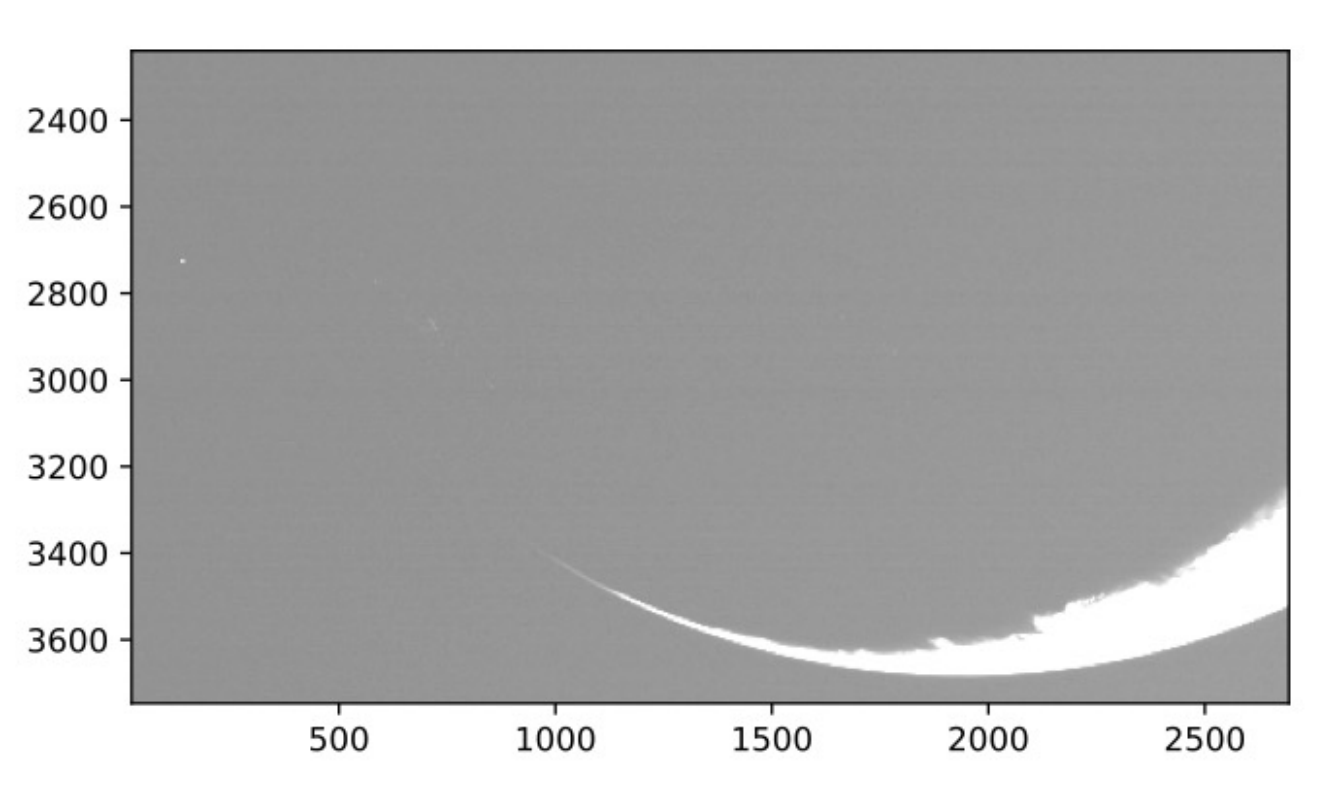
CHARACTERIZATION OF THE VIS/NIR CHANNELS OF SEVIRI WITH VENUS



