DICOM connection setup

Quick User Guide

http://petctviewer.org/

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## I-   Goal and basic knowledge for networking setup

This guide will present you how to connect the PET/CT viewer to your existing DICOM network.

You will be allowed to query, receive and send dicoms to your existing workstations in your department. You will also get number of features and possibilities: You will be able to transform any computer in a connected PET/CT workstation without any additional setup.

The global architecture has to be understood: the system rely on a DICOM server called Orthanc (http://www.orthanc-server.com/) .

Orthanc server will be installed in one of your computer and will handle all requests to receive, query and send DICOM to your existing DICOM node (commercial workstation, PACS…).

Using BIdatabase plugin, you will be to connect Fiji to your Orthanc server to fetch image and review them with the PET/CT viewer. You will be able to connect several Fiji sessions to the same Orthanc server almost without limits.
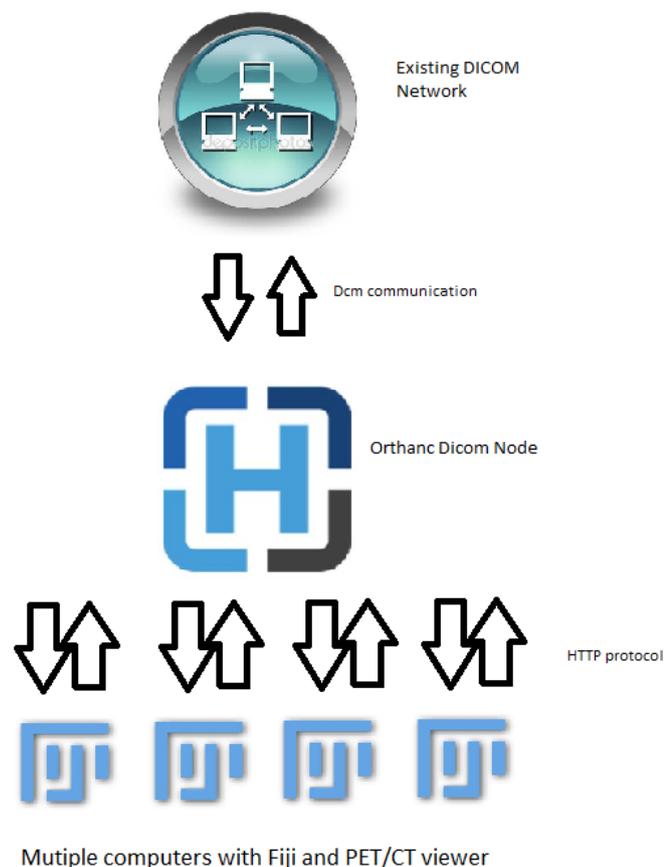
Global architecture of Networking

Some terms have to be understood before setting the network:

Dicom Node: Is a DICOM server, you have already several DICOM nodes installed in your department. A DICOM Node is defined by 3 parameters: AET which is a name (ex: "XELERIS"), IP (ex : 192.168.0.10) and a port (ex : 4242).

IP: Is an address in a Local Area Network (LAN). Each computer connected in your department has a specific IP (ex:192.168.0.10) that allows other computer to reach it. IP could be static (always the same address) or dynamic (changing at each computer startup). To set the Orthanc server, we will need to have a computer with a static IP (see further).
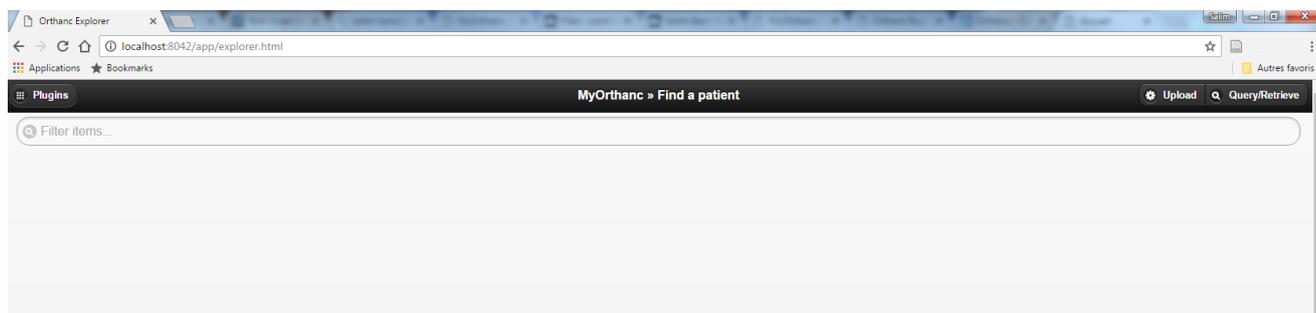
II- Installing Orthanc Server

