Computed Tomography
IMAGE RECONSTRUCTION (2)

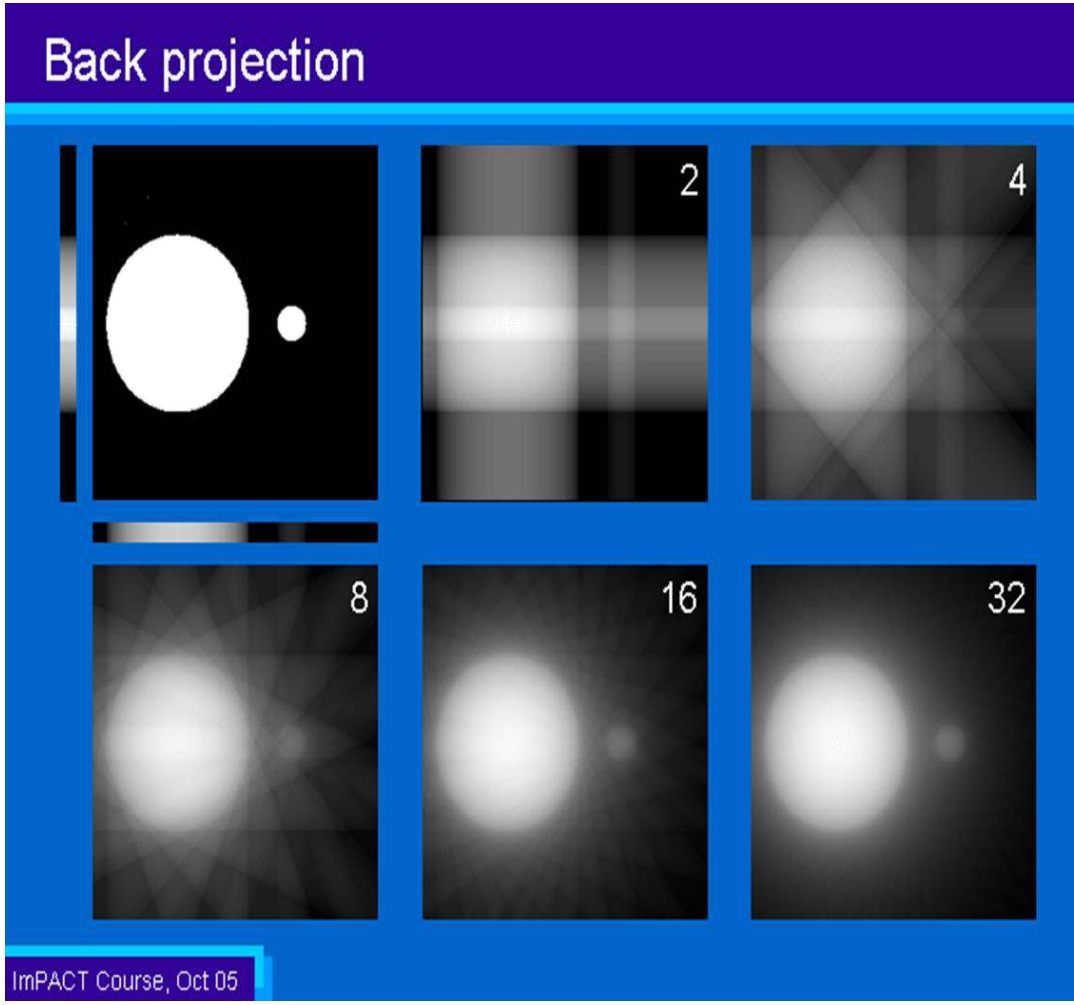
- PREPARED BY :AHMED JASEM ABASS
- MSC MEDICAL IMAGING





