

## SAM memo (2014-05-06)

**ROTANGLE:** 0 = nominal, range +/-180, 90 = SAM looking down.  
GP coordinates at PA=0: +X points to the East, +Y to the North +Z along beam.

**Field center in SAMI (FCX,FCY, pix):** 1935 2100 (at ROTANGLE=0, changes!)  
Take focused image of GP1 in SAMI with 0.5s exposure, V-filter, 100% dimmer  
To take donut images, defocus GP by +/-3mm (5s exposure)

### Zernike aberrations to other parameters:

Smaller Z(GP) ==> larger a4

$a_{2,3}(\text{micron}) = 15.66 * [Y, X](\text{mm}) = 1.721 * [Y, X]$  (WFS pixels); 1 micron tilt = 0.201".

### Sensitivity of focus to various parameters:

$a_4 = +1 \mu\text{m} \rightarrow \text{FWHM} = 1.394'' \rightarrow F_{\text{SOAR}} = +7.66 \text{mm} \rightarrow \text{Hexapod} = +0.075 \text{mm} \rightarrow$   
 $\text{WFS\_stage} = -4.7 \text{mm} \rightarrow Z = +0.081 \text{km}$  (58mm/km).

**Focus from donuts (Z1,Z2 – range, S1,S2 – FWHM):**  $Z_0 = Z_1 + S_1/(S_1 + S_2) * (Z_2 - Z_1)$   
cl> samfocus, fwhm(12mm), fhwm(20mm) ==> WFS stage position for best focus

**WFS aperture numbers:** 0 - upper left, 3 - lower left, 68 - upper right, 71 - lower right  
(as displayed in ICS). WFS pixel 0.344", field 2.75". WFS stage setting: 16.0

**SOAR scale:** (F=68.176m): 0.3305mm/" (3.025 "/mm).

**SAMI pixel:** 15.0um = 0.0454". SAMI rotation: 0deg (North points Up, West Left)

**RTC settings:** mnoise 8; KC1=0.015; KC3=0.08

**TurSim:** 40% rotation, modes 25-30, disk#1: r0=0.5m, Flux ~1000 ke/s (dZ=0.5km)

**Beam centering in the LLT:** photo-diodes x1=UL, x2=LL, y1=UR, y2=LR  
LLT M4-A1 moves LL (x2+, y1-) M4-A2 moves LR (y2+, x1-)

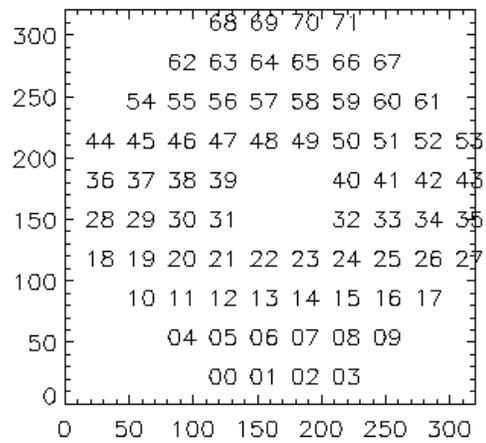
### LGS settings and range gate

Z,km	dZ,km	WFS stage	F10ADJ
7	0.15	16	0
10	0.3	111	-15.3

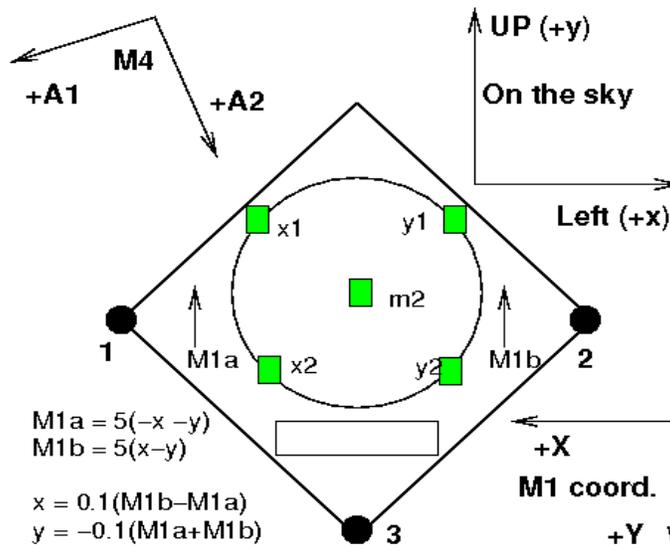
### Guide-probe offsets (mm)

