Raising The Bar For Excellence

Pax-i3D Premium

Dental Pioneer
VATECH
VATECH Global

- What are some things you **need**?
- What's the best way to resolve your **real concerns**?

Dental Pioneer VATECH
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Doctor says..

"Because of a limited field of view,
There are diagnostic limitations
with my own dental X-ray equipment.
I need something that provides
Larger FOV for diagnosis of
specialized areas."

Check out what you really need

What do you need in a large FOV device?

When you get a “Large FOV X-ray imaging system”, you need to check...

Type of Sensors

The X-ray performance in regards to image quality will be different by the type of sensor. For example, CMOS sensors are easy to readout at high speed which minimizes ghosting on the images. **TFT sensors on the otherhand performs poorly with high speed readouts,** so it is more suitable for one-shot images.

TFT	CMOS
	

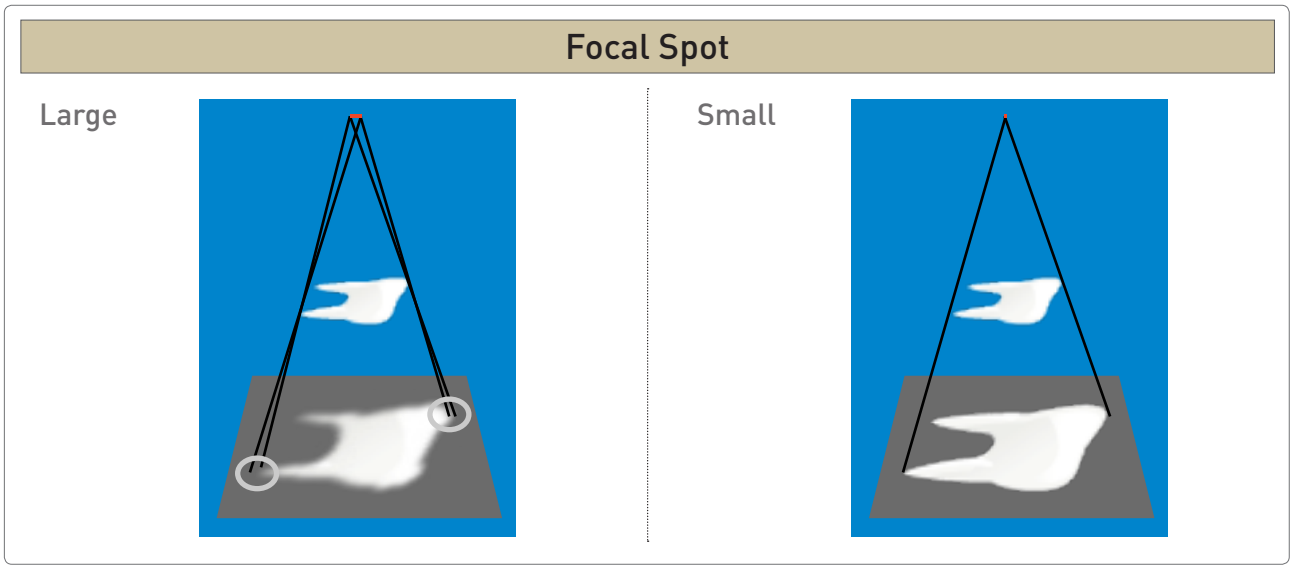
Unstitched FOV

Image stitching is the process of **combining multiple small images with overlapping FOV** to produce a large single image. Stitching technology needs double or sometimes triple scans which increases scan time, patient discomfort and unnecessary x-ray exposure.

What do you need in a large FOV device?

Focal Spot

A smaller focal spot ensures better image quality. This means that **the larger the focal spot of the X-ray tube head, the worse image quality** you will get. This is because larger focal spots mean the margin of error around the edges can be increased, creating more blur on images, decreasing the level of detail.



System Functionality

If you only focus on Large FOV, you may miss other basic functions. New X-ray systems should Include the functions that you normally use, such as Pano (Bitewing, TMJ, Sinus, Wide, Narrow, Child) and Ceph(PA, LAT, SMV, WAT, Carpus).
It is very important that **your diagnostic imaging needs are met.**

What are your Real Concerns?

- What **FOV size** is suitable for diagnosis?
- Is **image quality** still high although the FOV is larger?
- Are there longer **scan times** to get larger images?
- Is the **effective dose** of a larger image much higher?
- What kinds of **diagnostic tasks** can you complete with a large FOV device?

See how we can solve your real concerns

Real Concerns

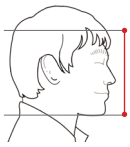
- What **FOV size** is suitable for diagnosis?

Large FOV Size	Image Quality	Scan Time	Effective Dose	Diverse Diagnosis
* FOV 21X19	* CMOS	* High-Speed Scan	* Low Dose	* Airway Analysis
	* Small Voxel Size	* Unstitched FOV	* Multi FOV	* TMJ Analysis
			* 1 Scan 6 Images	* Sinus Analysis
			* Unstitched FOV	* 3D Photo

Your Real Concerns:

What FOV size is suitable for diagnosis?

1. The 21X19 FOV:

Measuring part	Breadth	Thickness	Length
			
Average size (Unit: cm)	16.74	20.90	18.44

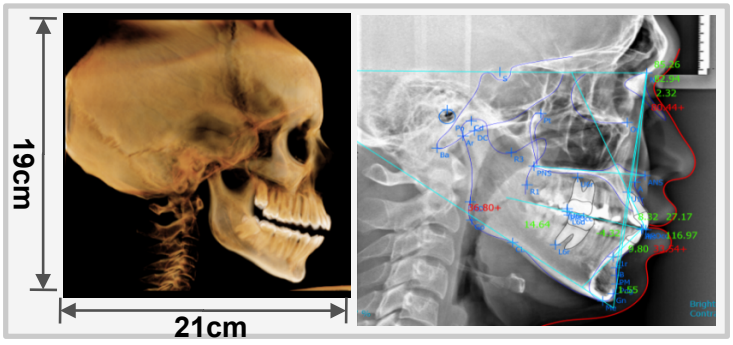
- Oral and maxillofacial surgery
- Facial reconstructions
- Orthodontic treatment planning
- Complex orthognathic cases

※ Subject : A total of 261 adults of both sexes between 25 and 29 years (Size Korea)

The CBCT FOV determines how much of the patient's anatomy you will be able to visualize. A 3D orthodontist said that the most important feature to consider when buying a CBCT for orthodontic use is the CBCT's largest field of view (FOV).

However, this does not mean the largest FOV is always the best choice. The best choice is to buy a CBCT that provides suitable FOV size for your needs. As you can see above table, 21x19 is the most suitable FOV size to diagnose the maxillofacial regions.

21x19 FOV will show you the roof of the orbits and nasion down to the hyoid bone. With the FOV height of 19cm, this size is also useful for Cephalometrics and traditional orthodontic analysis.



