**Budget Justification**

**Labor: Salaries and Wages:**

**Ray Grout, Ph.D** (0.4FTE/yr): Dr. Grout will use his extensive background in computational science, turbulent combustion simulation and simulation of point defect chemistry to collaborate on the research objectives at multiple levels. A major focus will be developing prototype implementations for the candidate MCMC and implicit filtering approaches for the combustion and point defect chemistry that can be used to characterize the methods in the context of the similarities and differences between these applications. Further, he will liaise with staff at the NREL Photovoltaic Measurements and Characterization group to identify similarities and contrasts between the example applications chosen to be representative of the broader class of problems for which the proposed research is relevant.

**Peter Graf, Ph.D** (0.4FTE/yr)**:** Dr. Graf has extensive experience in several areas relevant to this project: developing targeted evolutionary (especially population based) optimization algorithms; reduced order modeling; estimation algorithms; multiscale modeling, and, especially, bridging the gap between mathematics research and applied application science. He has worked for several years in direct collaboration with both battery and photovoltaics researchers. Dr. Graf will therefore contribute to several areas of the current project: novel optimization algorithms that may be necessary to implement implicit sampling in a multiscale setting; formulation of the multiscale implicit sampling algorithm; reduced order scale-bridging models; application to multiscale battery parameter estimation and uncertainty quantification.

**Domestic and Foreign Travel**

Four domestic trips per year are requested to attend weeklong project meetings: two each for the two involved NREL researchers. These meetings will likely be held 4-6 months apart at or near the other collaborating institutions (San Francisco Bay Area and New York City), but the exact dates are unknown. The yearly budget amounts of $10k/$11k/$11k are based on recent Internet searches for flights plus GSA per diem rates and previous expenses from similar trips. It is possible that one of these trips per year may be replaced with a project review meeting in Washington DC which has travel costs of a similar order of magnitude. In light of the distributed nature of the collaborating institutions, as typical of DOE laboratories, these trips are expected to considerably enhance the research by allowing in-person contact that would otherwise not be possible. While we intend to augment this interaction by online conferencing, significant “facetime” immeasurably improves productivity of the virtual meetings.

**Equipment**

No items $5,000 or more are requested.

**Materials and Supplies**

Costs will cover typical office supplies and equipment necessary for the involved researchers. Specific items making up a significant portion of the costs include desktop computing hardware ($2500 per researcher per year) and software licenses ($2500/yr ; PGI complier, MAPLE maintenance).

**Other Direct Costs:**

No funding for other direct costs is requested.