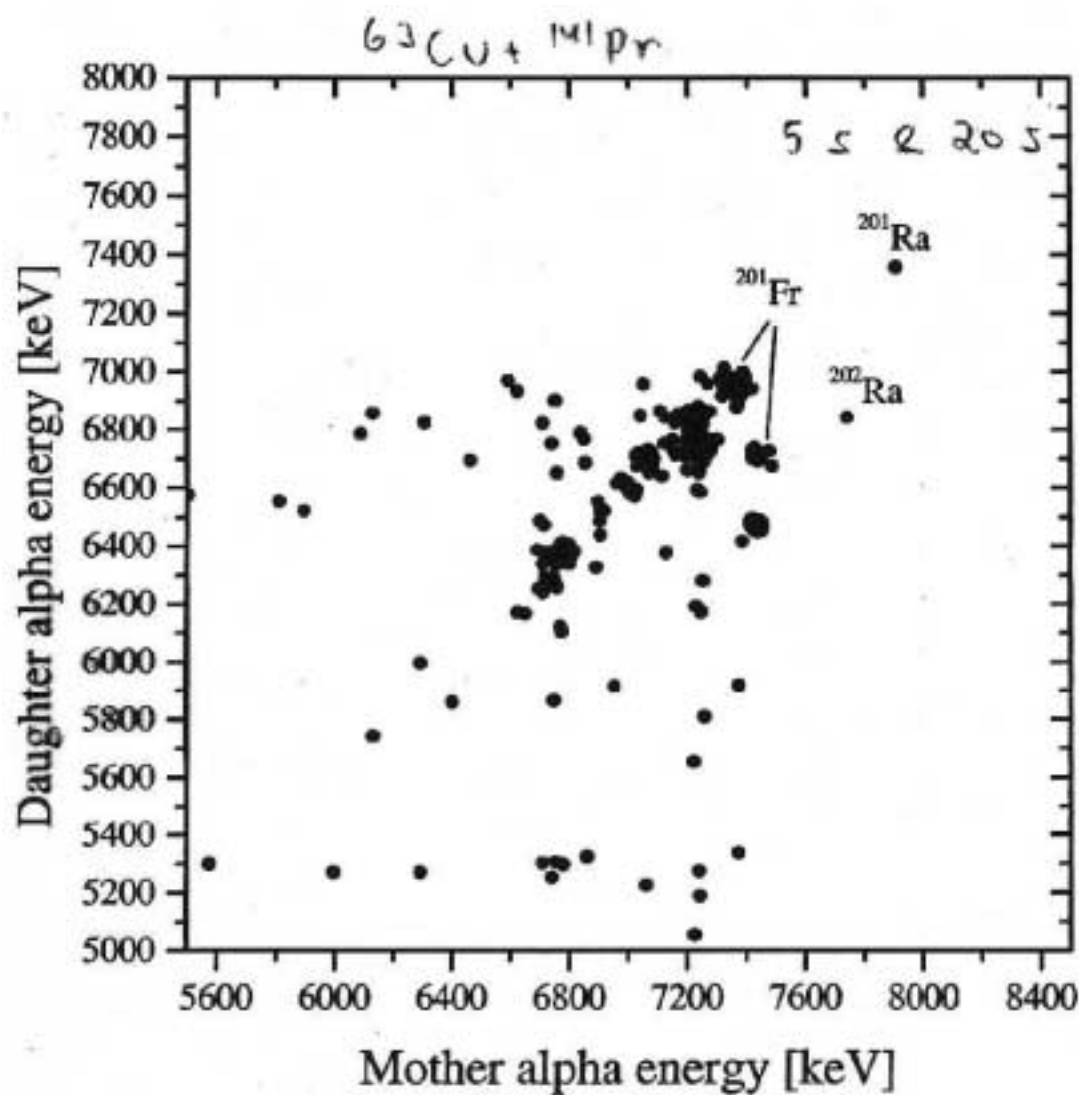
1000 cu. m/h Roots Booster – Eliminates need for C gas containment window

Development of TOF detector system

Beam/Fusion–Evaporation discrimination from E–TOF

Removal of low–energy background in region of alpha /proton energies





$I_b \sim 40 - 75 \text{ pA}$, target $\sim 600 \mu\text{g}/\text{cm}^2$

RITU rates $\leq 30 \text{ Hz}$ total

140 h run

1 event $\sim 60 \text{ pb}$

$p \sim 0.7 \text{ mbar He}$

Collimator $\varnothing: 10 \text{ mm}$, $L: 70 \text{ mm}$