

making functional MRI easy



nordicBrainEx

Tutorial – Handling image data

Please note that this tutorial is for the latest released nordicBrainEx.
If you are using an older version, please upgrade.

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1 Configuring the DICOM server

nordicBrainEx can communicate with DICOM entities (scanners, databases, PACS, etc.) using the built-in DICOM server. For this communication to function you need to enter some required information about the remote DICOM entities.

nordicBrainEx supports two different DICOM service classes. First, it supports DICOM storage, both as an SCP (Service class provider) and as an SCU (Service class user), meaning that nordicBrainEx can send images to remote entities as well as receive images from remote entities. Secondly, nordicBrainEx supports DICOM query/retrieve as an SCU, meaning that you can query remote entities from nordicBrainEx to retrieve information about available DICOM images and retrieve these. Remote entities cannot perform queries towards nordicBrainEx.

1.1 Gathering information about remote DICOM entities

For each interface you want to communicate with, you need the following information:

- AE Title
- IP address or DNS name
- Port

You also need to know what services the entity supports (Storage SCP and/or Query SCP), as well as if there are any differences between the services if more than one is supported, typically with regards to the AE Title.

1.2 Adding remote DICOM entities to nordicBrainEx

First you need to open the DICOM server, you do this by clicking on the Database button if you are in the Patient selection window or by selecting Database in the File menu if you are in the visualization step.

To register remote DICOM entities you want to communicate with, go into the Settings tab in the nordicBrainEx Database.

First, fill in a name and a description of the entity. Depending on the capabilities of the entity you then fill in the forms for a Storage SCP and/or a query SCP. For both types of SCPs you need to fill in

- the AE title.
- the IP address or the DNS name in the Node field.
- the port number.

In nordicBrainEx it is possible to save a session (see section 6 Saving, loading and sending a Session), and a session can be sent to other nordicBrainEx installations. To enable sending you will have to enter the necessary information in the frame below the SCP frames, the nordic Workstation frame. The connection that needs to be established for sending a session requires the node name and the port. This port is usually set to 65432. Be aware that sending a session will also include sending the image series related to the session, and it is therefore necessary also to include the Storage SCP information for the corresponding nordicBrainEx DICOM node.

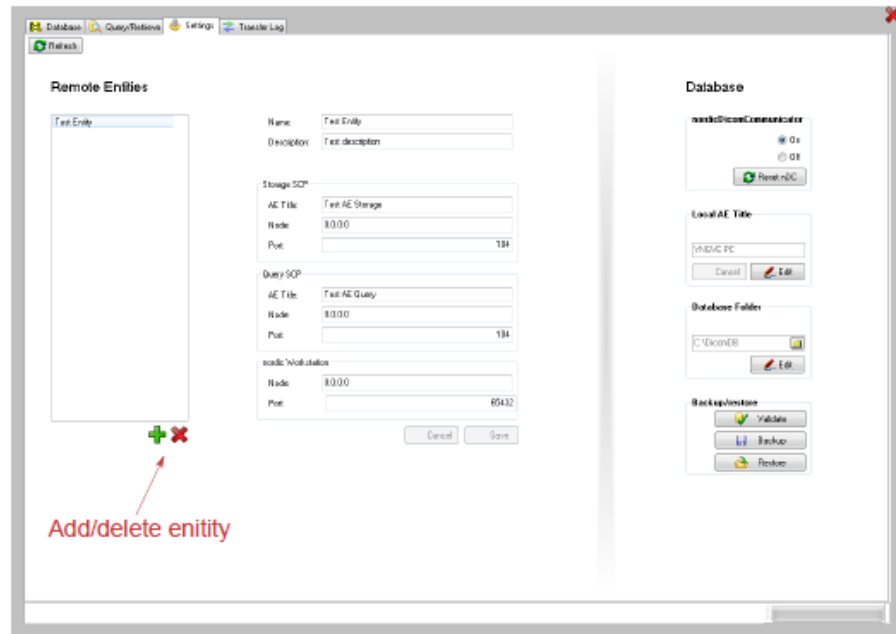


Figure 1: The DICOM settings tab.

Finally click *Save* to store this entity.

If you want to add another entity, press “+”. To delete an entity, press “X”.

1.3 Finding the nordicBrainEx Storage SCP information

If you want a DICOM entity (e.g. an MR scanner) to send images to your nordicBrainEx database, you need to supply the scanner with the information needed for it to connect and communicate with nordicBrainEx.

AE title

Open the nordicBrainEx DICOM Server Settings tab, as described above. In the framebox Local AE title you can find the current AE title.

IP or machine name

To obtain the machine name or IP--address you should consult your Windows manual or system administrator.

