

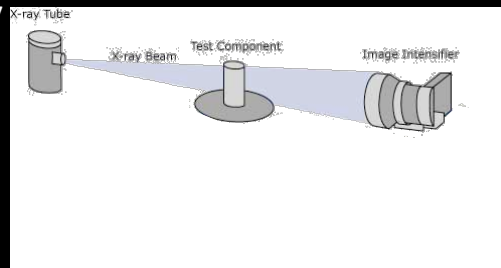
CT BASICS

Computed Tomography

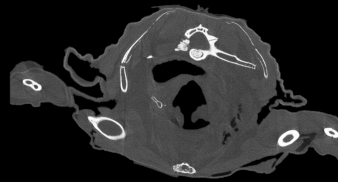
- Overview of algorithm
- Rotation Number
- Common artifacts
 - Sample movement
 - Rotation mismatch
 - Ring artifacts
 - Dead pixels
 - Beam hardening
 - Scattering
- Sample Preparation
- Growing Regions of interest
- Data handling
- Dissemination
 - oVert
 - Morphosource

CT Basics: Difference Between X-ray and CT

- Computed Tomography
 - “Tomos” = Section or slice
- Slices through a 3D density map
- Sequential X-ray Images in Complete Circle
- Computer Algorithm Creates 3D Volume

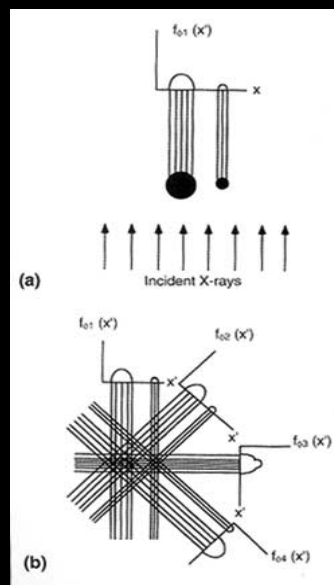


<http://www.asnt.org/publications/Materialseval/basics/may00basics/may00basics.htm>



CT Basics: Difference Between X-ray and CT

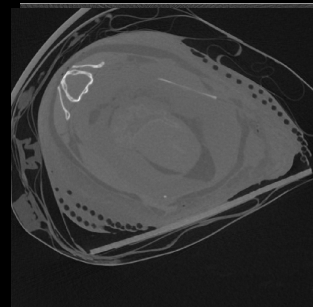
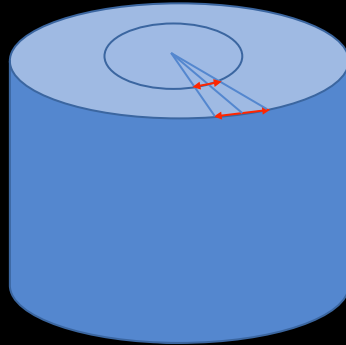
- CT Algorithm
 - 2D Projection Gray Values = Attenuation Measurement
 - Location Specific
 - Values → Stored & Normalized To Others
 - For Every Pixel, Every Image, Whole Circle
- Back-projection → 2D Cross Section Reconstruction



<http://www.asnt.org/publications/Materialseval/basics/may00basics/may00basics.htm>

Number of rotations

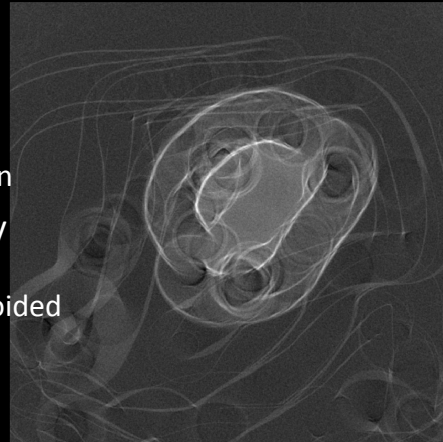
- CT algorithm uses a number of rotated images to reconstruct tomograms
- Each rotation move distal edge a specific distance
- Increasing the diameter of sample increases the travel of distal edge
- Algorithm will struggle to reconstruct the outer areas of the scan
- Increase the numbers of projections per 360° rotation
 - Decreases rotation angle per image
 - Decreases travel at distal edge



Projection number = 1.5 per pixel width

Common issues

- Sample Movement
 - Sample moved during scan
- Center of rotation off
 - Incorrect location information
- Reconstruction seems blurry
 - Can be corrected for during reconstruction but better avoided



