

# RECENT RESULTS FROM MEASUREMENT P

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**M THE MISTRAL MASS**

**ROGRAM AT ISOLDE**

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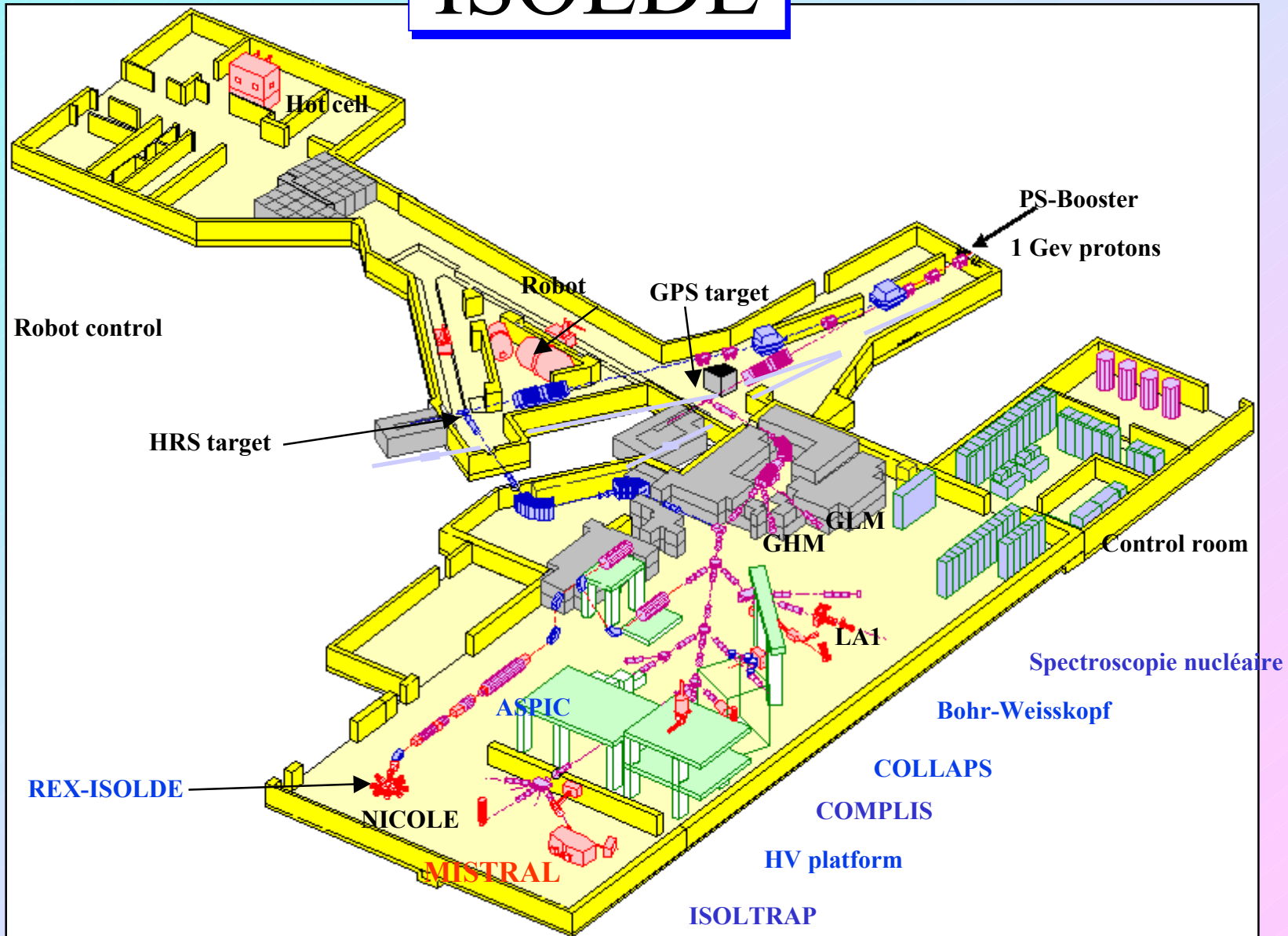
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MISTRAL

