The Deuteron Tensor Structure Function b_1.

The proposed experiment uses a 5 Tesla solenoid field pointing along the beam axis to hold a tensor polarized, frozen, deuterated ammonia target. The inelastic scattered beam electrons are momentum analyzed and detected in the two spectrometers HMS and SHMS respectively. Cross section ratios are determined from data taking periods with and without the target deuterium being tensor polarized. Each separate data taking period covers a proposed time of about 12 hours.

Solid state polarized target operations have been successfully performed at Jlab in all three experimental Halls. The proposed target configuration in conjunction with the two spectrometers HMS and SHMS are well within the expertise of the collaboration, Hall C and Jlab. However the interpretation of the data based on the proposed number of data points and their uncertainty is rather marginal and a discrimination between different predictions as shown in figure 7 is very unlikely. To reach this level of interpretation based on the results more data points are needed with half the proposed error bars.
The current state of the art polarized deuteron targets reach 14% while the calcluations use a value of 20%. A significant increase in the FOM can potentially be achieved by a substantial improvement of the target polarization. Developments to reach routine tensor polarizations at the level of 30% are highly encouraged.

A major concern is the stability of the target thickness, packing fraction, and dilution factor over the time period of two times 12 hours as proposed for the two polarization states (tensor polarized and unpolarized.) The expected asymmetry (in fact a cross section difference!) is very small hence small variation in the target thickness can have a large impact on the result. In particular when the target material has to be annealed the temperature gradients can cause the ammonia beads to crack and rearrange in the target cell causing changes in the packing fraction and hence the target density as seen by the beam. Therefore it will probably not be possible to average over several unpolarized data taking periods, in particular if they are separated by a target annealing cycle.

A possible mitigation of some normalization issues may lay in the fact that the electron beam is polarized and the target can also have a substantial vector polarization while being tensor-polarized or tensor-unpolarized. Such data can be used to calculate a beam-spin cross-section difference based on equation 16 of the proposal between the two beam polarization states. The knowledge of P_z, P_B and A_1 would allow to monitor the unpolarized cross section within the time period of a single tensor polarization state. While an absolute measurement of the unpolarized cross-section in this way is likely not accurate enough, the relative determination may well be.