MEASUREMENT OF PARTICLE DENSITY DURING EXPLOSIVE PARTICLE DISPERSAL

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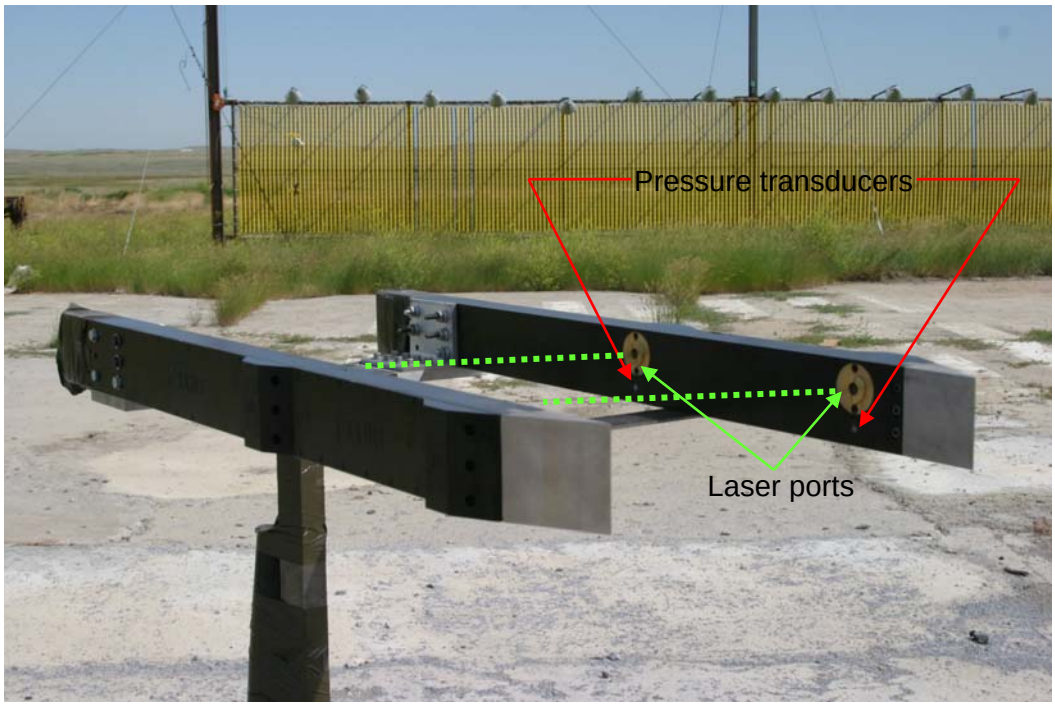
A gauge based on laser light attenuation has been developed to determine the temporal history of particle number density at two locations during the explosive dispersal of inert particles. The optical scheme of the gauge employs narrow band pass and spatial optical filters that protect the optical sensors from ambient light and laser light scattered by particles. Thus, for the particle size considered (d > 30 μm), the light attenuation is governed by geometrical optics and as a result can be directly related to the particle number density by a simple analytical expression. The expression was verified by measuring light attenuation by a uniform cloud of nickel particles levitated in an electrostatic cell. The gauge was used in field experiments to determine the particle density field from the detonation of spherical metalized explosive charges containing a packed bed of either iron, nickel or glass particles saturated with nitromethane. Comparisons with multiphase calculations indicated that the particle density field inferred from the light intensity signals was consistent with the computations until the point at which the combustion products arrived at the gauge, blocking the laser light.



Photograph of laser attenuation particle density gauge