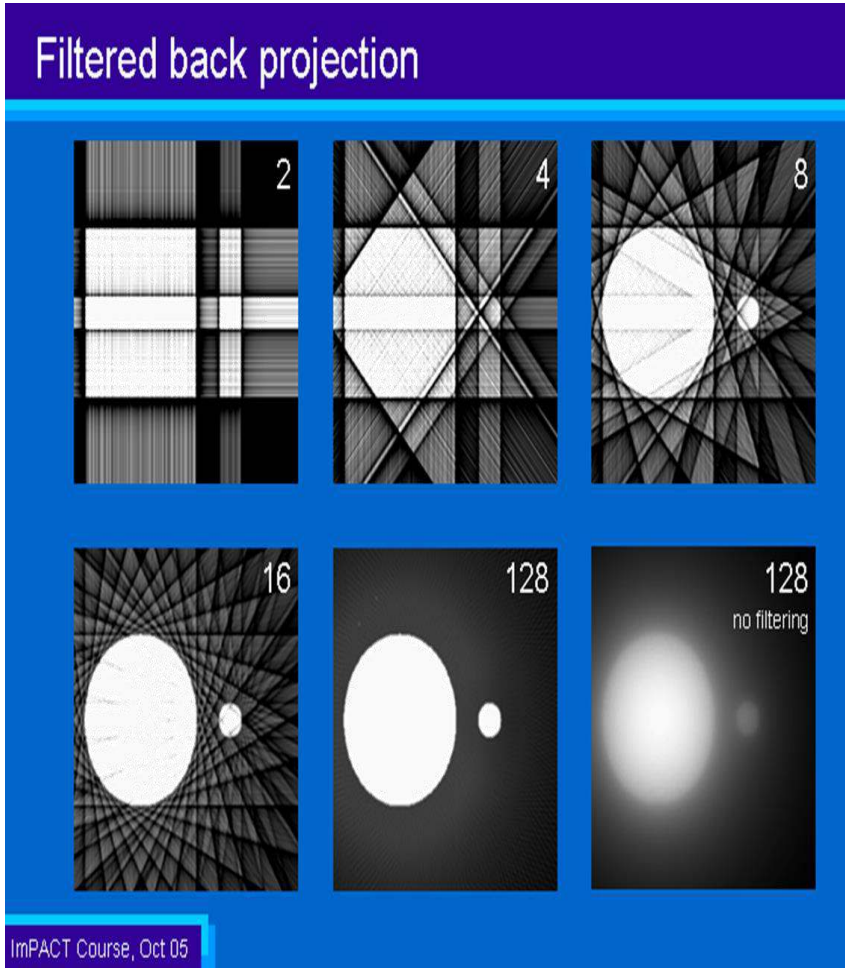
BACK PROJECTION

- REVERSE THE PROCESS OF MEASUREMENT OF PROJECTION DATA TO RECONSTRUCTED IMGE



FILTERED BACK PROJECTION

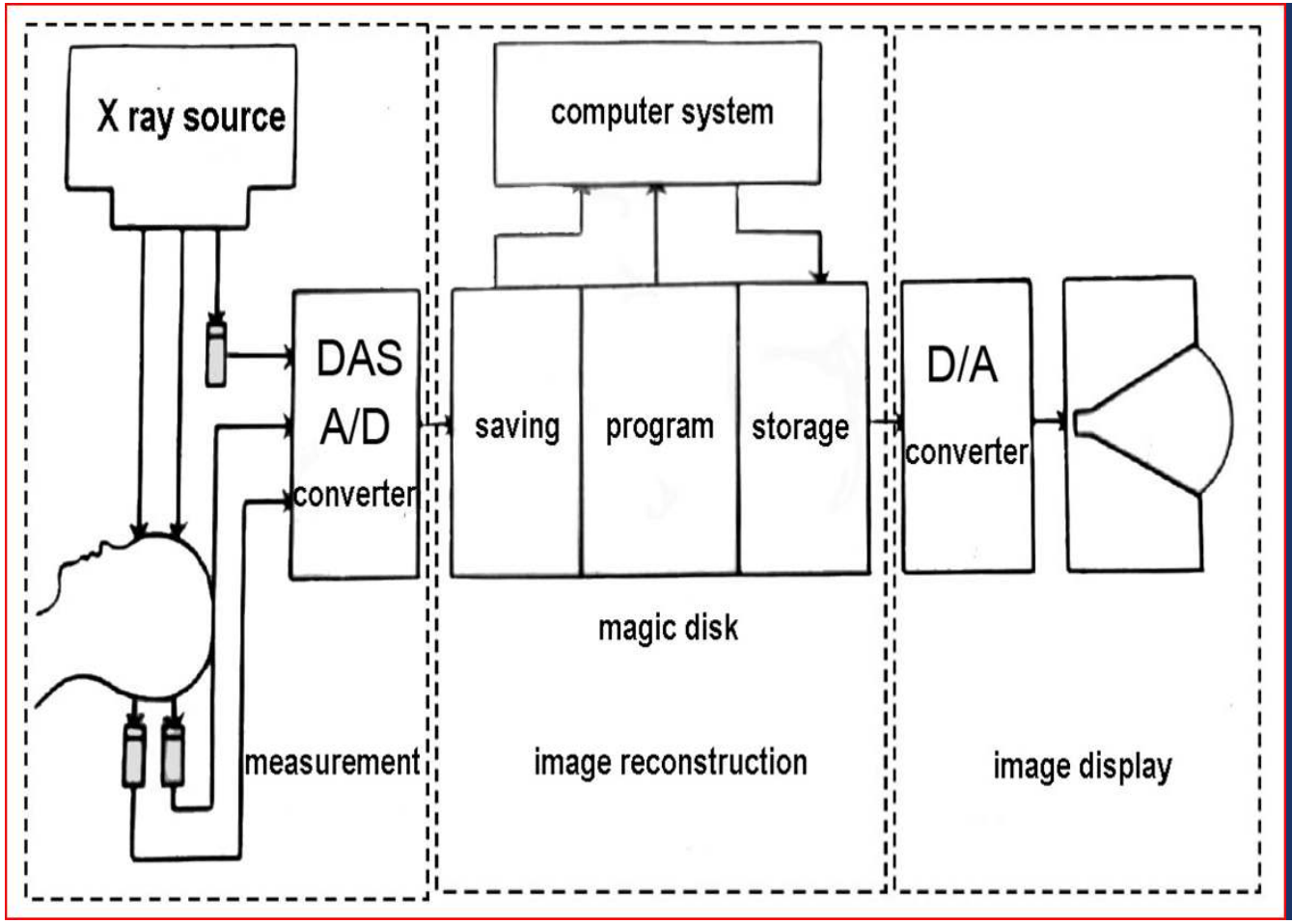
- BACK PROJECTION PRODUCES BLURRED TRANS-AXIAL IMAGES
- PROJECTION DATA NEEDS TO BE FILTERED BEFORE RECONSTRUTION
- DIFFERENT FILTERS CAN BE APPLIED FOR DIFFERENT DAIGNOSTIC PURPOSES
- SMOOTHER FILTAERS FOR VIEWING SOFT TISSUE
- SHARP FILTERS FOR HIGH RESOLUTION

