Automatic Phasing of SCRF Cavities

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The superconducting linac in ISAC (Isotope Separator and Accelerator) consists of 40 quarter wave cavities, with each cavity providing ~1 MV of acceleration to the beam. During the setup of a tune, these cavities are phased one at a time, sometimes resulting in lengthy setup times. Currently if a cavity fails after a tune has already been setup, and the cavity cannot be recovered, this leads to a SCRF expert being called in, or worse to a re-tune of the linac. This can cause significant amounts of downtime. However, if the accelerating gradient of each cavity is known (along with TTF curves, intercavity distances, etc.), the linac can be automatically re-tuned by calculating the new arrival time of the beam at each subsequent cavity. Pairing a utility that can make these calculations with an easy to use graphic interface can potentially allow an operator to restore the tune to an experiment on their own (in the middle of the night for example), preventing large amounts of downtime. This utility also has the potential to allow automatic setups of the linac, eliminating the need for long setup times altogether. In this way, an automatic phasing program would greatly improve the overall reliability of the superconducting linac.