Port

nordicBrainEx uses port 104 by default for its DICOM communication.

2 Importing data from local hard-drive

To open the import user interface you need to click the *Import* button in the Patient Selection window.

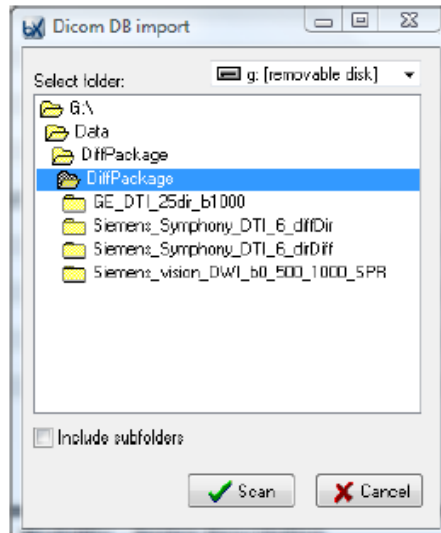


Figure 2: Local DICOM import user interface.

To import your DICOM images do the following:

- Select the drive you want to import from.
- Browse to the folder containing your images. Double click the folder to import.
- If you want to include sub--folders in the import, check the option *Include subfolders*.
- Click *Scan*.
- Check the result of the scan, if it seems reasonable, click *Ok* to start importing the images.
- Click *Close* when the import is done.

3 Performing Query/Retrieve

nordicBrainEx supports DICOM Query/Retrieve as an SCU (Service Class User). That means that you can perform queries and retrieve images from remote DICOM nodes if those nodes support DICOM Query/Retrieve as an SCP (Service Class Provider). To enable you to perform a query/retrieve you need to register the remote entity with Query SCP information. This is described in section 'Configuring the DICOM server'.

To start a Query/Retrieve click the *Query/Retrieve* button in the *Patient selection window*.

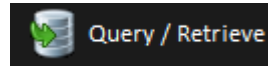


Figure 3: Query/Retrieve button on "Select patient window".

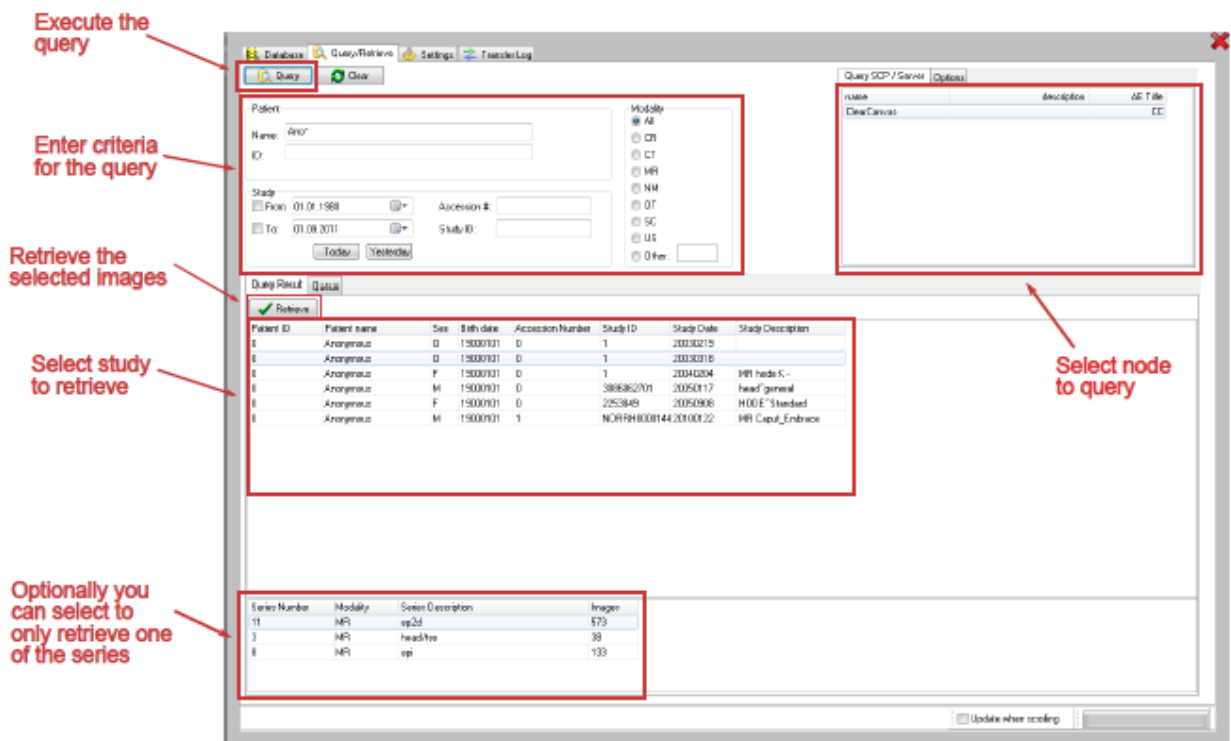


Figure 4: Enter criteria, select node and click query.

