CT, HIT / Case Study

AI-POWERED TAVR ASSIST+ ENHANCES TAVR PLANNING EFFICIENCY

"Our experience with Vitrea TAVR Assist+ demonstrated a substantial reduction in user interaction time while maintaining excellent consistency of key measurements required for TAVR planning. By automating valve plane positioning and aortic root measurements, TAVR Assist+ simplified our workflow for both cardiology and radiology users and reduced the amount of manual interaction required during pre-procedural planning.

Combined with high-quality cardiac CT datasets acquired on Aquilion ONE / INSIGHT Edition and reconstructed using PIQE Cardiac and CLEAR Motion Cardiac, Vitrea TAVR Assist+ provided reliable and reproducible results that have the potential to improve workflow efficiency in daily clinical practice."





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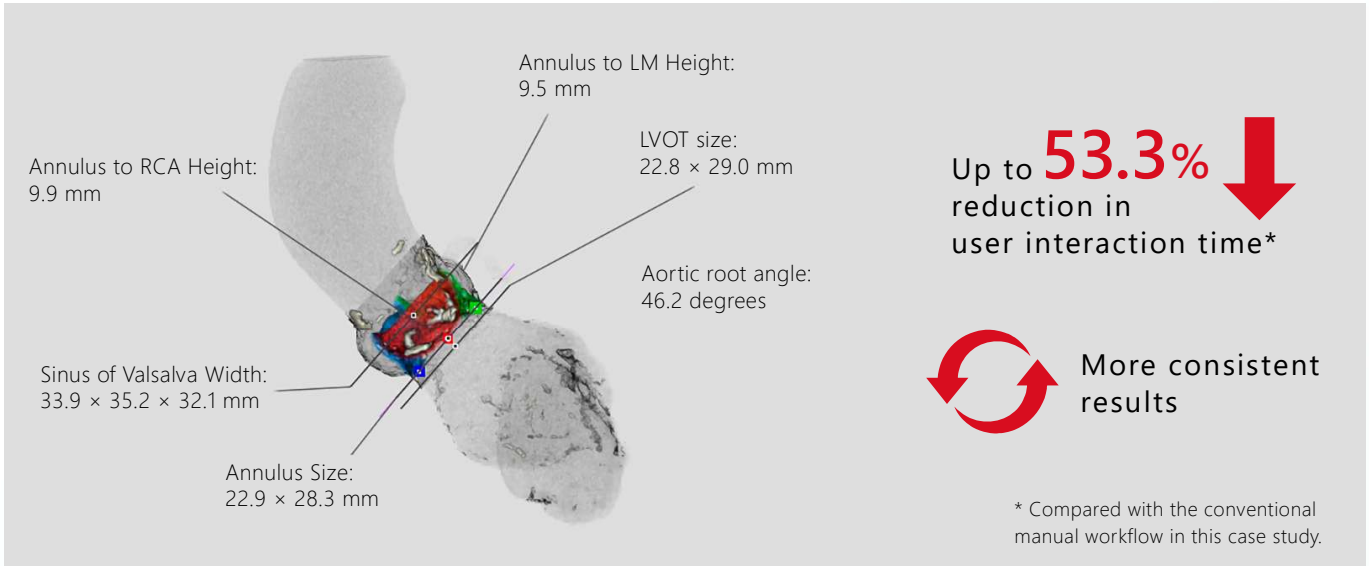


Figure 1. TAVR Assist+ automatically initializes the valve plane and key aortic measurements without the need for user interaction, helping streamline workflow and reduce planning time.

Introduction

The University Hospitals of Strasbourg (Hôpitaux Universitaires de Strasbourg) is one of France's leading academic medical centers and a major tertiary referral center for complex cardiovascular care in northeastern France, where structural heart interventions, including Transcatheter Aortic Valve Replacement (TAVR), are routinely performed.

Accurate CT-based TAVR planning has become a critical component of the pre-procedural assessment of patients with severe aortic valve disease. Appropriate valve sizing and procedural planning rely on precise evaluation of the aortic root anatomy to help optimize patient outcomes and minimize procedural complications.

Several anatomical measurements must be performed accurately, including annular dimensions, coronary ostial heights, sinus of Valsalva dimensions, and left ventricular outflow tract (LVOT) measurements. Traditionally, these measurements require multiple manual or semi-automated workflow steps that can be time-consuming and operator-dependent. As TAVR procedure volumes continue to increase, there is growing interest in improving workflow efficiency, reducing manual workload, and promoting greater consistency between readers with different levels of experience.

