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M1Po3B-06: Inconel 625 flange development for Cu-based superconducting radio frequency cavities

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Depositions of superconducting Nb₃Sn (T_c ~18K) layers on Cu is a promising approach to developing superconducting radio frequency (SRF) cavities comprising the next generation's high-efficiency linear accelerators operating at 4K. This technology can significantly reduce costs beyond the 2K state-of-the-art Nb-based technology. Developments in physical and chemical vapor depositions of Nb₃Sn on Cu are underway and require high cavity processing temperatures between 750C- 950C for multiple hours to achieve high-quality superconducting Nb₃Sn. Beyond the superconducting layer development, permanent fastening methods are needed to develop Cu-based SRF systems. Here, we present the development of electron beam welding of Inconel 625 flanges directly to copper that can withstand high deposition temperatures and thermal shock during cooling. Development tests with replica Inconel 625 blanks butt-welded to Cu indicate excellent weldability as observed by homogeneous mixing, no weld defects, and successful leak check tests. Progress on the final welding of Inconel 625 flanges to 1.3GHz hydroformed seamless Cu cavities will be presented.

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Authors: O'BRIEN, Adam (The Thomas Jefferson National Accelerator Facility); VALENTE-FELICIANO, Anne-Marie (The Thomas Jefferson National Accelerator Facility); GROSE, Gregory (The Thomas Jefferson National Accelerator Facility); BUTTLES, John (The Thomas Jefferson National Accelerator Facility); HRYHORENKO, Oleksandr (The Thomas Jefferson National Accelerator Facility); BALACHANDRAN, Shreyas (The Thomas Jefferson National Accelerator Facility); PROSPER, Tom (The Thomas Jefferson National Accelerator Facility)

Presenter: O'BRIEN, Adam (The Thomas Jefferson National Accelerator Facility)

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