

# Vascular

## Development of Trinias Series unity edition Angiography Systems

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### 1. Introduction

The Trinias series of angiography systems has been introducing ever more functions and proprietary image guidance applications to support minimally invasive treatment (reduced exposure, reduced contrast media usage, and reduced examination times). Recent years have seen a rapid increase in the sophistication of interventional technologies, with therapeutic equipment becoming smaller and more delicate, just as a wider variety of functions are required of angiography systems. Trinias series "unity edition" greatly expands Shimadzu's product lineup by increasing its areas of application while also bringing improved proprietary image guidance software, all in the support of state of the art treatment. This article describes these changes.

\*unity: unlimited intelligent technology

### 2. Trinias Series unity edition

Trinias series "unity edition" anticipates future advancements in interventional technology by improving system performance based on the following 3 concepts to provide a new minimally invasive experience for all interventions.

- Personalize your experience for ultimate flexibility
- Intelligent design for intelligent care
- Limitless Potential for Efficient Workflow

### 3. Three Concepts of "unity"

#### 3.1 Personalize your experience for ultimate flexibility

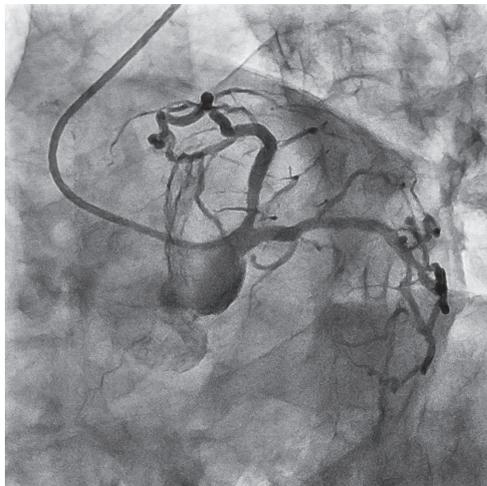
Today's interventions require angiography systems compatible with an expanded region of treatment including not just the heart but also the head, abdomen and extremities, that can also be used for hybrid techniques that combine internal medical and surgical treatment. To meet these requirements, Shimadzu's product lineup of angiography systems has been updated to the "unity edition" that introduces a 16 × 12 inch FPD option in addition to existing 8 × 8 inch and 12 × 12 inch FPD options, allowing a field-of-view choice best suited to the target region of treatment (Fig. 1). The 16 × 12 inch FPD continues the minimalist design philosophy of previous FPDs in cover size, and rotating the rectangular FPD for use in portrait or landscape orientation allows the 16 × 12 inch FPD to accommodate interventions in the heart in addition to the abdomen and extremities (Fig. 2). Patient tables compatible



Fig.1 Trinias series unity edition

with Trinias series unity edition systems include existing catheterization tables, as well as the SMART Table multipurpose catheterization table (Fig. 3), which introduces tilt and roll adjustment and electrically-assisted panning control to provide a range of positioning adjustable to the needs of the intervention. SMART Table uses a cable box built into the table to minimize console cable visibility and improve cleanliness in the operation room, and allow emergency CPR to be performed without repositioning the tabletop. An optional wireless foot switch that can be assigned control over fluoroscopy, radiography, raising and lowering

the table and other operations is also available (Fig. 3). Unity edition systems also come with a "SMART Touch" touch panel digital system controller (Fig. 4) as standard that transforms the operating environment for the operator and examination room operators and allows functions to be selected based on the techniques being used. SMART Touch provides stress-free control, comes with custom function settings for each operator, and if used with the optional large-screen SMART Display, the SMART Touch controllers also allow for easy modification of the display layout.



a) Coronary Artery



b) Common Iliac Artery



c) Subclavian Vein

Fig.2 Clinical Images from Trinias C16 unity edition



Fig.3 SMART Table and Wireless Footswitch



Fig.4 SMART Touch

### 3.2 Intelligent design for intelligent care Japanese

Unity edition systems have a stylish design based on white tones and a color palette that conveys cleanliness, calmness, and comfort (Fig. 5) out of consideration for both the customer and the peace of mind of the patient. High product quality has been achieved by performing all production steps, from product manufacture to quality inspection, within the plant in Japan (Fig. 6). Maintenance systems have also been enhanced, and services are available to connect with the customer at any time. A 365-day, 24-hour support system in the form of a customer support center (unavailable in some regions) and the ability to ascertain system status at any time through online monitoring allow for precautionary measures to prevent system failure before it occurs. With



Fig.5 Clean Design

unity edition, utmost importance has been given to achieving better reliability and peace of mind for both customers and patients.

### 3.3 Limitless Potential for Efficient Workflow

Trinias series systems have made it possible to perform interventions with reduced dose level and better device visibility, and come with proprietary SCORE Imaging image processing technology to meet the demands of real-time acquisition and assist in reducing overall examination times and contrast media usage. For unity edition systems, further advances have been made with SCORE Imaging and a new minimally invasive experience has been achieved. This article describes 4 original image processing technologies of unity edition.

