

Final Configuration and Testing of a System for the Purification of ^{211}At

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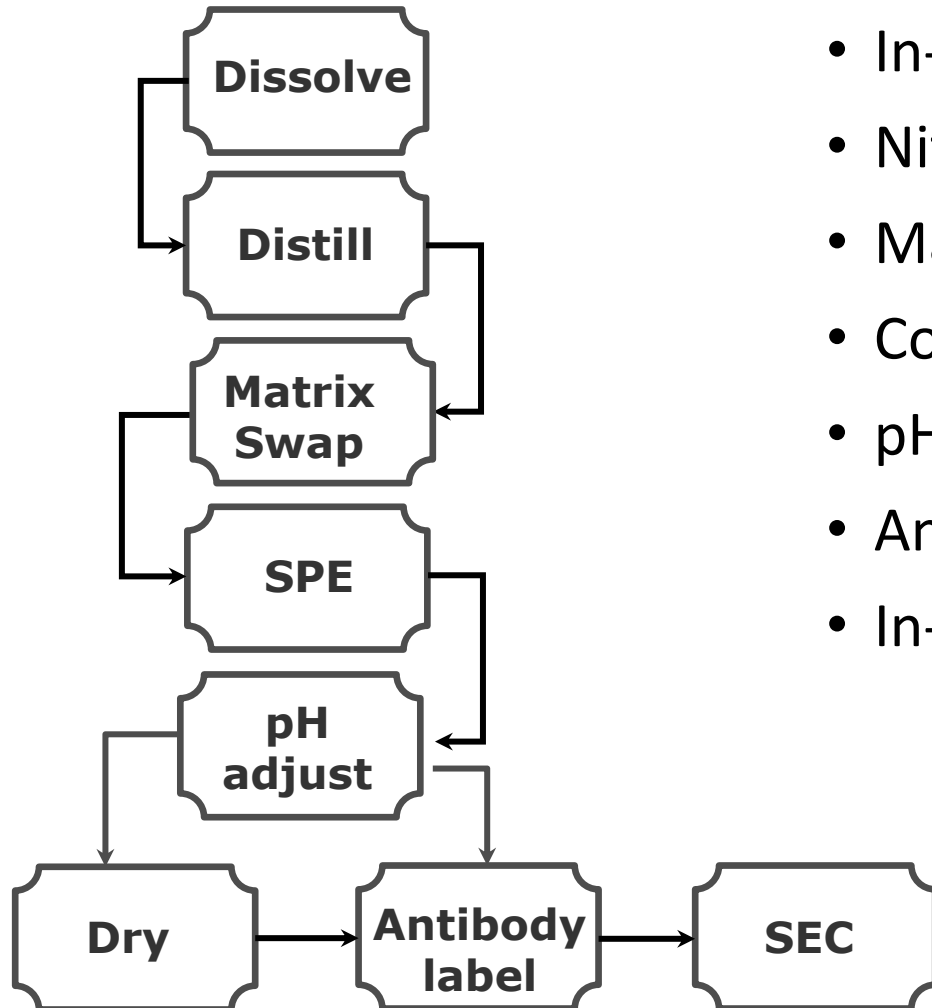
Global FIA & PNNL Collaboration

