

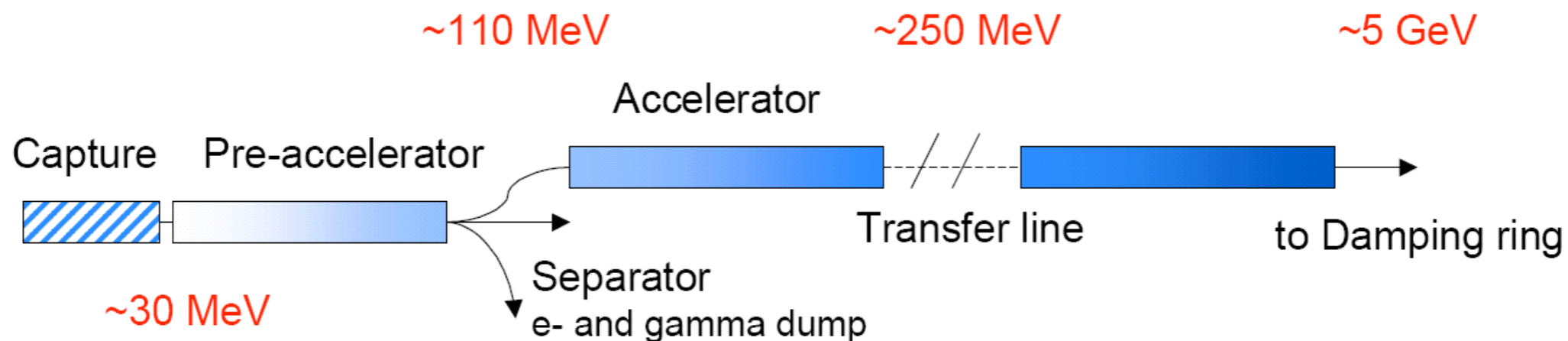
Low-Energy Polarimetry

Summary from Positron Source Meeting

A. Schälicke

Purpose of a Low-Energy Polarimeter?

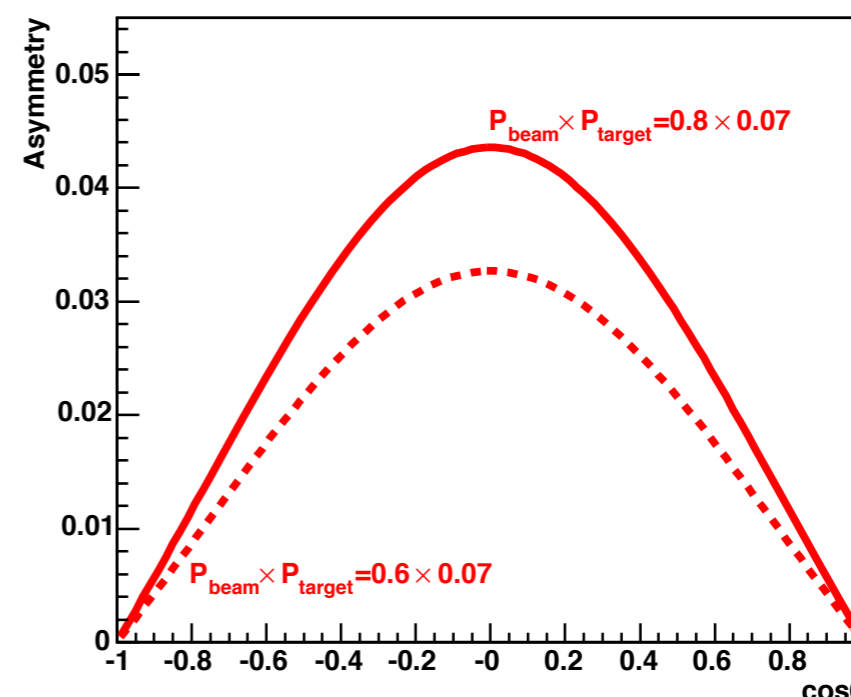
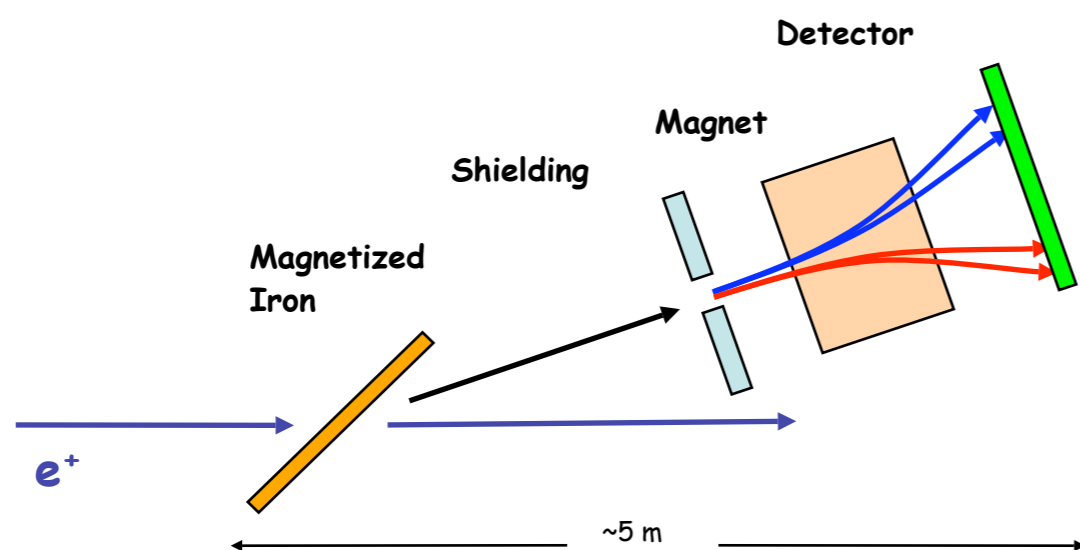
- used during commissioning
- Optimisation of positron source performance
- few percent precision
- complementary to measurement at IP



