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Development of radiation hard and magnetic field compatible vacuum gauges for the ITER project

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The ITER Tokamak, designed to study deuterium-tritium fusion reactions and to demonstrate its viability as a sustainable and clean energy source, is currently being built in South France, on Cadarache site. Its vacuum system, one of the largest and most complex vacuum systems ever to be built, requires several hundred of vacuum sensors for the pressure monitoring of its high vacuum systems.

High vacuum gauges operating under magnetic fields as high as 300mT, with gamma radiation in excess of 1MGy and significant neutron fluency, will be necessary in order to fulfill the pressure measurements of the torus vessel, neutral beam injectors, cryostat vessel, diagnostics, cryogenic distribution and heating systems of the ITER Tokamak.

Following an international call for tender and the signature of a Strategic agreement between ITER and the company INFICON, specific pirani and cold cathode gauges with remote controller have been developed and qualified to operate under the difficult ITER environment. Other sensors of novel technologies are also being developed to overcome the ITER vacuum instrumentation challenges.

In this paper the ITER specific environmental conditions and requirements for pressure measurements are reminded. The standardization process for ITER passive vacuum gauges and controllers is then described and emphasis is given toward the products development and qualification testing. Final gauges performances are then detailed and successfully commercialized ITER standard products are lastly exposed.

To complete the picture, highlight is given on additional vacuum sensing development required to complete the ITER vacuum instrumentation portfolio and achieve an operationally safe design.

Author: BOUSSIER, Bastien (ITER Organization)

Co-authors: Mr WOLFERS, Gilles (ITER Organization); Mr PEARCE, Robert (ITER Organization); MARKI, Janos (Inficon); Mr TRUNIGER, Markus (INFICON AG); Mrs SCHAEPER-VOGT, Petra (INFICON AG); Dr ANDREAS, Bernhard (INFICON AG)

Presenter: BOUSSIER, Bastien (ITER Organization)

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