

Dental Cone Beam CT – A review of our experience

Matt Pryor
Regional Radiation Protection Service
Royal Surrey County Hospital,
Guildford,
Surrey
matt.pryor@nhs.net



What is Dental cone beam CT?

“The new era of user-friendly, 3-dimensional digital radiography has just begun. 3D Accuitomo FPD is a cone beam x-ray CT(Computed Tomography) for Dento-Maxillo-Facial area by J. Morita Mfg. Corp.”



Other system available?

Kodak
Ilumina

Sirona
Galileos

Newtom 9000
9000+

Morita
Accuitomo

I-CAT

Ewoo
EPX-Impla

Hitachi
MercuRay

What shall we test?

Treat it like an x-ray unit?

- Leakage
- HVL
- Focal spot

Treat it like a Panorax unit?

- Output measurements
- DAP at tube
- Beam Height / Width
- Beam Alignment

Treat it like a CT Scanner?

- CTDI measurements
- Slice thickness
- Resolution
- CT number linearity

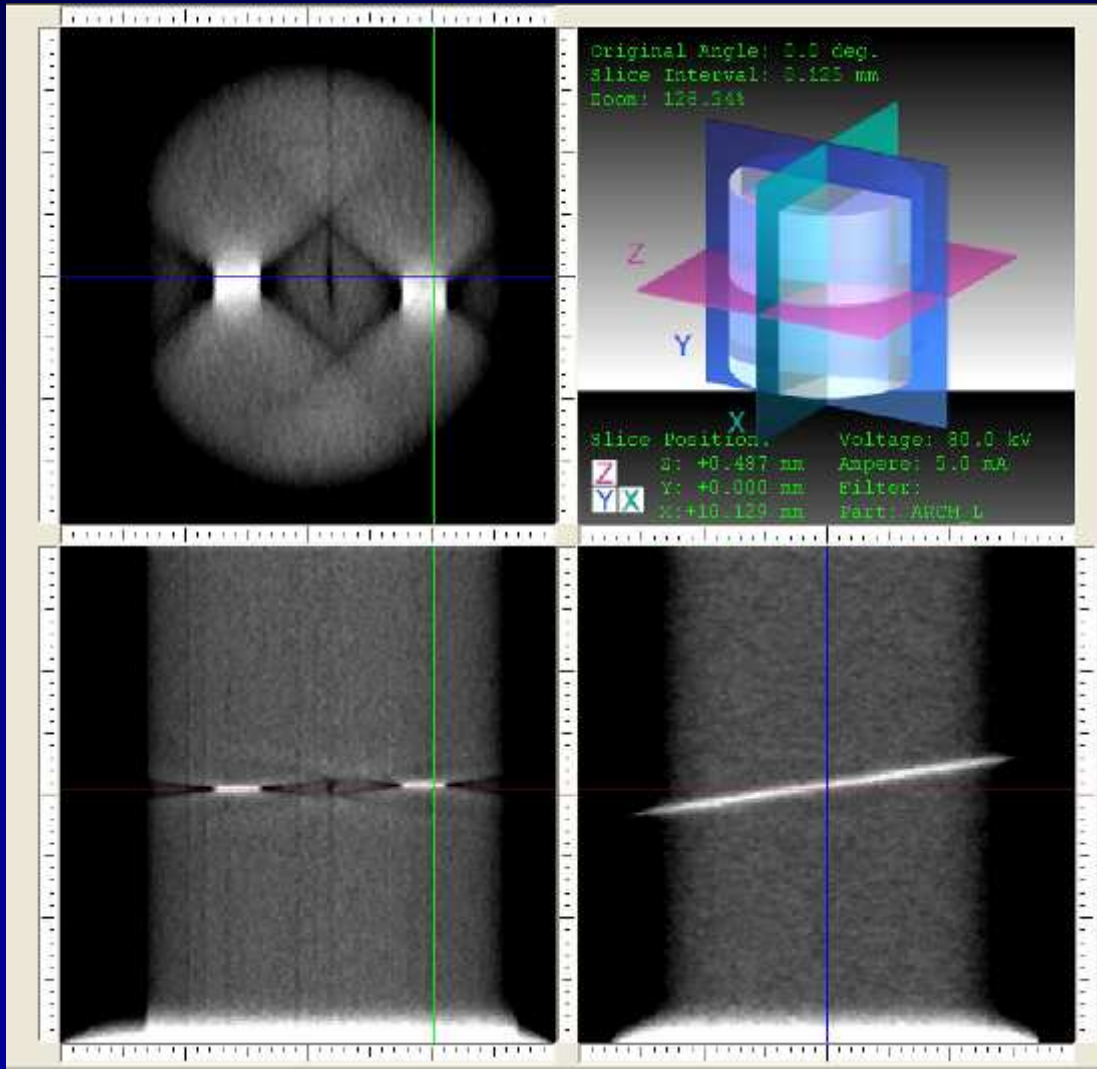
Dose measurements

System	Morita		E-woo	Sirona	Average Panoral
Exposure Settings	80kV 87.5mAs		85kV 81mAs	85kV 28mAs	80 80mAs
Irradiated Area @ isocentre (cm ²)	16	36	64	143	1.1
Output / rotation (mGy)	7.66		4.22	1.25	15
DAP (cGy.cm ²)	448	915	1232	488	75
CTDI _w (mGy/100mAs)	5.7	---	3.2	4.9	---

Image Quality Measurements



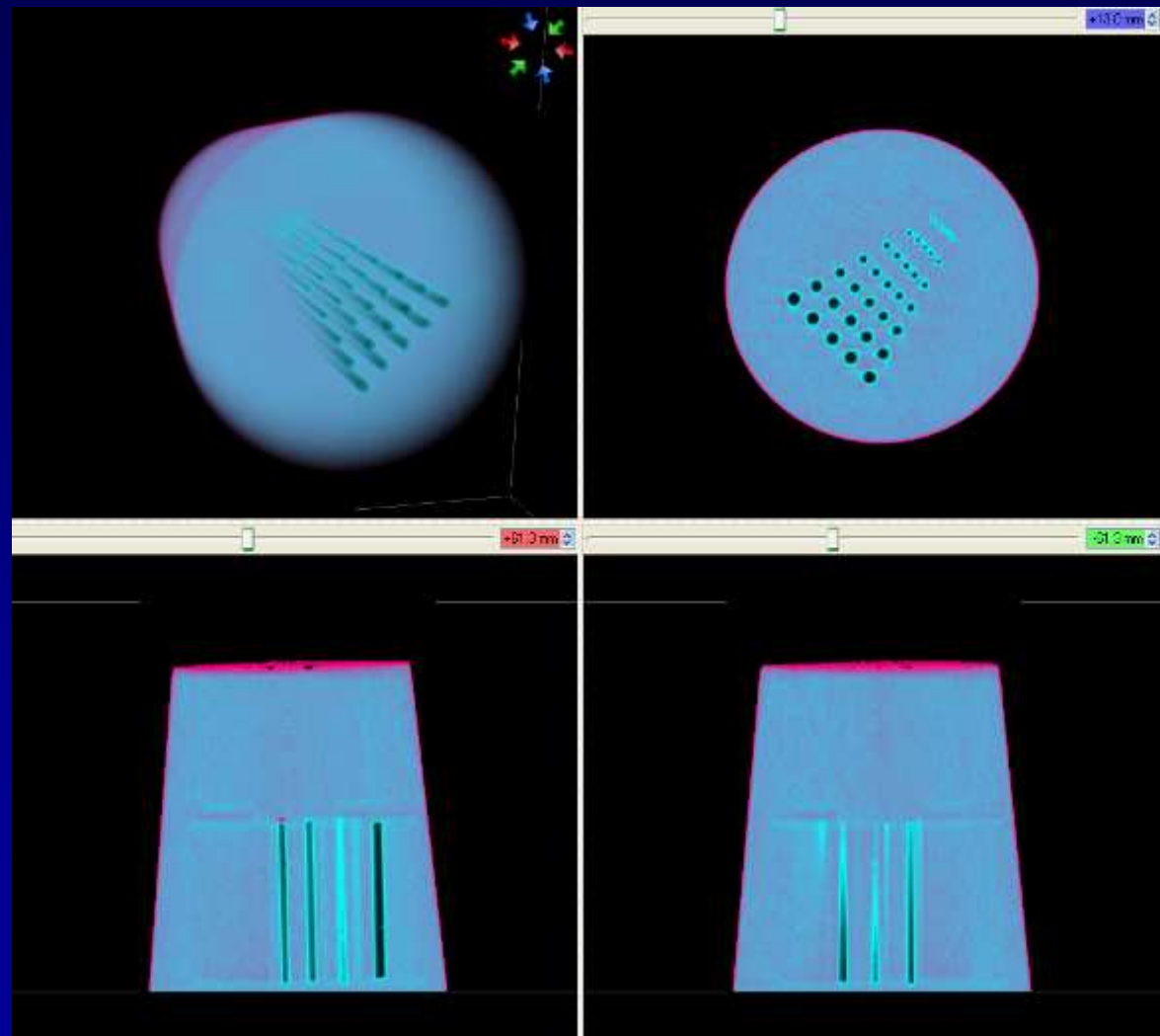
Imaged Slice Thickness



Set (mm)	Morita	Ewoo	Sirona
0.125	0.71	-	-
0.3	-	-	0.6
0.5	0.72	0.53	-
1	1.1	-	-
2	1.79	-	-

Resolution

	Resolution (lp/mm)
Morita	1.0
Ewoo	0.92
Sirona	1.0



Other Tests

Noise

- Difficult to quantify due to test objects available and scan parameters.
- Useful for annual consistency checks?