- positions at different beam energy possible
- poor beam properties before DR provide a challenge

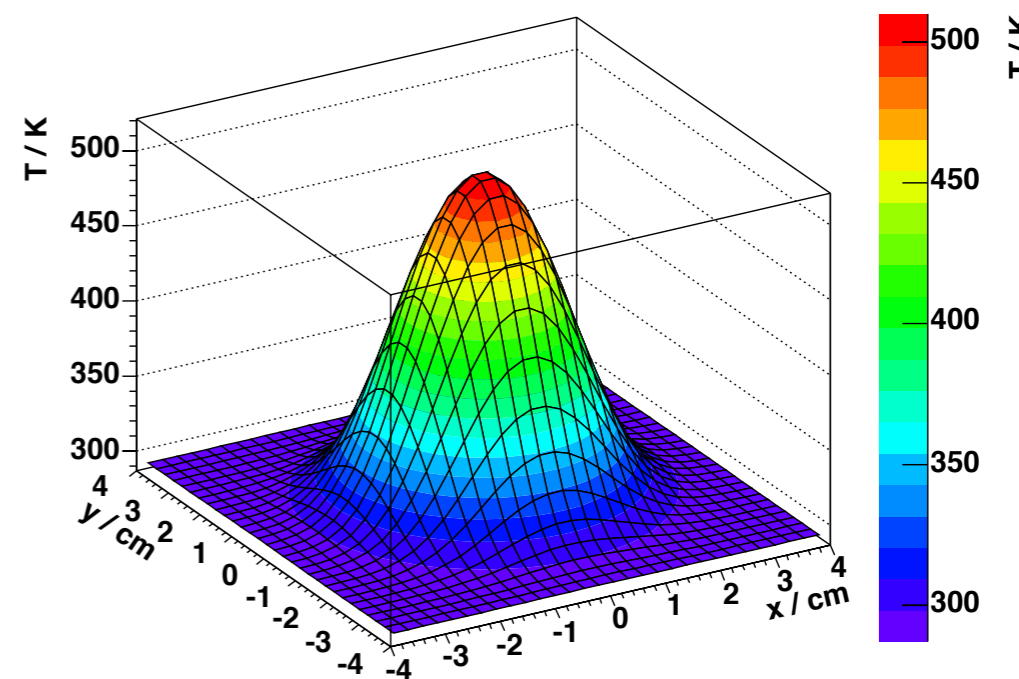
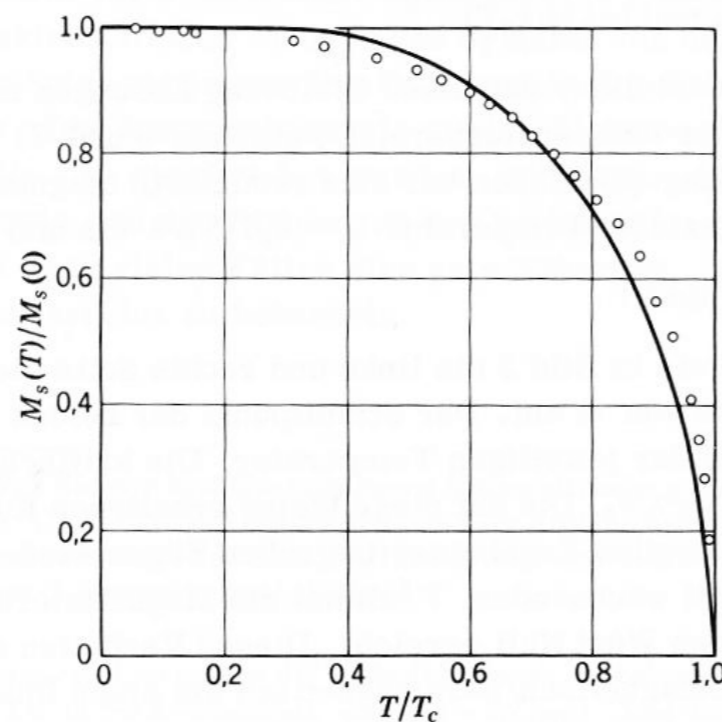