• Reference : The 3D Orthodontist(http://www.3dorthodontist.com), 2016

Your Real Concerns:

- Is **image quality** still high although the FOV is larger?

Large FOV Size	**Image Quality**	Scan Time	Effective Dose	Diverse Diagnosis
* FOV 21X19	*** CMOS**	* High-Speed Scan	* Low Dose	* Airway Analysis
	*** Small Voxel Size**	* Unstitched FOV	* Multi FOV	* TMJ Analysis
			* 1 Scan 6 Images	* Sinus Analysis
			* Unstitched FOV	* 3D Photo

Your Real Concerns:

Is image quality still high although the FOV is larger?

1. CMOS (Complimentary Metal Oxide Semiconductor)

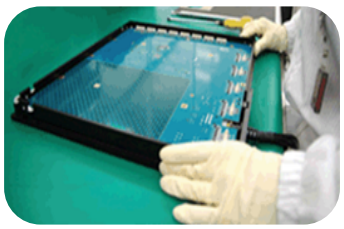
According to the report for the evaluation of digital X-ray detectors, SNR (Signal to Noise Ratio) is one of the most important factors which affects the image quality. You see less noise with higher SNR value and DQE (Detective Quantum Efficiency) provides a measure of the SNR transfer from the input to the output of a detector. Therefore, higher DQE brings higher image quality.

As you can see in the following comparison chart of the X-ray performance by detectors, CMOS sensors have the highest DQE values. It means CMOS has the most powerful ability to visualize object details of a certain size and contrast (contrast-detail resolution).

[Comparison of the X-ray performance by detectors]

Detector	CMOS	a-Si:H TFT	CCD
Scintillator	CsI:T1	CsI:T1	CsI:T1
DQE peak	**0.66**	0.61	0.39

PaX-i3D Green Premium utilizes a 49.5㎛ high resolution X-ray sensor. With the latest 49.5㎛ pixel size in X-ray sensors, it is the smallest pixel/high resolution dynamic X-ray sensor for CBCT available on the market.



High Performance X-ray Sensor

- Ultra Fine Resolution (Pixel pitch: 49.5㎛)
- High Sensitivity

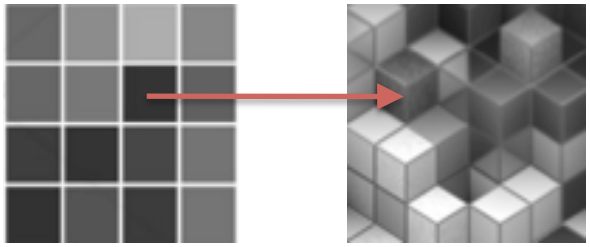
• Reference :Evaluation of digital X-ray detectors for medical imaging applications, Anastasios C, University College London, 2011

Your Real Concerns:

Is image quality still high although the FOV is larger?

2. Small Voxel Size

A voxel is a unit of graphic information that defines a point in three-dimensional space. Since a pixel defines a point in two-dimensional space, a third is needed.
Each of the 3 coordinates is defined in terms of its position, color, and density.



[Pixel] [Voxel]

As you can see in the images below, 3D models have different resolutions by voxel size. Smaller voxel sizes create more detailed images.

	Pax-i3D Premium	P Company	I Company
Skull FOV (cm)	21x19	23x16	23x17
Voxel (mm)	0.3/0.4	0.4/0.6	0.3/0.4

" Voxelized characters at different resolutions. What do you think?"

• Reference : Whatls.com, TechTarget, 2015

Your Real Concerns:

- Are there longer **scan times** to get larger images?

Large FOV Size	Image Quality	**Scan Time**	Effective Dose	Diverse Diagnosis
* FOV 21X19	* CMOS	*** High-Speed Scan**	* Low Dose	* Airway Analysis
	* Small Voxel Size	*** Unstitched FOV**	* Multi FOV	* TMJ Analysis
			* 1 Scan 6 Images	* Sinus Analysis
			* Unstitched FOV	* 3D Photo

Your Real Concerns:

Are there longer scan times to get larger images?

1. High-Speed Scan Technology

A voxel is a discrete unit of the scan volume resulting from reconstruction of the scan data.

The smallest voxel size brings a high scan resolution, but at the cost of longer acquisition times. Therefore, the trade-off between scan resolution and scan time must be carefully considered.

As you can see on the table below, PaX-i3D Green Premium has the smallest voxel size with the largest FOV compared to other systems. At the same time, its scan time is the shortest among the systems.

- The largest FOV 21 x 19
- The smallest voxel size 0.3mm
- **The shortest scan time 18 sec**

	PaX-i3D Premium	P Company	I Company
Skull FOV (cm)	21x19	23x16	23x17
Voxel (mm)	0.3/0.4	0.4/0.6	0.3/0.4
Scan Time (sec)	18	40	26.9

• Reference: Osteoporosis Research, Gustavo Duque

Your Real Concerns:

Are there longer scan times to get larger images?

2. Unstitched FOV

To get one single large image, you or your staff might have the workflow shown below.

Workflow	Single Image	Stitching Image	
Patient Positioning	20 sec	20 sec	
3D Image Acquisition	18 sec	20 sec	
Equipment Positioning	-	5 sec	
3D Image Acquisition	-	20 sec	→ Double Scan
Reconstruction & Saving	Vary depending on PC specifications		
S/W Stitching Process	-	300 sec	→ S/W Stitching
Simple Planning for Treatment	60 sec	60 sec	
Time			

Condition : Large FOV

As you can see the scan time will be double and stitching process requires more time on the software. Why waste your time on stitching?

Save your time and see more patients with one single large image

Your Real Concerns:

- Is the **effective dose** of a larger image much higher?

Large FOV Size	Image Quality	Scan Time	**Effective Dose**	Diverse Diagnosis
* FOV 21X19	* CMOS	* High-Speed Scan	*** Low Dose**	* Airway Analysis
	* Small Voxel Size	* Unstitched FOV	*** Multi FOV**	* TMJ Analysis
			*** 1 Scan 6 Images**	* Sinus Analysis
			*** Unstitched FOV**	* 3D Photo

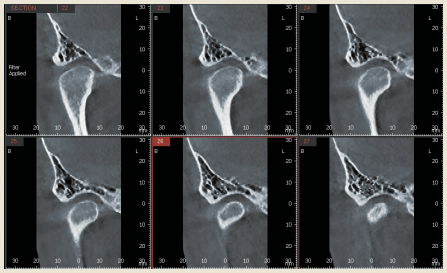
Your Real Concerns:

Is the effective dose of a larger image much higher?

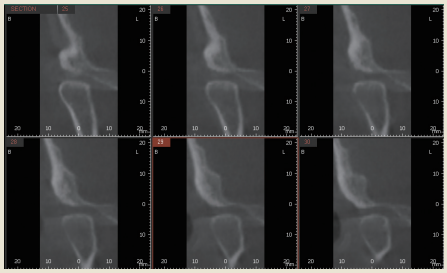
1. Low Dose Technology

68% reduction in dose yet clinically diagnosable scans

Effective Dose of Green CT®



PaX-i3D Green Premium
Ultra Low Dose Mode FOV 21x19
DAP 1,570 / 129μSv



Old Large FOV Model
Standard Mode FOV 24x19
DAP 4,877

Since the ALARA(as low as reasonably achievable) principle is getting emphasized more and more, we are also focusing on this principle for the safety of both patients and radiological personnel.