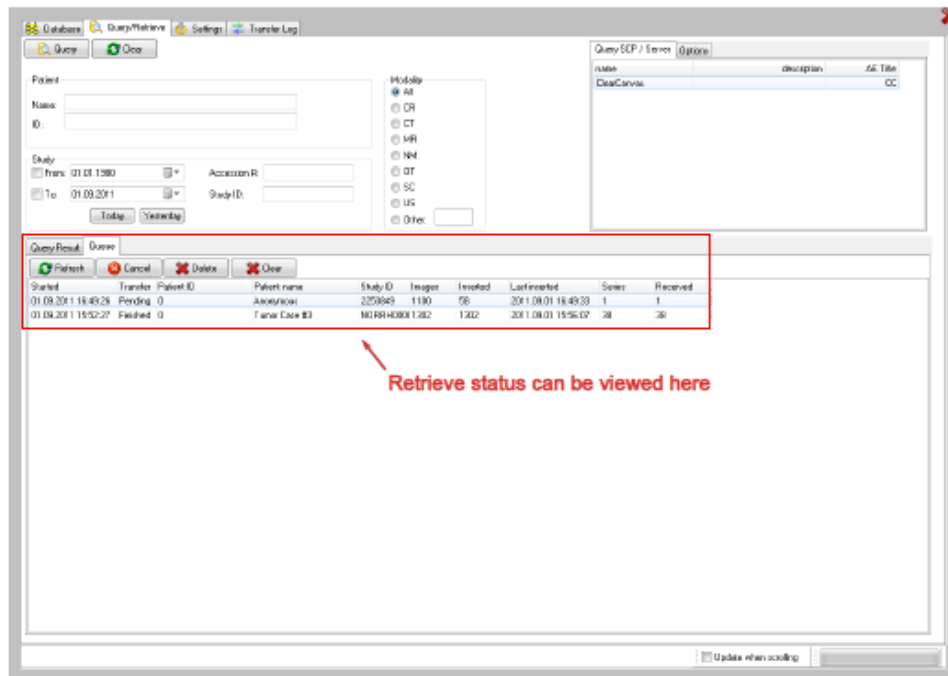
3.1 Perform a query

- Enter search criteria, by default a wildcard is appended to your search criteria, but this can be changed in Options.
Please note that Modality, Accession number and Study ID search criteria are not always supported by the DICOM Query/Retrieve SCP.
- Select the node you wish to query by clicking on it in the list.
- Click the *Query* button to execute the query.

3.2 Retrieve the images

After performing the query you are now ready to retrieve the images you need, continue with the following steps.

- Click on a study in the query result list to retrieve a list of the series belonging to that study.
- When you have clicked on the study or series you wish to retrieve, click the *Retrieve* button to initiate the transfer.
- The view will change to display the retrieve queue where you can see the progress of the retrieve.



Different columns reflect the status of the process.

Figure 5: Retrieving DICOM images.

- *Transfer*
A transfer will be marked as "Pending" when the receiver has confirmed that it has accepted the instruction, as "Failed" if the transaction fails, and as "Finished" after a successful transfer.
- *Images*
The total number of images that have been received.
- *Inserted*
The number of images that has been inserted in the database. The images are first stored in a temporary folder before being inserted in the database.
- *Series*
The number of series in the transfer.
- *Received*
The number of series that have been received.

4 Loading image data

When starting nordicBrainEx the *Patient Selection Window* is displayed. In this window, the patient and image series to be analyzed are selected.