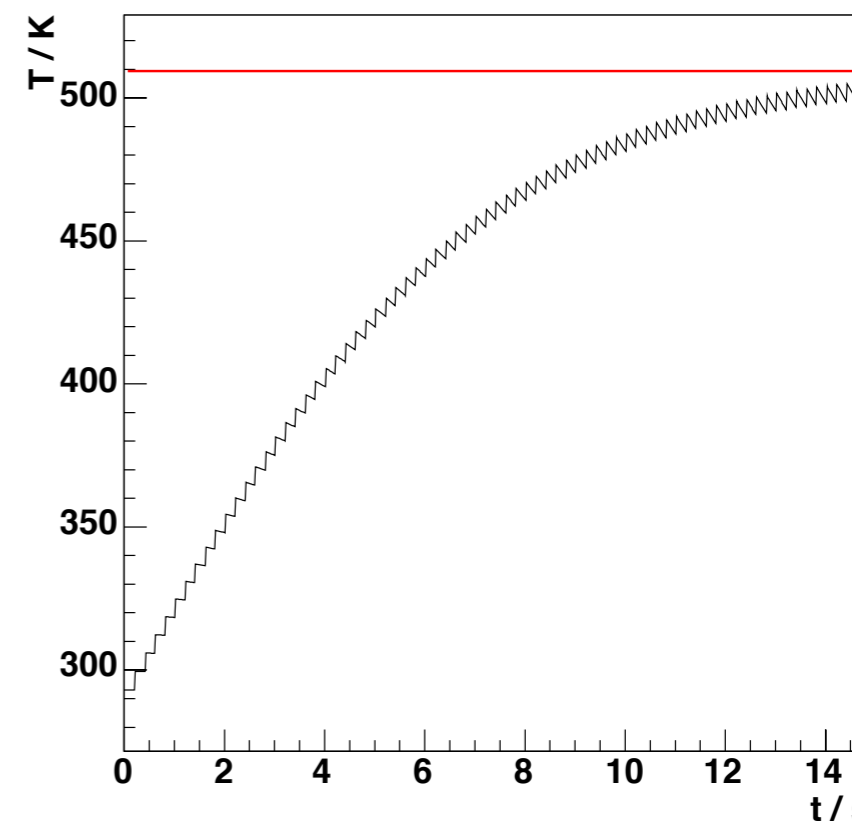
- scattering of positrons in thin magnetised iron foil
- relatively simple setup
- non-destructive
- asymmetry of a few percent

