

# Speeding up gas-phase chemistry to access elements beyond Fl

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15<sup>th</sup> Workshop on  
Recoil Separator for Superheavy Element Chemistry



# Motivation

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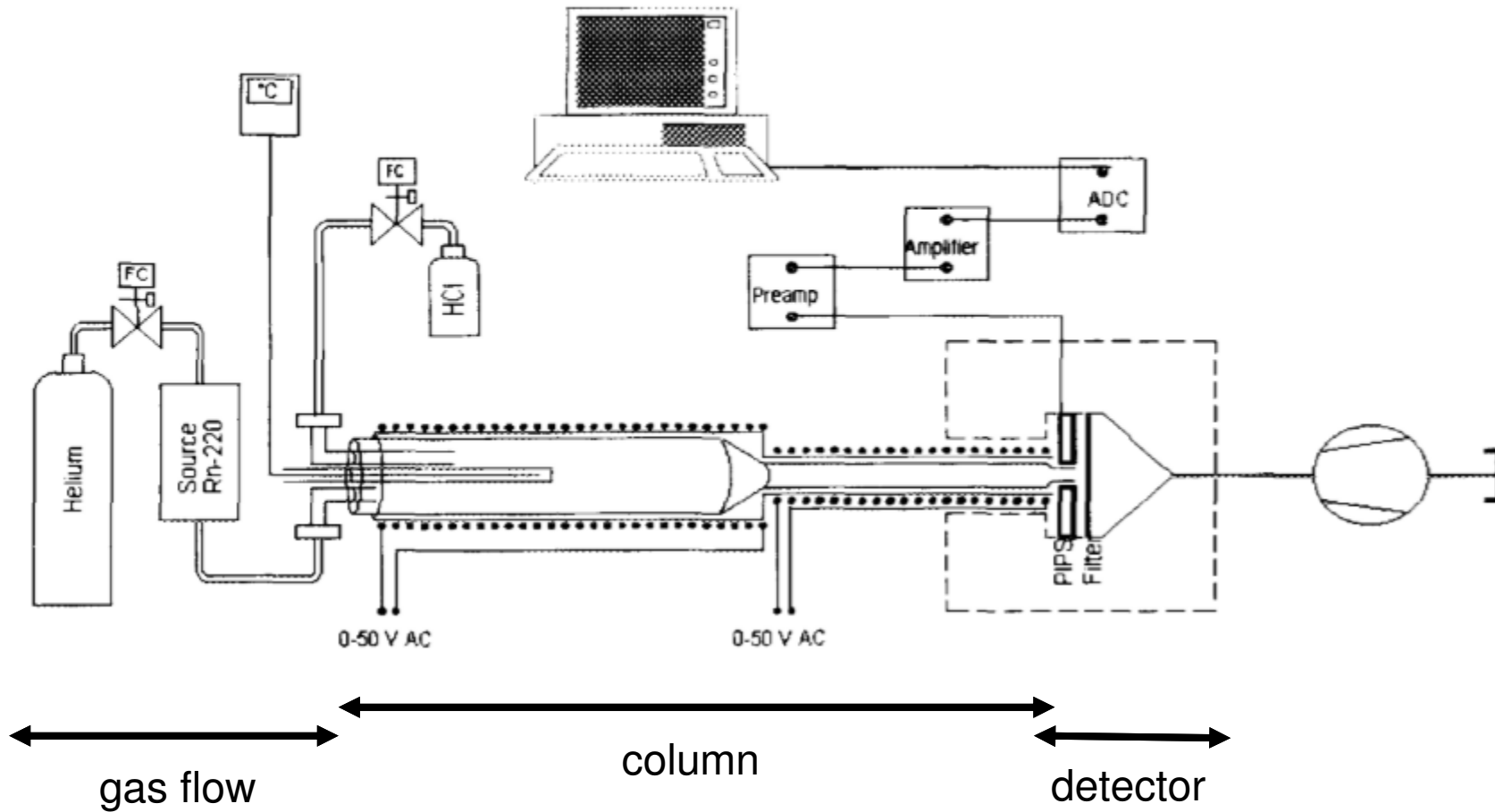
chemical investigation of elements  $Z \geq 104$

Gas-phase chemical techniques:

- access to the influence of relativistic effects on chemical properties
- low limits of detection needed
- first gas chromatography was in the 1960s

