A_{LR} with Positron Polarization (Comment)

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This is to call your attention to the usefulness of positron polarization in reducing the systematic error on A_{LR} as described in our old note: KEK Preprint 95-127

Combined Polarization

$$P_{comb} \equiv \frac{P_- - P_+}{1 - P_- P_+}$$

right-handed helicity basis:
P=-1 means 100% left-handed

A_{LR}

$$A_{obs} \equiv \frac{N_L - N_R}{N_L + N_R} = -P_{comb}\, A_{LR}$$

$$\frac{\Delta A_{LR}}{A_{LR}} \simeq \sqrt{\left(\frac{\Delta P_{comb}}{P_{comb}}\right)^2 + \frac{1}{N\left(P_{comb} A_{LR}\right)^2}}$$

Systematic Error on P_{comb} dominates if N >>1

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Reduction of Systematic Error

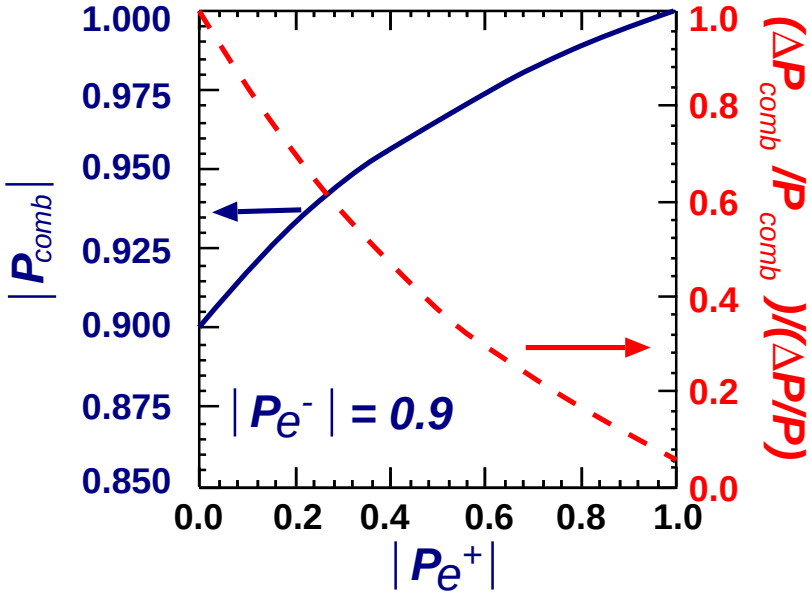
Polarization measumement will be dominated by systematic error

$$\Delta P_{comb} = \left(\frac{\partial P_{comb}}{\partial P_-}\right)\left(\frac{\Delta P_-}{P_-}\right)P_- + \left(\frac{\partial P_{comb}}{\partial P_+}\right)\left(\frac{\Delta P_+}{P_+}\right)P_+$$

Linear Error Propagation

Identical apparatuses will be used for both electrons and positrons

$$\frac{\Delta P_-}{P_-} = \frac{\Delta P_+}{P_+} \equiv \frac{\Delta P_\pm}{P_\pm}$$

$$\boxed{\frac{\Delta P_{comb}}{P_{comb}} = \frac{1 + P_- P_+}{1 - P_- P_+}\left(\frac{\Delta P_\pm}{P_\pm}\right)}$$

Significant reduction of systematic error already at $P_{e^+} = 0.5$