Contribution ID: **35** Type: **Oral**

Simulation of the Evolution of the Residual Gas Particle Density –an Analytical Approach

Thursday 14 April 2016 09:30 (15 minutes)

Ultrahigh vacuum is a basic requirement for the Future Circular Colliders (FCC). The size of the vacuum chambers and the high energy of the circulating particles will make this requirement challenging. Simulations that predict the pressure distribution due to thermal outgassing as well as beam induced effects will allow to evaluate different designs and to choose an optimal pumping solution.

The mathematical model behind the simulations will be presented. Four coupled differential equations describe the mass conservation of the residual gas particles in the beam pipe. The model includes both distributed and local pumping, and take into account gas sources generated by synchrotron radiation, electron and ion-induced desorption.

The equation system is solved by an analytical method. This requires a transformation to first order equations for which a general valid solution exists. Adding a particular solution and the inclusion of appropriate boundary conditions define the solution function. The big advantage here is that an analytical simulation delivers fast results over large systems.

The model has been implemented in a Python environment. It has been cross checked with VASCO [1] and MolFlow [2]. Data obtained from the Large Hadron Collider's (LHC) pressure gauges were successfully compared to the simulation outputs. These encouraging results give trust to produce accurate vacuum forecasts for the FCC.

---

[1] Rossi A.; VASCO (VAcuum Stability Code); Multi-gas Code to Calculate Gas Density Profile in UHV System. Geneva: CERN; 2004. LHC-Project-Note-341.

[2] Kersevan R., Ady M.; MolFlow - A test-particle Monte-Carlo simulator for ultra-high-vacuum systems. Geneva: CERN; 2009. https://test-molflow.web.cern.ch/

Primary authors: AICHINGER, Ida (CERN); SOPOUSEK, Jan (CERN); CHIGGIATO, Paolo (CERN); KERSEVAN, Roberto (CERN)

Presenter: AICHINGER, Ida (CERN)

Session Classification: Technologies R&D

Track Classification: Technologies