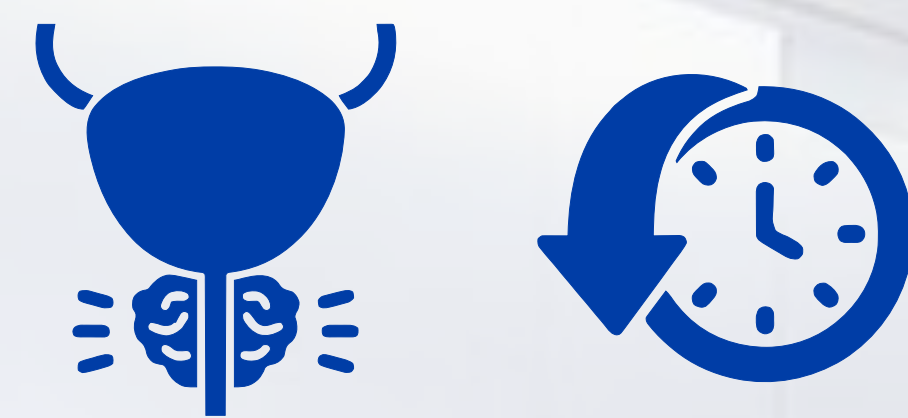


Faster Treatments without Compromise: VMAT vs IMRT on the 1.5T MR-Linac

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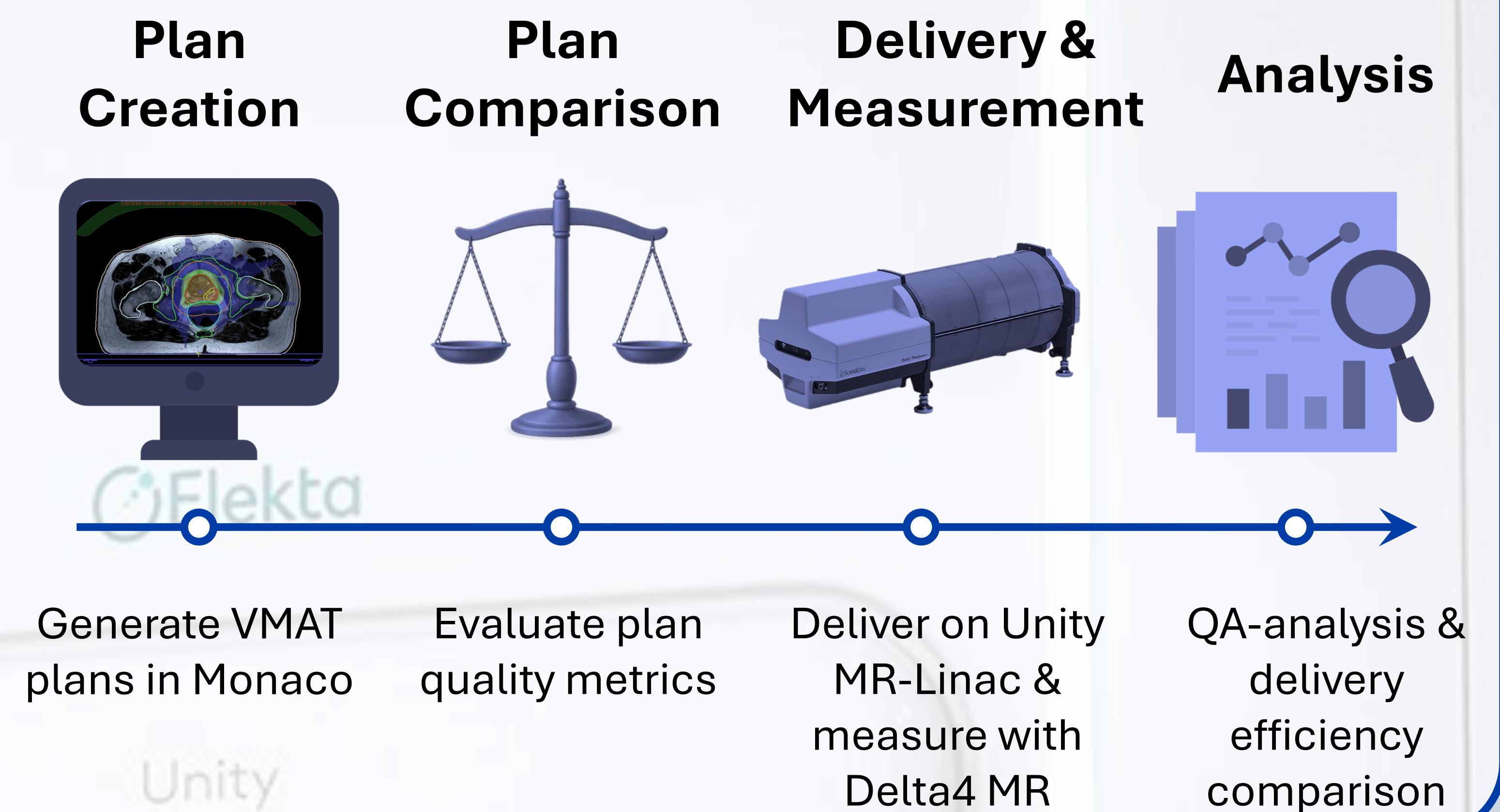
1 Introduction



