OpenREM Documentation

Release 0.3.9

Ed McDonagh

March 09, 2014

Contents

OpenREM is an opensource framework created for the purpose of radiation exposure monitoring. The software is capable of importing and displaying data from a wide variety of x-ray dose related sources, and then enables easy export of the data in a form that is suitable for further analysis by suitably qualified medical physics personnel.

Please see openrem.org for more details.

Contents:

Installation instructions

1.1 Quick setup

Note: Most path names are represented using the linux convention of a / separator. If you are installing in a Windows environment you will need to use the Windows \ separator.

1. Install python (might need to be 2.7)
2. Install setuptools and pip
3. **Install OpenREM**
   - `pip install OpenREM-ver.tar.gz`
4. **Configure OpenREM**
   - Locate install location, typically `something/lib/python2.7/site-packages/openrem`
   - **There are two files that need renaming:**
     - `openrem/openrem/settings.py.example` to `openrem/openrem/settings.py`
     - `openrem/openrem/wsgi.py.example` to `openrem/openrem/wsgi.py`
   - in the `settings.py` file, set the database details.
   - **For testing ONLY, use**
     - `'ENGINE': 'django.db.backends.sqlite3',`
     - **`'NAME': '/ENTER/PATH/WHERE/DB/FILE/CAN/GO'`**
       - Windows example: `'NAME': 'C:\Documents\User\OpenREM\openrem.db'`
       - Linux example: `'NAME': '/var/openrem/openrem.db'`
5. **Create the database**
   - `python path/to/openrem/manage.py syncdb`
   - (optional when just testing) `python path/to/openrem/manage.py convert_to_south remapp`
6. **Start test web server**
   - `python path/to/openrem/manage.py runserver`

- If you are using a headless server and need to be able to see the web interface from another machine, use `python path/to/openrem/manage.py runserver x.x.x.x:8000` replacing the 'x' with the IP address of the server and '8000' with the port you wish to use.

7. Open the web addesss given, appending `/openrem` (http://localhost:8000/openrem)
8. **Add some data!**
    - `openrem_rdsr.py rdsrfile.dcm`

1.2 More in depth process

1. **Install virtualenv or maybe virtualenvwrapper** Recommended if the server is ever going to be used for more than one python application – virtualenv sets up an isolated python environment
2. **Install OpenREM** As per the Quick setup instructions above. Don't configure OpenREM yet
3. **Install a production database** SQLite is great for getting things running quickly and testing if the setup works, but is really not recommended for production use on any scale. Therefore it is recommended to use a different database such as PostgreSQL or MySQL.

    Here are the authors instructions for installing PostgreSQL on linux:

1.2.1 Installing PostgreSQL for OpenREM on Ubuntu linux

Install PostgreSQL and the python connector

- `sudo apt-get install postgresql`
- `sudo apt-get build-dep python-psycopg2`

The second command installed a lot of things, at least some of which are necessary for this to work!

If you are using a virtualenv, make sure you are in it and it is active (`source bin/activate`)

- `pip install psycopg2`

Create a user for the database

- `sudo passwd postgres`
- Enter password, twice
- `sudo -u postgres createuser -P openrem_user`
- Enter password, twice
- Superuser, *No*
- Create databases, *No*
- Create new roles, *No*

Optional: Specify the location for the database

You might like to do this if you want to put the database on an encrypted location

For this example, I'm going to assume all the OpenREM programs and data are in the folder `/var/openrem/`:

- `sudo /etc/init.d/postgresql stop`
- `mkdir /var/openrem/database`
- `sudo cp -aRv /var/lib/postgresql/9.1/main /var/openrem/database/`
- `sudo nano /etc/postgresql/9.1/main/postgresql.conf`

  Change the line

  - `data_directory = '/var/lib/postgresql/9.1/main'` to
  - `data_directory = '/var/openrem/database/main'`
- `sudo /etc/init.d/postgresql start`

Create the database

- `su postgres`
- `psql template1`
- `CREATE DATABASE openrem_db OWNER openrem_user ENCODING 'UTF8';`
- `\q`
- `exit`

Change the security configuration

The default security settings are too restrictive to allow access to the database.

- `sudo nano /etc/postgresql/9.1/main/pg_hba.conf`
- **Add the following line:**
  - `local openrem_db openrem_user md5`
- `sudo /etc/init.d/postgresql restart`

Configure OpenREM to use the database

Find and edit the settings file, eg

- `nano local/lib/python2.7/site-packages/openrem/openrem/settings.py`

Set the following (changing name, user and password as appropriate):

- `'ENGINE': 'django.db.backends.postgresql_psycopg2',`
- `'NAME': 'openrem_db',`
- `'USER': 'openremuser',`
- `'PASSWORD': 'openrem_pw',`

Fire it up with OpenREM

- `python path/to/openrem/manage.py syncdb`
- `python path/to/openrem/manage.py convert_to_south remapp`

4. **Install and configure a production webserver** Unlike the database, the production webserver can be left till later and can be changed again at any time.

   However, for performance it is recommended that a production webserver is used. Popular choices would be either Apache or you can do as the cool kids do and use Gunicorn with nginx.

5. **Configure OpenREM** Follow the 'Configure OpenREM' instuctions in the Quick setup section above, but this time with the production database details.

   Configure the production webserver too.

6. **Create the database**

   - `python path/to/openrem/manage.py syncdb`

7. **Convert the database to use South** South is a django application to manage database migrations. Using South means that future changes to the database model can be calculated and executed automatically with simple commands when OpenREM is upgraded.

   - `python path/to/openrem/manage.py convert_to_south remapp`

1.3 Related guides

1.3.1 Running Conquest on Windows as a service

Note: Content contributed by DJ Platten, with edit by ET McDonagh

This guide assumes Conquest has already been installed and runs ok. These instructions are based on Windows XP. **Run as a service**

1. Make sure conquest isn't running.
2. Open a file browser and navigate to your conquest folder.
3. Right-hand click on the "ConquestDICOMServer.exe" file and choose "Run as..."
4. Enter the username and password of a Windows user with administrator rights.
5. Once conquest is running, click on the "Install server as NT service" on the "Configuration" tab.
6. Close the conquest Window.
7. Log in to Windows as a user with administrator rights.
8. Go to "Control panel" -> "Administrative Tools" -> "Services".
9. There will be a service with the same name as conquest's AE title. Right-hand click the mouse on this service and select "Properties".
10. On the "Log On" tab check the box that says "Allow service to interact with the desktop".
11. Click "Apply" then "OK".

12. Right-hand click on the service again and click "Restart".

The "Allow service to interact with the desktop" seems to be necessary for the batch to run that puts the dose report into OpenREM.

Firewall settings

Windows is able to change its firewall settings after you think everything is working ok! Assuming you have control of the firewall, add three port exceptions to the Windows firewall on the server computer: ports 80 and 443 for Apache, and whichever port that was chosen for conquest (104 is *the* port allocated to DICOM, but you may have used a higher port above 1024 for permissions reasons).

The firewall instructions at portforward.com were found to be a useful guide for this.

1.3.2 Backing up MySQL on Windows

Note: Content contributed by DJ Platten

These instructions are based on Windows XP.

