

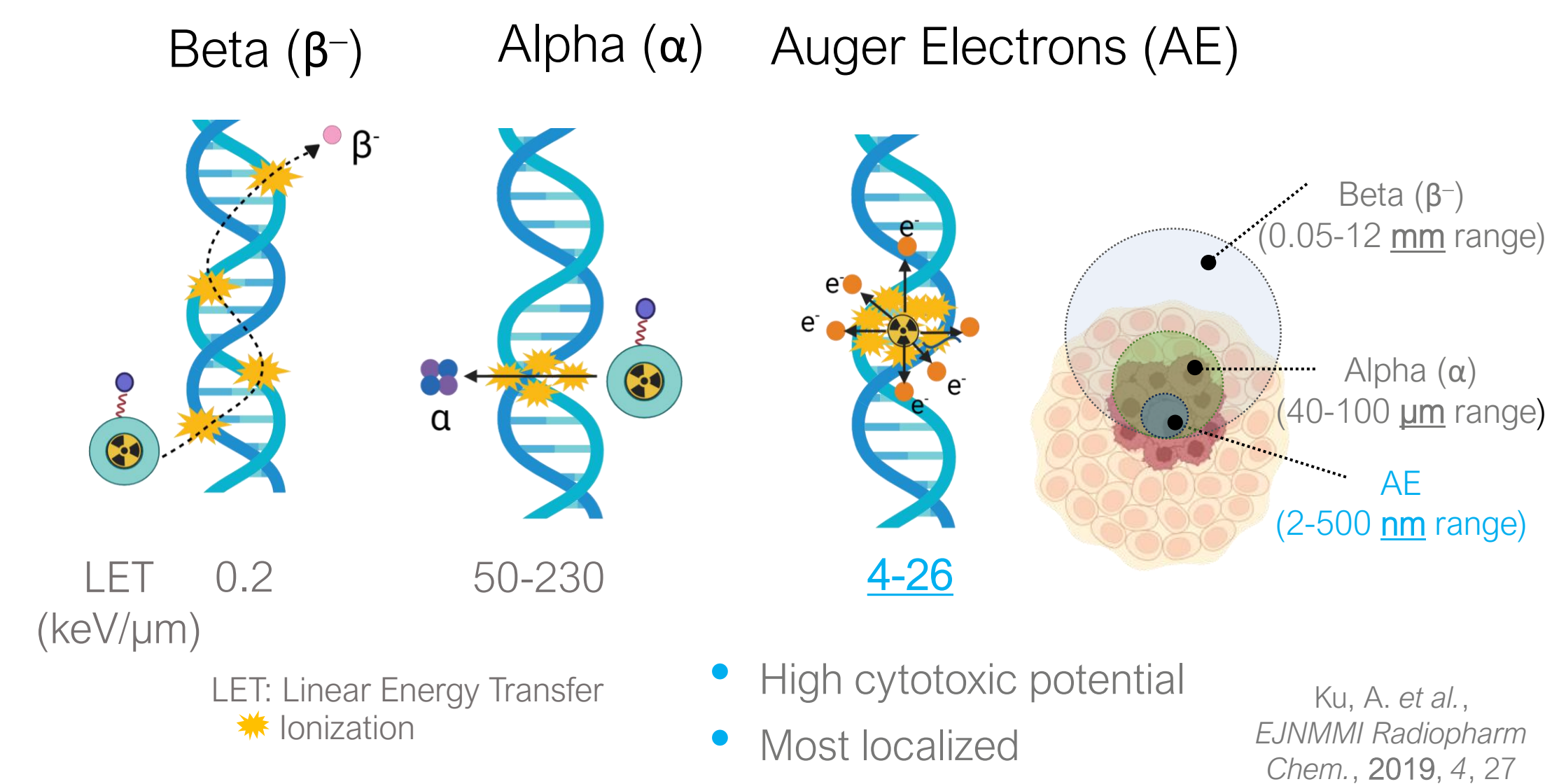
# TRIUMF Production of Mercury-197(m/g) for Targeted Auger Electron Therapy (TAET)

