Compact, Achromatic Non-scaling FFAG Accelerators for Muon Acceleration and Cancer Therapy

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A new concept in non-scaling FFAGs has been invented in which the machine tune is stable over an extended acceleration cycle, a factor of a 3-6, or more, in momentum. Fermilab Research Association (FRA) has elected to patent this concept and a strong collaborative design effort to optimize, simulate, and demonstrate the technical feasibility of this accelerator approach is underway to be followed by an engineering design. Sophisticated simulation tools within the advanced accelerator simulation code, COSY INFINITY, have been developed to fully and accurately describe the FFAG's complex electromagnetic fields - including realistic edge-field effects and high-order dynamics. Predicted performance showed the promised tune stability, and a sustainable slow acceleration rate by a modest acceleration system. The new nonscaling variant retains important features of the synchrotron: smaller radial aperture, variable energy, and kicker and resonant extraction, yet has the high curr ent advantage of the cyclotron.

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