What has been developed at Vatech breaks many conventions in dental radiography.
It was always believed that with low radiation comes inferior image quality, which renders it useless in clinical diagnosis.

However, PaX-i3D Green Premium provides clinically diagnosable X-ray scans at a low X-ray dosage. With low dose X-ray radiography, achieving clinically diagnosable image quality is the new golden-standard.

• Reference : Mosby's Medical Dictionary, 9th edition. 2009, Elsevier / NC State University, Radiation Safety and ALARA

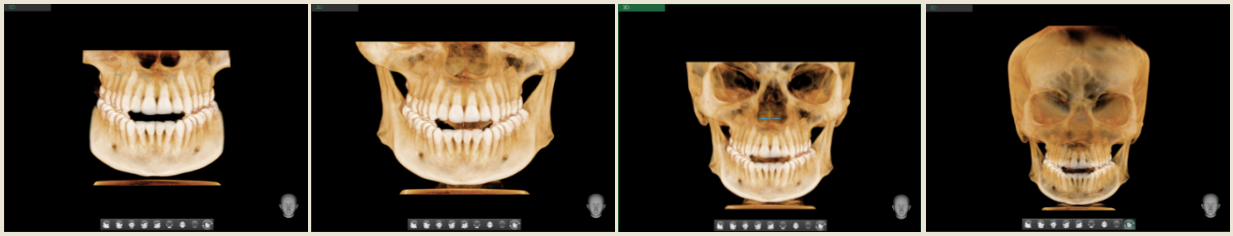
Your Real Concerns:

Is the effective dose of a larger image much higher?

2. Multi FOV

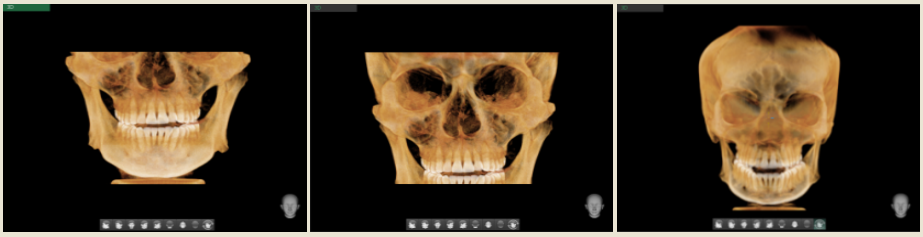
FOV size is related to radiation; Acquiring a smaller FOV sized image exposes loser doses of radiation than acquiring higher FOV images. The collimators of the equipment limits the radiation exposure to the region of interest, allowing optimal FOVs to be selected.

DENTAL CT



8 x 8 | 12 x 9 | 17 x 15 | 21 x 19

ENT CT



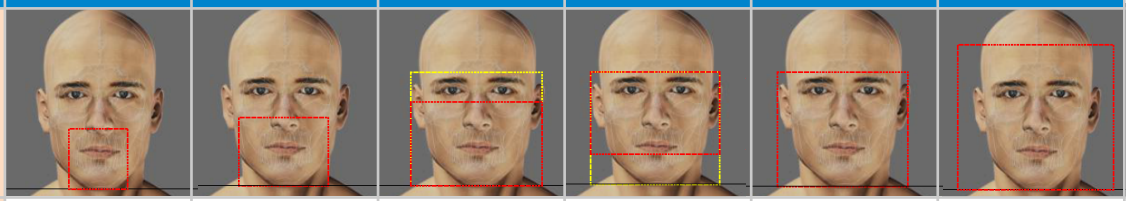
17 x 11 (Airway) | 17 x 11 (TB&PNS) | 21 x 19

Your Real Concerns:

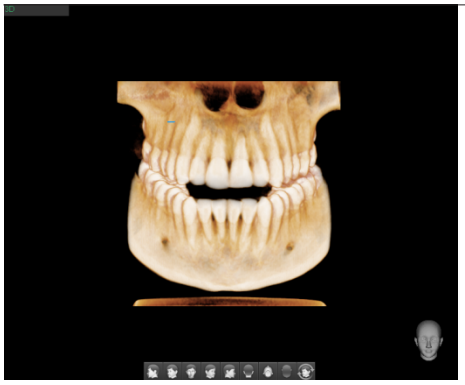
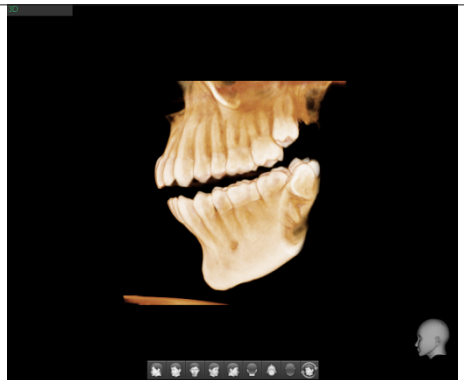
Is the effective dose of a larger image much higher?

2. Multi FOV

You can select the optimal FOV for your diagnostic tasks to limit the radiation exposure to your patients. As you can see on the table below, six different FOVs are available in PaX-i3D Green Premium. Its multi FOV sizes range from 8x8 to 21x19. Meaning, you can select the most appropriate FOV for a particular diagnostic task.

FOV	8 x 8	12 x 9	17 x 11(A)	17 x 11(T)	17 x 15	21 x 19
Region						
2nd Molars	O	O	O	O	O	O
3rd Molars	X	O	O	O	O	O
Airway	X	X	O	X	O	O
Sinus	X	O	O	O	O	O
TMJ	X	X	X	O	O	O
TB&Sinus	X	X	X	O	O	O
Full Skull	X	X	X	X	X	O

“Find the most appropriate FOV for your diagnostic tasks”

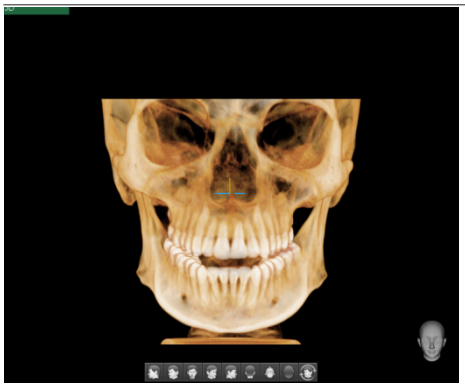
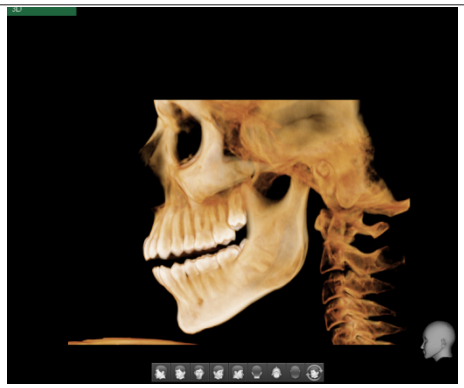



