

# **New DICOM CT/ MR objects will enhance clinical radiology**



**Budapest, Hilton Westend  
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# **New DICOM CT/ MR objects will enhance clinical radiology**

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Co-Chair CT-MR Taskforce

# Abstract

- This presentation will describe the enhanced interoperability for many clinical CT and MR applications in distributed networks once the new standard has been implemented in both the modalities and in clinical workstations.
- We will summarize the results of the SCAR 2005 session and familiarize those that have not been involved so far with the future plans of the Enhanced CT-MR Taskforce for RSNA 2005.

# Clinical Questions

- Can I store my research results with the clinical images, without a separate server
- Can I store the raw data for a second reconstruction
- Can I store my Spectroscopy results?
- Can I separate the different Diffusion images
- Can I sort cardiac images according to their timing
- Can I improve the performance of transfer for CT/MR

# YES

All these questions can be answered with YES

when both the modality and the PACS  
support the Enhanced CT or MR objects

# What is the difference?

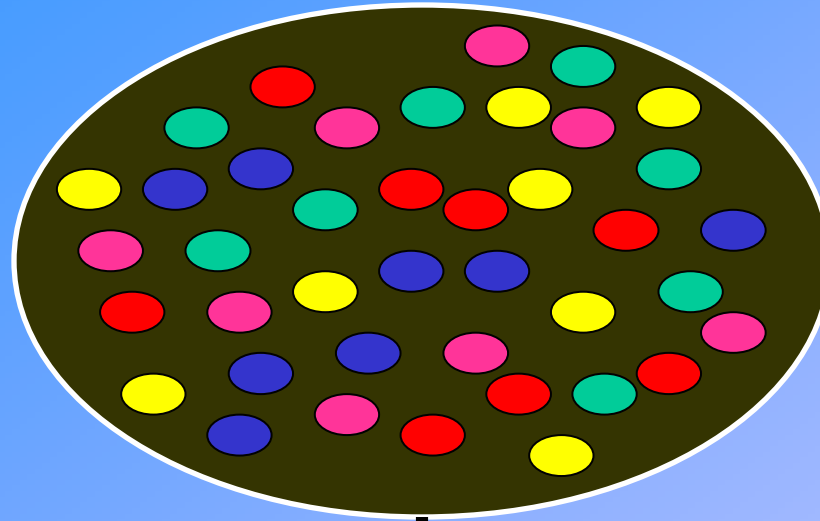
- DICOM 1993
  - contained many MR and CT attributes, without much of a structure
- DICOM 2003
  - contains more attributes, but now with a clinically oriented structure.
  - The new attributes remove the need for many Private attributes,

	CT		MR	
SOP Class	Original	Enhanced	Original	Enhanced
Attributes (Mandatory)	18 (0)	41 (39)	44 (2)	103 (94)
Terms (Enumerated)	4 (2)	86 (18)	38 (9)	228 (47)

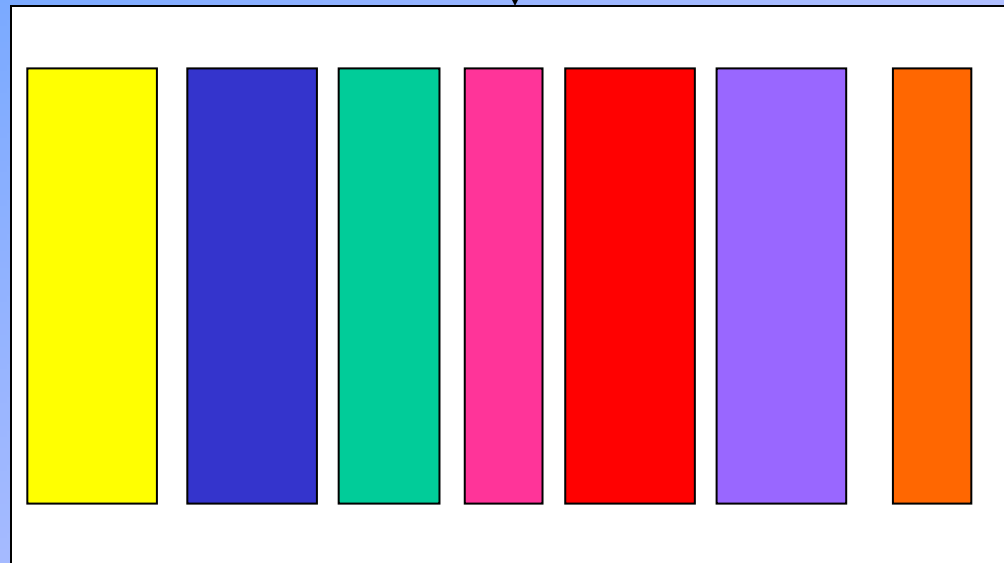
# What is the consequence?

- The Clinical Structure enables the combination of the attributes in functional groups. (this required a lot of analysis)
- The values in a Functional group may be equal for all images in a series, or differ from image to image.
- The combination of images into frames of a multi-frame object.
- The structure herewith provides context information

1993

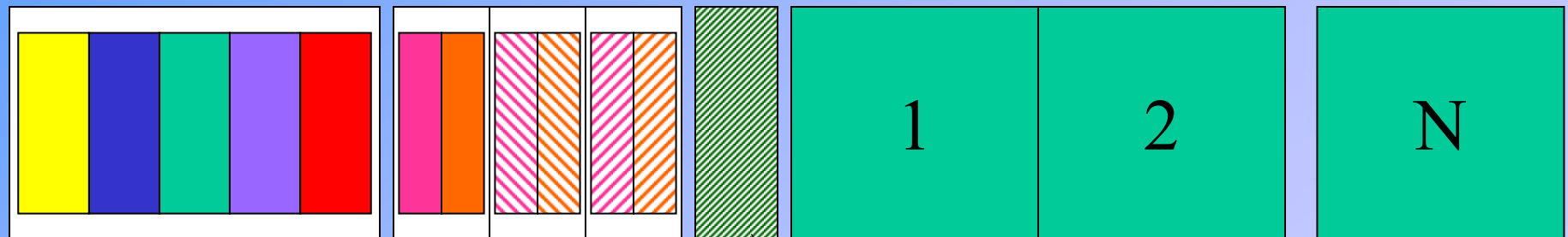
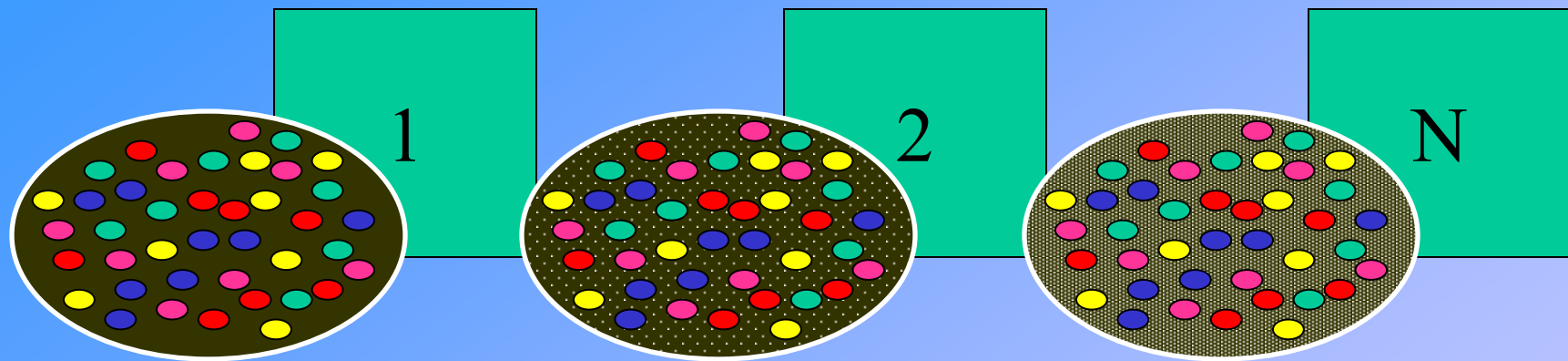


