

# Spiders – Some Intermediate Results and Outlook

....i.e. what we tried but didn't finish and what we wanted to  
do but didn't start...

# Acknowledgements

---

- ▶ MPIA Heidelberg: M. Feldt, S. Hippler, F. Cantalloube, T. Bertram, ...
- ▶ University Leiden/NOVA: R. Stuik
- ▶ ESO Garching: M. LeLouarn
- ▶ LAM Marseille: C. Correia, C. Bond
- ▶ JKU Linz: R. Ramlau, I. Shatokhina, V. Hutterer, S. Raffetseder, G. Auzinger, ...



# Content

---

- ▶ Challenges
- ▶ What I announced to talk about (abstract)
- ▶ Reconstruction Methods – (incomplete) Overview
- ▶ The Mickey Mouse again
  - ▶ Unseen modes
  - ▶ Using statistical regularization
  - ▶ Using measurement extension methods
- ▶ NCPAs and Tomography
- ▶ Outlook
  - ▶ A Piston Reconstructor for the segmented Pyramid
  - ▶ Linearizing the Pyramid WFS model „around“ the NCPA (instead of zero)

# Challenges

---

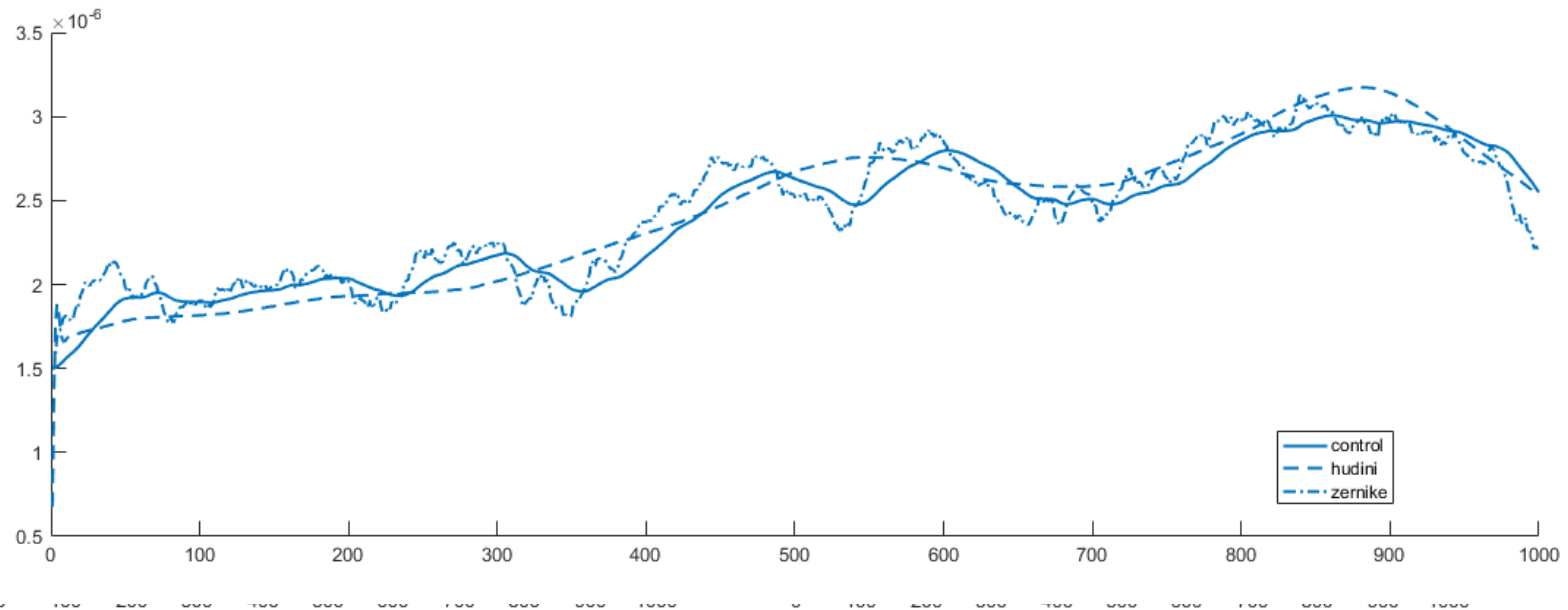
- ▶ **More obstructed subapertures**
  - ▶ Segmentation
  - ▶ Less information (WFS data)
- ▶ **Unseen modes (?), LWVE – formerly known as**
  - ▶ It **MUST** be a problem, it has a serious name now
- ▶ **Fancy DM – the „real-life“ M4**
- ▶ **NCPAs (stability w.r.t. increasing NCPAs)**
- ▶ **Tomography (Poster Raffetseder)**