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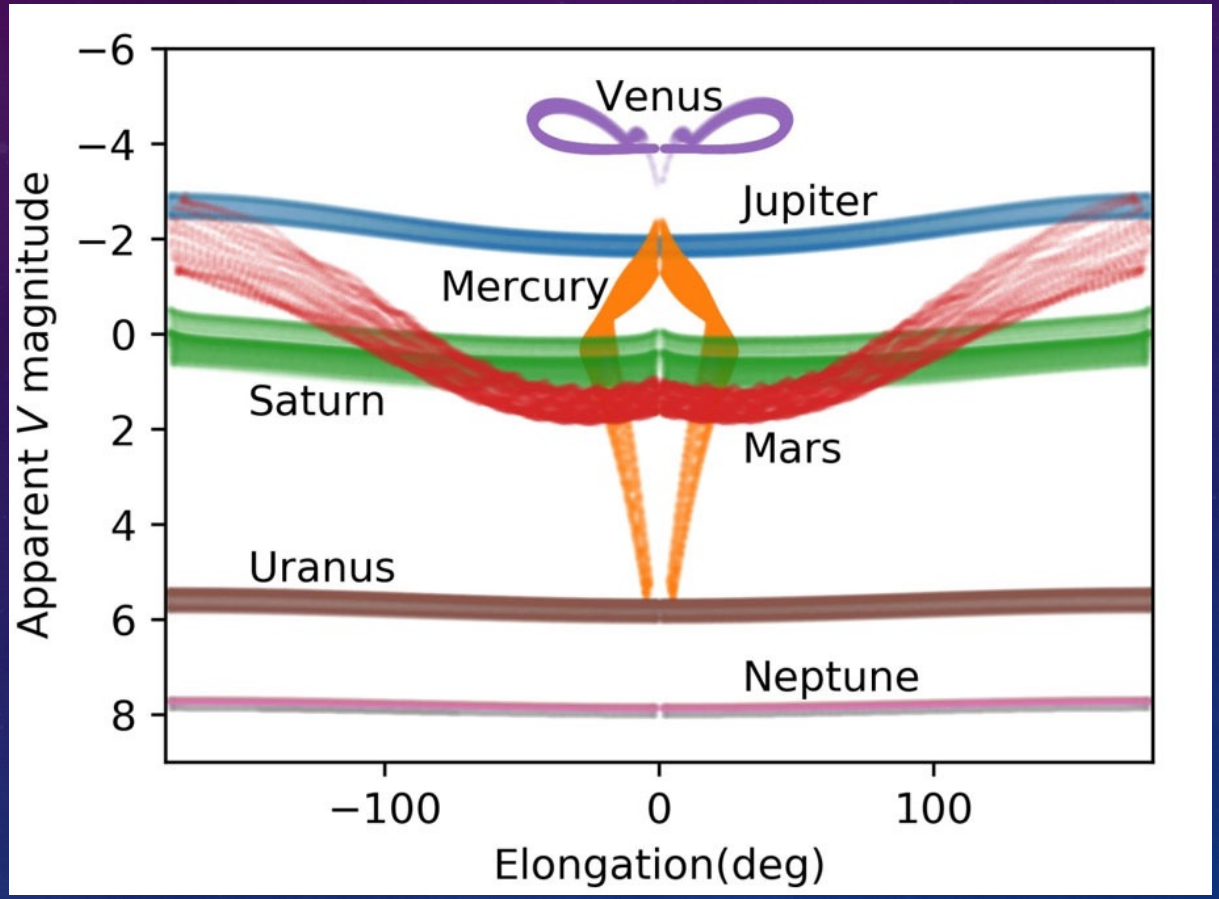
INTRODUCTION: WHY USE PLANETS FOR CAL/VAL?

