Resonant polarimetry: a new way to non-invasive fast measurement of beam polarization?

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Content:

- functional principle
- relativistic Stern-Gerlach force
- analytical formulas for the analyzing power using pill-box cavities
- expected signal power
- layout of a pop experiment and further applications

Abstract:

In principle, resonant cavities can be excited by magnetic moments of a polarized beam, thus allowing to determine the beam's polarization by measuring the amplitude of the resonating cavity's fields. The steady state field amplitude can be determined by calculating the energy transferred from the beam to the resonator's fields. Analytic formulas for different cavity modes are obtained by integrating over the longitudinal relativistic Stern-Gerlach force. It is shown that in case of ultra-relativistic electrons the signal for transverse polarization is independent of beam energy whereas the signal for longitudinal polarization scales with 1/gamma. The expected signal power is derived for different cavity modes and compared with thermal noise and background by cavity excitation due to charge interaction. A possible layout for first prove-of-principle experiments at CEBAF/JLAB and ELSA/Bonn is presented.