ITER REMOTE HANDLING BASIC OPERATION TYPES AND DIFFERENT FACTORS AFFECTING THEM

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Remote handling operations are carried out by human operators working in the control room. In ITER, there are several different kinds of operations expected from fully automated sequences to manually operated tasks using for example haptic device. However, for safety reasons there is always a man in the loop in every operation. The amount of people performing the operations also varies from one operator to cooperation between several operators and even between different teams.

For making the design and definition of different operations easier and faster, basic operation types shall be defined. This paper describes simplified models of different types operations from one person's manual operation to fully automated sequence in cooperation with more than one team. These operation types are analyzed and defined by using three factors: technical solutions, working environment and human operators. By analyzing these operation types their risks, requirements and other characteristics are found.

ITER remote handling operation design can be guided by combining and varying the results of these basic operation types. Real operation is presumably a combination of more than one of these basic operations types; for example it can start with a simple task that needs only one operator, but end as cooperation with two teams and several operators. Therefore it is needed to combine elements and requirements from more than one basic operation type. However, if operations are cut into small enough peaces requirements and characteristics of one operation type are met.

This paper explains situations where these different operation types fit in the ITER remote handling operations, especially in the divertor area maintenance. Other possible variations of operation types are also discussed. These operation type analyzes can be used as templates when designing and defining the real operations in ITER. DTP2 environment in Tampere is discussed as a case study for different kinds of operations.