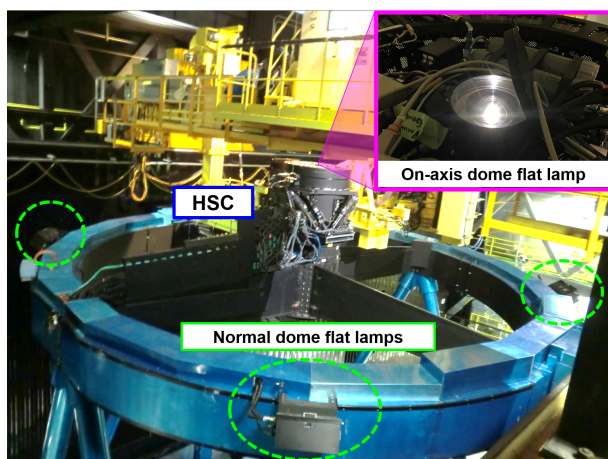


HSC On-Axis Dome Flats

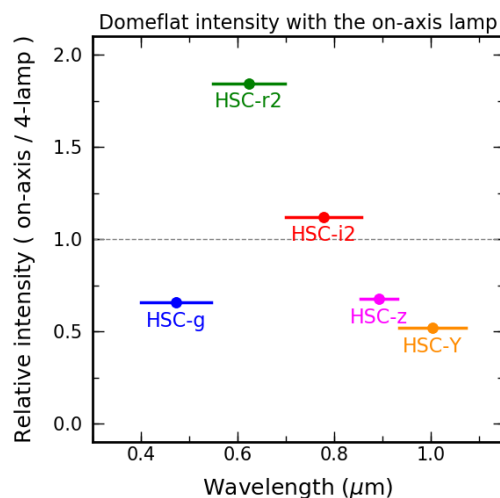
January 22, 2021

T. Terai (Subaru Telescope)

- A single lamp called “on-axis lamp” is attached on the top of HSC camera unit for dome flats.
- The lamp module is composed of a tungsten halogen lamp, a reflecting mirror, concave lenses, and filters for color temperature conversion and infrared blocking, which allows to illuminate the dome flat panels uniformly.
- HSC dome flats will be fully shifted from the normal ones with flat lamps on the telescope top ring to those with the on-axis lamp as the default science calibration data since the S21A February run.
- Flatness of science images reduced by the on-axis dome flats (with the rotator angle of 90°) mostly reaches a gradient across the image of $\sim 1\%$ /deg, much better than those reduced by the normal dome flats ($\sim 4\%$ /deg).
- The appropriate exposure times of on-axis dome flats in the narrow band filters have not yet been set. Further tests are required.



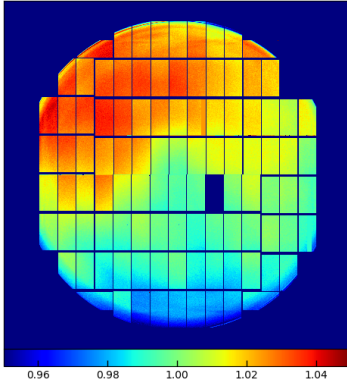
Normal flat lamps and HSC's on-axis lamp



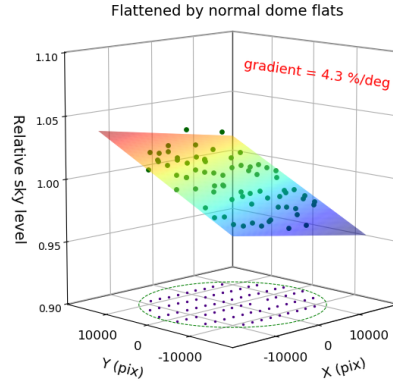
Difference in the dome flat intensities between the on-axis and normal lamps

