



Panoramic Near-Infrared Camera 

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# Performance of the HAWAII-4RG Detector for PANIC-4K

Vianak Naranjo, 18.07.2022

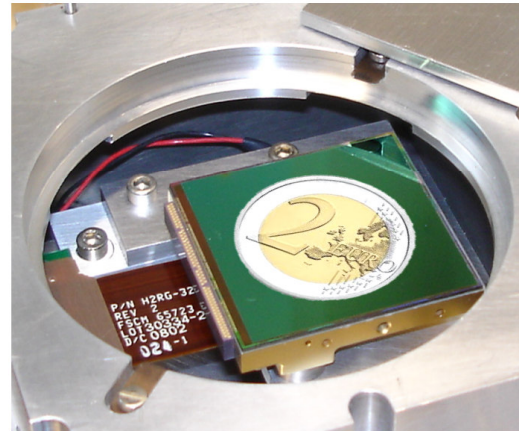
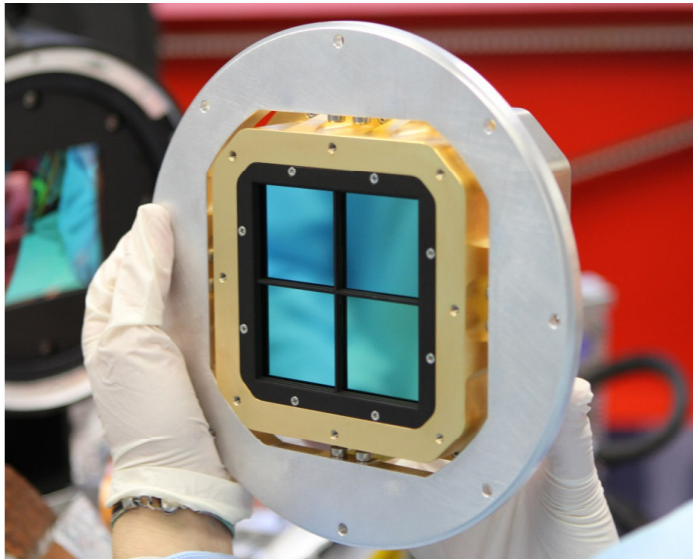
# Overview

- Short background
- Complications & Solutions
- Results of the Characterization
- Status & Outlook

# Short background....

P. Bizenberger: ATT I-2020

- PANIC operated at Calar Alto from 2014 to 2018

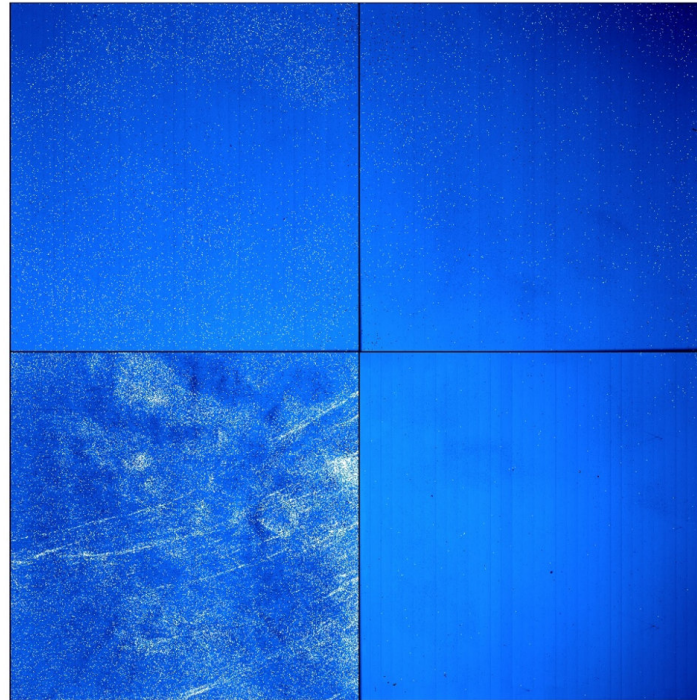
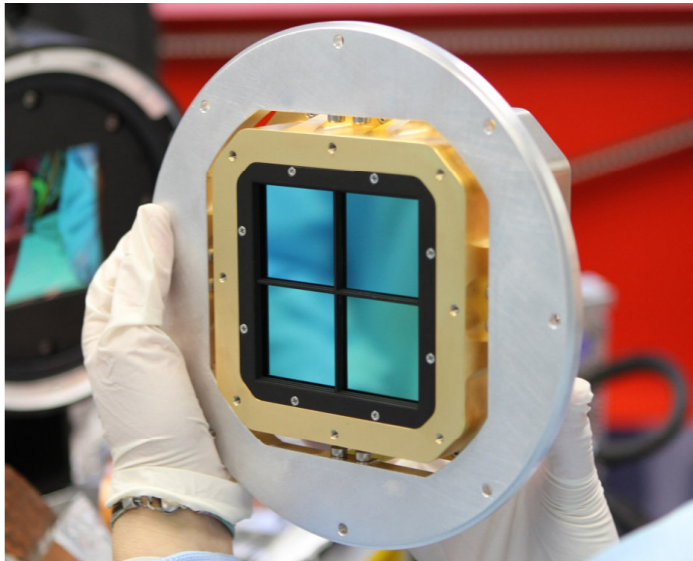


