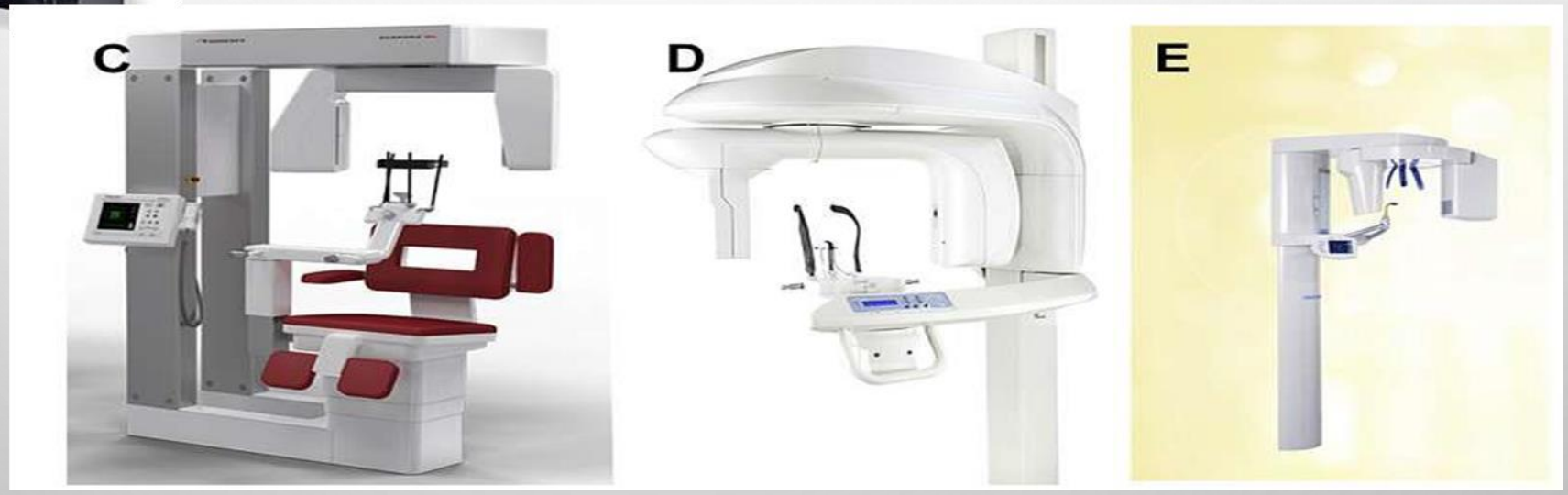
CBCT in dentistry

ASST. PROF. ZAINAB H. AL- GHURABI

LECT. RESHA JAMEEL

ASST. LECT. FARAH ABD ALSALAM


B


C
D
E

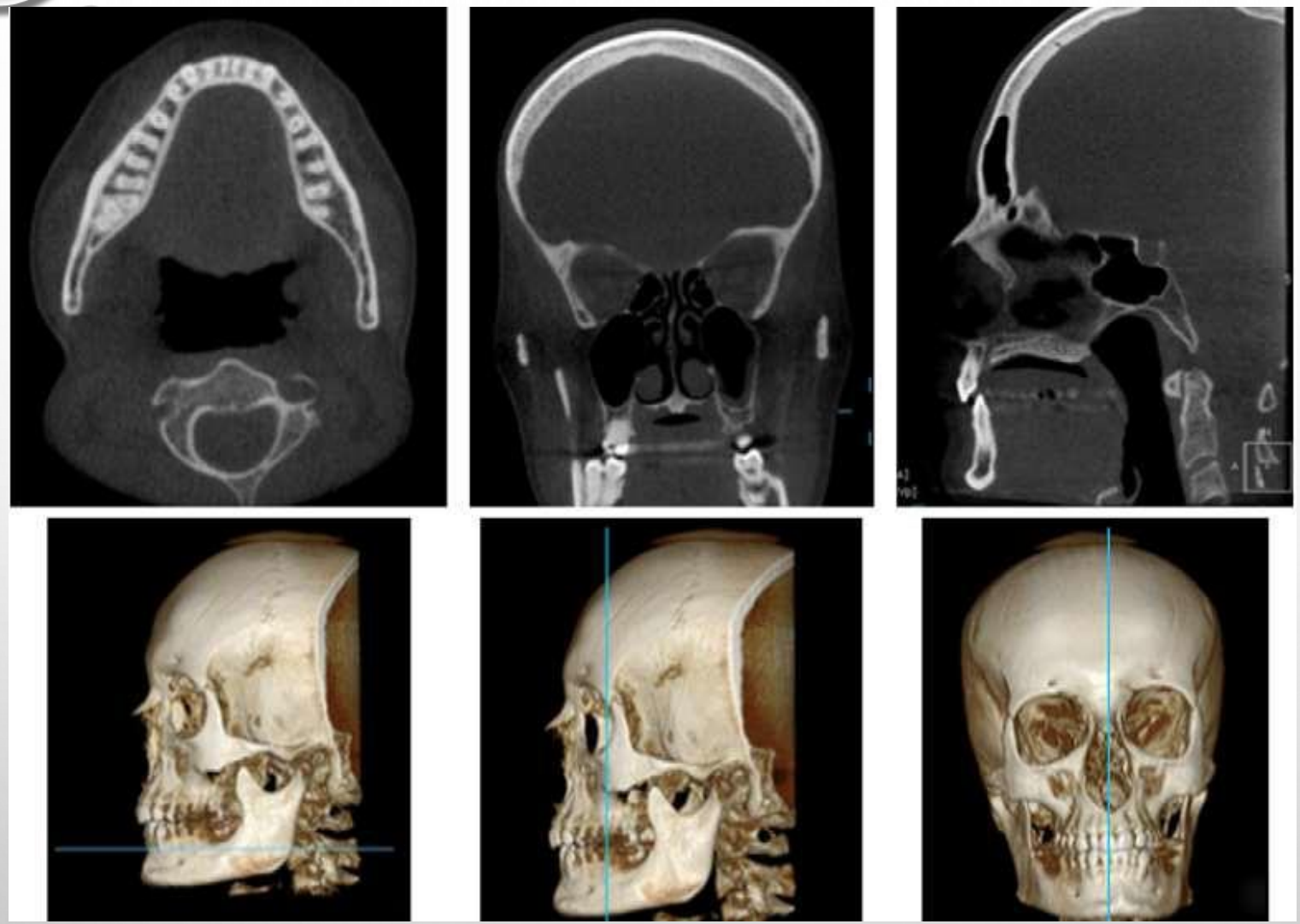
Introduction

Cone-beam computed tomography (CBCT) is an advanced imaging modality that has high clinical applications in the field of dentistry.

CBCT proved to be a successful investigative modality that has been used for dental and maxillofacial imaging.

Radiation exposure dose from CBCT is 10 times or more less than from conventional CT scans during maxillofacial exposure.