Probe	X(*-fiber)	Y(*-fiber)	OFFX	OFFY	Z-SAMI	Z-HRCAM
GP1	0.21	0.41	0	0	-3.5	1
GP2	0.13	-0.68	-0.3	0.65	-10.5	-5.5

## Pictures



WFS apertures in image files (ICS/RTC display is turned 90deg CW, so X-horizontal)



LLT coordinates (from LLT guide)

## Phone numbers

SOAR: 500, 503, 504  
 Remote observing room: 341  
 M.Martinez: 315  
 R.Cantarutti: 373  
 O.Estay: 341  
 A.Tokovinin: 206 (home: 251)

## Command tips

**Field offset procedure:** Mark star in GMAP --> display pointing image in IRAF (mscd)  
--> click in SAMI GUI, press F3 --> point star in DS9, press 'c' --> Press FO in GMAP  
In GMAP: FO and right-click of mouse set FO=0.

**Coordinate lists** send to: [soarops@ctio.noao.edu](mailto:soarops@ctio.noao.edu)

### ICSoft commands:

SET/GET SAMIFCX 1938 ; field center in SAMI where GP(X,Y)=0  
SET/GET SAMIFCY 2044  
SET/GET GP2APDY 0.68 ; offsets for GP1 and GP2 in mm

RTC RNOISE 8 ; Set readout noise  
RTC rt tt llt [close/open/KC3/HstarZ/offset x y] ; LLT control  
To set the **2x2 WFS binning**: % cd /home/ao/RTSoft/Bin ; % ./chprf 2

**HRCAM revival:** reinstall driver before turning Luca ON.

```
%sudo /sbin/rmmod ehci_hcd
%sudo /sbin/modprobe ehci_hcd
%cd andor/examples/console/image [@image link from home directory]
%image
```

### IRAF commands for SAMI display/analysis

Run IRAF in xgterm window. In DS9, zoom--> invert X to match Gmap orientation  
Packages: >iraf >ecl >mscred  
> set imt=4096  
> mscdisplay file [zs- zr- z1=0 z2=40000]  
> msceexam (press a, r to get FWHM and centroid; s - surface, c - contour)  
>mscarith img1 img2 img3  
>mscstat img

Laser power iboot: 139.229.15.56 user:[empty] pwd:  
Laser electronics power: 139.229.15.65 user: admin pwd:  
(outlet1 - laser box, outlet 2 - M4 and LLT)  
Pachon DIMM: 139.229.34.57/seeingmonitor/webserver/seeing.html  
Pachon MASS: 139.229.34.57/seeingmonitor/mass/webserver/mass.html

Dirty exit from SLGM: ./exit\_labview.sh

# Start-stop SAM sequence

## 1. Cold start

### Switch on the hardware:

**Remotely** (vnc to soarenv:1 Op-Nazmyth Left):

SAM PXI (must be always on!), SAM PS motors, SAM Leach WFS, SAMI Leach, SAM PS APD, SAM DM drive, SAM Pockels.

In Op-Nazmyth Right: SAM Peltier

**Remotely through browser:** laser box, M4 (LLT electronics - through ICSOft)

**Manually:** two SAM electronic boxes, HRCam power and filters (if needed)

**Computers:** RTC (soar ttg4), AOM (in the electronics cabinet on the platform), HRCam, if they are not running

### Run the SAM software:

LGS, AOM, LCH engineering GUIs on the AOM computer. RTSoft on RTC, SAMI on HRCam.

