

From Asgard/NOTT to LIFE:

Grasping the power of nulling interferometry

R. Laugier, D. Defrère and the Asgard/NOTT collaboration

Contact: romain.laugier@kuleuven.be

This work has received funding from European Research Council (ERC) under the European Union's Horizon 2020 research and innovation program (grant agreement CoG - 866070) and from the Research Foundation - Flanders (FWO) under the grant number 1234224N



Longer period planets and their systems ?

- Planets characterized by direct imaging methods

What if we could image planets at smaller angular separations?

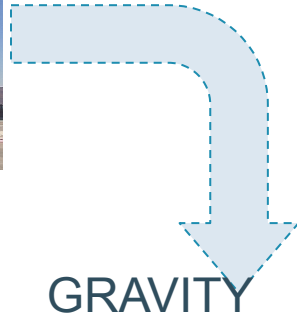
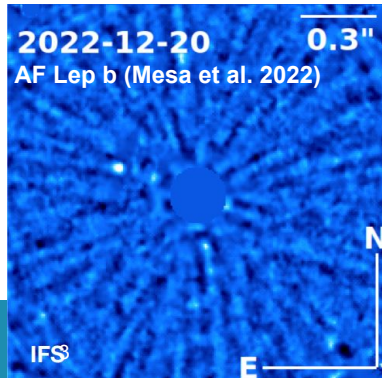


High-contrast direct imaging

8m telescope



~ 100 mas limit

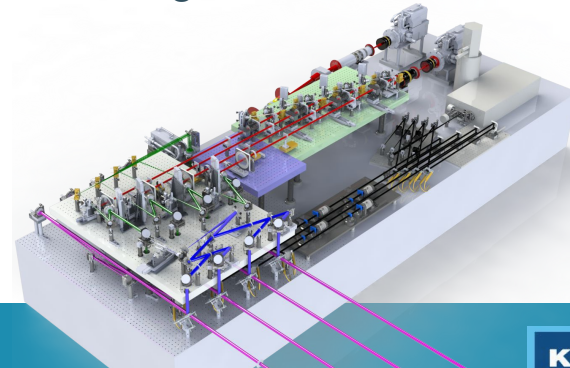


Now with nulling beam combiner
130m equivalent telescope

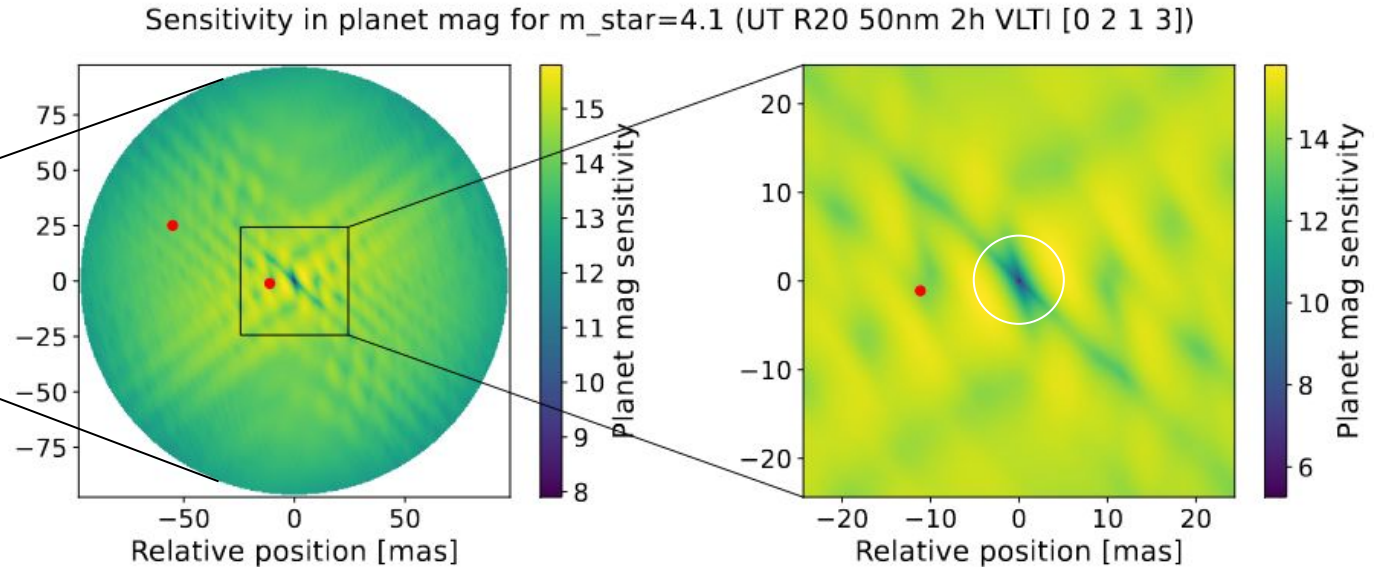
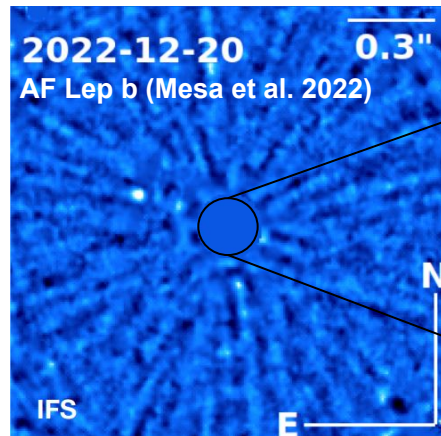


