CREATIS

Centre de Recherche En Acquisition et Traitement de l'Image pour la Santé

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON
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INGENIERIE
SCIENCES INFORMATIQUES
Inserm
Université Jean Monnet Saint-Étienne

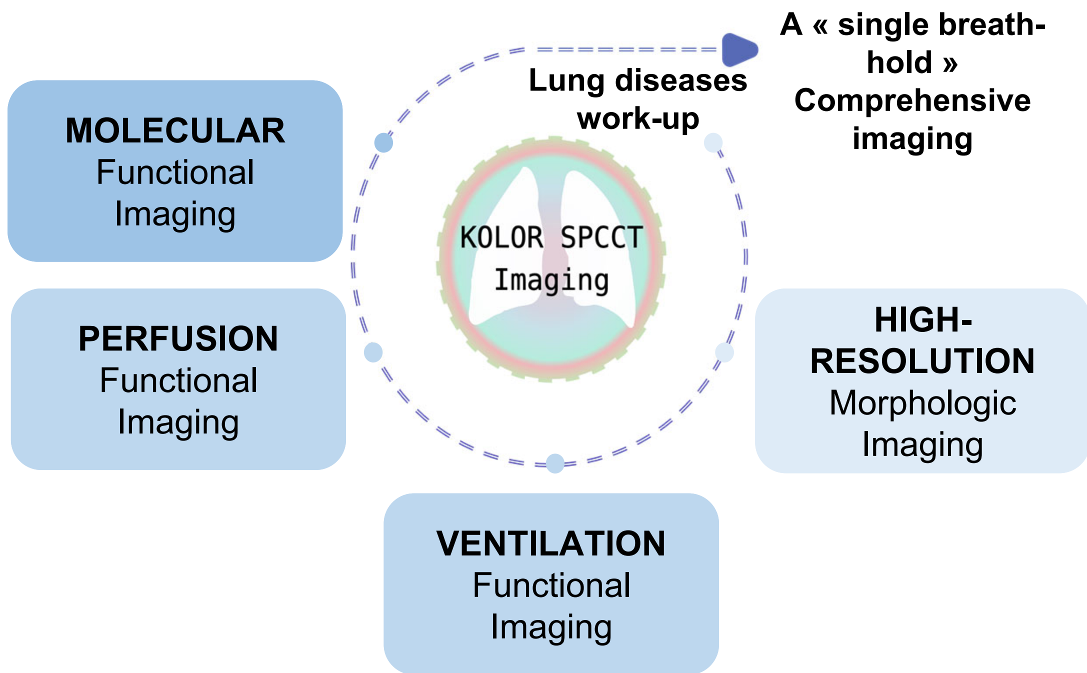
Faits marquants 2023

- KOLOR SPCCT Imaging : ERC starting grant
- Dynamic 31P MRS: Bridging the Gap from Academic Research to Clinical Application – Methodological Insights and Clinical Impact
- Intelligence artificielle pour aider au choix de réglages de ventilateur en SDRA
- MUST: Open-source MATLAB toolbox for the ultrasound
- Neurologie fonctionnelle interventionnelle : New Auto-calibrated tissue hemodynamic monitoring
- ^{177}Lu monitoring with 360° SPECT system is feasible and efficient
- Les enjeux de l'IRM : Techniques et méthodes quantitatives pour la santé

By combining medical imaging, respirology, chemistry and physics, **KOLOR SPCCT Imaging** will bridge **lung morphological and functional imaging** in **one single breath-hold**.

