



TMALab

TMALab is a web-based function in eSlide Manager, working for Tissue Microarrays (TMAs). TMAs allow researchers to validate new biomarkers or discover and dissect molecular pathways in hundreds of tissue samples simultaneously. They also ensure consistency in slide staining and preparation. TMALab allows you to use predefined array blocks to automatically segment whole slide images of any standard file format; rapidly access adjacent sections and compare stains by automatically retrieving corresponding spots across multiple slides; and submit batch jobs for server-side image analysis. You will be able to analyze entire spots and designate regions of analysis.

TMALab is part of the Human Tissue Resource Center's Advanced Training for digital pathology. Before scheduling training for TMALab, users must have first taken the required online courses and gone through Basic Training. For details, please visit the HTRC website: <http://htrc.uchicago.edu/training.php>.

1 – TMA Lab Features

A. Key Features

- **TMA Block Templates** – By creating a re-usable TMA block template that suits your TMA slides, it then becomes quick and easy to use the block to segment a slide to identify each core within a TMA.
- **Auto Segment** – The auto segment feature makes it easy to segment a TMA slide to identify each core.
- **View TMA Spots** – After a TMA block is associated with a TMA digital slide, you can view individual spots in high resolution, using all the ImageScope tools to pan, zoom, and annotate the image. You can also view multiple spots simultaneously for comparison at different zoom levels.
- **Analyze TMA Spots** – Accurately quantify TMAs (for example, measure stain intensity) using image analysis algorithms and eSlide Manager's batch analysis feature.
- **Export Metadata and Images** – Export TMA block metadata and TMA spot images for use with third-party applications.

B. Terminology

- **Core** – The tissue sample that runs through a TMA paraffin block. For the purposes of TMA Lab, think of the core as the location in the TMA block that will be associated with an image from the TMA slide when the slide is segmented.
- **Segmenting** – The process by which the grid defined in the TMA block is associated with a TMA digital slide, isolating each TMA spot so it can be viewed or analyzed.
- **Spot** – A 2D cross-section of a 3D core. For the purposes of TMA Lab, it is the image from a TMA slide associated with the TMA core when the TMA digital slide is segmented.
- **TMA** – Tissue microarrays consist of paraffin blocks in which up to 1,000 separate tissue cores are assembled in an array.
- **TMA Block** – Within TMA Lab, it is a map of the cores in a TMA slide, arranged so that each core is isolated and identified. A TMA block is a template that can be applied to many digital slides.

C. Workflow

- Add a new TMA block. This defines the structure of the TMA digital slide by creating a grid which will align to the cores of the TMA digital slide.
- Apply the TMA block to a TMA digital slide or create a new one directly on the digital slide. This associates the TMA block with the digital slide. It is called segmentation.
- Optionally associate a specimen with a TMA block core.
- View TMA spots.
- Analyze TMA spots.

2 – Adding a New TMA Block

A. Creating a New TMA Block

- Under the **TMA Blocks** menu, select **Add TMA Blocks** or select **Add New TMA Blocks** under the TMA Blocks heading on the main eSlide Manager page.

User: Dr. Beth Edwards, Role: Research_Supervisor Projects Specimens Digital Slides TMA Blocks Analysis

Add New TMA Blocks

➕ Add TMA Block(s)

Block ID

Created By

Created Date yyyy-mm-dd

Comment

Status

Data Group

- Type in information about the TMA block and click **Add**.

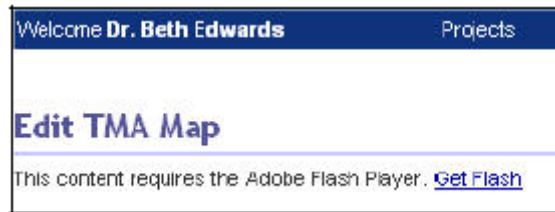
User: Dr. Beth Edwards, Role: Research_Supervisor Projects Specimens Digital Slides TMA Blocks Analysis A

Add New TMA Blocks

TMA Block(s):

Block ID: 1A
 Created By: Dr. Beth Edwards
 Created Date: 2008-11-15 yyyy-mm-dd
 Comment:
 Status: In Progress
 Data Group: Project 49

- If you do not have Flash Player installed on your workstation, you will see a link to download the free application.



- Now you see the **Edit TMA Map** page where you can define the grid that fits your TMA digital slides.

