



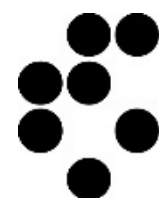
Augmented cooperation in education
and training in nuclear and radiochemistry

Calculation of results for Po-210 in sediment by alpha spectrometry

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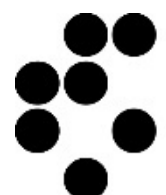
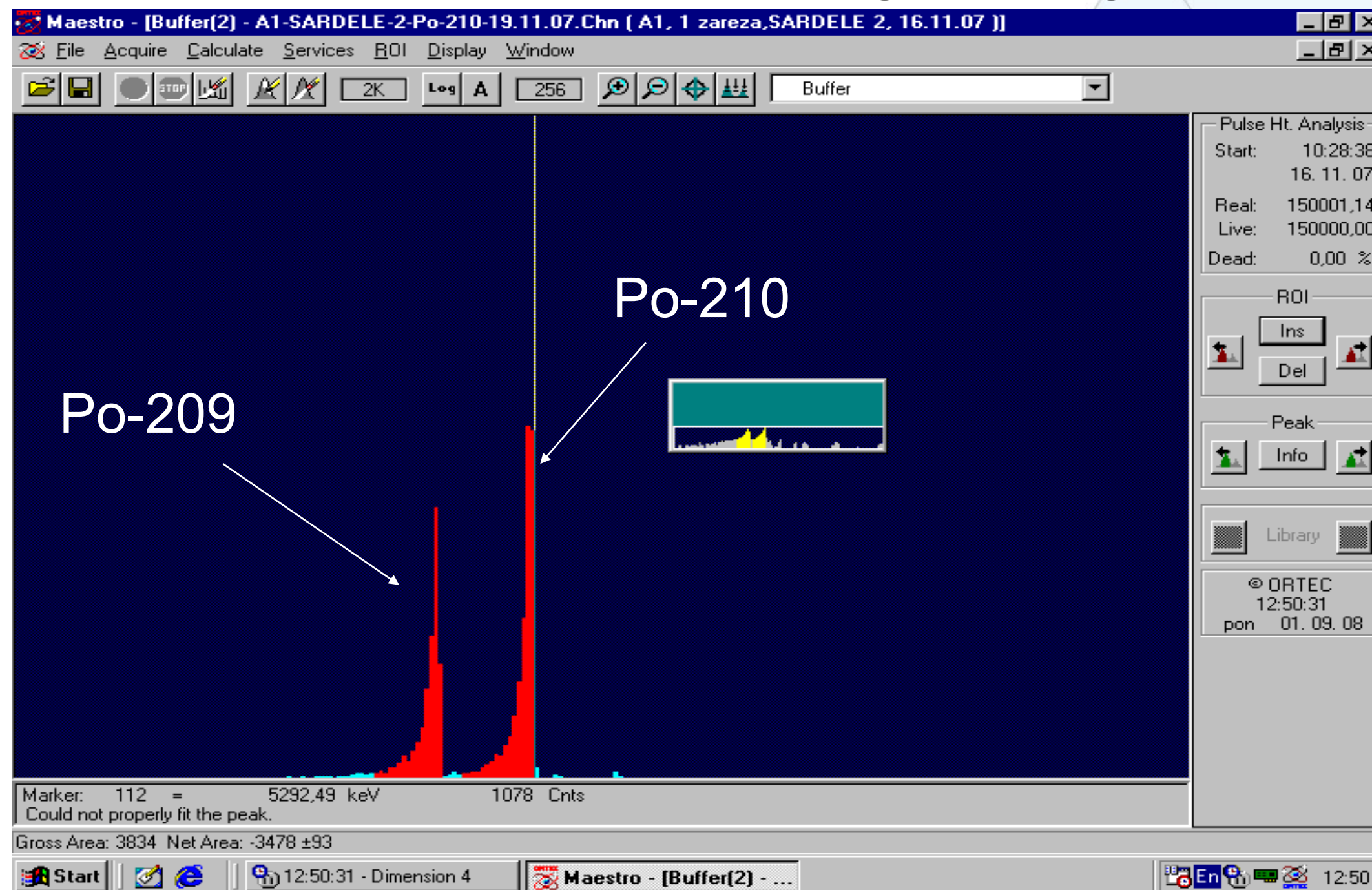
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Po-210 and Po-209 tracer alpha spectrum