# Motivation

chemical investigation of elements  $Z \geq 104$

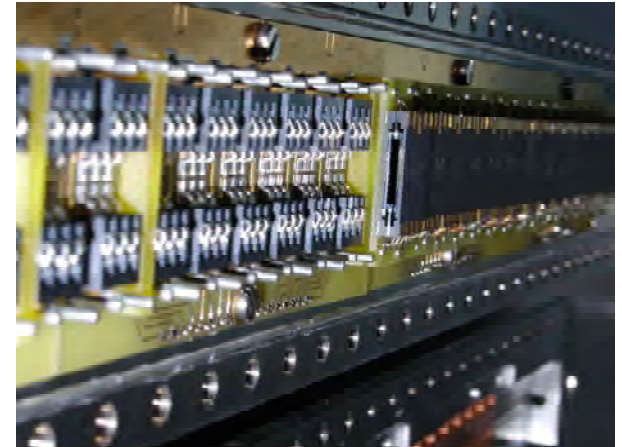


# Motivation

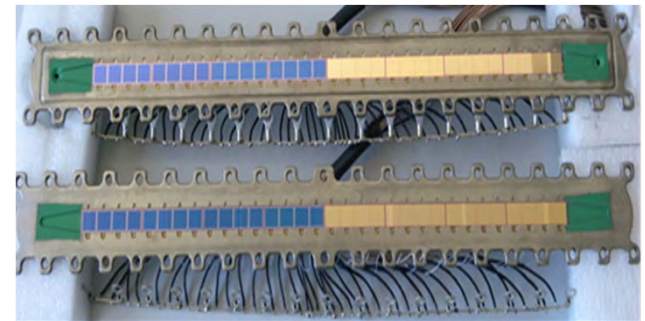
chemical investigation of elements  $Z \geq 104$

- three types of detectors:
  - Cryo-Thermochromatographic Separator (CTS)
  - Cryo On-Line Detector (COLD)
  - Cryo-Online-Multidetector for Physics And Chemistry of Transactinides (COMPACT)
- in previous experiments the properties of Cn and Fl have been determined

