Abstract Submitted
for the DPP11 Meeting of
The American Physical Society

Dust in the divertor sheath: a problem or a possible solution to a problem? GIAN LUCA DELZANNO, XIANZHU TANG, LANL — In this work, we will present results on dust transport in the magnetized sheath near the divertor plate of a tokamak. We consider conditions relevant to present short-pulse tokamak machines as well as conditions for long-pulse ITER/DEMO reactors. We solve the dust charging equation, the dust equation of motion and the equations for dust heating and mass loss in the magnetized sheath. We present parametric studies changing the divertor plasma conditions and the angle of the equilibrium magnetic field relative to the wall. Our main result is that, for conditions relavant to DEMO, the stronger heat flux to the wall severely limits the dust survivability and mobility. Consequently, a single dust grain tends to redeposit the material locally, in contrast to what happens in short-pulse machines. We will also discuss two fusion technology solutions to DEMO PFC based on externally introduced solid particulates.The dust patch represents a mitigation strategy where engineered solid dust particles are injected in the chamber to patch areas of net erosion at runtime. In the dust shield concept, tungsten dust particles are suspended above the divertor by the sheath electric field and are circulated poloidally by the sheath plasma flow. Thus, dust particles can be injected at one end of the divertor and be collected at the other end before they melt. During their transit across the divertor, they form a circulating shield that provides the primary heat exhaust.

Gian Luca Delzanno
Los Alamos National Laboratory

Date submitted: 27 Jul 2011 Electronic form version 1.4