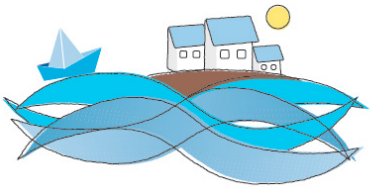

Mediterranean Thematic Workshops in Advanced Molecular Imaging

Contribution ID: **33** Type: **Oral**

A Flagship project for Europe? Towards 10ps Time-of-Flight PET for a 10-fold sensitivity increase and equivalent dose reduction

Wednesday 4 May 2016 09:00 (30 minutes)

Results achieved by European researchers in recent years make it likely that the 100 ps TOFPET resolution barrier can be broken. Research to reach the 10ps limit is already supported by EU funded projects (ERC Advanced grant #338953 to one member of the consortium, COST action FAST #TD1401). On the same line another member of the consortium has been recently awarded an ERC Advanced grant to improve PET sensitivity, benefiting from this ultimate TOF performance to reconstruct the Compton event, otherwise discarded in the reconstruction algorithms. Moreover, new data processing and image reconstruction algorithms are required to optimally exploit the additional information acquired with such systems.

Summary

In the USA, the Explorer project by UC Davis, Berkeley Lab, and U Penn, funded by a $15.5 million, 5-year NIH Transformative Research Award, aims at the world's first total-body PET/CT scanner with a 2 m long axial length, so as to demonstrate the clinical value of a ˜40-fold improved system sensitivity, which can in particular be used to reduce radiotracer dose and scan times. However, the system concept is intrinsically expensive as it is based on a multiplication of existing scintillation detector technology (in particular a 10-fold increase in the total detector area by extending the scanner length by the same factor).

A different way to achieve the same improvement in effective sensitivity is to push time-of-flight (TOF) resolution to the ˜10 ps level, representing a ˜40-fold improvement over the current state-of-the-art. In fact, this would cause a paradigm shift in in vivo molecular imaging by enabling direct 3D event localization, eliminating the need for statistical image reconstruction. Another approach is to not restrict the PET reconstruction to photoelectric events but to use also the information carried out by Compton events.

Results achieved by European researchers in recent years make it likely that the 100 ps time resolution barrier can be broken. Research to reach the 10ps limit is already supported by EU funded projects (ERC Advanced grant #338953 to one member of the consortium, COST action FAST #TD1401). On the same line another member of the consortium has been recently awarded an ERC Advanced grant to improve PET sensitivity, benefiting from this ultimate TOF performance to reconstruct the Compton event, otherwise discarded in the reconstruction algorithms. Moreover, new data processing and image reconstruction algorithms are required to optimally exploit the additional information acquired with such systems.

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