Choose a computer that will become the Orthanc server, you can choose any computer you want but since the server will store many images we recommend you to choose a computer with a decent hard disk space.

- To install Orthanc Server go to : http://www.osimis.io/fr/download.html and select the installer for your distribution.
- Install Orthanc on your computer using the installer you downloaded.

Once installed Orthanc will run automatically in your computer without even noticing it.
- To check that Orthanc is correctly installed, open you web-browser and go to : http://localhost:8042/

You should see the Orthanc Web server as follow:

If you see this web-page your Orthanc Server is properly installed.
- You have now to verify that you have a static IP address in you LAN.
  - o If you don't know how to do, call you Network manager, this is a trivial operation that every LAN manager will able to address.

- Identify and note your IP address
  - o Ask your network manager or go to the network connection detail of your OS (here for windows)
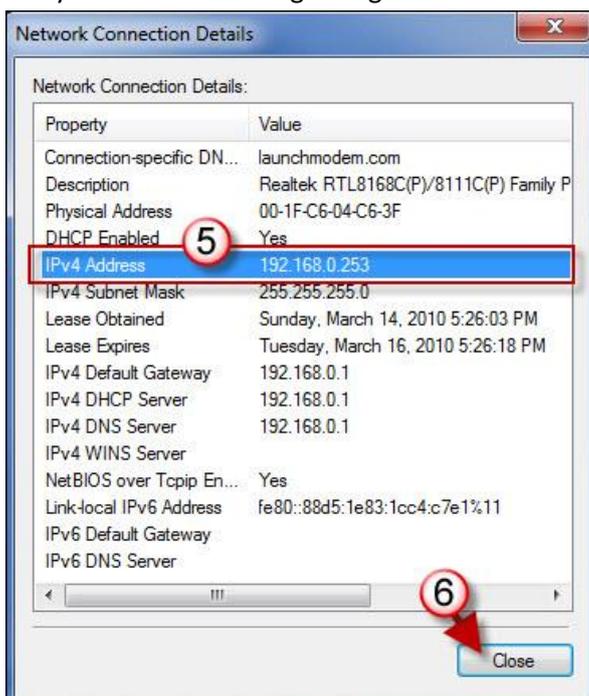
  - o In this example your IP address would be "192.168.0.253"
  - o Note this IP address, it will be important to connect Fiji to Orthanc.

III-   Editing Orthanc's settings

Orthanc's Settings is defined by a text file called "orthanc.json" (located in C:\Program Files\Orthanc Server\Configuration for windows), it has to be modified to allow remote access.

You can choose to ignore this step only if you don't want to use network services of Orthanc, in that case you will be only allowed to review PET/CT in the computer you are setting (no remote connection).

Edit the following lines in orthanc.json (use a text editor like Notepad++ for easier edition ; For windows users you also can also access the configuration file through the menu start=>"orthanc"=>"Edit Orthanc settings"):

-    Line 121: Change to "true" value, you should have "RemoteAccessAllowed" : true,

> "RemoteAccessAllowed" : true,

-    If you want to secure your access with login and password to Orthanc you have to change the following lines:
    o   Line 131 : change to "true" value : "AuthenticationEnabled" : true,
    o   Line 136 : uncomment the line remove the "//" and chose what login and password you want for example "User":"Password"

