Notes on the estimation of the contribution of the Light of Night Sky per pixel

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Light of the Night Sky

The amount of light from the night sky (LONS) has been measured, and is around

$$\langle \mathrm{LONS} \rangle = 2 \cdot 10^{12}\,\mathrm{ph}/\,\mathrm{m}^2\,\mathrm{s}\,\mathrm{sr}$$

Estimation of the LONS per pixel for MAGIC

For this calculation, the following parameters have to be taken into account:

$S_{\mathrm{mirror}} = 230\,\mathrm{m}^2$	Reflectivity $= 80\%$
$\epsilon_{\mathrm{l.guides}} = 90\%$	$\epsilon_{\mathrm{plexiglas}} = 95\%$
$\epsilon_{1^{\mathrm{st}}\mathrm{dyn.coll.}} = 90\%$	$\theta_{1\mathrm{pixel}} = 0.1^\circ$
$\theta_{\mathrm{h.pixel}} = 0.05^\circ$	$\mathrm{QE}_{\mathrm{LONS}} \sim 13\%$
$\Delta\Omega = 2\pi(1-\cos\theta_{\mathrm{h.pixel}}) = 2.39 \cdot 10^{-6}\,\mathrm{sr}$	

Then, the mean number of photons arriving at the entrance of the pixel in 1 ns is:

$$\begin{aligned} \mathcal{N}_{\mathrm{in}} &= \langle \mathrm{LONS} \rangle \cdot t \cdot S_{\mathrm{mirror}} \cdot \epsilon_{\mathrm{l.guides}} \cdot \epsilon_{\mathrm{plexiglas}} \cdot \Delta\Omega \\ &= (2 \cdot 10^{12}\,\mathrm{ph}/\,\mathrm{m}^2\,\mathrm{s}\,\mathrm{sr}) \cdot (10^{-9}\,\mathrm{s}/\,\mathrm{ns}) \cdot (230\,\mathrm{m}^2) \cdot (0.90) \cdot (0.95) \cdot (2.39 \cdot 10^{-6}\,\mathrm{sr}) \\ &= 0.94\,\mathrm{ph}/\,\mathrm{ns} \end{aligned}$$

Since our mean QE for the LONS is $\mathrm{QE}_{\mathrm{LONS}} \sim 13\%$, this means:

$$\mathcal{N}'_{\mathrm{in}} = \mathcal{N}_{\mathrm{in}} \cdot \mathrm{QE}_{\mathrm{LONS}} \cdot \epsilon_{1^{\mathrm{st}}\mathrm{dyn.coll.}} = 0.11\,\mathrm{ph.e.}/\,\mathrm{ns}$$

If we use then a gate of $\Delta T = 5\,\mathrm{ns}$, we arrive at a mean contribution of LONS per pixel per gate of:

$$\langle \mathrm{LONS} \rangle_{1\ \mathrm{pixel}} = \mathcal{N}'_{\mathrm{in}} \cdot \Delta T = 0.55\,\mathrm{ph.e.}/\,\mathrm{gate}$$