To reach this goal, **KOLOR SPCCT Imaging** will:

1. Color K-Edge IMAGING: **develop** a high-sensitive dedicated imaging tool
2. Diagnosis of lung diseases: **provide** a “one-breath hold” ventilation and perfusion imaging in healthy animals and animal models (fibrosis, pulmonary embolism, cancer)
3. Prediction of lung diseases: **provide** a “one-breath-hold” monitoring of the molecular inflammatory burden in animal models (fibrosis, cancer)

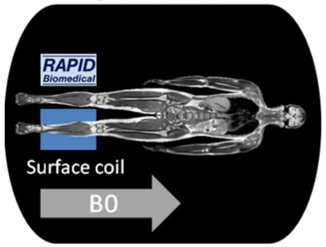


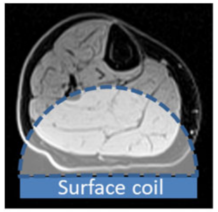
Kick-off to be scheduled in April 2024
Duration: 5 years, Grant: 1.6 M €, recruitment in progress (2–3 PhD, 1 post-Doc, 1 Eng & 1 Ass Eng)

Dynamic 31P MRS: Bridging the Gap from Academic Research to Clinical Application – Methodological Insights and Clinical Impact

Acquisition & Parameters Extraction → Quality Control → Clinic

3T MRI

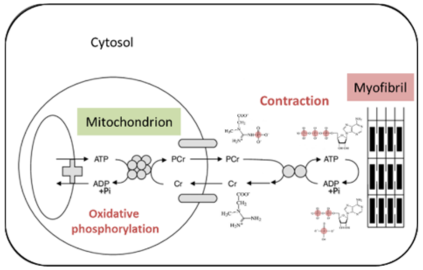


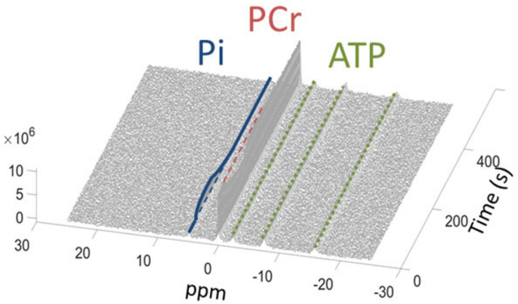


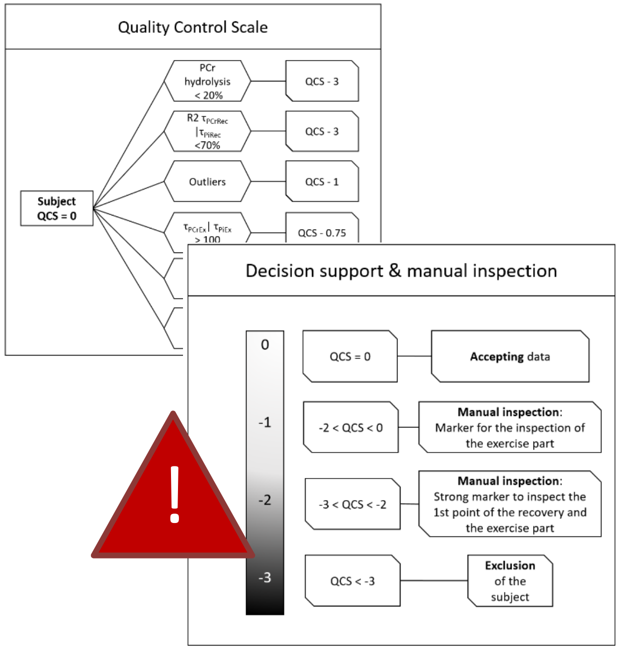
FEDER Fonds européen de développement régional

CHU saint étienne

Energy metabolism

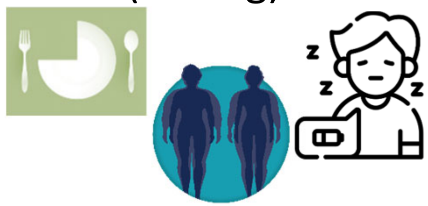




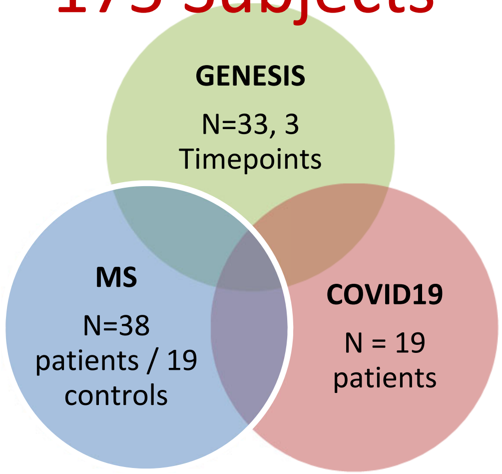


[A. Naegel, et al. NMR in Biomed, 2023 a]
[A. Naegel, et al. NMR in Biomed, 2023 b]