Once modified reboot your computer to make the changes take effect. After reboot check that the Orthanc web page is still accessible at http://localhost:8042/
-    If OK you can continue to the next paragraph, we are going to connect Fiji and Orthanc
-    If you can't access the Orthanc page you might broke the settings file, check that you didn't removed the "," at the end of the line you have modified.
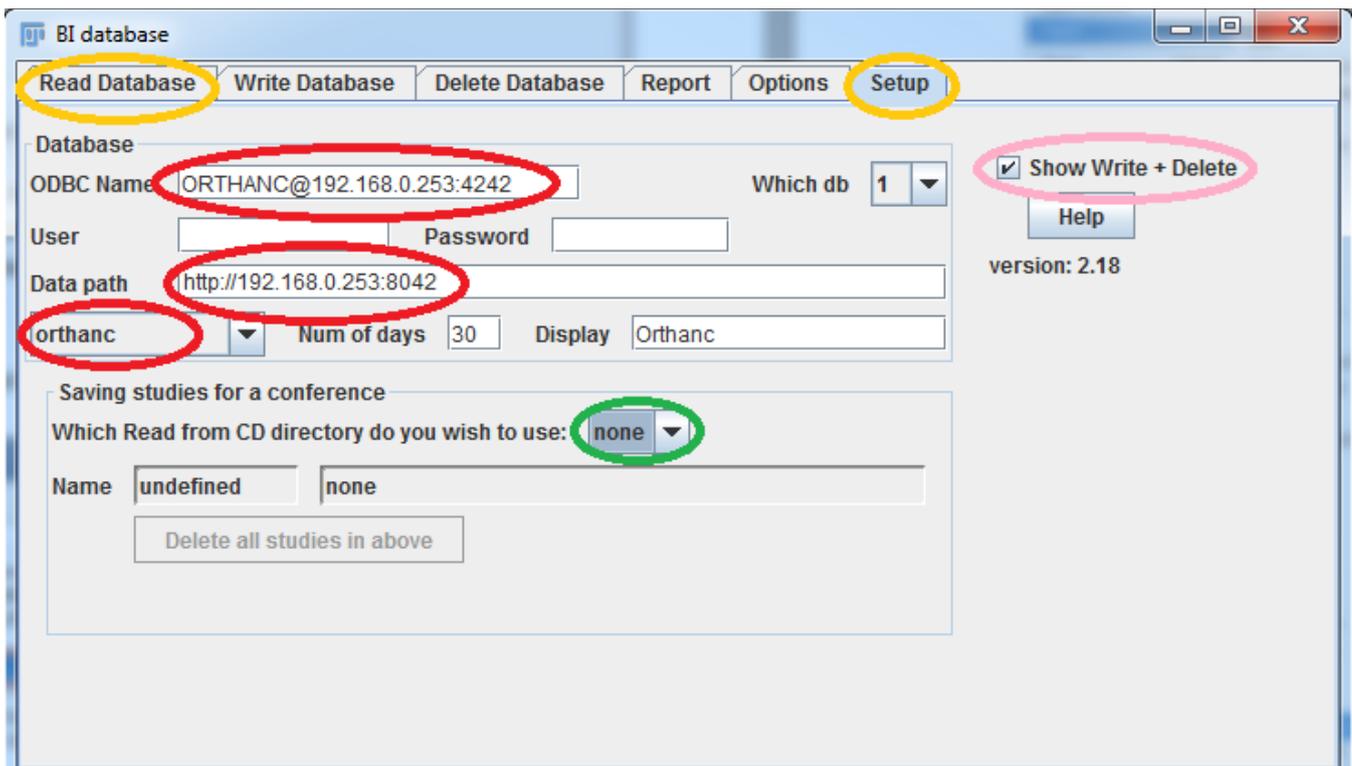
In the last paragraph of this guide we will come back to this orthanc.json file to declare the DICOM stations of your network and make Orthanc able to communicate with them.

IV-   *Connecting Fiji to Orthanc Server*

- Open Fiji and BIdatabase (File=>Import=> Read BI Studies)
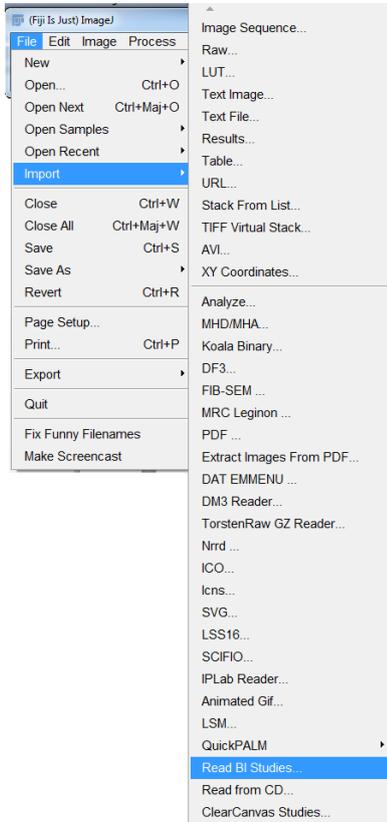
- Go to the setup tab of BI database plugin :

