Setting up CASK Virtual Microscopy Viewer and adding slides

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For whom is this manual?

This manual is targeted at a person who wants to set up the CASK Virtual Microscopy Viewer to enable users to view virtual microscopy slides in it. This might be either on a local computer or on a web-server.

What does this manual cover?

This manual describes how to embed virtual microscopic slides in the CASK Virtual Microscopy viewer, how to configure the slide's settings, add credits and how to create menus of slides and make slide thumbs for the slides appear amongst the menus.
Also it describes how to add a 'view': a shortcut URL that will call the slide with a pre-set location, zoom-level and labels.

What do you need?

- Software: CASK viewer and a text-editor such as Notepad or an HTML editor.
- One or more Virtual slide images in the Zoomify format (see Manual 1 "Creating or Converting Virtual Microscopy Slides for CASK Virtual Microscopy viewer")

Getting the CASK Virtual Microscopy Viewer

Get the CASK viewer at www.caskanatomy.info/products/caskviewer .

How to run CASK Virtual Microscopy Viewer locally on your computer

- Unzip the downloaded viewer file.
- Double-click the file 'index.html' in the root folder.

*Note 1: When using **Internet Explorer** to run CASK viewer locally,you will need to confirm a popping up question 'Allow blocked content' to allow running scripts and Active X Controls - these are specific techniques used only by Internet Explorer.*
When using direct links in a new tabbed window (direct link = URL link to a specific slide,with pre-set position, zoom and labels), you'll have to enter the URL twice, as IE first loses the URL information upon asking the 'Allow blocked content' question.

*Note 2: When using **Google Chrome** to run CASK viewer locally, all additional functionality such as labelling, getting a direct link, etc. does not work. This is due to the fact that Google Chrome regards the left panel with the menus to be on a different computer than the right panel with the slides and blocks communication between these panels for security reasons. Other browsers such as Firefox, Safari and Internet Explorer correctly recognize that both panels are on the same computer and do not have this restriction.*

Firefox and Safari do not have these restrictions.

How to run CASK Virtual Microscopy Viewer online as a web-site

- Unzip the downloaded viewer file.
- Copy all folders and files to a server connected to the internet. A file server is sufficient, no server side scripting is used.
- CASK viewer can now be accessed at:
  http://...URL of your site.../folder where you placed the caskviewer/

Basics of the CASK Virtual Microscopy Viewer

The viewer contains the folders: html, css, scripts, img, **slides**, and the file 'index.html'. Only work in the folder '**slides**'! The other folders contain the program files.

css	26-3-2013 4:17	File folder
html	26-3-2013 4:17	File folder
img	26-3-2013 4:17	File folder
scripts	26-3-2013 4:17	File folder
slides	29-3-2013 2:27	File folder
index.html	15-3-2013 1:50	Firefox HTML Document

The folder '**slides**' contains the slides and the main configuration files:

P-2	26-3-2013 4:17	File folder
credits.js	26-3-2013 4:15	JS File
menus.js	25-3-2013 16:55	JS File
slides.js	26-3-2013 4:15	JS File
views.js	25-3-2013 16:55	JS File

In this example there is 1 slide, whose data are in the folder 'P-2' and there are the main configuration files:

- credits.js   contains texts and logos of the credits that are shown on a slide
- menus.js   contains the organisation and titles of the menus
- slides.js   contains the configuration data and the titles of the slides
- views.js   contains URL queries that are stored as a 'view' shortcut

A **slide data folder** (such as the folder 'P-2' in the image above) contains subfolders named TileGroup0, TileGroup1, TileGroup2, etc. and a file 'ImageProperies.xml'.

TileGroup0	26-3-2013 4:16	File folder
TileGroup1	26-3-2013 4:16	File folder
TileGroup2	26-3-2013 4:16	File folder
TileGroup3	26-3-2013 4:16	File folder
TileGroup4	26-3-2013 4:16	File folder
TileGroup21	26-3-2013 4:17	File folder
TileGroup22	26-3-2013 4:17	File folder
TileGroup23	26-3-2013 4:16	File folder
TileGroup24	26-3-2013 4:16	File folder
TileGroup25	26-3-2013 4:16	File folder
0-0-0rot.jpg	3-2-2013 16:31	JPG File
ImageProperties.xml	3-2-2013 16:31	XML File

The CASK viewer can be used locally from a hard drive, USB drive or CD/DVD or placed on a web server to be accessed over the internet.

