

### Microbeam radiation therapy and other therapies with synchrotron X rays

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Microbeam Radiation Therapy (MRT) uses a spatially fractionated filtered white X-ray beam from a high energy wiggler Synchrotron Source (energies 50-350keV) with extremely high dose rates (up to about 20kGy/s). The typical planar beam width in an array is 25-100µm with 100-400µm wide spaces between beams. Such beams are very well tolerated by the tissue,

even the high “peak” doses delivered in the path of the microbeams, when respecting a dose prescription in the “valley” that corresponds to a dose used of conventional RT converted to a single exposure. The superior tumor control when compared to that realized by conventional RT is achieved by differential effects of MRT on the normal tissue vasculature versus the tumor vasculature.

The MRT technique has been technically set up, tested and successfully applied during the last 20 years on various tumour models. Presently, the project is mature enough to be used for the treatment of spontaneous tumours in pets. Unified efforts from several teams with very different expertise now permit Microbeam Radiation Therapy in animal patients with a high degree of safety, in pursuit of the ultimate goal of clinical applications in humans.

The MRT trials for animal pets as tumor patients required substantial work for developing, upgrading and progressively implementing instrumentation, dosimetry protocol, as well as the crucial patient safety systems. Progress on the homogenous dose measurements using ionisation chambers and Alanine dosimetry as well as the comparison of high resolution dosimeters with the dose calculations based on a novel tumor planning system will be summarized. A general overview on the different achievements will be presented as well as a vision for possible human trials.

In addition, the principle of the on-going SSRT (Stereotactic Synchrotron Radiation Therapy) clinical trials will be briefly introduced.