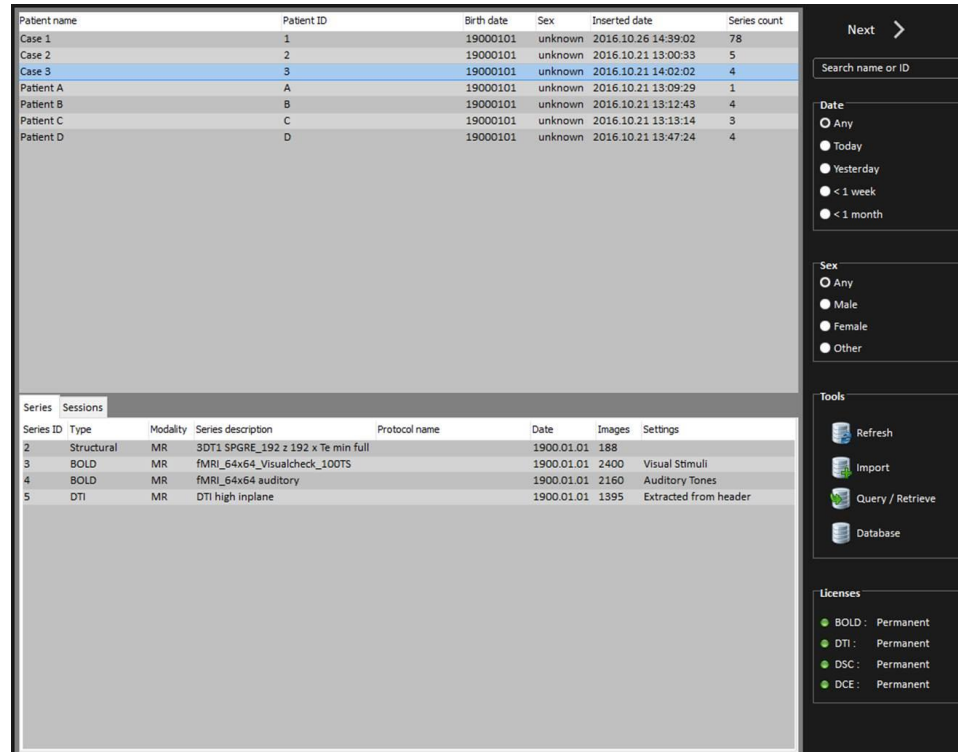


Figure 6: Loading DICOM images. Select patient, and then series. If type is unknown, right-click to set type (structural / BOLD / DTI / DSC / DCE / other). Hit 'Next' to continue to load the data.

To select the series to load

- Click on the patient you want to work with.
- For the series you want to load, check that the correct type is set. If not, right click the series and choose the appropriate type.
 - BOLD: This will perform a BOLD fMRI analysis on the selected series (BOLD design file must be used).
 - DSC: This will perform a perfusion (DSC) analysis on the selected series.
 - DCE: This will perform a DCE (Dynamic contrast enhanced perfusion) analysis on the selected series
 - DTI: This will perform a DTI analysis on the selected series.
 - Dynamic: Use this to load any dynamic series that is not BOLD, DSC, DCE or DTI. No analysis will be performed, but all general tools are available (view dynamic series, intensity curves etc.).
 - Other: Use this to load any other type of data, either structural or dynamic series.
 - Structural: All structural series should be labelled 'Structural'. Note that in order to start any analysis, at least one structural series has to be selected.

- Mark the series you wish to load by clicking on them.
- Click on the *Next* button to load the selected series.

The analysis settings for the BOLD, DTI, DSC, DCE series can be set by right clicking on the series and using the drop down menus that appear. For details about analysis settings see ‘Tutorial – BOLD’, ‘Tutorial – DTI’, ‘Tutorial DSC’ and ‘Tutorial DCE’.

4.1 Filter and sort patients and series

When you have large amounts of data in your DICOM Server, you might want to filter and sort the patient and series lists to make it easier to find the series you are looking for. You can do filtering on the date, sex and the name/ID. The text in the name/ID field is compared to both the name and the ID of the patients. In this field you can use a wildcard (*), and it is automatically assumed to be a wildcard at the end of the text (see [Figure 6](#)).

If you want to sort a list by a specific column, you simply need to click the column header of that specific column. When you click the same column several times you switch between ascending and descending sorting of that column.

5 Saving data to database and PACS

In nordicBrainEx you will typically find three options that relates to saving images to the database and sending them to remote DICOM nodes, like e.g. PACS. These are:

- Save to database
- Send
- Save and send

These options will be presented either by buttons, menus or by right--clicking and selecting from a pop-up menu.

5.1 Save images to database

nordicBrainEx creates derived image series that can be saved to the database. This can be initiated by right-clicking on the icon of a derived image series and choosing *Save to database*, pressing the *Export* button for the BOLD series or DTI fiber groups, or when creating a snapshot. nordicBrainEx will then create new DICOM image files and save these in the database. You will be presented with an interface where you can change some basic settings for the creation of these images (see [Figure 7](#)).

