

NEW SOFTWARE FOR THE DOSIMETRY IN THE RADIOIODINE THERAPY

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INTRODUCTION

PTKManager is software intended for a fast implementation of experimental algorithms and tools to a clinically usable form. The main goal was to develop an environment that would be

- user friendly and reliable for users,
- flexible and extensible for developers.

A set of plugins that process and store the data from the radioiodine therapy in the form of NEMA DICOM¹ Structured Reports was developed for this application.

DESCRIPTION MAIN WINDOW

The main window was designed as a datasets browser at DICOM defined levels: study, series, dataset/instance. Local data lists are extracted directly from DICOM files stored in a selected directory: no index files or a specific directory structure is demanded. Remote dataset list is received using C-FIND service. Data can be transferred from local database to remote SCP and vice versa using C-GET, C-STORE or C-MOVE. Local data can be loaded to the user-defined processing workflows.

PatientID	StudyDate	SeriesTime	SeriesDescription
Anonymous*000	20180611	122716	Dosimetric Measurements
Anonymous*002	20180611	122856	Dosimetric Measurements
Anonymous*004	20180611	124201	Dosimetric Measurements
Anonymous*005	20180611	141332	Dosimetric Measurements
Anonymous*006	20180611	145444	Dosimetric Measurements

WORKFLOW MANAGER

The processing workflow consists of various functions. Each function is represented by a XML header and a dynamically loadable library (dll) and can be inserted to the workflow as a plugin. Input and output parameters to these plugin functions are passed as pointers so that the functions may pass any type of data to each other.

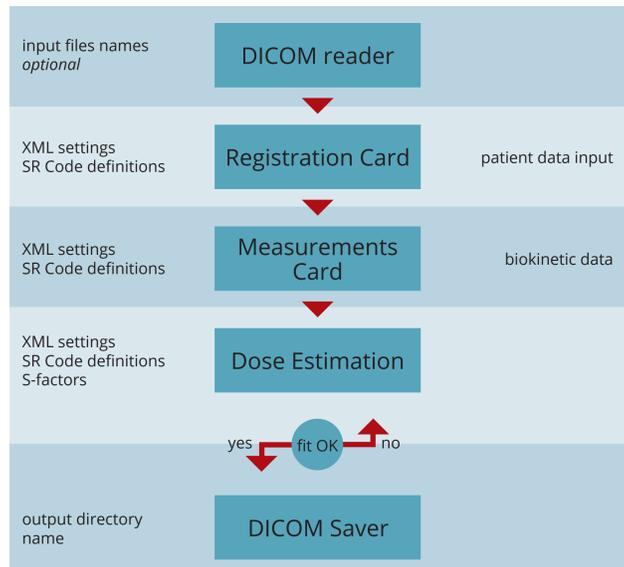
DOSIMETRIC WORKFLOW PROTOCOL

- a protocol for the data processing of dosimetric measurements compliant to the EANM guidelines^{2,3};

LITERATURE

- 1 NEMA PS3 / ISO 12052, Digital Imaging and Communications in Medicine (DICOM) Standard, National Electrical Manufacturers Association, Rosslyn, VA, USA (available free at <http://medical.nema.org/>)
- 2 EANM Dosimetry Committee guidelines for bone marrow and whole-body dosimetry. Hindorf C, Glatting G, Chiesa C, Lindén O, Flux G; EANM Dosimetry Committee. Eur J Nucl Med Mol Imaging. 2010 Jun; 37(6):1238-50
- 3 EANM Dosimetry Committee series on standard operational procedures for pre-therapeutic dosimetry II. Dosimetry prior to radioiodine therapy of benign thyroid diseases. Häscheid H1, Canzi C, Eschner W, Flux G, Luster M, Strigari L, Lassmann M. Eur J Nucl Med Mol Imaging. 2013 Jul; 40(7):1126-34
- 4 OFFIS DCMTK - DICOM Toolkit. <https://dicom.offis.de/dcmkt.php/en>
- 5 ROOT - An Object Oriented Data Analysis Framework, Proceedings ALHNP'96 Workshop, Lausanne, Sep. 1996, Nucl. Inst. & Meth. in Phys. Res. A 389 (1997) 81-86. <http://root.cern.ch/>
- 6 <http://www.fltk.org/>

CONFIGURATION



USER INTERACTION

- the protocol may be extended or simplified to fit local needs;
- all the settings are stored in XML files;
- patient data can be loaded from any DICOM file;
- the data is stored in three separate DICOM files;

DICOM READER AND SAVER PLUGINS

- plugins for reading files to a DCMTK⁴ DcmFileFormat objects and storing them to a file

REGISTRATION CARD PLUGIN

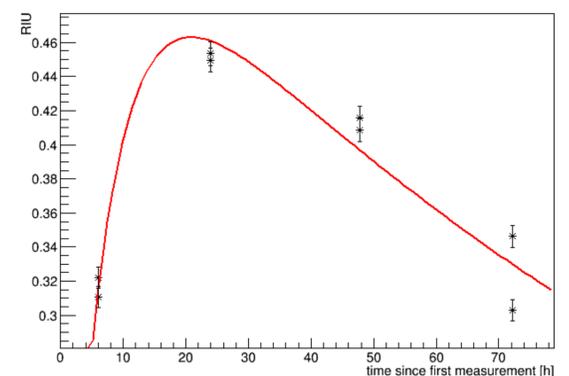
- a plugin that generates a DCMTK⁴ DcmFileFormat object from a XML file and an interactive graphical user interface;
- any change of the SOP Class, the SR Template or their extensions by private tags can be done modifying the XML settings file only;
- Structured Report sequence tags can be set in a simplified syntax referencing Code Meaning only, keeping all the used code definitions in a separate file;
- Radiopharmaceutical Radiation Dose Structured Report SOP Class is produced by default;

MEASUREMENTS CARD PLUGIN

- an extension to the Registration Card plugin for measurements data storage;
- attenuation correction by geometric mean calculation, dead time correction, background correction and statistical error estimation are available;
- Measurement Structured Report is produced by default;

DOSE ESTIMATION PLUGIN

- an extension to the Registration Card plugin for RIU curve, residence time and dose in target tissue estimation;
- uses data from Radiopharmaceutical Radiation Dose SR and Measurements SR ;
- various fitting methods as well as the fitted functions can be set at the ROOT⁵ Fit Panel;
- S-factors are defined in a separate XML file for easy updates;
- Patient Radiation Dose Structured Report is produced by default;



SUMMARY

PTKManager with the Dosimetric Workflow Protocol is a highly flexible tool for processing and storing dosimetric measurements into DICOM datasets. The software was built using the DCMTK⁴ and FLTK⁶ projects libraries, the Dose Estimation Plugin in addition depends on the ROOT⁵ framework. All the presented software is available under the open source licence GPL at <https://sourceforge.net/projects/ptkmanager/>.