Adding a slide to CASK Virtual Microscopy Viewer

To add a slide CASK Virtual Microscopy Viewer follow the steps:

1. Copy the folder with the slide data in the CASK Virtual Microscopy Viewer. (1-5 min)
   The slide is not yet visible in the viewer now!

2. Add the slide to the system's slide list and configure it. This is done by adding an entry for the slide in the file **'slides.js'**. (2 - 5 min)
   Now the slide will show up under the menu 'Body Regions>All slides'

3. (Optional) Add credit information on the slide. This may or may not require adding information to the file **'credits.js'**. (0.5 - 10 min)
   Now credit information (logo, text) will be shown on the slide.

4. (Optional) Add the slide to one or more other menus. You do this by adding entries to the file **'menus.js'**. (1 min)
   Now the slide will show up under the menus to which you added it.

Step 1 Copy the folder with the slide data in CASK Virtual Microscopy viewer

Manual 1. "Creating or Converting Virtual Microscopy Slide for CASK Virtual Microscopy viewer" describes how to create a slide in the 'Zoomify' format that is used in the CASK viewer. Such a slide consists of a folder with subfolders named TileGroup0, TileGroup1, TileGroup2, etc. and a file ImageProperies.xml (see chapter 'Basics of CASK viewer'). Such a folder will be named a '**slide-folder**' in the rest of this manual.

Copy and paste the slide-folder into the folder '**slides**' in the CASK viewer.

Tip: If you copy large amounts of folders and files with the standard Windows copy function, and one file has a problem, the copy process will break, leaving you without knowing what it has copied and what not. To prevent this risk you might use a specific copying tool (e.g. Teracopy http://codesector.com/teracopy) or first enclose the whole in a compressed file (e.g. WinZip (in Windows), WinRar http://www.rarlab.com/), then copy it and unzip it.

Step 2. Add the slide to the system's slide list and configure it

The system's slide list is in the file 'slides.js'. This section describes how to add the slide to this list and configure it.

a. Open the file '**ImageProperies.xml**' in the slide-folder. You need the figures mentioned here.

```
<?xml version="1.0"?>
<IMAGE_PROPERTIES TILESIZE="256" VERSION="1.8" NUMIMAGES="1" NUMTILES="4126" HEIGHT="17899" WIDTH="11059"/>
```

b. Open the file '**slides.js**' (in the folder 'slides') with Notepad or a text- or html-editor.

How to open slides.js in Notepad? Right click it and choose 'Edit'. This will open it in Notepad. If this doesn't work, open Notepad first (Start>All Programs>Accessories>Notepad) and open the file via File>open.

The file slides.js contains a listing of all available slides in the CASK viewer. Each line regards one slide.
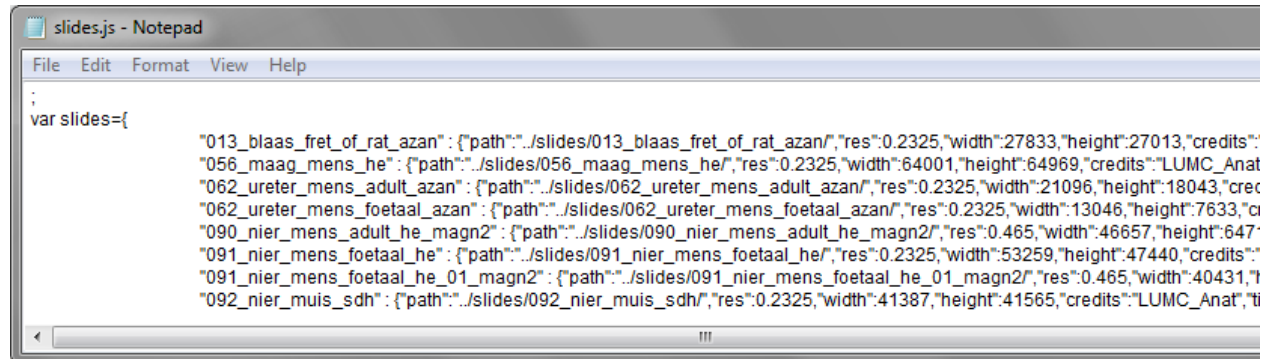
c. Add a line for the new slide in the following format:

"name" : {"path": "xxx", "res":"xxx", width: "12345", etc....},

For the syntax and possible caveats, see "Appendix: Working in JSON-files".
This line contains the settings for the slide, its title and optional settings.

d. Fill in the settings. The table below shows the possible settings. The settings written in black are mandatory, the settings written in grey are optional. Use or omit quotes as shown in the table.

e. Save the file slides.js

Settings for a slide in the file 'slides.js':

Setting	What is it? What to fill in?	Example
"name"	Name used in the code as reference to this slide. This name will also be used in the URL if you refer to the slide directly. *Use only the letters a-z, the numbers 0-9 and underscores. Use underscores instead of spaces. Don't use diacritics. Preferably use only lowercase.* These restrictions are necessary because of the use of this name in code and URLs.	"carotid_atherosclerosis"
"path"	The path from the viewer root to the slide-folder.	"../slides/carotis/"
"res"	Resolution of the slide. This number is used to calculate the size bar. See section "Determining the 'res' number" below how to determine this number.	0.2325
"width"	Number of pixels of the width of the full image. Get this from the 'WIDTH' in the file 'ImageProperies.xml' in the slide-folder	12480
"height"	Number of pixels of the height of the full image. Get this from the 'HEIGHT' in the file 'ImageProperies.xml' in the slide-folder	25581

"title"	The text that is shown at the top of the slide and below the slide in the slide menu. *For diacritics and special characters use HTML codes:* *http://www.w3schools.com/tags/ref_entities.asp* *Double quotes should be "escaped", i.e. prepend a backslash. So use \" to get ".* These restrictions are necessary because slides.js is a code file and because the output will be in HTML.	"Carotid Artery. Atherosclerosis."
"credits"	*Optional.* A reference to a credits entry in the credits.js file. This will cause a logo and credit text to appear bottom left on the slide. See section ' Add credit information for the slide' for details.	"LUMC_Anat"
"thumb"	*Optional.* File name of a thumbnail image that will be projected on the slide in the slide selection panel. The thumbnail image file itself should be placed in the slide-folder. If this property isn't set, the file "slide-folder /TileGroup0/0-0-0.jpg" will be projected on the slide. Reasons to use a specific separate thumbnail image are e.g. to rotate the image or to obtain a transparent background.	"0-0-0rot.jpg"
"thumbwidth"	*Optional, only needed if a thumb was given.* Width in pixels of the thumbnail-image.	199
"thumbheight"	*Optional, only needed if a thumb was given.* Height in pixels of the thumbnail-image.	97

Determining the 'res'-number

The 'res' or 'resolution' number is the amount of micrometers /pixel of the virtual slide at the highest zoom level (i.e. of the full size image). It is only needed for the system to correctly calculate the scale bar. It is one of the fields that must be set in the slides.js file.

 The scale bar

Preferably you have exact information about the original slide resolution from the slide-scanner.

- Appendix "*Determining the 'res' number from Mirax slides*" describes how to determine the res number in case the 'Mirax' system was used as scan-system, such as is the case in the LUMC. If your slides originate from another scan-system this appendix may nevertheless serve as an example. Apply equivalent calculations.

If you do not have exact information about the original slide resolution you may make a reasonable estimation by using on-screen measurements.

- Appendix "Calculating the 'res' number if you have no original resolution data" describes how.

When you have determined the 'res' number fill it in amongst the settings of the slide as "res": xxx in the file slides.js.

Step 3. Add credit information on the slide

This section describes how to add credits to a slide. These will show up as a logo and text at the bottom left on the slide.
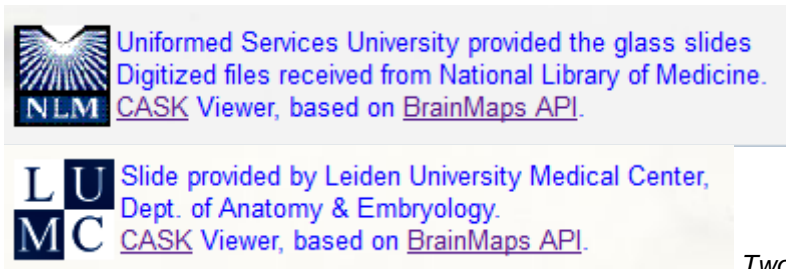
Two examples of credits

To cause such credits to be shown on a slide, follow these steps:
    a. Create a logo image file and place it in the folder 'img'.
    b. Add an entry in the file 'credits.js' with the text and a reference to the logo image.
    c. Refer to the credit-entry in the slide in the file 'slides.js'.

