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Dedicated detector systems for brain imaging

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The aim of this contribution is to show the need for dedicated Brain PET imagers in the clinical practice. A review of former designs of such system will be shown, as well as new developed ideas# and running projects. Dedicated Brain PET could be used as a standalone solution but also combined with other imaging techniques such as MRI. Novel ideas from Majewski's group to use a Flexible PET configuration in the operation room could help clinicians to carry out surgery procedures with the help of complementary PET information. The aim of the adaptive configuration is to better position the PET system around the head without disturbing the surgeon work. An "ambulatory"neuroscience version is also suggested by this group. The major idea behind this design is to provide the user with a portable Brain PET system, that is, motion tolerant but also imaging agents on-demand. Currently, at least two EU projects are undergoing, with the aim to design and develop, Brain PET detector, with the capability of being MR compatible. They are led by Del Guerra in Italy (Trimage) and Benlloch in Spain (MindView). They have different approaches that will be shown in this contribution. A deeper view to the MindView idea will be described. Pilot tests with 3 layers of staggered 1.5 mm pixels have been tried with 12x12 SiPM arrays providing encouraging results. Alternatively to the pixelated approach, monolithic slabs 50x50x20 mm3 have also being successfully tried. The special readout returning information on each SiPM array row and column, offers an innovative method to characterize the light distribution within the crystal. Center of Gravity methods, as well as Fitting tools to the light distribution and Neuronal Networks are being tested. The aim of both pixelated and monolithic approaches is to reach an intrinsic detector resolution in the 1-1.5 mm regime and, therefore, reconstructed images nearing 1 mm FWHM resolution.

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