Furthermore, CBCT is highly accurate and can provide a three-dimensional volumetric data in axial, sagittal and coronal planes with one rotation



Axial coronal sagittale

Basic plans

This imaging technique is based on a cone shaped X-ray beam, 2D detector that performs one rotation around the object, producing a series of 2D images.

CBCT generates 3D images at a lower cost and absorbed dose compared with conventional CT.

PRINCIPLE OF CBCT IMAGING

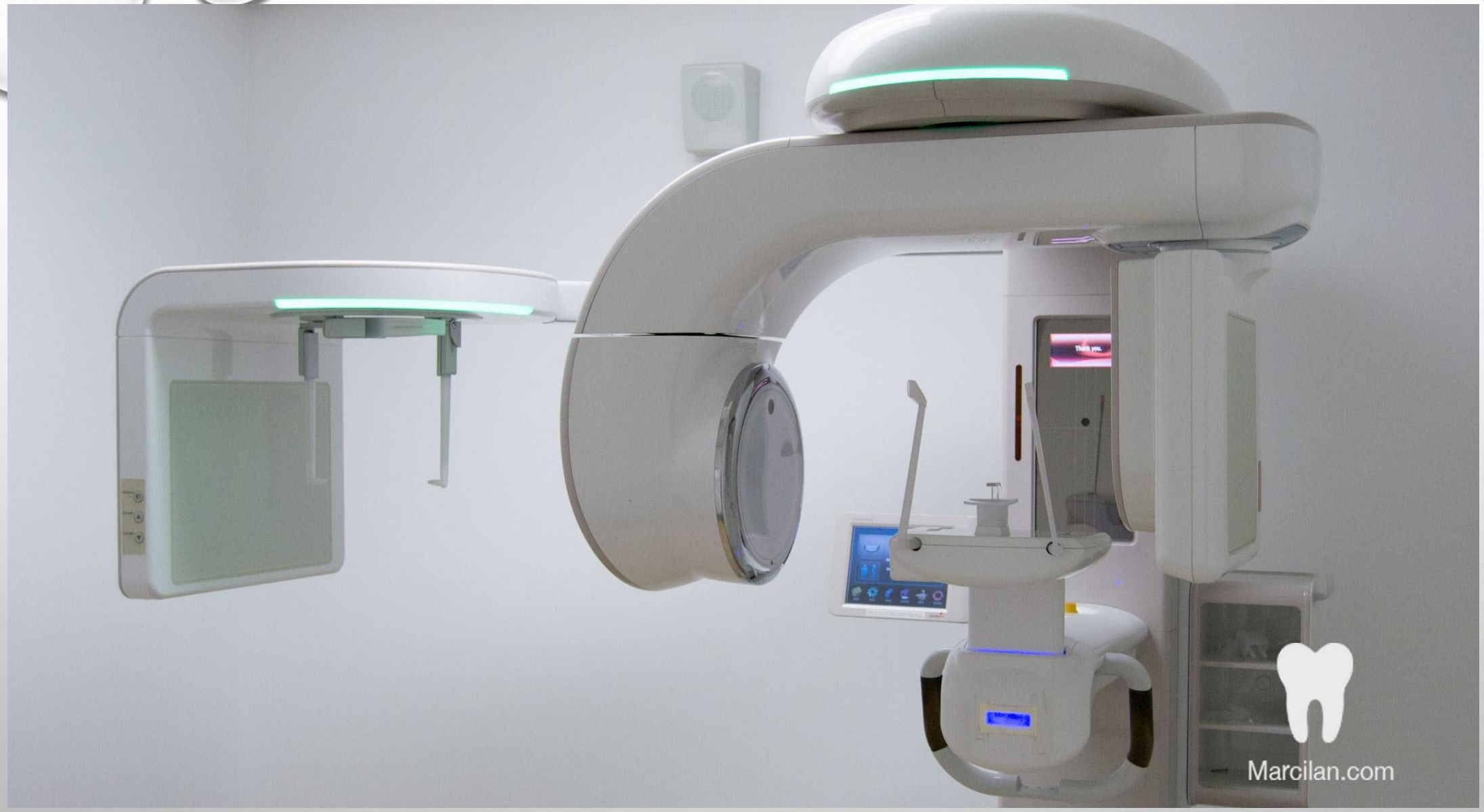
CBCT is based on fixed X-ray source and detector with a rotating gantry.

