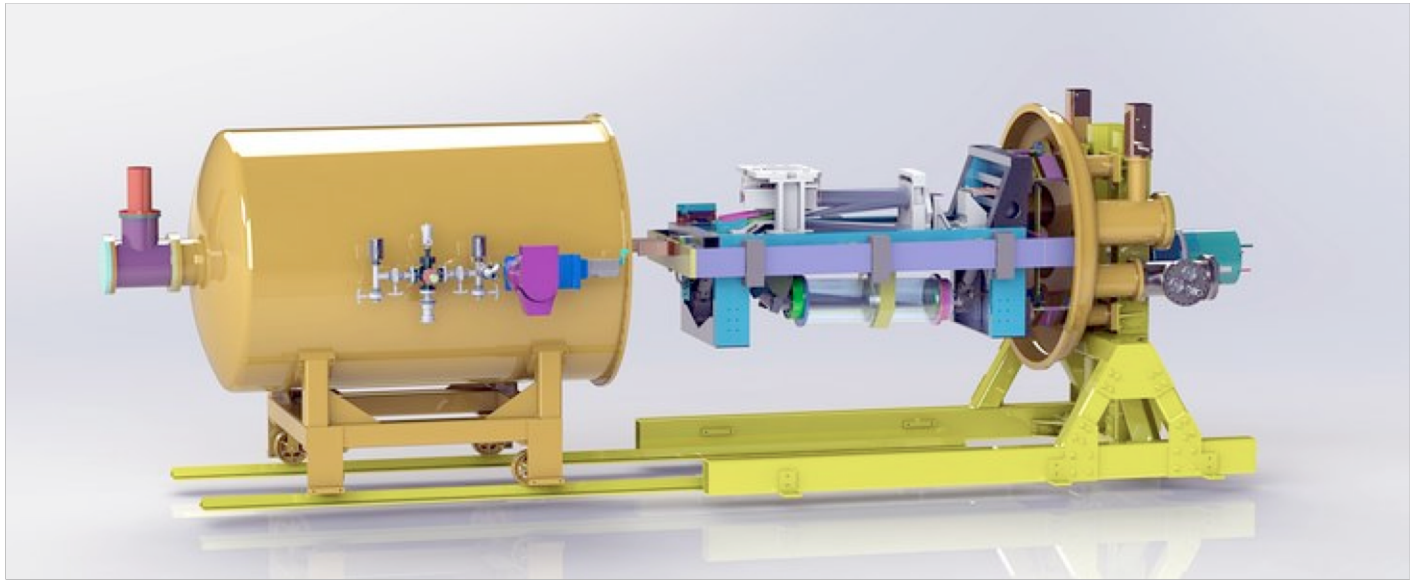
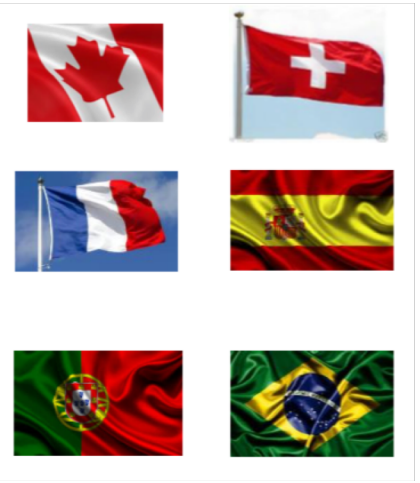
NIRPS: Near-Infrared Planet Searcher on track to join HARPS on the ESO 3.6-m

François Bouchy and the NIRPS consortium
Astronomy department of Geneva University



http://www.astro.umontreal.ca/nirps

NIRPS
LOOKING FOR BLUE PLANETS AROUND RED STARS



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Co-Is : F. Pepe, N. Santos, R. Rebolo, X. Delfosse,
J. De Medeiros, G. Wade
Proj. Scientist : E. Artigau (UdM)
Proj. Manager : M. Ouellet + L. Malo (UdM)
System Engineers : F. Wildi (Geneva)
N. Blind (Geneva)
V. Reshetov (NRC)

Top Level Requirements

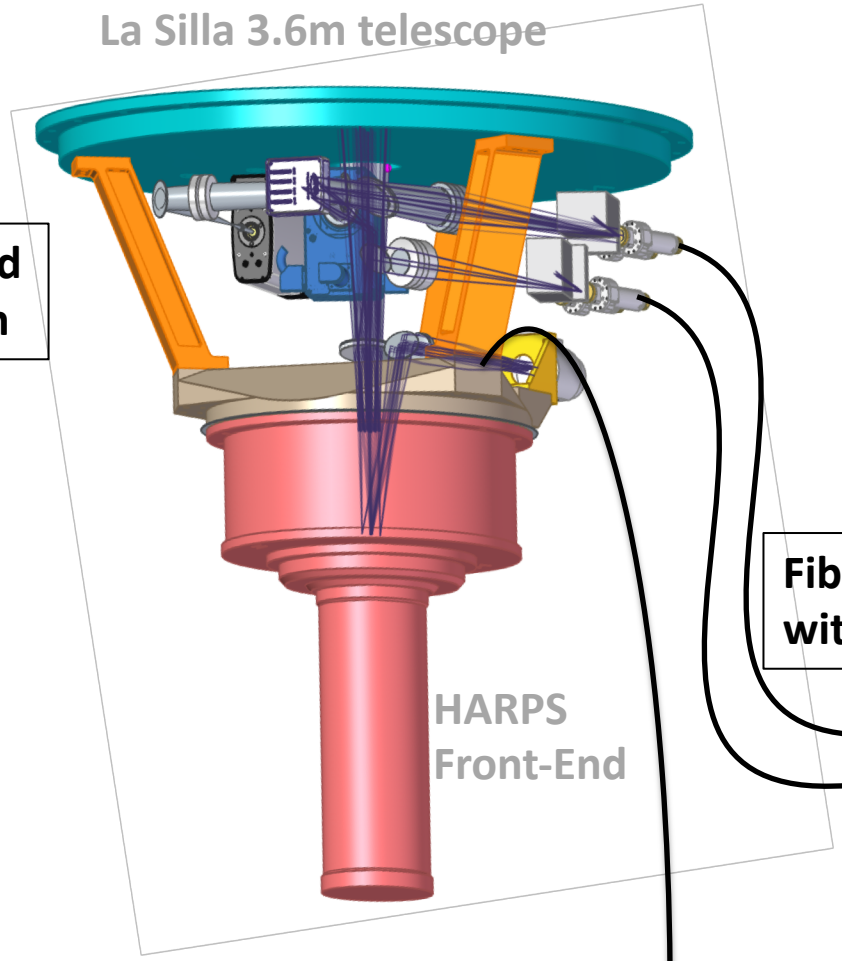
- Y, J, H bands
- R = 100'000
- High RV precision (1 m/s)
  and high spectral fidelity
- Simultaneous operation with HARPS
- No spectro-polarimetry
- Science operation in 2020

Core Science team members

Canada : D. Lafrenière, A. Cumming, S. Metchev, J. Matthew, D. Valencia,
B. Benneke, J. Rowe
Swizerland : C. Lovis, S. Udry, D. Ehrenreich, C. Mordasini, D. Ségransan
Brazil : B. Canto Martins, I. de Castro Leao
France : X. Bonfils, I. Boisse
Portugal : P. Figueira, E. Delgado Mena
Spain : J. Gonzalez Hernandez, A. Suarez Mascareno
ESO : C. Melo