2003



Functional  
Groups





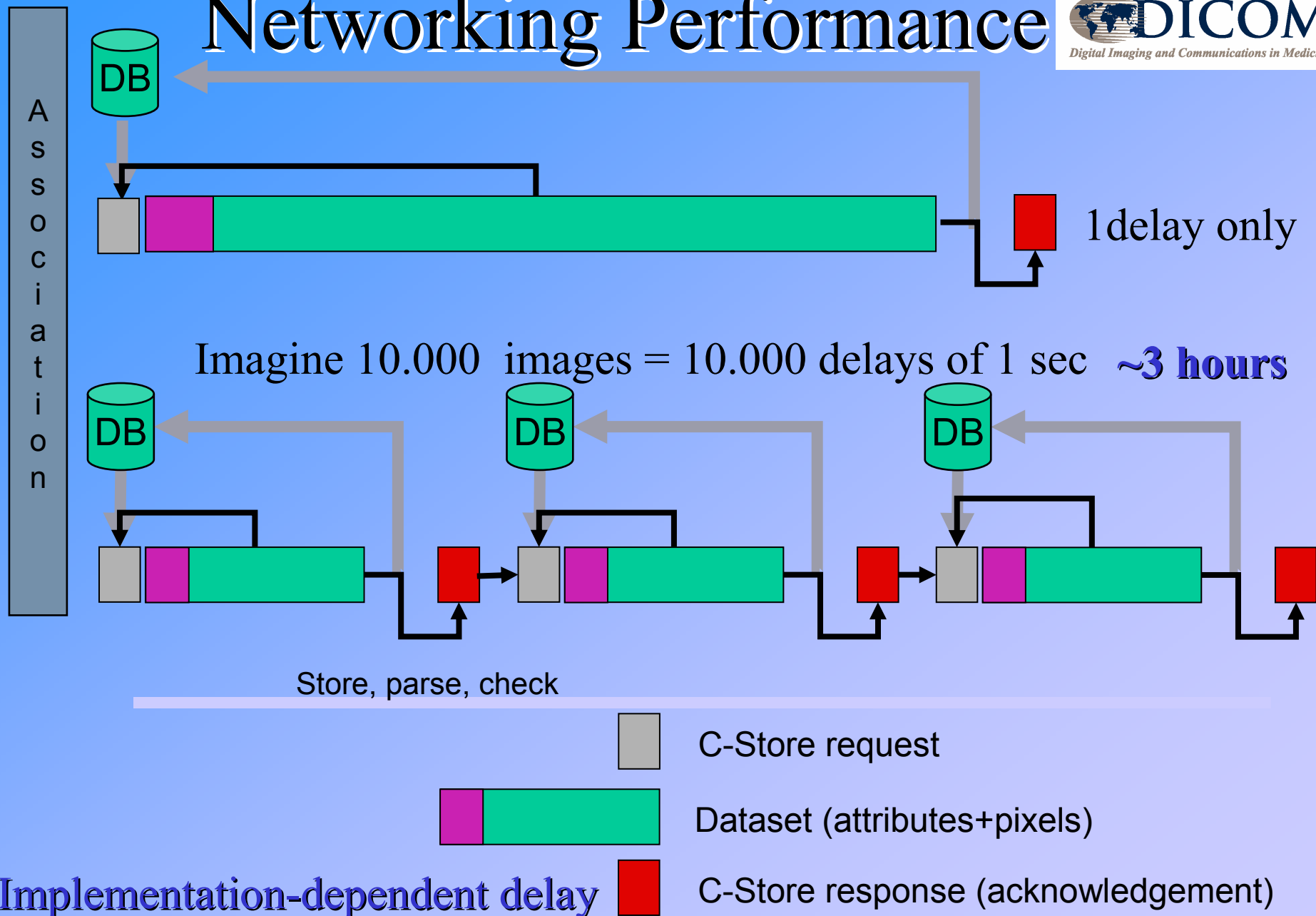
Shared

Per-Frame  
Frame 1-N

Dimensions

Pixel values Frame 1-N

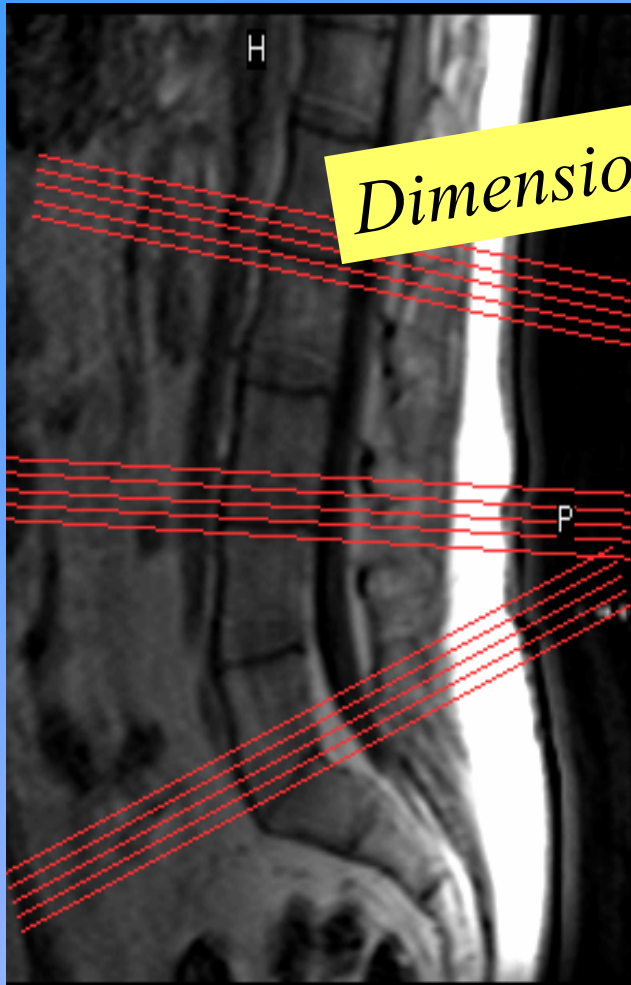
# Networking Performance



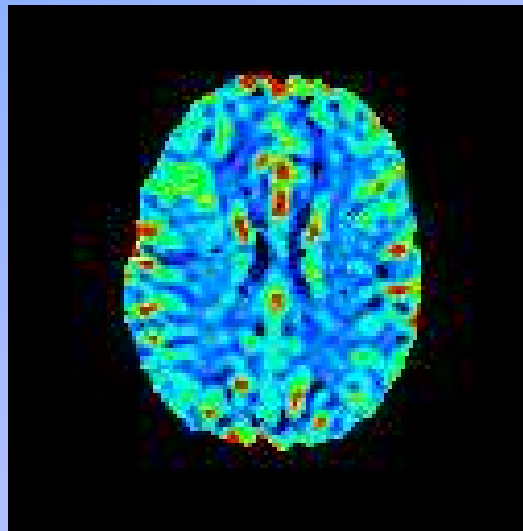
# More Clinical Information available in less time