As a one-off, create a MySQL user called `backup` with a password of `backup` that has full rights to the database:

```
C:\Program Files\MySQL\MySQL Server 5.6\bin\mysql.exe -u root -p -e "CREATE USER 'backup'@'local
```

Grant the `backup` user full privileges on the database called `openremdatabasemysql`:

```
C:\Program Files\MySQL\MySQL Server 5.6\bin\mysql.exe -u root -p -e "GRANT ALL PRIVILEGES ON ope
```

Grant the `backup` user privileges to create databases:

```
C:\Program Files\MySQL\MySQL Server 5.6\bin\mysql.exe -u root -p -e "GRANT CREATE ON *.* TO 'bac
```

Reload the privileges to ensure that MySQL registers the new ones:

```
C:\Program Files\MySQL\MySQL Server 5.6\bin\mysql.exe -u root -p -e "FLUSH PRIVILEGES";
```

To backup the contents of the database from the command line to a file called `backup.sql` (note that the lack of spaces after the `-u` and `-p` is not a typo):

```
C:\Program Files\MySQL\MySQL Server 5.6\bin\mysqldump.exe -ubackup -pbackup openremdatabasemysql
```

To restore the database, assuming that it doesn't exist anymore, first it needs to be created:

```
C:\Program Files\MySQL\MySQL Server 5.6\bin\mysql.exe -ubackup -pbackup -e "CREATE DATABASE open
```

Then restore the contents of the database from a file called `backup.sql`:

```
C:\Program Files\MySQL\MySQL Server 5.6\bin\mysql.exe -ubackup -pbackup openremdatabasemysql < b
```

An example DOS batch file to back up the contents of the `openremdatabasemysql` database using a time stamp of the form `yyyy-mm-dd_hhmm`, zip up the resulting file, delete the uncompressed version and then copy it to a network location (the network copy will only work if the user that runs the batch file has permission on the network):

```
@echo off
For /f "tokens=1-4 delims=/ " %%a in ('date /t') do (set mydate=%%c-%%b-%%a)
For /f "tokens=1-2 delims=/:" %%a in ('time /t') do (set mytime=%%a%%b)

"C:\Program Files\MySQL\MySQL Server 5.6\bin\mysqldump.exe" -ubackup -pbackup openremdatabasemys

"C:\Program Files\7-Zip\7z.exe" a F:\OpenREMdatabase\backup\%mydate%_%mytime%_openremdatabasemys

del F:\OpenREMdatabase\backup\%mydate%_%mytime%_openremdatabasemysql.sql

copy F:\OpenREMdatabase\backup\%mydate%_%mytime%_openremdatabasemysql.zip "\\Srv-mps-001\xls_pro
```

CHAPTER 2

Importing data to OpenREM

2.1 Importing dose related data from DICOM files

If you are using linux or have put `"`C:\Python27\Lib\site-packages\openrem\scripts"` and `"C:\Python27\Lib\site-packages\openrem"` onto your path, you should be able to import from the command line:

2.1.1 Radiation Dose Structured Reports

- `openrem_rdsr.py filename.dcm`

2.1.2 For mammography DICOM images

- `openrem_mg.py filename.dcm`

The facility for extracting dose information from mammography DICOM images has been designed and tested with images created with the GE Senographe DS. It has now been tested in a limited fashion with the images generated by the following systems:

- GE Senographe Essential
- Hologic Selenia
- Siemens Inspiration

See *Mammography module* for testing restrictions.

2.1.3 For CT dose summary files from Philips CT scanners

- `openrem_ctphilips.py filename.dcm`

2.2 Importing dose related data from csv files

2.2.1 Patient height and weight information

If height and weight data is not available in the DICOM data, but is available from another source, then it can be imported into the database using the `openrem_ptsizecsv.py` function. Normally the key to match the size information with the studies in the database will be the accession number; however in some situations this isn't available and the Study Instance UID can be used instead.

usage: `openrem_ptsizecsv.py [-h] [-u] [-v] csvfile id height weight`

`-h, --help` Print the help text.

`-u, --si-uid` Use Study Instance UID instead of Accession Number.

`-v, --verbose` *New in 0.3.7* Print to the standard output the success or otherwise of inserting each value.

`csvfile` csv file containing the height and/or weight information and study identifier. Other columns will be ignored. Use quotes if the filepath has spaces.

`id` Column title for the accession number or study instance UID. Use quotes if the title has spaces.

`height` Column title for the patient height (DICOM size) - if this information is missing simply add a blank column with a suitable title. Use quotes if the title has spaces.

`weight` Column title for the patient weight - if this information is missing simply add a blank column with a suitable title. Use quotes if the title has spaces.

Changed in version 0.3.7: Verbosity flag added to supress printing to the standard output unless requested.

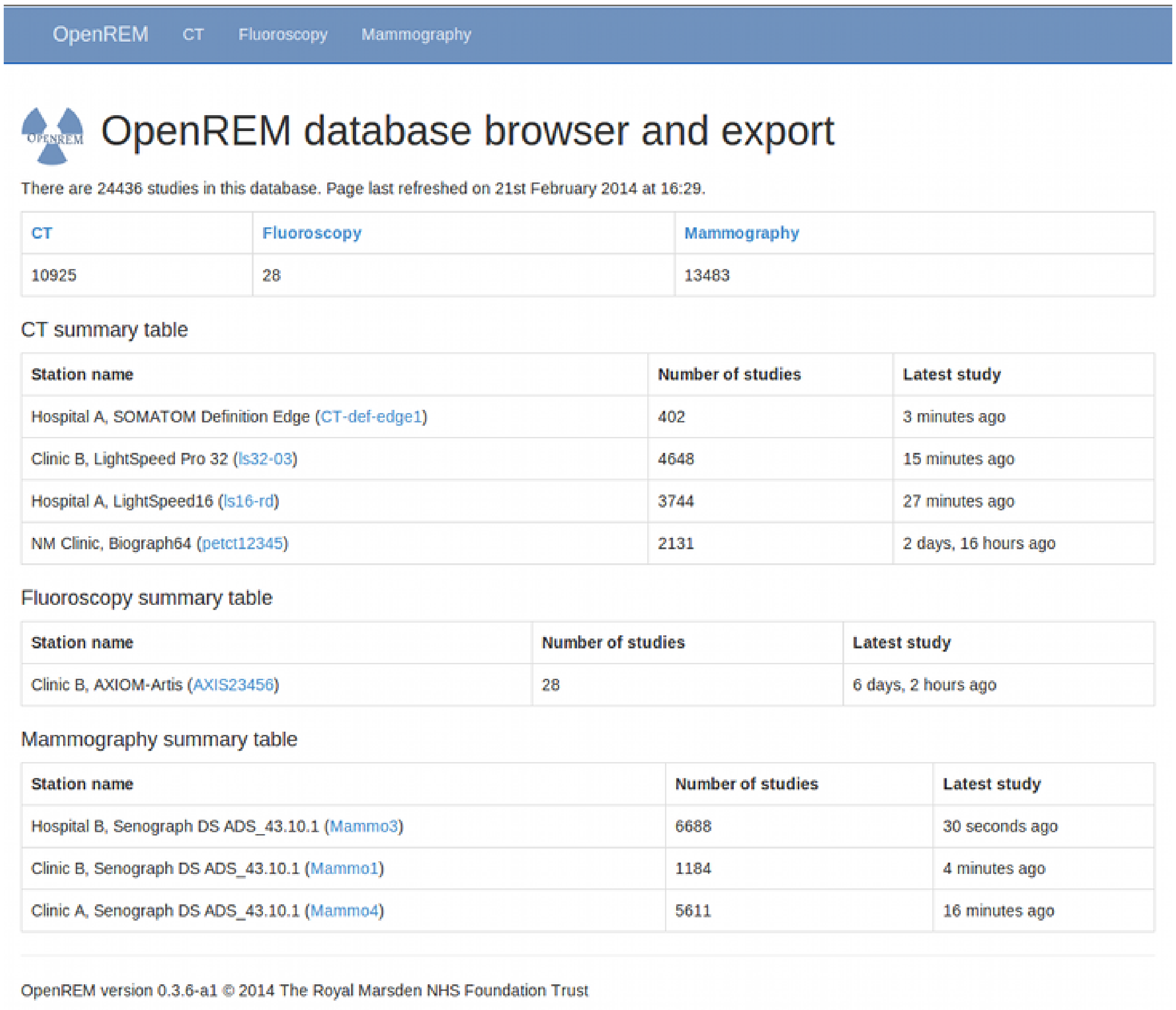
CHAPTER 3

Using the OpenREM interface and export function

3.1 Navigating the OpenREM web interface

Depending on your web server setup, your web interface to OpenREM will usually be at http://yourserver/openrem or if you are using the test web server then it might be at http://localhost:8000/openrem.

