FOR IMMEDIATE RELEASE
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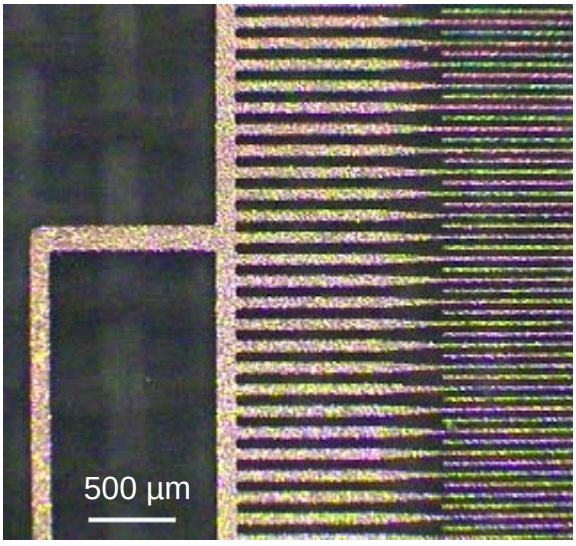
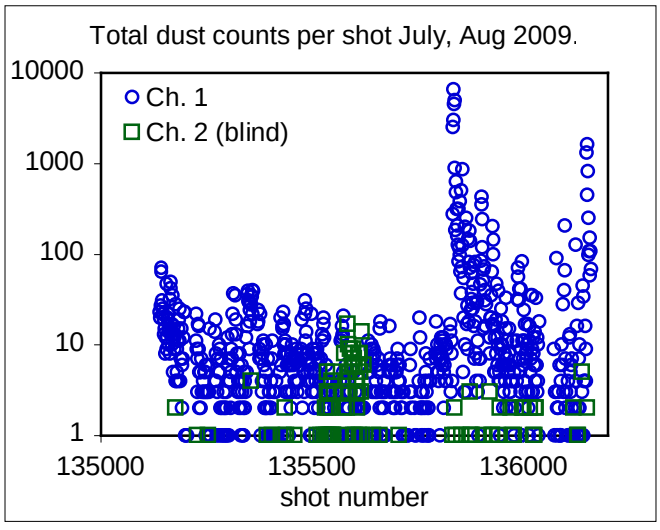
Dealing with dust in ITER

PRINCETON, New Jersey, November 2, 2009 – The first local real-time measurements of surface dust in a tokamak, an important step in the development of local dust monitors for ITER, will be reported in a post deadline contributed paper to be given at the 51st Annual Meeting of the Division of Plasma Physics of the American Physical Society in Atlanta, Georgia, November 2-6, 2009.

Dealing with dust is a familiar household chore, but it is also an issue for next-step machines such as ITER. Dust will accumulate in ITER from its intense plasma-wall interactions and long pulse length. Just like at home, this dust will predominantly be on flat surfaces low down in the vessel. Local measurements of dust are part of the ITER dust management strategy - the question is how can you measure dust that will settle on surfaces in the activated and hard-to-access ITER vacuum vessel? One potential method that was developed at PPPL utilizes a fine grid of interlocking circuit traces biased to 50 v. Impinging carbon dust particles cause a temporary short circuit and the resulting current pulse can be recorded by standard nuclear counting electronics. The configuration worked well in the laboratory but was initially not sensitive enough to monitor the low dust levels in contemporary tokamaks such as the National Spherical Torus Experiment, NSTX. With the help of several National Undergraduate Fellows, ultrafine and large area grids were tested and improvements made in the detection electronics that increased the sensitivity by four orders-of-magnitude, low enough to match the dust levels in



Close up of dust detector and for comparison 100 µm dia. of human hair



Dust counts per shot. The large signals on the right are from lithium particles injected into the machine for wall conditioning.

NSTX. However the increased sensitivity came at a price – increased vulnerability to electrical pickup in the complex high power electrical environment of a tokamak. The final breakthrough came with the development of a differential detection circuit that is largely immune to electrical noise. The absence of electrical pickup is evidenced by almost no signals on a second 'blind' detector that is covered with insulating mica to isolate it from dust, while large signals are observed on an exposed detector. The signal increases dramatically when lithium particles are injected into the machine for wall conditioning. Future work is needed to adapt this detector to metallic dust and to the radiological environment of ITER. The first detection of surface dust in a tokamak is a significant step in the development of local dust monitors for ITER.

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Related presentation at the 51st Annual Meeting of the Division of Plasma Physics of the American Physical Society, Hyatt Regency Atlanta, Georgia, Postdeadline Poster Session on Friday morning, November 6 - Grand Hall East. : "First real-time detection of surface dust in a tokamak." **C.H. Skinner,** L. Roquemore, H.W. Kugel, R. Marsala, T. Provost.

The laboratory work was previously featured in *DOE Pulse:* Science and Technology Highlights from DOE National Laboratories Number 230 March 12, 2007

Previous publications on the laboratory results:

1. Electrostatic Dust Detector with Improved Sensitivity
   D. P. Boyle, C. H. Skinner, A. L. Roquemore
   J. Nucl. Mater. 390-391 (2009) 1086 - 1089.
2. "Large Aperture Electrostatic Dust Detector"
   C.H. Skinner, R. Hensley, and A.L Roquemore
   J. Nucl. Mater., 376 (2008) 29–32.
3. "Controlling surface dust in a tokamak"
   C. V. Parker, C. H. Skinner, and A. L. Roquemore.
   J. Nucl. Mater. 363-365 (2006) 1461.
4. "Electrostatic Dust Detection on Remote Surfaces"
   C. Voinier, C. H. Skinner and A. L. Roquemore,
   J. Nucl. Mater. 346 (2005) 266–271.
5. "Development of an Electrostatic Dust Detector for use in a Tokamak Reactor"
   A. Bader, C.H. Skinner, A.L. Roquemore, and S. Langish,
   Rev. Sci. Instrum. v. **75** (2004) p. 370-375.
6. "Advances in Dust Detection and Removal for Tokamaks"
   Alejandro Campos and Charles H. Skinner
   Journal of Undergraduate Research (2009) in press.