## - VVV SMP review –

RID=Review Item Discrepancy, RIC=Review Item Comment, RIQ=Review Item Question Please use a separate page per RIx.

Reviewer: ESO Survey Team	
Document No	VVV SMP
RID, RIC or RIQ ?	RID
Section	Survey Observing Strategy
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EST – Date : 08.03.2007

1. The estimated total areas of the bulge (300 sq deg) and of the disk (220 sq deg), to be covered in one night are overestimated. The survey team has not considered the 1 hour needed for the VISTA standard calibration, nor the time required for telescope pre-set. As an example, if preset, acquisition image, and comparison with finding charts takes only 30 s (which would be unusually short for an ESO telescope) this translates into an additional overhead of two hours in each night for the VVV survey! The PI should provide his best estimate for a "minimum" area, in case of the *worse* and *best* outcome scenarios from the VISTA commissioning.

2. The PI has not justified and has not endorsed the recommendation of the PSP in terms of contiguous nights. The request of 79 contiguous nights in the 3<sup>rd</sup> year and 54 nights in the 4<sup>th</sup> year is equivalent to setting a higher scientific priority for VVV in these trimesters over the other surveys, which are observable during the same time of the year (VHS, VIKING, ULTRAVISTA). This request is a scientific one and cannot be approved or implemented by the EST, standing the current PSP recommendation for VVV. The survey strategy must be revised in the new re-submission of the SMP.

3. The seeing requirements in the first and last epoch have not been relaxed as requested by the PSP.

4. The spreadsheet calculations appear to have some major weaknesses (1) assuming a very large aperture in a crowded field like the bulge seems in error (2) 3-sigma limits on detection seem very weak, particularly considering that this is primarily a variable star search.

## EST – Date: 07.10.2007

Open issues related to current Review item (RIX) after VISTA PS senior review (22.10.07) and EST report (28.06.07)

The VISTA PSP recommendations and the EST comments to the VVV SMP have not been adequately addresses by the survey team. The team's answers to this RIX do not provide a constructive approach to the questions listed. The ESO policies for Public Surveys state that the DG will approve the time allocation to the surveys only after the successful outcome of the SMP review.

Concerning the bulk allocation of 3 months and 2 months in the 3<sup>rd</sup> and 4<sup>th</sup> year respectively: they are not supported by the VISTA PSP approved science case. The survey team should provide a plot showing the periods of the variables as justification for a core of contiguous nights to be request. The additional input from the VISTA PSP on this specific topic will be sent to the PI as a separate document.

The team must realize that the telescope time allocation for 5 years is subject to several reviews, and it is allocated if the survey successfully passes these reviews. It is <u>not</u> automatically allocated, nor extended.

The VISTA commissioning will be crucial to define a "realistic area coverage" in one night for the multi-epoch survey, and the survey team must take this into account.

Reply from Survey Team – Date: 22.05.2007 Name: Dante Minniti, Valentin Ivanov, Phil Lucas –

1. The observations are to be carried out mostly during the fall-winter time at Paranal. The official length of the nights (between two astronomical twilights) is:

15 May 10:28

01 June 10:37

15 June 10:40

01 July 10:38

15 July 10:33

Roughly half of the calibrations can be taken outside this time, e.g. skyflats during twilight. Thus, there is plenty of time for the ESO requirement of 1 hour standard calibrations at the beginning and end of the night. We think that our 10 hr long observations per night for VVV are possible.

However, we do not need calibrations other than the standard calibrations. Our science is designed to use the survey images for additional calibrations.

This is a variability survey, different from the other VISTA surveys. We had not evaluated the additional overheads because these were not known. We basically need one preset per OB. The adjacent fields are then mapped with small sub-field offsets in order to fully cover the survey area and create a mosaic of the fields. VISTA does not take acquisition images and operation does not use finding charts. After checking the coordinates of a first image, the following observations do not need comparison with finding charts, or acquisition images, but can be directly observed. It is expected that the relative pointing accuracy of VISTA is similar to other ESO telescopes. The overheads are then basically due to readout (already covered by the ETC), and due to the small sub-field offsets and jitter pattern. In the revised spreadsheets we have taken into account a worst-case scenario, requiring presets after each tile (10 sec), plus 25 sec for filter changes (only in the 5-filter OBs), plus 30 sec for LOWFS every 15 minutes. Obviously, these numbers may have to be revised after we get better overhead estimates from the Science Verification.

The PSP and the OPC has approved our VVV project to do 300 sq deg + 220 sq deg in the Galactic bulge and plane. We think that this field coverage can be done if VISTA is efficiently run. The first year is critical because it will not only help us refine the strategy, but also tell us if we need to plan a smaller field coverage per night. The worse outcome of the commissioning scenario will then be that we have to reduce the total field covered nightly (by about 10%) for the variability campaign in the 3<sup>rd</sup> and 4<sup>th</sup> years, and that we would have to extend our survey for a few more years. The best scenario would be that we have been too conservative and we can cover nightly a larger field during the variability campaign, and that our survey would be finished on time.

