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On Pressure Wave Simulations in Liquid Metal Neutron Source Targets JANA R. FETZER, ANDREAS CLASS, Karlsruhe Institute of Technology (KIT) — Sound waves generated by fluid flow at low Mach numbers is associated with separated scales and thus with difficulties to construct efficient numerical methods for their approximation. One method is the Multi Pressure Variables (MPV) approach introduced for aero-acoustic applications [1,2]. The MPV approach is based on a single time scale multiple space scale asymptotic analysis derived for subsonic flow by an asymptotic series expansion in the Mach-number. Distinguished are the flow and acoustic length scales resulting in three pressure contribution, i.e. thermodynamic, acoustic and dynamic pressure which are discretized on numerical meshes of different resolution. We propose to apply MPV to analyse liquid metal cooled spallation targets with a pulsed proton beams. These targets are operating in high power neutron sources for fundamental research. The nearly instantaneous heating of the liquid metal results in volumetric expansion of inertia confined liquid and thus to high pressure waves, which represent a major lifetime limiting thread. Our development accompanies design activities for the META:LIC (MEgawatt TArget: Lead bIsmuth Cooled) target proposed for the European Spallation Source.

[1] Munz C.-D. et al. J Computers & Fluids 2003; 32
[2] Klein R. J. Comput Phys 1995; 121

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