~ 5 mas limit in L band

The Asgard/NOTT instrument



New realms in angular separation

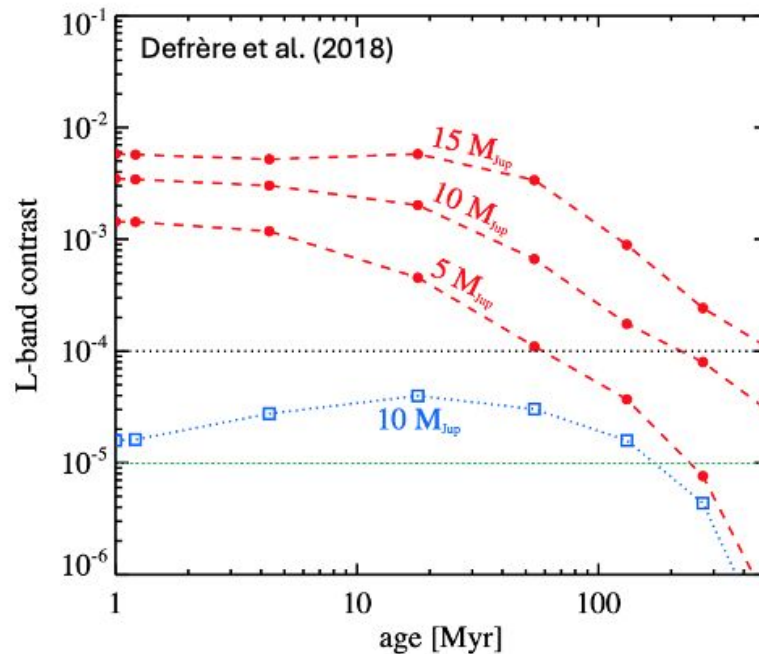


Laugier et al. 2023, Dandumont et al. in prep

Rationale for NOTT : The L' band

L' band: 3.5-4 μ m

- Peak thermal emission of young planets
- Near optimal contrast with solar type stars
- Probing the temperature of young planets