$$\frac{d\sigma}{d\Omega} = r_0^2 \frac{(1 + \cos \theta)^2}{16\gamma^2 \sin^4 \theta} \left\{ (9 + 6 \cos^2 \theta + \cos^4 \theta) - P_{e^+} P_{e^-} (7 - 6 \cos^2 \theta - \cos^4 \theta) \right\}$$

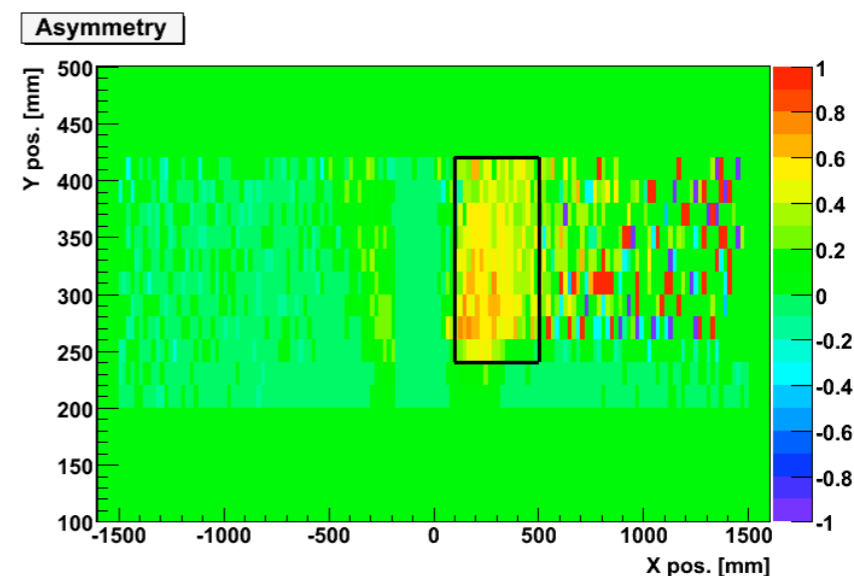
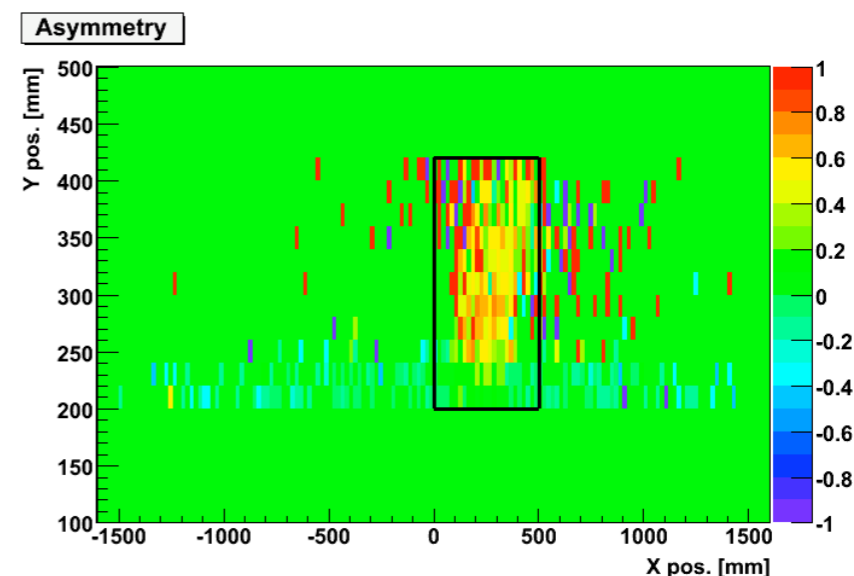


R. Dollan

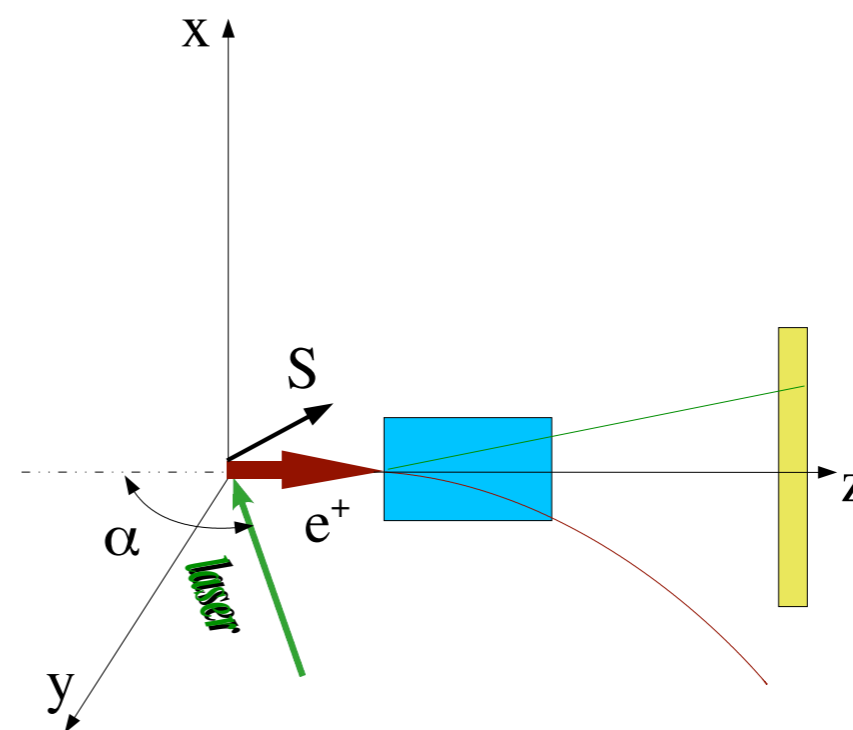
- Target
 - thin iron foil
 - critical Temperature 1043 K
 - equilibrium temperature $\sim 500\text{K}$



- Backgrounds:
 - Bremsstrahlung
 - Multiple scattering
 - Beam halo
 - Beam loss
- possible mitigation
 - Shielding
- Detector
 - 20cm x 20cm
 - Material Si?

