

Institut für Materialphysik im Weltraum

Aerodynamic Levitation

for neutron scattering experiments and thermophysical properties

P. Eckstein,¹ F. Yang,¹ J. Sutherland,² T. Hansen,² S. Savin,² A. Meyer²

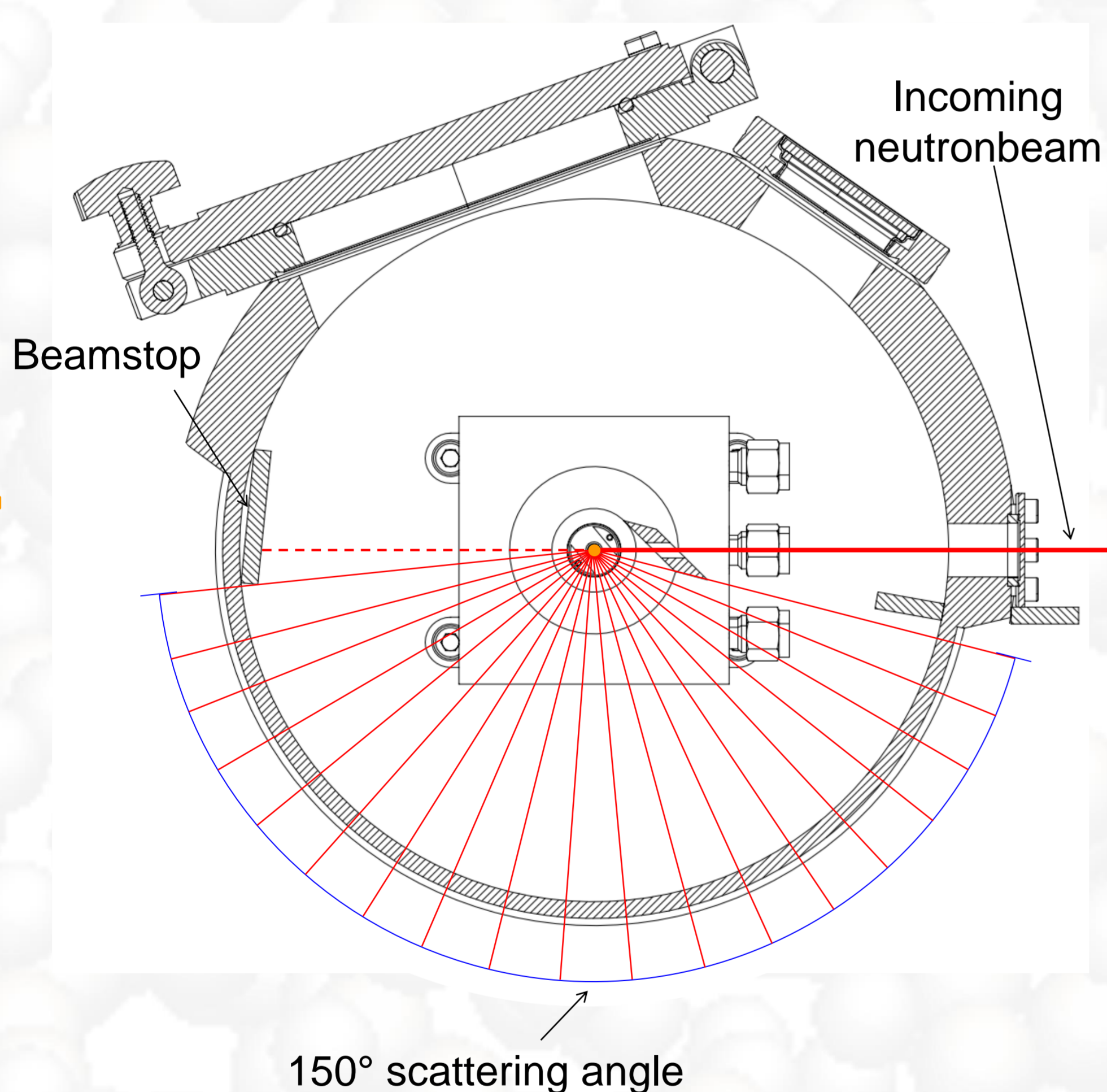
¹ Institut für Materialphysik im Weltraum, Deutsches Zentrum für Luft- und Raumfahrt (DLR), 51170 Köln, Germany

² Institut Laue-Langevin (ILL), 38042 Grenoble, France

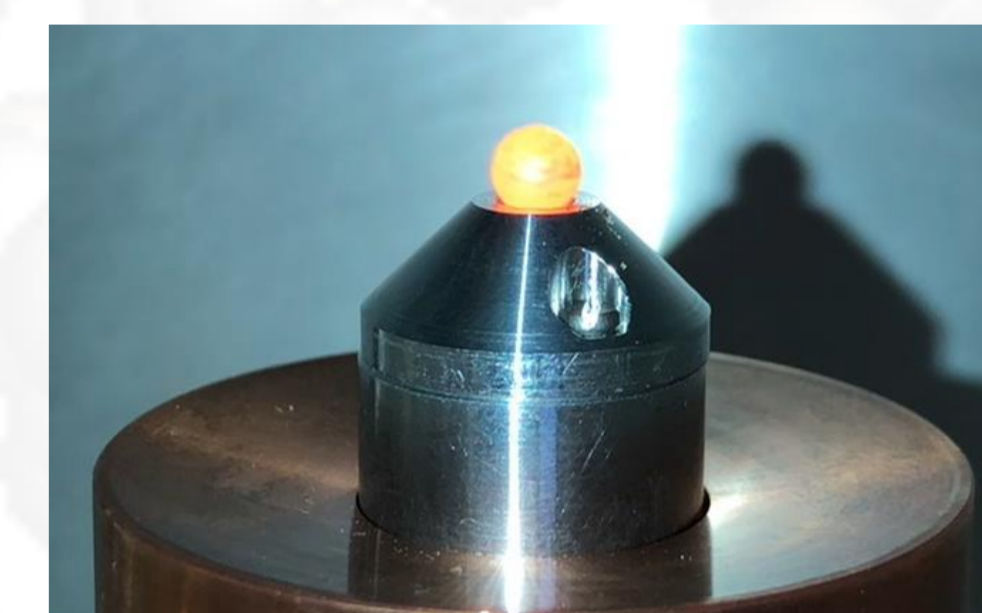
Motivation

- Containerless levitation is a promising technique to process reactive samples
 - No crucible material → No contamination (particularly at high temperature)
 - Accessing metastable and undercooled liquid
- Aerodynamic levitation allows processing of materials which cannot be investigated with other levitation techniques such as electrostatic or electromagnetic levitation (low melting point and high vapor pressure)
- In-situ study of crystallization behavior, melt structure and dynamics

Construction



- Nozzle made from B4C or Vanadium to reduce bragg scattering and background
- Levitating of spheres up to 4 mm in diameter in suspension by the Bernoulli effect
- Accessible scattering angle of 150° (suited for most of diffraction and time-of-flight instruments)
- Melting and cooling processes of samples under controlled atmosphere, heating from above and below reducing temperature gradient



Performance

- First successful diffraction measurements of low-melting, glass-forming PdNiS alloy melts on the XtremeD instrument at Institut Laue-Langevin (ILL) to study the melt dynamics (Figure 1)
- In-situ measurements on crystallization behaviour of oxide melts possible (Lunar Regolith, a few minutes counting time on the D20 instrument at ILL, Figure 2)
- Excellent signal-to-background ratio by introducing a new type of chamber and outlook to dynamic studies (time-of-flight)

