



## **Orion:** Target diagnostic



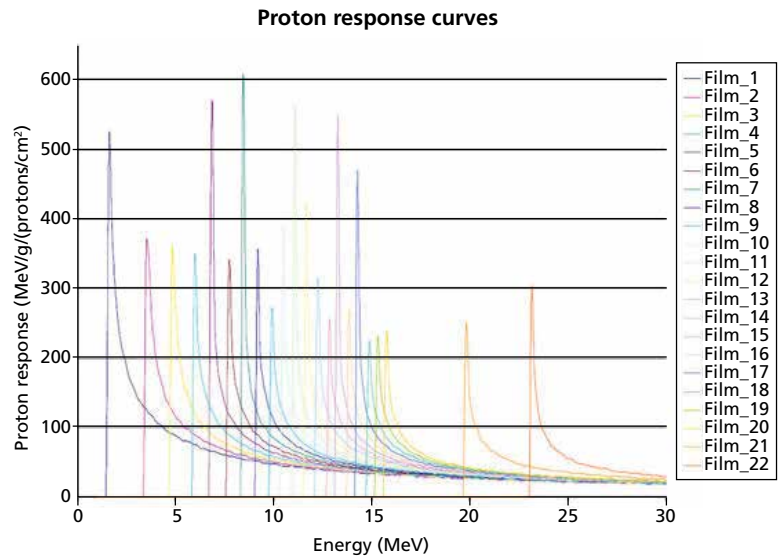
### **CR39 Detector**

The Orion laser facility at AWE Aldermaston, one of the largest scientific capital investments in the UK, houses a large neodymium glass laser system and a target chamber in which the high energy density physics experiments are performed. This is necessary to support certification of performance and safety of the UK deterrent.

[www.awe.co.uk](http://www.awe.co.uk)

The CR39 Detector is deployed in the Orion TIM and is used to record protons up to 13 MeV. CR-39 is transparent in the visible spectrum and is almost completely opaque in the ultraviolet range. CR-39 has the chemical formula  $C_{10}H_{18}O_7$ , is about half the weight of glass (density of  $\sim 1.30 \text{ gcm}^{-3}$ ) and is resistant to most solvents and other chemicals, gamma radiation, aging, and to material fatigue.

In the radiation detection application, raw CR-39 material is exposed to incident ions and/or neutrons. CR-39 will record particles with  $Z/\beta \geq 6$  where  $\beta$  is the relativistic velocity meaning it will record protons



### Specification

TIM based

Detector material: California Resin Type 39 (CR-39)

Dimensions of detector: 50 x 50 mm or 100 x 100 mm

Proton/ion energy range: 0.75 - 13 MeV

up to 13 MeV. A charged particle entering the plastic will be brought to rest by losing energy through ionization, damaging the polymer. An ion needs to have a minimum of  $\sim 75 \text{ keV}$  to cause this damage. The damage manifests as 'tracks' through the material which are enlarged by an etching process in a  $\sim 80^\circ\text{C}$  bath of sodium hydroxide. The enlarged ion tracks are counted under a microscope (magnification  $\sim 100\times$ ), and the number of ion tracks is proportional to the amount of incident radiation. The tracks for heavy ions and protons are quite distinctive under microscopic analysis, so can yield useful information about the ionic species present.

© British Crown Owned Copyright 2014/AWE

AWE Aldermaston, Reading, Berkshire, RG7 4PR

[www.awe.co.uk](http://www.awe.co.uk)