Targeted irradiation of biological cells using an ion microprobe – Why a small beam spot is not sufficient for success

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When people plan to adapt their ion microprobe for the targeted irradiation of biological cells, they often claim that they expect a targeting accuracy in the range of their beam spot diameter, because they assume that reaching a sub-lm beam spot is the most difficult part of the job. Although many microprobes have now a beam spot diameter of some hundred nano-meters or less, nobody reached a targeting accuracy below 1 μm. Besides obvious reasons, like mechanical or thermal instabilities, there is a more difficult problem to overcome: one still needs a light microscope to locate both the microbeam and the cells to be irradiated, and there are various light-optical effects, which can give misleading information about the position of the beam and the cells.