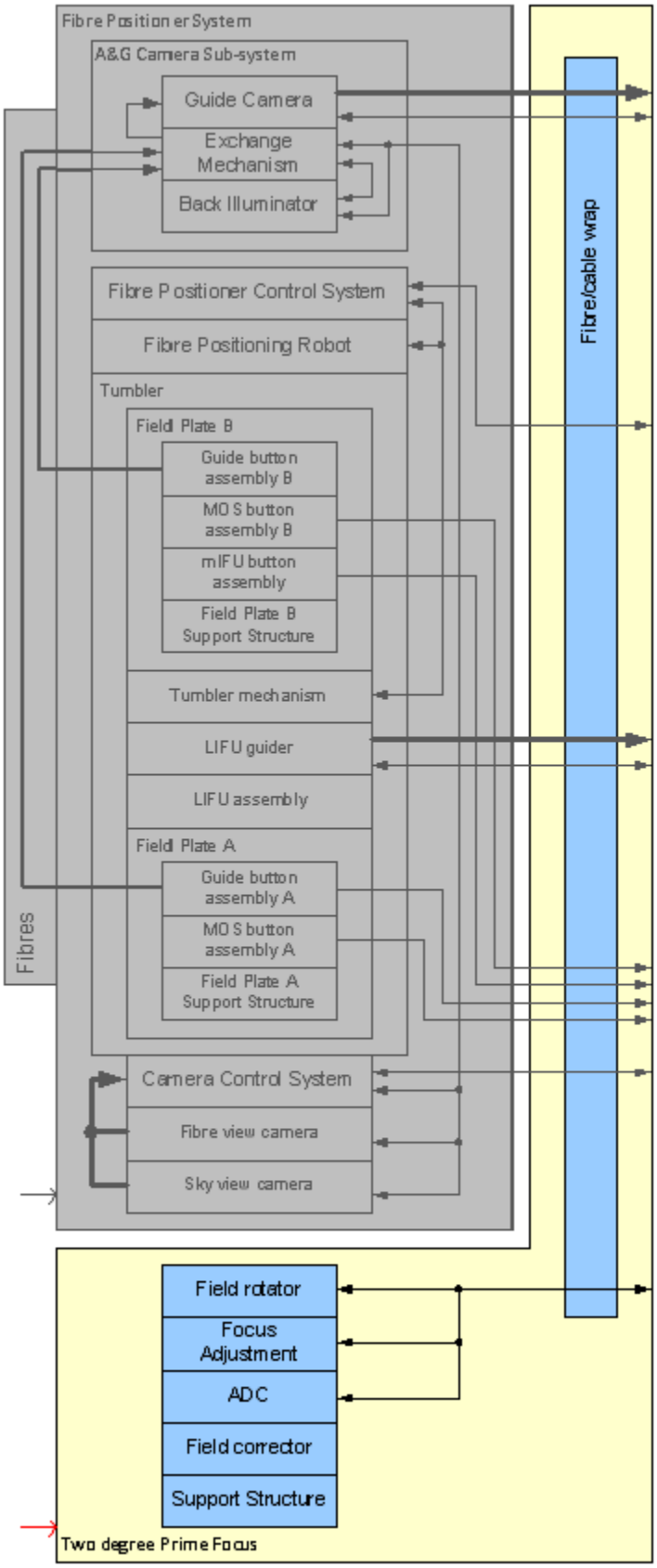
WEAVE: Prime Focus Corrector System (Public)

WEAVE

Prime Focus Corrector System

The following image shows an extract from the WEAVE instrument block diagram which depicts the sub-assemblies (blue) that constitute the Two-degree Prime Focus system (yellow). These sub-assemblies will be delivered as part of this system however the control aspects of the moving mechanisms are described in WEAVE Observatory Control System.