INIT all motors (or just guiders) in AOM, LLT, laser box, M4.

Check the CCDs in WFS and SAMI (take test images)

Run the ICSOft on AOM computer

## 2. Calibrations and tests at the start of the run

(fill the checklist form)

WFS CCD: record new bias, measure rms noise in ADU.

Deploy TurSim, get spot images (without turbulence), center them.

Take new flat DM (after >30min warm-up, rotator at zero), interaction matrix.

Re-compute reconstruction matrix (threshold 0.01)

Record AO closed-loop data with TurSim (disk #1, 40% speed)

Place GP1 at center, flatten DM, and take image with SAMI, V-filter (check focus)

Optional: record sky images with WFS at 4 rotator angles to check pupil alignment

Check that the ACAM and ATP Prosilica cameras are working.

Check communication with SAMI, verify headers.

Check laser sync pulses (laser diodes on, see TurSim spots with laser sync, not auto)

Propagate laser in the dome with LLT cover open, center the beam on M1 (SOAR at zenith). Center by running M4.lua in ICSOft (several times, until OK).

## 3. Preparation for the night

Send target coordinates to soarops@ctio.noao.edu

Configure SOAR to send light to SAM (M3 to opt. Nasmyth, M4 in the ISB in)

Load PAM file in the LCH GUI.

Switch on the DM driver, APD power, Pockels cell power

Switch on the laser 30min before operation, call the LCH. Log the time and laser power.

After >30min warm-up of DM driver, take the fresh flat (for open-loop work)

Open the SAM and LLT environmental covers

Propagate laser in the closed dome, record LLT photo-diode signals, center the beam

#### **4. End of the night**

Switch off the laser diodes and the 220V laser power (remotely).

Report end of laser operation to LCH.

Close LLT and SAM covers. Power-off LLT motors.

Un-arm WFS trigger, Pockels cell HV off.

Set DM at 0V. Switch off DM driver, APD power supply, Pockels cell power supply.

Prosilica power in LLT and WFS off.

#### **5. End of the SAM run**

Turn off the laser power key on the rack side, remove the key.

Exit **ALL** SAM software modules.

Switch off **ALL** SAM hardware (see 1), except PXI.

Leave the computers running.

## SAM setup checklist

Date: \_\_\_\_\_

Who checked: \_\_\_\_\_

SAM power-on at: \_\_\_\_\_

Notes:

### SAM AO module

Device	Test	Results
WFS	Bin,noise	Binning: 2x2 Rnoise: [ADU]
WFS	Bias	Bias frame taken at UT:
DM	Flat	Flat time UT: Min-Av-Max[V]:
AO loop	Imat	Imat time UT: Reconstructor modes:
TurSim	CL data	AO CL data UT: r0: (disk #1, speed 40%)
TurSim	Flux	Flux: [ke/s] (range 7km, gate 0.5km, no disk)
SAMI	Center	FCX: FCY: (SAMI pixels un-binned)
SAMI	GP1 image	Image number: (2x2 bin, 0.5s, V-filter, z=-3.5)
HRCAM	GP1 image	Calibrate scale and angle by X,Y motion.

### SAM laser system

Device	Rest	Results
Laser	Power	Power: [W] (after 30 min. warm-up)
M4+LLT	Beam cent.	A1: A2: [micron] (M4.lua)
	Ph-diodes:	x1: x2: y1: y2: M2:
LLT	M1	X: Y: [mm] (LGS at night)
LLT	Focus	[micron]
Pockels cell	Range gate	Z: dZ: [km] (after SAMI focusing)
WFS stage		[mm] (after SAMI focusing)

SAM power-off after the run at: \_\_\_\_\_

Laser key removed at: \_\_\_\_\_