Time Transfert by Laser Link (T2L2) :
Optics of the Space Segment

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Principle of T2L2

- T2L2 on board Microsat Myriade
- Altitude = 800 km
- Field of Views = 120°
**Link Budget**

**Adjustment of optical parameters in order to get photons**

Detection Unit:
- Field of views
- Surface of detection

Reflection Unit:
- Size
- Shape
- Refractive index
The Reflection Unit

Linear detection optics

\[ n = 1.8 \]

Aluminium protected coating

Corner cube vertex truncated

Angle errors \( \varepsilon_{\beta} \sim 0.7'' \) a deviation of \( \alpha \sim 2'' \)
At 800 km \( \phi_s = 10'' \)

Method of compensation:
Cylindrical Lens

\( R_c = 1.6 \text{ Km} \)
\( n = 1.8 \)
\( D = 140 \text{ mm} \)
Interferometric Analysis

Input face:
Surface Accuracy: $\frac{\lambda}{2}$ (P-V)
Surface Quality: 40/20

Output face:
Surface Accuracy: $\frac{\lambda}{4}$ (P-V)
Surface Quality: 10/5

Reflective faces:
Surface Accuracy: $\frac{\lambda}{6}$ (P-V)
Surface Quality: 40/20

Wave reflected by the Corner Cube: 1.28 $\lambda$
Results of Polarization study

![Graph showing polarization study results]

- **Relative Return Flux**
  - **p-polarized beam**
  - **s-polarized beam**

- **Angle (°)**: 
  - -80
  - -60
  - -40
  - -20
  - 0
  - 20
  - 40
  - 60
  - 80
Reflectance factor

for Primary Layer
$\text{Al}_2\text{O}_3 = 205\text{mm}$

for Primary Layer
$\text{Al}_2\text{O}_3 = 0\text{mm}$
Diffraction spots – Real link budget

Incident position of laser station

Calculation

Real Link budget

Position of laser station for return spot of diffraction

Return photons number

Zenithal angle
The detection Optic

A coupling optic

A multimode graded index fiber

ON = 0.29 \rightarrow \theta_f = 34^\circ

D_{core} = 100 \, \mu m
Output flux of the detection fiber
Experimental measures

Flux of detection Relative

Theoretical points

Experimental points

Angle (°)
K14 Photodiode: Experimental Results

- Frequency [Hz]
- Humidity [%]
- Dose [kRad]
- Temperature [°C]

Graph showing data for Diode 1, Diode 2, Humidity, Temperature, and Dose over time from 01/02/04 to 02/05/04.
First Time Transfert at ground

First results last week!