PROBING THE TOP-BESS MODEL AT THE ILC

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Banská Bystrica, September 6-9, 2010

Top BESS Model

Electroweak Symmetry Breaking in the Standard Model of Electro-weak Interactions (SM) $\Rightarrow$ the Higgs boson.

BESS (Breaking Electroweak Symmetry Strongly), top-BESS – introduce a new strongly interacting vector particle – the ρ resonance – in the form of a triplet (ρ^0, ρ^+, ρ^-) as an alternative to the SM Higgs.

The Top-BESS model – ρ couples directly only to the top and bottom quarks – motivated by the extraordinary large mass of the top quark that is comparable to the ESB scale.

The top-BESS Model Lagrangian

$$L_{\rho}^{(t,b)_L} = b_L g \overline{\psi}_L \gamma^{\mu} W_{\mu}^{a} \tau^{a} \psi_L + b_L \frac{g''}{2} \overline{\psi}_L \gamma^{\mu} \rho_{\mu}^{a} \tau^{a} \psi_L$$

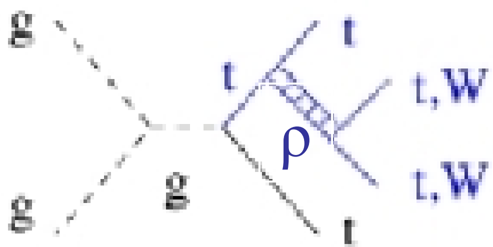
$$L_{\rho}^{(t,b)_R} = b_R g' (\overline{\psi}_R P_0) \gamma^{\mu} B_{\mu} \tau^{3} (P_0 \psi_R) +$$

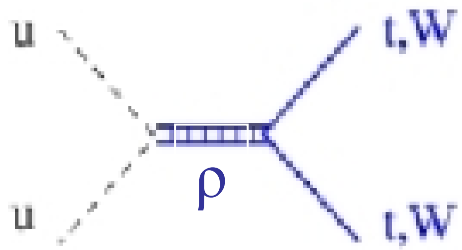
$$b_R \frac{g''}{2} (\overline{\psi}_R P_0) \gamma^{\mu} \rho_{\mu}^{3} \tau^{3} (P_0 \psi_R)$$

$$\boxed{\psi = \begin{pmatrix} t \\ b \end{pmatrix}}$$

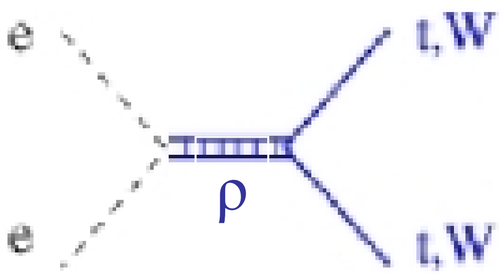
LHC Versus e^+e^- Colliders

LHC – search for new particles
– large backgrounds





ILC, CLIC – precise measurements of the parameters



Analyzed processes

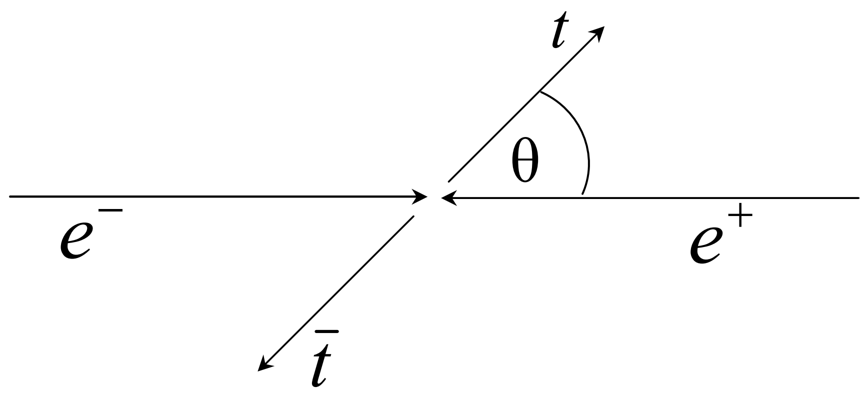
$$\boxed{e^+e^- \xrightarrow{\rho} t\bar{t}}$$

$$\boxed{e^+e^- \xrightarrow{\rho} b\bar{b}}$$

Using the software CompHEP into which we implemented our model we calculated cross sections and forward-backward asymmetries. Both polarized and unpolarized beams of electrons and positrons were considered.