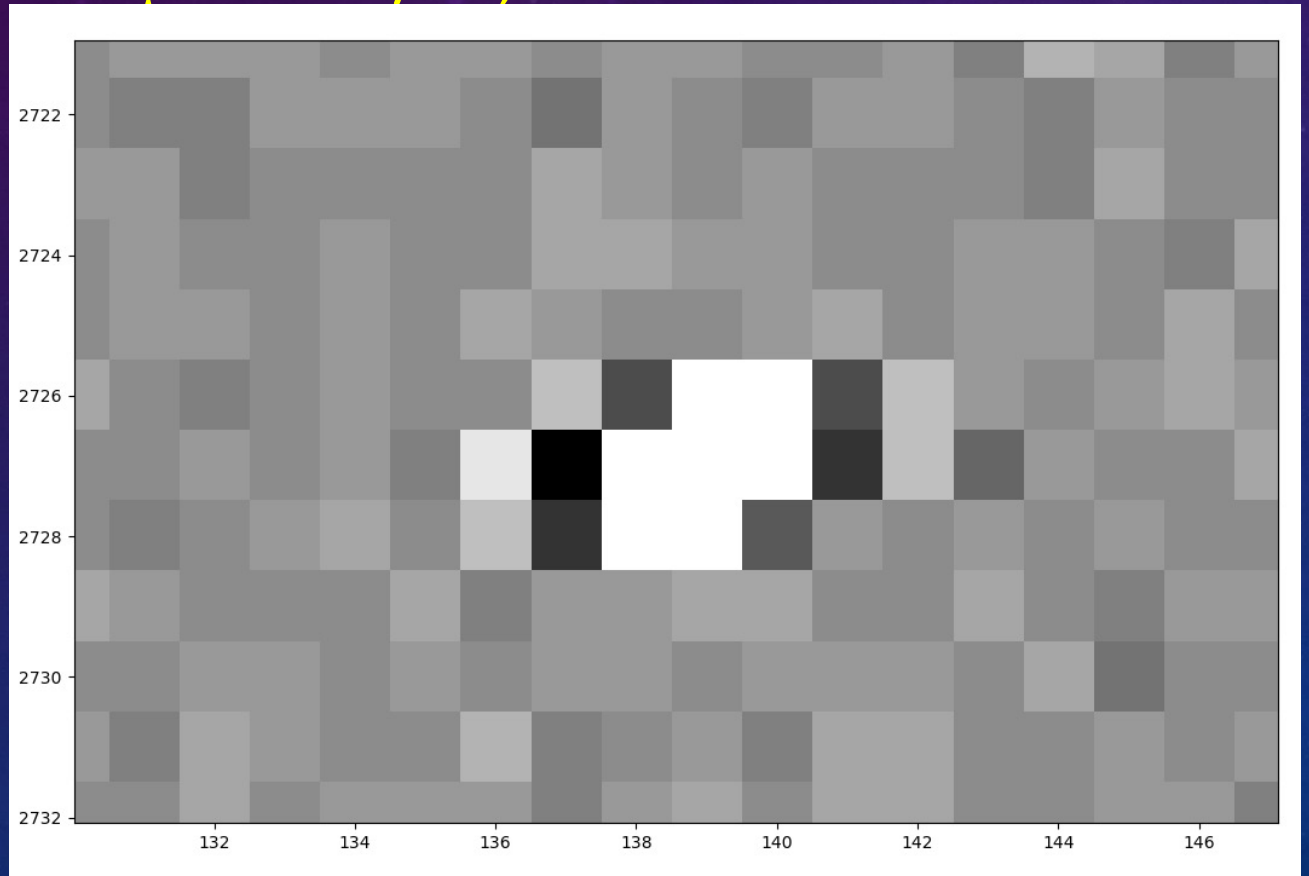
- Serendipitous obs. of well-known objects in flight during mission
- Geometric calibration: position well known, object < IFOV
- Checks ground characterization in flight
- Radiometric calibration: Venus covered by clouds, disk-integrated
- Check photometric stability, alternative to vicarious cal. / SNO
- How accurate are the observations of celestial objects?

