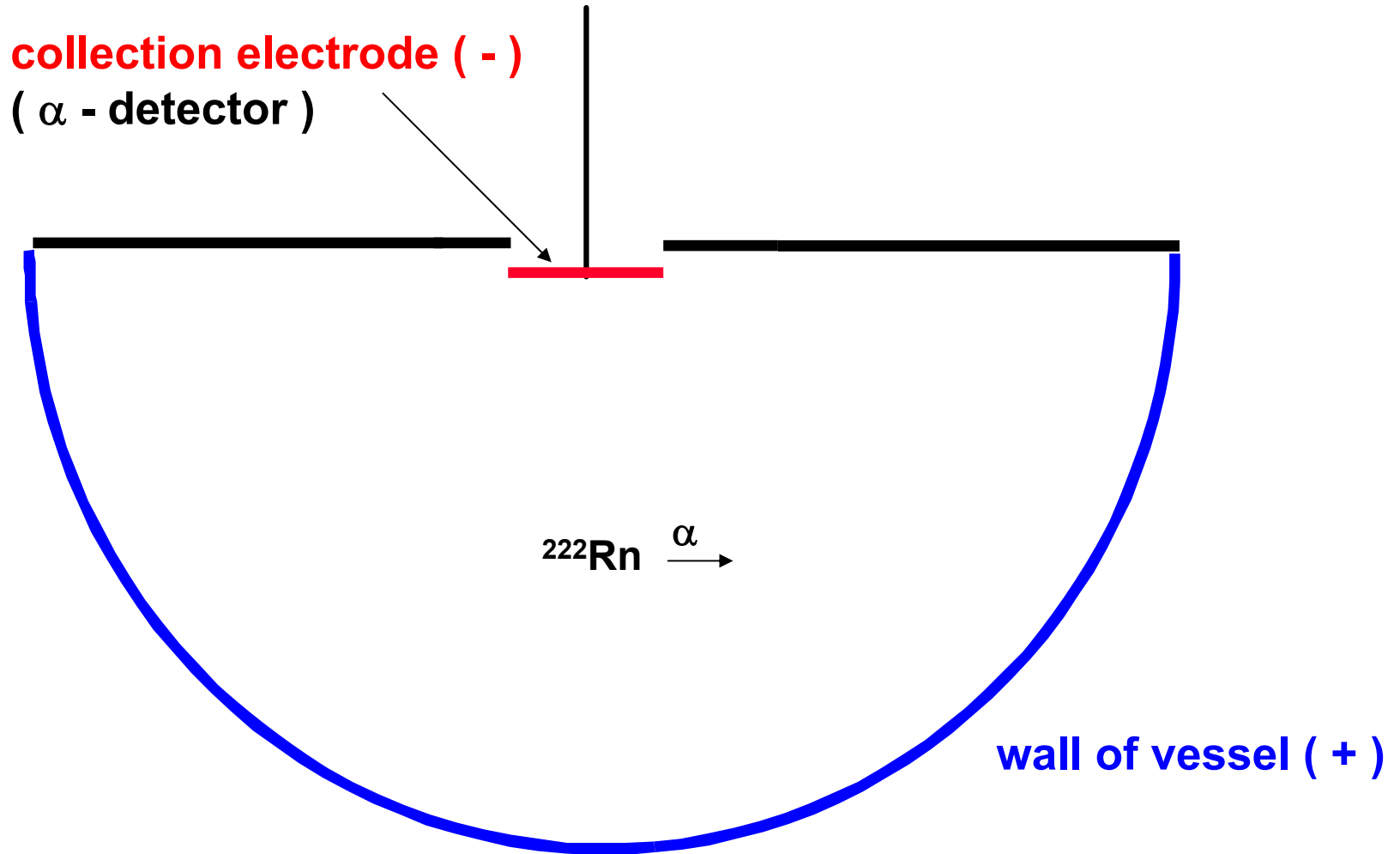


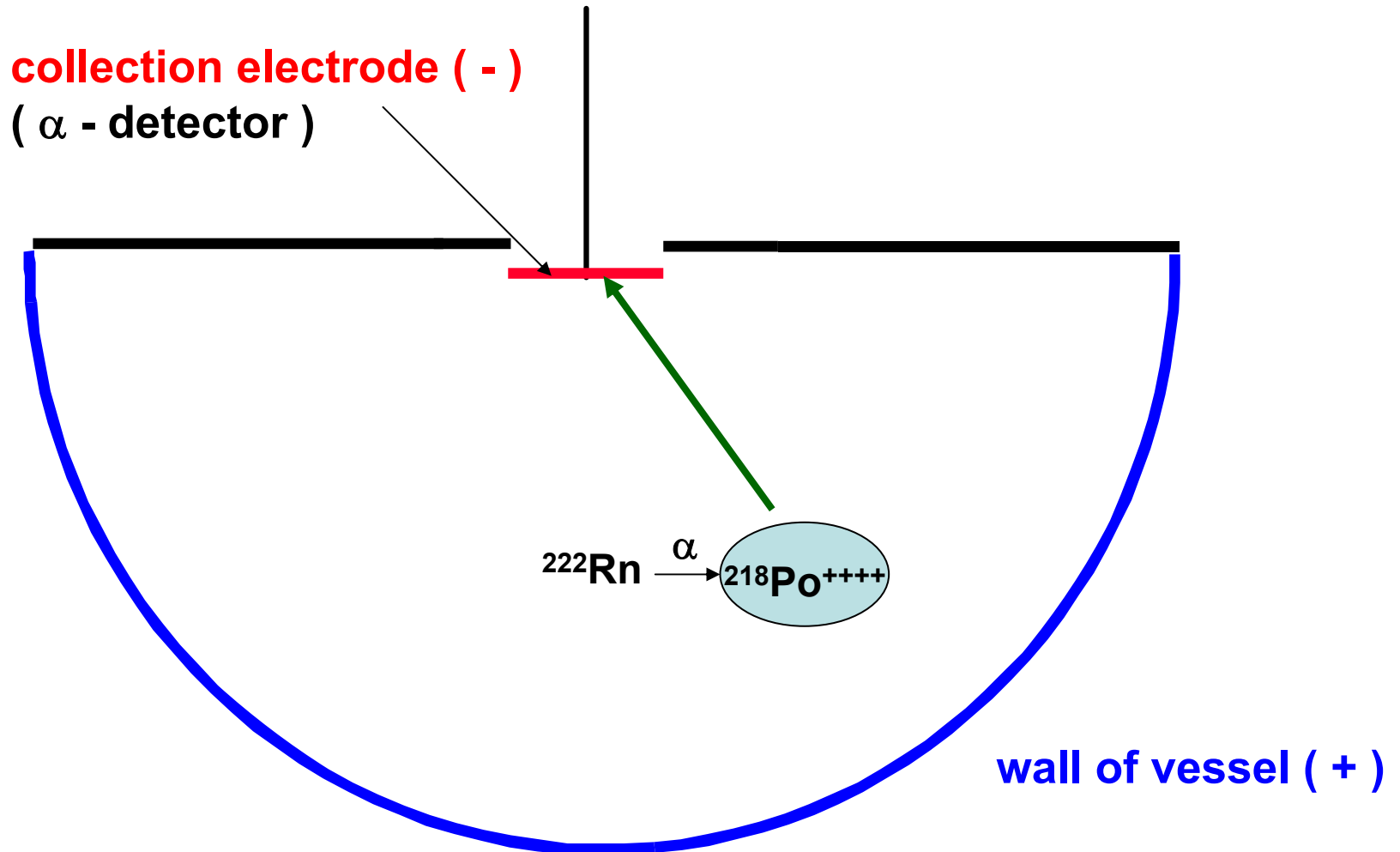
Rn monitor GERDA

Status
and
basic principles

electrostatic Rn - detector



electrostatic Rn - detector



Rn Monitor for GERDA



160 cm

$$Z = \varepsilon * A * V + B$$

Z : measured count rate of Po α decays

ε : collection – and detection efficiency

A : **volume – activity of Rn**

V : volume of vessel

B : background

$$\varepsilon = \varepsilon_D * \varepsilon_S * \varepsilon_C(E(r), LT)$$