Steps a and b are only needed once to create a new credit-entry. From that moment onwards, only step c is needed to let the credits in this entry be shown on a slide.

Step 3a Create a logo image file and place it in the folder 'img'
- Create an image with the logo of (approximately) 50x50 pixels.
- It should have a web-image-format, i.e. .jpeg, .gif or .png
- Copy and paste the image file in the folder 'img'
  (Note: this is the only exception where you edit something in another folder than the folder 'slides')

Step 3b Add an entry in the file 'credits.js' with the text and a reference to the logo image.

The file credits.js contains a listing of credits in the CASK viewer. Each line regards one credits entry.

The file credits.js

- Add a line for a new credits in the following format:

"name" : {"logo": "../img/xxx.xxx","text":"......","url":"http://...."},

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For the syntax and possible caveats, see "Appendix: Working in JSON-files".
This line contains the text, a reference to the logo image and an url.

- Fill in the settings. The table below shows the possible settings. Use or omit quotes as shown in the table.

- Save the file credits.js

Settings for a credit-entry in the file 'credits.js':

Setting	What is it? What to fill in?	Example
"name"	Name used in the code as reference to this credit-entry. *Use only the letters a-z, A_Z, the numbers 0-9 and underscores. Use underscores instead of spaces. Don't use diacritics.* These restrictions are necessary because of the use of this name in code.	"LUMC_Anat"
"logo"	Optional. The location of the the logo image file, starting at the viewer root.	"../img/logo_lumc50x50.png"
"text"	Optional. The text that is shown at the top of the slide and below the slide in the slide menu. *Use HTML codes, eg: For a line break use For diacritics and special characters use HTML codes: http://www.w3schools.com/tags/ref_entities.asp Double quotes should be "escaped", i.e. prepend a backslash. So use \" to get ".* These restrictions are necessary because credits.js is a code file and because the output will be in HTML.	"Slide provided by Leiden University Medical Center, Dept. of Anatomy & Embryology."
"url"	Optional. A full web address (of the provider of the slide). This site will be opened if the user clicks on the image logo or text.	"http://images.nlm.nih.gov/pathlab"

- **Step 3c Refer to the credit-entry in the slide in the file 'slides.js'.**

In the file slides.js, in the line of the slide on which you want the credits to be shown, add the setting: "credits":"name_of the_credits"

Example:
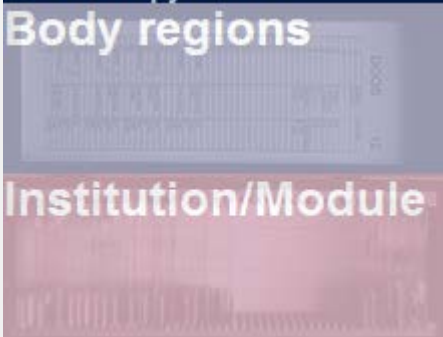
...,"res":0.2325,"width":29049,"height":65088,**"credits":"LUMC_Anat",**"title":"115 Ileum human HE",...

For each slide on which you want the same credits to be shown, you only have to add this reference. Steps 3a and 3b need not be repeated.
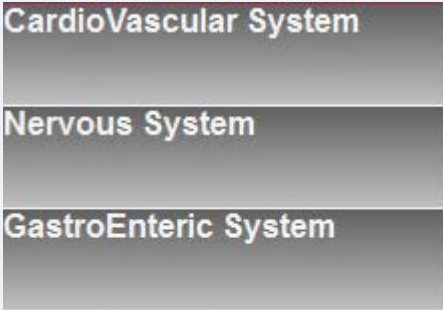
Step 4. Add the slide to one or more menus

In this step you will allocate the slides to one or more menus as shown in the CASK viewer, see the panel below.
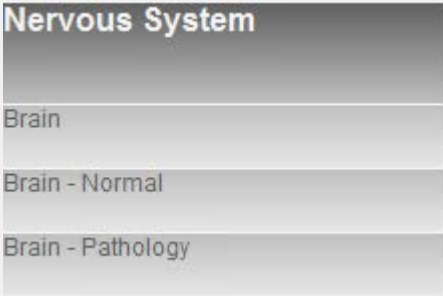
Main Menu Choice
There are the two main menus in the BMC viewer.

