

Integrating Clinical Images into the Data Review Process

Kellie Riley, Roche, Welwyn, UK

ABSTRACT

Reviewing images, either to assess the primary efficacy parameters or to evaluate potential prognostic biomarkers, is part of the work at the frontier of science. Using TIBCO Spotfire® as an interface, we are able to link the numeric clinical data stored in our RAVE™ database to the Clinical Images themselves, by linking directly into the Clinical Image repository MIRA™. We are also able to perform accurate reconciliation of numeric data, clinical images and eCRF assessment information.

This interface enables clinical and imaging scientists to review all data in an integrated approach irrespective of data origin (EDC, Lab, Images) and allows for a medical review that combines the right data in an end-user friendly way using a single tool.

TIBCO Spotfire® is the tool of choice to look at the data and launch calls to view images, essentially allowing the selection of a Subject or group of Subjects, highlighting the analyte(s) of interest and generating a list of available images based on selections, which are then shown in separate window allowing for optimum and accurate data review.

INTRODUCTION

90% of all oncology studies have an imaging component. Very often the primary endpoint is based on imaging information. Imaging plays an increasingly critical role in oncology drug development, as it allows us to understand what is happening in the tumor, in response to treatment, in humans, on an ongoing basis. Only imaging technologies can provide such detailed information in a non-invasive way.

But images do not follow the traditional pattern of clinical trial data: the files are huge, the information is not just a number or a character variable. This creates a challenge regarding the appropriate storage. At Roche MIRA™ (ICON) is used to store and manage images. With the use of systems like MIRA™, more and more studies are requesting obtaining clinical images to be brought in-house for our imaging teams to analyze.

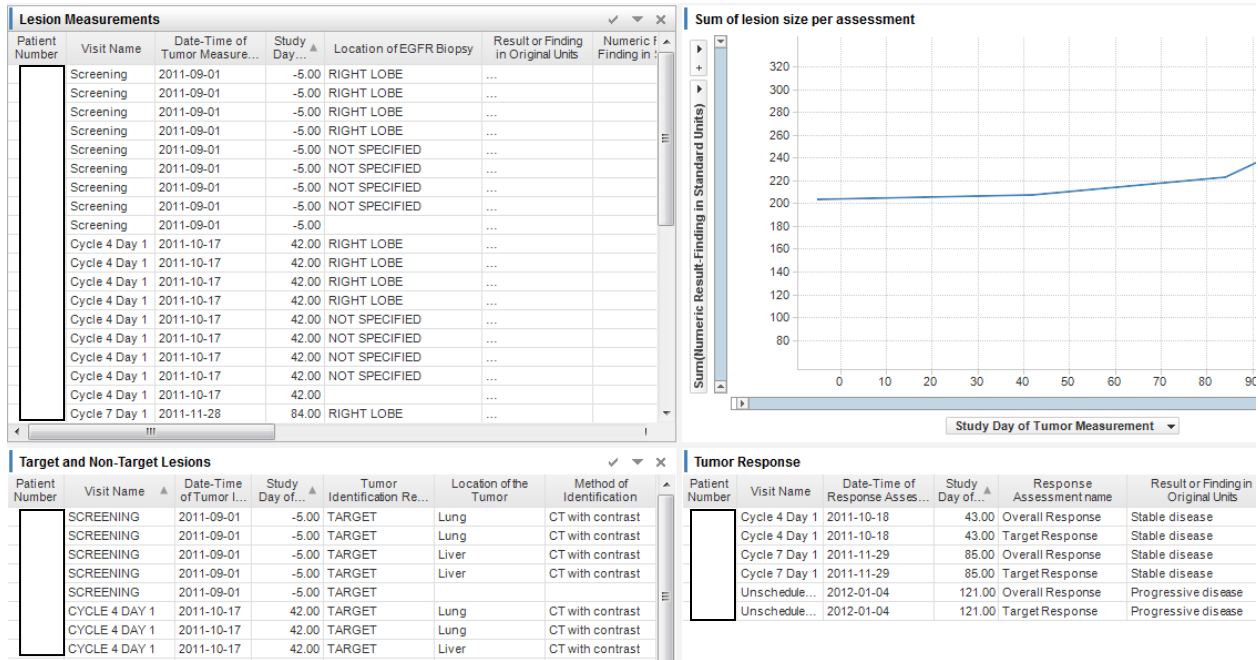
Clinical and imaging scientists have a wide range of tools available for analyzing different types of data during study conduct; however until now this consisted of reviewing different data types in different systems, which is not efficient or convenient. The images being stored not in the same database as the other data captured in a study creates another hurdle: an integrated review of images and clinical data required to work with two systems in parallel: MIRA™ and RAVE™.

