

Targeting tumours with protons

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What do protons do that x-rays don't?

2 beam proton plan

VMAT x-ray plan



Proton therapy enables much lower dose to surrounding tissues





What do protons do that x-rays don't?









X-ray

Proton





Why does it work?





Why does it work?



How to deliver proton therapy?







Realising the potential of proton therapy

Are we delivering what was intended?



Range uncertainty

The advantage of protons is that they stop.

The disadvantage of protons is that we don't always know where...





10% range error





Tumour shrinkage during treatment fractions



Research is focusing on fast & efficient automated re-plan based upon daily imaging



Impact of daily anatomical change



Variation of bowel gas over multiple images for a single paediatric patient



Kidney motion over multiple images for a single paediatric patient

Image every day and deliver optimal plan



Predicting motion and future anatomy



Can we adapt treatment delivery in response to predicted anatomical change?





What is the biological effect along the proton path?







Some big challenges in proton therapy



Move towards planning based on predicted biological effect rather than deposition of radiation energy