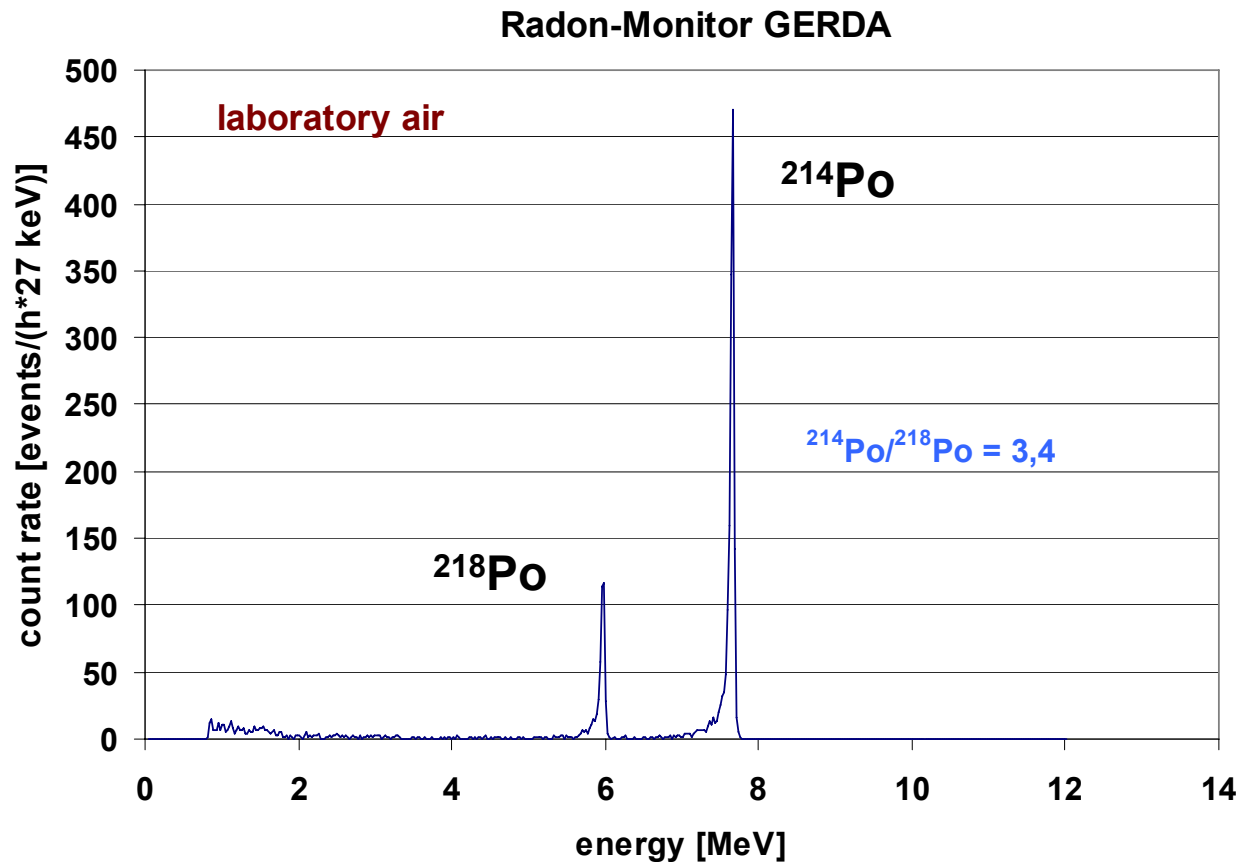
$\varepsilon_D \cong 0,5$ detection probability of α - particles from Po decay on the detector surface. **2π - geometry**

$\varepsilon_S \leq 1$ evaluation efficiency of the measured spectrum

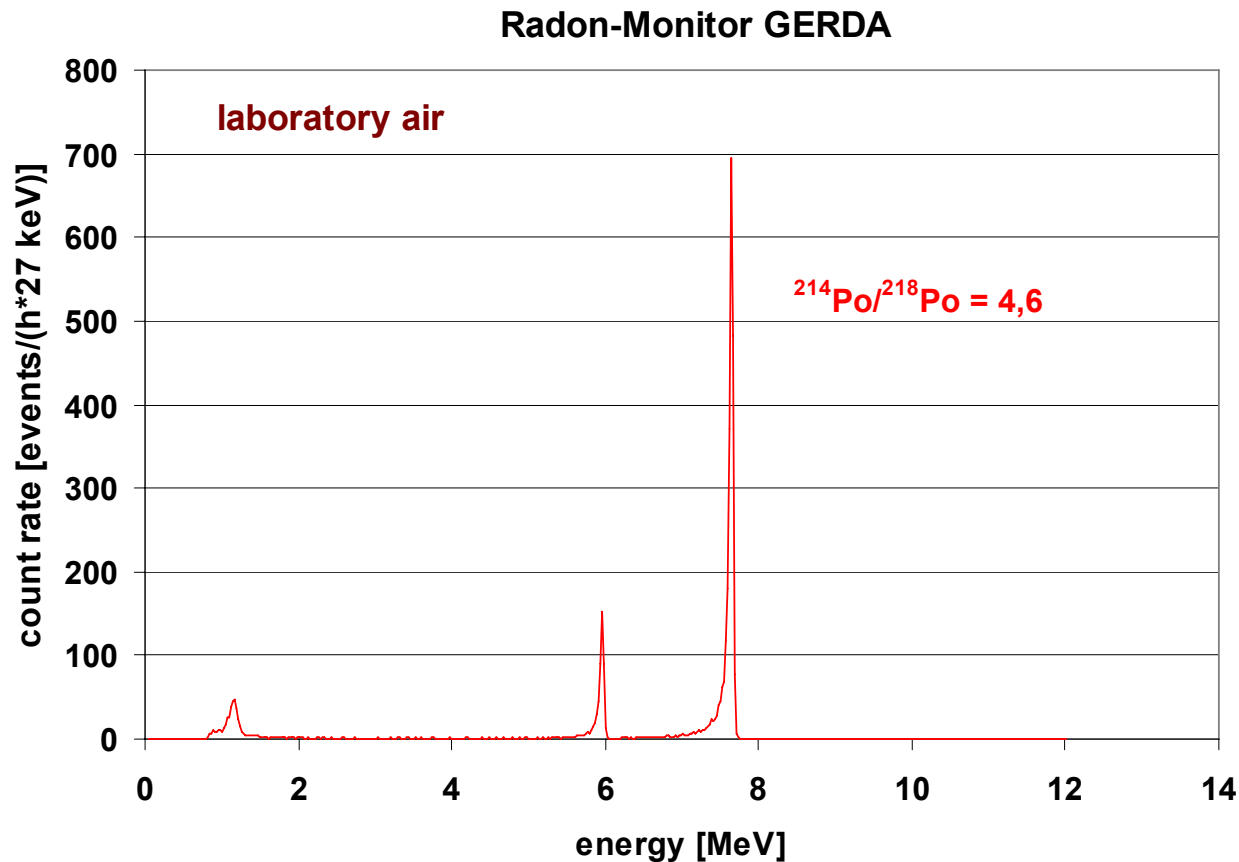
$\varepsilon_C \leq 1$ collection efficiency of Po – ions depending on field distribution and lifetime of isotopes as positive ions

\Rightarrow **Critical components in air:**
 $H_2O, NO_2, OH^-, hydrocarbons, \dots$

