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## Coherent control of high harmonic generation in a large-volume capillary for seeding of free-electron lasers

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FEL-1 at FERMI@Elettra is a seeded free-electron laser using sub-harmonic seeding to generate soft x-rays down to 10 nm. The current seed laser, a standard solid-state laser followed by frequency quadrupling in nonlinear crystals, has a minimum wavelength of 200 nm. Injecting much shorter seed-laser wavelengths, for which high-harmonic generation (HHG) is of high promise, can shorten the laser output wavelength significantly. However, the minimum seed pulse energy required is not readily available with standard approaches to HHG. To increase the energy available in a particular harmonic for seeding, we use a gas-filled capillary with a large diameter (500 $\mu$m), pumped by an 8 mJ, 35 fs Ti:Sapphire laser. A wide capillary allows a large gas volume for HHG, thereby increasing the output energy. We also investigate the coherent control of HHG by shaping the spectral phase of the drive laser using an acousto-optic programmable dispersive filter. Here, we use a learning algorithm with the objective to simultaneously tune and selectively enhance an individual harmonic order. We present first results including pressure dependent harmonic output energy, spectrum and beam stability, as these are important for seeding of FELs. Further, we discuss initial experiments with coherent control that has shown selective enhancement up to a factor of 10.