# Development and Implementation of an Auto Planning Module for Accelerated Partial Breast Irradiation (APBI) in the Eclipse Treatment Planning System

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## INTRODUCTION & OBJECTIVE

- To develop and evaluate an in-house auto-planning module within the Eclipse Treatment Planning System (TPS) using Eclipse Scripting API (ESAPI)
- Improve the standardization, efficiency, and reproducibility of Accelerated Partial Breast Irradiation (APBI) treatment planning, with potential extension to other treatment sites.

## MATERIAL & METHODS

- The in-house scripts were developed in C# using Microsoft Visual Studio and ESAPI, a .NET class library integrated within Eclipse TPS (version 18.1).
- A fully automated Volumetric Modulated Arc Therapy planning module was designed to support the entire workflow, from plan creation to final dose calculation.
- The system automates key steps, including optimization structure generation, beam configuration, optimization setup, and dose calculation, enabling plan generation with minimal manual intervention.
- The auto-planning module consists of three primary components:
- Auto Optimization Structure Module, which generates optimization structures such as optimized planning target volumes (O-PTVs), dose control rings, and avoidance structures.
- Auto Beam Module, which creates treatment plans using predefined beam configurations, with optional user adjustments to gantry angles, collimator angles, field shaping, DRRs, and setup beams;
- Auto Optimization Module, which generates optimization objectives using RapidPlan models combined with user-defined constraints and performs full optimization and dose calculation within Eclipse.
- Validation was conducted using an anonymized dataset of 10 APBI patient cases in a non-clinical environment. Evaluation focused on workflow efficiency, plan consistency, and reliability of automated processes.

## RESULTS

- **Figures 1 and 2** illustrate the graphical user interfaces (GUIs) of the modules. All components functioned without errors.

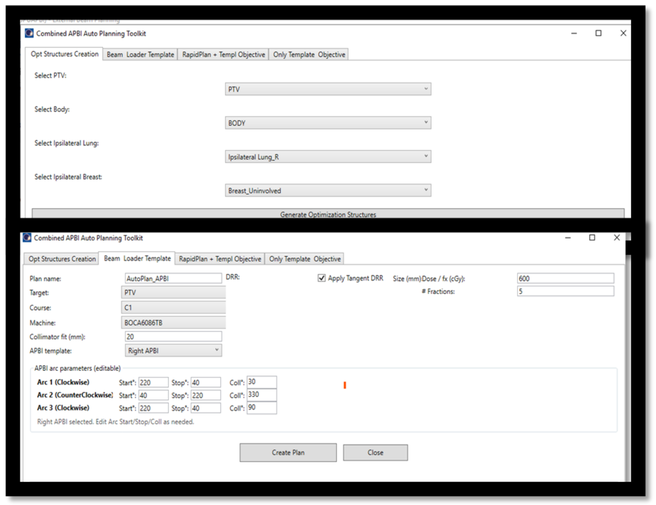


Figure 1: The graphical user interfaces (GUIs) of the Auto Optimization Structure Module and Auto Beam Module, demonstrating automated generation of optimization structures and beam configuration for treatment planning.


Figure 2: The graphical user interface (GUI) of the Auto Optimization Module, highlighting RapidPlan-based DVH estimation, structure matching, and automated generation of optimization objectives for plan preparation and dose calculation..

## CONCLUSION

- The auto-planning module improves efficiency, consistency, and standardization in APBI planning with minimal manual intervention and shows strong potential for clinical implementation and extension to other treatment sites

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