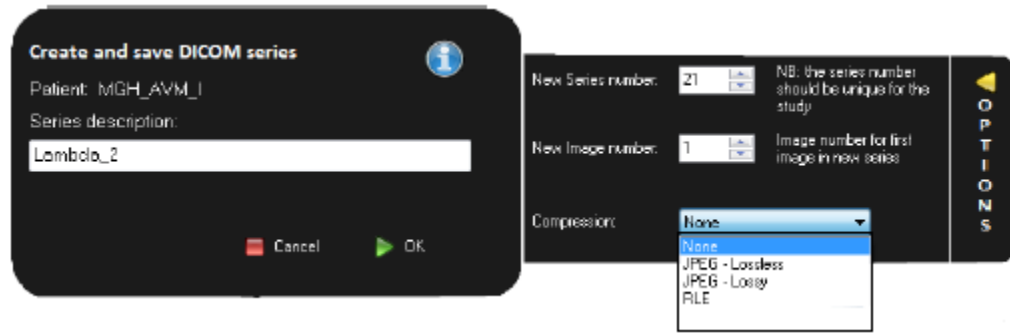


Figure 7: Options for saving derived DICOM images.

The most common thing you would like to alter is the series description. By clicking *Options* on the right side of the dialog, you also have the option of specifying what series number the series should be saved with, and what image number the first image of this series should have. The image numbers will be saved by increasing the number by one for each image in the series. Finally, you can also choose to save the images with compressed pixel data. nordicBrainEx supports three different algorithms for compressing DICOM images. *RLE and JPEG - Lossless* are algorithms that do not cause any pixel information to get lost during compression. *JPEG - Lossy* compression on the other hand causes loss of pixel information. Note that your selection will be stored as a preferred selection and automatically used in subsequent saving processes. When you are done with setting the options click *OK*.

Series that are ‘Merged’ for neuronavigational systems are created as MR SOP Class images, while other series are saved as Secondary Capture SOP Class. The reason is that neuronavigational systems only accepts MR SOP Class image files.

5.2 Send

Send will initiate sending of DICOM images to a remote DICOM node, like e.g. a PACS system. To enable sending images you must first enter the information about the remote DICOM node as described in section ‘Configuring the DICOM server’. Also, to be able to send images, they must be present in the database. Sending images can be initiated from the DICOM Server (File -> Database) by pressing the *Send* button or by selecting *Send* by right-clicking on any series loaded in nordicBrainEx.

You then need to choose what remote DICOM node you want to send the images to, and then click *OK* to start sending (Figure 8). There are three different priorities when sending images:

- **High** Stops all other pending transfers, and transfer this first
- **Normal** Adds it to the normal transfer queue, and transfers them in the order they are added
- **Low** Wait for all other transfers to finish before transferring this one

Log of sent images can be found in the DICOM Database under the *Transfer Log* tab. Press the *Show Details* button to get more details about a transfer (see Figure 9).

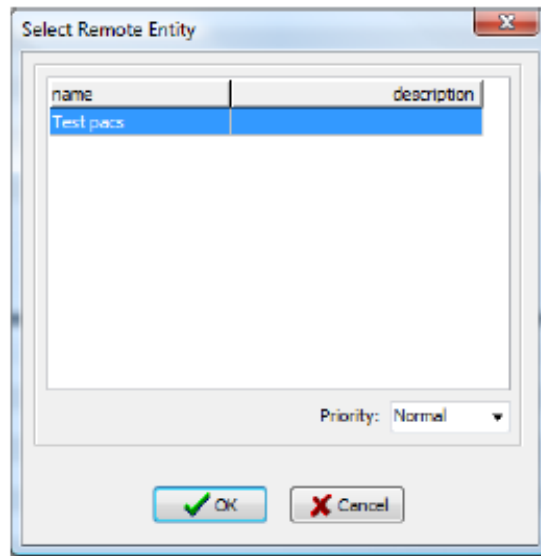


Figure 8: Select a remote DICOM node to send images to.

5.3 Save and send

This is an automated process to make it easier to save images created during the session, and send them to PACS in one operation. This option first performs a *Save to database* followed by a *Send*.

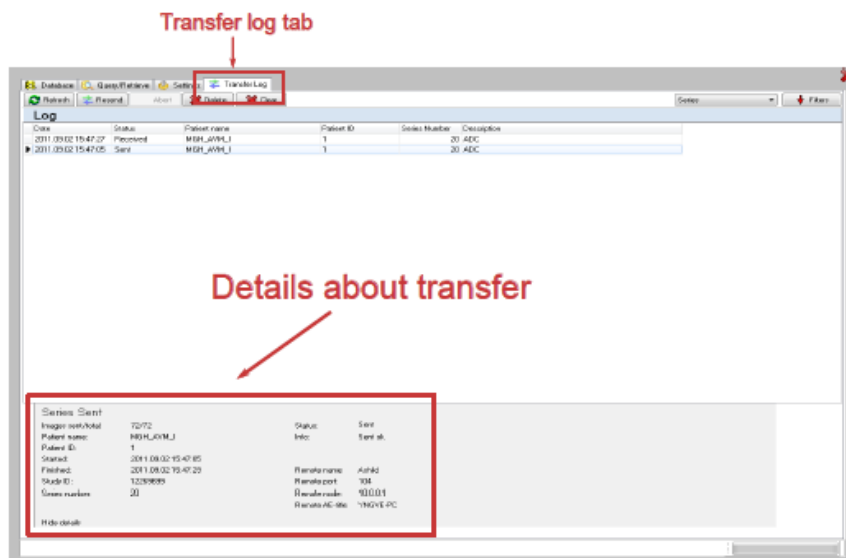


Figure 9: Log of DICOM transfers.