User: Dr. Beth Edwards, Role: Research_Supervisor Projects Specimens Digital Slides TMA Blocks Analysis Administrative Help Font Size Log off

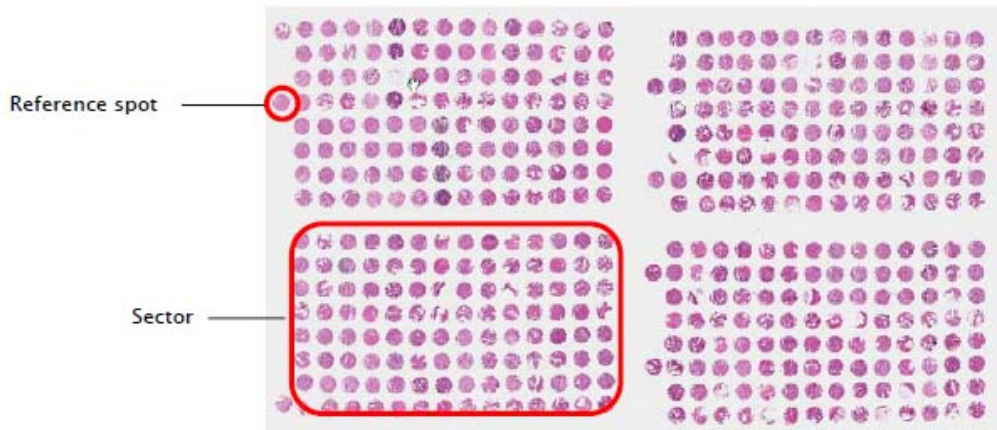
TMA Block successfully added

Edit TMA Map

Sectors
 Row:
 Col:
 Seed Size:

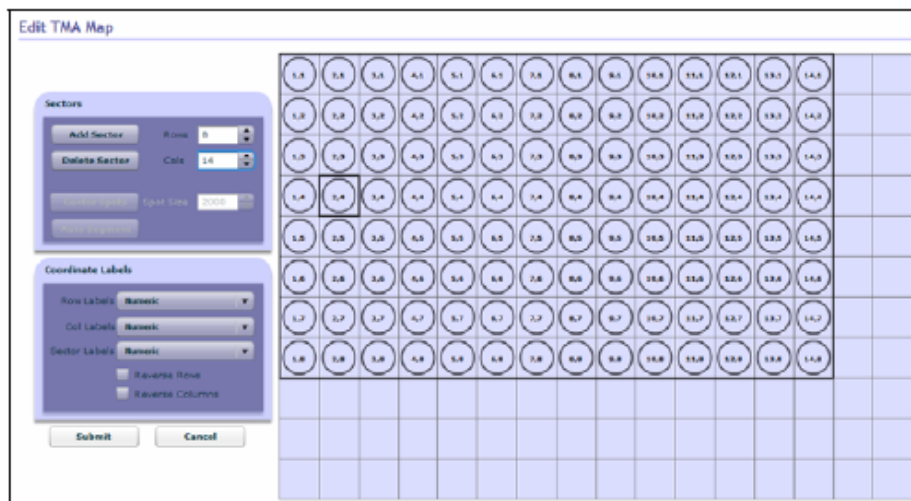
Coordinate Labels
 Row Labels: Numeric
 Col Labels: Numeric
 Sector Labels: Numeric
 Reverse Rows
 Reverse Columns

- Many TMA slides contain multiple groups, or *sectors*, of cores. You may also see isolated reference points that you may not want to identify or analyze. See example below.