PLANETARY MAGNITUDES AS SEEN FROM EARTH

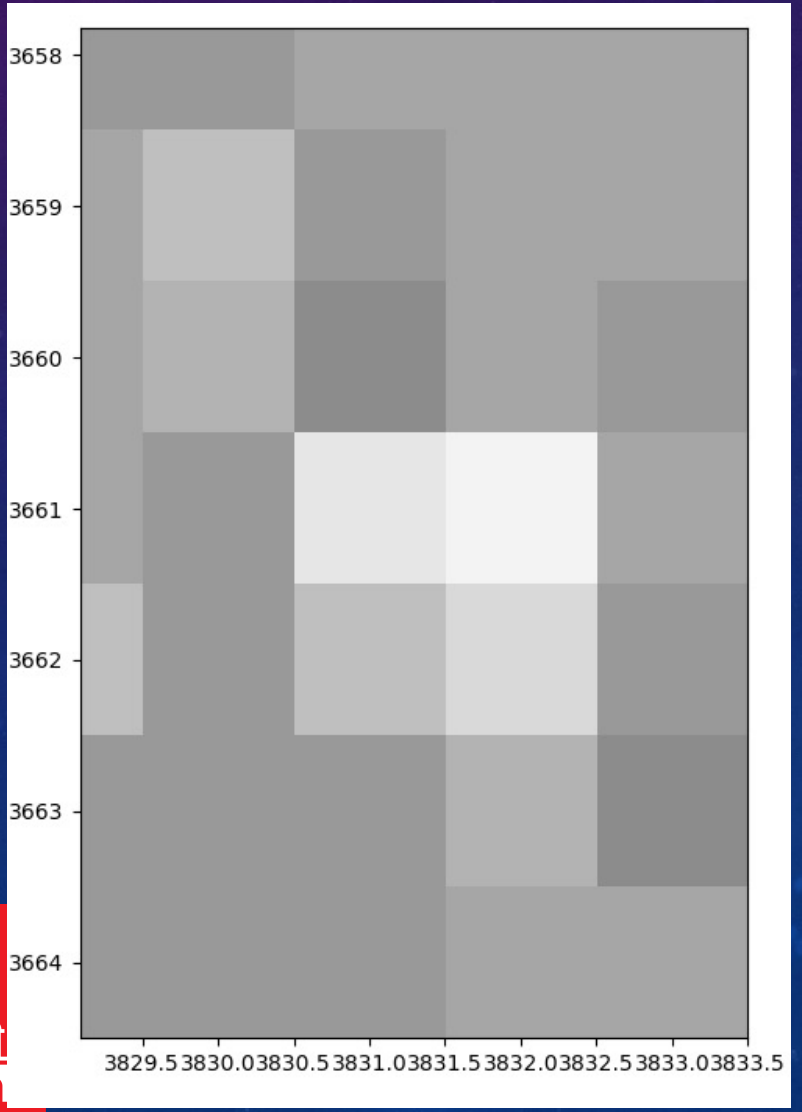


SIMULTANEOUS OBSERVATIONS OF MERCURY & VENUS

Venus with SEVIRI on MSG-3 at 1.6 μm on 5/15, 2017

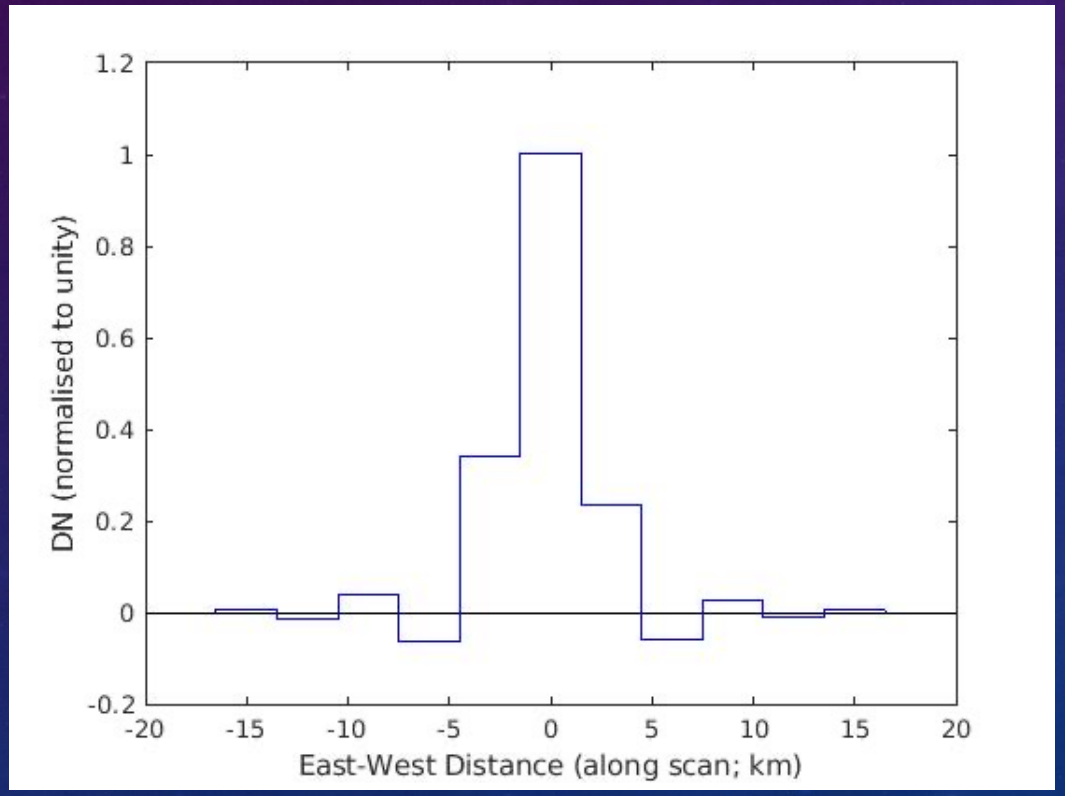


Mercury NIR

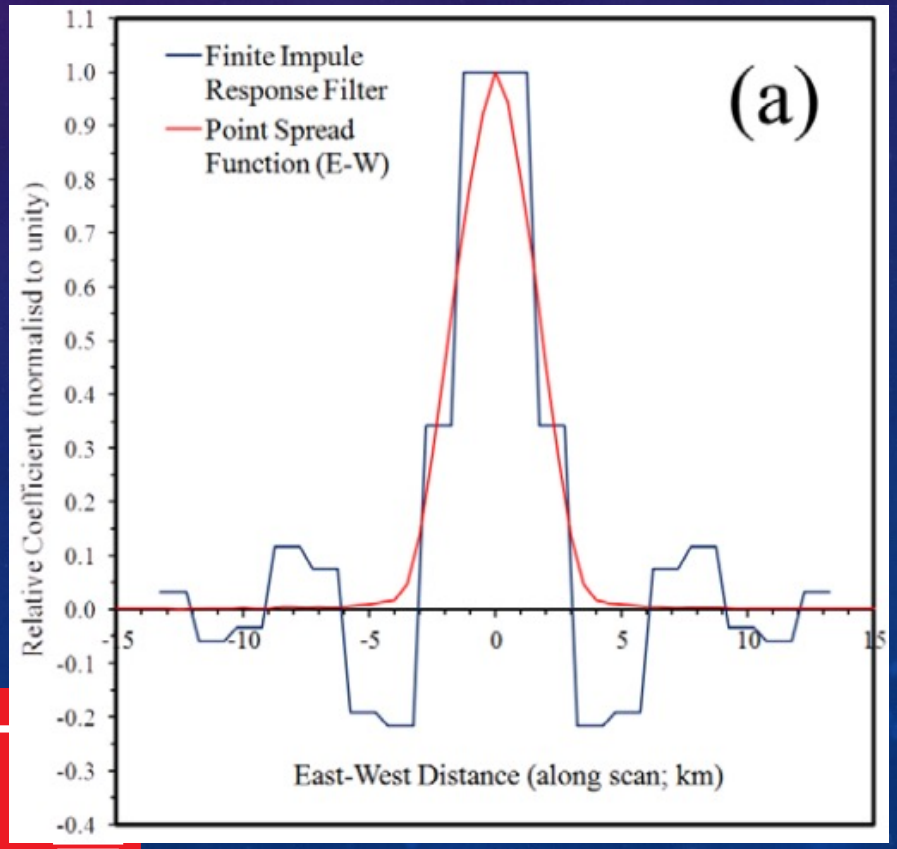


THE E-W POINT SPREAD FUNCTION OF SEVIRI ON MSG-3 AND THE FINITE IMPULSE RESPONSE