COLD

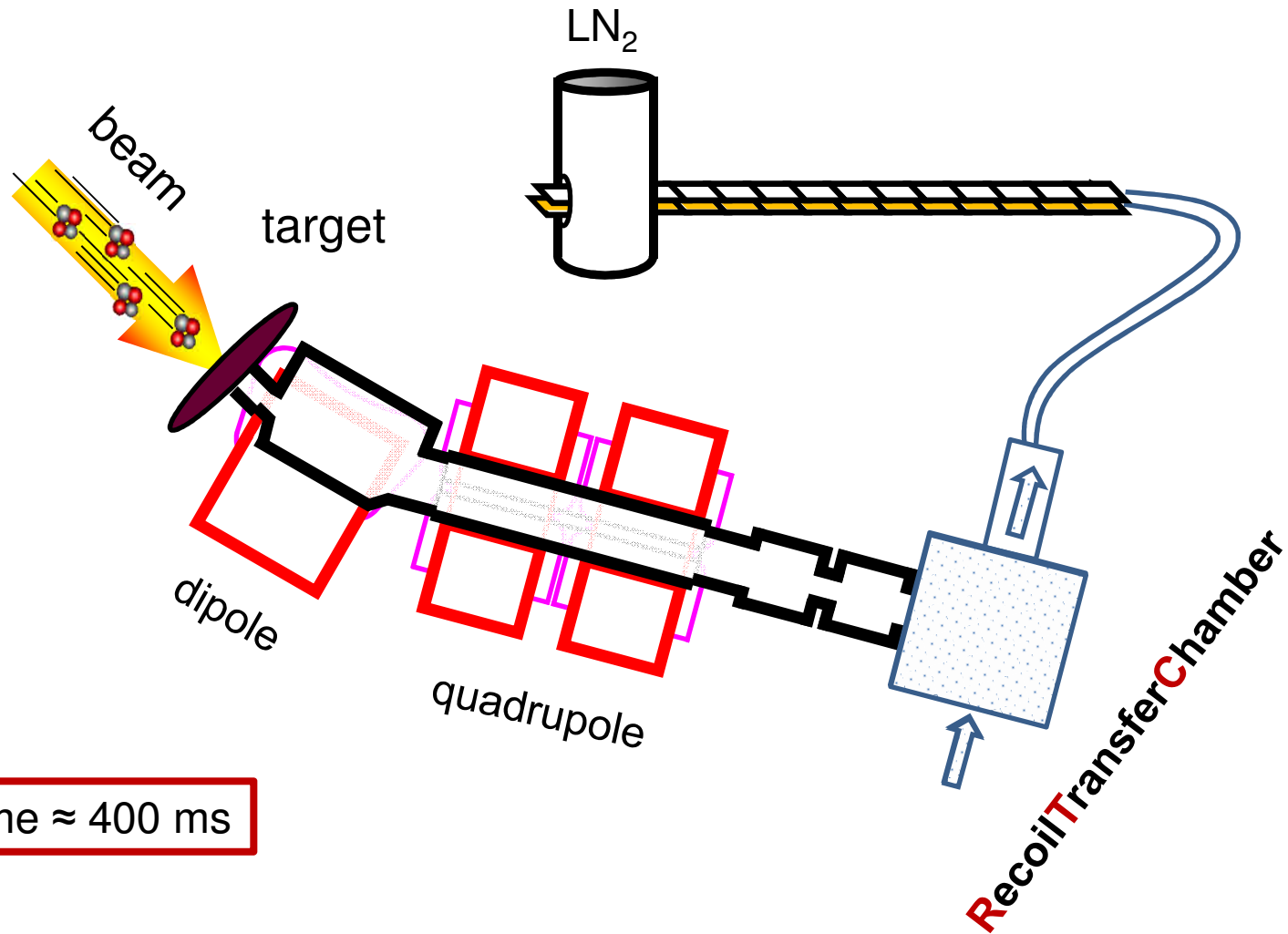


COMPACT

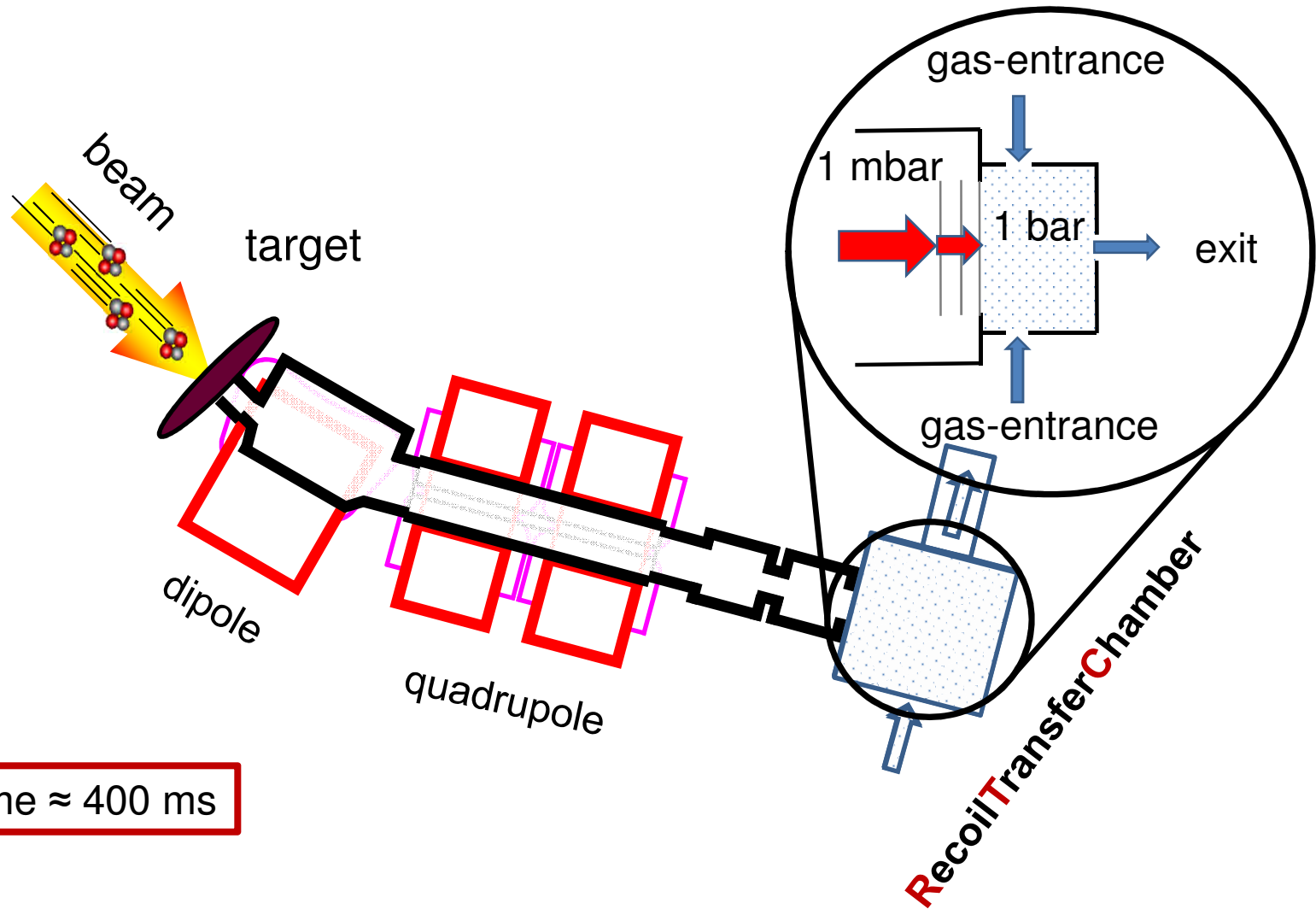


column & detector

# TASCA



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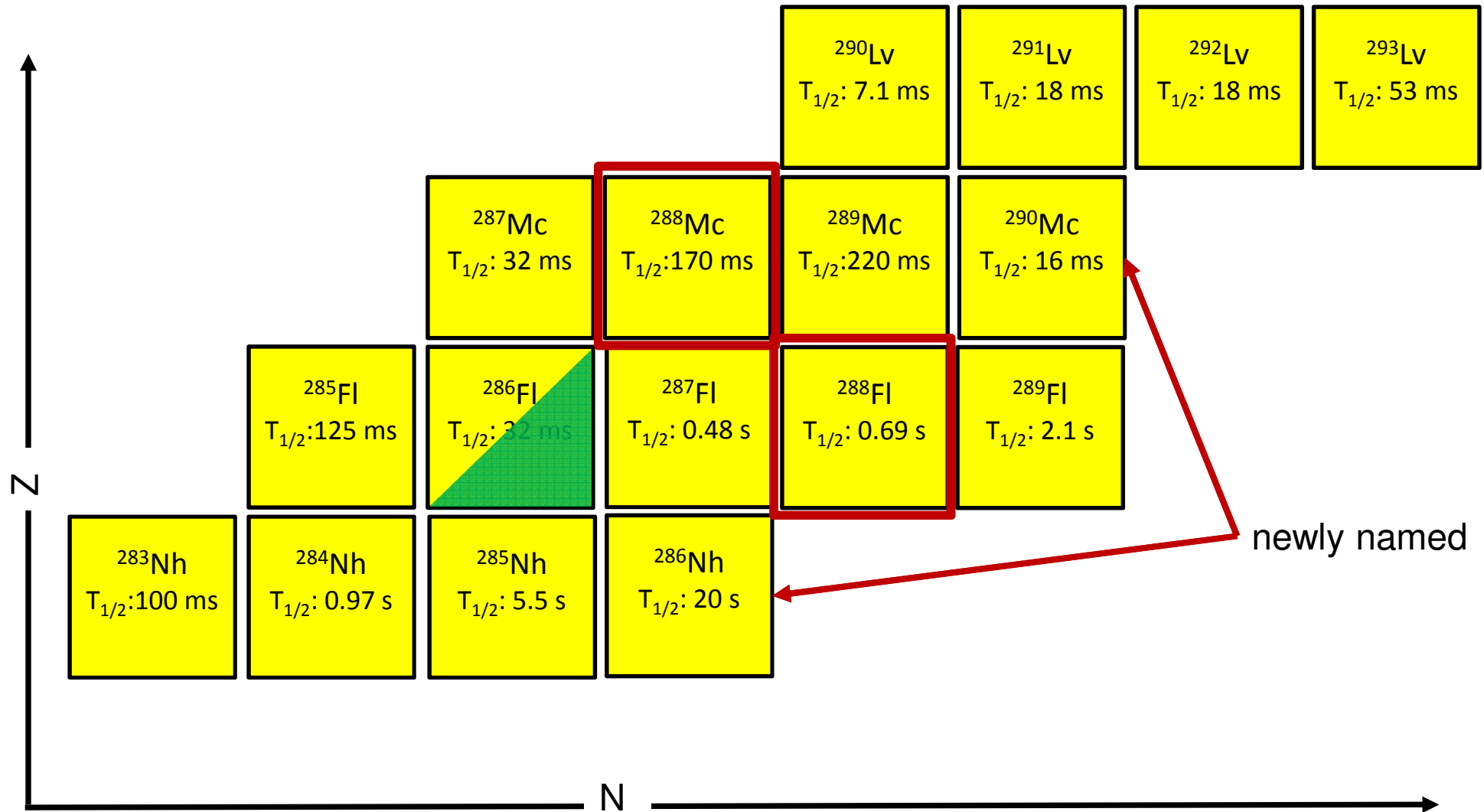