5.4 Save all and send all

It is possible to save all or send all derived maps in bulk.

- *Save all* will save all unsaved derived maps to the local database.
- *Send all* will attempt to send all derived maps to an external dicom node. In order to do this all these series must be saved to the local database first, so the same procedure as for *Save all* is initialized. Once all series are saved, the sending proceeds. If only one remote entity is defined in the local database, this node will be automatically selected. Otherwise, the user can select from a list with the different nodes.

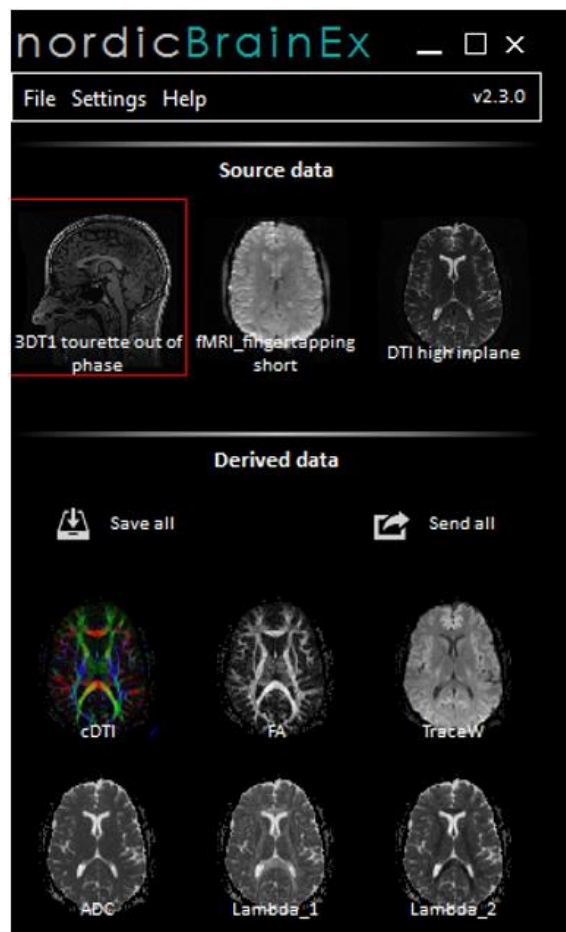


Figure 10: All derived data can be saved and sent by using Save all and Send all.

6 Saving, loading and sending a Session

After analyzing BOLD, DTI, DSC and DCE data you can save the current status by saving the session. This will save all BOLD activation maps with their applied thresholds, all output maps from DTI, DCE and DSC, fiber tracts, fiber groups, coregistration results, applied VOIs and the current status of the report.

If you want to save a session, click on *File -> Save Session* and enter a session name. The session name you entered will appear under the session tab on the *Select patient* interface.

Reloading a session can be done from the *Select patient* interface.

1. Choose a patient in the upper table.
2. Open the Session tab in the lower table and choose the session you want to reload.
3. Click on the *Next* button in order to start re-loading the session.

Sending a session is also done from the *Select patient* interface. Right-click on the session that should be sent and choose *Send* from the popup-menu. If there are no remote DICOM entities defined with the necessary information (*both* a Storage SCP and a nordic Workstation) the send item will not appear in the popup-menu.

7 Deleting data

Deleting data is performed under the *Database* tab in the DICOM Database. In the Study, Series and Image level it is possible to select one or more entries, right click and select *Delete selected*, as can be seen in [Figure 11](#).

In order to delete more than one patient at the time there is an option in the right-click menu called *Delete many...* This opens a new view where it is possible to use normal windows controls to mark many patients simultaneously and delete. See [Figure 12](#).

