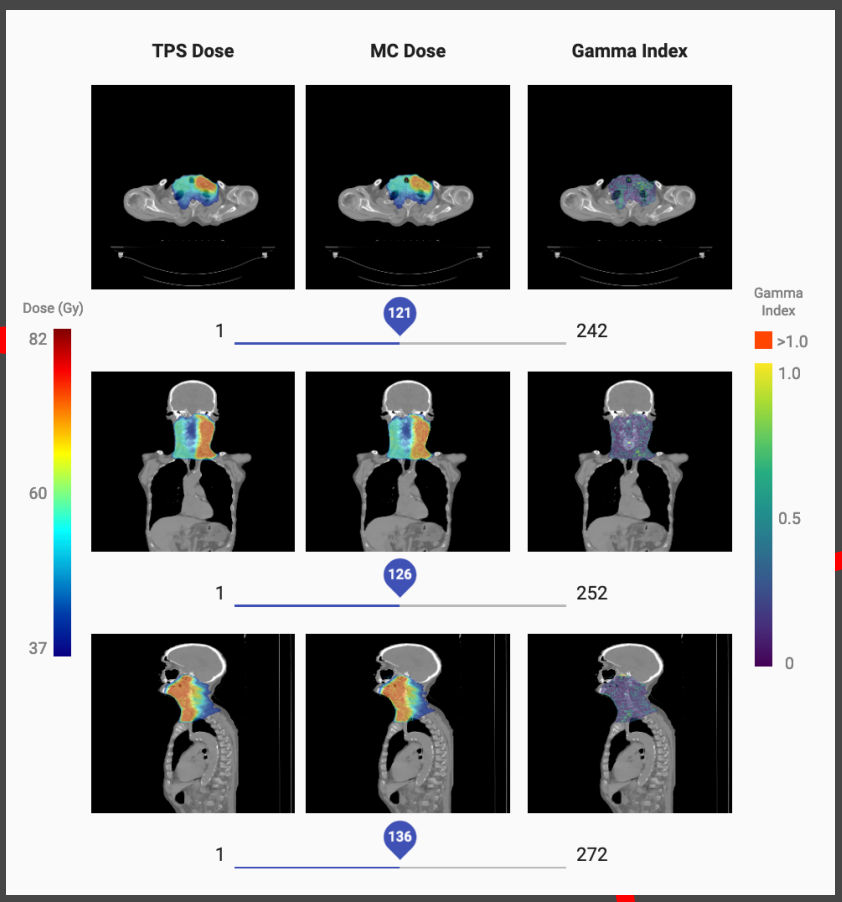
INTDose

FAST AND ACCURATE INDEPENDENT DOSE VERIFICATION



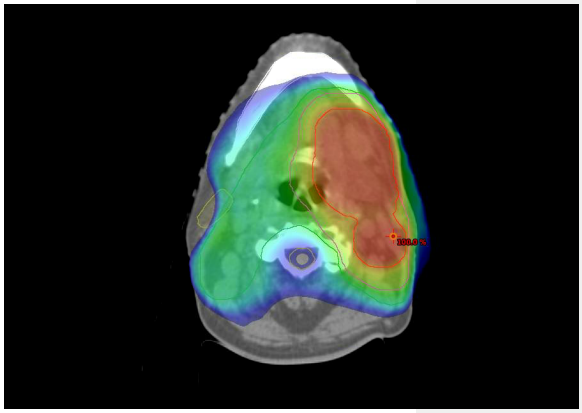
CARINA

Monte Carlo Based Independent Dose Verification

INTDose is a Monte Carlo based tool for independent dose verification in radiotherapy. Monte Carlo simulation is regarded as the gold standard for estimating the amount of energy deposited into a medium by ionizing radiation. INTDose uses in-house developed virtual source models to describe the radiation fields at respective machines' treatment heads, accompanied with parallel computation to achieve fast and accurate simulation results.

INTDose's advanced Monte Carlo 3D dose verification algorithms deliver accurate results within minutes* and support multiple treatment delivery machines, including:

- TomoTherapy®
- Conventional Linacs from Varian®
- Varian® Halcyon™.