The home page for OpenREM should look something like this when it is populated with studies:



OpenREM database browser and export

There are 24436 studies in this database. Page last refreshed on 21st February 2014 at 16:29.

CT	Fluoroscopy	Mammography
10925	28	13483

CT summary table

Station name	Number of studies	Latest study
Hospital A, SOMATOM Definition Edge (CT-def-edge1)	402	3 minutes ago
Clinic B, LightSpeed Pro 32 (ls32-03)	4648	15 minutes ago
Hospital A, LightSpeed16 (ls16-rd)	3744	27 minutes ago
NM Clinic, Biograph64 (petct12345)	2131	2 days, 16 hours ago

Fluoroscopy summary table

Station name	Number of studies	Latest study
Clinic B, AXIOM-Artis (AXIS23456)	28	6 days, 2 hours ago

Mammography summary table

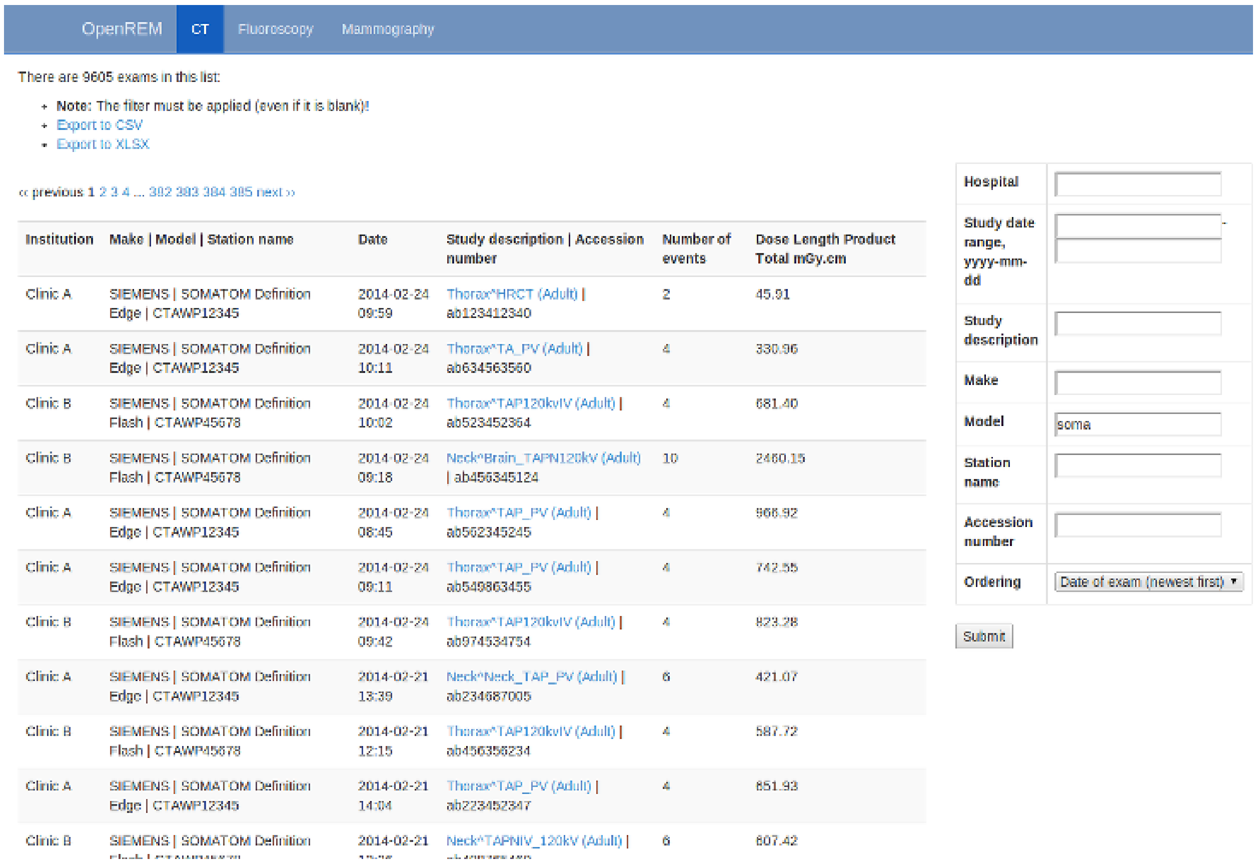
Station name	Number of studies	Latest study
Hospital B, Senograph DS ADS_43.10.1 (Mammo3)	6688	30 seconds ago
Clinic B, Senograph DS ADS_43.10.1 (Mammo1)	1184	4 minutes ago
Clinic A, Senograph DS ADS_43.10.1 (Mammo4)	5611	16 minutes ago

OpenREM version 0.3.6-a1 © 2014 The Royal Marsden NHS Foundation Trust

By selecting the links in the navigation bar at the top, you can view all of the CT, fluoroscopy or mammography studies. Alternatively, if you click on the station name link (in blue) you can filter to just that source modality.

3.2 Filtering for specific studies

This image shows the CT studies view, filtered by entering terms in the boxes on the right hand side to show just the studies where the modality model name includes the term ‘soma’:



There are 9605 exams in this list:

- **Note:** The filter must be applied (even if it is blank)!
- Export to CSV
- Export to XLSX

« previous 1 2 3 4 ... 382 383 384 385 next »

Institution	Make | Model | Station name	Date	Study description | Accession number	Number of events	Dose Length Product Total mGy.cm
Clinic A	SIEMENS | SOMATOM Definition Edge | CTAWP12345	2014-02-24 09:59	Thorax^HRCT (Adult) | ab123412340	2	45.91
Clinic A	SIEMENS | SOMATOM Definition Edge | CTAWP12345	2014-02-24 10:11	Thorax^TA_PV (Adult) | ab634563560	4	330.96
Clinic B	SIEMENS | SOMATOM Definition Flash | CTAWP45678	2014-02-24 10:02	Thorax^TAP120kvIV (Adult) | ab523452364	4	681.40
Clinic B	SIEMENS | SOMATOM Definition Flash | CTAWP45678	2014-02-24 09:18	Neck^Brain_TAPN120kV (Adult) | ab456345124	10	2460.15
Clinic A	SIEMENS | SOMATOM Definition Edge | CTAWP12345	2014-02-24 08:45	Thorax^TAP_PV (Adult) | ab562345245	4	966.92
Clinic A	SIEMENS | SOMATOM Definition Edge | CTAWP12345	2014-02-24 09:11	Thorax^TAP_PV (Adult) | ab549863455	4	742.55
Clinic B	SIEMENS | SOMATOM Definition Flash | CTAWP45678	2014-02-24 09:42	Thorax^TAP120kvIV (Adult) | ab974534754	4	823.28
Clinic A	SIEMENS | SOMATOM Definition Edge | CTAWP12345	2014-02-21 13:39	Neck^Neck_TAP_PV (Adult) | ab234687005	6	421.07
Clinic B	SIEMENS | SOMATOM Definition Flash | CTAWP45678	2014-02-21 12:15	Thorax^TAP120kvIV (Adult) | ab456356234	4	587.72
Clinic A	SIEMENS | SOMATOM Definition Edge | CTAWP12345	2014-02-21 14:04	Thorax^TAP_PV (Adult) | ab223452347	4	651.93
Clinic B	SIEMENS | SOMATOM Definition	2014-02-21	Neck^TAPNIV_120kV (Adult) |	6	607.42