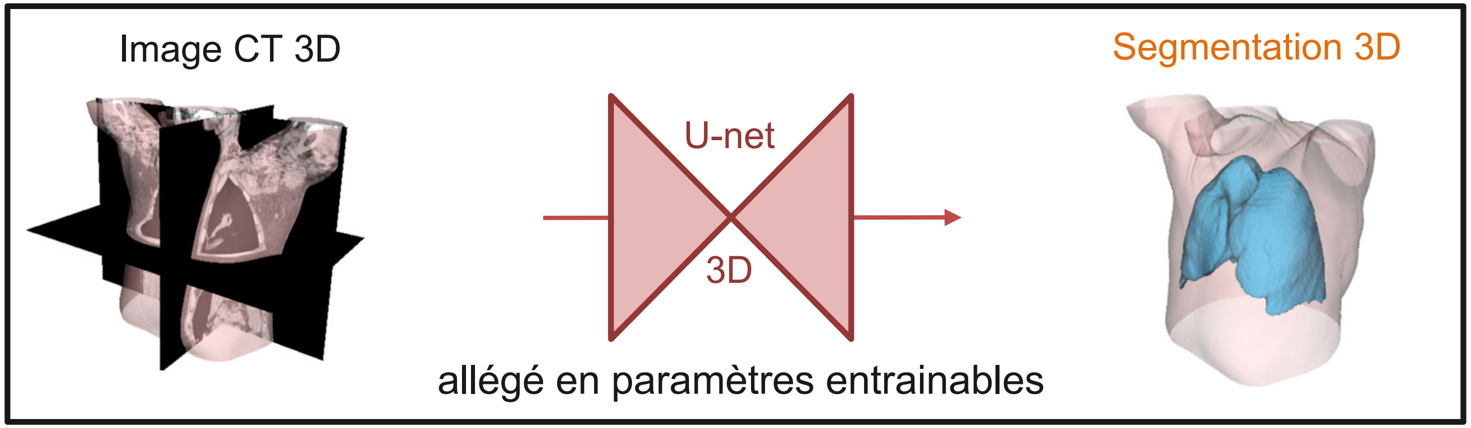
Study of muscle fatigue and clinical intervention (fasting) ?



175 Subjects



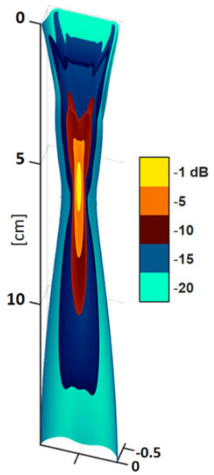
IA pour aider au choix de réglages de ventilateur en SDRA

