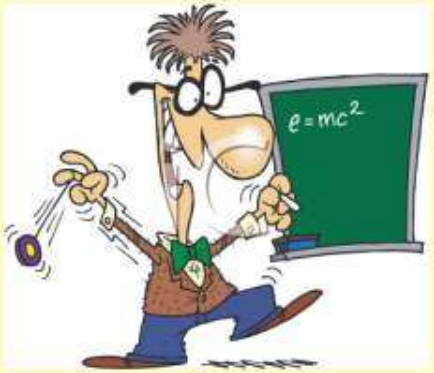
A Collaborative Model of Medical Physics Education Including Online Resources



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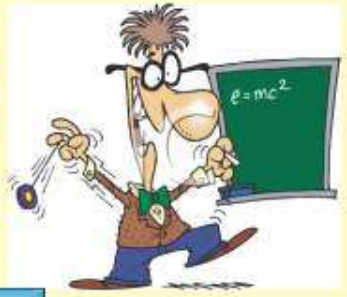
Emory University
sprawls@emory.edu
and
Sprawls Educational Foundation
www.sprawls.org

View this presentation at
www.sprawls.org/ipad

Collaborative Teaching with



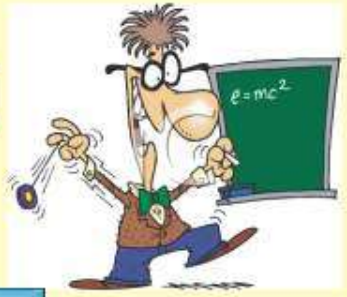
Addresses two of the major challenges of medical physics education:

Visualization

Interactivity with Feedback

Sprawls

Collaborative Teaching with



Enhancing the performance of medical physics teachers

Enriches learning activities for students/residents

Sprawls

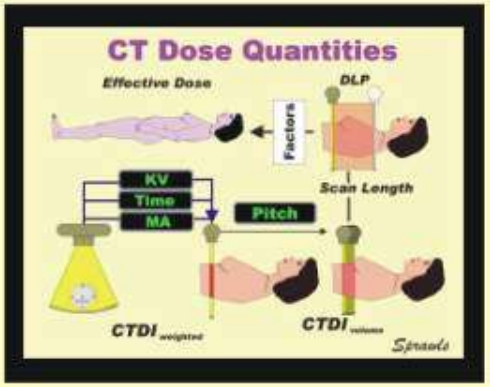
Collaborative Teaching

with

Example for Today

Medical Physics Education for Image Quality Optimization and Dose Management in CT

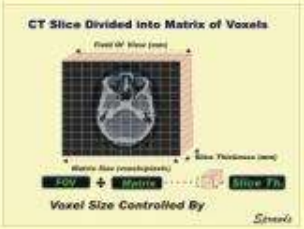
(Around the World)



Sprawls

The Traditional Classroom

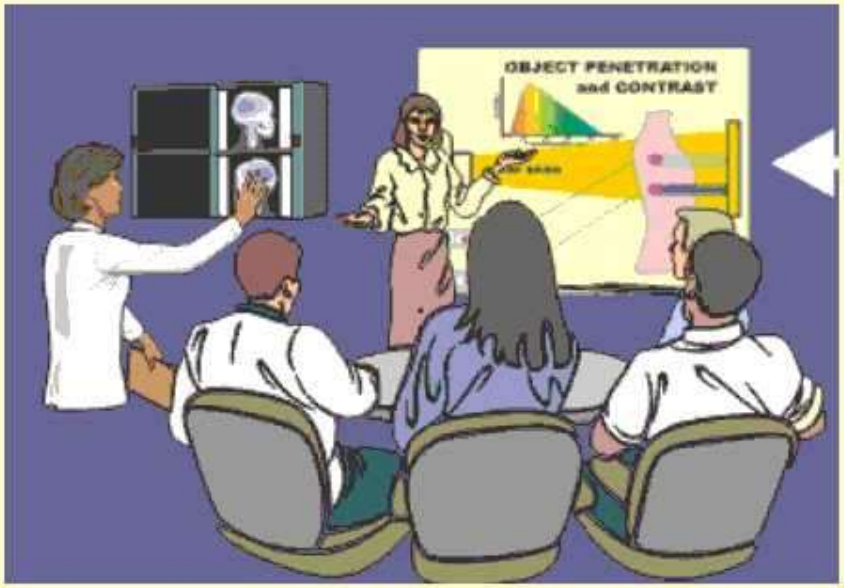
" A Box for Enclosing Students..."



And hiding them from the world about which they should learning.

Rich Classroom and Conference Learning Activities

Learning Facilitator "Teacher"



Visuals

Representations of Reality

- **Organize and Guide the Learning Activity**
- **Share Experience and Knowledge**
- **Explain and Interpret What is Viewed**
- **Motivate and Engage Learners**