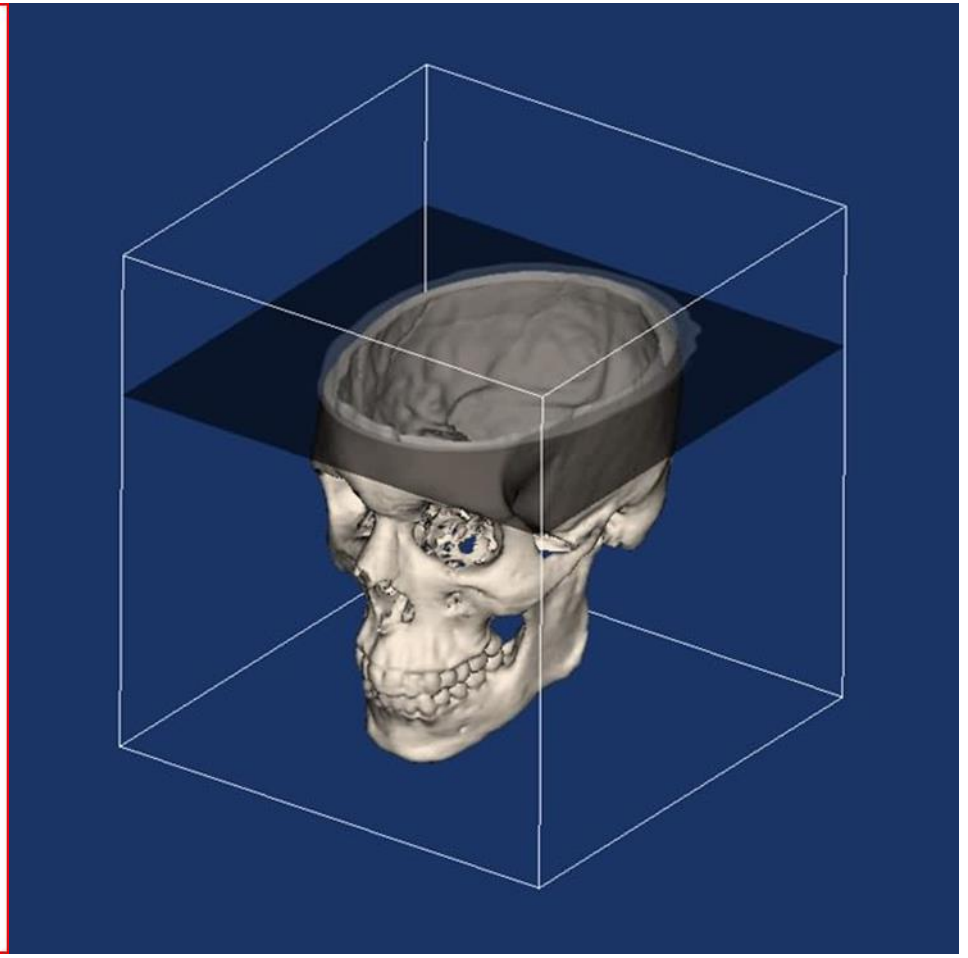


CT IMAGE RECONSTRUCTION

- DATA THAT HAVE BEEN BACKPROJECTED INTO THE IMAGE MATRIX TO CREATE CT IMAGES DISPLAYED ON THE MONITOR
- THE OBJECTIVE OF CT IMAGE RECONSTRUCTION IS TO DETERMINE HOW MUCH ATTENUATION OF THE NARROW X-RAY BEAM OCCURS IN EACH VOXEL OF THE RECONSTRUCTION MATRIX .THESE CALCULATED ATTENUATION VALUES ARE THEN REPRESENTED AS GREY LEVELS IN A2- DIMENTIONAL IMAGE OF THE SLICE .

