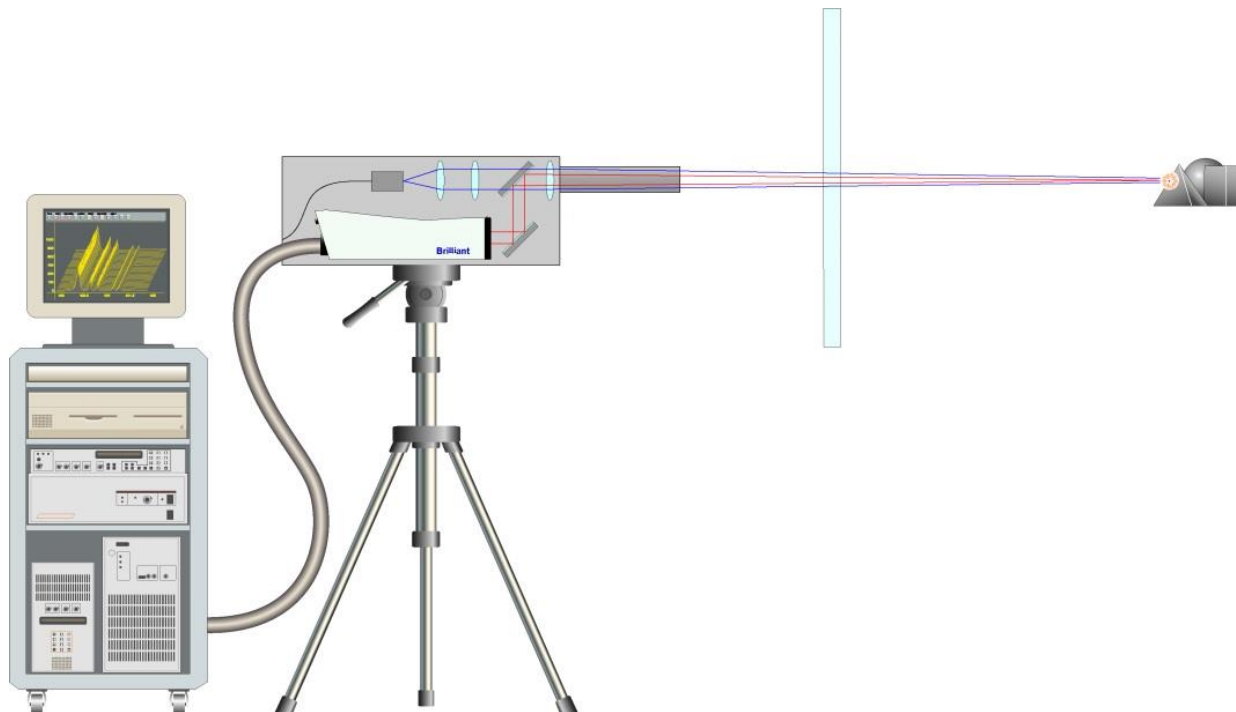


A technical demonstration of Stand-Off LIBS (ST-LIBS) for characterisation of materials within a glovebox

