

# **A Modular Data Acquisition System for High Resolution Clinical PET Scanners**

(available online at: [http://oa.upm.es/5684/1/GIANCARLO\\_SPORTELLI.pdf](http://oa.upm.es/5684/1/GIANCARLO_SPORTELLI.pdf))

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This doctoral thesis proposes a new technological architecture, able to achieve state of the art PET imaging performance by means of a compact, cost efficient acquisition platform, suitable for adoption in different applicative environments. To this direction, two reference applications were considered: PEM and in-beam PET for dose monitoring in hadrontherapy.

Firstly, the state of the art and the controversies that prevent the broad use of dedicated PET in the clinical environment were explored. Special attention was paid to the technological solutions and characteristics of previous PEM scanners. Additionally, the current status of ibPET was reviewed, with particular focus on the performance required to effectively support treatment planning in hadrontherapy.

Secondly, a conceptual design solution was discussed. Various alternatives were proposed and justified, with the aim of maximizing detection efficiency and minimize system cost. Through a series of intermediate prototypes the various design choices were implemented and characterized.

Thirdly, a final prototype of the acquisition system was designed and implemented. This piece of hardware integrates and extends the solutions that have been validated on the previous systems.

The research carried out during this thesis has allowed evaluation of a state of the art acquisition system that is suitable for specialized PET imaging in the clinical environment, able to be used for further research in PEM and ibPET imaging.