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CLARA Update: First Accelerated Beam

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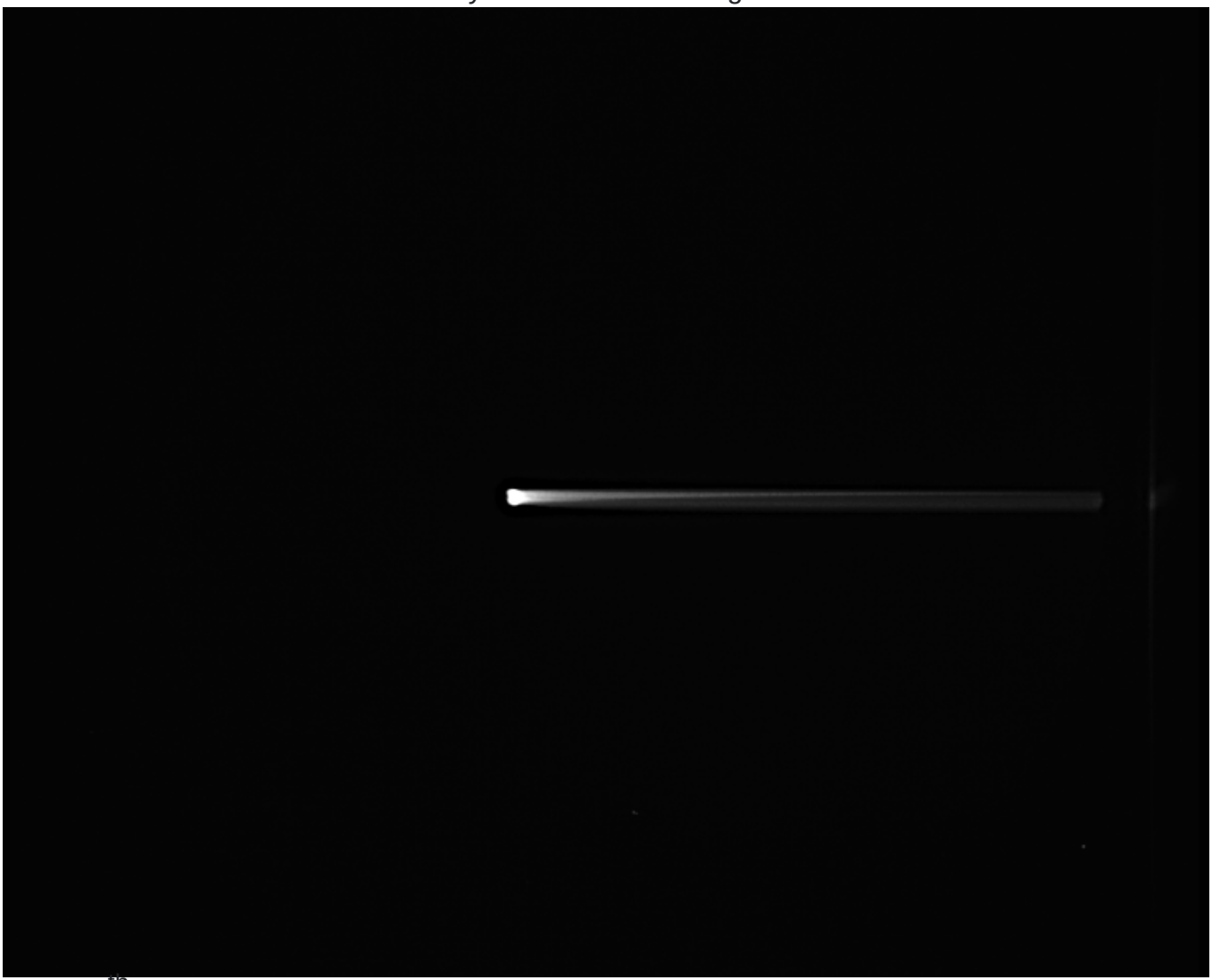
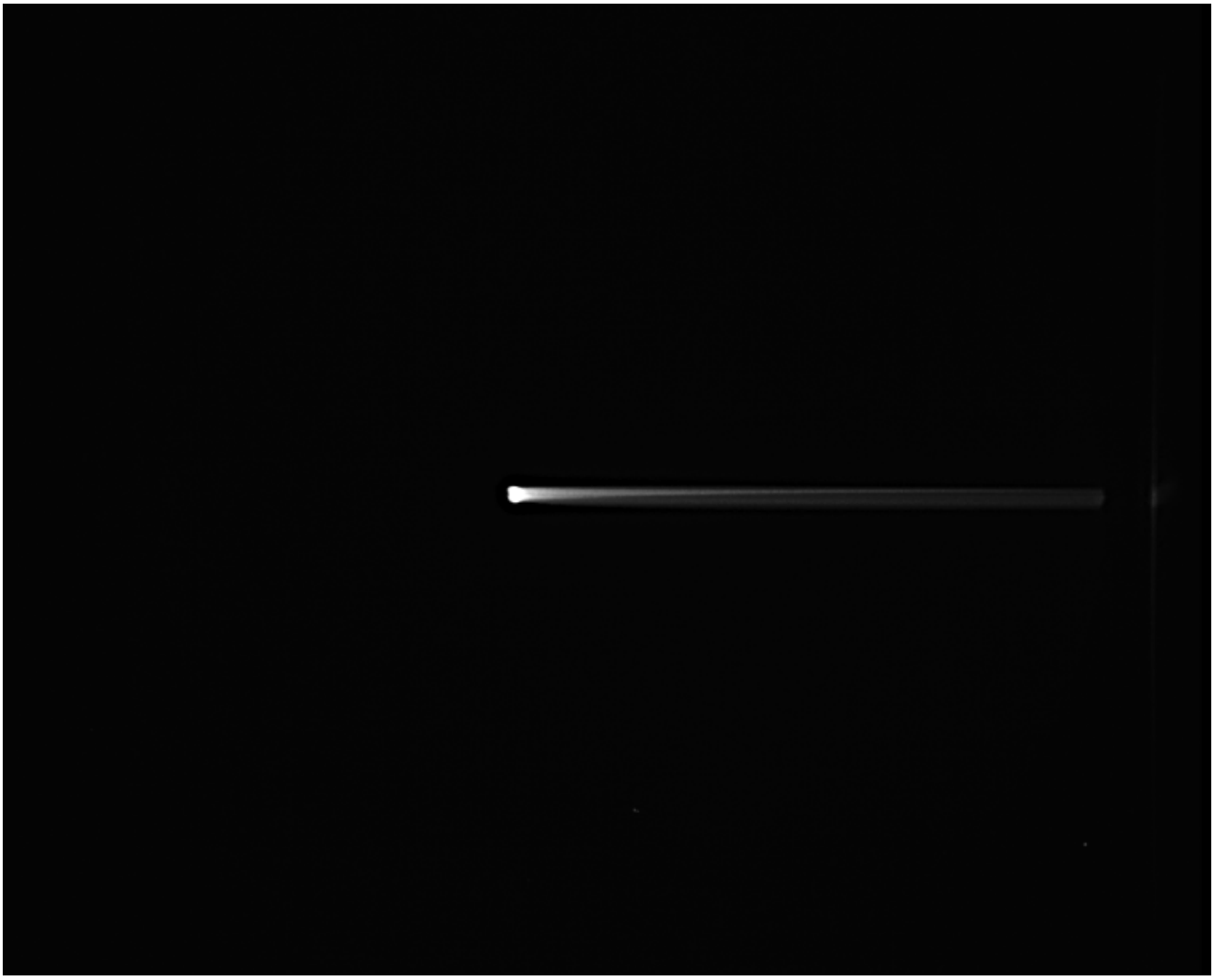
Free electron facility STFCC