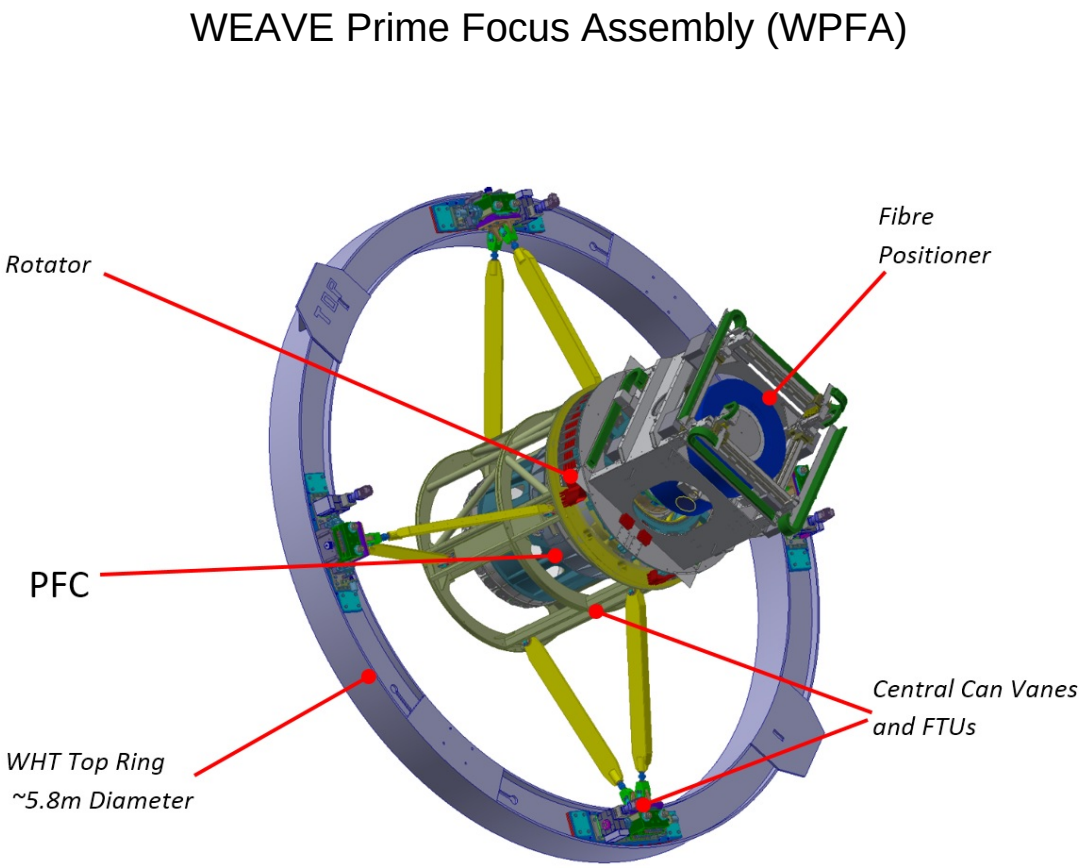


The Two-degree Prime Focus system (PRI) is composed of:

- Two corrector lenses
- Four lenses which constitute the Atmospheric Dispersion Corrector (ADC)

- The corrector housing
- A "Central Can"
- The rotator
- The cable wrap subsystem
- Eight telescope vanes
- The Focus Translation System (FTS)

