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the Tynode: a new vacuum electron multiplier for ultra fast pixelized particle detectors

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By placing, in vacuum, a stack of transmission dynodes (tynodes) on top of a CMOS pixel chip, a generic, digital, single free electron detector could be made with potentially one ps time resolution. Its essential element is the tynode: an ultra thin membrane, which emits, at the impact of an energetic electron on one side, a multiple of electrons at the other side. The electron yields of tynodes have been calculated by means of GEANT-4 Monte Carlo simulations, applying special low-energy extensions.
By means of MEMS technology, tynodes have been realised. The secondary electron yield of several tynode prototypes has been measured. Our best result so far is a transmission secondary electron yield of 5.5, obtained with an MgO membrane made using Atomic Layer Deposition ALD technology. Several possibilities to improve the yield are presented, and the methods of measuring the yield (using a SEM, and a setup including an electron gun and a set of TimePix chips) are set out.

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Primary author: Prof. VAN DER GRAAF, Harry (Nikhef & Delft University of Technology)

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