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A Concept for the ILC Positron Source

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The ILC polarized positron source design is based on a polarized photon beam produced in an undulator striking a 14 mm Ti target. Because both the instantaneous and average power is high, the concept of a rotating Ti hoop in the accelerator vacuum is accepted. The baseline approach in the TDR uses water cooling introduced through rotating seals, and rotating seals are used for an axial drive shaft. We are developing a concept using radiation cooling of high performance Ti alloy blades to a water cooled vacuum can, completely eliminating water channels in the vacuum space. The hoop must rotate at ~2000 rpm, and in a blade design should be precisely synchronized to the beam. We are developing a concept for magnetic suspension and drive of the hoop that does not require permanent magnets. The figure below shows one of the concepts.

Figure 1- A magnetic suspension system concept for the ILC positron source.

Here, the whole rotating body comprising the Ti target, shaft, and rotor is magnetically levitated in a total of five degrees of freedom and driven about z-axis. One thrust active magnetic bearing (AMB) constrains the axial translation, one radial AMB radially supports the center of mass of the whole body, and a self-bearing hysteresis drive radially supports the end of the shaft. The hysteresis self-bearing drive, which is magnet-free, can generate suspension forces as well as the required torque to rotate the whole body.

Author: Prof. BREIDENBACH, Martin (SLAC)

Co-authors: Prof. TRUMPER, David (MIT); Dr ORIUNNO, Marco (SLAC); Mr NOH, Minkyun (MIT)

Presenter: Prof. BREIDENBACH, Martin (SLAC)

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