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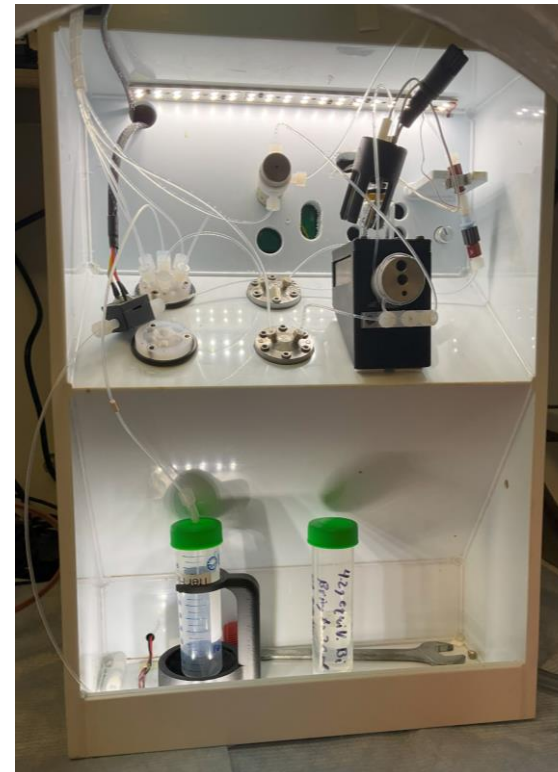
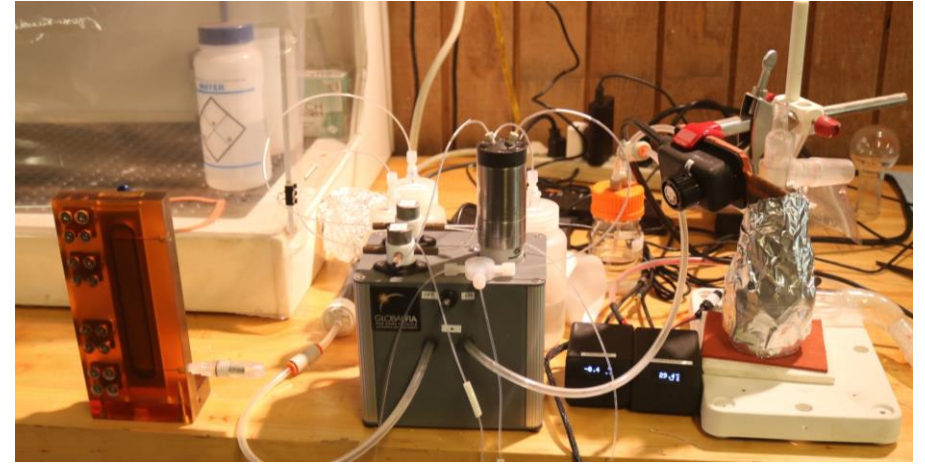
