

LUCI-1 Shared-Risk Science Release

Notice to Users

09-Jan-2017

Diffraction limited imaging with LUCI1 is offered in a shared-risk mode. Presently, the instrument is available for reference stars in the magnitude range 3.5 to 9.8 with degraded performance, and at design performance for fainter reference stars (down to ~16). It is expected that full AO performance with LUCI1, and diffraction limited imaging and spectroscopy with LUCI2, will become available in the course of 2017A. In case of questions please consult either Jochen Heidt (jheidt@lsw.uni-heidelberg.de) from the LUCI-team or Dave Thompson (dthompson@lbto.org) from LBTO. Don't hesitate to ask !!!

This note assumes a working knowledge of adaptive optics. Observers new to AO are encouraged to consult the following references:

- *Natural guide star adaptive optics systems at LBT: FLAO commissioning and science operations status*, Esposito, et al., SPIE (2012)
- *Field Guide to Adaptive Optics*, Tyson & Frazier, SPIE Press (2012)
- *Adaptive Optics and its Applications*, C. Max, <http://www.astro.caltech.edu/~srk/ay122/ClaireMax.pdf>

Preparation and execution of LUCI1-AO observations:

1. A version of the exposure time calculator (ETC version 1.34.13.5) with a beta version for AO imaging is now available at: <http://luci-etc.lbto.org/calculator.py>
2. A scripting tool (<http://scriptor.lbto.org>) is available for preparing observing scripts. Observers are advised to consult with "Jochen Heidt" jheidt@lsw.uni-heidelberg.de and "Dave Thompson" dthompson@lbto.org to design a dither pattern that will allow for the removal of artifacts. The list of known artifacts includes, but is not restricted to, ghosts, reflections, diffraction spikes and channel crosstalk.
3. The User's Manual (https://drive.google.com/open?id=0B7Z3J_vREo0zeGniLVN0dkpNOXc) has been updated and includes all relevant information for diffraction limited observations.
4. The FOV available is 30" by 30" (scale is 0.015"/pixel). All filters implemented in LUCI1 can be used. The reference star (RS) must be brighter than $R = 16$ mag and can be within a patrol field of 2' by 3' centered on the detector. The correction achieved depends of the brightness of the RS, the distance from the RS and the wavelength. The isoplanatic patch has a radius of about 8".
5. Overall clock time for a preset, collimation and closing the loop is ~10min. For a sequence yielding one minute on target/sky, the overhead for dither, readout, and save-to-disk is about 30sec, yielding an overall duty cycle of order 65%.
6. Windowing of the detector is not offered. This sets the minimum detector integration time (DIT) to 2.53sec. All RS brighter than 11th mag are saturated with a minimum DIT.

Current limitations and caveats:

1. At present, the AO-system can reliably be used to achieve a maximum of ~60% Strehl at K-band on-axis even for very bright stars. The configuration, which provides best correction using 400 modes and potentially delivers a Strehl of 80% or more, is not sufficiently stable at present - and thus not yet offered. This issue is under active investigation.
2. The system runs still with passive flexure compensation (as in seeing-limited mode). In order to minimize degrading of the image quality, the maximum exposure time per dither position should be set to 60sec.

3. The software handshake between LUCI and AO does not yet seamlessly handle loop-open events during a sequence. A work-around exists that properly waits for operator intervention to reclose the loop and thereby avoids the need for a complete restart. However this recovery procedure requires either a LUCI/AO expert on site or specialized knowledge on the part of the observer and/or OSA.

Further information:

- I. The planned operational model for LUCI/AO will not require additional personnel beyond the telescope operator and observer (once initial orientation provided by the introducing support astronomer has completed). During the first period of the science release, an AO scientist will be available to assist.