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## ATF2-3 hardware upgrade and new experimental results to maximize luminosity potential of linear colliders

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The ATF2-3 beamline is the only facility in the world for testing the Final Focus Beamline of linear colliders and is essential for the ILC and the CLIC projects. A vertical electron beam size of 41 nm (within 10% of the target), a closed-loop intra-bunch feedback of latency 133 ns, and direct stabilization of the beam position at the Interaction Point to 41 nm (limited by IP BPM resolution) have all been achieved at ATF2. These results fulfilled the two main ATF2 design goals, but were obtained with reduced aberration optics and a bunch population of approximately 10% of the nominal value of  $10^{10}$  electrons. Recent studies indicate that the beam degradation with the beam intensity is due to the effects of wakefields. To overcome this intensity limitation, hardware upgrades including new vacuum chambers, magnets, IP-Beam Size Monitor laser, cavity BPMs, wakefield mitigation station, as well as a comprehensive R&D program to maximize the luminosity potential are being pursued in the framework of the ILC Technology Network. This new R&D program focuses on the study of wakefield mitigation techniques, correction of higher-order aberrations, tuning strategies, including AI techniques, as well as beam instrumentation issues, such as the BPMs, advanced Cherenkov Diffractive Radiation monitors, and fast feedback systems, among others. This paper summarizes the hardware upgrades, the R&D program and the results of the Fall 2023-Winter 2024 experimental campaign performed in ATF2-3.

### Footnotes

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