

1. Scope of Project

This specification describes 5 volume holographic elements, which are to be used in the Prime Focus Imaging Spectrograph on the Southern African Large Telescope (SALT). These gratings are to be produced on customer-supplied fused silica substrates.

2. Physical specifications

Size and Clear Aperture (See Figure)

Grating	lines/mm	Size (mm)		Clear Aperture (mm)*	
		length	width	length	width
1	900	200	175	180	155
2	1300	230	175	210	155
3	1800	250	175	237	155
4	2300	250	175	237	155
5	3000	250	175	237	155

* Corners of rectangular clear aperture may be rounded by a 50 mm radius (See Figure)

For all gratings:

- Fringe tilt 0 (normal to surface)
- Fringes oriented along short (155 mm) dimension of grating, so that dispersion is parallel to long axis.
- Capped with customer supplied fused silica
- Use low-shrinkage epoxy (please specify)
- 6 mm or smaller border for capping.

3. Performance specifications

The following table gives the parameters for a reference VPH design. Efficiency vs wavelength and grating angle curves generated by Rigorous Coupled Wave Analysis (RCWA) for these designs meet the efficiency performance specifications below

Reference RCWA Designs

Grating	lines/mm	holograph thickness (μm)	index modulation
1	900	3.0	0.1
2	1300	3.0	0.1
3	1800	3.5	0.1
4	2300	3.0	0.1
5	3000	2.0	0.1

Superblaze Peak Specifications

Grating	lines /mm	Tilt (deg)	Reference Design			Specification	
			Peak Wavelength (nm)	Peak Efficiency	Bandwidth FWHM (nm)	Peak Efficiency	Bandwidth FWHM (nm)
1	900	15.7	600	0.913	500	>.85	>450
2	1300	21.3	560	0.96	350	>.90	>320
3	1800	33.9	620	0.93	175	>.87	>160
4	2300	36.7	520	0.90	125	>.84	>115
5	3000	32.7	360	0.94	110	>.88	>100

Blue Efficiency Specifications

Grating	lines /mm	Tilt (deg)	Reference Design		Specification	
			Peak Wavelength	Peak Efficiency	Peak Wavelength	Peak Efficiency
1	900	12.2	540	0.85	±50	>0.79
2	1300	15.1	480	0.78	±30	>0.72
3	1800	23.9	485	0.61	±15	>0.55
4	2300	27.4	420	0.66	±12	>0.60
5	3000	29.7	335	0.92	±10	>0.80

Ultraviolet Efficiency Specification

Grating	lines /mm	Tilt (deg)	Reference Design		Specification
			Wavelength	Efficiency	Efficiency
1	900	12.2	350	0.57	>0.40

Red Efficiency Specifications

Grating	lines /mm	Tilt (deg)	Reference Design		Specification	
			Peak Wavelength	Peak Efficiency	Peak Wavelength	Peak Efficiency
1	900	19.7	670	0.86	±50	>0.80
2	1300	32.2	770	0.79	±30	>0.73
3	1800	50.0	840	0.72	±15	>0.66
4	2300	50.0	660	0.75	±12	>0.69
5	3000	50.0	500	0.69	±10	>0.63

4. Optical Specifications

- a. Total spherical wavefront distortion < 5 waves @ 633 nm
- b. Total non-spherical wavefront distortion < 1 wave @ 633 nm

5. Customer supplied substrates:

- a. Thickness: 10 mm
- b. 2 substrates + 1 spare for each grating
- c. Material: Corning HPFS 7980 Grade 2F
- d. Front/Back parallelism: better than 2 arcmin
- e. Surface figure @ 633 nm: 1/4 wave RMS over 4 inches
- f. Scratch/ Dig: 40-30
- g. 220 grit edge finish
- h. Bevel 1-2 mm

6. Documentation

- a. Efficiency vs wavelength over at least the FWHM of the grating, at above superblaze tilt, and the blue and red grating tilts
- b. Wavefront distortion interferograms

VPH Grating Size and Clear Aperture