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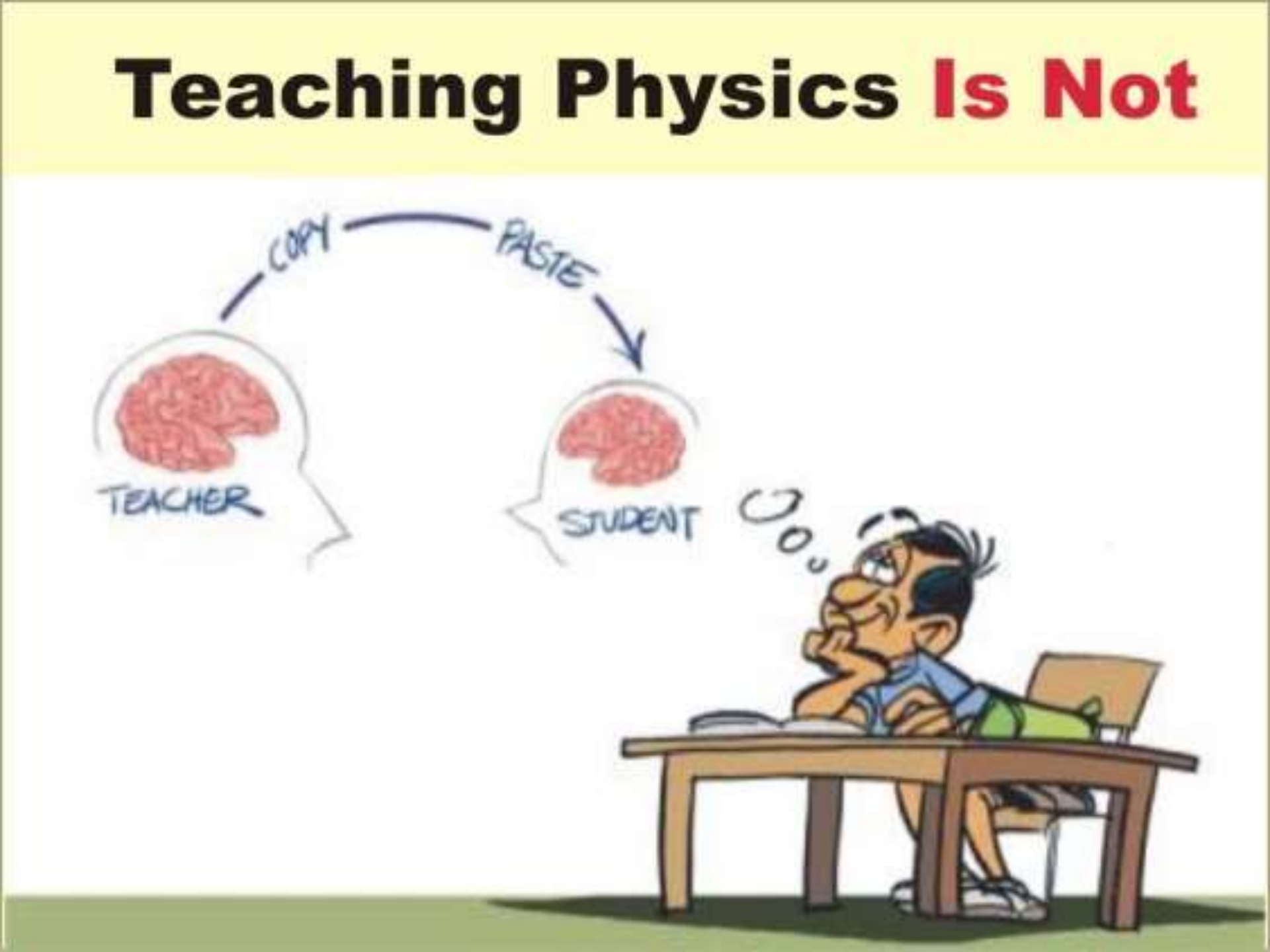
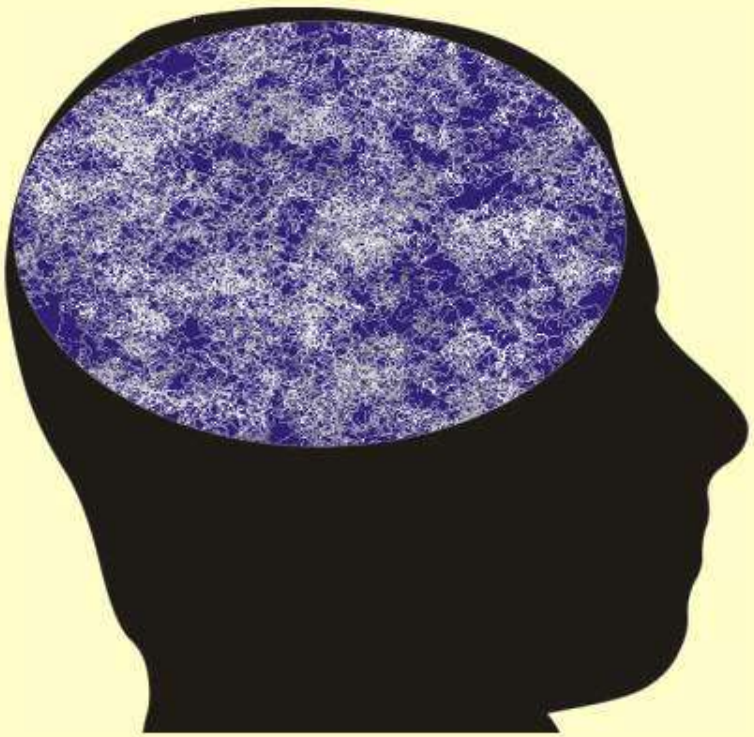
Teaching Physics Is Not



Learning Medical Physics

is

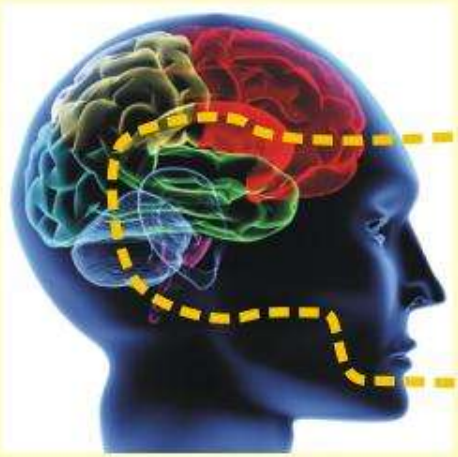


Building a Knowledge Structure in the Mind

Sprawls

The Elements of
A Highly Effective Educational Session

The Brain

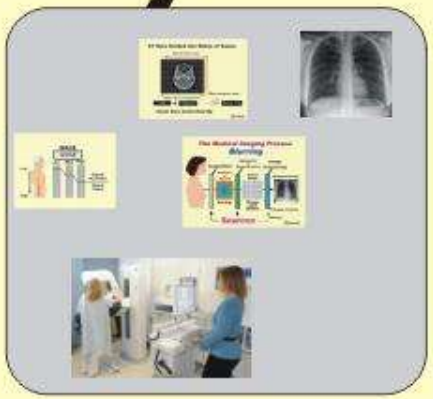


Connection

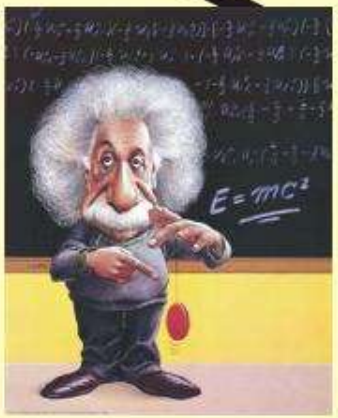
Observe

Interact

The Physical Universe
(Physics of Medical Imaging)