- 2048 x 2048 pixels
- 18  $\mu\text{m}$  pixel size
- 77K operating temperature
- 2.5 $\mu\text{m}$  cut-off wavelength

# Short background....

P. Bizenberger: ATT I-2020

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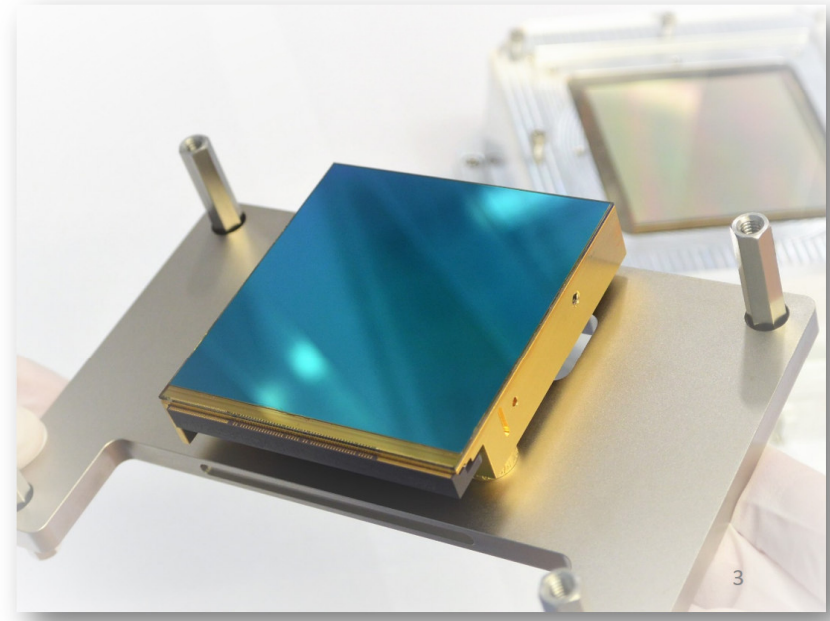


# Short background....

P. Bizenberger: ATT I-2020

- PANIC operated at Calar Alto from 2014 to 2018
- Back to Heidelberg in 2018 to exchange detectors: instead of 4x H2RG's only 1x H4RG => delivered in 2019

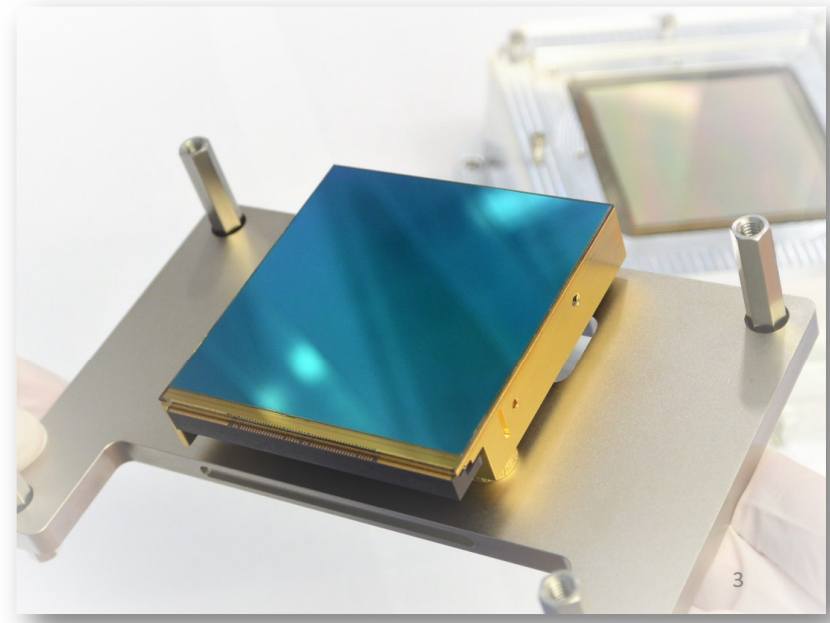
- 4096 x 4096 pixels
- 15  $\mu\text{m}$  pixel size
- 77K operating temperature
- 2.5 $\mu\text{m}$  cut-off wavelength



