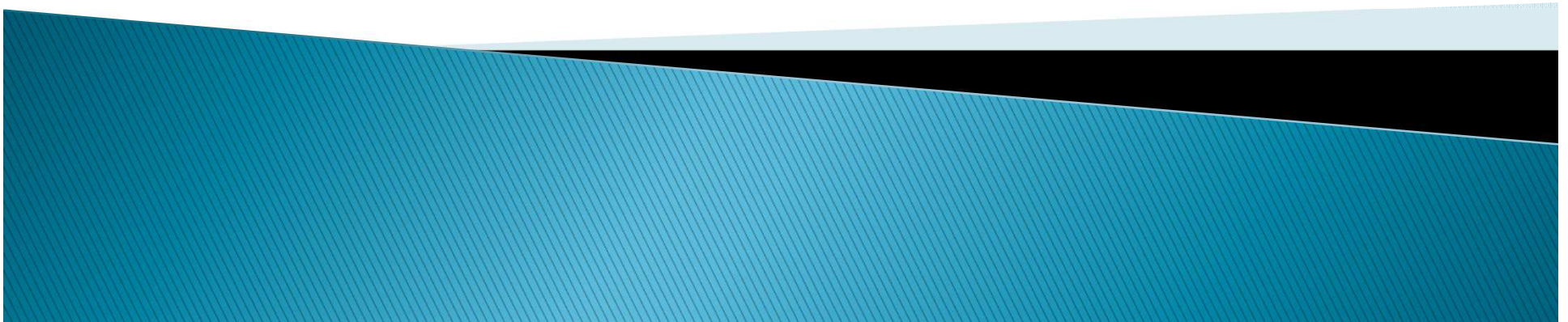


*Summary BRAPHYQS
Questionnaire on
Interconnectivity
of Brachytherapy Treatment
Planning Systems*

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BRAPHYQS

ESTRO 

EUROPEAN SOCIETY FOR
RADIOTHERAPY & ONCOLOGY

BRAPHYQS

*BR*achytherapy *PHYS*ics *Q*uality *ass*urances *S*ystem

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BRAPHYQS / Probate work packages

(WP1+2) Dose delivery audit, Geometric reconstruction audit (completed)

(WP3) QA recommendations (completed)

(WP4) TG43 website

(WP5) Calibration for LDR and HDR

(WP6) Prostate survey of practices (completed)

(WP7) Phantom studies for physics part

(WP8) Evaluation of clinical part (completed)

(WP9) New recommendations

(WP10) DVH calculation evaluation (completed)

(WP11) Physics data on radiation protection

(WP12) QA for prostate implant dosimetry in LDR and HDR

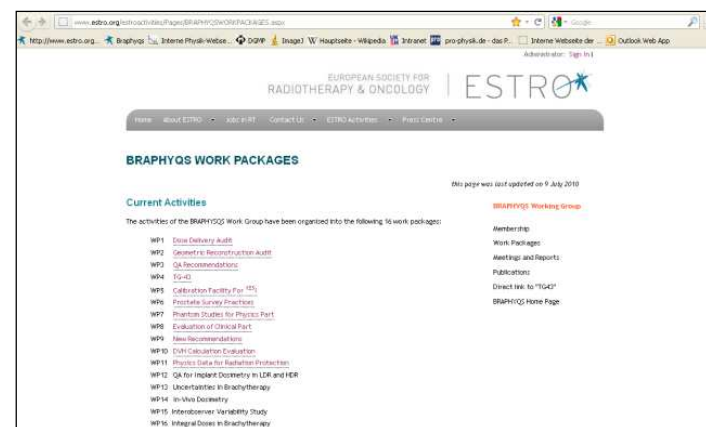
(WP13) Uncertainties in Brachytherapy

(WP14) In-Vivo dosimetry

(WP15) Interobserver variability study

(WP16) Integral doses in BT

Dicom standard in Brachytherapy



BRAPHYQS web page can be found at www.estro.org

Introduction

Brachytherapy treatment planning systems (BTPSs) of different manufacturers contain different DICOM import/export options.

- Common properties such as RTPlan and RTDose
- Additional properties, like structure sets defining the catheters, dose normalization and prescription, isodose lines etc.

Questionnaire on interconnectivity of BTPSs.

- To assess the need for analysis and/or comparison of treatment plans generated by different centers.

Why is the current DICOM export/import not suitable for treatment plan exchange

- ▶ **The common DICOM properties available today are aimed at reporting treatment plans**, not at interconnecting planning systems of different manufacturers.
- ▶ **Dose calculation data**, such as the AAPM TG43 source data and the source calibration data, **are not part of the DICOM export/import files.**
- ▶ **Source channel data**, such as applicator and catheters, **are not part of the DICOM export/import files.**
- ▶ **Normalization of dose distributions** (which dose value to prescribe on) **differs considerably between BTPSs of different vendors.**

Questionnaire on required options for DICOM export/import

1) Exported DICOM Treatment Plan (dose distribution, dwell positions, treatment times).

The information currently available in a DICOM export file as common properties. Note that some BTPSs transfer applicator or catheter structures as additional properties.

2) Exported DICOM Treatment Plan with ROIs and catheters.

