Mean vs. Variance with OPTIMAT v2
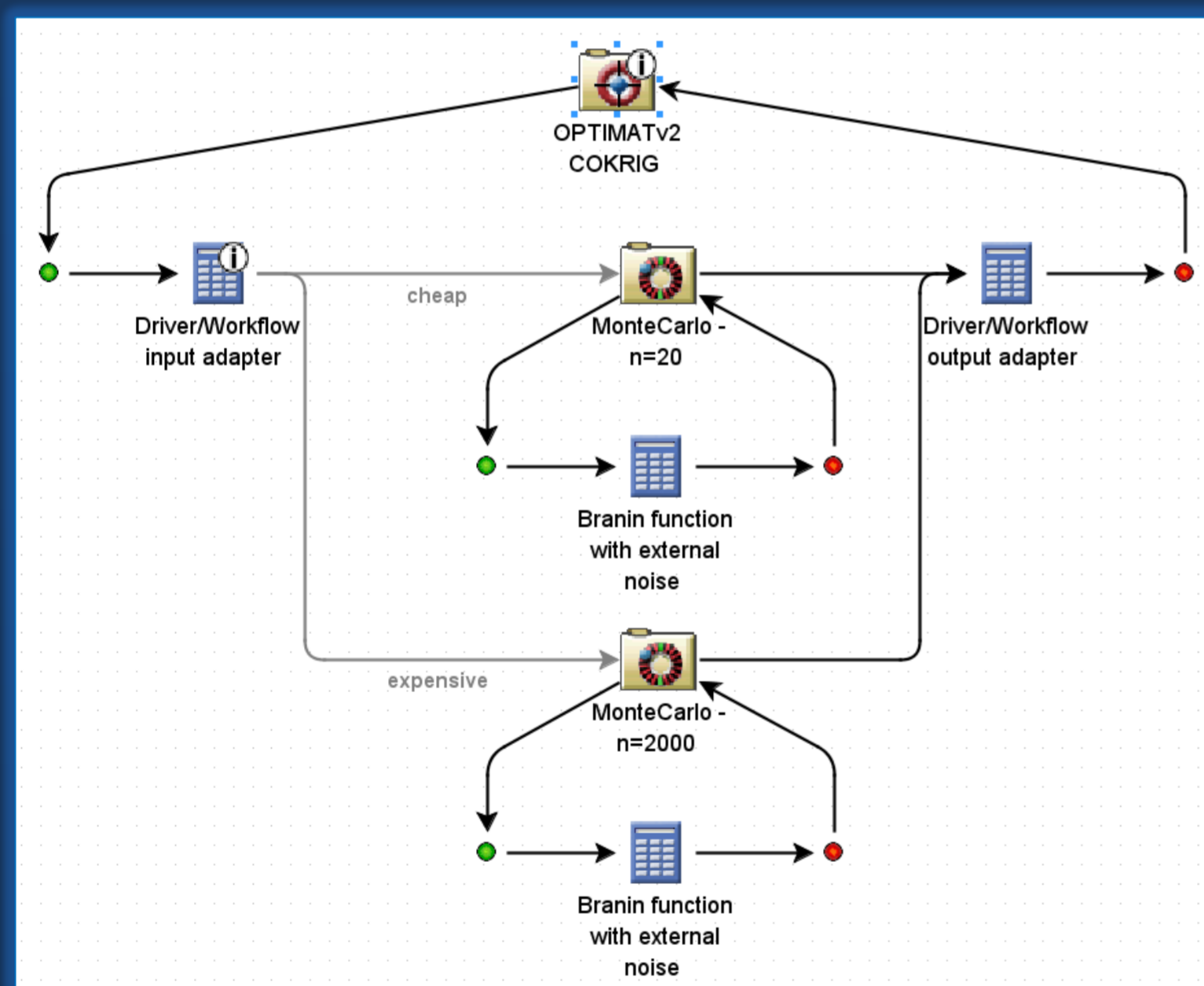