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Turbocompressor test facility operating with Neonium mixtures and heat transfer effects

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Within the framework of the Future Circular Collider (FCC) and the EASITrain project, a major revision of the entire cryogenic cycle for the new machine is investigated in comparison to the LHC architecture. In particular, a closed-loop cryogenic cycle relying on turbocompressors and operating with Neonium mixtures is foreseen to enable the pre-cooling of helium.

To better understand the challenges and opportunities associated with the design and operation of radial compressors with such light gases, a closed loop test facility has been designed, built and commissioned at the ITSM (University of Stuttgart). The test facility has been developed to operate with air as well as with helium-neon gas mixtures of varying mixing ratios.

In this presentation, an overview of the test facility is first presented with its architecture, the components used together with a description of the operating procedure. Experimental results are then provided and validated against numerical evaluations. Moreover, the compressor motor being liquid cooled, a heat transfer between the coolant and the operating fluid leads to a modification of the operating fluid temperature and with it the measured aerodynamic efficiency. A model valid for all operating points and gases has been developed to remove this effect from measurements and is introduced here.

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