Computed Tomography IMAGE QUALITY (III)

- PREPARED BY :AHMED JASEM ABASS MSC MEDICAL IMAGING





CT IMAGE QUALITY

SPATIAL RESOLUTION

RADIATION DOSE



IMAGE ARTIFACTS

CONTRAST RESOLUTION

NOISE

SPATIAL RESOLUTION

- DEGREE OF BLURRING IN THE IMAGE
- MEASURE OF THE ABILITY TO DISCRIMINATE OBJECTS OF VARYING DENSITY A SMALL DISTANCE APART AGAINST A UNIFORM BACKGROUND

FACTORS AFFECTING SPATIAL RESOLUTION

- SLICE THICKNESS
- FOCAL SPOT SIZE
- DETECTOR WIDTH
- TYPE OF CONVOLUTION FILTER (KERNEL)
- MATRIX SIZE
- FOV

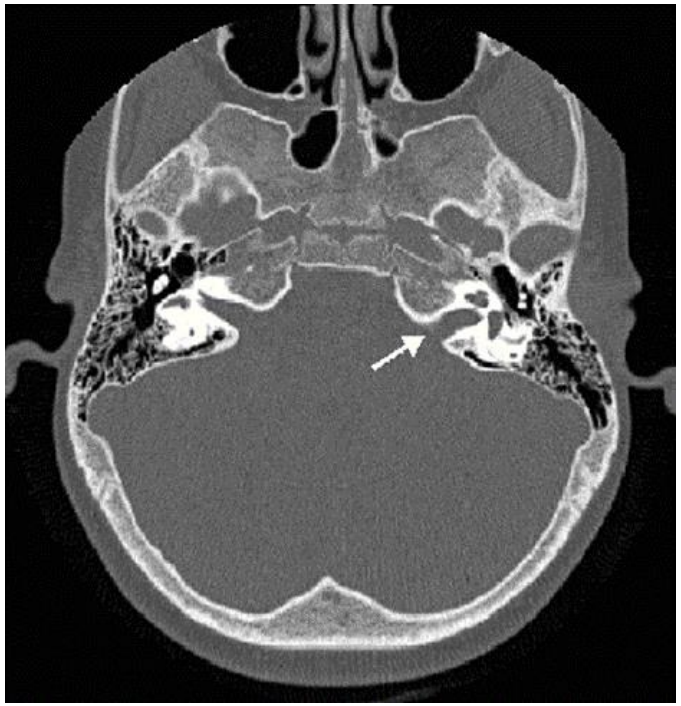
SLICE THICKNESS

SLICE THICKNESS



5 MM

S. RESOLUTION



1 MM

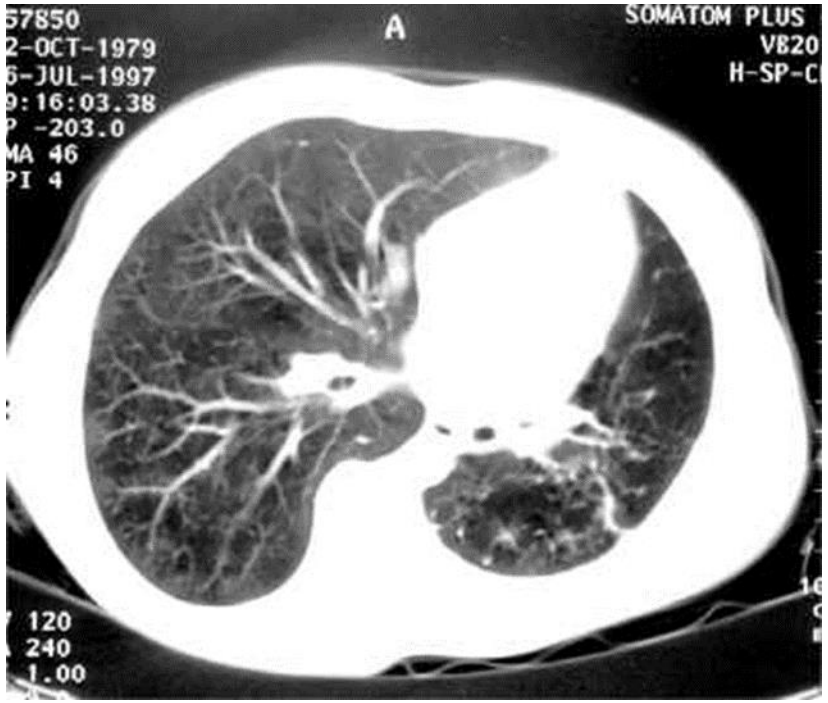
FOCAL SPOT SIZE AND DETECTOR WIDTH

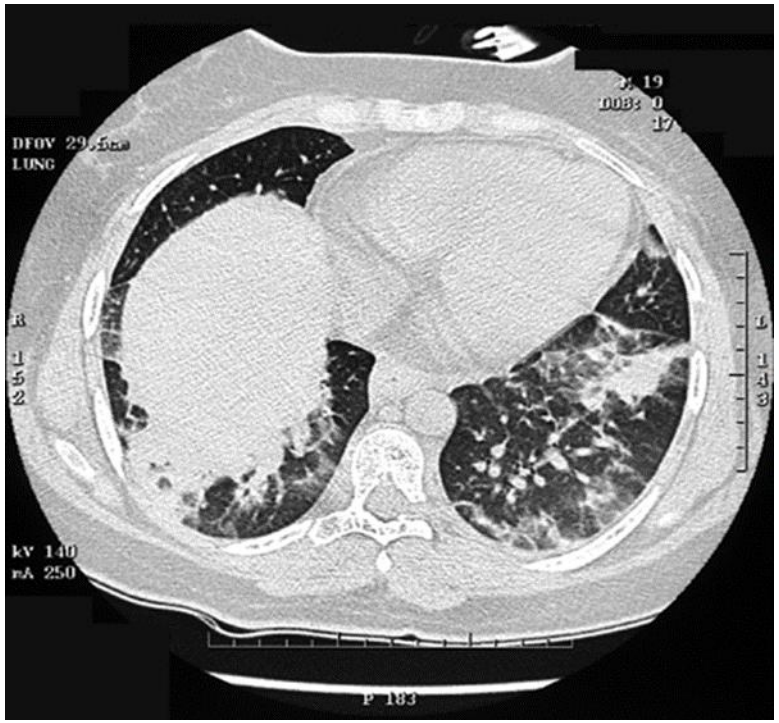
DETECTOR WIDTH	**S. RESOLUTION**
FOCAL SPOT SIZE	S. RESOLUTION

TYPE OF CONVOLUTION FILTER