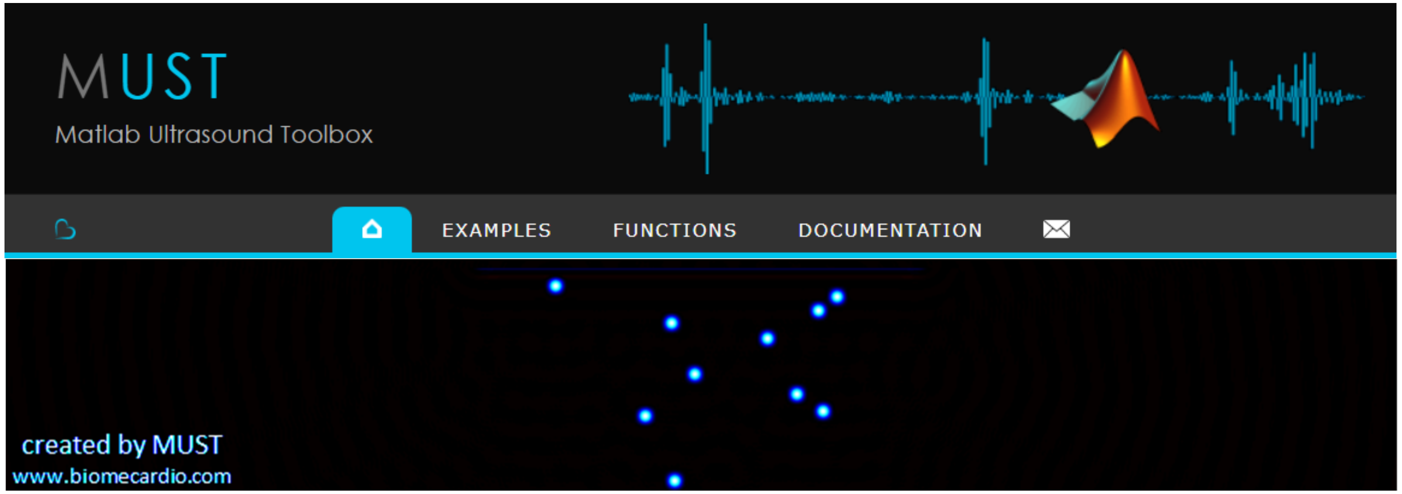


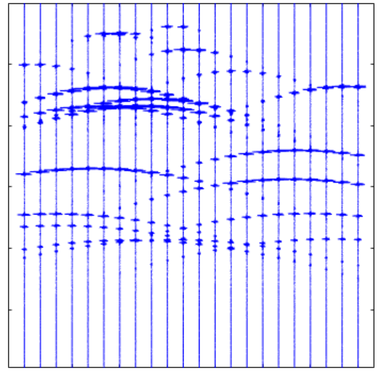
- Syndrome de détresse respiratoire aiguë : **très forte mortalité** (>30%), surtout dans **COVID-19**.
- **Quantification** de l'aération pulmonaire grâce à la **segmentation** des poumons sur des images **scanner**.
- Algorithme d'**apprentissage supervisé** (thèse de Ludmilla Peñarrubia [1]) et entraîné grâce aux annotations réalisés par des réanimateurs de l'hôpital de la Croix Rousse.
- Implantation dans le **logiciel creaSDRA** (E. Dávila Serrano - service info-dev) [2,3].
- **7 juillet 2022 : première utilisation au Service de Réanimation de l'hôpital de la Croix Rousse pour personnaliser les réglages de la ventilation mécanique des patients atteints du SDRA.**

[1] L. Peñarrubia, Quantification de l'aération pulmonaire sur des images CT de patients atteints du syndrome de détresse respiratoire aiguë, thèse de doctorat 2022LYO1164, J.-C. Richard, M. Orkisz, E. Roux co-directeurs, UCB Lyon 1, 5/12/2022.
[2] E. E. Dávila Serrano, et al. "Software for CT-image Analysis to Assist the Choice of Mechanical-ventilation Settings in Acute Respiratory Distress Syndrome", International Conference on Computer Vision and Graphics, Warsaw, Poland, September 14-16, 2020, L. J. Chmielewski, R. Kozera, A. Orłowski Eds., Springer, LNCS 12334, pp 48-58.
[3] L. Bitker, et al. Validation of a novel system to assess end-expiratory lung volume and alveolar recruitment in an ARDS model, Intensive Care Medicine Experimental, 9:46, 2021.

