



Contribution ID: 5

Type: **not specified**

A Robotic System for Remote Interventions in the FCC Complex

Thursday 1 July 2021 16:40 (20 minutes)

The perception, cognition and control of robotic systems was advancing rapidly in the last decades and is even speeding up, benefiting from increasing computation power and technologies like artificial intelligence. These developments enabled robots to handle more complex tasks with a higher degree of automation. Extrapolating the state of robotic intelligence by about two decades, the time when the FCC Robot would operate in the FCC tunnels, such systems will be able to handle most of the planned interventions that are currently, mainly conducted manually and many of the unplanned or emergency situations. Additionally, most of the manually performed interventions in the LHC complex can not be applied to the three times longer FCC tunnel, without either increasing efforts in workforce and money or accepting longer machine down times. Thus, a robotic system will decrease machine down time, reduce the radiation exposure of workers and will locate, guide and possibly rescue workers in case of emergencies.

This work presents a robust robotic system for remote and automated interventions over the full life cycle of the FCC complex. First, a Remote Maintenance Code of Practice, which is based on the experience of over 1000 robotic operations at CERN will be presented. The code of practice provides guidelines for standardized, robotic friendly designs which are key to facilitate most efficient interventions. Furthermore, a survey listing the most important robotic interventions and the derived requirements and restrictions will be discussed. Some ongoing work concerning the integration of the robotic system in the cross section of the FCC tunnel and related logistics will be shown. Finally, results from simulations, design optimizations and the corresponding future prototype for proof of concept studies will be presented.

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Session Classification: Technology R&D

Track Classification: Accelerators: Technology R&D