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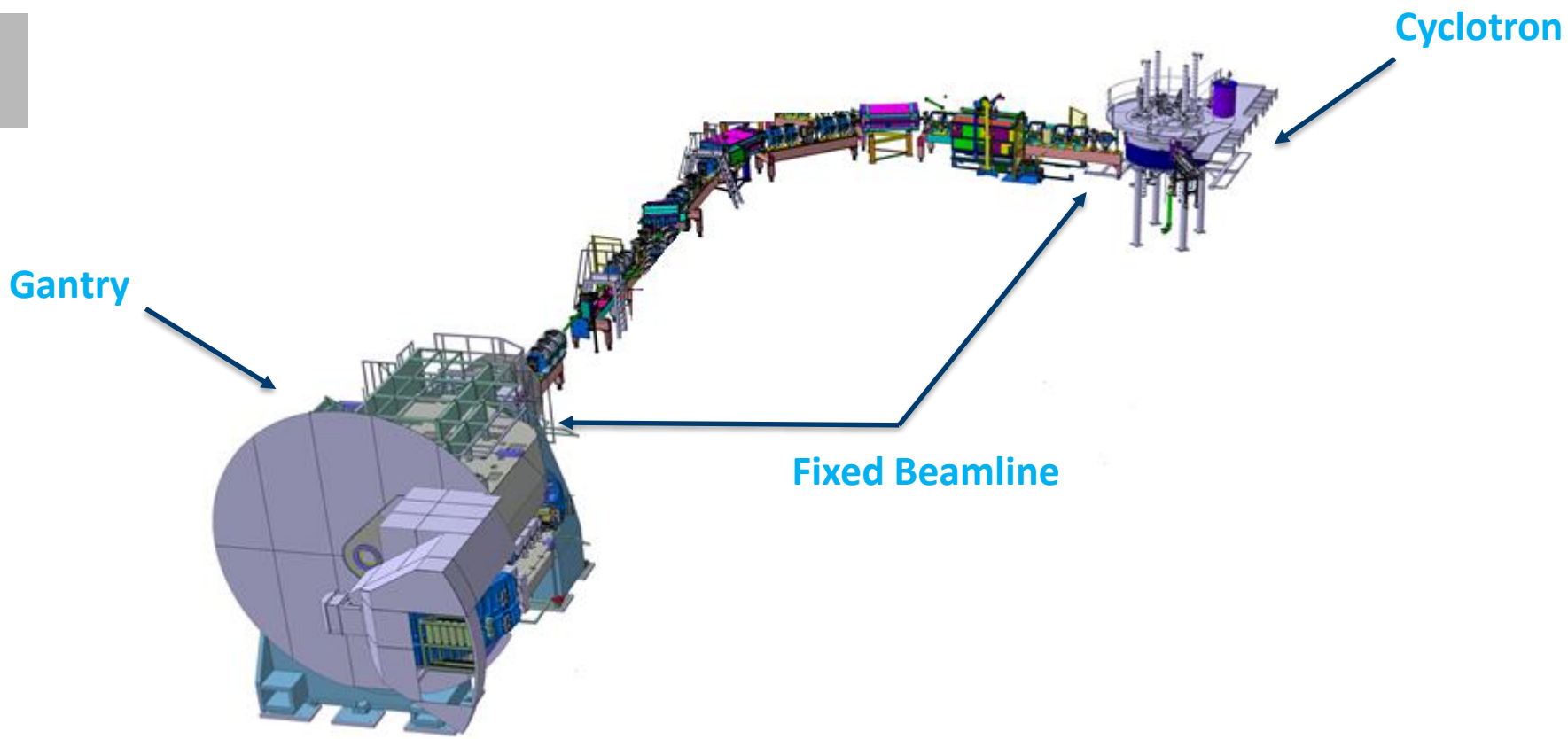
PSI

A novel beam optics concept to maximize the transmission through cyclotron-based proton therapy gantries