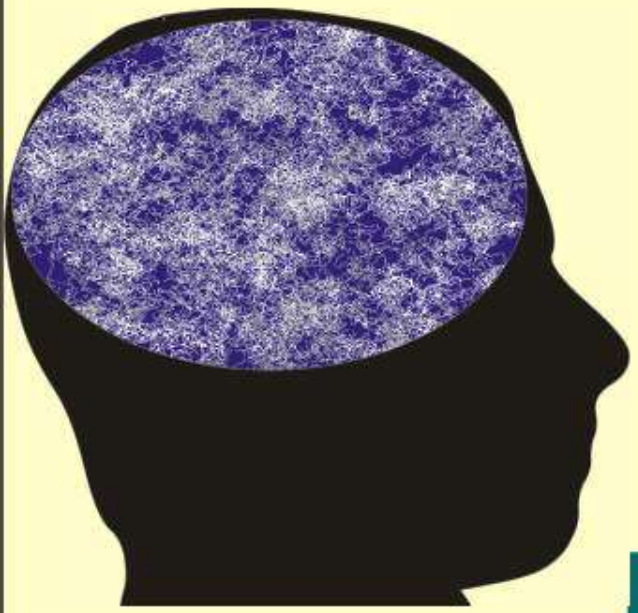
"Window"



Teacher /Guide

Sprawls

Teaching Medical Physics



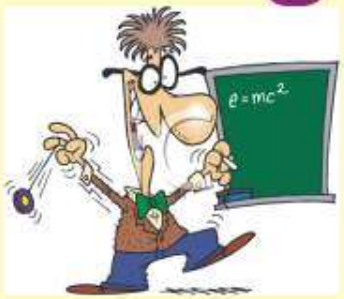
"Window"

Medical Physics Universe

Provide Window

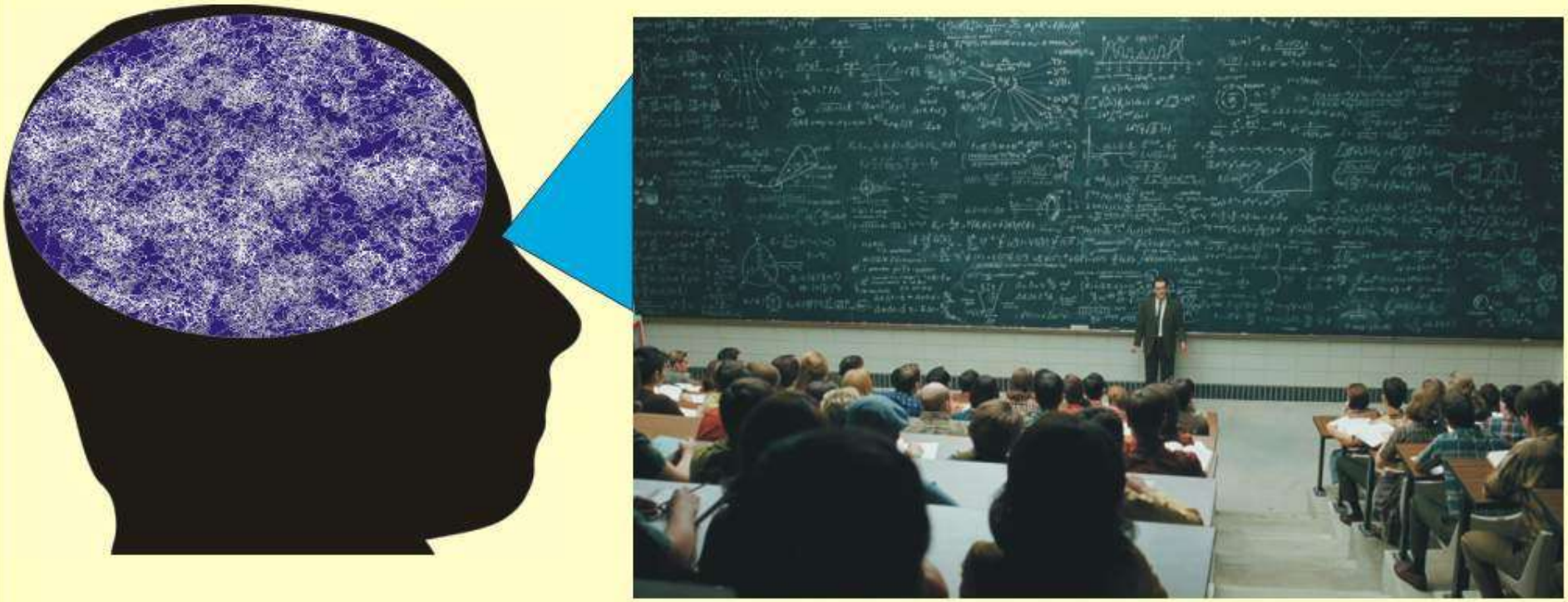
Guide the Learning Process

Teacher must



Sprawls

A Traditional "Window" to the Physical Universe



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The Physical Universe

The inverse square law is.....

Twice the Distance

Photon Concentration (Exposure) decreased to 1/4th

X-ray beam now covers four times the area

The Inverse Square Law

$$\frac{I_1}{(I_2)} = \frac{(d_2)^2}{(d_1)^2}$$

I_1 is the initial intensity of radiation, d_1 is the initial distance, and d_2 is the final distance, and I_2 is the final intensity.

