

## PURPOSE

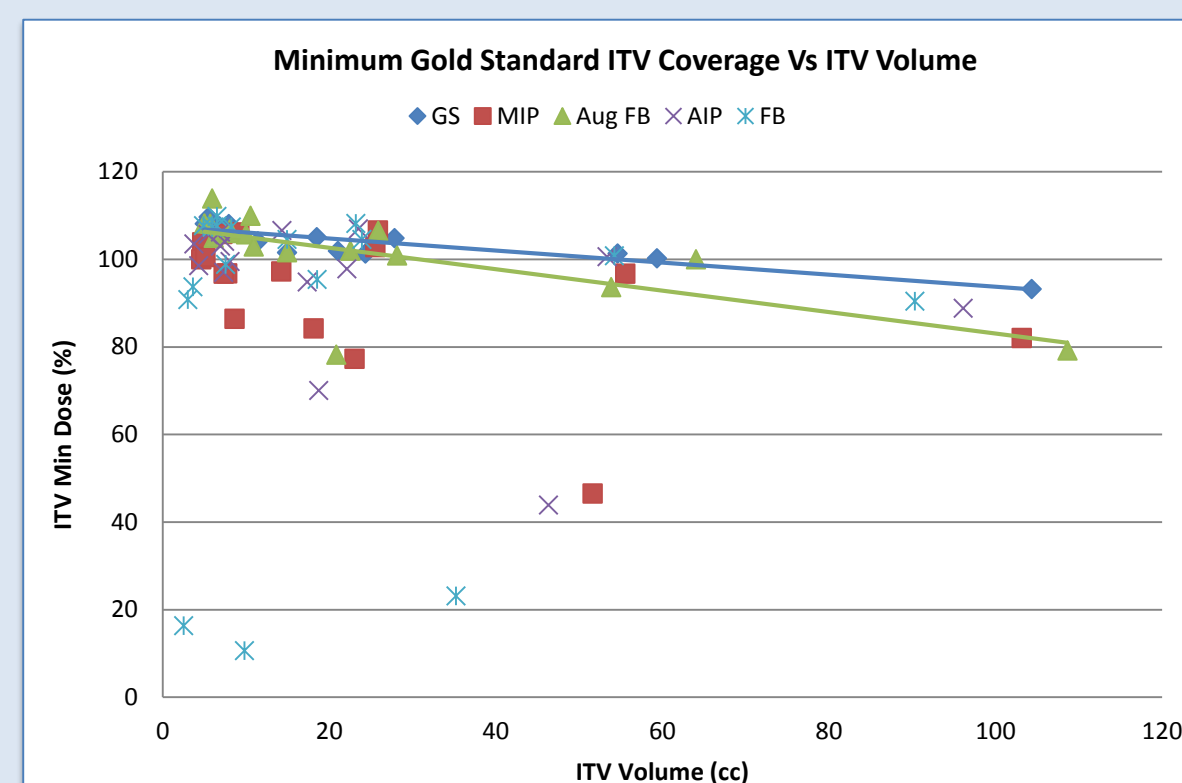
- Motion Management to adequately treat a moving GTV is a major concern when treating NSCLC using SBRT.
- Gold standard method for generating internal target volumes (ITV<sub>GS</sub>) requires contouring of gross tumor volumes (GTVs) in 10 phases of a respiratory cycle follow-up with Boolean-OR operation. However, various image types e.g. MIP, FB etc. are used in clinical practice to segment tumor yielding ITV and hence PTV's.
- Do alternatively created PTV's adequately provide sufficient dose coverage in comparison to the Gold Standard model (10 Phases)?