# Short background....

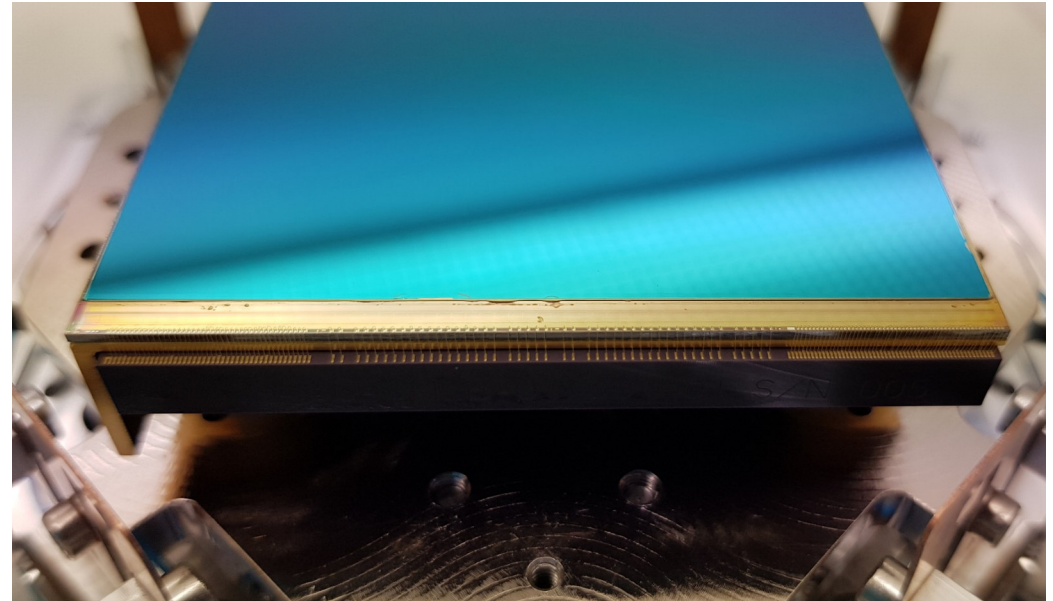
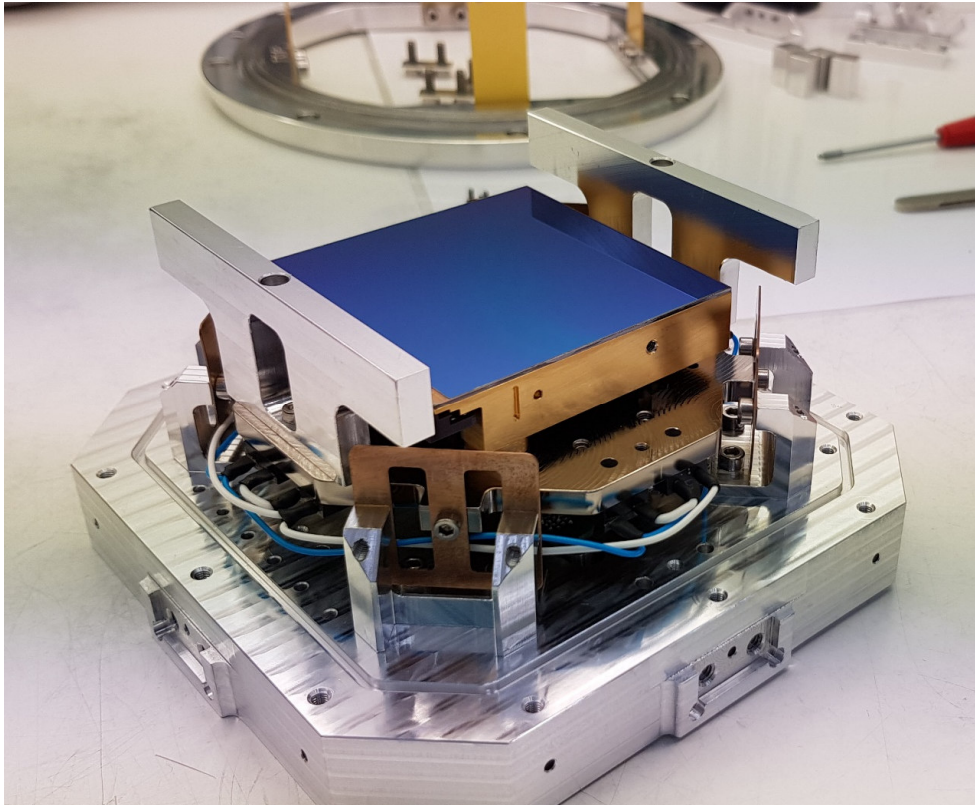
P. Bizenberger: ATT I-2020

- PANIC operated at Calar Alto from 2014 to 2018
- Back to Heidelberg in 2018 to exchange detectors: instead of 4x H2RG's only 1x H4RG => delivered in 2019
- First cold tests in February 2020  
=> Proc. SPIE 114542J
- Lock down in March 2020
- Back in operation in August 2020



