DIRECT DETECTION OF EXOPLANETS USING TUNABLE KERNEL-NULLING

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In a nutshell

This thesis aim to enhance nulling interferometry for exoplanet detection using a four-telescope architecture named Kernel-Nuller. By integrating 14 active phase shifters, it aims to mitigate phase aberrations caused by manufacturing defects. An algorithm is developed to optimize device performance, validated through simulations and lab experiments. A second phase consist in analyzing intensity distributions produced by Kernel-Nuller and applying statistical tests and machine learning to extract science information. This poster present the preliminary results.

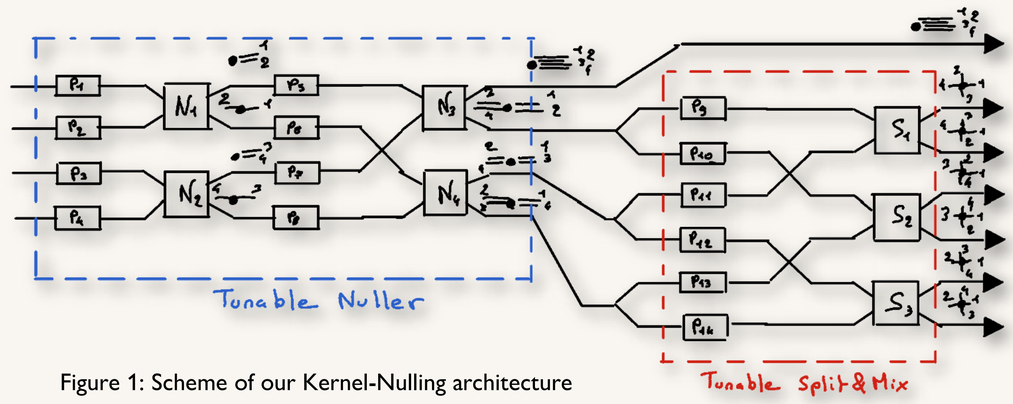


Figure 1: Scheme of our Kernel-Nulling architecture

Nulling interferometry

On the VLTI

Blablabla

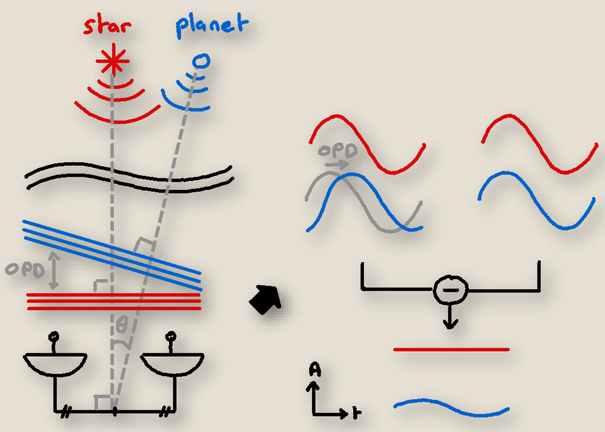
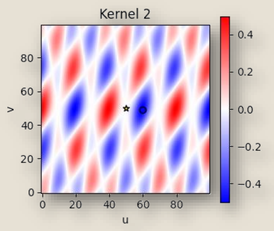


Figure 2: Concept of nulling interferometry



Thermo-optic phase shifter

- Wavelenght : $1.65 \mu m$
- Response time: $< 1\ ms$

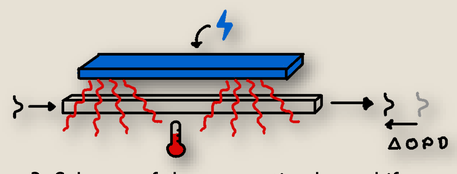


Figure 3: Scheme of thermo-optic phase shifter

Active optical components

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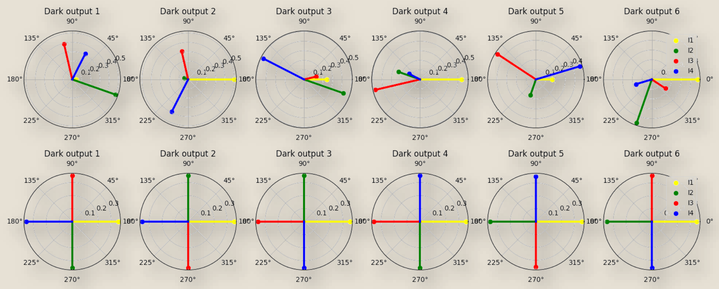
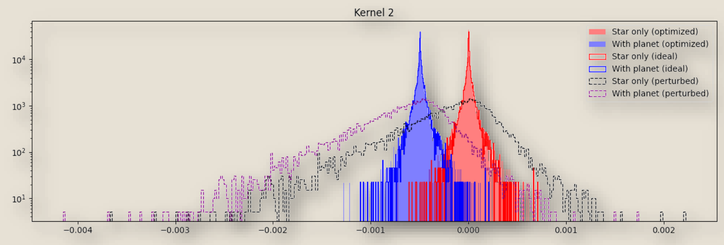
Calibration algorithme

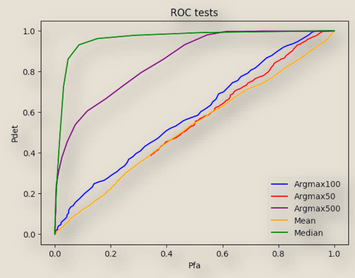
- Method
- Metrics
- Convergence speed
- Limitations

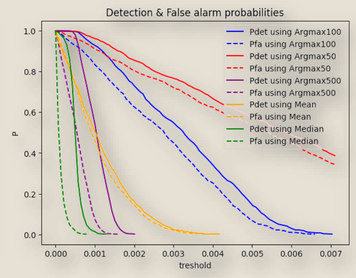


Statistical analysis

- Kernel outputs
- Distributions
- Estimation of the true value







Discussions & prospects

- Angular diversity
- Test in lab
- Usage of physics based MMI models
- Implementation on the VLTI

References

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