Pico Perfect Placement: The Era of Atom Precise Manufacturing Has Begun

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We have developed an open loop positioning device that achieves incomparable 1 picometer placement repeatability within a 2 micron^3 volume. All other devices suffer from creep, that is, uncontrolled movement that occurs even when a position controlling voltage has ceased to change. Practically, creep has caused atom-scale fabrication processes, for example on a silicon substrate, to require hundreds of seconds per atom, whereas with the new device that time is reduced to a millisecond. This capability, combined with previously reported AI automation of probe conditioning and defect elimination initiates a new era of atom precise manufacturing (APM). The first commercial APM tool will be delivered in less than one year. Adopting a TSMC-like model, the first Atomic Foundry is planned where wide ranging atom defined quantum devices will be manufactured for diverse clients.

Examples of first components to be made, including atom defined wires and gates will be shown. Indications of our progress toward an atom-defined quantum primary thermometer will be given. The concept due to Pekola has been proven to work. Until now the operation range has been limited due to lithographic limitations to below 60K. We will achieve room temperature operation. Remarkably, there exists no practical (less than room-size) room temperature primary thermometer.

All of these advances can as well be deployed to build spin-based quantum devices.