Radioactive barium-in-xenon tests with Caribu

Felix Rosenau, Wolfhart Feldmeier, Peter Fierlinger, Michael Marino

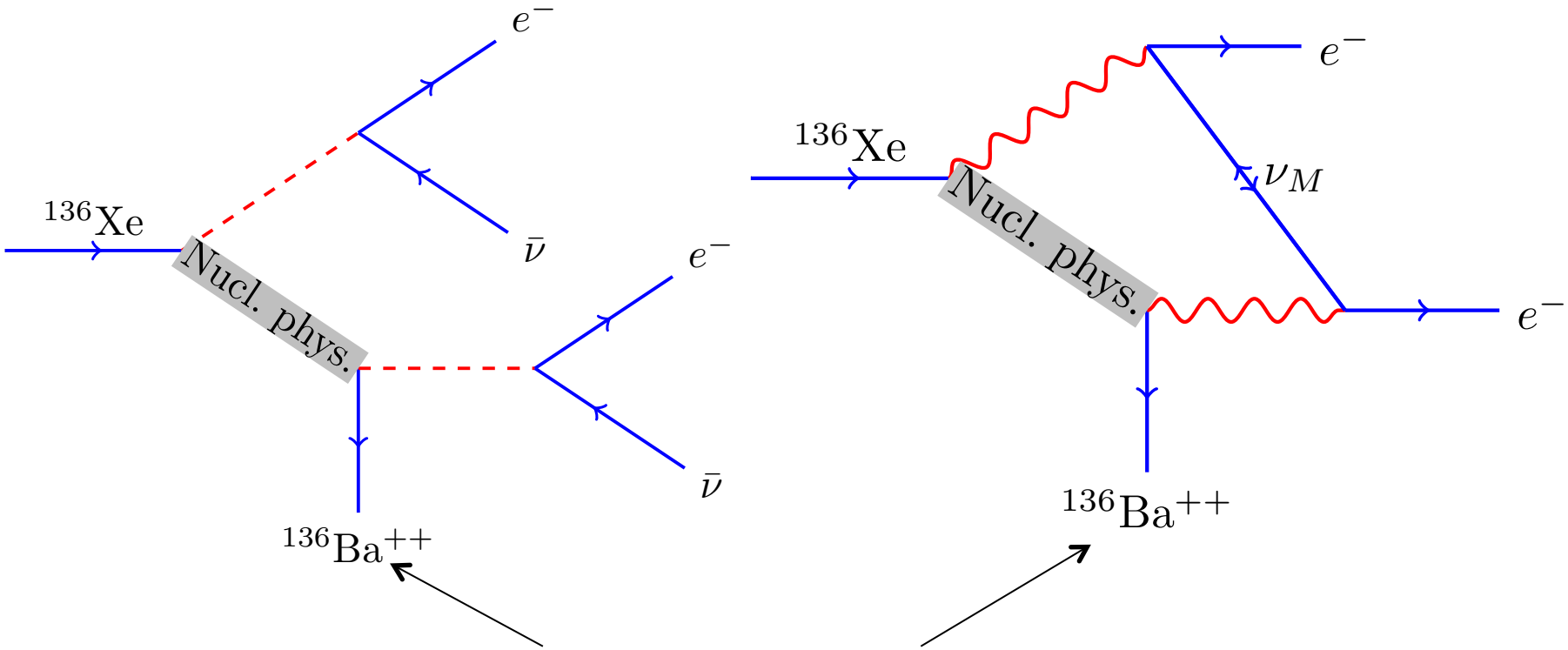
TU München

Guy Savard

Argonne National Lab