Hospital	
Study date range, yyyy-mm-dd	-
Study description	
Make	
Model	soma
Station name	
Accession number	
Ordering	Date of exam (newest first)

Submit

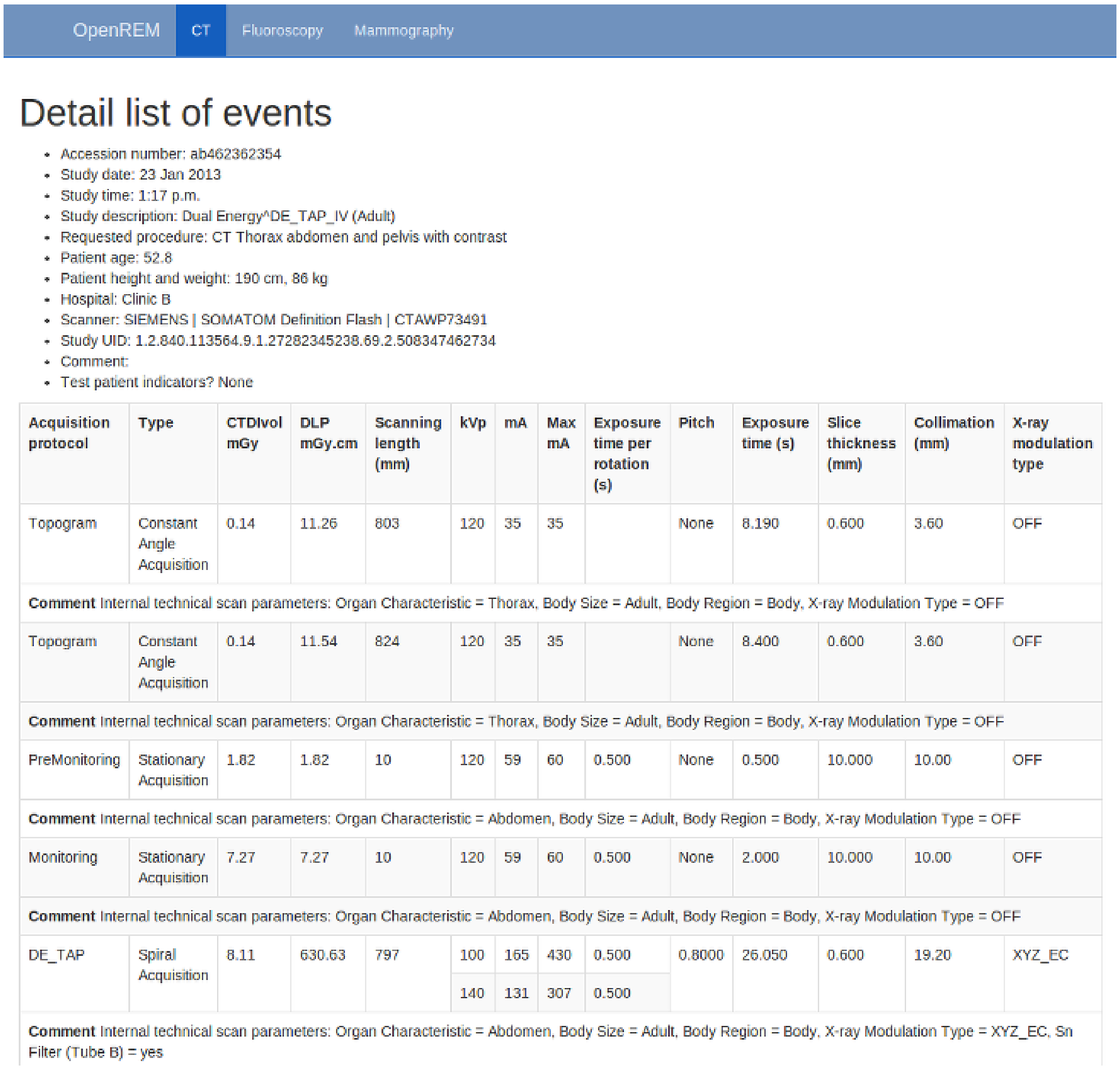
The search fields can all be used on their own or together, and they are all case insensitive 'contains' searches. The exception is the date field, where both from and to have to be filled in (if either are), and the format must be `yyyy-mm-dd`. There currently isn't any more complex filtering available, but it does exist as issue 17 for a future release.

The last box below the filtering search boxes is the ordering preference.

New in 0.3.8 Ordering by date now takes account of the time of the study (issue 37).

3.3 Viewing study details

By clicking on the study description link (in blue), you can see more details for an individual study:



Detail list of events

- Accession number: ab462362354
- Study date: 23 Jan 2013
- Study time: 1:17 p.m.
- Study description: Dual Energy^DE_TAP_IV (Adult)
- Requested procedure: CT Thorax abdomen and pelvis with contrast
- Patient age: 52.8
- Patient height and weight: 190 cm, 86 kg
- Hospital: Clinic B
- Scanner: SIEMENS | SOMATOM Definition Flash | CTAWP73491
- Study UID: 1.2.840.113564.9.1.27282345238.69.2.508347462734
- Comment:
- Test patient indicators? None

Acquisition protocol	Type	CTDIvol mGy	DLP mGy.cm	Scanning length (mm)	kVp	mA	Max mA	Exposure time per rotation (s)	Pitch	Exposure time (s)	Slice thickness (mm)	Collimation (mm)	X-ray modulation type
Topogram	Constant Angle Acquisition	0.14	11.26	803	120	35	35		None	8.190	0.600	3.60	OFF
Comment Internal technical scan parameters: Organ Characteristic = Thorax, Body Size = Adult, Body Region = Body, X-ray Modulation Type = OFF													
Topogram	Constant Angle Acquisition	0.14	11.54	824	120	35	35		None	8.400	0.600	3.60	OFF
Comment Internal technical scan parameters: Organ Characteristic = Thorax, Body Size = Adult, Body Region = Body, X-ray Modulation Type = OFF													
PreMonitoring	Stationary Acquisition	1.82	1.82	10	120	59	60	0.500	None	0.500	10.000	10.00	OFF
Comment Internal technical scan parameters: Organ Characteristic = Abdomen, Body Size = Adult, Body Region = Body, X-ray Modulation Type = OFF													
Monitoring	Stationary Acquisition	7.27	7.27	10	120	59	60	0.500	None	2.000	10.000	10.00	OFF
Comment Internal technical scan parameters: Organ Characteristic = Abdomen, Body Size = Adult, Body Region = Body, X-ray Modulation Type = OFF													
DE_TAP	Spiral Acquisition	8.11	630.63	797	100	165	430	0.500	0.8000	26.050	0.600	19.20	XYZ_EC
					140	131	307	0.500					
Comment Internal technical scan parameters: Organ Characteristic = Abdomen, Body Size = Adult, Body Region = Body, X-ray Modulation Type = XYZ_EC, Sn Filter (Tube B) = yes													

