Measurement of ALR using radiative return at ILC 250

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A_{LR} Measurement

A_{LR}: left-right asymmetry in the total rate for Z production

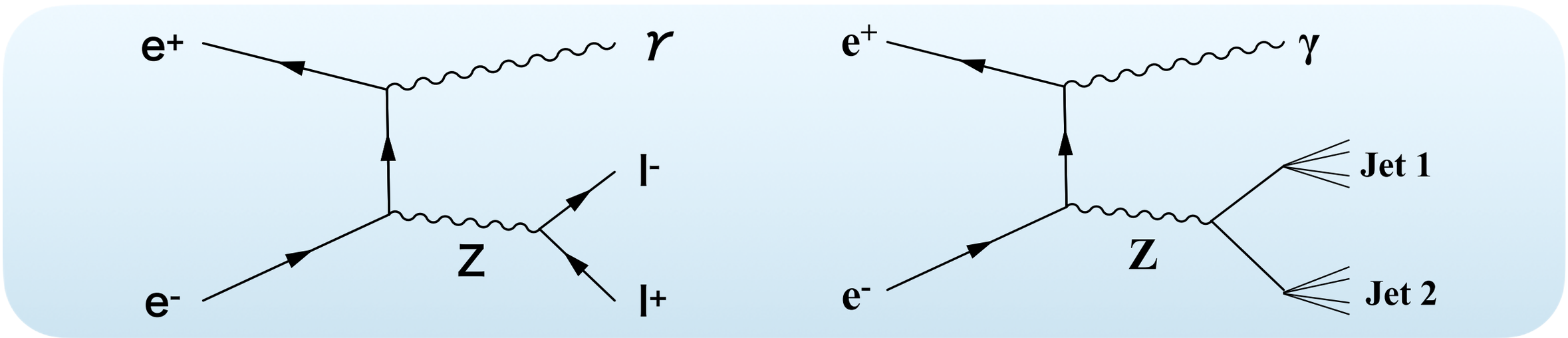
$$A_{LR} \equiv \frac{\sigma_L - \sigma_R}{\sigma_L + \sigma_R}$$

σ_L (σ_R):the cross section for 100% polarized $e^-_L e^+_R$ ($e^-_R e^+_L$) initial states.

➡ Constraint for operators c_{HL}, c'_{HL}, and c_{HE} in the global SMEFT fit

SLC: ~1% Improve at the ILC

At the ILC250, we can use the radiative return process, $e^+e^- \to \gamma Z$ $Z \to ff$, to measure the A_{LR}.



90 Million events expected
(a factor of 100 more than the total number of Z produced at SLC)

Signal events tagging

We can tag signal events using precisely measured polar angle at the ILC detectors.

To describe the method simply, we will use the approximations that the fermions are massless and the photon is collinear to the beam directions.

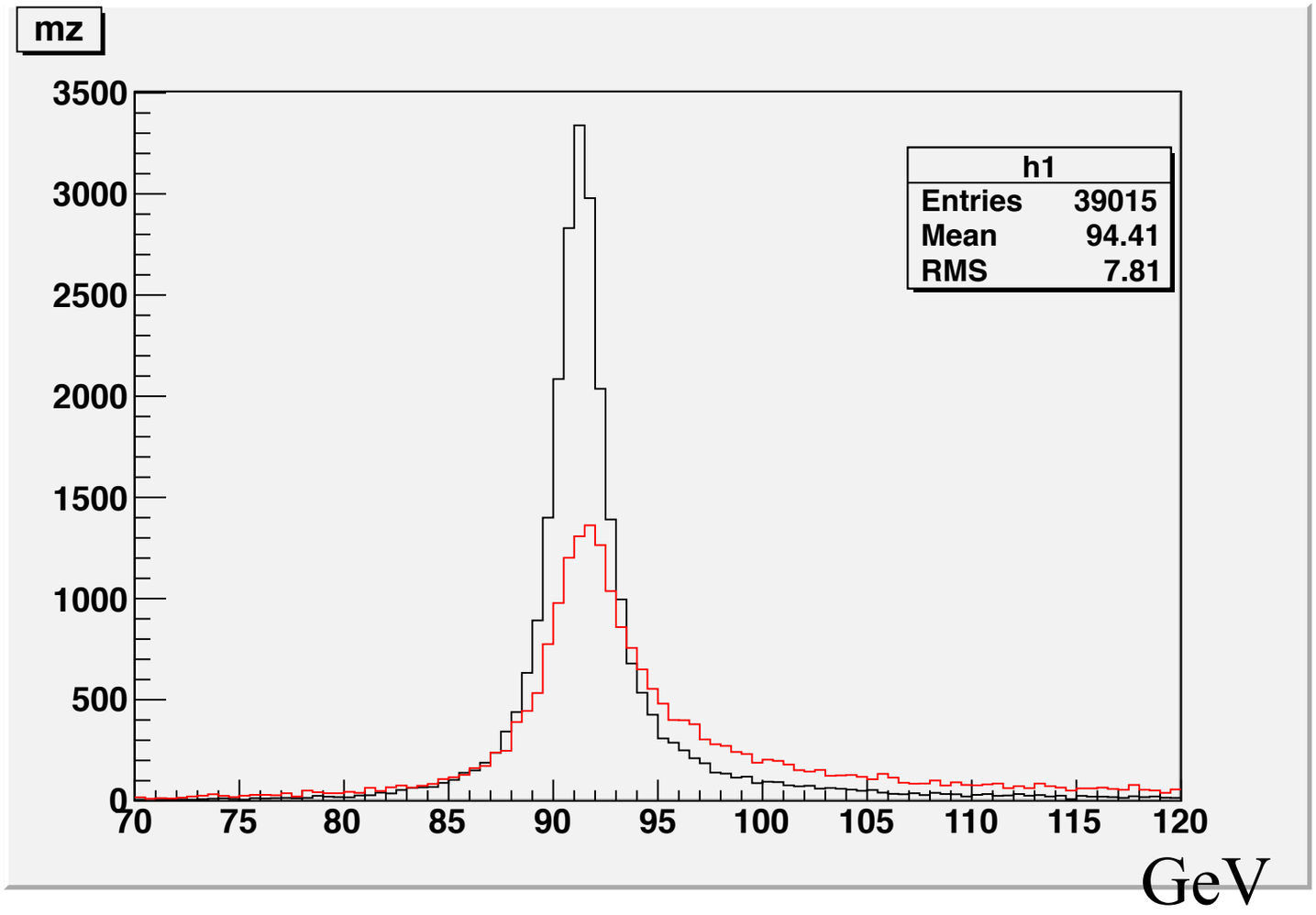
The fermion pair is boosted only in the beam direction. The boost factor is:

$$|\beta| = \frac{|E_1 cos\theta_1 + E_2 cos\theta_2|}{E_1 + E_2} = \frac{|sin(\theta_1 + \theta_2)|}{sin\theta_1 + sin\theta_2}$$

E_i and θ_i denote the energy and polar angle, respectively, of each final lepton or jet (i=1,2).

$$m_{12}^2 = \frac{1 - |\beta|}{1 + |\beta|} \cdot s$$

Signal events tagging



Preliminary Result
e^+e^- -> γZ, Z->2jets
E_{CM}=250 GeV
- Truth
- Reconstructed

Full detector simulation study to get more realistic estimations including systematic errors

2 dominant systematic errors:

① uncertainty of beam E_{CM}

② uncertainty of beam polarization

Current best measurement of A_{LR} = 0.1514±0.0019 (statistic error) ±0.0011(systematic error) (SLD)

We would like to access how much we can improve these systematic errors.