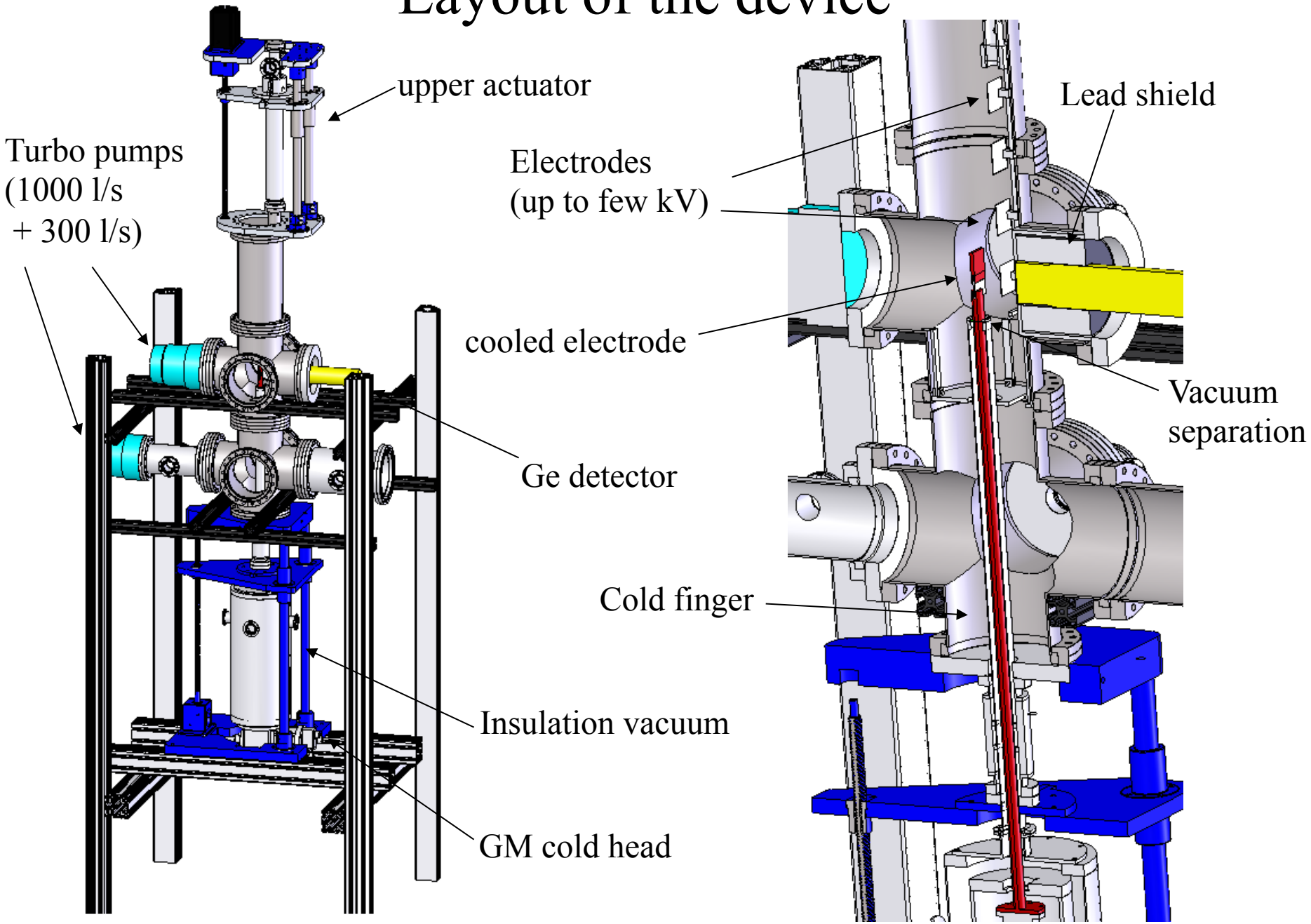
Physics motivation

- EXO-200 is looking for double-beta decay and wants to tag the final Ba^{++} ion in Xenon to reduce backgrounds. How long does the Ba ion remain ionized?

