Simple Optima Searching for Pulsed-Power Design

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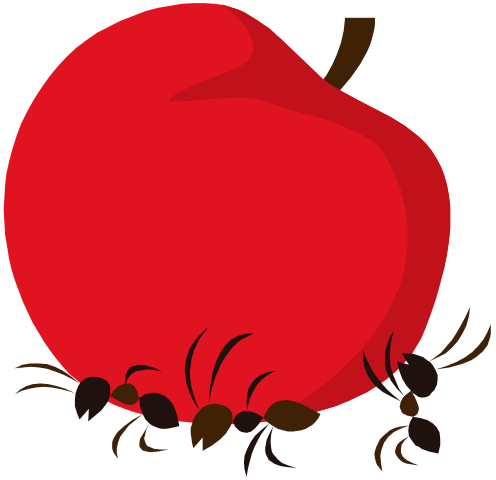
The Task of Optimization

- **Problems with Manual Optimization**
  - **Incomplete and Inefficient**
  - **Depends on Investigator Intuition**

- **Solutions: Computational Optimization**
  - **Simple Point-wise Search**
  - **Genetic Algorithms**
  - **Particle Swarm Optimization**
  - **Ant-Colony Optimization**

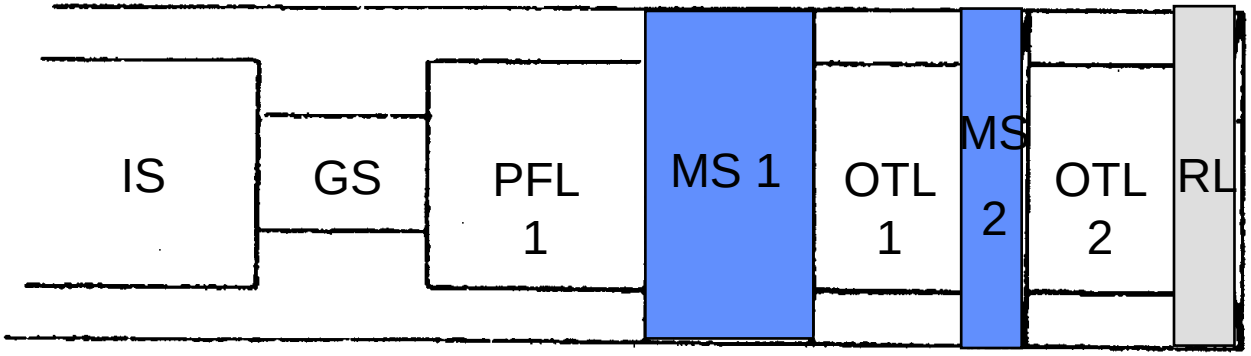


Scripting Scheme

- Define search space to be probed.
- Partition variable ranges or take discrete values.
- Establish a grid of points representing the configurations to test based on the partitioned variable ranges or discrete values.
- For each point in the grid:
  - Represent the point as an input file.
  - Run the simulation with the input file.
  - Read the simulation output.
  - Evaluate constraints and execute any post processing necessary.
  - Write in a log file the desired outputs and figures of merit.

ScreamerAE2:
A User Friendly Script for Point-wise Optimization

- **Template File**
  - **Substitution Syntax**
- **Settings File**
  - **Variable Declaration**
  - **Dependent Variable, IO-related and Figure of Merit Functions**
  - **Constraints**
  - **Time Relations and Time-related Calculations,**
  - **Environmental Variables**