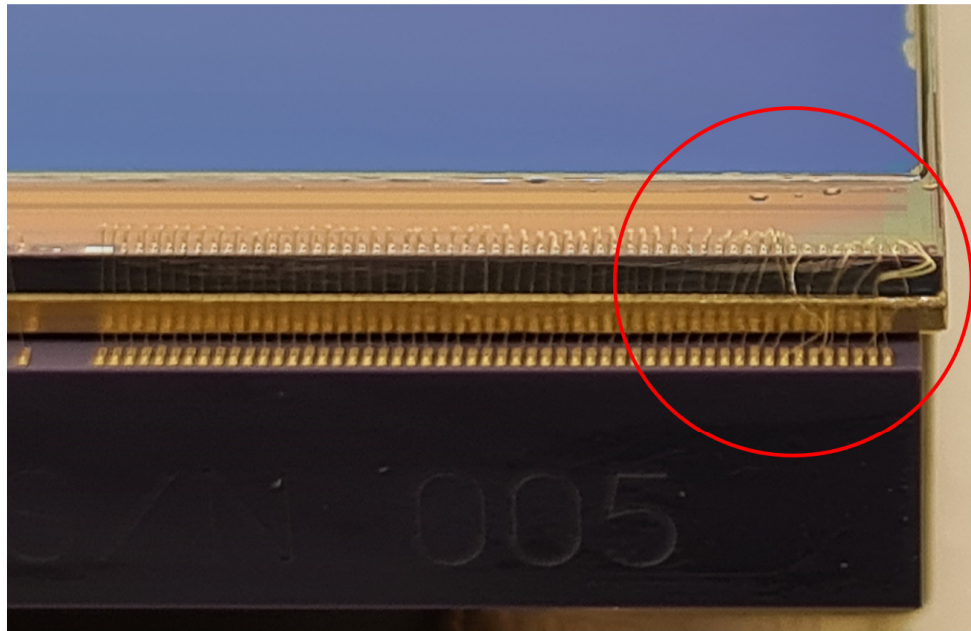


# Complications...



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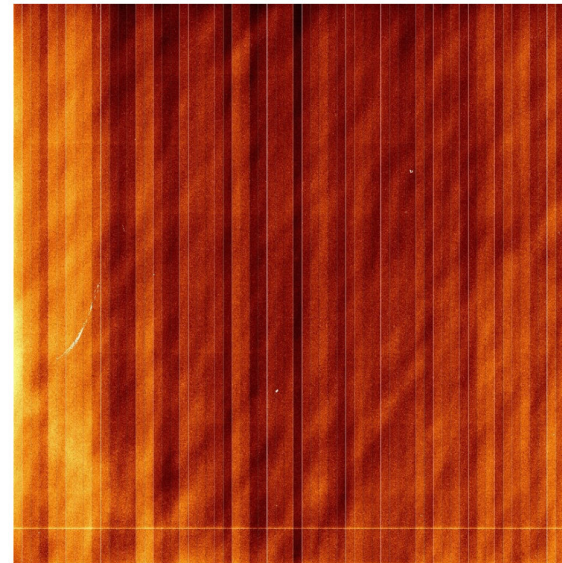
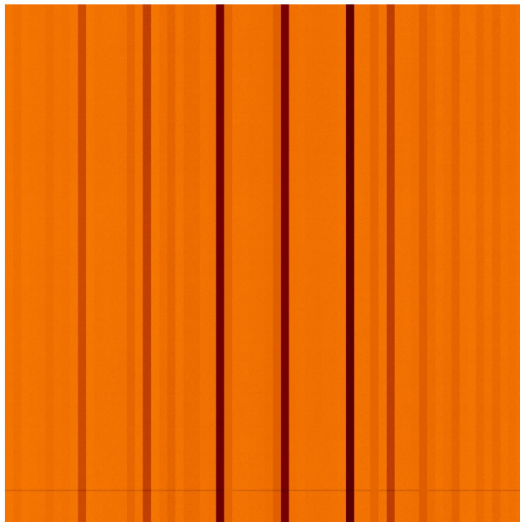
- Some wirebonds were bent during integration





# Complications....

- Some wirebonds were bent during integration
- Repositioned by MPIA Team and warm tests successful
- Cold tests revealed no detector signal



# Complications....

- Some wirebonds were bent during integration
- Repositioned by MPIA Team and warm tests successful
- Cold tests revealed no detector signal
- H4RG sent back to Teledyne in December 2020 for repair
- Inspection @ Teledyne revealed a short cut between 2 of the supply voltages
- No real repair possible, but workaround to make the detector operational
- Detector back at MPIA in August 2021

# Workaround...

- Usually 4 voltages to play with... Dsub, Vbiasgate, Vreset, Vextbias
- And 1 voltage fixed: Vbiaspower

Vextbias: corrects offset

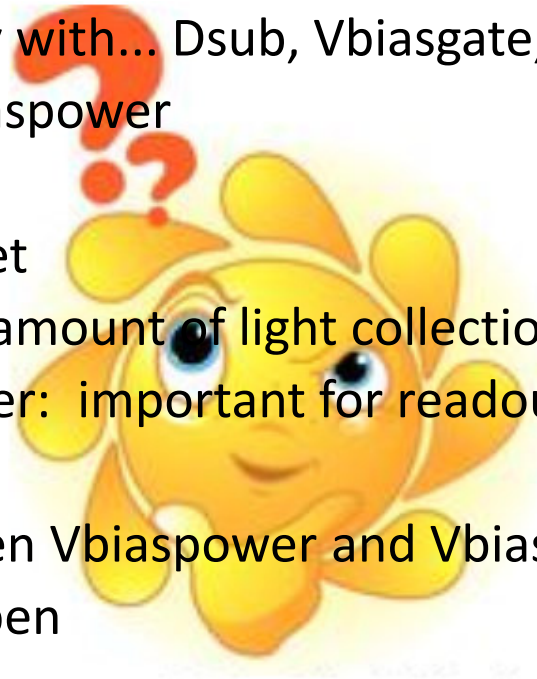
Dsub & Vreset: adjust amount of light collection capacity (full well capacity)

Vbias gate & Vbiaspower: important for readout of the signal/light collected

Problem: short cut between Vbiaspower and Vbiasgate

Workaround: Vbiasgate open

- Drawback: because of the short, only 3 values available: Dsub, Vreset & Vextbias



# Solution...

⇒ Vbiaspower!