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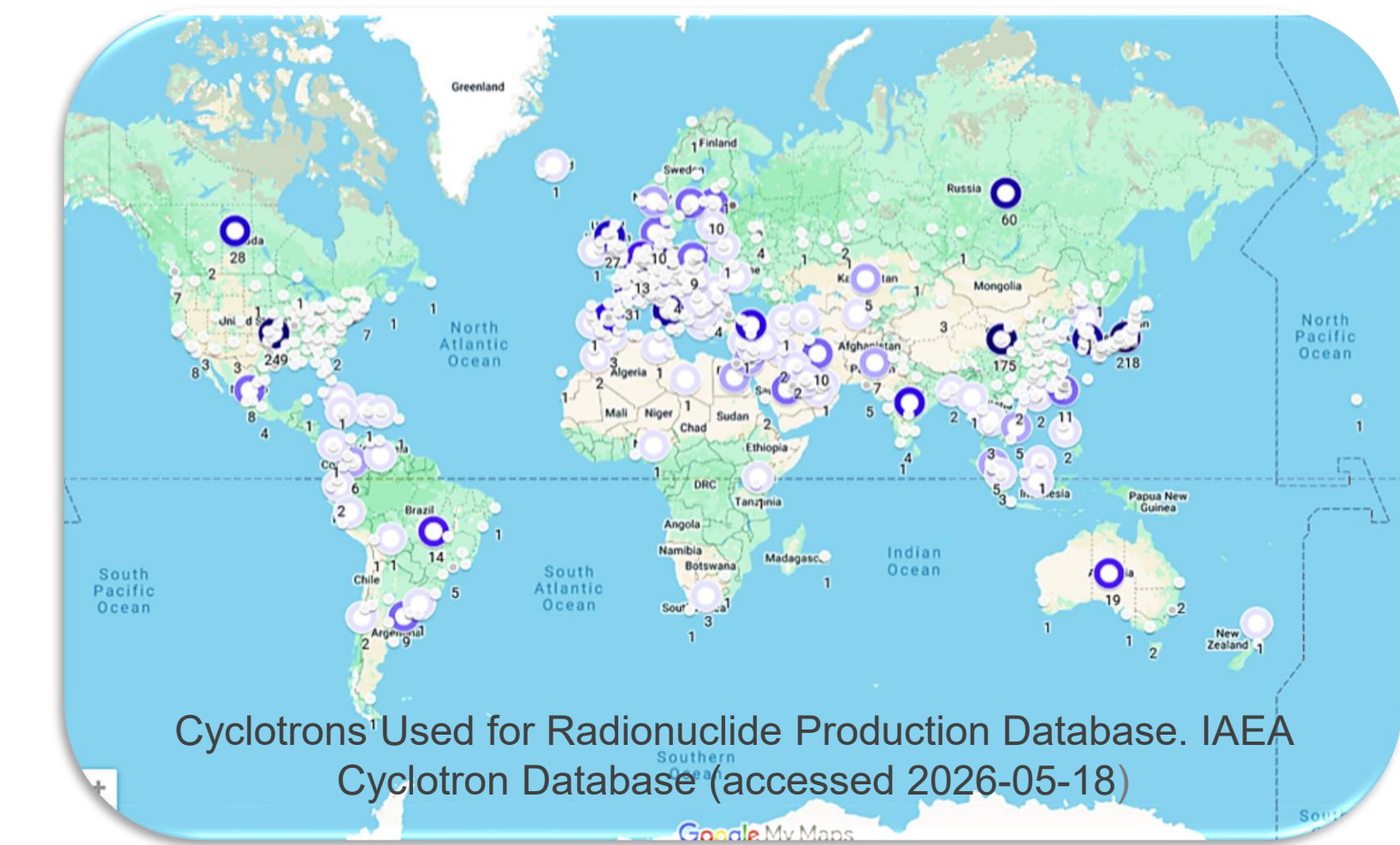
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## Introduction

