

Møller Polarimeter for CLAS12

Presented for Brian Raue, FIU

DISCLAIMER: The presenter of this material is in no way responsible for the content and was not given sufficient time to prepare. It is all Brian's fault.

Yeah, you better believe it! - SEK

Present CLAS Polarimeter

Utilizes elastic $\vec{e}_{\text{beam}} + \vec{e}_{\text{tgt}} \rightarrow e + e$ scattering.

- Target

- Permendur target (49% Fe, 49% Co, 2% V)
- Polarized by Helmholtz coils (P_T^Z)

- Scattered particle separated by pair of quadrupoles.

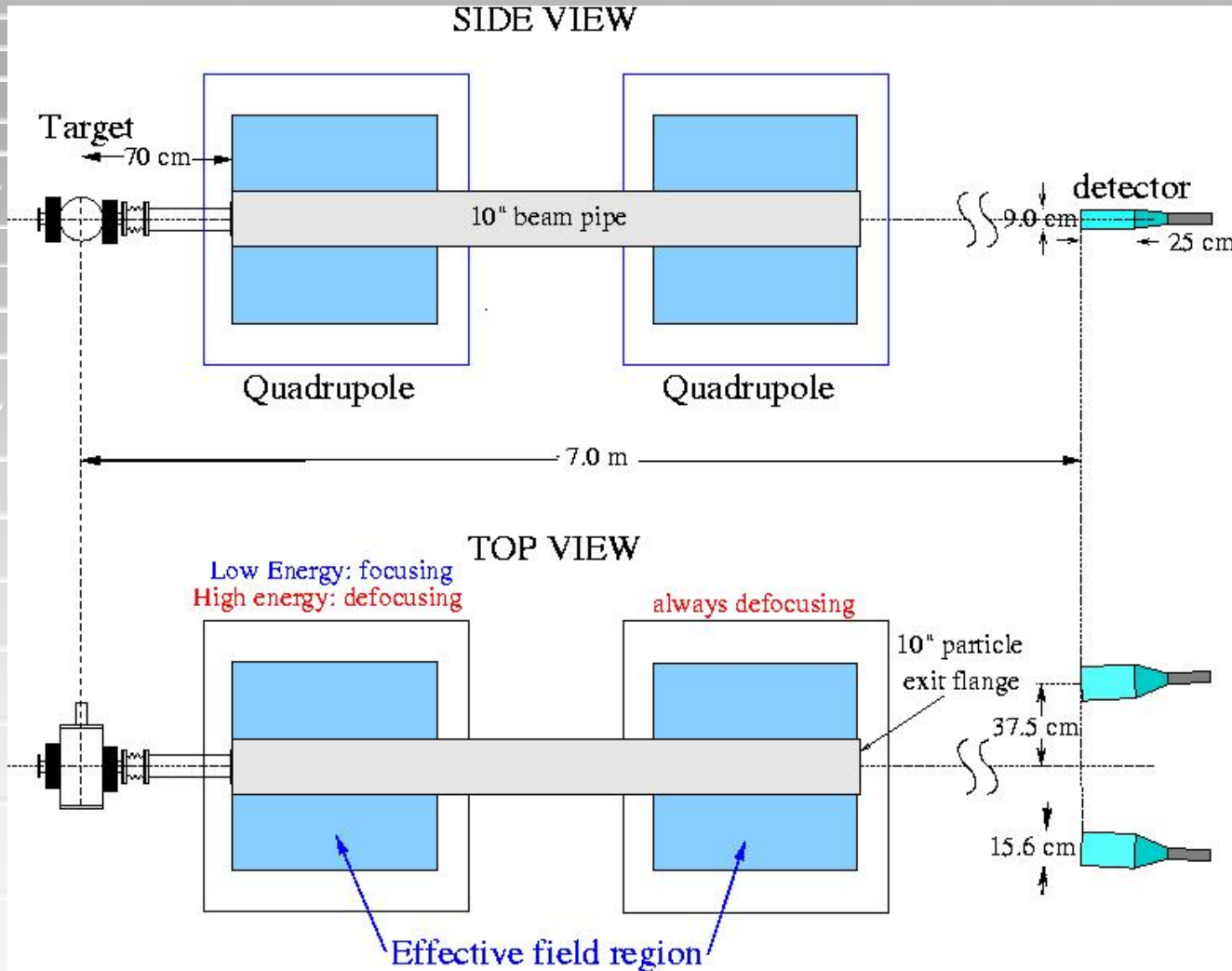
- *Coincident pairs* detected in Pb/Scintillating-fiber detectors.