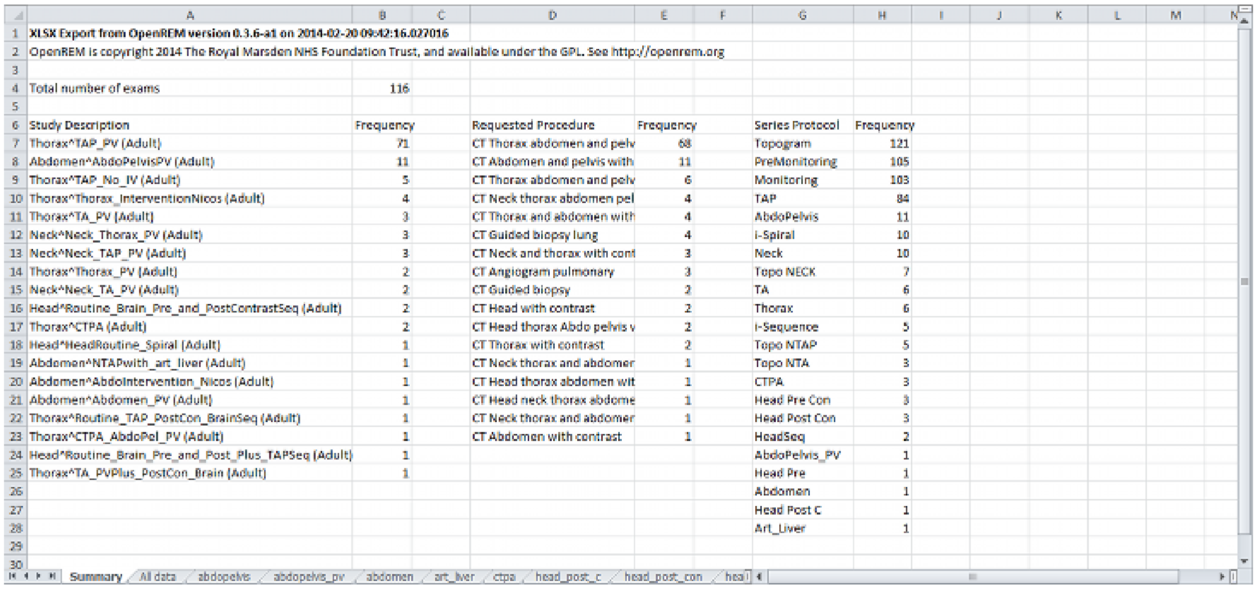
Not all the details stored for any one study are displayed, just those thought to be most useful. If there are others you'd like to see, add an issue to the tracker.

The final field in the summary at the top is called 'Test patient indicators?' When studies are imported the ID and patient name fields are both ignored, but they are parsed to check if they have 'phy', 'test' or 'qa' in them to help exclude them from the data analysis. If they do, then this information is added to the field and is displayed both in the web interface as a Test patient indicator and in the Excel export. The name and ID themselves are not reproduced, simply the presence of one of the key words. Therefore a patient named 'Phyliss' would trigger this, but only 'Phy' would be reproduced in this field. Other fields will also help to confirm whether a study is for a real patient such as the lack of an Accession Number and an unusual patient age.

3.4 Exporting to csv and xlsx sheets

From any of the modality pages in the OpenREM interface, you can export the displayed studies to a csv spreadsheet by clicking on the link near the top. In the CT interface, you can also export to an enhanced XLSX spreadsheet.

For CT, the XLSX export has multiple sheets. The first sheet contains a summary of all the study descriptions, requested procedures and series protocol names contained in the export:

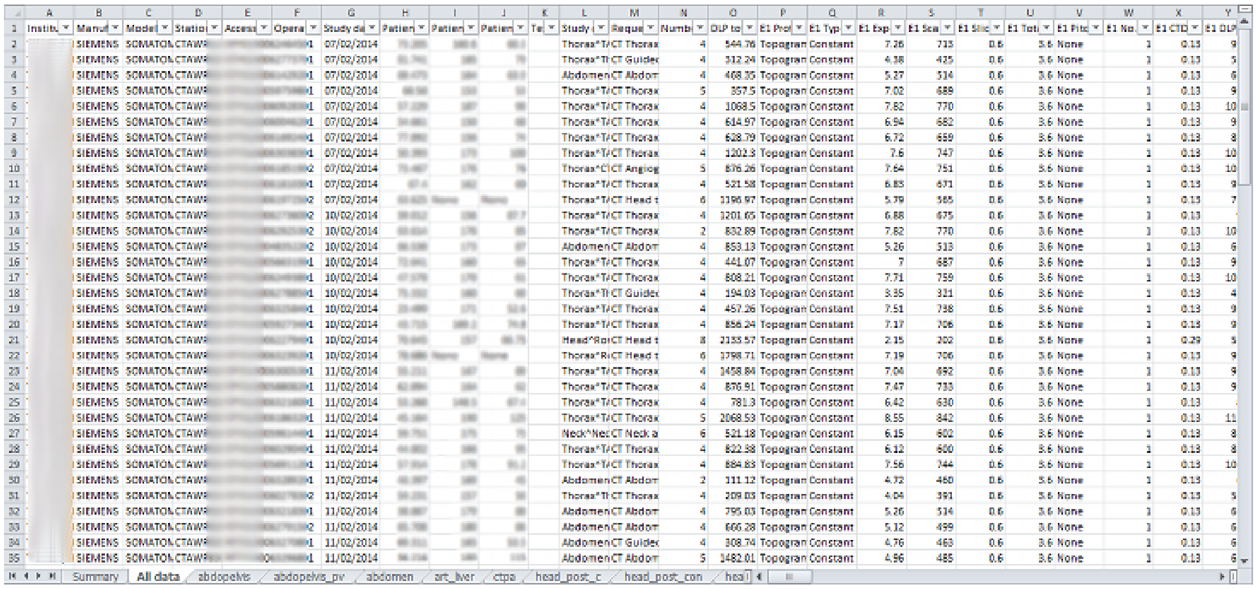


	A	B	C	D	E	F	G	H
1	XLSX Export from OpenREM version 0.3.6-a1 on 2014-02-20 09:42:16.027016							
2	OpenREM is copyright 2014 The Royal Marsden NHS Foundation Trust, and available under the GPL. See http://openrem.org							
3								
4	Total number of exams	116						
5								
6	Study Description	Frequency		Requested Procedure	Frequency		Series Protocol	Frequency
7	Thorax^TAP_PV (Adult)	71		CT Thorax abdomen and pelv	68		Topogram	121
8	Abdomen^AbdoPelvisPV (Adult)	11		CT Abdomen and pelvis with	11		PreMonitoring	105
9	Thorax^TAP_No_IV (Adult)	5		CT Thorax abdomen and pelv	6		Monitoring	103
10	Thorax^Thorax_InterventionNicos (Adult)	4		CT Neck thorax abdomen pel	4		TAP	84
11	Thorax^TA_PV (Adult)	3		CT Thorax and abdomen with	4		AbdoPelvis	11
12	Neck^Neck_Thorax_PV (Adult)	3		CT Guided biopsy lung	4		i-Spiral	10
13	Neck^Neck_TAP_PV (Adult)	3		CT Neck and thorax with cont	3		Neck	10
14	Thorax^Thorax_PV (Adult)	2		CT Angiogram pulmonary	3		Topo NECK	7
15	Neck^Neck_TA_PV (Adult)	2		CT Guided biopsy	2		TA	6
16	Head^Routine_Brain_Pre_and_PostContrastSeq (Adult)	2		CT Head with contrast	2		Thorax	6
17	Thorax^CTPA (Adult)	2		CT Head thorax Abdo pelvis v	2		i-Sequence	5
18	Head^HeadRoutine_Spiral (Adult)	1		CT Thorax with contrast	2		Topo NTAP	5
19	Abdomen^NTAPwith_art_liver (Adult)	1		CT Neck thorax and abdomer	1		Topo NTA	3
20	Abdomen^AbdoIntervention_Nicos (Adult)	1		CT Head thorax abdomen wit	1		CTPA	3
21	Abdomen^Abdomen_PV (Adult)	1		CT Head neck thorax abdome	1		Head Pre Con	3
22	Thorax^Routine_TAP_PostCon_BrainSeq (Adult)	1		CT Neck thorax and abdomer	1		Head Post Con	3
23	Thorax^CTPA_AbdoPel_PV (Adult)	1		CT Abdomen with contrast	1		HeadSeq	2
24	Head^Routine_Brain_Pre_and_Post_Plus_TAPSeq (Adult)	1					AbdoPelvis_PV	1
25	Thorax^TA_PVPlus_PostCon_Brain (Adult)	1					Head Pre	1
26							Abdomen	1
27							Head Post C	1
28							Art_Liver	1
29								
30								