### Radioactive Emissions for Targeted Radiation Therapy (TRT)

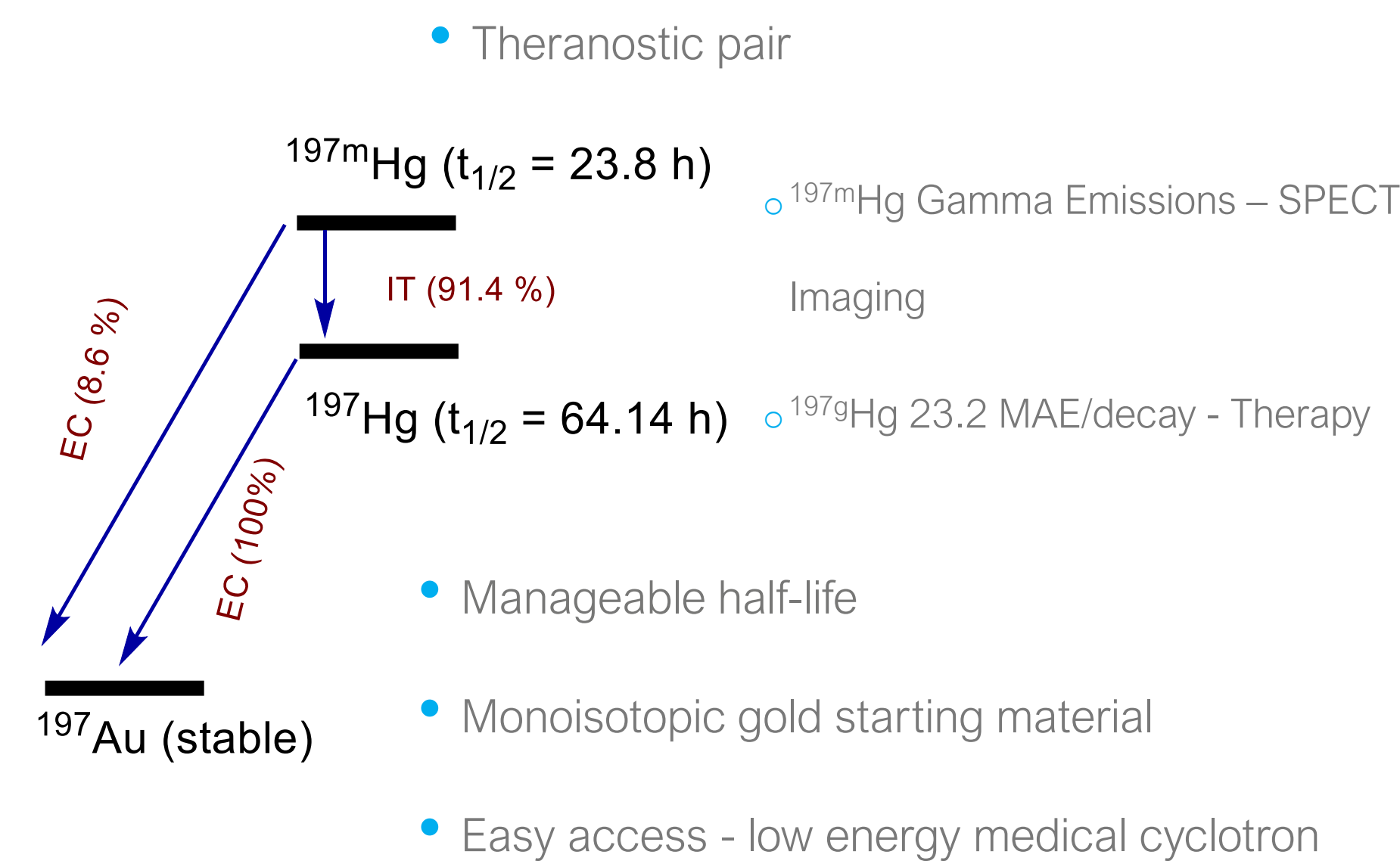


### Potential Availability of Auger Emitter

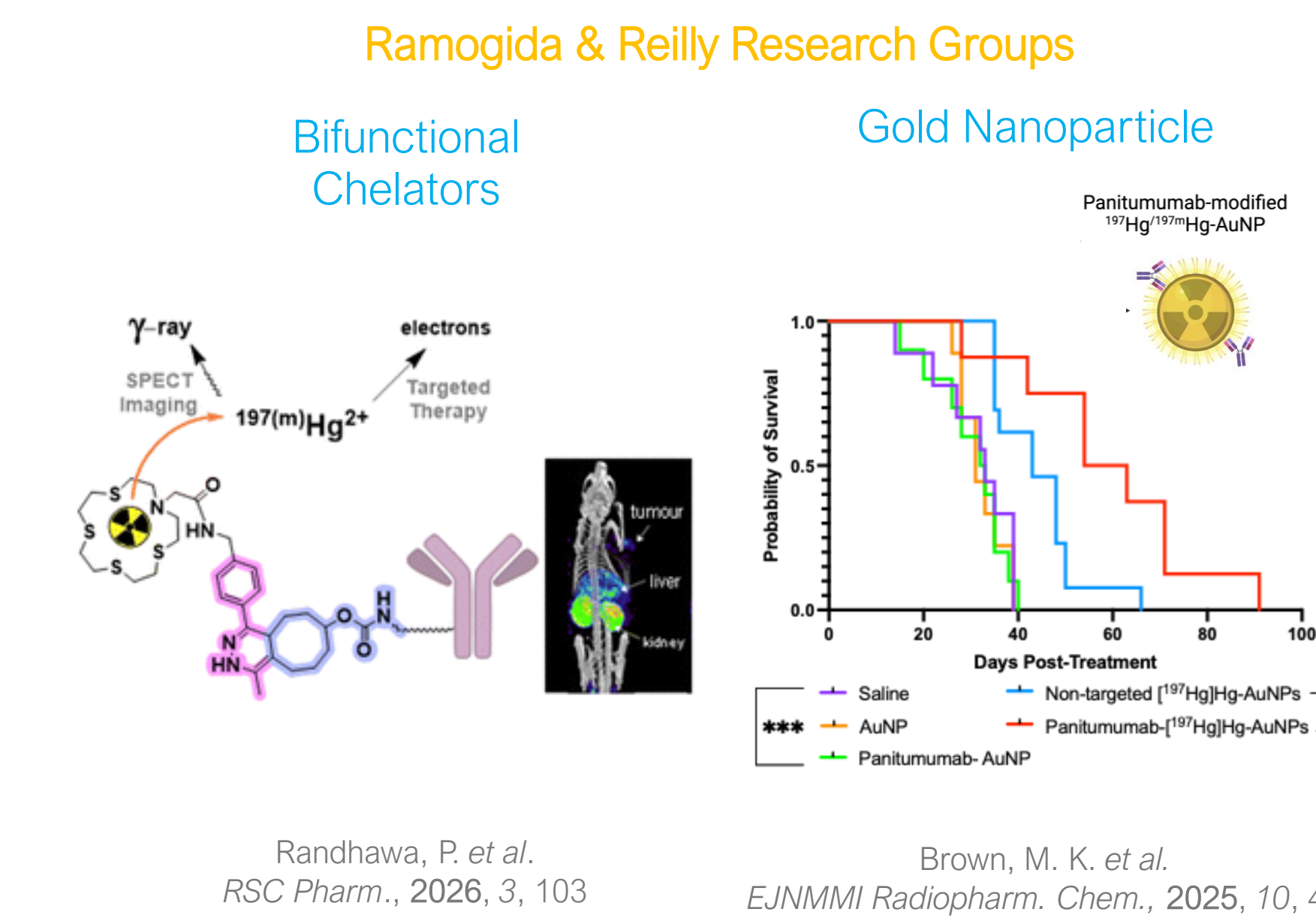


- Existing Infrastructure
