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## Recent developments & contribution to TAT of systems dedicated to $\alpha$ autoradiography

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# Recent developments & contribution to TAT of systems dedicated to $\alpha$ autoradiography



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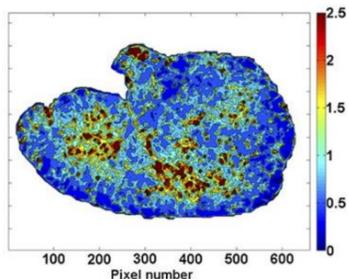
2: S.A.S. AI4R



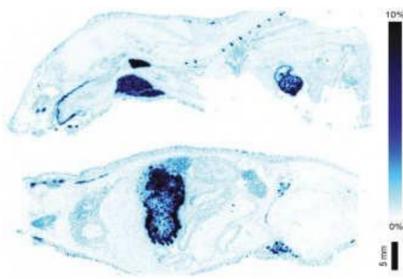
How to **identify** and **locate** the **biodistribution** of  $\alpha$  radiopharmaceuticals when the decay chain of the emitter is generally composed of  $\beta$  &  $\alpha$  and traditional imaging approaches (scintigraphy or SPECT) is not accurate enough?

With **Autoradiography**, an emission imaging technique !

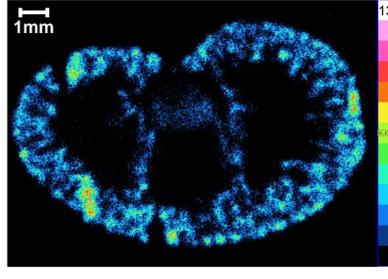
- ✓ Allows to study and locate in 2 dimensions the radioactivity emanating from a surface sample at scales until **micrometer**
- ✓ Well suited for pre-clinical TAT as it allows **understanding** and **quantifying biodistributions** in tissues at **high spatial resolution** at **low activity**
- ✓ Variety of applications : Radio-TLC, Geological Studies, Radio Toxicology...



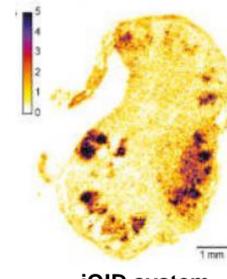
$\alpha$ -Camera system  
<sup>211</sup>At in OVCAR-3 xenografts [1]



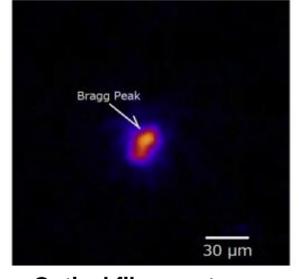
Biomolex 700 DSSD system  
Mouse injected with <sup>211</sup>At [1]



BeaQuant system  
Mouse kidney labelled with <sup>225</sup>Ac

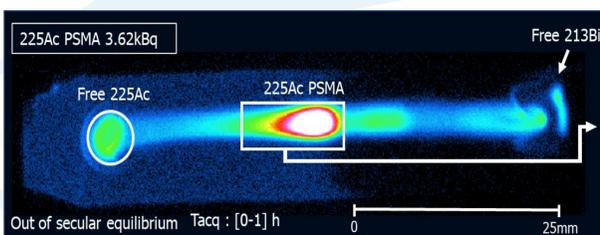


iQID system  
Cryosectioned canine lymph node  
labelled with <sup>211</sup>At [2]

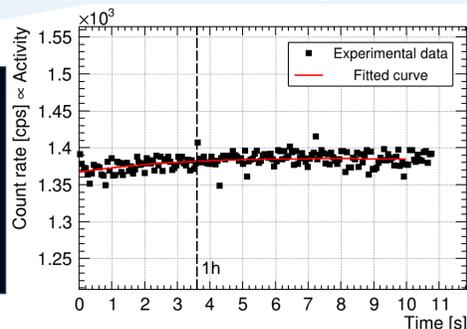


Optical fiber system  
Po-218 alpha particle [3]

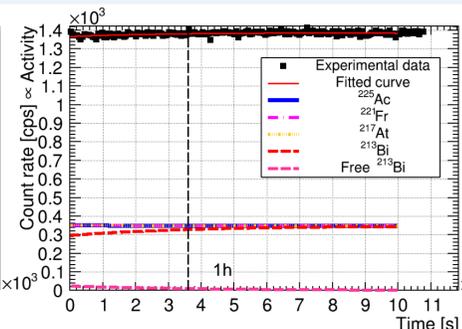
In addition to the image: It's possible to simultaneously combining autoradiography with a spectral measurement (Time or/and Kinetic energy[4]): **Spectroscopic autoradiography (SA)** → useful to discriminate the isotopes...



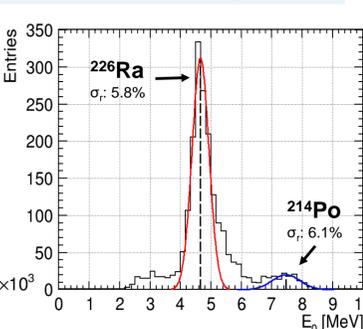
BeaQuant system  
TLC with <sup>225</sup>Ac-PSMA



Evolution of the <sup>225</sup>Ac PSMA count  
as a function of the acquisition time



Evolution of the composition of the ROI  
containing Actinium PSMA as a function  
of the acquisition time



BeaQuant system  
Spectrum of a <sup>226</sup>Ra source

For  $\alpha$  particles, **different** types of **detector technologies** make this measurement possible **But** there is often a trade-off between spatial resolution, energy, time resolution, the Field Of View and the ability to distinguish between different types of particles...

	$\alpha$ -Camera [1]	BeaQuant [4,5]	Biomolex [1,6]	iQID [1,2]	Optical fiber [3]
<b>Spatial resolution</b> [ $\mu\text{m}$ ]	20-35	20	50	20	11-25
<b>Quantification</b>	YES	YES (counting mode)	YES	YES	YES?
<b>Field Of View</b> [ $\text{cm}^2$ ]	5 x 5	23 x 23	6.3 x 2.6	12.5 x 12.5	0.064 x 0.064
<b>Real-time D.C.</b>	YES	YES	YES	YES	YES
<b>Technology</b>	Solid scintillation EMCCD	Gaseous detector Micro-patterned	Semiconductor DSSD	Solid scintillation CCD/CMOS	Fiber scintillation EMCCD



## Reference

- [1] M. Ljungberg, Handbook of Nuclear Medicine and Molecular Imaging for Physicists: Instrumentation and Imaging Procedures, Volume I, CRC Press, 2021.  
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 [6] A. Örbom et al., « Characterization of a double-sided silicon strip detector autoradiography system », Medical Physics, vol. 42, no 2, p. 575-584, 2015.

Proof of concept