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Reproducibility of plan specific dosimetric quality assurance procedures of patients treated with a Helical TomoTherapy system

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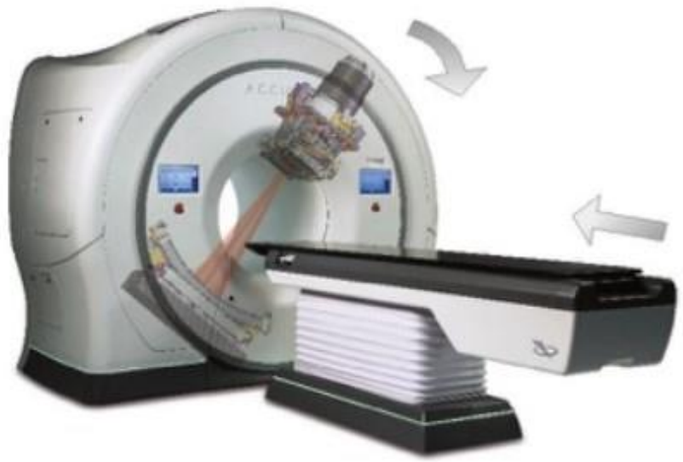
1. Background-Aim

Background

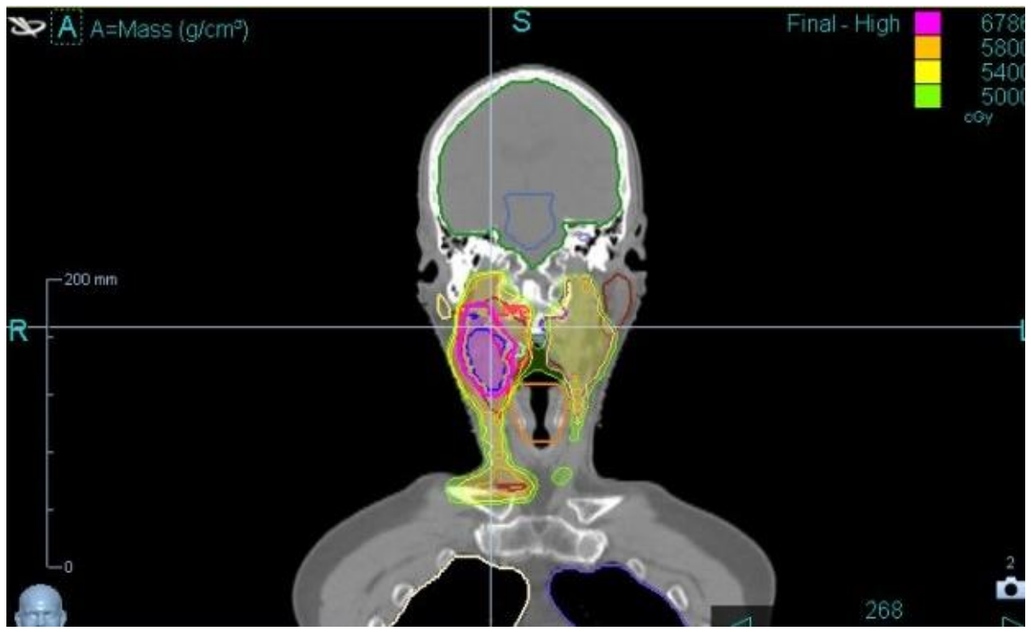
1. IMRT treatments are commonly used
2. IMRT Patient plan Dose-Quality-Assurance is mandatory
3. Patient DQA commonly performed prior to treatment
4. Assumption: Reproducible machine properties throughout treatment schedule
5. Common IMRT treatments: 20-35 fractions (4-7wks)



Aim

Assessment of the reproducibility of plan QA results over the treatment course of patients undergoing IMRT treatment with a helical TomoTherapy HDA system (Accuray Inc., CA, USA)

2. Materials & Methods



Treatment plans tested	
IMRT system platform	TomoTherapy HDA
Anatomical sites	Prostate, Head & Neck
# Patients	10
# Plan QA tests	39
# structures evaluated	20
Distribution of performed tests	Throughout treatment duration

2. Materials & Methods

Processing tool: Delivery Analysis Software (Accuray Inc.)

