WFS control using pixels in the science detector image

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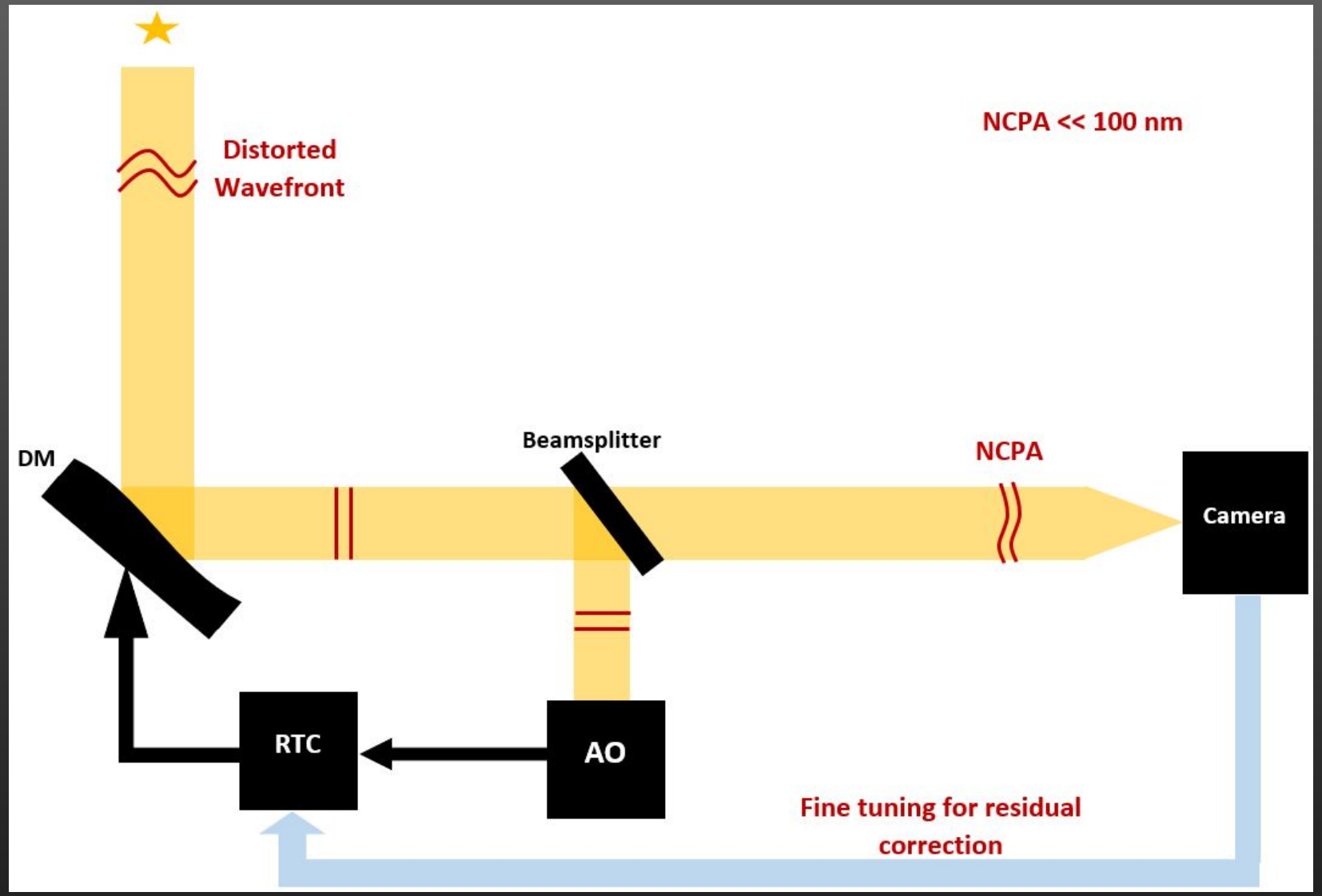
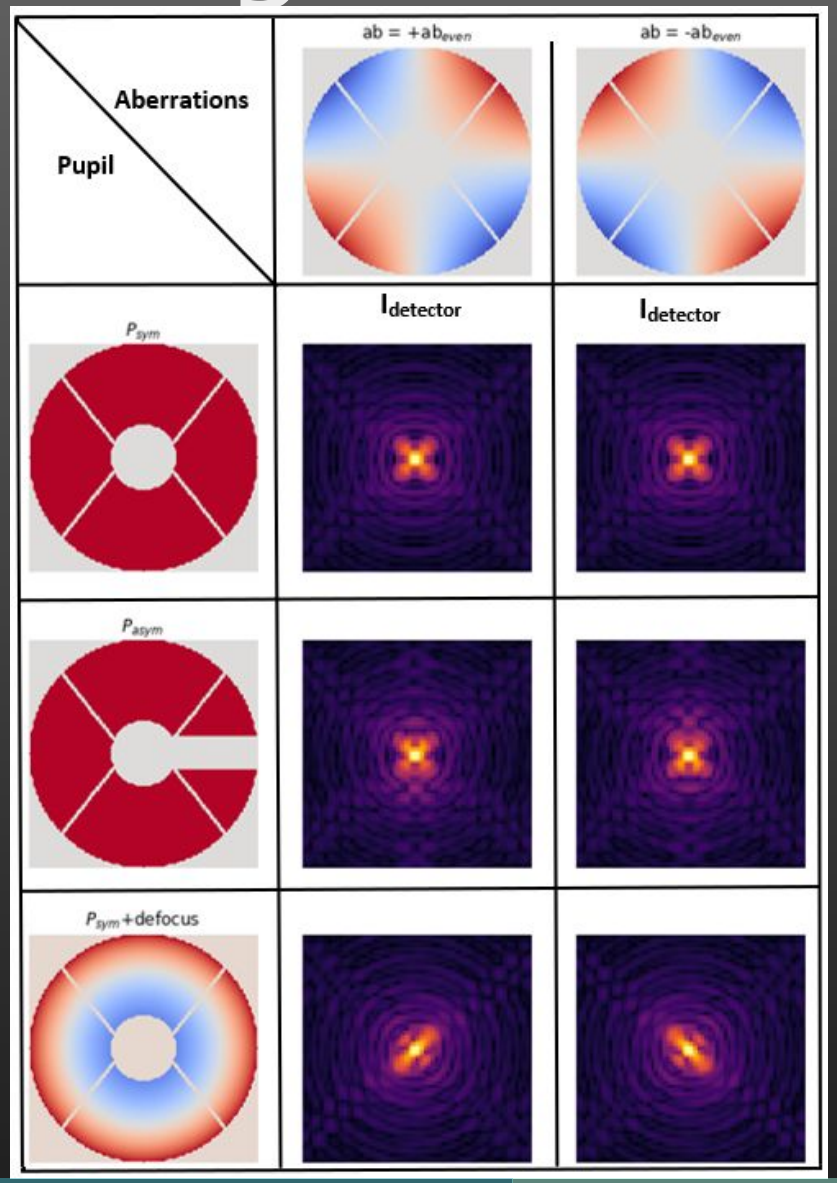
Introduction



