

Development of an mid-infrared integrated optics 4-telescope beam combiner for the Hi-5 instrument

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Nulling interferometry is one of the most promising techniques to detect and directly image exoplanets within the habitable zone and look for bio-signatures, which would profoundly impact our understanding of the Universe and how solar systems form. The progress towards the development of an integrated optic mid-infrared (3.5-4.0 μm) 4-telescope beam combiner for the proposed Hi-5 instrument[1] at the VLT array in Paranal, Chile is reported. The beam combiner is based on the ‘‘Double Bracewell’’ architecture to perform nulling interferometry [2]. Ultrafast laser inscription is used to create low-loss single-mode waveguide in mid-infrared transparent chalcogenide glass [3]. A schematic of the beam combiner is shown in Fig.1. The design and fabrication parameters of the Y-junctions and directional couplers are being optimised to achieve achromatic behaviour and high interferometric contrast.

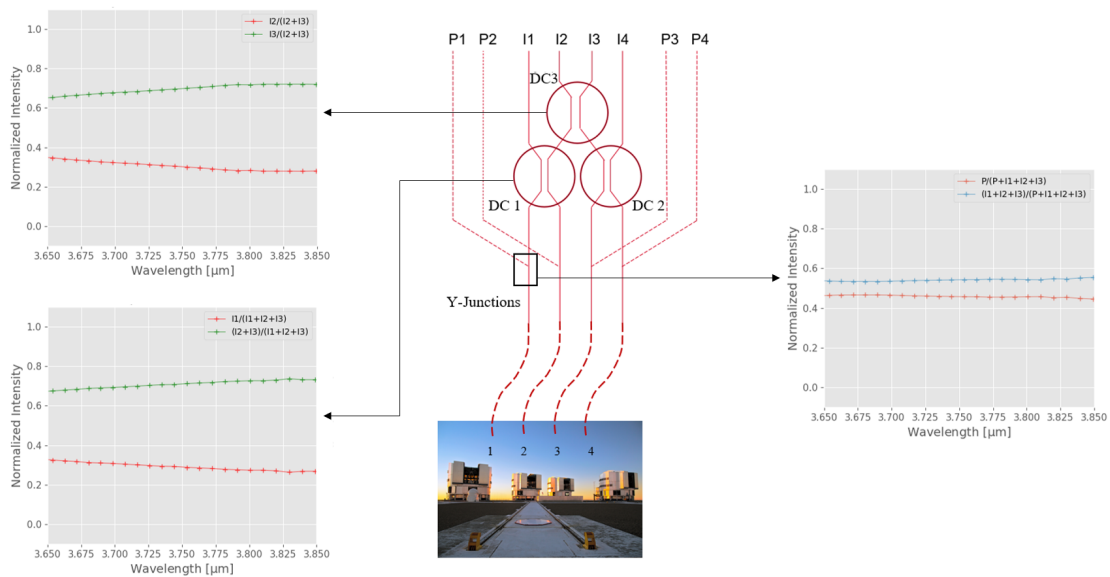


Figure 1: (right) Schematic of the beam combiner. The four inputs are followed by Y-junctions for photometry and 3 cascaded directional couplers. (left) Wavelength-dependent splitting ratios of a prototype chip showing little chromaticity.

[1] D. Defrère et al., *Experimental Astronomy* **46**, 475 (2018).

[2] R. N. Bracewell, *Nature* **274**, 780 (1978).

[3] T. Gretzinger et al., *Optics Express* **27**, 8626 (2019).