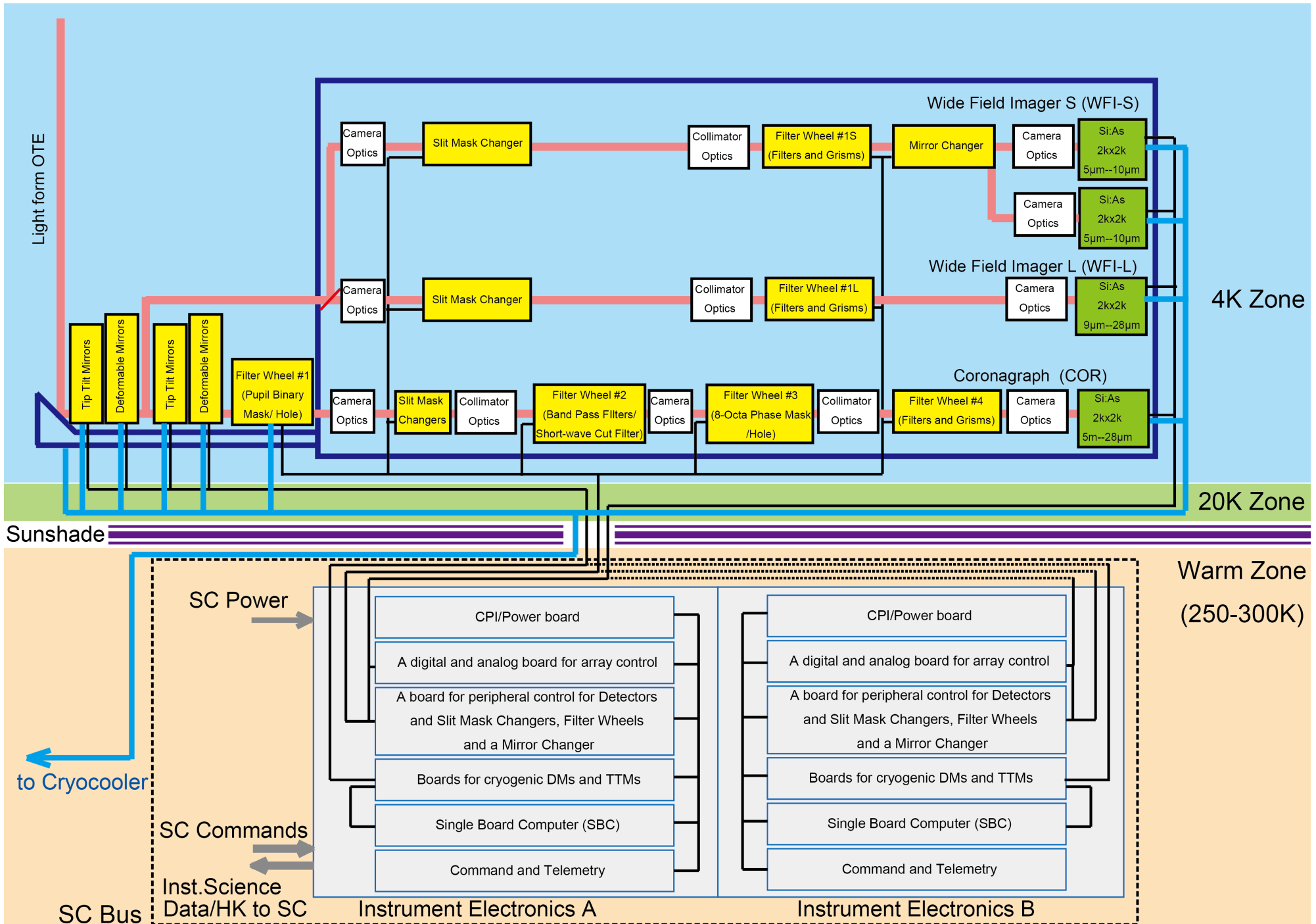


# Pointing Requirements for MISC

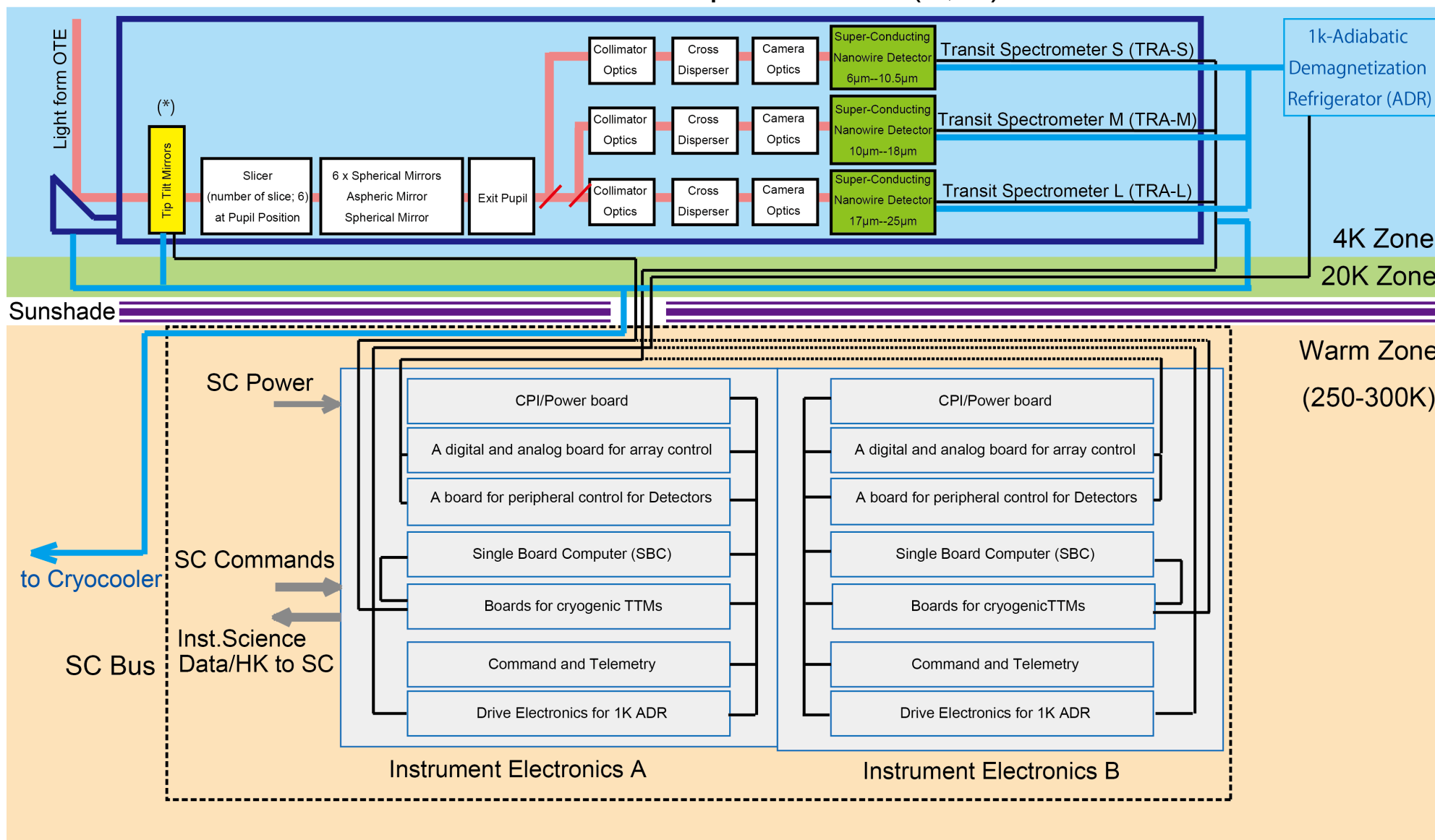
OST concept 2

16 April 2018

# OST/MISC Camera - with coronagraph channel



# OST/MISC Transit Spectrometer (A, B)



# MISC Observing Mode 1

1. **Stare with MISC Camera/Wide Field Imager (WFI) - Imaging and low resolution spectroscopy (slit, slit-less) with MISC Camera/WFI-S and WFI-L.**
  - ***Pointing accuracy:*** the target is placed on a specified location on the MISC focal plane 5" (TBC) required from the observatory, and the MISC tip-tilt mirror will do what else is needed to place it within 71 mas, 1 sigma radial
  - ***Pointing reconstruction;*** N/A for MISC
  - ***Pointing stability:*** 36 mas, 1 sigma radial for ~600 sec

## Notes and rationale:

- The slit width of the WFI-S;  $1.22 \times 10 \mu\text{m} / 5.9\text{m} = 0.426 \text{ arcsec}$ , 3 sigma pointing stability =  $\frac{1}{4}$  of the slit width during the longest exposure
- The first tip-tilt mirror (TTM#1) in the fore-optics of MISC camera **will** be used to correct for the pointing jitter and drift
- If science images are not required from the short wavelength array it will operate in Window Mode, where up to 8  $32 \times 32$  sub-arrays will be read out at 20 Hz. Centroid measurements will be sent to the first MISC tip-tilt mirror to correct for jitter and drift.