Evaluation of flatness

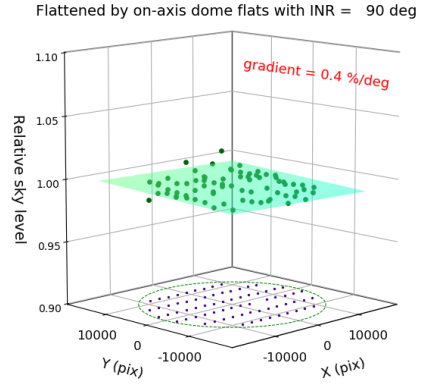
HSC-g filter



On-axis / Normal

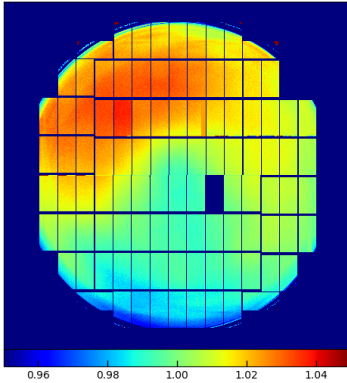


Science images reduced by normal dome flats

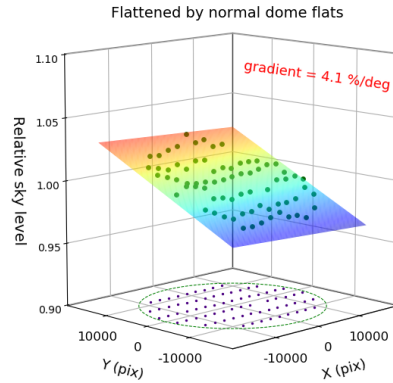


Science images reduced by on-axis dome flats

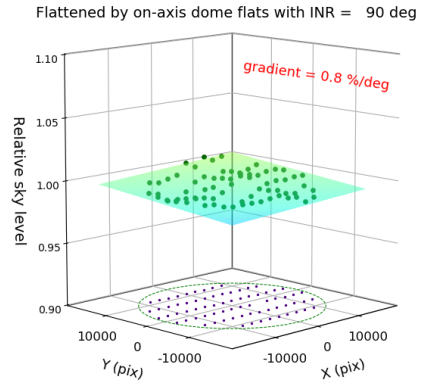
HSC-r2 filter



On-axis / Normal

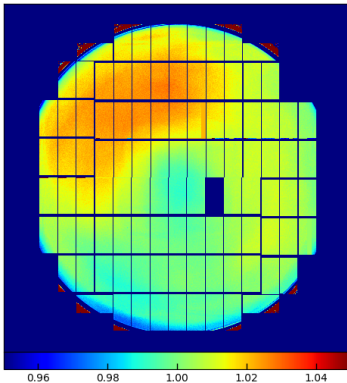


Science images reduced by normal dome flats

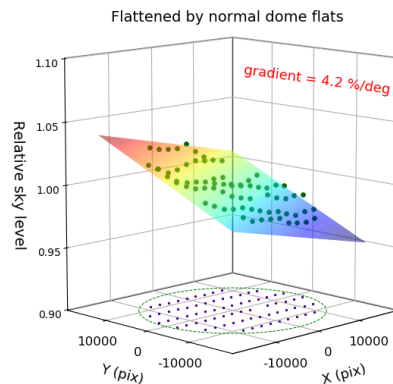


Science images reduced by on-axis dome flats

