

Top W Helicity Measurement - Update

Nathan Goldschmidt

Ken Bloom

Stephen Miller

Dave Gerdes

Dan Amidei

Mitch Soderberg

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Introduction

- physics motivation
- measurement strategy

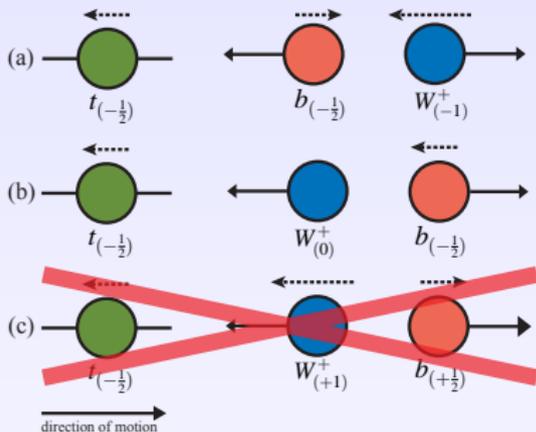
Samples

- lepton+jets
- lepton+track

Parameter and Confidence Interval Estimation

- the likelihood function and fitter
- confidence interval estimation
- the Feldman-Cousins method

Conclusions

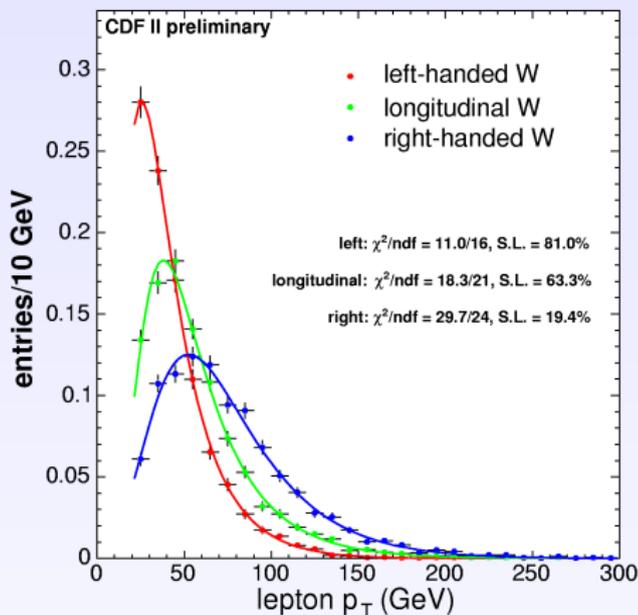
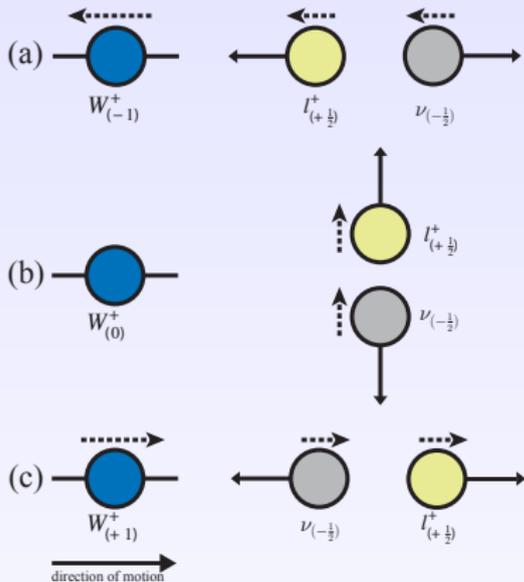


- ▶ SM: Only **left-handed** and **longitudinal** W 's may be produced in the top-quark rest frame.
- ▶ SM: $t \rightarrow W_0 b$ is enhanced

$$F_0 = \frac{\Gamma(W_0)}{\Gamma(W_0) + \Gamma(W_T)}$$

$$= \frac{\frac{1}{2} \left(\frac{m_t}{M_W}\right)^2}{\frac{1}{2} \left(\frac{m_t}{M_W}\right)^2 + 1} \simeq 0.7$$