Menus
Each main menu contains a number of menus:

Entries – slide sets
Each menu may contain a number of entries, each referring to a set of slides:

---

a. Open the file '**menus.js**' in the folder '**slides**' *(howto?: see opening file slides.js in previous section)*. It contains the data that drive the construction of the menus in the CASK viewer and allocates the slides to slide sets.

```
var menus= {
    "menuAnatomicalRegions":
    [
        {
            "header":{title:"CardioVascular System",slides:""},
            "sets":[
                {title:"Elastic arteries",slides:"120a_aorta_foetus_mens_he,1
                {title:"Muscular arteries",slides:"view=carotis1,119a_musculeu
                {title:"Large veins",slides:"122a_vena_cava_inferior_mens_he,
                ]
        },
        {
            "header":{title:"Respiratory System",slides:""},
            "sets":[
                {title:"Trachea",slides:"093a_trachea_mens_he,093b_trachea_mer
                {title:"Lung",slides:"094a_long_varken_azan,094b_long_varken_
                {title:"Demo label Trachea",slides:"view=trachea"}
                ]
        },
        {
            "header":{title:"Gastrointestinal System",slides:""},
            "sets":[
                {title:"Stomach",slides:"056_maag_mens_he"},
                {title:"Small Bowel",slides:"115_ileum_mens_he"},
                {title:"(empty)",slides:""}
                ]
        },
```

The file 'menus.js' shown in a code-editor

Organisation of the file 'menus.js'

For the syntax and possible caveats, see "Appendix: Working in JSON-files".
The data is stored at a number of levels.

1. The top level regards the Main Menus:
  • "menuAnatomicalRegions" : the sets according to Body Regions
  • "menuInstitutionsModules" : the sets for specific modules in specific institutions.
  Don't touch this!

2. The second level contains the menus:
       "header":{title:"Nervous System",slides:""},
and a container for the slide-sets:
       "sets":[.......
            ......
            ]

3. The third level contains the slide-sets:
       {title:"Brain", slides:"brain,hippocamp_he,hippocamp_ad"},
       {title:"Brain - Normal", slides:"brain, hippocamp_norm_he"},
       etc.

Adding a Menu
To add a new Menu, copy-paste a menu-section and adapt its contents:

```
{
        "header":{title:"Nervous System",slides:""},
        "sets":[
                {title:"Brain",slides:"brain,hippocampus"},
                {title:"Brain - Normal",slides:"brain,hippocampus_norm"}
                ]
},
```

Adding a slide-set
To add a new slide-set, copy-paste a slide-set and adapt its contents:

```
        {title:" Brain", slides:"brain,hippocampus"},
```

Adding a slide to a slide-set
To add a slide to a set, add its name to the list of slides in the set:

```
        {title:" Brain",slides:"brain,hippocampus,amygdala"},
```

Settings:

Setting	Fill in	Example
"header"	settings determining a header	{title:"Nervous System",slides:""}
"sets"	settings referring to sets of slides. Each row contains the settings for one set.	{title:"Brain", slides:"brain,hippocampus"}, {title:"Brain - Normal", slides:"brain,hippocampus_humaan_normaal_he"}, {title:"Brain - Pathology", slides:"hipp _ad_tau_protein,hipp_humaan_ad_he1"}
"title"	the text to be shown on the header or entry	"Nervous System" or "LUMC, Module 7, exercise 'Microscopy of the Brain'"
"slides"	A listing of slides and/or views. Thumbs of these slides will be shown in the slide menu. Give either: • the **slide name** as stated in the file slides.js • **view= xxx**, where xxx is the view name as stated in the file views.js Separate with commas. In the header line only fill this in if the header contains no list with (sub)entries.	"brain,view=carotis1,hippocampus_humaan_normaal_he"

Adding views

Background

It is possible to create a direct link (URL) to a specific slide, at a specific position, zoom-level and with labels. This is described in Manual 3. "End user manual CASK Virtual Microscopy viewer".

The resulting URLs may be quite long (example 1). It is possible to store them as a '**view**' in the file '**views.js**'. Then the same direct link can be achieved with a shortcut URL (example 2), or by clicking on a thumb in a menu (example 3).