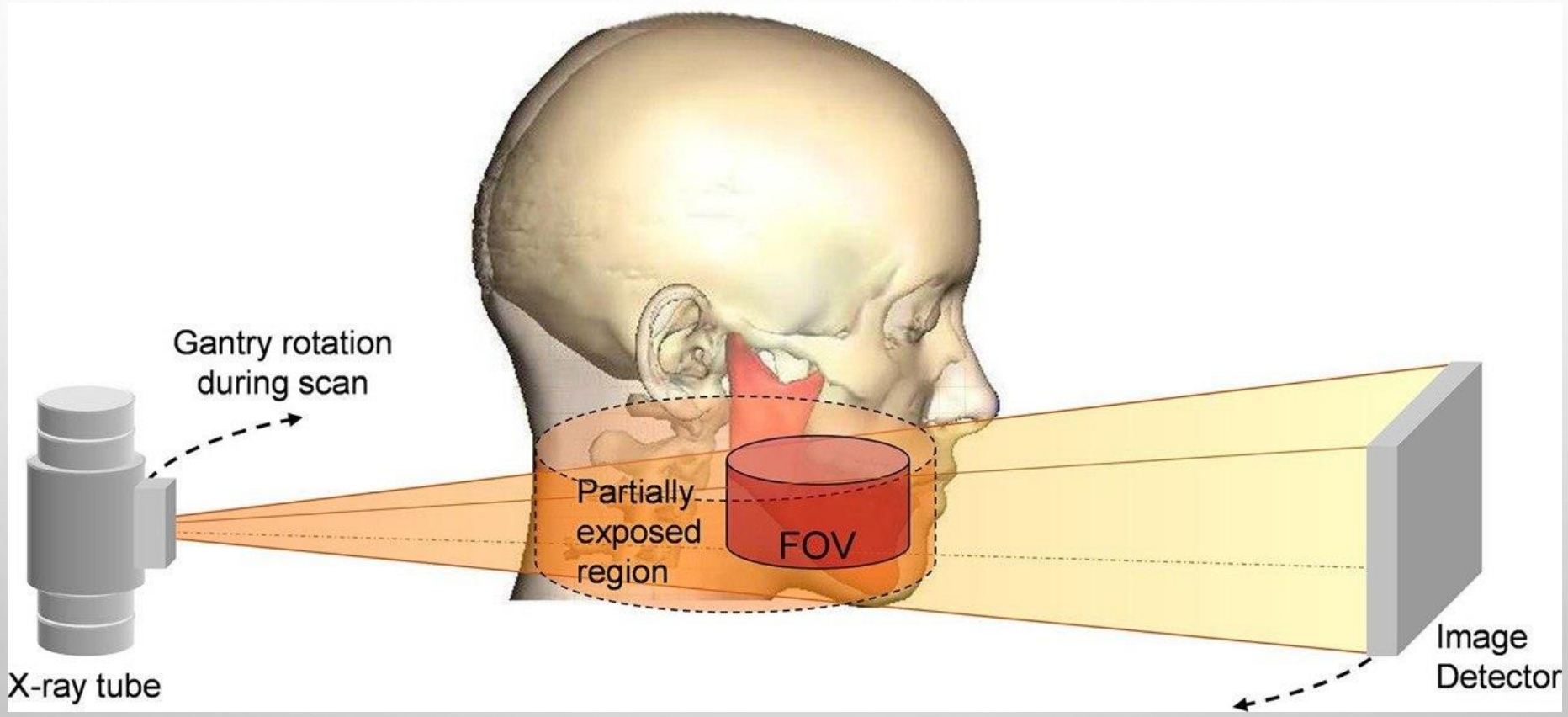
A divergent pyramidal or cone-shaped source of ionising radiation is directed through the middle of the region of interest (ROI).