# Abstract – what I was supposed to tell

---

- ▶ About the SH and segments
  - ▶ A lot of methods, all of them working (they do/ they don't)
- ▶ Using Zernikes to estimate the piston



# Reconstruction Methods

---

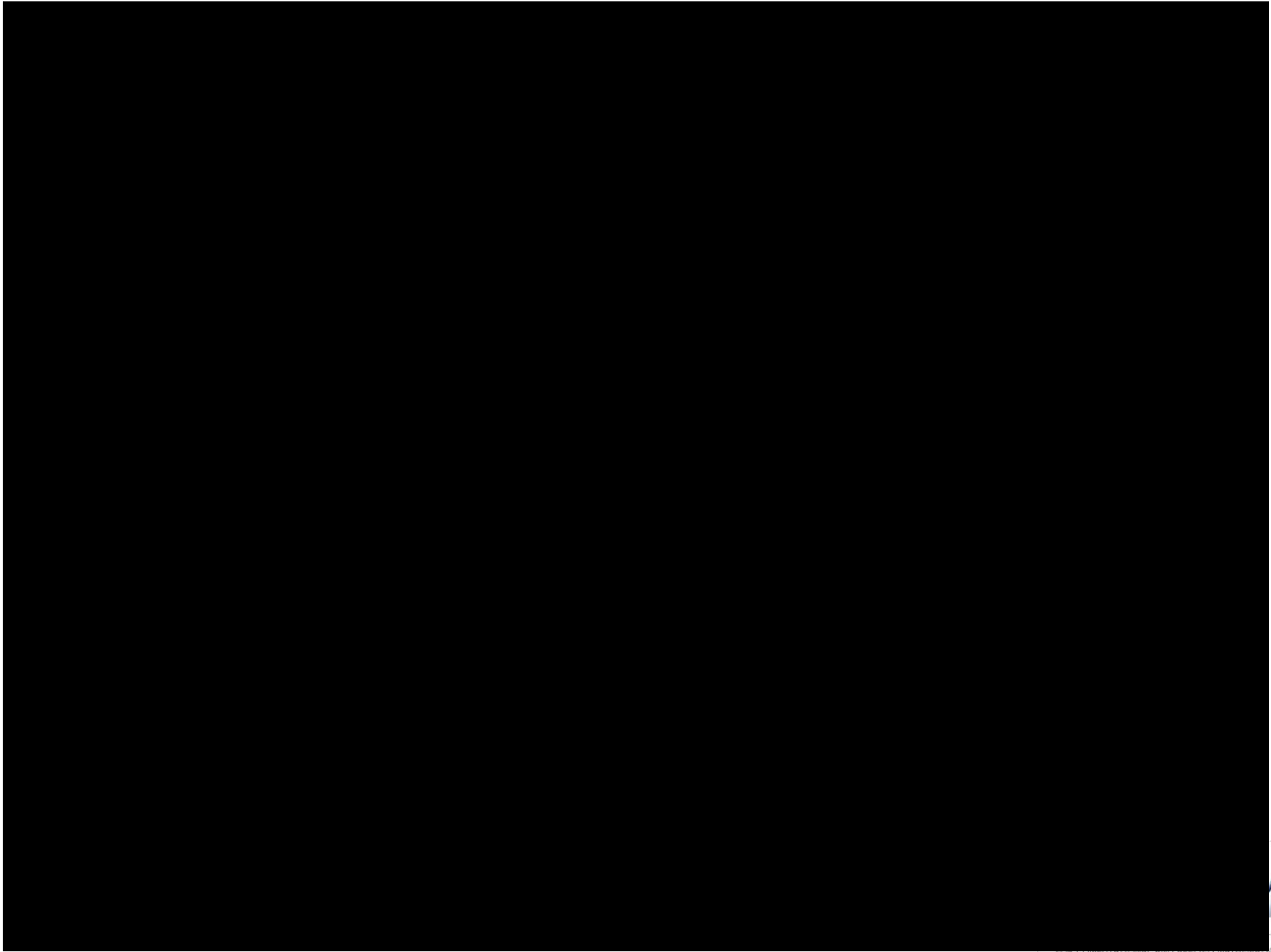
- ▶ **MVM**
  - ▶ Poke-Matrix Inversion
  - ▶ Modal/Zonal/any other basis + projection on DM
- ▶ (P)-CuReD + do some with the segment piston
- ▶ FEWHA / FrIM
- ▶ CLIF/PFTR
- ▶ PKI, SVTR → New developments by V. Hutterer



