We present our current capabilities and plans targeting the simulation of 3D vacuum arc discharge in realistic geometries. Vacuum arc discharge is an incredibly challenging problem due to the enormous dynamic changes in plasma growth, collisional processes, and time scales. Our simulation model targets a co-planar Cu-Cu vacuum breakdown experiment. We will estimate the computational requirements for this physically relevant breakdown system assuming a fully kinetic description. A fully kinetic description is required to accurately capture the initial breakdown. Progress on unstructured mesh collisional PIC methodology, dynamic particle weighting, managing multiple temporal and spatial scales, electrode models, and efficient parallel scaling will be addressed.

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