In the poster presentation we will graphically show the implementation of the Spotfire® interface between numeric imaging data, the images themselves and how we ensure quality of data by combining with all associated eCRF assessment information.

CLINICAL DATA REVIEW

At Roche, the clinical data generated in a study are entered in RAVE™ (electronic case report form) and our Biostat Computing Environment (BCE), where these data are cleaned, reconciled and stored. The data are extracted and transformed into standardized SDTM-based formats, which can then be reviewed using TIBCO Spotfire®. With TIBCO Spotfire® large data sets can be visualized and drill down functionality allows the switch from population view to subject view of data. It provides rapid data access with data structures tailored for data review and allows for exploratory data evaluation using interactive graphical displays.

Figure 1: Demonstrates a view of numeric imaging and eCRF assessment data. Using TIBCO Spotfire® it is easy to create visualisation templates that enable easy comparison, analysis and graphical representation on specific data of interest and can be used across studies.



MIRA™ IMAGE REPOSITORY AND ANALYSIS TOOL

Clinical imaging can be an asset for the better understanding of the efficacy of a drug with regards to aspects such as mechanism of action, biodistribution and target occupancy. It is important to get access to study images and results in order to maximize information for decision making and designing further clinical development steps. MIRA™ is the Medical Image Review and Analysis software which is used as a Roche repository for clinical images, measurement data and study documents. Protocols, sites and subjects can be added to the system as needed for each clinical trial maintained in the system.

MIRA™ is a validated system designed to service image data in DICOM format, which is the predominant standard for the communication of clinical images. Images can be exported from the system for use in presentations or linking to measurement data in other software applications. Processed images and measurement data may then be loaded back to MIRA™ as the central repository.

Figure 2: Listing of clinical images loaded into MIRA™. Selecting a set of images allows the system to open the image DICOM files for review in the image viewing pane. Refer to figure 3.

Client	Site	Code	Subject	Visit	Read Visit	Modality	Study ID	Study Date	Study Time	# Series	Study Description
ROE1		1002	1002	Screening		MR	1	11/8/2011	4:05 PM	1	PROTOCOLS*ROCHE_AS
			1002	Period 1 Day 1		MR	1	11/10/2011	8:45 AM	46	PROTOCOLS*ROCHE_AS
			1002	Period 2 Day 1		MR	1	11/17/2011	8:54 AM	37	PROTOCOLS*ROCHE_AS
			1002	Period 3 Day 1		MR	1	11/24/2011	8:54 AM	33	PROTOCOLS*ROCHE_AS
			1002	Period 4 Day 1		MR	1	2/2/2012	11:17 AM	33	PROTOCOLS*ROCHE_AS

