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R&D ideas in relation to robotics

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Robots of different characteristics and designs are emerging and becoming essential for solving challenging problems in industry and harsh environments. Aiming to increase safety, robots can help perform repetitive and dangerous tasks, which humans either prefer to avoid or are unable to do because of hazards, size constraints, or the extreme environments in which they take place, such as radioactive experimental areas.

The design of present HEP detectors relies on optimizing the installation, maintenance, and repair work to minimize effective dose on personnel.

Radiation levels in a future hadron collider and radiation-cooling times will severely constrain operational and maintenance scenarios. As an example, towards the end of the FCC-hh operation, the foreseen dose rate levels are around 1 mSv/h in the entire tracker cavity after about 1 week of cooling time, and the values do not decrease significantly for 1 month or 1 year of cooling time. This radiation comes mainly from the highly activated calorimeters, so the detector opening and the placement of shielding must be automated to a large extent in order to limit the dose for personnel.

All this calls for detectors design and interface adaptations accounting for shielding, remote opening-manipulation and limited (short) human access as well as for a study about the use of automated and robotic solutions for services connectivity, inspection and early intervention.

R&D program shall start from the identification of possible available suitable robotic systems, compatible with the needs of future detectors, and proceed with the definition of space and interfaces to host such systems, already in the very first phase of the a detector design.

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