Successful TAVR planning also relies on high-quality cardiac CT datasets with excellent spatial resolution and minimal motion artifacts. Aquilion ONE / INSIGHT Edition combines one-beat cardiac acquisition with advanced AI reconstruction technologies, including Precise IQ Engine (PIQE) Cardiac 1024 Matrix reconstruction for improved spatial resolution and CLEAR Motion Cardiac deep learning-based motion correction to improve visualization of the aortic valve, coronary arteries, and surrounding cardiac structures.

Vitrea TAVR Assist+ was developed to help further streamline the planning workflow through AI-powered automatic anatomical detection and measurement generation. This evaluation was conducted to assess the potential of TAVR Assist+ to improve workflow efficiency while maintaining consistency of key anatomical measurements compared with a conventional manual TAVR planning workflow.

Materials and Methods

Canon aimed to assess the workflow efficiency and accuracy of TAVR Assist+ compared to conventional manual TAVR planning workflow. A total of 20 cases were included in the evaluation. All scans were acquired on an Aquilion ONE / INSIGHT Edition using a one beat acquisition of the entire heartbeat. Images were reconstructed at systolic phase (40%) with PIQE Cardiac 1024 matrix (DLR) and CLEAR Motion Cardiac (DLR based whole heart motion correction).

Two experienced cardiovascular imaging specialists, with 16 and 12 years experience, performed the evaluation. The following measurements were recorded: Annulus size, Sinus of Valsalva width, left ventricular outflow tract (LVOT) size, annulus to left main coronary height (LM height) and annulus to right coronary artery height (RCA height). The cases were reviewed in a randomized order and the evaluations were performed 7 days apart between each workflow. The amount of correction needed when using TAVR Assist+ was also recorded: none, minor (<30 s adjustment) and major (>30 s adjustment).

To evaluate workflow efficiency, the time required to complete each analysis was recorded and compared between the two approaches. For TAVR Assist+, timing focused on the user review and validation phase after the automated results had been generated, while the manual workflow included the complete manual planning process. This approach was chosen to reflect the actual user interaction required by each method in routine clinical practice.