# ISOLDE



# Motivations

**MISTRAL:** Mass measurement at ISOLDE with a Transmission and Radiofrequency spectrometer on-Line

## ★ Mass measurement:

- Nuclear Structure

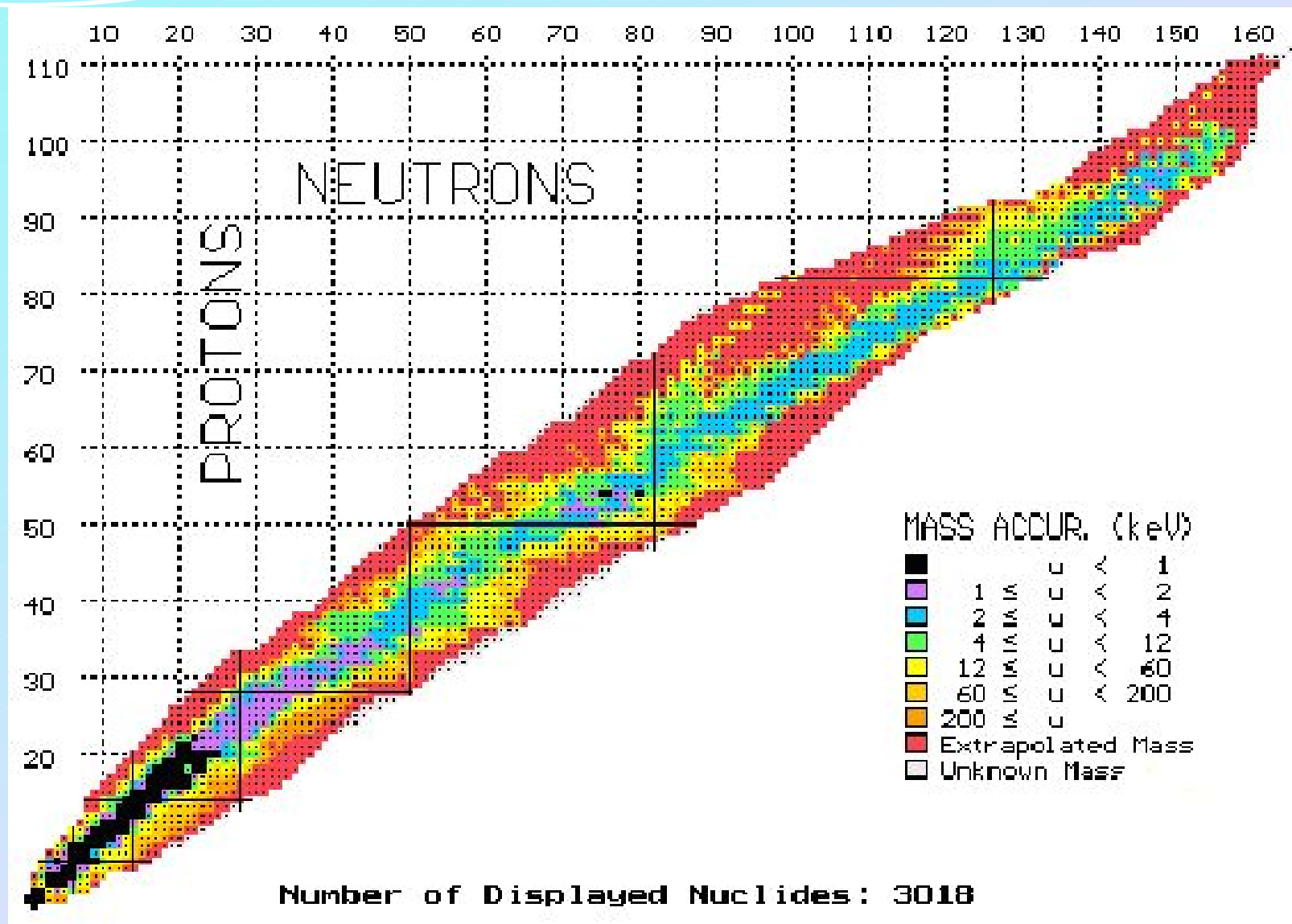
(shell closure, pairing, nuclear shapes,...)

- Check of nuclear structure models

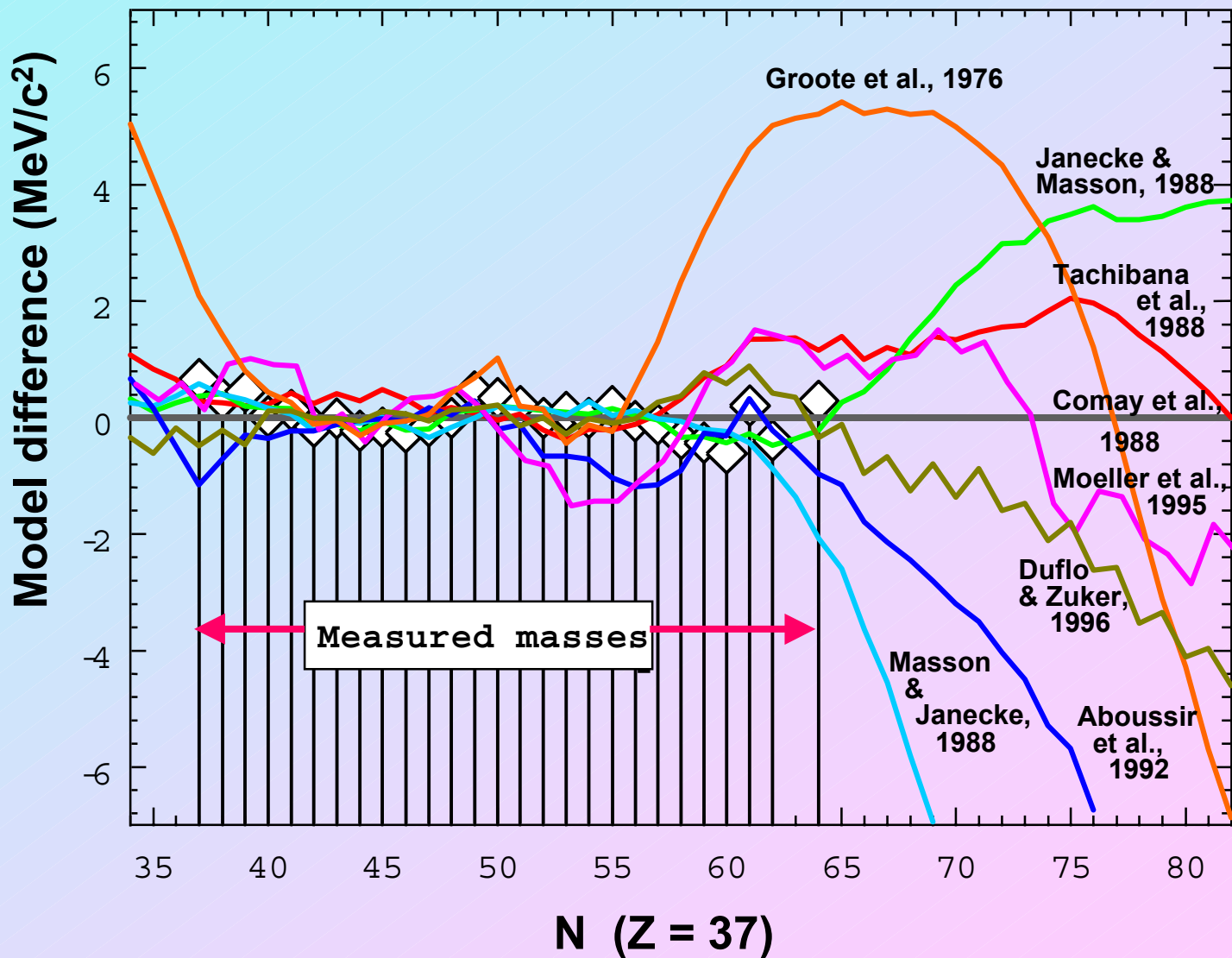
⇒ new constraints:



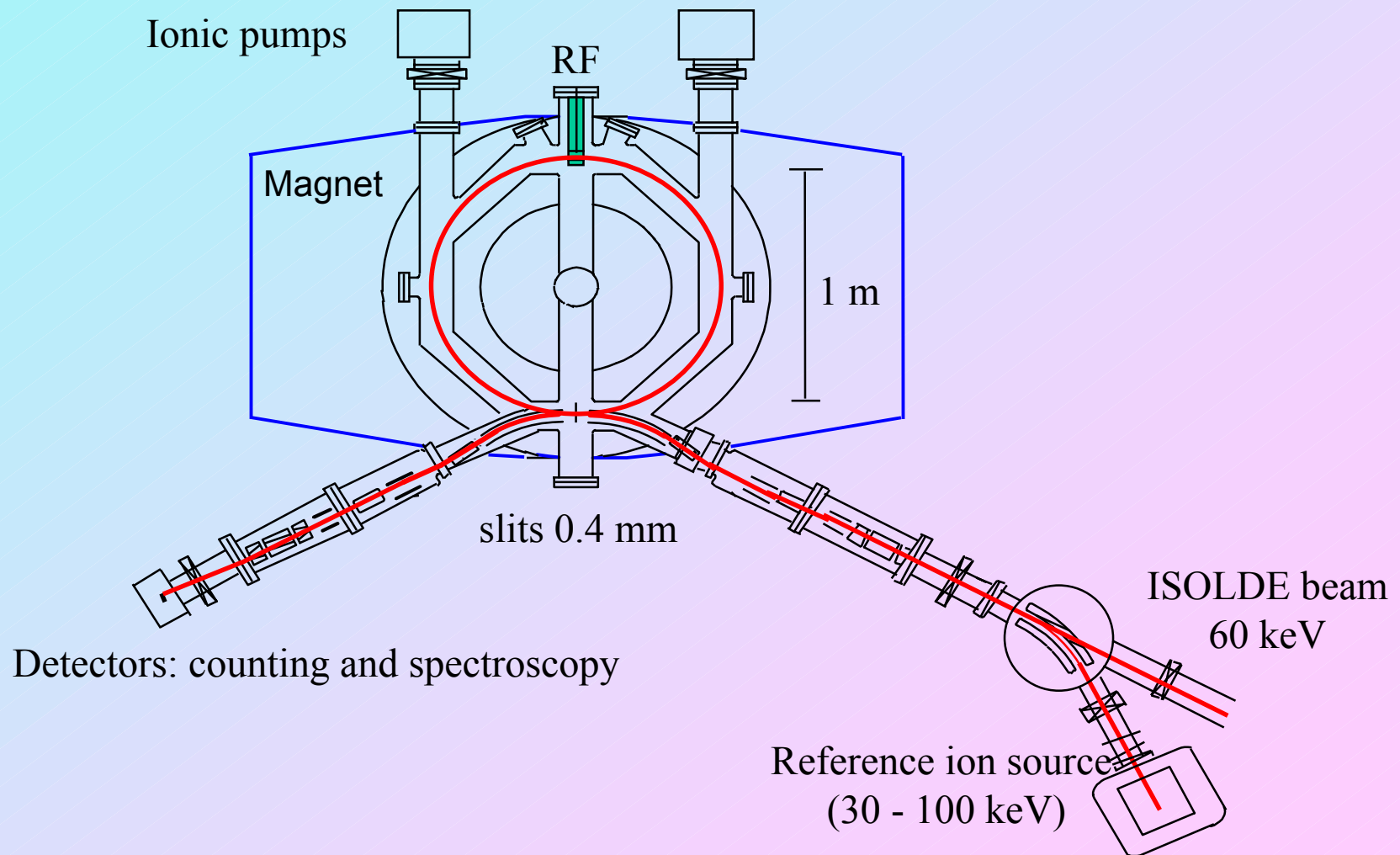
Mass measurement of exotic nuclei



# Models



# Principle



# MISTRAL features

**Ion kinetic energy: 30 – 60 keV**

**TOF in the spectrometer:  $\sim 50 \mu\text{s}$**

**Frequency band: 250 – 500 MHz**

**Mass resolving power:  $\sim 10^5$**

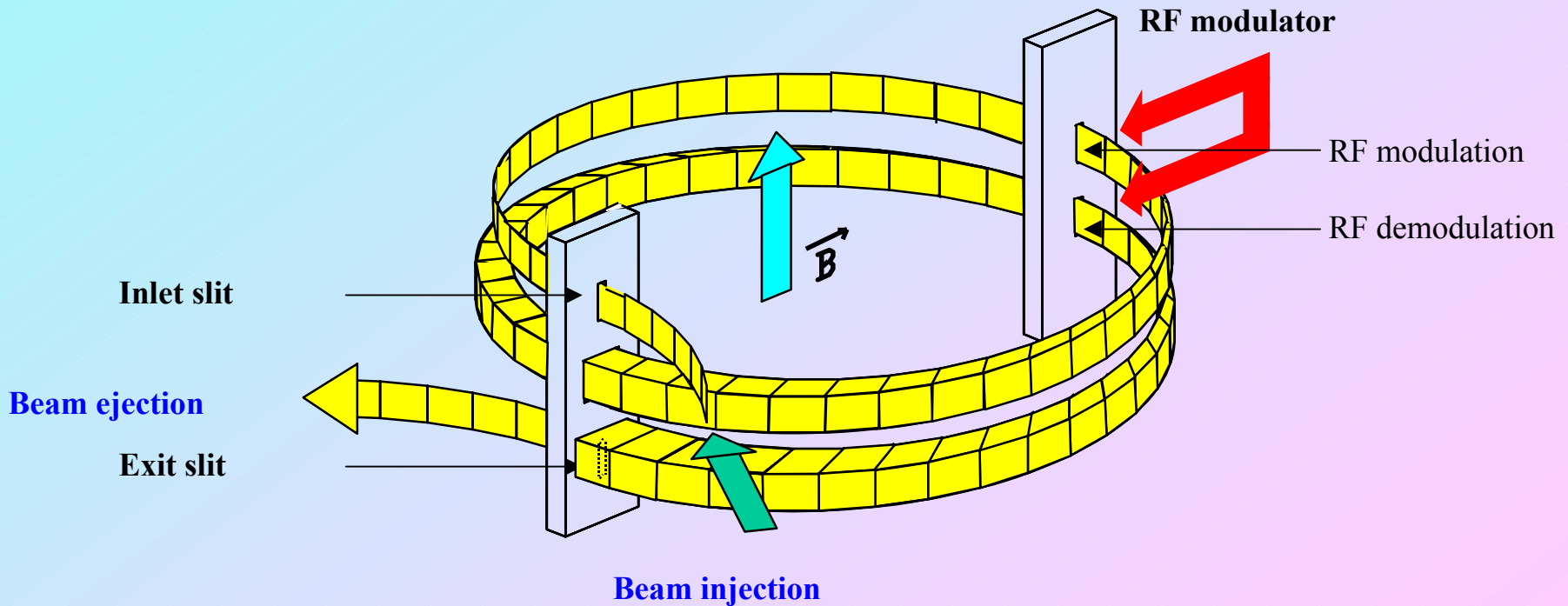
**Sensitivity:  $10^3$  ions/s**

**Precision:  $\frac{\Delta m}{m} \approx 5 \times 10^{-7}$**

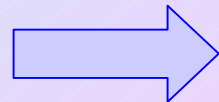