MUST – MATLAB UltraSound Toolbox by CREATIS

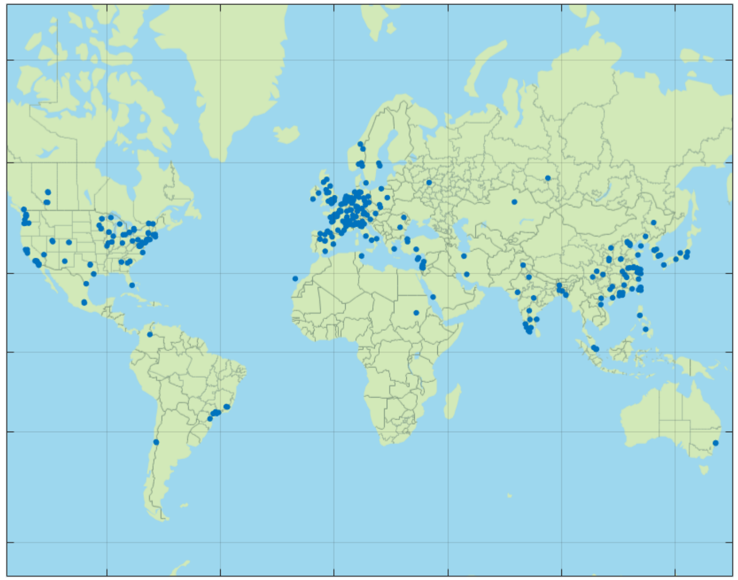




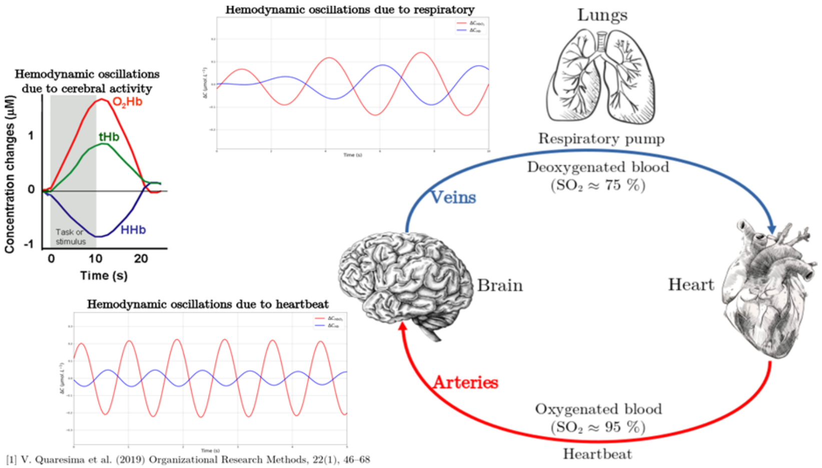


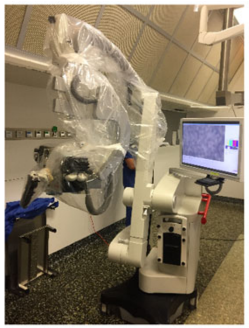
- Open-source MATLAB toolbox for the ultrasound community
- Design and post-processing – Simulations – Pedagogy
- Develop & test ultrasound sequences
- Develop & test approaches for tissue and flow imaging
- Create large image datasets for training neural networks
- Already used in >600 sites worldwide
- website

ULTIMA



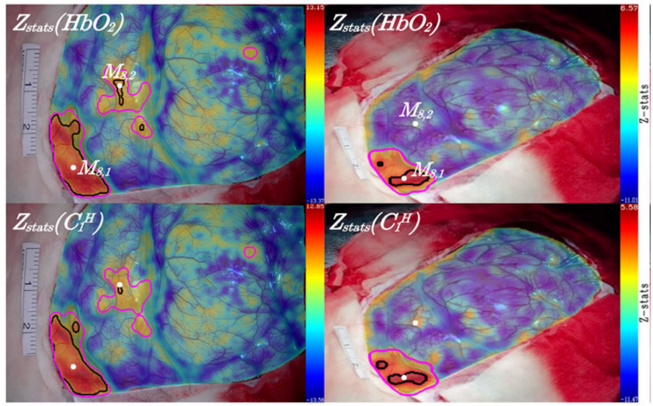
New Auto-calibrated tissue hemodynamic monitoring