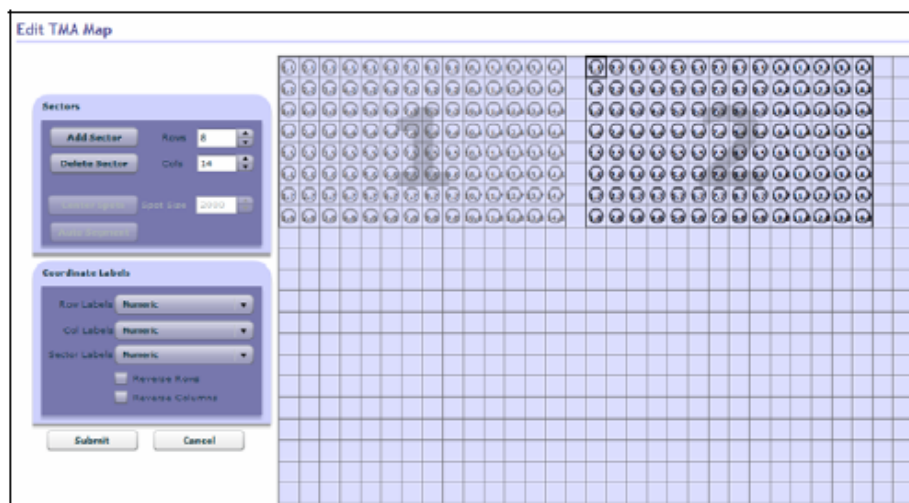


B. Creating Sectors

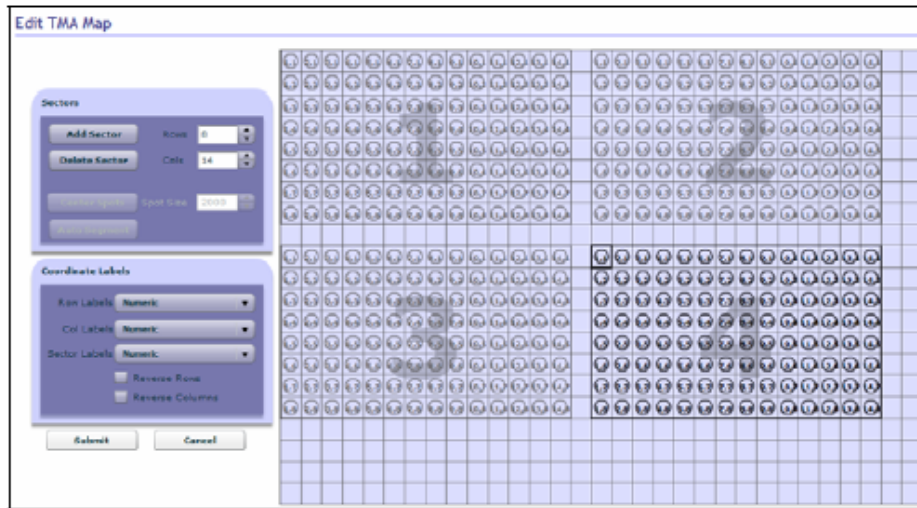
- Click the upper left hand corner of the map and click **Add Sector**.
- Enter the number of rows in the **Rows** box and the number of columns in the **Columns** box. You see the first sector defined (the example below has 8 rows and 14 columns).



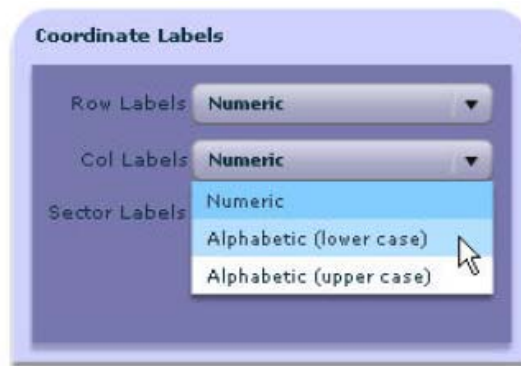
- Now position your cursor one column to the right of the first sector and click **Add Sector** again to define a second sector of the same size.



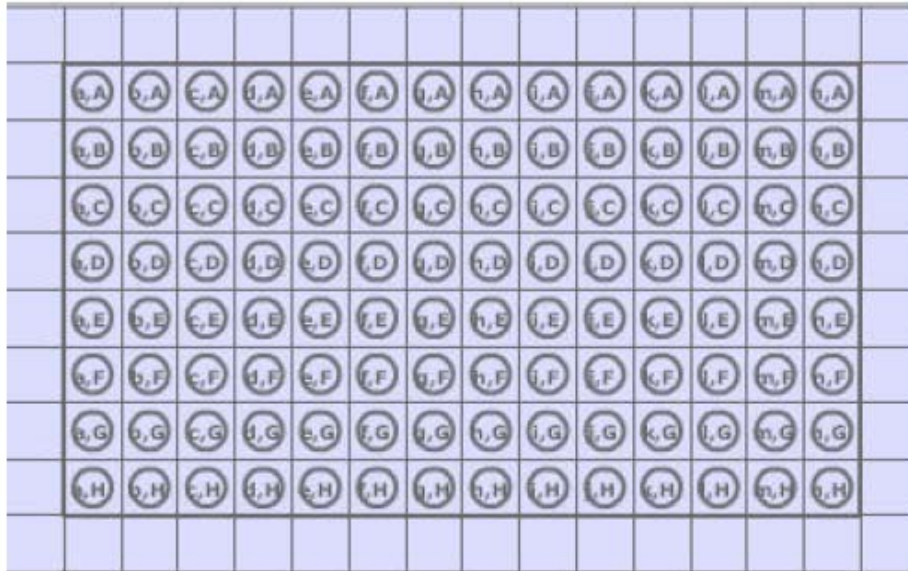
- Position your cursor two rows below the first sector, leaving a blank row and click **Add Sector** to define the third sector. Position your cursor two rows below the second sector leaving a blank row and click **Add Sector** to define the fourth sector.



- Change the core labeling to match the method used by your lab by choosing the label drop-down lists for **Row**, **Column**, and **Sector**.



- In the example below, **Alphabetic (lower case)** was used for **Columns** and **Alphabetic (upper case)** for the **Rows**.




- Click **Submit** to save this TMA block. It will appear in the **TMA Blocks** list page.

User: Dr. Beth Edwards, Role: Research_Supervisor Projects Specimens Digital Slides TMA Blocks

TMA Map successfully updated

TMA Blocks

[Open Data](#) | [Delete](#) | [New](#) | [Export Data](#) | [View Audits](#)

<input type="checkbox"/>		TMA ID	Block ID	Created By	Created Date
<input type="checkbox"/>		2	1A	Dr. Beth Edwards	2008-11-16
<input type="checkbox"/>		1	1A	Dr. Beth Edwards	2008-11-15

3 – Segmenting a TMA Digital Slide

A. Selecting a TMA Digital Slide

- In the **Digital Slides** menu, choose **All Digital Slides (As List)**. Select the TMA slide and click **Open Data**.
- On the **Digital Slide Details** page, click **Segment TMA**.

