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# Particle free ESS vacuum system

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The European Spallation Source (ESS) is a neutron source based on a 2GeV-5MW linear accelerator. The goal of ESS is to be the brightest neutron facility and to enable novel science in many fields such as biology research, environmental technologies and fundamental physics. The ESS Linear Accelerator (LINAC) is under construction, Ion source and LEBT installation is started in Q1-2018.

The protons receive the most of their acceleration in the cold LINAC, from 90 MeV out from the warm section to 2GeV into the beam delivery systems. Three types of cryomodules are used: Spoke cryomodules (352.21 MHz, B=0.5) medium β cryomodules (704.42 MHz, B=0,67) and High β cryomodule (704,42 Mhz, B=0.86). These superconducting accelerating structures are sensitive to particle contamination and need to be protected to avoid performances loss.

At ESS three main sources of contamination are detected for the installation of the particle free accelerator.
1. Quantity of particle generates from active components like pumping systems, gate valves, instruments.
2. Particle contamination during LINAC construction from environment (dust in the tunnel or coactivity).
3. Particle contamination during assembly (human activities or tools non-adapted)

The control of particle free is based on 3 ways. Avoid the transport of particle inside the beam pipe, work in clean and classified environment and set up acceptance criteria and procedure to control them. Each part of the cold LINAC will be particle free checked before and during their installation.

This contribution will discuss the tools and particle free control of the ESS cold LINAC from particle pumping cart to the quantity of particle generated by SAES NEG pump (new generation of low particle vacuum pump).

References:
1. Cleanrooms and associated controlled environments –
Classification of air cleanliness by particle concentration (ISO 14644-1:2016)
2. Particle free pump down and venting of UHV Vacuum Systems THPP0104 (M. Böhnert, D. Hoppe, L. Lilje, H. Remde, J. Wojtkiewicz, K. Zapfe, Deutsches Elektronen Synchrotron DESY.)

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