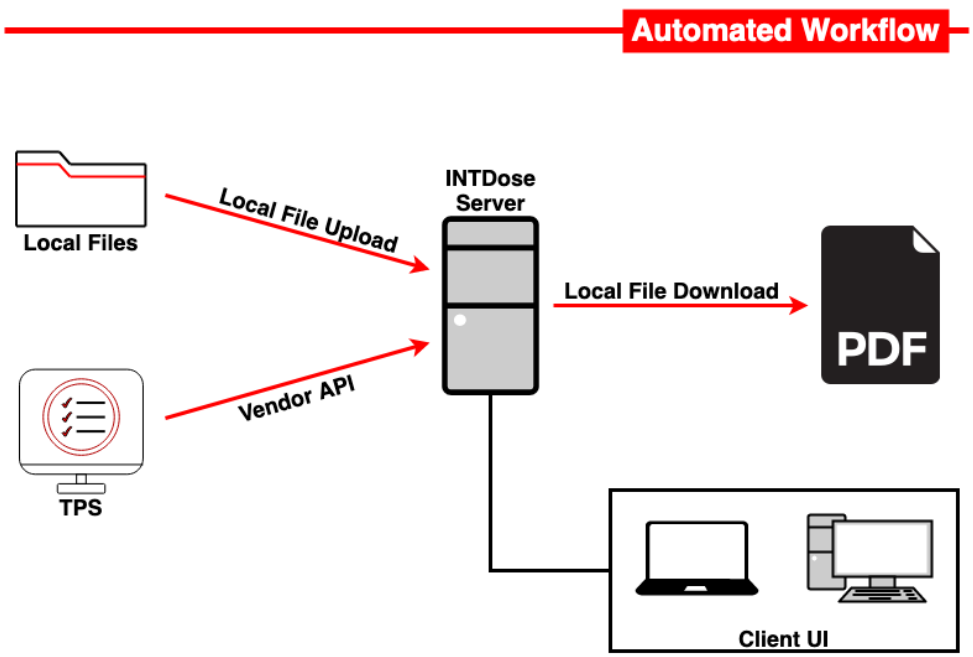
**INTDose Monte Carlo calculations usually complete in less than 5 minutes, and can vary depending on several hardware factors.*

Automated Workflow

INTDose is designed to integrate seamlessly with all your clinical workflows and includes multiple avenues for workflow incorporation. INTDose is installed locally on a workstation and is run as a web service, which can be accessed by any clients within the network. All data and communications are limited to within the local network

INTDose can be accessed using the web-based interface and DICOM tools (DICOM push or direct upload from disk). Additionally, INTDose can be called using Varian APIs.

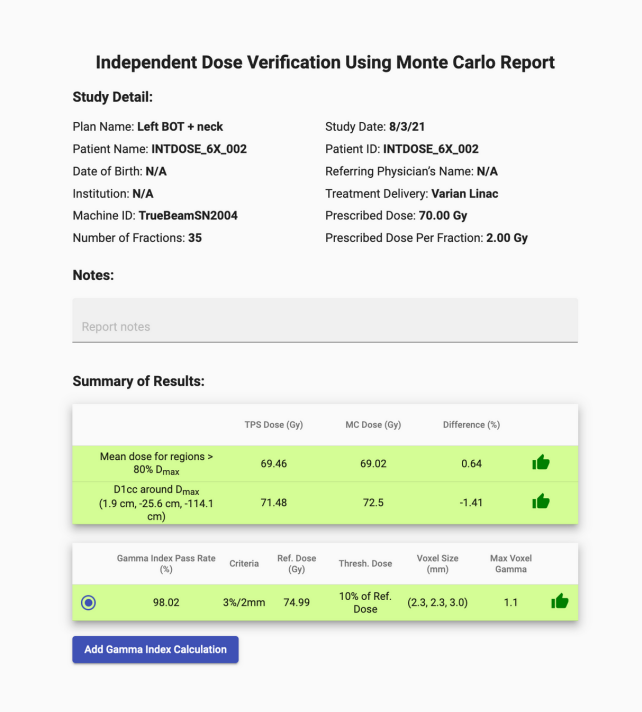
INTDose also provides functionality to perform independent dose verification automatically as new studies are added. The automatic task execution workflow is configured to check continuously for new studies at a user-specified time interval. Once a new study is found, the workflow automatically runs an independent dose verification and generates a PDF report.



