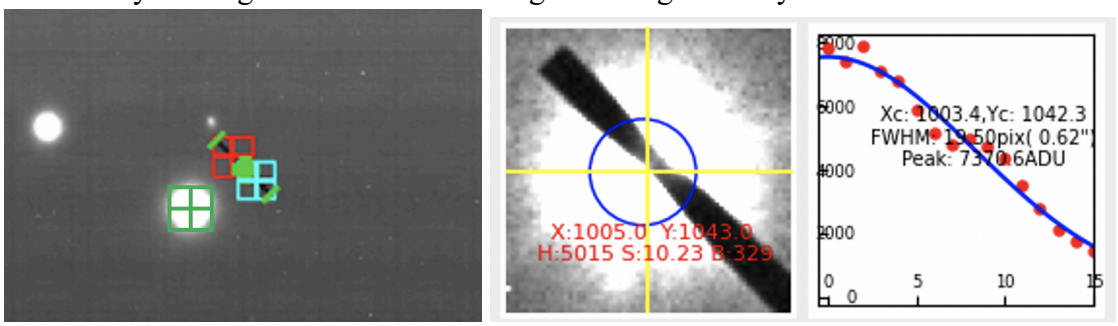
3.1.1.6 Example of target acquisition process

- Once the telescope slewing is done, take single exposure by clicking the “Exposure” button.
- Identify the target and click on the target in image directly to fit the centroid of the target.



- Green cross will appear upon the clicked position.
- The fitted center is shown with the blue circle on the top left display.
- Click the “Center” button to send the target to the center of the slit by applying telescope offset.
- Once the offset is applied, take another single exposure by clicking the “Exposure” button.
- Confirm that the target moved to the center of the slit.
- For detailed step-by-step sequence for difference observing scenarios, please refer to Observation Scenarios in this manual.

8 Observation Scenarios

Due to the significant and variable sky emission, NIR observing strategies always use some type of dithering or offset pattern to effectively subtract the background from the source. For high-resolution spectroscopy the preferred method is ABBA nodding, followed by ON-OFF.

8.1 ABBA Observing Sequence

Example in the Science Cases: **Young Stellar Object, Stellar Abundance, Brown Dwarf**
General use: point source targets in good to average seeing.

Observer
- ≻ select observation according to the plan for the night
- ≻ check and update PA if necessary and queue it

Operator
- ≻ load the observation in TCC and slew the telescope to the target
- ≻ setup guiding with PWFS2 and send the light to the instrument

Observer
- ≻ take a single short exposure with the SVC in the ObsApp and identify the target.
- ≻ update Slit-viewer Camera exposure time if necessary
- ≻ click on the target to mark its position and assess IQ
- ≻ click on Center button to move the target to the center of the slit
- ⇒ The software will automatically compute and apply p,q offsets
- ≻ take a second exposure to verify the target is centered
- ≻ apply small offsets if necessary to re-center the target
- ≻ load observation in the seqexec and start sequence
- ⇒ seqexec will take the control and start sequence
- ⇒ while seqexec is running, continuous SVC image exposure proceeds to allow monitoring

Slit-view imaging sequence
Depending on the needs defined by PI, the slit-view camera image sequence can be run using seqexec before running the ABBA sequence. For a normal acquisition image, the default offset is given in the direction perpendicular to the slit, -5.0″ in p.

For a normal ABBA nodding, default offsets along the slit are +/- 1.25″ in q
H and K spectra will be automatically displayed on Gemini QuickLook tool (ds9 + Iraf) or python Seqplot script.
S/N can be monitored on IGRINS Quicklook Data Pipeline or equivalent tool.
Additional AB nods can be added to the sequence to reach the requested total S/N ratio.
Even though there are no significant issues on the persistence in the H- or K band detector (There has been issue in the case of the H detector of the original IGRINS) it is recommended to keep the maximum counts level not too high, ex) below 5,000 ADU.