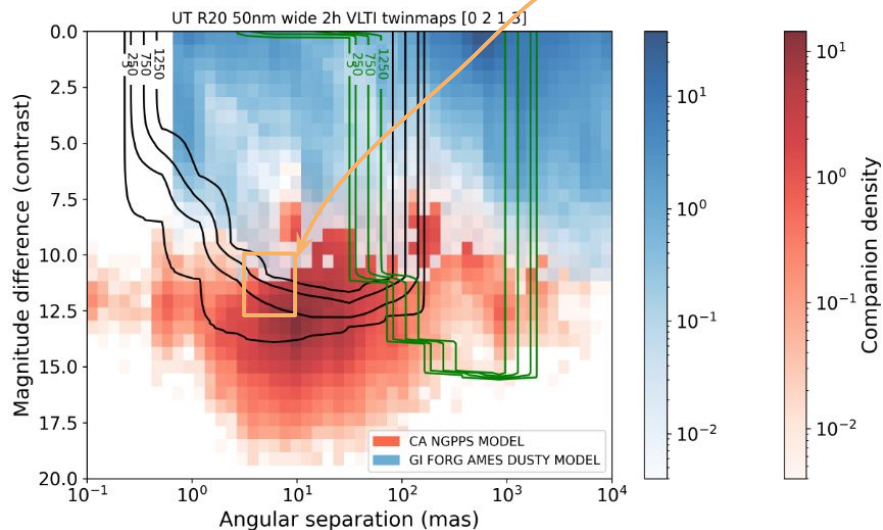


Red circles: BT-Settl models, Allard et al 2013

Blue squares: “cold start” model, Spiegel and Burrows 2012

New populations and old favorites

Coming GAIA planet candidates around young stars



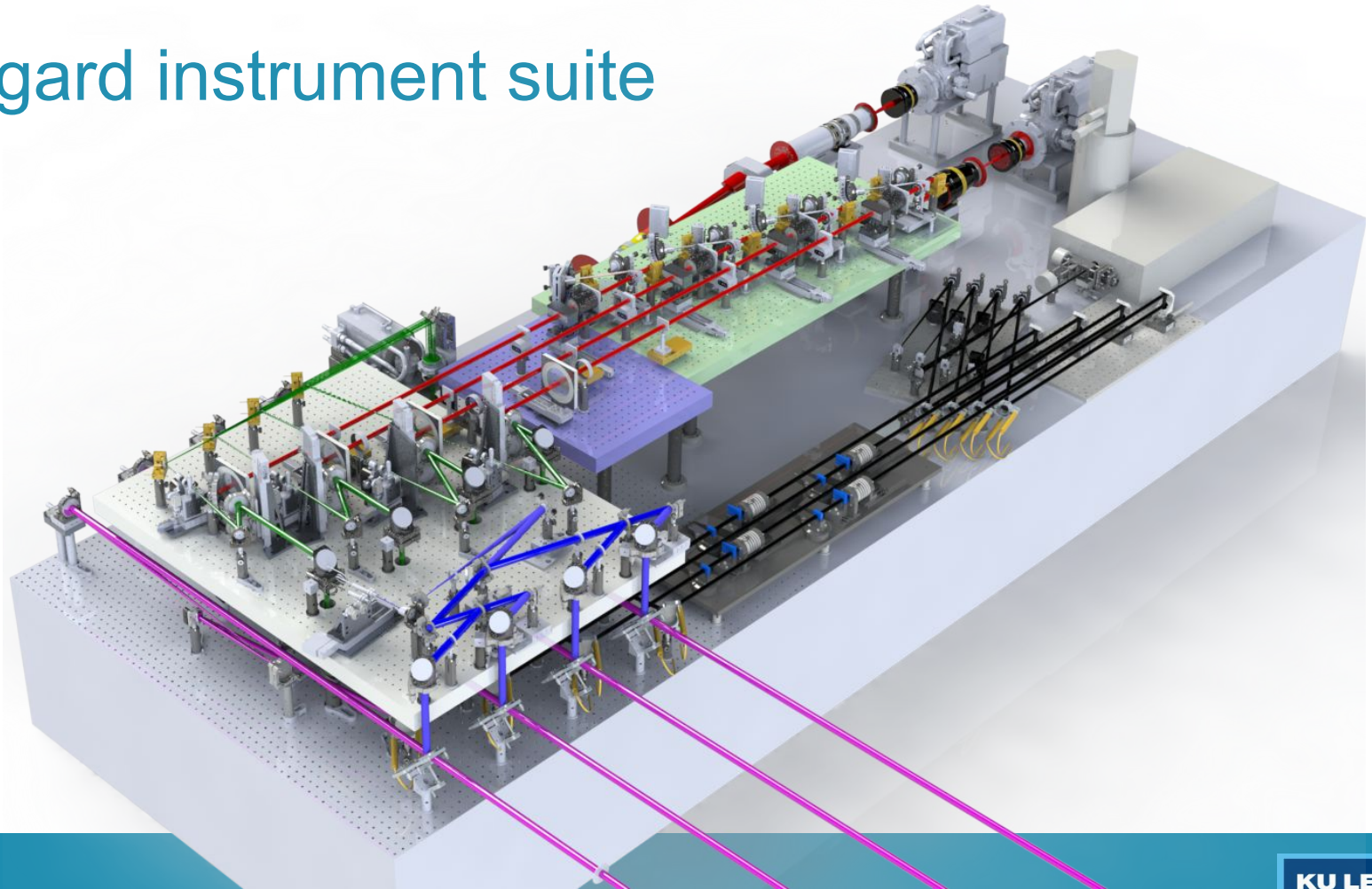
Dandumont et al. in prep.

Historical RV hot jupiters
(thermal equilibrium model)

Planet name	Separation (mas)	Contrast ($\log_{10} c$)
GJ 86 A b	10	-4.03
BD+20 2457 b	7	-4.56
HD 110014 c	7	-4.56
11 Com b	12	-4.59
ksi Aql b	9	-4.61
61 Vir b	6	-4.67
HIP 105854 b	10	-4.68
HIP 107773 b	7	-4.75
HD 74156 b	5	-4.84
mu Ara c	6	-4.86
HD 168443 b	8	-4.87
HIP 67851 b	7	-4.91
HD 69830 b	6	-4.94
HD 16417 b	5	-4.99

