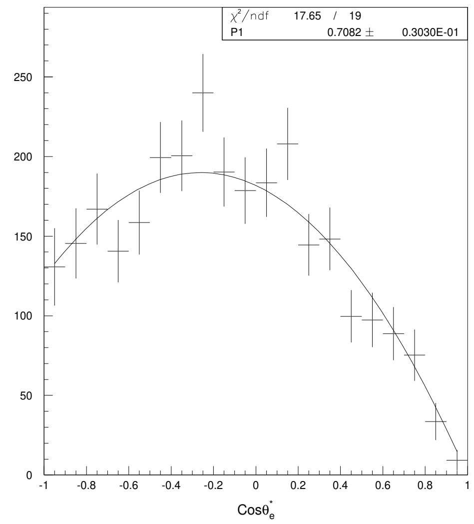
Decay Properties (cont.)

Polarization Studies:

Because the top quark decays prior to forming hadrons, the helicity information of the coupling Wtb is carried in the decay products. The W polarization can be studied by the lepton helicity angle

$$\cos\theta_e^* \approx \frac{2M_{eb}^2}{m_{eb\nu}^2 - M_W^2} - 1$$

Left-handed W polarization will follow a $(1-\cos\theta)^2$ distribution while longitudinal polarized events will follow a $(\sin\theta)^2$ distribution.



From this distribution, we can extract the ratio of longitudinal to left-handed polarization and compare it to the expectation from the Standard Model:

$$\frac{W_{long}}{W_{left}} = 1/2(\frac{\mathrm{M_t}}{M_W})^2$$

which for $\mathrm{M_t} = 175$ GeV/c^2 is 2.4 (*i.e. 70% of the W's have longitudinal polarization)*. With the data sets available in Run II, this quantity should be measured to a precision of about **5-6%**.