*Dimensions provide context*

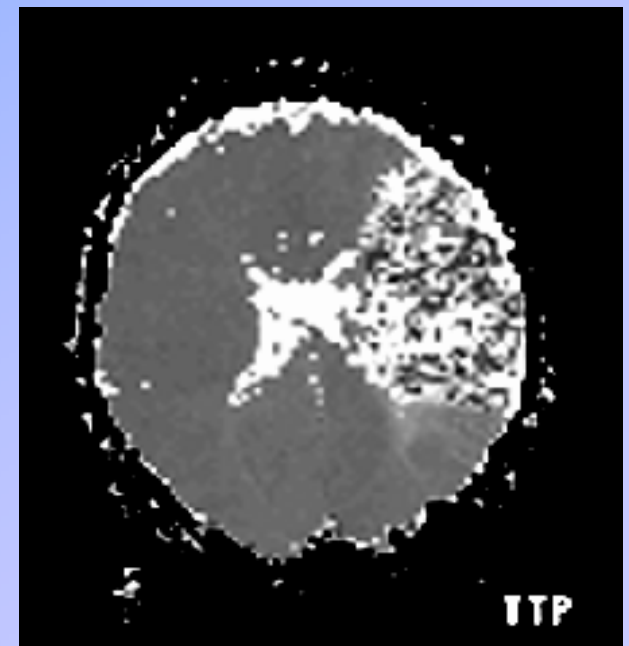
*Multi-frame*



*Multi-stack*

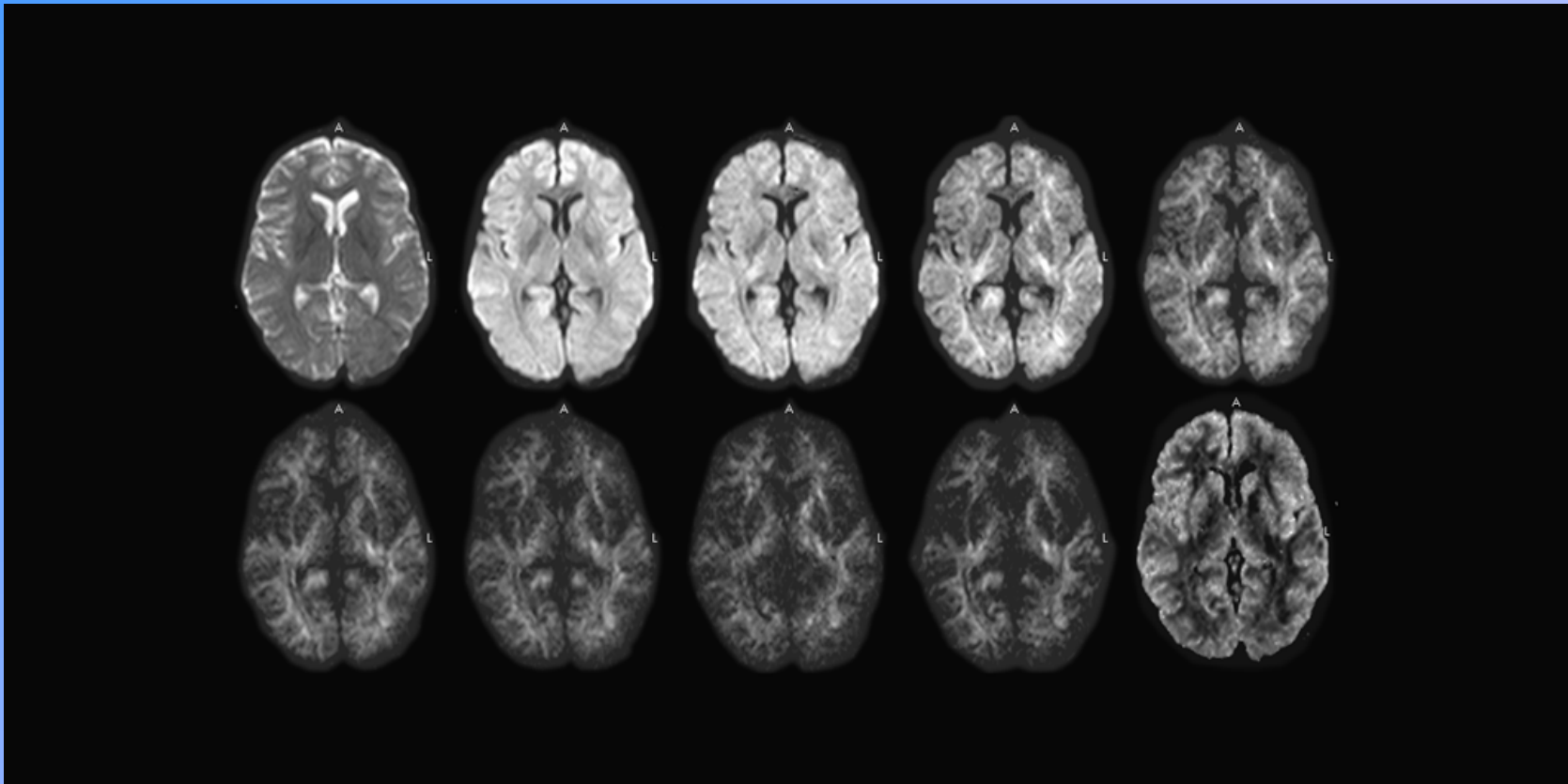


*Color*