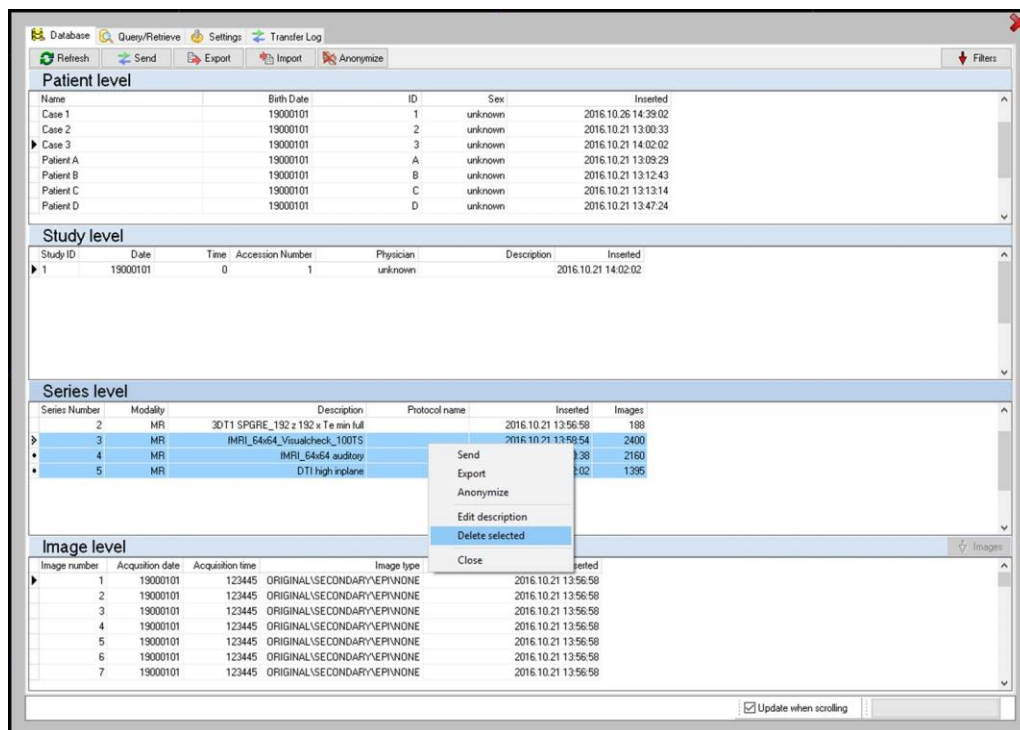


Figure 11: Deleting several series.

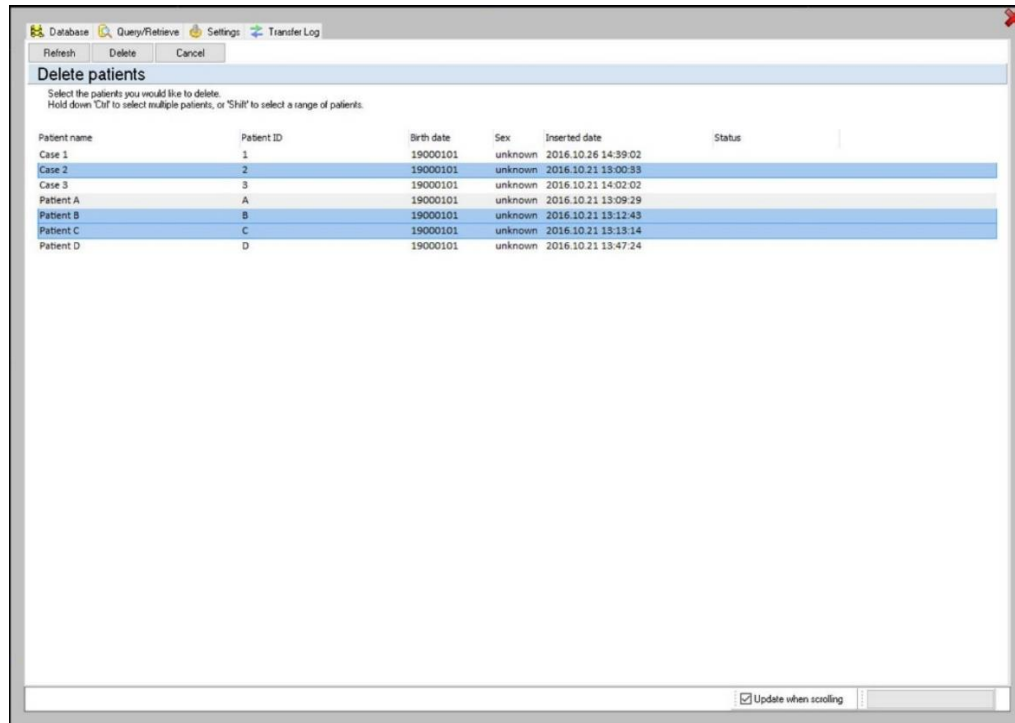


Figure 12: Deleting several patients.