Overview of the NIRPS conceptual design

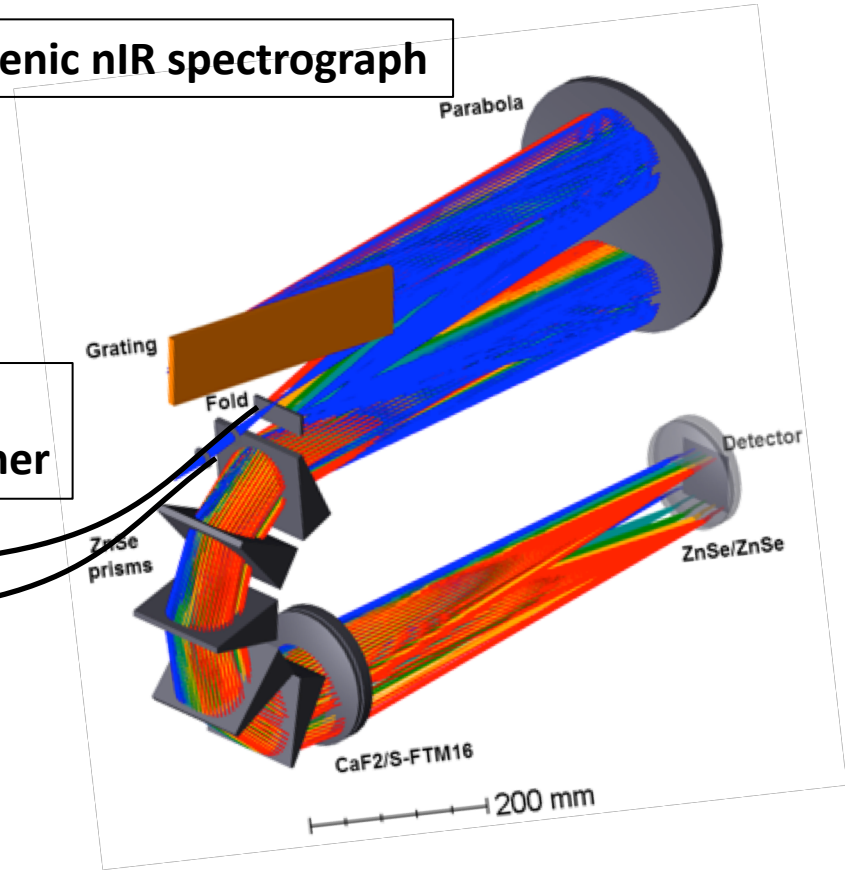
La Silla 3.6m telescope



NIRPS Front End with AO system

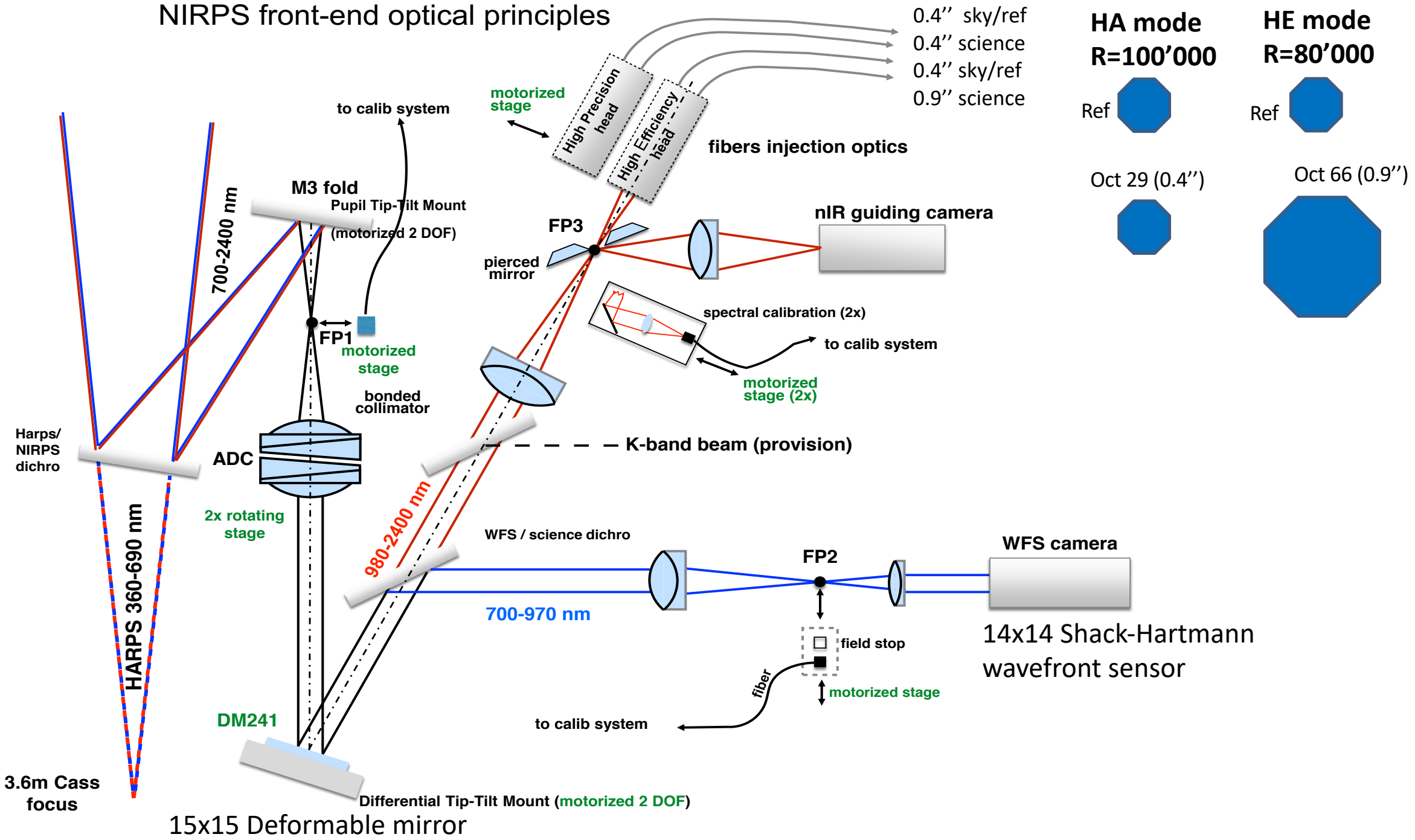
Fiber Link with stretcher

Cryogenic nIR spectrograph

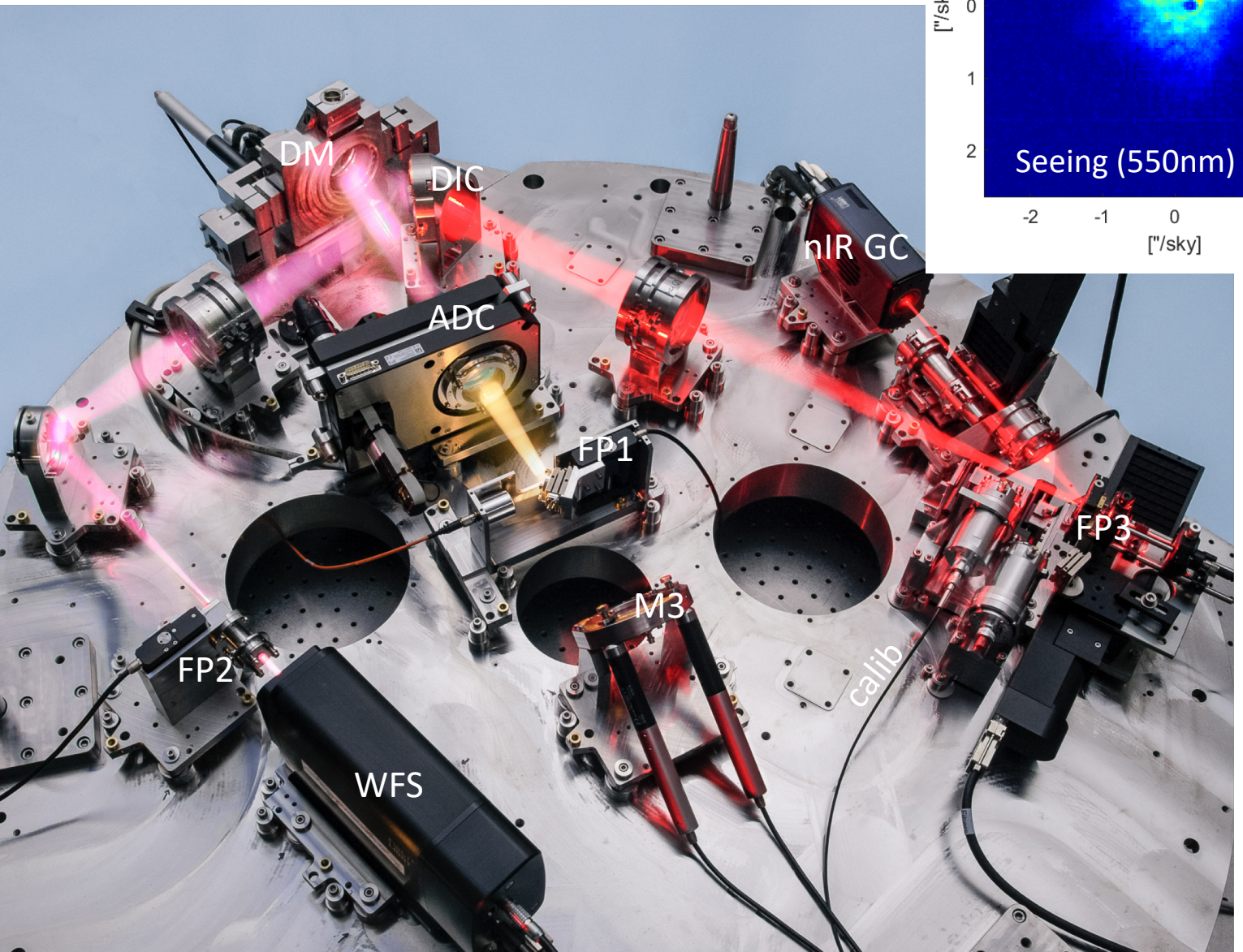