Code	Visit	Modality	In Prot	Lock	For Read	Series #	Series Date	Series Time	# Files	# Fram	Series Description
	Screening	MR	Y	no	Y	3	11/8/2011	4:21 PM	176	176	T1 MPRAGE SAG ISO1.0mm
	Period 1 Day 1	MR	Y	no	Y	1	11/10/2011	9:08 AM	128	128	AAHScout_32ch
	Period 1 Day 1	MR	Y	no	Y	2	11/10/2011	9:08 AM	4	4	AAHScout_32ch_MPR
	Period 1 Day 1	MR	Y	no	Y	3	11/10/2011	9:17 AM	176	176	T1 MPRAGE SAG ISO1.0mm
	Period 1 Day 1	MR	Y	no	Y	4	11/10/2011	9:18 AM	72	72	GRE FIELD MAP 3mm
	Period 1 Day 1	MR	Y	no	Y	5	11/10/2011	9:18 AM	36	36	GRE FIELD MAP 3mm
	Period 1 Day 1	MR	Y	no	Y	6	11/10/2011	9:22 AM	1	1	StarFMRI
	Period 1 Day 1	MR	Y	no	Y	7	11/10/2011	9:22 AM	200	200	EPI HAFIRI ISO4.0mm TR=3s
	Period 1 Day 1	MR	Y	no	Y	8	11/10/2011	9:22 AM	200	200	act_MoCoSeries
	Period 1 Day 1	MR	Y	no	Y	9	11/10/2011	9:23 AM	177	177	intermediate tMap
	Period 1 Day 1	MR	Y	no	Y	10	11/10/2011	9:32 AM	1	1	Design
	Period 1 Day 1	MR	Y	no	Y	11	11/10/2011	9:32 AM	1	1	EvaSeries_GLM
	Period 1 Day 1	MR	Y	no	Y	12	11/10/2011	9:32 AM	3	3	Mean_L_tMaps
	Period 1 Day 1	MR	Y	no	Y	13	11/10/2011	9:33 AM	3	3	ASL ISO4mm 28COUPES_TE=21ms
	Period 1 Day 1	MR	Y	no	Y	15	11/10/2011	9:33 AM	1	1	Perfusion_Weighted
	Period 1 Day 1	MR	Y	no	Y	16	11/10/2011	9:33 AM	1	1	reICBF
	Period 1 Day 1	MR	Y	no	Y	17	11/10/2011	9:37 AM	405	405	ASL ISO4mm 28COUPES_TE=21ms
	Period 1 Day 1	MR	Y	no	Y	18	11/10/2011	9:37 AM	405	405	MoCoSeries
	Period 1 Day 1	MR	Y	no	Y	19	11/10/2011	9:56 AM	1	1	Perfusion_Weighted
	Period 1 Day 1	MR	Y	no	Y	20	11/10/2011	9:56 AM	1	1	reICBF
	Period 1 Day 1	MR	Y	no	Y	21	11/10/2011	9:56 AM	3	3	ASL ISO4mm 28COUPES_TE=9.7ms
	Period 1 Day 1	MR	Y	no	Y	23	11/10/2011	9:56 AM	1	1	Perfusion_Weighted
	Period 1 Day 1	MR	Y	no	Y	24	11/10/2011	9:56 AM	1	1	reICBF
	Period 1 Day 1	MR	Y	no	Y	25	11/10/2011	10:00 AM	128	128	AAHScout_32ch
	Period 1 Day 1	MR	Y	no	Y	26	11/10/2011	10:00 AM	4	4	AAHScout_32ch_MPR
	Period 1 Day 1	MR	Y	no	Y	27	11/10/2011	10:06 AM	405	405	ASL ISO4mm 28COUPES_TE=9.7ms
	Period 1 Day 1	MR	Y	no	Y	28	11/10/2011	10:06 AM	405	405	MoCoSeries
	Period 1 Day 1	MR	Y	no	Y	29	11/10/2011	10:26 AM	1	1	Perfusion_Weighted
	Period 1 Day 1	MR	Y	no	Y	30	11/10/2011	10:26 AM	1	1	reICBF
	Period 1 Day 1	MR	Y	no	Y	31	11/10/2011	10:27 AM	128	128	AAHScout_32ch
	Period 1 Day 1	MR	Y	no	Y	32	11/10/2011	10:27 AM	4	4	AAHScout_32ch_MPR
	Period 1 Day 1	MR	Y	no	Y	33	11/10/2011	10:27 AM	2	2	ASL-TrueFISP TI=1200 ms NR=2 6/8
	Period 1 Day 1	MR	Y	no	Y	34	11/10/2011	10:30 AM	1	1	ASL-TrueFISP TI=1200 ms NR=100 6/8

Figure 3: Clinical images populated for review by clicking on a selection of specific images as demonstrated above.



BRINGING THE DATA TOGETHER

Using a specialized Spotfire® interface, we can directly link into the MIRA™ system which allows us to quickly review selected medical images relating to specific subject numeric data being reviewed within Spotfire®. The end result provides ideal, quick comparisons between numeric and image data allowing a greater, more accurate and more efficient integrated data review.

Figure 4 shows this interface linking the two systems. The template contains detailed instructions of steps to follow to select the subject specific images of interest required to be reviewed. By simply clicking on the green highlighted bar in the images available in MIRA™ table in Spotfire®, it automatically switches to the MIRA™ software to display the selected image/s of interest, as seen displayed in Figure 5 below.

Numeric analysis measurements based on the clinical images as read by the imaging vendors can be uploaded to Spotfire® (as demonstrated in Figure 6). Because of our Spotfire/Mira interface, our internal Roche Translational Imaging team is more optimally able to analyse the medical images first hand, allowing the review and comparison against the vendor provided numerical analysis, ensuring the most accurate and valuable data for the study.

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Figure 4: The Spotfire® to MIRA™ interface template.