- In ODBC Name (Red), you have to declare the location of the orthanc dicom server following the syntax AET@IP:Port
    o The IP is the value we have found in the end of the chapter II, in this example it is 192.168.0.253.
    o The default AET and Port are ORTHANC and 4242.
        ▪ For now we didn't modify it, so you have to use these default values. We will see in chapter VI how to modify them if you need to (You can stay safely with the default parameters otherwise).
    o If you secured your server with login and password in orthanc's settings you will have to enter you login/password in the box under the ODBC name.
- In "data path" : we are going to declare the http link of Orthanc. The syntax is http://IP:Port
    o You should use the default http port is 8042, so in this example the link should be http://192.168.0.253:8042
- Select "Orthanc" in the menu (third box in red in the screen capture)
- Check "Show Write + Delete" (pink) to enable writing and deletion feature (import DICOM and erase stored DICOM in Orthanc).

The connection is made: the "Read Database" tab will now show you what is stored in Orthanc.
At this stage your Orthanc server should be empty so it is normal to have an empty list, you can go to http://localhost:8042/app/explorer.html#upload to upload DICOM to Orthanc and you should then see the data you have uploaded into the "Read Database" tab.

V-   DICOM declaration

You need to declare the ORTHANC dicom node to each DICOMnode you want to connect. (This declaration is made once for all)

- To declare the ORTHANC dicom node in your existing workstation you probably need to call the commercial service of your workstation company and give them the following parameters:

AET : ORTHANC
IP : The IP of your ORTHANC server as seen before (in this example : 192.168.0.253)
Port : 4242

NB : If you want a custom AET Name and/or port for dicom communication, you have to modify the orthanc.json file of Orthanc in lines 80 and 86.
NB2 : In some workstation like XELERIS you have a free access to the declared AET in the setting panel so you can declare it by yourself but otherwise you will need to ask your workstation/PACS provider.

- You will also need to declare your existing AETs to Orthanc, for that you will need to follow and edit the orthanc.json file at the "DicomModalities" section starting line 146.
    o You need to know the AET, IP and Port of each workstation (or PACS) you want to communicate with, ask you provider to give you these data.
    o For example your declaration in line 164 could be something like :

    > "PhilipsEBW1" : ["EBW1", "192.168.1.1", 104, "GenericNoUniversalWildcard"],
    >
    > "PhilipsEBW2" : ["EBW1", "192.168.1.18", 104, "GenericNoUniversalWildcard"],
    >
    > "SIEMENS" : ["PACS", "192.168.1.15", 11112, "SyngoVia"]

Please note that if you declare more than 1 AET, the line should be ended by a comma "," except the last line.
Please note that your AET name should not contain any space.
We recommend you to use "GenericNoUniversalWildcard" as it seems to be the most compatible parameter with usual workstations.

You are now done with settings, reboot your computer and to check your DICOM communication go to your Orthanc PC and reach http://localhost:8042/app/explorer.html#query-retrieve . You should be able to query one of your remote dicom node (you can use "Test Echo" button to test the connection without real query).