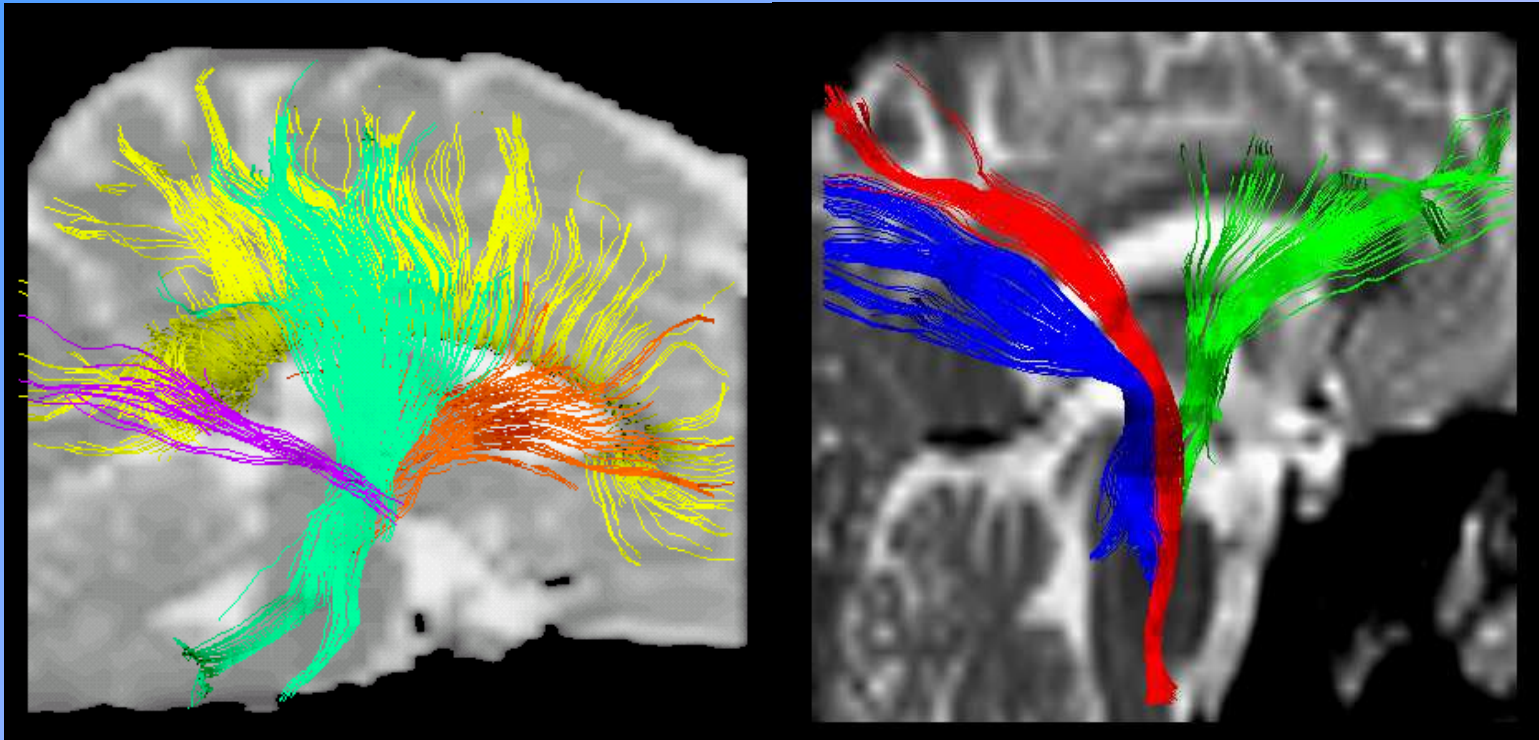
*Real World Values*

# Diffusion Imaging



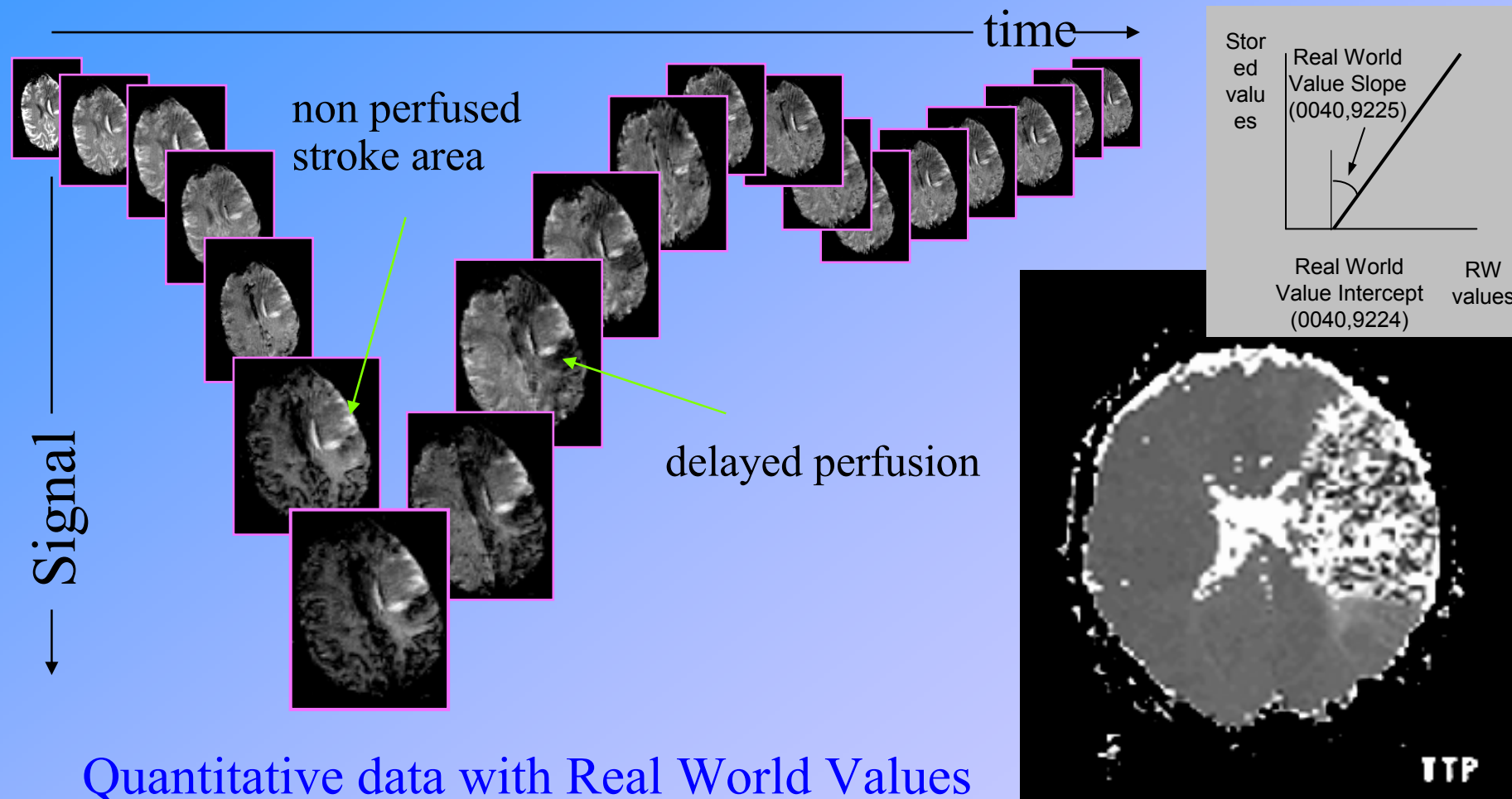
“Diffusion b-values” from 0 to 8000 and an ADC image