Summary / All data / abdopelvis / abdopelvis_pv / abdomen / art_liver / ctpa / head_post_c / head_post_con / hea

This information is useful for seeing what data is in the spreadsheet, and can also be used to prioritise which studies or protocols to analyse based on frequency.

The second sheet of the exported file lists all the studies, with each study taking one line and each series in the study displayed in the columns to the right.



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y
1	Institu	Manuf	Model	Statio	Access	Opera	Study da	Patien	Patien	Patien	Te	Study	Reque	Numb	DLP to	E1 Prot	E1 Typ	E1 Exp	E1 Sca	E1 Slic	E1 Tot	E1 Pitc	E1 No.	E1 CTD	E1 DLP
2	[redacted]	SIEMENS	SOMATON	CTAW	[redacted]	[redacted]	07/02/2014	[redacted]	[redacted]	[redacted]		Thorax^T/	CT Thorax	4	544.76	Topogran	Constant	7.26	713	0.6	3.6	None	1	0.13	9
3	[redacted]	SIEMENS	SOMATON	CTAW	[redacted]	[redacted]	07/02/2014	[redacted]	[redacted]	[redacted]		Thorax^Th	CT Guidec	4	312.24	Topogran	Constant	4.38	425	0.6	3.6	None	1	0.13	5
4	[redacted]	SIEMENS	SOMATON	CTAW	[redacted]	[redacted]	07/02/2014	[redacted]	[redacted]	[redacted]		Abdomen	CT Abdom	4	408.35	Topogran	Constant	5.27	514	0.6	3.6	None	1	0.13	6
5	[redacted]	SIEMENS	SOMATON	CTAW	[redacted]	[redacted]	07/02/2014	[redacted]	[redacted]	[redacted]		Thorax^T/	CT Thorax	5	357.5	Topogran	Constant	7.02	689	0.6	3.6	None	1	0.13	9
6	[redacted]	SIEMENS	SOMATON	CTAW	[redacted]	[redacted]	07/02/2014	[redacted]	[redacted]	[redacted]		Thorax^T/	CT Thorax	4	1068.5	Topogran	Constant	7.82	770	0.6	3.6	None	1	0.13	10
7	[redacted]	SIEMENS	SOMATON	CTAW	[redacted]	[redacted]	07/02/2014	[redacted]	[redacted]	[redacted]		Thorax^T/	CT Thorax	4	614.97	Topogran	Constant	6.94	682	0.6	3.6	None	1	0.13	9
8	[redacted]	SIEMENS	SOMATON	CTAW	[redacted]	[redacted]	07/02/2014	[redacted]	[redacted]	[redacted]		Thorax^T/	CT Thorax	4	628.79	Topogran	Constant	6.72	659	0.6	3.6	None	1	0.13	8
9	[redacted]	SIEMENS	SOMATON	CTAW	[redacted]	[redacted]	07/02/2014	[redacted]	[redacted]	[redacted]		Thorax^T/	CT Thorax	4	1202.3	Topogran	Constant	7.6	747	0.6	3.6	None	1	0.13	10
10	[redacted]	SIEMENS	SOMATON	CTAW	[redacted]	[redacted]	07/02/2014	[redacted]	[redacted]	[redacted]		Thorax^C	CT Angiog	5	876.26	Topogran	Constant	7.64	751	0.6	3.6	None	1	0.13	10
11	[redacted]	SIEMENS	SOMATON	CTAW	[redacted]	[redacted]	07/02/2014	[redacted]	[redacted]	[redacted]		Thorax^T/	CT Thorax	4	521.58	Topogran	Constant	6.83	671	0.6	3.6	None	1	0.13	9
12	[redacted]	SIEMENS	SOMATON	CTAW	[redacted]	[redacted]	07/02/2014	[redacted]	[redacted]	[redacted]		Thorax^T/	CT Head t	6	1196.97	Topogran	Constant	5.79	565	0.6	3.6	None	1	0.13	7
13	[redacted]	SIEMENS	SOMATON	CTAW	[redacted]	[redacted]	10/02/2014	[redacted]	[redacted]	[redacted]		Thorax^T/	CT Thorax	4	1201.65	Topogran	Constant	6.88	675	0.6	3.6	None	1	0.13	
14	[redacted]	SIEMENS	SOMATON	CTAW	[redacted]	[redacted]	10/02/2014	[redacted]	[redacted]	[redacted]		Thorax^T/	CT Thorax	2	832.89	Topogran	Constant	7.82	770	0.6	3.6	None	1	0.13	10
15	[redacted]	SIEMENS	SOMATON	CTAW	[redacted]	[redacted]	10/02/2014	[redacted]	[redacted]	[redacted]		Abdomen	CT Abdom	4	853.13	Topogran	Constant	5.26	513	0.6	3.6	None	1	0.13	6
16	[redacted]	SIEMENS	SOMATON	CTAW	[redacted]	[redacted]	10/02/2014	[redacted]	[redacted]	[redacted]		Thorax^T/	CT Thorax	4	441.07	Topogran	Constant	7	687	0.6	3.6	None	1	0.13	9
17	[redacted]	SIEMENS	SOMATON	CTAW	[redacted]	[redacted]	10/02/2014	[redacted]	[redacted]	[redacted]		Thorax^T/	CT Thorax	4	808.21	Topogran	Constant	7.71	759	0.6	3.6	None	1	0.13	10
18	[redacted]	SIEMENS	SOMATON	CTAW	[redacted]	[redacted]	10/02/2014	[redacted]	[redacted]	[redacted]		Thorax^Th	CT Guidec	4	194.03	Topogran	Constant	3.35	321	0.6	3.6	None	1	0.13	4
19	[redacted]	SIEMENS	SOMATON	CTAW	[redacted]	[redacted]	10/02/2014	[redacted]	[redacted]	[redacted]		Thorax^T/	CT Thorax	4	457.26	Topogran	Constant	7.51	738	0.6	3.6	None	1	0.13	9
20	[redacted]	SIEMENS	SOMATON	CTAW	[redacted]	[redacted]	10/02/2014	[redacted]	[redacted]	[redacted]		Thorax^T/	CT Thorax	4	856.24	Topogran	Constant	7.17	706	0.6	3.6	None	1	0.13	9
21	[redacted]	SIEMENS	SOMATON	CTAW	[redacted]	[redacted]	10/02/2014	[redacted]	[redacted]	[redacted]		Head^Ro	CT Head t	8	2133.57	Topogran	Constant	2.15	202	0.6	3.6	None	1	0.29	5
22	[redacted]	SIEMENS	SOMATON	CTAW	[redacted]	[redacted]	10/02/2014	[redacted]	[redacted]	[redacted]		Thorax^R	CT Head t	6	1798.71	Topogran	Constant	7.19	706	0.6	3.6	None	1	0.13	9
23	[redacted]	SIEMENS	SOMATON	CTAW	[redacted]	[redacted]	11/02/2014	[redacted]	[redacted]	[redacted]		Thorax^T/	CT Thorax	4	1458.84	Topogran	Constant	7.04	692	0.6	3.6	None	1	0.13	9
24	[redacted]	SIEMENS	SOMATON	CTAW	[redacted]	[redacted]	11/02/2014	[redacted]	[redacted]	[redacted]		Thorax^T/	CT Thorax	4	876.91	Topogran	Constant	7.47	733	0.6	3.6	None	1	0.13	9
25	[redacted]	SIEMENS	SOMATON	CTAW	[redacted]	[redacted]	11/02/2014	[redacted]	[redacted]	[redacted]		Thorax^T/	CT Thorax	4	781.3	Topogran	Constant	6.42	630	0.6	3.6	None	1	0.13	
26	[redacted]	SIEMENS	SOMATON	CTAW	[redacted]	[redacted]	11/02/2014	[redacted]	[redacted]	[redacted]		Thorax^T/	CT Thorax	5	2068.53	Topogran	Constant	8.55	842	0.6	3.6	None	1	0.13	11
27	[redacted]	SIEMENS	SOMATON	CTAW	[redacted]	[redacted]	11/02/2014	[redacted]	[redacted]	[redacted]		Neck^Nec	CT Neck a	6	521.18	Topogran	Constant	6.15	602	0.6	3.6	None	1	0.13	8
28	[redacted]	SIEMENS	SOMATON	CTAW	[redacted]	[redacted]	11/02/2014	[redacted]	[redacted]	[redacted]		Thorax^T/	CT Thorax	4	822.38	Topogran	Constant	6.12	600	0.6	3.6	None	1	0.13	8
29	[redacted]	SIEMENS	SOMATON	CTAW	[redacted]	[redacted]	11/02/2014	[redacted]	[redacted]	[redacted]		Thorax^T/	CT Thorax	4	884.83	Topogran	Constant	7.56	744	0.6	3.6	None	1	0.13	10
30	[redacted]	SIEMENS	SOMATON	CTAW	[redacted]	[redacted]	11/02/2014	[redacted]	[redacted]	[redacted]		Abdomen	CT Abdom	2	111.12	Topogran	Constant	4.72	460	0.6	3.6	None	1	0.13	
31	[redacted]	SIEMENS	SOMATON	CTAW	[redacted]	[redacted]	11/02/2014	[redacted]	[redacted]	[redacted]		Thorax^Th	CT Thorax	4	209.03	Topogran	Constant	4.04	391	0.6	3.6	None	1	0.13	5
32	[redacted]	SIEMENS	SOMATON	CTAW	[redacted]	[redacted]	11/02/2014	[redacted]	[redacted]	[redacted]		Abdomen	CT Abdom	4	795.03	Topogran	Constant	5.26	514	0.6	3.6	None	1	0.13	6
33	[redacted]	SIEMENS	SOMATON	CTAW	[redacted]	[redacted]	11/02/2014	[redacted]	[redacted]	[redacted]		Abdomen	CT Abdom	4	666.28	Topogran	Constant	5.12	499	0.6	3.6	None	1	0.13	6
34	[redacted]	SIEMENS	SOMATON	CTAW	[redacted]	[redacted]	11/02/2014	[redacted]	[redacted]	[redacted]		Abdomen	CT Guidec	4	308.74	Topogran	Constant	4.76	463	0.6	3.6	None	1	0.13	6
35	[redacted]	SIEMENS	SOMATON	CTAW	[redacted]	[redacted]	11/02/2014	[redacted]	[redacted]	[redacted]		Abdomen	CT Abdom	5	1482.01	Topogran	Constant	4.96	485	0.6	3.6	None	1	0.13	6

