# A MTR FUEL ELEMENT FLOW DISTRIBUTION MEASUREMENT PRELIMINARY RESULTS

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## ABSTRACT

An instrumented dummy fuel element (DMPV-01) with the same geometric characteristics of a MTR fuel element was designed and constructed for flow distribution measurement experiments at the IEA-R1 reactor core. This dummy element was also used to measure the flow distribution among the rectangular flow channels formed by element fuel plates. Two probes with two pressure taps were constructed and assembled inside the flow channels to measure pressure drop and the flow velocity was calculated using pressure drop equation for closed channels. This work presents the experimental procedure and results of flow distribution measurement among the flow channels. Results show that the flow rate in the peripheral channels is 10 to 15% lower than the average flow rate. It is important to know the flow rate in peripheral channels because of uncertainties in values of flow rate in the open channel formed by two adjacent fuel elements. These flow rates are responsible by the cooling of external fuel plates.

## 1. Introduction

The IPEN IEA-R1 is a 5 MW pool type research reactor that uses MTR (Material Testing Reactors) fuel elements in the core. Each fuel element has 18 fuel plates assembled on two lateral support plates, forming 17 independent flow channels. Actually, the reactor core has 20 fuel elements, 4 control fuel elements and a central irradiator, assembled in a square matrix 5x5. The safe operation of the reactor is guaranteed maintaining suitable safety margins in any operational conditions. These safety margins (DNBR, ONB, CHF and maximum surface temperature) are verified in the thermal-hydraulic analysis (THA) of the core. To perform the THA it is necessary to know some parameters, such as: heat flux distribution, geometric characteristics, material properties and flow rates through the fuel elements. The uncertainties of these parameters are also necessary for the THA.

The flow rate through the fuel elements is an important parameter and it is difficult to determine due to the geometric complexity of the core. The IAEA (International Atomic Energy Agency) TECDOC 233 [1] suggests that the flow rate through the fuel elements is the total reactor primary flow rate divided by the number of fuel elements. This value is not completely true because the core has fuel elements and other components such as: reflectors, irradiators, plugs and still secondary bypass holes, gaps and couplings. A dummy fuel element (DMPV-01) [2] was designed and