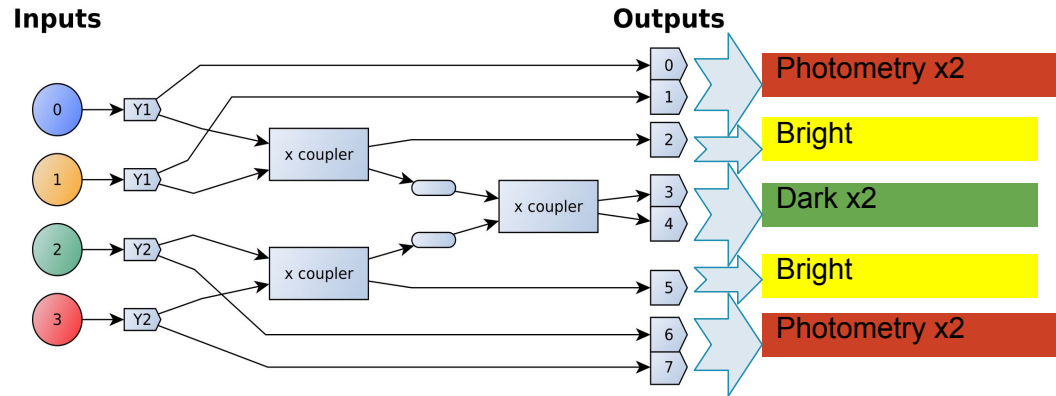
Martinache & Ireland 2018

Asgard instrument suite

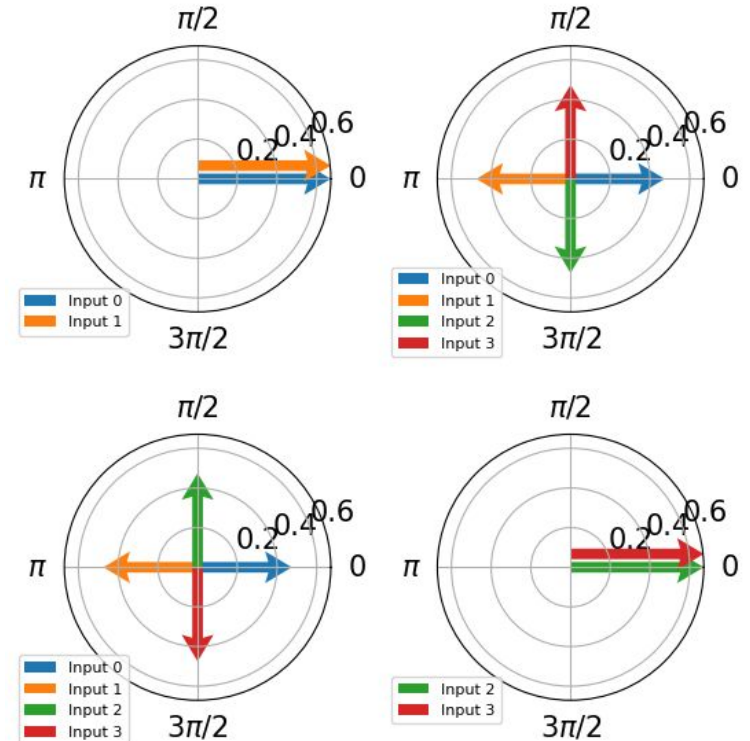


Planet mode

Differential output: **Antisymmetric signal**



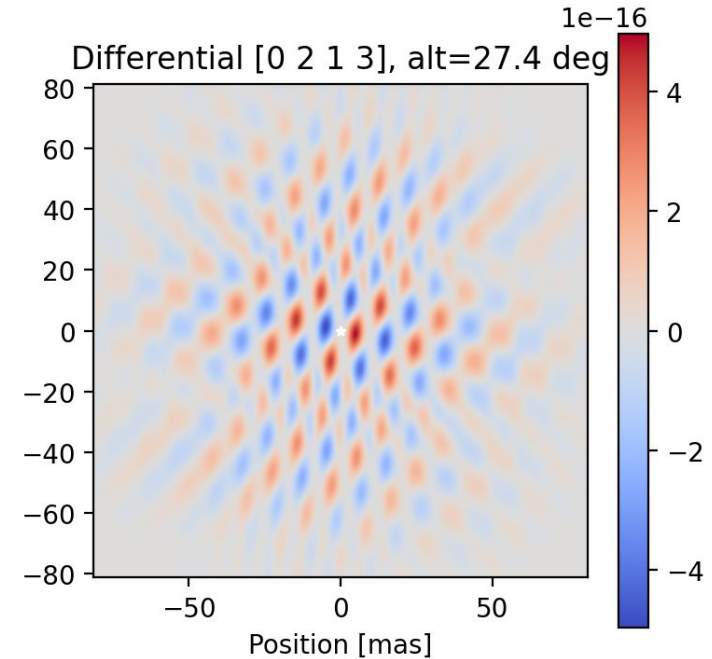
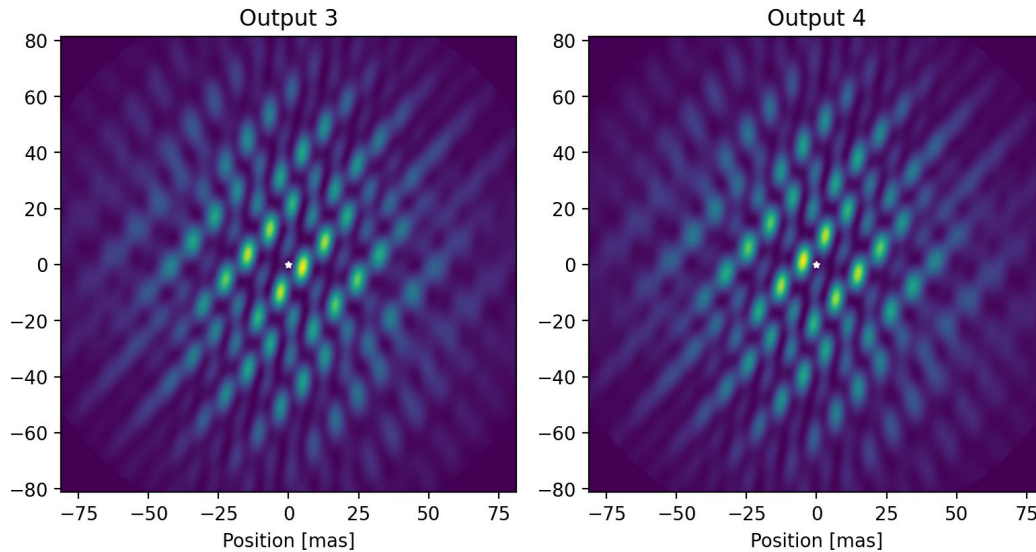
The null configurations
of all the 4 outputs