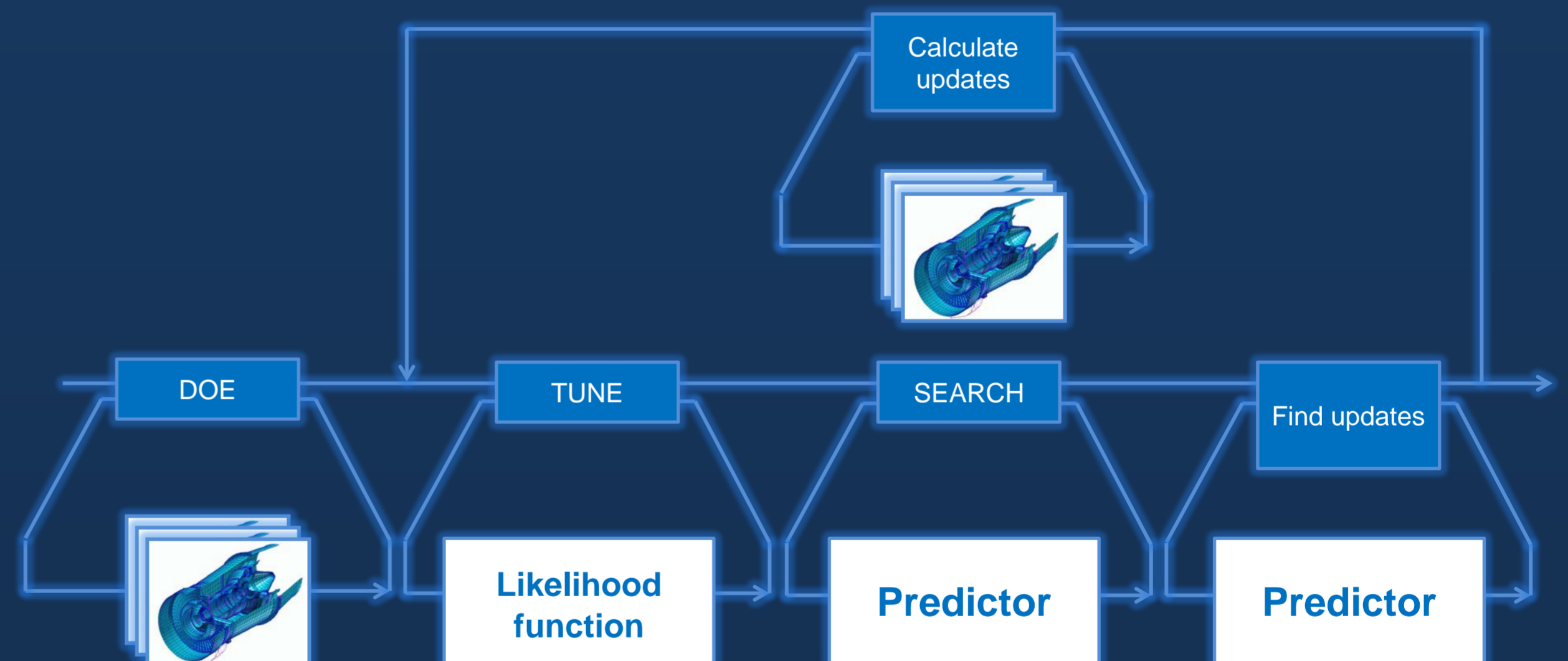
OPTIMAT v2