# Diffusion Tensor Imaging data



Reconstructed Fiber Maps in the colors as seen by the creator

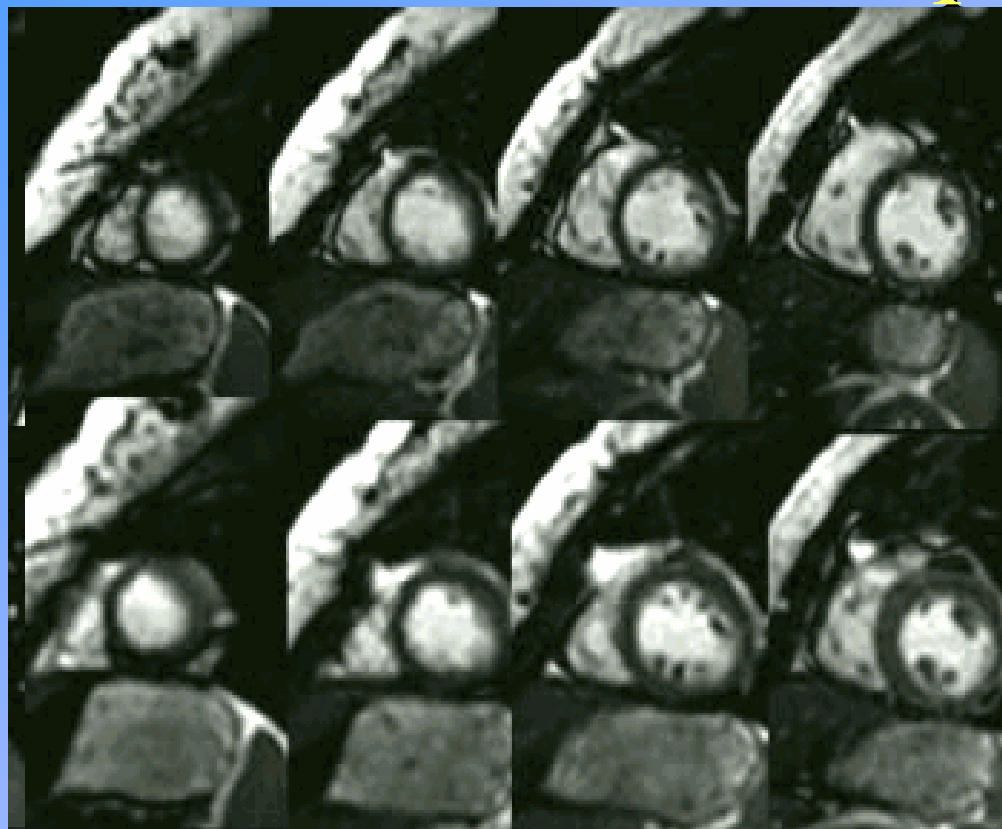
# MR Perfusion Imaging



Quantitative data with Real World Values

time-to-peak map

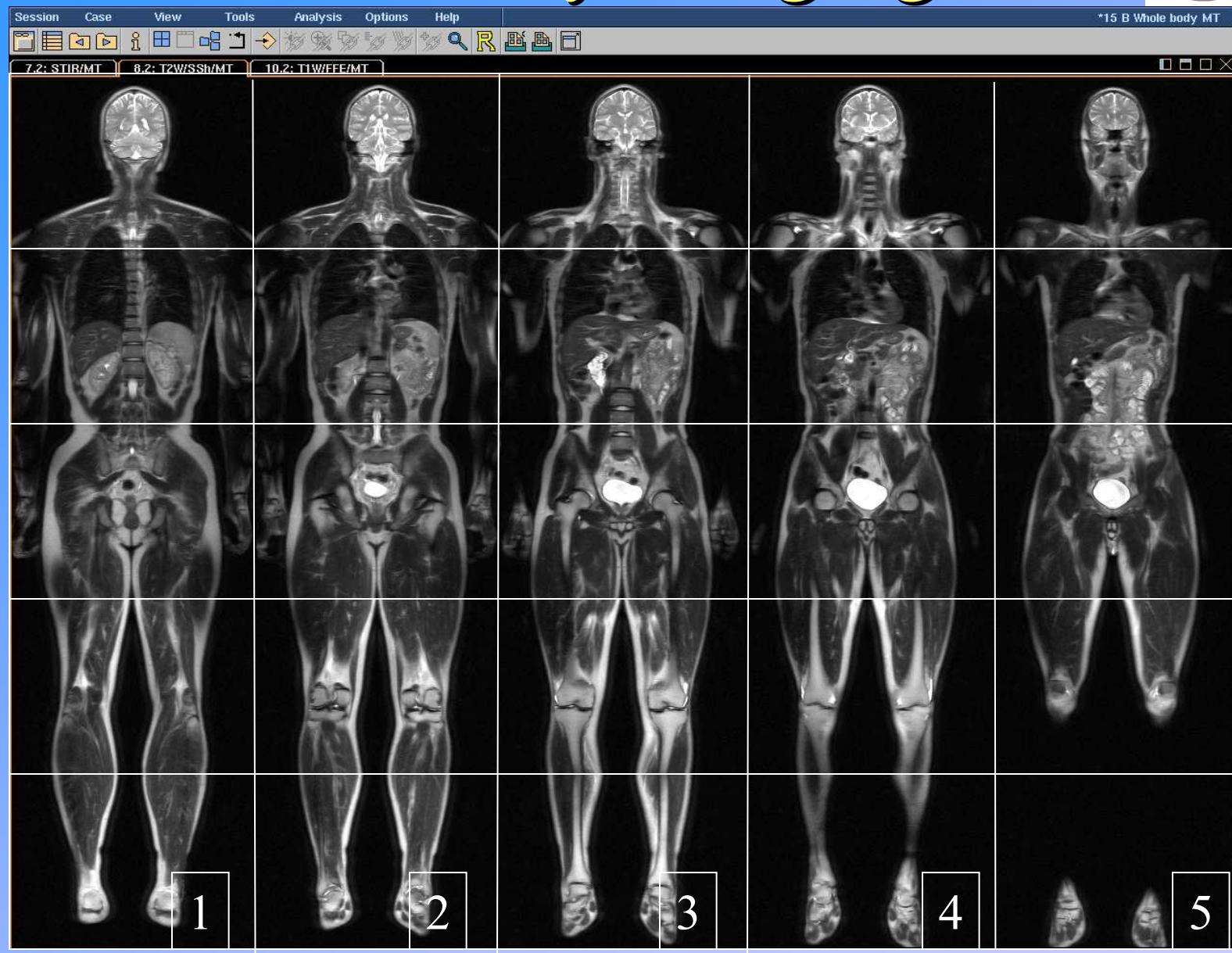
# Cardiac Cine Loops



Enables automatic multi-slice / multi-phase display, even for standard workstations



