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Axial Silicon Emission and External Magnetic Field Investigation on the Fusion Z-Pinch Experiment (FuZE) BRIAN HENDERSON, ANTON STEPANOV, URI SHUMLAK, University of Washington — Previous studies on the Fusion Z-Pinch Experiment at the University of Washington (FuZE) have indicated emission lines of silicon associated with neutron production. Here the relationships between silicon emissions and external magnetic fields with both neutron production and plasma pinch current are investigated for the purposes of identifying potential instabilities and characterizing the plasma's neutron production period. Silicon emissions are studied axially along FuZE's compression region to construct a temporally and spatially resolved profile; these emissions imply plasma protrudes from the slotted outer conductor on FuZE and ionizes the silica windows of the vacuum vessel. Magnetic fields are studied adjacent the windows at peak silicon emission locations to consider whether this leakage plasma is current carrying; their magnitudes are compared against simulated 2D magnetic field profiles for FuZE's geometry with no leakage plasma. Silicon emissions appear around the peak pinch current time and increase exponentially until a peak intensity roughly 9 μs later. Magnetic field estimates at 18 cm off-axis for on-axis 300 kA pinch currents and uniform return currents agree with the measured magnitude of 10-3 T at this location, and furthermore the vector profile suggests significant contributions from unexpected radial currents in addition to the expected plasma column's axial current. Possible theories are developed to explain the presence of silicon emissions with plasma instability and plasma expansion and their relationship with neutron production.

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