Digital Slide Details

[< Previous Digital Slide](#) | [Digital Slide List](#) | [Assign To New Specimen](#) | [Assign To Existing Specimen](#) | [Assign To New](#)



Slide ID: 37
 Barcode ID: Capistrano Oncology Center/Research Project 49/ER
 Block ID: 1A
 Stain: ER
 Data Group: Project 49

Digital Slide Attachments

[Add Attachment](#)
(No data to display)

Digital Slide Images

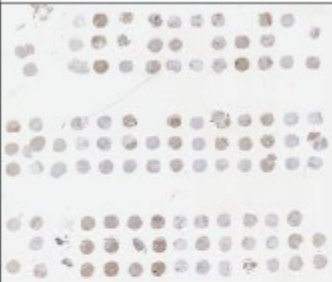
[Add Image](#)

[Unassign Image](#) ➔ [Segment TMA](#)

Image ID: 54
 Captured Date:
 File Location: C:\Images\TMA\ROS1-I_ER_1295.svs
 Description: Capistrano Oncology Center/Research Project 49
 Rack:

User: Dr. Beth Edwards, Role: Research_Supervisor Projects Specimens Digital Slides TMA Blocks Analy



TMA Blocks

Select an existing TMA Block or create a new one.

TMA ID	Block ID	Created By	Created Date	Comment
<input type="radio"/>	4	5B	Dr. Jeff Garcia	2008-11-15
<input type="radio"/>	3	5B	Dr. Jeff Garcia	2008-11-16
<input type="radio"/>	2	1A	Dr. Beth Edwards	2008-11-16
<input type="radio"/>	1	1A	Dr. Beth Edwards	2008-11-15

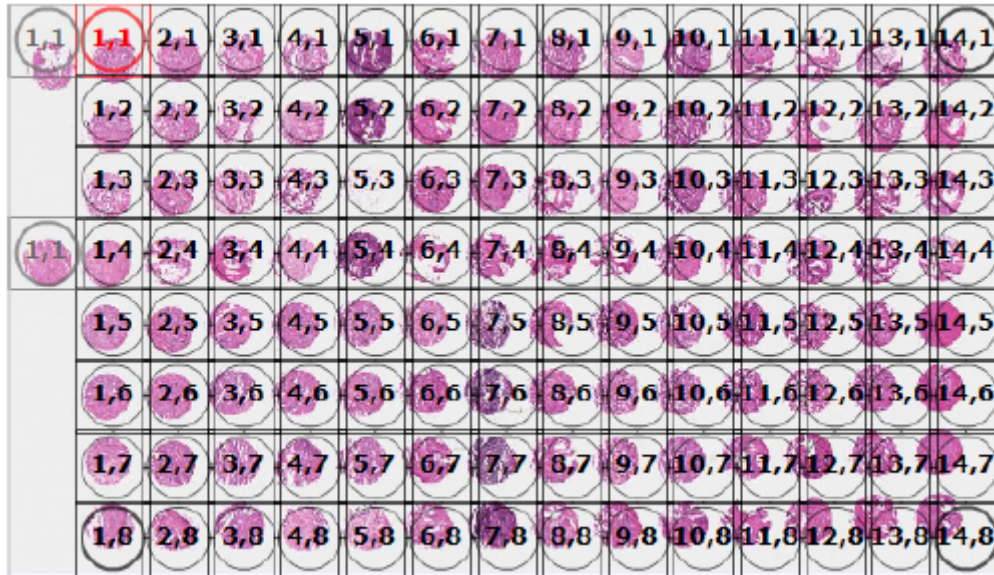
- Now you can either select an existing TMA block to segment the digital slide or create a new TMA clock directly on the digital slide.

B. Segmenting Using an Existing TMA Block

- After selecting a digital slide, opening the slide's details page, and clicking **Segment TMA**, select the button next to the existing TMA block and click **Select TMA Block**.

- The Edit TMA Map page appears.

Note: It is very likely the grid defined earlier is not perfectly aligned with the cores on the TMA slide.



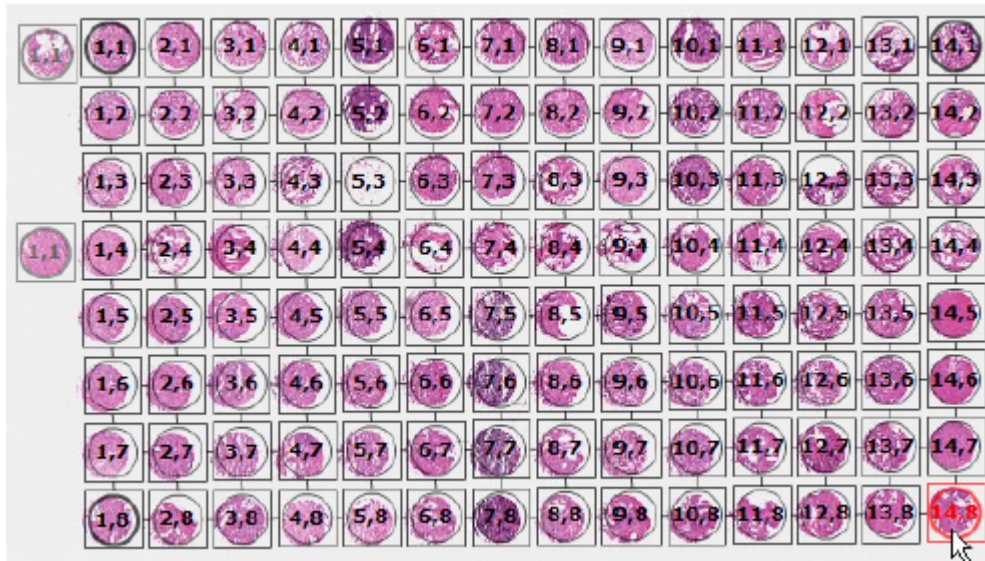
- You must align the grid with the TMA cores so that each core is in a box and is centered in the box. You can do this manually or by using the **Auto Segment** button.
 - To manually adjust TMA Map, click the top left corner of the first sector and drag it so that the first spot is centered in the box.