# Total body Imaging



5

4

3

2

1

1

2

3

4

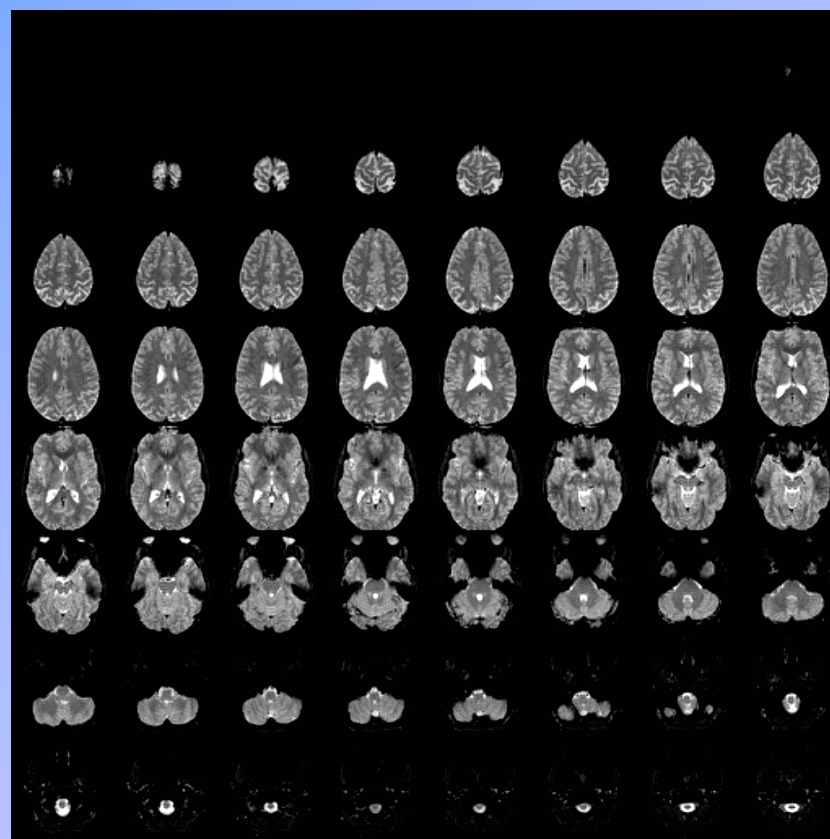
5

Display the correct image at the correct spot using **Stacks** and **In-stack positions**



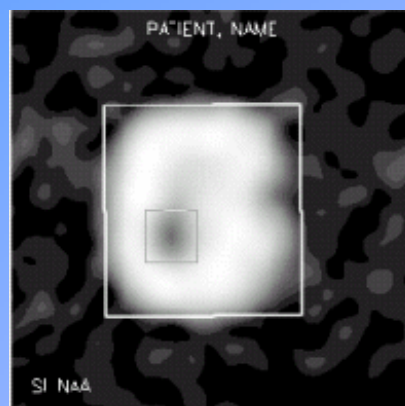
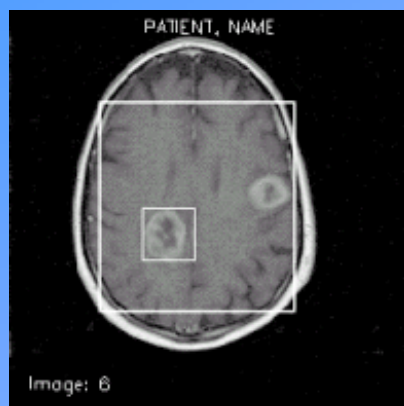
# Functional Brain Imaging

- 10-60 slices
- all slices measured in one TR
- repeated 100-1000 times to get sufficient signal
- leading to **> 60,000** images in one object

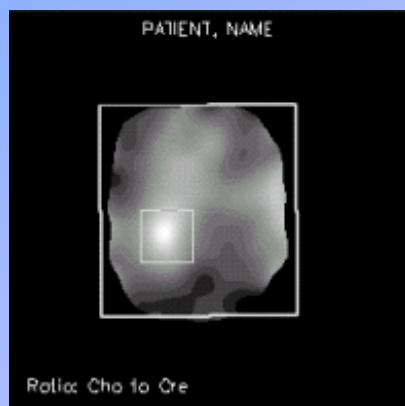
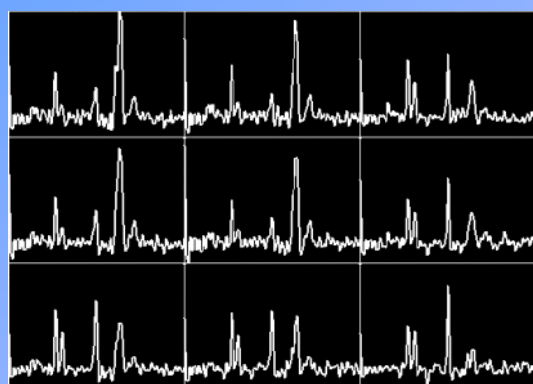


Store thousands of images in one object and display them in a consistent way using Multi-frame Header and Dimension Module

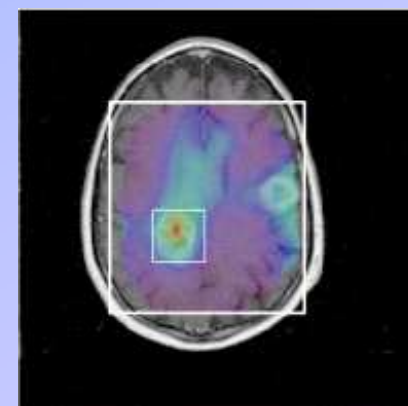
# Spectroscopy and Spectroscopic Imaging



Relative  
NAA  
peak-height



Ratio of  
Choline  
and  
Creatinine  
peaks

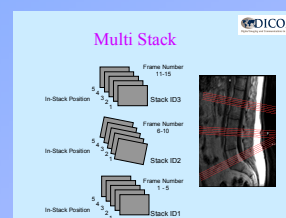


# New Standard's Benefits

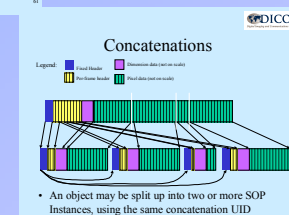
- Improved networking performance
- Improved context information
- Improved clinical information