# Principle

- Cyclotron frequency
- 2-mass comparison



$$f_c = \frac{q}{m} \times \frac{B}{2\delta}$$



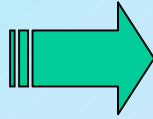
At constant B :

$$\left( \frac{m_1}{q_1} \right) = \left( \frac{m_2}{q_2} \right) \times \frac{f_{c2}}{f_{c1}}$$

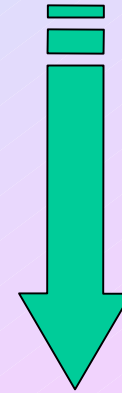
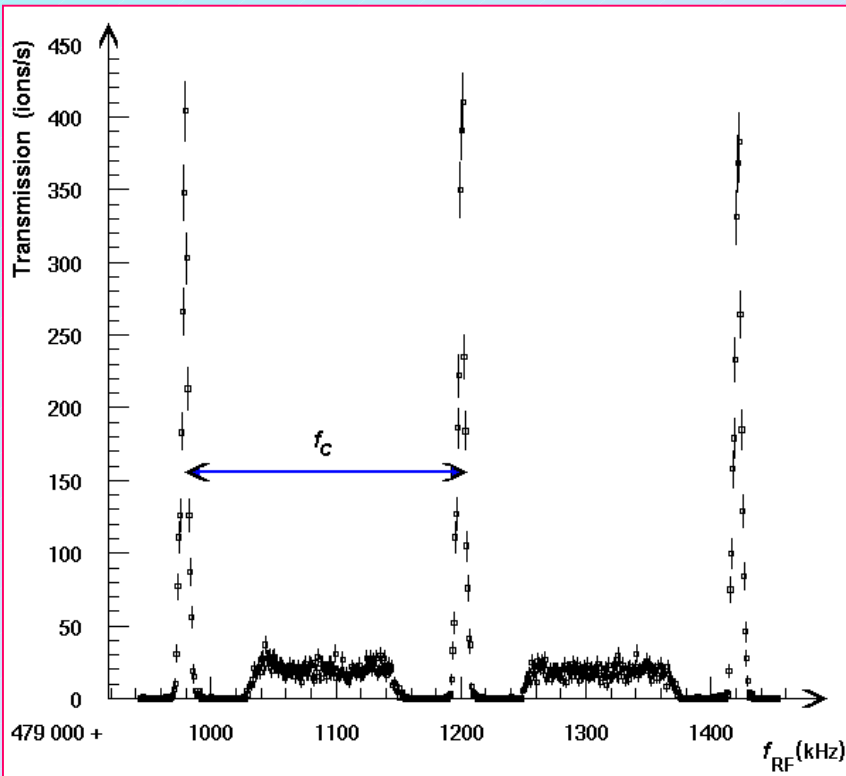
# Principle