## VI- How to use BI database in routine and additional features

In routine use :
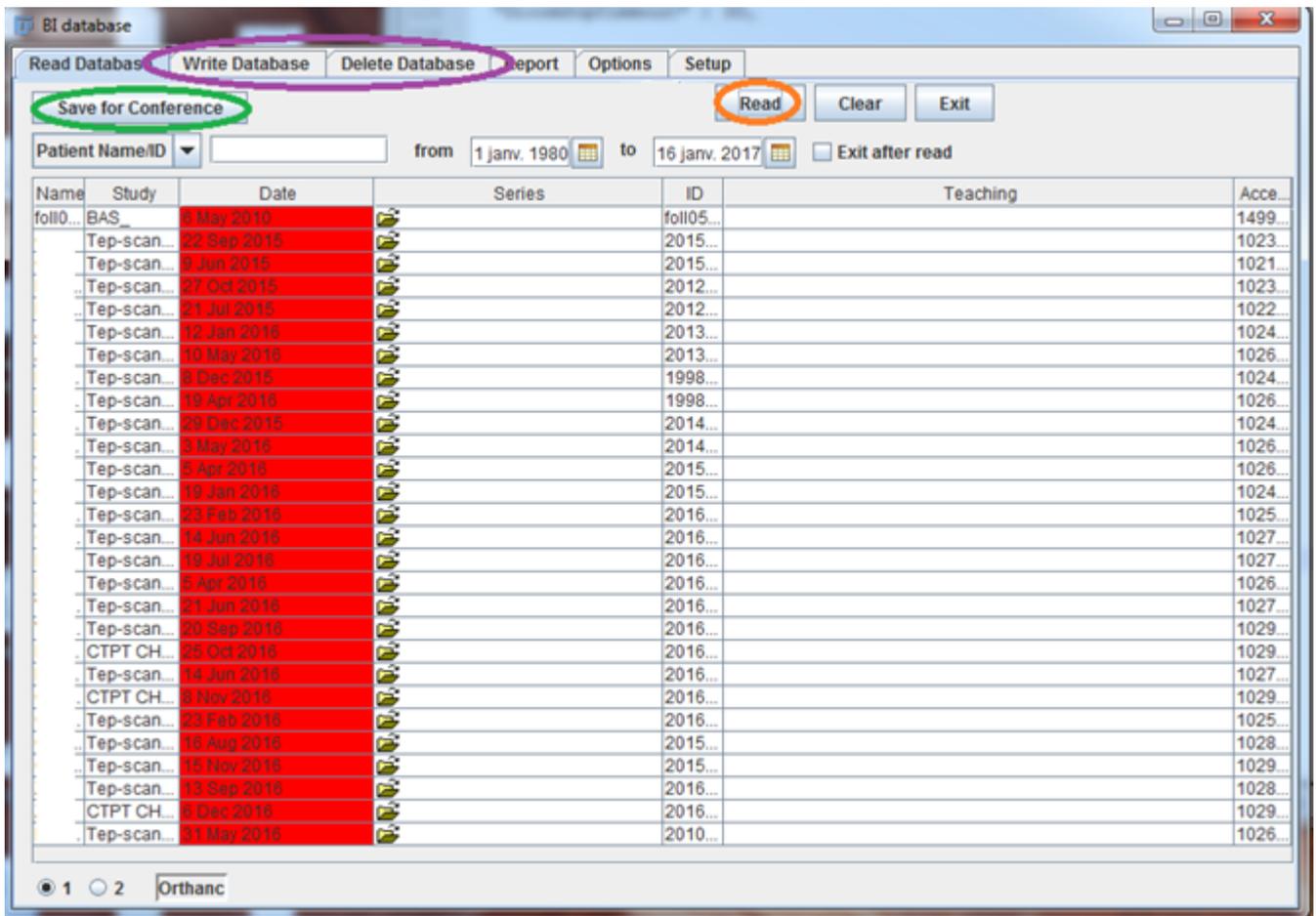
- The Read button (in orange) is for finding studies and opening series
  - You can use a filter by Name / ID/ Date and then find you patient by pressing Read
  - Once you found you patient, select the series you want to open and press Read
    - If you selected PET + CT series the viewer should come automatically.
- The write and delete tab allows you to send DICOM files to Orthanc or delete studies
- Please note that all that features are not limited to the computer where you installed Orthanc
  - You can setup several computers running Fiji that will access your Orthanc server (just repeat chapter IV for each computer you want to connect).