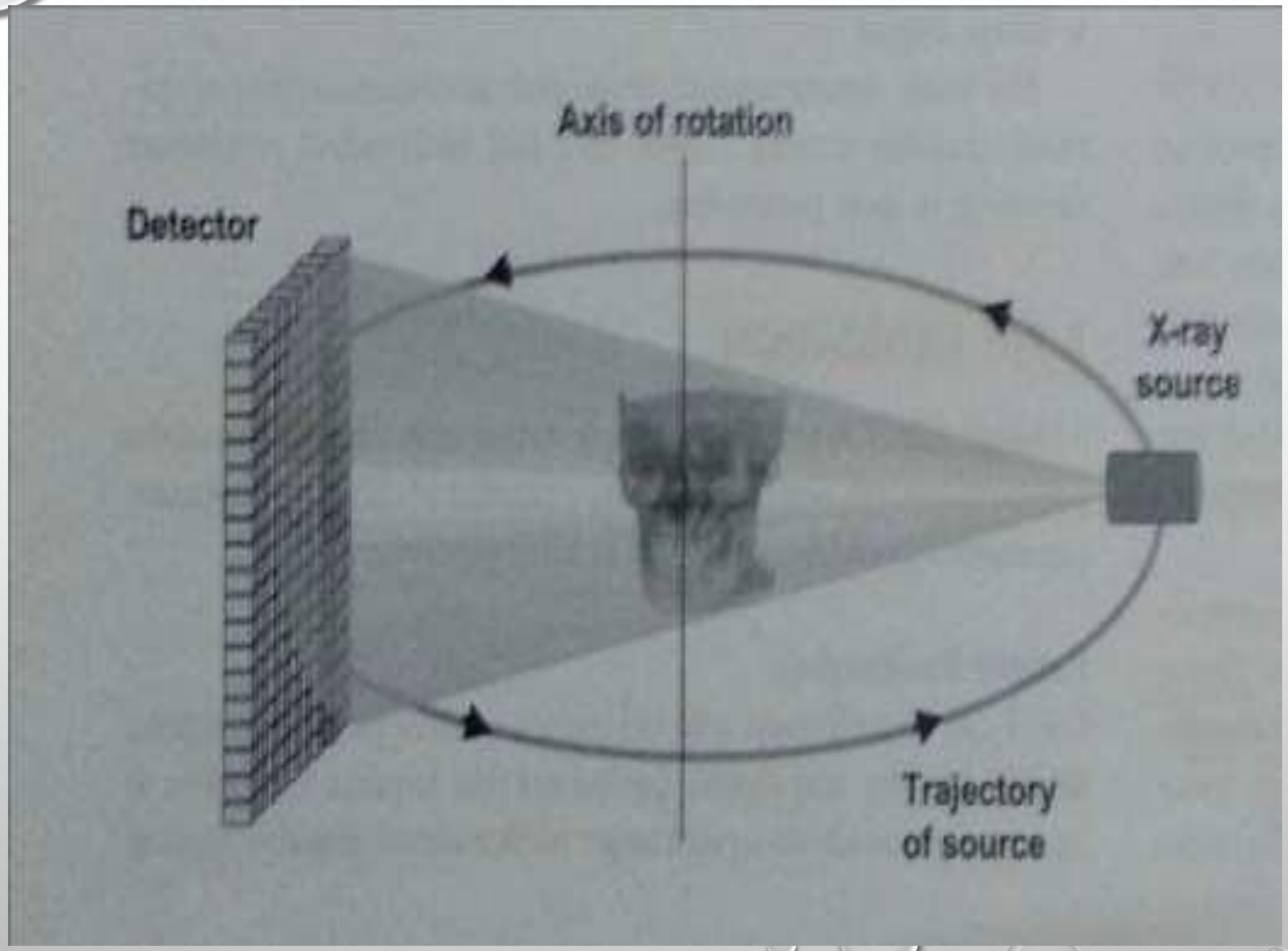
CBCT scanner utilises a 2D X-ray detector on the opposite side, which allows for a single rotation of the gantry to generate a scan.