- Cyclotron frequency
- 2-mass comparison

$$f_c = \frac{q \cdot B}{2\pi \cdot m}$$



Comparison of 2 masses in the **same** magnetic field



$$m_{Ref} \cdot f_{c_{Ref}} = m_{Unk} \cdot f_{c_{Unk}}$$

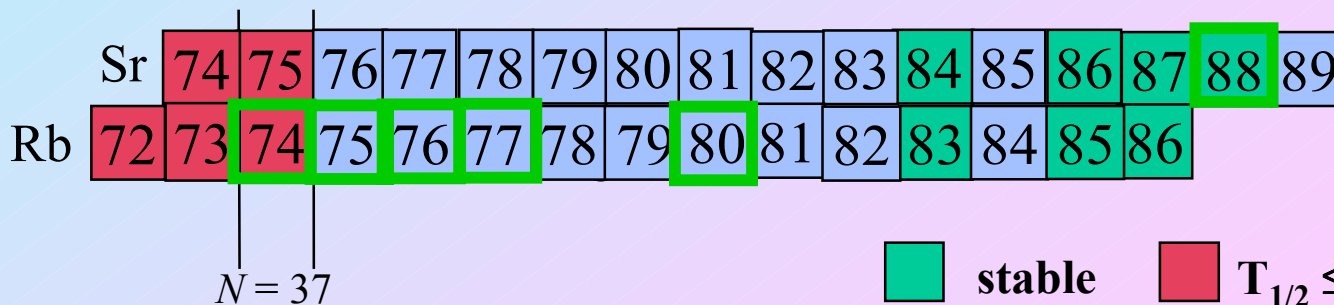
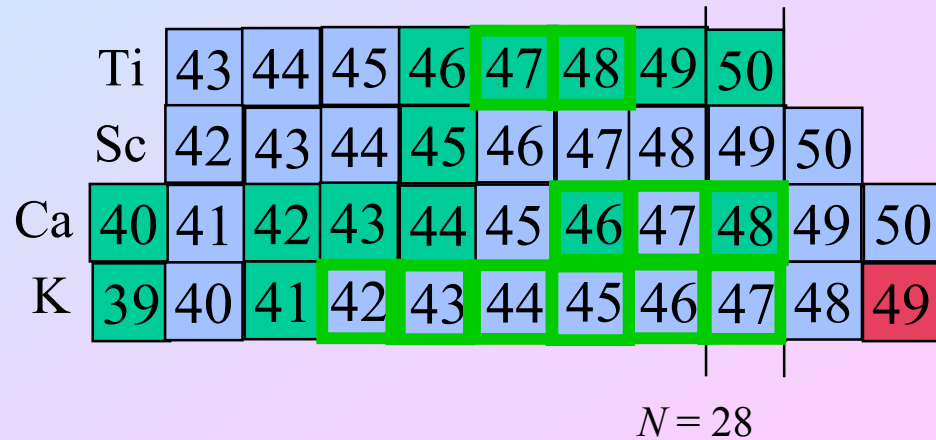
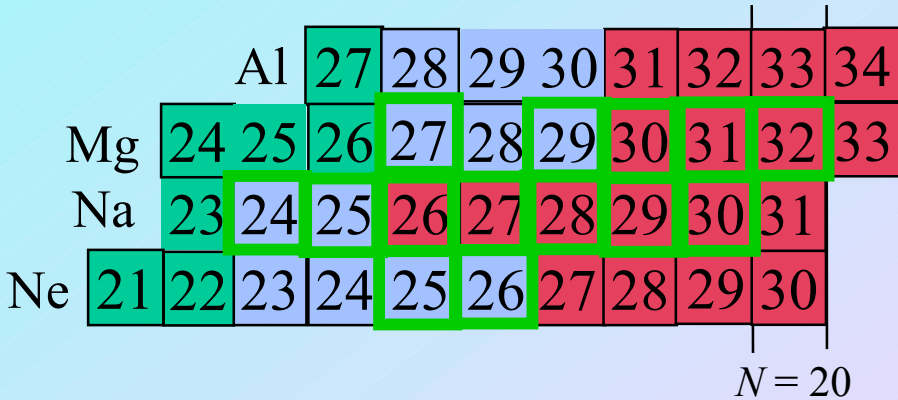
# Measurements

