

## **An organ DVH based optimization algorithm for ultrasound guided prostate implants**

A clinical concern with prostate implant using I-125 or Pd-103 seeds is how to limit the rectal and urethra dose. Because the volume of prostatic urethra is also part of the target, the dose-volume histogram (DVH) of the target alone could not provide adequate information for “goodness” of treatment plans. Based on an objective function sensitive to organ DVHs, we developed an inverse planning method that considers the urethra and rectal wall as critical structures in optimization of source locations. The objective function was constructed using different importance factors for the target and critical structures with an additional term to restrict the number of needles involved for source loading. The objective function is minimized by an iteration algorithm. During an iteration each source is moved to a neighboring location if the objective function is decreased. With every source migration the source strength is rescaled to match the minimum target dose to the prescribed dose. The organ DVHs are controlled by an appropriate set of importance factors and the pre-specified organ tolerance doses. To avoid being trapped into an undesired local minimum state, a series of trials with different numbers of sources and randomized initial source positions are generated. Each trial takes less than two minute on a 233 MHz PC. The system selects the final plan by automatically evaluating the “optimal” solutions resulting from these trials. Our system also has the flexibility to adapt the source strength available.