# On the Low-Wind-Effect (local piston)

---

- ▶ **Statistical regularization**
  - ▶ Minimize the jumps between the segments
  - ▶ Use e.g. boundary integrals
  - ▶ „Successfully“ used for the SH-WFS
- ▶ **Measurements extension**
  - ▶ Same as for regularization...has some drawbacks
  - ▶ Interpolation vs. Damped Interpolation vs. clever
- ▶ **SH-WFS vs Pyramid WFS**
  - ▶ Modulated P-WFS is the new baseline for METIS
- ▶ **Yeah! A movie (all credits to S. Hippler)**





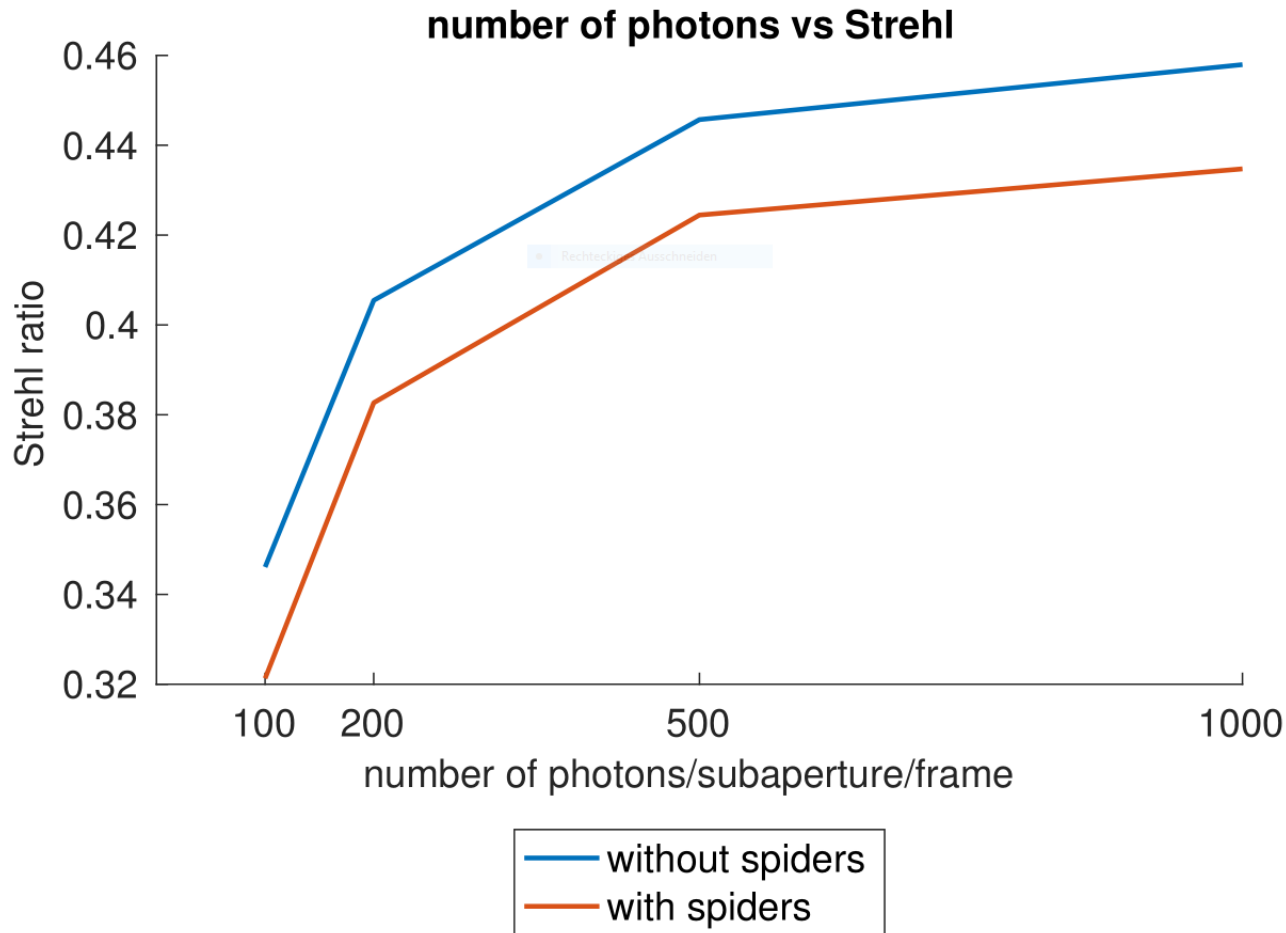
# Intermediate Conclusions

---

- ▶ Local/Segment piston is „seen“ by the Pyramid
- ▶ Poke Matrix Inversion does the job for -some- cases
- ▶ Merge with the experience from the SH simuls....
  
- ▶ Split reconstruction approach:
  - ▶ MVM for the lokal piston only
  - ▶ P-CuReD for the rest
  - ▶ No, neither implemented nor tested yet
  - ▶ No, success is not guaranteed
  - ▶ Yes, we are optimistic, we always are.