FOV 8x8

- Surgical guides
- Complex extractions
- Bone grafting

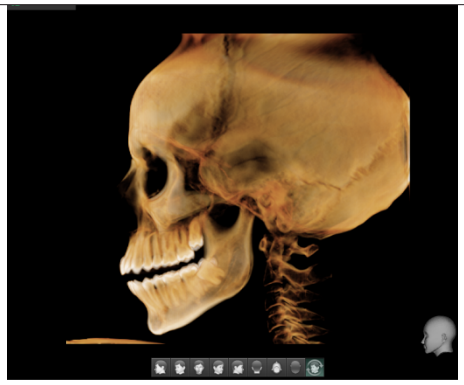

FOV 12x9

- Surgical guides
- Sinus lifts for both sinuses
- 3rd molar extractions
- Oral and maxillofacial surgery for mandibular arch reconstruction

FOV 17x15

- Oral surgery
- Facial reconstructions
- Simultaneous diagnosis for both TMJs
- Orthodontic treatment planning

FOV 21x19

- Oral and maxillofacial surgery
- Facial reconstructions
- Orthodontic treatment planning

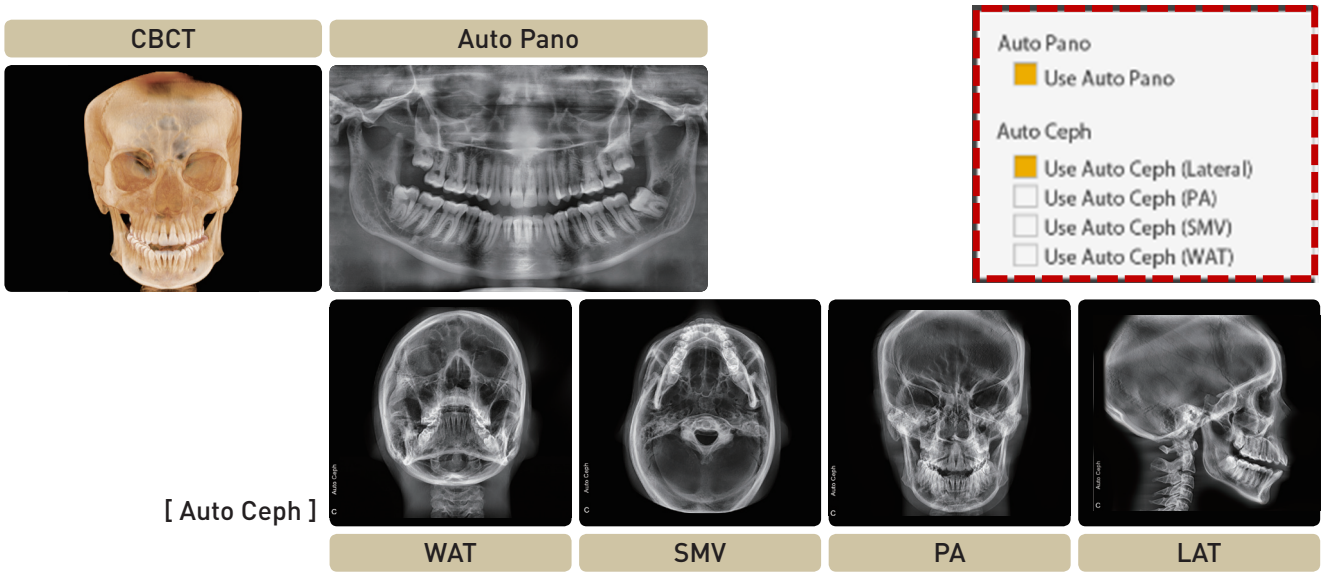
Complex orthognathic cases

Your Real Concerns:

Is the effective dose of a larger image much higher?

3. 1 Scan 6 Images

[Select Auto Images]



One scan with a PaX-i3D Green Premium gives you not only a CT image but also an Auto images. An auto image is a additional image that is captured automatically with a CT image without any additional radiation.

The function is especially useful for the surgery cases which take CT image acquisition, such as a cleft lip case. In these situations, the doctor would be obtaining six different images with the CT which is required for treatment planning.

You can also select the Auto images that you need for your treatment planning; PaX-i3D Green Premium provides a maximum of 6 images at the same time, helping you increase your dental workflow.

Your Real Concerns:

Is the effective dose of a larger image much higher?

3. 1 Scan 6 Images

[Total Effective Dose]

[Unit: μSv]

Images	PaX-Reve3D (15x15)	PaX-i3D Green Premium (21x19)
CT	169.30	129
Pano	16.45	No Need
Ceph PA	1.69	No Need
Ceph LAT	1.16	No Need
TOTAL	**188.6**	**129**

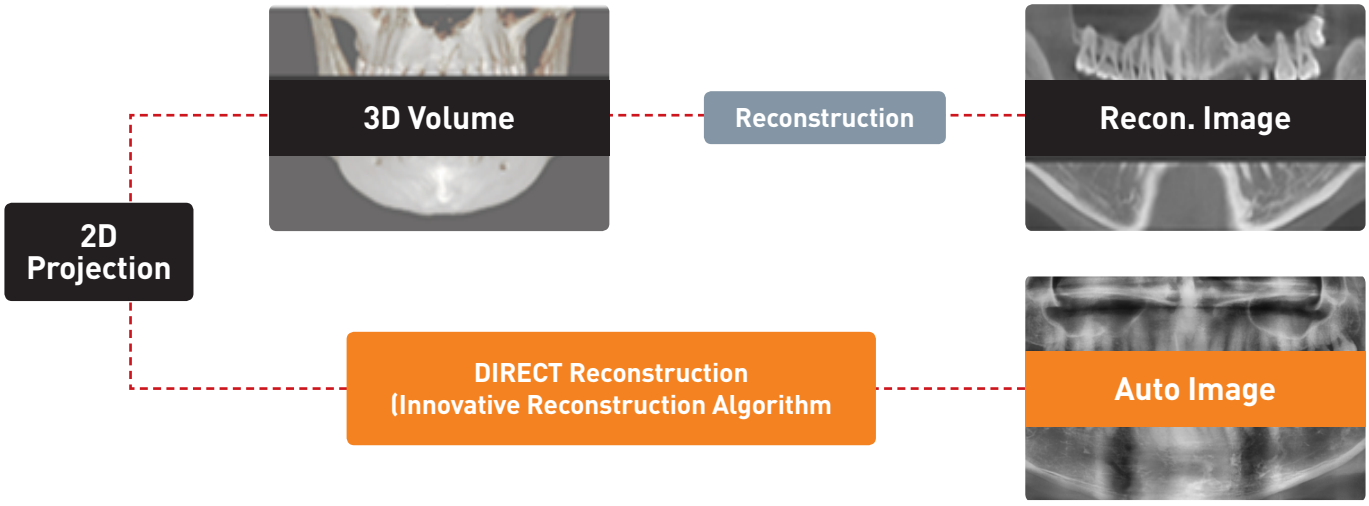
※ICRP 2007 Tissue Weights: International commission on Radiological Protection (ICRP). Recommendations of the ICPR. ICRP Publication 103. Ann ICRP

Thanks to Auto images that are automatically created from 2D projections of CT data, total effective dose is decreased.