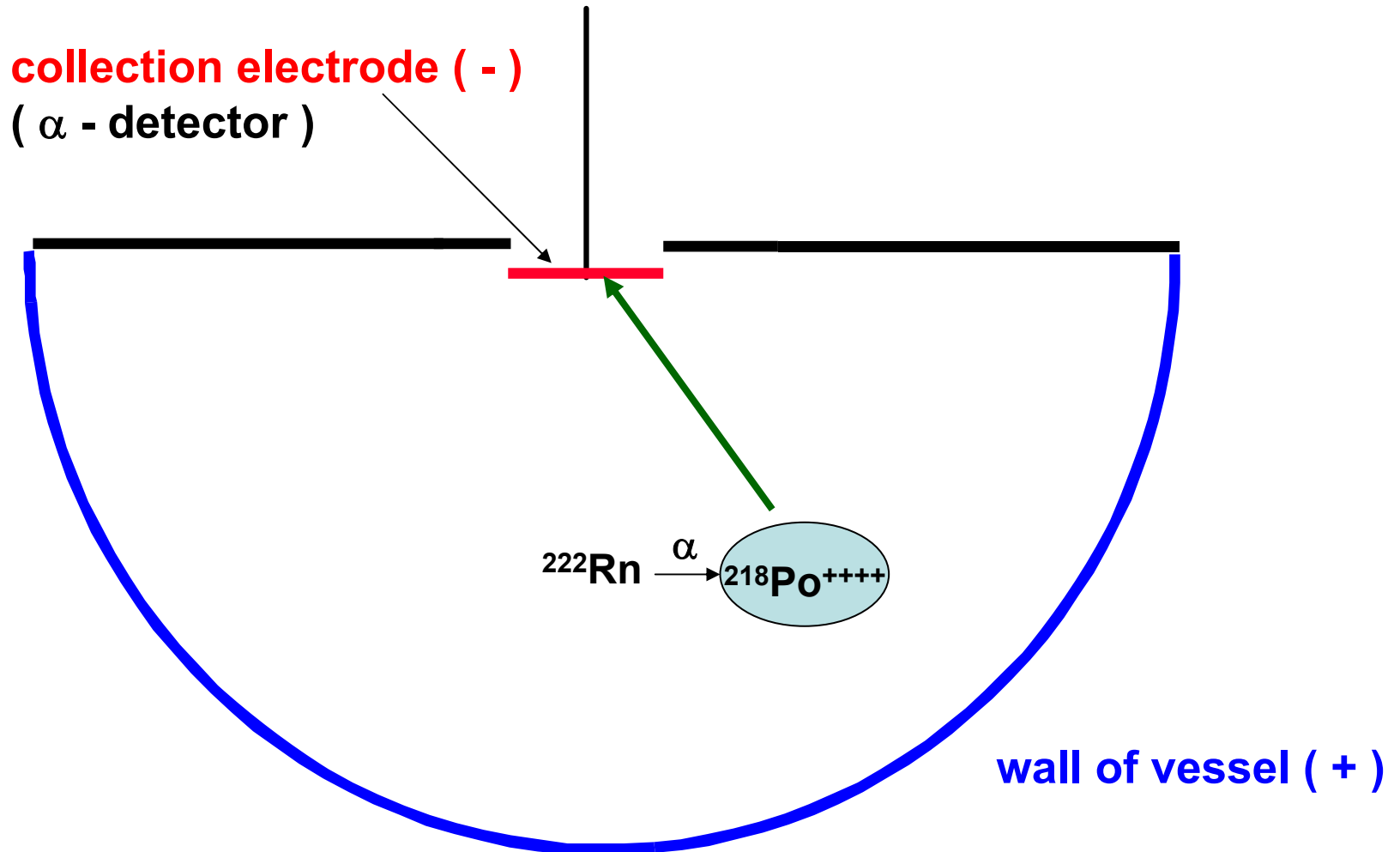
α spectrum of ^{218}Po and ^{214}Po



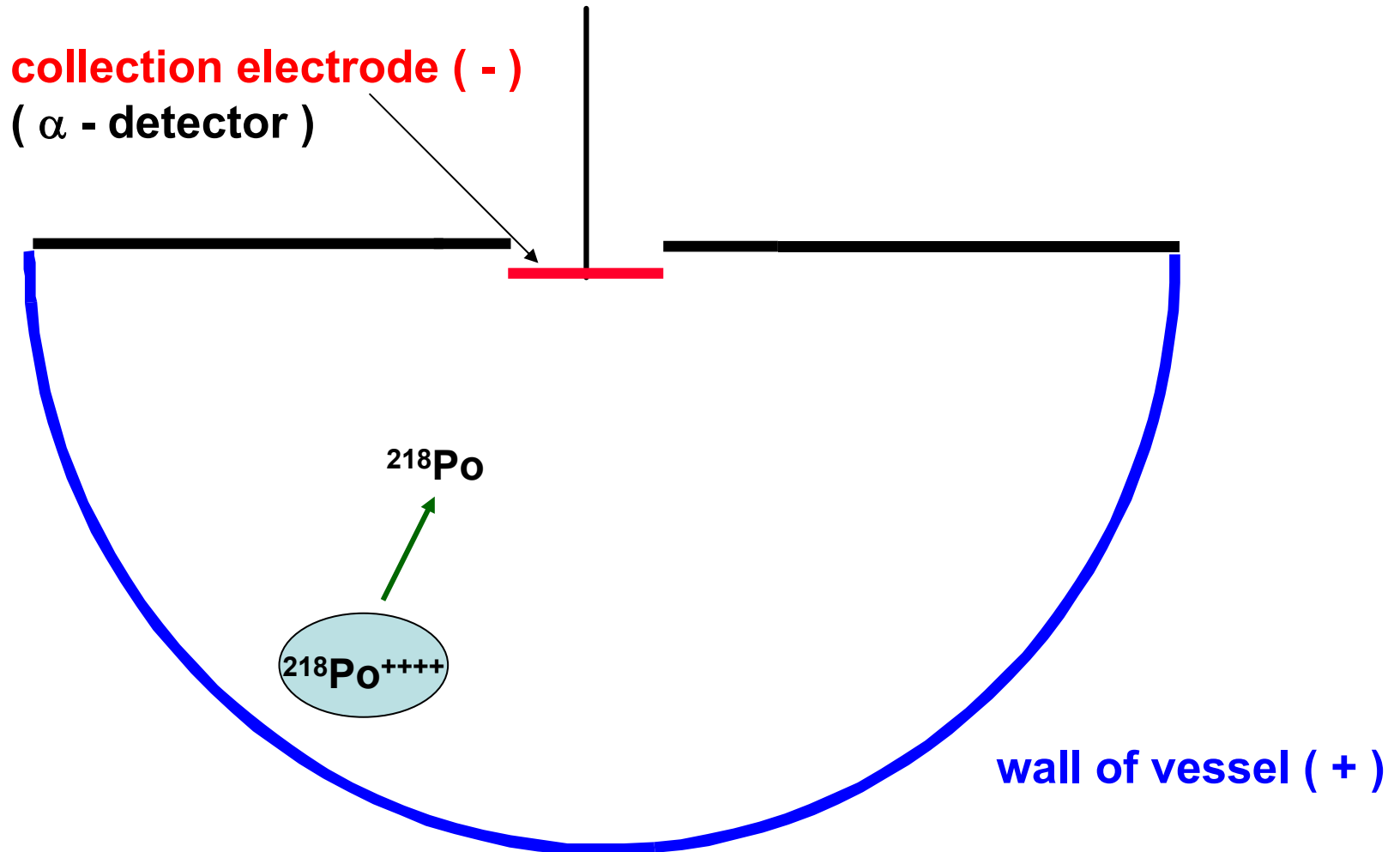
α spectrum of ^{218}Po and ^{214}Po



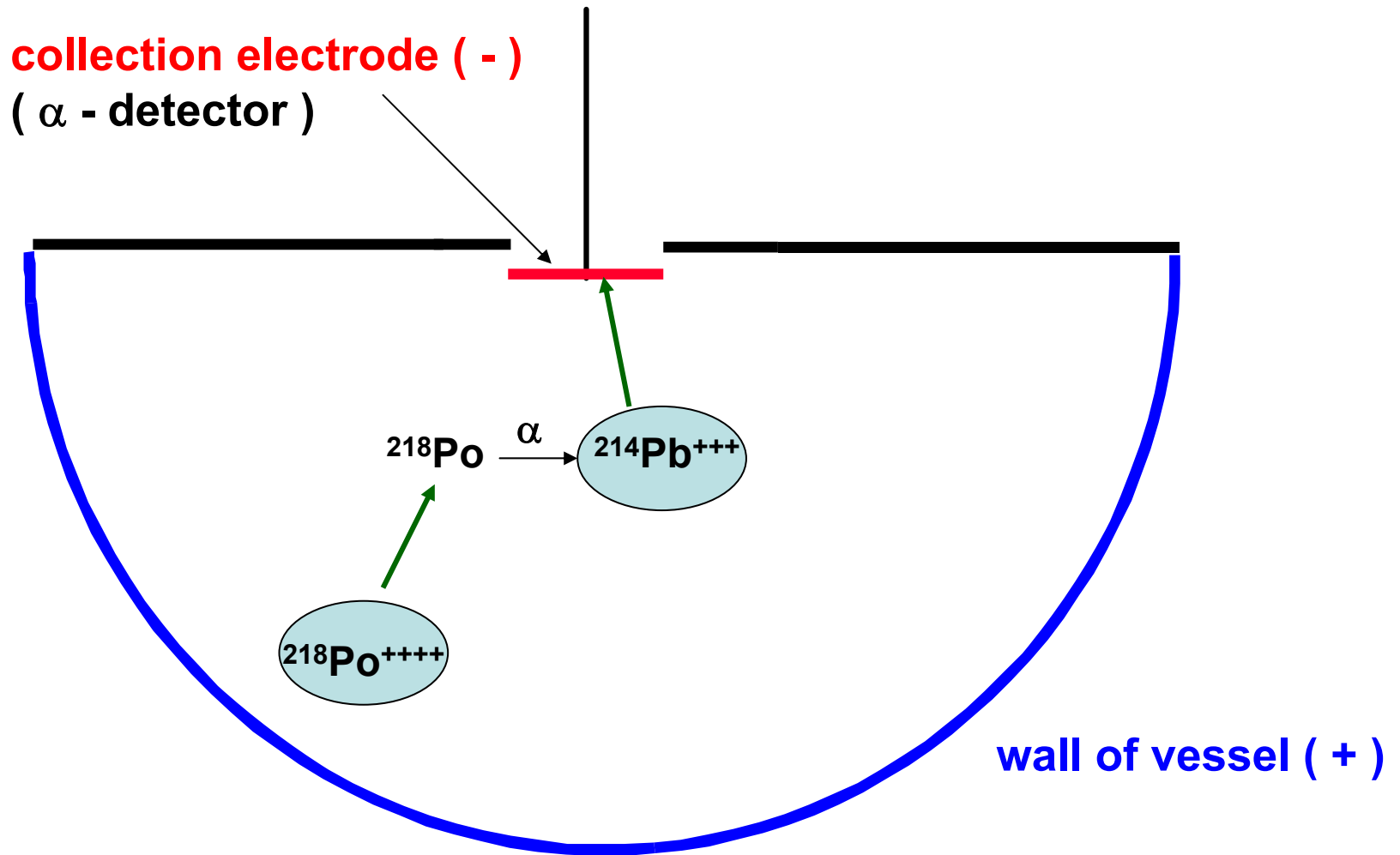
electrostatic Rn - detector