V. Maradia, D. Meer, A. C. Giovannelli, A. J. Lomax, D. C. Weber, J. M. Schippers, S. Psoroulas

Center for Proton Therapy, Paul Scherrer Institute, Villigen, Switzerland

Cyclotron based proton therapy facility



Currently used PSI's Gantry-2 beam optics with 1:1 imaging

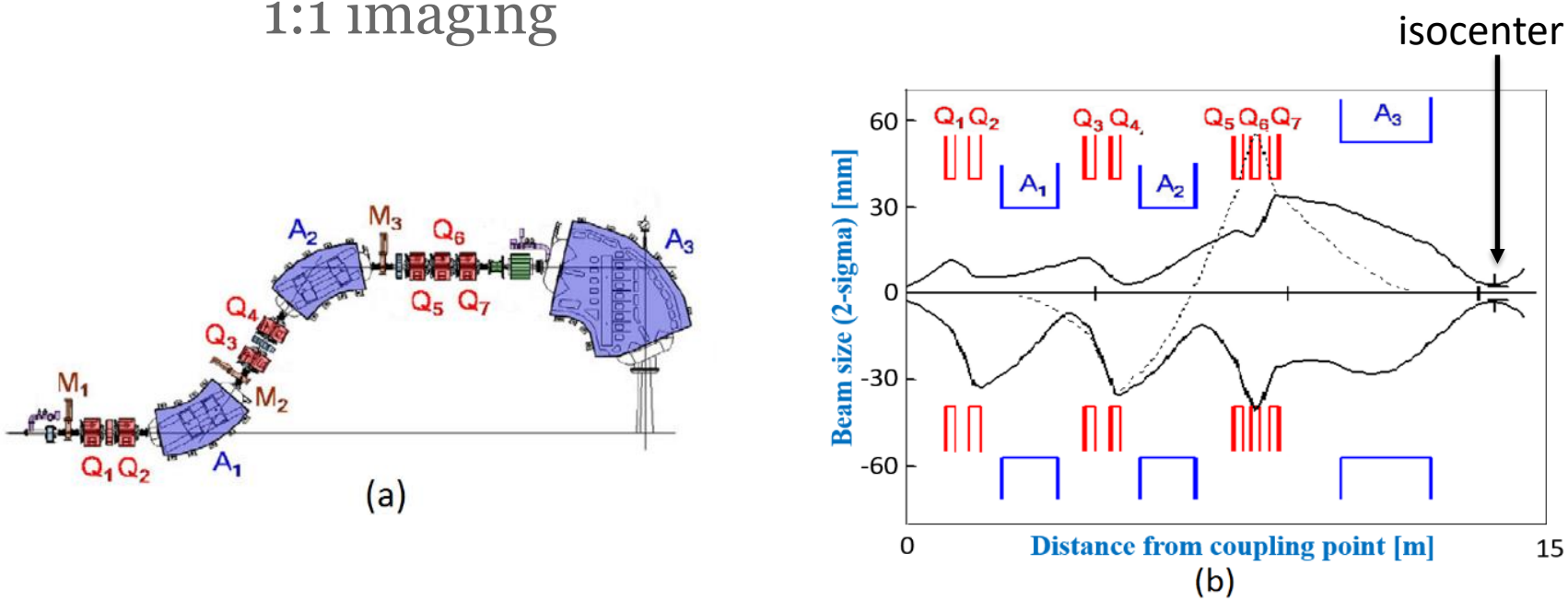
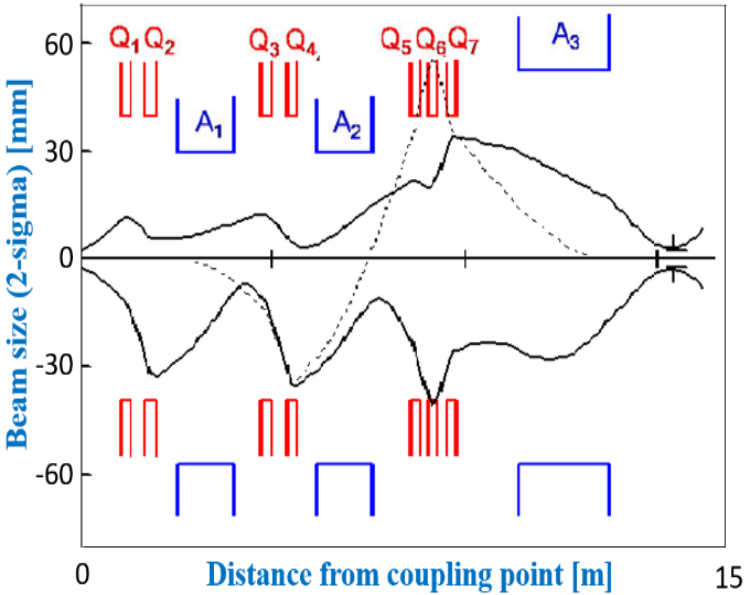


