BEAM ENERGY SPECTROMETER

At LC

Beam Instrumentation required

- Beam Energy (our concern)
- Polarization
- Luminosity

Significant overlapp with other efforts:

Accelerator, Beam Delivery, Detector Groups, Physics Groups

Energy Precision needed

(dictated by Physics)

- Target $(1-2)\times 10^{-4}$ for $\Delta E_b/E_b$
  from $2\ \mathrm{m}_{top} < \sqrt{s} < 1$ TeV
  $\Rightarrow \Delta m_{top}, \Delta m_{Higgs} \sim 50$ MeV

- Recognize 5×10^{-5} at $\sqrt{s} = 2m_W$
  $\Rightarrow \Delta m_W \sim 6$ MeV

- New Z line shape scan
  $\Delta E_b/E_b \sim 10^{-5}(-10^{-6})$

Questions / Comments

- Can basic requirements on precision be achieved ?
- Should we have a design that will do at least
  $\Delta E_b/E_b \sim 5 \times 10^{-5}$ or better ?
- How to measure correlations between E, P, L ?
- Extrapolation of existing devices or clever new ideas needed ?
- Energy, energy width (after IP) needed ?
- redundant measurement(s) necessary ?
  cross-checks / different technique(s)
- default energy: $E_b = 250$ GeV
  extreme cases: 45 GeV, 400 GeV

Techniques proposed

- Beam Instrumentation
  - Magnet Spectrometer (LEP)
  - Moller (Bhabha) scattering (?)
  - Spin Precession method (Telnov)
  - Wire-imaged synchrotron radiation detector (SLAC)
    WISRD - style spectrometer
  - 'Wire' scanner at high dispersion point

- 'Physics' Techniques

  - Radiative returns using Z mass: $e^+e^- \to Z\gamma \to \mu^+\mu^-(\gamma)$

    'gold-plated channel'

    (muon momentum measurements in forward direction,

    $\sim$ 200 - 400 mrad)

BPM - based Spectrometer

- In-beam line spectrometer with fixed bend angle
- BPMs used to measure beam position $\Rightarrow$ bending angle θ

$$\boxed{E_b \sim \frac{1}{\theta} * \int B dl}$$

TESLA: large bunch spacing ~330 ns (~180 ns)
combined with fast high-precision BPMs

$\Rightarrow$ E_b (e^+/e^-) for each bunch

Lot of questions / problems

- Magnets
- BPMs
- Alignment / Stability (mechanical, electronic)

$\Rightarrow$ Items of the Meeting