Positioning

- Only available on some systems with smaller FOV's
- Requires a 'scout' image and therefore more dose.

CT Values

- No relationship with measured values on any system.

Cone Beam CT in Dentistry

A few issues.....

Phil Hollaway

Royal Surrey County Hospital, Guildford, Surrey

phil.hollaway@nhs.net



Increasing
number of makes
and models

No standards
or guidance

Protection
requirements
variable

Dental Cone Beam CT

Local QC

Wide range in
doses

Separate
OPG?

Dental CBCT Equipment

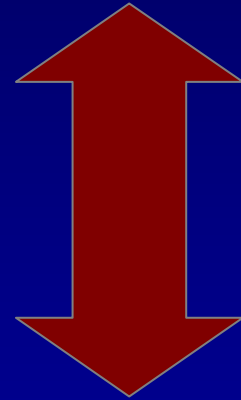
- Units available from most of the dental X-ray equipment manufacturers and some specialist companies
- Broad range of technologies and designs....
- Flat panel and image intensifiers
- FOV 4-22cm square or circular
- Pulsed or continuous exposure
- Built in panoramic option either true 2D or reconstructed 3D



Radiation Protection Aspects

Carestream (Kodak) Iluma:

Up to 120 kV up to 152 mAs (3.8 mA/40 sec)
continuous



Different
protection
requirements ?

Sirona Galileos:

85kV up to 35 mAs pulsed

Radiation Protection Aspects

- Protection issues not always clearly understood by installers
- Limited amount of scatter data available from suppliers
- Companies not in a position to complete critical examinations
- Significant time (and cost) to test thoroughly




Dental CBCT Panoramic Exposures

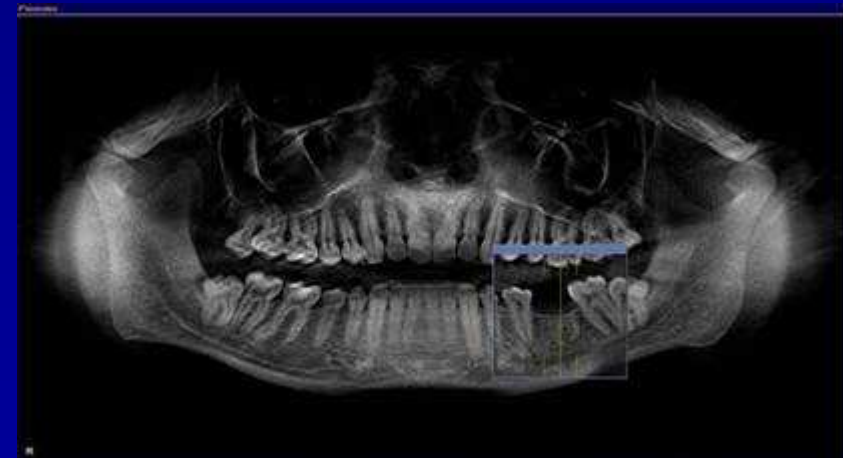
- Some CBCT have a secondary collimator and programming to produce a 2D image
- Other units produce a panoramic image from the CT data (with a cone beam CT dose)
- Typical panoramic dose ~70 mGycm²
- Remedial (IPEM 91) 100 mGycm²
- Sirona 85 kV 28 mAs ~ 500 mGycm²
- For panoramic imaging NOT ALARA! – use dedicated panoral instead.

The 3 main USPs of **GALILEOS 3D**

- 1. **SCAN** – A single, quick scan provides a large 3D field-of-view encompassing the complete oral/ maxillofacial region
- 2. **PANoramic and cephalometric views included - no added costs**
Patented diagnostic evaluation window / slice views with real time correlation
- 3. **PLAN** - Seamless integration of superior 3D visualization software and application software modules (e.g. implant planning, orthodontic software, periodontic evaluation)-



GALILEOS^{3D} The Dental Company **sirona**



Wide range in doses

Ref. Dosimetry of recently introduced CBT Units for Oral and Maxillofacial Radiology. John B Ludlow, Laura E Davis-Ludlow, Andre Mol University of North Carolina

Unit	Effective Dose μSv
Galileos (Default)	29.3 μSv
Iluma (Standard)	331.0 μSv
Promax 3D (small/large adult)	156.8/210.2 μSv



