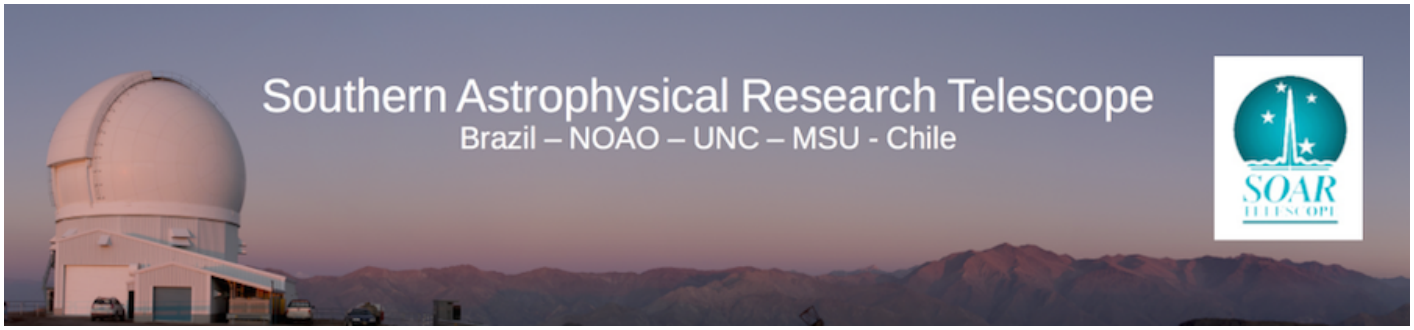

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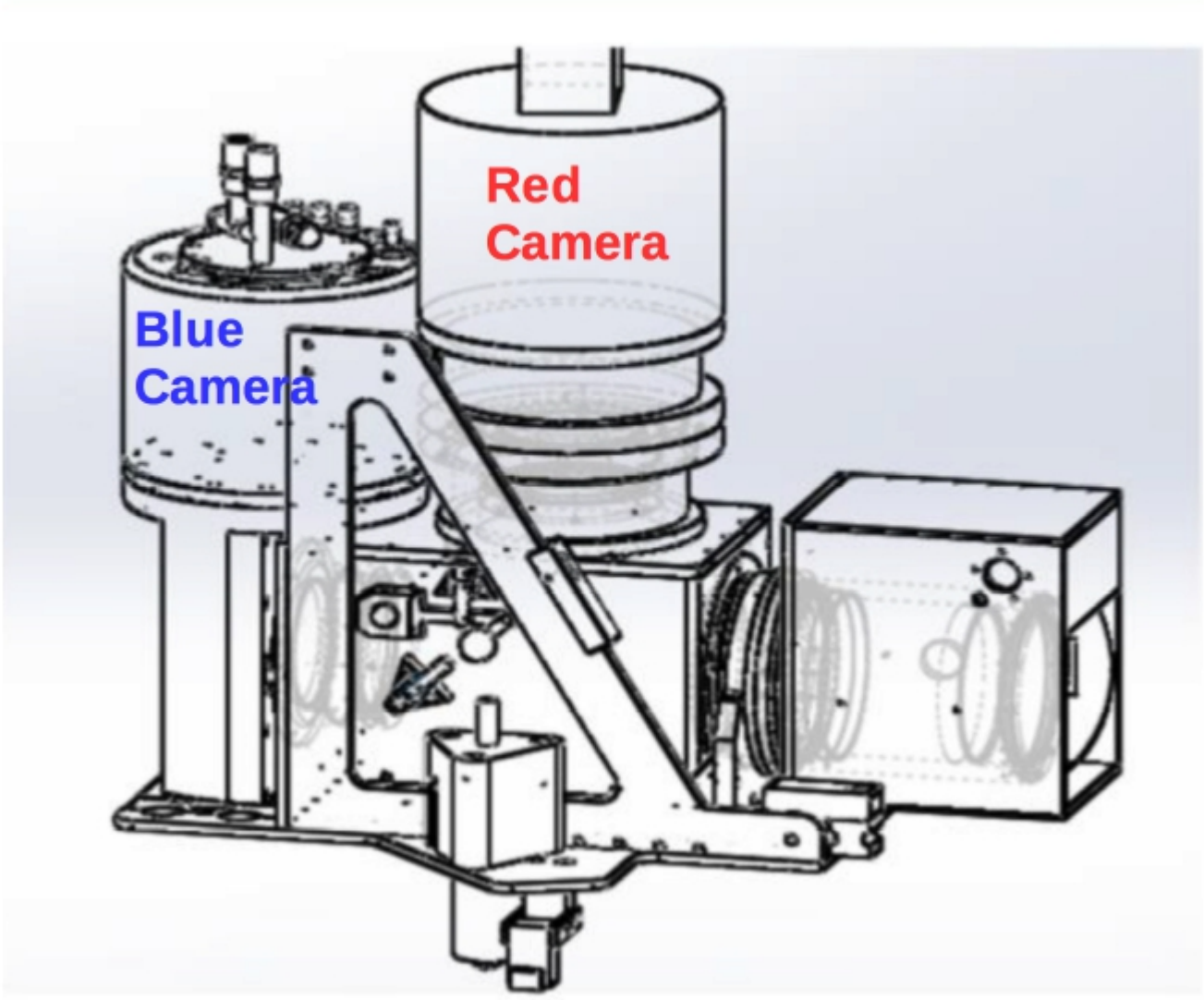
The Goodman Hardware