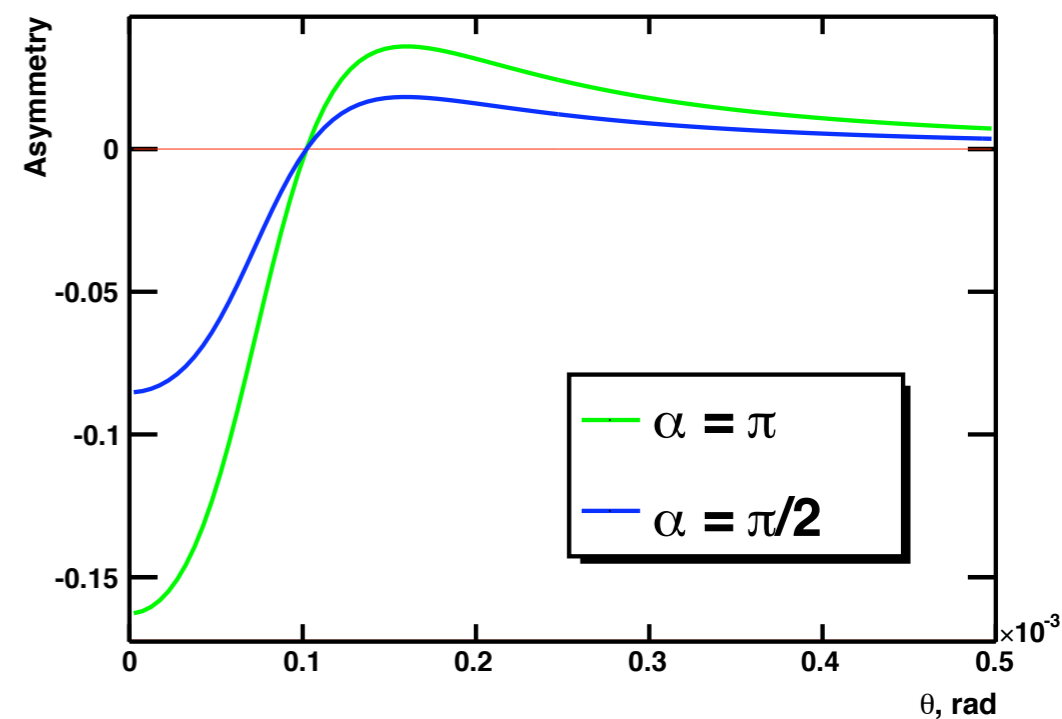


- after the damping ring
 - at energy of 5 GeV
- as complementary to IP
- setup
 - multi photon mode
 - calorimeter measurement
- options
 - pulsed/cw laser
 - crossing angle
 - longitudinal or transverse polarisation

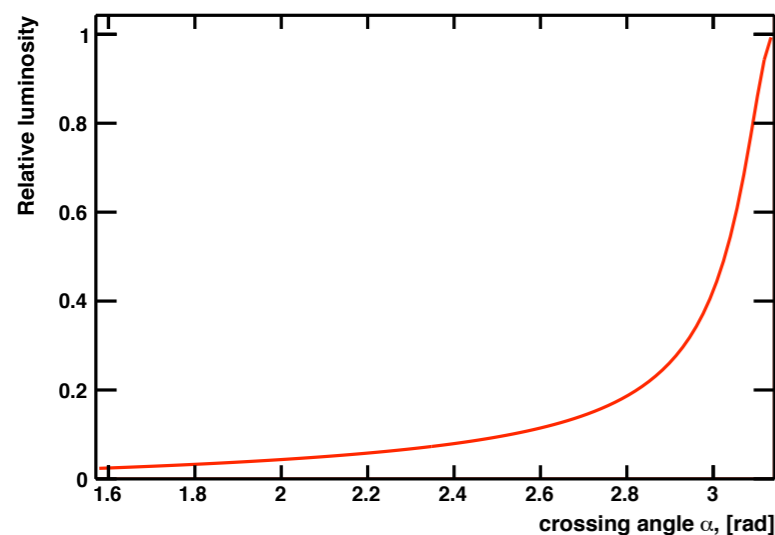


- Crossing angle options
 - head on
 - perpendicular
- (possibility to share laser-wire infrastructure?)