Example 1.
A complete URL calling a pre-set slide:
http://anatomie01.lumc.nl/microscopy/html/caskviewer.html?slide=093b_trachea_mens_azan_01&zoom=2&x=0.4999&y=0.5005&labels=(0.282,0.4017,Trachea,Note+the+cartilage+in+the+trachea+wall%21)

Example 2.
The same pre-set slide being called with a shortcut URL using a 'view'
http://anatomie01.lumc.nl/microscopy/html/caskviewer.html?**view=trachea**

Example 3.
The same pre-set slide being called from a thumb in a menu:

Note the addition "(view: trachea)" to the slide name.

Adding a view

The file views.js contains a listing of views. Each line regards one view entry.

The file view.js

- Add a line for a new view in the following format:

"name" : "...query....",

Where it reads ....**query**....: put the so-called query-part of the URL, that is the part behind the '?' in the URL. Example: **use** the green part, **omit** the red part:
http://anatomie01.lumc.nl/microscopy/html/caskviewer.html?slide=093b_trachea_mens_azan_01&zoom=2&x=0.4999&y=0.5005&labels=(0.282,0.4017,Trachea,Note+the+cartilage+in+the+trachea+wall%21)

For the syntax and possible caveats, see "Appendix: Working in JSON-files".

- Save the file views.js

Using a view

The created view can be used in two ways:

1. **Create a shortcut URL (as in example 2 above).**
   This has the format:

   ....ROOT-URL....**?view=xxxx**

   where:

   ....ROOT-URL.... = the location of the CASK-viewer, either online or local, e.g.:
   - http://anatomie01.lumc.nl/microscopy/html/caskviewer.html
   - file:///D:/.../caskviewer.html

   xxx = the name of the view, as stated in the file views.js, e.g.
   - trachea

2. *Use the view in a thumbnail in the menu (as in example 3 above).*

   To this aim, in the menus.js file, at the desired place in the menu, in the entry 'slides', instead of using the slide-name, write: **view=xxx**

   Example:
   {title:"Demo label Trachea",slides:"**view=trachea**"}

   Also see: chapter "Adding a slide to CASK Virtual Microscopy Viewer" > Step 4. Add the slide to one or more menus.

Appendix: Working in JSON-files

BE AWARE!   Bears ahead….

The configuration files use the so-called JavaScript Object Notation or JSON* syntax.
 → Editing these you are working directly in a programming code file.

This requires meticulous accuracy to maintain the correct syntax.

This is the price to be paid to enable running and configuring the viewer from a local computer or USB stick without the need for a server or for installation of any program. It is not really difficult, you can't break anything, but if you make a mistake the viewer will not work.

The syntax is as follows:

- The basis is **{ }**, indicating a so-called 'object'.
- Within the object are pairs of properties and values, separated by a colon:
  Example: **"property" : "value"**
- The property should be a string without spaces or diacritic characters, enclosed in double quotes: **"property"**
- The value may be a string in double quotes, or a nested object.
  Example: **"property" : { }**
- Within the nested object again are property-value pairs.
- Property-value pairs may be listed, by separating them with a comma.
  Important: after the last one there should be no comma!!!
  Example 1:
  "property1":"value1" , "property2":"value2" , "property3":"value3"
  (Note: no comma at the end!)
  Example 2:
  "property1" : {"prop1a":"value1a","prop1b":"value1b"} ,
  "property2" : {"prop2a":"value2a","prop2b":"value2b"} ,
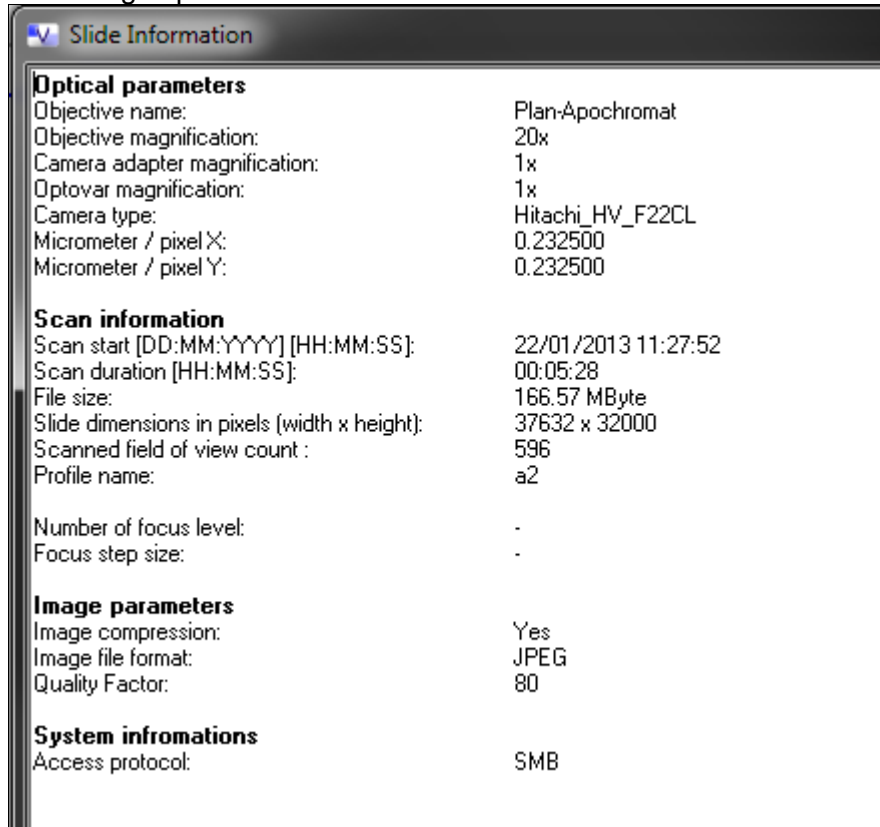 **"property3" : {"prop3a":"value3a","prop3b":"value3b"}**
  (Note: no comma at the end!)