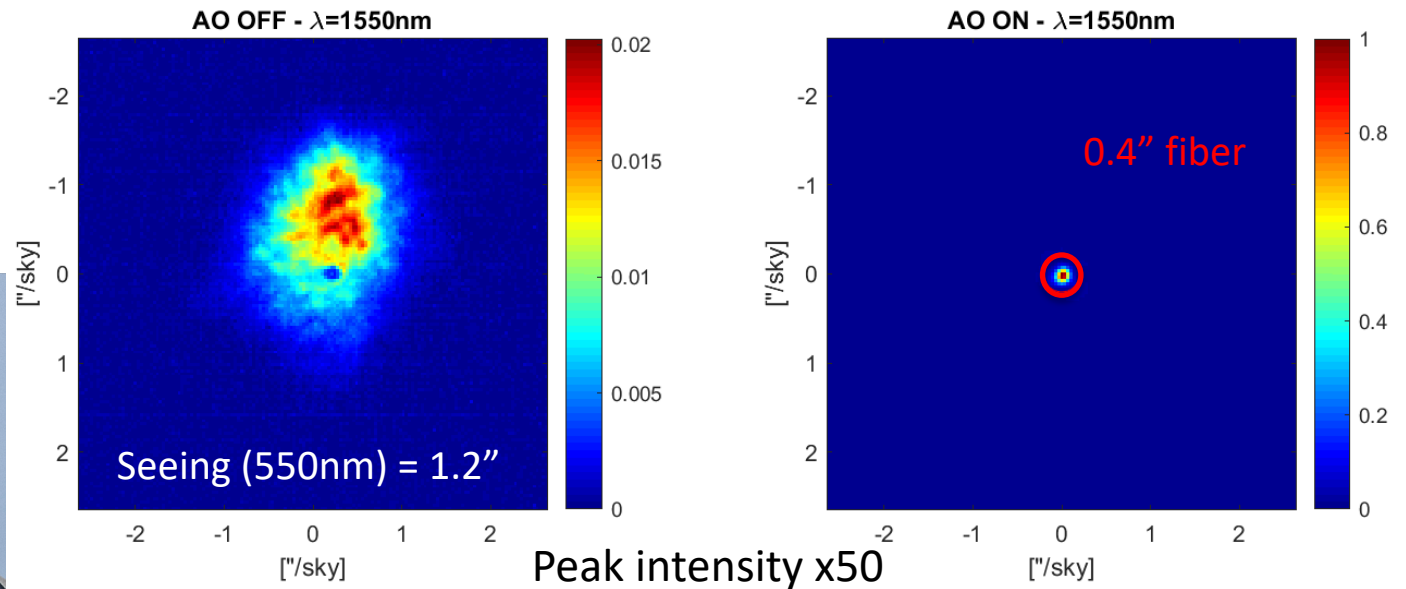
Calibration Unit

NIRPS front-end optical principles

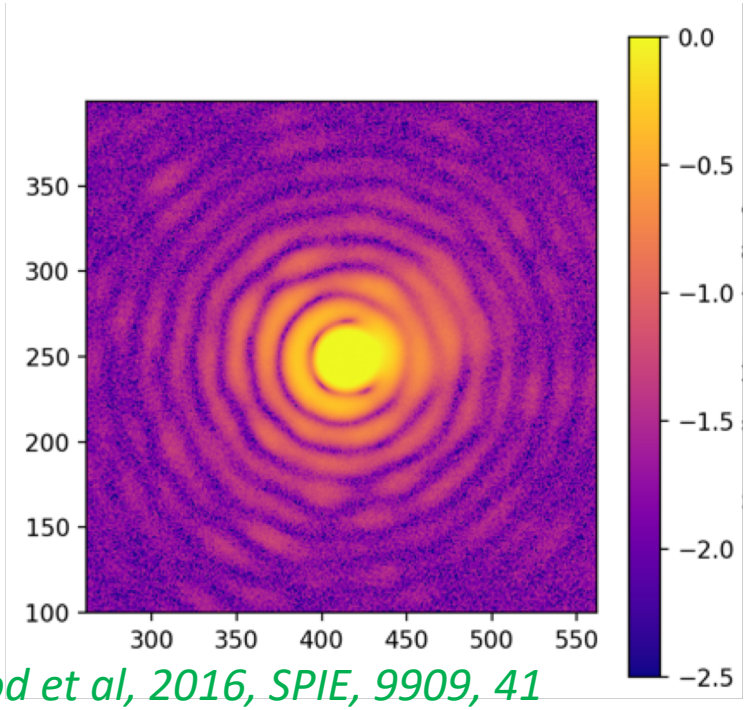


Front end from UniGe





Peak intensity x50



Conod et al, 2016, SPIE, 9909, 41
Wildi et al., 2017, SPIE, 10400, 18
Blind et al., 2017, proc. AO4ELT5, arXiv1711.00835