Calculation of results

$$A_{\text{Po-210}} = \frac{(R_{\text{Po-210}} - R_{\text{b,Po-210}})A_{\text{Po-209}}m_{\text{Po-209}}}{(R_{\text{Po-209}} - R_{\text{b,Po-209}})m_s} \quad (1)$$

$$R_X = \frac{N_X}{t_m} \quad (2)$$

$A_{\text{Po-210}}$ → activity concentration of Po – 210 [Bq/L]

$R_{\text{Po-210}}$ → Po – 210 count rate [1/s]

$R_{\text{b,Po-210}}$ → Po – 210 background count rate [1/s]

$R_{\text{Po-209}}$ → Po – 209 count rate [1/s]

$R_{\text{b,Po-209}}$ → Po – 209 background count rate [1/s]

$A_{\text{Po-209}}$ → activity concentration of Po – 209 tracer [Bq/g]

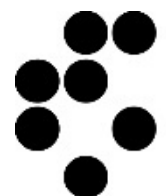
$m_{\text{Po-209}}$ → mass of Po – 209 tracer added [g]

m_s → sample mass [g]

R_X → count rate of radionuclide X or background [1/s]

N_X → number of counts of radionuclide X or background

t_m → measurement time [s]



Calculation of measurement uncertainty

$$u_{c, \text{Po-210}} = A_{\text{Po-210}} \sqrt{\left(\frac{u_{R_{\text{Po-210}} - R_{b, \text{Po-210}}}}{R_{\text{Po-210}} - R_{b, \text{Po-210}}}\right)^2 + \left(\frac{u_{R_{\text{Po-209}} - R_{b, \text{Po-209}}}}{R_{\text{Po-209}} - R_{b, \text{Po-209}}}\right)^2 + \left(\frac{u_{A_{\text{Po-209}}}}{A_{\text{Po-209}}}\right)^2 + \left(\frac{u_{m_{\text{Po-209}}}}{m_{\text{Po-209}}}\right)^2 + \left(\frac{u_{m_s}}{m_s}\right)^2} \quad (3)$$

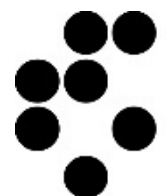
$$u_{R_{\text{Po-210}} - R_{b, \text{Po-210}}} = \sqrt{(u_{R_{\text{Po-210}}})^2 + (u_{R_{b, \text{Po-210}}})^2} \quad (4)$$

$$u_{R_{\text{Po-209}} - R_{b, \text{Po-209}}} = \sqrt{(u_{R_{\text{Po-209}}})^2 + (u_{R_{b, \text{Po-209}}})^2} \quad (5)$$

$$u_{R_X} = \frac{1}{\sqrt{N_X}} \quad (6)$$

$u_{c, \text{Po-210}}$ → combined standard uncertainty for Po – 210 [Bq/g]

u_X → standard uncertainty of X



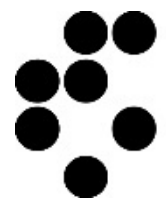
Reporting of the results

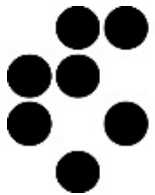
$$U_{\text{Po-210}} = k u_{\text{c,Po-210}} \quad (7)$$

$U_{\text{Po-210}}$ → expanded uncertainty for Po – 210 activity concentration [Bq/g]

k → coverage factor ($k = 2$ for 95% coverage)

$$A_{\text{Po-210}} = A_{\text{Po-210}} \pm U_{\text{Po-210}}$$





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