## METHODS

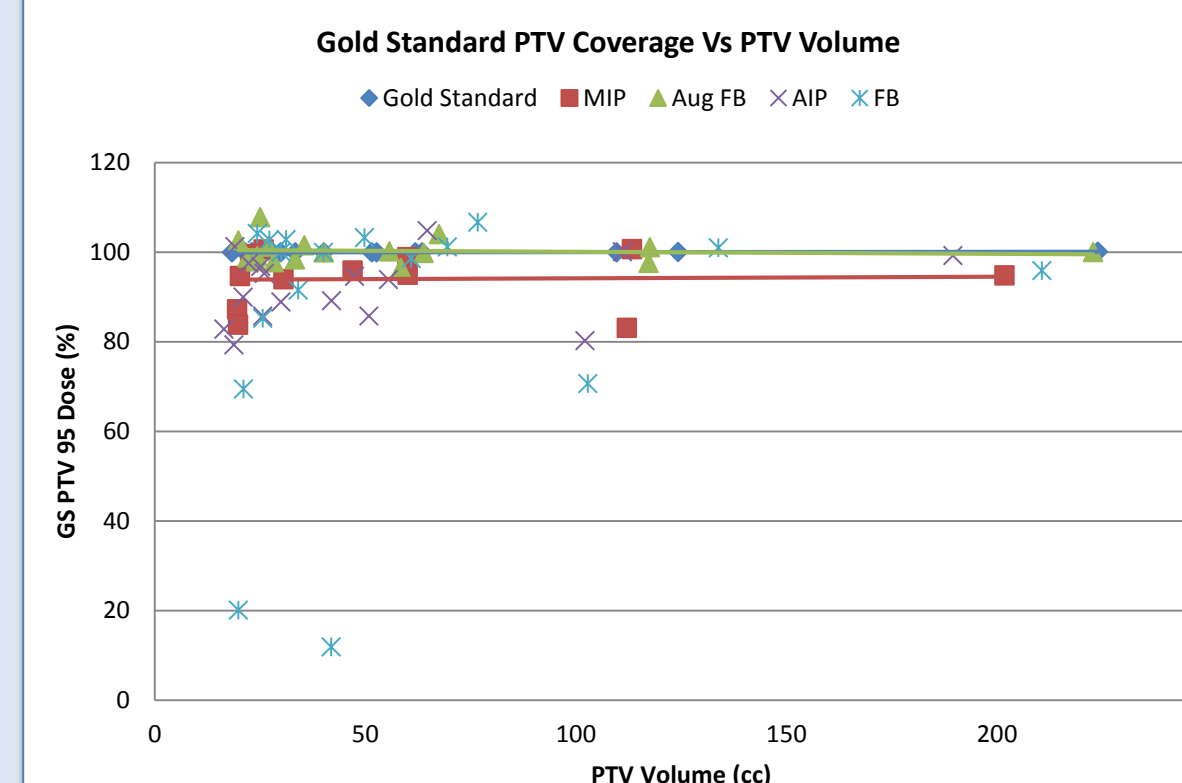
- Study cohort constituted of 17 lower lung patients with NSCLC
- Clinical 3D SBRT treatment plans were normalized to target the PTV<sub>GS</sub> to cover 100% of the PTV volume to receive 95% of the prescribed dose
- Gold standard ITV (ITV<sub>GS</sub>) created from Boolean-OR operation on GTV's from 10 phase 4DCT image set
- Alternative GTV/ITV's, representing different methodologies utilized clinically were created; Free Breathe (FB), Maximum Intensity Projection (MIP), and Average Intensity Projection (AIP)
- A fourth ITV, Augmented Phase Free Breathe (Aug FB) created using Boolean-OR operation on the 0-phase, 50-phase breathing cycle, and GTV<sub>FB</sub>
- PTV's for the AIP, MIP, and Aug FB created with a 0.5cm expansion of ITV/GTV
- PTV<sub>FB</sub> was created using RTOG 0915 protocol [10mm craino-caudal, 5mm Radially]
- Identical dose prescription, beam geometry, beam energy, target expansions, computation model [AAA] and computation grid [0.2 mm<sup>3</sup>] were used to re-plan to the experimental target PTVs