- Beam polarization (P_B) from measured asymmetry:

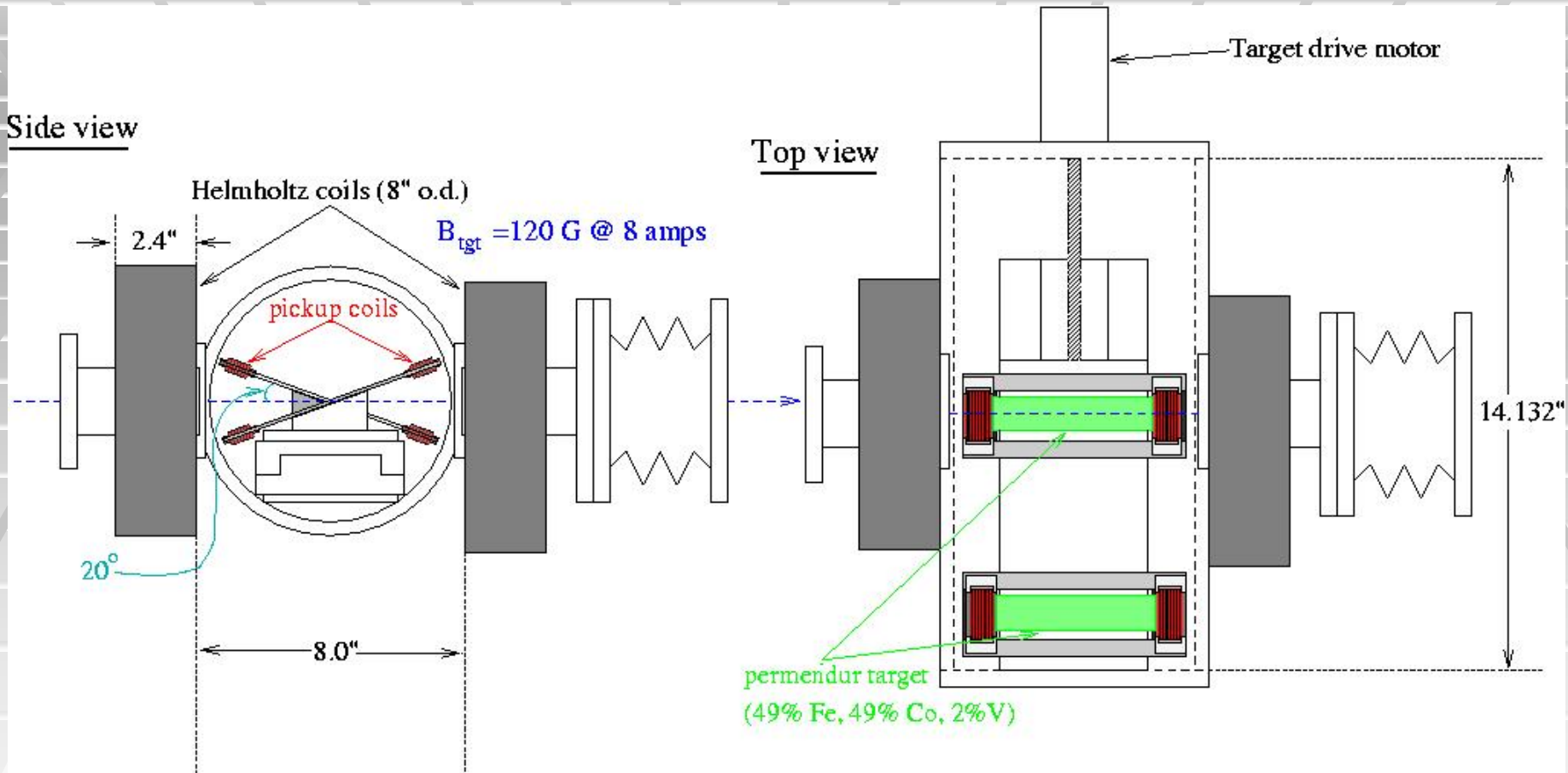
$$A = \left(\frac{N^+ - N^-}{N^+ + N^-} \right) = A_{ZZ} P_B^Z P_T^Z$$

A_{ZZ} = analyzing power.
 $\Delta P_B / P_B < 0.025$

Present Layout



Present Target



Target polarization ~ 0.08

Uncertainty dominates beam polarization uncertainty.

Can it be adapted for 12 GeV?

- We would need larger magnetic fields in quads for present layout.

Can the present magnets be pushed?

--Arne thinks maybe 11 GeV is the limit.

Can the present power supplies work?

- Longer flight path to detectors would help.
Limited by available space. Maybe extend by ~1m
- Combination of both.

We need to do simulations to find out required field for the largest available flight path.

Large cost savings if present quads and power supplies work.

Target Improvements

We should consider superconducting target magnet (\$) and a pure IRON target like in Hall C.

They produce a brut-force polarization of the two outer-shell iron electrons with a 4 T field.

- Target polarization is know since both outer-shell electron spins are aligned with field.
- Reduced target polarization uncertainty to 1/4% (relative)

Hall C claims <1% relative uncertainty on beam polarization measurements.

Work List

1. Need to run simulations to find out if present configuration (or something close) will work.
2. If not, need to consider replacing magnets and/or power supplies (pain).
3. Need to figure out what we gain in terms of beam polarization uncertainty with a new target configuration and compare it to what is needed by the experimental program. (Unknown to me.)
4. Estimate costs of any changes.