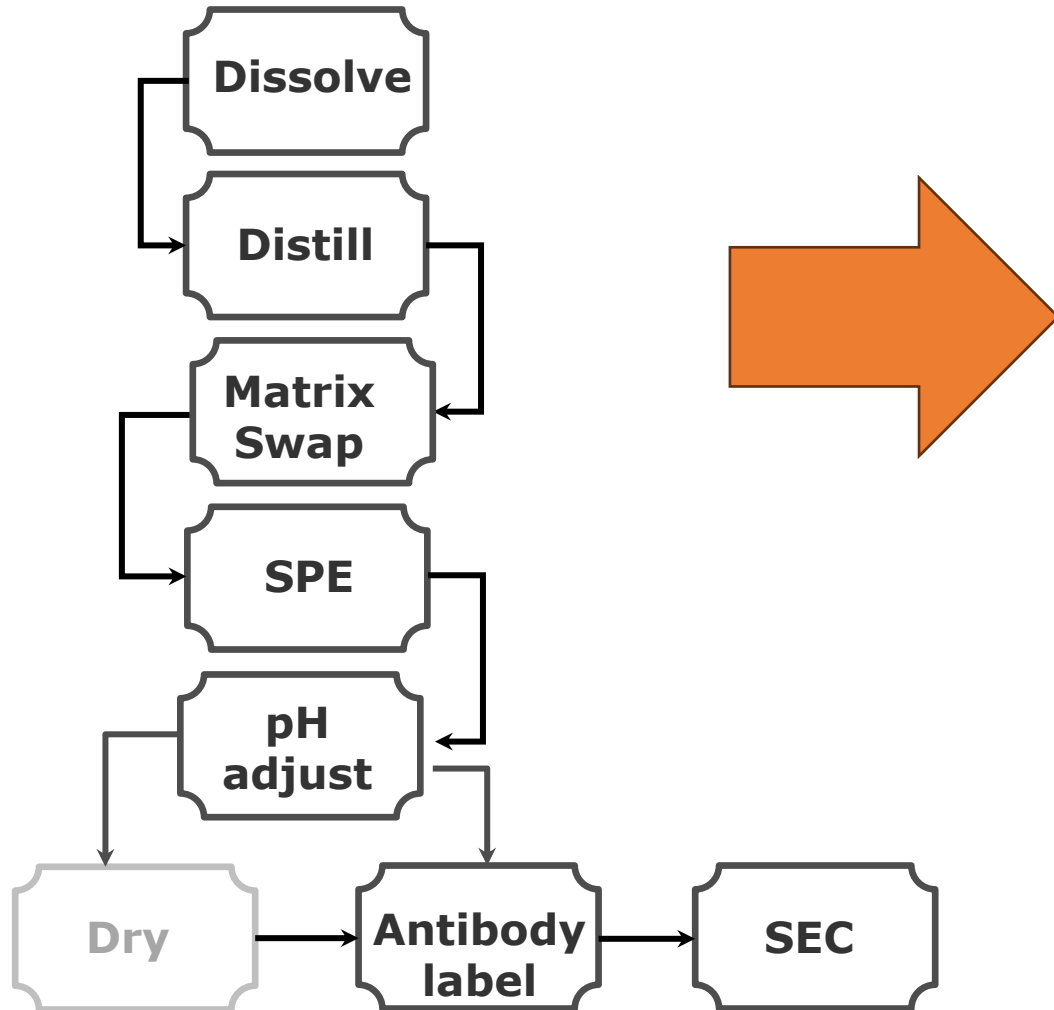
Proposed end-to-end automated process for producing Ab-labeled ^{211}At



