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A. Scripts Quick Summary (for details of each, see B.)

1. *On Mimir_Ops_Window_1_Polarimetry_and_Imaging*

Button Name	Arguments (or notes)	Actions
GPIPS Data Collection Scripts		
gpips_dither		Starts a 96+16 image pol obs in H-band
gpips_cal	Exp_T – exposure time in sec	Same as gpips_dither, but variable expT
go_bias	N_bias	Puts in dark filter, takes N_bias 0 sec images
gpips_dark		Takes sets of darks with various times – see list
pol_reset		Resets HWP angle to home
Generic positioning and data collection scripts		
recenter	xnow, ynow, xto, yto, platescale	Does a relative move from the Now X,Y pixel values to the To X,Y values, using platescale
hpol_dither	Exp_T, N_exp, Throw_rad	Similar to gpips_dither, but can set key values
kpol_dither	Exp_T, N_exp, Throw_rad	Same as hpol_dither, but for K-pol
pol_UQ_loop	Exp_T, N_exp, do_bias	Does one 16 HWP pol data collection + bias
phot_dither	Exp_T, N_exp, arcsec_rad	Hex dither in current filter
jhk_dither	Exp_T, N_exp, arcsec_rad	Hex dither in J, H, and K filters
Mode Set-Up Commands (Filter Wheels Rotated)		
set_H-Pol		Moves wheels to set up H-Pol mode with H
set_K-Pol		Same, for K-Pol mode with Ks filter
set_H2-On-Pol		Same, for K-Pol mode in H2-On filter
set_H2-Off-Pol		Same, for K-Pol mode in H2-Off filter
set_Dark		Puts dark filter in FW1
set_All_Dark		Puts dark filters in FW1, 2, 3 (not better)
set_J		Sets J-band photometry mode
set_H		Same, for H-band
set_K		Same, for Ks-band
set_L		Same, for L'-band
set_M		Same, for M'-band
set_H2-On		Same, for narrow-band filter at 2.122um
set_H2-Off		Same, for narrow-band filter at 2.0896um
set_IZYJ-Wide		Puts in IZYJ Blocker to pass 0.767-1.380 um
set_IZYJ-Med		IZYJ Blocker + IZYJ BP to pass 0.829-1.360um
Detector Readout and LOIS Reporting Options		
Full_Frame		Resets readout to use the full array size
Sub_Frame	X_size, Y_size	Sets up sub-framing of the detector array
display_on		Turns display of images to DS9 back on
display_off		Turns off image display (speeds up scripts)
Tele_GUI_on		Turns on the updating of the telescope GUI
Tele_GUI_off		Turns off the updating of the telescope GUI
Logging_on		Turns on error logging to the Mimir window
Logging_off		Turns off error logging to the Mimir window
Reset_coadd		Resets coadding to 1 (no coadding)

2. *On Mimir_Ops_Window_2_Spectroscopy_and_Friends*

Button Name	Arguments (or notes)	Actions
Data Collection & Common Utility Scripts		
AB_dither	dRA, dRAdP, dDEC, dDECdP, N_pairs, Exp_T	Executes an A-B-B-A dithered data collection, using indicated offsets and offset steps with pair number. Number of images obtained is 4*N_pairs
ABn_dither	dRA, dRAdP, dDEC, dDECdP, N_pairs, N_exp, Exp_T	Same as above, but allows for multiple image collection at each position
go_bias	N_bias	Puts in dark filter, takes N_bias 0 sec images
spec_dark		Takes sets of darks with various times – see list
recenter	xnow, ynow, xto, yto, scale	Relative move from Now to To X,Y values, scaled
domeflat_on	Use 'Narrow Band' lamps and dimmer on back of telescope	Turns on the flat field continuum lamps
domeflat_off		Turns those lamps off
argon_on	The argon lamp must be positioned using the GAF cmd	Turns on the argon line lamp
argon_off		Turns the argon lamp off
1-D Short λ Spectroscopy Mode Set-Up Commands (Filter Wheels Rotated) – short λ to long λ		
set_IZYJ-Spec		Spec from 0.829-1.38 um (two orders on array)
set_J-Spec		Spec from 1.17-1.34 um (two orders)
set_JHK-Spec		Spec from 1.17-2.32 um (one order)
set_HK-Spec		Spec from 1.40-2.50 um (one order)
set_IZ17-Spec	For any F17 Spec mode, the user must position the camera – these scripts only rotate the filter wheels.	F17 Spec from 0.83-1.00 um
set_J17-Spec		F17 Spec from 1.25-1.35 um
set_H17-Spec		F17 Spec from 1.52-1.97 um
set_K17-Spec		F17 Spec from 1.8-2.35 um
2-D Cross-Dispersed Mode Spectroscopy		
set_IZYJ-X-Spec		Cross-dispersed IZYJ, using low-R grism
1-D Long λ Spectroscopy Mode Set-Up Commands		
set_LM-Spec		Spec from 2.80-5.50 um (1 order)
set_L-Spec		Spec from 3.45-4.13 um (1 order)
set_M-Spec		Spec from 4.59-4.78 um (1 order)
set_LM17-Spec	See note above concerning F17 Spec modes	F17 Spec from 3.47-4.63 um
set_L17-Spec		F17 Spec from 3.47-4.13 um
set_M17-Spec		F17 Spec from 4.59-4.78 um
Calibration Data Collection and Camera Motion		
Take_H-Pol_Flats	Exp_T	Manages H-Pol Flat-Field Data Collection
Take_K-Pol_Flats	Exp_T	Manages K-Pol Flat-Field Data Collection
LinDat_Lts_On	Max_Time, N_steps	Manages Linearity Data Collection with lights on
LinDat_Lts_Off	Max_Time, N_steps	Same, for lights off (needed for conversion gain)
Cam_Home		Sends the camera block to the home position
Cam_F5		Positions camera block to the F/5 wide field cam
Cam_F17	These commands require users to tweak w/ camera command	Tries to position to the F/17 narrow field cam
Cam_PV		Tries to position to the Pupil Viewer cam