(almost) Ready for La Silla
Newport
RP Reliance

Calibration module from Uni Bern

Design similar to ESPRESSO Calibration Unit

5 selectable light sources for spectrograph calibration

- UrNe #1
- UrNe #2
- Tungsten Halogen
- Fabry Perot
- Frequency Comb slot

2 fiber-coupled laser diodes for AO calibration

Fiber link from IAC (Spain)

HA mode
R=100’000

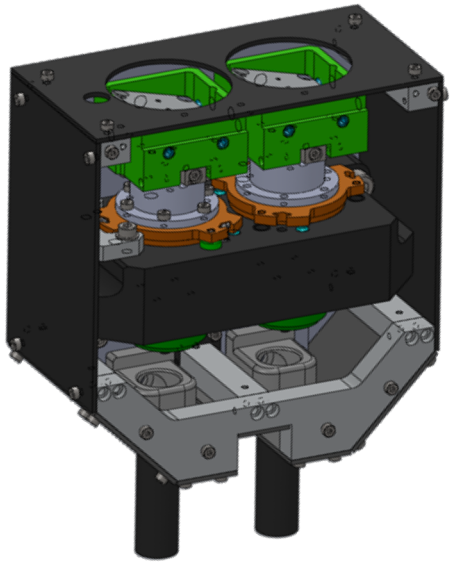
Ref

HE mode
R=80’000

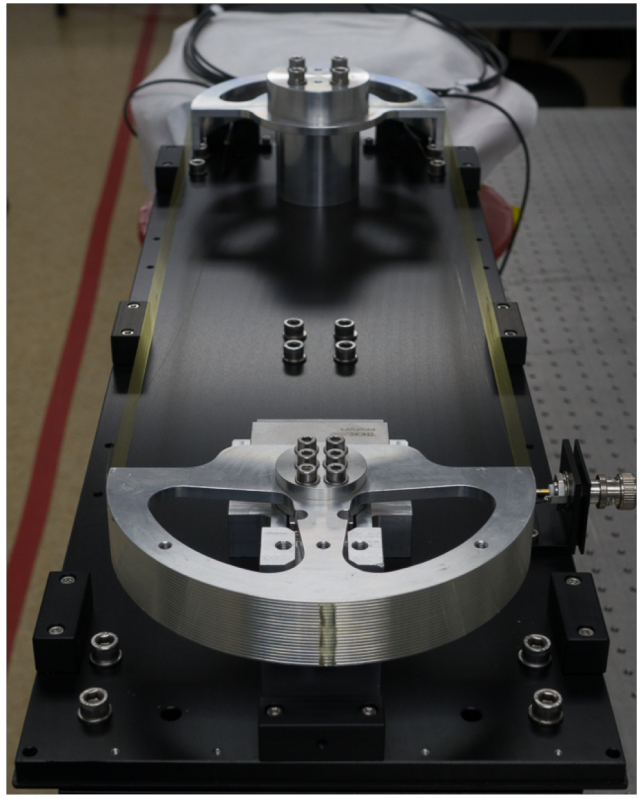
Ref

Oct 29 (0.4’’)

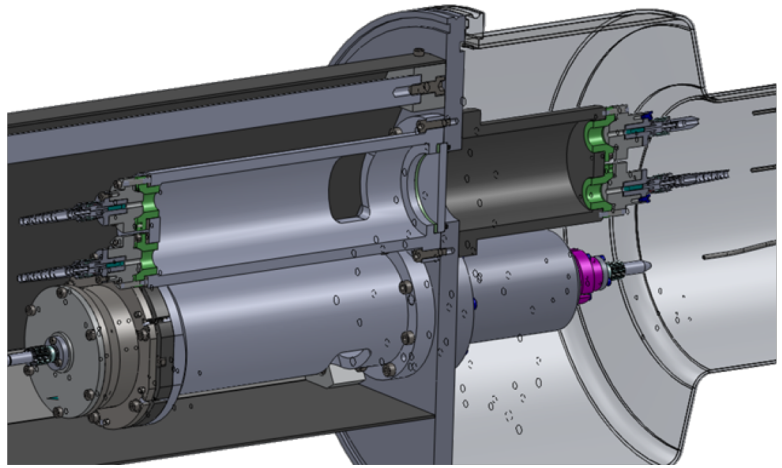
Oct 66 (0.9’’)