- In-line Bi target dissolution,
- Nitric acid elimination,
- Matrix conversion to hydrochloric acid
- Column isolation of ^{211}At using solid phase extraction (SPE) ¹
- pH adjustment of ^{211}At isolate
- Antibody-labeling of ^{211}At
- In-line size-exclusion chromatography (SEC)

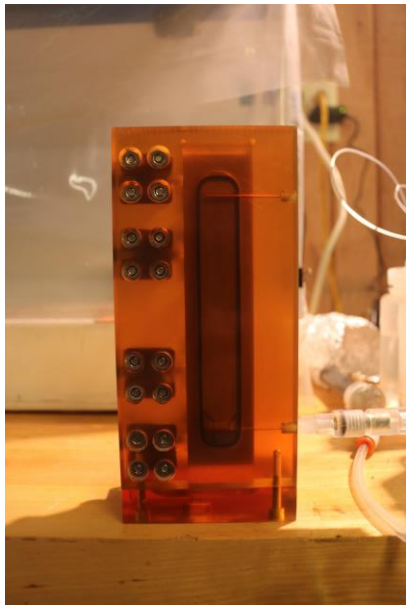
[1] US Patent: O'Hara, M.J., "System and process for purification of astatine-211 from target materials", US20220148751A1, granted 4/4/23.

