



*1 Integrated Pockels cell
for space missions.*

Pockels cell for space missions

If laser systems are to be used in space, e. g. LiDAR for atmospheric research, the optomechanical components these systems contain, such as Pockels cells, must be stable, both mechanically and thermally. Since the BBO crystal has such special mechanical properties, it is difficult to build a Pockels cell. Not only does the assembly of the crystal pose a challenge, but so does its need to withstand thermal loads of $-30\text{ }^{\circ}\text{C}$ to $+50\text{ }^{\circ}\text{C}$ and mechanical loads of up to 20 Grms. Furthermore, the assembly should be carried out without organic substances. For these reasons, Fraunhofer ILT is using a soldering technology it developed to assemble a Pockels cell.

Setup of the Pockels cell

The BBO crystal was soldered into a ceramic housing with special steel grid structures. A soft solder was used to reduce the mechanical stresses in the crystal. Furthermore, the stresses were reduced by the geometrical structure of the soldered connection. The ceramic housing was then soldered onto a holder and adjusted using the pick & align process in the laser system.

Pockels cell concept successfully implemented

The entire assembly, consisting of the Pockels cell and holder, has undergone an extensive qualification program. The Fraunhofer ILT not only carried out electro-optical tests,

but also analyzed the internal stress of the crystal, and measured capacitance and inductance. All test criteria were met during this series of tests. In the environmental tests, the position deviation was below the required $100\text{ }\mu\text{rad}$. Finally, the Pockels cell was subjected to an overvoltage test with 5 kV direct current and a long-term test with 6.21 GShots. No damage was detected on the overall assembly, especially on the crystal. After successful qualification, the Pockels cell was installed in the MERLIN EQM system. The Pockels cell concept can be used for high-performance applications or when laser systems are used in harsh environmental conditions.

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