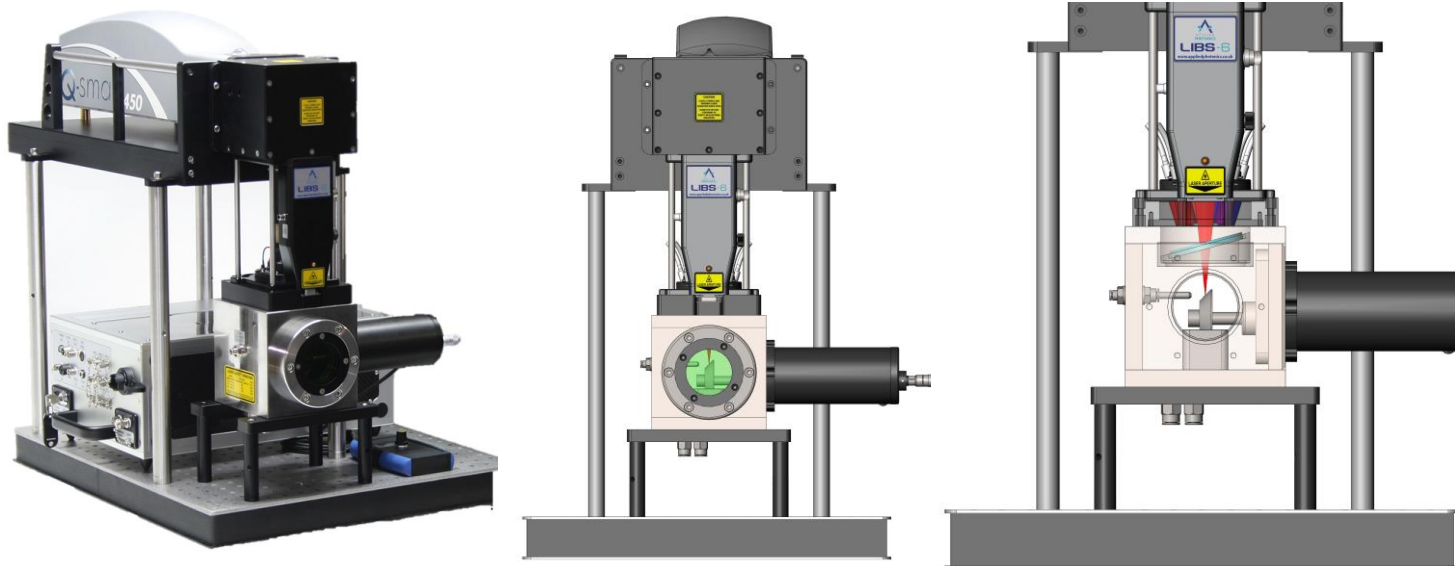


Liquids analysis modular sample chamber



LIBS-6 module (left) with laser head and adaptor platform using one of our modular SC-LQ2 sample chambers.

