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First Positrons from the McMaster Intense Positron Beam Facility (MIPBF)

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The McMaster Intense Positron Beam Facility (MIPBF) is a new research reactor based e+ source for atomic physics and materials science. In this prelimary operation, decay gamma's from the reactor core are incident on a platinum foil in vacuum. Pair production provides electrons and positron in the foil which also acts as a moderator, thermalizing many of the e+ to low energy. Such thermal positrons are ejected from the foil and are accelerated away from the core with an applied electric potential of ~10V. These low energy e+ as well as a much larger number of higher energy, unmoderated positrons are guided using magnetic fields out of the pool and external biological shielding block for experiments. Positrons passing through an aperture are incident on a target and annihilate into back-to-back gamma photons for coincident detection in NaI (Ti) scintillation crystal detectors.

Varying electric potentials and magnetic fields throughout the 5 meter path allows study of the e+ beam properties. In this initial test, a moderated positron beam energy width of <10eV is measured in a cm radius beam, well suited for the buffer gas accumulator that has been assembled for this facility. In addition to these low energy particles we observe a 10 times higher rate of unmoderated e+ with energies near 100keV. This secondary beam may be remoderated to enhance the low energy e+ for trapping. It is also well suited for defect studies of surfaces or in bulk matter for materials science, also a part of this user facility.

Initial estimates of this source scaled to full reactor activity indicate that the design rate of ~109 moderated e+/second should be achievable with an additional more intense component at higher energies.

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