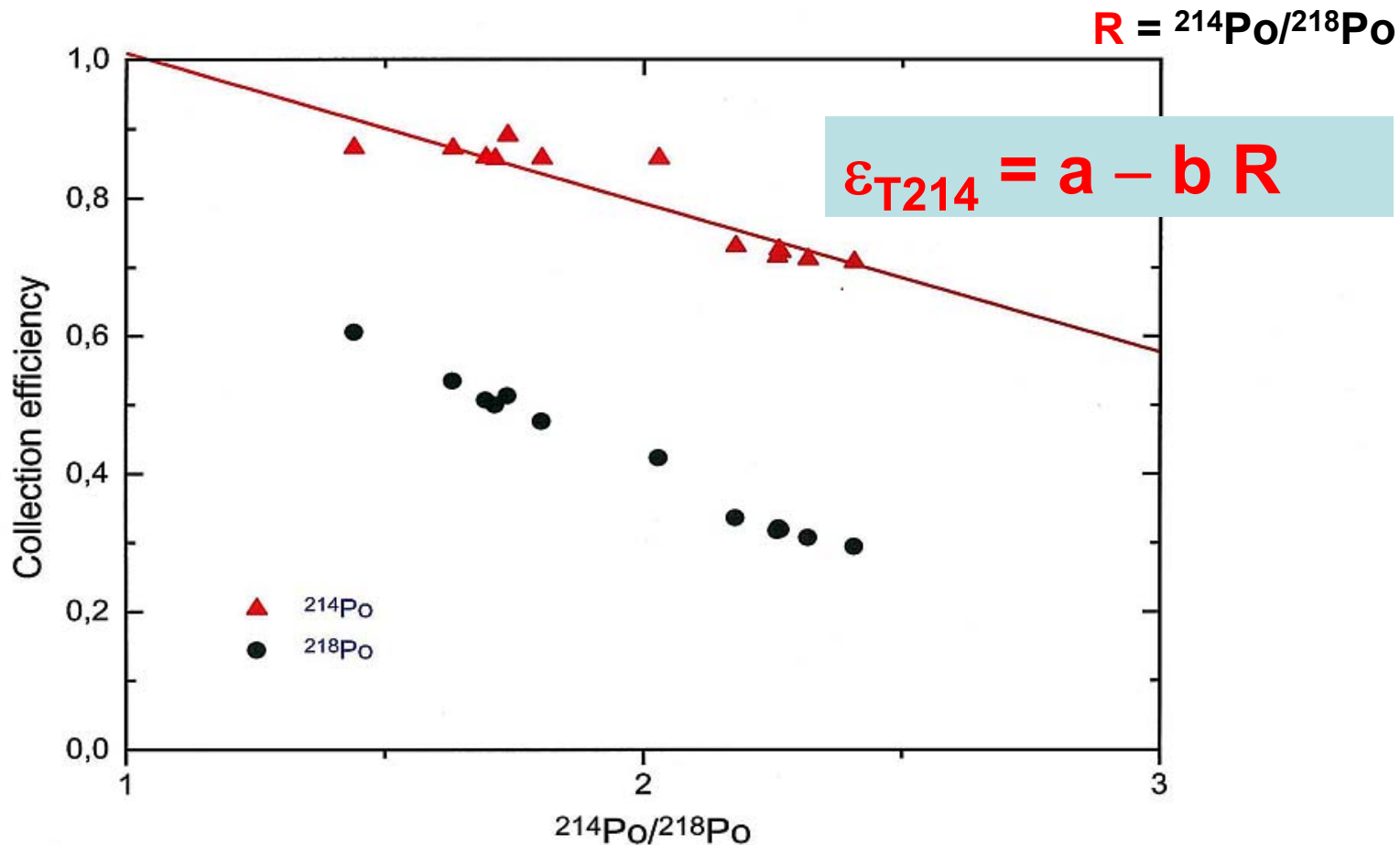
Collection process



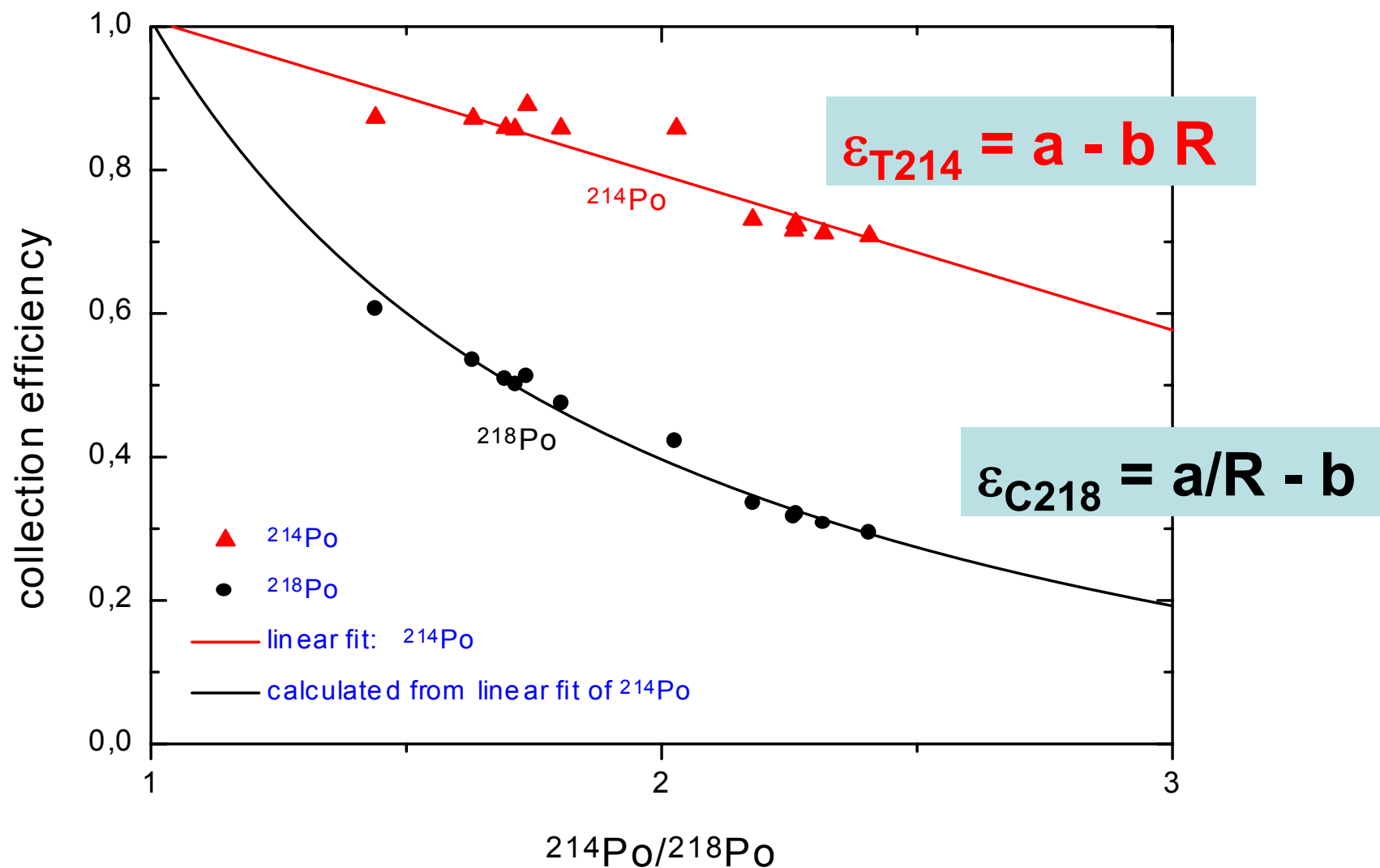
Collection process



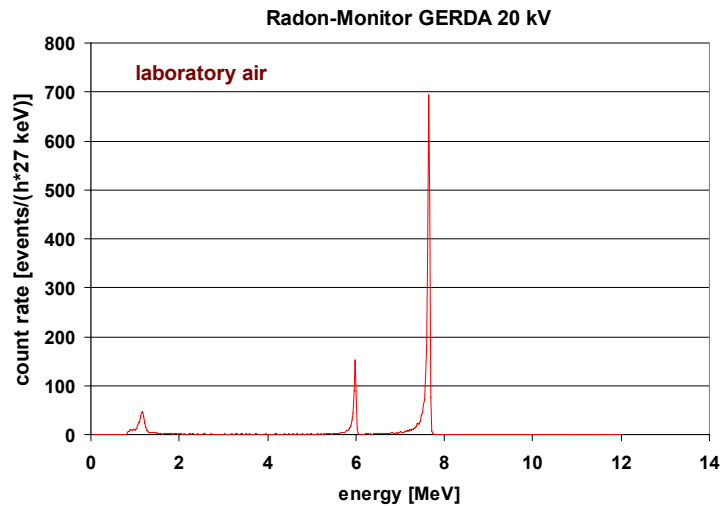
Efficiency diagram Borexino Rn - Monitor