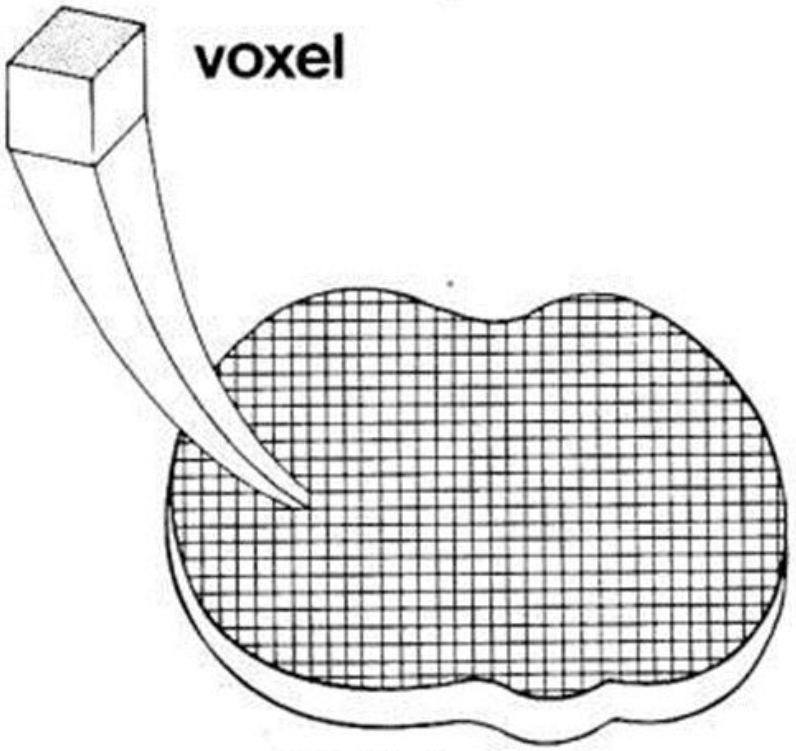
The X-ray source and the detector rotate around a rotation fulcrum fixed within the centre of the ROI.

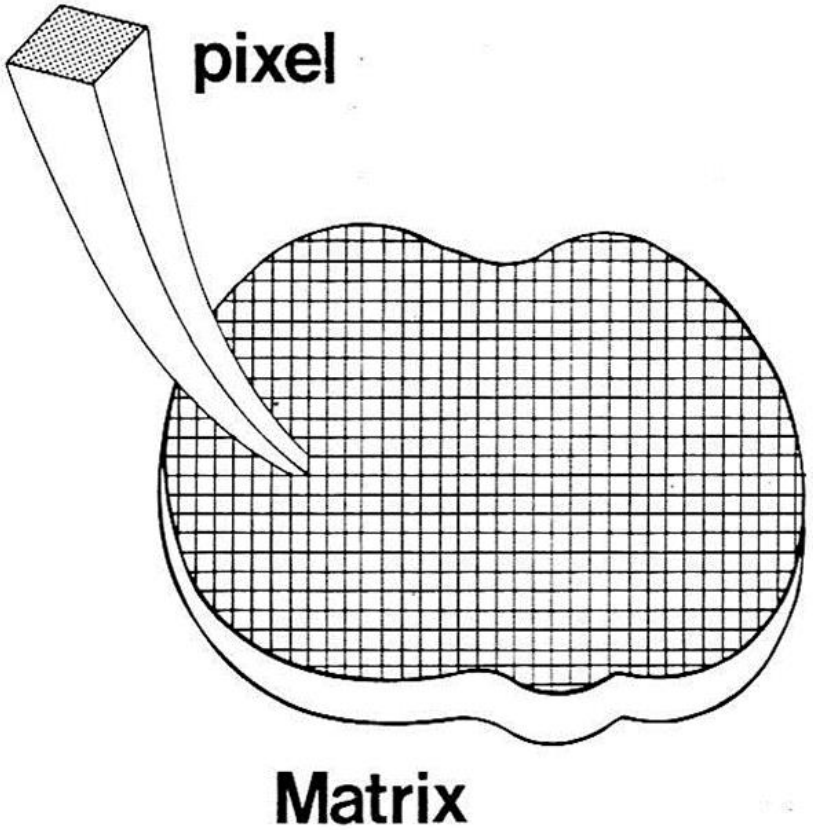
.

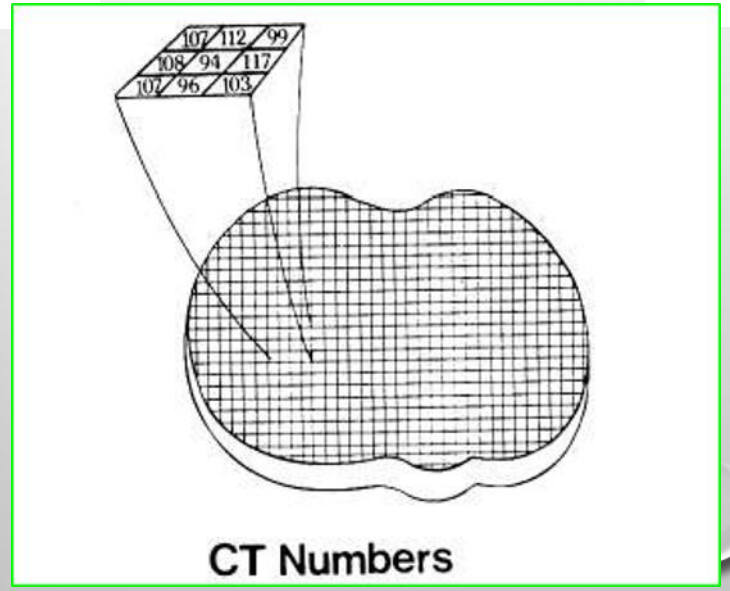

Marcilan.com


Gantry rotation
during scan
Partially
exposed
region
FOV
X-ray tube
Image
Detector