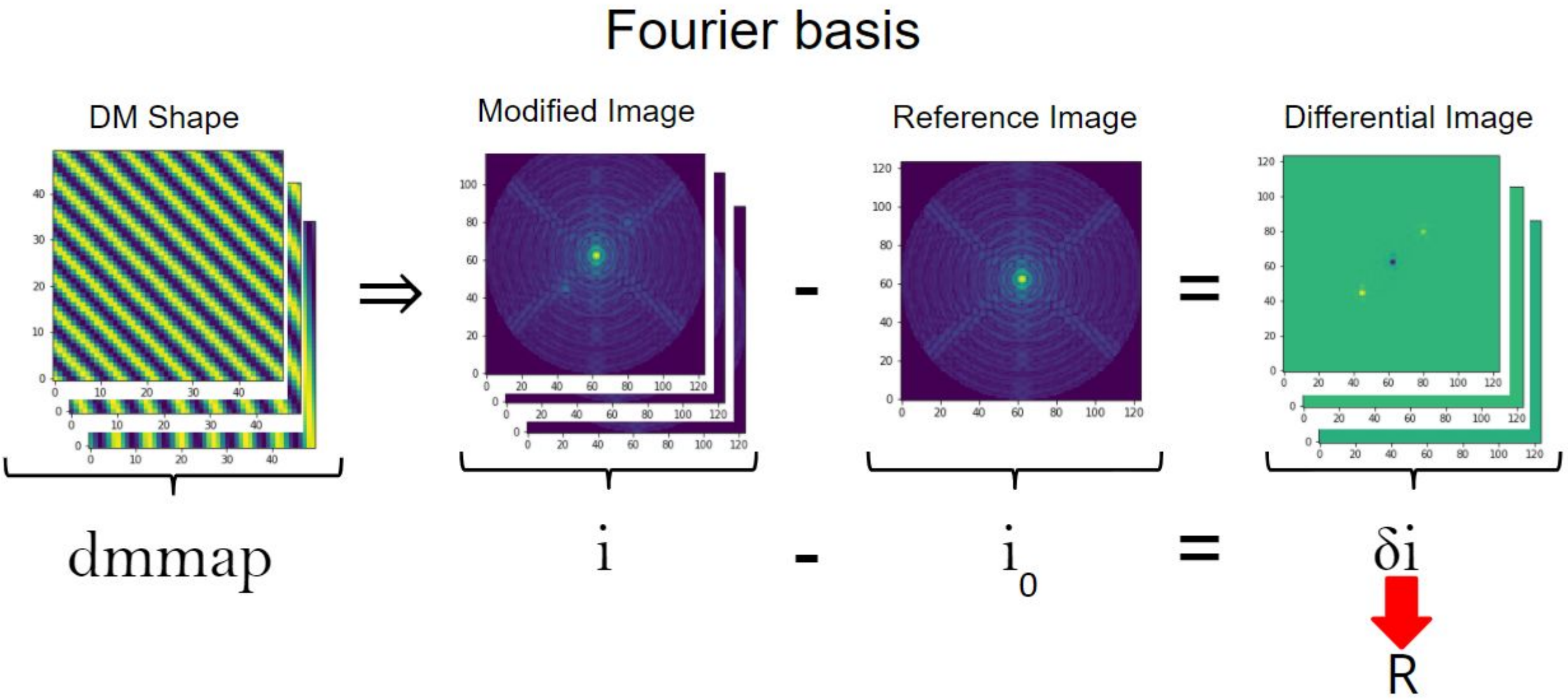
Use an image as a WFS



→ Degenerate image : non simple solution

Degeneracy lifted by asymmetry or additional defocus

Build a response matrix R

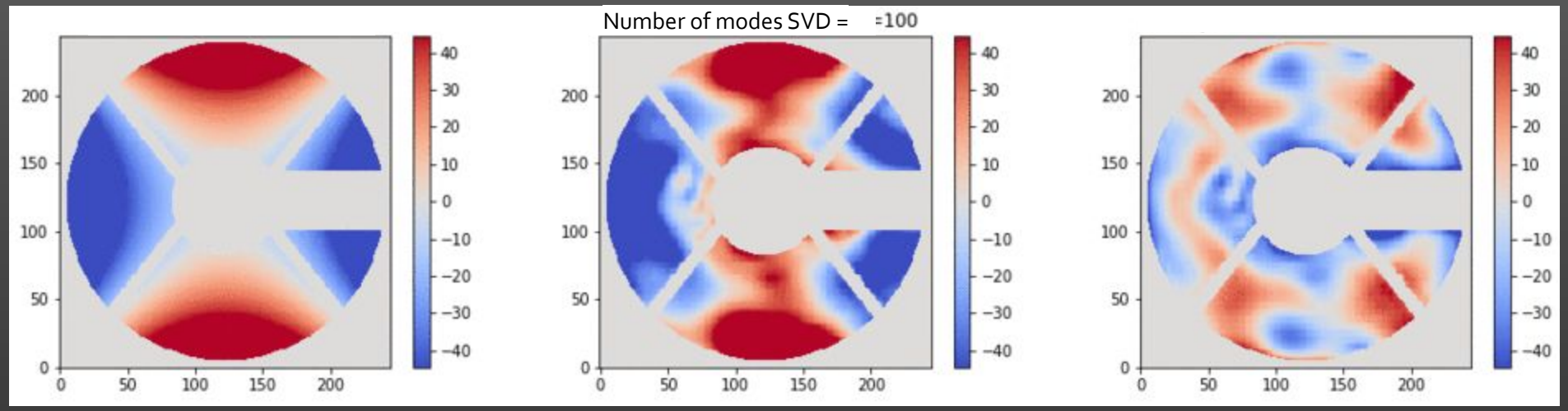


Examples of reconstruction

Input aberration

Reconstructed wavefront