Simulation Reports

Reports include:

- Mean dose comparisons
  - Global
  - Organ at risk stratified
- Gamma index analyses
- 1D and 2D dose profiles
- DVH analyses



Independent Dose Verification Using Monte Carlo Report

Study Detail:

Plan Name: **Left BOT + neck**
Patient Name: **INTDOSE_6X_002**
Date of Birth: **N/A**
Institution: **N/A**
Machine ID: **TrueBeamSN2004**
Number of Fractions: **35**

Study Date: **8/3/21**
Patient ID: **INTDOSE_6X_002**
Referring Physician's Name: **N/A**
Treatment Delivery: **Varian Linac**
Prescribed Dose: **70.00 Gy**
Prescribed Dose Per Fraction: **2.00 Gy**

Notes:

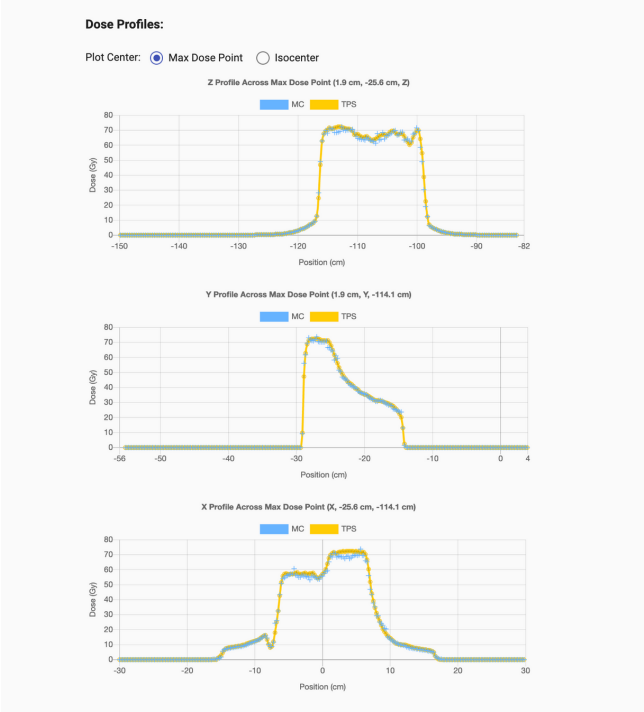
Report notes

Summary of Results:

	TPS Dose (Gy)	MC Dose (Gy)	Difference (%)
Mean dose for regions > 80% D_{max}	69.46	69.02	0.64
D1cc around D_{max} (1.9 cm, -25.6 cm, -114.1 cm)	71.48	72.5	-1.41

	Gamma Index Pass Rate (%)	Criteria	Ref. Dose (Gy)	Thresh. Dose	Voxel Size (mm)	Max Voxel Gamma
	98.02	3%/2mm	74.99	10% of Ref. Dose	(2.3, 2.3, 3.0)	1.1

Add Gamma Index Calculation



Dose Profiles:

Plot Center: Max Dose Point / Isocenter

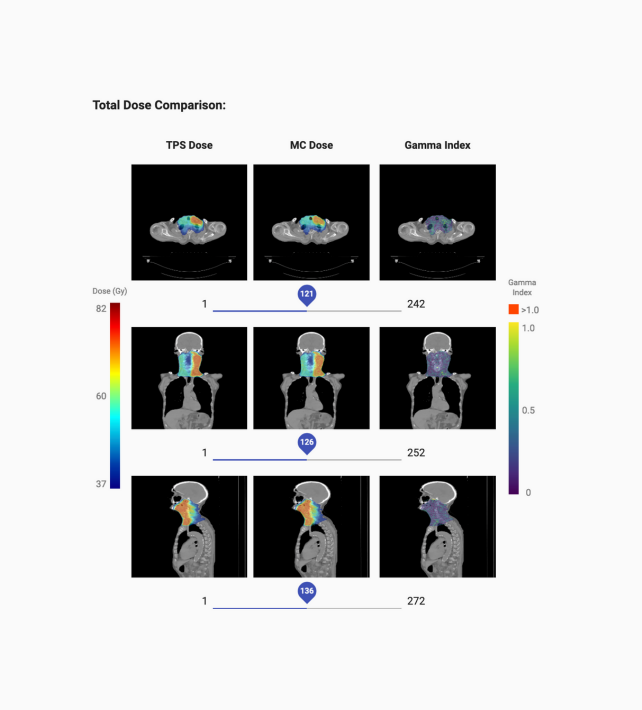
Z Profile Across Max Dose Point (1.9 cm, -25.6 cm, Z)

