

## Considerations about LIRIS MOS observations

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The use of multi-object spectroscopic mode in LIRIS is restricted to a small number of masks for each observing period. This is mainly due to two reasons: first any mask exchange involves a thermal cycle of the whole dewar (at least 5 days), and second the manufacturing process takes about a month. This note establishes basic regulations about the use of MOS in LIRIS.

**Number of allowable masks:** The maximum number of available wheel positions for multi-object spectroscopy is 6. The available positions have to be shared among granted proposals in a equal opportunity basis. It is foreseen to have a maximum of two mask exchanges during the semester. As a baseline a number of three masks per proposal is a convenient number.

**Scheduling restrictions:** We define as *reference date*, the first night that LIRIS is mounted on Cass for the observing period that includes the observations with the MOS Masks. There must be:

- A minimum gap of **11** weeks between the official announcement of the telescope schedule and the reference date.
- A minimum of 2 weeks with LIRIS at Parking for thermal cycling and integration of the masks and cooling before the reference date.

**Mask Definition:** It is the responsibility of the PI of any granted LIRIS MOS proposal to provide the required information (number of masks and coordinates for each of them) to the LIRIS people ([liris@iac.es](mailto:liris@iac.es)) within **9 weeks** in advance to the reference date.

| WEEK   | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | Reference date |
|--|---|---|---|---|---|---|---|---|---|----|----|----------------|
| MOS definition by PI of any granted LIRIS MOS proposal |   |   |   |   |   |   |   |   |   |    |    |                |
| MOS Design – Manufacturing and delivery                |   |   |   |   |   |   |   |   |   |    |    |                |
| LIRIS warming at parking (1 day)                       |   |   |   |   |   |   |   |   | * |    |    |                |
| MOS Integration, LIRIS Vacuum and cooling              |   |   |   |   |   |   |   |   |   |    |    | ◆              |

Table 1. *Scheduling summary table*

**Quality of the masks:** The final decision about the mask design is under the responsibility of the PI of the proposal. People in the LIRIS team may give advice about the mask design. Main points of concerns are wavelength range and collisions between adjacent slits and observing technique. See Appendix below for tips about good mask design.

**IAC responsibilities:** The LIRIS team at IAC will be responsible of the MOS masks manufacturing and their installation in the cryostat.

**Costs:** The cost of the masks manufacturing will be covered by IAC.

## Appendix. Tips for a good mask design for LIRIS MOS.

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The LIRIS field of view covers  $4 \times 4 \text{ arcmin}^2$  with a pixel scale of  $0.25''$ . The maximum number of slitlets is around 25.

**Observing technique:** Given the high and variable sky emission contamination, observations in the near infrared range need frequent sampling of the sky emission. This is usually achieved by nodding the telescope setting the target along the slit at 2 or 3 different well spaced points. Nodding the telescope between two points is usually enough to guarantee a sufficiently good sky subtraction for bright sources. For very faint sources the 3 points nodding is preferred against 2 points because flat-field and bad pixels are better corrected.

**Minimum Slit length:** The minimum slit length should provide enough space to contain the observations of point sources. This will depend on the number of nodding points, 2 or 3 as mentioned above. The minimum separation of nod points for compact sources should be at least twice the value of the seeing. Therefore the minimum slit length would be  $5''$  or  $7.5''$  for 2 and 3 nod points, respectively. These numbers apply for good seeing conditions, otherwise the sky subtraction will be compromised if very short slit-lets are required.

**Minimum slit-let separation:** There should be a minimum gap between slit-lets which are adjacent along the long side (spatial direction). This gap must avoid contamination between slit-lets. A reasonable value for this gap is  $0.5''$ , or equivalently two pixels.

**Reference stars:** A number of point sources (2 minimum, 3 is desirable) must be used as reference targets to perform mask centering. These reference targets will be located into circular apertures of  $3\text{-}4''$  diameter and should be brighter than  $J=18$  magnitude in order to facilitate target acquisition.

**Checking stars:** When observing very faint targets it is convenient to include a slit-let around a relatively bright target to monitor the stability of sky conditions.

**Wavelength coverage:** The wavelength range for each slit-let will change as function of the distance along the spectral direction (the short slit dimension), to the center of the field of view,. For example a slit-let shifted to the border will have shift the wavelength range by half of its value.

**Row cross talk avoidance:** The Hawaii I detectors suffers an effect called row cross talk. LIRIS rows correspond to spectral direction and columns to the spatial one. The effect appears when a row of a set of them are exposed to a bright illumination, such as bright continuum source. Then an extra charge appears uniformly distributed in a row symmetric with respect to the center of the detector. For instance if there is a bright star whose spectrum is dispersed along row 672, there will an extra-illumination at row 160, which is a factor  $1/100000$  of the total count numbers in row 672. The distance on the sky is  $128''$ . Hence one should avoid to locate slit-lets separated by that distance if one of the targets is very faint compared to the other to avoid contamination.