Point Spread Function in Flight



Simulation in Wooster et al. (2009)



SUMMARY – GEOMETRIC PERFORMANCE

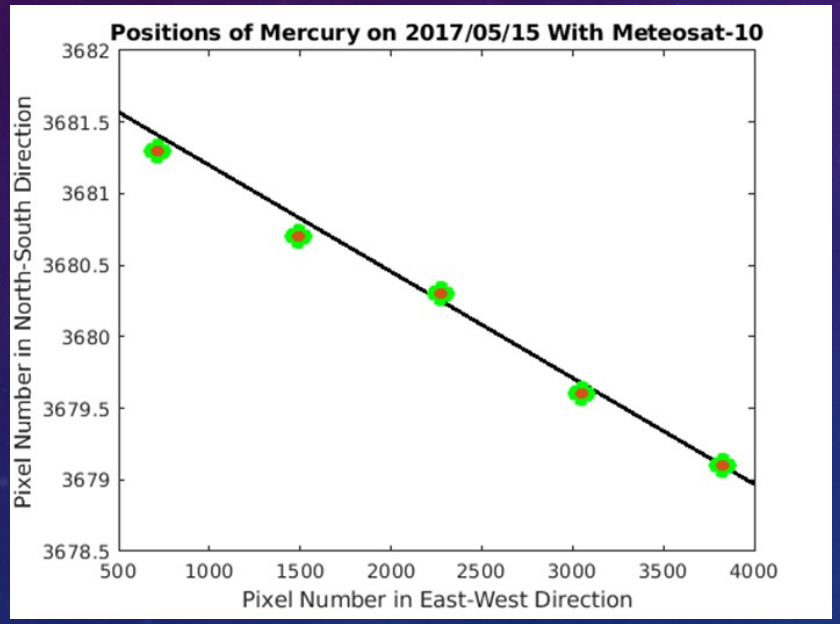
- Point Spread Function
  - Good agreement with expectation – easy to measure for all channels

CHECK GEOMETRIC PERFORMANCE FROM EXACT POS.