Verbal

Sensory

Mathematical

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The Collaborative Teaching Model

Online Resources

Modules Books Visuals

Enhance the performance of physics faculty

Knowledge
Experience
Guidance
Role Model

Local Universities *Sprawls*

The Collaborative Teaching Model

Sprawls Online Resources

Modules Books Visuals

Enhance the performance of physics faculty

Residents & Radiologists

Local Universities

Sprawls

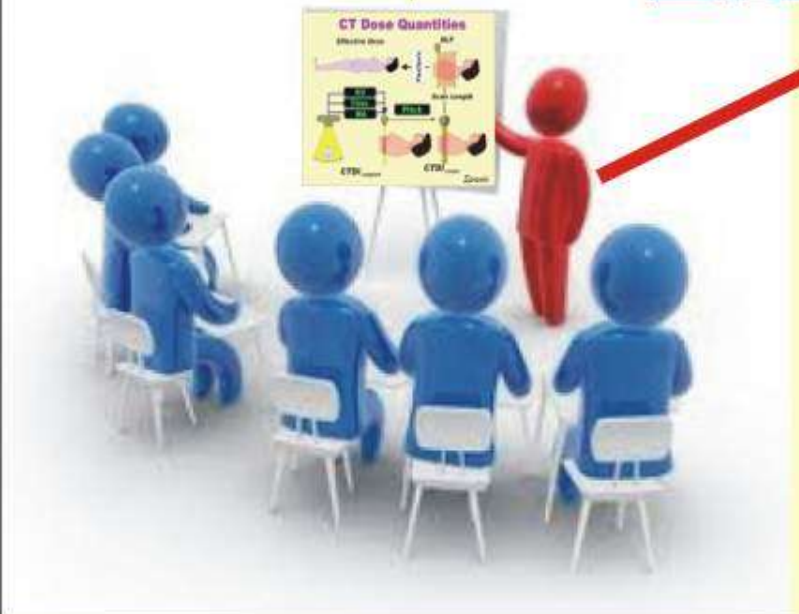
Collaborative Teaching is Sharing the Work

Resource Physicist

Create visuals and related resources

Share with the World

Medical Physics Universe



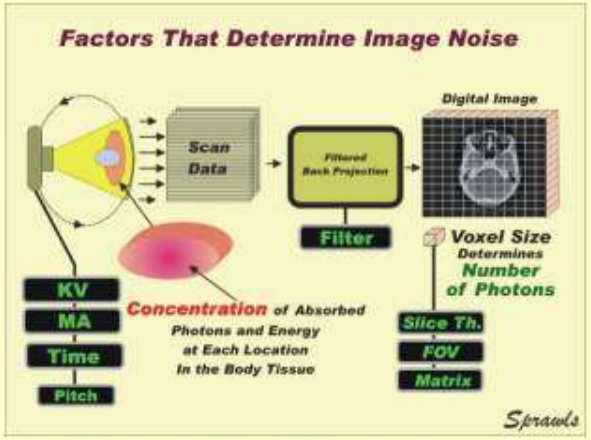
Local Physicist

Organizes
Guides
Shares Experience
Motivates
Role Model

Sprawls

Collaborative Teaching is Sharing Experience, Perspectives, and Opportunities

Physicist



Radiologist

Clinical Applications

Radiology Residents

Principles and Concepts

Sprawls

How to Use This Resource

Table of Contents and List of Topics

Mammography Physics and Technology
for effective clinical imaging

Perry Sprawls, Ph.D.

Outline	Mind Map	Learning Objectives	Visuals for Discussion		Text Reference

To step through module, CLICK HERE.

To go to a specific topic click on it below

Visuals

to be used by

Physicists in Classroom and Conference Discussions

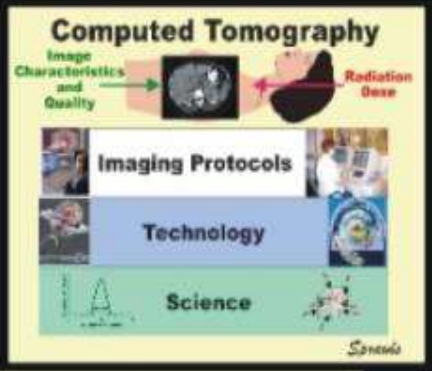
SPRAWLS EDUCATIONAL FOUNDATION
Open Resources for Learning and Teaching
The Physical Principles of Medical Imaging

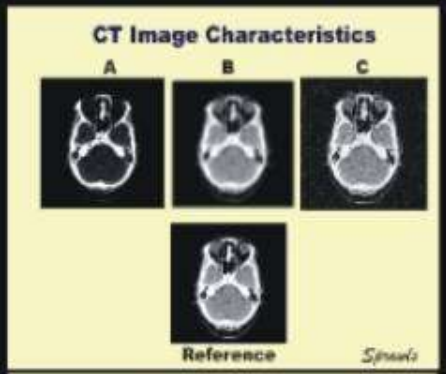
Visuals
for
Classroom, Conference, and Collaborative Learning

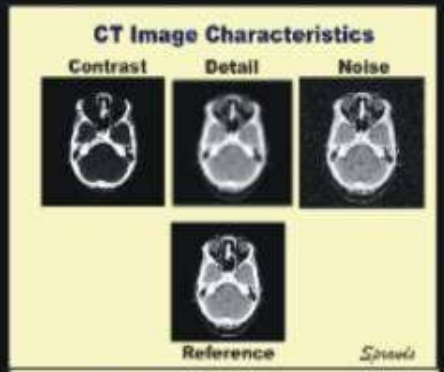
RIGHT CLICK on each visual to download and use in PowerPoint or other display programs.

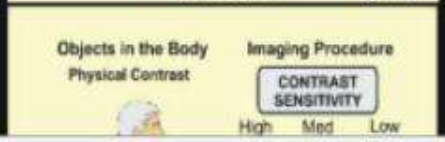
Computed Tomography Image Quality Optimization and Dose Management

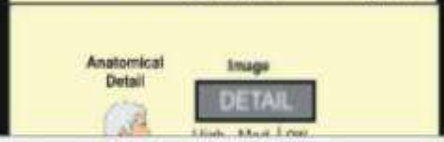
Companion Module
http://www.sprawls.org/resources/CTIQDM/











Modules for Self Study
and
Collaborative Learning in the Clinic

How to Use This Resource

Table of Contents and List of Topics

Computed Tomography Image Quality Optimization and Dose Management

Perry Sprawls, Ph.D.

