1. INTRODUCTION

The *Far Ultraviolet Spectroscopic Explorer* (*FUSE*) was launched into a 768 km low earth orbit on June 24, 1999. After an initial period of on-orbit guidance tests, the two far ultraviolet detectors were powered on in August, 1999, and several months of In Orbit Checkout and Science Verification activities began. This included investigations of the instrument performance, and preliminary instrument characterization. Although a transition to normal science operations was made in late 1999, characterization activity will continue throughout the three year mission at a continually decreasing frequency. Results from these early investigations show that the satellite is generally performing well; most measures show that the performance is at or near preflight predictions. This paper will briefly describe the design of FUSE, and present the results of on-orbit performance tests, as of March, 2000.

FUSE was designed to obtain high resolution, far ultraviolet spectra of faint astronomical objects in the 905 - 1187 Å wavelength range. This mission, built as part of the NASA *Origins* program, will address many important astrophysical problems, including the measurement of the deuterium to hydrogen ratio, the distribution of hot gas in the Galaxy, and the properties of molecular hydrogen in interstellar clouds. *FUSE* is the first long-duration mission to obtain high resolution spectra in this wavelength region since *Copernicus* in the 1970s. Since that time, important advances have been made in mirror coating technology and in the development of large format detectors with low background. These and other improvements allow *FUSE* to make significant performance gains over *Copernicus*. An overview of the mission and its scientific objectives has been given by Moos et al.[1]

2. DESIGN AND IMPLEMENTATION

The FUSE instrument (**Figure 1**) consists of four coaligned optical channels. Each channel is made up of an off-axis parabolic primary mirror, a focal plane assembly (FPA) containing four spectrograph entrance apertures, a large, holographically-ruled, aberration-corrected spherical grating with a high groove density, and half of a double delay line microchannel plate detector. The gratings and mirrors of two of the channels are coated with silicon carbide (SiC), which provides an approximately constant reflectivity across the entire FUSE bandpass, while the remaining two are coated with lithium fluoride (LiF) over aluminum, in order to maximize the instrument throughput above ~1000 Å. This design limits the number of reflections in each channel to two, which is important in the ultraviolet where reflectivities are typically poor. In addition, the multiple channel design ensures that nearly the entire wavelength range is covered by multiple channels. This redundancy was included to ensure that a partial failure did not compromise the wavelength coverage, while simultaneously maximizing the effective area from ~1000 to 1100 Å, where all four channels overlap in wavelength coverage. Details of its design and the predicted performance based on preflight measurements have been given previously[2,3].

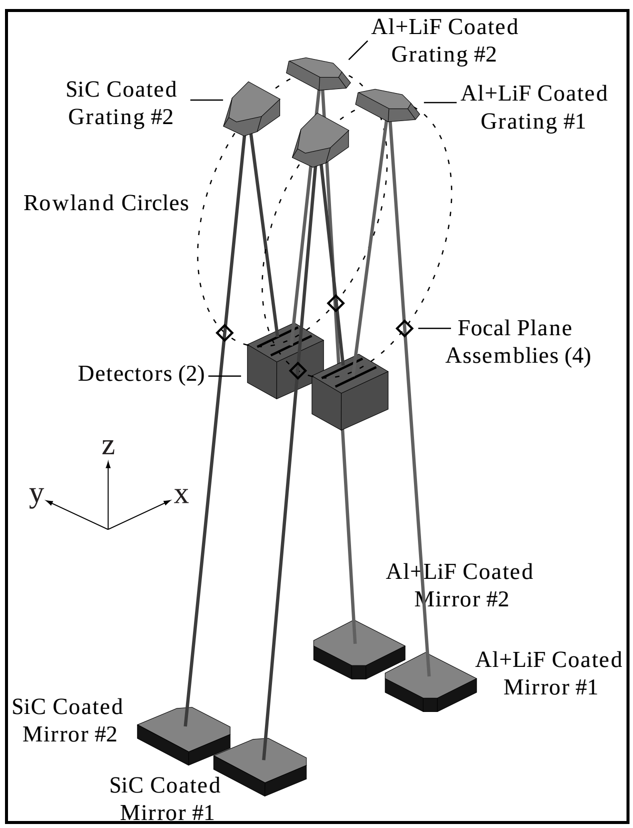

Figure 1 A schematic view of the FUSE optical system.

The optical design is identical for the two LiF channels; the wavelength coverage differs only because the two detectors are slightly shifted with respect to each other along the Rowland circle. This offset allows gaps in the wavelength coverage due to spaces between the detector segments to fall at different wavelengths on the two channels. The two SiC channel designs are also identical. The SiC and LiF channels have slightly different dispersions (averaging 1.03 Å/mm and 1.12 Å/mm respectively). The optical design leads to different two dimensional point spread functions between the SiC and LiF channels[4]. The astigmatic heights of the spectra (and consequently the resolution) vary between ~200 µm and ~1200 µm across the FUSE spectral band. Also, because of differences in the alignment of identically-designed channels, the focus can be slightly