Ring artifacts

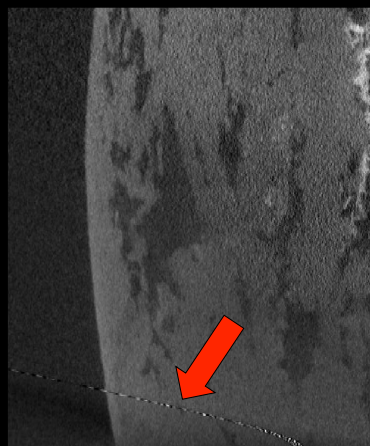
- Problem:
 - Poorly calibrated detector
- Solution
 - Add detector shift
 - Recalibrate detector Gain



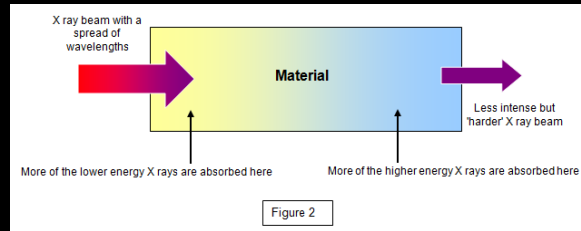
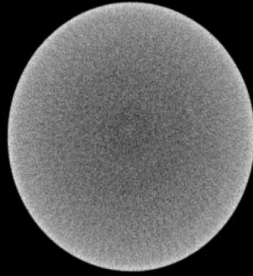
Dead pixels

Dead pixels

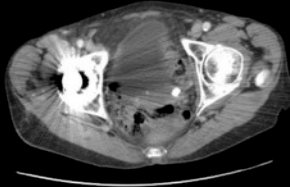
- Problem:
 - Dead Pixels in Detector → White or Black Whole Scan
 - Reconstruction → Creates a saw shaped bowl artifact



Beam hardening and scattering



http://www.schoolphysics.co.uk/age16-19/Medical%20physics/text/X_ray_absorption/index.html



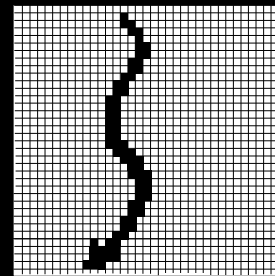
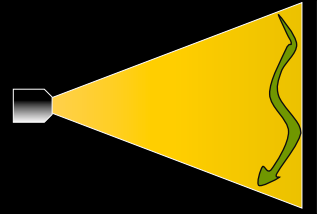
- Increase overall x-ray energy
- Add filters
- Increase Voltage
- Decrease density transitions

Planning the scan

- What questions are you asking?
- What measurements will you need to take?
- How many specimens will you need to scan?
- Optimization
 - Resolution
 - Spatial differentiation
 - Contrast
 - Density differentiation
 - Noise } Factor of Resolution and contrast
 - Speed }

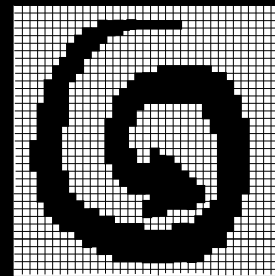
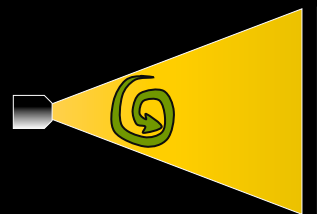
Sample preparation

- Maximize the resolution of the scan
 - Square Detector plate
 - Efficient use of space
 - Cylindrical is better
 - Centralized position
 - Multi-scan used for odd shaped samples
- Specimen Must remain perfectly still!
 - Well secured
 - Must not dry out
- Minimize unnecessarily dense material
 - Ziploc bags instead of glass jars
 - Soda bottles and packing peanuts



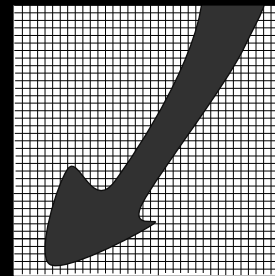
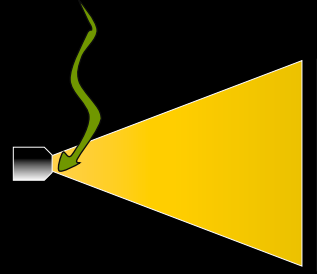
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Single scans vs Burrito scanning

- Resolution vs throughput
- Increased post-processing to untangle specimens
- How to process Z-stacks?
- Some utility
 - Double scanning Frogs
 - Double output
 - Minimal additional processing
 - Easy to Reconstruct separately
 - No loss of resolution
 - Similar sized, square-ish specimens.