Additional features:
- Export DICOM function : The "Save for conference" button is an export function that will copy the DICOM you are reading to an export folder (Go to the setup tab to choose the export folder, the destination folder proposed to you are the folder you defined in the Read From CD plugin)
  - You can press it before opening study (the button remain pressed) : In that case all study you are going to open will be stored in the folder destination you have specified in the setup tab
  - You can press it after opening studies of interest: In that case all already opened studies in Fiji will be stored in the destination folder (one shot export).
- Autostart BIdatabase at Fiji startup
  - If you want to auto-start the BIdatabase plugin at Fiji startup go to Fiji menu : Plugin => Nuclear Medicine=>Choose startup program.

- Query: This program allows you to Query external AET (that you declared previously in Orthanc) and make retrieve study. Once retrieved the studies will be available in BIdatabase
    o Auto / Batch Query (see further)
- Anonymize : With Orthanc you will have a full DICOM anonymizer and sharing service as described in this documentation
- Import : You can import DICOM to Orthanc with 2 ways, using the "write database" tab of BIdatabase (to import images loaded in Fiji) or "Orthanc Import" plugin (to make a mass import of a directory file system)
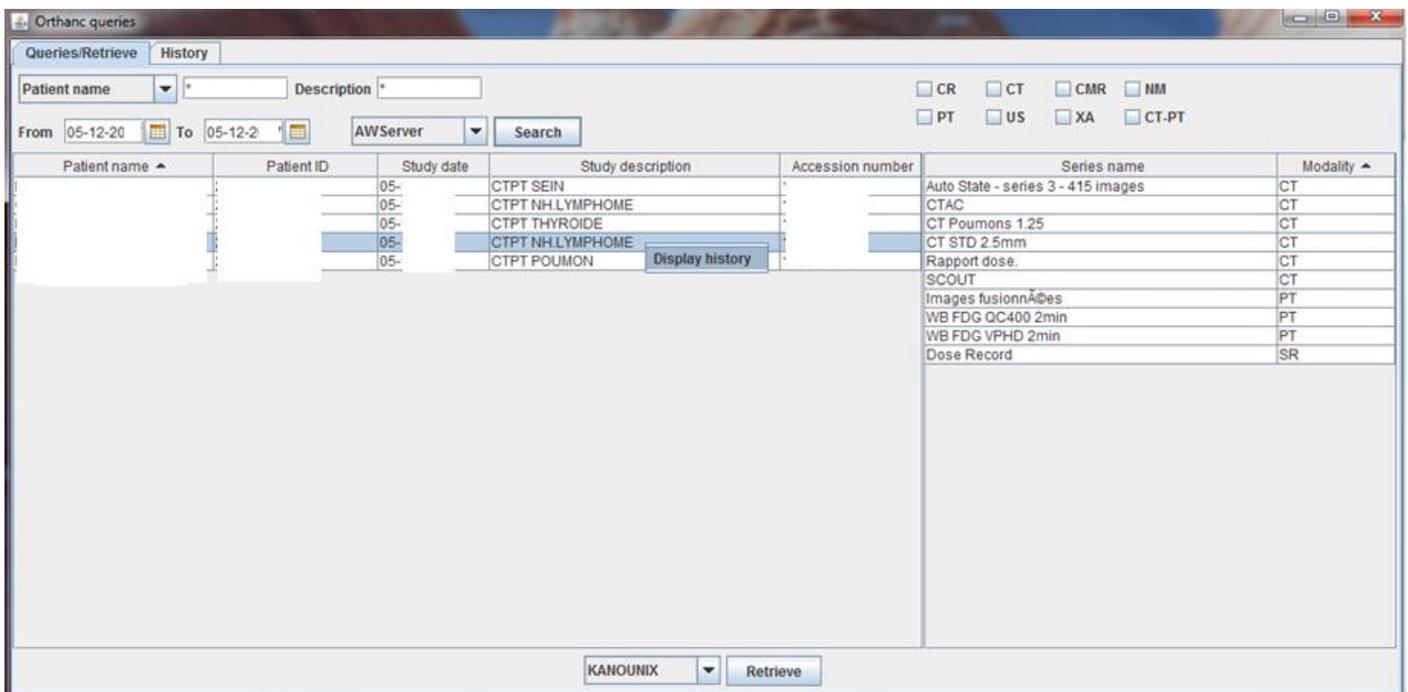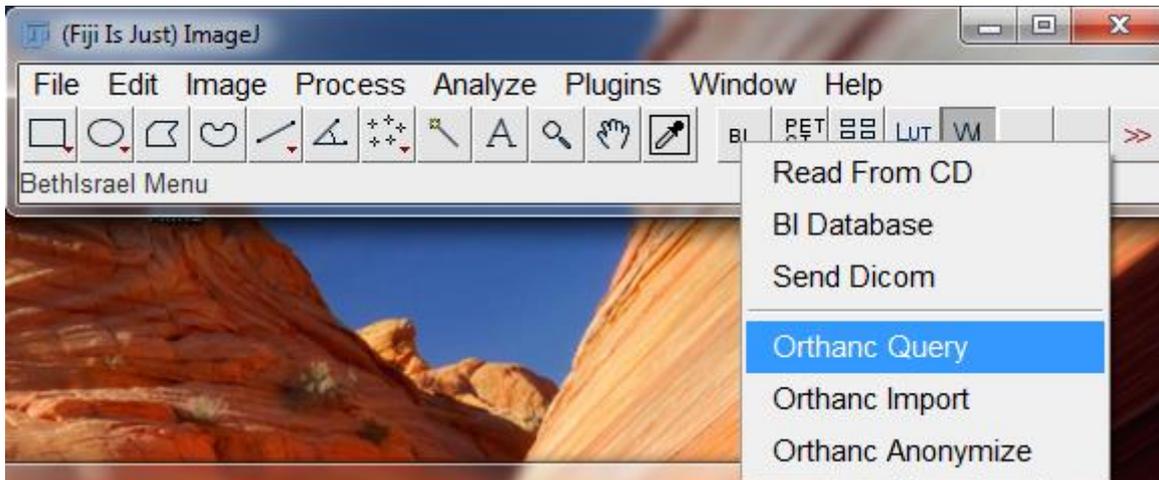
Query interface