  - Low-energy medical cyclotron - diagnostic and therapeutic isotopes
- Filosofov, D. et al., Nucl. Med. Biol., 2021, 94, 1

### Auger Electron Emitter <sup>197m(g)Hg</sup>



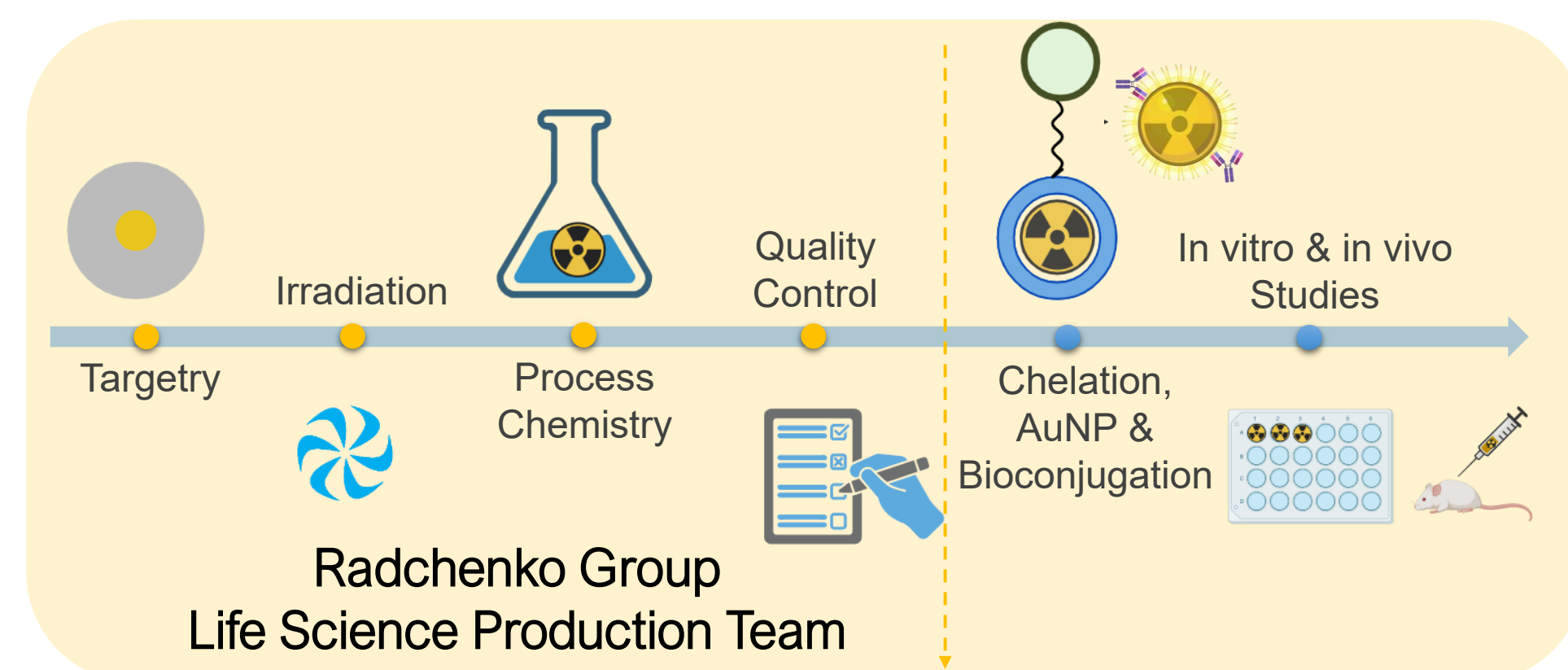
### Delivery of <sup>197m(g)Hg</sup> for TAET