Start Here

1. [Launch MIRA Session in Citrix](#)
2. Provide login credentials to connect to MIRA session
(Required for first request only)

MIRA Username:

MIRA Password:
(does not support paste)

Login

3. Select data in Scatter Plot.
4. Select option: Exclude thumbnail images
5. Get list of images
6. Select in the table, which images to open in MIRA.
7. Select what to do in MIRA:

Add to series or Replace series

Instructions

- Follow the instructions on the left side of the screen "Start Here"
- After "Login" is pressed, select one or multiple patients in the windows "All Patients"
- Select "Get list of images" in the left panel
- The list of images available for the selection made will be shown in the window "Images Available in MIRA"
- Select in the window "Images Available in MIRA" the images of interest and click either "Add to series" or "Replace series" in the left

All Patients										
Clinical Research Trial Number	Patient Number	Investigator Name	Date-Time of Birth	Age	Age Units	Sex	Race	Planned Arm Code	Description of Planned Arm	Co
			1967-12-07	44.00	YEARS	M	WHITE	PADESC	ARM A: DOSE ESCALATION	NLD
			1969-12-12	41.00	YEARS	F	WHITE	PBLD	ARM B: LOW DOSE	NLD
			1971-09-21	40.00	YEARS	M	WHITE	PBLD	ARM B: LOW DOSE	NLD
			1941-04-08	70.00	YEARS	M	WHITE	PBLD	ARM B: LOW DOSE	NLD
			1945-01-14	67.00	YEARS	M	WHITE	PBLD	ARM B: LOW DOSE	NLD
			1941-05-12	71.00	YEARS	M	WHITE	PBLD	ARM B: LOW DOSE	NLD
			1968-06-19	43.00	YEARS	F	WHITE	PBLD	ARM B: LOW DOSE	NLD
			1951-01-18	61.00	YEARS	M	WHITE	PBLD	ARM B: LOW DOSE	NLD
			1949-10-23	62.00	YEARS	M	ASIAN	PBLD	ARM B: LOW DOSE	NLD
			1945-01-10	66.00	YEARS	M	WHITE	PADESC	ARM A: DOSE ESCALATION	FRA
			1949-11-07	61.00	YEARS	M	BLACK...	PADESC	ARM A: DOSE ESCALATION	FRA
			1947-05-29	64.00	YEARS	F	WHITE	PADESC	ARM A: DOSE ESCALATION	FRA
			1953-01-23	58.00	YEARS	F	WHITE	PADESC	ARM A: DOSE ESCALATION	FRA
			1957-12-09	54.00	YEARS	M	WHITE	PADESC	ARM A: DOSE ESCALATION	FRA
			1957-03-23	55.00	YEARS	F	WHITE	PADESC	ARM A: DOSE ESCALATION	FRA
			1954-02-14	58.00	YEARS	F	BLACK...	PADESC	ARM A: DOSE ESCALATION	FRA
			1940-12-29	71.00	YEARS	F	WHITE	PADESC	ARM A: DOSE ESCALATION	FRA
			1943-06-16	68.00	YEARS	F	WHITE	PADESC	ARM A: DOSE ESCALATION	USA
			1931-10-10	80.00	YEARS	F	WHITE	PADESC	ARM A: DOSE ESCALATION	USA
			1956-08-17	55.00	YEARS	M	WHITE	PADESC	ARM A: DOSE ESCALATION	USA

