Technical Justification

As defined by Bellazzini et al. (2013), the NGC 3109 filament is distributed along a line extending from Leo P in the north ($\delta = +18°$, $b = +54°$) to Antlia in the south ($\delta = -27°$, $b = +22°$); Sextans B is about 3° to the west of this line (see Figure 1). While galaxies belonging to the NGC 3109 association might not lie along the filament defined by the 5 known members, the structure provides the most obvious 'lamp post' under which to search for new members. The southern part of the filament will be observed with LSST (coverage to $\delta < +10°$ to the necessary depth), but the northern portion is out of LSST's reach. The SDSS coverage of the northern portion of the filament is of insufficient depth for our purposes. We have defined a series of Megacam pointings covering a $2° \times 6°$ region south of Leo P in the direction towards Sextans A and B; (Figure 1, right panel). This area subtends 44×136 kpc at the distance of the NGC 3109 association; for comparison, the tidal truncation radius of Sextans A is about 3 kpc (Bellazzini et al. 2014). As the Figure shows, our defined fields are also quite close to Leo I and will be used to probe the outer regions of this galaxy. The position of the MegaCam field nearest Leo I has been adjusted slightly to avoid the bright star Regulus.

MegaCam imaging in two filters is important for separating the giant branches of additional NGC 3109 members from both foreground Galactic stars and background unresolved galaxies. Bellazzini et al. (2013, 2014) successfully demonstrated the ability to effectively remove contamination using colour information in an LBT study of Sextans A and B in g and r. Of the MegaCam filters, the r band is best-matched to the SED peak of red giants in an old stellar population. The imaging depth is set by the requirement to detect enough stars for a significant measurement of overdensity. With data reaching 3 magnitudes below the TRGB, McQuinn et al. (2013) found Leo P to have a *central* surface brightness of $\mu_V = 24.5$ mag arcsec^2 and only a few hundred RGB stars. We aim to reach a depth of two magnitudes below the TRGB ($M_r = -3.1$, or $r = 23$ at 1.7 Mpc), meaning $r = 25$; this is shallower than the Bellazzini et al. data, but their fainter objects were dominated by background galaxies. The $g - r$ colour found by Bellazzini et al. at $r = 25$ was $g - r \approx 1.0$ so the required g-band depth is $g = 26$.

We will search for new, faint members of the NGC 3109 association using the standard methods in the field: searching for spatial overdensities of resolved stars within magnitude and colour ranges expected for the stellar populations. The resolved stellar population studies of known NGC 3109 group members (Bellazzini et al. 2014, McQuinn et al. 2013) provide excellent templates for this work. Foreground and background (stellar and galaxy) populations are also well-characterized in these studies and others, so filtering out only the populations of interest is feasible. Finding and accounting for distant members of Leo I will be important in the southern-most fields; these should be significantly brighter than those belonging to NGC 3109 group members since Leo I is about 4 times closer. Combining the Leo I star counts with published surface brightness data will allow a search for the predicted tidal break.

To estimate exposure times, we assume less-than-ideal conditions (dark time, 1 arcsec seeing, airmass 1.2, 90% transparency) since our proposed observations overlap in RA with Large Programs MATLAS and LUAU and we have not tightly constrained the observing conditions. Assuming overheads for 4 dithered exposures per filter, reaching $r = 25$ and $g = 26$ at $S/N = 5$ requires 1.5 hours per field, 0.5 in r and 1.0 in g. This is consistent with the successful MegaCam detection of more than a dozen dwarf galaxies in the M81 group by Chiboucas et al. (2009), who had somewhat better conditions than assumed here and reached $r = 25$ in approximately 1200 s exposures. We therefore request a total of 18 hours of exposure time.