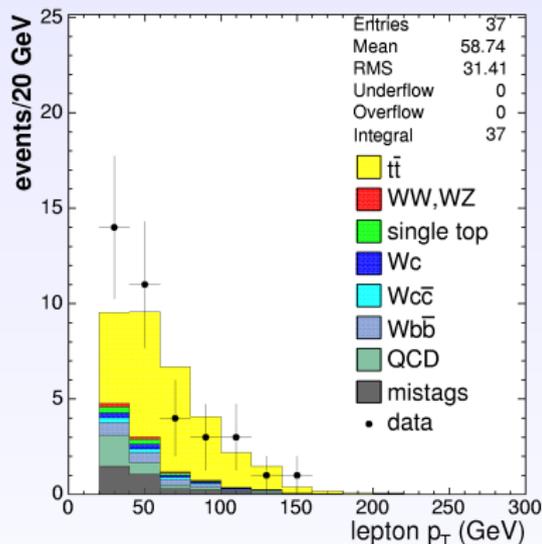
- ▶ Exploring the the tWb coupling should lend insight to the nature of EWSB.
- ▶ It's a reasonable place to look for new physics.
- ▶ It provides us with opportunity to test predictions of the SM.



- ▶ charged-lepton p_T is affected by the W helicity
- ▶ we can estimate the helicity content of $t\bar{t}$ samples by analyzing their charged-lepton p_T shape
- ▶ we accomplish this by doing unbinned maximum-likelihood fits

lepton+jets dataset

- ▶ We're going ahead and using the "optimized" event selection (level 5 corrections, jet $E_T > 20\text{GeV}$, $\Delta\phi$ cut).
- ▶ Stephen is nearing completion of the Method 2 bg estimates for the $\sim 170\text{ pb}^{-1}$ dataset.
- ▶ everything else is in hand (e.g. lepton p_T shapes from standard MC samples, events from the data)



lepton+track dataset

- ▶ We're working to incorporate the lepton+track dataset and bg estimates into this analysis
- ▶ The l+track group has agreed to provide us with histograms of lepton p_T which we'll use model the background content of that sample
- ▶ They also agreed to run their event selection on the fixed-helicity HERWIG 6.5x MC samples and provide us with histograms to model the signal
- ▶ We thank them for their kind assistance

the likelihood function and fitter

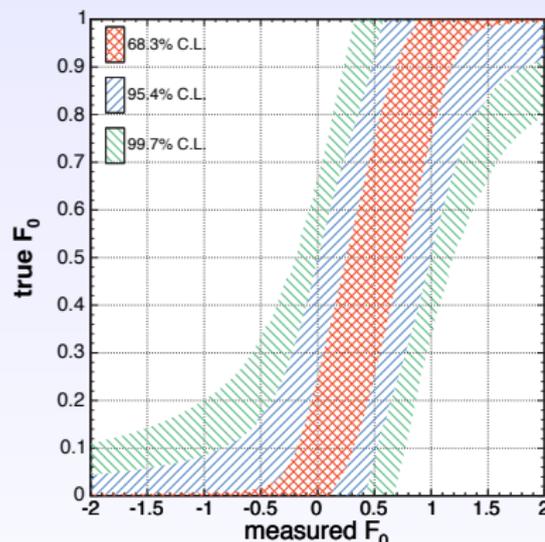
- ▶ The form of the likelihood function will be unchanged from LP 2003
- ▶ We have completely re-written the code which negotiates minimization of $-\log(L)$ by MINUIT
- ▶ We now properly handle situations where $L < 0$; the new fit procedure is more robust

confidence interval estimation

- ▶ last time we had trouble where some of the data was very unlikely, given our model
- ▶ $F_0 \in [0, 1]$, however in one case, our estimator \hat{F}_0 was well outside the defined range
- ▶ In Run I we had a situation where the estimator was in the defined range, but the 1σ interval was not
- ▶ We've adopted a policy which will avoid these problems and allow us to make coherent statements about the true values F_0 and F_R for all possible outcomes

the Feldman-Cousins method

- ▶ Where the likelihood-ratio fails to produce an interval within the defined range we will apply the Feldman-Cousins method
- ▶ By construction this method always produces intervals within the defined range
- ▶ We expect we'll use this to set an upper limit on F_R
- ▶ We already have code which calculates FC intervals given a parameterization of *a-priori* experimental sensitivity



Conclusions

- ▶ We're moving ahead and hope to stay on schedule for a February 5th. pre-blessing.
- ▶ Once all the templates are in hand estimates of systematic uncertainty should come quickly (we've done it once already).
- ▶ No central values 'till the pre-blessing
- ▶ Please visit the analysis web-page by clicking [here](#).