Forward-backward Asymmetry

$$A_{FB} = \frac{\sigma_F - \sigma_B}{\sigma_F + \sigma_B} = \frac{\sigma_F - \sigma_B}{\sigma}$$



Low Energy Limits. Parameters.

$$-0.009 < b_L - 2\lambda_L < 0.003$$

$$-0.029 < b_R + 2\lambda_R < 0.031$$

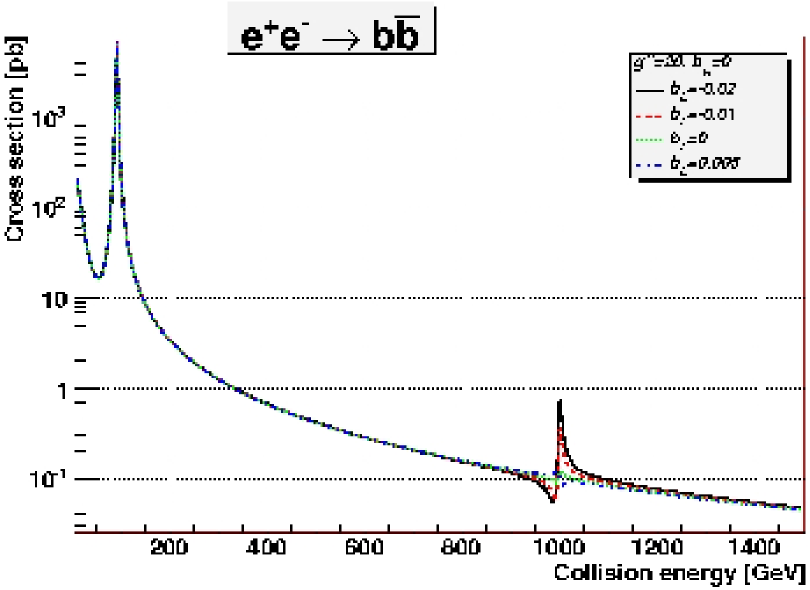
$$10 < g''$$

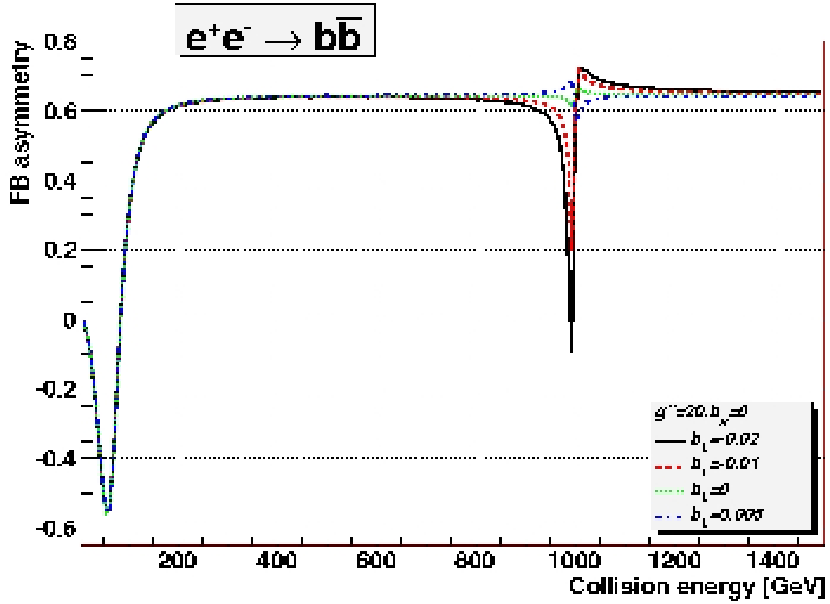
