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Optical Design of the DIVA Interferometer and design implementations for GAIA

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DSS have been performed under a contract by the Landessternwarte Heidelberg (LSW in the following) (LSW-DIVA01) [1] the optics concept definition for DIVA (Deutsches Interferometer für Vielkanalphotometrie und Astrometrie) in close cooperation with the Astronomisches Recheninstitut Heidelberg (ARI) concluded in June 1997. This paper concludes the DSS activities on this topic which in fact represent a concerted design optimization of the DIVA optics with both above quoted institutions.

The main objectives of this work were the review of a pre-defined concept (by LSW and ARI) [1] as a derivative of a revised optical concept for the ESA GAIA mission (Global Astrometric Interferometer for Astrophysics) [2] in terms of technical feasibility for DIVA and GAIA, to identify alternative solutions, their feasibility and extensions to GAIA.

Several different optical designs for the DIVA Interferometer have been investigated in this study, and been examined by their optical performance and technical feasibility.

Starting point for the study was a pre-design by the customer described in [1] for a dual beam Fizeau-Interferometer for a simultaneous observation of two sky sections with a single aperture of 50 x 50 mm and a base length of 100 mm. The demands for this study were the proof of this design with respect to the technical feasibility, the optical performance and the possibilities for a scaling of this system to the dimensions of GAIA (Global Astrometric Interferometer for Astrophysics).

The critical design review of the given pre-design [1] revealed that the proposed off-axis aspheric folding mirrors are technical extremely critical and w.r.t. to their alignment hardly feasible with the current optical manufacturing techniques for the large GAIA dimensions.

The paper summarizes the trades and results of the DIVA instrument optical design study, presenting different Fizeau interferometer designs and the selection result. All herewith shown optical designs are feasible with low technical risk, and adequate optical performance. Furthermore, the selected baseline design is scalable to the dimensions of GAIA [2], and some modifications (quadruple and light-weighted interferometer concepts) of the DIVA design in response to the extremely demanding astrometric resolution and accuracy for the GAIA instrument will be presented.