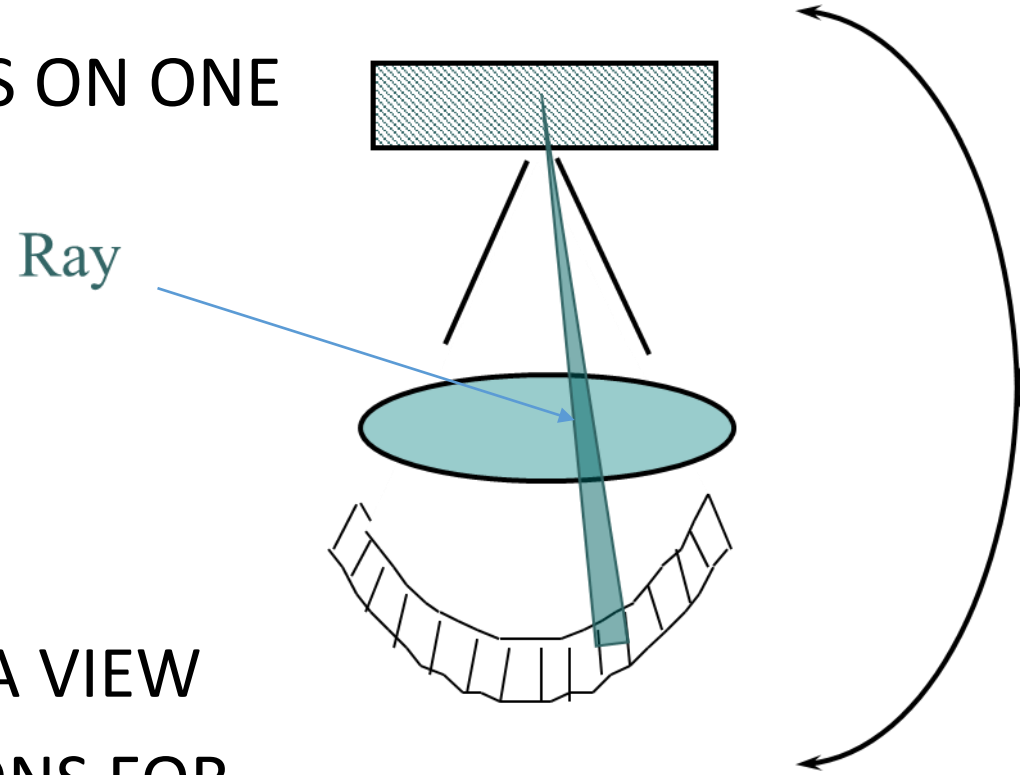
IMAGE RECONSTRUCTION





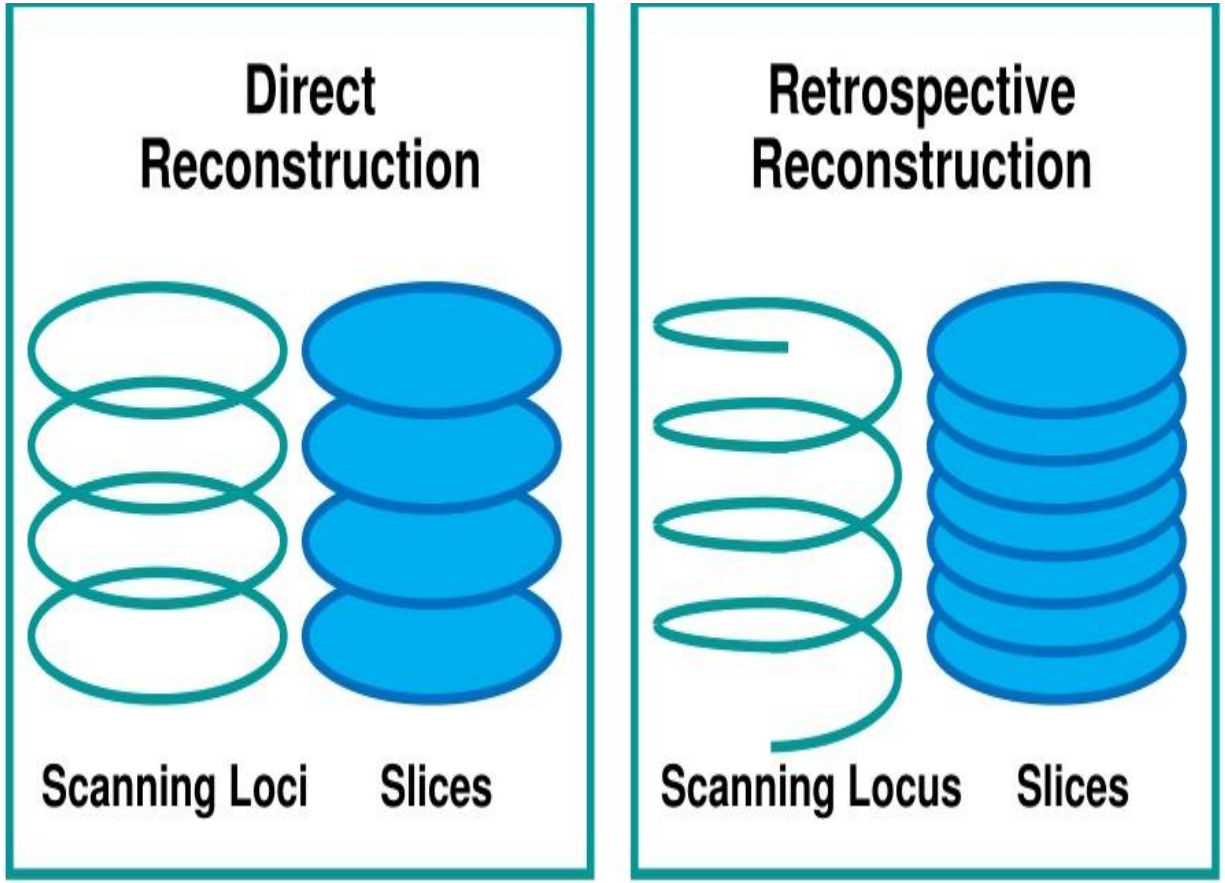
TERMINOLOGY OF IMAGE RECONSTRUCTION

- RAY: PART OF THE X-RAY BEAM THAT FALLS ON ONE DETECTOR
- VIEW:COLLECTION OF THE RAYS FOR ONE TRANSLATION ACROSS THE OBJECT
- PROFILE:ANALOG SIGNAL GENERATED IN A VIEW
- ALGORITHM-A SET OF RULES OR DIRECTIONS FOR GETTING SPECIFIC OUTPUT FROM SPECIFIC INPUT



