Correlation of the Presence of Submicron Dust Observed in DIII-D During Normal Plasma Operation With Plasma Operating Parameters*

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Submicron dust is observed in the upper scrape off layer and lower divertor of DIII-D during normal plasma operation. The dust is observed from Rayleigh scattering of 1064 nm, pulsed laser light also used for Thomson scattering. The system has detection channels in the upper scrape-off layer (SOL), core plasma, and divertor. Observation events are rare, averaging just a few per discharge, or less than one event per detection channel per 1000 laser pulses. The rarity of events is due in part to the fact that the diagnostic system is optimized for the measurement of electron density and temperature at high spatial resolution and also to the fact that the density of dust particles is quite low. Nonetheless, over a six week period of operation, ~700 shots on DIII-D, a significant number of dust events have been observed and some correlation with plasma characteristics are seen. The distribution of particle radii observed falls in the range of 30 to 100 nm. Dust events are observed in the SOL and divertor, but not in the core plasma. In the upper SOL, dust events are much more common when operating in either balanced double null or upper single null, but there is a significant cross correlation in operation with high powered beam injection when the upper null is active. Dust in the lower divertor is not as strongly correlated with plasma configuration. The measured average dust density in the upper SOL over the 700 discharges is only 4.1×10^{3} m^{-3}, and from the estimated averaged particle radius, dust constitutes an equivalent carbon density in the SOL of only 1.2×10^{12} m^{-3}. While the diagnostic system does not yield information on the velocity of the dust particles, the measured densities are sufficiently low that it seems very unlikely that submicron dust is a significant contributor to contamination of the core plasma.

The Rayleigh detection channels for the Thomson scattering system are always acquiring data during plasma operation. We will continue the processing of the data taken during the last campaign to increase the database. Further analysis of correlations with plasma operating parameters will be presented.

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