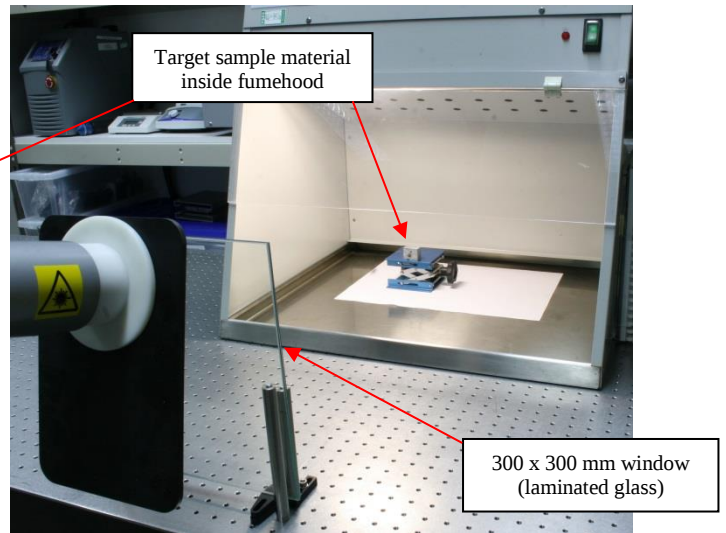
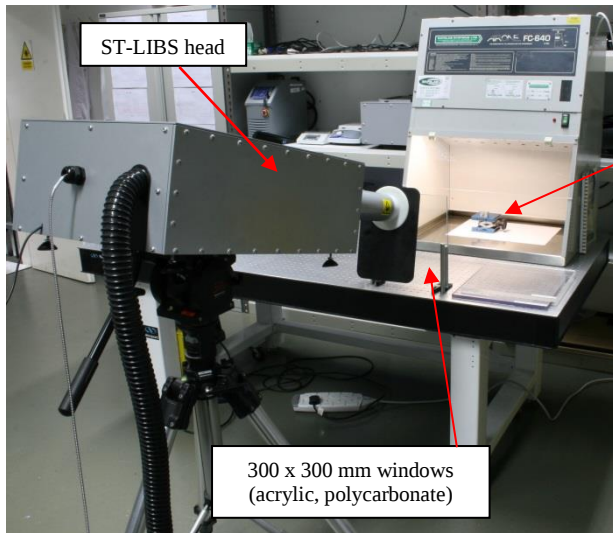
This was the second of three inactive technical demonstrations to show the applicability of LIBS technology in selected application areas of interest to nuclear decommissioning. The aim of this particular demonstration was to show the ability of APL's ST-LIBS technology to provide a means of performing in-situ elemental characterization of materials located inside a glovebox by directing the laser beam through the glovebox window. Prior experiments were conducted in order to thoroughly investigate any evidence of laser-induced damage to the window material (polycarbonate, glass, acrylic). A range of inactive materials were used to test the reliability of ST-LIBS for correctly identifying these materials in this particular application.

The demonstration rig is illustrated schematically in the following diagram and images.

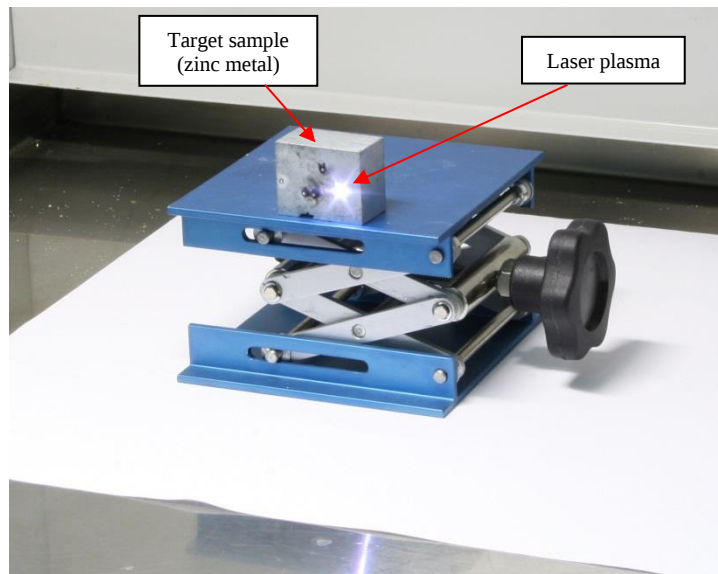


The principal aim of the demonstration was to show how ST-LIBS may be used to perform non-invasive characterization of a material inside a glovebox. The equipment and components used during the demonstration are listed as follows:

- Stand-Off LIBS instrument (APL proprietary design) utilizing a 1064 nm laser and capable of operating at ranges between approx. 1.0 metre and 20 metres.
- APL's LIBS software including chemometric data analysis feature for real-time material identification
- Various samples of materials (magnesium, zinc, gadolinium, copper, vit glass, titanium, hafnium, 316 stainless steel, lead, graphite, gold, zircaloy, 6082 aluminium alloy, chromium, concrete, uranium)
- Three windows (approx. 300 mm square) to simulate a glovebox window – 6 mm laminated glass (Skipton Glass Ltd), 12 mm polycarbonate (Makrolon), 12 mm acrylic (Plexiglass).



General view of ST-LIBS demonstration rig



Close-up view of laser-induced plasma on zinc metal target

Prior to the demonstration, various tests were undertaken to establish the risk of laser-induced damage to the three types of window material used. No obvious signs of damage were observed even when the laser intensity ($\text{watts} / \text{cm}^2$) was increased to approximately 4x the level normally expected at the window during a typical ST-LIBS measurement.

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