Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Jet mixing in a down-scaled model of a rotary kiln SOFIA LARSSON, SIMON JOHANSSON, Luleå University of Technology, Sweden — Rotary kilns are large, cylindrical, rotating ovens with a burner in one end that are used in various industrial processes to heat up materials to high temperatures. Kiln burners are characterized by long diffusion flames where the combustion process is largely controlled by turbulent diffusion mixing between the burner fuel jet and the surrounding combustion air. The combustion air flow patterns have a significant effect on the mixing and hence the combustion efficiency and flame shape, motivating a systematic study of the kiln aerodynamics and the mixing characteristics. In this work, a downscaled, isothermal model of a rotary kiln is investigated experimentally through simultaneous particle image velocimetry and planar laser-induced fluorescence measurements. The kiln is modeled as a cylinder with three inlets in one end; two semicircular-shaped inlets for what is called the secondary fluid divided by a wall in between, called the back plate, where the burner nozzle is located. Three momentum flux ratios of the secondary fluid are investigated, and the interaction with the burner jet is scrutinized. It is found that the burner jet characteristics, its mixing with the secondary fluid and the resulting flow field surrounding the jet are dependent on the momentum flux ratio.

Sofia Larsson
Luleå University of Technology, Sweden

Date submitted: 26 Jun 2015 Electronic form version 1.4