DIRECT AND RETROSPECTIVE RECONSTRACTION

- RECONSTRUCTION WHEN ONE OR MORE TECHNICAL FACTORS ARE MODIFIED IS CALLED:RETROSPECTIVE RECONSTRUCTION



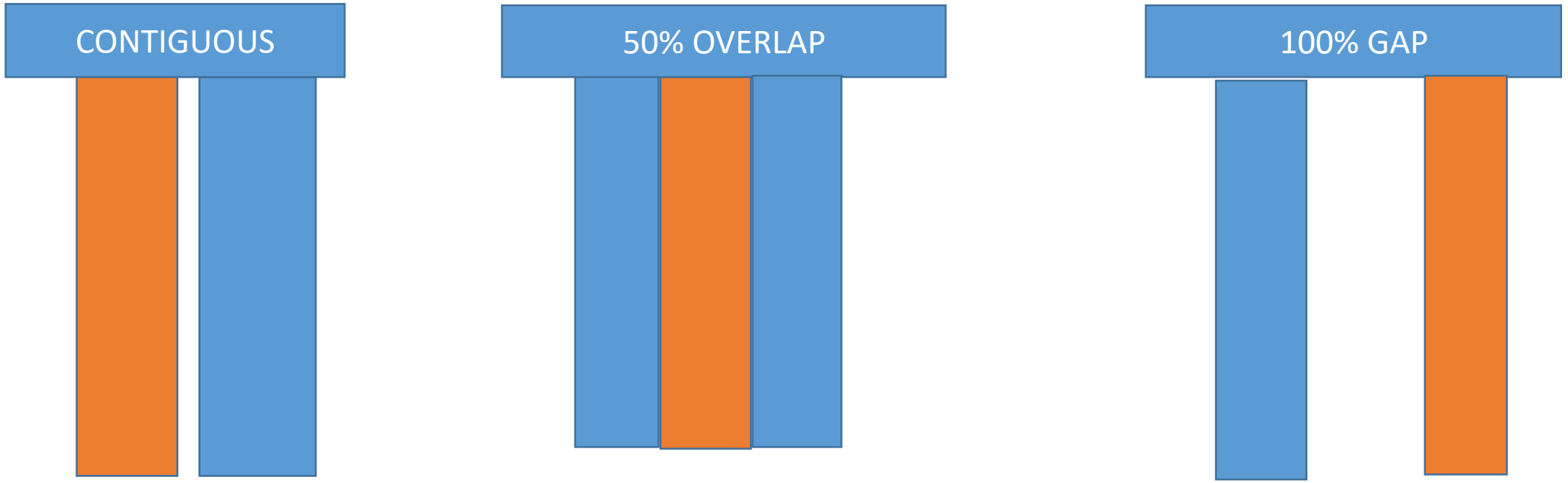
FACTERS THAT CAN BE CHANGED DURING RECONSTRUCTION

- DFOV
- MATRIX
- SLICE THICKNESS :RECONSTRUCTION IN DIFFERENT THICKNESS ONLY POSSIBLE IN THE MULTISLICE UNIT

- SLICE INCREMENTATION:RECONSTRUCTION IN DIFFERENT SLICE INCREMENTATION POSSIBLE IN SINGLE AND MULTISLICE UNITS
- ANGLE

INCREMENTATION

SLICE	2MM	SLICE	2MM	SLICE	2MM
INCREMENT	2MM	INCREMENT	1MM	INCREMENT	4MM



TYPES OF DATA

- MEASUREMENT DATA:DATA THAT ARISES FROM DETECTORS. IT NEEDS TO BE PREPROCESSED TO ELIMINATE ARTIFACTS.
- RAW DATA:DATA AVAILABLE:IT'S THE RESULT OF SCAN DATA BEING PRE-PROCESSED
- CONVOLVED DATA:FILTERED BACKPROJECTION IS THE ALGORITHM USED BY MODERN CT.
- IT REQUIRES FILTERING AND THEN BACKPROJECTION. RAW DATA IS FILTERED USING MATHEMATICAL FILTER.(CONVOLUTION)
- IT REMOVES BLURR. CONVOLUTION CAN ONLY BE APPLIED TO RAW DATA.

- IMAGE DATA

FOR BEST QUALTY IMAGES

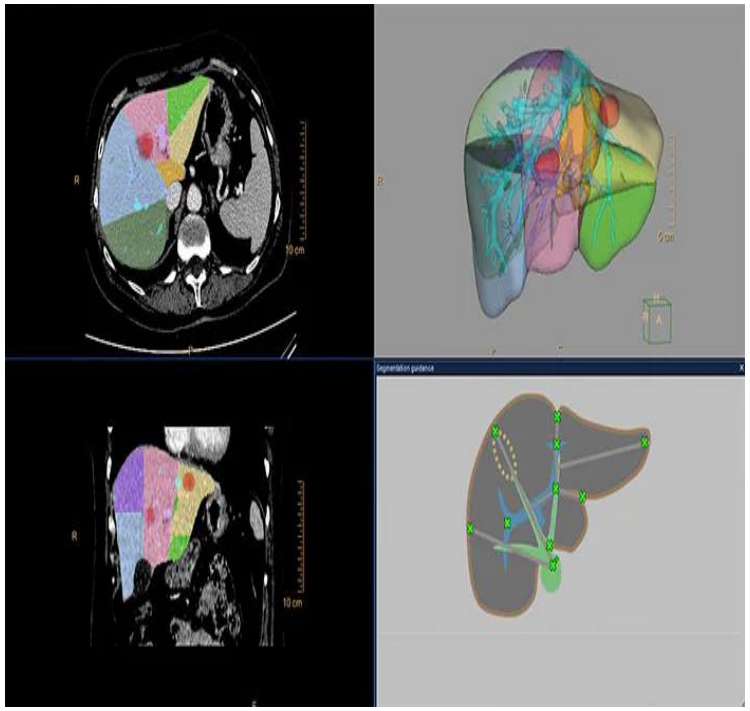
- USE VOLUMETRIC DATA ACQUSITION
- RECON YOUR ORIGINAL THICKER SLICES INTO VERY THIN SLICES (2mm OR 1 mm)
- SELECT RECON INCREMENT THAT WOULD CREATE AT LEAST 50% OVERLAP BETWEEN SLICES