In this section you will find a description of the hardware and main components of the Goodman HTS. **Click on this link for a PDF file containing photos and further notes of each mechanism.** [1]

The Blue/Red Camera Stage

Both the Blue [2] and Red [3] cameras are installed on an articulated stage, which is moved by a wormdriven annular stage directly encoded with a resolution of 0.6 µ-radians. To minimize flexure the camera platform rides on a concentric 400mm curved bearing rail. The platform that holds the camera optics and dewar is attached at two points to the central stage and at two points to the bearings on the curved rail. The coupling between the bearing assembly and the camera platform is through tuned flexures that both relieve the overconstraint between the central bearing and the rail, and act as a restoring spring for two piezo-electric actuators that can move the whole platform up and down to compensate for instrument flexures. These flexures are pre-loaded with 100kg of tension, which is more than twice the total weight of the camera assemblies, to insure that the bearings on the curved rail remain on the same contact surface (the underside of the rail) during rotation of the instrument. Flexure compensation on the orthogonal axis uses the articulation motion at very low speed.



The Camera Focus Stage

The camera optics tube rides on lead-screwdriven crossed roller bearing stages. The camera stage is a custom low profile design that had to be incorporated into the articulation assembly. The camera focus stage incorporates external temperature sensors, constructed from temperature-to-voltage converters that feed built-in analog-to-digital converters in the Silvermax motors driving the stage. The optics mounts do not include passive thermal compensation, so measurements are required to correct for focus changes with temperature.

The Shutter

The clear aperture at the front of the camera is 4” and it is 2.8” at the last optic, which doubles as a dewar window. The shutter adds only ¼” to the width of the camera optics (except for a strategically positioned motor), and adds only 1” in length to the front of the camera. It consists of a friction driven curved stainless plate 0.010” thick that rides in a curved teflon track to cover the 4” entrance to the camera optics. The stepper motor can open or close the shutter in under 200 msec.

The VPH Gratings

We have available VPH gratings of 400, 600, 930, 1200, 1800, 2100 and 2400 l/mm, that have been produced in a holographic exposure facility at UNC that is currently capable of making 4” size VPH gratings. These gratings are of quality equal to or exceeding those produced by most vendors.

The Grating Rotation and Translation Stages

The grating changer can position any of three gratings at the 75 mm pupil, or lower them out of the way for imaging mode. This translation is subordinate to the grating rotation, so that the grating can be inserted and removed quickly from the pupil without resetting the angle. The rotation is driven by a Newport rotary stage at the bottom and a matching bearing at the top. This stage was retrofitted with a Silvermax motor. The stage is directly encoded with a resolution of 0.9 µ-radians, and the Silvermax motor uses feedback from this encoder for fine position control. Gratings are mounted in frames that are held by ball detents in the translation mechanism.

The Filter Wheels

The Goodman spectrograph uses two filters wheels.
The first filter wheel is used mostly for imaging. It can hold up to 4 holds 4x4 inch square filters. The SOAR filter page [4] shows the list of available filters.
The second filter wheel has 6 positions for 4-inch diameter circular filters. It normally holds the 5 spectroscopic order sorting filters, and an open position.
Filters are placed in the collimated beam where they cause a pupil shift instead of a more irritating refocus, but this made them large, to accommodate the 75 mm pupil, and difficult to place. The wheels are suspended from a plate mounted to a cantilevered extension to the truss. The wheels are tilted enough to place any reflection ghosts the filters generate outside of the imaging field. Filters are mounted in rings that are held in the wheels using spring loaded ball detents. This allows exchange of filters without tools or fasteners that get lost or dropped in the instrument. Likewise, the wheels are held on their bearings by a hub that can be removed by hand. The wheels have teeth around their perimeter and are driven by smaller gears engaged by a spring loaded mechanism.

The Collimator

The Goodman Spectrograph collimator has a set position at this time and cannot be moved. The collimator focus value is 1000.

Slit Masks

Goodman slit masks are 3x5 arcmin on the sky. Single longslits are available in widths ranging from 0.46 to 10 arcsec. They are all roughly 3.9 arcmin long. See the Goodman longslit page for more details. [5] Slit masks are installed on a 36 position carrousel.

Multiobject slit masks are also 3x5 arcmin on the sky. At present the mask carrousel can hold 17 MOS

masks at one time, the remaining 19 positions are used by longslits, image slicers, and a few non-operative slots. Changing MOS masks is a daytime operation.

Links
[1] http://www.ctio.noao.edu/soar/sites/default/files/GOODMAN/where_does_the_light_go.pdf
[2] http://www.ctio.noao.edu/soar/content/goodman-blue-camera
[3] http://www.ctio.noao.edu/soar/content/goodman-red-camera
[4] http://www.ctio.noao.edu/soar/content/filters-available-soar
[5] http://www.ctio.noao.edu/soar/content/ghts-long-slits