Microbeam radiation therapy (MRT) is an irradiation modality for therapeutic purposes which uses arrays of collimated quasi parallel microbeams, each up to 100 μm wide, to deliver high radiation doses. Several studies have reported the extraordinary tolerance of normal tissues to MRT irradiation; conversely, MRT has been shown to be highly efficient on tumor growth control. The original and most widely developed application of MRT, yet in the preclinical phase, consists in using spatially fractionated X-ray beams issued from a synchrotron radiation source in the treatment of brain tumors. More recently, MRT has been tested in successful pioneering assays to reduce or interrupt seizures in preclinical models of epilepsy. The MRT concept has also been extended to proton therapy. The development of MRT towards its clinical implementation is presently driven by an EU-supported consortium of laboratories from 16 countries within the COST Action TD1205 (SYRA3). The results of the first SYRA3 workshop on “RadiationTherapy with Synchrotron Radiation: Achievements and Challenges” held in Krakow (Poland) during March 25-26 2014 are summarized in this issue with an overview presented in this paper. The papers reflect the multidisciplinary international activities of SYRA3. The topics covered in this focus issue include medical physics aspects, pre-clinical studies, clinical applications, and an industrial perspective; finally an outlook towards
future prospects of compact sources and proton microbeams.

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