# Vendors of CT-MR, Workstations & Archives prepare for implementation:

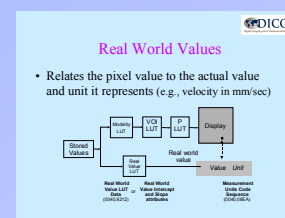
Prepare for Dimensions and Dimension Organizations



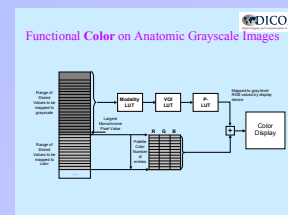
Prepare the databases for large objects



Prepare for real-world values



Prepare the color pipeline



# How to manage the transition ...

- The DICOM Standards Committee and the DICOM Working groups for CT and MR have decided for:
  - The creation of a facility to introduce and test the new objects.
  - an educational program for users and vendors

They have established a taskforce to arrange this.

# CT-MR Taskforce: activities

- **Create CT-MR DICOM Test-tool (contracted to PixelMed (D.Clunie))**
  - Create Sample Enhanced MR Image sets
  - Create Sample Enhanced CT Image sets
  - Display of images and DICOM header tags
  - Import of enhanced image sets
  - Validation tool for enhanced image sets
- **Organize: Test and demonstrate “early and successful” implementations at SCAR 2005**



# Ready For The New CT & MRI DICOM Standard?

“The” Test and Demonstration session  
hosted by SCAR 2005,

for the implementation and promotion of:

- Enhanced CT Image
- Enhanced MR Image
- MR Spectroscopy data
- Raw Data

# Participating companies/groups at SCAR 2005:

- Agfa,
- Dynamic Imaging,
- GE,
- Hitachi,
- INFINITT,
- jMRUI,
- McKesson,
- Philips,
- Siemens,
- Toshiba,
- Vital Imaging (not demonstrating)





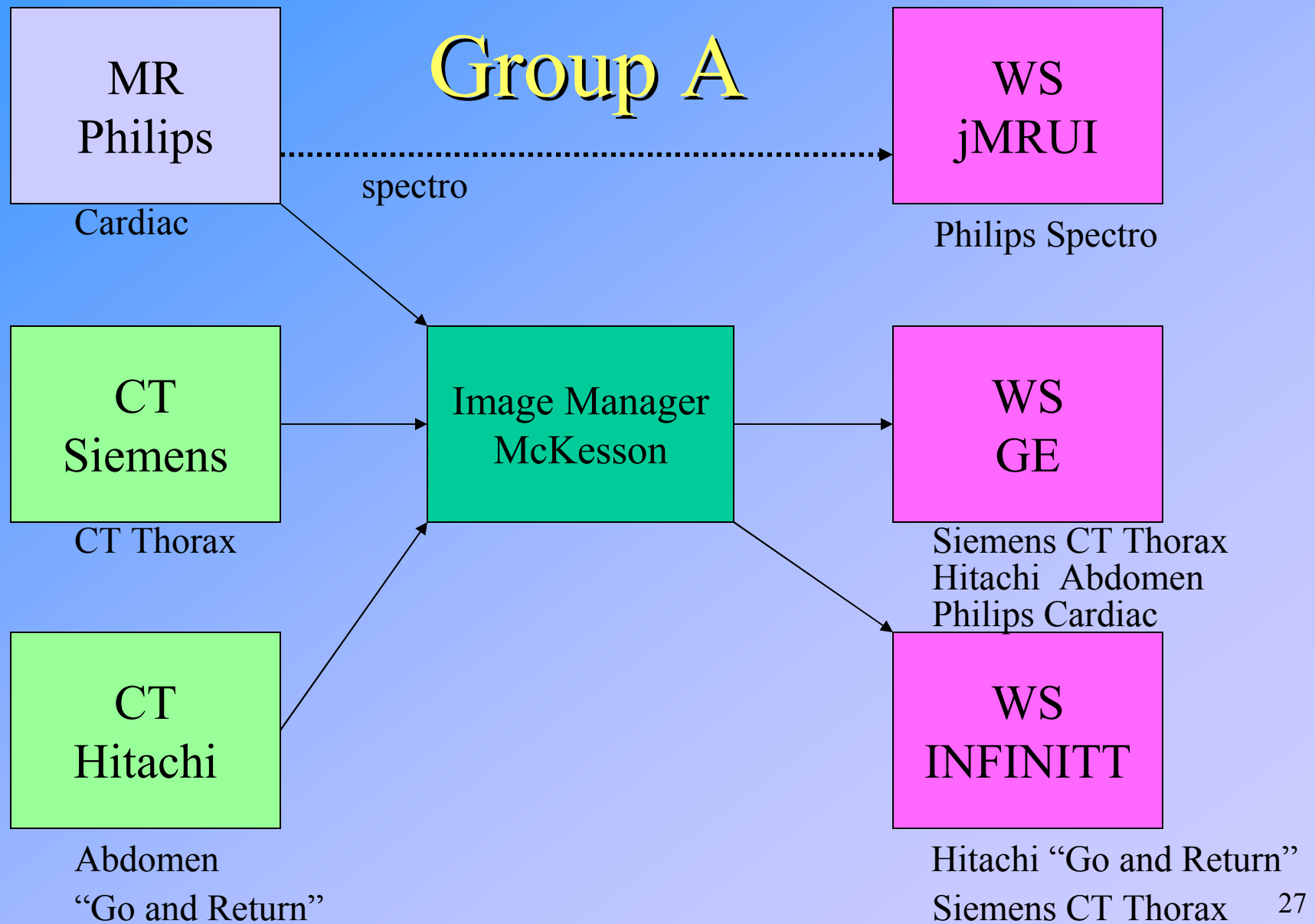
# Agenda for SCAR 2005 (Orlando)