- MR-Linac treatments currently use **IMRT**, which can be time-consuming
- VMAT** has the potential to improve **delivery efficiency** and **reduce treatment time**
- Clinical implementation of **VMAT on MR-Linac** is not yet established
- Need to verify **plan quality** and **deliverability**
- This study compares **VMAT** with clinical **IMRT** for **prostate SBRT**

2 Methods

- 10 patients, **5 x 7.25 Gy prostate SBRT**
- Monaco Version 6.29.0.0 for VMAT planning
- Delivered on the **1.5 T Unity MR-Linac** (Elekta)
- Measured with the **Delta4 MR phantom** (Scandidos)
- QA: global gamma score (3%/3mm)
- Delivery efficiency = % of maximum dose rate



3 Results

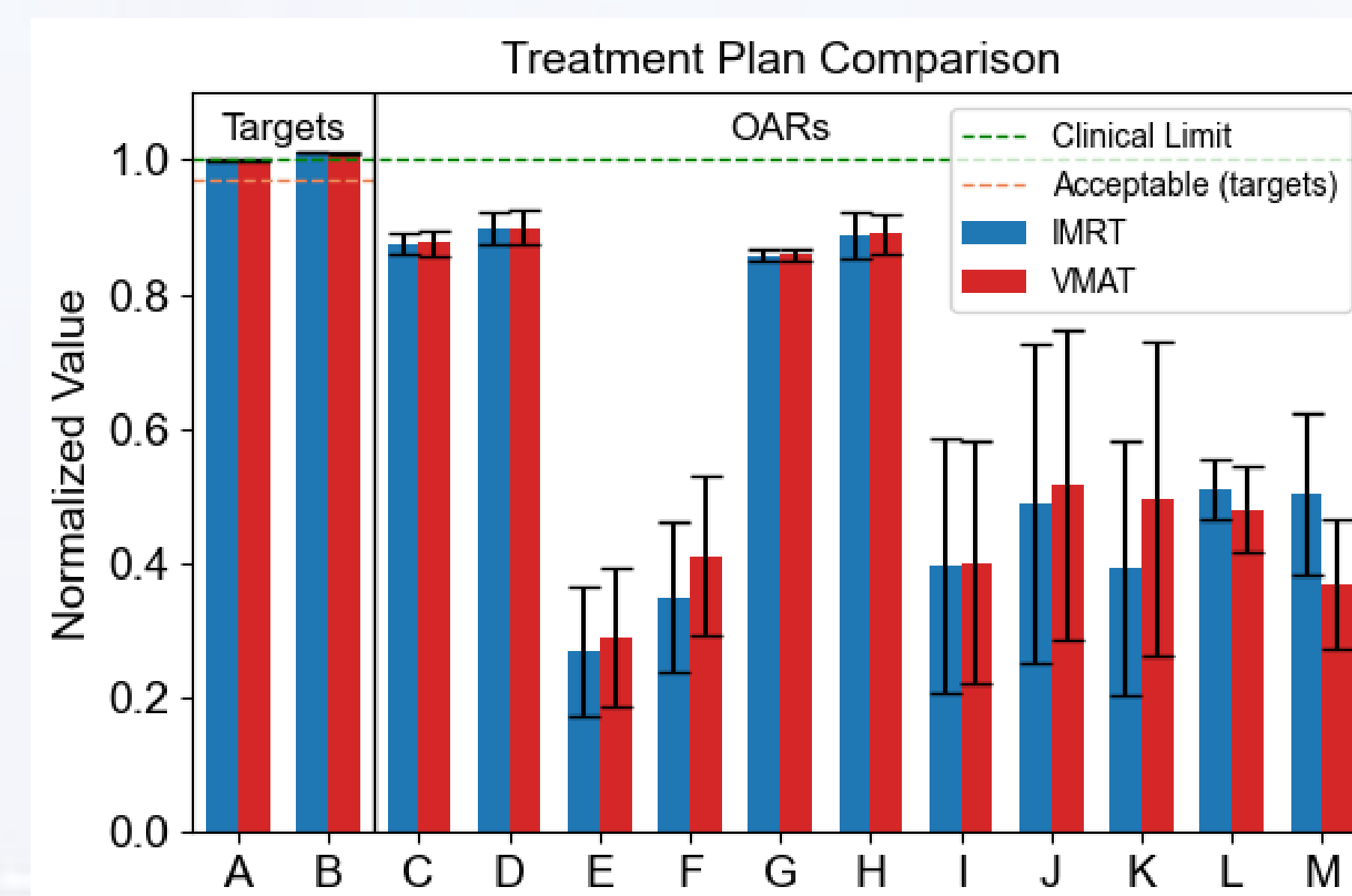
Dose Constraint

Target Coverage

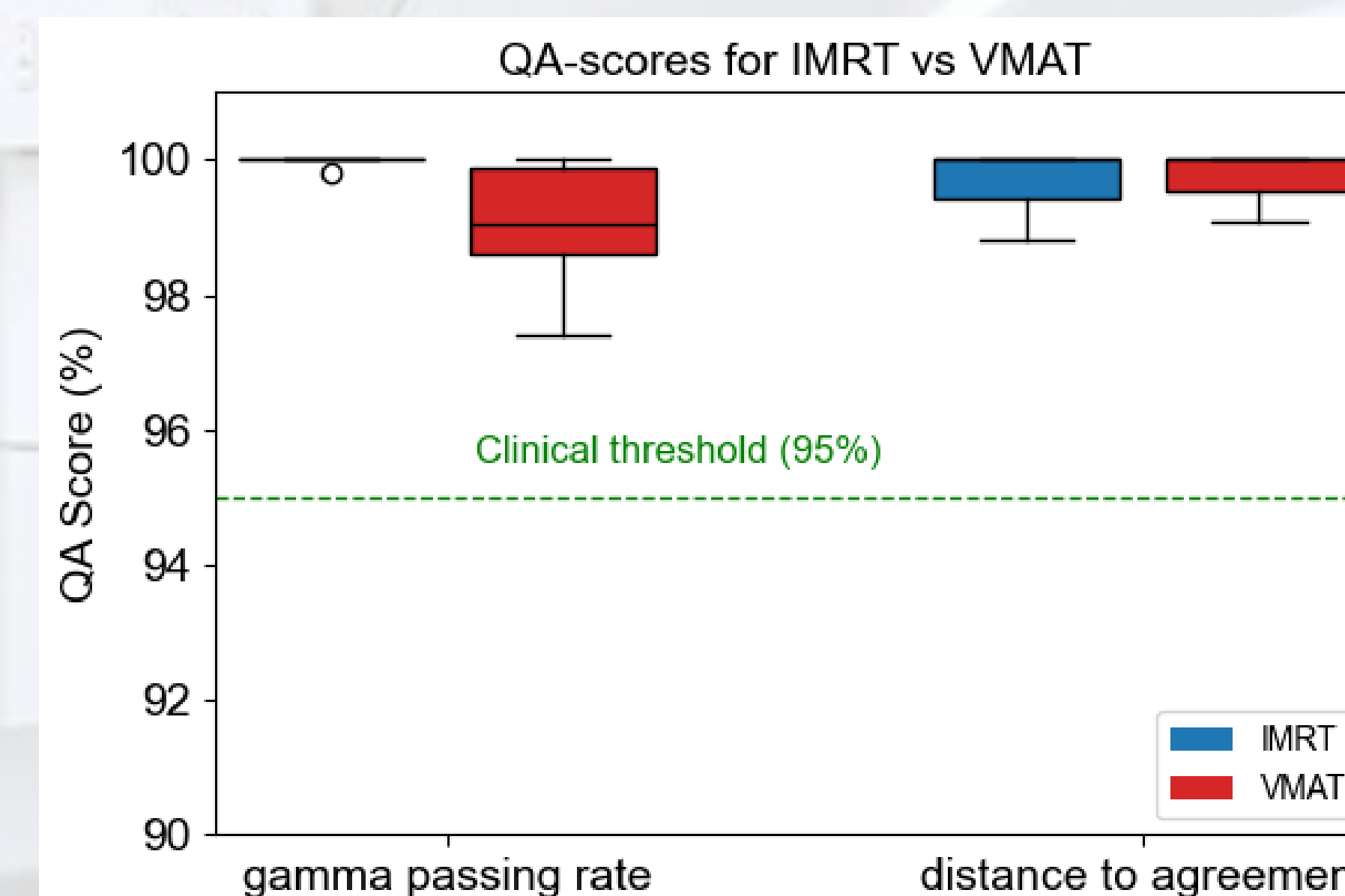
A	PTV_3625	V34.44Gy > 99% (-3%)
B	CTV_3625	V34.44Gy > 99% (-0.1%)