Fiber Head
F/10.9 - F/4.2

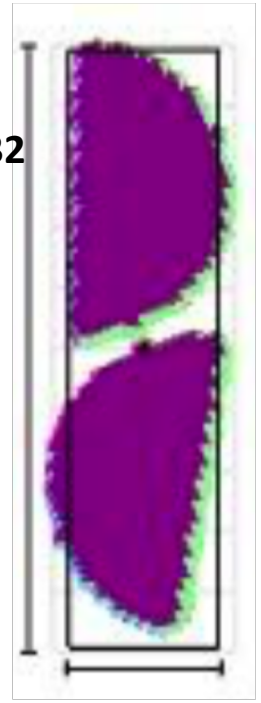


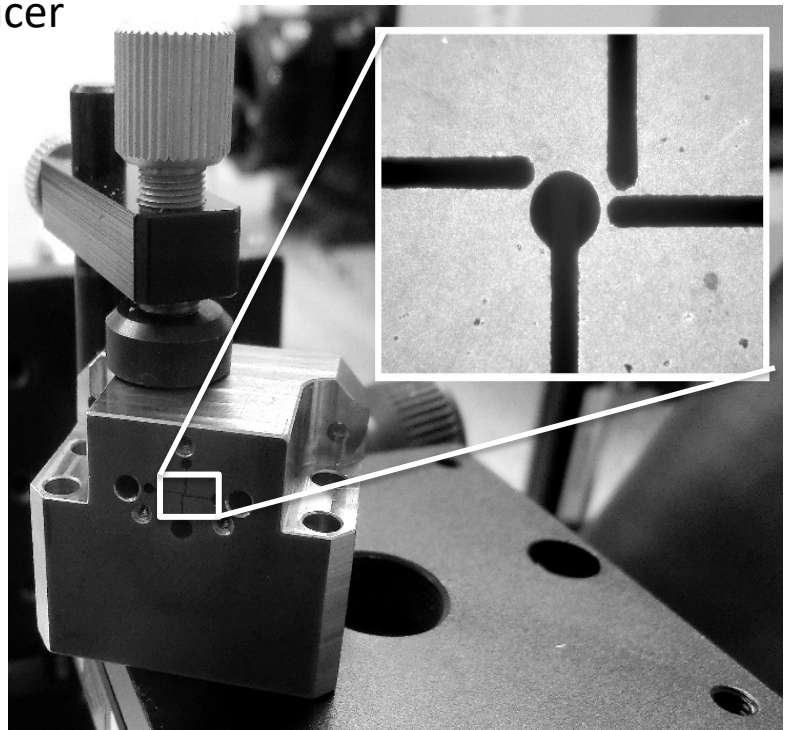
Fiber stretcher
from Geneva



Double scrambler + Slicer

Oct 66 (0.9’’) → Rect 33x132

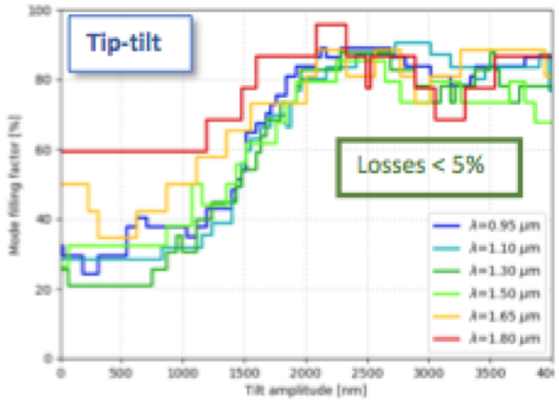


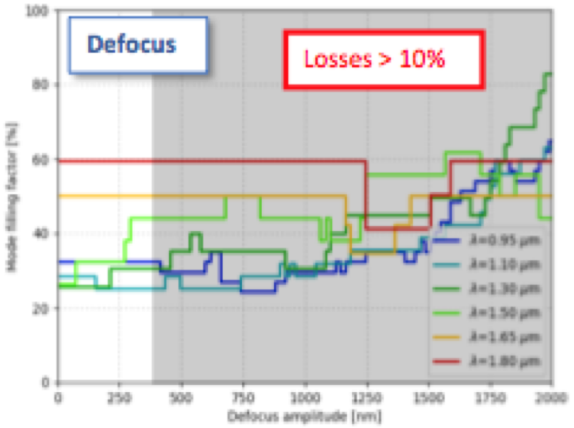


Output End
F/4.2 – F/8.0

Modal noise mitigation

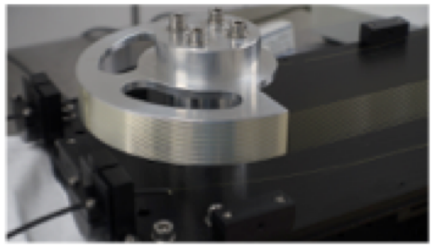
At injection: fill the modes with AO system

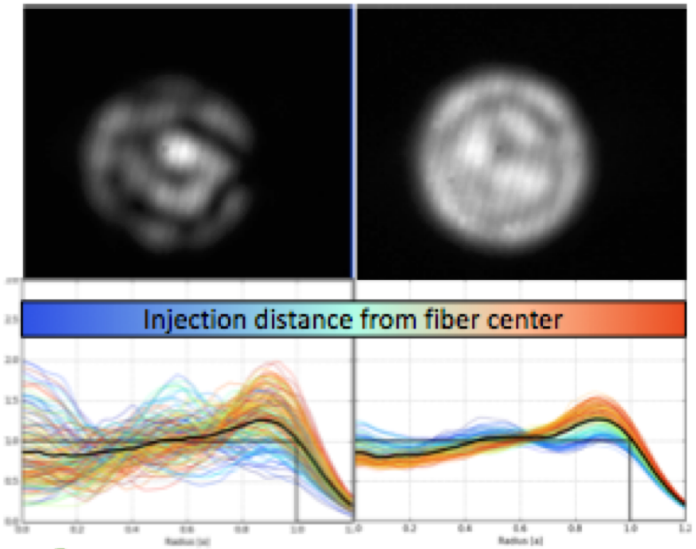




✓ Efficient with tip-tilt

In fiber: modulate the phase with fiber stretcher

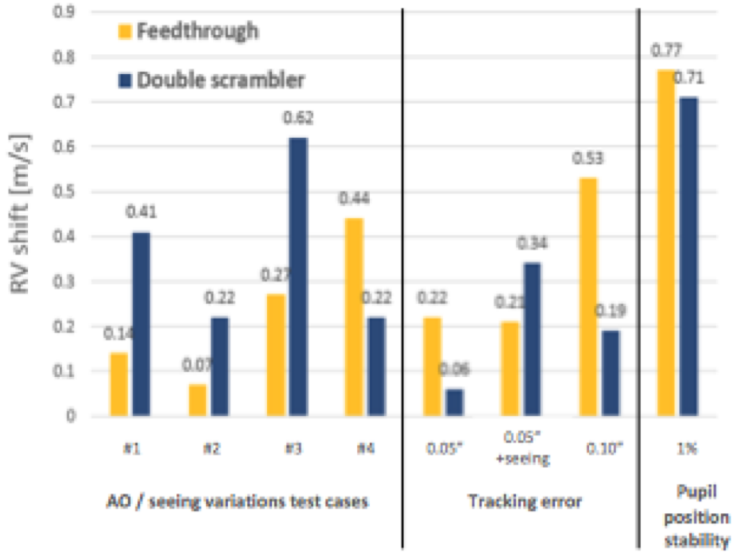




✓ 8mm stretch ➡ dT > 50K over 30m

Double scrambler

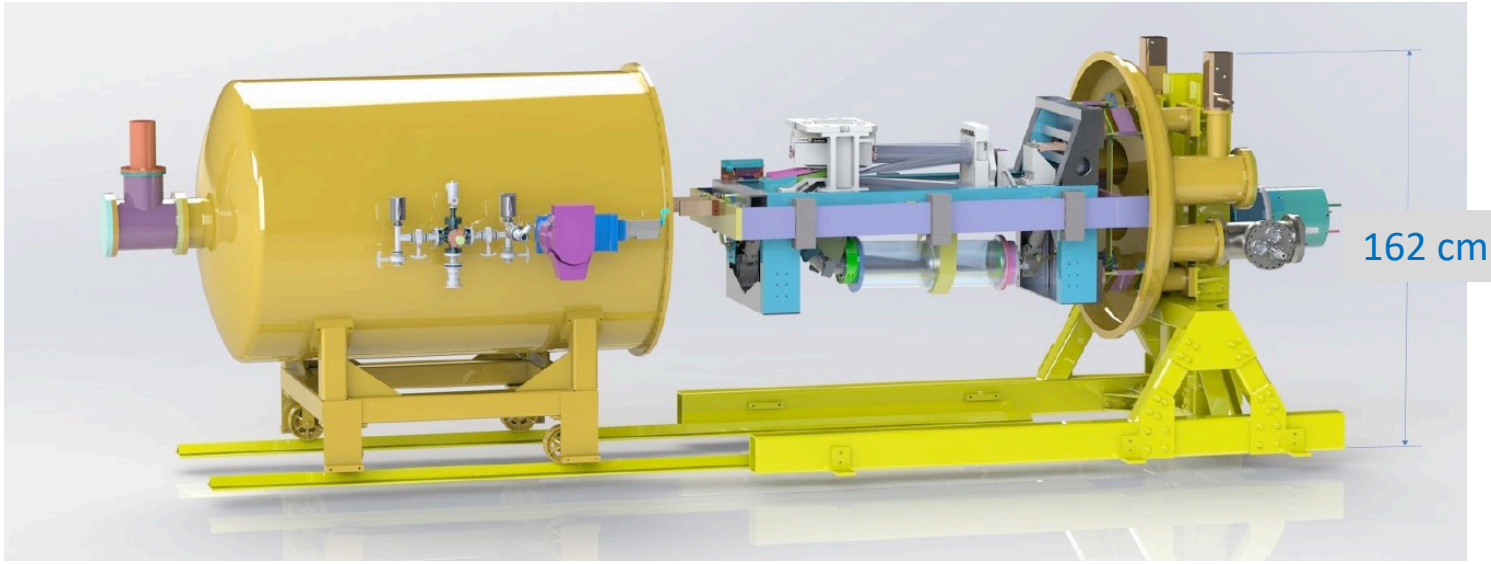
NF & FF measurements injected in spectrograph design, with various perturbations