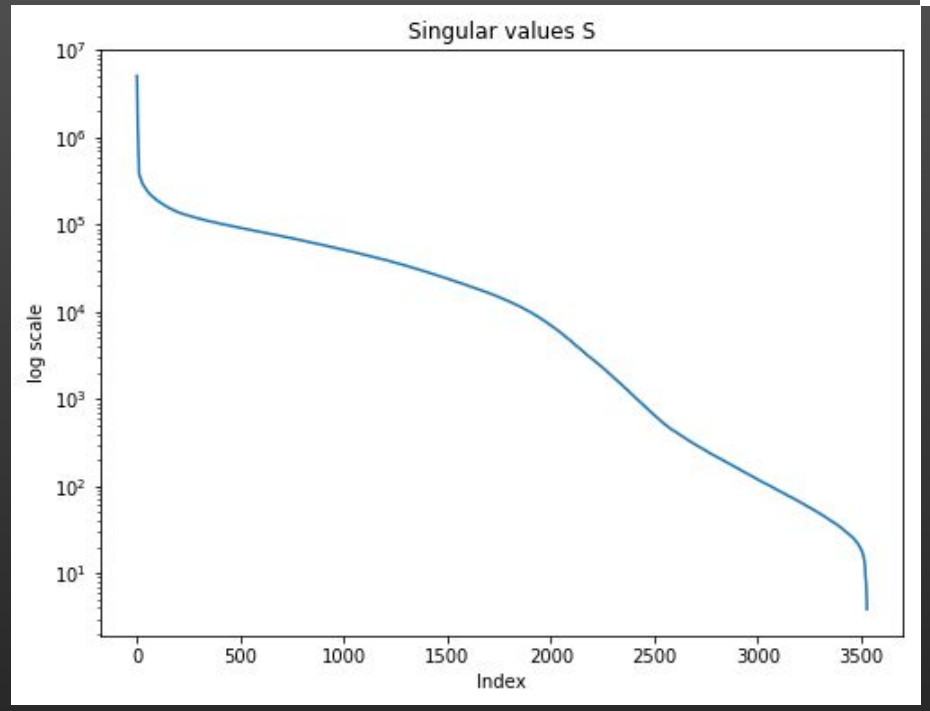
Residual error



Invert the response matrix

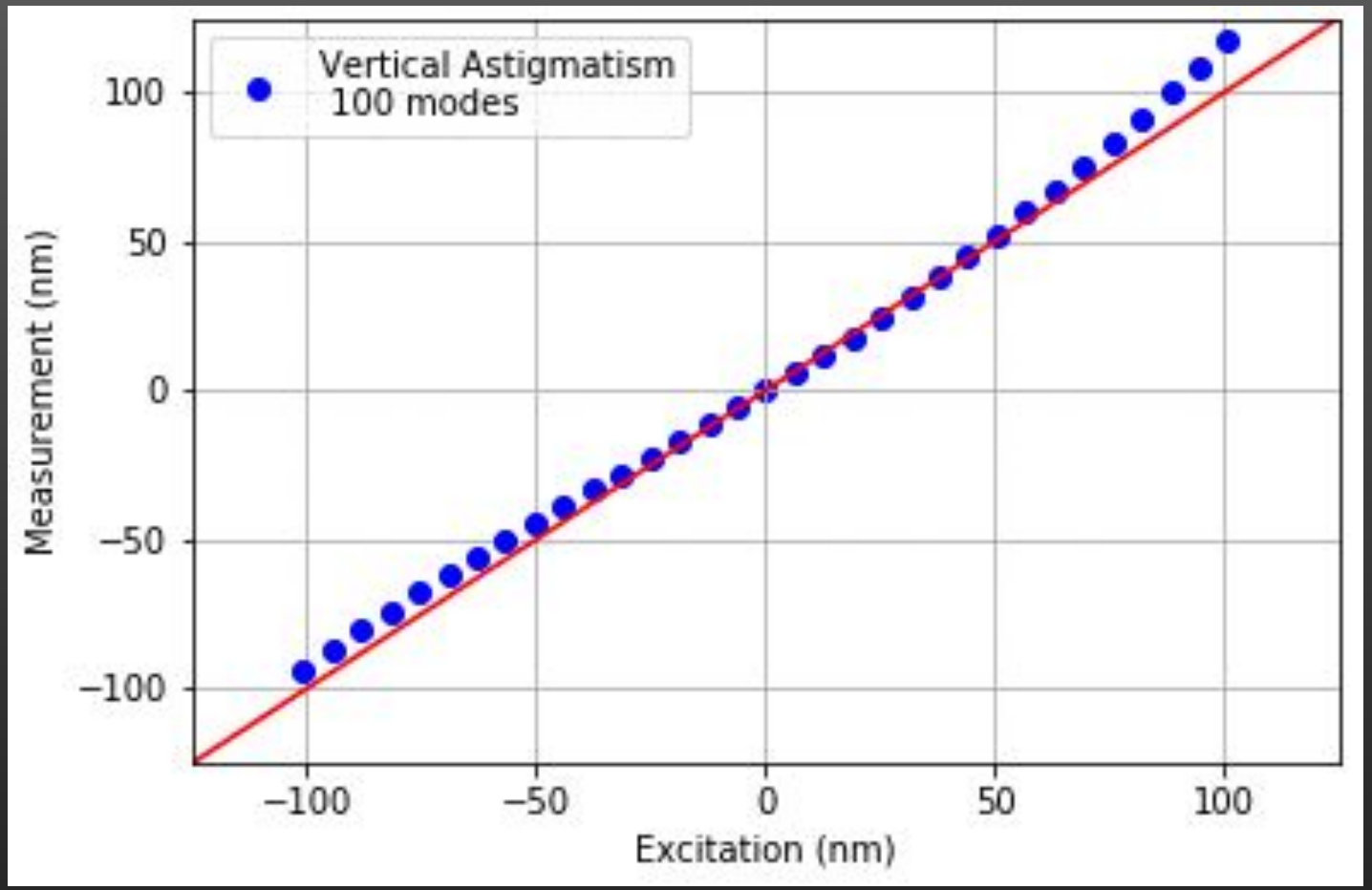
BUT R is not square SVD:

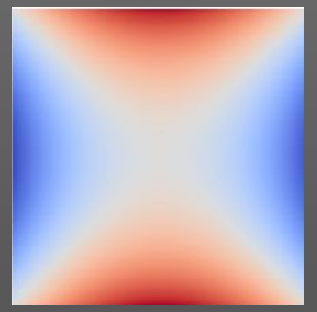
$$\mathbf{R} = \mathbf{U} \cdot \mathbf{S} \cdot \mathbf{V}^{\mathbf{T}}$$



 How many modes should we keep?

Simulation results





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Vertical astigmatism

Asym. Pupil

- Usable for a wide range of aberration
- Linearity domain between -50 to +50 nm
- Reconstruction fidelity= f(number of modes)
- Ongoing sensitivity study