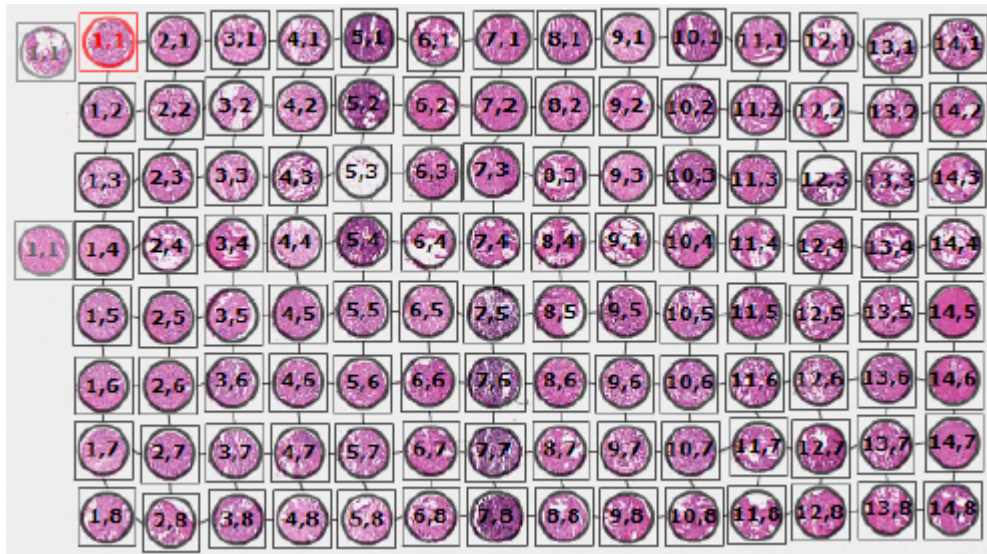
- Adjust the size of the boxes by changing the value in the Spot Size box so the spot fills the selected box.



- Select the other corner boxes of the sector and drag them to match the spot positions.



- Select a box in a sector and click Center Spots to center each spot in its box. The grid moves so that the spots are centered.



- You may also drag individual boxes to make the cores fit better.

Note: If the core does not correctly fit within the box, those areas of the core that are outside the center of the box will not be included with the core once segmentation is complete.

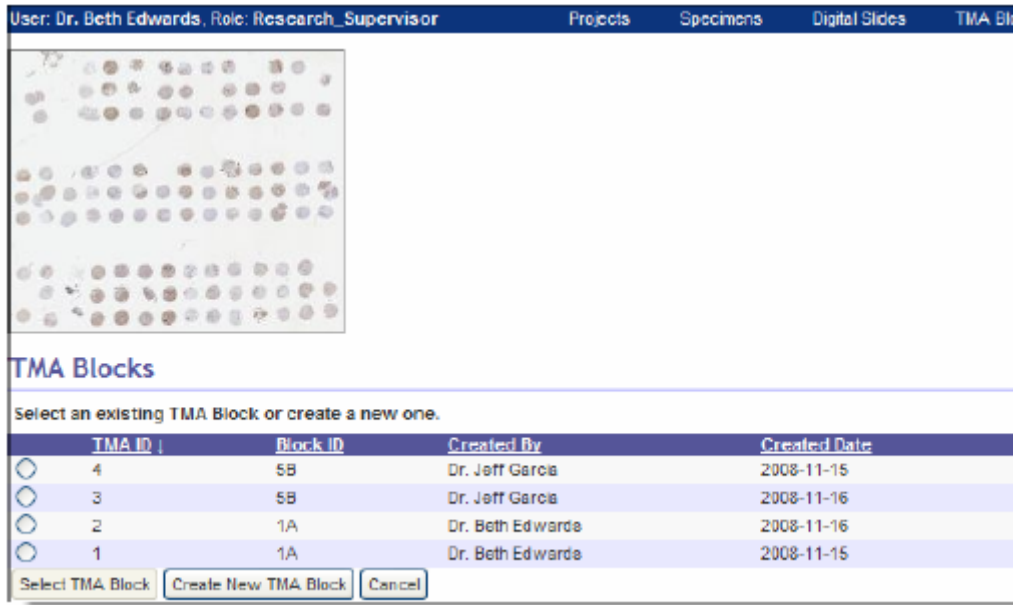
- To auto segment, click the **Auto Segment** button on the **Edit TMA Map** page.