transport time  $\approx$  400 ms

**TASCA @ GSI**

**TransActinide Separator and Chemistry Apparatus**

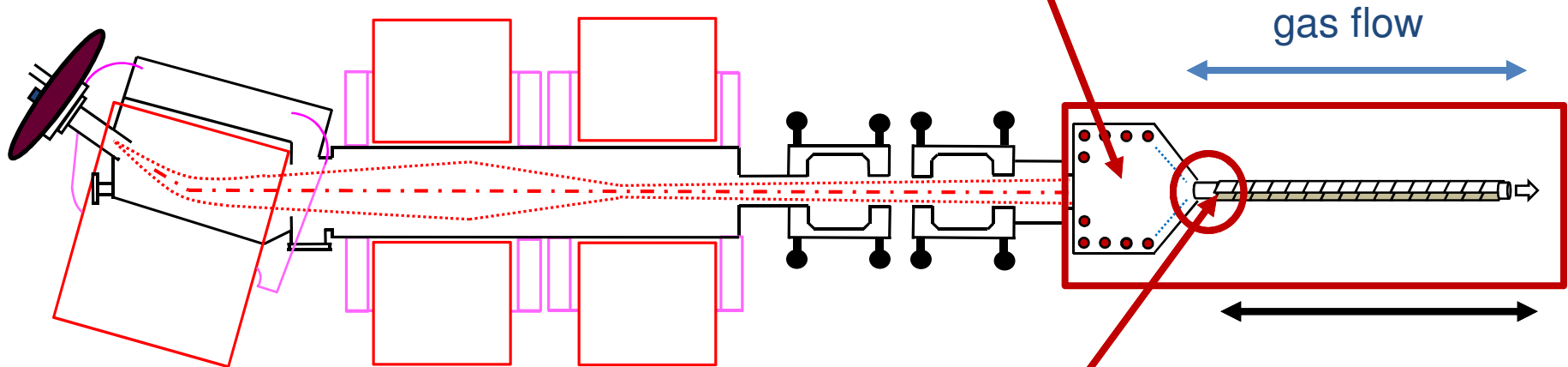
# The Experiment



# The Experiment

gas cell for ion guiding:

- DC-gradient
- RF-funnel

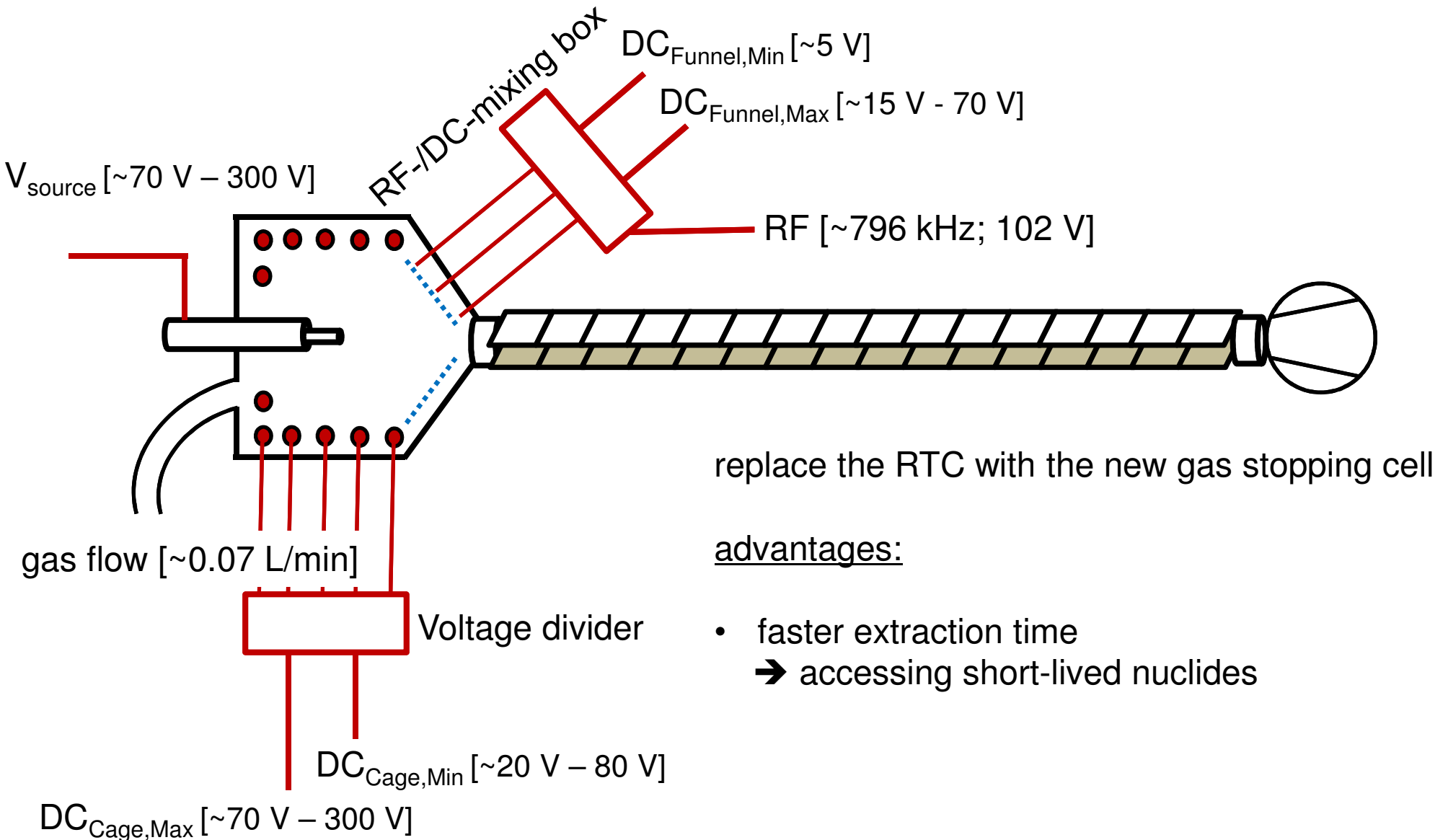


COMPACT  
2 x 32 PIN Diodes  