#### • SCORE StentView PCI Stent Placement Support Application

PCI sometimes requires a stent or other device to be positioned accurately during cardiac motion. SCORE StentView is a device placement support application that limits the effects of cardiac motion in real time and displays the sum of multiple frames. This allows it to display an enhanced

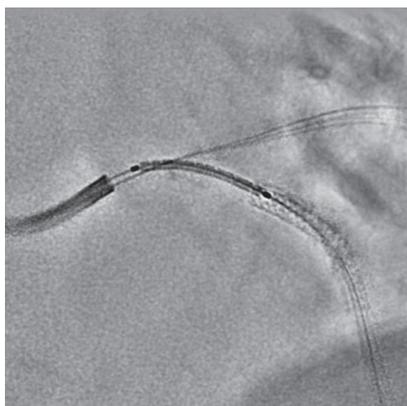


Fig.7 SCORE StentView Images

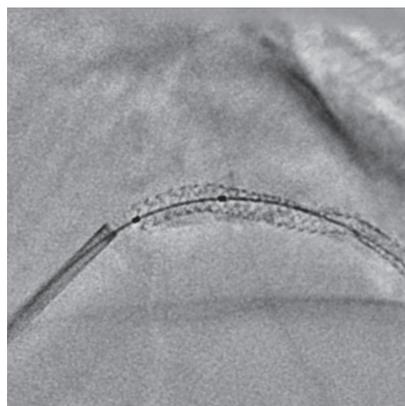


Fig.8 SCORE StentShot Image

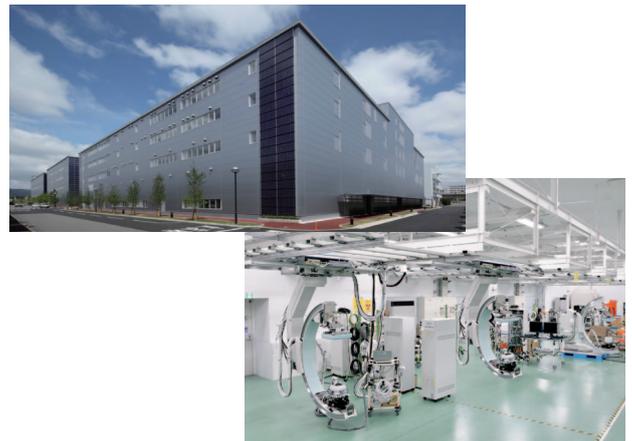
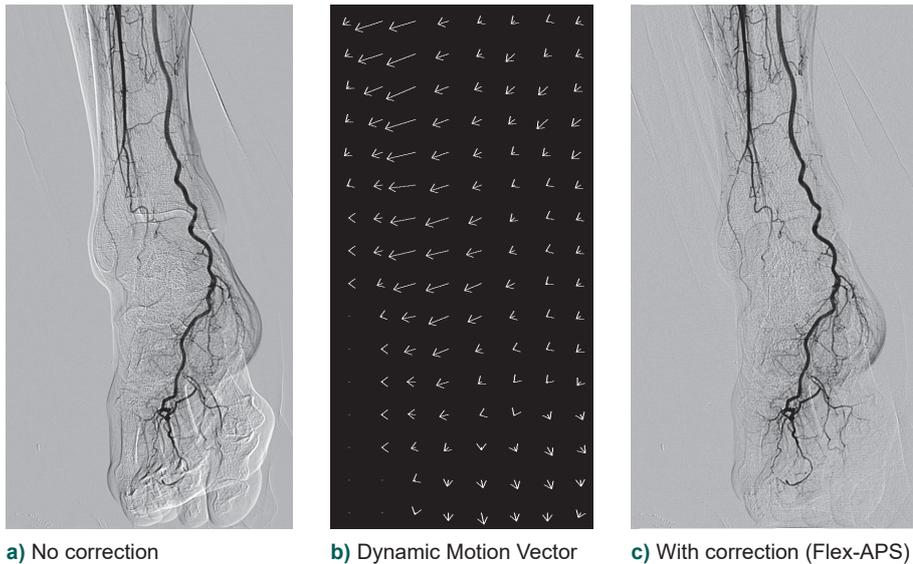