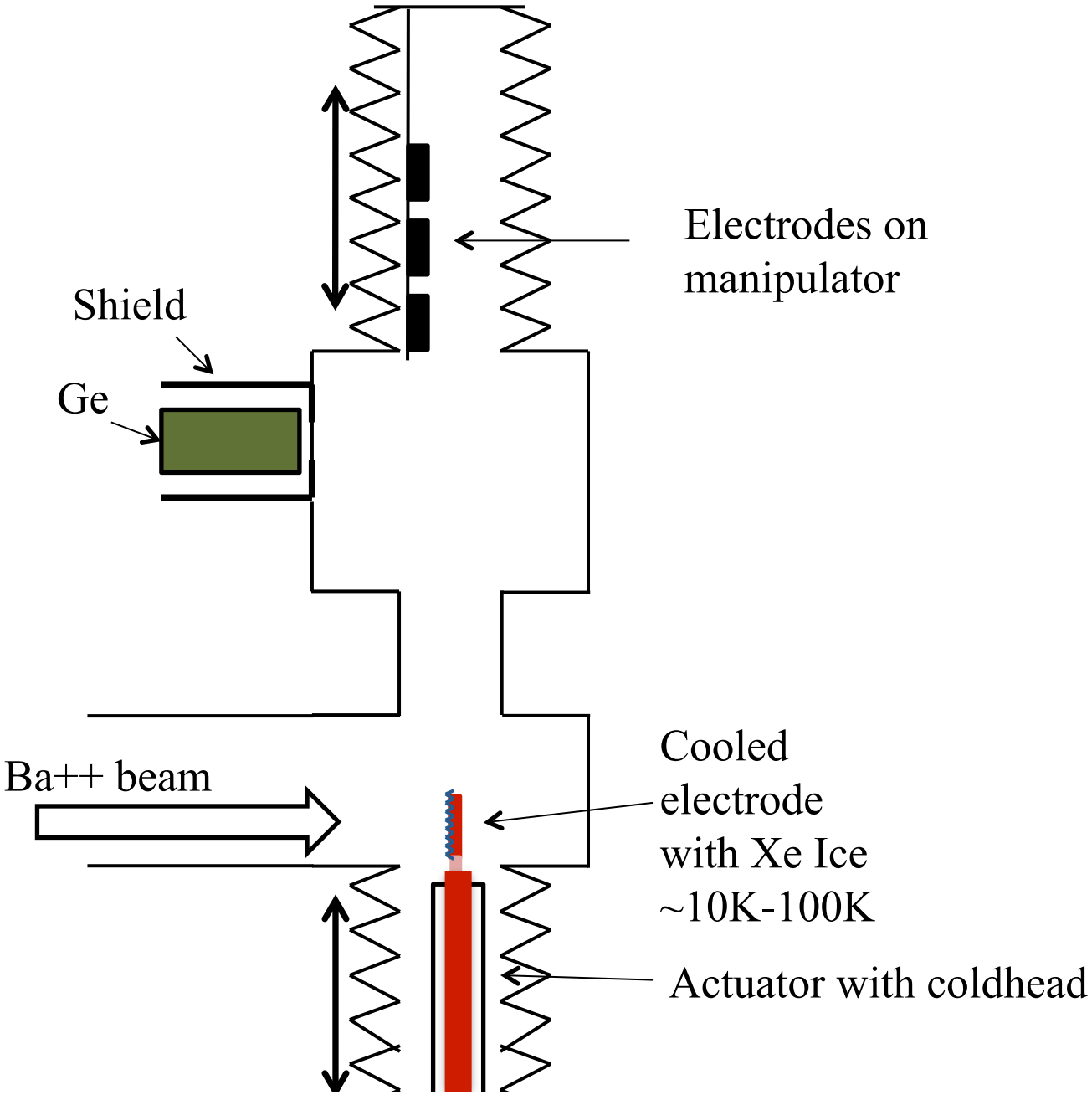


How long does this stay +(+) in Xe?