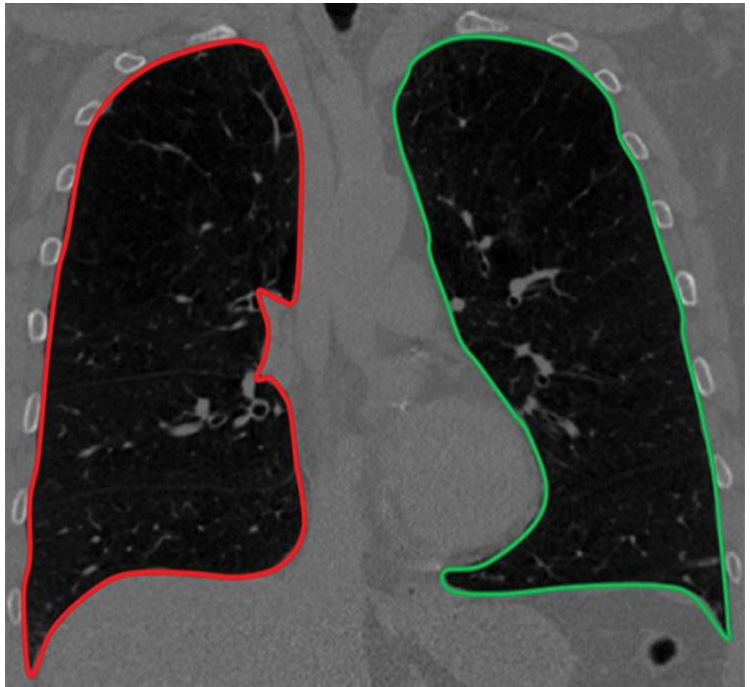
PROCESSING FOR 3-D

- SEGMENTATION:
- THRESHOLDING
- OBJECT DELINEATION
- RENDERING

SAGMANTATION :

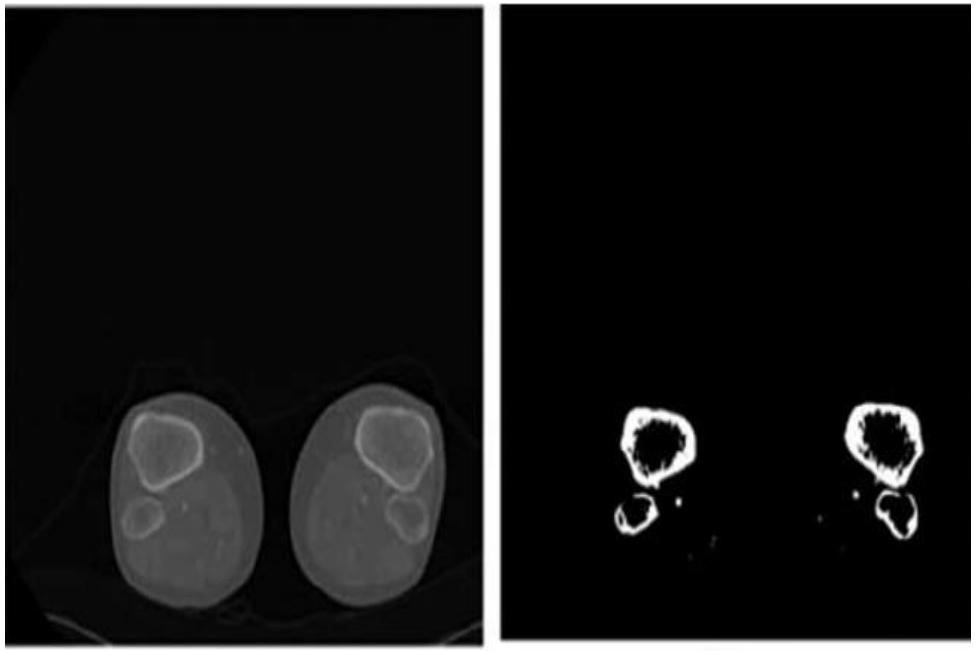
- SEGMENTATION:PROCESSING TECHNIQUE USED TO IDENTIFY THE STRUCTURE OF INTEREST IN A GIVEN IMAGE. IT DETERMINES WHICH VOXEL ARE PART OF THE OBJECT AND SHOULD BE DISPLAYED AND WHICH ARE NOT AND SHOULD BE DISCARDED.





THRESHOLDING

- METHOD OF CLASSIFYING THE TYPES OF TISSUES REPRESENTED BY EACH OF THE VOXELS. CT NUMBER IS USED TO DETERMINE THIS.



