



MuSES[®]

Plume Radiance Module



MuSES BRDF Rendering of Hardbody and Plume in MWIR

Principal Features

MuSES Plume Rendering

Plume radiance rendered seamlessly with hardbody and background

Plume radiance statistics reported in BRDF rendered output

MuSES casts rays from each pixel toward target and background

Rays intersecting the plume volume mesh from CFD generate LOS data

Radiance code called for each LOS

Sensor-band radiance and attenuation along LOS are computed

Fully Integrated Infrared Plume Radiance

Plumes can contribute significantly to the overall infrared signature of a vehicle or system, with radiance from exhaust dominating the total signature under certain operating conditions. The Plume Module for MuSES integrates a computed 3-dimensional plume field with the standard MuSES hardbody surface models to yield a highly accurate and realistic composite rendering for ships, aircraft and ground vehicles.

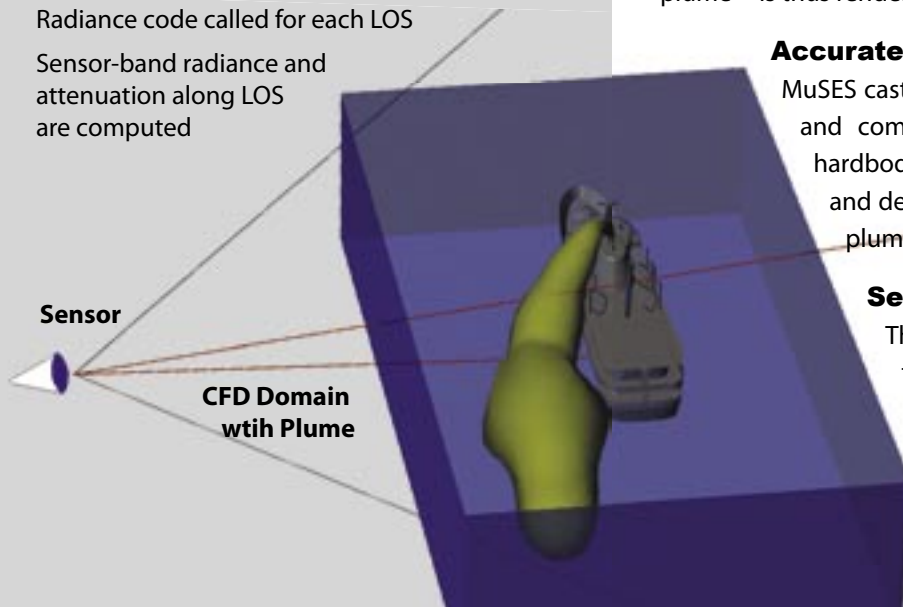
The radiance values are computed using imported plume temperature and chemical species data from a computational fluid dynamics (CFD) code, such as Fluent or Star-CD. The total signature of the target—hardbody and plume—is thus rendered over the user-defined bandwidth of the sensor.

Accurate Reporting of Plume Statistics

MuSES casts rays from the sensor position through the plume and computes radiances along the line of sight to the hardbody. This results in a seamless computation of radiance and detailed reporting of pixel counts and radiance of the plume, the target hardbody, and the background.

Seamless Integration within MuSES

The Plume Module is a separately licensed feature that operates within the MuSES environment. The license is loaded automatically and the user needs only to specify the names of input files and threshold values to truncate “cold” or dispersed areas of the plume.



MuSES Plume Rendering Input Data

The user needs only specify a mesh file and results file from a CFD code. Plume data are imported on a 3D cell basis can include pressure, temperature, and mole fraction of H₂O, CO₂, CO, and soot. Radiant emissions and transmittance of background radiance are computed automatically as part of the BRDF rendering. The user can choose to include reflections of plume radiance off the hardbody of the target.



Limiting Render Time

Because the computation of emittance and transmittance along each line of sight through the plume is processor intensive, the total size of the plume boundary can be truncated by a threshold temperature or a threshold concentration of plume species. Higher threshold values reduce BRDF computation time by reducing the net size of the plume to regions where concentration and temperature either occlude the background or produce significant emissions.