SHARP KERNEL S. RESOLUTION

SMOOTH **SHARP**

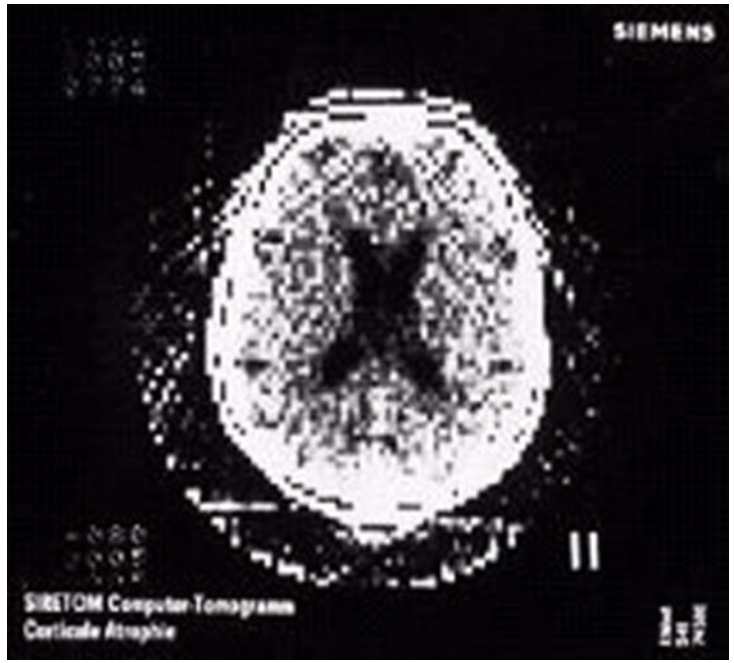




MATRIX SIZE

MATRIX SIZE ↑ S. RESOLUTION ↑

80 X 80



512 X 512



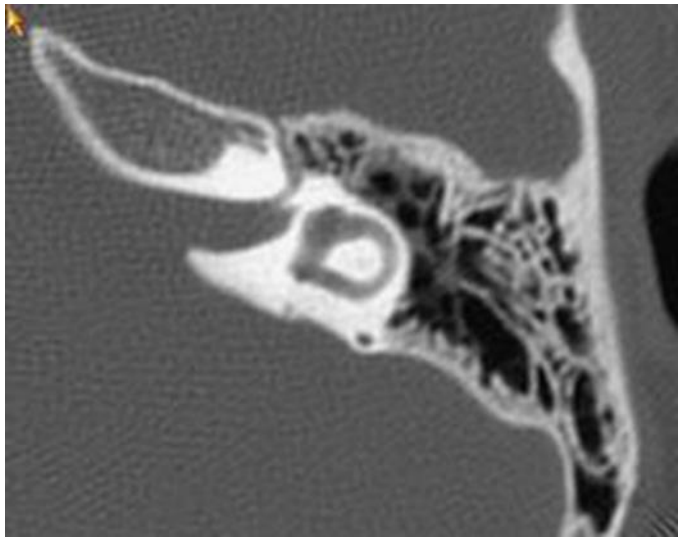
DFOV SIZE

DFOV ↑ S. RESOLUTION ↓

20CM



10CM



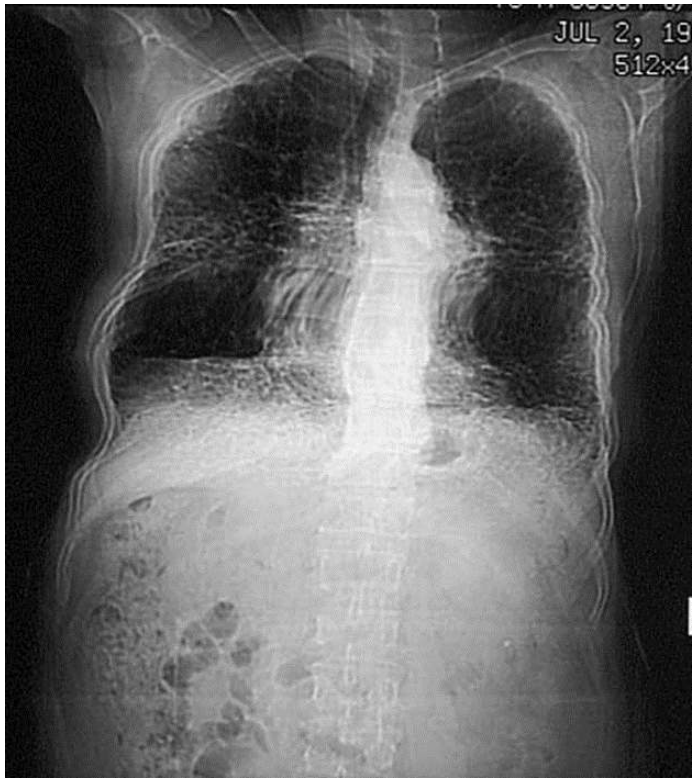
ARTIFACT

- ANY DISCREPANCY BETWEEN THE CT NUMBERS REPRESENTED IN THE IMAGE AND THE EXPECTED CT NUMBER BASED ON THE LINEAR ATTENUATION COEFFICINT .