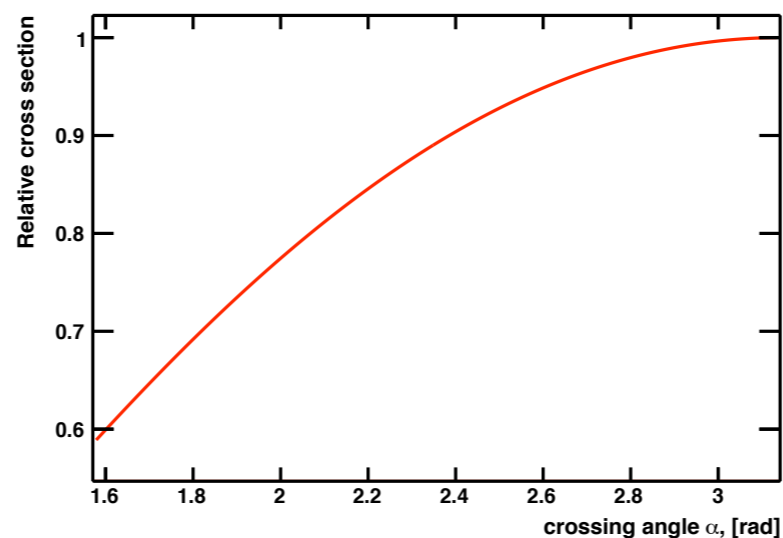
asymmetry



luminosity

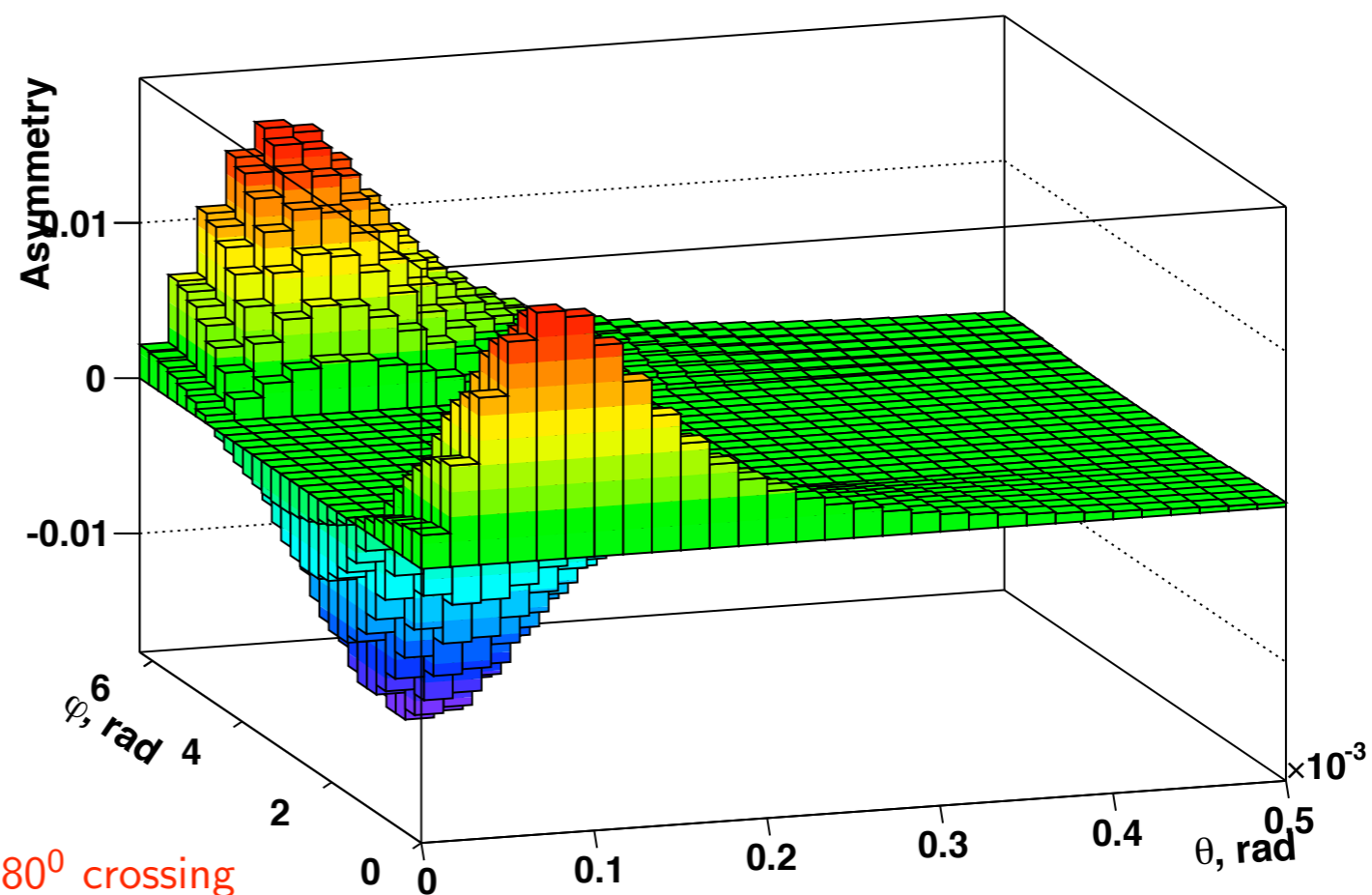


cross section



- Transverse polarisation