Leica microscope (RGB)
Acquisition +++
Non-calibrated system

Iphone SE (RGB)
Acquisition -
Non-calibrated system



Estimation of hemodynamic changes without device calibration and spectral *a-priori*

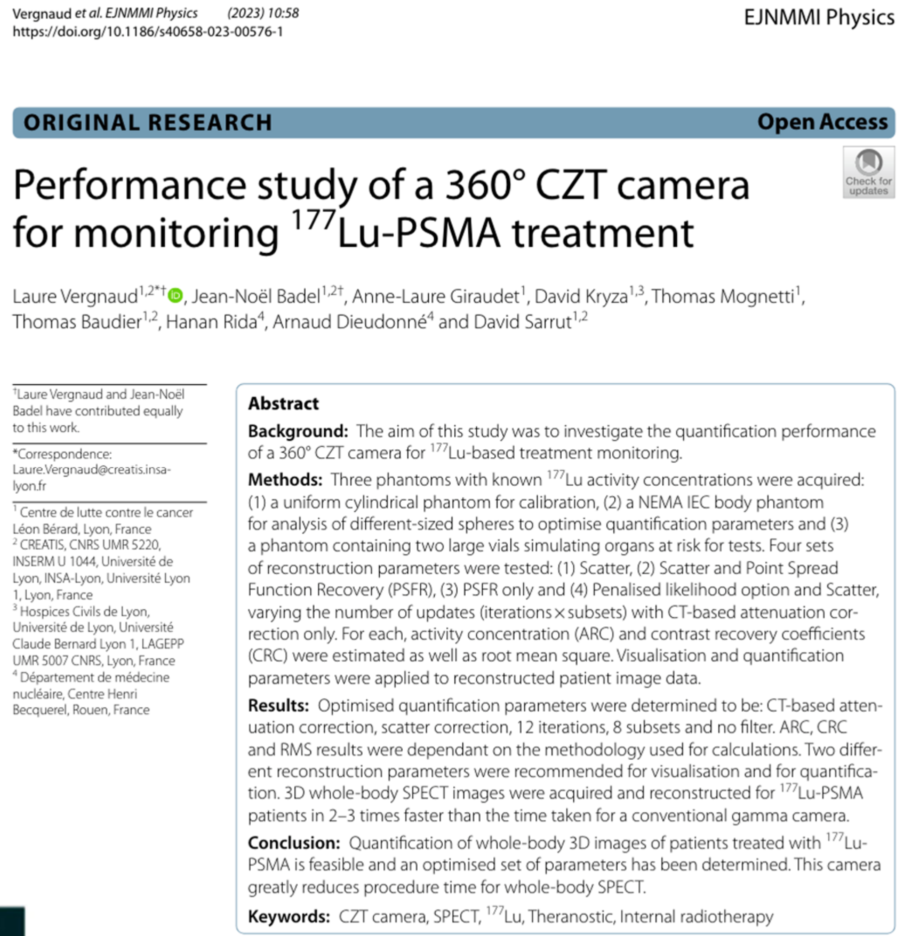
Patent with Pulsalys *[C. Caredda, et al. . France, PCT/FR2022/050692]* *(international extension underway, and two requests for the assignment of the patent are under review, one in India and the other in the United States")*

Followed by

A publication *A-priori* free spectral unmixing method for tissue hemodynamic monitoring and intraoperative functional brain mapping *[C. Caredda, et al., Biomedical Optics Express 2023]*

^{177}Lu monitoring with 360° SPECT system is feasible and efficient

- First 360° SPECT CZT device
- First time applied to ^{177}Lu treatment
- Quantification feasible
- Acquisition time 3x times faster than conventional devices


Vergnaud et al. EJNMMI Physics (2023) 10:58
https://doi.org/10.1186/s40658-023-00576-1
EJNMMI Physics