## Goals

- Translate <sup>197m(g)Hg</sup> production from R&D to routine preclinical production
- Produce reliable <sup>197m(g)Hg</sup> sample for downstream applications
  - High specific activity
  - High radionuclidic, radiochemical & chemical purity
  - Less acidic <sup>197m(g)Hg</sup> sample
  - Safe isolation method
  - Fast separation & automation
- Advance the TAET and theranostic application of <sup>197m(g)Hg</sup>

## Results and Discussions



### <sup>197</sup>Au Target Preparation & Irradiation



### Radiochemical Separation and Purification

- Separation of ng of <sup>197m(g)Hg</sup> from mg of Au
  - Challenges associated with current methodology – purity, acidity & batch reproducibility
- Column purification based on Walther, M. et al., Appl. Radiat. Isot., 2015, 97, 177 & Chen, S. et al., J. Chromatogr. A., 2023, 1688, 463717

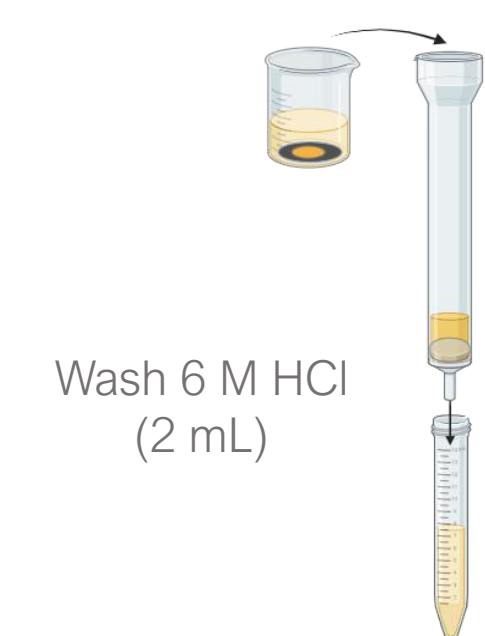
#### 1. Dissolution of Irradiated Gold Target



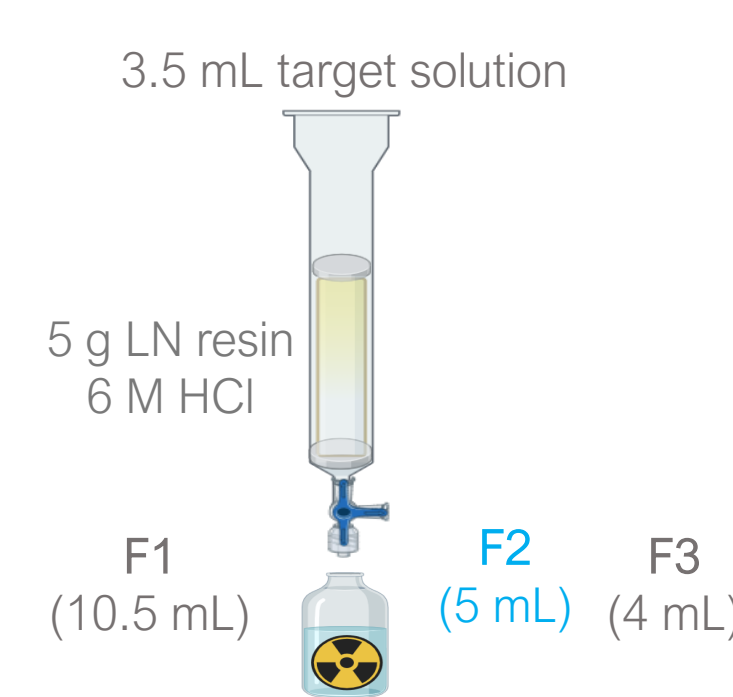
Optimization Area:

- [Au] loading
- Column packing
- Stability of LN resin in 6 M HCl
- Separation efficiency: 99.99999% (using <sup>198</sup>Au tracer produced at ARRONAX GIPS by <sup>197</sup>Au(d,p)<sup>198</sup>Au reaction)

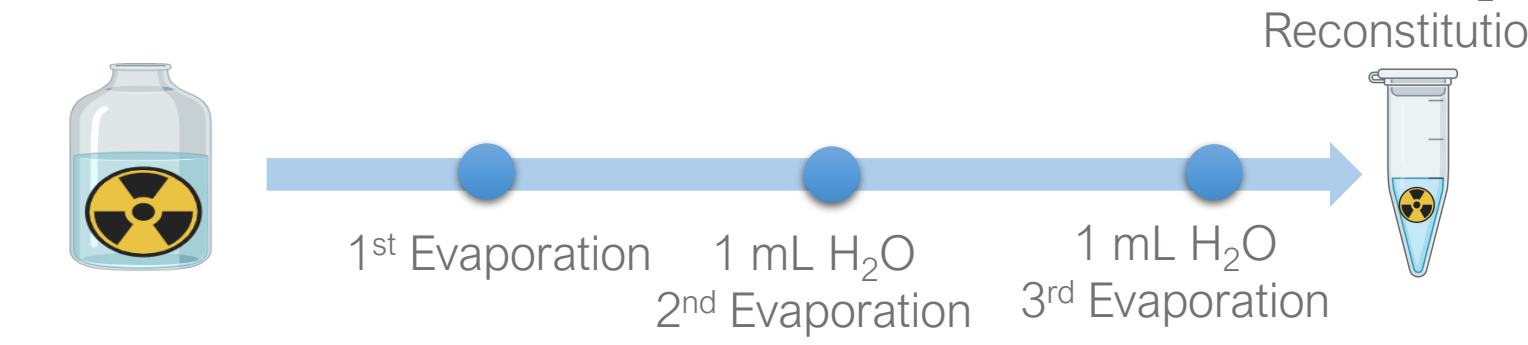
#### 2. Filtration



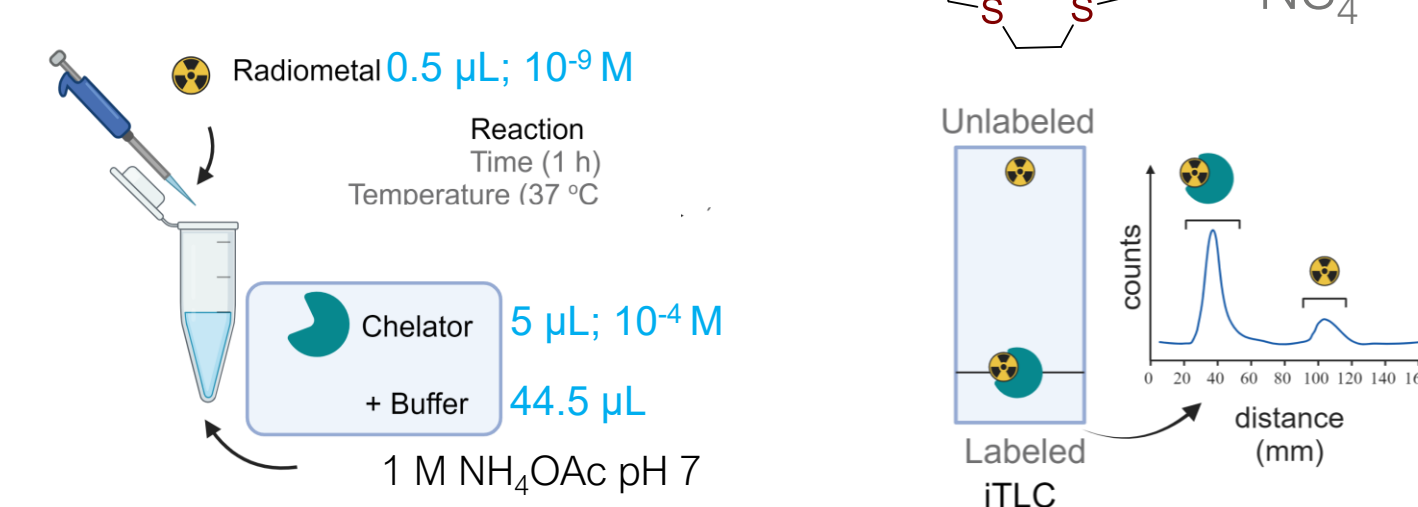
#### 3. LN-Resin Separation and Purification