Unit operations divided into three modules



Unit Operation I: Dissolve target and convert matrix from HNO₃ to HCL

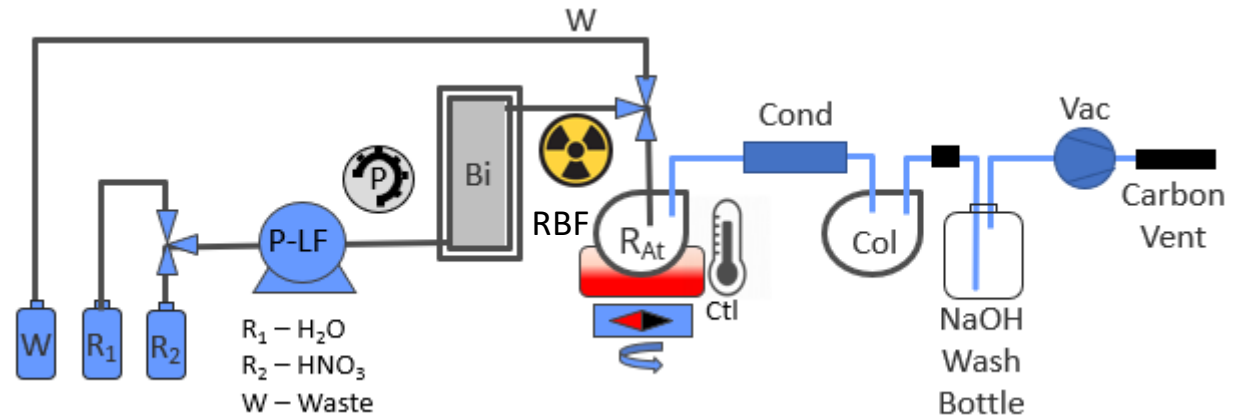
Operation	Time, min
Dissolve & Distill	25
Matrix Conversion	8



In-line cyclotron target dissolution block



RBF with dried [211At]Bi(NO₃)₃ saltcake

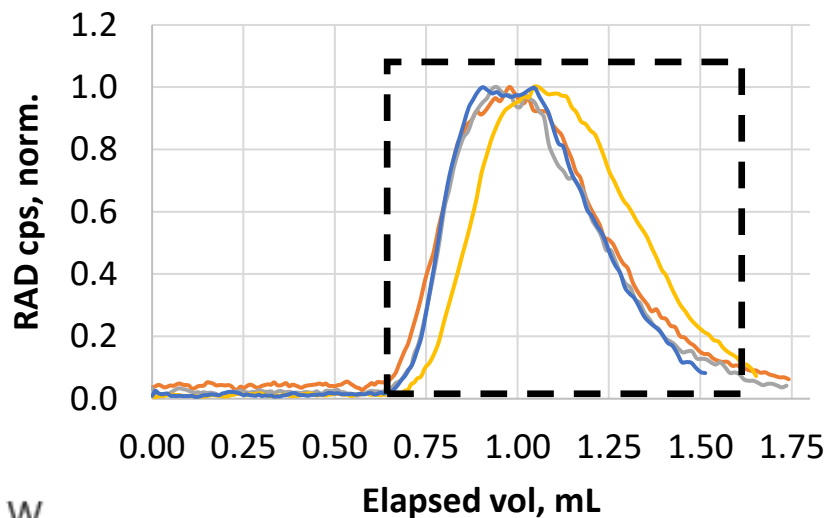


Unit Operation II: Column isolation of ^{211}At ; titrate ^{211}At product to near-neutral pH