Axis of rotation
Detector
X-ray source
Trajectory of source

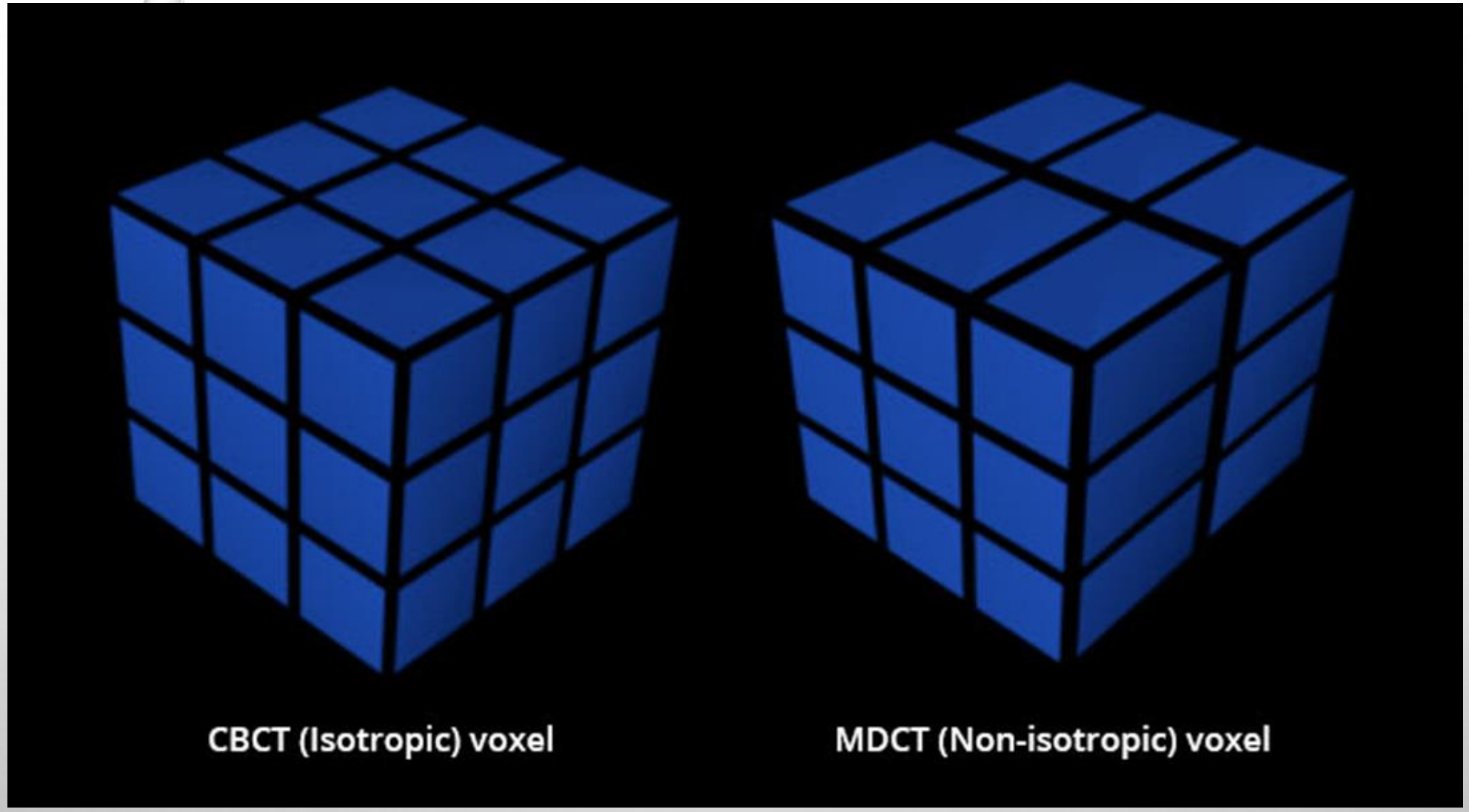

voxel
Matrix


pixel
Matrix


107 112 99
108 94 117
102 96 103
CT Numbers

The voxel on CBCT images is isotropic, which means that all the sides are the same dimension with uniform resolution in all directions.