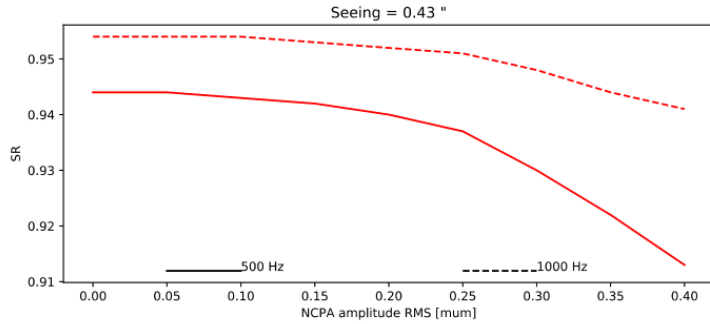


# Tomography (S. Raffetseder)

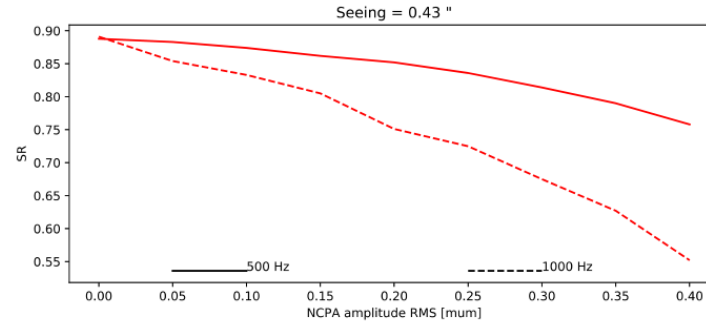


# NCPAs (M. Feldt)

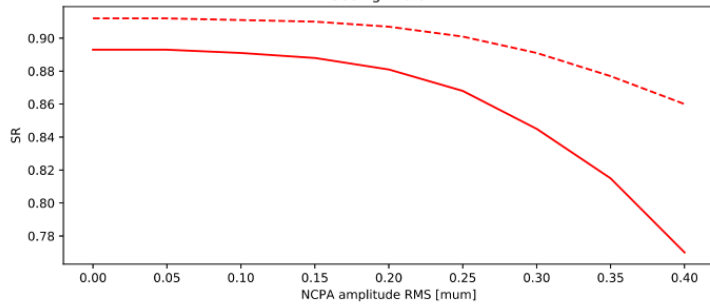
METIS WFS NCPA Analysis,  $\lambda=2.20\mu\text{m}$ , mag=02.80



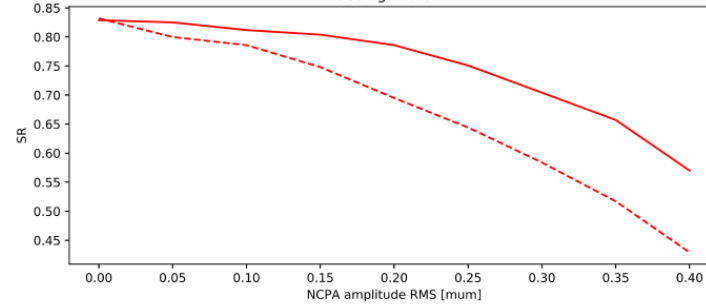
METIS WFS NCPA Analysis,  $\lambda=2.20\mu\text{m}$ , mag=10.00



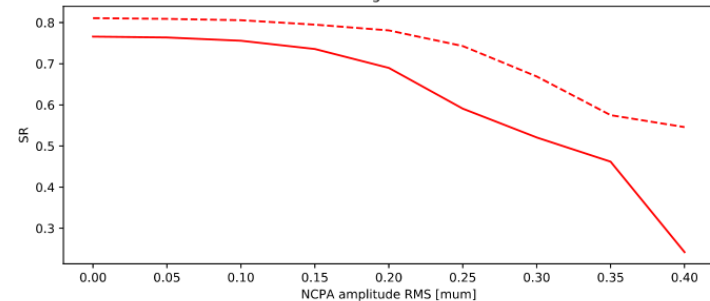
Seeing = 0.64 "



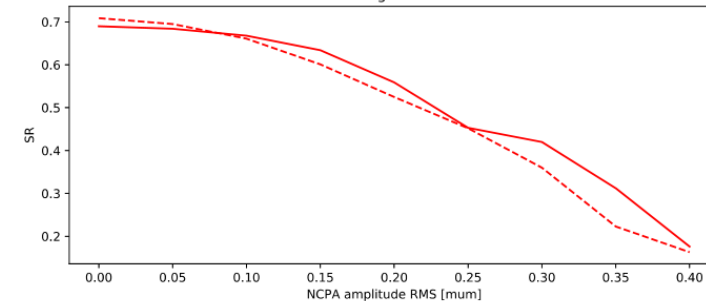
Seeing = 0.64 "



Seeing = 1.04 "



Seeing = 1.04 "



# Adapting the Reconstructor to NCPAs

---

- ▶ Pyramid has a „small“ linearity range →  
Do not linearize around 0, but „around the NCPA“
- ▶ Wild guessing: create a poke matrix with NCPAs applied to the DM already





Thanks for your attention

...on Friday ☺

# Simulation Parameters

---

- ▶ 37m diameter, 0.28% central obstruction
- ▶ Modulation 4  $\lambda/D$ , sensing in the K-Band
- ▶ 35 Layer atmosphere, ESO site spec
- ▶ Standard YAO poke matrix inversion used

1st: 800nm piston on one segment → Mickey Mouse

2nd: close the loop (no atmospheric turbulence)

3rd: introduce turbulence with 0.65" seeing