Summary / All data / abdopelvis / abdopelvis_pv / abdomen / art_liver / ctpa / head_post_c / head_post_con / hea

The remainder of the file has one sheet per series protocol name. Each series is listed one per line. If a single study has more than one series with the same protocol name, then the same study will appear on more than one line.

CHAPTER 4

Upgrade instructions

4.1 Upgrading from tar.gz package

Note: Make sure you have setup South before you upgrade – see *7. Convert the database to use South* for details.

4.1.1 Code upgrade

1. `pip install OpenREM-version.tar.gz`

4.1.2 Database migration

Always do a database migration using South after an upgrade in case any of the database models have changed. This will normally not be the case.

1. **`python path/to/openrem/manage.py schemamigration --auto remapp`** eg
   ```
   python lib/python2.7/site-packages/openrem/manage.py schemamigration --auto remapp
   ```
2. If response to the last command is 'Nothing seems to have changed', no migration is required. Else, follow the instructions to migrate.

4.1.3 Restart the web server

1. Restart the web server to enable any changes that have been made to the web interface.

Documentation for the OpenREM code

Contents:

5.1 DICOM import modules

5.1.1 RDSR module

Ultimately this should be the only module required as it deals with all Radiation Dose Structured Reports. Currently this has only been tested on CT and fluoroscopy structured reports, but it also has the logic for mammography structured reports if they start to appear.

`remapp.extractors.rdsr.`**`rdsr`**`(`*rdsr_file*`)`

Extract radiation dose related data from DICOM Radiation SR objects.

Parameters **filename** (*str.*) – relative or absolute path to Radiation Dose Structured Report.

Tested with:

- CT: Siemens, Philips and GE RDSR, GE Enhanced SR.
- Fluoro: Siemens Artis Zee RDSR

5.1.2 Mammography module

Mammography is interesting in that all the information required for dose audit is contained in the image header, including patient 'size', ie thickness. However the disadvantage over an RSDR is the requirement to process each individual image rather than a single report for the study, which would also capture any rejected images.

`remapp.extractors.mam.`**`mam`**`(`*mg_file*`)`

Extract radiation dose structured report related data from mammography images

Parameters **filename** (*str.*) – relative or absolute path to mammography DICOM image file.

Tested with:

- GE Senographe DS software versions ADS_43.10.1 and ADS_53.10.10 only.
- Limited testing: GE Senographe Essential
- Limited testing: Hologic Selenia
- Limited testing: Siemens Inspiration

5.1.3 CT non-standard modules

Initially only Philips CT dose report images are catered for. These have all the information that could be derived from the images also held in the DICOM header information, making harvesting relatively easy.

`remapp.extractors.ct_philips.`**`ct_philips`**`(`*philips_file*`)`

Extract radiation dose structured report related data from Philips CT dose report images

Parameters **filename** (*str.*) – relative or absolute path to Philips CT dose report DICOM image file.

Tested with:

- Philips Gemini TF PET-CT v2.3.0
- Brilliance BigBore v3.5.4.17001.

5.2 Non-DICOM import modules

5.2.1 Patient height and weight csv import module

This module enables a csv file to be parsed and the height and weight information extracted and added to existing studies in the OpenREM database. An example may be a csv extract from a RIS or EPR system.