- Usually fixed at 3.3 V nominal
- Lowered it in 0.3V steps (resistors changed on the CLK/Bias board) and tested iteratively the detector performance
- Fixed it at 2.7 V

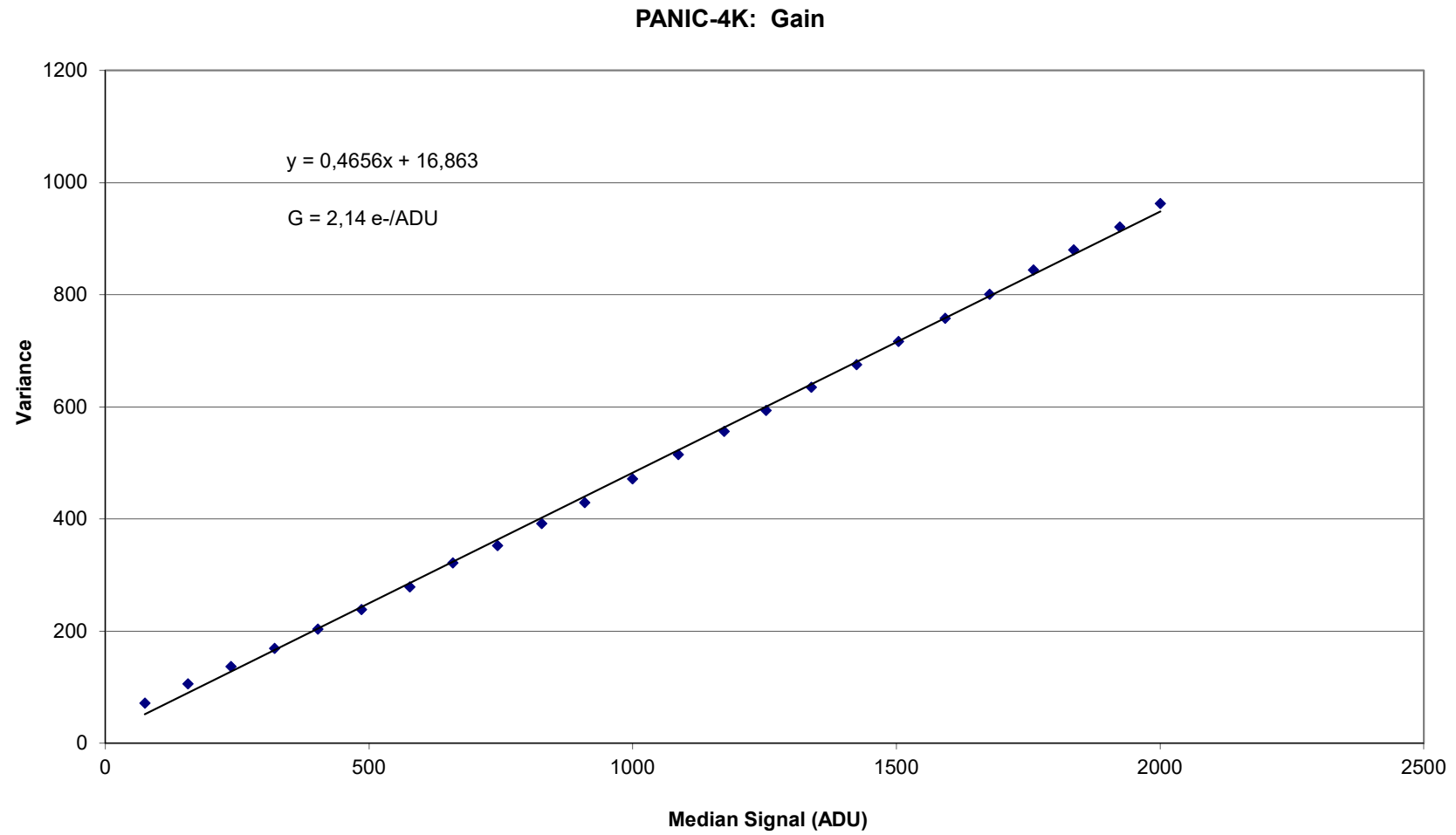