Auto/Batch Query: This feature allows you to list all needed study and retrieve them by batch with a schedule feature.

For example if you have 50 PET/CT to retrieve for a study from your PACS, you can list all patients you need and schedule them for retrieve starting 10 PM (outside working hour to avoid network overload), the software will retrieve all needed studies during the night and your dataset will be ready the next morning.
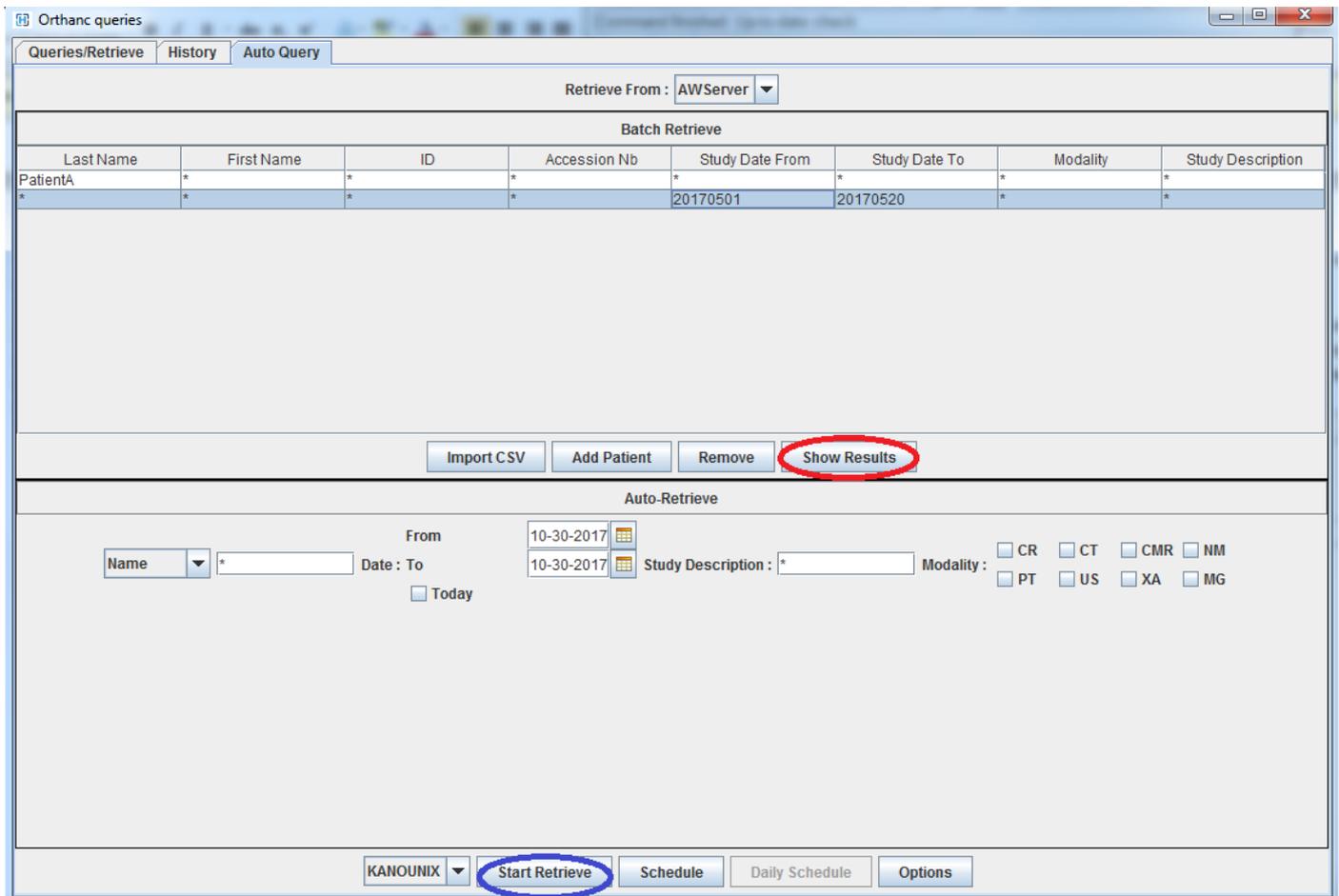
Auto-Query tab:

