

# Fast laser field reconstruction method based on a Gerchberg-Saxton algorithm with modes decomposition

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Numerical simulations of laser-plasma acceleration in the non-linear regime require an accurate modelling of the laser driving the plasma waves. To reconstruct the transverse laser field distribution from fluence measurements, a fast and flexible field reconstruction method based on the Gerchberg-Saxton Algorithm with Hermite-Gauss Modes Decomposition (GSA-MD) has been developed [2].

The minimisation of the reconstruction error via tuning of the Hermite-Gauss modes origins is used to improve the accuracy of the GSA-MD.

This algorithm was used to reconstruct the asymmetries of the energy distribution in the focal volume [1,2,3] from fluence images collected during two experimental campaigns at the APOLLON and Lund Laser Centre facilities.

It will be shown how using the GSA-MD-reconstructed laser field as input for quasi-cylindrical PIC simulations allowed to obtain a better agreement with experimental results compared to using an ideal laser field [1,3]. This led to a better understanding of the effects of laser asymmetries on the quality of the output electrons bunch in the injector stage.

## References

- [1] *I. Moulanier et al., Physics of Plasmas 30, 053109 (2023)*
- [2] *I. Moulanier et al., Submitted paper to JOSA B (2023)*
- [3] *L. T. Dickson et al., Physical Review Accelerators and Beams 25, 101301 (2022)*

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