🔬 Quantum Genetics Accelerator – Technical Pitch

Summary: A modular platform that simulates quantum logic behavior on FPGA to process and analyze synthetic DNA sequences exhibiting aging-related mutations.

Key Features:

- **Quantum Gate Simulation on FPGA:** Implements Hadamard, CNOT, and Toffoli gate behavior using bitwise logic and pseudo-random modulation. Each DNA base (A/T/C/G) maps to simulated qubit registers. Decoherence and measurement collapse are emulated via entropy-injection functions.
- **Synthetic Genomics Engine:** Python-based pipeline to generate DNA sequences with tunable mutation rates and structural degradation — simulating biological aging or environmental stress (e.g. radiation exposure in aerospace).
- **AI-Powered Mutation Analysis:** Scikit-learn models classify genomic sequences by entropy, mutation type, and simulated "biological age." Supports PCA, clustering, anomaly detection, and supervised classifiers (SVM, RandomForest).
- **Neuro-Feedback Expansion (Celebro Cerberus):** EEG input integrated as control vectors for DNA gate behavior — enabling real-time modulation of mutation logic from brainwave patterns.
- **Application Layer:** Designed for predictive genomics, accelerated biomarker discovery, neuroscience integration, and deep-space mission resilience simulations.

Tech Stack: Verilog · MSYS2 · Python 3 · Bash · SQLite3 · Scikit-learn · NumPy · FPGA-compatible simulation tools (Yosys, nextpnr, openFPGALoader)