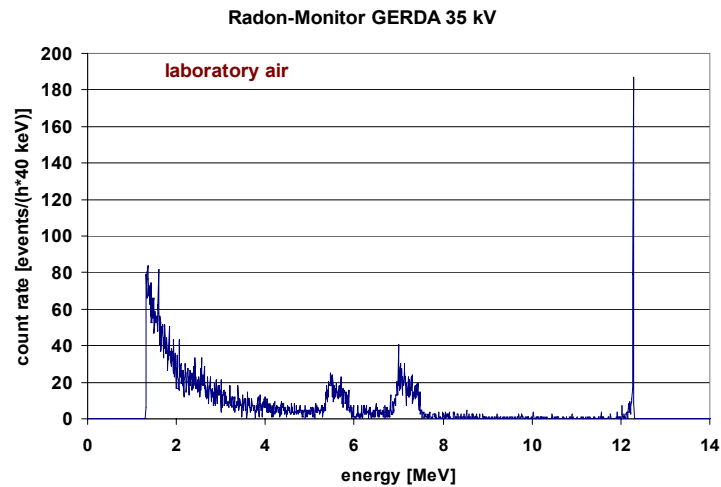
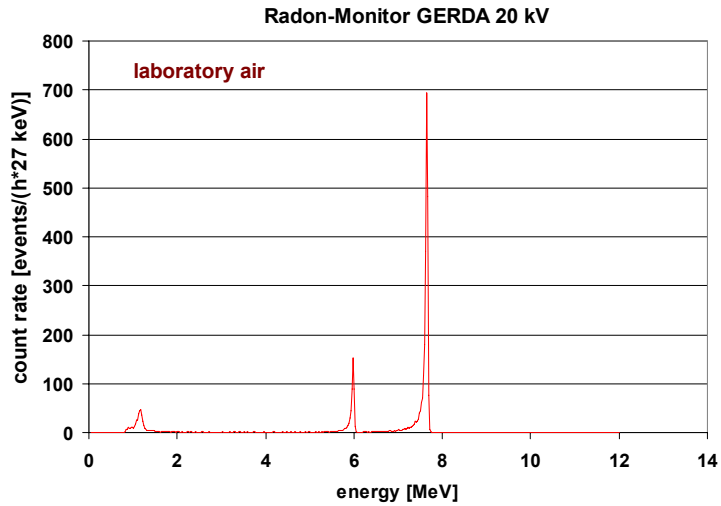
Borexino Rn - Monitor



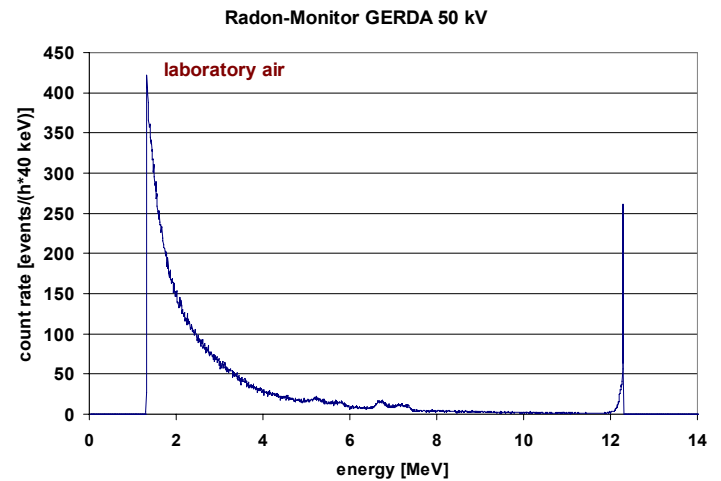
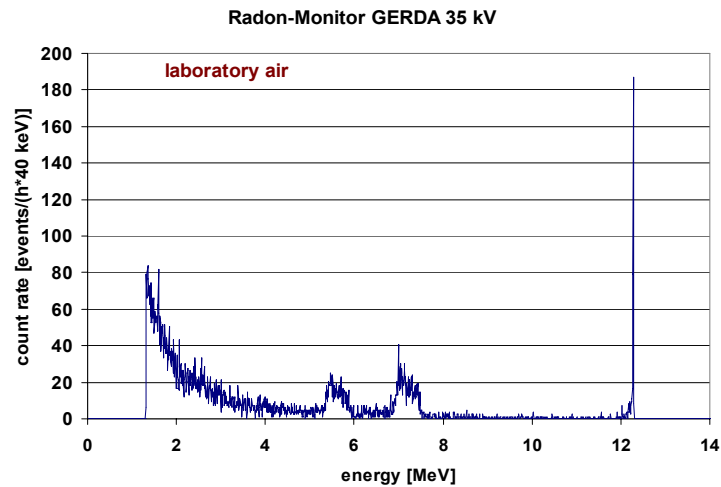
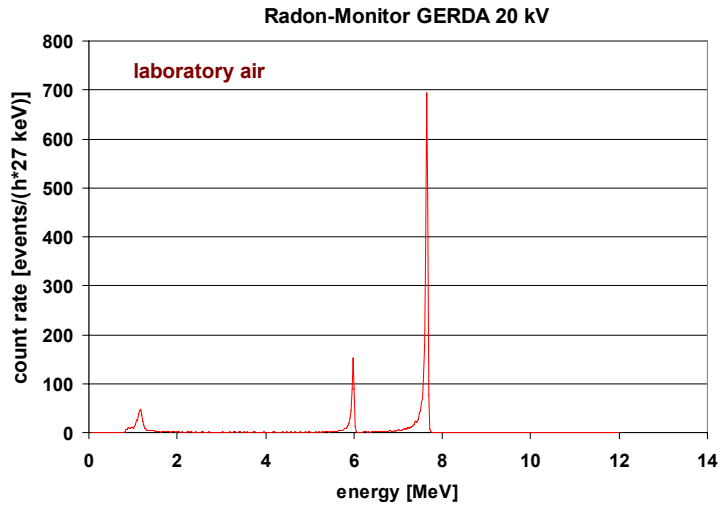
Po spectra in dependence on high voltage



Po spectra in dependence on high voltage

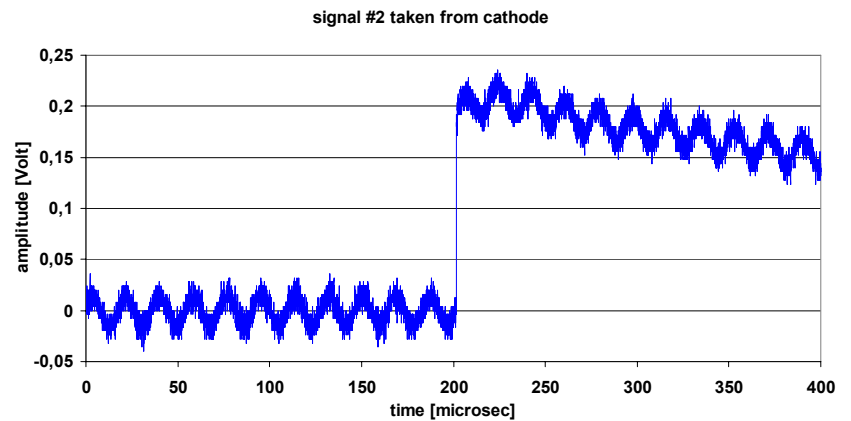
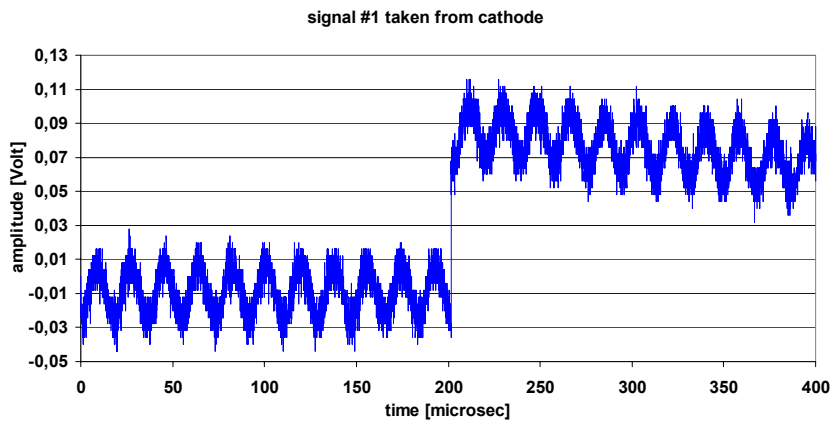