$M_{\rho^0} = 1$ TeV $\qquad g'' = 20$

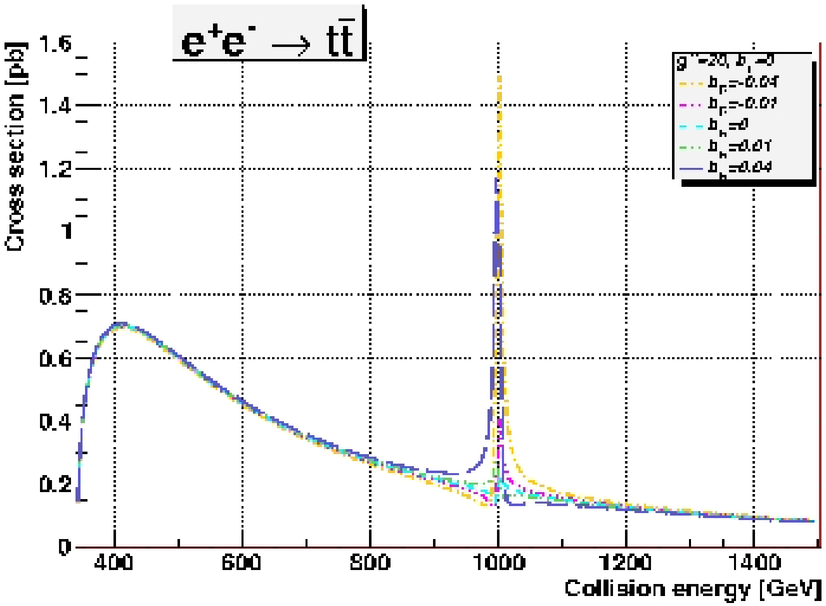
$b_R = 0 \quad b_L \begin{cases} -0.02 \\ -0.01 \\ 0 \\ 0.005 \end{cases} (b\bar{b})$

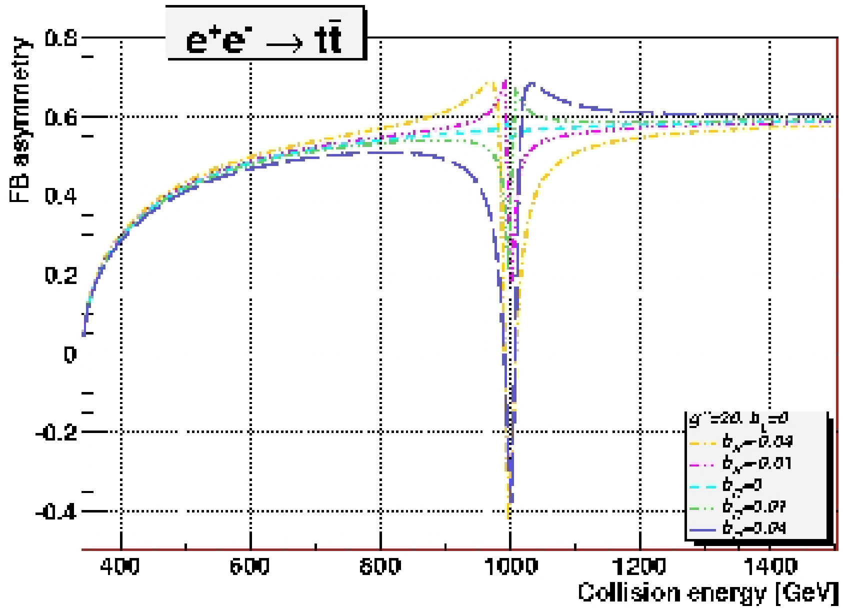
$b_L = 0 \quad b_R \begin{cases} -0.04 \\ -0.01 \\ 0 \\ 0.01 \\ 0.04 \end{cases} (t\bar{t})$