Results

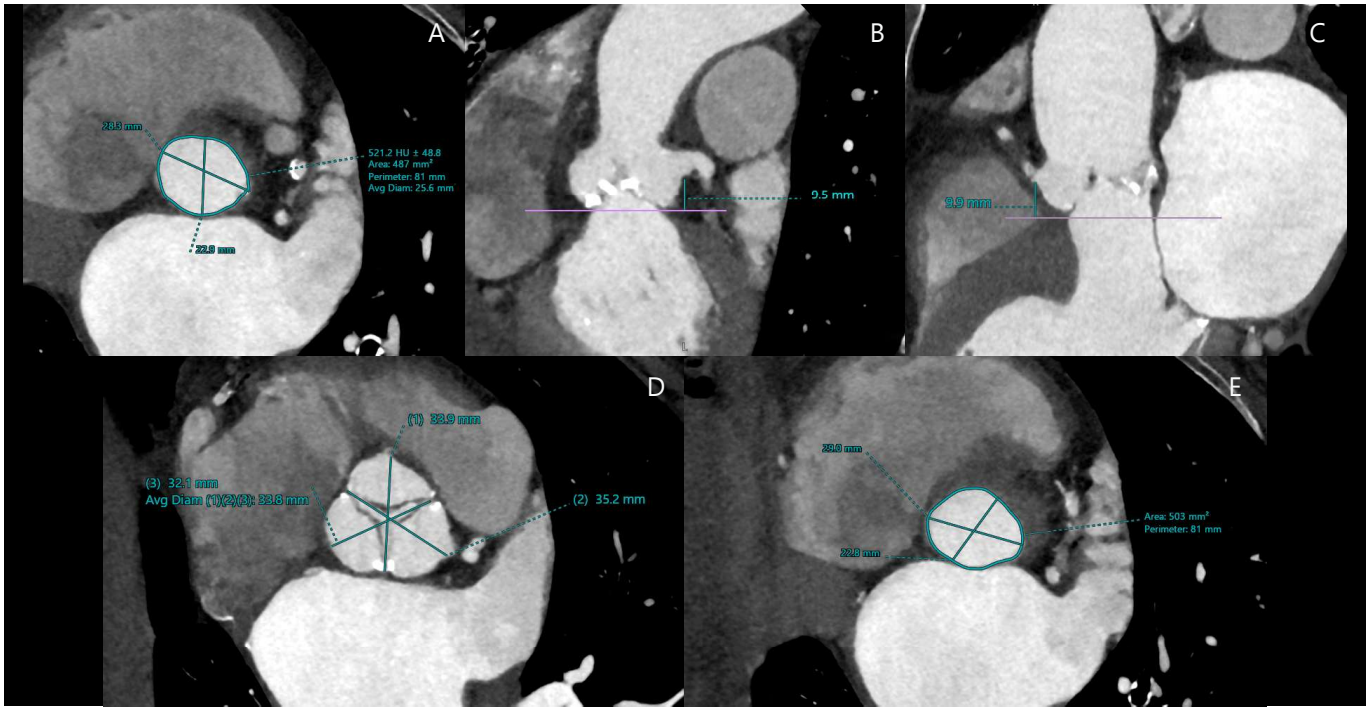


Figure 2. Example of TAVR Assist+ automation in a patient with severe aortic valve stenosis referred for pre-TAVR CT planning. The examination was acquired on Aquilion ONE / INSIGHT Edition using a one-beat cardiac scan at a heart rate of 108 bpm and reconstructed with PIQE Cardiac 1024 Matrix and CLEAR Motion Cardiac. Automatically initialized measurements include: (A) Annulus size, (B) Annulus to LM height, (C) Annulus to RCA height, (D) Sinus of Valsalva width, and (E) LVOT size.

TAVR Assist+ demonstrated up to a 53.3% reduction in user interaction time compared with the manual workflow. By streamlining planning and reducing repetitive manual tasks, it improves operational efficiency and supports the scalability of high-volume TAVR planning programs (Figure 3).

The measurement remained highly consistent between the manual workflow and TAVR Assist+, suggesting TAVR Assist+ can help with reducing manual effort while maintaining consistency in key valve sizing measurements used in TAVR Planning (Table 1).

Inter-reader variability was reduced with the TAVR Assist+ workflow compared with the manual workflow (Table 2).

The majority of examinations required no manual adjustments with TAVR Assist+ (87.5%), while the remaining examination required only minimal adjustment (12.5%), reducing the amount of user interaction needed to complete TAVR Planning.

	Manual (mm)	AI-Assisted (mm)	Difference (mm)
Annulus	25.0	25.0	0
Sinus Valsalva	34.1	33.8	0.3
LVOT	23.7	24.4	0.7
LM Height	14.6	14.4	0.2
RCA Height	15.2	15.2	0

Table 1: Measurement agreement between manual and AI-assisted workflow. Values are the average of maximum and minimum size measurements.

	Manual (mm)	AI-Assisted (mm)
	Difference	Difference
Annulus	0.9	0.5
Sinus Valsalva	1.6	1.4
LVOT	0.7	0.4
LM Height	0.3	0.0
RCA Height	0.3	0.1

Table 2: Inter-reader variability between manual and AI-assisted workflows. Values are the average of the maximum and minimum size measurements.