# MISC Observing Mode 2

**2. Stare with MISC Camera/Wide Field Imager (WFI) (short wavelength only in window mode) and provide correction signals to the telescope FSM - tracking Guide Stars while another instrument is operated in stare mode.**

- ***Pointing knowledge:*** Determined by the other instrument's requirements
- ***Pointing reconstruction:*** Determined by the other instrument's requirements
- ***Pointing stability:*** : Determined by the other instrument's requirements

## **Notes and rationale:**

- The short wavelength imaging array will be used in window mode, where up to 8 32 x 32 sub-arrays will be read out at 20 Hz. Centroid measurements will be sent to the telescope FSM to correct for jitter and drift.
- The first tip-tilt mirror (TTM#1) in the fore-optics of MISC camera will ***not*** be used to correct for the pointing jitter

# MISC Observing Mode 3

## 3. Scan with MISC Camera/Wide Field Imager (WFI). Tracking Guide Stars while another instrument is operated in scan mode

- ***Pointing knowledge***: Determined by the other instrument's requirements
- ***Pointing reconstruction***: Determined by the other instrument's requirements
- ***Pointing stability***: : Determined by the other instrument's requirements

### Notes and rationale:

- The short wavelength imaging array will be used in window mode, where up to 8 32 x 32 sub-arrays will be read out at 20 Hz. Centroid measurements will be sent to the telescope FSM to correct for jitter and drift.
- The first tip-tilt mirror (TTM#1) in the fore-optics of MISC camera will be used in a saw-tooth pattern to keep up with the linear scan rate , but will not be used to correct for the pointing jitter and drift
- Can also be used while doing Lissajou pattern scanning, although the MISC cannot accommodate Lissajou patterns greater than  $\sim 1' \times 1'$  (TBC)

# MISC Observing Mode 4

**4. Stare with MISC Camera/Coronagraph (COR).** Coronagraph Imaging and low-resolution spectroscopy (slit and/or MOS with micro shutter array)

- ***Pointing Accuracy***: : the target is placed on a specified location on the MISC focal plane 5" (TBC) required from the observatory, and the MISC tip-tilt mirror will do what else is needed to place it within 8.7 mas, 1 sigma radial
- ***Pointing reconstruction***: N/A in this mode
- ***Pointing stability***:  $0.05 \times 5\mu\text{m}/5.9\text{m} = 8.7 \text{ mas}$ , 1-sigma radial *with the help of the internal tip-tilt mirror (TTM#2) for the MISC Camera/Coronagraph*

## **Notes and rationale:**

- The narrowest slit width of the COR;  $1.22 \times 10\mu\text{m}/5.9\text{m} = 0.426 \text{ arcsec}$
- The central star should be settled in the middle of the 8-OPM mask (within  $0.05 \times \lambda/D$ , radial  $0.05 \times 5\mu\text{m}/5.9\text{m} = 8.7 \text{ mas}$ , 1-sigma radial ) to achieve the  $10^{-6}$  contrast.
- The short wavelength imaging array will be used in window mode, where up to 8  $32 \times 32$  sub-arrays will be read out at 20 Hz. Centroid measurements will be sent to the MISC coronagraph tip-tilt mirror (TTM#2) to correct for jitter and drift.

# MISC Observing Mode 5

## 5. Stare with MISC Transit Spectrometer (TRA). Super stable spectroscopy with MISC TRA

- ***Pointing Accuracy:*** the target is placed on a specified location on the MISC focal plane 5" (TBC) required from the observatory. The MISC short wavelength imaging array will provide the information needed for the telescope FSM to bring it within 1", 1-sigma radial (TBC)
- ***Pointing reconstruction:*** N/A in this mode
- ***Pointing stability:*** 30mas over 1-10 hours

### Notes and rationale:

- The short wavelength imaging array will be used in window mode, where up to 8 32 x 32 sub-arrays will be read out at 20 Hz. Centroid measurements will be sent to the telescope FSM to correct for jitter and drift.
- The pointing jitter should be smaller than 30mas over 1-10 hours to achieve a few ppm stability.
- *If the 10mas stability is not achieved by the observatory, the MISC transit spectrometer is going to need its own tip-tilt mirror in its fore-optics.*