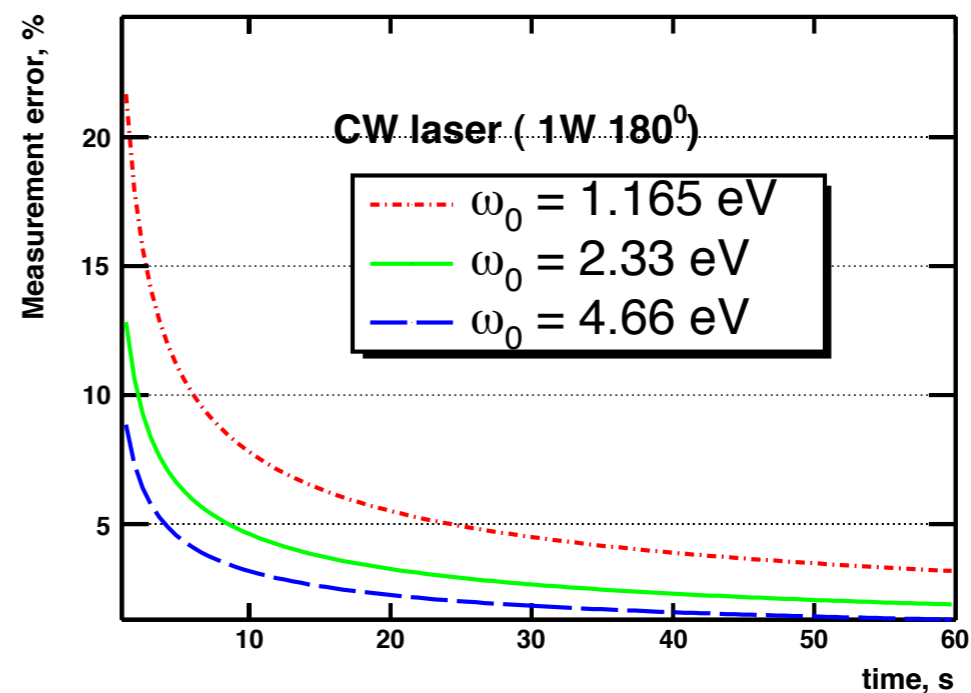
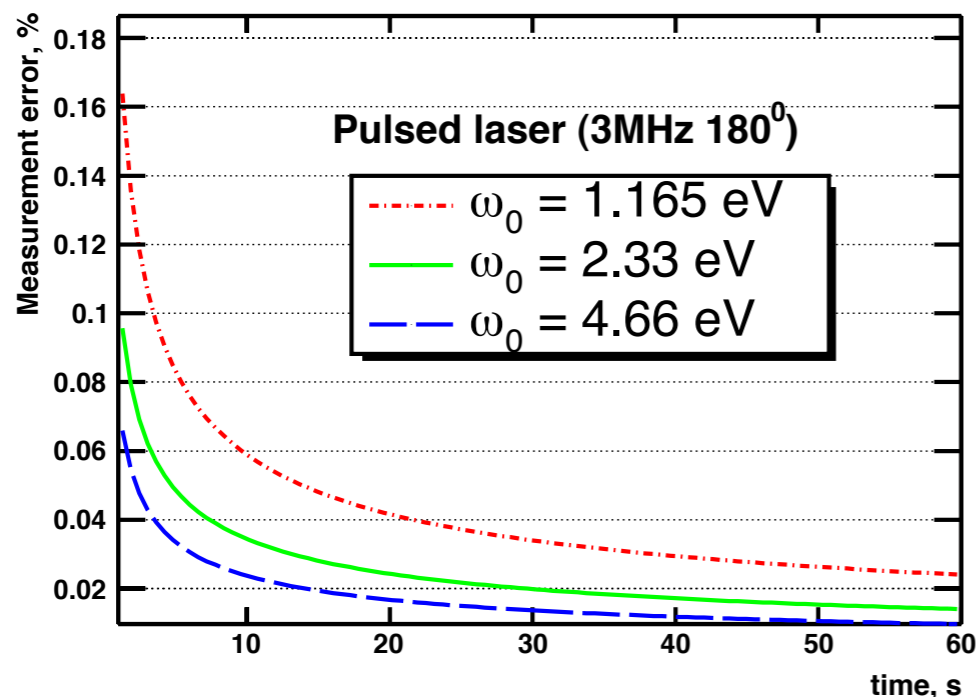
- asymmetry
- available before spin rotators