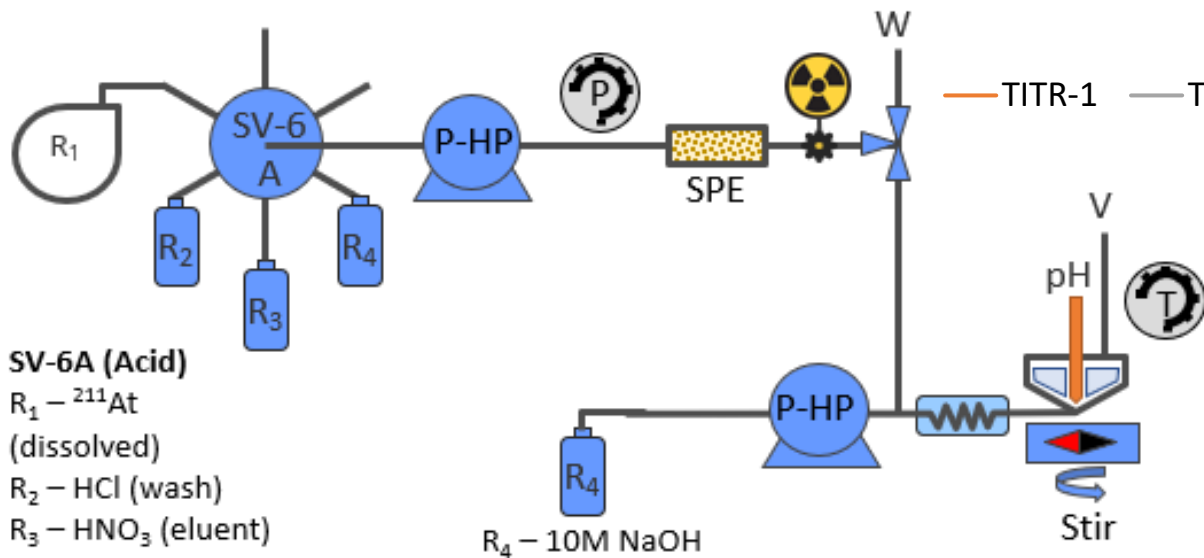
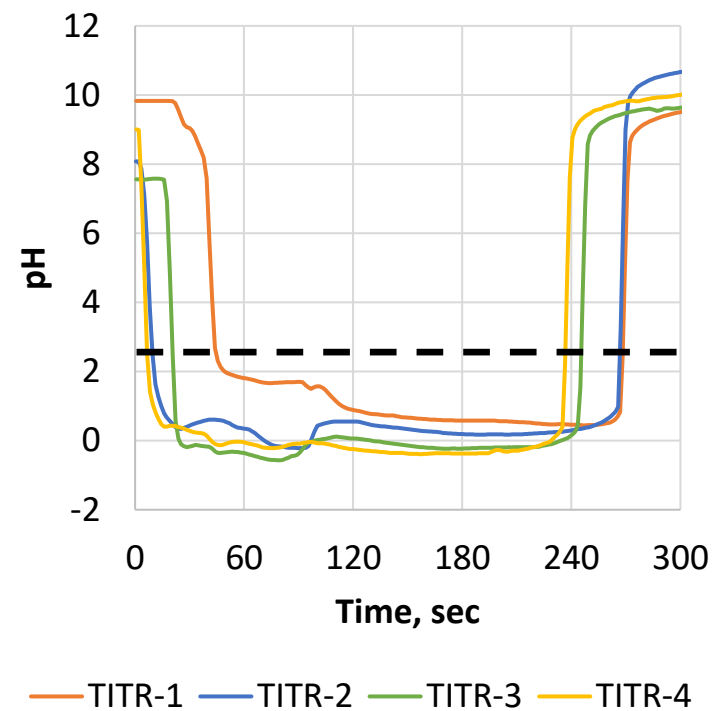
Device	Fraction, %
Product	93.2
Source vial	0.3
Column	0.7
Waste	5.9