In contrast, an MDCT voxel is in general nonisotropic meaning that one side of the voxel is different in dimension

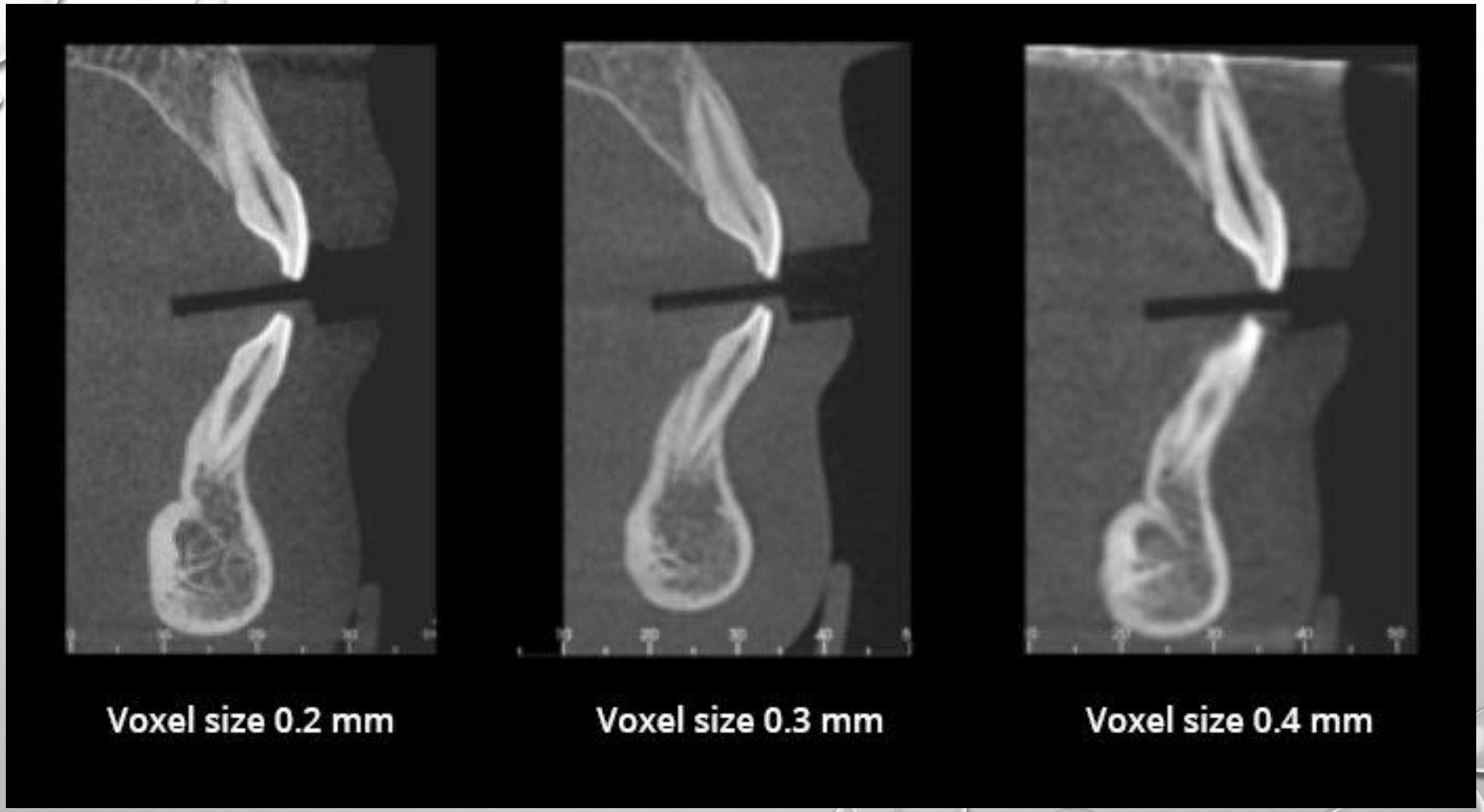

CBCT (Isotropic) voxel
MDCT (Non-isotropic) voxel

The small field of view units may use a small voxel size of 0.076 mm, which enables visualization of very small changes to structures.

Other voxel sizes available for CBCT units are variable, such as 0.2 mm, 0.3 mm, and 0.4 mm.

It is important to note that the larger the voxel size, the less resolution the image will have and less capability to differentiate between small structures

In our device Dentium CBCT the voxel size is ~ 100 micrometer which equal 0.1 mm


Voxel size 0.2 mm
Voxel size 0.3 mm
Voxel size 0.4 mm

FOV

The FOV or the region of interest ….selected can be small, medium and large.

Small FOV(5*5 cm) endodontic diagnosis, periapical conditions, root fracture and implant planning

Single arch, FOV is 5–7 cm

Interarch, 7–10 cm
maxillofacial, 10–15 cm
craniofacial, greater than 15 cm.

In our device there are 3 FOV

*5*5 for Endodontic and periapical assessment*

*10*16 for Maxillofacial (interarch area, max sinus and TMJ)*

*16*18 for Craniofacial region*

Dose of radiation

Radiation dose is a measure of how much energy is absorbed when something or someone is exposed to X-rays.