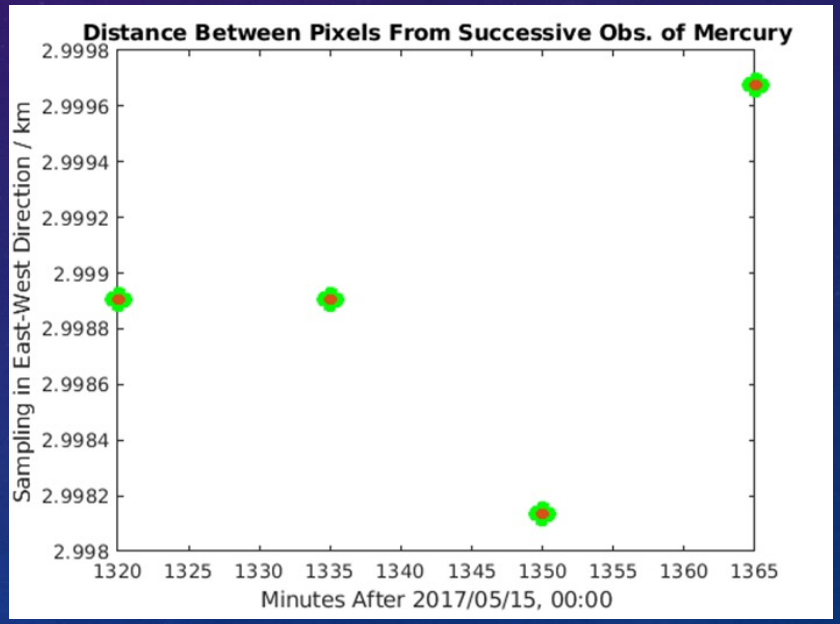
```
*******************************************************************************
 Date__(UT)__HR:MN     R.A._____(ICRF)_____DEC    APmag   S-brt  Ang-diam  1-way_down_LT     S-T-O
*******************************************************************************
$$SOE
 2017-May-15 21:45 *m  00 40 33.49 +03 28 34.0   -4.615   1.479  30.19823     4.59606672  103.6037
 2017-May-16 21:45 *m  00 43 37.63 +03 41 01.3   -4.604   1.479  29.77729     4.66103652  102.8027
 2017-May-17 21:45 *m  00 46 44.44 +03 53 56.3   -4.592   1.479  29.36658     4.72622472  102.0150
 2017-May-18 21:45 *m  00 49 53.80 +04 07 17.9   -4.581   1.478  28.96583     4.79161288  101.2400
$$EOE
*******************************************************************************
```

CONSECUTIVE OBSERVATIONS OF A PLANET

Movement in North-South direction agrees with obs.



