The Super-ACO Storage Ring Free Electron Laser Operating with an Harmonic RF Cavity, M. BILLARDON, ESPCI/CNRS; M.-E. COUPRIE, L. NAHON, D. NUTARELLI, B. VISENTIN CEA; A. DELBOULB, G. FLYNN, R. ROUX, LURE - The Super-ACO Storage Ring Free Electron Laser (SRFEL) so far operates in the Ultra-Violet with a 100 MHz cavity. With a recently installed 500 MHz harmonic cavity properly tuned with respect to the main cavity, the bunch is shortened by a factor 2 (150 kV) to 3.5 (280 kV), but it can be rather instable (vertical excitation that can be partially damped with a high chromaticity and phase oscillations relaxing with a frequency betwen 200 and 800 Hz). The SRFEL operation stabilizes both the longitudinal and vertical instabilities, but its own stability is decreased. A reasonably "stable" SRFEL is achieved in the 90 - 150 kV range, with a tunability extended by a factor of 2 and a higher output power than with the 100 MHz cavity alone. In the future we aim at a better understanding of the beam behaviour so that the SRFEL should operate at the maximum harmonic cavity voltage of 300 kV, thus extending the spectral range in the deep UV and providing a higher output power.