For example, orthodontists often take 4 images for a complete diagnosis: a 2D Pano image, a Ceph PA image, a Ceph lateral image and a 3D image. However, your patient does not need to be exposed unnecessary X-rays for obtaining these images when you use the PaX-i3D Green Premium.

Your Real Concerns:

How can 1 Scan 6 Images technology be possible?



Auto Images are produced from raw data which is acquired during CBCT data acquisition. This process is done separately with 100 μm pixel size before reconstruction of 3D volume. It is very similar to acquiring real conventional Pano and Ceph images and the result of innovative technology of the New VATECH algorithms.

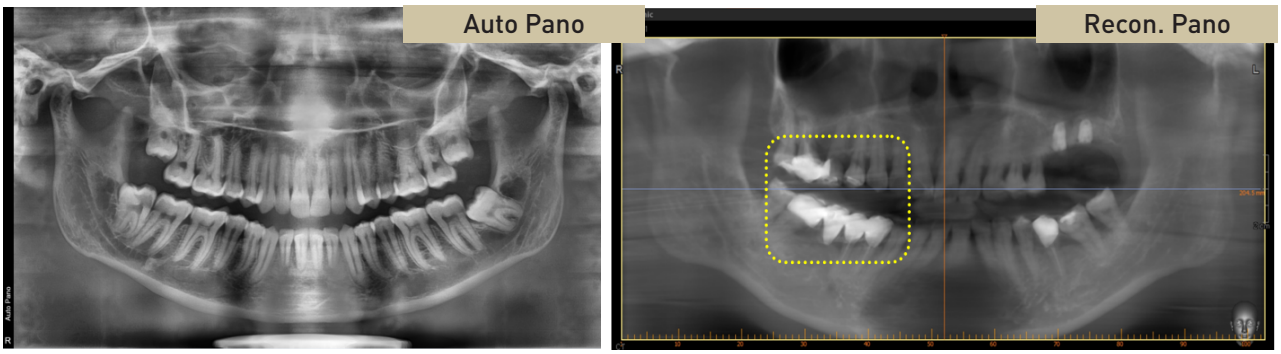
On the other hand, a Reconstructed Pano is literally "reconstructed" image from 3D volume data. As it is reconstructed with fixed level of voxel size such as 300μm, the resolution cannot be greater than what a CBCT image has.

1 Scan 6 Images,

Difference between Auto and Recon Images

The different process of Auto Pano and Recon. Pano Images makes different results as below.

	Auto Pano Image	Recon. Pano Image
Image Quality	Higher resolution	Lower resolution
Metal Artifact	No metal artifact	Seen in CBCT image



Comparing an Auto Pano to a Reconstructed Pano is incorrect.

Normally in 3D Viewers you can create panoramic image by drawing a panoramic curve. However, to obtain all anatomical information, you must make the curve very thick to obtain an image that is similar to an actual pano. However, by doing so, you are essentially creating a lower quality image.

1 Scan 6 Images,

Is the effective dose of a larger image much higher?

4. Unstitched FOV

More and more people are conscious of radiation and reluctant to be under X-rays. The overlapped area in Figure 1 shows the amount of unnecessary X-ray exposure to the patient.

As you can see, the effective dose of stitching image is much higher than a single image.

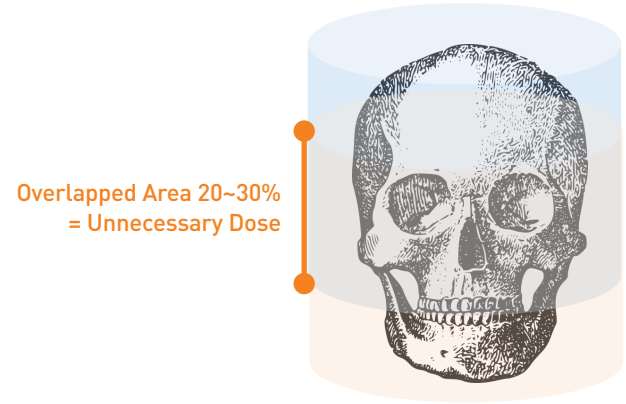
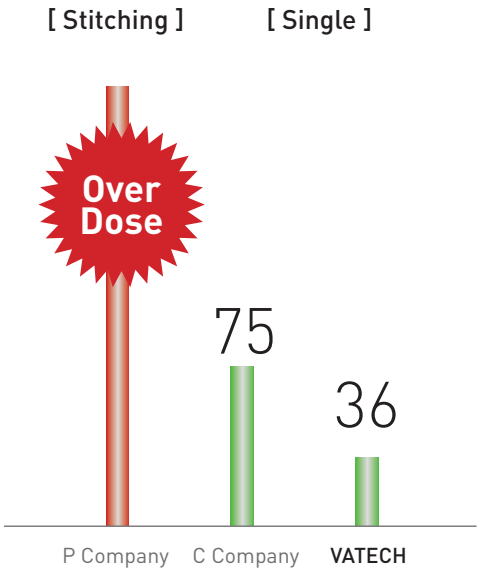


Image	Company	FOV (cm)	Effective Dose (μSv)
Stitching	P Company	9 x 8	236.2
Single	C Company	8 x 8	75
	Vatech	8 x 8	36

※ Effective Dose
Calculated by multiplying actual organ doses by risk weighting factors and adding up the total of all the numbers.
It represents the dose that total body could receive uniformly.



• Reference : Effective dose comparison between protocols stitched and usual protocols in dental CBCT for complete arcade, 2014
www.hps.org

Your Real Concerns:

- What kinds of **diagnostic tasks** can you complete with a large FOV device?