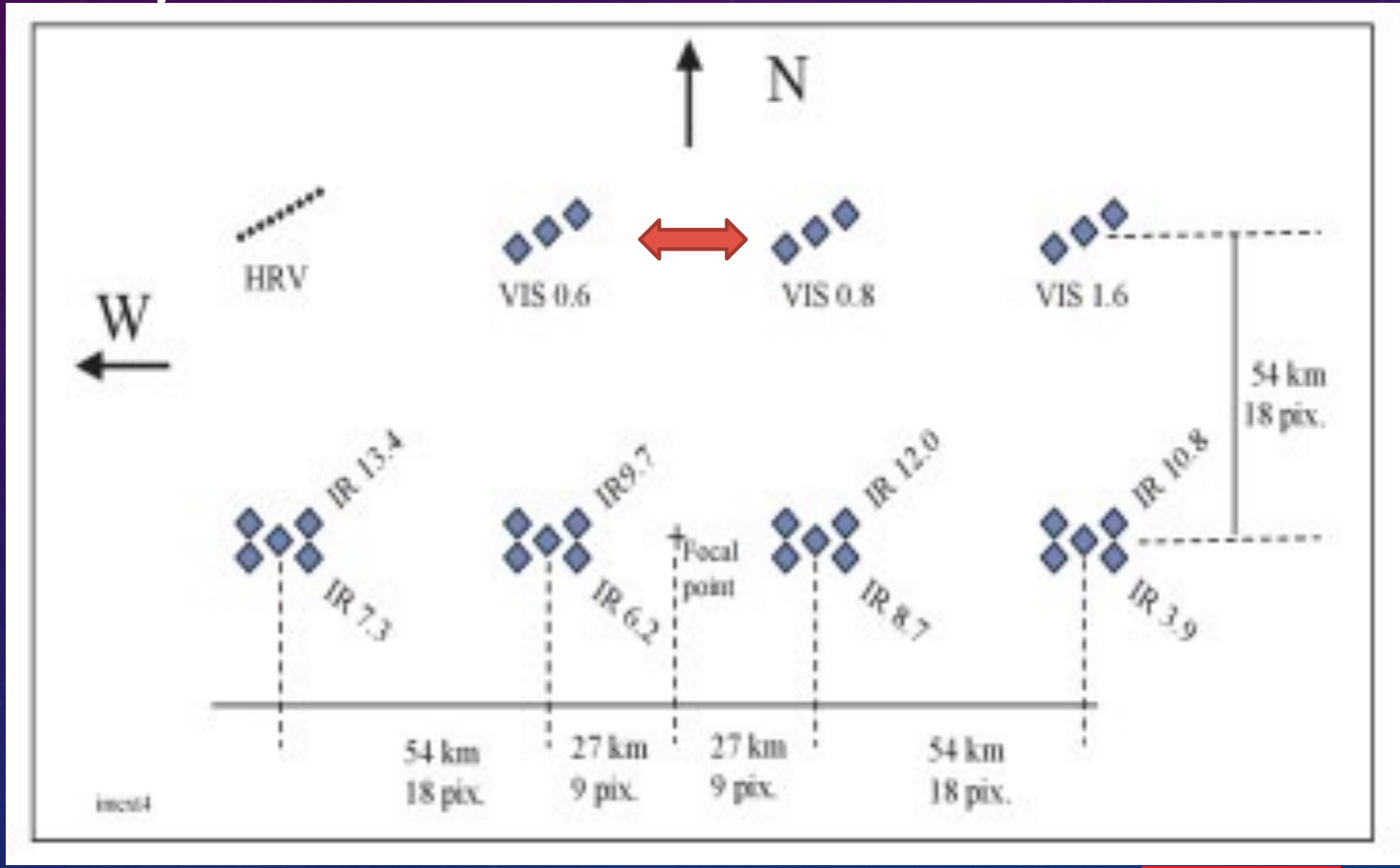
Sampling is accurate within a fraction of a ‰ over one hour.



SUMMARY – GEOMETRIC PERFORMANCE

- Point Spread Function
  - Good agreement with expectation – easy to measure for all channels
- Relative accuracy within an image and between consecutive images
  - Rel. accuracy tested with Mercury and Venus standing 18.3° (> Ø of Earth) apart: sampling error 1.6 m (MSG-3), tilt <0.04°
  - Confirmed with five consecutive observations of Mercury

