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An electron spectrometer for multi-GeV laser-plasma acceleration

The advance in laser plasma acceleration techniques pushes the regime of the resulting accelerated particles to higher energies and intensities. In particular the upcoming experiments with the FLAME laser at LNF will enter the GeV regime with more than 100pC of electrons.
At the current status of understanding of the acceleration mechanism relatively large angular and energy spreads are expected. There is therefore the need to develop a device capable to measure the energy of electrons over three orders of magnitude (few MeV to few GeV) with still unknown angular divergences.
Within the PlasmonX experiment at LNF a spectrometer is being constructed to perform these measurements. It is made of an electro-magnet and a screen made of scintillating fibers for the measurement of the trajectories of the particles. The large range of operation, the huge number of particles and the need to focus the divergence present unprecedented challenges in the design and construction of such a device.

But the most challenging part of the system is the use of photodetectors in an extremely dirty environment, with both electromagnetic shots and bursts of Xrays directly on multi-pixel photomultipliers, representing an unprecedented challenge in this field.

We will present the design considerations for this spectrometer, the results of the test-beams on a prototype and the first results on the experiment.

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