Transmission "planet"

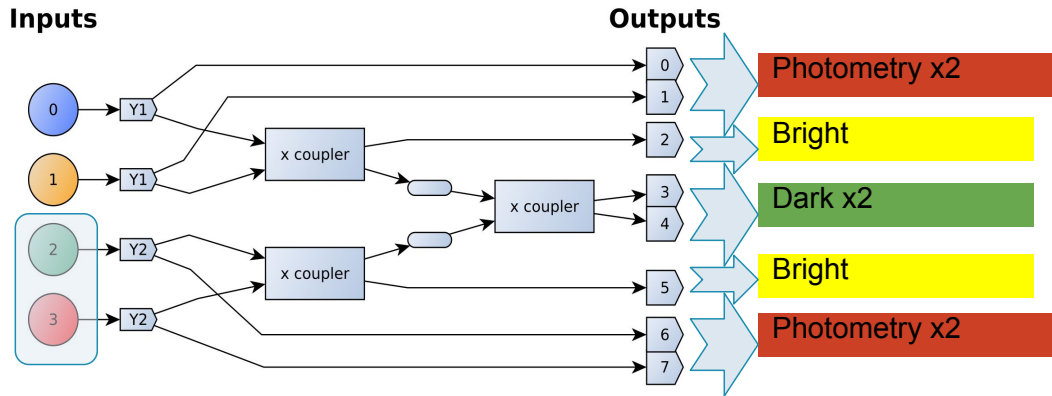
Differential output: **Antisymmetric signal**

The compound maps for all wavelengths 3.5 to 4.0 μm for block 4

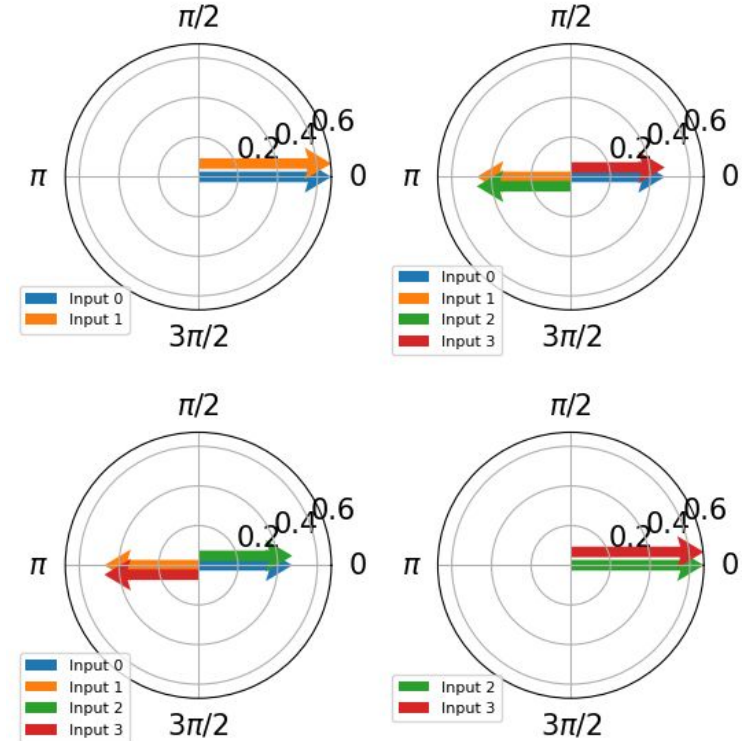


Disk mode (differential)