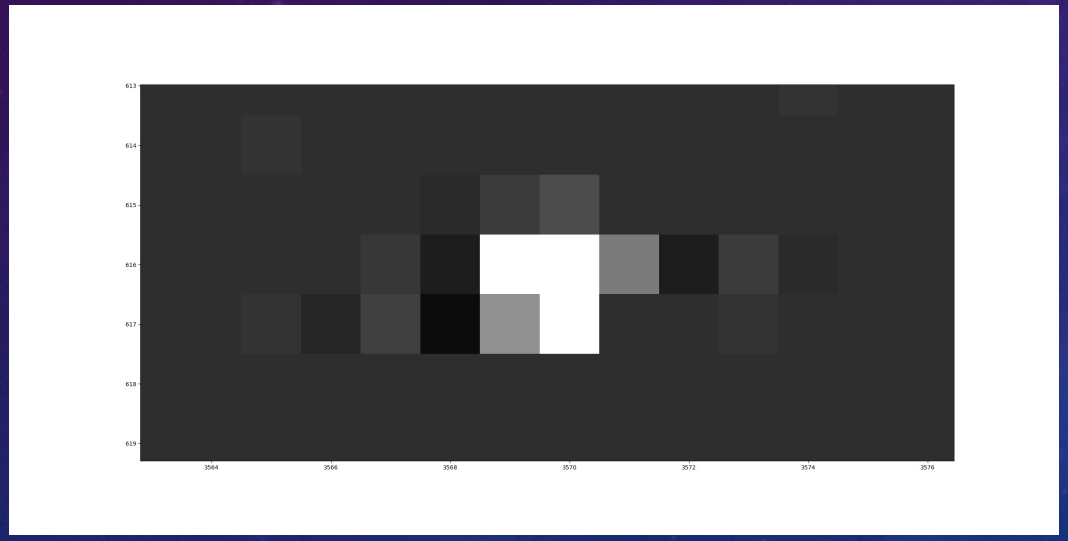
SOUTH/NORTH SEPARATION OF VNIR CHANNELS



Nain & Mueller, 2019

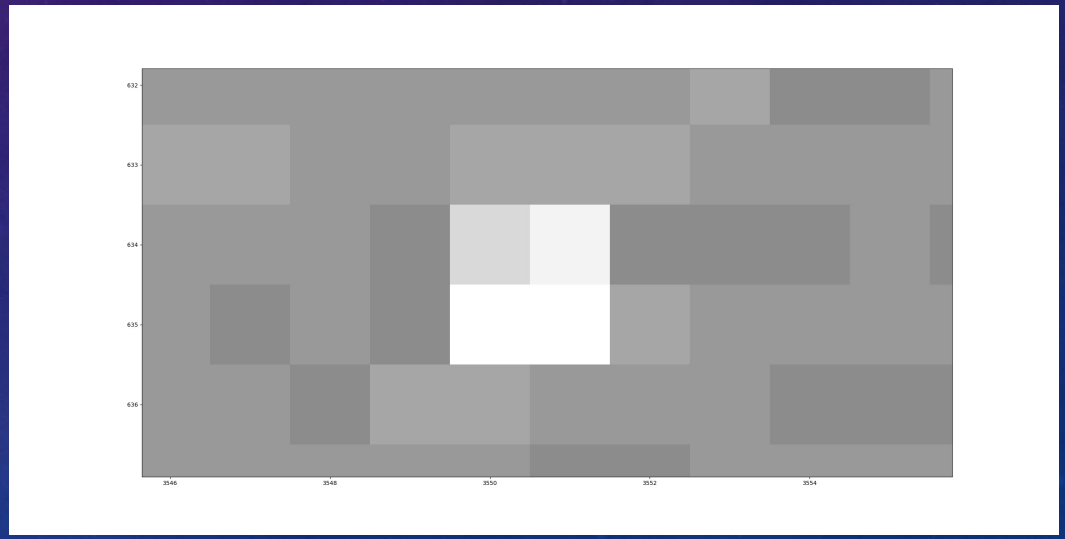
CHANNEL CO-REGISTRATION WITH SEVIRI ON MSG-4

Venus at 800 nm on 9/30, 2019



Venus at 6200 nm on 9/30, 2019

Distance IR-VIS channels: 1.4 km



SUMMARY – GEOMETRIC PERFORMANCE

- Point Spread Function
  - Good agreement with expectation – easy to measure for all channels
- Relative accuracy within an image and between consecutive images
  - Rel. accuracy tested with Mercury and Venus standing 18.3° (> Ø of Earth) apart: sampling error

    1.6 m (MSG-3), tilt <0.04°
  - Confirmed with five consecutive observations of Mercury
- Mis-registration in different channels
  - Poor co-registration of focal planes, both in N-S (≈1 km) and E-W (≈10 km) direction

GEOMETRIC AND RADIOMETRIC PERFORMANCE

- Point Spread Function
  - Good agreement with expectation – easy to measure for all channels
- Relative accuracy within an image and between consecutive images
  - Rel. accuracy tested with Mercury and Venus standing 18.3° (> Ø of Earth) apart: sampling error 1.6 m (MSG-3), tilt <0.04°
  - Confirmed with five consecutive observations of Mercury
- Mis-registration in different channels
  - Poor co-registration of focal planes, both in N-S and E-W direction
- Radiometric calibration
  - Measurement uncertainties in VIS/NIR similar to vicarious calibration (2% - 5% single obs.)
  - In spite of mismatch between IFOV and sampling

CONCLUSIONS

- Venus in the corners of the image is helpful for characterising the geometric performance of SEVIRI's VIS/NIR (and IR) channels in flight.
- Characterisation of radiometric stability possible for successive images – how constant is albedo?
- For VIS/NIR imagers with small IFOV (ABI, AHI, AMI): star close to celestial equator, e g Procyon
- Manoeuvres unnecessary – but access to raw data is needed.