VFPS addendum

Impact of t and $x_{\mathbb{P}}$ resolution on VFPS physics program

During the meeting on 11/7/2000 regarding the VFPS proposal, R.Klanner submitted the following question to the VFPS group for futher clarification:

> *How does the $x_{\mathbb{P}}$ and t-resolution affect the VFPS physics program*

The $x_{\mathbb{P}}$ resolution

As stated in the VFPS proposal, the $x_{\mathbb{P}}$ measurement obtained with the VFPS detector alone has a resolution of about 8% and is quite independent of $x_{\mathbb{P}}$. This resolution is far better than the one obtained from the central H1 detector information which is 20%. Hence the VPFS physics program would only benefit from this improved resolution. The worst case scenario ($\sigma_{x_{\mathbb{P}}} \approx 20\%$) would coincide with the quality of the present H1 analysis as far as the $x_{\mathbb{P}}$ resolution is concerned with the addition that we can cross check the $x_{\mathbb{P}}$ reconstruction.

The t-resolution

As mentionned before the VFPS is optimised for acceptance, not particularly for resolution. Nevertheless, as stated in the proposal, it is possible to measure differentially in 3-4 bins in t. This moderate t-resolution could enable to answer some of the presently pressing questions as to what is the size of the interacting dipole in diffraction. The answer to this question would necessitate a discrimination between t-slope values of 4.5 and 7 GeV^{-2}. That this is perfectly whithin the reach

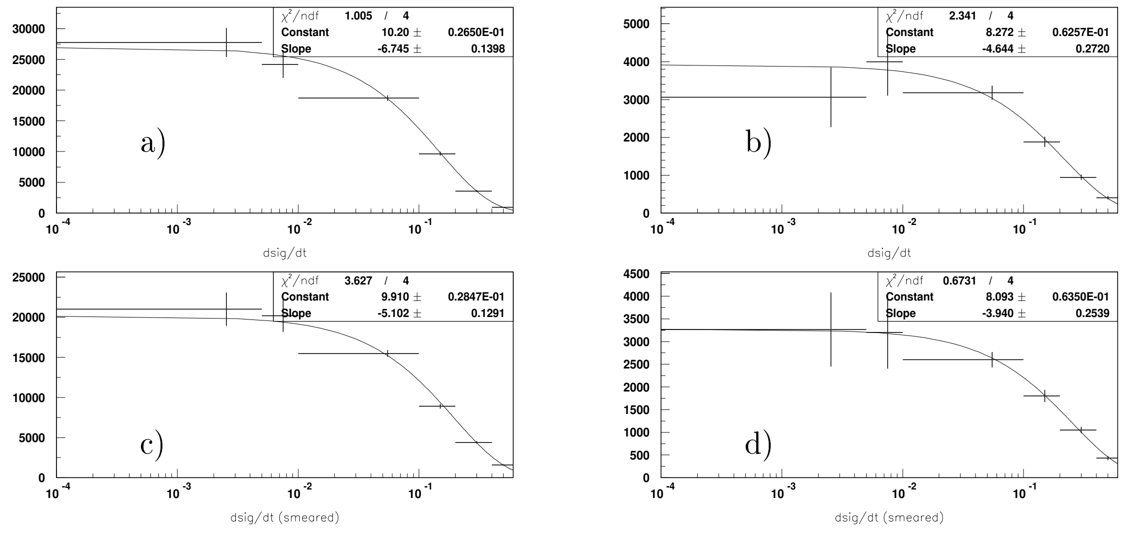

Figure 1: Generated and reconstructed t-distributions for 2 t-slope values 4.6 and 7 GeV^{-2}

of the VFPS program is shown by the plots in fig 1. Fig.1.a,b show for jet events the generated t-distributions with t-slopes of resp. 4.6 GeV^{-2} and 7 GeV^{-2}; fig.1.c,d show the reconstructed t-distributions. Slopes of 7 GeV^{-2} and 4.6 GeV^{-2} are reconstructed to values of 5.1 ± 0.13 GeV^{-2} resp. 3.9 ± 0.25 GeV^{-2}. Comparison of t-slopes between inclusive measurements and hard processes (charm, jets) will be extremely illuminating.

The t-resolution and diffraction dissociation

Although the t-resolution of the VFPS is smaller than the one from the LPS, we still wish to emphasize than this is not cutting down on the physics program if one takes into account the high statistics (compared to the LPS and FPS) and the high purity of the VFPS data (compared to the other diffraction measurements). These points are well illustrated in fig.2 showing the $F_2^{D(3)}$ measurements for a typical (β, Q^2) bin. The data points were derived from the 1994 H1 QCD fit with statistical errors scaled to 360 pb^{-1}, the expected integrated VFPS luminosity. The systematic errors on the data represented by the triangles result from the central detector systematics (energy calibration LAr, SPACAL..) only. In the systematics of the second data set represented by the dots, slightly displaced for visibility, are included the systematics of the present forward tagging detectors. They are clearly dominating the systematics everywhere. Tagging of the proton with the VFPS will hence result in a he dramatic reduction of the systematics and vastly improve the measurements. In addition, the current assumption that proton dissociation background is uniformly distributed in kinematical variables which is highly questionable and challenged by available data is by the same token also removed.

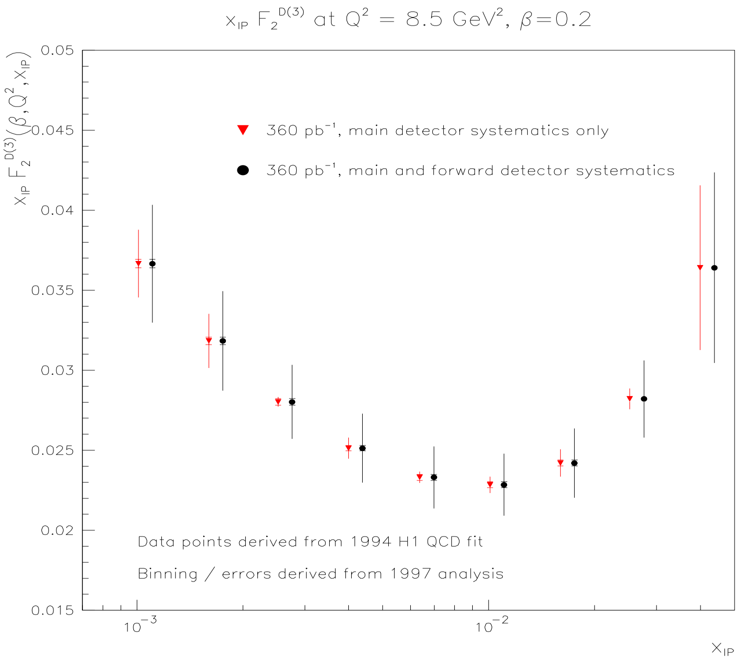

Figure 2: $F_2^{D(3)}$ mesurements derived from the 1994 H1 QCD fit with statistical errors scaled to 360 pb^{-1}. The data points are shown with two different sets of systematics: intrinsic detector systematics only (triangles) and intrinsic detector systematics plus systematics due to the present forward detectors.