Motion Artifacts

SHADING ,STREAKING ,BLURRING,OR GHOSSTING)





REMEDY:

- VOLUNTARY MOTION: EXPLANATION OF THE PROCEDURE AND GOOD COMMUNICATION WITH A PATIENT
- INVOLUNTARY MOTION: SHORT SCAN TIME

- USE POSITION AIDS OR IMMOBILIZATION DEVICE .

- CONSIDER SEDATION PARTICULARLY FOR PEDIADTRIC PATIENTS

BEAM HARDENING

- IT OCCURS WHEN THE AVERAGE ENERGY OF AN X-RAY BEAM PASSING THROUGH THE PATIENT INCREASES. BEAM IS “HARDENED” HIGH ENERGY PHOTONS ARE ATTENUATED LESS BY THE TISSUE. AS A RESULT, THEY ARE PASS THROUGH THE PATIENT AND REACH THE DETECTORS. THIS ARTIFACT IS ALSO CALLED “CUPPING” ARTIFACT BEACAUSE THE HARDENING IS MOST PRONOUNCED IN THE CENTER AND LESS AT THE PERIPHERY. IT RESAMBLES A CUP.



REMEDY

- INCREASE kVp
- DECREASE SLICE THICKNESS
- INCREASE FILTRATION – BOWTIE FILTER

METAL ARTIFACT

- MANIFEST ITSELF AS “STAR STREAKING” ARTIFACT. IT’S CAUSED BY PRESENCE OF METALLIC OBJECTS INSIDE OR OUTSIDE THE PATIENT. METALLIC OBJECT ABSORBS THE PHOTONS CAUSING AN INCOMPLETE PROFILE





