Nightly AO on-sky checkout

Issue - 3.2

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Contents

1 Introduction 1
2 Scope 1
3 Procedure 1
A Conclusions from 30-31 March On-Sky Tests 4
B Background Material 4
C Revision History 4

1 Introduction

This document provides the procedure for an AO On-Sky check-out. This procedure is to be used immediately after sunset on LUCI/AO nights, but should not delay the upcoming science observing. The procedure references documentation on the wiki.¹ Background material is given in appendix B.

2 Scope

The OSAs are the intended audience for the procedure given in section 3. The material given in the appendix, Background Material, is for a broader audience at the observatory.

3 Procedure

1. 30 minutes before opening the chamber:²

   (a) Bring up the AO software and initialize AO for the night. Details are given in the Getting Started section of Greg’s Operational AO manual.

   (b) Prepare for using IDL as follows³

¹ Each text item that appears in light blue is a hyperlink that will bring up the referenced web page.
² Other steps to possibly include later: (1) Check system functionality using Greg’s script (Details TBD) (2) Tell anyone following along in Tucson to use scry in /lbt/observer/bin/ to eavesdrop on the OSA screens.
³ These steps were taken from Doug’s IDL Twiki Page for Preset.
i. Open a new xterm
ii. % idl
(c) Using the IIFGUI, authorize for LUCI/LUCI as usual.
(d) In the IDL xterm, type: `IDL> iif_register,/TCS`
(e) Confirm that LUCI filter wheels are set to blind/blind.
(f) Choose the star that will be used for pointing and AO. Use an 8-9 R-mag star from the AOref engineering star catalog (e.g., AO363 which is a 9.4 R-mag star can be used in the Spring).

10 minutes after opening the chamber:

1. Establish Pointing and Collimation
   (a) Restore the last known IE/CA for LUCI/LUCI.
   (b) Acquire the star selected in 1f above (e.g., AO363) using the off-axis guider and collimate on-axis using “the normal procedure.” Reduce exposure time as required to not saturate.
   (c) Select a 9 to 10th magnitude star for collimation and use GCS to collimate using “the normal procedure.”

2. Acquire the AO reference star
   (a) Just like step 1b above. Use the same IRAF command, but with these parameters:
      i. Adaptive
      ii. AOMODE = ACE
      iii. AOREF = 0
      iv. GS = 1
      v. PA = 90

3. Close the AO loops
   (a) Set up for intervention mode. Details are given in the Get Ready for Preset section of the Greg’s on line document to force intervention mode on the next preset.
   (b) Use the following IDL runAO

   ```idl
   IDL> iif_binoc_runao,type=repoint
   ```
   (c) Follow steps 2.2 through 2.5 of the GT on line doc.
      i. Center Star
      ii. Center Pupils
      iii. Check Flux
      iv. Close Loop.
   (d) Optionally complete steps 2.6 and 2.7.

4 This IDL command checks with TCS to learn which instrument is authorized, and then sets up accordingly.
5 To protect from persistence. They should be switched to the crossed filter set up that reduces about 7 magnitudes before AO loops are closed to avoid light entering through other filters as they rotate into position.
6 Alternatively, perform by-eye active optics on defocussed pointing star.
7 These last two steps are optional because they could be a waste of time training-wise. Once Arectri has automated these two steps the procedure for the OSA will change. The advantage would be that the IQ would be more valid and so monitoring could start earlier. So this needs some discussion.
ii. Apply Optical Gain

4. Measure and Record IQ

(a) Take a LUCI image: Work with the assigned ISA to take an image with LUCI. Taking a sky frame will be needed. Subframing and a narrow-band filter will also be needed.

(b) Measure IQ: Work with the assigned ISA to measure and record the FWHM and Strehl of the star as seen in the sky-subtracted LUCI image. Record that information in the night log.
A Conclusions from 30-31 March On-Sky Tests

At the beginning of two engineering nights in late March, 2018, we (Steve, Doug, Al) ran through earlier versions of the procedure. The key result from these tests was a change to the collimation procedure. We determined that of these two choices:

1. Collimate by-eye using the CCD-47.
2. Collimate using the off-axis guider and the standard method.

the latter is the better choice. Although the former allows an earlier start, the latter is faster and more reliable in the end. This is largely due to the smaller field of view offered by the CCD-47.

A side benefit of this decision is that, for the collimation step, it is not necessary to develop an IIF command driven procedure (IDL or IRAF), nor to train the OSA in its use.

For the AO portion of the procedure an IIF command driven method is still required. The procedure currently is written to use IDL, but this will likely change once the IRAF IIF interface has been extended to provide the necessary AO functionality.

B Background Material

These sections appeared at the beginning of the document originally, and are now just retained as an appendix for historical purposes.

B.1 Potential Benefits

Potential benefits will be realized because the on-sky AO checkout will:

1. Further familiarize the OSA on the operation of the AO system and continue training.
2. Serve as a preventative maintenance program; discovering hardware and software problems before they are found on-sky at the expense of science.

B.2 Targets

Initially we would use a bright star, however, the possibility to someday include targets of scientific monitoring interest (e.g., Titan or Io) exists.

B.3 Performance Monitoring

A decision whether to use a paper-only, semi-electronic, or fully electronic system (e.g., SQL database) for recording data and analyzing trends will have to be made. A fully electronic solution would likely require support from software engineering.

C Revision History