JULY 12–16
2020 VIRTUAL
JOINT AAPM | COMP MEETING
EASTERN TIME [GMT-4]

An Update of Virtual LINAC for External Beam Radiation Therapy Treatment Planning

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INNOVATION/IMPACT

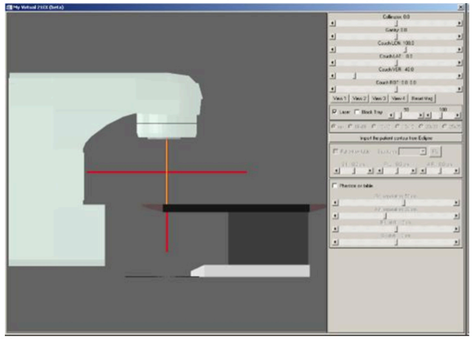
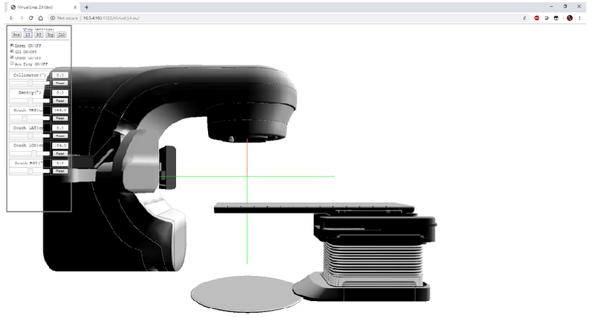
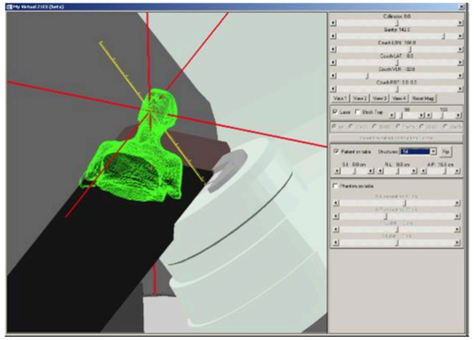
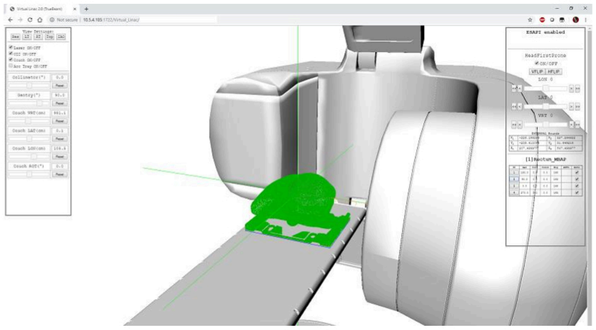
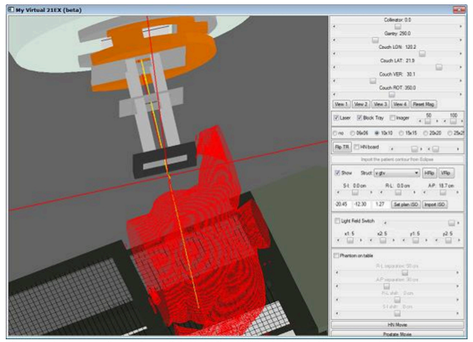
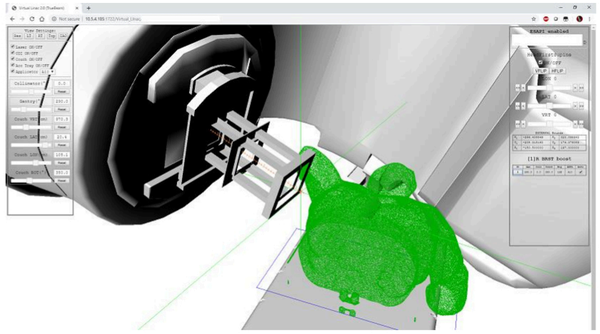
The rendering engine in this updated version was built with WebGL and JavaScript. It could run on any web browsers and no additional software or runtime environment installation was needed. Users launched it directly from Varian Eclipse through ESAPI. Therefore, no DICOM export/import was required. Auto patient positioning and treatment field quick set buttons were implemented to allow users easily navigating through specific treatment plan configuration and determine the possibility of collision. These new features encouraged users to perform virtual dry run more often to reduce the chance of invalid plans due to collisions.

PURPOSE

To improve the utilization of Virtual LINAC for treatment plan dry run and collision check, an updated version of Virtual LINAC has been implemented and it can be launched through Eclipse Scripting API (ESAPI). Eclipse users can easily check treatment plans without exporting or importing DICOM files.

METHOD

Varian TrueBeam™ 3D model was added. WebGL was used for developing the rendering engine in this update instead of IDLTM compared to the previous version of Virtual LINAC. All 3D objects could be rendered in common web browsers, such as Microsoft IE or Google Chrome. The application could be launched from either Eclipse thick client or Citrix environment, and here was no additional software installation required. The structure set (external) and treatment plan parameters were retrieved and communicated directly through Eclipse Scripting API. The patient position relative to the couch was automatically determined by the external structure boundaries and couch structures. It could be adjusted interactively through the user interface as well.

2010 Virtual Linac	Key Changes	2019 Virtual Linac 2.0
	• Development Platform Changed from IDL to JavaScript/WebGL • No installation required	
	• Contour transferring workflow changed from DICOM export/import to ESAPI. • One click to launch application	
	• Patient positioning changed from manual alignment to automatic setup and easy field navigation • One click to perform collision check	

RESULTS

The functionalities and user navigating abilities were retained from its previous version. The machine components including the gantry, collimator, couch, and accessory selection could be adjusted interactively and the patient external could be rendered as part the 3D virtual environment. Treatment field quick set buttons were added and users were allowed to switch between fields and isocenters quickly to examine the possibility of collisions. The application could be invoked by 1-click ESAPI execution and this had significantly increased the utilization. Compare to the previous version, the utilization had significantly increased from 2-5 plans checked every month to over one hundred executions in a single month (124 in January 2020).

CONCLUSIONS

Web-based platform implementation and seamless integration with ESAPI successfully improved the utilization of this Virtual LINAC software. The convenience of this updated version encouraged users to perform collision check more often. This application was naturally adapted as a planning and pre-treatment QA tool.

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