Operation	Time, min
Dissolve & Distill	25
Matrix Conversion	8
SPE & pH adjust	20

^{211}At Elution Profiles



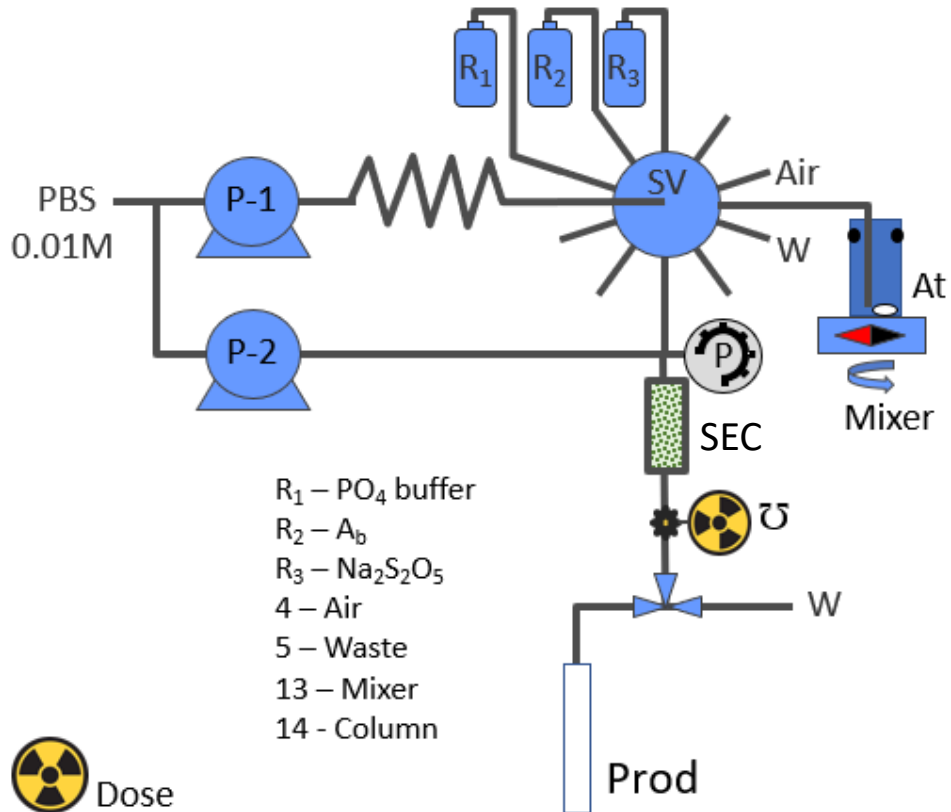
Titration Profiles



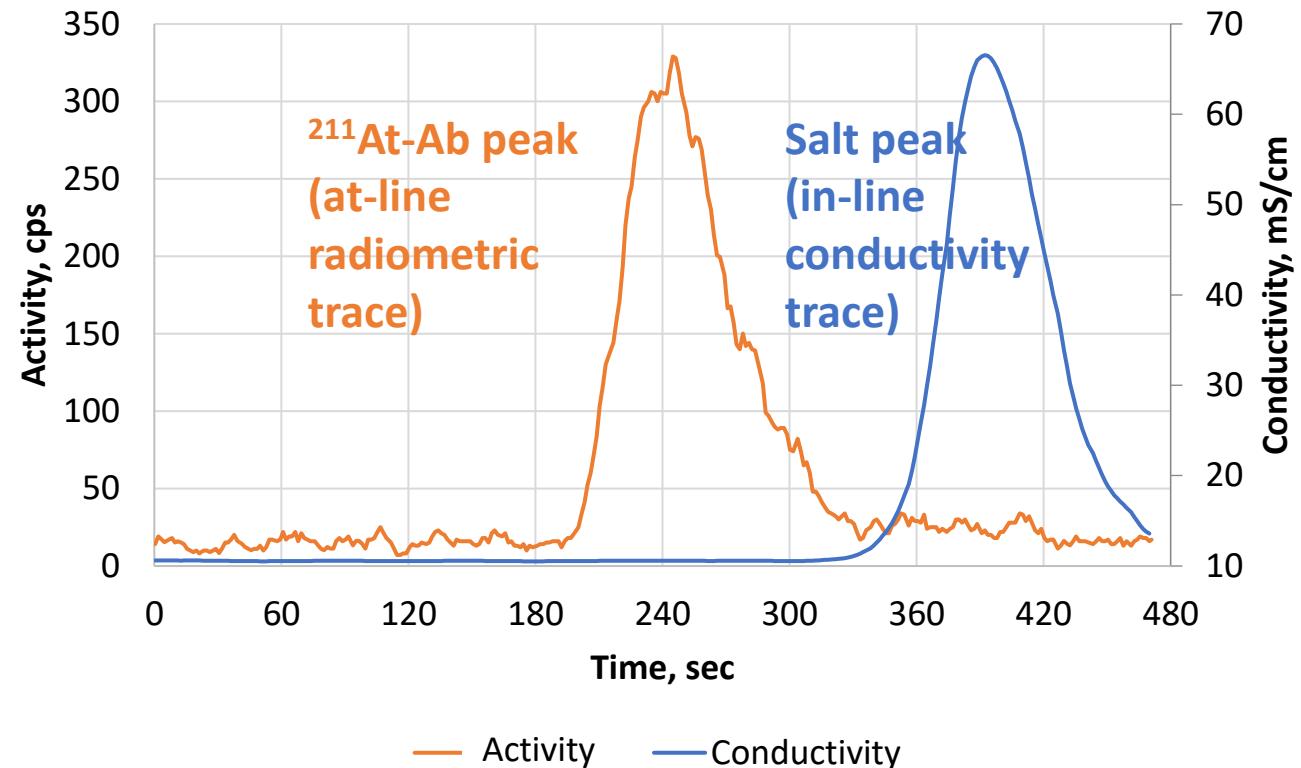
Titration Cell

Unit Operation III: In-line antibody (Ab) labeling & labeled Ab isolation

Operation	Time, min
Dissolve & Distill	25
Matrix Conversion	8
SPE & pH adjust	20
Ab label	7
SEC	40
Total	100