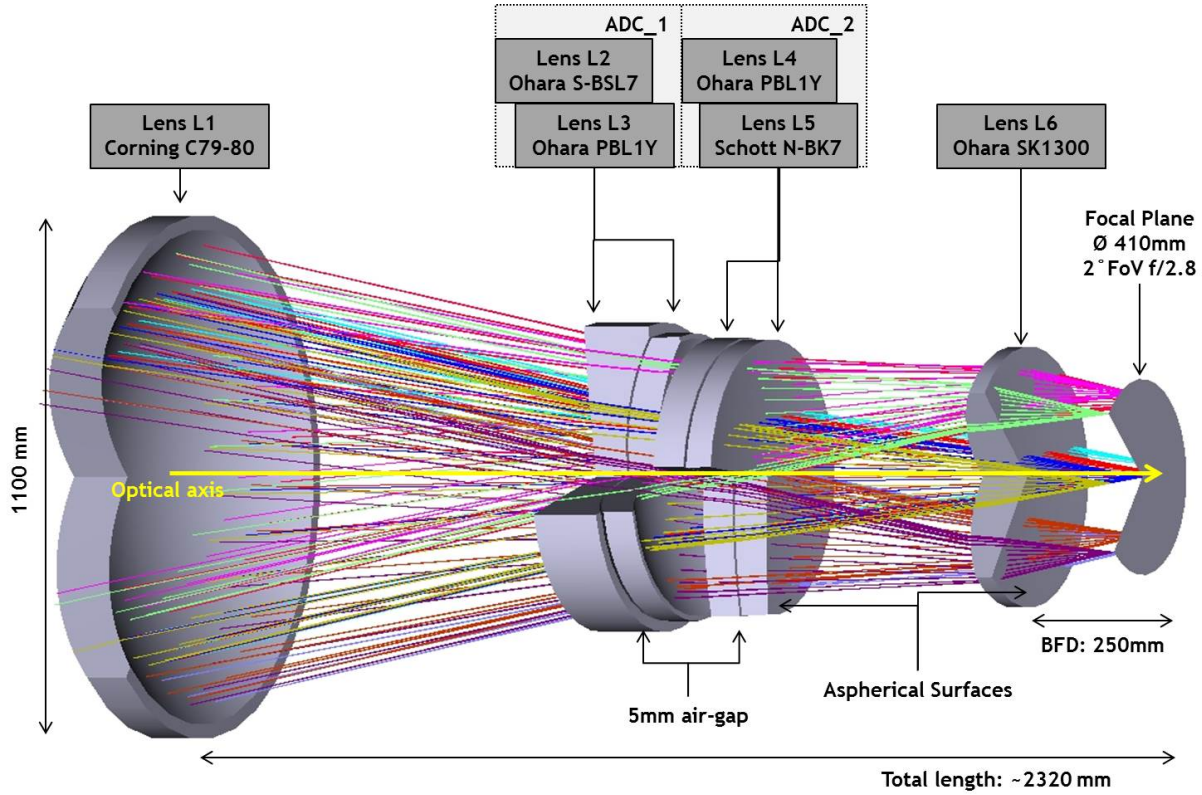
The following pictures represents the system. The Fibre Positioner which is for completeness does not form part of this system.



The optical system for the WEAVE Prime Focus Corrector is composed of six lenses made of different materials with specific characteristics.

The purpose of the WEAVE Prime Focus Corrector (PFC) is to correct for the (geometrical) optical aberrations in the two-degree field-of-view (WHT's primary mirror is parabolic). It also comprises an Atmospheric Dispersion Corrector (ADC), performed by two pairs of counter-rotating air-separated doublets, to compensate for atmospheric dispersion (chromatism) whilst the telescope is moving in elevation.

The optical layout for the PFC design is shown below:



The characteristics of the optical design are:

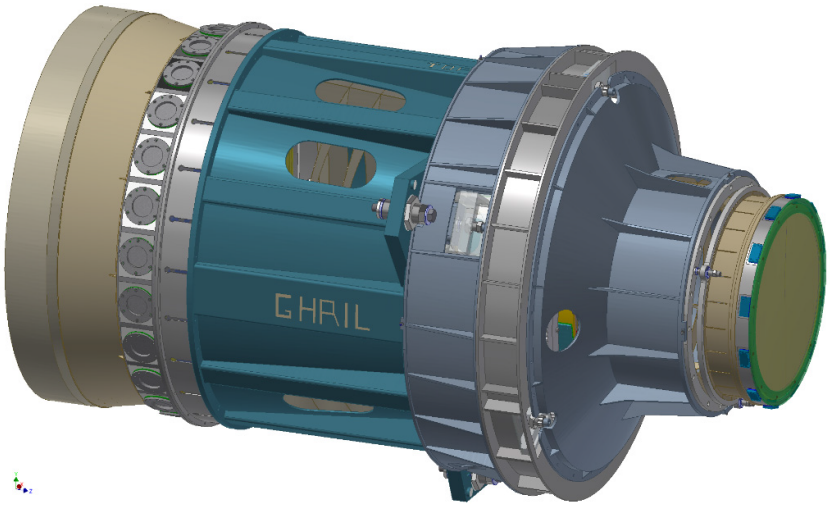
- Field-of-view: 2 degree diameter (410mm diameter)
- Beam aperture: f/2.5 input - f/2.8 output
- Plate scale: 56.4 um/arcsec
- Non-telecentricity: 4 degrees at 1deg field-of-view
- Vignetting: 3% at 1deg field-of-view
- Throughput ~80% (L1 not coated)
- Distortion: 1.5% at 1deg field-of-view
- Star drift: 7.5um (in the direction of telescope elevation)
- Worst ghost focus: located at 10mm from the focal plane

The performance of the optical design is such that 80% of the energy is encircled within 1” or 56um (~50% contribution from the optical design & ~50% contribution from the manufacturing tolerances).

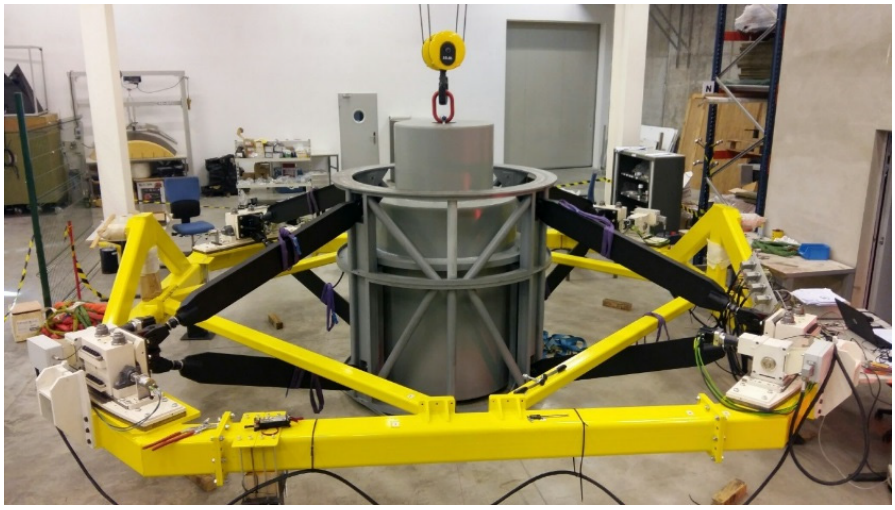
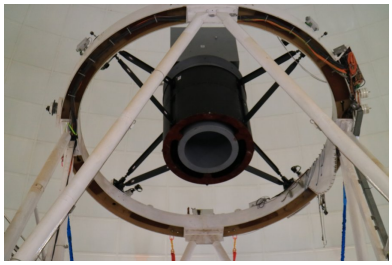
This image quality is met for these conditions, simultaneously:

- Range of telescope elevation angles: from zenith to 25 degrees
- Range of wavelengths: from 370nm to 1000nm
- Range of temperatures: from -5degC to +25degC

A model of the proposed PFC is shown beneath. The six lenses are held within this structure which has a physical interface with the Central Can.



The Central Can (already manufactured) is attached to the vanes which are attached to the Focus Translation System. In this photo the dummy PFC is inserted into the Central Can.



In June 2017, the Focus Translation System with the dummy corrector, dummy Fibre Positioner and the dummy rotator were mounted to the WHT for the first time.