Layout of the device



Measuring the Ba-Ion lifetime in Solid Xe



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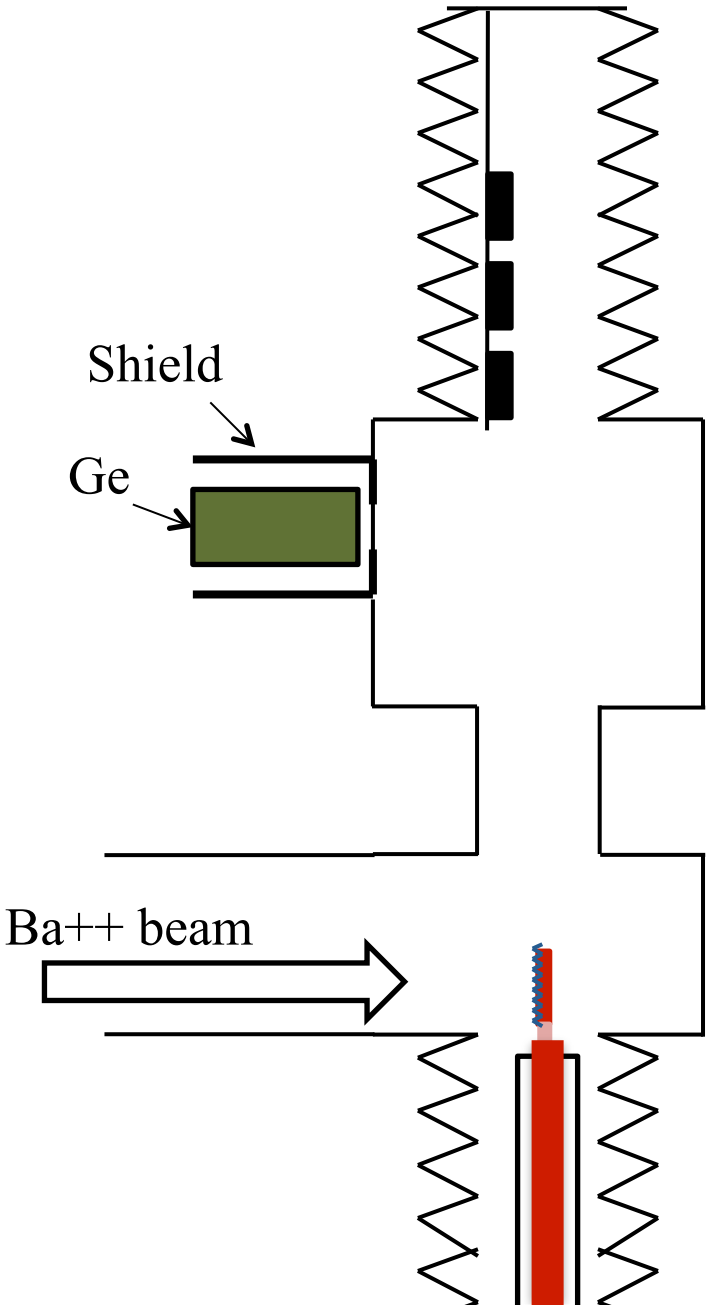
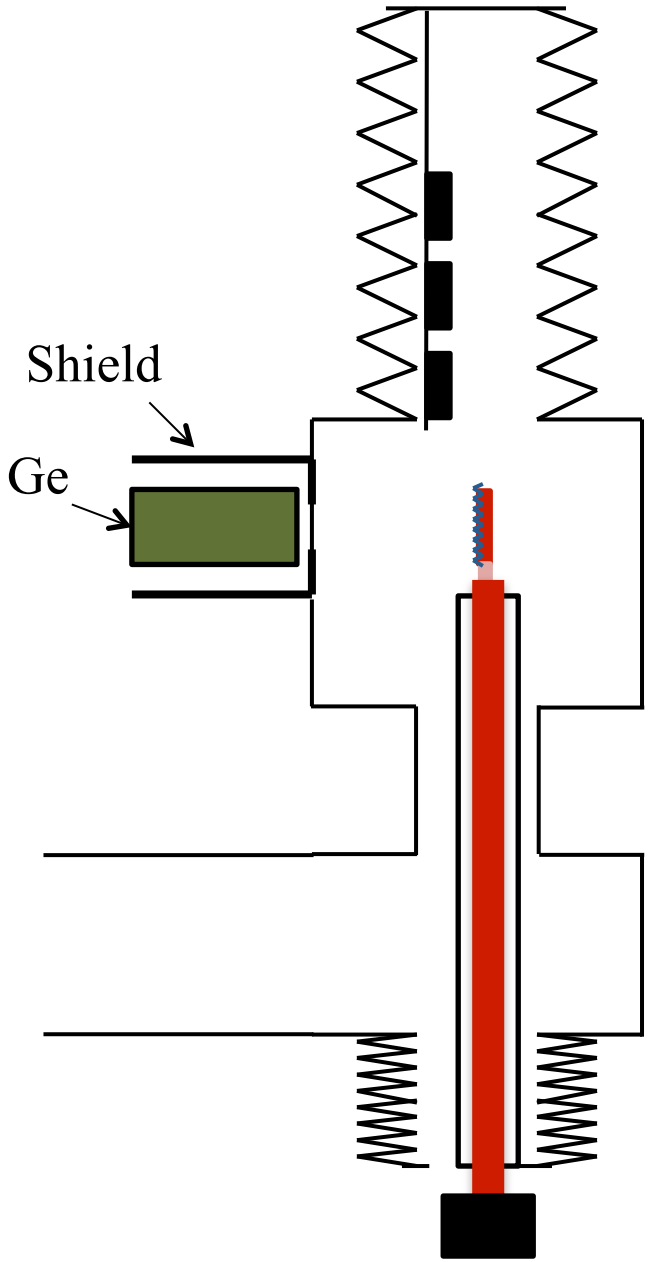