# Characterization...

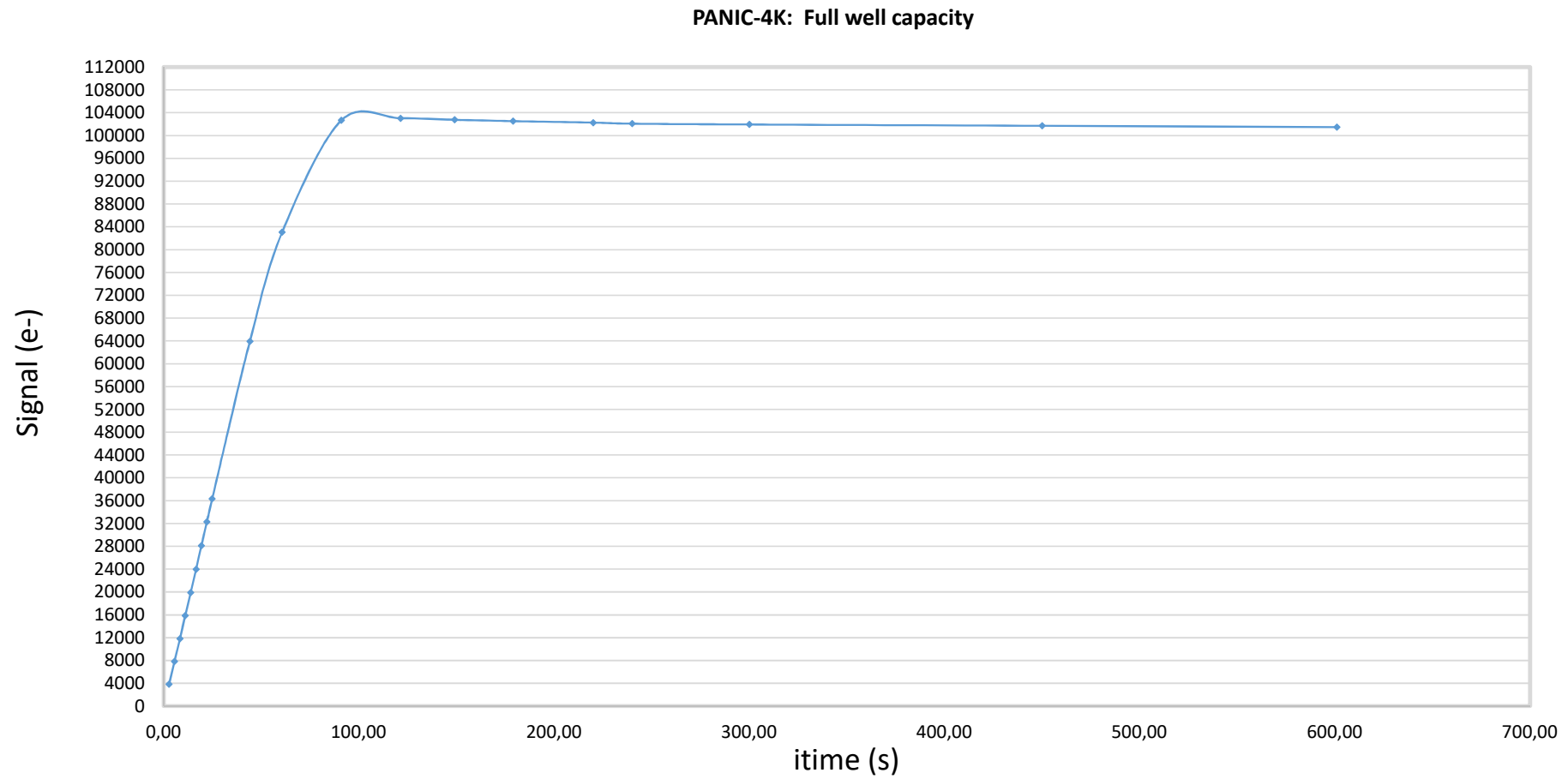
- System Gain
- Full Well Capacity
- Linearity
- Read Out Noise (RON)
- Crosstalk
- Persistence (pending)