There needs to be a common unique identifier for the exam - currently this is limited to accession number or study instance UID.

`remapp.extractors.ptsizecsv2db.`**`csv2db`**`(`**args*, ***kwargs*`)`

Import patient height and weight data from csv RIS exports. Can be called from `openrem_ptsizecsv.py` script

Parameters

- **–si-uid** (*bool*) – Use Study Instance UID instead of Accession Number. Short form -s.
- **csvfile** (*str*) – relative or absolute path to csv file
- **id** (*str*) – Accession number column header or header if -u or –si-uid is set. Quote if necessary.
- **height** (*str*) – Patient height column header. Create if necessary, quote if necessary.
- **weight** (*str*) – Patient weight column header. Create if necessary, quote if necessary.

Example:

```
openrem_ptsizecsv.py -s MyRISExport.csv StudyInstanceUID HEIGHT weight
```

5.3 Export from database

5.3.1 Multi-sheet Microsoft Excel XLSX exports

This export has a summary sheet of all the requested and performed protocols and the series protocols. The next sheet has all studies on, one study per line, with the series stretching off to the right. The remaining sheets are specific to each series protocol, in alphabetical order, with one series per line. If one study has three series with the same protocol name, each one has a line of its own.

`remapp.exports.xlsx.`**`ctxlsx`**`(`*request*`)`

Export filtered CT database data to multi-sheet Microsoft XSLX files.

Parameters **request** (*HTTP get*) – Query parameters from the CT filtered page URL.

5.3.2 Single sheet CSV exports

`remapp.exports.exportcsv.`**`exportFL2excel`**`(`*request*`)`

Export filtered fluoro database data to a single-sheet CSV file.

Parameters **request** (*HTTP get*) – Query parameters from the fluoro filtered page URL.

`remapp.exports.exportcsv.`**`exportCT2excel`**`(`*request*`)`

Export filtered CT database data to a single-sheet CSV file.

Parameters **request** (*HTTP get*) – Query parameters from the CT filtered page URL.

`remapp.exports.exportcsv.`**`exportMG2excel`**`(`*request*`)`

Export filtered mammography database data to a single-sheet CSV file.

Parameters **request** (*HTTP get*) – Query parameters from the mammo filtered page URL.

5.4 Tools and helper modules

5.4.1 OpenREM settings

Administrative module to define the name of the project and to add it to the Python path

`remapp.extractors.openrem_settings.`**`name_of_project`**`()`

Returns the name of the project. Default OpenREM

`remapp.extractors.openrem_settings.`**`add_project_to_path`**`()`

Add project to path, assuming this file is within project

5.4.2 Get values

Tiny modules to reduce repetition in the main code when extracting information from DICOM headers using pydicom.

`remapp.tools.get_values.`**`get_value_kw`**`(`*tag*, *dataset*`)`

Get DICOM value by keyword reference.

Parameters

- **keyword** (*str.*) – DICOM keyword, no spaces or plural as per dictionary.
- **dataset** (*dataset*) – The DICOM dataset containing the tag.

Returns str. – value

`remapp.tools.get_values.`**`get_value_num`**`(`*tag*, *dataset*`)`

Get DICOM value by tag group and element number.

Always use get_value_kw by preference for readability. This module can be required when reading private elements.

Parameters

- **tag** (*hex*) – DICOM group and element number as a single hexadecimal number (prefix 0x).
- **dataset** (*dataset*) – The DICOM dataset containing the tag.

Returns str. – value

`remapp.tools.get_values.`**`get_seq_code_value`**(*sequence*, *dataset*)
From a DICOM sequence, get the code value.

Parameters

- **sequence** (*DICOM keyword, no spaces or plural as per dictionary.*) – DICOM sequence name.
- **dataset** (*DICOM dataset*) – The DICOM dataset containing the sequence.

Returns int. – code value

`remapp.tools.get_values.`**`get_seq_code_meaning`**(*sequence*, *dataset*)
From a DICOM sequence, get the code meaning.

Parameters

- **sequence** (*DICOM keyword, no spaces or plural as per dictionary.*) – DICOM sequence name.
- **dataset** (*DICOM dataset*) – The DICOM dataset containing the sequence.

Returns str. – code meaning

`remapp.tools.get_values.`**`get_or_create_cid`**(*codevalue*, *codemeaning*)
Create a code_value code_meaning pair entry in the Content_item_descriptions table if it doesn't already exist.

Parameters

- **codevalue** (*int.*) – Code value as defined in the DICOM standard part 16
- **codemeaning** – Code meaning as defined in the DICOM standard part 16

Returns Content_item_descriptions entry for code value passed

5.4.3 Check if UID exists

Small module to check if UID already exists in the database.

`remapp.tools.check_uid.`**`check_uid`**(*uid*, *level='Study'*)
Check if UID already exists in database.

Parameters **uid** (*str.*) – Study UID.

Returns 1 if it does exist, 0 otherwise

5.4.4 DICOM time and date values

Module to convert betweeen DICOM and Python dates and times.

`remapp.tools.dcmdatetime.`**`get_date`**(*tag*, *dataset*)
Get DICOM date string and return Python date.

Parameters

- **tag** (*str.*) – DICOM keyword, no spaces or plural as per dictionary.

- **dataset** (*dataset*) – The DICOM dataset containing the tag.

Returns Python date value

`remapp.tools.dcmdatetime.`**`get_time`**(*tag*, *dataset*)

Get DICOM time string and return Python time.

Parameters

- **tag** (*str.*) – DICOM keyword, no spaces or plural as per dictionary.
- **dataset** (*dataset*) – The DICOM dataset containing the tag.

Returns python time value

`remapp.tools.dcmdatetime.`**`get_date_time`**(*tag*, *dataset*)

Get DICOM date time string and return Python date time.

Parameters

- **tag** (*str.*) – DICOM keyword, no spaces or plural as per dictionary.
- **dataset** (*dataset*) – The DICOM dataset containing the tag.

Returns Python date time value

`remapp.tools.dcmdatetime.`**`make_date`**(*dicomdate*)

Given a DICOM date, return a Python date.

Parameters **dicomdate** (*str.*) – DICOM style date.

Returns Python date value

`remapp.tools.dcmdatetime.`**`make_time`**(*dicomtime*)

Given a DICOM time, return a Python time.

Parameters **dicomdate** (*str.*) – DICOM style time.

Returns Python time value

`remapp.tools.dcmdatetime.`**`make_date_time`**(*dicomdatetime*)

Given a DICOM date time, return a Python date time.

Parameters **dicomdate** (*str.*) – DICOM style date time.

Returns Python date time value

5.4.5 Test for QA or other non-patient related studies

`remapp.tools.not_patient_indicators.`**`get_not_pt`**(*dataset*)

Looks for indications that a study might be a test or QA study.

Some values that might indicate a study was for QA or similar purposes are not recorded in the database, for example patient name. Therefore this module attempts to find such indications and creates an xml style string that can be recorded in the database.

Parameters **dataset** (*dataset*) – The DICOM dataset.

Returns str. – xml style string if any trigger values are found.

5.5 Models

5.6 Filtering code

5.7 Indices and tables

- *genindex*
- *modindex*
- *search*

Note: OpenREM does not currently include a DICOM Store SCP, ie you will need to install a DICOM store server in order to send RSDRs or other DICOM files from modalities.

If you have no preference, Conquest is recommended as a free, open source, scriptable DICOM server. Please note though that you will need to include the RSRD SOP in the dgatesop.lst file.

CHAPTER 6

Indices and tables

- *genindex*
- *modindex*
- *search*