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OPTIMATv2 is particularly suitable to solve robust optimization problems due to some of its features:

- OPTIMATv2 is intrinsically **multiobjective**, and so is any Robust optimization problem by definition as it needs to optimise minimum of two objectives – Mean vs. Variance.

- Various methods to estimate **Mean and Variance**.
  - **Monte Carlo** simulation – conventional random sampling. Requires high number of function evaluations. One can use OPTIMAT's or Isight's native components.
  - Taylor series expansion – use the Isight's six-sigma component – requires less function evaluations, but not accurate for complex functions.
  - **Sparse quadrature** – designed to produce Mean and Variance estimates with fewer function evaluations. Highly efficient for noise-free function evaluations.

- Highly tuned **Response surface model** (RSM) building engine that can be used in number of ways:
  - Build RSMs of the objective with several update iterations using Prediction Error and Spacefill strategies. Run Monte-Carlo simulation using the obtained RSMs. Some-times referred to as **Reduced Monte-Carlo**
  - Build RSMs for the Mean and Variance, using few design points, apply efficient update strategy to improve their accuracy, run multiobjective optimization, validate and suggest new updates. Repeat until convergence. Use any of the supplied RSM methods: Radial basis functions (**RBF**), Kriging (**KRIG**), Gradient enhanced kriging (**GKRIG**), Non-stationary Kriging (**NSKRIG**), Universal Kriging (**UKRIG**)
  - Use the **Multifidelity Co-kriging (CO-KRIG)** models to combine effectively higher and lower iteration count Monte-Carlo simulations.
  - Start with a Sparse grid of lower accuracy. Use the points to construct RSMs. Find points amongst the higher-level grid, that maximise the prediction error. Compute objectives and re-tune RSMs. Use the RSMs to predict the rest of the points of the higher level design. The technique is called **Reduced Sparse Quadrature**

- Increase efficiency further by utilizing the **parallel RSM tune** and update engines that make use of both Computer and Graphic card processor units (**CPUs** and **GPUs**)
- OPTIMATv2 is available for MATLAB, Isight and standalone, with training material and Rolls-Royce license. Contact Ron.Bates@Rolls-Royce.com for details.
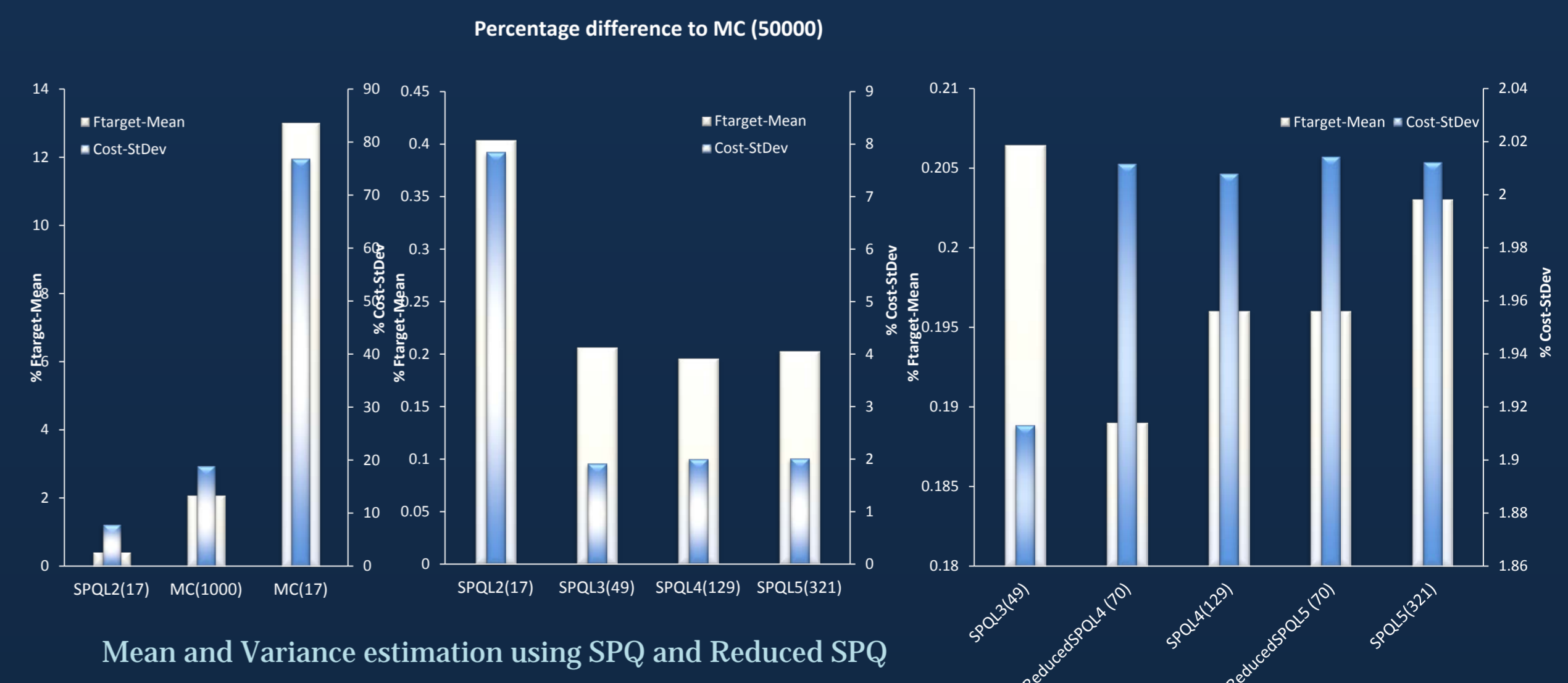