Unpolarized Beams

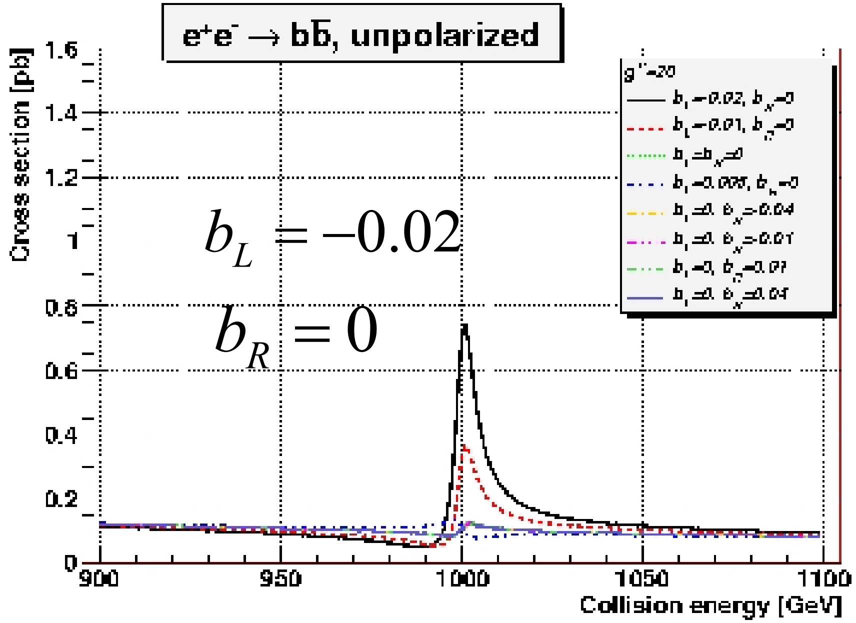


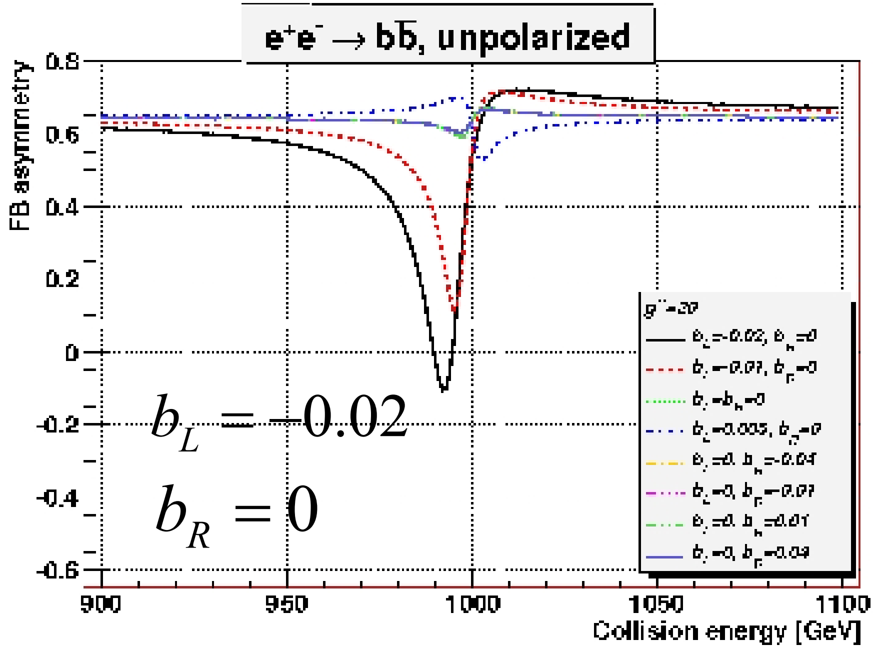


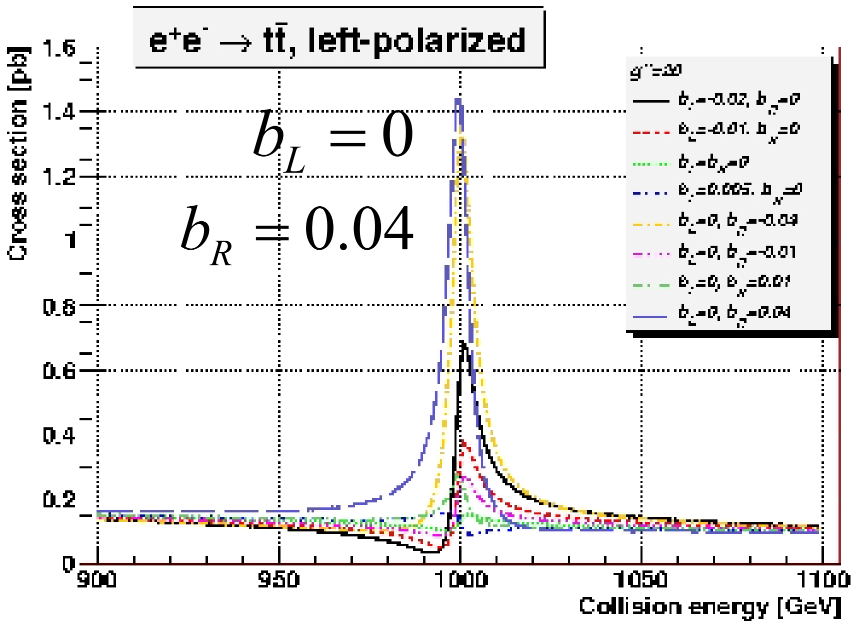


