OBJECTIVES

We propose a quantitative analysis of loss mechanisms occurring in Luminescent Sheet Concentrators (LSC) and a simple scheme explaining interactions between loss mechanisms.

Concentrations systems and LSC

Imaging concentrators (Fresnel lens, dish, parabolic mirrors ...):
- Optical efficiency = 80% and concentration factor higher than 500
- Sun tracker required (expensive)
- Only direct light component concentrated (in temperate area, diffuse light component can reach 40% of the total light)

LSC concentrators:
- Both direct and diffuse light components are concentrated \( \Rightarrow \) no expensive sun tracker required
- Cost low
- Optical efficiency highly dependent on the coverage fraction \( f \) and LSC parameters non ideals.

LSC and dye description

Performances for an idealized LSC:

Optical efficiency highly dependent on the coverage fraction (\( f \) and LSC parameters)

Illustration of non ideality consequence

- High sensitivity : \( R_{\text{mirror}} = 0.99 \Rightarrow c_{\text{max}} = 100 \)
- Hierarchy on LSC parameters : \( R_{\text{mirror}} \) more critical than PLQY
- Interdependency : loss mechanism interdependent

Realistic system

Loss hierarchy depends on \( f \) ... and on LSC parameters themselves

LSC parameters impact ALL loss mechanisms through statistical data (MBEOs)

Simple equations to assess loss mechanisms influence:

\[
\begin{align*}
L_{\text{ext}} &= \left( \frac{\int_0^\infty AM(\lambda) \cdot R_{\text{front}}(\lambda) d\lambda}{\int_0^\infty AM(\lambda) d\lambda} \right) \cdot I_{\text{in}} \\
L_{\text{PLQY}} &= (1 - \text{PLQY}^{\text{abs}}) \\
L_{\text{back}} &= 1 - \left( 1 - \cos(\theta) \right) \left( 1 - R_{\text{back}}^{\text{hitback}} \right) \\
L_{\text{matrix}} &= (1 - \exp(-\alpha_{\text{matrix}} d_{\text{dis}})) \\
G_{\text{conv. photon}} &= (1 - (1 - f) \cdot \text{hitback})
\end{align*}
\]

Equations validation

Conclusions and perspectives

- Modeling enables to discriminate loss causes
- Strong sensitivity to non idealities
- No generality : loss hierarchy depends on LSC parameters
- MBEO \( \Rightarrow \) key element to understand LSC interdependencies
- Manufacturing LSC to corroborate modeling (under progress)
- Determine MBEO expressions depending only on LSC parameters