8 Database settings

On the right side of the Settings tab, there are some tools for database handling and DICOM settings, see [Figure 13](#).

nordicDicomCommunicator is the service that allows for sending and receiving of DICOM data. If this for some reason is turned off, it can be turned on here, or reset. It might be necessary with administrative rights to the pc in order to change this setting.

The Local AE Title is the name of the nordicBrainEx DICOM node. nordicBrainEx is a DICOM node as it is capable of communication in the way described in the DICOM standard. By default it is set to the name of the computer but may be changed by the user.

The database Folder is the folder where all imported DICOM data is saved. Upon installation this is C:\DICOMDB, but this can be changed by the user.

Backup/restore is for validation, backup or restore of the database.

- Validation: checks the integrity of the database.

- Backup: will create a backup file that can be used for a *restore*. The backup does not contain any images, only metadata.
- Restore: will restore the database from a backup file.

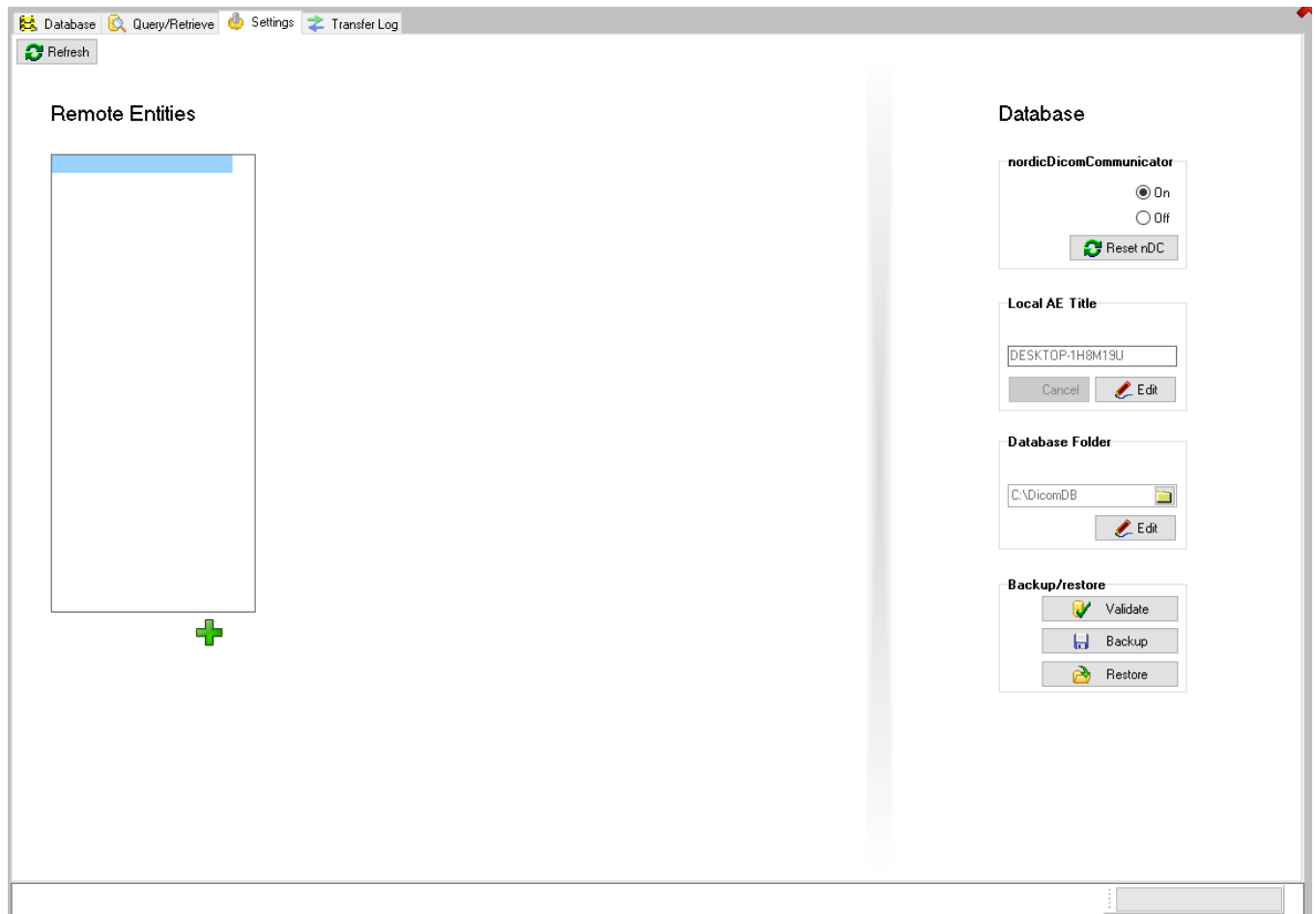


Figure 13: Tools for database settings.