- Once you have finished segmenting click **Submit**.

C. Creating the TMA Block Directly on the Digital Slide

- After selecting a digital slide, opening the slide's details page, and clicking **Segment TMA**, click **Create New TMA Block**.



- On the **Add New TMA Blocks** page, type in the information about the block and click **Add**.
- The Edit TMA Map page appears and you can guild the TMA block directly on the TMA digital slide using manual or auto segment.









- Once you have finished segmenting click **Submit**.

D. Finishing Up

- To see the TMA Block Details page, click the TMA block icon next to the block.

TMA Blocks

[Open Data](#) | [Delete](#) | [New](#) | [Export Data](#) | [View Audits](#)

<input type="checkbox"/>		TMA ID ↑	Block ID	Created By	Created Date
<input type="checkbox"/>		8	1A	Dr. Beth Edwards	2008-11-16
<input type="checkbox"/>		7	1A	Dr. Beth Edwards	2008-11-15
<input type="checkbox"/>		5	1A	Dr. Beth Edwards	2008-11-16
<input type="checkbox"/>		4	5B	Dr. Jeff Garcia	2008-11-15
<input type="checkbox"/>		3	5B	Dr. Jeff Garcia	2008-11-16

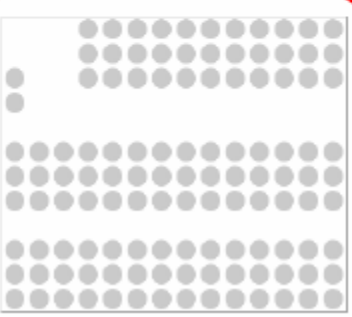
TMA Block Details

[TMA Block Table](#) | [Export TMA Data](#) | [Extract Spot Images](#) | [Next TMA Block >](#)

TMA ID:
 Block ID:
 Created By:
 Created Date: yyyy-mm-
 Comment:
 Status:
 Data Group:

TMA Block Attachments

[Add Attachment](#)
(No data to display)



[Edit TMA Map](#)

- Click on a core on the **TMA Blocks Details** page graphic to see information about that core and the spot that is now associated with it.



[Edit TMA Map](#)

- This takes you to the **TMA Core Details** page.

- Here you will be able to associate the core with a specimen and traverse the core map shown on this page to look at information on each core and spot. You will also be able to work with spot images (adjusting the boundary, analyze, view, and extract spot images).

4 – Additional Functions Working with TMA Blocks

A. Add Attachments

- You may add attachments to TMA Blocks by going to the **TMA Block Details** page and clicking **Add Attachment**.

User: Dr. Beth Edwards, Role: Research_Supervisor Projects Specimens


Save Reset

TMA Block Details

[TMA Block Table](#) | [Export TMA Data](#) | [Extract Spot Images](#) | [Next TMA B](#)

TMA ID: 5
 Block ID: 1A
 Created By: Dr. Beth Edwards
 Created Date: 2008-11-16
 Comment:
 Status:
 Data Group: Project 49

TMA Block Attachments

[Add Attachment](#) 
 (No data to display)

B. Exporting Data

- To export TMA block data, go to the **TMA Block Details** page and choose the TMA block of interest.
- Click **Export TMA Data**.
- On the **TMA Export Options** page, you can select which TMA slide you want to export spot information for.

User: Dr. Beth Edwards, Role: Research_Supervisor

TMA Export Options

Include spot data from these slides:

Slide 37 - ER
 Slide 41 - ER

Export Cancel

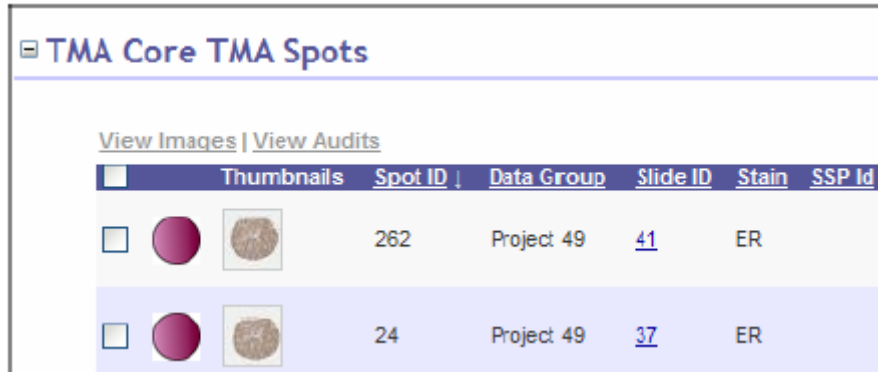
- Click **Export**.
- To open the exported file, go to Excel **File** menu and select **Open**. Navigate to the exported file and open it.