Au covered

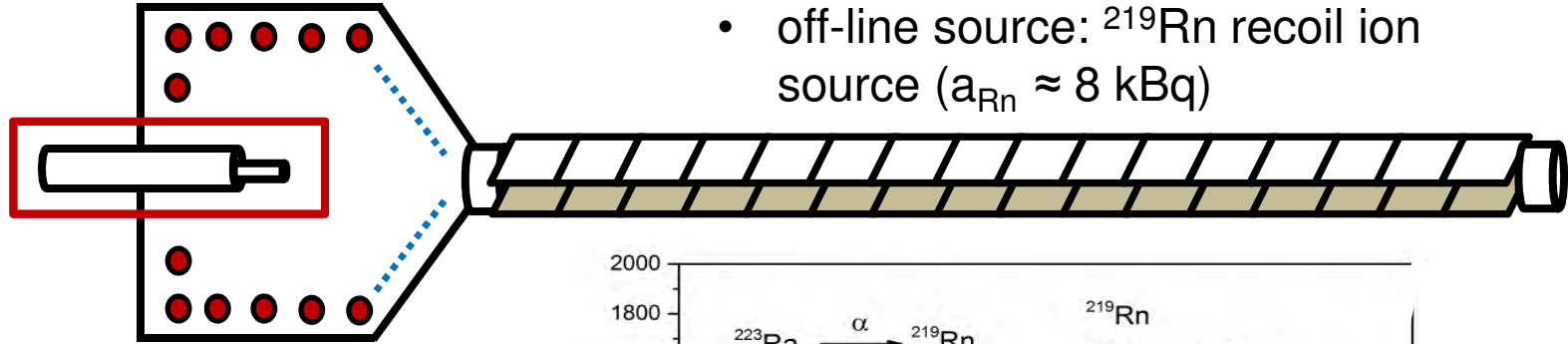
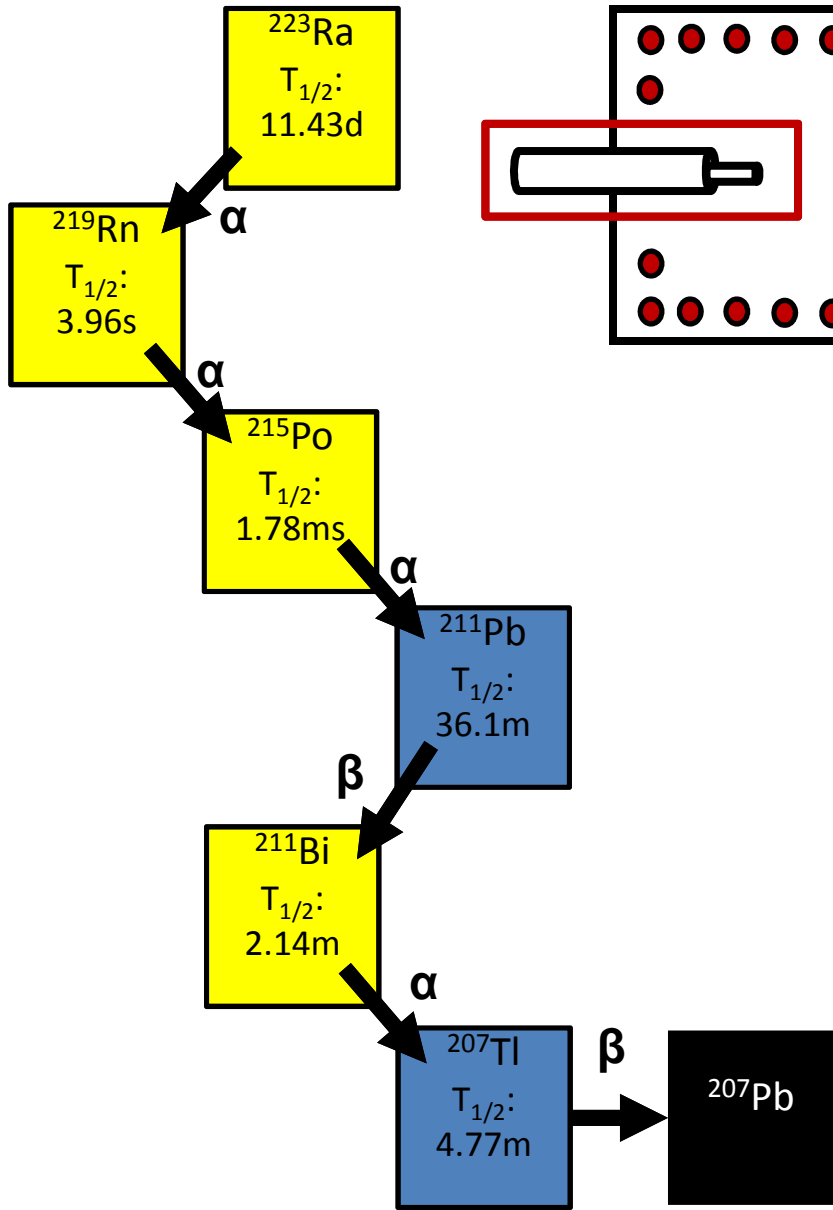
neutralisation



