

KOSMOS System Design Note 1.02

Title: Mayall RC Spectrograph Demand
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Introduction

Dianne Harmer reviewed KP 4m proposals for RCSP in its primary mode, and as the vehicle for MARS, long slit and multi-slit proposals, that were submitted to TAC in semesters 07A through 09B. These statistics are intended as one point of reference for defining OSMOS maximum spectral resolution and individual dispersers.

Proposal Data

There were 107 proposals; 16 of which were for MARS (3 of those were multi-slit proposals); 91 were RCSP (2 of which were multi-slit proposals).

Several proposals required more than one wavelength region, and chose to do this by selecting a grating that could be used in 2nd order - thereby minimizing physical reconfigurations. In several other cases, it was necessary to carry out a mid-run configuration change. RCSP's large grating suite allows configurations to be tailored to most requirements, offering good selection, especially when dispersions are high enough that the wavelength range covered may be only 1000Å or less.

MARS proposals. The 16 proposals requested use of 20 setups, equally divided between the new VPH-red grating (10) and a mixture of "bluer" options from the regular grism sets (10). The nominal resolution of these configurations is $R=1500$ or less.

RCSP proposals show a desire to exploit most of the available facilities, at the physical ruling frequencies, and the "effective" ruling frequencies drawn from gratings used in 2nd order where practical. As noted, some proposals requested more than one wavelength region and/or change of configuration - 101 setups for 91 proposals. These are summarized in the table below. Some possible configurations are not listed if they were not requested.

Where the wavelength ranges recorded were less than 2000Å, there was considerable variety in the wavelength ranges selected for observing.

The resolution listed corresponds to 2 pixels on the detector, though observers typically use a somewhat wider slit and therefore low resolution. Note that the useful coverage on the detector is ~800 resolution elements (2-pixel slit) or less (wider slit or lowest resolution gratings).

The second table provide a breakdown of the setups by approximate resolution and color (separating “red” and “blue” at 5000Å).

RC Spectrograph Grating Requests

Grating	g/mm	Blaze ^a	Order	Range	Resolution (2 pixels) ^b	No.of Proposals	Notes
250	158	4000	1	>octave	360	3	Not needed for a T2K
400	158	7000	1	>octave	630	2	Not needed for a T2K
10A	316	4000	1	<4100	720	18	
181	316	7500	1	4100	1350	13	
		3750	2	2000		3	
17B	527	5540	1	2500	1650	6	
420	600	7500	1	2300	2470	5	
		3750	2	1150		4	
007	632	5200	1	2100	1870	8	
22B	632	8500	1	2100	2950	3	
		4250	2	1050		7	
450	632	5500	2	1050	3900	10	
18C	790	9500	1	1700	4170	1	
24	860	5400	2	800	5050	6	
380	1200	9000	1	1100	6080	6	
		4500	2	550		6	

^aBlaze listed for the order in which grating is used

^bResolution specified is for 2 pixel slit at blaze wavelength (approximately 1.6 arcsec).

Setup Categories (RCSP + MARS) – Percentage

Resolution	Blue	Red	Blue+Red
<2000	28%	32%	60%
2000-3000	9%	7%	16%
3800-4200	0%	9%	9%
>5000	5%	10%	15%

The summary table reveals, first of all, that the bulk of the setups requested are for resolutions under 2000; an instrument offering a maximum resolution of ~3000 would satisfy 76% of requests. The highest resolution available with the spectrograph is roughly 6000 (requested roughly 10% of setups). At lower resolutions the proportions between red and blue setups are roughly equal (remembering that the division is specified as 5000Å). At the higher resolutions there are more “red” setups.

It is also worth remembering that the RC spectrograph slit widths normally used are greater than 1 arcsec, whereas the KOSMOS specifications assume a 1 arcsec slit. This implies an increase in slit losses with the new instrument, or else use of a wider slit. In

the latter case the spectral resolution will be reduced by a corresponding amount. This suggests that, in order to provide maximum flexibility, it should be possible to achieve at least $R=2000$ with a 1.5 arcsec slit on KOSMOS.

Versions

Version	Date	Changes
1	September 24, 2009	First draft based on Harmer e-mail of 8/25/09