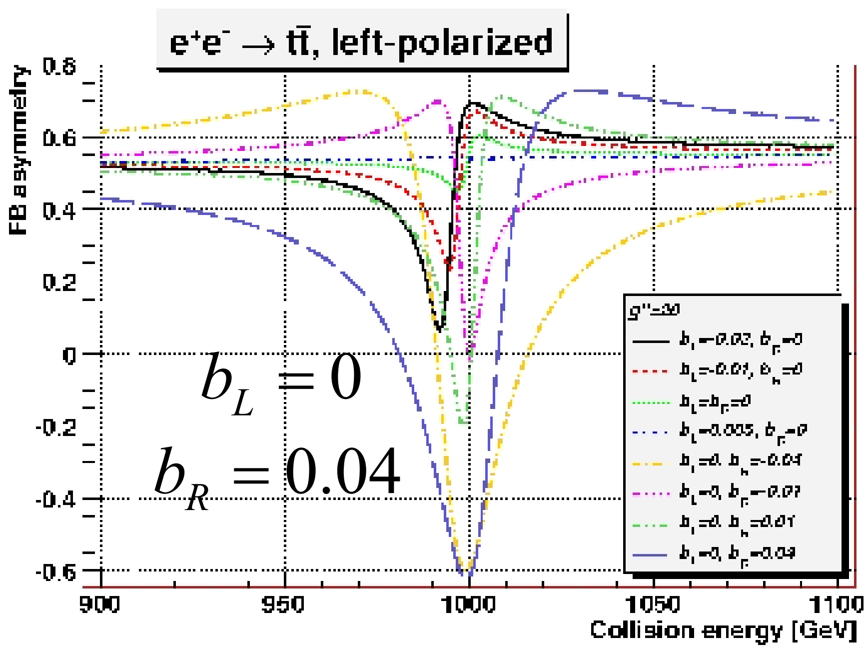


$e^+e^- \to b\bar{b}$ sensitive to b_L , $e^+e^- \to t\bar{t}$ sensitive to b_R .