## RESULTS

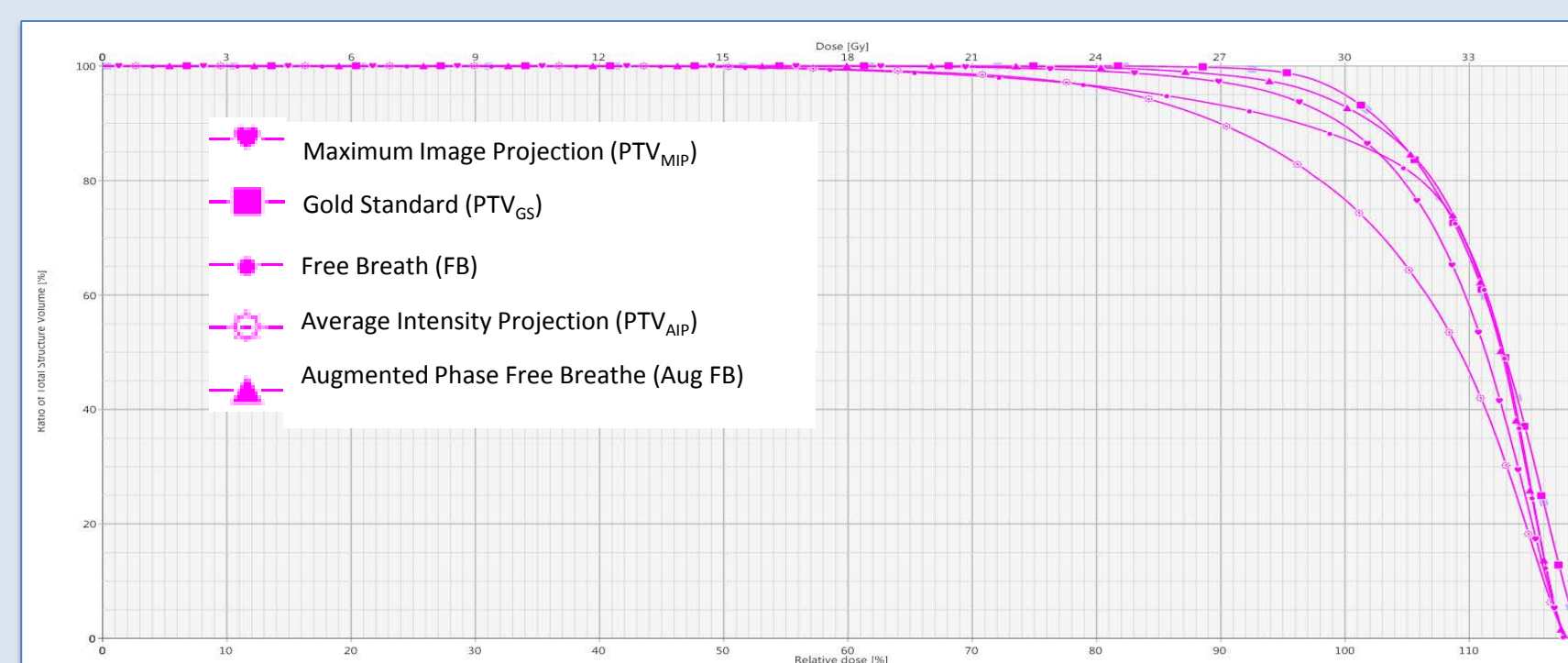
- FB targeted plans under-dosed the PTV<sub>GS</sub> and ITV<sub>GS</sub> on average by 86.2% ± 27.7 and 86.9% ± 33.1, respectively (Fig. I & II)
- The MIP met the minimum dose coverage at 95.7% ± 6.6 to the PTV<sub>GS</sub>, but under dosed the ITV<sub>GS</sub> with minimum dose coverage of 94% ± 14.9. (Fig. I & II)
- The AIP plans under-dosed the PTV<sub>GS</sub> covering 92.1% ± 7.4. The ITV<sub>GS</sub>, on average, met dose coverage at 96.2 ± 15.8% (Fig. I & II)
- PTV's derived from the Augmented Free Breathe image set were the most comparable to the Gold Standard bench mark with coverage to 100.3% ± 2.7% of the PTV<sub>GS</sub> and 101.7% ± 9.5% to the ITV<sub>GS</sub> (Fig. I & II)



**Figure I.** Minimum Dose coverage of the ITV<sub>GS</sub> for FB, Aug-FB, AIP & MIP data sets Vs. ITV Volume for the 17 lower lobe lung patients



**Figure II.** Percent Volume of PTV<sub>GS</sub> covered by 95% of prescription dose for FB, Aug-FB, AIP & MIP data sets Vs. PTV Volume for the 17 lower lobe lung patients



**Figure III.** DVH representing PTV<sub>GS</sub> coverage for plans targeting PTV<sub>GS</sub> FB Aug PTV PTV<sub>MIP</sub> PTV<sub>AIP</sub> and FB PTV

## CONCLUSION

- PTV<sub>FB</sub> and PTV<sub>AIP</sub> yield insufficient coverage of the PTV<sub>GS</sub> and ITV<sub>GS</sub>
- PTV<sub>MIP</sub> was generally acceptable to the PTV<sub>GS</sub> and ITV<sub>GS</sub>, but were inconsistent resulting in deviations that under-dosed both structures
- Augmented Free Breathe image set provides the best compromise between dose delivery accuracy and work-flow efficiency