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## Breaking Convention: Novel Normal-Conducting Electron Sources for Higher 6D Brightness

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As part of an international collaboration between PSI and INFN, two novel C-band RF photoguns have been designed and realised in the context of the IFAST programme. These RF photoguns aim to push the brightness of the next generation of FELs through an increased cathode gradient achieved through reducing the filling time of the device. In this work, we demonstrate how these newly developed photoguns will impact upon the achievable beam brightness. This begins with the presentation of the first high power testing of these new photoguns in dedicated tests stand at the Paul Scherrer Institut. The beam brightness will be modelled using beam dynamics simulations including the effects of intrabeam scattering, which is now known to greatly impact upon the sliced energy spread. Finally, as we continue to look forward and further push the machine brightness, we discuss how we can continue to push the peak cathode gradient, and consequently beam brightness, of 'conventional' normal-conducting electron sources using unconventional high bandwidth RF designs.

### Footnotes

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