** the format as used in the CASK viewer configuration files is not 100% JSON, due to the prefix: **var xxx = { }***

Appendix: Determining the 'res' number from Mirax slides

If your slides were scanned with the Mirax system (and after that converted to the Zoomify format used in the CASK viewer) and you use the Pannoramic viewer, you can determine the 'res' number as follows:

a. In the Pannoramic viewer click the information button: **i** > Slide information
    This brings up information about the slide:

```
Slide Information

Optical parameters
Objective name:                              Plan-Apochromat
Objective magnification:                     20x
Camera adapter magnification:                1x
Optovar magnification:                       1x
Camera type:                                 Hitachi_HV_F22CL
Micrometer / pixel X:                        0.232500
Micrometer / pixel Y:                        0.232500

Scan information
Scan start [DD:MM:YYYY] [HH:MM:SS]:          22/01/2013 11:27:52
Scan duration [HH:MM:SS]:                    00:05:28
File size:                                   166.57 MByte
Slide dimensions in pixels (width x height): 37632 x 32000
Scanned field of view count :                596
Profile name:                                a2

Number of focus level:                       -
Focus step size:                             -

Image parameters
Image compression:                           Yes
Image file format:                           JPEG
Quality Factor:                              80

System infromations
Access protocol:                             SMB
```

b. Relevant here is the figure for 'Micrometer / pixel X' and 'Micrometer / pixel Y'

c. Now you need the magnification you have used during the Mirax export (see Manual 1 "Creating or Converting Virtual Microscopy Slides for CASK Virtual Microscopy viewer")

d. The res number can be calculated with the formula: **Micrometer/pixel x magnification**
    The table below gives precalculated values for the micrometer/pixel values delivered by the Pannoramic Viewer.

| Micrometer/pixel	Magnification	Res number
0.232500	1:1	0.2325
0.232500	1:2	0.465
0.232500	1:4	0.93
0.232500	1:8	1.86

Appendix: Calculating the 'res' number if you have no original resolution data

You have a picture of the original slide with a scale bar, but no exact resolution.
You will need to make an estimate based on comparing sizes on the image of the original and a measurement in the CASK viewer. This is illustrated with a slide originating from the Mirax slide system, viewed in the Pannoramic viewer. If you used another scan-system, details probably differ but the principle should be the same.