To step through module, CLICK HERE.
To go to a specific topic click on it below.

Introduction and Overview	Image Quality Characteristics	Contrast Sensitivity
Visibility of Detail	Visual Noise	Spatial (Geometric) Characteristics
Artifacts	Identifying Characteristics	Characteristics Identified
Image Quality and Dose	CT Image Formation Process	The Scanning Motions
Views and Rays	Multiple Row Detectors	Helical and Spiral Scanning
Image Reconstruction and Voxels	CT Numbers	Hounsfield Unit Scale
Optimizing CT Procedures	Absorbed Dose	Dose Distribution Within Patient
CT Dose Index (CTDI)	Weighted CTDI	Volume CTDI
Dose for Multiple Slices	Dose Length Product (DLP)	Effective Dose
Summary of CT Dose Quantities	Factors That Determine Dose	Factors Affecting Image Detail
Measuring CT Image Noise	Controlling Image Noise	Voxel Size Compromise

Effective Medical Imaging Physics Learning ...In The Clinic

The Real World **Motivating** **Interactive** **Collaborative**

The Physicist Provides:
Learning Modules & Collaboration

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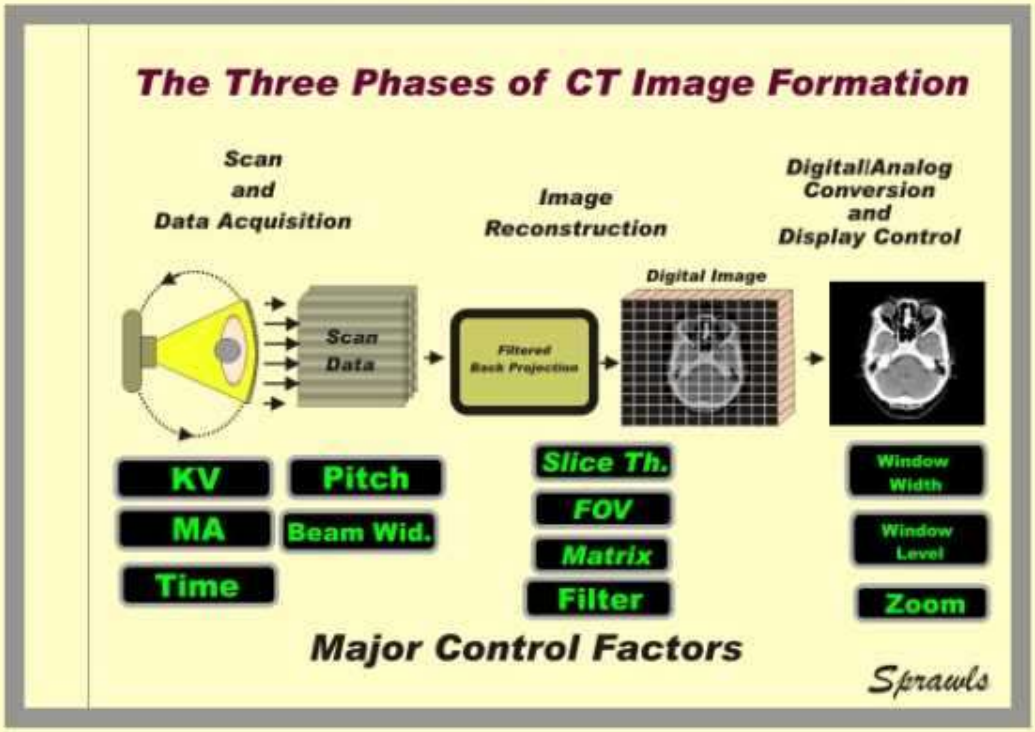
Visuals for Learning and Teaching

The Imaging Process



Clinical Images

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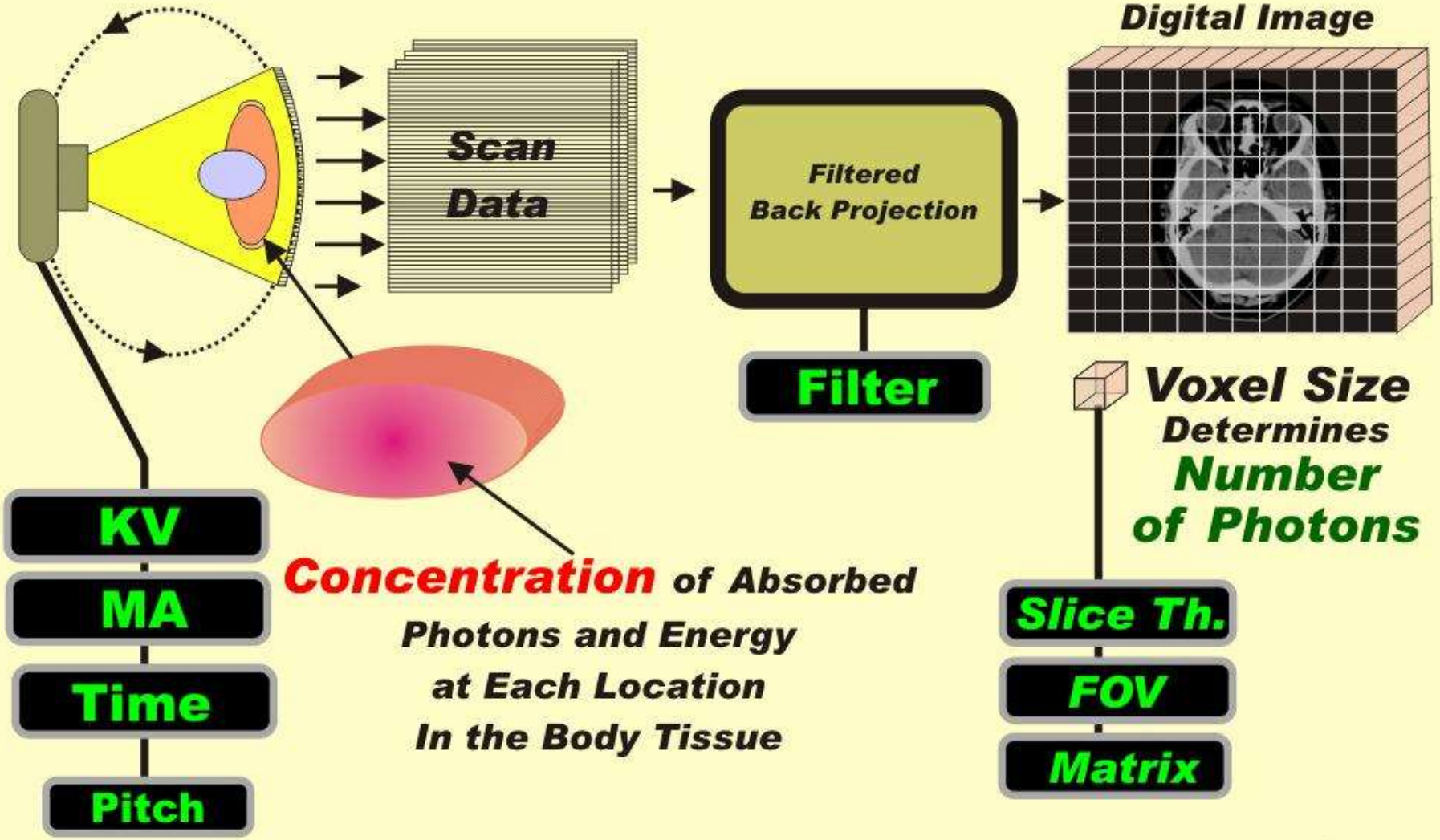
Factors That Determine Image Noise



