



ETI Annual Workshop, March 29-30, 2022



Radiological Source Term Estimation with Particle Filters in Obstacle Rich Environments

Samuel Kemp

Advisor: Jonathan Rogers

Georgia Institute of Technology

skemp32@gatech.edu

Abstract:

This work presents a review of challenges faced when performing source term estimation (STE) for an arbitrary number of point sources using simple Geiger-Müller counters with a particle filter in an obstacle rich environment. Common issues with particle filters including degeneracy and sample impoverishment are addressed. New issues arising from discontinuities in the state space due to the inclusion of obstacles are also addressed. Progressive correction, a stochastic form of particle flow with log-homotopy is effectively applied to mitigate degeneracy and sample impoverishment. Occasionally resampling with particles outside of the prior distribution also greatly alleviated degeneracy but introduced new issues where newly spawned locally high weight particles outcompeted globally high weighted particles leading to inaccurate results. This is partially caused by the observability problem where measurements cannot inform remote states. Recommendations of techniques are made to combat the issues encountered in this study.