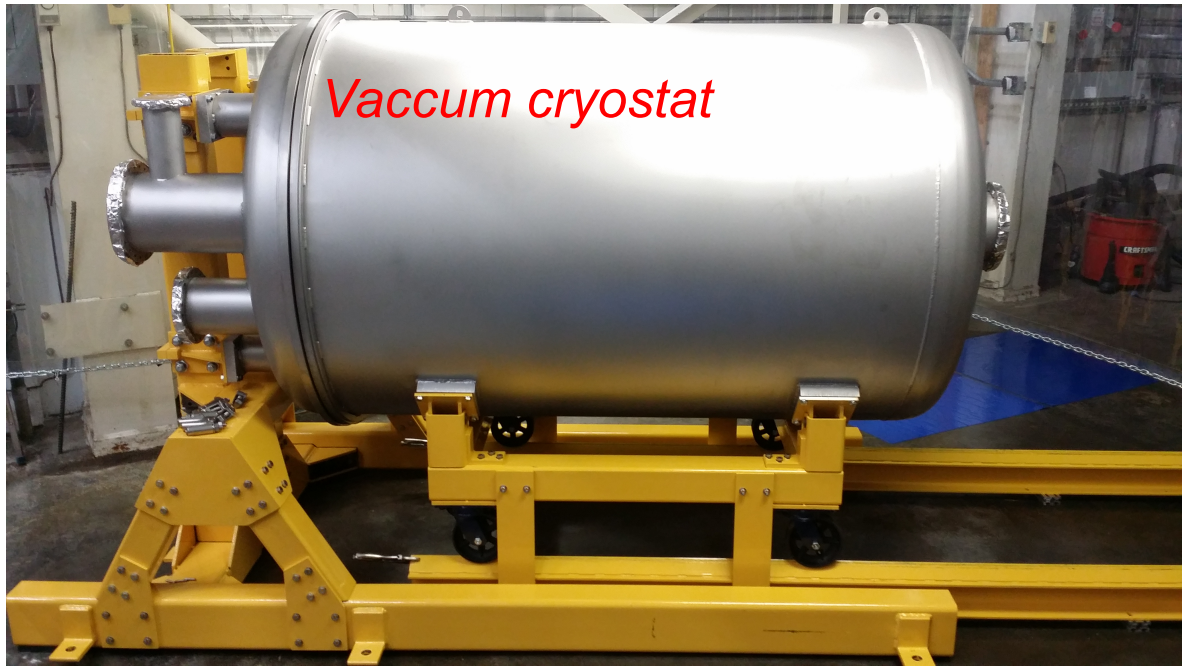


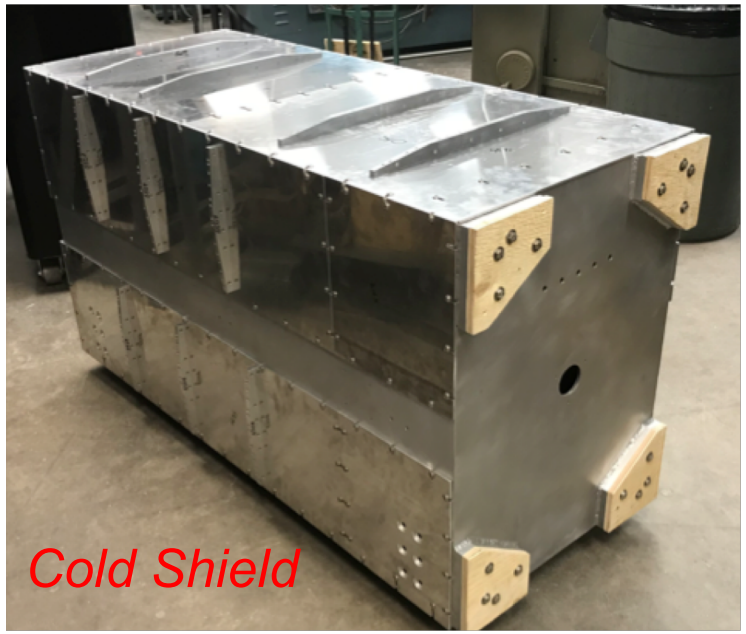
✗ No clear gain
Costs photons (NF / FF mismatch)

→ See Nicolas Blind Poster

Cryogenic cryostat from NRC (Victoria)

