

## **FabuBlox: From Process Design to Enabling the Next Generation of Intelligent, AI-Powered, High-Flexibility Fab Ecosystems**

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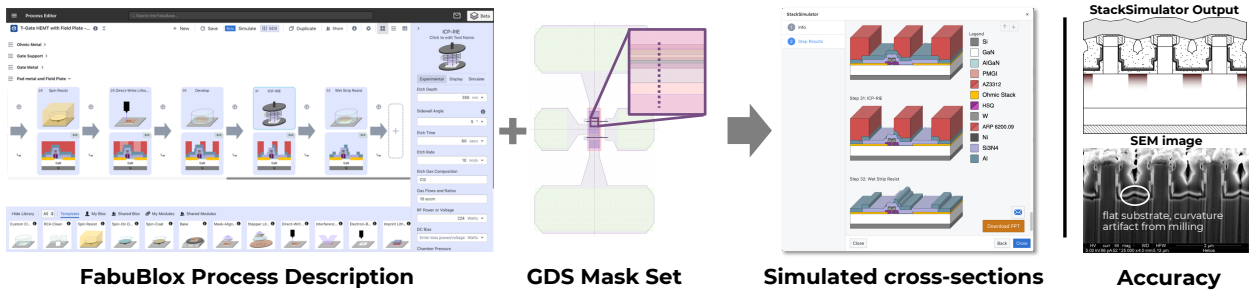
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Modern microelectronics and nanofabrication innovation increasingly depend on high-flexibility, multi-facility environments, where reproducibility, repeated problem-solving, technology transfer, and scale-up remain persistent challenges. Process knowledge is typically passed along as “tribal” know-how and remains fragmented across tools, facilities, and teams, leading to limited reuse, inconsistent execution, and slow, manual lab-to-fab transitions. These challenges are further compounded by growing process complexity and the lack of structured data required to enable AI-driven process discovery, execution, and optimization – an area of increasing importance for national competitiveness in microelectronics. Collectively, these limitations constrain rate of innovation and hinder rapid, reliable technology scale-up in one of the most capital-intensive technology ecosystems.

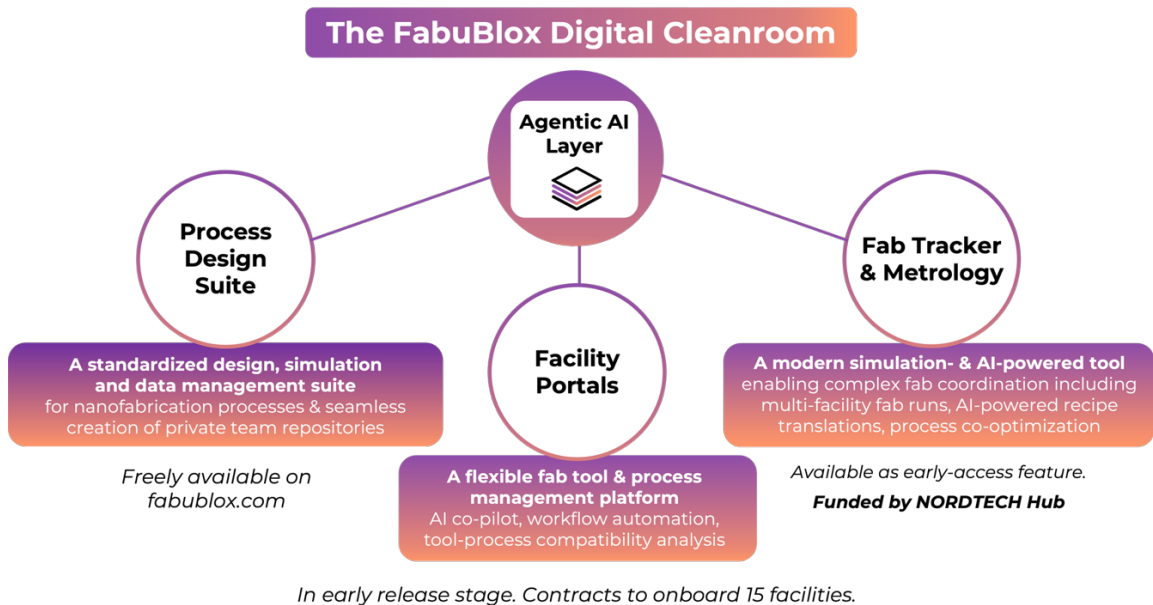
Over the past year, FabuBlox has expanded its unified platform for version-controlled process design, layer stack emulation, and structured fab knowledge management across teams and facilities to nearly 3,000 users in over 20 countries. Most recently, FabuBlox released two major platform additions: Facility Portals and a Fab Run Planner & Tracker. Facility Portals provide a standardized digital representation of high-flexibility cleanroom environments, capturing tool capabilities, calibrations, resources, restrictions, parameter rules, and user roles. This enables process design, discovery, and evaluation under real fabrication constraints while streamlining operations, reducing tool downtime, and improving reproducibility through standardized process management, parameter rule enforcement, and automated contamination control. Complementing this, the Fab Run Planner & Tracker structures execution workflows, including wafer tracking, parameter splits, and verification tasks via integrated metrology. This creates a closed-loop system with full process version control, linking process intent to experimental outcomes and subsequent process iterations.

Together, these systems form the foundation of an emerging agentic AI layer embedded in the FabuBlox platform, centered on multi-dimensional compatibility analysis between process flows and real fab environments. The FabuBlox agentic AI assistant retrieves and reasons over structured representations of tool capabilities, constraints, and recipe-level requirements to evaluate process feasibility within and across facilities. This includes contamination-aware compatibility analysis enabled by a newly released global materials database, leveraging a FabuBlox-developed material data model. The system identifies contaminant classes and tracks wafer exposure histories across process steps and tools, enabling automated evaluation of contamination risks and enforcement of facility- and tool-specific rules. By seamlessly integrating these compatibility checks with process design and discovery, FabuBlox enables a transition from static documentation and tribal knowledge to executable, data-driven fabrication workflows, supporting scalable, multi-facility coordination, improved reproducibility, and predictive process discovery.

Upcoming releases will incorporate vendor-level material data alongside integration of physical properties, enabling FabuBlox agents to recommend materials and suppliers based on technological requirements, historical usage, and constraints such as purity and compatibility. This will accelerate AI-driven discovery, process optimization, and provide deep insights into the complex technology trade-offs arising from material selection.



**Figure 1.** The FabuBlox Process Designer – A rapid prototyping process design and layer stack emulation tool. Originally developed for GaN transistor development at MIT, the FabuBlox StackSimulator highly-accurate 2D simulations of complex device cross-sections with cutlines automatically extracted from GDS design files.



**Figure 2.** FabuBlox building the next generation of AI-driven Digital Cleanrooms by combining intuitive process design & database building with its Facility Portals, standardizing tool capability management, agentic AI-powered compatibility analysis, and fab run tracking capabilities.