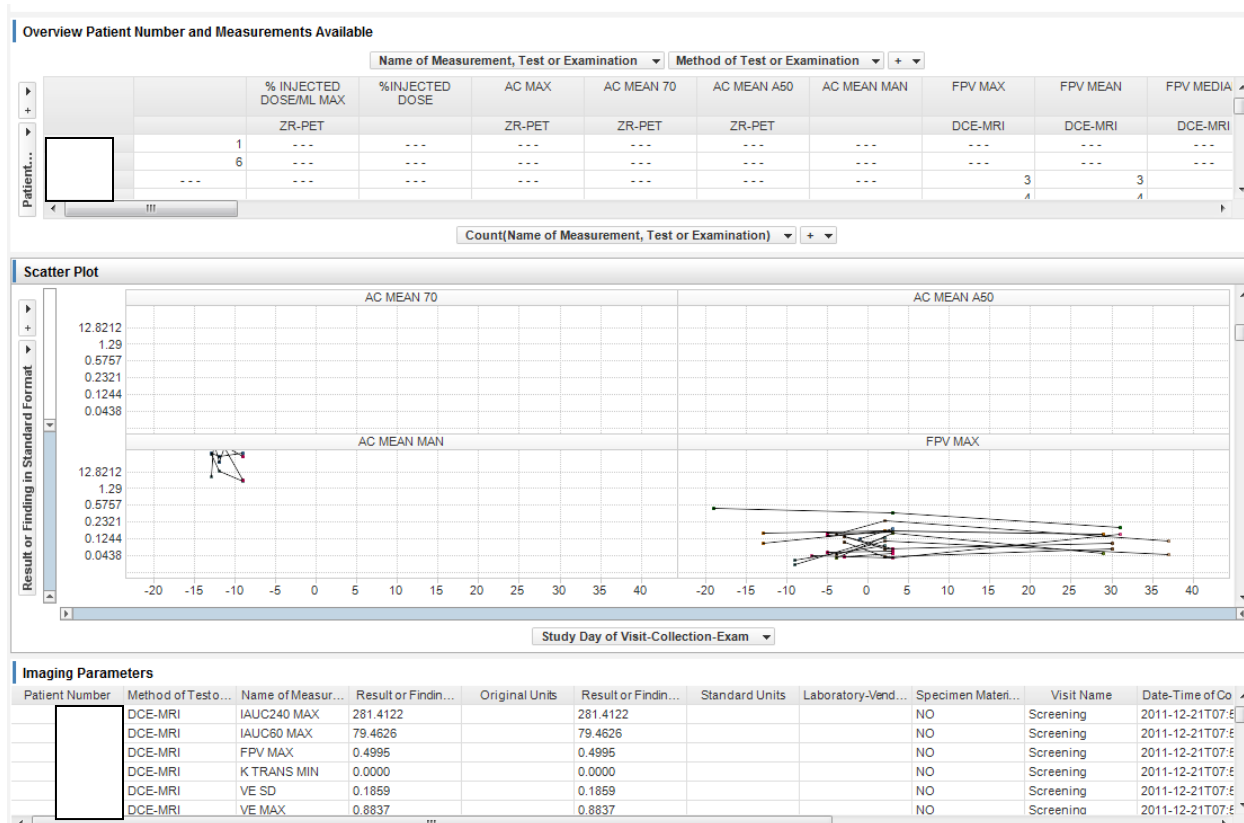
Images Available in MIRA								
Subject	VisitName	Modality	SeriesDescription	SeriesDateTime	Thumbnail	SeriesID	SiteNumber	
	Cycle 1 Day 1	CT	Body-Low Dose CT	2012-03-30 06:04:48		21337	42098	
	Cycle 1 Day 1	PT	[WB_NAC] Roche BP25385 Zr	2012-03-30 06:05:29		21339	42098	
	Cycle 1 Day 1	PT	[WB_CTAC] Roche BP25385 Zr	2012-03-30 07:02:39		21338	42098	
	Cycle 1 Day 2	CT	Body-Low Dose CT	2012-03-31 08:16:08		21340	42098	
	Cycle 1 Day 2	PT	[WB_NAC] Roche BP25385 Zr	2012-03-31 09:16:51		21342	42098	
	Cycle 1 Day 2	PT	[WB_CTAC] Roche BP25385 Zr	2012-03-31 09:53:18		21341	42098	
	Cycle 1 Day 5	CT	Body-Low Dose CT	2012-04-03 06:26:19		21343	42098	
	Cycle 1 Day 5	PT	[WB_NAC] Roche BP25385 Zr	2012-04-03 06:27:12		21345	42098	

Figure 5: The specific images of interest displayed within MIRA™ as selected via the Spotfire® interface.



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Figure 6: Specialised data generated by image analysis can be reviewed and compared in Spotfire® between internal and external imaging experts for optimum data quality.



CONCLUSION

We at Roche have created a powerful data visualization interface allowing quick, accurate and high quality data analysis, incorporating eCRF, numerical, electronic and statistical graphical data with the medical images to provide optimum data value for each study.

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CONTACT INFORMATION

Your comments and questions are valued and encouraged. Contact the author at:

Kellie Riley
Roche Products Ltd
6 Falcon Way,
Shire Park,
Welwyn Garden City,
AL7 1TW
UK

Tel. +44 (0)1707 361125
Fax +44 (0)1707 384118
kellie.riley@roche.com

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