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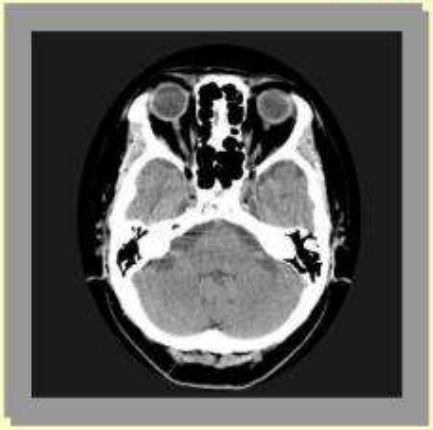
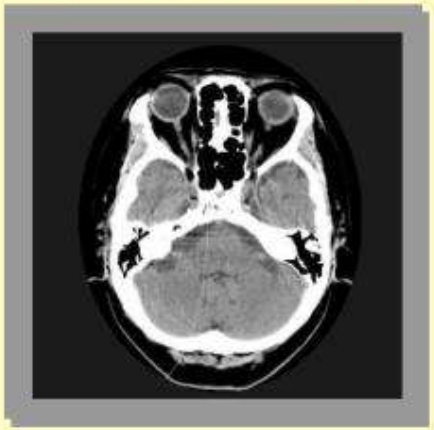
Relationship of Radiation Dose to Image Detail

Lower Dose



Higher Dose

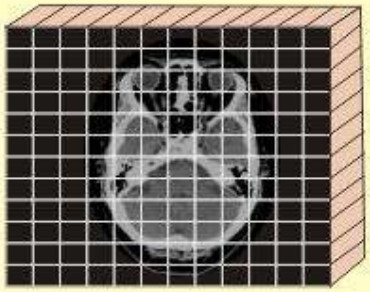


When detail is increased by

- Decreasing **Slice Th.**
- Increasing **Matrix**
- Decreasing **FOV**

Noise Increases

Because of decreased voxel size



Dose must be increased to reduce noise.