ORIGINAL RESEARCH Open Access

Performance study of a 360° CZT camera for monitoring ^{177}Lu-PSMA treatment

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Abstract

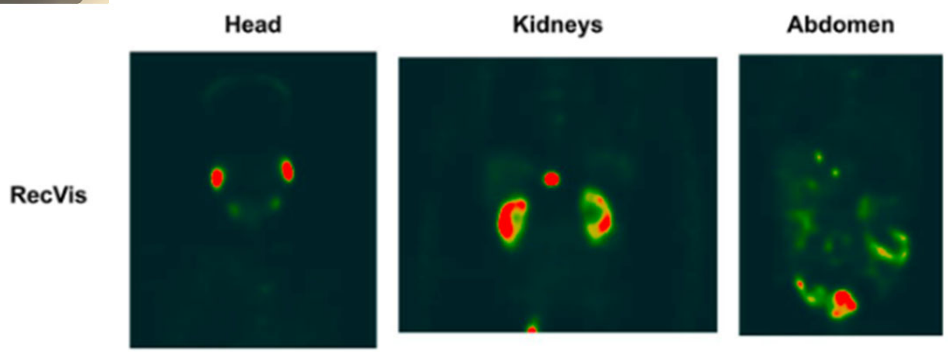
Background: The aim of this study was to investigate the quantification performance of a 360° CZT camera for ^{177}Lu-based treatment monitoring.

Methods: Three phantoms with known ^{177}Lu activity concentrations were acquired: (1) a uniform cylindrical phantom for calibration, (2) a NEMA IEC body phantom for analysis of different-sized spheres to optimise quantification parameters and (3) a phantom containing two large vials simulating organs at risk for tests. Four sets of reconstruction parameters were tested: (1) Scatter, (2) Scatter and Point Spread Function Recovery (PSFR), (3) PSFR only and (4) Penalised likelihood option and Scatter, varying the number of updates (iterations × subsets) with CT-based attenuation correction only. For each, activity concentration (ARC) and contrast recovery coefficients (CRC) were estimated as well as root mean square. Visualisation and quantification parameters were applied to reconstructed patient image data.

Results: Optimised quantification parameters were determined to be: CT-based attenuation correction, scatter correction, 12 iterations, 8 subsets and no filter. ARC, CRC and RMS results were dependant on the methodology used for calculations. Two different reconstruction parameters were recommended for visualisation and for quantification. 3D whole-body SPECT images were acquired and reconstructed for ^{177}Lu-PSMA patients in 2–3 times faster than the time taken for a conventional gamma camera.

Conclusion: Quantification of whole-body 3D images of patients treated with ^{177}Lu-PSMA is feasible and an optimised set of parameters has been determined. This camera greatly reduces procedure time for whole-body SPECT.

Keywords: CZT camera, SPECT, ^{177}Lu, Theranostic, Internal radiotherapy



[Vergnaud et al, EJNMMI 2023]
https://doi.org/10.1186/s40658-023-00576-1

Les enjeux de l'IRM : Techniques et méthodes quantitatives pour la santé

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https://www.istegroup.com/fr/produit/les-enjeux-de-lirm/

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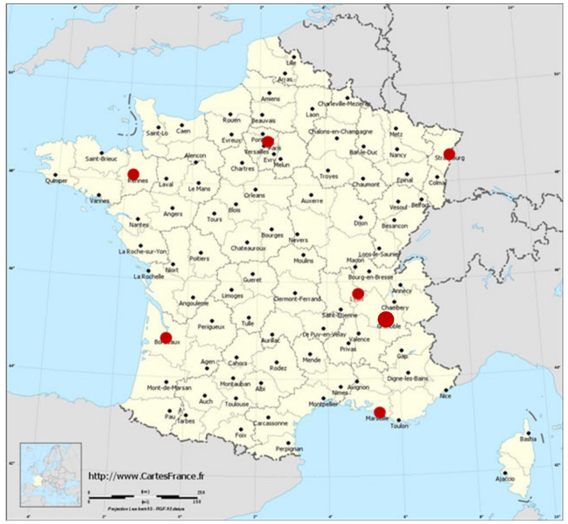

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Lyon, ville lumière!

Valpré, le 26 septembre 2023