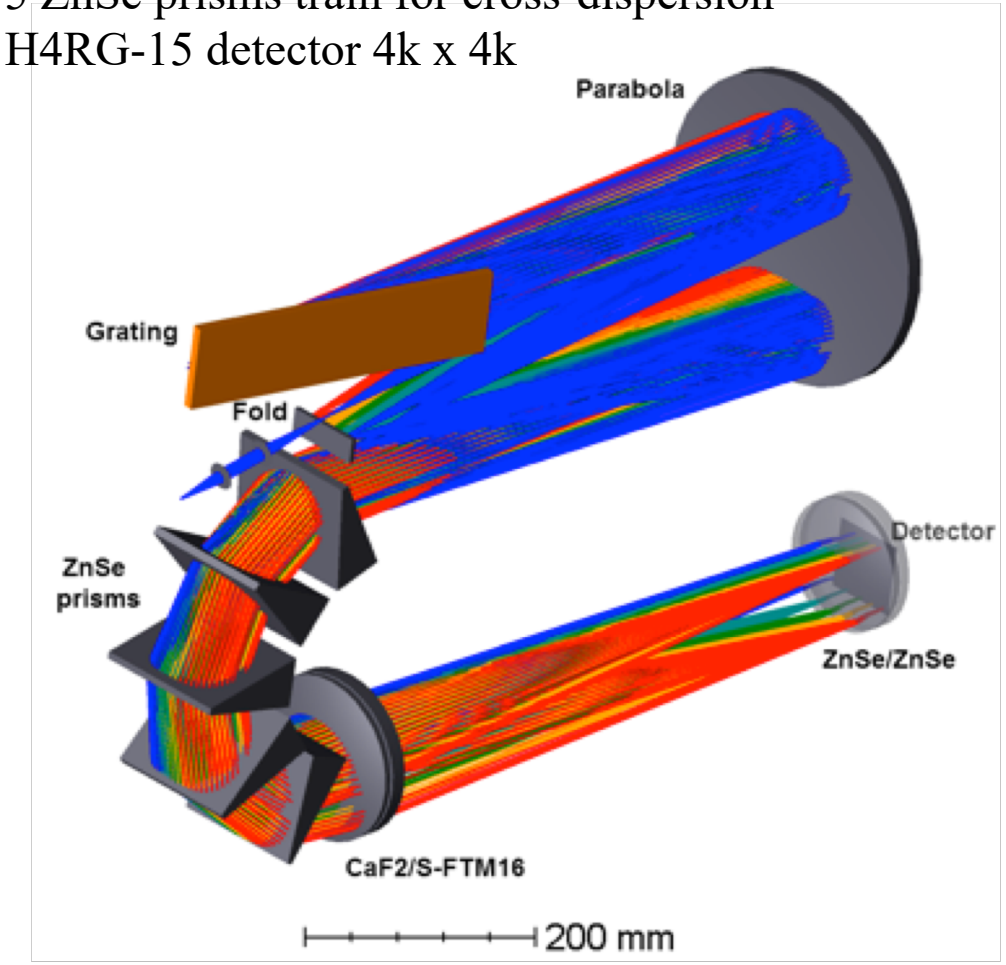




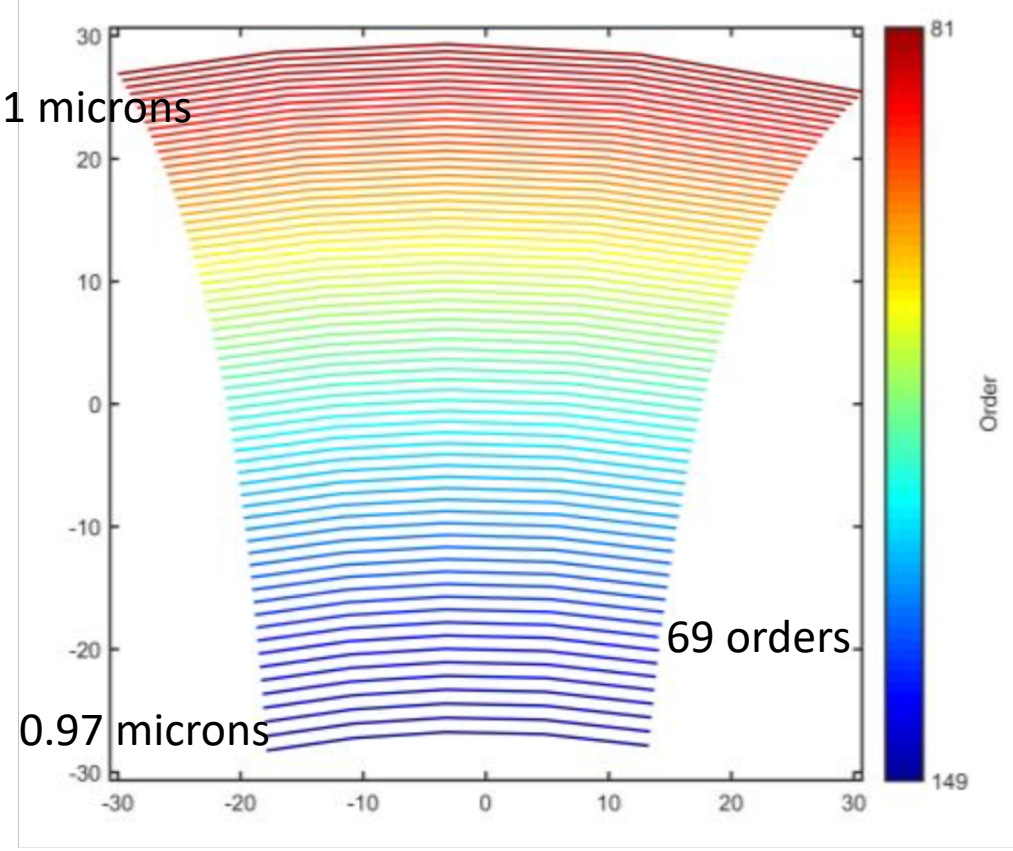


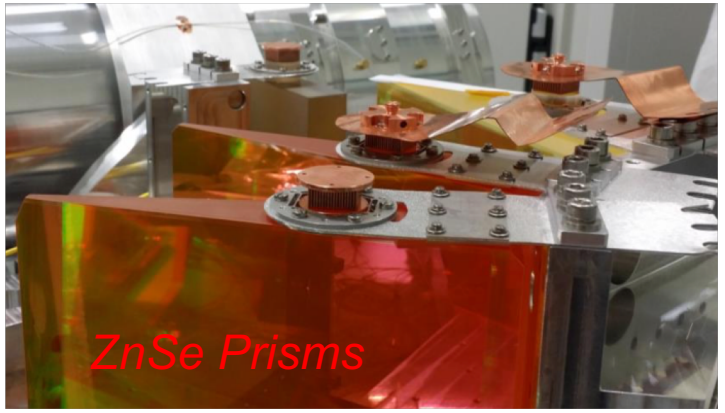
Spectrograph from Uni Laval (Québec)

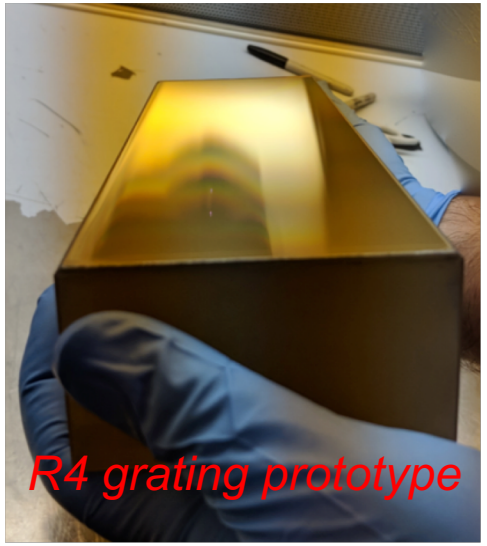
White pupil spectrograph
R4 echelle grating (73x73 mm pupil, 13.3 l/mm)
5 ZnSe prisms train for cross-dispersion
H4RG-15 detector 4k x 4k



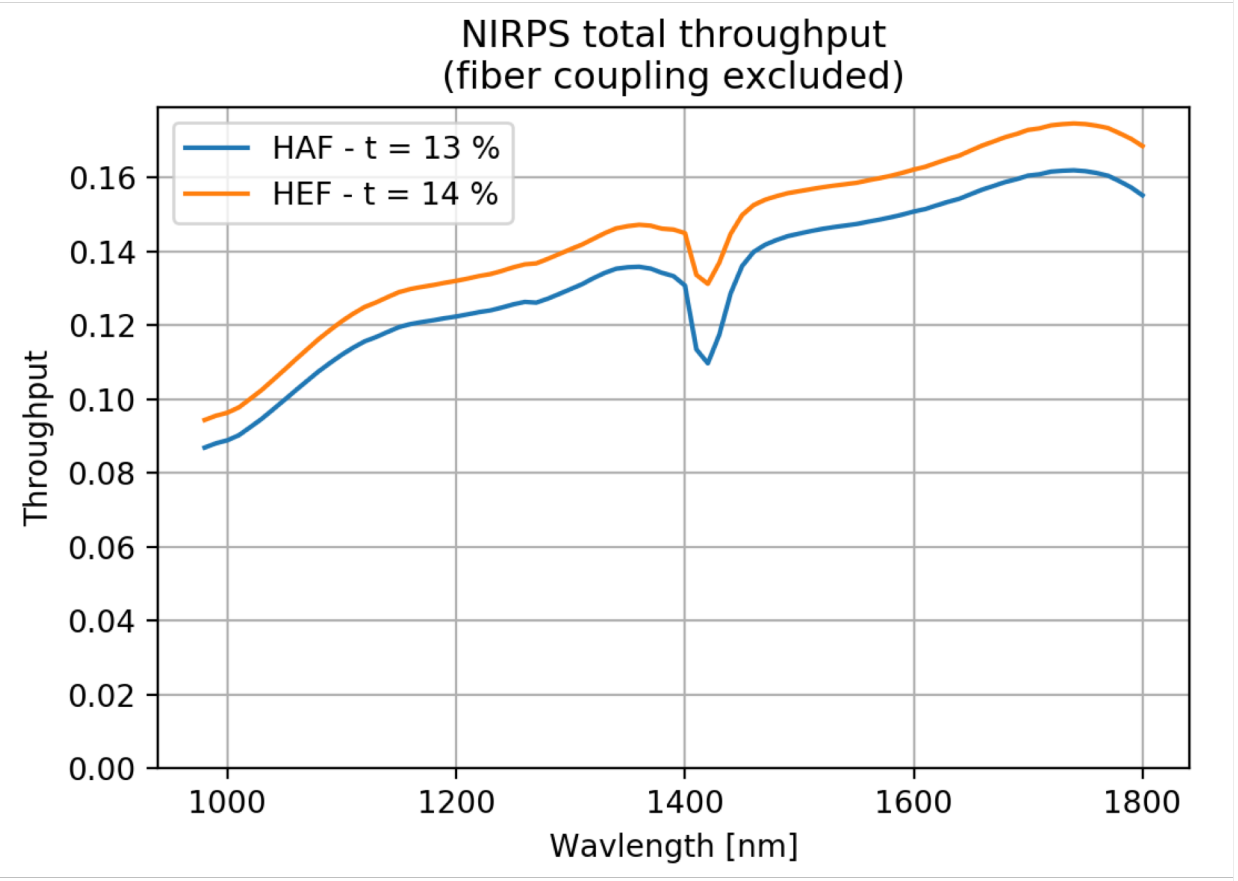
Compact and fully symmetrical design
for best insensitivity to gravity