	A	B	C	D	E	F	G	H	I
1	Core ID	Row	Col	Sector	TMA ID	Data Group	Spot ID (S	Data Group	Image ID
2	449	1	1	1	5	Project 49	1	3	5
3	450	1	2	1	5	Project 49	2	3	5
4	451	1	3	1	5	Project 49	3	3	5
5	452	1	4	1	5	Project 49	4	3	6
6	453	1	5	1	5	Project 49	5	3	6
7	454	1	6	1	5	Project 49	6	3	6
8	455	1	7	1	5	Project 49	7	3	6
9	456	1	8	1	5	Project 49	8	3	6
10	457	1	9	1	5	Project 49	9	3	6
11	458	1	10	1	5	Project 49	10	3	6
12	459	1	11	1	5	Project 49	11	3	6



5 – Cores and Spots

A. Working with Cores and Spots

- To view the **TMA Core Details** page, go to **All TMA Blocks (As List)**. Select the TMA block and click **Open Data**. The **TMA Block Details** page appears. Select the core from the page graphic.
- Because you can use the same TMA block for multiple digital slides, you may see multiple core spots listed on the **TMA Core Details** page.



The screenshot shows a table titled "TMA Core TMA Spots" with columns: Thumbnails, Spot ID, Data Group, Slide ID, Stain, and SSP Id. Two rows are visible, both for Project 49 with ER stain.

Thumbnail	Spot ID	Data Group	Slide ID	Stain	SSP Id
	262	Project 49	41	ER	
	24	Project 49	37	ER	

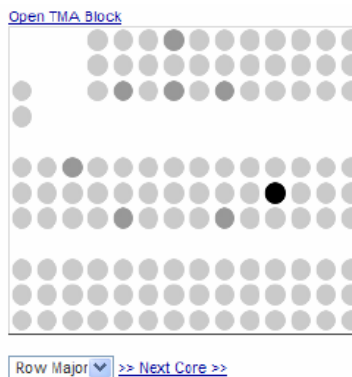
- The **TMA Core TMA Spots** section also displays analysis results and the text of any layer attributes from annotations created on that spot image.

B. Working with Spot Images

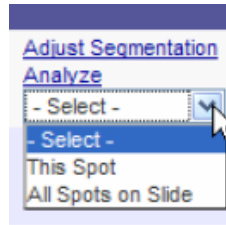
- Now that spot images are associated with the cores, you can do several things with these images.
 - **Adjust** – If the spot image on the **TMA Core Details** page is not centered or not entirely visible, click **Adjust** under the image to see the TMA block grid. You can adjust the grid to fit the spot.
 - **Analyze** – Click **Analyze** under the image on the **TMA Core Details** page.
 - **View** – Click the thumbnail image on the **TMA Core Details** page to open it in ImageScope.
 - **Extract** – To extract images for all spots associated with the TMA block, so to the **TMA Block Details** page and click **Extract Spot Images** at the top of the page.
- To see information on more cores, click other cores on the TMA block shown on the Core Details page or click the **Next** button to move through the grid. The Traversal drop-down list lets you select how you will move through the grid when you click the **Next** button—by row, by column, or randomly through unvisited cores.



- Cores that have been visited are shaded gray and the currently selected core is shown in black.

