Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Minimizing Platelet Activation-Induced Clogging in Deterministic Lateral Displacement Arrays for High-Throughput Capture of Circulating Tumor Cells JOSEPH D'SILVA, KEVIN LOUTHERBACK, ROBERT AUSTIN, JAMES STURM, Princeton University — Deterministic lateral displacement arrays have been used to separate circulating tumor cells (CTCs) from diluted whole blood at flow rates up to 10 mL/min (K. Loutherback et al., AIP Advances, 2012). However, the throughput is limited to 2 mL equivalent volume of undiluted whole blood due to clogging of the array. Since the concentration of CTCs can be as low as 1-10 cells/mL in clinical samples, processing larger volumes of blood is necessary for diagnostic and analytical applications. We have identified platelet activation by the micro-post array as the primary cause of this clogging. In this talk, we (i) show that clogging occurs at the beginning of the micro-post array and not in the injector channels because both acceleration and deceleration in fluid velocity are required for clogging to occur, and (ii) demonstrate how reduction in platelet concentration and decrease in platelet contact time within the device can be used in combination to achieve a 10x increase in the equivalent volume of undiluted whole blood processed. Finally, we discuss experimental efforts to separate the relative contributions of contact activated coagulation and shear-induced platelet activation to clogging and approaches to minimize these, such as surface treatment and post geometry design.

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Date submitted: 09 Nov 2012 Electronic form version 1.4