# Recent Development of large volume and sensitive calorimeter for nuclear material accountability

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Among non intrusive and non destructive assay techniques for the characterization of nuclear materials, calorimetry is the most accurate method in particular for large volume items. The radioactive decay of special nuclear materials is a source of heat. By quantifying the rate of heat generation in a calorimeter the quantity of material can be determined non-destructively. The calorimetric technique has many advantages. It provides an accurate measurement, generally not subject to matrix effects. No initial sample preparation is needed for this non destructive technique. The size of the calorimeters is such that they are directly adapted for use with standard containers used in the nuclear industry. The assay is independent of the sample geometry and the nuclear material distribution within the item. The technology can be applied for the assay of feed, product, scrap and waste where high accuracy is needed.

For more than 30 years, flexible differential heat flow calorimeters using Peltier thermal elements have been used for nuclear applications including the assay of tritium and plutonium. A new calorimeter developed by SETARAM Instrumentation has been installed in a major nuclear center and a set of improvement for a 3.3 liters unit will be presented to demonstrate the accuracy of this equipment.

The calorimeter is defined as an Active Differential Isothermal Calorimeter and is built in order to measure with accuracy very weak thermal effects generated by high volume sample. Current design favours also the air bath design over the water bath design for purposes of minimizing cleanup at a facility in the event of a major accident.