1998: Na, K, Ca

1999: Mg, Ne, Al

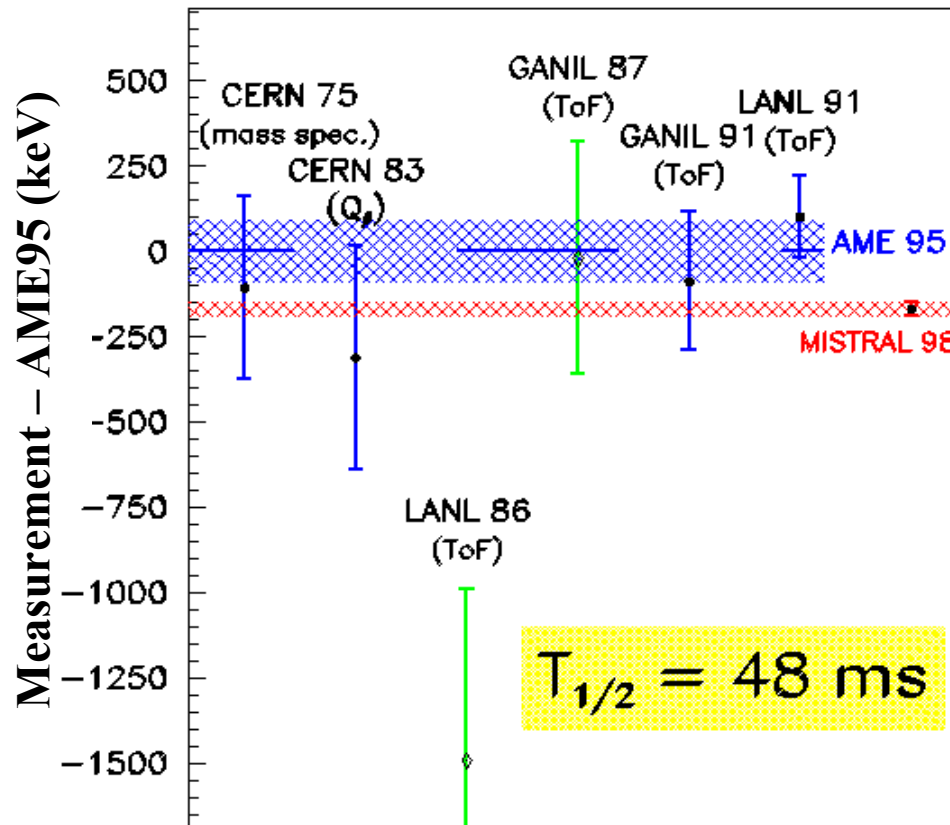
2000: Ge, Rb, Sr

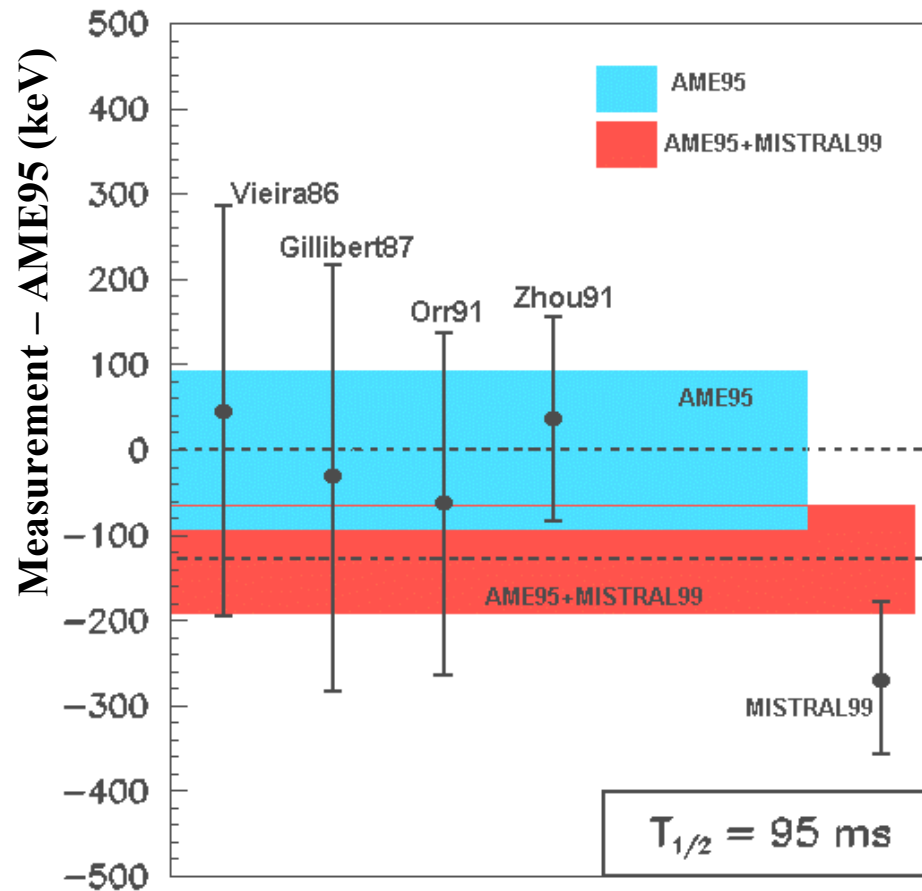
