Top at the NLC

Since the top quark's lifetime is so short, no sharp resonance or characteristic spectroscopy of toponium will exist near threshold. Instead, the cross section rises approximately monotonically through the $t\bar{t}$ threshold. At threshold

$$\sigma_{t\bar{t}} \approx \sigma(\mathrm{M_t}, \alpha_s, \Gamma_t, \beta_H)$$

- A threshold scan with $\approx 50\ \mathrm{fb}^{-1}$ allow the extraction of these parameters:
  - $\delta\mathrm{M_t} = 300$ MeV
  - $\delta\Gamma_t \approx 10\%$
  - $\delta\alpha_s = 0.007$
  - $\delta\beta_H = 25\%$
- The challenge will be to understand the spread in the beam energy and the WW backgrounds.

An advantage of the quick decay of the top quark is that the decay products carry the properties of the quark itself. This allows a detailed study of the couplings of the top quark and form factors by analyzing the helicity angles in the final state.

$$M^{\mu,(\gamma,Z)} = e\gamma^\mu[Q_V^{\gamma,Z}F_{1V}^{\gamma,Z} + Q_A^{\gamma,Z}F_{1A}^{\gamma,Z}\gamma_5] + \frac{ie}{2m_t}\sigma^{\mu\nu}k_\nu[Q_V^{\gamma,Z}F_{2V}^{\gamma,Z} + Q_A^{\gamma,Z}F_{2A}^{\gamma,Z}\gamma_5]$$

$$M^{\mu,W} = \frac{g}{\sqrt{2}}\gamma^\mu[P_L F_{1L}^W + P_R F_{1R}^W] + \frac{ig}{2\sqrt{2}m_t}\sigma^{\mu\nu}k_\nu[P_L F_{2L}^W + P_R F_{2R}^W]$$

With 50 fb^{-1} the form Factors (F's) will be measured to $\approx$ the 10-20% level (@90% CL).