

KOSMOS System Design Note 3.02

Title: CCD Selection for KOSMOS
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Introduction

This document describes the selection of the KOSMOS CCD detectors. The detectors are specified at a level sufficient to (a) design and cost electronics and software and (b) describe approximate performance for the design review. Some future revisions of specifications may occur during the actual procurement process.

Initial Selection

The initial down-select (SDN 3.01) resulted in a specification of a device with 15-micron pixels, with the overall format (4k x 4k vs. 2k by 4k) dependent on optical design results. There are several potential suppliers listed in the down-select document.

Subsequent Developments

Two important developments occurred since the initial down-select document was written:

- The optical design work showed that a pixel scale of 0.3 arcsec/pixel is feasible, which in turn implies that a 2k x 4k format would be adequate (only a small loss of field of view would occur compared with a 4k x 4k device).
- The opportunity arose to acquire 2 red-sensitive LBNL devices, one of which would be used for the Hydra upgrade at CTIO. Some KOSMOS funds would be used for this acquisition, but enough would remain in the detector budget to acquire a second device.

Device Selection

We elected to participate in the LBNL acquisition. This provides KOSMOS with a device with excellent red sensitivity, and also a format that can be used for nod-and-shuffle (serial register in 4k axis). The LBNL is not a good all-purpose device, primarily because it is very thick and therefore very responsive to cosmic rays. Blue response is good but not outstanding.

A second device is therefore desirable that is less affected by cosmic rays and might provide better blue response. The nod-and-shuffle capability is desirable but not essential, since this is mainly useful at wavelengths with many strong OH lines – i.e., the far red. Such a CCD would in fact be the primary detector for KOSMOS.

Although there are several devices that might satisfy the need, we chose the same device as the Mosaic 1 upgrade (e2v CCD 44-82) for several reasons:

- The device will be a “known quantity” by the time the KOSMOS detector is delivered and therefore development and commissioning costs are reduced
- The vendor is reliable in terms of both performance and schedule. This allows us to avoid relying on the LBNL device as the commissioning detector.
- The overall response of the e2v devices with a 2-layer coating is very good; in fact we may be able to use one of the devices acquired for Mosaic 1 which has unusually high response.

The baseline detectors for KOSMOS are therefore an e2v CCD 44-82 device as the primary detector and the LBNL device as an alternative red-sensitive detector. All planning should assume that both devices are procured and that each is installed in a “universal” dewar, and that all dewar-specific electronics hardware is duplicated.

Both of these are 2k x 4k devices, where the 4k axis is intended to run in the dispersion direction.

Additional Issues

The e2v device we have selected does not permit nod-and-shuffle for the layout we have chosen (4k axis is dispersion). The manufacturer has indicated that a defective 4k x 4k device might fill this need (e.g, one with only two appropriate amplifiers working). Obviously, this is not something that can be ordered, but after the design review we will check whether something like this is available, what its characteristics are (poor QE would outweigh the ability to do nod-and-shuffle, for example), and also whether the price is consistent with our budget. The probable configuration for such a CCD would be to mount it in a dewar on-center but mount the dewar off-center in KOSMOS. It is necessary also to verify that any re-design to accommodate this option does not significantly delay delivery of the instrument.

Versions

Version	Date	Changes
1	April 6, 2010	First draft
2	April 7, 2010	Released, clarified that baseline comprises 2 detectors in dewars