Fig.6 Plant in Japan and System Inspection

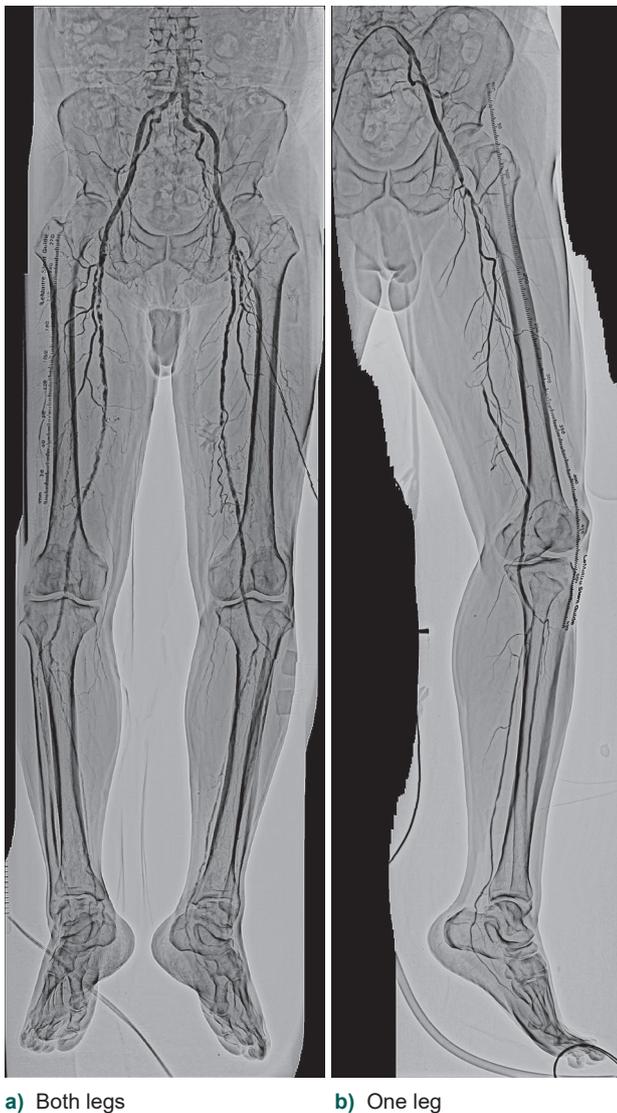
video image of a device during device placement compatible with ongoing positional adjustments of the device. Unity edition also modifies the previous 3-part split screen display and introduces a larger full screen display which does not need changing the clinical direction of the device in a region of interest (Fig. 7). Unity edition includes Shimadzu's proprietary ROI mode that uses the preceding image to define regions of interest, and supports device placement in any situation.

#### • SCORE StentShot PCI Stent Shape Confirmation Support Application

Verifying the state of stent dilatation after placement is an important part of PCI, and having an even more detailed understanding of stent shape is also important. SCORE StentShot retains the real-time performance of SCORE StentView, but displays even more defined shape of the stent in real time during X-ray exposure by combining all acquired images of the stent (Fig. 8). Since the combined image of the stent is displayed live during X-ray exposure, unnecessary exposure can be avoided by stopping X-ray exposure when the stent shape is verified.



**Fig.9** Flex-APS



**Fig.10** SCORE Chase Images

### • Flex-APS\* Real-Time Non-linear Pixel Shift Processing

Pixel shift processing is a means of correcting for misregistration artifacts during DSA by shifting, rotating, and rescaling a mask image relative to a live image. In actual clinical practice, twisting and other 3-dimensional movements commonly occur that prevent adequate image correction with pixel shift processing that can result in the need for repeat acquisitions. To resolve this issue, Flex-APS (Fig. 9) has been designed to deal with movement in 3 dimensions by analyzing direction and quantity of movement between each individual frame and applying correction on a pixel-by-pixel basis. Flex-APS can reduce substantially the amount of time and labor required by image processing since correction processing is performed on all images in real time. This also reduces the number of re-acquisitions, reducing unnecessary exposure and contrast media usage and also reducing examination times.

\*APS: Active Pixel Shift

### • SCORE Chase EVT Support Application

SCORE RSM is a frequency subtraction application that is highly motion-tolerant and does not require the acquisition of mask images. SCORE RSM has been used in lower extremities and other long regions for bolus contrast imaging. In unity edition, by linking patient table position with enhanced images, SCORE Chase (Fig. 10) makes it possible to display the entire lower extremities from stitched images obtained during a single contrast imaging acquisition. Complete images of the lower extremities are displayed immediately after bolus

contrast imaging, eliminating the waiting time for images during treatment. The greatest advantage of this application is that it can accommodate table movement in both longitudinal and transverse directions, so initial patient positioning is not of utmost necessity and complete images of the lower extremities can be created with ease. When combined with SMART Table, by specifying regions of interest from the complete images of the lower extremities, patient table positioning can be adjusted automatically without X-ray exposure and to provide smooth treatment.

## 4. Summary

Development of Trinias series "unity edition" continues on a daily basis in cooperation with all parties involved in interventions with the aim of achieving a higher quality of treatment. This article ends with the sincere hope that Shimadzu's latest technologies will be of help to everyone. We also wish to express our gratitude to all the doctors and experts who assisted in product development.