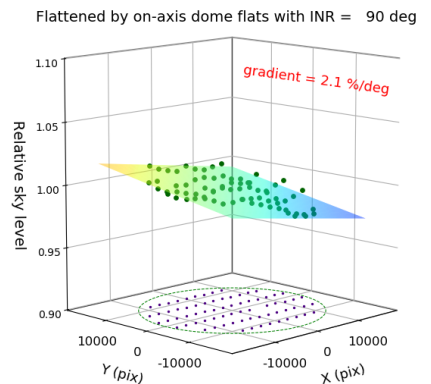
HSC-z filter



On-axis / Normal



Science images reduced by normal dome flats

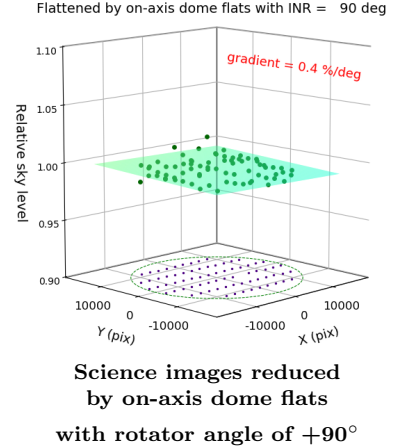
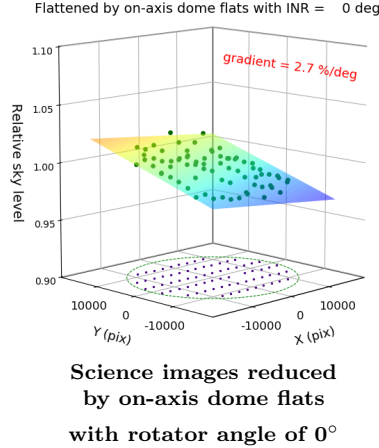
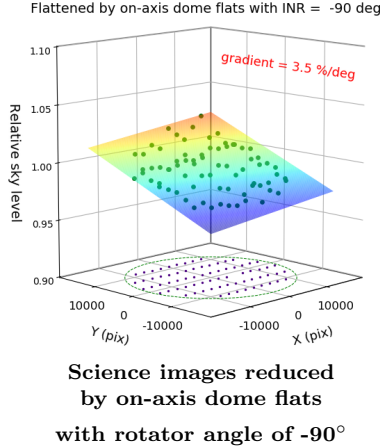


Science images reduced by on-axis dome flats

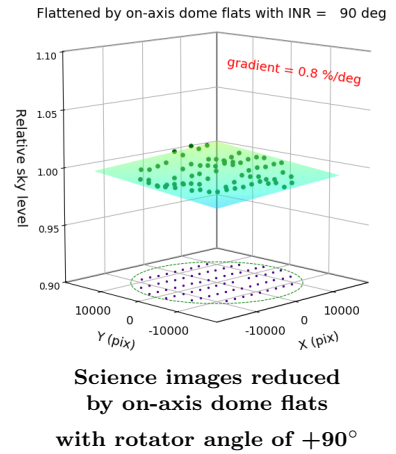
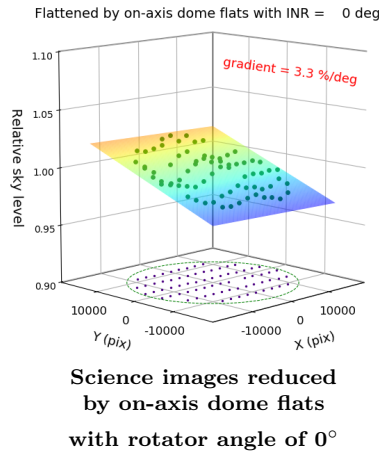
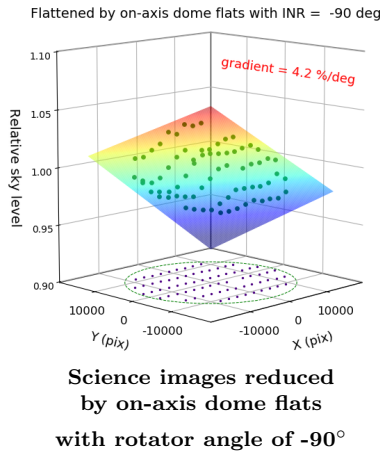
Evaluation of dependency on the rotator angle

The analysis results show that the gradients of background levels are minimized around at $+90^\circ$.