- Uses the photon fluence incident to the onboard detectors
  a) without patient (for plan-QA purposes)
  b) with patient (for treatment delivery monitoring purposes)
- Recalculates the dose distribution based on the daily measured photon fluence (Dose delivery QA)
- γ-index analysis

Structures evaluated	
Prostate	**Head and Neck**
SIB Prostate	SIB
SIB Ln	SIB LN
PTV Prostate	PTV High
PTV Med	PTV Med
PTV Ln	PTV Ln
Rectum	Spinal canal
Anal Canal	Esophagus
Bladder	Parotid L
Bowel Bag	Parotid R
External	External

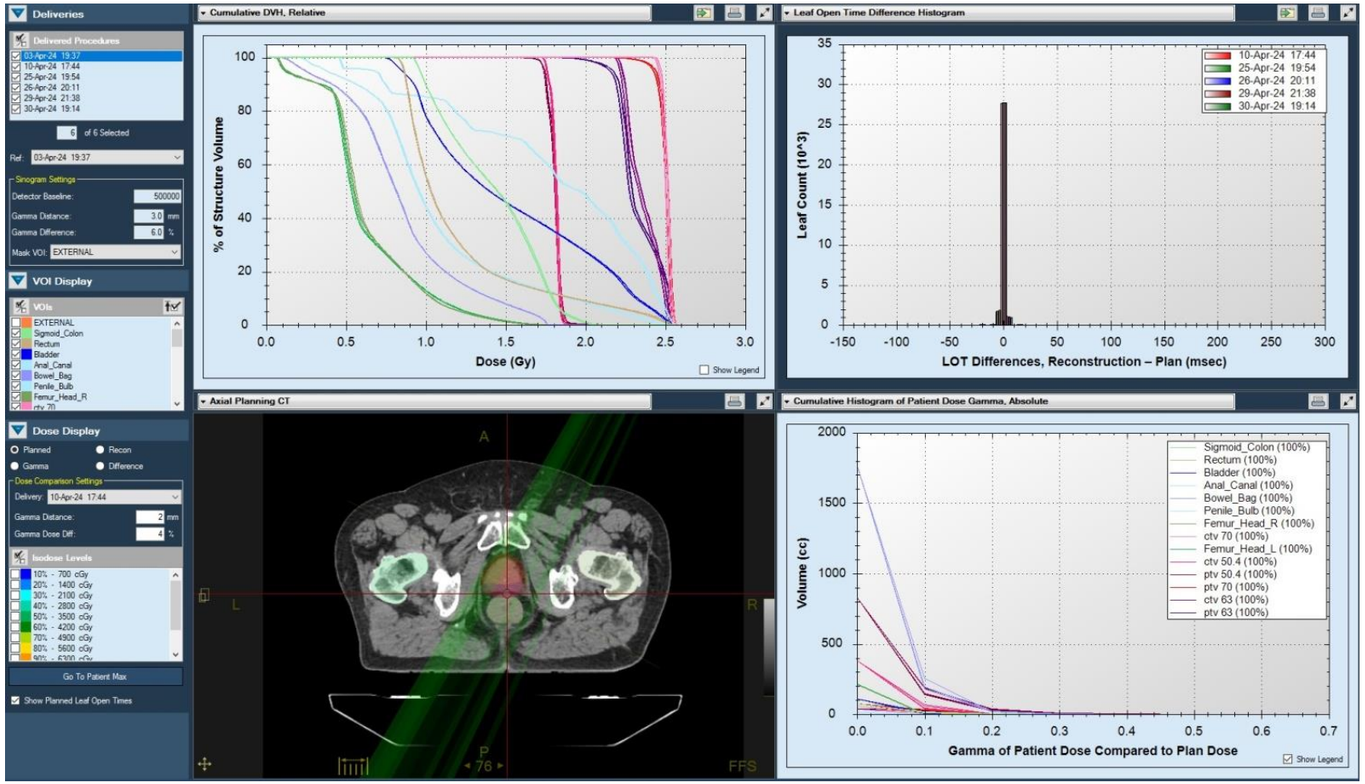
2. Materials & Methods

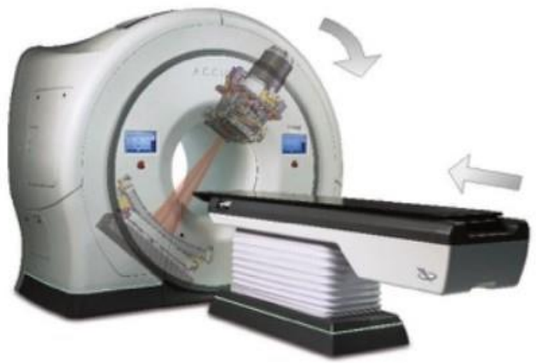
Comparison tools:

1. γ-index (global, per individual structure)
2. Criteria: Distance-To-Agreement (DTA) and Dose Difference (DD) criteria 2mm/3%

Tolerance limits (AAPM TG-218):

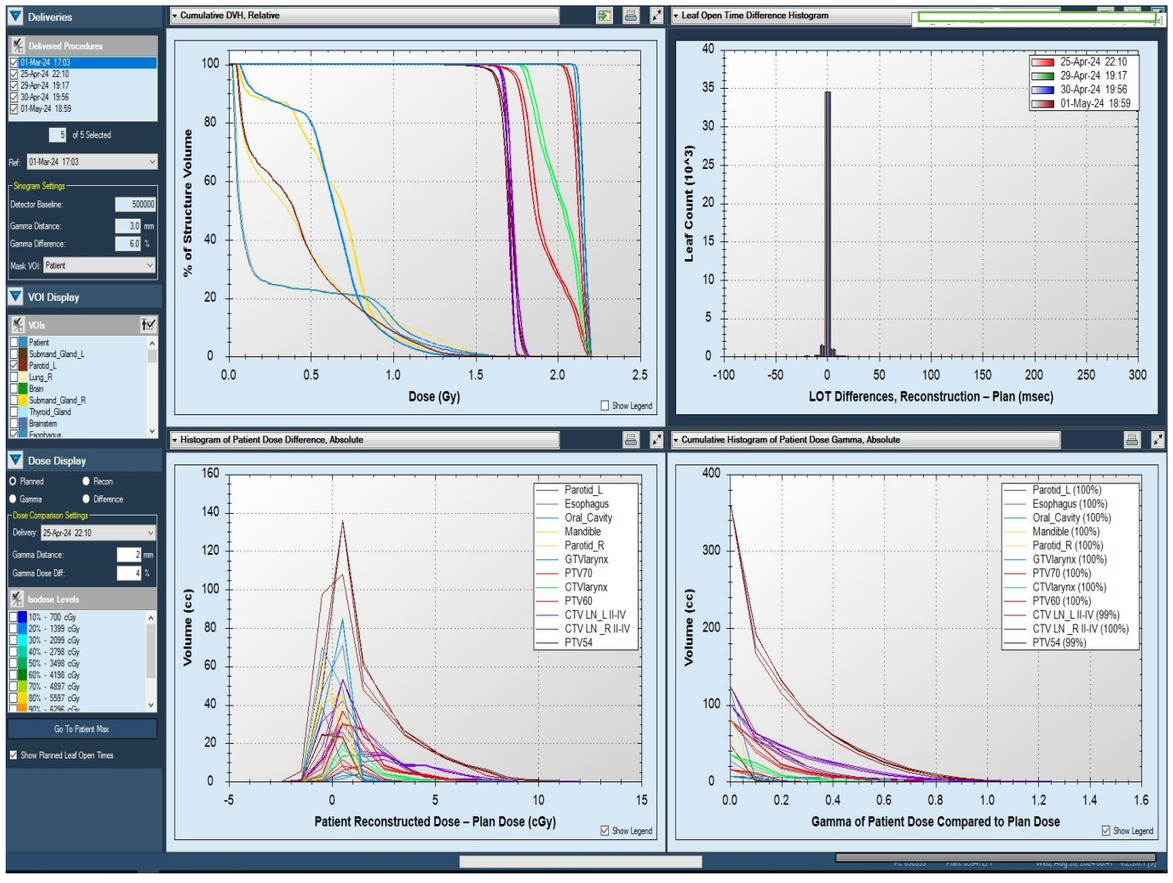
- γ passing rate >95% (global volume)
- Dose difference:10% (global volume)