# System Gain...

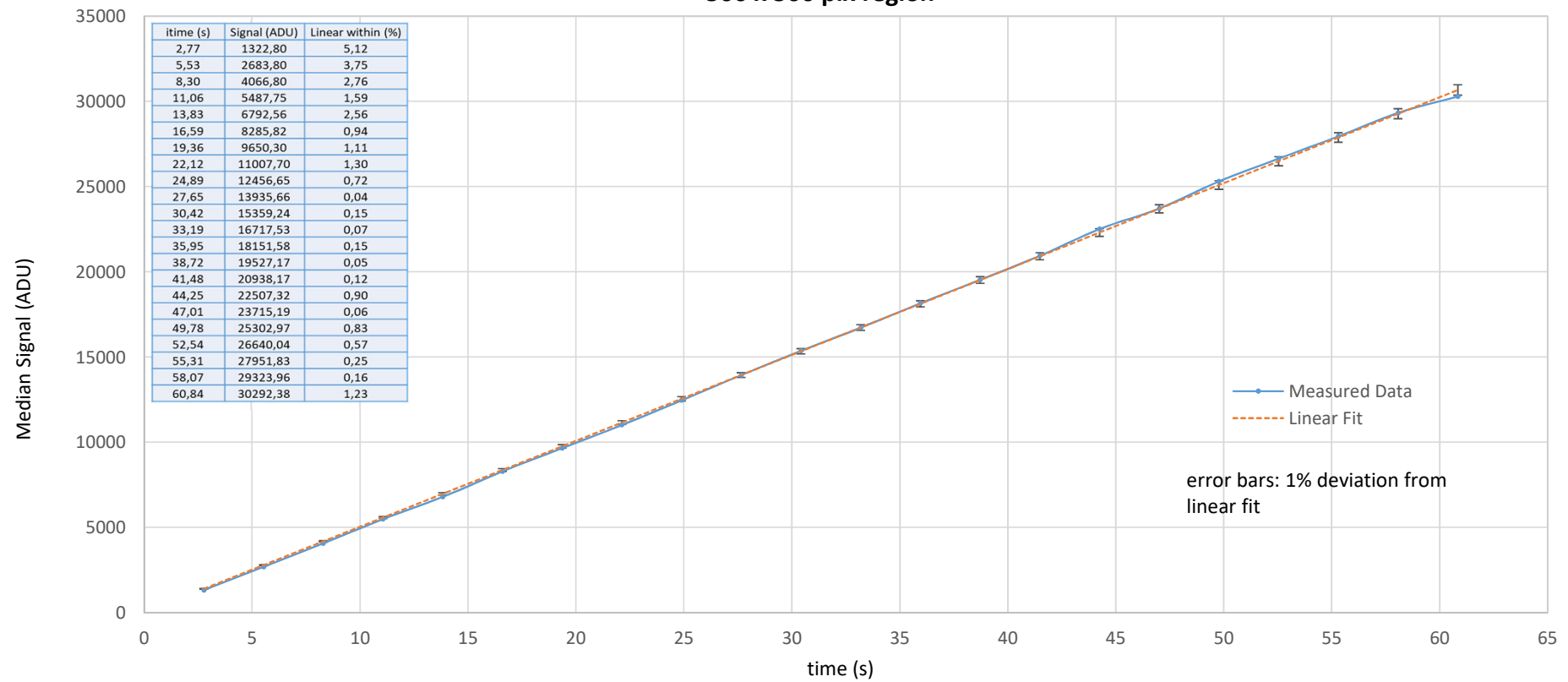


# Full Well Capacity

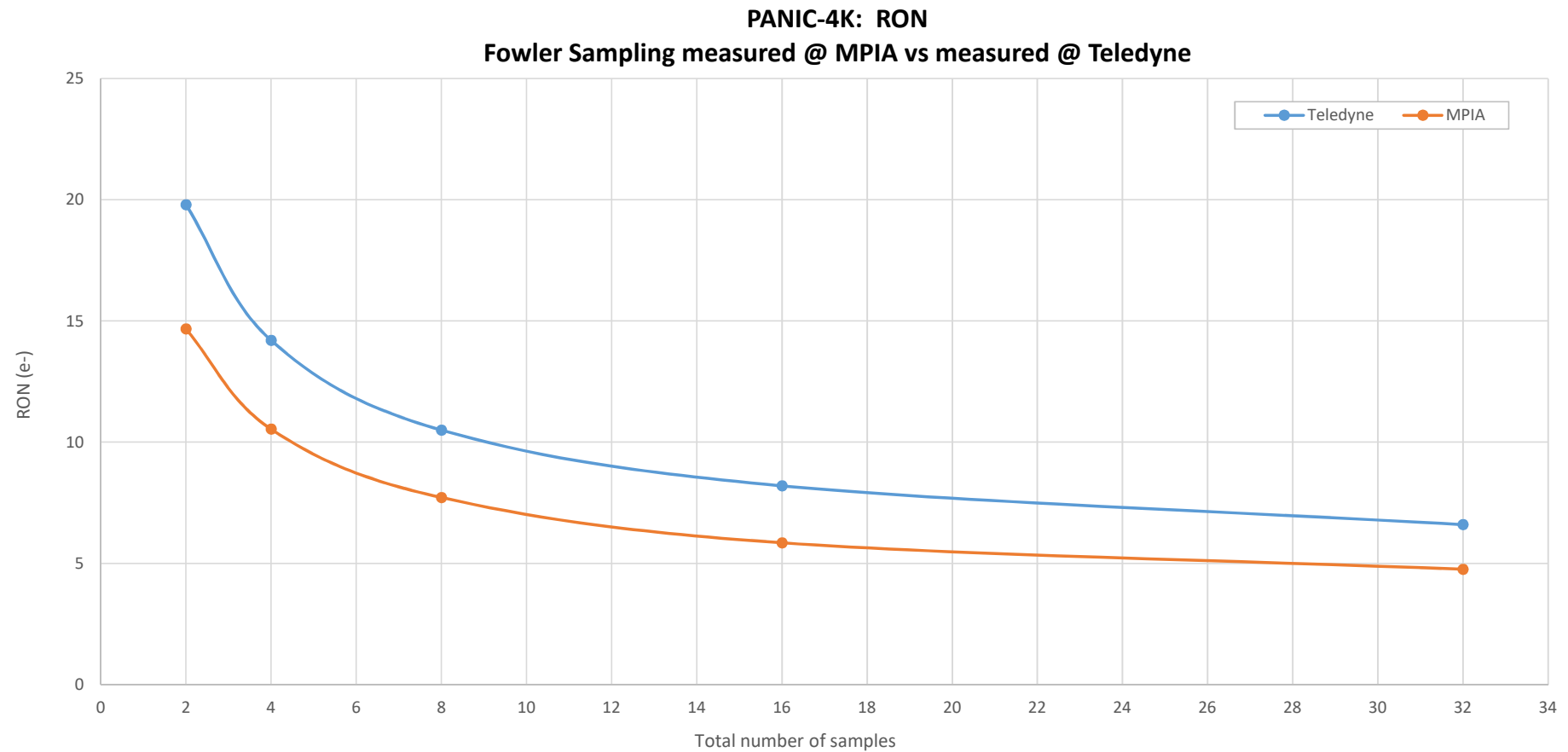


# Linearity

**PANIC-4K: Linearity**  
**500 x 500 pix region**

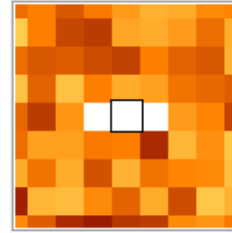
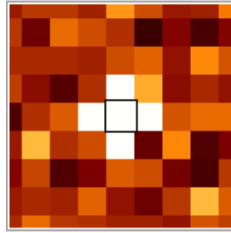
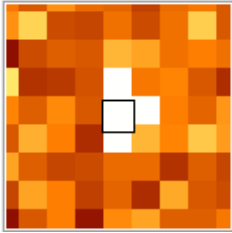


