SPARTAN Near-IR Camera

(Revised February 5, 2020)

System Overview
The Spartan Infrared Camera is a high spatial resolution near-IR imager. Spartan has a focal plane consisting of four "Hawaii-II" 2048x2048 pixel HgCdTe detectors. **NOTE** - the detectors don't have all quadrants fully functional - see the "Cookbook" for details. Although two different scales were provided, only one is now supported: the f/12 channel offers an FOV of 5.04 x 5.04 arcmin at 0.066 arcsec/pixel; the scale was chosen to resolve the diffraction-limited core of tip-tilt-corrected images in the H, and K bands. The f/21 channel, which has been disabled, had an FOV of 3.05 x 3.05 arcmin with a scale of 0.040 arcsec/pixel ([Loh et al., 2012, PASP, 124, 343]) [1]. Spartan has two filter wheels which together can hold a total of 29, 50mm diameter filters of thickness up to 15mm. Broadband Y, J, H and K (based on the MKO-NIR prescription) and 9 narrow-band filters are available. (For details see Spartan filters [2].)

For more information, contact the SPARTAN support staff [3]. Further information is available from the Spartan IRC home page at MSU. [4] (In particular, look at the "observer" pages. However, be aware that the MSU pages are "legacy" information. In case of discrepancies between the MSU pages and the SOAR pages,
the latter are likely to be correct; contact support staff if necessary.)

**Useful Information**

The [Spartan Cookbook](#) provides a good introduction, however some of the specifics related to bad quadrants or recommended flat field exposure times have evolved.

*This page on trouble-shooting* [6] will solve many problems. **Note** - some of the steps listed are things the observer can do, but please let the telescope operator know beforehand, since they may also be able to help. The more extreme interventions require the operator.

**SPARTAN Cheat Sheet** [7]

**NOTE** - All magnitudes in the documentation are "Vega" magnitudes (Vega = 0), not "AB" magnitudes.
### Geometric Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pixel size</td>
<td>66 mas</td>
</tr>
<tr>
<td>Field width (edge-to-edge)</td>
<td>5.04'</td>
</tr>
<tr>
<td>Field width (single detector)</td>
<td>2.25' (2048 pix)</td>
</tr>
<tr>
<td>Blank strip</td>
<td>0.56'</td>
</tr>
<tr>
<td>Min. Exposure Time</td>
<td>10 s</td>
</tr>
<tr>
<td>Skew and distortion</td>
<td>24 pix max; 10 pix RMS</td>
</tr>
<tr>
<td>Distortion (after removing skew, quadratic terms, and barrel distortion)</td>
<td>0.16 pix max; 0.03 pix RMS</td>
</tr>
</tbody>
</table>

### Detector Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Detector 0</th>
<th>Detector 1</th>
<th>Detector 2</th>
<th>Detector 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gain [e/DU]</td>
<td>4.9</td>
<td>3.6</td>
<td>3.8</td>
<td>4.6</td>
</tr>
<tr>
<td>Detector noise [e]</td>
<td>15</td>
<td>11</td>
<td>14</td>
<td>16</td>
</tr>
<tr>
<td>Saturation [kDU]</td>
<td>30</td>
<td>33</td>
<td>33</td>
<td>26</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Parameter¹</th>
<th>Filter J</th>
<th>Filter H</th>
<th>Filter K</th>
</tr>
</thead>
<tbody>
<tr>
<td>QE (photons above atmosphere → electrons)</td>
<td>0.35</td>
<td>0.41</td>
<td>0.41</td>
</tr>
<tr>
<td>Rate for 15th mag star [ke s⁻¹]</td>
<td>11</td>
<td>15</td>
<td>7.5</td>
</tr>
<tr>
<td>Sky [ke s⁻¹arcsec⁻²]</td>
<td>3.5</td>
<td>23</td>
<td>46</td>
</tr>
</tbody>
</table>

¹The parameters are for detector 0. The values for detectors 1-3 are similar.
Exposure Times with SPARTAN

Caption - Map of the 4 detectors on the sky. Note the gap between detectors. The scale is in arcmin. The axes show the direction of increasing rows and columns. The orientation in the sky can change since the instrument is mounted at a Nasmyth port. The map is stored in the FITS header.
Caption - Exposure time for a given S/N ratio for a star of magnitude m for the J (solid line), H (dashed line), and K band (long dashed line). The seeing is 0.7arcsec(FWHM), and the diameter of the aperture is 1.0arcsec. The temperature, which affects the K band, was 13C. For the narrow-band filters, the approximate factors by which to increase the exposure time are 22 for HeI λ10830 (J band), 13 for [FeII] λ16400 (H band), 11 for HeI/CIV λ20650 (K band for this and the following), 10 for H2 λ21170, 19 for Brγ λ21620, and 4.3 for CO λ23310.

Further information is available from the [Spartan IRC home page at MSU](http://www.ctio.noao.edu/soar/content/spartan-near-ir-camera)