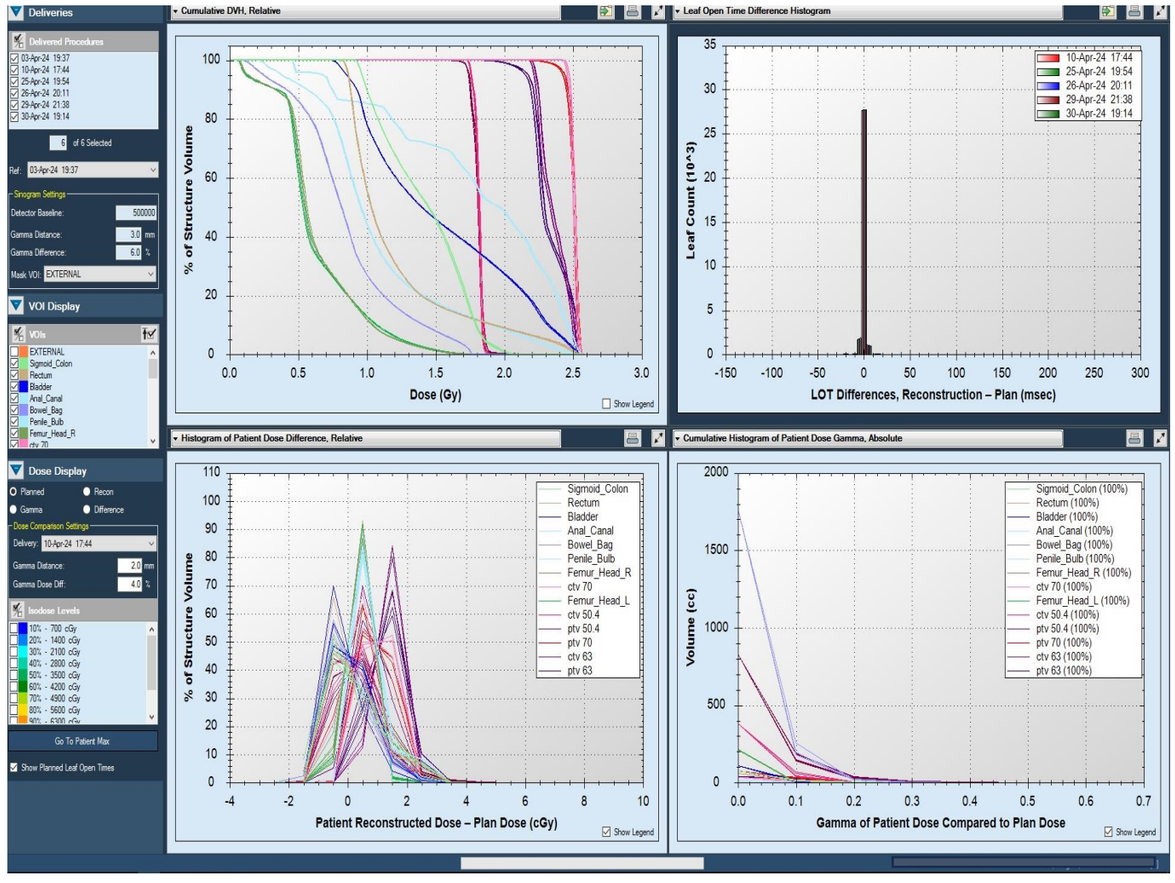




3. Results

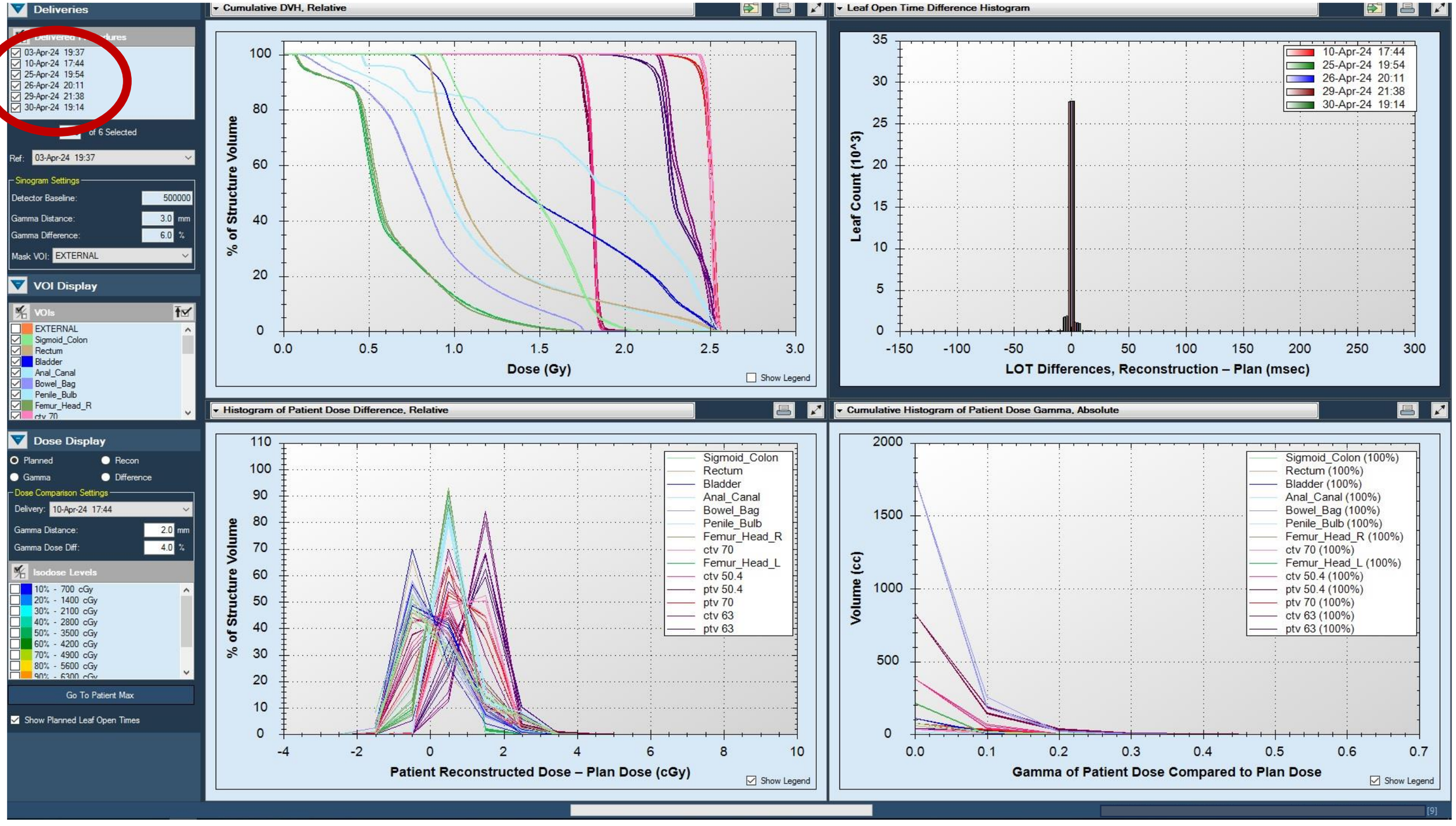
1. γ-passing rates: global distribution>98%, individual structures >95%
2. γ-variation within treatment course <1%
3. Dose difference <2% in all cases





