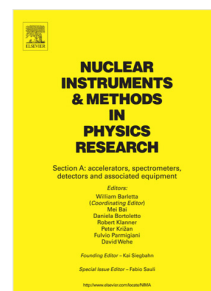


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# Investigating the Origins of Double Photopeaks in CsI:Tl Samples through Activator Mapping

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## Abstract

Careful examination of the origins of double photopeaks in CsI:Tl provides a foundation for exploring the relationship between activator homogeneity and photopeak resolution in scintillators. In rare cases, certain CsI:Tl crystals exhibit a second photopeak in the pulse-height spectrum. A combination of optical mapping and ICP-MS measurements reveals the presence of two distinct regions with differing Tl concentrations in these crystals. The oscillator strength of the 299 nm absorption A-band of Tl in CsI was measured to be  $0.0526 \pm 0.0008$ ; this parameter can be used to quantify activator concentration from the optical absorption. Using published measurements of luminescence intensity versus Tl concentration, the distributions of Tl measured from optical absorption maps of the samples were reconstructed into photopeaks in good agreement with experiment. The distribution of Tl concentrations in these particular crystals allowed examining luminescence pulse shape as a function of Tl concentration.

*Keywords:* CsI:Tl, double photopeak, oscillator strength, activator inhomogeneity, absorption mapping, ICP-MS

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## 1. Introduction

Several studies have examined scintillator crystal inhomogeneities on both large and small scales. Activator impurity nonuniformity and light output variations have been measured using charged particle beams [1–3], neutron imaging

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