2. The PSP said this as a suggestion, and not a mandate. We have explained that we can relax this for the Galactic plane survey, but not so much for the bulge survey. The PSP and OPC approved our VVV, which cannot be done unless we have contiguous nights in the 3<sup>rd</sup> year for the bulge. In practice, there are only about 2.5 months where the bulge can be observed for 10 hrs a night, and it would be unacceptable to spread the bulge variability campaign over several years.

We can relax the request for the 4<sup>th</sup> year, as the disk fields are more spread out in RA and their coverage would probably have to spread over non-contiguous nights. But we cannot relax too much the request for the main bulge variability campaign made during the 3<sup>rd</sup> year. Yes, this is a scientific request and we would like to insist on this. The other surveys have little overlap, and they are different: they do not have the variability requirements that we have. The other surveys can have priority the other seasons. We can relax our request by allowing 3 nights/month to be used for other surveys during the 3<sup>rd</sup> year bulge campaign, when the moon is located on the bulge.

Contiguous nights for the bulge survey are very important and are absolutely needed:

- to have sufficient continuity in the bulge light curves,
- to build good local (in space and time) templates,
- to remove spurious points in the short period variables,
- to help in the interpretation of the light curves of variables with 0.1 < P(d) < 30,
- to discriminate Blazskho and multimode RR Lyrae,
- to allow the search for planetary transits,
- to measure rotation periods using starspots (eg for M\*s, BDs),
- to better design the variability campaign, and

As an additional consideration, there are competing projects, and our VVV Public Survey would lose this important edge if no effort is made to have continuity in the light curves. 3. We have relaxed the seeing for the first and last years to 0.8". Note that this also was a suggestion from the PSP, but not a mandate. We have taken the PSP comment seriously, and explained this in our SMP before: to do more relaxing of the seeing would damage the scientific return of the survey. These images are critical templates for the source identification to be used in the variable search, and in the proper motions.

4. We fixed the spreadsheets, and attach the new one including all overheads. This should be considered a worse case scenario, compared with the best-case scenario presented with the original Survey Management Plan.

## <u>Reply to open issues related to current Review item (RIX) after VISTA PS senior</u> review (22.10.07) and EST report (28.06.07)

Name: Radostin Kurtev, Marcio Catelan, Manuela Zoccali, Jura Borissova, Dante Minniti, Valentin Ivanov, Phil Lucas –

It was always our intention to be constructive and to work with ESO to carry out successfully this exciting VVV public survey. We apologize if we might have sound non cooperative, we simply tried to explain our arguments. We have now made modifications to the SMP in order to comply with all the requirements.

We are assuming nights with 10h long, and added all overheads, including the standards for the single epoch YZ filter calibrations during the 1<sup>st</sup> year. This means that all fields cannot be cycled during one night, we simply take a hit to the total number of epochs. Our simulations have shown that this would have less impact on the science than if we reduce the area. In addition, this has the advantage of randomizing the nightly schedule of observations of any particular field, helping to reduce the period aliases (P~1/n days).

In order to comply with the requests, we have performed light curve simulations using the updated plan for the bulge (6 consecutive nights on the  $1^{st}$  year, 20 non consecutive nights on the  $2^{nd}$  year, 40 consecutive + 20 non consecutive nights on the  $3^{rd}$  year, and 12 non consecutive nights on the  $5^{th}$  year), testing the impact on the periods, amplitudes and completeness. As requested, below we include 4 plots from the simulations, with explanatory captions.



from that of Fig 1. The top shows that the period is well measured in spite of the small amplitude (typically sigma\_P < 1%).



Fig. 3. These are the simulated amplitudes of peaked RRLyrae type ab (worst case scenario) recovered vs the number of consecutive nights of observations for the 3<sup>rd</sup> year. The amplitude errors shown here will be mitigated with the addition of the epochs from the other years.



Fig. 4. This is the completeness of the recovered simulated RR Lyrae as function of the periods using the 40 core contiguous nights in year 3 plus the rest of non consecutive nights. RR Lyrae type c are more affected than RR Lyrae type ab, but in all cases the completeness is >80%.

The only problem that we have found is that a small fraction of the more peaky light curves get underestimated amplitudes. However, the overall conclusion from our simulations is that the bulk of the VVV RR Lyrae science would not be compromised. The microlensing and transit searches would be more incomplete, but these were deemed of secondary importance by the PSP review. Therefore, we reduce the number of contiguous nights to 40 for the bulge and 27 for the disk, as requested.

We are aware that all surveys will be subject to reviews.

We look forward to receiving VISTA commissioning data in order to better quantify the overheads and hence the areal coverage. UKIRT experience indicates that the first years data will provide a worst case scenario for the overheads, which later get reduced as the camera readout is fine-tuned.