B. **Script/Command Details (by order in tables)**

1. *In Window 1: Polarimetry and Photometry*

- **gpips_dither** – moves off from central position to first hex dither position, with radial offset of 15 arcsec. Puts in H-Pol filters, homes HWP, collects 16 images (for 16 distinct HWP angles). Moves to second hex dither position, repeats 16 HWP image collection. Continues until all 6 hex positions sampled. Releases guide lock. Puts in dark filter in FW1, collects 16 zero-sec darks (bias images). Puts up 'Done' pop-up window. Exposure time is fixed at 2.3s (plus 0.2s readout, for a total integration time of 2.5s).
- **gpips_cal** – same as gpips_dither, but allows for arbitrary integration time
- **go_bias** – puts in dark filter in FW1, then takes *N_bias* zero-second exposures. Leaves dark filter in place upon exit.
- **gpips_dark** – takes sets of dark images for a range of common integration times. Starts and ends with zero sec bias image sets. Puts 'Bias' in the FITS header for the Biases and 'Dark' for the Darks. The following table lists the order, integration time, and number of the 320 images taken:

gpips_dark data collection order and type		
Type	**Integration Time [sec]**	**Number of Images**
Bias	**0**	**32**
Dark	**2.3**	**32**
Dark	**0**	**32**
Dark	**0.5**	**32**
Dark	**0.4**	**32**
Dark	**0.15**	**32**
Dark	**5**	**32**
Dark	**10**	**32**
Dark	**20**	**32**
Bias	**0**	**32**

- **pol_reset** – sends the HWP cell in the POL wheel to its home position
- **recenter** – issues a relative move to MOVE based on the pixel location difference between the 'Now' X and Y values and the 'To' X and Y values, multiplied by the platescale (in arcsec per pixel).
- **hpol_dither** – general form of gpips_dither. Executes hex dither with 16 HWP images per dither position plus 16 bias images at end. The integration time, number of images per HWP step, and size of the radial offset to the hex pattern are all adjustable.