Differential output: **Symmetric signal**



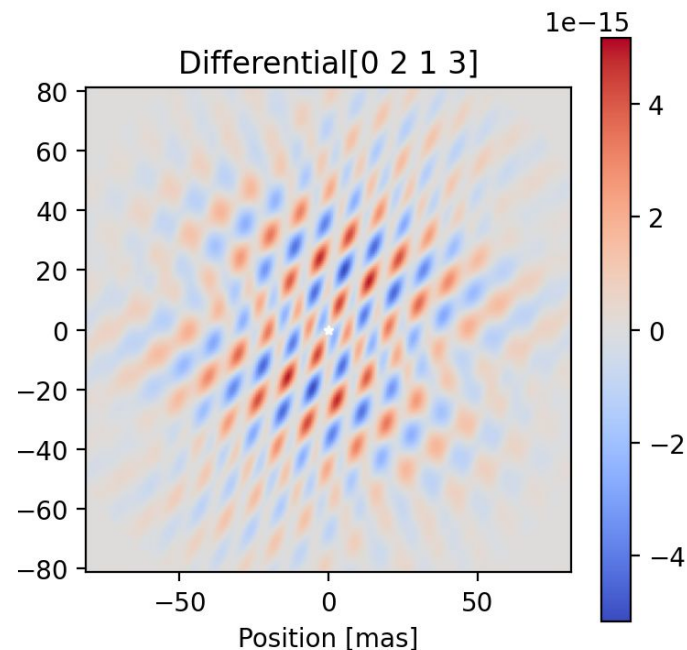
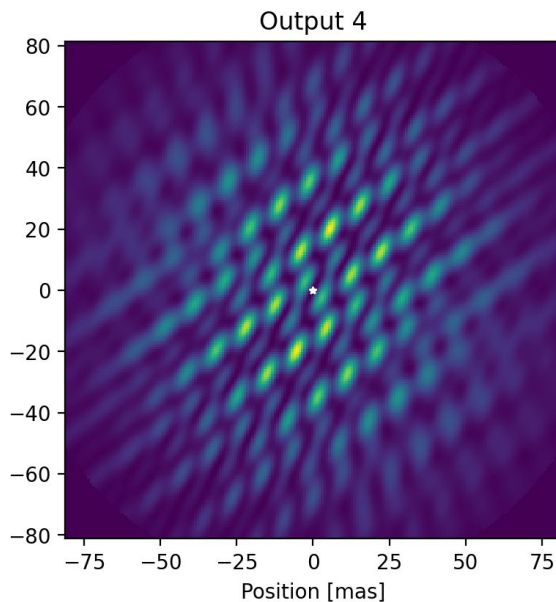
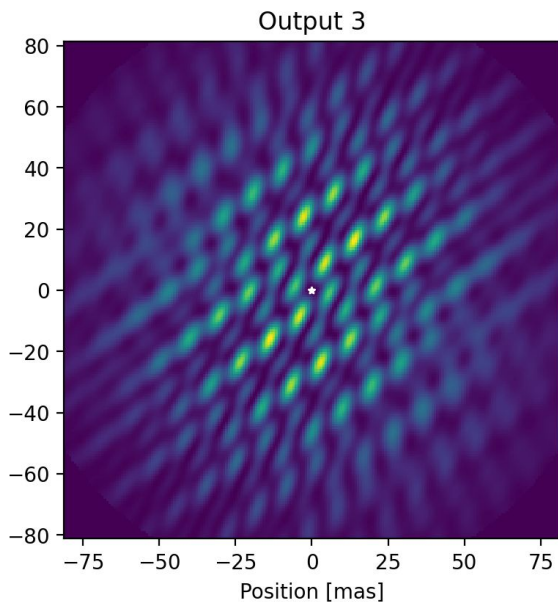
The null configurations
of all the 4 outputs



Transmission "Disk"

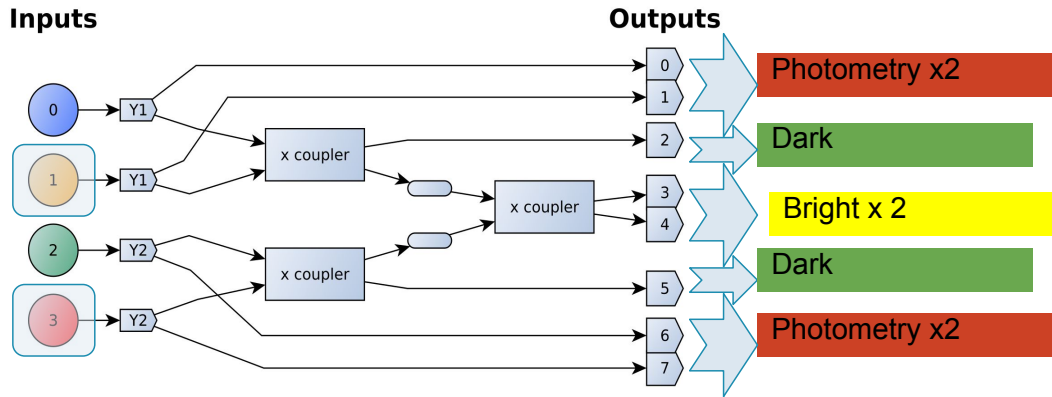
Differential output: **Symmetric signal**