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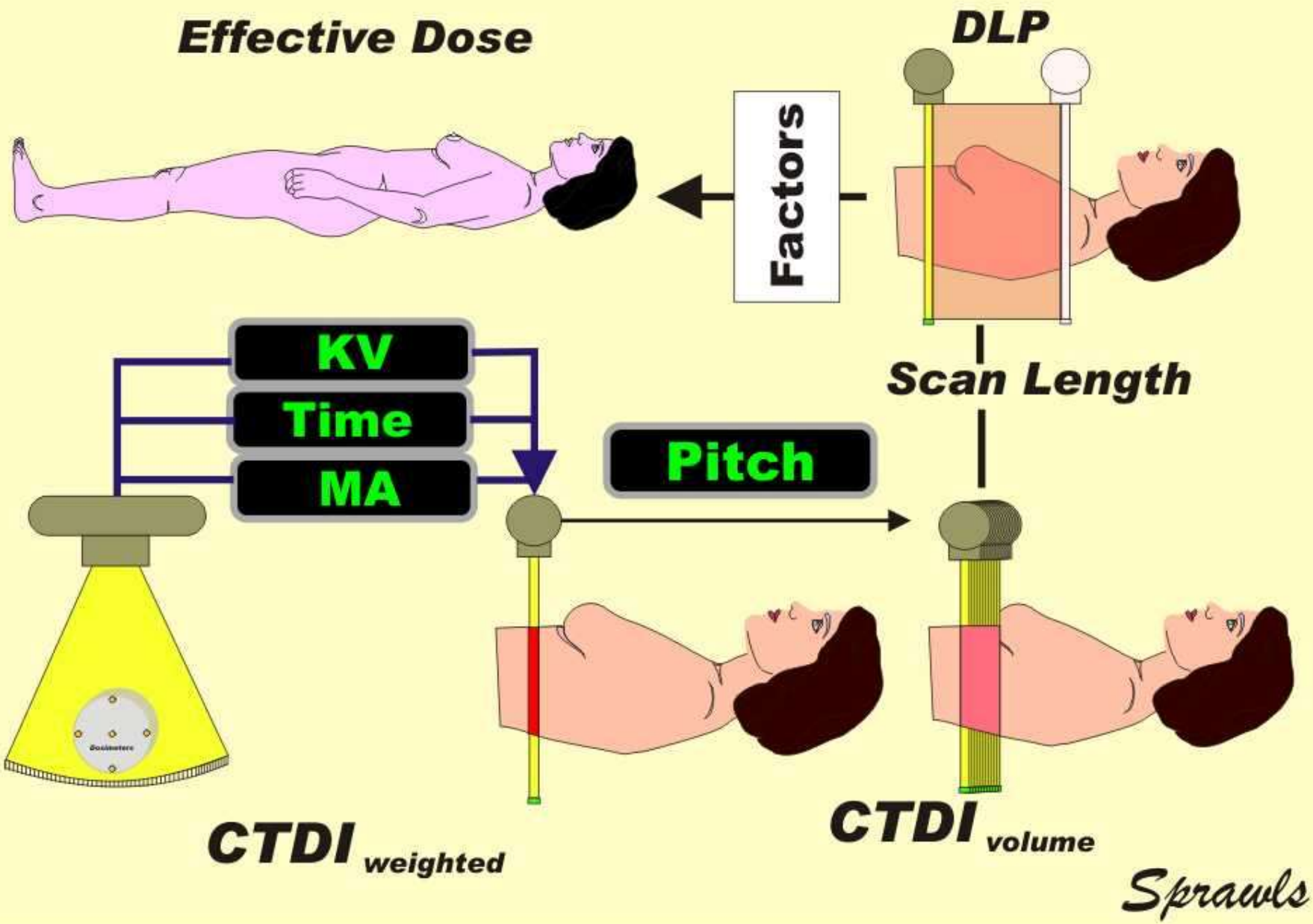
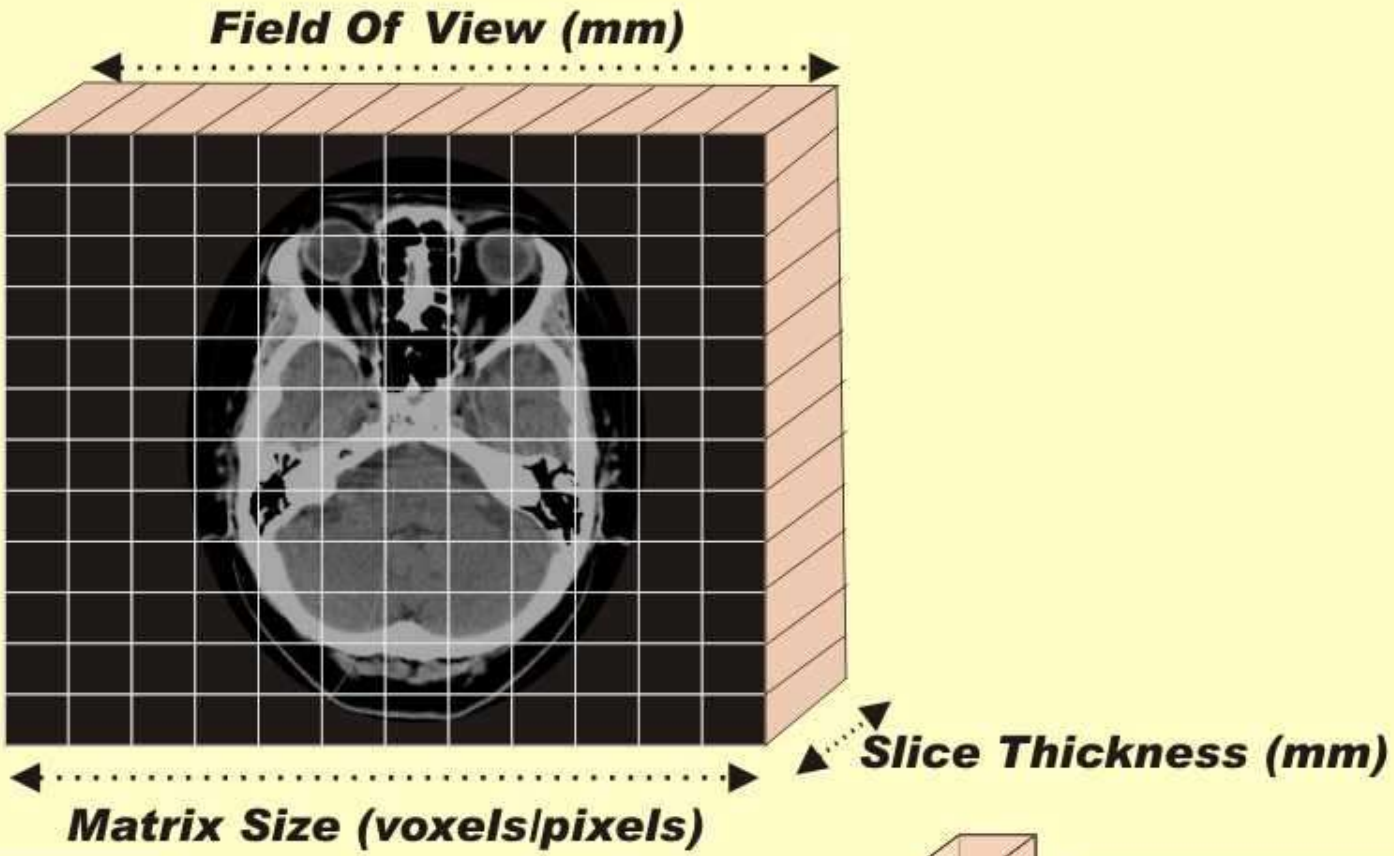
CT Dose Quantities



CT Slice Divided into Matrix of Voxels



FOV ÷ Matrix ····· Slice Th.

