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Viscoplastic sculpting in stable triple layer heavy oil transport flow PARISA SARMADI, University of British Columbia, SARAH HORMOZI, Ohio University, IAN A. FRIGAARD, University of British Columbia — In [1] we introduced a novel methodology for efficient transport of heavy oil via a triple layer core-annular flow. Pumping pressures are significantly reduced by concentrating high shear rates to a lubricating layer, while ideas from Visco-Plastic Lubrication [2] are used to eliminate interfacial instabilities. We purposefully position a shaped unyielded skin of a viscoplastic fluid between the transported oil and the lubricating fluid layer to balance the density difference between the fluids. Here we address the sculpting of the shaped skin within a concentric inflow manifold. We use the quasi-steady model to provide inputs to an axisymmetric triple layer computation, showing the development of the streamwise skin profile and establishment of the flow. For this, we use a finite element discretization with the augmented-Lagrangian method to represent the yield surface behaviour accurately and a PLIC method to track the interface motion. [1] P. Sarmadi, S. Hormozi and I.A. Frigaard," Triple-layer configuration for stable high-speed lubricated pipeline transport", Phys. Rev. Fluids, 2(4) pp 044302, (2017). [2] S. Hormozi, G. Dunbrack, I. Frigaard, "Visco-plastic sculpting", Phys. Fluids, 26 pp. 093101 (2014).

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