The compound maps for all wavelengths 3.5 to 4.0 μm for block 10

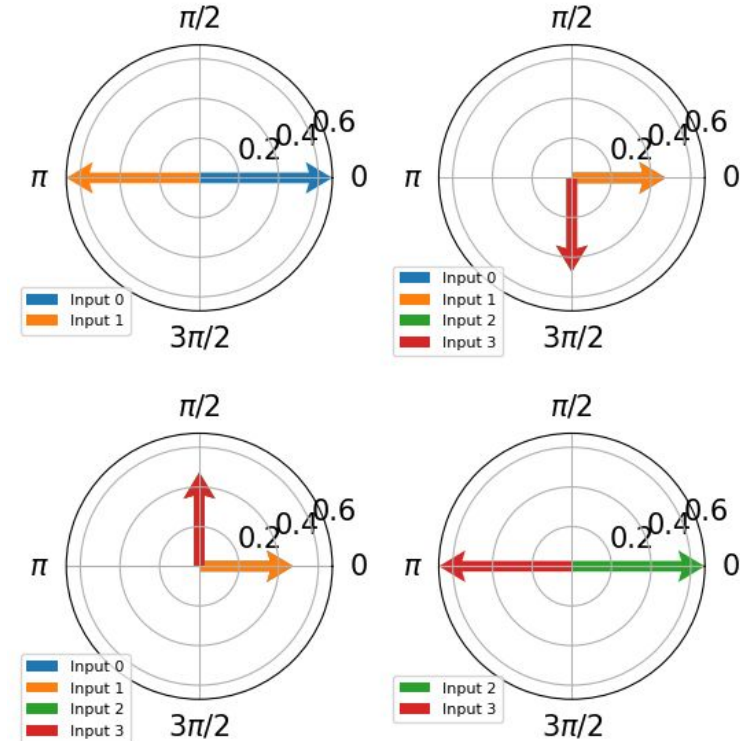


Backup Disk mode

Low-risk nulling: 2 independent nulls



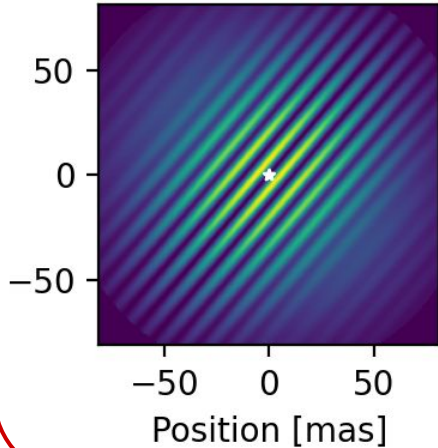
The null configurations of all the 4 outputs



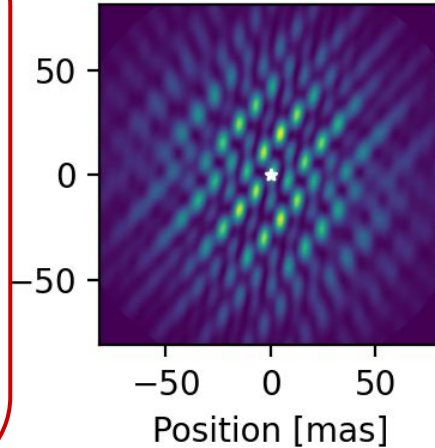
Transmission "backup disk"