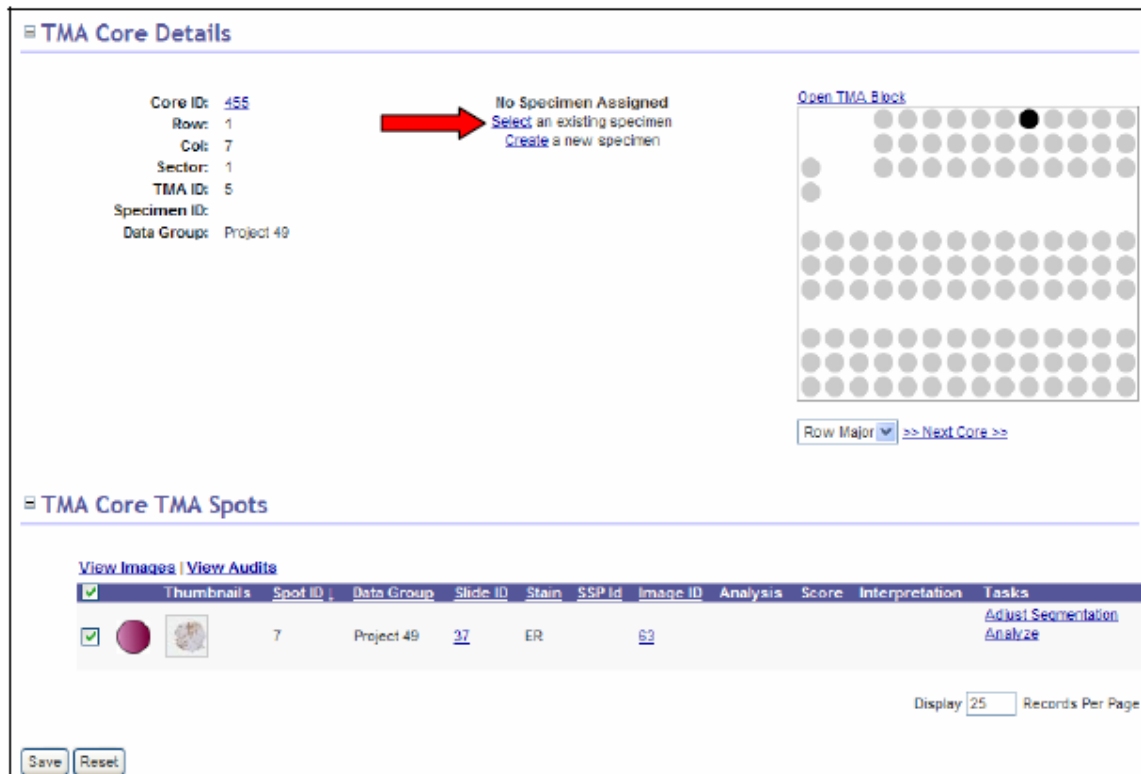


- If you want to analyze a core, click **Analyze** on the **TMA Core TMA Spots** section of the **TMA Core Details** page next to the spot you want to analyze.
- A drop-down list will appear and you will define the area of the digital slide you want to analyze: this core spot or all spots.



C. Assigning Cores to Specimens

- You may assign a core to a specimen by adding an existing specimen or creating a new specimen.
- Go to the **TMA Core Details** page to add specimen to a core.



- Here is where you may also remove a specimen from a core.

TMA Core Details

Core ID: [508](#)
 Row: 2
 Col: 11
 Sector: 3
 TMA ID: 5
 Specimen ID: 2
 Data Group: Project 49

Remove Specimen

Specimen ID: [5](#)
 Accession Number: S08-03005 (Clinical)
 Procedure: Right Breast Mastectomy
 Body Site: Breast
 Collected Date: 2005-01-02 00:00:00
 Received Date: 2005-02-10 00:00:00
 Released Date: 2005-02-13 00:00:00
 Specimen Received:
 Microscopic Description:
 Storage Location:
 Comment:
 Status:
 Hospital Accession Number:
 External Specimen ID:
 Data Group: Project 49

TMA Core TMA Spots

[View Images](#) | [View Audits](#)

Thumbnail	Spot ID	Data Group	Slide ID	Stain	SSP Id	Image ID	Analysis	Score
	203	Project 49	41	ER		356		

D. Extracting Spot Images

- Open the TMA block of interest and on the **TMA Block Details** page, click **Extract Spot Images**. The **Extract TMA Spot Images** page appears.

Spectrum: [Advanced Search](#)

Projects Specimens Digital Slides TMA Blocks Analysis Second Slide Administrative Help Log off

Extract TMA Spot Images

Extract spot images from these slides:

Slide 160 -

File Options

File Format: *.JPG (JPEG lossy compression)

ICC Profile

Some images contain ICC profiles. If the original images contain ICC profiles would you like to embed the profiles in the spot images, apply the profiles to the spot images, or ignore the profiles?

Embed ICC Profiles
 Apply ICC Profiles
 Ignore ICC Profiles

- Select the slide you want to extract spot images from and choose your file format.
- Select **Embed** for the ICC profile.
- Click **Extract**. Extracting the images can take quite a while as there may be hundreds of spot images from multiple TMA digital slides associated with the TMA block. See the status page below.

Extracting images may take a significant amount of time to complete. Do not close this window or navigate to another page until all extractions have completed.

Extracting Practice_1_1_1_.jpg... Completed.
Adding to Practice.zip... Completed.
Extracting Practice_1_1_2_.jpg... Completed.
Adding to Practice.zip... Completed.
Extracting Practice_1_1_3_.jpg... Completed.
Adding to Practice.zip... Completed.
Extracting Practice_1_1_4_.jpg... Completed.
Adding to Practice.zip... Completed.
Extracting Practice_1_1_5_.jpg... Completed.
Adding to Practice.zip... Completed.
Extracting Practice_1_2_1_.jpg... Completed.
Adding to Practice.zip... Completed.
Extracting Practice_1_2_2_.jpg... Completed.
Adding to Practice.zip... Completed.
Extracting Practice_1_2_3_.jpg... Completed.
Adding to Practice.zip... Completed.

- By default, TMA Lab chooses the Block ID you specified when you created the TMA block as the base file name. In this example, the Block ID was "Practice". TMA Lab inserts this base text to the beginning of the spot file names. For example, the spot image files created by this export might have the names "Practice_1_1_1_ER.jpg," "Practice_1_1_2_ER.jpg," and so on. (The numbers indicate the row/column/sector location of the spot in the TMA block.)

*Note: Do **NOT** close this page or click the browser back button until the image extraction is complete. You can open another browser window to continue your work in eSlide Manager while you wait.*

Extracting Practice_1_8_2_.jpg... Completed.
Adding to Practice.zip... Completed.
Extracting Practice_1_8_3_.jpg... Completed.
Adding to Practice.zip... Completed.
Extracting Practice_1_8_4_.jpg... Completed.
Adding to Practice.zip... Completed.
Extracting Practice_1_8_5_.jpg... Completed.
Adding to Practice.zip... Completed.

Download Archive

You may now close this window or press the back button.

- The bottom of the status page displays "You may now close this window or press the back button." When the image extraction is complete, choose **Download Archive**.