Y Profile Across Max Dose Point (1.9 cm, Y, -114.1 cm)

X Profile Across Max Dose Point (X, -25.6 cm, -114.1 cm)

MC TPS

Dose (Gy) Position (cm)



Total Dose Comparison:

TPS Dose MC Dose Gamma Index

Dose (Gy) 82 60 37

Gamma Index >1.0 1.0 0.5 0

1 121 242

1 126 252

1 136 272

Dose Volume Histograms:

TPS MC

Relative Volume Percentage [%] Dose (Gy)

Deselect All, GTV, CTV 1, PTV 1, CT ISO, CTV 2, PTV 2, Lung Left, Lung Right, Cord, Eye Right, Eye Left, Lens Right, Lens Left, Brainstem, Cochlea Right

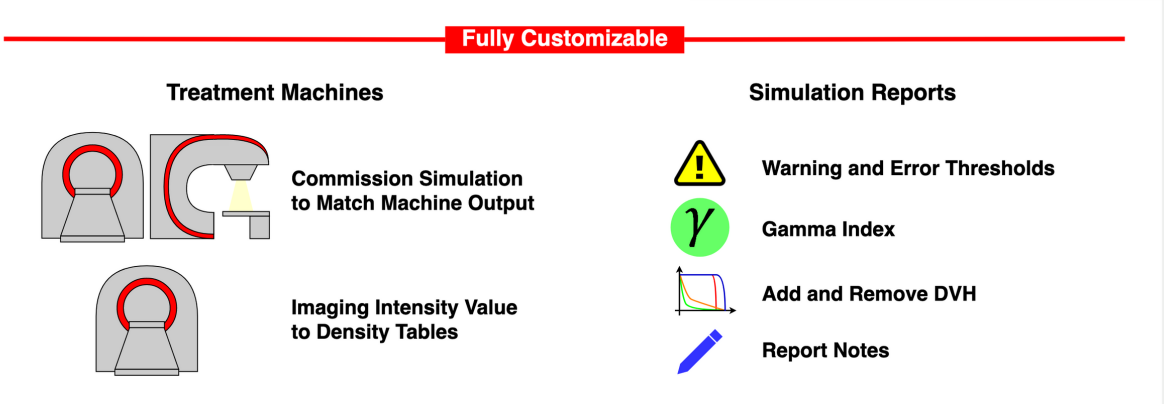
ROI Table:

ROI	Mean TPS Dose (Gy)	Mean MC Dose (Gy)	Difference (%)	Gamma Index Pass Rate (%)
GTV	71.83	71.67	0.22	100.00
CTV 1	71.94	71.21	1.02	99.74
PTV 1	71.67	71.06	0.86	99.67
CT ISO	0.00	0.00	N/A	0.00
CTV 2	58.08	57.82	0.44	100.00
PTV 2	57.88	57.76	0.21	99.99
Lung Left	1.64	1.64	0.04	100.00

Easily Adjustable

Tunable Algorithms

The Monte Carlo algorithm can be commissioned for each treatment machine to ensure that simulation output matches machine output. Treatment machines can be further modified to include custom settings, including jaw settings and latency curves for TomoTherapy® or multileaf collimator settings for linacs. Each treatment machine will have an accompanying, customizable intensity value to density table to ensure accurate conversion from Hounsfield units to densities that will be used in simulations.



Interactive Reports

Dynamic reports generated for each case can be customized to focus on relevant information and analyses. Warning and error tolerances can be set to help draw attention to deviations between Monte Carlo and TPS doses. Gamma index analyses can be customized on the fly to help identify regions with significant deviations. Structures can be added or removed from DVH plots to help focus on the most revelant targets and organs at risk.

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