

# The Effect of Different Aperture Shape Controller Modes in Eclipse Photon Optimizer for Lung SBRT Planning

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## INTRODUCTION

The Eclipse v15.6 Photon Optimizer incorporates Aperture Shape Controller (ASC) to decrease field modulation during VMAT delivery [1]. However, there is not much materials and publications show how and when to use this feature. Higher modulation results longer treatment time, which potentially increases the risk of patient movement during treatment and reduce the accuracy. This is crucial topic in SBRT. By analyzing the impact of different ASC modes to the plan quality, this work will provide some evidence to help choosing ASC for Lung SBRT planning.

## METHODS

Six Lung SBRT patients with different PTV volume were selected. They were categorized to three groups – small PTV (9.38 cc and 24.3 cc), medium PTV (43.17 cc and 45.58 cc), and large PTV (115.59 cc and 114.86 cc). Six individual plans were generated for each patient using Acuros XB and Photon Optimizer with same algorithm and optimization parameters, but different ASC modes including off, very low, low, moderate, high, very high. All plans met RTOG 0653 criteria, and in-house dose constraints to OARs. Modulation factor (MF), maximum and minimum dose to the PTV (PTVmax and PTVmin), R50%, and D2cm were analyzed and compared

## RESULTS & DISCUSSION

Six patients with 6 different ASC mode plans are analyzed. Based on the statistical results, ASC mode does not make significant difference to all 5 parameters (p-value > 0.05). However, the p-value for MF is 0.084, which provides at least 90% confidence that ASC mode has the influence on MF. Further analysis shows that MF is significant lower (p-value < 0.05) with ASC low or moderate mode than ASC off mode in small PTV volume patients. Figure 1 is the box and whisker plot of all plans for Modulation Factor (MF). All data has been normalized to ASC off mode for comparison purpose. Two factor ANOVA tests are performed to obtain p-value among different data groups. Table 1 shows the p-values of 5 testing parameters for all patients. In addition, Paired t-tests are performed on MF for patients with small PTV volume to further analyze the impact of different ASC modes. Table 2 shows that MF is significant lower (p-value < 0.05) with ASC low or moderate mode than ASC off mode in small PTV volume patients.

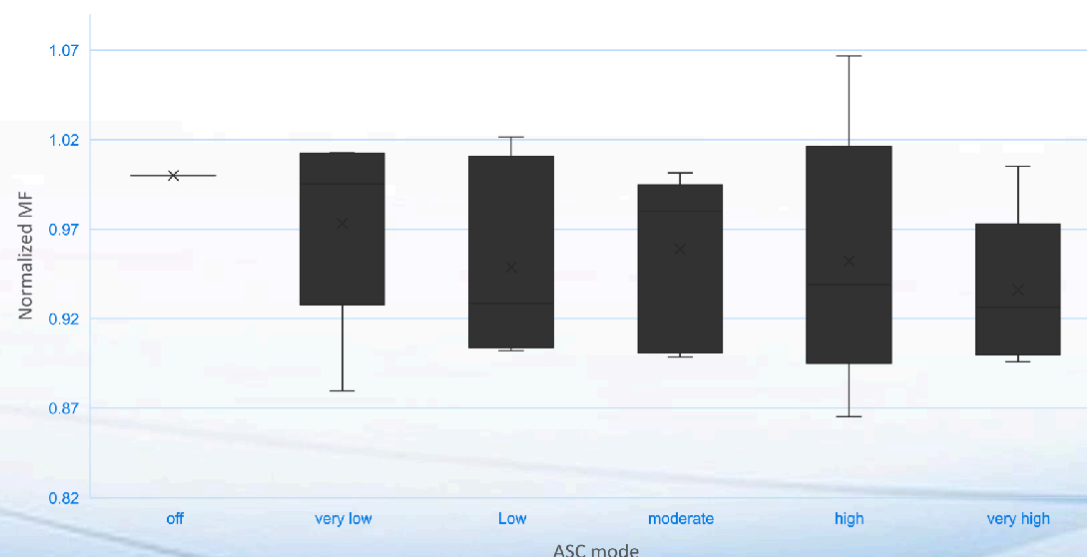


Figure 1. Plot for MF for all plans (Normalized to ASC off mode)

Plan Data	MF	PTVmax	PTVmin	R50%	D2cm
p-value	0.084	0.238	0.572	0.540	0.935

Table 1. Two factor ANOVA tests among different data groups

ASC mode	Off	Very low	Low	Moderate	High	Very high
Off	-	0.111	0.016	0.004	0.092	0.064
Very low		-	0.469	0.383	0.189	0.461
Low			-	0.107	0.246	0.380
Moderate				-	0.207	0.255
High					-	0.426
Very high						-

Table 2. p-value results of paired t-tests for MF with different ASC mode in small PTV volume patients

## CONCLUSION

This work indicates the usage of proper ASC mode during Lung SBRT planning. For patients with small PTV volume (< 30 cc), Monitor Unit can be significantly less without losing plan quality when utilizing ASC low or moderate mode. There is no significant difference among 5 individual “on” modes for PTVmax, PTVmin, R50%, and D2cm. For patients with medium and large PTV volume (> 30 cc), ASC plays less important role in Lung SBRT planning. More patient data will be added for statistical analysis to make this study more robust in the future.

## REFERENCES

[1] Varian Medical Systems, *Eclipse Photon and Electron Algorithms Reference Guide*. P1015026-001-A, Dec 2015