UK’s Free Electron Laser Test Facility reached another significant milestone.



On 16th November 2017 CLARA, the UK’s Free Electron Laser Test Facility being built at STFC

Daresbury Laboratory, reached another significant milestone – accelerating electron beam with Linac 1 for the first time. At the first attempt a beam energy of 48 MeV was reached, far exceeding the minimum facility requirement of 40 MeV. Before attempting acceleration, the normal conducting RF photoinjector and linac both had to go through an intense period of RF conditioning which involved carefully feeding higher and higher RF powers into each cavity to ensure they were capable of withstanding the very large electric fields required for acceleration.



The figure shows the 48 MeV beam image recorded in the CLARA spectrometer line. © STFC

Before the beam attempt was made a number of other systems had to be optimised, most notably the photoinjector laser and associated laser optical transport and the new water cooling systems which must keep the linac and gun cavities at a fixed operating temperature within very small margin otherwise they will not sustain the correct RF frequency. Additionally, a large team, led by STFC staff, have worked hard behind the scenes to ensure all of the other systems were operational on the day; these include the magnets, diagnostic screens, control system, vacuum system, power supplies and so on.

The focus of the commissioning has now shifted to proving the performance of the other

technical systems, including the Faraday Cups, Wall Current Monitor, and the Beam Position Monitors before detailed beam characterization begins. The new high energy beam will also now be transported through the VELA beam line towards Beam Areas 1 and 2 in preparation for exploitation later in 2018. The team is also looking forward to commissioning the new 400Hz Photoinjector during 2018. It is installed and ready to be tested at an opportune moment.

This process went particularly smoothly for the linac which was testament to the high-quality engineering of the system as it had not been subjected to high power RF previously.

Meanwhile, the next phase of CLARA, which will take the beam energy up to the final energy of 250 MeV, is being assembled offline at Daresbury with installation slated for 2019. The CLARA project is recognised as a vital stepping stone towards a possible UK X-ray FEL user facility. The new FEL output schemes that will be tested on CLARA will pave the way for a state-of-the-art FEL facility for the UK, while simultaneously contributing to international R&D.

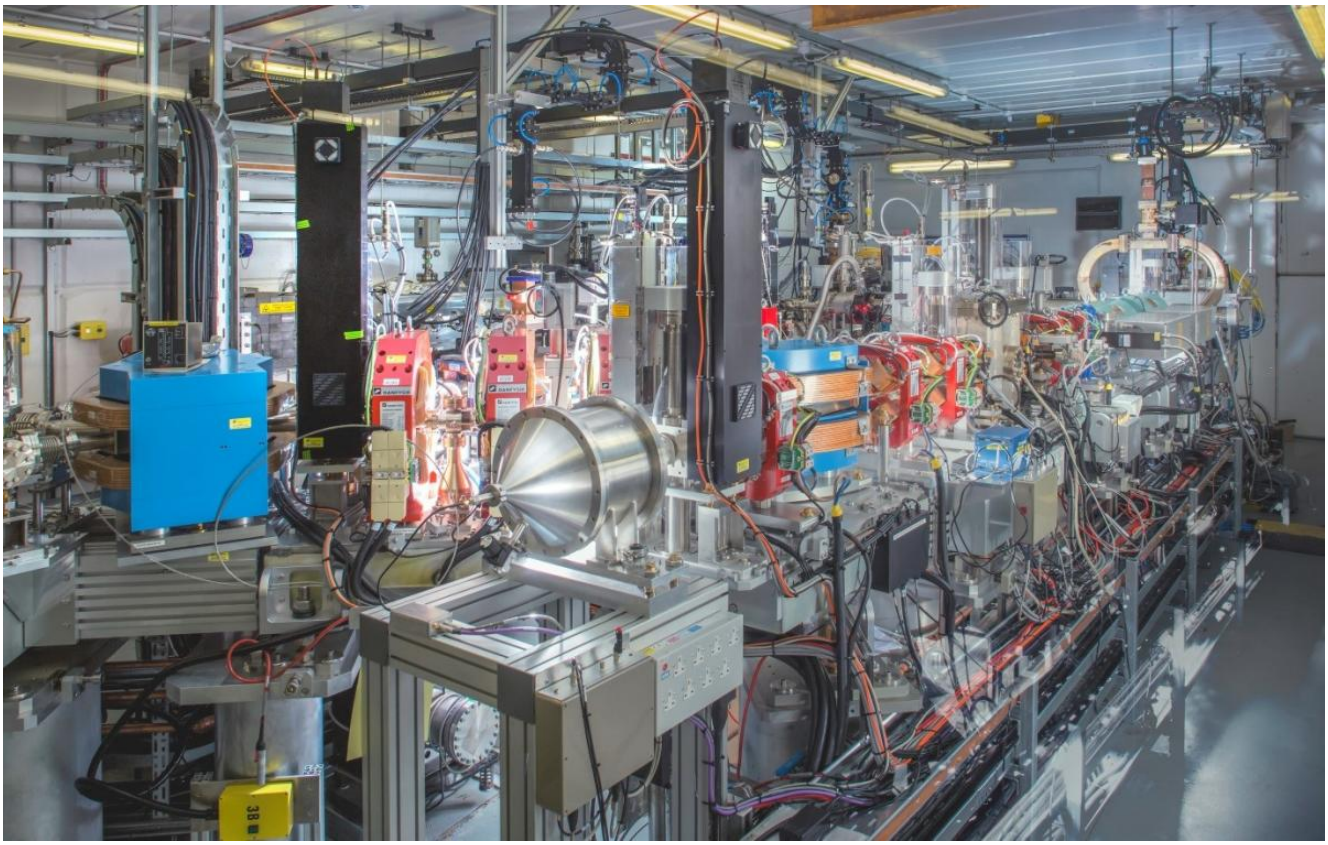


Photo of the CLARA Front End which has now generated 48 MeV electrons. © STFC