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Choosing Cavity Voltages and Phases for the CBETA Multi-Pass Energy Recovery Linac

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I describe a method for finding a set of cavity voltages and phases for the CBETA multi-pass energy recovery linac. The beam in CBETA makes up to 8 passes through its 6 cavity linac. The voltage and phase for each cavity can be set individually, and the path length for each arc energy can be set as well. I show that solutions can be found where each cavity has energy gains and losses balanced and all of the arc energies are precisely their design values. There are multiple families of solutions characterized by where the beam is with respect to the linac crest on each pass. I will choose the solution family that reduces the amount of energy spread generated by the beam going through cavities off-crest. I will plot solution parameters as a function of the effective linac phase (which I will define) for the first pass, and show that a given solution family can be found only for a certain range of that first pass phase.

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Footnotes

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Yes

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