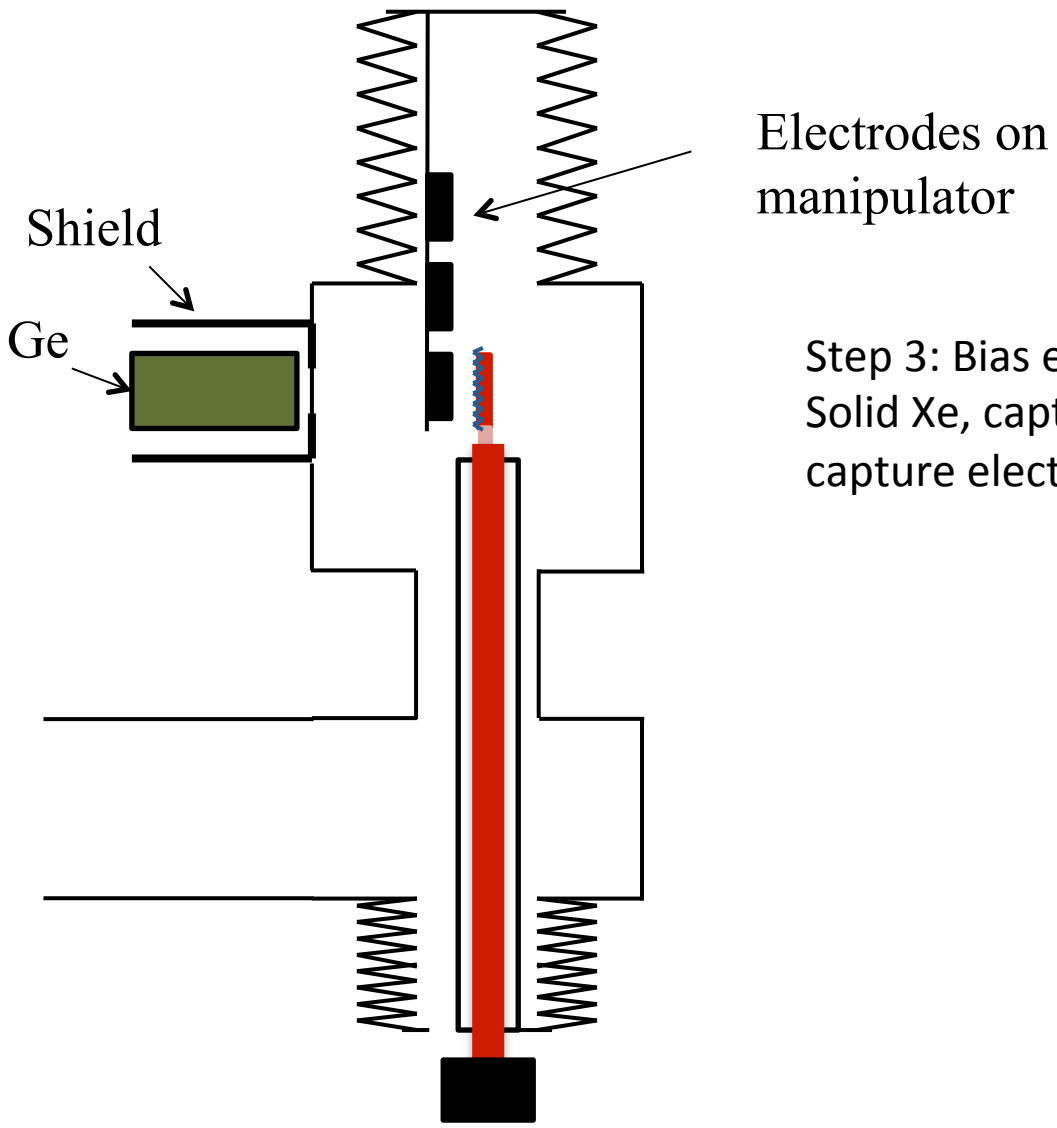
Step 1: Insert Xe gas, freeze on cold electrode. Deposit radioactive Ba ions.