a. Open the Mirax slide in Pannoramic viewer (or the viewer that comes with the scanner-software of the scanner with which you scanned your slide)
b. Use a part of the subject where it is maximally large, and that you can measure reasonably reproducable horizontally and/or vertically. Zoom out to have that part being completely visible.
c. Use the Mirax 'Measure size' tool to measure the sizes (in micrometers).
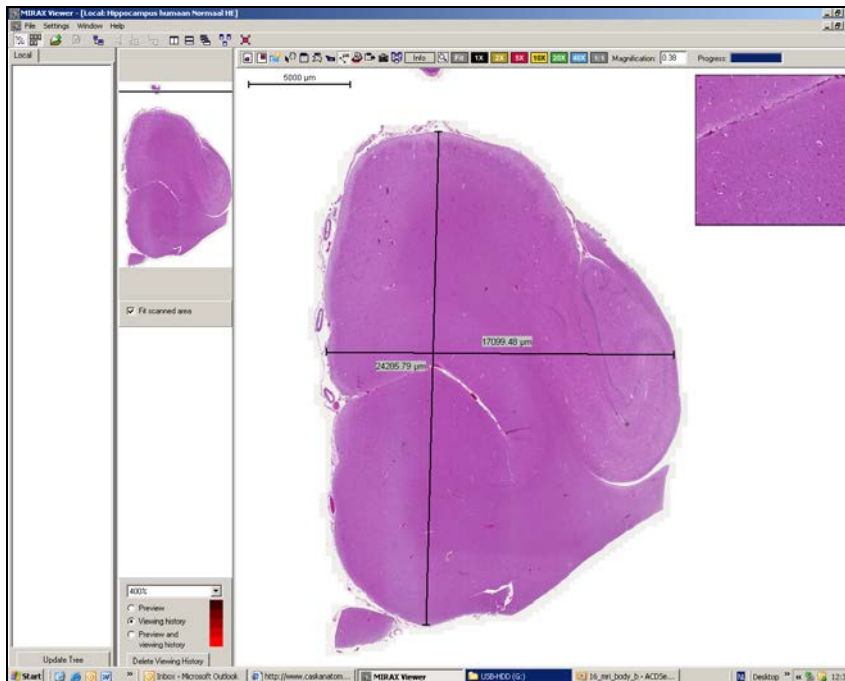
d. Open the same (converted) slide in the CASK viewer.
e. Zoom out to have the measured parts being completely visible.
f. Use a pixel ruler e.g. Jr Screen ruler http://www.spadixbd.com/freetools/jruler.htm
g. Measure the parts as used above, now in number of pixels

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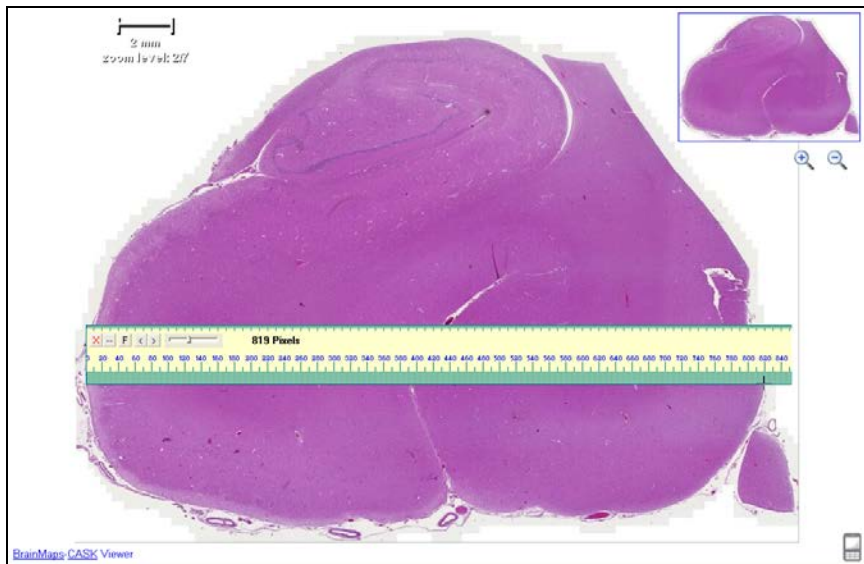
h. Calculate the res number with the following formula:

Formula:

$$res = a_\mu / (b_{px} * 2^{power(d_{max\ zoom} - c_{used\ zoom})})$$

where:

a = µ of the part

b = pixels of the part

c = zoom-level of CASK viewer at which you measured

d = max number of zoom levels of this slide in the CASK viewer

Example (see pictures)

measured part (largest size):

- in Mirax: 24286 µm
- in BMC viewer: 819 px
- in BMC viewer: zoom-level: 2
- in BMC viewer: max zoom-level: 7

a = µ of the part
b = pixels of the part
c = present zoom factor
d = max zoom = aantal zoom levels

res =   a µ / (b px * $2^{(max\ zoom\ -\ c\ zoom)}$)

res = 24286 / (819 * $2^{(7\ -2)}$) ➔ res= 0,927