A Validation of neutron radiography

The method proposed in Section 2.2 to determine the liquid fraction was initially tested for its validity. The same procedure described by Equations 1 and 2 was used to estimate the thickness Δ_w of a glass wedge filled with a foaming solution, as depicted in Figure A2 (a). For the reader's convenience, we repeat the adopted analysis to estimate the wedge thickness Δ_w.

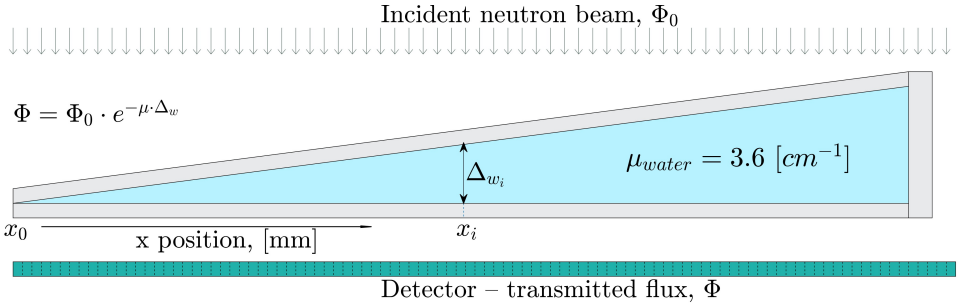
The measured transmittance of neutron beam,

$$T = \Phi/\Phi_0 \tag{1}$$

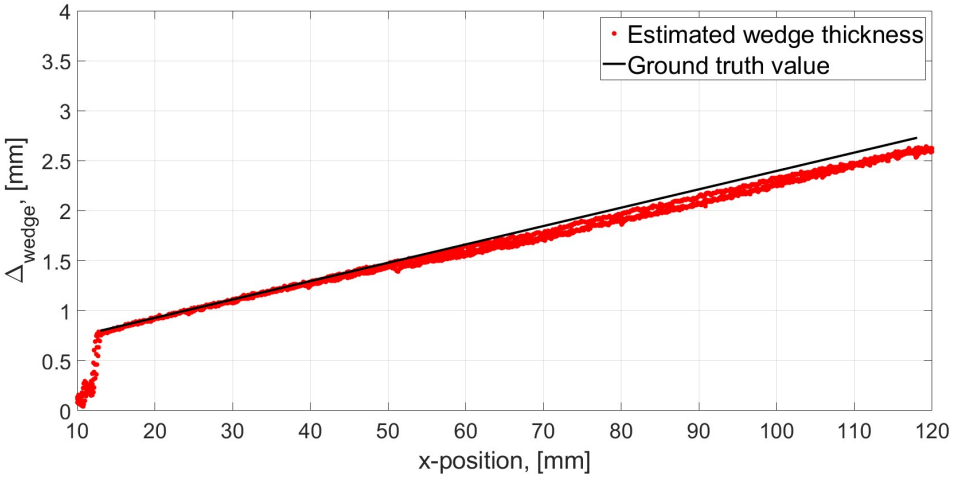
with the signal intensity without Φ_0 and with Φ foaming solution in the wedge. The amount of water Δ_w, representing the wedge thickness, along the path of the neutron beam through the wedge can be calculated

$$\Delta_w = -\frac{1}{\mu} ln(T). \tag{2}$$

The thickness of the wedge varied between 0.5 mm to 3 mm, corresponding to liquid fraction values ranging from 0.5 % to 3 %.



(a)



(b)

Figure A2: The wedge geometry (a) and the comparison (b) of measured $\tilde{\Delta}_w$ (dots) — Eq. 2 and actual wedge depth Δ_w (solid line).

The results demonstrated a high level of agreement between the actual wedge thickness Δ_w and the estimated values $\tilde{\Delta}_w$ obtained through neutron radiography (Figure A2, (b)). The relative deviation between the estimated and actual wedge thickness fell within an acceptable range of ±10%.