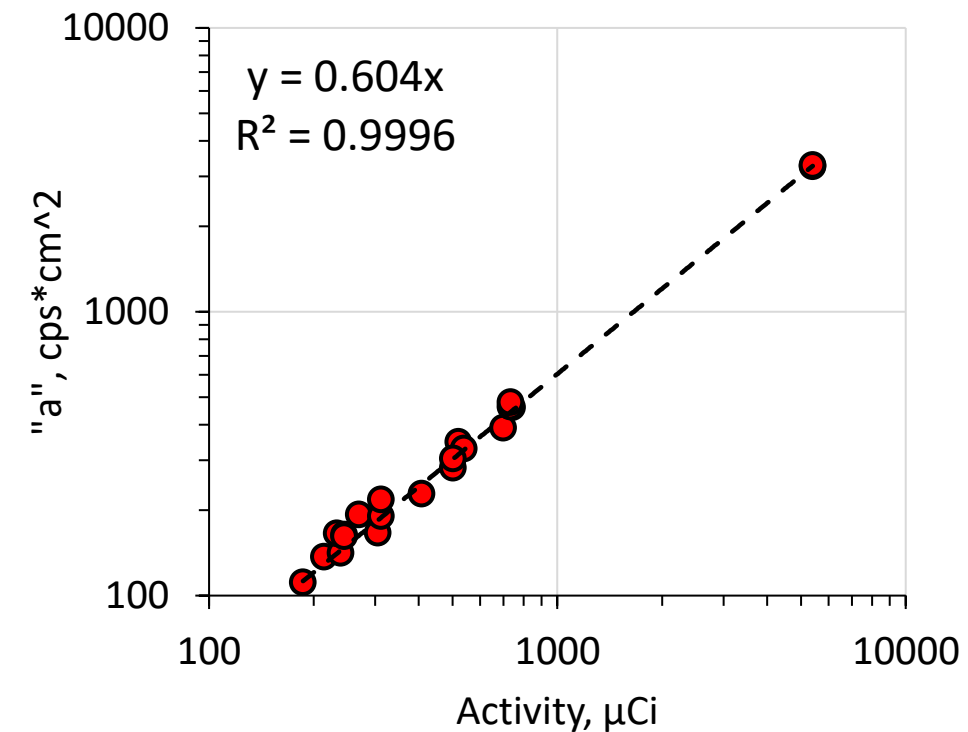
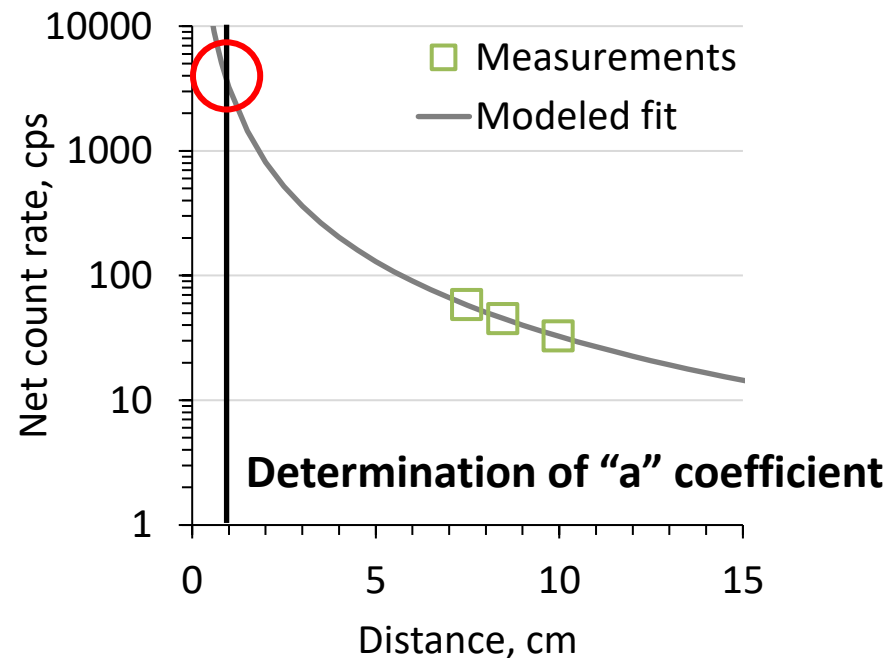
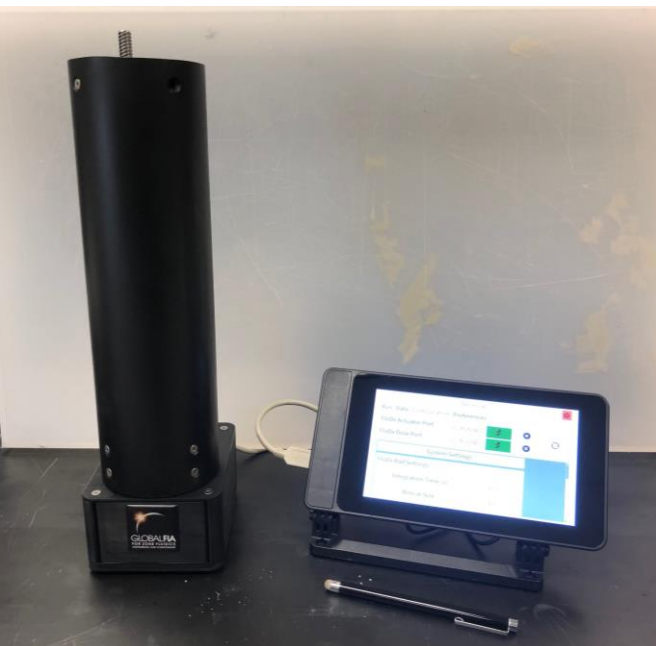


Activity & Conductivity Profiles



Supplemental activity: Development and testing of inexpensive GM tube-based dose calibrator

- Operates on inverse square principle – probes the sample vial at 3-4 distances from GM tubes
- Count rate vs. distance data undergoes non-linear (negative power function) regression
- The negative power function coefficient “a” (where $[y = ax^{-2}]$) defines the count rate at 1 cm distance
- The coefficient is multiplied by the known nuclide-specific measurement efficiency on the device
 - Thus, converting count rate to disintegration rate



Acknowledgements

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