Half-life < 50 ms



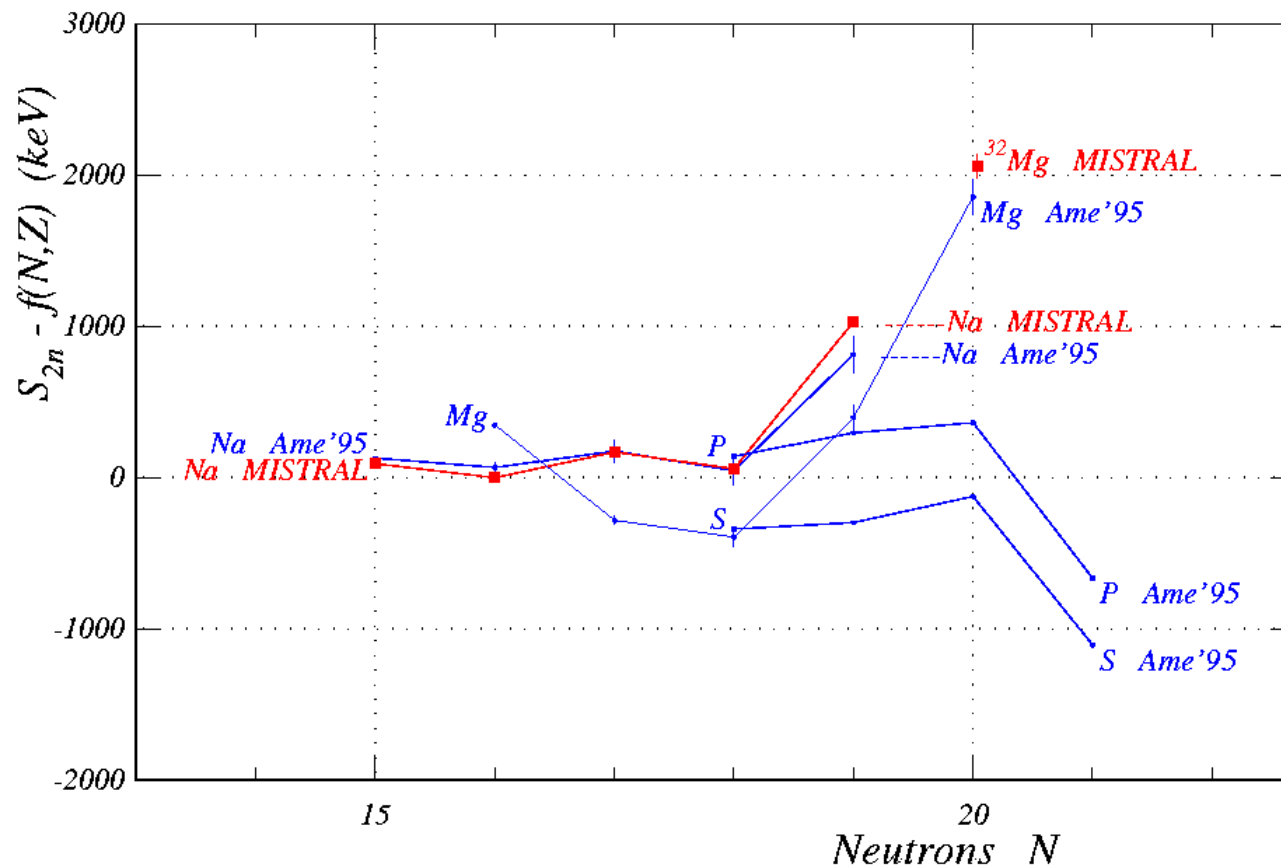
stable   
   $T_{1/2} \leq 1$  s   
  MISTRAL