- **kpol_dither** – same as hpol_dither, but inserts the correct filters to perform K-Pol polarimetry. Same hex dither, same parameters.
- **pol_UQ_loop** – this is the basic 16 HWP image collector for polarimetry. It can be used outside of dithering in this form. Adjustable are the integration time and number of images per HWP angle. Also a flag identifies whether 16 biases will be collected at the end or not.
- **phot_dither** – single filter band hex dither. Filter choice must be set via one of the 'set_...' buttons prior to starting this script. Adjustable are the integration time, the number of images to take at each hex dither position, and the size of the hex offset, in arcsec.
- **jhk_dither** – same as phot_dither, but takes J-band, then H-band, then K-band images at each hex position. Adjustable are the integration time (though all bands get the same integration time, note), the number of images per hex position (the data collected will be N_images x J, then N_images x H, then N_images x K at each position), and the hex offset, in arcsec.
- **set_H-Pol** – sets the POL, FW1, FW2, FW3 wheel positions to implement H-band linear imaging polarimetry
- **set_K-Pol** – same as previous, but sets up Ks-band linear polarimetry
- **set_H2-On-Pol** – using the K-band HWP and a narrow band filter – could test whether H2 S(1) line flux is seen by reflection
- **set_H2-Off-Pol** – same, for the off-band filter – maybe useable for very bright targets?
- **set_Dark** – puts a dark filter in the optical path for the FW1 wheel
- **set_All_Dark** – same, for FW1, 2, and 3 – there is no difference in light passed between Dark and All_Dark, but AD is provided for both the purists and as a way to put all FWs to the same, known position with a single button.
- **set_J** – sets the FWs to implement J-band bandpass (MKO J)
- **set_H** – same for H (MKO H)
- **set_K** – same for Ks (MKO Ks)
- **set_L** – same for L' (MKO L')
- **set_M** – same for M' (MKO M')
- **set_H2-On** – sets FWs for the narrow band H2 S(1) line filter
- **set_H2-Off** – same for the off-band reference narrow band filter
- **set_IZYJ-Wide** – sets the FWs to permit imaging through the IZYJ Blocker filter (0.75 – 1.38 um, though not much flux shortward of 0.9 um)
- **set_IZYJ-Med** – same for the Block and BandPass (BP) IZYJ filters (0.825 – 1.38, again not much shortward of 0.9 um)
- **Full_Frame** – resets the detector array electronics to create images using the full 1024x1026 pixels of the array
- **Sub_Frame** – turns on sub-framing, causing images to only contain the indicated X and Y widths, centered on the array center (no offsets allowed), and limited to steps of 8 in X and 2 in Y

- **display_on** – turns back on display of images to the DS9 window (this is normally only used when an observing script hangs or dies)
- **display_off** – turns off display of images to the DS9 window. Display adds about 1 sec of overhead, so during GPIPS-type polarimetric hex dithering, the display is turned off. It is turned back on by those scripts as they exit.
- **Tele_GUI_on** – similar to display, but turns on refresh of the LOIS GUI of telescope status that mirrors the MOVE display.
- **Tele_GUI_off** – turns off that GUI. Again, painting this LOIS GUI adds some overhead to GPIPS data collection, so is turned off in those scripts at the beginning and turned back on at exit. So, if a script breaks, the display, tele_gui, and logging all need to be turned back on via these buttons to regain manual control and display.
- **Logging_on** – turns on full logging of errors, warnings, and status to the Mimir Instrument Control window of LOIS
- **Logging_off** – limits logging to serious errors and image storage, again to save some overhead. GPIPS scripts turn off logging as they start, then turn logging back on at exit.
- **Reset_coadd** – the option to coadd images exists in the Mimir Exposure Control window. In that window, putting a `1' in the COADDS buffer and hitting Enter will reset coadding to single images. Alternatively, pushing this button does the same action.

2. *In Window 2: Spectroscopy*

- **AB_dither** – runs an A-B-B-A dithered data collection program. User selects B offsets, relative to A position, as dRA and dDEC, in arcsec. User selects number of 'pairs' (really quads) of data collection. User can also include an extra increment of RA of Dec offset to add after each ABBA quad is observed. These are dRAdP (change in RA with pair number) and dDECdP, both in arcsec. This permits, for example, moving along the slit so as to avoid repeatedly falling back on the same bad pixels. (see Spectroscopy Cookbook section in the Mimir Quick Start Guide). User also specifies the exposure time.
- **ABn_cal** – same as above, but also allows N_exp exposures at each A and B positioning.
- **go_bias** – takes N_bias zero-second dark images for use as bias images
- **spec_dark -** – takes sets of dark images for a range of common integration times. Starts and ends with zero sec bias image sets. Puts 'Bias' in the FITS header for the Biases and 'Dark' for the Darks. The following table lists the order, integration time, and number of the 304 images taken:

spec_dark data collection order and type		
Type	**Integration Time [sec]**	**Number of Images**
Bias	0	32
Dark	0	32
Dark	1	32
Dark	5	32
Dark	10	32
Dark	20	32
Dark	30	32
Dark	60	16
Dark	120	16
Bias	0	32

- **recenter** – issues a relative move to MOVE based on the pixel location difference between the 'Now' X and Y values and the 'To' X and Y values, multiplied by the platescale (in arcsec per pixel).
- **domeflat_on** – turns on the PDU port connected to the flat field lamp control on the back of the telescope which turns on the flat field lamps located at the front (top) of the telescope. Normally, the 'Narrow-Band' lamps are selected and the dimmer is set to a value indicated in the Mimir Quick Start Guide and the telescope is pointed at the in-dome flat-field screen, or, for spectroscopy, the telescope is pointed to the inside of the dome wall.
- **domeflat_off** – turns off that PDU port, so the lamps turn off