Po spectra in dependence on high voltage



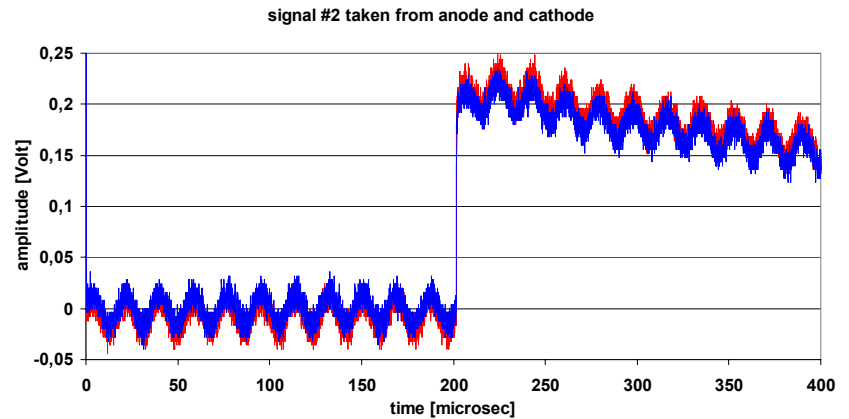
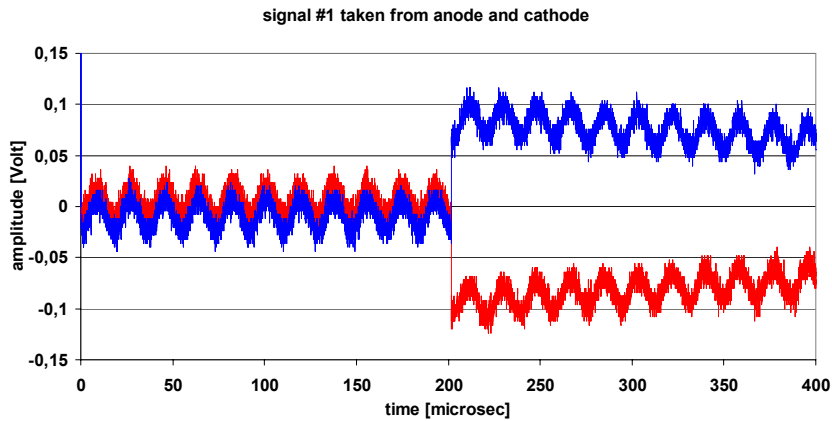
2 signals recorded from the Rn – Monitor

which one is a background event?



2 signals recorded from the Rn – Monitor

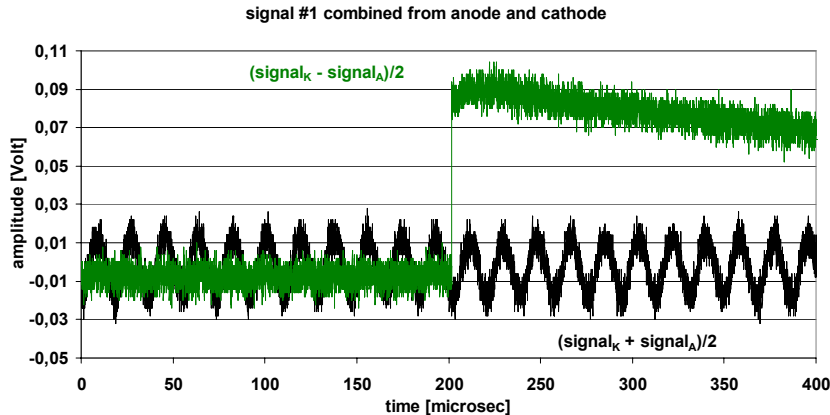
simultaneous acquisition of anode and
cathode signals



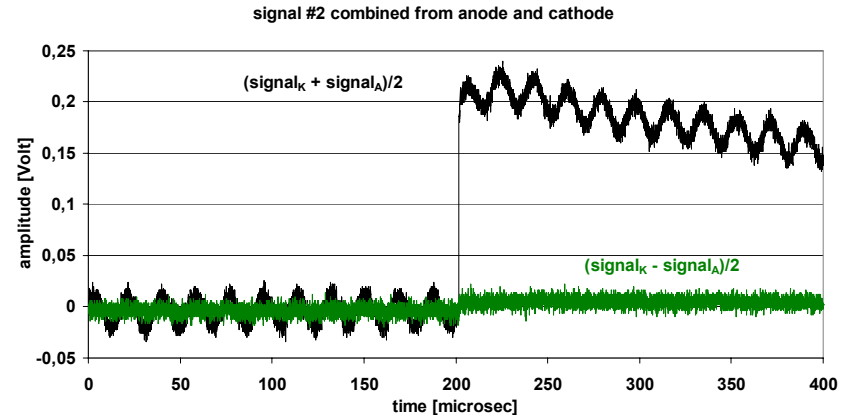
2 signals recorded from the Rn – Monitor

