Optical Design support for HARMONI VIS and NIR Spectrograph Cameras

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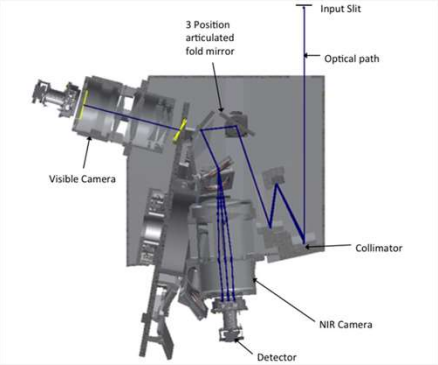


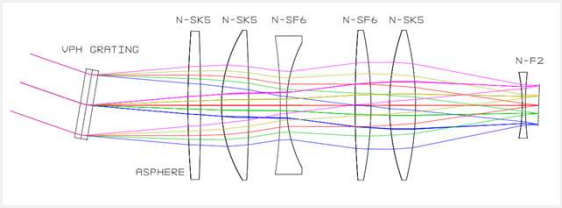
VOLUME ≈ 2m3

The Harmoni instrument is the ELT first-light near-infrared and visible integral field spectrograph. It is required to operate in cryogenic environmental conditions (130 K, <0.001 mbar), with strict mechanical requirements for space budget considerations. Based on initial designs from David Freeman and RAL Space, ASE Optics has worked on further development of the optical design of the spectrograph cameras with special emphasis in optical quality, ghost analysis, tolerancing and manufacturability.

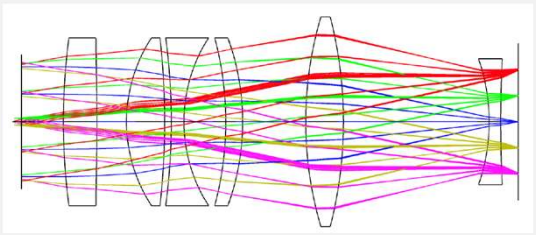
The system has 11 grating configurations (VIS + 10 NIR), with high transmission requirements of over 90% (NIR) and 95% (VIS) that limit the number of lenses to a maximum of 6.. Strict image quality requirements apply for several pupil sizes (circular and elliptical) on the order of 250 nm for a 73 mm circular pupil to 30 nm for a 13 x 16 elliptical pupil. Additionally, distortion and lateral colour must be minimized along the spatial axis of the spectrograph to ensure the image falls within the sensor and spatial information as a function of wavelength is maintained.

VIS Camera

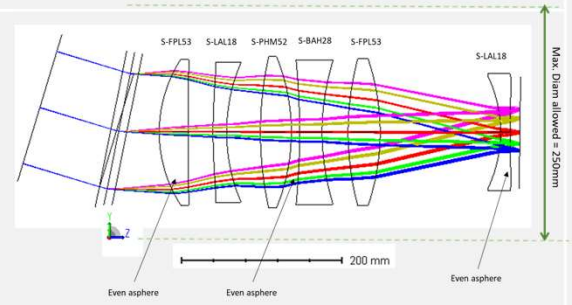
Phase A



PDR

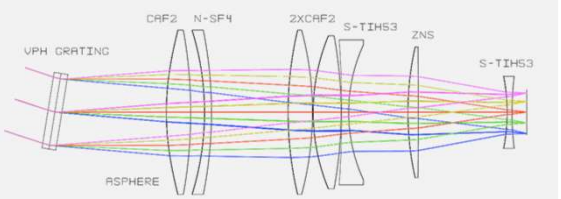


CDR



NIR Camera

Phase A



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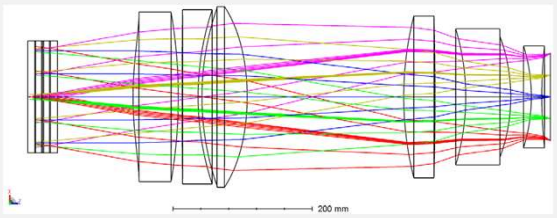

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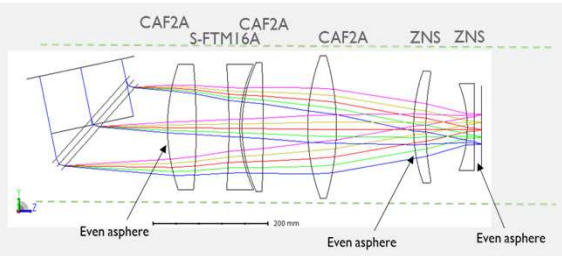

Conclusions

The driving factors of the design are tight transmission, lateral colour and image quality (WFE) requirements. The manufacturability of the lenses was also a problematic issue due to their large size, with limited availability of blanks of the required sizes poses an additional challenge.