Measuring the Ba-Ion lifetime in Solid Xe



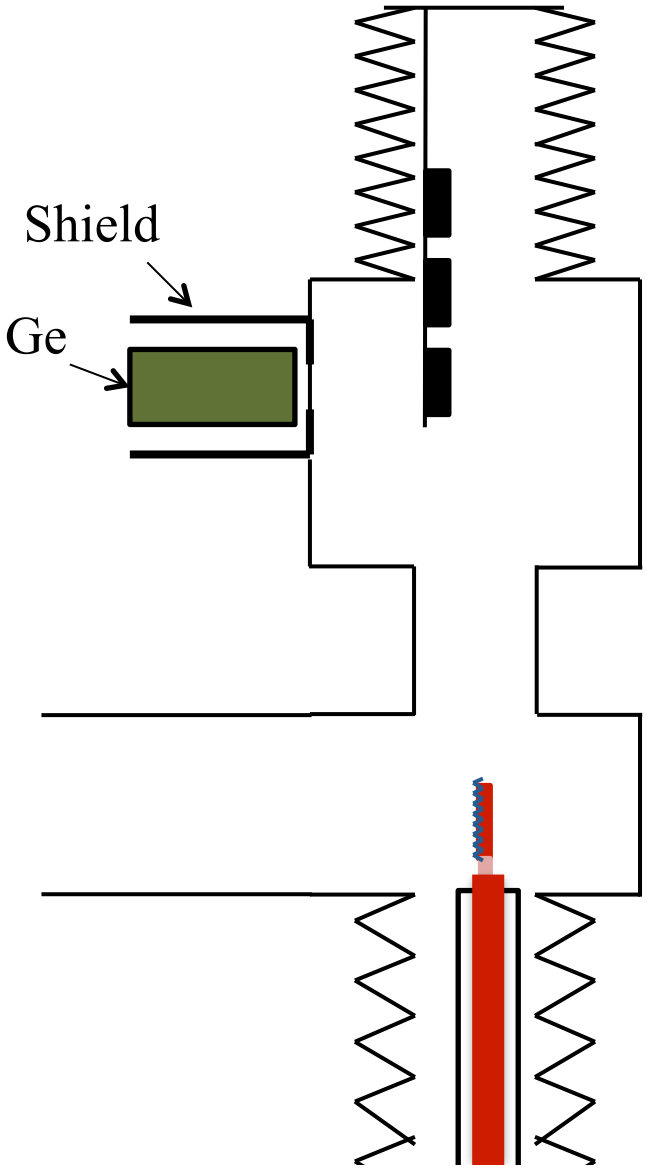
Step 2: Move and measure

Measuring the Ba-Ion lifetime in Solid Xe



Step 3: Bias electrodes and melt Solid Xe, capturing Ba ions on capture electrodes.