Basic principle of operation

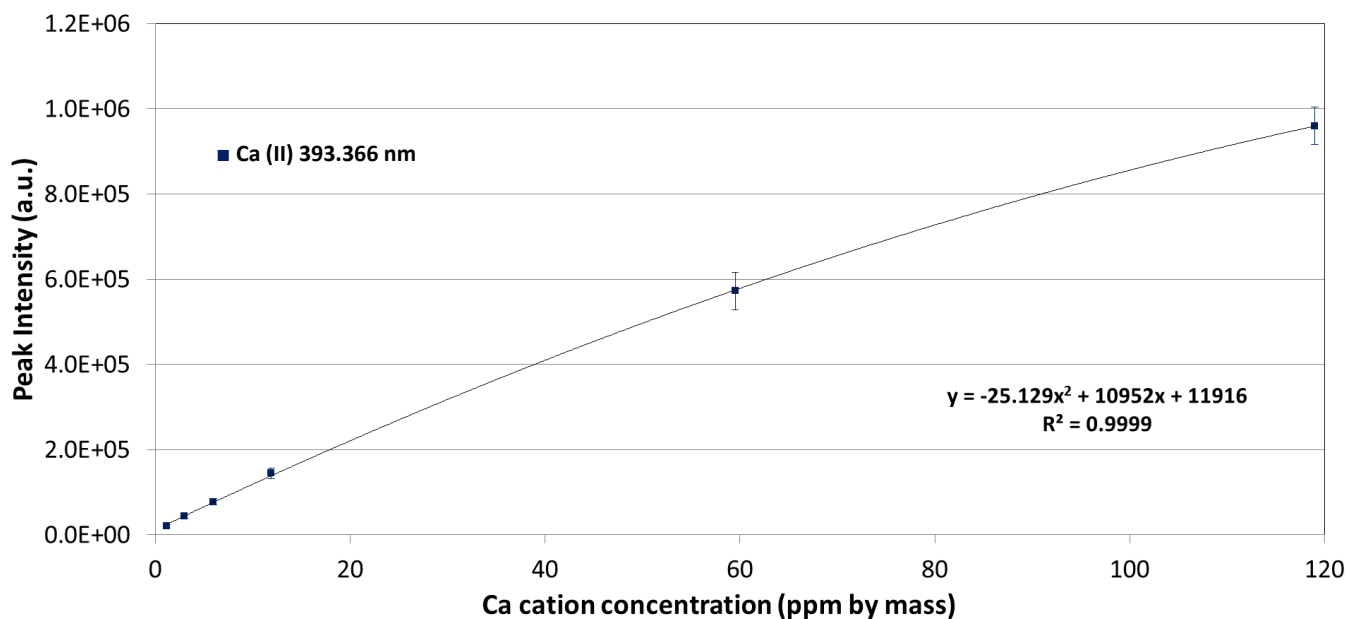
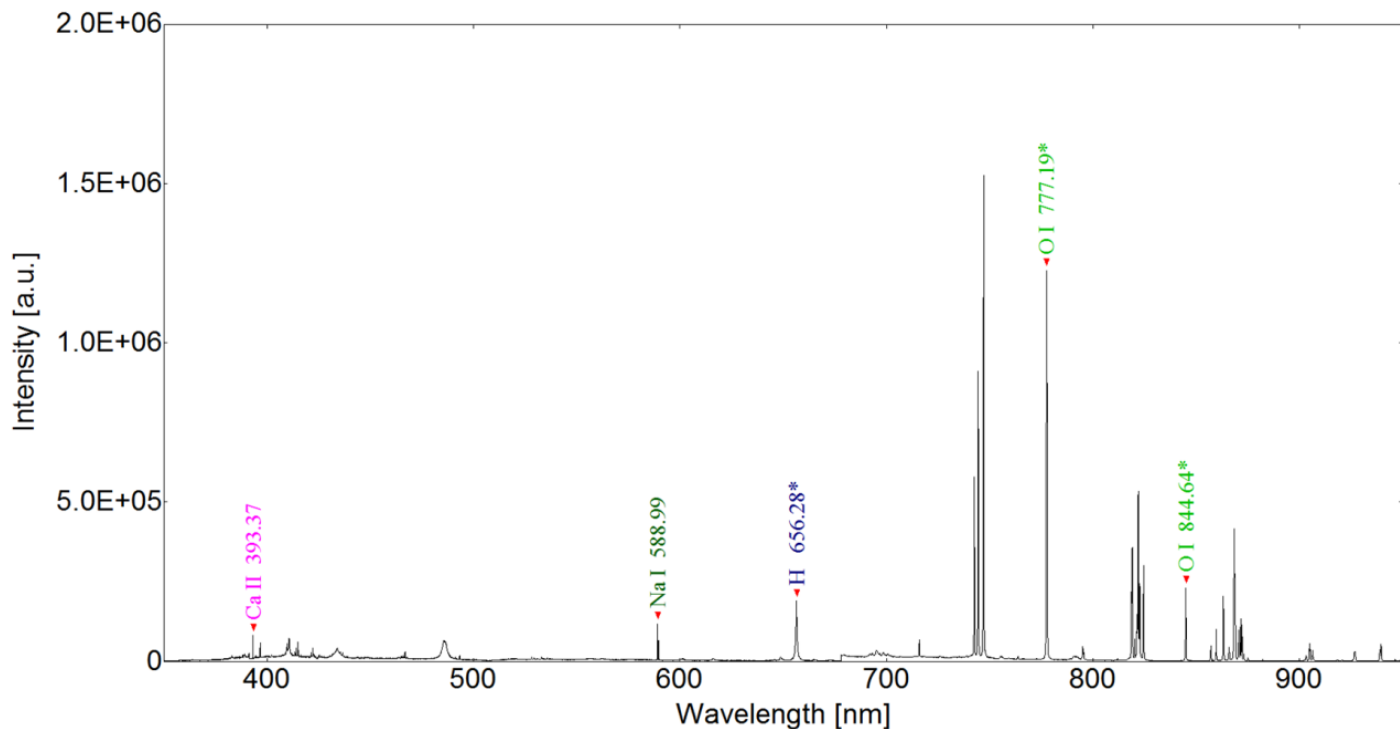
Direct analysis of bulk liquids by LIBS can be problematic in that the action of the laser causes considerable disturbance to the liquid surface which can result in undesirable effects such as splashing. In addition to causing the liquid to coat internal components including lenses, windows etc, the distance to the liquid surface also changes as the liquid is disturbed making it difficult to maintain focus of the laser beam and consistent plasma formation. With our liquids sample chamber, the liquid is presented to the laser beam as a thin film on a metallic surface in such a way that the volume of liquid at the focal lane of the laser beam is continually replenished. The general design of the liquids sample chamber is illustrated in the diagram above. A rotating stainless steel wheel is wetted by the liquid by submerging the lower section of the wheel in the liquid which is contained in a small bath at the bottom of the sample chamber. A gas purge jet (preferably argon but other gases may be used) is directed at the surface of the wheel to reduce the thickness of the surface film of liquid. As the wheel rotates (typically a few revolutions per minute and user adjustable), the liquid film spreads evenly and thinly over the surface of the wheel. The laser beam is then brought to focus on the upper side of the wheel, with the focal plane being user adjustable. By adjusting the laser focus, the laser pulse energy, the rotational speed of the wheel and the flow of purge gas, it is