combination of anode and cathode signals

α - decay



background

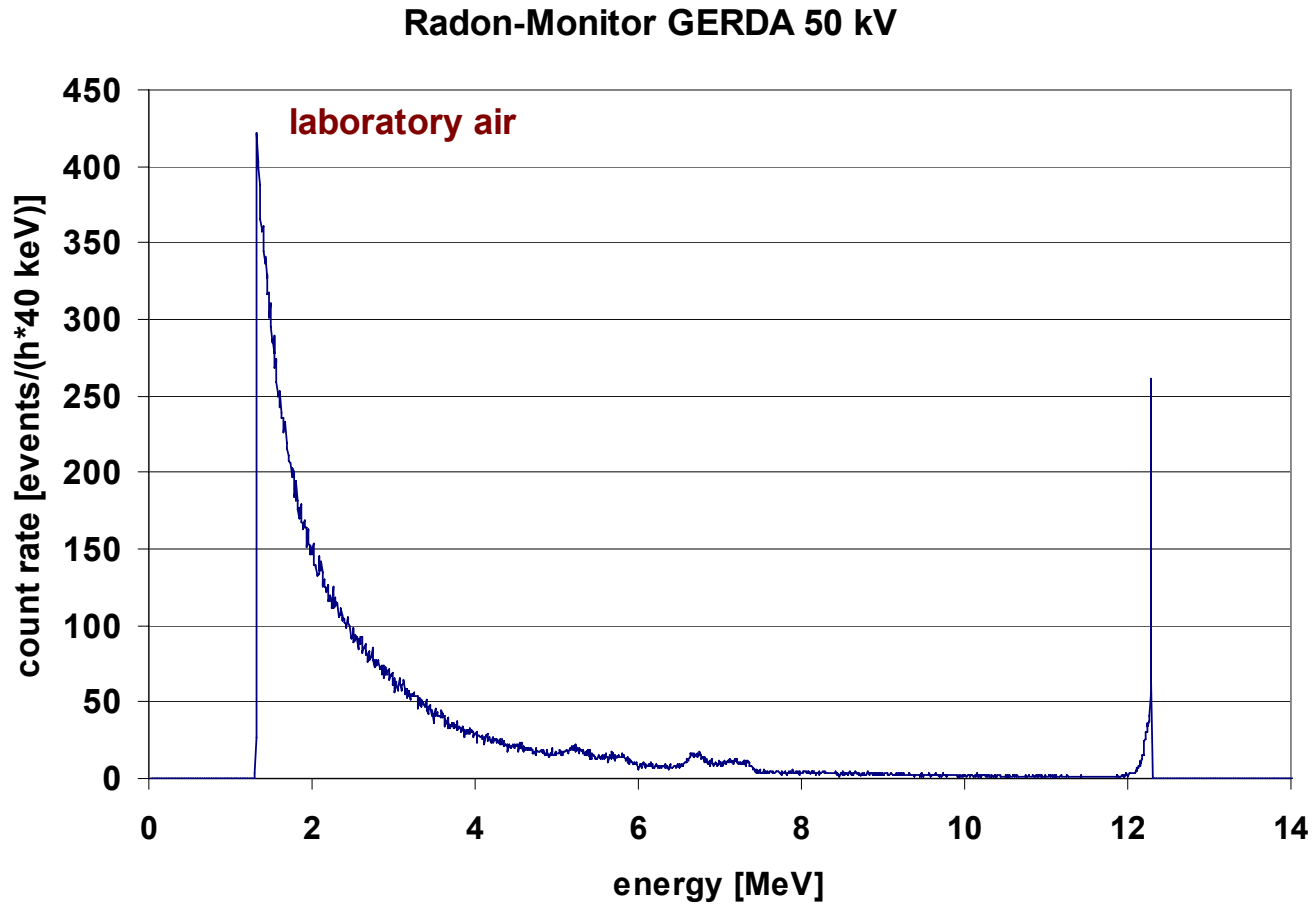


Discrimination power of the double amplifier technique*

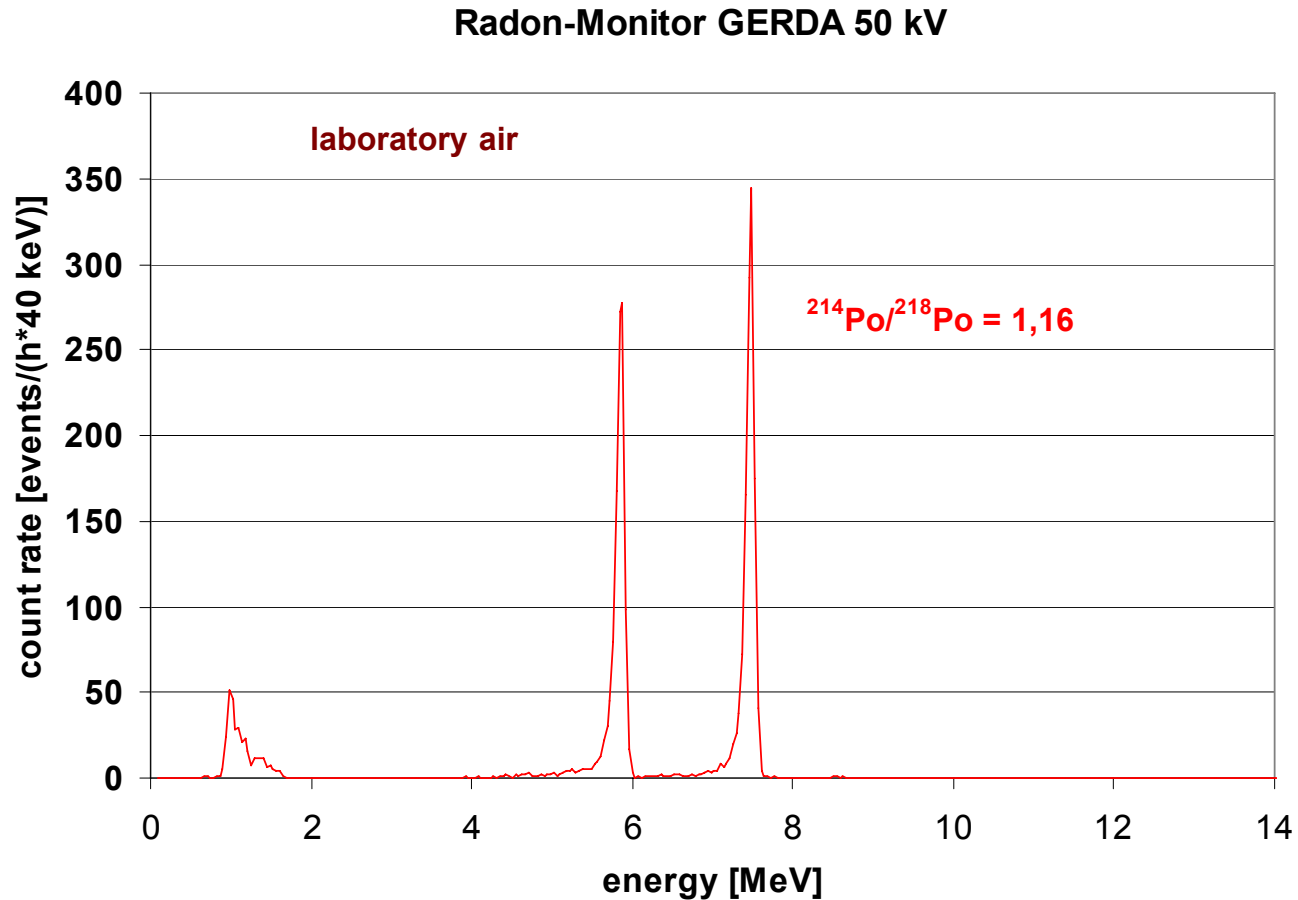
- **reduces amplifier noise**
- **distinguishes between detector signals and signals picked up from the environment**
- **allows to reject background events**

* [J. Kiko, Nucl. Inst. Meth. A 482 \(2002\) 434-440](#)