REMEDY

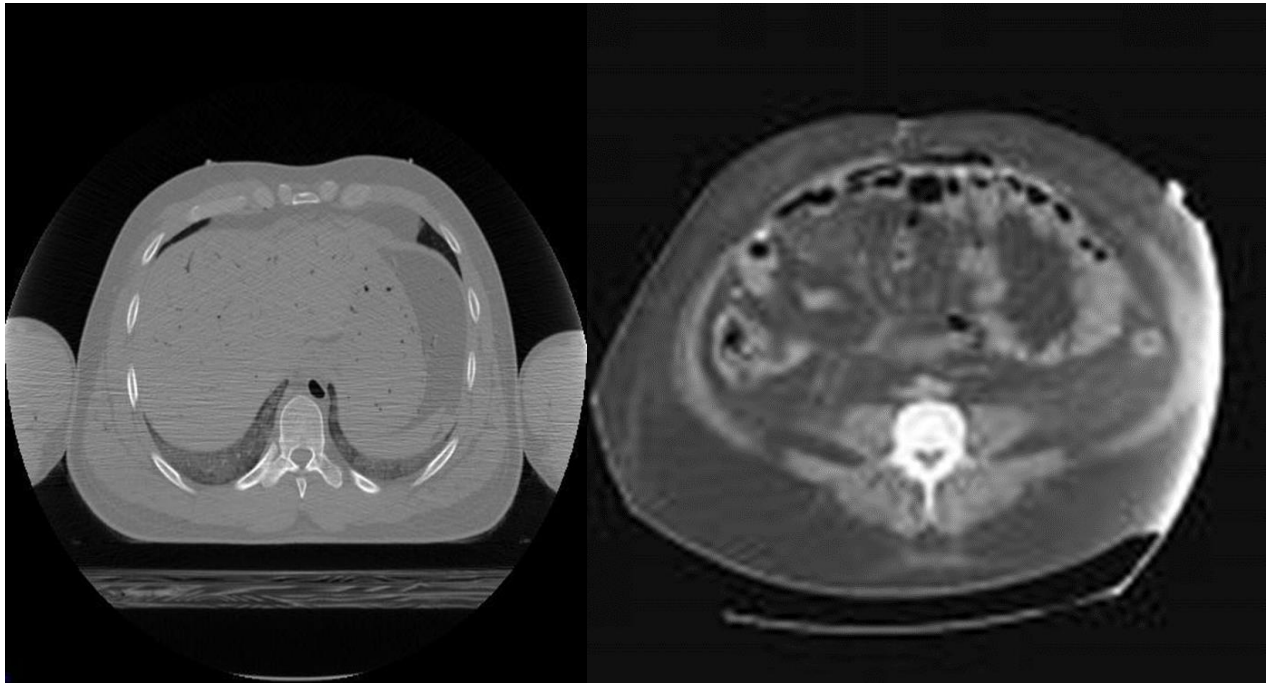
- REMOVAL OF EXTERNAL METALLIC OBJECTS
- MAR SOFTWARE
- GANTRY ANGULATION

- INCREASE TECHNIQE PARTICULARLY KVP.

- USE THIN SLICE

OUT OF FIELD ARTIFACT

- PATIENT IS NOT ENTIRELY ENCLOSED IN THE SCANNING FIELD OF VIEW. PATIENTS BODY CAN OBSTRUCT DETECTORS. IN ADDITION, PATIENT TISSUE OUTSIDE THE SFOV WILL FURTHER HARDEN THE X-RAY BEAM. ARTIFACT APPEARS AS STREAKS AND SHADING.