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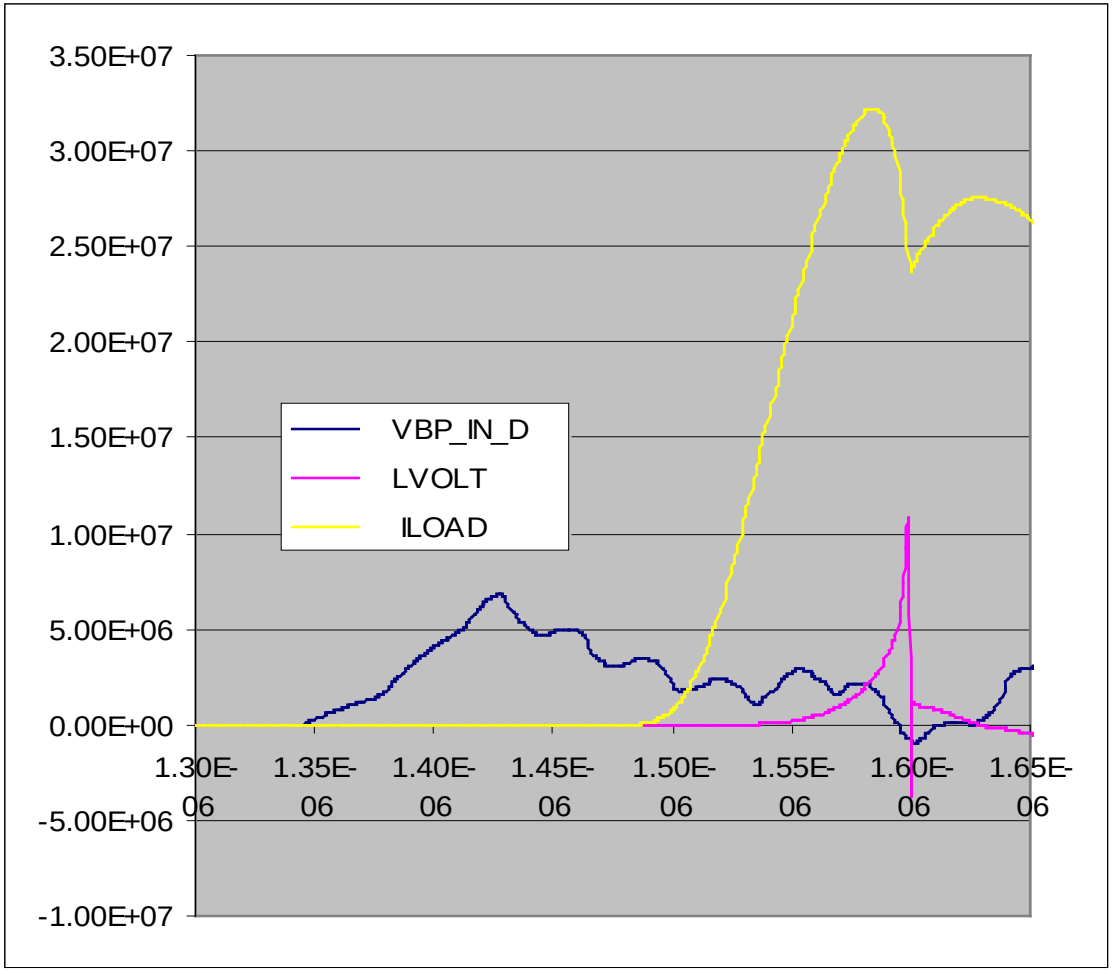
Improvements to Baseline Magnetic Switching Approach

- **Implosion Current: increased 2MA**
- **Implosion Time: decreased ~2ns**
- **Water Breakdown Safety Criterion: margin greatly improved**



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Next Steps

- **Niche of SAE2**
  - **Suits the Quality and Resolution of SCREAMER Codes**
- **Higher Quality Simulation Codes**
  - **Particle Swarm Optimization**
  - **Genetic/Cultural Algorithms**

References and Support

- *Computational Intelligence*
  - Andries P. Engelbrecht
- *Python in a Nutshell*
  - Alex Martelli
- *Core Python*
  - Wesley Chun
- www.swarmintelligence.org
- www.particleswarm.info

- Pace VanDevender
- Mark Kiefer
- Cynthia Phillips
- Brian Adams
- Mike Pasik
- Dillon McDaniel
- Michele Caldwell
- Larry Schneider