Voxel Size Controlled By

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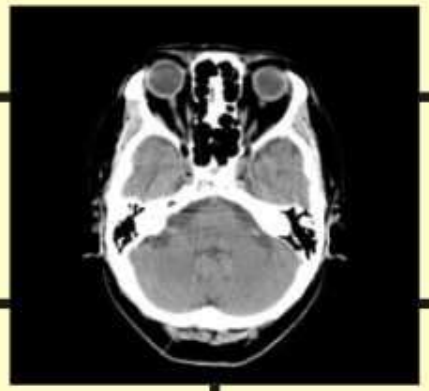
CT Image Characteristics



Spatial

Artifacts

Detail

Noise

Contrast Sensitivity

KV

Pitch

Slice Th.

Window Width

MA

Beam Wid.

FOV

Window Level

Time

Filter

Matrix

Zoom

Major Protocol Factors

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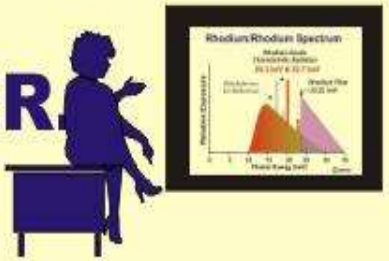
The Values We Hold

The PHYSICIST is the TEACHER.



TECHNOLOGY is the TOOL that can be used for effective and efficient teaching.

Technology should be used to enhance human performance of both learners (residents, students, etc.) And teachers

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The Sprawls Resources

Sharing the Emory Experience with the World

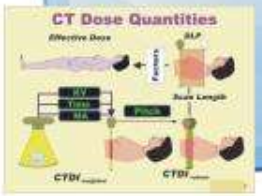
With Emphasis on the Developing Countries

Emory

www.sprawls.org/resources

Open Access

Educational Resources



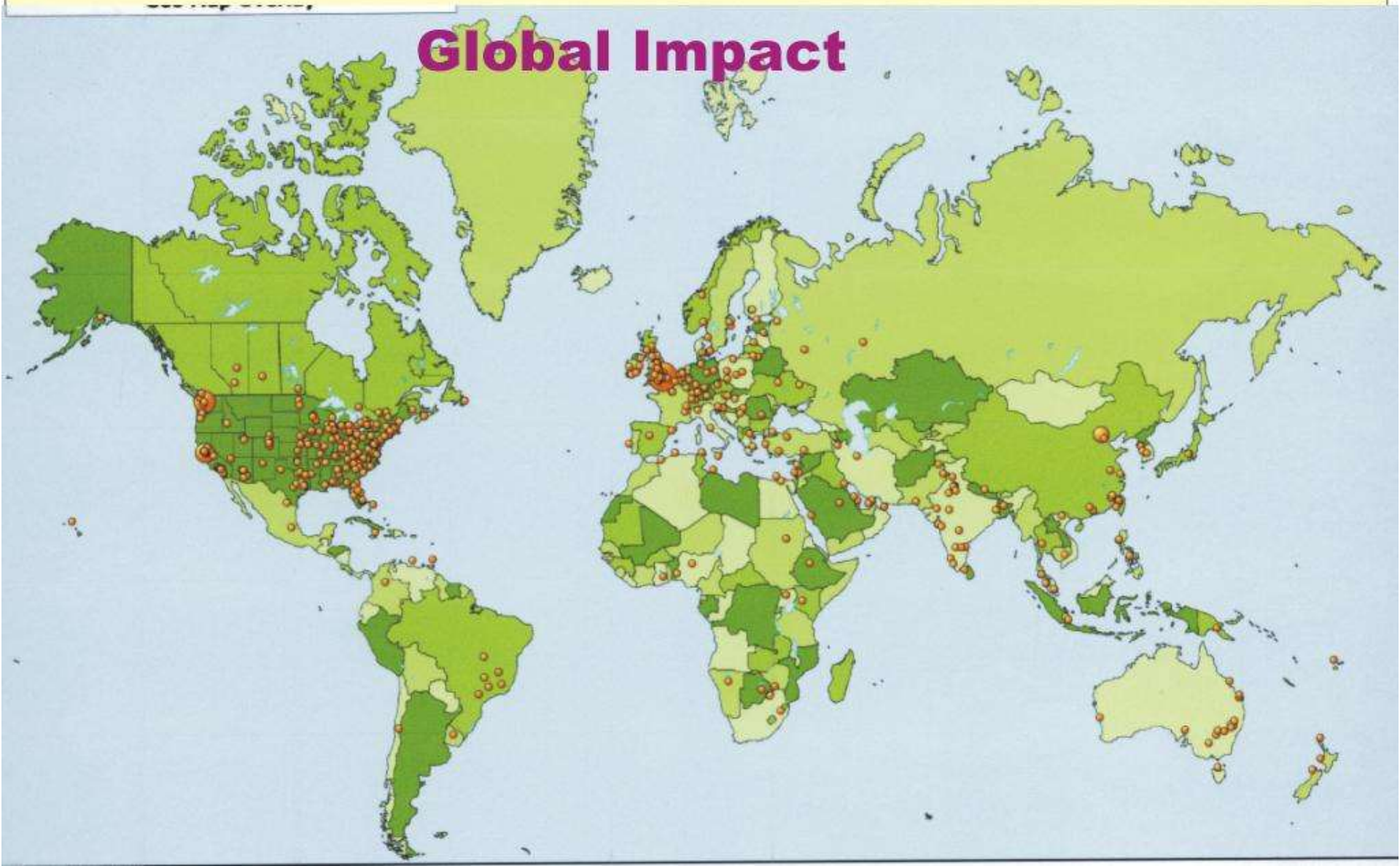
Visuals **Books** **Modules**

Global Impact

Enhancing Radiology Education in Every Country of the World

The Sprawls Resources

Users, April 2013



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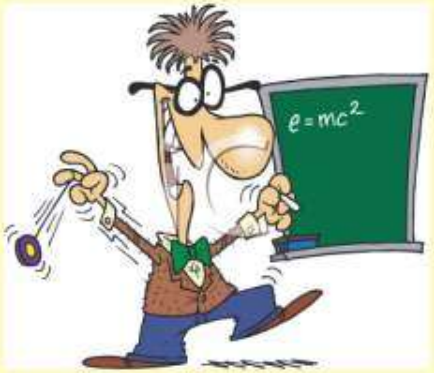

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