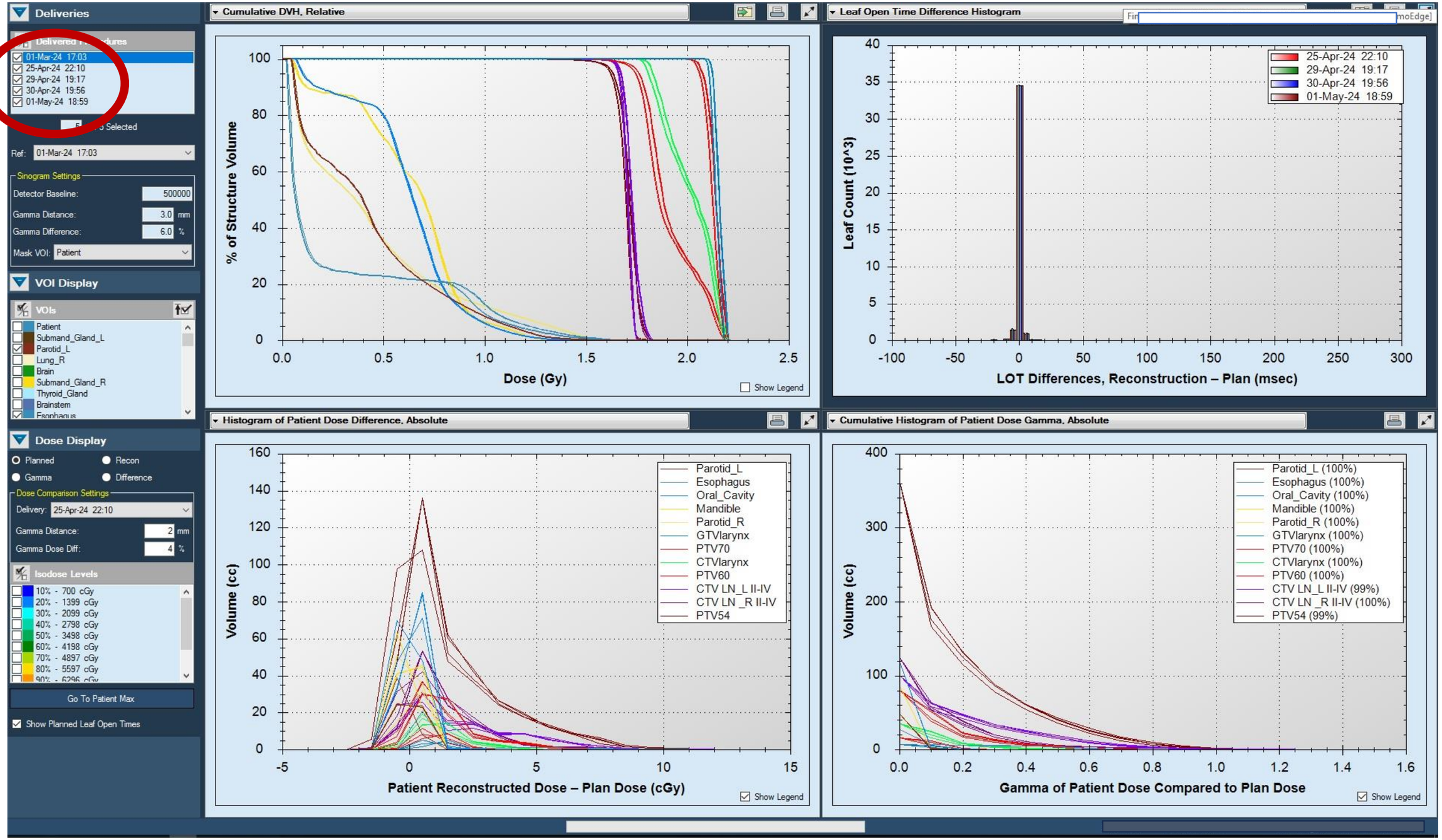
3. Results

Prostate patient specific plan QA tests performed throughout treatment course



3. Results

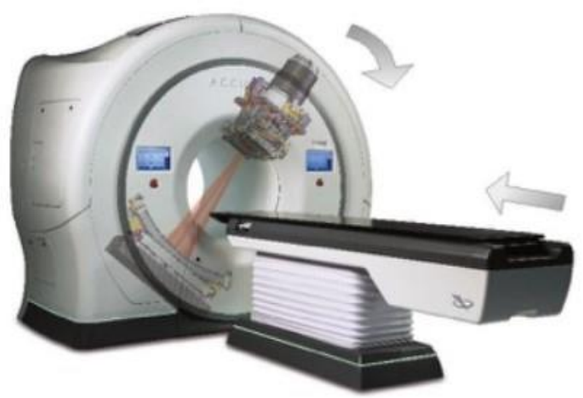
Head & Neck: patient specific plan QA tests performed throughout treatment course



4. Conclusions

1. IMRT + SIBs increases plans complexity
   - Delivery of highly modulated beam fluences
2. TomoTherapy is equipped with onboard imaging (Xe-based detector)
3. TomoTherapy onboard trend machine QA and treatment delivery monitoring tool
4. Onboard exit fluence measurements are crucial for treatment delivery and QA purposes
5. **Strict machine and patient plan QA procedures ensures reproducible plan dose distribution**

ΙΑΤΡΟΠΟΛΙΣ
ΟΜΙΛΟΣ ΙΑΤΡΙΚΩΝ ΕΤΑΙΡΙΩΝ



5. References

1. Tolerance Limits and Methodologies for IMRT Measurement-Based Verification QA: Recommendations of AAPM Task Group No.218 (2018)
2. Delivery Analysis Software (Accuray Inc.), Manual Guide

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