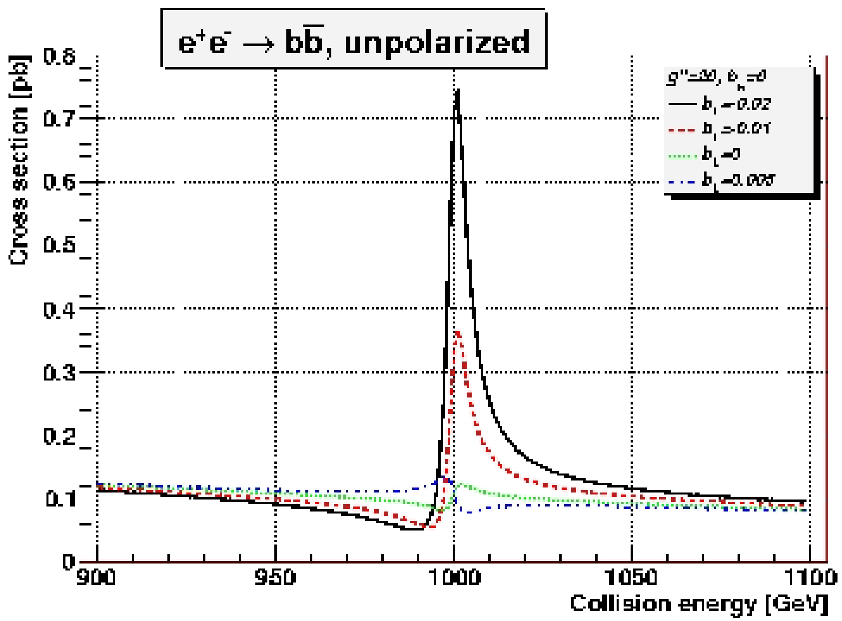


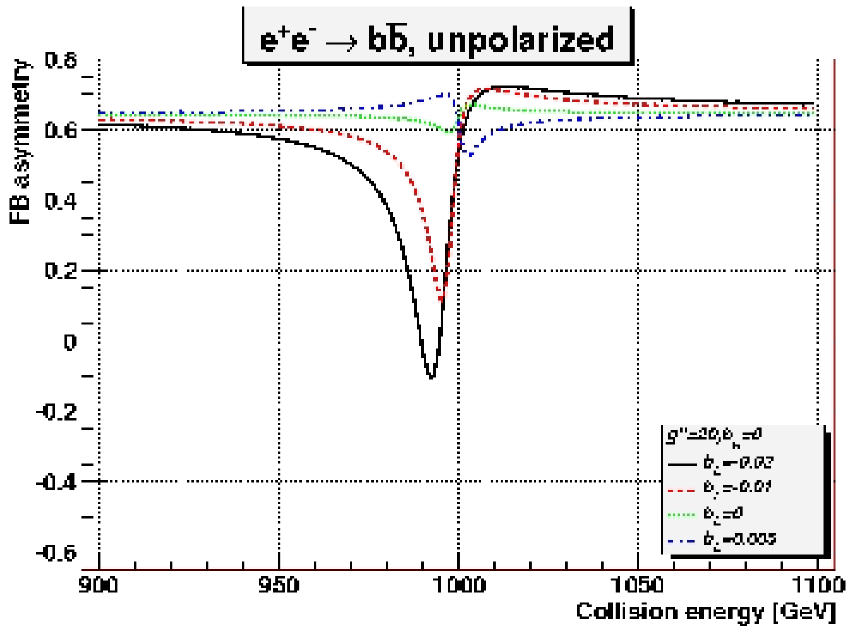


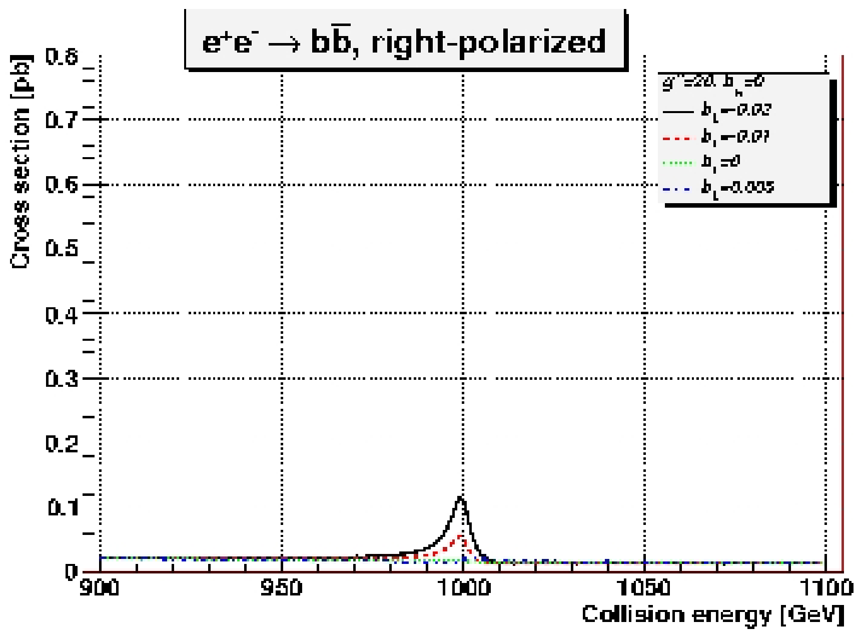


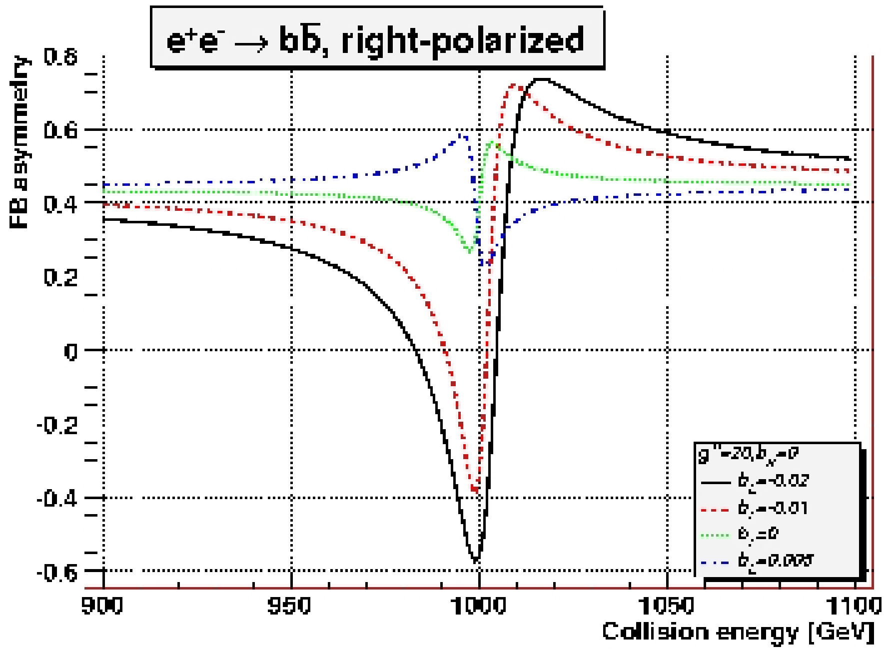


Polarization



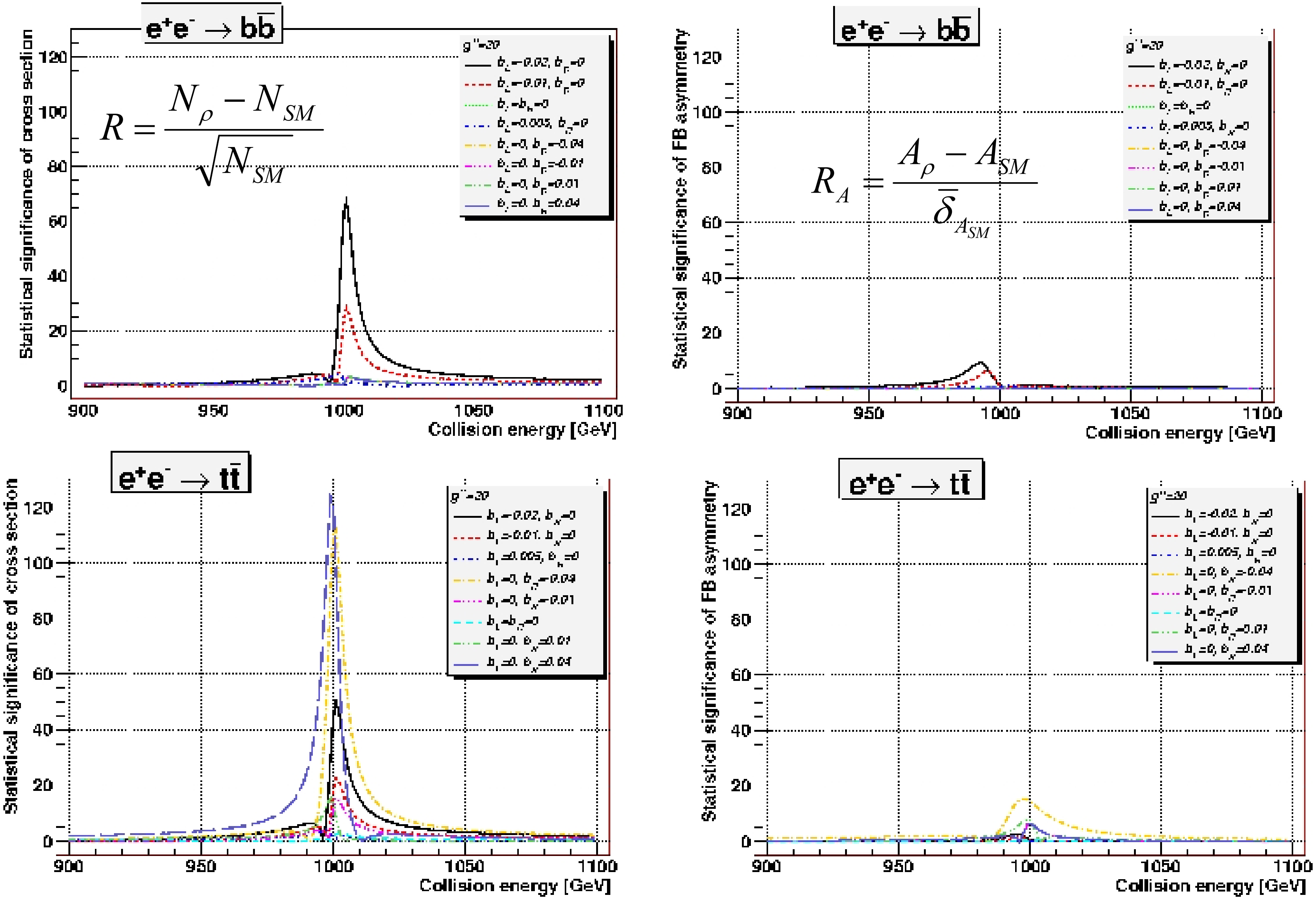






Statistical significance. SM versus ρ.

Unpolarized beams. L=1 fb^{-1}.



Conclusions

* The calculated R and RA suggest that the e^+e^- processes may be sensitive probes of the ρ presence.

* Besides cross section also the FB asymmetry may be good means for measuring the model parameters

* Measurements with polarized beams may be in some cases more sensitive to the ρ presence than the measurements with unpolarized beams

* Deeper analysis is necessary that would include reducible back-grounds and detector reconstruction efficiencies.