2000/02/16 14.28

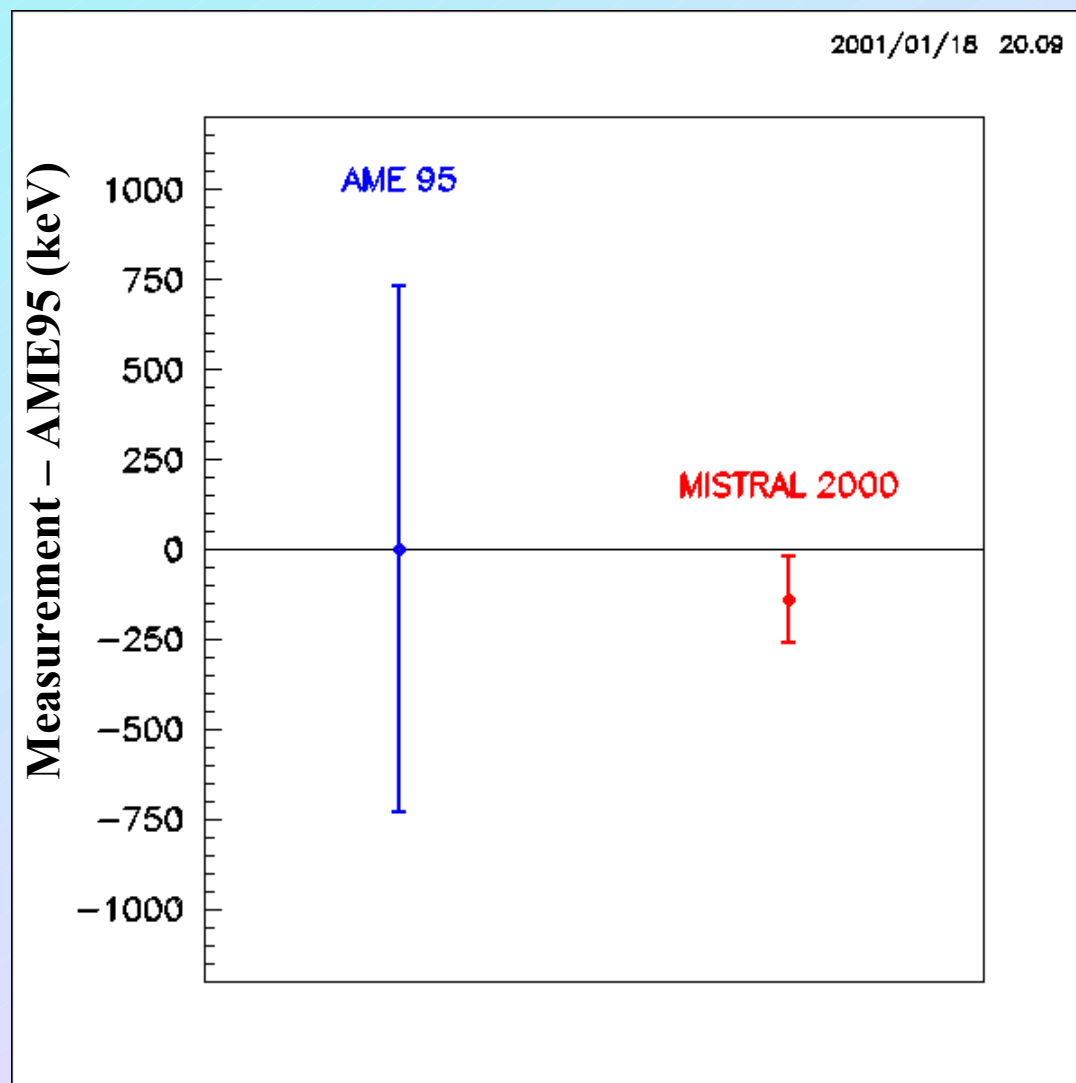


$^{32}\text{Mg}$ 

# Results $^{30}\text{Na}$ & $^{32}\text{Mg}$

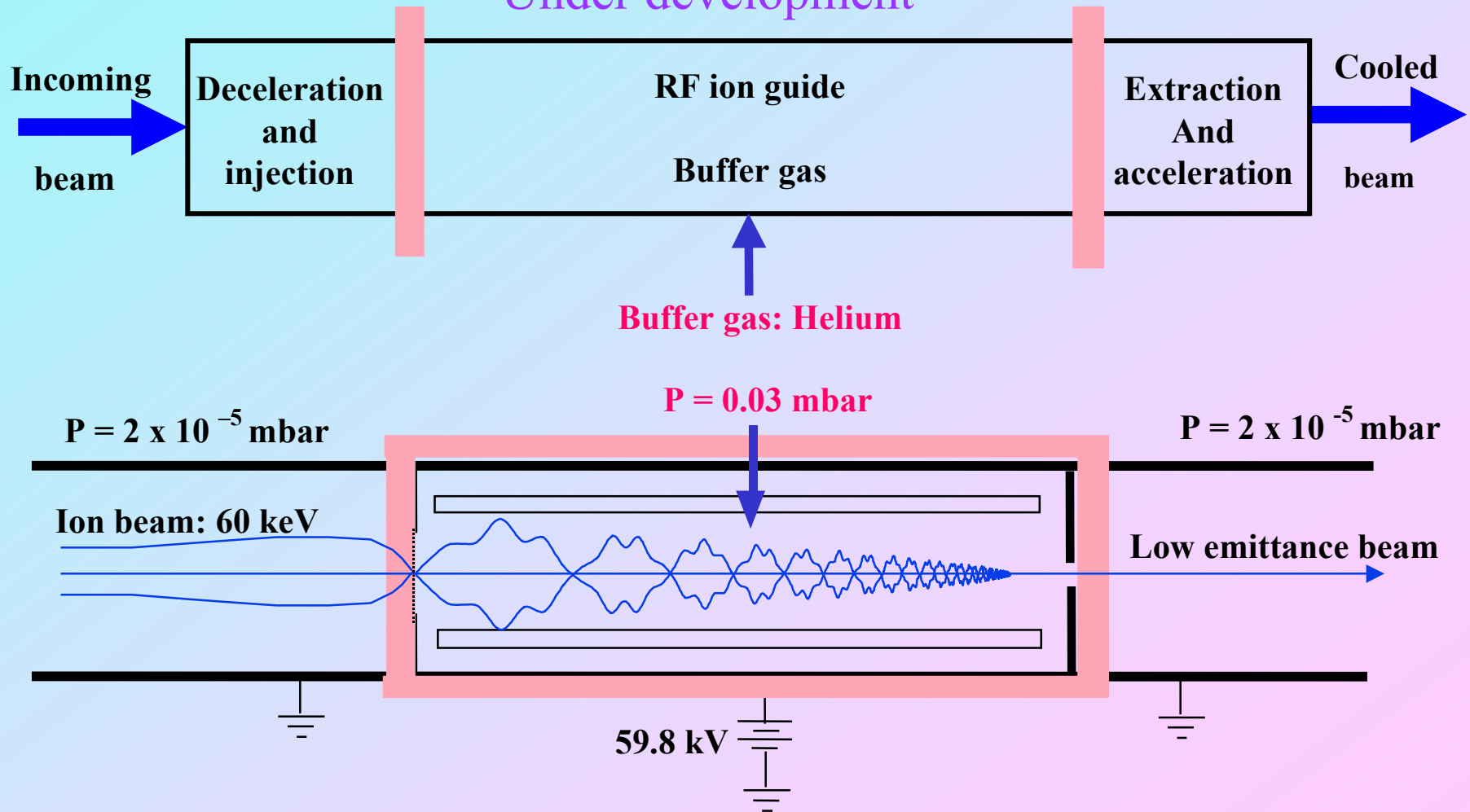


# Preliminary result: $^{74}\text{Rb}$



# Beam emittance reduction

Under development





# Results

Nuclides	Mass(u)	Mass excess (keV)	MISTRAL-AME95 (keV)
$^{25}\text{Ne}$	24.997707 (32)	-2136 (30)	-77
$^{26}\text{Ne}$	26.000461 (33)	429 (30)	0
$^{26}\text{Na}$	25.992630 (9)	-6865 (8)	38
$^{27}\text{Na}$	26.994080 (16)	-5515 (15)	66
$^{28}\text{Na}$	27.998935 (17)	-991 (16)	42
$^{29}\text{Na}$	29.002868 (17)	2672 (16)	53
$^{30}\text{Na}$	30.009041 (22)	8422 (20)	-173
$^{32}\text{Mg}$	31.998858 (113)	-1063 (105)	-268
$^{74}\text{Rb}^*$	73.944348 (107)	-51836 (100)	-116

\* Preliminary result