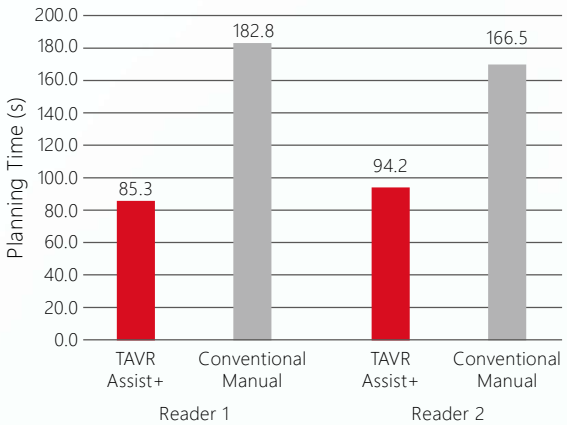


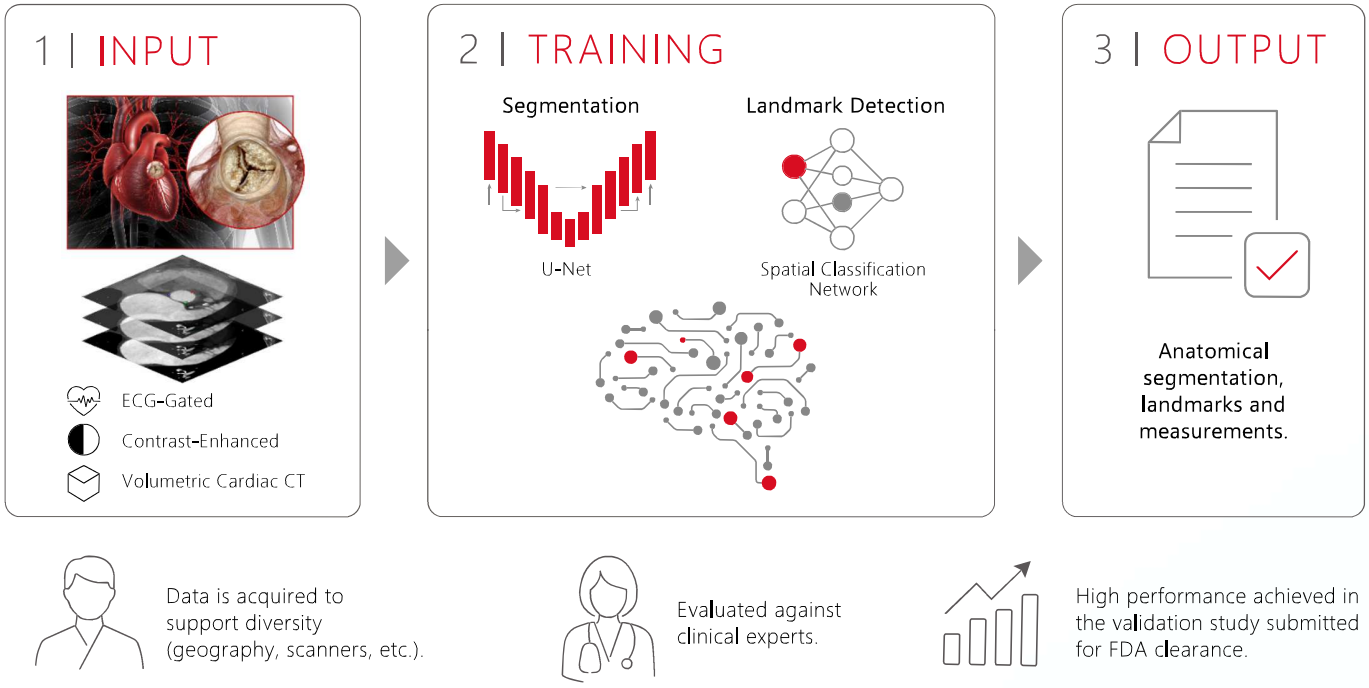
Figure 3: Reduction in user interaction time between TAVR Assist+ and conventional manual workflows.

Technology

Input: The TAVR Assist+ algorithm uses curated ECG gated, contrast enhanced, volumetric cardiac CT imaging data. This provides the foundation for advanced analysis, enabling simultaneous understanding of anatomical structures and spatial relationships.

Training: The TAVR Assist+ algorithm leverages deep learning architectures, combining a U-Net model for precise anatomical segmentation with a spatial classification network (SCN) for accurate landmark detection. Both models are trained using optimized learning strategies and exposed to diverse, real-world variability through intelligent data augmentation, enabling reliable performance across a broad range of patient anatomies and imaging conditions.

Clinical Implementation: Once trained, the network generates anatomical segmentation, landmarks and automated measurement outputs which are validated against clinical experts for evaluating automation performance. The validated TAVR Assist+ algorithm is installed in Vitrea Advanced Visualization (AV) platform, where it does not continue to learn.



Conclusion

This evaluation of 20 cases demonstrated that TAVR Assist+ has the potential to significantly improve the efficiency of CT-based TAVR planning while maintaining excellent consistency of key anatomical measurements and reduce inter-reader variability. Compared with a Strasbourg's manual workflow, TAVR Assist+ reduced valve sizing workup time by up to 53.3%, helping to simplify a traditionally time-consuming and operator-dependent process.

The evaluation also demonstrated excellent agreement between TAVR Assist+ and the manual workflow with 87.5% of cases requiring no manual correction following automated processing. These results highlight the ability of AI-powered TAVR Assist+ in streamlining the TAVR planning workflow. Leveraging this new aortic valve measurement automation and existing femoral access automation, TAVR Assist+ has the potential to further enhance workflow efficiency while supporting consistent, confident clinical decision-making.

Combined with high-quality cardiac CT datasets acquired on Aquilion ONE / INSIGHT Edition and reconstructed using PIQE Cardiac and CLEAR Motion Cardiac, TAVR Assist+ supports an efficient TAVR planning workflow with consistent measurements between readers across the cases evaluated in this study.

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