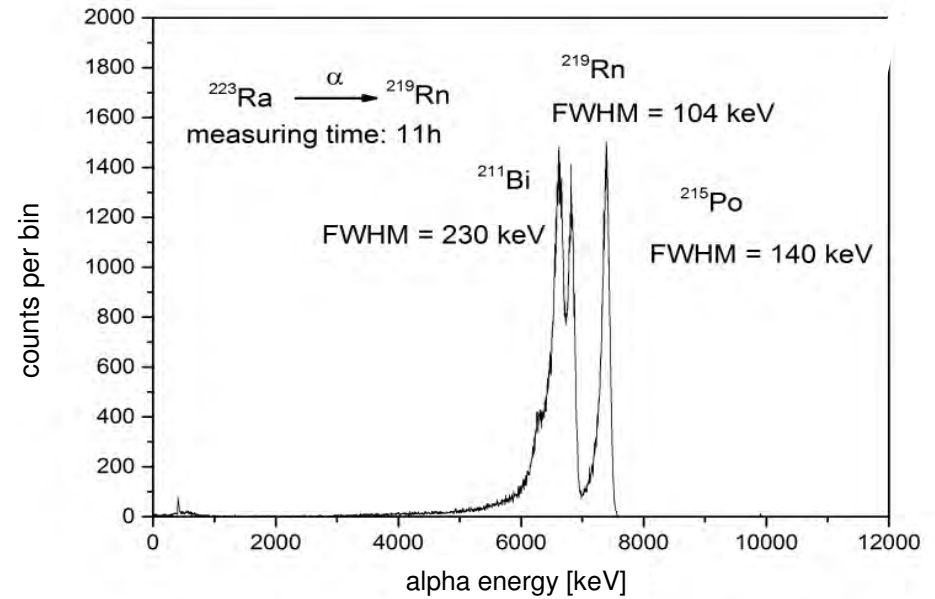
# The Experiment (Off-line)



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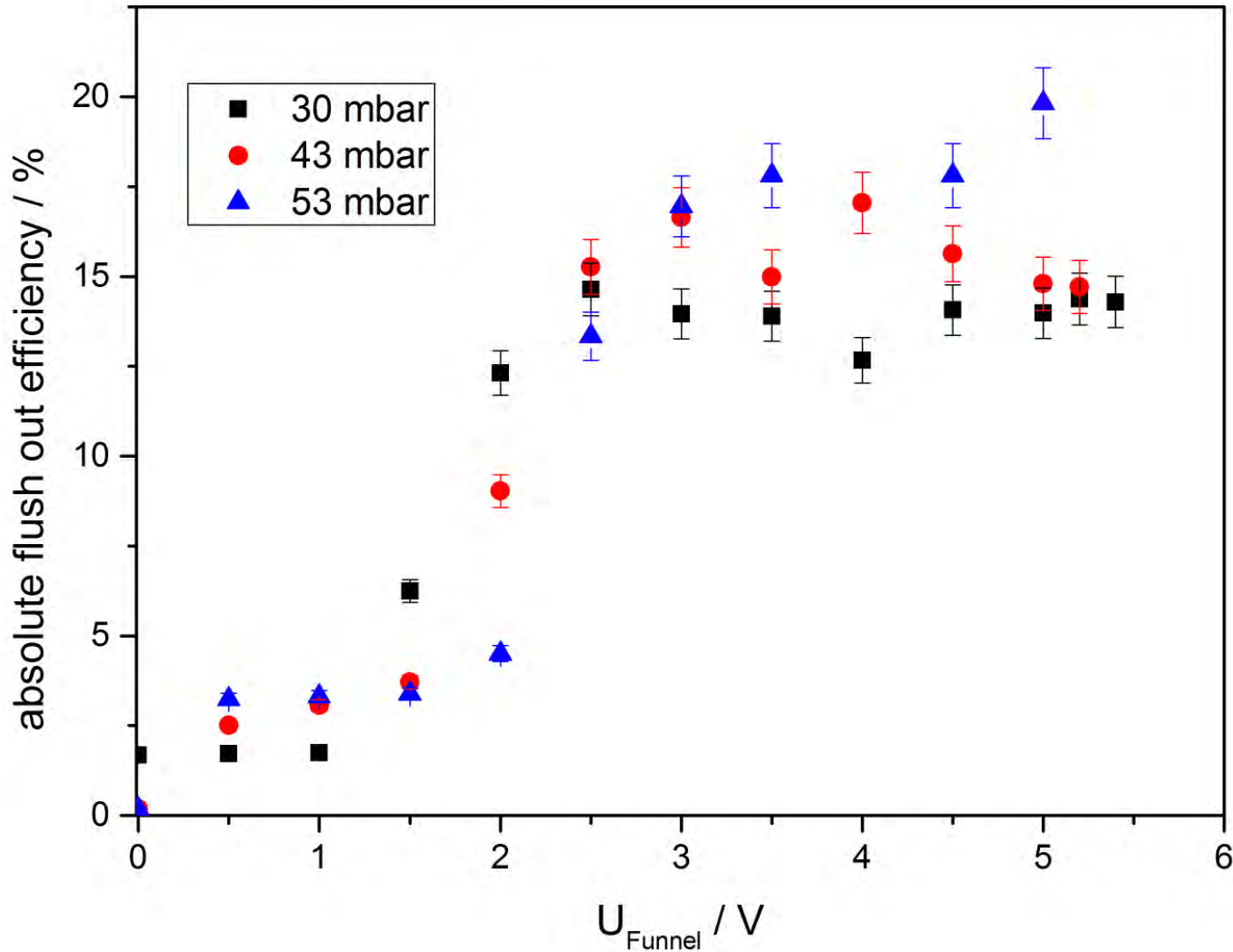