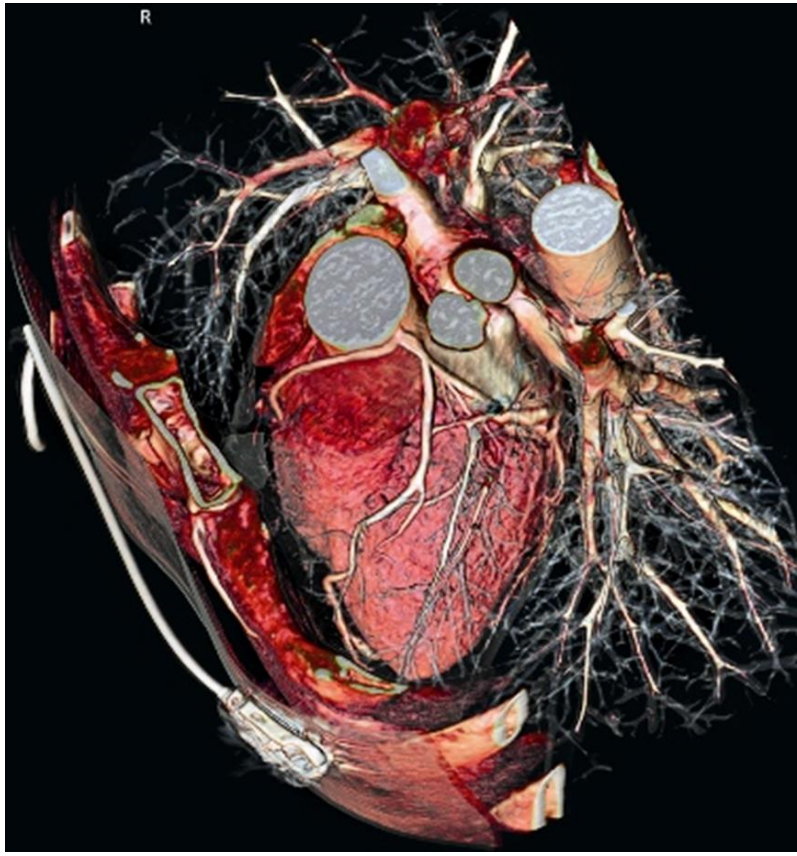
SURFACE RENDERING-SSD

- SIMPLER OF THE TWO METHODS. DISPLAYS THE IMAGE ACCORDING TO ITS CALCULATIONS OF HOW THE LIGHT RAYS WOULD BE REFLECTED TO THE VIEWERS EYES.
- COMPUTER CREATES INTERNAL REPRESENTATION OF SURFACES
- NOT MUCH COMPUTING POWER REQUIRED
- ONLY CONTOUR IS USED
- INFO OF STRUCTURES INSIDE OR BEHIND THE SURFACE IS NOT DISPLAYED!!