# Read Out Noise (RON)

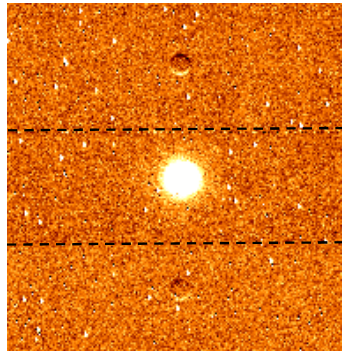


# Crosstalk

- Pixel crosstalk



- Channel crosstalk





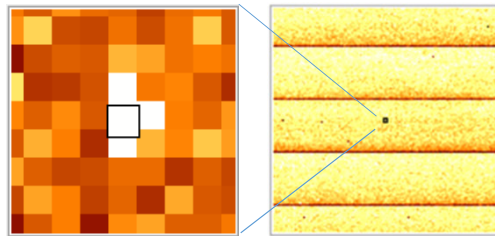
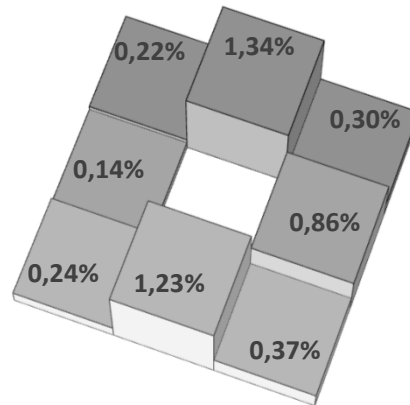
# Pixel Crosstalk

## Measured @ MPIA

xtalk\_Ks\_10000ns\_0001.fits



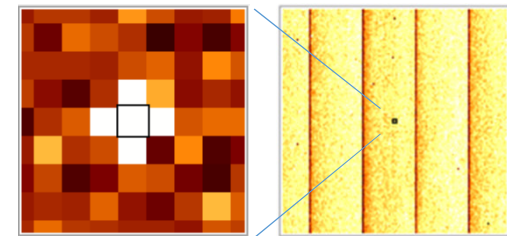
xtalk\_Ks\_14142ns\_0001.fits



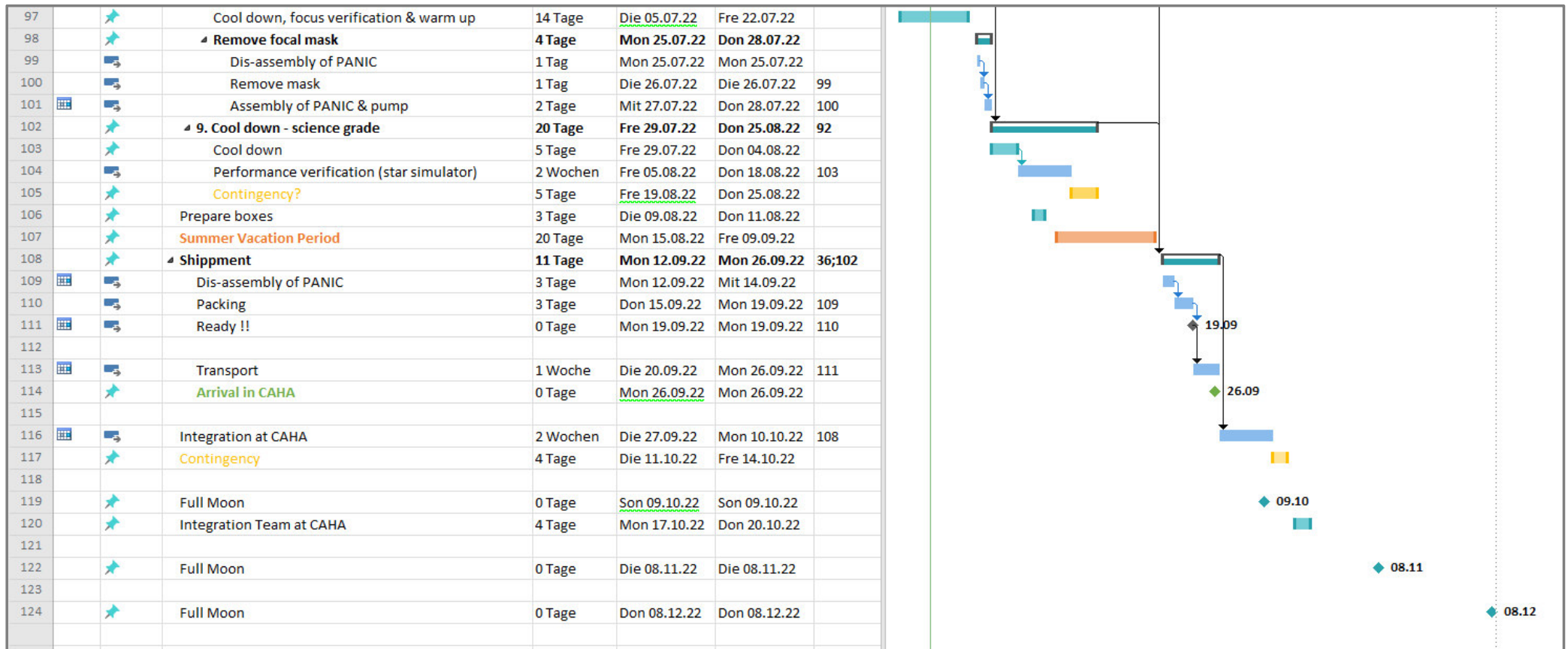
## Teledyne's Test Report



Average CrossTalk = 1.0%



# Status & Outlook



Danke!