#### Optimization of Evaporation

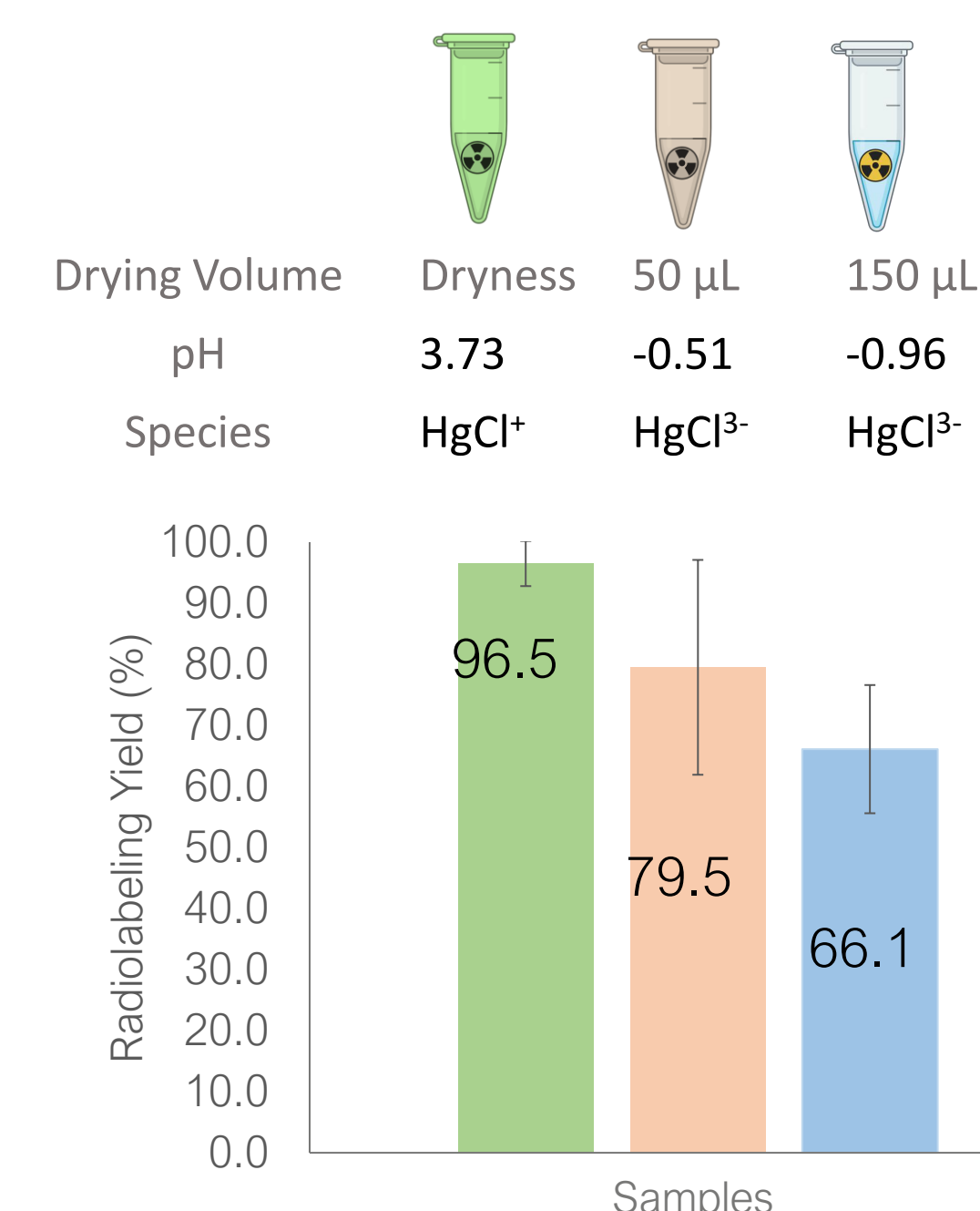


#### ✓ Radiolabeling



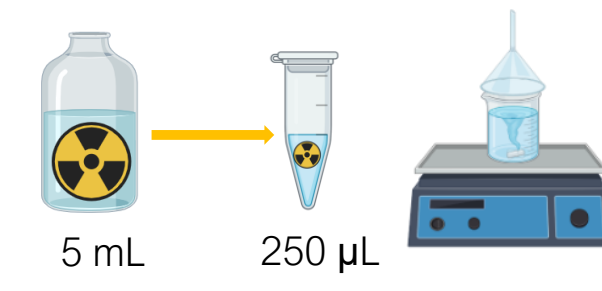
#### ✓ Inductively Coupled Plasma Mass Spectrometry (ICP MS) Analysis – trace metals

Drying Volume – pH | chloride concentration | Mercury speciation | labeling



#### 4. Concentration of <sup>197m(g)Hg</sup> Sample

##### Previous concentration method



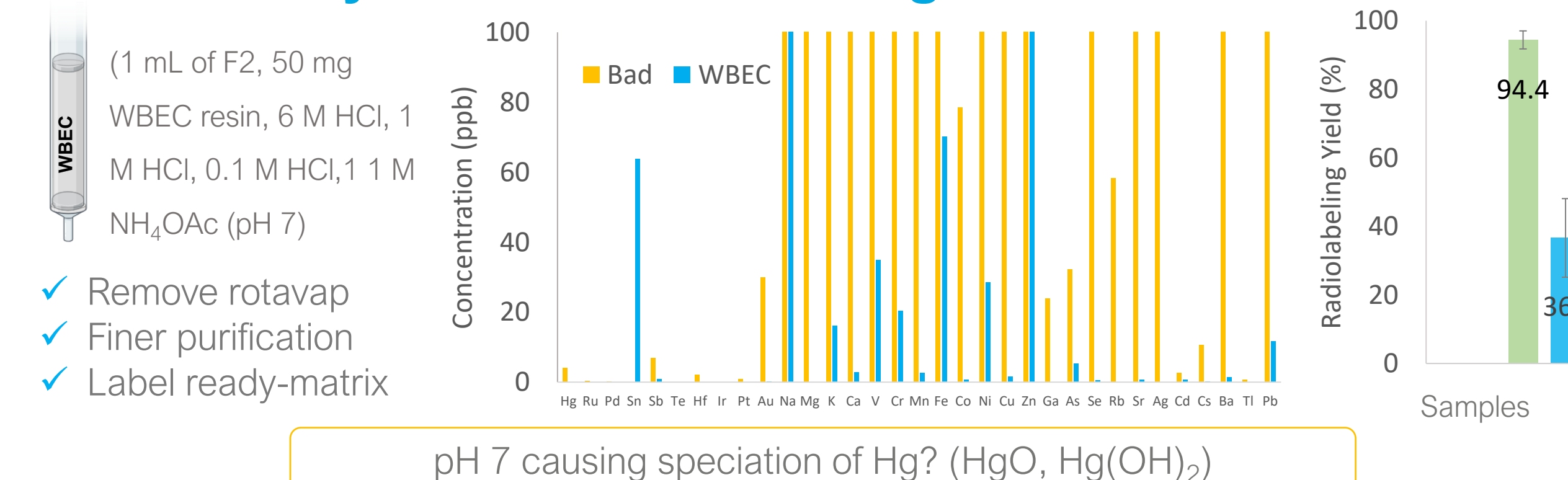
Heating on hot plate in an open system (160 °C, 600 rpm)

##### Current concentration method



- Control of the cooling temperature
- Time for evaporation (1 h)
- Safer method
- Back-flow contributes to impurities
- Highly acidic sample

### Secondary Weak Base Exchange Column



## Conclusions

	2024	2026	Ideal Sample
Radiolabeling yield	~50	>95	>95
Volume (μL)	350	<100	<100
MBq/μL	0.3	1.3	>1.5
pH	<1	3.7	4-5
Time	>8 h (2 d)	<8 h (4 h)	<4
Reproducibility	✗	✓	✓
Automation	✗	✗	✓

2024: 15 shipments (~38 mCi)  
2025: 21 shipments (70 mCi)  
2026 (Mar-June): 6 shipments (20 mCi)

## Acknowledgement

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[Radchenko, Ramogida, and Reilly Groups](#)