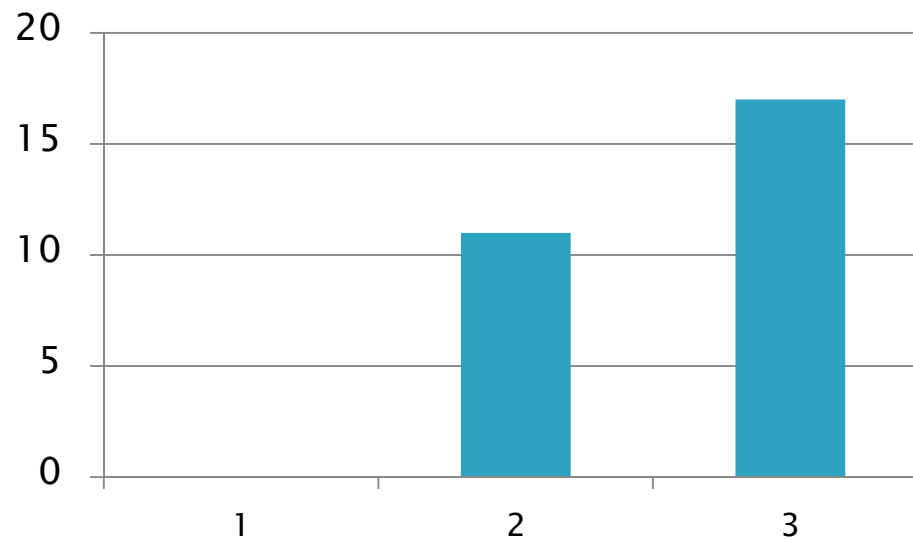
TP data plus source channel information such as applicator or catheters. Currently, the option in a BTPS to read a DICOM export file must be adapted to a specific planning system to read these additional properties from the structure sets in the DICOM export file.

3) Imported and recalculated complete DICOM Plan.

Complete set of treatment planning data to recalculate the dose distributions and to report the treatment plan data. The dose distribution will be recalculated using the TG43 data set of the BTPS.

Results of Dicom questionnaire

- ▶ Replies 10 centers, with opinion of 17 physicists
- ▶ 1: 0 vote (Exported DICOM Treatment Plan)
- ▶ 2: 11 votes (Exported DICOM Treatment Plan with ROIs and catheters)
- ▶ 3: 14 votes (Imported and recalculated complete DICOM Plan)
- ▶ (some returned two votes)



Major DICOM wish list items from the questionnaires

- ▶ For **clinical brachy trial QA** option 2 is needed for the dose values exported as planned .
- ▶ For **independent brachy review** software , which may be on another TPS, option 3 is needed.
- ▶ For **multi-institution protocols** option 3 is needed to export to a reference brachy TPS. Then recalculate and compare in order to draw valid conclusions. **Bench marking and QA of dose calculation engines.**
- ▶ For complete **transfer of brachy treatment plan to an external beam TPS** option 3 is needed. For **addition of brachy and external beam treatment plans.**
- ▶ **Source channel information** (applicators, catheters) .
- ▶ **Characteristics of dose and DVH data** – any set maximum dose, whether or not dose within the applicator/catheters is calculated/included.

Summary

According to the returned questionnaires:

Options **2) Exported DICOM Treatment Plan with ROIs and catheters** and **3) Imported and recalculated complete DICOM Plan** are **both needed**.

“..., so that brachy plans could be shared and compared between different manufacturers for intercomparison between vendors, for protocol development and for the addition of external beam and brachy plans.”

Take into account newest developments in BTPSs, like Model-based dose calculation algorithms...

Comments on returned questionnaires

- ▶ AAPM–ESTRO recommendations and RTOG clinical trial mandatory requirements for the sources require that all BTPSs should be based on the same consensus TG43 data sets. Differences between option 2 and 3 are then minor, differences in interpolation, fitting etc.
- ▶ ROIs are essential for reporting of / prescribing to doses to organ / target contours.
- ▶ For multi–institution protocols, treatment plans, including applicator geometry, should be recalculated on a reference BTPS using option 3, for comparison to draw valid conclusions.
- ▶ Option 3 is essential for complete transfer of brachy treatment plan to external beam TPS.
- ▶ When exporting and then importing, do not renormalise the plan but keep dwell times and source strength to the exported value. (Added by RvdL: Thus export also source calibration data, Reference Air Kerma rate on date of dose cube calculation.)
- ▶ Export /import of:
 - source channels
 - applicator (manufacturer, device reference, geometric info, material)
 - catheters, needles)
 - image fusion
 - source type, Reference Air Kerma Rate on date of dose calc.
 - afterloader type

Comments on returned questionnaires

- ▶ TPS uses the contours in individual slices to inter/extrapolate a 3D volume out of it. This means that the same contours, even transferred via DICOM, result in different DVH (see BRAPHYQS DVH paper).
- ▶ The 3D anatomy set and the dwell position info (source positions, source directions) should all be relative to the same (DICOM) origin, in order to validate the reconstruction accuracy.
- ▶ If registration between different image modalities was performed, the registration coordinates (vectors) should be part of the DICOM transfer in order to reproduce these when importing a study via DICOM.
- ▶ DICOM export data should allow for benchmarking and QA, especially for dose calculation engines beyond TG-43.