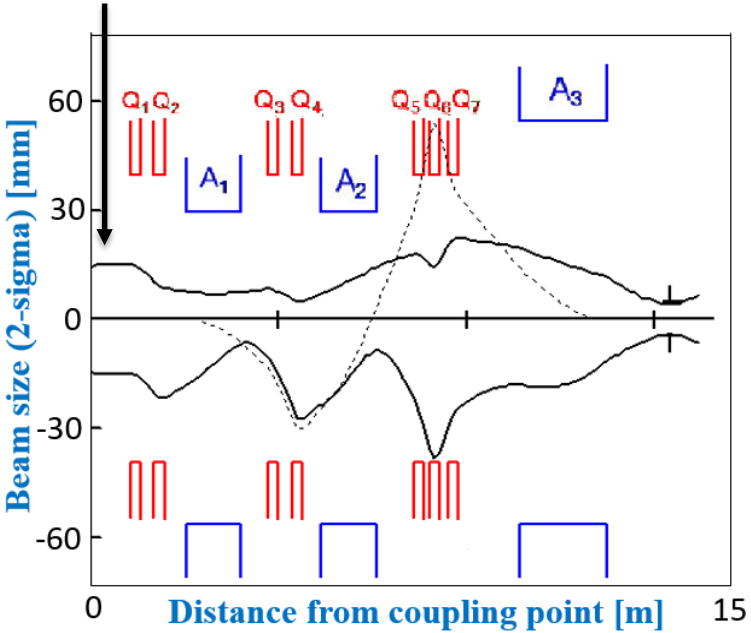
Figure 1 : (a) Shows the PSI's Gantry 2 layout, with three dipoles (elements A) and seven quadrupoles (elements Q). (b) Shows the 2-sigma beam envelope and the dispersion (dashed line, dp/p=0.7%) along the gantry with 1:1 imaging (The lower half shows beam envelope in X-plane (bending plane) and the upper half shows envelope in Y-plane.)

Proposed gantry beam optics with 3:1 imaging



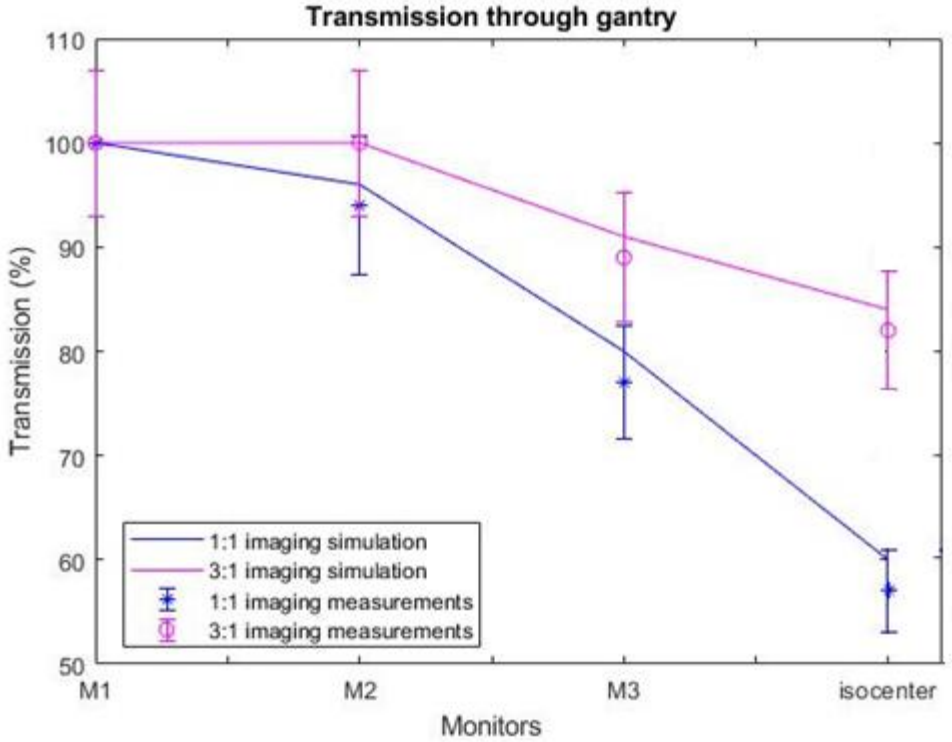
Currently used 1:1 beam optics

Large beam size and low divergence



Proposed 3:1 beam optics

Transmission through gantry with different imaging



Conclusion

- We have shown that the transmission of the beam through PSI's Gantry 2 can be increased by 40% using alternative beam optics imaging.

- This has been achieved by increasing the beam size and decreasing the beam divergence at the gantry entrance, in combination with novel beam optics, which de-magnifies the image of the beam entry at the isocenter by a factor of 3.

- Since the optics of PSI's Gantry 2 is comparable to other gantries, the presented improvement could also be of advantage in other gantries.

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Thank You