Multifidelity (COKRIG), multiobjective RSM, Robust optimization

OPTIMAT is fully automatic Multiobjective, Multifidelity, Response surface model construction tool

Full grid vs. Sparse grid
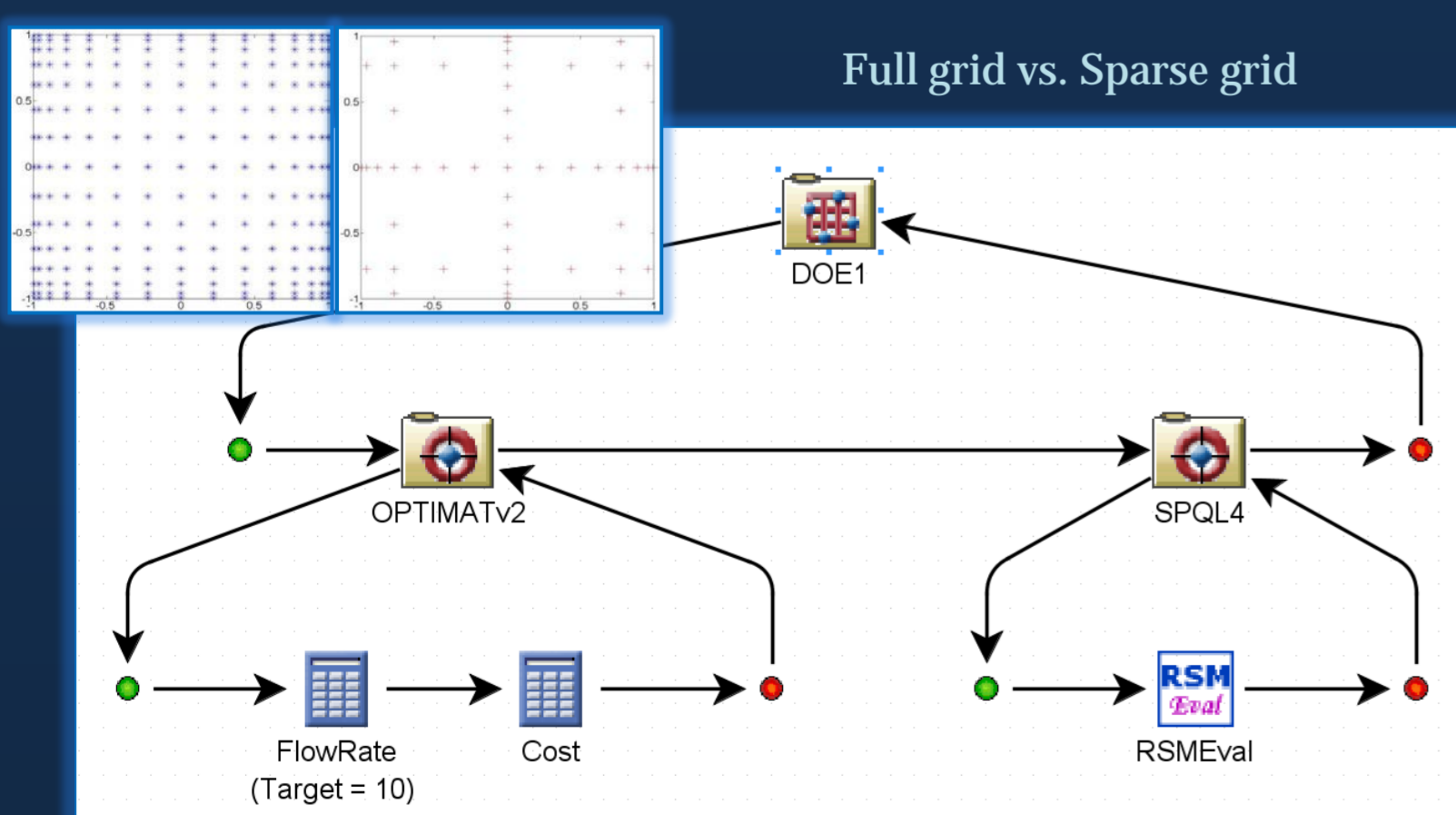
Automated Reduced SPQ with OPTIMATv2

Mean and Variance estimation using SPQ and Reduced SPQ