

**Recommendations for the beam entrance hole:**

Hypothesis: Maximum beam diameter = 3cm.

The optimal diameter is 7 cm.

The minimum diameter is 5 cm.

MCNPX predicts non linear and non symmetric small effects of the beam displacements.

If the beam is moved in X direction, keeping the beam parallel to the target axis, for a parabolic beam of 2.5 cm diameter in a 7 cm hole, changes of +1.0, +2.0, -1.4, +1.2% in the total neutron production are observed for displacements of -2.2 -1 +1 +2.2 cm.

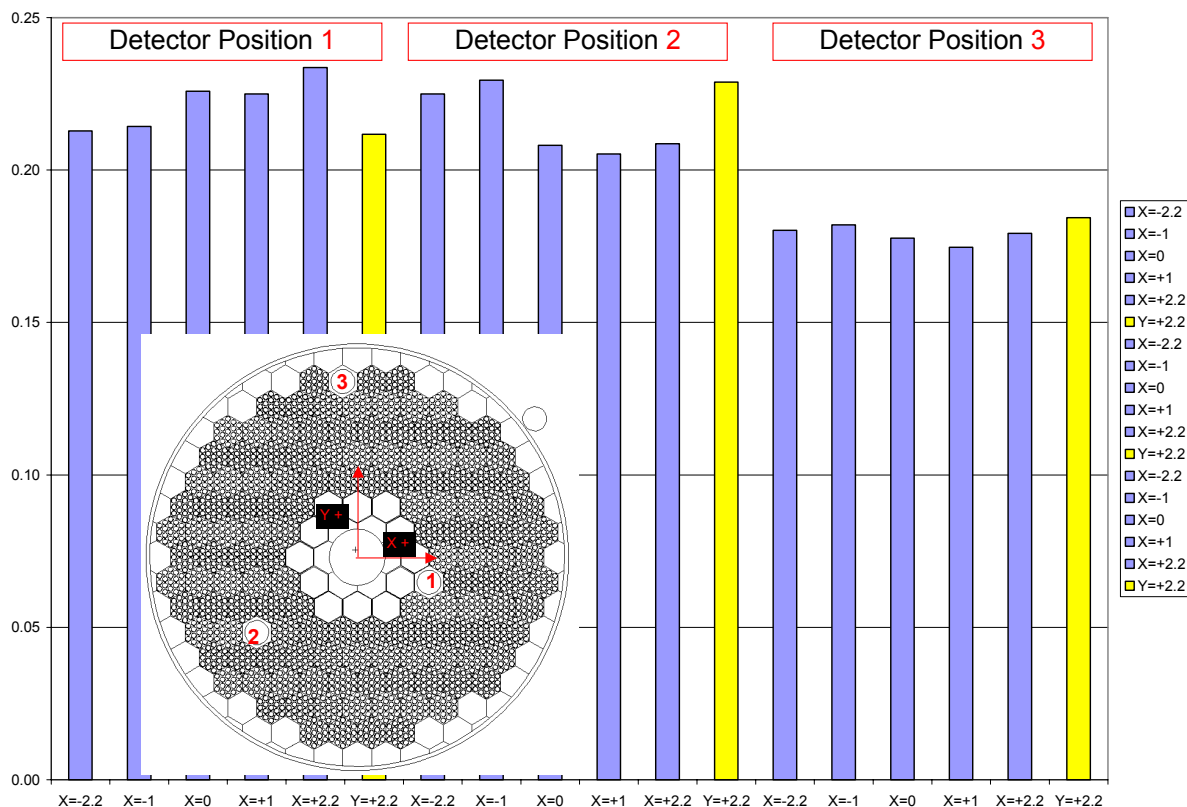
The changes on the counting rates of detectors however are quite different depending on the detector position.

For a detector in the central core exp. channel the changes are -5.8, -5.1, -0.4, +3.4% respectively

For a detector in the middle core exp. channel the changes are +8.1, +10.3, -1.3, +0.3% respectively

For a detector in the external core exp. channel the changes are +1.4, +2.4, -1.7, +0.9% respectively

Note that same displacements on X and Y are not equivalent !!



**Requirements for the experimental channel actuators:**

Hypothesis: There are 3 in-core vertical, 3 out-core vertical and 2? out-core horizontal experimental channels

**The optimal requirements:**

All the experimental channels (8) have actuators able to position samples and detectors with a resolution of 1 mm. Range of movements larger than 1 meter for all actuators.

The actuators in the central and middle core exper. vertical channels are able to move a 51 cm long x 3 cm diameter B4C control rod 51 cm in less than 2 seconds. Programmable speed curves during movement from 25cm/s to 1cm/s, in positive and negative ways, should be possible. No special requirements for the mass and speeds on the other channels, but at least masses of up to 200 grams and times of less than 5 minutes for 100 cm should be acceptable.

#### The minimum requirements:

The 3 in-core vertical, 2 out-core vertical and 1 (top) horizontal experimental channels (6 in total) have actuators able to position samples and detectors with a resolution of 5 mm, with reproducibility of 1 mm. Range of movements larger than 1 meter for all actuators.

The actuator in the central core exper. vertical channel is able to move a 51 cm long x 3 cm diameter B4C control rod 51 cm in less than 2 seconds, in the 2 ways. Only one speed is possible.

The actuator in the middle core exper. vertical channel is able to move a 51 cm long x 3 cm diameter B4C control rod 51 cm but only at low speed.

No special requirements for the mass and speeds on the other channels, but at least masses of up to 200 grams and times of less than 5 minutes for 100 cm should be acceptable.

#### The motivation for the requirements:

The experiments will require to perform measurements at different positions in all experimental channels in fast sequences, both for electronic detectors and for sample irradiations. Similarly it will be needed to perform measurements with radioactive neutron sources in different positions of the 3 in-core channels and 2 out-core vertical channels.

Fast reactivity (positive/negative) insertions by movements of a B4C rod in the central in-core vertical channel allow to simulate reactivity feedbacks. The movement of a B4C rod in the middle in-core vertical channel allow to simulate the hypothetical control system reaction.

**B4C rods are experimental devices and they do not form part of the safety or control system of SAD.**