possible to obtain stable and consistent plasma formation without splashing of the liquid. Furthermore, optimisation of the measurement conditions results in virtually zero contribution to the LIBS signal from the rotating wheel. This allows the wheel to be made using a corrosion-resistant material such as 316 stainless steel. We have tried various materials for the rotating wheel including polymers, carbon, and metal alloys but 316 stainless steel offers the best overall performance. All components used in the liquids sample chamber are corrosion-resistant allowing the analysis of acidic or caustic solutions to be performed.

Features

- Modular sample chamber compatible with our LIBS products (LIBSCAN range, LIBS-6, LIBS-8)
- Static liquid reservoir or flow-through operation
- Reservoir capacity of approximately 100 ml, flow through capacity of typically 25 - 50 ml / per minute
- Precision-engineered using corrosion resistant materials
- Micrometer control of position of liquid surface film relative to focal plane of laser beam
- Viewing port equipped with laser protective window (OD 6+ @ 1064 nm)
- External dimensions of approx. 285 mm x 385 mm x 180 mm.

The following spectra & calibration curve were obtained using prepared solutions of artificial seawater

500 ppm Tropic Marin (5.95 ppm Ca) in distilled water (50 accumulation shot LIBS spectrum, purge gas: N₂)



Sample	Tropic Marin (ppm)	Ca (ppm)	Mean	SD	RSD (%)
1	100	1.19	20663	3109	15.1
2	250	2.98	42924	4510	10.5
3	500	5.95	77465	7750	10.0
4	1000	11.9	144645	12592	8.71
5	5000	59.5	572522	44096	7.70
6	10000	119	959830	44431	4.63