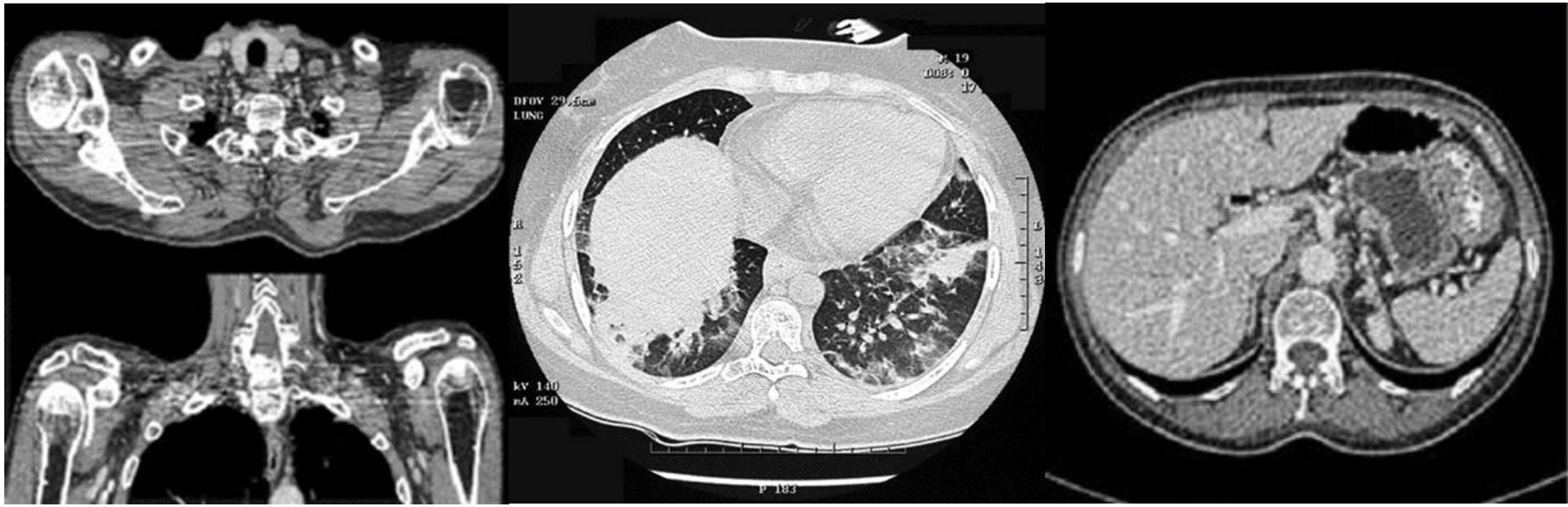


REMEDY

- SELECTION OF LARGER SFOV
- TAPING PATIENT TISSUE
- RAISING PATIENTS ARMS ABOVE THEIR HEAD ON THE SCAN OF CHEST AND ABDOMEN

NOISE

- FLUCTUATION OF CT# BETWEEN POINTS IN THE IMAGE FOR A SCAN OF UNIFORM MATERIAL SUCH WATER.



REMEDY

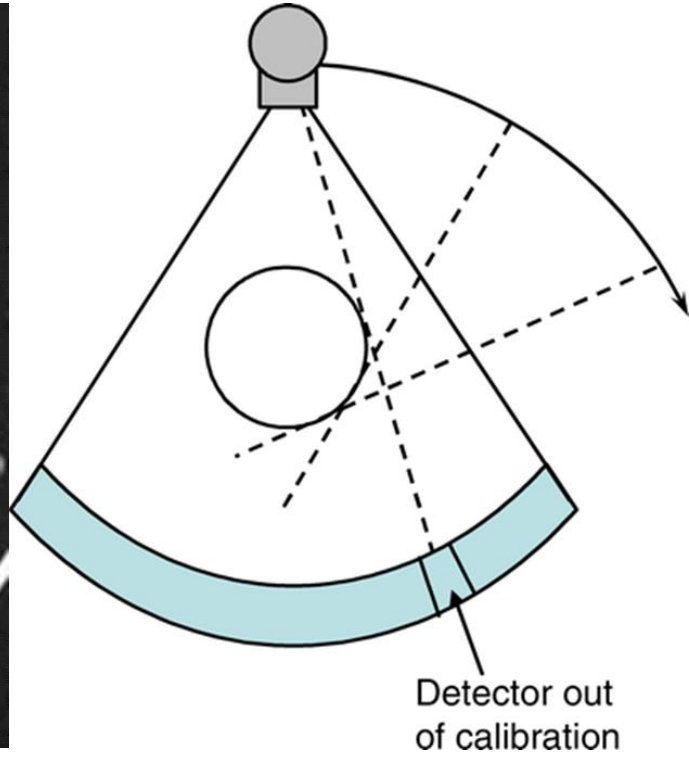
- kVp INCREASE
- mAs INCREASE
- SLICE THICKNESS INCREASE

RING

- MALFUNCTION OF A DETECTOR IN A THIRD GENERATION SCANNER
- REMEDY

- DETECTOR CALIBRATION
- DETECTOR REPLACEMENT





TUBE ARCING

- TUNGSTEN VAPOR FROM ANODE AND CATHODE INTERCEPTS THE PROJECTILE ELECTRONS INTENDED FOR COLLISIONS WITH THE TARGET. CRACKLING SOUND!!!!
- REMEDY
- GAS BURNOFF
- TUBE REPLACEMENT



LINE IN TOPOGRAM

- BAD DETECTOR CAUSES CONTINUOUS LINE ON THE TOPOGRAM
- REMEDY
- DETECTOR REPLACEMENT



STAIRCASE

- IMPROPER SELECTION OF SLICE THICKNESS AND SLICE INCREMENTATION WHEN GENERATION MPR AND 3-D IMAGES
- THIN SLICE USE
- 50% OVERLAP ON RECON SLICE INCREMENTATION



QUESTIONS

- DEFINE BEAM HARDENING?
- WHAT is ARTIFACT?
- WHAT IS THE DIFFERENCE BETWEEN SLICE THICKNESS AND DFOV ON IMAGE QUALTY?



