ILC Polarimetry: BDS Spin Tracking Studies to Estimate Uncertainties

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Overview

- Precise polarization measurement is not only a question of good polarimeters

- Distance of 2 km between up-/downstream polarimeters and IP requires spin tracking studies

- Key points of this study:
  - SB-2009: changes in the BDS design
  - Special issues in the interaction region
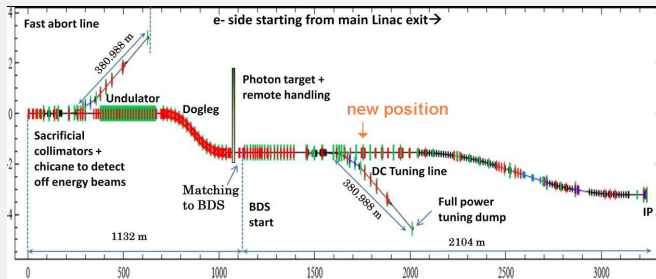 - Alignment / ground motion

Simulation

- Beamline simulation incl. spin tracking: BMAD
- Beam-beam collision: Guinea-Pig/CAIN (yet to be included)
- Data processing and analysis: ROOT
- Polarimeter simulation: LCPolMC (under construction)
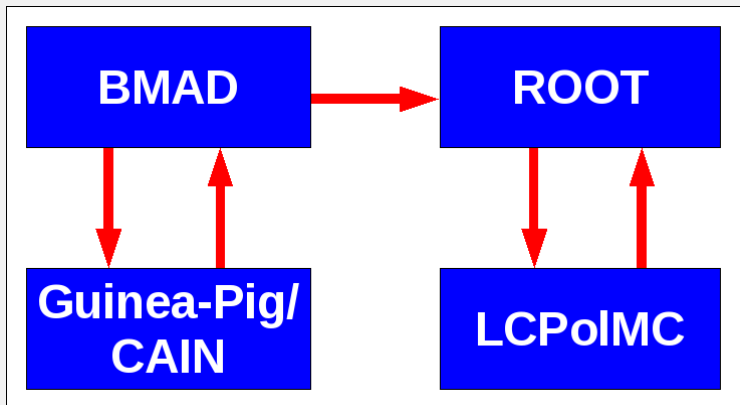
SB-2009: New Upstream Polarimeter Location

- Separation of polarimeter and laser-wire chicane
- New polarimeter chicane behind branch-off to tune-up dump line
- Consequences for polarization measurement?
    - New lattice file under construction (until September)
    - Later: Shortening of BDS
    - Spin tracking study to examine suitability of new location

- Spacing:
    - Tune-up dump line branches off at small angle
    - Sufficient lateral space at new location?
    - Dispersion of chicane (1-11 cm)
    - Space requirement for Čerenkov detector
    - Additional space for electronics, shielding etc.
    - However, beam optics require quadrupoles between branch-off and pol. chicane
- Work status: waiting for new lattice
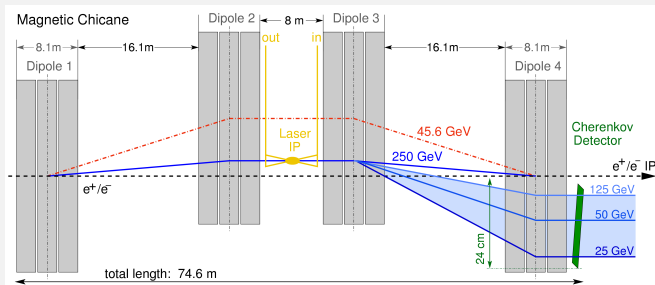
Special Issues in the Interaction Region

- Some elements are not yet included in lattice
  - Detector solenoid, anti-DID plus correctors
  - Crab cavity
  - SB-2009: cavity for travelling focus

- Effect of beam-beam collision to be investigated

- Work status (implementation):
  - Solenoid etc.: in progress
  - Collisions: later

Alignment / Ground Motion

- Magnet misalignments between polarimeters contribute to measurement uncertainty
- Need to investigate effect of static misalignments and ground motion
 Requirements on alignment and BPM precision
- Effect of beam alignment at Compton IPs vs. other effects

$$\theta_{\text{Spin}} = a\gamma \cdot \theta_{\text{Orbit}} = 2.27 \cdot \frac{E}{\text{GeV}} \cdot \theta_{\text{Orbit}}$$

- Compensation by feed-back correctors?
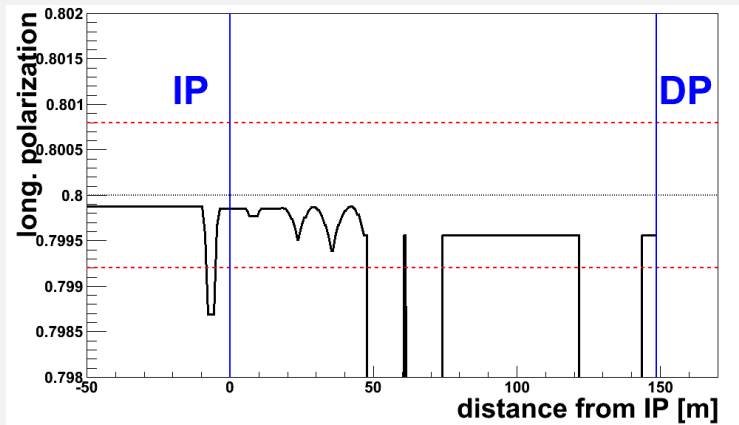 Need for additional correctors?
- Work status: coming soon

First Results

- Up to now basically function tests
- Parameter cross-checks (simulation $\leftrightarrow$ RDR) successful
- Plot: longitudinal polarization along BDS
  - Using latest available lattice
  - RDR beam parameters
  - Perfect magnet alignment, no collision effects
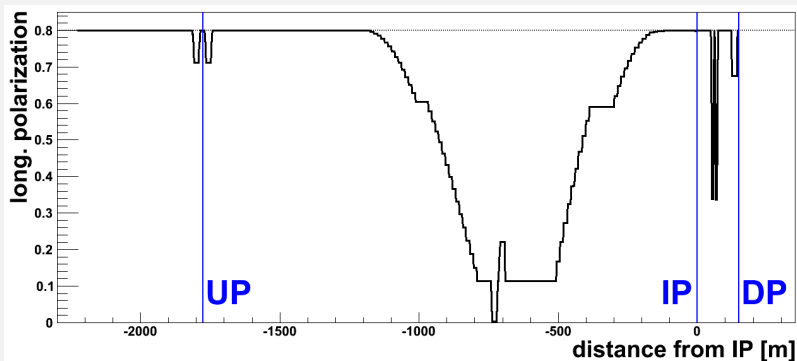
First Results (cont'd)

- Budget for BDS depolarization uncertainty: $\dfrac{dP}{P} = 0.1\%$
- Depolarization due to lateral beam size

Thanks for your attention!