Standard signal acquisition

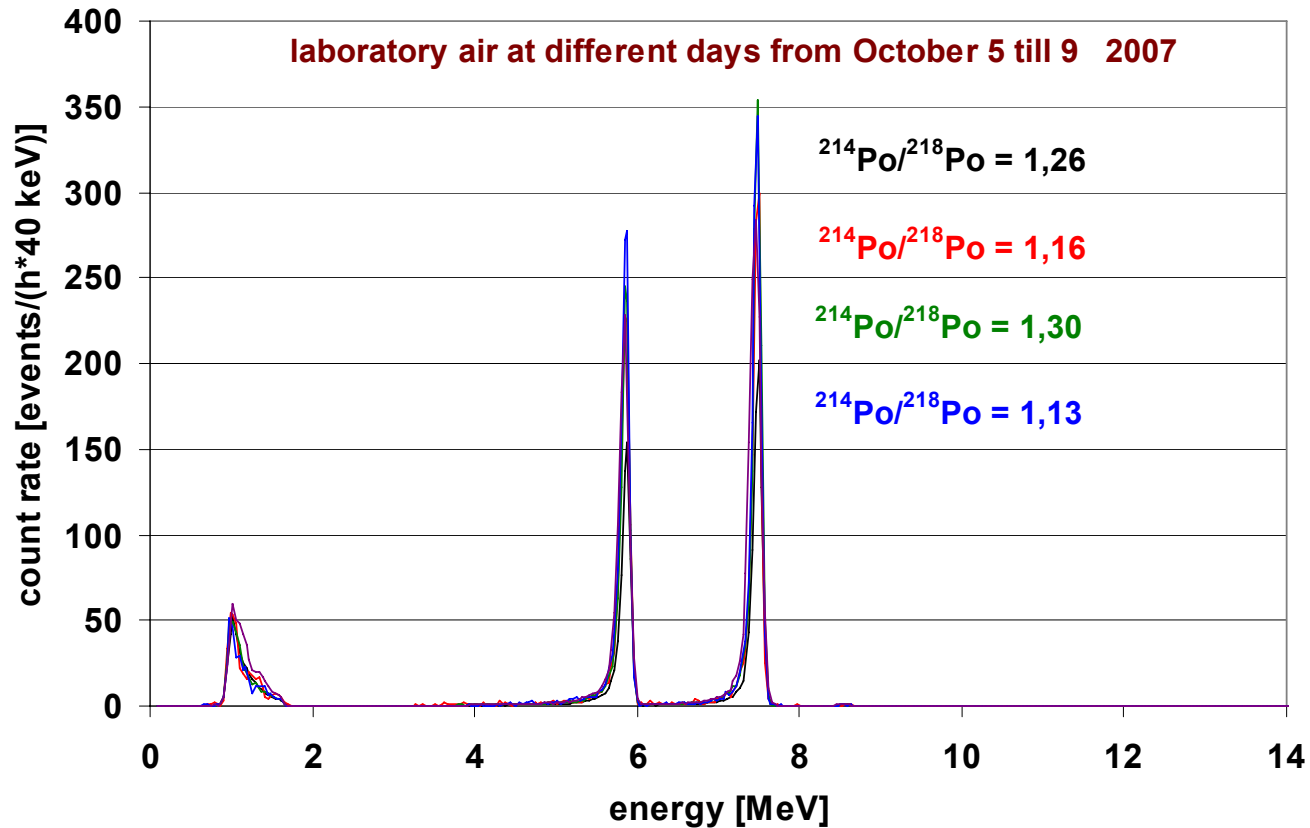


With double amplifier technique



With double amplifier technique

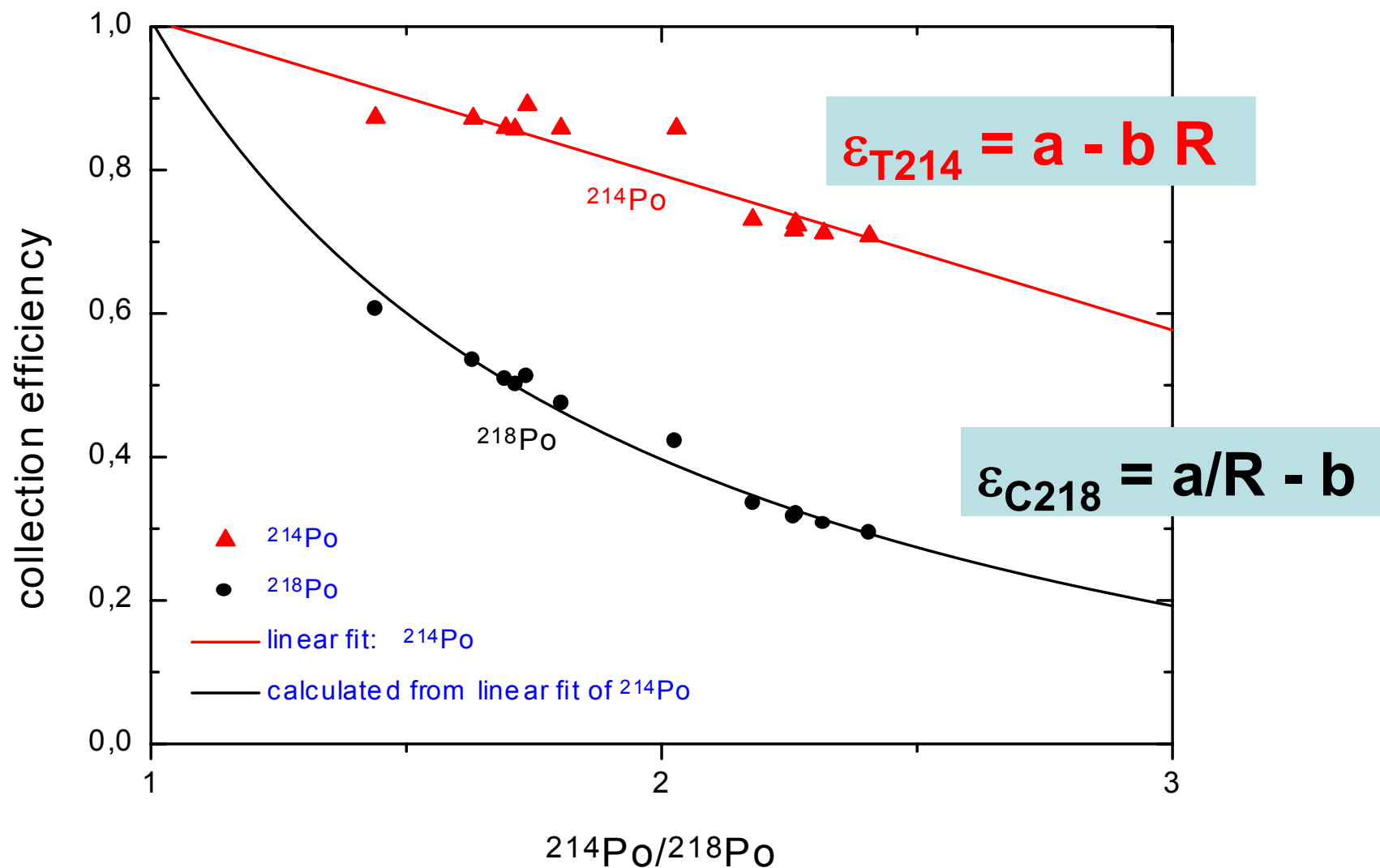
Radon-Monitor GERDA 50 kV

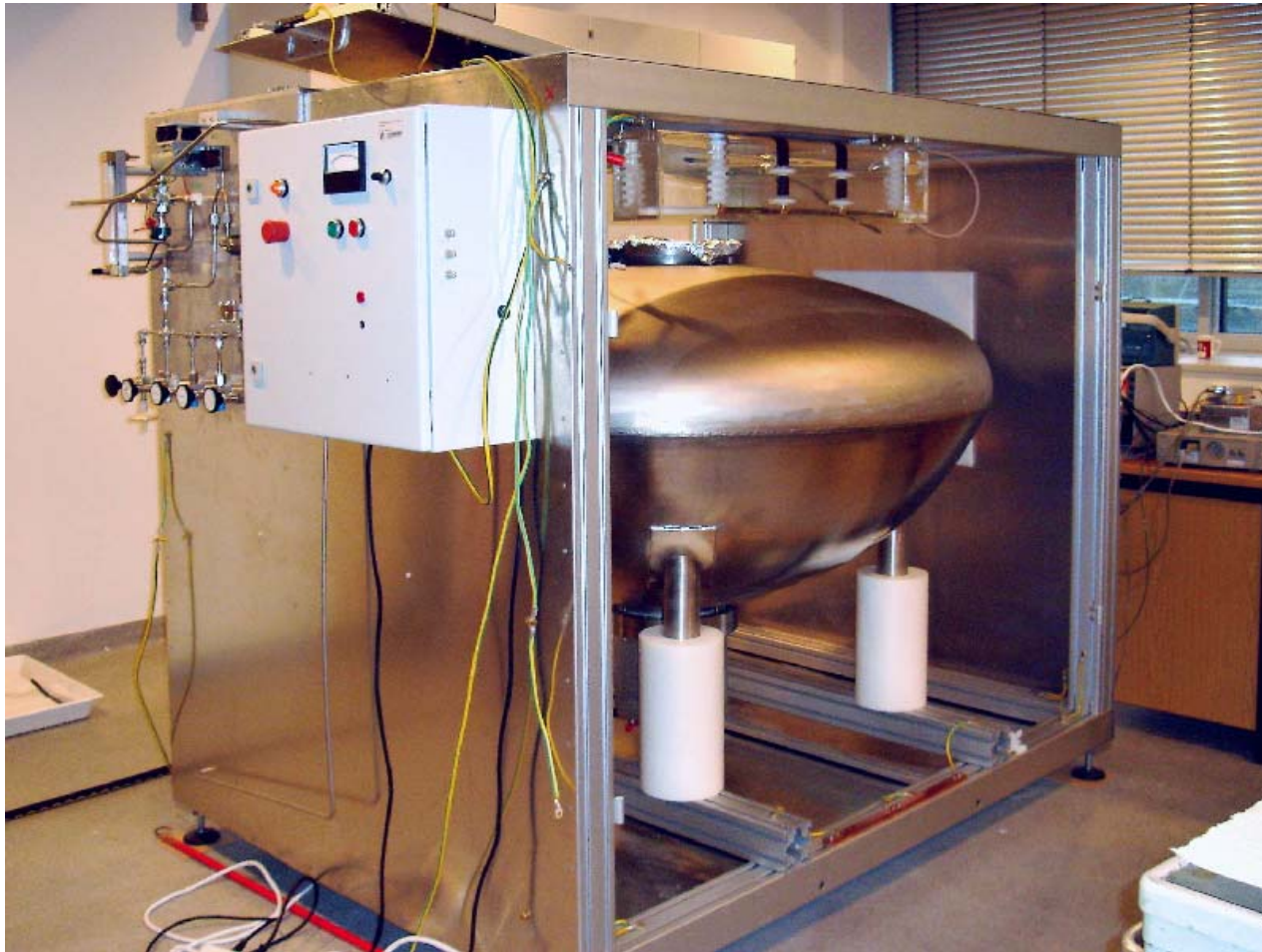


Next steps

- **Leak detection**
- **Calibration**
- **Study on the behavior of the monitor on pollution of the air with for instance H₂O and other gases with ion neutralization potential**

Borexino Rn - Monitor

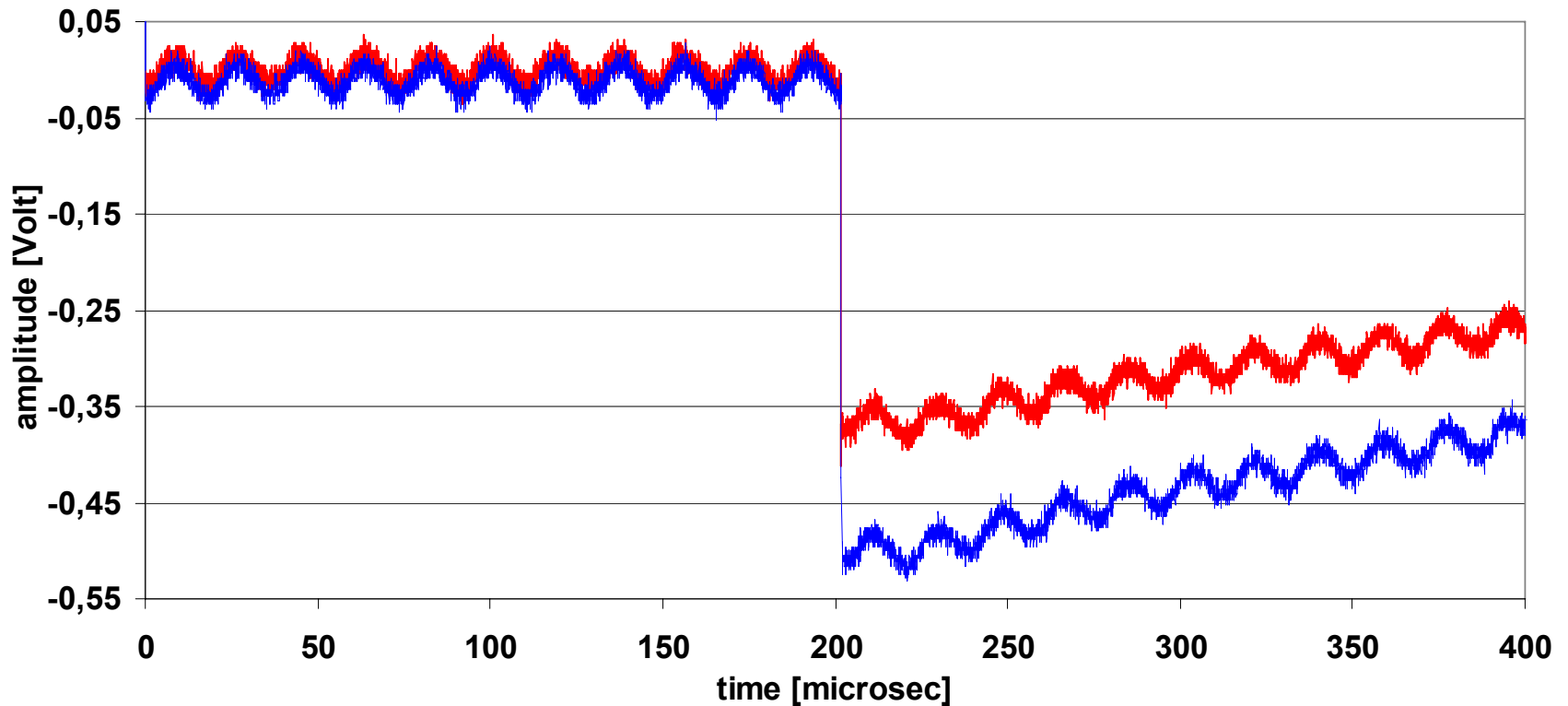




GERDA Meeting Assergi, November 2007, Jürgen Kiko, Jochen Schreiner

Background event with negative amplitudes at anode and cathode

signal #3 taken from anode and cathode



Radon-Monitor GERDA 50 kV