Measuring the Ba-Ion lifetime in Solid Xe



Step 4: Measure radioactive Ba ions on electrodes.

CAlifornium **R**are **I**sotope **B**reeder **U**pgrade

„CARIBU‘ source at ANL
Isotopes used:

- ^{139}Ba (165keV conversion-γ)
- ^{141}Ba
- ^{142}Ba

$T^{139Ba}_{1/2}$	~ 83.1m
Intensity	$3x10^5 s^{-1}$
γ-BR	24%
Daughter	^{139}La (stable)
Signal / Noise	~ $4x10^2$

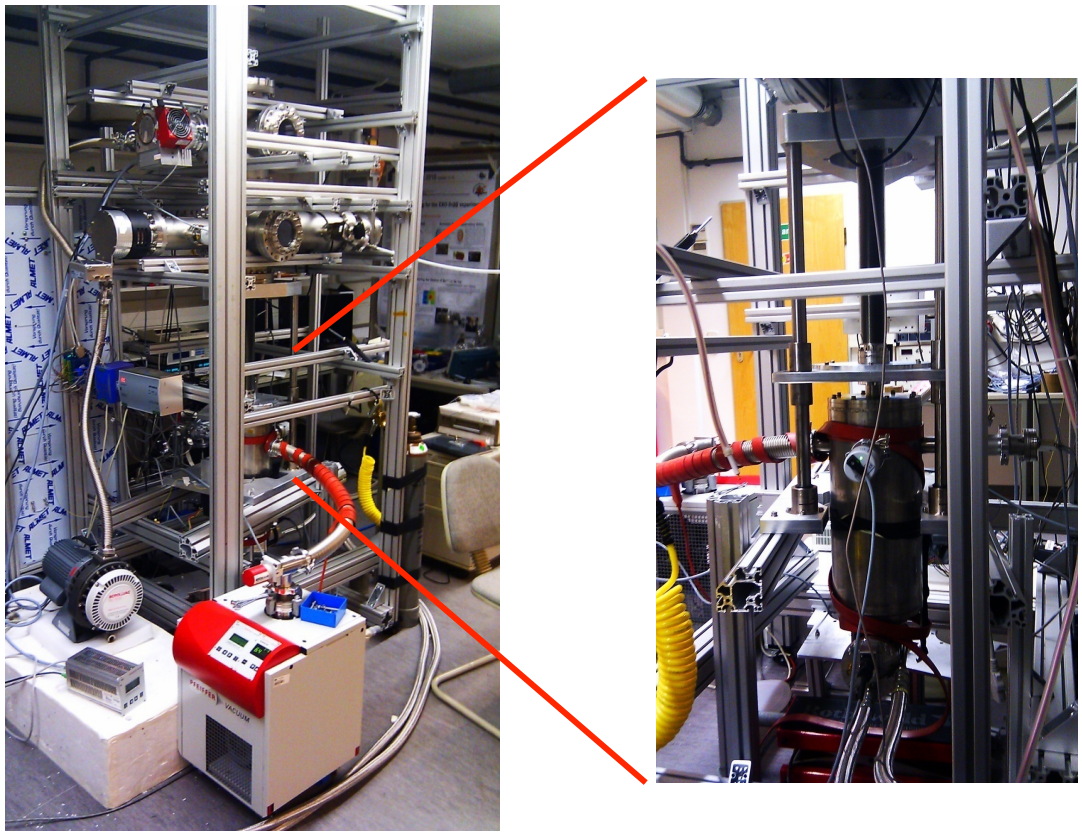



Illustration from 2010: setup before shipping