Table 7. Example sequence for typical slit-view image observation

Index	p	q	Guiding	Note
1	0.00	0.00	on	position for slit-view acquisition image > single MEF file
2	-5.00	0.00	on	position for slit-view acquisition image > single MEF file

Table 8. Example sequence for typical ABBA observation

Index	p	q	Guiding	Note
1	0.00	-1.25	on	nodding position "A" for H, K spectra > single MEF file
2	0.00	1.25	on	nodding position "B" for H, K spectra > single MEF file
3	0.00	1.25	on	nodding position "B" for H, K spectra > single MEF file
4	0.00	-1.25	on	nodding position "A" for H, K spectra > single MEF file

Data Label	Class	P	Q
GN-2023B-ENG-142-1188-001	Acquisition	0.0	0.0
GN-2023B-ENG-142-1188-002	Acquisition	5.0	0.0

Figure 18 Screenshot of example slit-view image sequence. Either P=5.0 or -5.0 can be used for the second image.

Data Label	Class	P	Q
GN-2023B-ENG-142-1189-001	Science	0.0	-1.25
GN-2023B-ENG-142-1189-002	Science	0.0	1.25
GN-2023B-ENG-142-1189-003	Science	0.0	1.25
GN-2023B-ENG-142-1189-004	Science	0.0	-1.25

Figure 19 Screenshot of example ABBA image sequence for H and K band.

8.2 ON-OFF Observing sequence

Example in the Science Cases: **Young Stellar Object**
General use: extended sources, crowded fields, point sources in poor seeing

ON-OFF will be defined in advance by the program Principal Investigator (PI) in the OT in such a way that

Nod A = target on the slit
Nod B = empty sky

Note: For a point-source target in poor seeing conditions, an offset of p ≥ 3” for the sky position usually works, while extended sources may require a significantly larger offset.

Acquisition sequence is exactly the same as for a normal ABBA sequence, always starting with the science target in the center of the slit.

8.3 Blind-offset Acquisitions

Example in the Science Cases: **Extended sources such as Planetary Nebula or Supernova Remnants**
General use: very faint targets or diffused sources not visible in SVC (even with the sky-subtracted mode)

Besides the science target and guide star, the PI could set up a nearby* reference star to be used for fine-tuning of the slit-centering. Since the SVC is used for the acquisition, the reference star should be reasonably bright in the K band.
Nodding sequence can be either ABBA or ON-OFF, depending if it is a point source or extended target. In both cases the acquisition is going to be done on the reference star following the procedures described above, ie. always starting with the target in the center of the slit.

Operator
- ➢ Slew the telescope to the science target first
- ➢ Swap science and reference targets
- ➢ Setup guiding with PWFS2

Observer
- ➢ Run acquisition as explained above using the SVC

Operator
- ➢ Switch back to science target
- ➢ Run observation sequence as usual

*Guideline for choosing reference star:
http://www.gemini.edu/observing/telescopes-and-sites/telescopes#BlindOffsetAcq
The current offset accuracy is approximately 0.2 arcsec for a reference star 50 arcsec from the science target.

8.4 Slow Guiding with SVC

Example in the Science Cases: **Extrasolar Planet Transits**
General use: very long observing sequences

IGRINS-2 always relies on the A&G PWFS2 Shack-Hartmann WFS for fast tip/tilt, focus and astigmatism corrections. Guiding with the SVC images is only used to compensate for any possible flexure between PWFS2 and the instrument during very long observations.

For slow guiding follow the procedure below:

Case 1: on-slit guiding (normal ABBA sequence)

- start normal acquisition procedure using the ObsApp and the SeqExec.
- In ObsApp, click on “Slow Guiding” to start sending p,q offsets to telescope
- load the observation in the seqexec and start seqexec
- the seqexec will automatically end slow guiding when the sequence is finished

Case 2: off-slit guiding

- start normal acquisition procedure using the ObsApp and the SeqExec.
- in ObsApp, click on “Set Guide Star” to select the guide star
- click on “Slow Guiding” to start sending p,q offsets to telescope
- load the observation in the seqexec and start seqexec
- the seqexec will automatically end slow guiding when the sequence is finished

Alternatively, the observer can decide to visually monitor the SVC camera and apply manual corrections to keep the target on the slit.