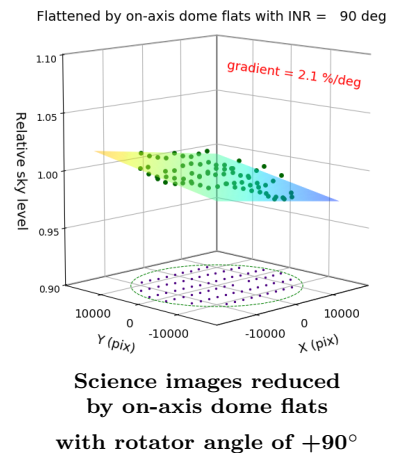
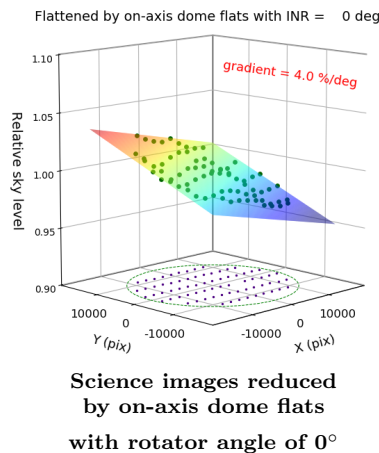
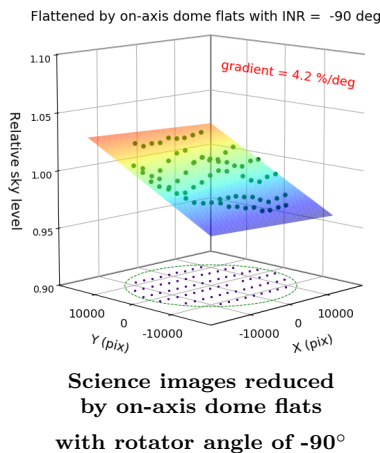
HSC-g filter



HSC-r2 filter

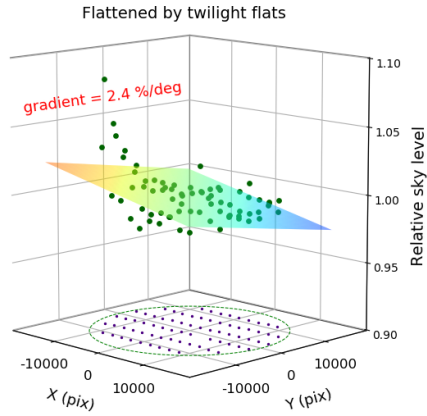


HSC-z filter

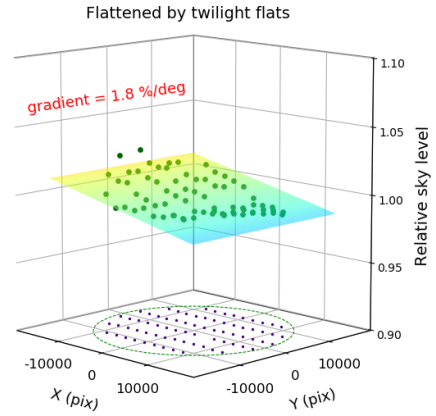


Appendix: twilight flats

HSC-g filter

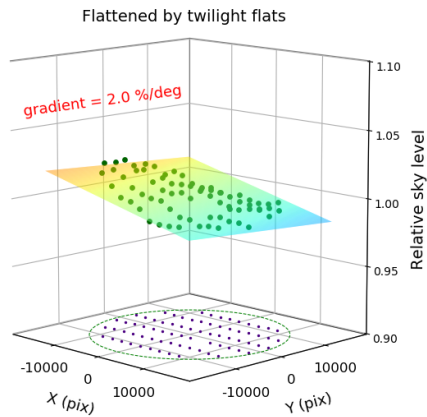


Science images reduced
by twilight flats
(2017 June)



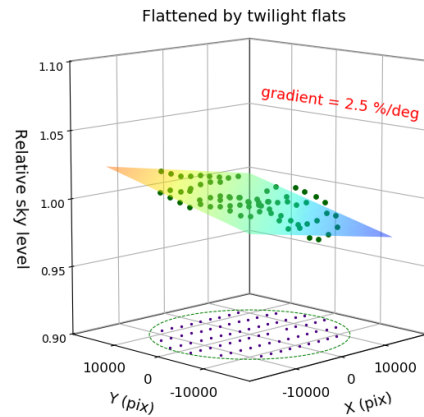
Science images reduced
by twilight flats
(2020 December)

HSC-r2 filter



Science images reduced
by twilight flats
(2017 July)

HSC-z filter



Science images reduced
by twilight flats
(2017 June)