- off-line source:  $^{219}\text{Rn}$  recoil ion source ( $a_{\text{Rn}} \approx 8 \text{ kBq}$ )



- successful stopping and extraction of  $^{219}\text{Rn}$
- decay in flight
- spectrum from COMPACT-detector

# Results

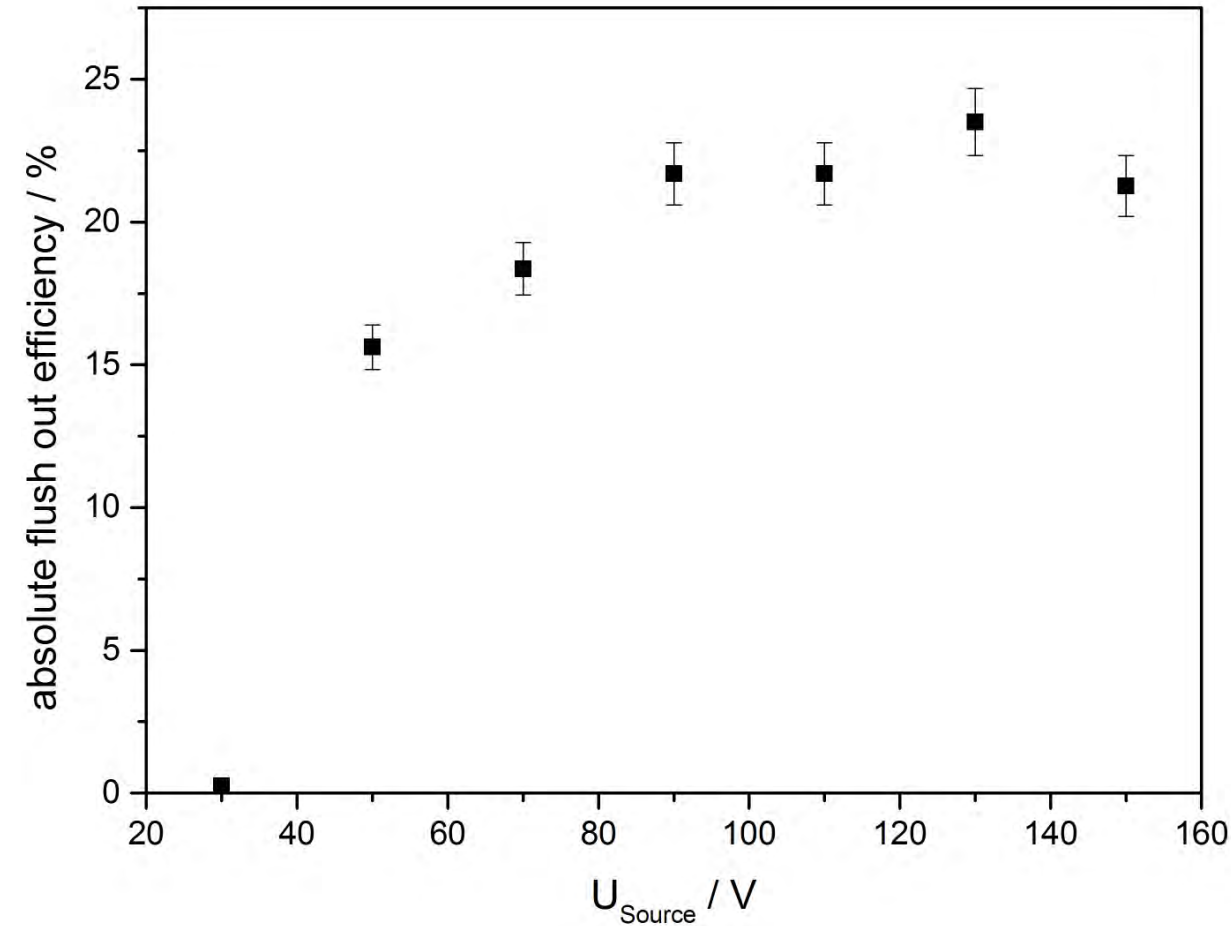


varied variables:

- Funnel RF-amplitude
- cell pressure

$DC_{\text{Funnel,max}}$	20 V
$DC_{\text{Funnel,min}}$	5 V
$DC_{\text{Cage,max}}$	64 V
$DC_{\text{Cage,min}}$	25 V
$DC_{\text{Source}}$	64 V

# Results



varied variable:

- source voltage

→ in the considered area, the source has only a small influence on the efficiency

→ opens possibility to operate the source in pulsed mode

$DC_{\text{Funnel,max}}$	20 V
$DC_{\text{Funnel,min}}$	5 V
$DC_{\text{Cage,max}}$	64 V
$DC_{\text{Cage,min}}$	25 V
RF Amplitude	102 V

# Summary and Outlook

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## achieved:

- ions extracted
- neutralization from wall collision

## Open questions

- transport time
- neutralization efficiency

## to do:

- determine the transport time using pulsed source operation
- maximize of the total efficiency of the system
- establish in On-line experiments at TASCA

# Summary and Outlook

