

## Title: The VISTA Hemisphere Survey(VHS)

### Appendix B: Response to PSP Report

**PSP Panel Issue 1** The proposal aims to image the entire Southern celestial hemisphere in four bands. The panel agreed that the proposal has a large legacy value. However the total time required is very large and the PSP believes that covering the sky in J+K is a considerably higher priority than Z+Y.

*Response:* The original VHS proposal was a 7 year program which aimed to survey the full  $20,000\text{deg}^2$  of southern celestial hemisphere with exposure times of 180, 180, 60, 60 seconds in Z, Y, J and K respectively. This required a total time of 7359hrs based on VISTA ETC(v1.1). With the new VISTA ETC(v1.3) this reduces to a total of 6750hrs.

In this resubmission we have excluded the regions that will be covered by VIKING( $1500\text{deg}^2$ ), the Magellanic Clouds( $200\text{deg}^2$ ) and galactic plane region with  $|b| < 5\text{deg}$  ( $1800\text{deg}^2$ ). In the case of the Galactic plane, this region is either covered by the VVV proposal or confusion may be an issue. This is an issue that needs to be evaluated in the future.

We have removed the Z band on the assumption that this will be provided by VST ATLAS or the DES project. The exposure time request in the Y band is reduced from 180secs to 60secs. The deeper exposure science goals can be partially met in the short term by the VIKING proposal. We have retained the Y and Z observations over the region that will be covered by VST ATLAS. We have reinstated the H band in the high latitude sky to aid photometric redshifts and stellar classification.

Part of the South Galactic Cap will be surveyed by the DES project with the CTIO 4m in z so the current VHS submission takes this into account.

The DES project has committed to include the Y filter in their survey if VISTA images the DES area in the near IR to a sufficient depth. See enclosed letter from the DES Project Director.

**PSP Panel Issue 2** At the beginning of the proposal, it is mentioned that  $7500\text{deg}^2$  could be surveyed in Z+Y initially, but the proposal does not explicitly discuss which  $7500\text{deg}^2$  of the sky are considered.

**Response:** The specific  $7500\text{deg}^2$  was intentionally left vague except to specify that VHS should cover the VST ATLAS regions.

**PSP Panel Issue 3** The proposers do not discuss the science goals behind the annual scan of the SDSS SGC equatorial strip. How much time is being devoted to this? Is it important to do this in all filters?

*Response:* We have removed the multi-epoch part of the proposal. However we have retained a single epoch for the purposes of photometric redshift calibration with SDSS, 2DF and other redshift surveys in this region. This training set is essential for the large scale structure studies based on photometric redshifts.

**PSP Panel Issue 4** The proposers discuss prioritising the targets but it is not clear why that particular strategy was selected, nor what scientific gains would accrue. Since this approach would certainly have an impact on the efficiency of the survey, the proposers should discuss the detailed observing plan and the perceived advantages and costs .

*Response:* Due to space requirements we did not give an lengthy description but provided these as examples of how in the short term, the scientific return of an large area survey could be maximised. In section 2.2.6 we had described in detail the case for galactic clusters.

The list of high scientific value fields has been removed since we accept that this may be impractical due to scheduling constraints and observing efficiency.

**PSP Panel Issue 5** The Panel strongly recommends that the PI submits a new proposal which focused on the science that can be achieved by covering the whole southern sky in J+K only. If the PI wishes he could add, as an option to be implemented at a later date, the additional observations in the Z+Y filters. Of course the incremental scientific objectives that could be achieved with these observations should also be part of the optional proposal. The panel felt that this strategy could provide a legacy database at the earliest opportunity.

*Response:* Many of the science goals proposed by the survey team are not satisfied by a survey that is in J+K bands alone. After careful consideration we have therefore retained an element of the Z and Y program in the proposal. We believe that this approach would both, deliver more scientific return in the short term and also deliver a higher value legacy survey for the ESO community.

The VHS sky coverage have been divided into 3 regions:

1. VHS-NGC (North Galactic Cap);  $b > 30^\circ$ ;  $\delta < 0^\circ$  ( $\sim 2500\text{deg}^2$ ) JKs and (Z)YH for 60secs per band. Propose to start with the VST ATLAS region, excluding the VIKING region.
2. VHS-SGC (South Galactic Cap);  $b < -30^\circ$ ;  $\delta < 0^\circ$  ( $\sim 8000\text{ deg}^2$ ) JHK for 120secs over DES region on the assumption that the DES project will project provide matching Y and Z. YJHK for 60secs over the remainder of the SGC starting with region covered with VST ATLAS.
3. VHS-GPS (Galactic Plane Survey);  $5 < |b| < 30\text{ deg}$  ( $\sim 8500\text{deg}^2$ ); J and K for 60secs per band

We propose that initially the VHS-DES region is surveyed with exposures of 120secs per band and then a second pass is obtained in order to reach the full depth requested by the VDES proposal.

**PSP Panel Issue 6** The panel asks the PI to contact Castander to discuss the Z+Y imaging in the area of the sky proposed by Castander (to be observed by DES) and to determine how this would add to the scientific objectives of the survey.

*Response:* The PI and Castander have met and discussed the Z+Y imaging.

The proposed CTIO 4m DES survey will cover  $5000\text{deg}^2$  of the South Galactic Cap. The DES design reference survey strategy is to survey the full  $5000\text{deg}^2$  in year 1 for 200secs per band

reaching 10sigma limits[AB mags] in g, r, i and z of 24.1, 23.7, 23.3 and 22.6 respectively. The same strategy is planned in year 2. The goal for the full 5 years is a total exposure of 400, 400, 1200, 2000 secs in g, r i and z respectively with 10sigma limit of 24.6, 24.1, 24.3 and 23.9.

Thus in principle the DES 'z' band data can be used to provide the z band data proposed for VHS. The DES project is currently reviewing whether DES could also obtain 'Y' data. On this basis that Z and Y can be provided by the DES project we no longer request Z and Y in the SGC region covered by DES. At a later date e.g. the two year review we propose that the PSP reconsider this decision. Further information about the DES project is provided in Appendix A.

Castander and McMahon agreed that a goal for VHS could be to:

1. cover full DES region (excluding the region of DES covered by VIKING i.e. around  $500\text{deg}^2$  with VHS by end of 2010. Thus by the end of the first season of DES we would have  $5000\text{deg}^2$  in grizY(DES) + JHK(VHS). Note that some of the DES region would also be covered by VST ATLAS so that independent of DES, VHS would be getting optical data over part of this region.
2. propose to PSP that to double the VHS Baseline exposures in J and K from 60secs to 120secs in the DES region.