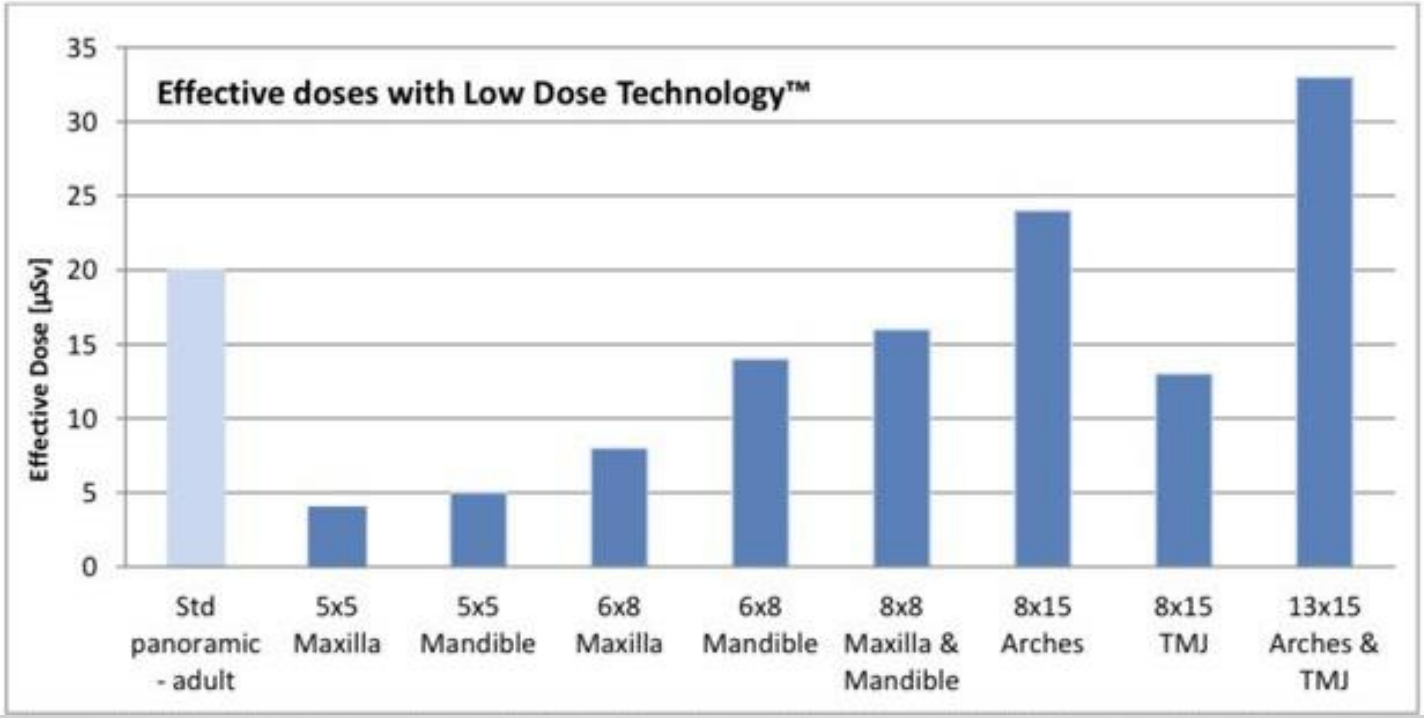
A commonly used quantity to express the dose to a person is effective dose which measured eith

S

Milli S

Micro S.

Results


Effective doses with Low Dose Technology™
Effective Dose [µSv]
35
30
25
20
15
10
5
0
Std panoramic - adult
5x5 Maxilla
5x5 Mandible
6x8 Maxilla
6x8 Mandible
8x8 Maxilla & Mandible
8x15 Arches
8x15 TMJ
13x15 Arches & TMJ

KAVO
Dental Excellence

Effective Dose Reduction Standard, High and ENDO resolutions compared to Low Dose Technology™	**Low Dose Technology™**	**Standard**	**High**	**ENDO**
5x5 - Maxilla	4 µSv	80 %	90 %	93 %
5x5 – Mandible	5 µSv	81 %	91 %	93 %
6x8 - Maxilla	8 µSv	80 %	90 %	
6x8 - Mandible	14 µSv	79 %	90 %	
8x8 - Maxilla & Mandible	16 µSv	79 %	90 %	
8x15 - Arches	24 µSv	80 %	83 %	
8x15 - TMJ	13 µSv	80 %	83 %	
13x15 - Arches & TMJ	33 µSv	60 %	74 %	

Table 1. Dose reduction [%], standard, high and ENDO resolutions compared to Low Dose Technology™.

From the above table it can be concluded that in general, dose reduction between Low Dose Technology™ and standard resolution is 77% and high resolution 86%.

The low dose protocol for the ORTHOPANTOMOGRAPH® OP 3D Pro results in statistically significant and clinically impressive reductions in patient dose for equivalent fields of view.


THANK
YOU!