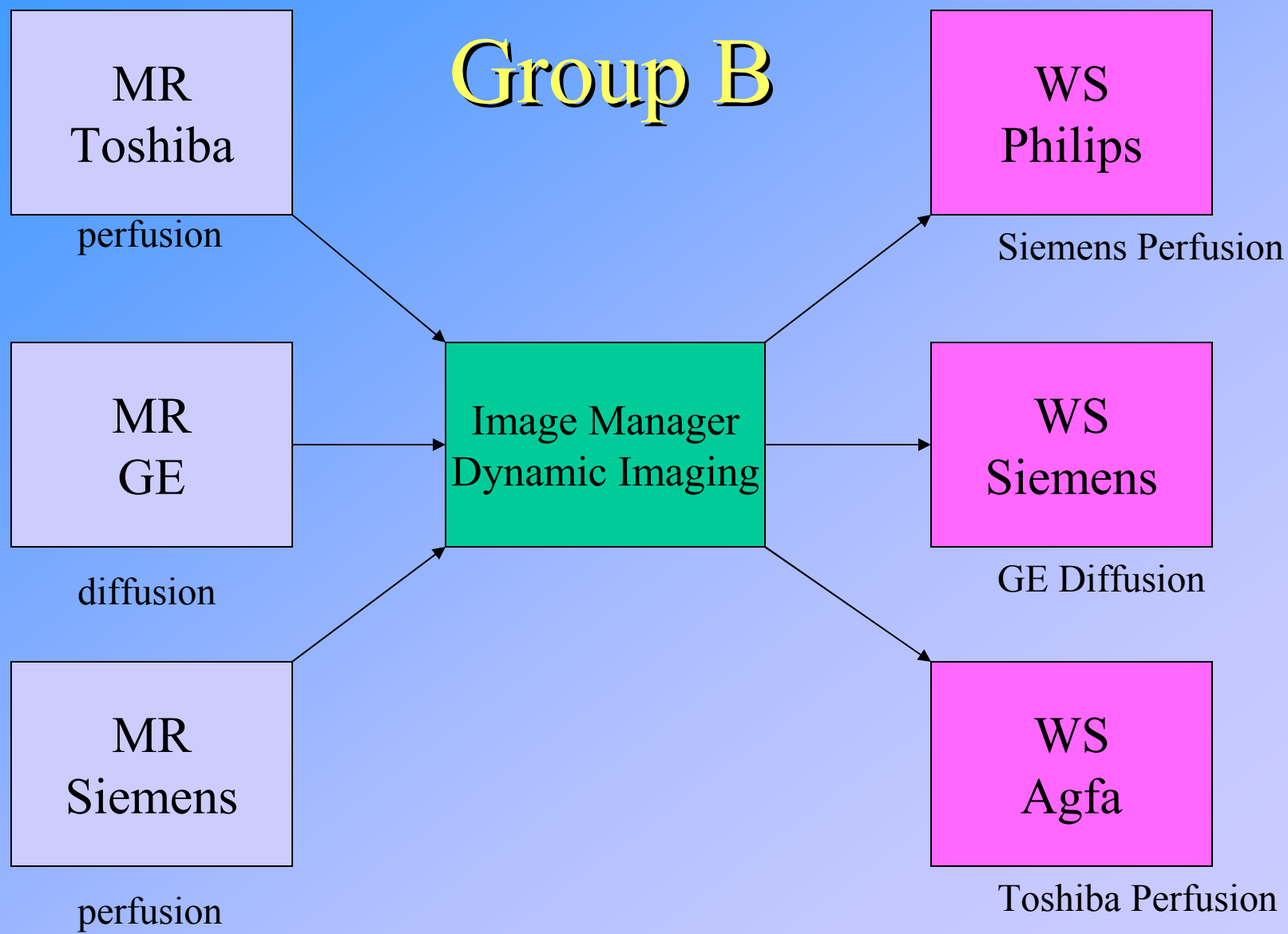
- a testing session open to participating vendors only:
  - June 1<sup>st</sup> and 2<sup>nd</sup>
- a dedicated education session:
  - June 3<sup>rd</sup> 8:00-9:30 am
- 2 days of demonstration for all SCAR participants:
  - June 3<sup>rd</sup> 9:30 am – 4:30 pm and June 4<sup>th</sup> 9:30 am – 12 noon

# **The New CT and MR DICOM Objects: *Why All the Fuss?***

Brad Erickson  
David Clunie







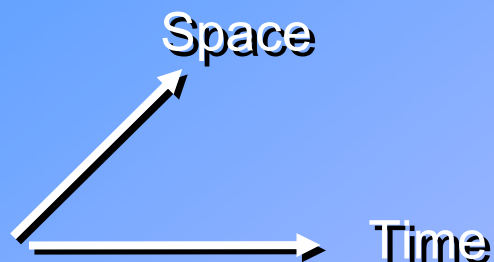
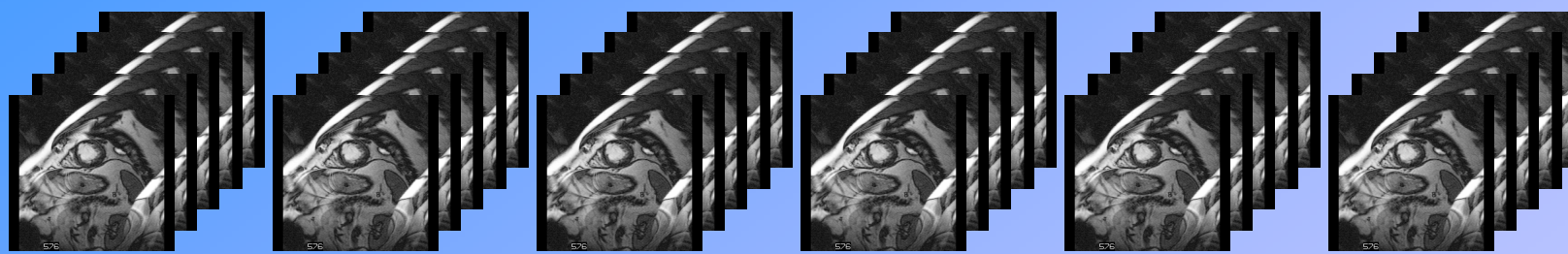
# Supported options

- Dimensions (limitations on functional groups)
- Concatenations (max size per object)
- Real world mapping (LUT or Rescale Intercept)
- Color images (color only or mixed)

# Purpose of the test and demo session

- Show that it works
- Show the benefits
- Explain that users have to invest, if they want the benefits in their infrastructure

# Dimension choices



## Navigation in multi-dimensional datasets ?

- Dimension Module gives a clue
- May be used by specialist systems
- Or they decide to take another order

**Still there is some freedom in the construct of the dimension module**

# How to deal with the freedom of choice ?

- Provide Clinical Scenarios
- Ask vendors to adhere to them
- Get feedback from clinical users
- At InfoRad at RSNA 2005
- After that provide the adapted scenarios to IHE for the development of Clinical Profiles



# Clinical Scenarios

- Cardiac CT and MR ,
- Perfusion,
- Multi-station Peripheral Angio,
- Diffusion,
- fMRI
- Spectroscopy

# Promotion at RSNA

- **RSNA 2005:**
  - **Repeat and extension of SCAR demonstration**
  - **Provide 2-tier approach**
  - **Tier 1 for Technical Compliance with tools**
  - **Tier 2 for Clinical Compliance with Scenarios**

**Educational sessions daily at the booth**

# RSNA Inforad Participants

- Agfa,
- Dynamic Imaging,
- Hitachi,
- INFINITT,
- jMRUI,
- McKesson,
- Philips,
- Siemens,
- Toshiba,

**Thank you**