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## Ultra high vacuum ZnSe window flange design for Phase Contrast Imaging diagnostics for the Wendelstein 7-X stellarator

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The Phase-Contrast Imaging (PCI) system is used to measure plasma density fluctuations in the W7-X stellarator at the Max-Planck-Institut für Plasmaphysik (IPP) in Greifswald, Germany. For this purpose, an expanded CO<sub>2</sub> laser beam with a wavelength of 10.6 $\mu$ m passes through the plasma and the scattered laser beam components yield information on plasma density fluctuations. The laser beam is expanded on an optical table by telescope optics to the desired beam diameter. A mirror system directs the beam through a zinc selenide (ZnSe) window at the entry port flange directly through the plasma center. Through a second opposite ZnSe window on the exit port flange, the beam is directed via a similar set of mirrors to the receiver optical table where the measurement takes place. A typical diameter of the laser beam is approx. 120mm. Due to the wavelength of the laser beam, ZnSe windows must be used.

The challenge is to seal the window, which represents the vacuum barrier, into the counter flange ultra high vacuum (UHV) tight. Additionally, the seal needs to fulfill W7-X requirements as compatibility with the bake-out temperature of 150°C and electron cyclotron resonance heating (ECRH) radiation resistance.

A standard solution is not provided commercially, since ECRH resistance demands for an all-metal seal and VITON® or another elastomer seal cannot be used. The challenge is the special window material (ZnSe) and the large window diameter. A metal gasket based on the principle of the CF gasket considered as a safe standard connection in UHV technology, but couldn't be used on the glass side. One solution seemed to be the HELICOFLEX® seal, which combines the elastic component with the temperature resistance. In addition to the special sealing concept for the PCI, the poster shows a market overview of the standard windows for the UHV area.

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