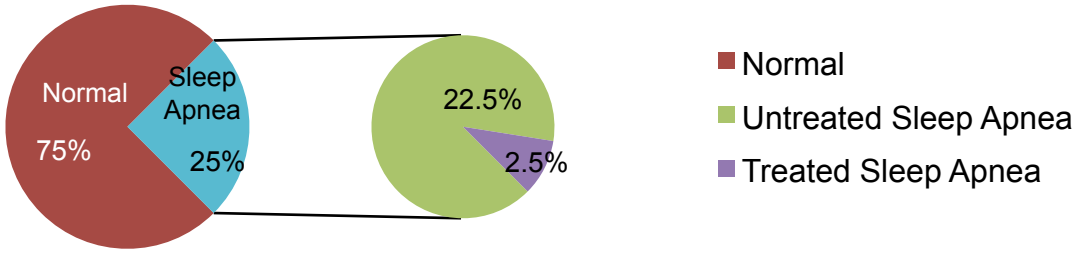
Large FOV Size	Image Quality	Scan Time	Effective Dose	**Diverse Diagnosis**
* FOV 21X19	* CMOS	* High-Speed Scan	* Low Dose	*** Airway Analysis**
	* Small Voxel Size	* Unstitched FOV	* Multi FOV	*** TMJ Analysis**
			* 1 Scan 6 Images	*** Sinus Analysis**
			* Unstitched FOV	*** 3D Photo**

Your Real Concerns:

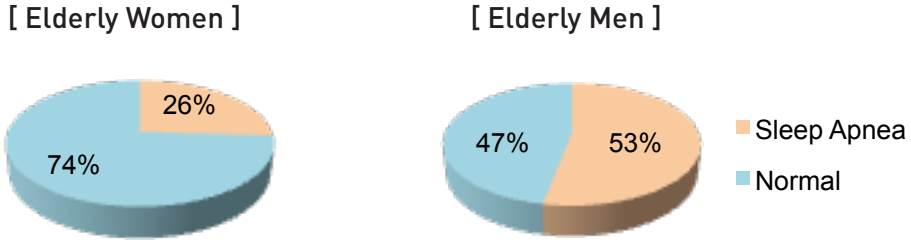
What kinds of diagnostic tasks can you complete with a large FOV device?

1. Airway Analysis

" 25% of population is at risk for Sleep Apnea "
" 85~90% of Sleep Apnea patients remain undiagnosed & untreated "



A research Center in New York University determined that elderly people who have sleep apnea were 10 years earlier to likely have mild cognitive impairment than the people who do not have it. Sleep apnea is very common in elderly group with 53% of elderly men and 26% of elderly women being affected. A large FOV device is vital tool in diagnosing airway problems such as sleep apnea.



※Subject : A total of 2,470 elderly group of both sexes between 55 and 90 years

• Reference : Interactions Between Obesity and Obstructive Sleep Apnea
Obstructive sleep apnea increases risk of CVD
• Reference : blog.naver.com, Seoul Tong Dental Clinic

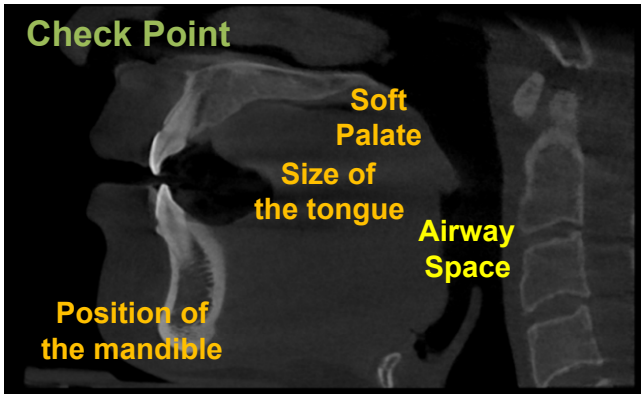
Your Real Concerns:

What kinds of diagnostic tasks can you complete with a large FOV device?

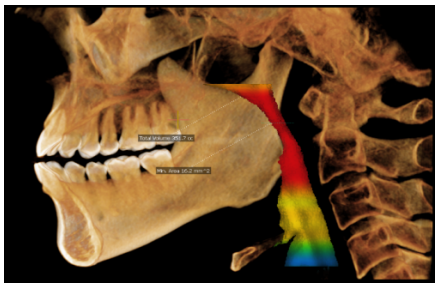
1. Airway Analysis

Nowadays, the use of CBCT is common to measure the airway volume. According to the European Journal of Orthodontics, the measurements of the airway volume using CBCT are reliable and accurate.

Sleep apnea patients have considerable differences such as size and position of the mandible, airway space, size of the tongue and the soft palate compared to patients without sleep apnea, making measurement of the airway volume necessary.



Ez3D-i V.4.1 | A powerful function for Airway Volume Analysis



Simple Airway Selection

- Select the airway area by **clicking a mouse only twice**

Automatic Airway Volume Measurement

- Measure total airway volume and show with **color code**
- **Calculate the value** of total and minimum airway volume

• Reference : European Journal of Orthodontics, 2011

Your Real Concerns:

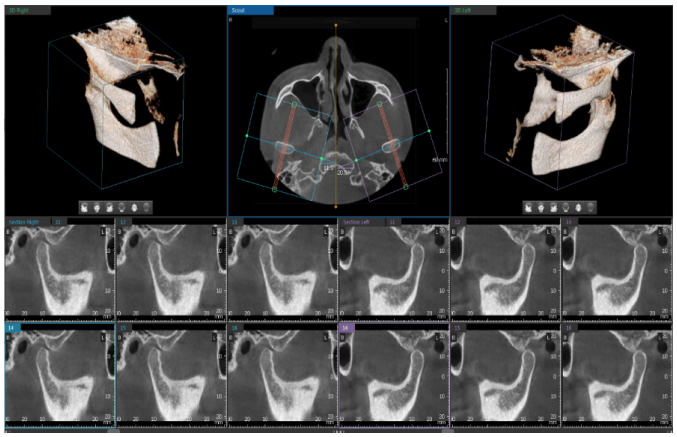
What kinds of diagnostic tasks can you complete with a large FOV device?

2. TMJ Analysis

TMD(Temporomandibular joint disorder) can cause pain in the jaw joint for your patients. It can be caused by trauma such as grinding the teeth(bruxism) and clenching. These habits can change the alignment of teeth and bring about pain in the TMJ and facial muscles when chewing.
In order to treat pain in the TMJ, a CBCT image may be taken of the mouth and jaw, showing the location of the TMJ disc so the doctors have a better idea for proper treatment.

[Bruxism & Clenching]

Ez3D-i V.4.1 | A powerful function for Airway Volume Analysis



Clipping

- Analyze TMJ by **clipping 3D Image**

TMJ Navigator

- Select the TMJ area to check the **cross section**

Segment TMJ

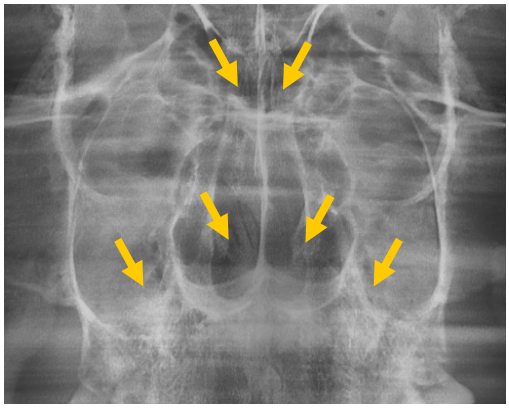
- **Separate condyle or fossa** to diagnose TMJ accurately

• Reference : Temporomandibular Joint (TMJ) Syndrome, Steven S. Bhimji, MD, MSc, PhD, 2015

Your Real Concerns:

What kinds of diagnostic tasks can you complete with a large FOV device?