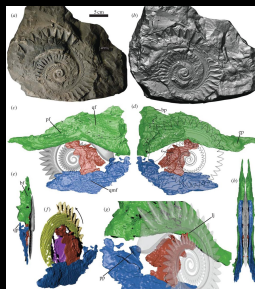
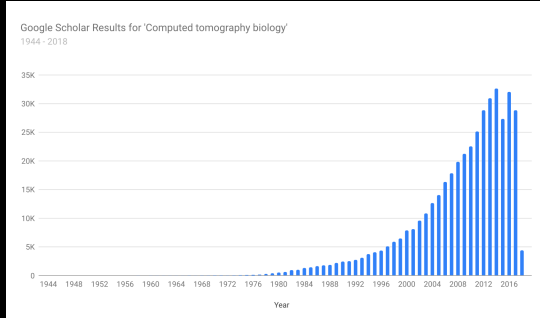
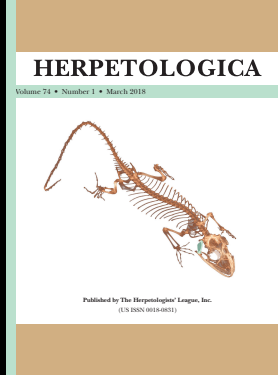
Growing regions of interest

- Segmentation of volume data set
 - 'Regions of Interest' (ROI)
- Visualize individual sections of volume
- Information of individual sections
 - Volume
 - Size
- Animation and articulation of multiple regions
- Export shapefiles (stl, obj, ply)
 - Morphometric packages

Data Handling

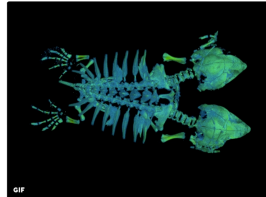
- Archiving
 - Lots of files
 - Large amount of memory (several GB per scan)
 - Files are sensitive to renaming and moving
 - Good idea to have a system in place BEFORE you scan
- Important files
 - X-ray images (raw data)
 - Metadata files (raw data)
 - Tomograms
 - Proprietary Volume files
 - Mesh Files

Dissemination



Social Media

Daniel J. Paluh (@Dan_Paluh) · Aug 18
Have you seen the two-headed sea turtle hatching found this week by UCF researchers? #FloridaMuseum Herpetology also has one! UF155385



Tweet Activity

Daniel J. Paluh (@Dan_Paluh)
Have you seen the two-headed sea turtle hatching found this week by UCF researchers? #FloridaMuseum Herpetology also has one! UF155385 pic.twitter.com/1eD9P3U4ur

Impressions	18,109
Media views	2,809
Total engagements	551
Retweets	156
Profile clicks	110
Replies	86
Link clicks	30
Detail expands	8
Detail engagements	6

Reach a bigger audience
Get more engagements by promoting this Tweet!

[Get started](#)

Ed Stanley (@EdStanley) · 8 Feb 2017
Talk about biting off more than you can chew! Check out the last & perultimate meal (toad & salamander) of this unfortunate hognose snake.



Tweet Activity

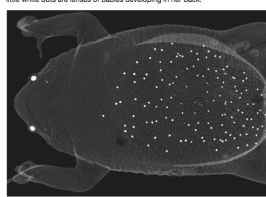
Ed Stanley (@EdStanley)
Talk about biting off more than you can chew! Check out the last & perultimate meal (toad & salamander) of this unfortunate hognose snake. pic.twitter.com/8NFluLzDX

Impressions	65,694
Total engagements	2,792
Media engagements	1,633
Link clicks	334
Detail expands	295
Retweets	256
Profile clicks	166
Replies	102
Detail engagements	5
Follows	1

Reach a bigger audience
Get more engagements by promoting this Tweet!

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David C. Blackburn (@davidcblackburn) · Jun 28
A rather creepy xray view of a mom Sabana Sumniman Toad (Pipa pipa). The little white dots are lenses of babies developing in her back.



Tweet Activity

David C. Blackburn (@davidcblackburn)
A rather creepy xray view of a mom Sabana Sumniman Toad (Pipa pipa). The little white dots are lenses of babies developing in her back. pic.twitter.com/8vE8E1u9g

Impressions	42,041
Total engagements	1,937
Media engagements	1,119
Link clicks	314
Detail expands	285
Retweets	145
Profile clicks	85
Replies	41
Detail engagements	8

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