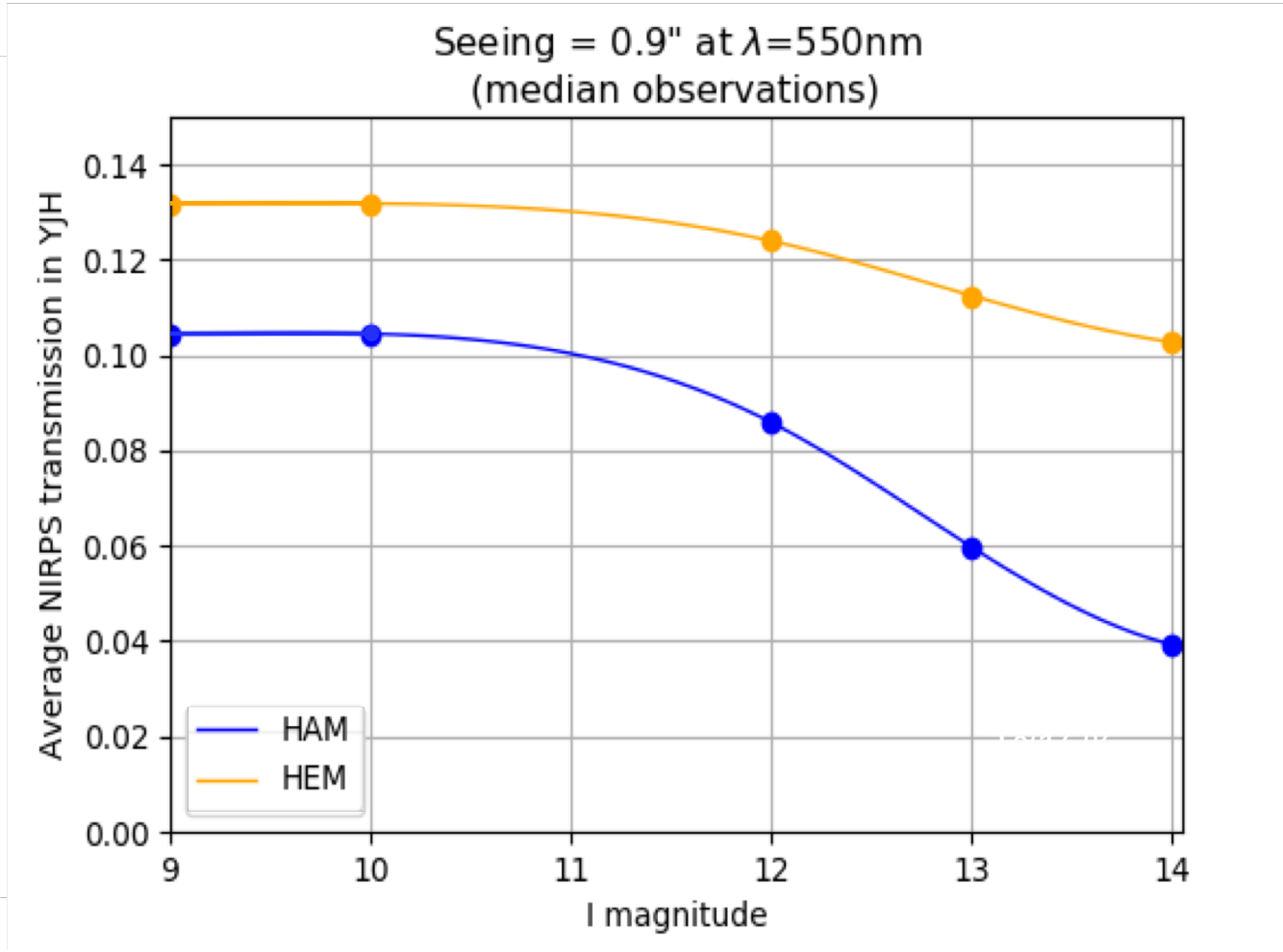






Total system transmission





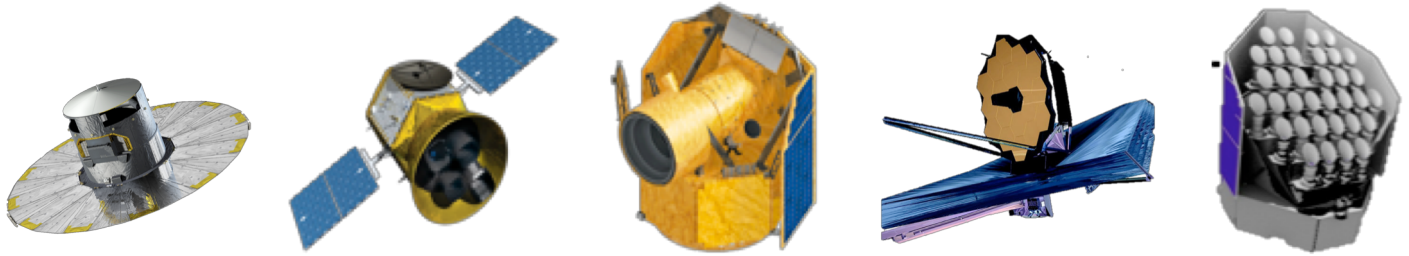
Milestones and schedule

Kickoff Jan 2016
PDR Oct 2016
FDR May 2017

PAE Fiber Link May 2019
PAE Front End June 2019
Front-End Comm Sept 2019
PAE Spectrograph 2019
First Light Q1 2020

NIRPS GTO 725 nights over 5 years

3 main programs
- M-dwarfs RV survey
- Transit Follow-up of M targets → mainly TESS
- Exoplanet atmosphere characterization



HARPS + NIRPS simultaneously to mitigate stellar activity
AO guiding camera to rule out blended EBs

Bouchy et al. 2017, The Messenger, 169, 21