3. Sinus Analysis

Sinus Lift	Sinusitis
	
[3D 12x9]	[Sinus PA]

The maxillary sinus can limit the amount of bone height for an implant placement. With a **sinus lift**, bone can be grafted under the sinus membrane to increase the height of bone. As the demand for implants has been growing, CBCT has become an essential tool for treatment planning.
By providing highly accurate 3D images, The PaX-i3D Green Premium delivers a comprehensive view of the patient's jaw and the anatomical structures needed to perform this procedure. The accurate relative positioning of implant fixtures is critical to avoid anatomical landmarks, which can result in injury to the patient.

Sinusitis is inflammation of the sinuses. Its common symptoms include: thick nasal mucous, a plugged nose, and pain in the face. For chronic cases, using a CBCT is recommended for definite diagnosis.

• Reference : CBCT and implants, Edward J. Mills, DDS
https://en.wikipedia.org/wiki/Dental_implant
https://en.wikipedia.org/wiki/Sinusitis

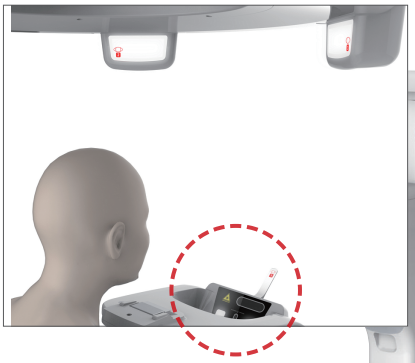
Your Real Concerns:

What kinds of diagnostic tasks can you complete with a large FOV device?

4. 3D Photography

In order to get a better understanding for treatment planning, intuitive consultation should be provided to patients.

With 3D photography technology in PaX-i3D Green Premium, your patient can see their facial form and its changes instantly during consultation, not only helping to increase the objectives of your treatment plans, but also to increase the rate of treatment acceptance.



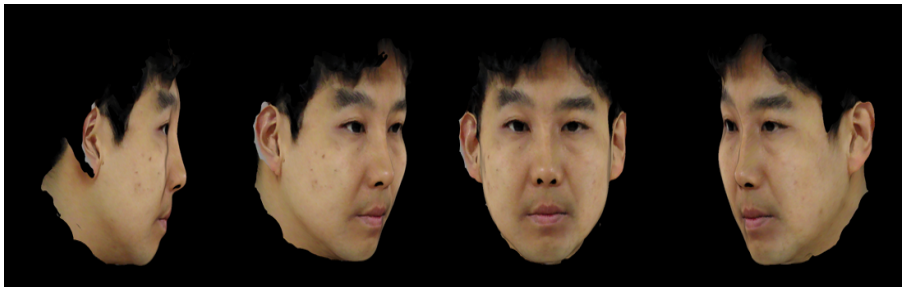
In this respect, PaX-i3D Green Premium is optimized for not only "Diagnosis" but also "Consultation".

3D photo

Powerful consultation with CBCT & 3D Photo simulation

- 3D Photo Mapping
- Soft-tissue Simulation

Superimposition for pre & post treatment comparison



Added Values:

Cutting-edge Design and Functionality

Posture Stability [Seated Type]

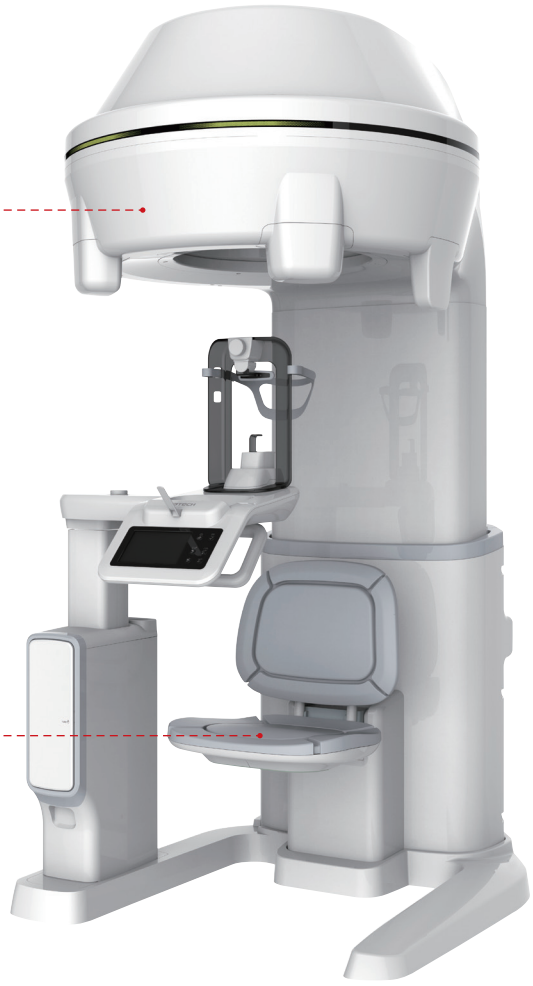
The system is designed specifically to maximize posture stability by utilizing a seated chair. According to the research note of human kinetics, stability three times higher in a sitting posture than in a standing position. The New design of PaX-i3D Green Premium supports reduction of patient movement and optimization of image quality.

Safety starts with Design

The design of the rotating unit is totally different from our existing systems. The sensor and generator move inside of the rotating unit. So, you will no longer worry about being hit by the unit during rotation

Wheelchair Accommodation

Detachable Dental Chair is designed for wheelchair users. Moreover, the process of detaching the chair is very simple, taking approximately 1 second.



• Reference : Unsupported Eyes Closed Sitting and Quiet Standing Share Postural Control Strategies in Healthy Individuals, Murielle Grangeon, human kinetics, 2015

Added Values:

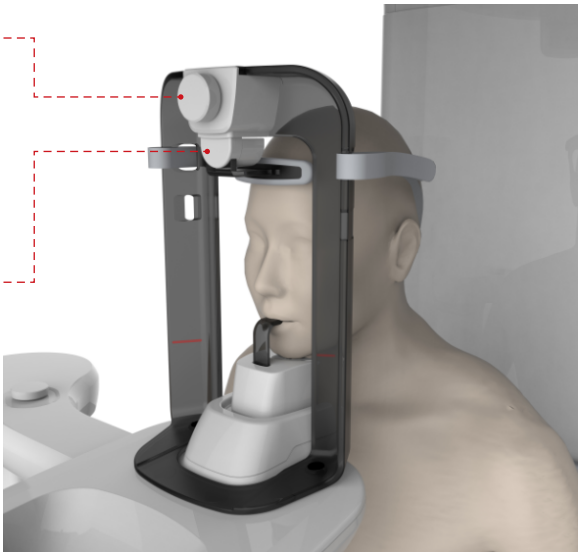
Cutting-edge Design and Functionality

Forehead Thickness Control

This control is possible for accurate fits in the shape of the patient forehead.