- **argon_on** – turns on the power supply for the argon emission lamp, located on the 'auxiliary focus arm' inside the autoguider box. If the GAF command has been issued in MOVE, the arm is positioned over Mimir's front window and the argon lamp illuminates the spectroscopic slit.
- **argon_off** – turns off the argon lamp. Be sure to issue a second GAF to get the arm out of the Mimir optical path
- **set_IZYJ-Spec** – sets FWs for IZYJ-bands spectroscopy from 0.83 – 1.36 um, using JHK grism (two orders; little throughput shortward of 0.9 um)
- **set_J-Spec** – sets FWs for J-band spectroscopy, using LM grism (2 orders)
- **set_JHK-Spec** – sets FWs for JHK-bands spectroscopy, using JHK grism (1.17 – 2.32 um; one order)
- **set_HK-Spec** – sets FWs for HK-bands spectroscopy, using JHK grism (1.40-2.50 um; one order)
- **set_IZ17-Spec** – sets FWs for F/17 IZ-bands spectroscopy, using JHK grism (0.83 – 1.00 um; one order; little throughput shortward of 0.9 um)
- **set_J17-Spec** – sets FWs for F/17 J-band spectroscopy, using LM grism (1.25 – 1.35 um; one order)
- **set_H17-Spec** – sets FWs for F/17 H-band spectroscopy, using JHK grism (1.52 – 1.97 um; one order)
- **set_K17-Spec** – sets FWs for F/17 K-band spectroscopy, using LM grism (1.90 – 2.4 um; one order)
- **set_IZYJ-X-Spec** – sets FWs for cross-dispersed IZYJ-bands spectroscopy, using JHK grism as main disperser and SED grism as cross-disperser (must use one of the very short height slits; 0.83 – 1.36 um; two orders; note little throughput shortward of 0.9 um)
- **set_LM-Spec** – sets FWs for LM-bands spectroscopy, using LM grism (2.80 – 5.50 um; one order)
- **set_L-Spec** – sets FWs for L-band spectroscopy, using LM grism (3.45 – 4.13 um; one order)
- **set_M-Spec** – sets FWs for M-band spectroscopy, using LM grism (4.59 – 4.78 um; one order)
- **set_LM17-Spec** – sets FWs for F/17 LM-bands spectroscopy, using LM grism (3.47 – 4.63 um; one order)
- **set_L17-Spec** – sets FWs for F/17 L-band spectroscopy, using LM grism (3.47 – 4.13 um; one order)
- **set_M17-Spec** – sets FWs for F/17 M-band spectroscopy, using LM grism (4.59 – 4.78 um; one order)
- **Take_H-Pol_Flats** – executes a complete H-Pol flat field data collection procedure. Turns flat-field lamps on, allows them to settle. Collects 16 HWP-angles of four images at each HWP angle. Turns flat-field lamps off and allows them to cool. Retakes 4 x 16 HWP-angle images. Takes 16 bias (0 sec darks) images. Repeats cycle of lights-on, lights-off, bias for 7 more times.
- **Take_K-Pol_Flats** – same as above, but for K-Pol

- **LinDat_Lts_On** – executes a complete linearity run with the flat-field lights on. Collects data for a ramp of exposure times up to a user-selected maximum exposure time in a number of steps given by the user. Collects biases at end of each ramp. Collects 10 ramp+bias sets.
- **LinDat_Lts_Off** – same, but with lights-off. This is useful for subtracting from the lights-on version in order to determine the conversion gain and read noise.
- **Cam_Home** – sends the camera block to its reference software home limit, and informs LOIS the camera has been homed and motor steps are reset to zero. If an image is taken, it should show a vertical bar on the left side of about 100 pixels width. Do not collect science data with the camera at home!
- **Cam_F5** – sends the camera block to the F/5 position (provided the camera had the correct home zero position). A K-band image of 2 sec duration should show a narrow vertical band at the left edge of no more than one column width as well as a small triangular wedge of warm pixels in the upper right corner.
- **Cam_F17** – tries to send the camera to the F/17 position, but usually doesn't completely succeed. Before executing, user should put a slit on the optical axis of the F/5 beam, then move to F/17 camera setting. Use the 'camera' command in the Mimir Control Window to refine the camera position until the slit image is in the center of the array.
- **Cam_PV** – same, for moving to the Pupil Viewer position. This is even farther away from home than F/17 so more prone to motor step skipping. This can be viewed directly in K-band (5 sec). Use the 'camera' command to fine position the camera block to center the pupil image on the detector.