- Features

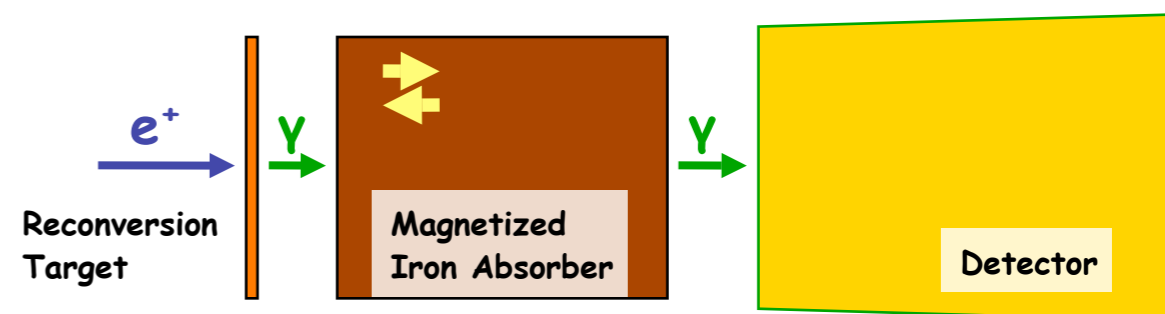
- lumi and xsec same as for longitudinal polarisation
- very small asymmetry
- complicated detector requirement

- CW laser
 - low event rate (single photon mode)
 - larger asymmetry available
- Pulsed laser
 - high event rate (multi photon mode)
 - faster measurement possible



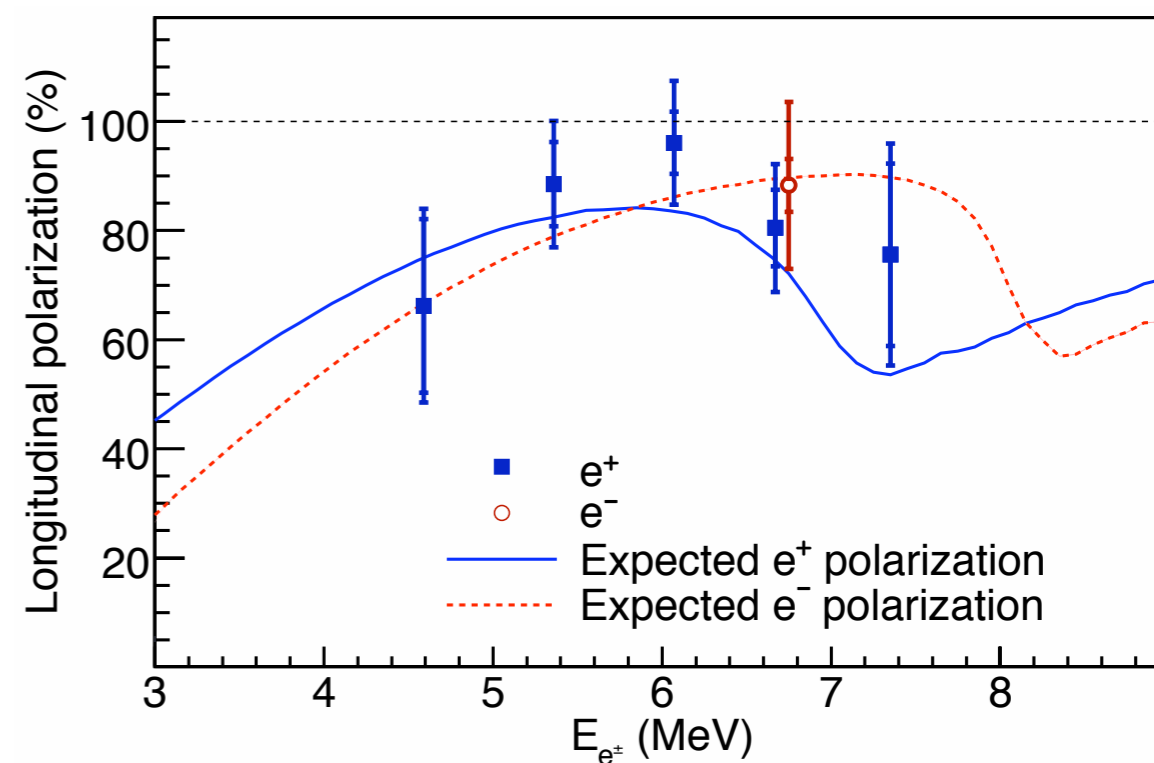
- Lepol Prototype experiment difficult

- no polarised positron beam with anticipated properties available



- E166 Experiment

- demonstrated production of polarised positrons
- polarisation measurement (for positrons) performed
- collected valuable experience



- Low-Energy polarimeter provides valuable diagnostics
- Bhabha very attractive candidate
- additional Compton polarimeter after DR possible (perhaps sharing Laser-wire infrastructure)
- E166 provides valuable experience for dealing with low-energy polarimetry (results now final)

- Addition design study needed
 - realistic backgrounds