- *Bath Retrieve: List every patient your need (by name, or date, modality…) the list will be retrieved one by one. The "Show result" button allows you to see the matching results and manually select them before Retrieve (so you can start with a large query and do manual selection on the results). You can also dump the result to a CSV edit-it and re-import the CSV file in the retrieve list*

- *"Auto-Retrieve" : This panel allows you to define 1 Query that will be repeated each day (click option to set the schedule hour)*

VII-   Questions and Troubleshooting

- I can't connect to Orthanc
    - o Go to your Orthanc PC and check that http://localhost:8042/ is responding
        - If not, you have a trouble in your Orthanc Server (go back to Chapter II and III)
        - If it is OK
            - Try to access http://IP:8042/ in a remote computer inside your institution (in this example : http://192.168.0.253:8042)
                - o If you can't connect it should be a firewall issue that is closing the access, check your firewall settings and add an exception for Orthanc service (open 8042 http port and 4242 dicom port).
    - o DICOM reading is slow
        - Usually the reading process shouldn't be much longer than reading local file with the Read From CD plugin, if the reading time is really long (>1 minute for a serie) it is probably due to a slow network, ask your network assistance for that.

- How many studies can I store on Orthanc ?
    - o By following this guide you made the default installation of Orthanc which is designed to handle properly 50 000 DICOM files, and this allow you to store safely 50 to 70 studies
        - You can store more but you might face performance decrease (slower reading)
    - o You can remove that limit by extending your Orthanc installation with Postgre database, it will remove all limitation for DICOM storage (except you hard disk size limit of course)
        - It is a free procedure, we wrote another guide to help you extend your Orthanc installation with Postgre database.
            - Follow this guide :
                - o http://petctviewer.org/images/Extending_Orthanc_with_PostgreDB.pdf

- I have questions about Orthanc
    - o Orthanc is an Open Source software provided by the university of Liege (Belgium).
    - o The project is in active developpement, Orthanc provides a lot of capabilities that are not described here.
    - o If you need to reach the Orthanc team here are the most important links :
        - Website : http://www.osimis.io and http://www.orthanc-server.com/
        - Documentation (manual, Dicom conformance statement…) : http://www.orthanc-server.com/static.php?page=documentation
        - Forum : https://groups.google.com/forum/#!forum/orthanc-users

- If you still face problems, feel free to contact us (Ilan.tal@gmail.com, Salim.kanoun@gmail.com)