Forehead Height Control

The position of forehead is different depending on the patient's facial appearance. This control enables to support the forehead accurately for the stable fixation.

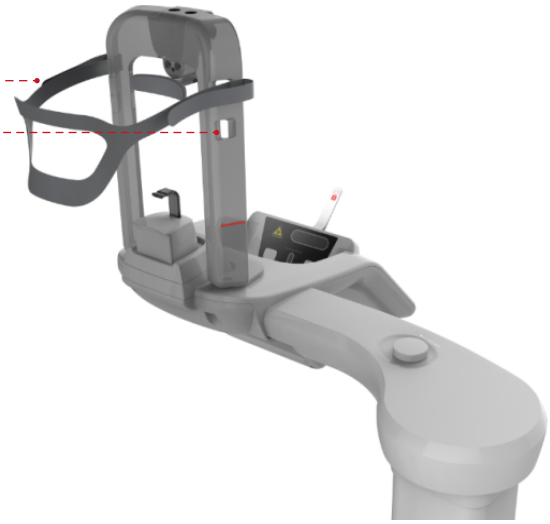


Headrest Length Control

The length of the headrest strap is adjustable to fit the patient's head.

Headrest Height Control

The size of head is different depending on the patient's age(Adult/Child).
Staff choose the holes to put the headrest according to the height of the patient's head.

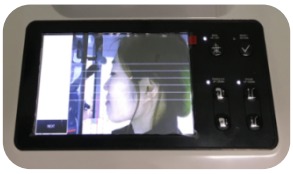


Added Values:

Cutting-edge Design and Functionality

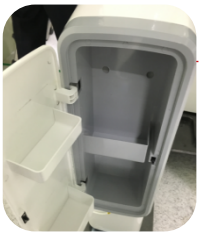
Ease of Operation

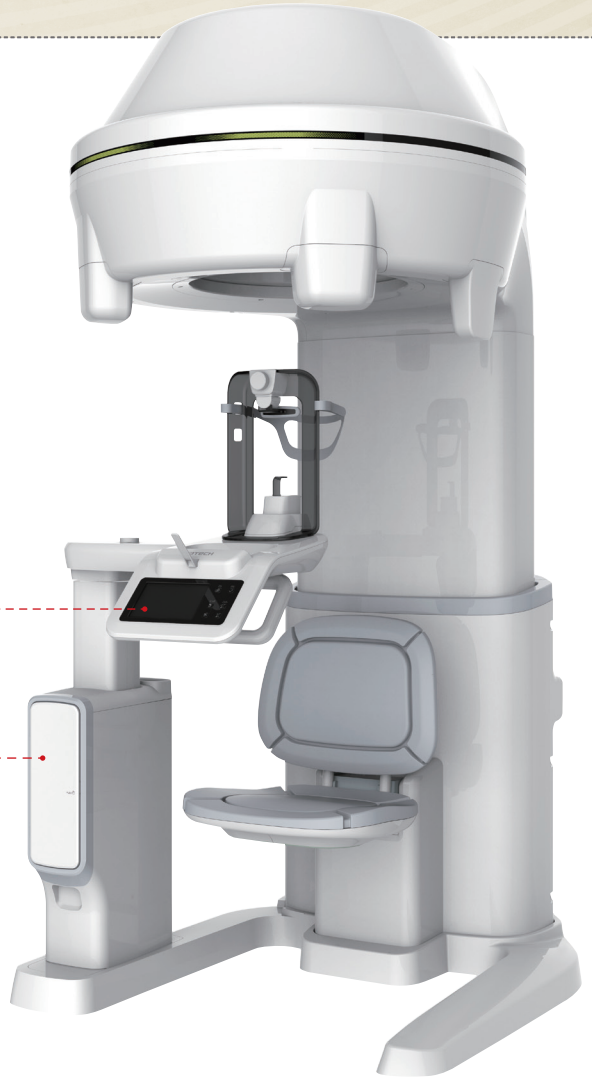
The PaX-i3D Green Premium uses a user-friendly touch control panel. Your staff can check the patient positioning And perform fine adjustments using the positioning line on the LCD.
Also, its intuitive graphical user interface guides you for a smooth work process.



Accessory Box

Use the build in accessory box to organize all kinds of accessories.





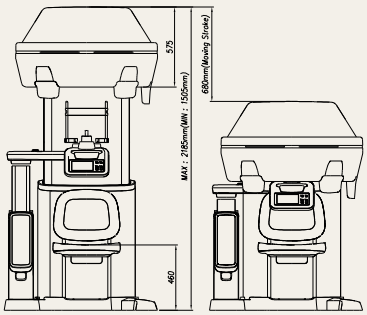
Compact for Clinics

The size of the system is optimized for clinics.
Refer to right product dimensions.

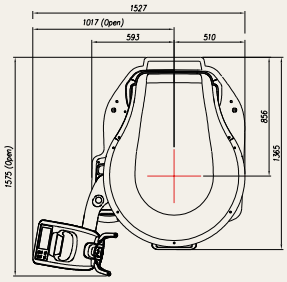
Model	Dimensions	
PaX-i3D Green Premium	Width (mm)	1,527
	Depth (mm)	1,575
	Height (mm)	2,185

Dimensions [Unit: mm]

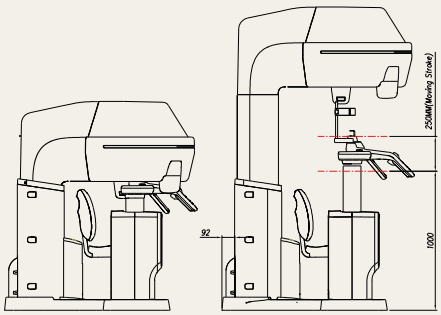
FRONT VIEW



TOP VIEW



SIDE VIEW



Specifications [PaX-i3D Green Premium : PCT-90LH]

Function	CT (Auto Pano/Auto Ceph) + Pano + i-Ceph* + 3D Photo	
CT FOV Size	**Dental**	21 x 19 · 17 x 15 · 12 x 9 · 8 x 8
	ENT	21 x 19 · 17 x 11[TB&PNS] · 17 x 11[Airway]
Scan Time (sec)	**Pano**	13.5
	CT	Max. 18
	i-Ceph	18
Voxel Size (mm)	0.2 · 0.3 · 0.4	
Focal Spot Size	0.5 mm [IEC60336]	
Gray Scale	14 Bit	
Tube Voltage	60 - 120 kV	
Current	4 - 10 mA	
Weight	321 kg (708 lbs)	
Dimensions	1575(L) x 1527(W) x 2185(H) mm	

* i-Ceph provides X-ray image similar to Ceph at lower dose than a CT.

• i-Ceph & 3D Photo functions are optional.
• The specifications are subject to change without prior notice.

Raising The Bar For Excellence

PaX-i3D Premium

Dental Pioneer
VATECH
VATECH Global