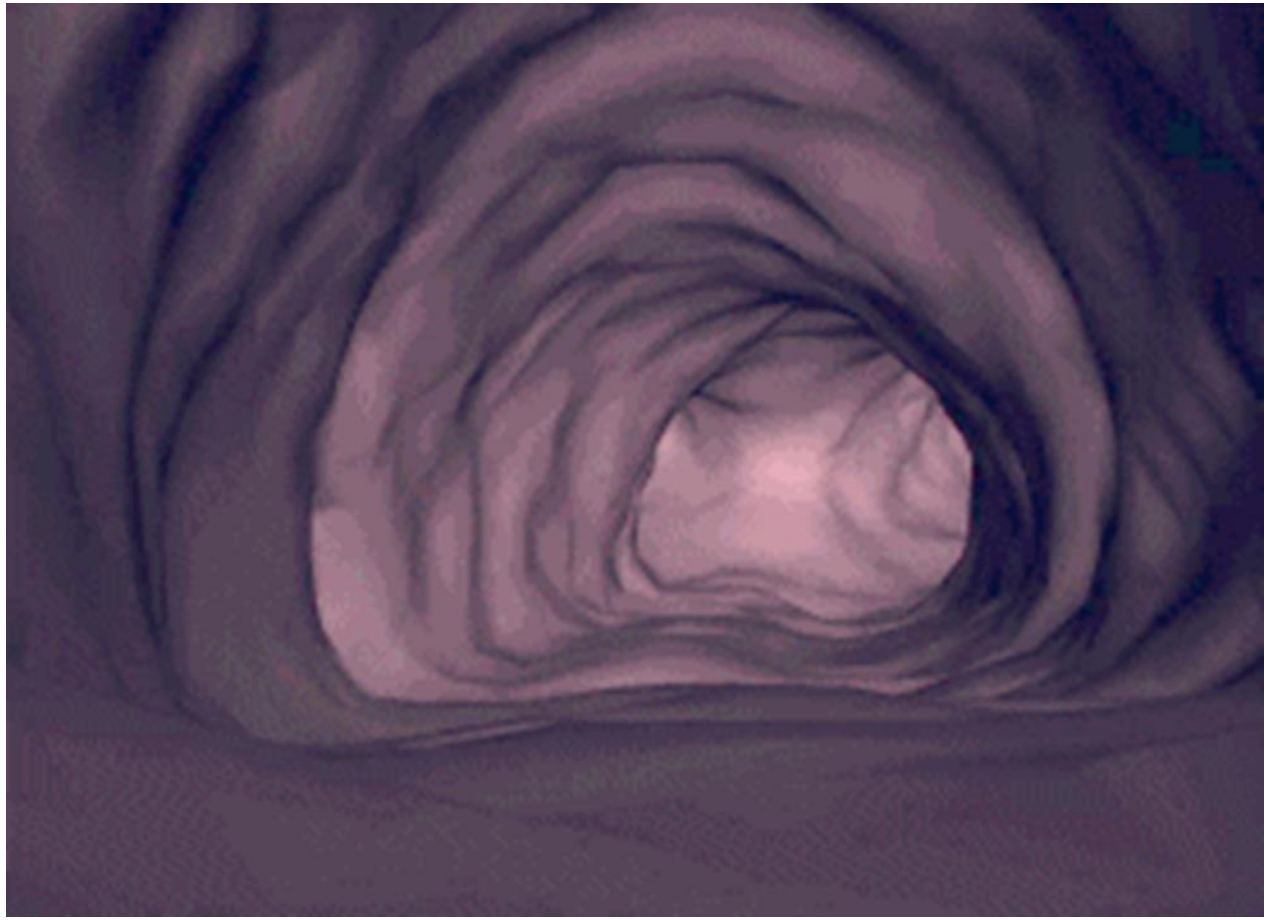


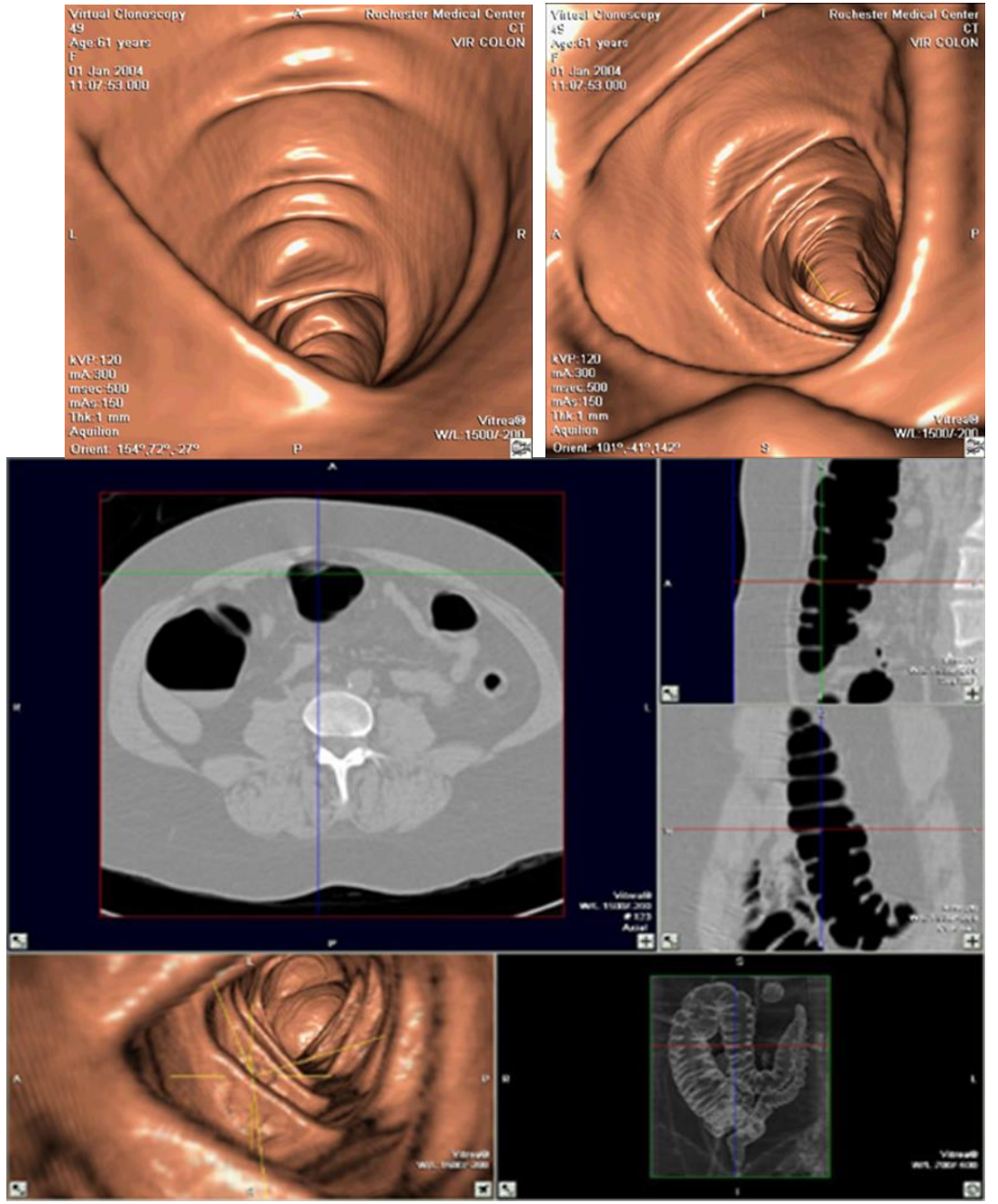
VOLUME RENDERING

- SOPHISTICATED TECHNIQUE. 3-D IMAGES HAVE BETTER QUALITY THAN IN SURFACE RENDERING. USES ENTIRE DATA SET FROM 3-D SPACE. IT REQUIRES MORE COMPUTING POWER.
- UNLIKE SSD, VOLUME RENDERING ALLOWS SEEING THROUGH SURFACES. IT ALLOWS THE VIEWER TO SEE BOTH INTERNAL AND EXTERNAL STRUCTURES.
- IT REQUIRES GREAT COMPUTING POWER – SOPHISTICATED COMPUTER EQUIPMENT



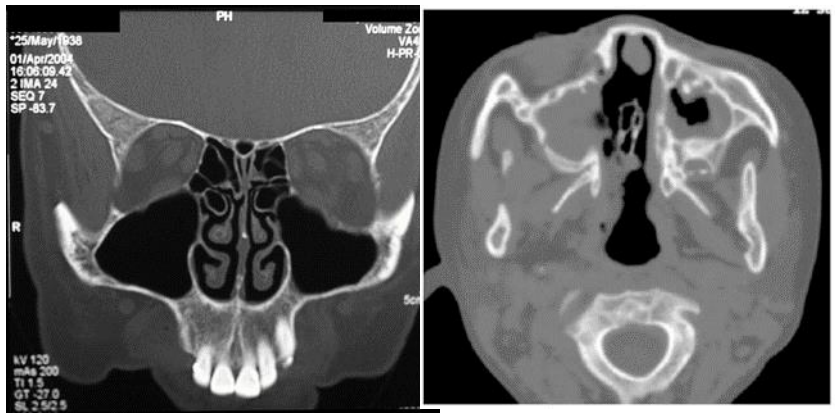
VIRTUAL ENDOSCOPY (VE)





MPR
MULTIPLANAR RECONSTRUCTION(REFORMATTING)

- MULTIPLANAR REFORMATTING (MPR) –ALLOWS IMAGESTO BE CREATED FROM THE ORIGINAL AXIAL PLANE IN EITHER THE CORONAL ,SAGITTAL ,OR OBLIQUE PLANE.
- IT USES IMAGE DATA





GOOD LUCK

