

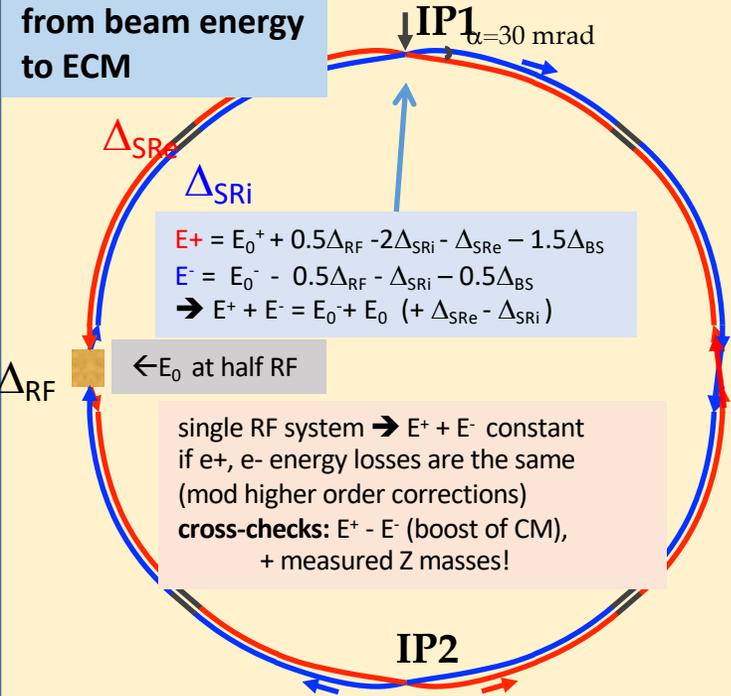
Context: FCC technical and financial feasibility study approved as CERN 'plan A'. First stage: 'tunnel and e+e- H/ EW factory'.

Motivation: precision measurement of $m_Z, \Gamma_Z, A_{FB}(m_Z), m_W$ allow exploring existence of more particles with SM Couplings

Opportunities: Huge lumi. \rightarrow tiny stat. err. 4 keV on m_Z, Γ_Z
Resonant depolarization \rightarrow 100keV (LEP,Z) or 6keV (VEPP4,J/ ψ)
monochromatization *maybe* feasible for e+e- \rightarrow H ($\Gamma_H=4$ MeV)

Challenges: can systematics match achievable statistics?

from beam energy to ECM



Plan to measure Energy by RDP on non-colliding pilot bunches. (1/10min)

Average energies E_0 around the ring are determined by the magnetic fields
 \rightarrow same for colliding or non-colliding beams
-- measured by resonant depolarization
-- can be different for e+ and e-

at the Z:
 $\Delta_{SR} = 2\Delta_{SRi} + 2\Delta_{SRRe} = 36$ MeV
 $\Delta_{SRRe} - \Delta_{SRi} \approx \alpha/2\pi \Delta_{SR} = 0.17$ MeV
 $\Delta_{BS} = 0$ up to 0.62 MeV
Beamstrahlung E loss compensated by RF.

Issue from collision offset x parasitic opposite sign IP dispersion

\rightarrow vernier scans and $D_{x,y}$ measurements
Radiative Bhabha monitor to measure beam-beam kick of colliding particles

Beam Energy measurement by RDP

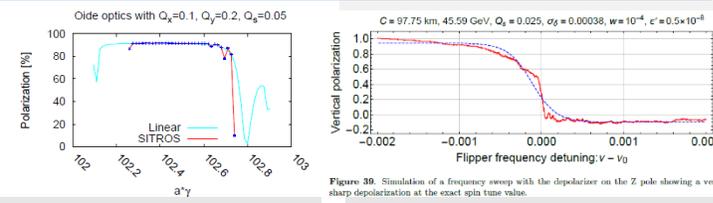
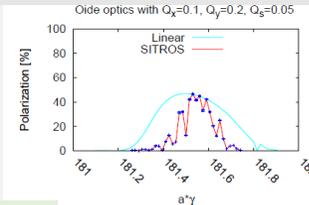
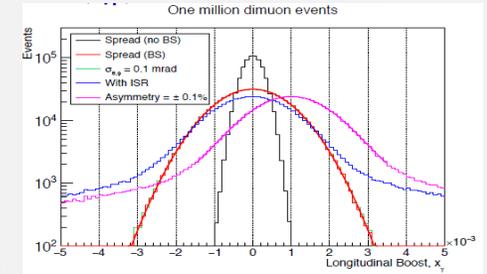
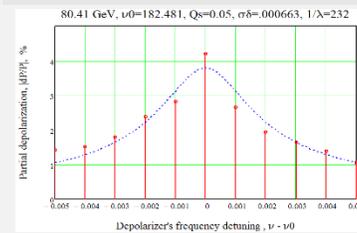


Figure 30. Simulation of a frequency sweep with the dipolarizer on the Z pole showing a very sharp depolarization at the exact spin tune value.

Sufficient degree of polarization at Z and W



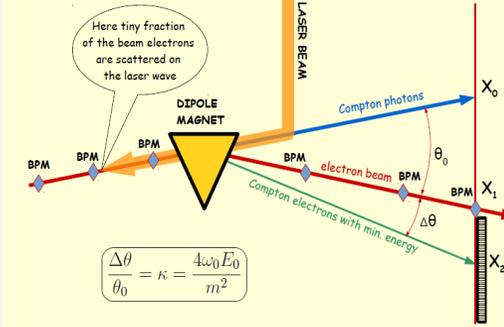
resonant depolarization at Z (sweep) and W (steps)



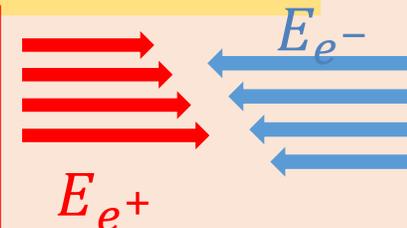
Muon pairs can be used to measure CM energy spread and average boost of CM

A few big challenges

- large ground motion! ± 90 MeV
- E_b vs f_{RDP} in imperfect ring
- interference with s,x,y motions
- parasitic IP dispersions IP offsets
- how well can we measure nul polarization?
- how do we operate it all ?



Compton Polarimeter uses scattered e & γ
 $e \rightarrow PyPZ \& Eb, \gamma \rightarrow PyPx$



FCC EPOL group:
arxiv [1909.12245](https://arxiv.org/abs/1909.12245)

AB, E. Gianfelice