OAR Constraints

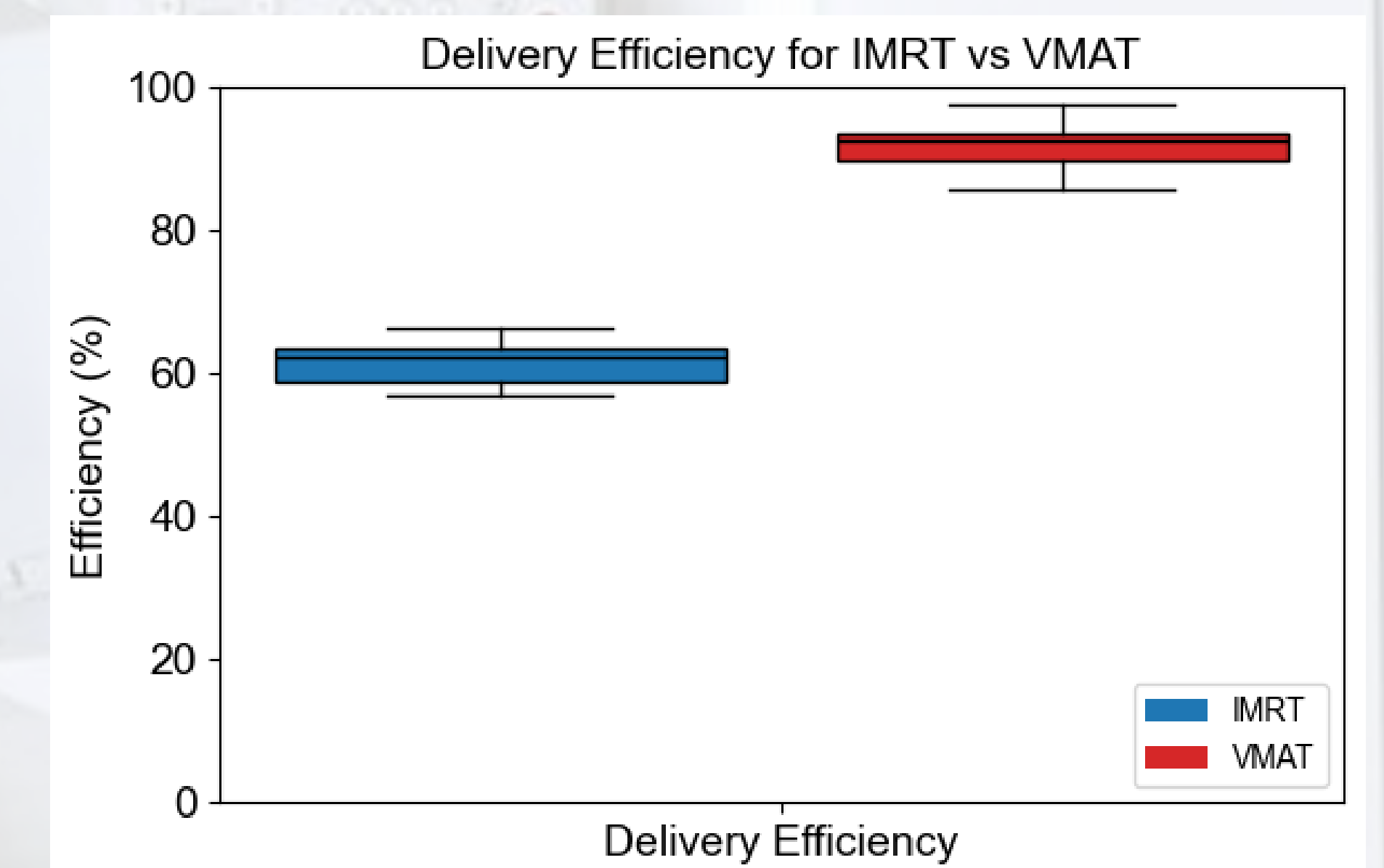
C	Rectum - CTV	D0.5cc < 40Gy
D		D1cc < 38 Gy
E		V32Gy ≤ 10%
F		V28Gy ≤ 15%
G	Bladder - CTV	D0.5cc < 42Gy
H		D5cc < 37 Gy
I		V32Gy ≤ 10%
J		V28Gy ≤ 15%
K	Sphincter - CTV	Dmean < 20Gy
L	Femur Left	D10cc < 30Gy
M	Femur Right	D10cc < 30Gy



All target coverage metrics are within clinically acceptable ranges. All OAR metrics within clinical limits. VMAT vs IMRT differences were small.



Mean gamma passing rate: IMRT 99.9% vs VMAT 99.1%. DTA identical at 99.7%.



VMAT significantly higher efficiency ($p < 0.002$): 92.0% vs 61.5%.

4 Conclusion



VMAT plans achieved a substantially higher delivery efficiency compared to the IMRT plans while maintaining comparable target coverage and OAR sparing, with all plans meeting clinical QA criteria.

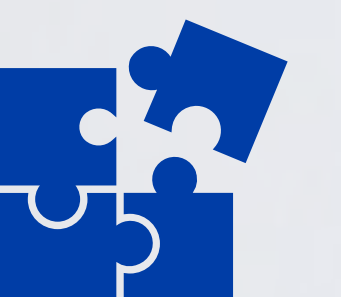


VMAT reduced average treatment times from 6.5 min to 4 min per fraction, resulting in a statistical significant improvement of 38.4% ($p < 0.002$).



The results indicate that VMAT can significantly improve treatment times without compromising plan quality for prostate SBRT.

5 Impact



- Demonstrates the feasibility of VMAT planning and delivery on the MR-Linac using Monaco
- Maintains clinically acceptable target coverage and OAR sparing
- Improves delivery efficiency compared to IMRT
- Reduces treatment times
- Enhances patient comfort and clinical throughput