Low-risk nulling: 2 independent nulls

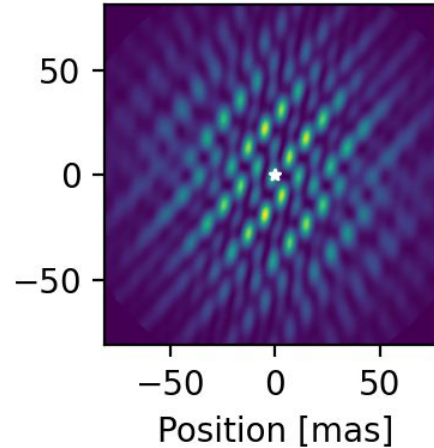
Output 2



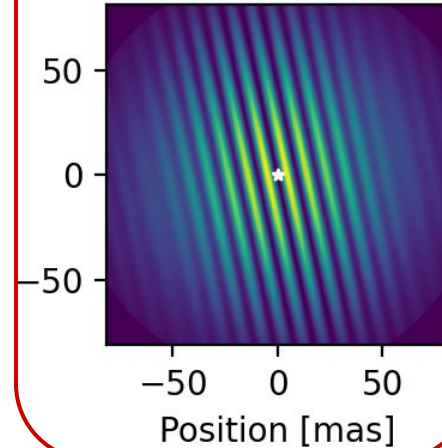
Output 3



Output 4



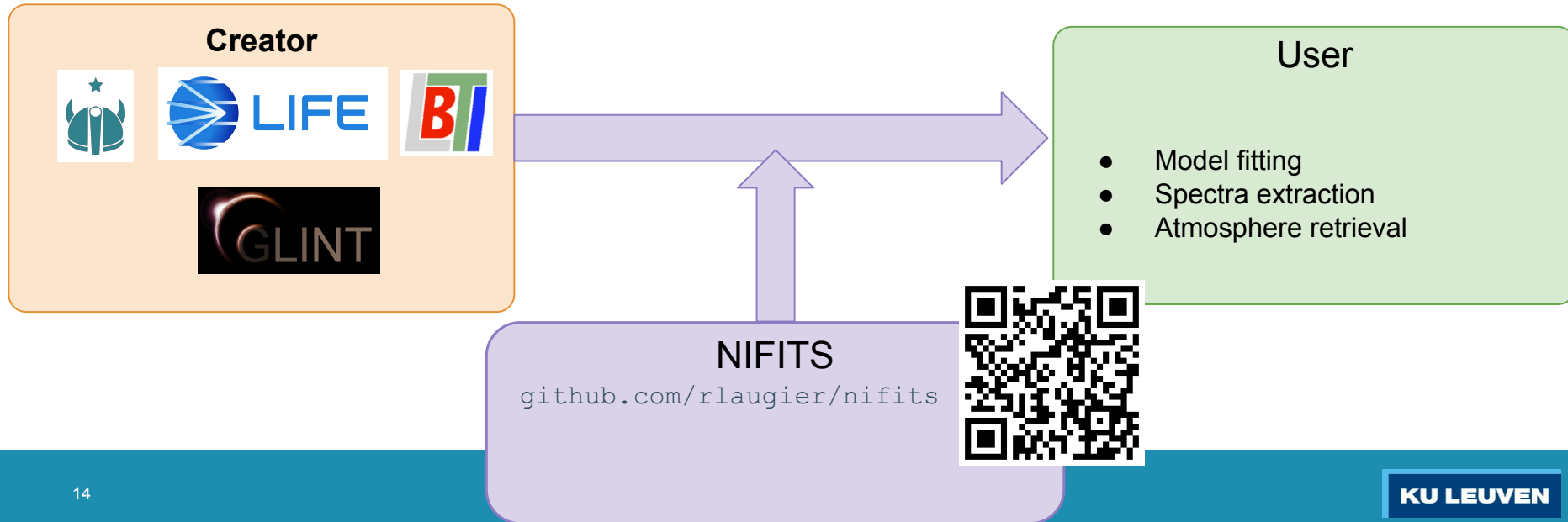
Output 5



Making sense of the data

New NIFITS data format **NEW!**

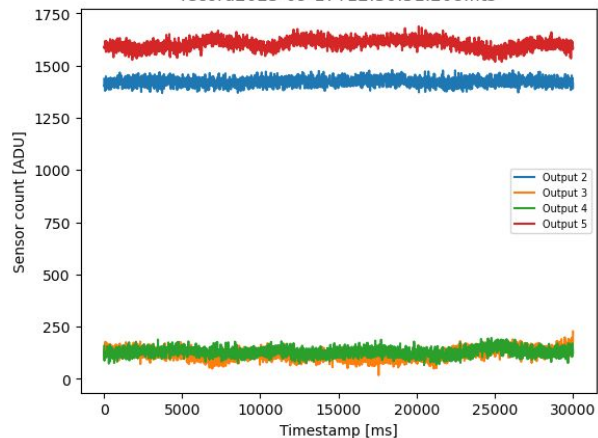
- The instrument model is included in the file
- File creator has burden of instrument expertise
- File user can remain agnostic



Early bench results : broadband nulls in all 3 modes

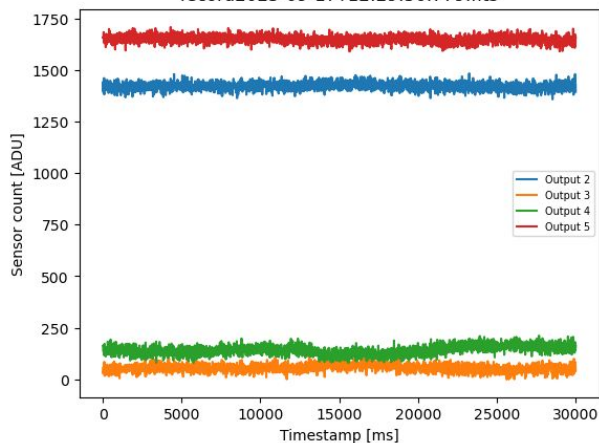
Planet mode

record2025-09-17T12:30:51.208.fits



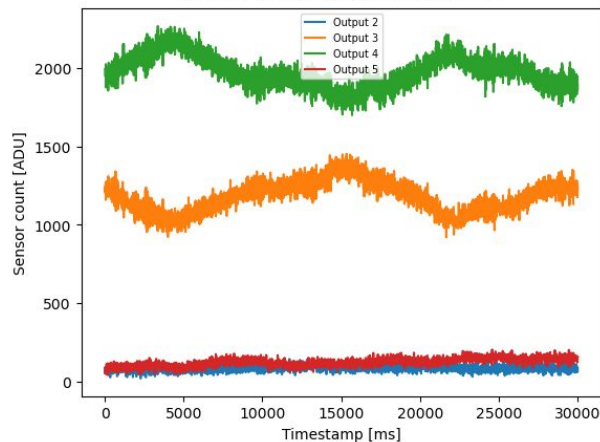
Disk mode

record2025-09-17T12:29:50.779.fits

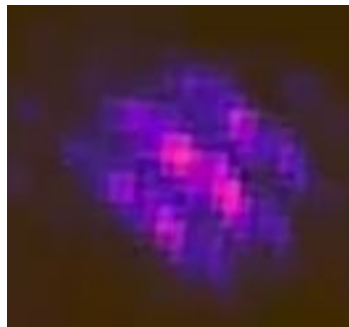


"Backup" mode

record2025-09-17T12:40:23.848.fits



What now?



Asgard fringe tracker already on sky since September

NOTT sent to Paranal in spring 2026

First light with ATs in the summer 2026 for exozodii disks

Planet hunting with UTs to come in 2027

Learn more about Asgard:

