ESTRO 2016 GHG

TROG Report

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TROG activities overview

- Policy for Cyberknife credentialing developed
- Dosimetry audits:
  - VESPA (Peter Greer)
  - Mailable phantom – Tomas Kron project for SAFRON-II and RAIDER
  - SRS – Discussions with RTTQA; hidden target test audits as recommended by Solberg and others (Kim et al., 2012; Solberg et al., 2008; Solberg et al., 2014). Robin Hill
- Flattening Filter Free credentialing procedures to be developed
- Data storage & transfer challenges (e.g. SPARK and associated KIM data); file sizes up to 140 Gb per patient resulting in functionality upgrades to CQMS for data upload.
- Secondary analysis is a key strategic direction – over 3000 RT plan exports are held centrally and discussions are underway re: potential projects

The problem of external dosimetry audits

- TROG has 75 recruiting centres
- ~52 centres want to use IMRT in trials
  - **19 (37%)** have a current IMRT external audit (last 5 years)
- ~30 centres want to use VMAT in trials
  - **10 (33%)** have a current VMAT external audit (last 5 years)

VESPA - Aims

- Virtual Epid Standard Phantom Audit
- Develop and implement a Level II dosimetry audit that can address TROG auditing IMRT/VMAT needs:
  - Low cost
  - Efficient
  - Standardised

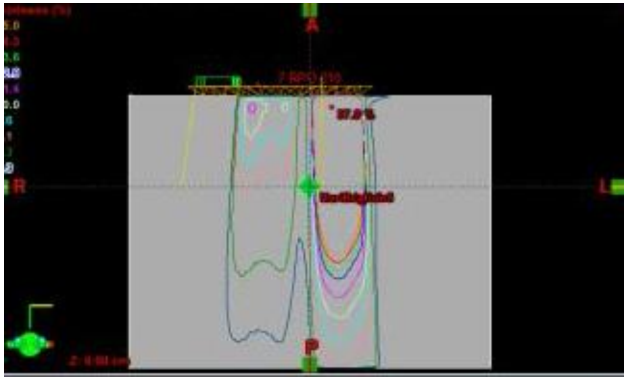
Slides courtesy Peter Greer

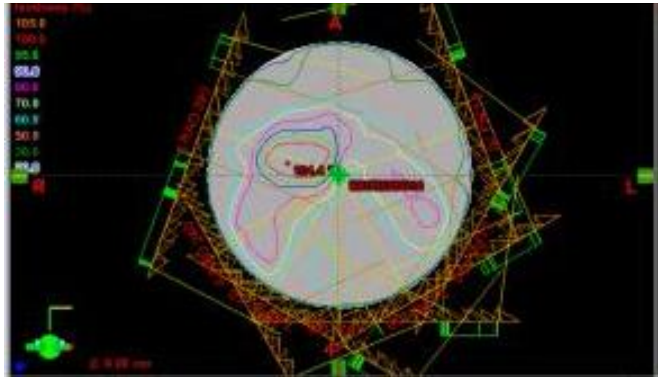
VESPA Model

1. Centre generates HPV and RAVES benchmark plans on standard patient CT datasets provided by TROG

VESPA Model

2. Centre transfers plan to "virtual standard phantoms" (CT datasets) provided. Flat water equivalent phantom field-by-field. Cylindrical water-equivalent phantom for composite 3D dose

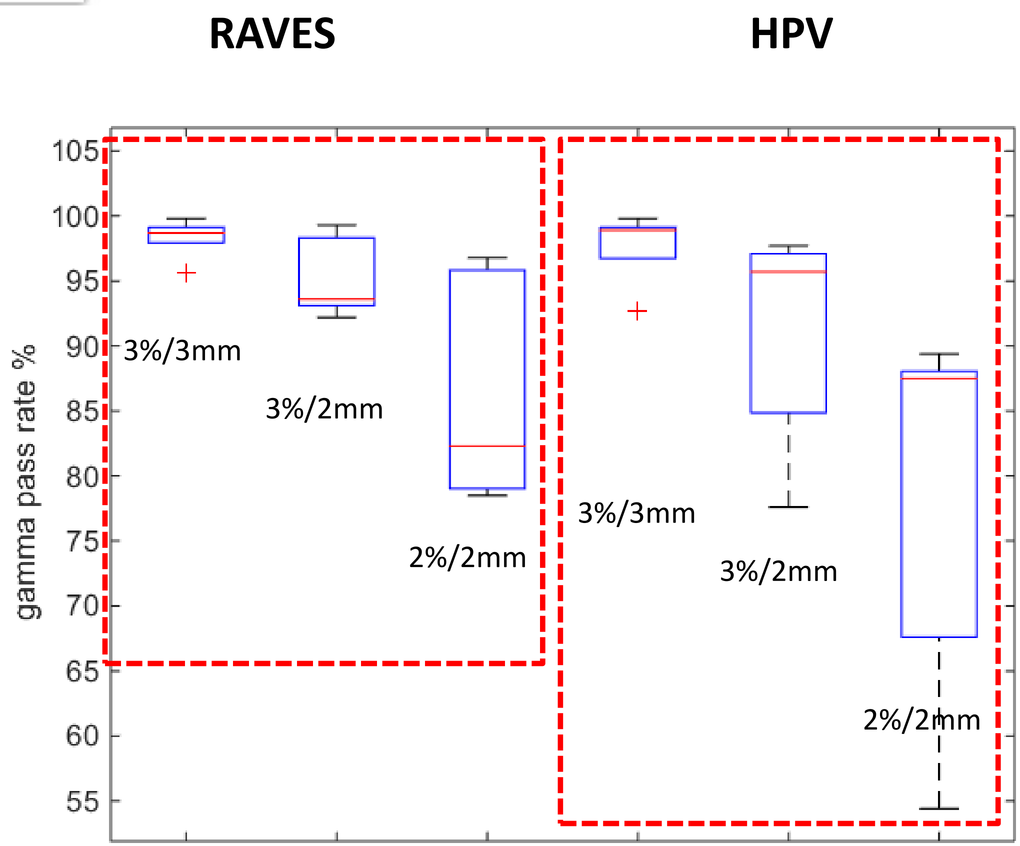




VESPA Model

3. Centre delivers plan in-air to EPID. No phantoms present. Also set of test and calibration fields.

Results – combined field gamma (3D)



And for VMAT……

- Uses same procedure and instructions as IMRT audit but requires EPID cine-imaging.
- Each image captures a small sub-arc of the delivery (few degrees).
- Only Varian at the moment
- Elekta VMAT procedure still in development (close), is more technically difficult

VESPA

- IMRT: 18 centres invited, 12 received data, 6 reports sent.
- VMAT: 10 centres invited, 6 received data, 3 reports sent.

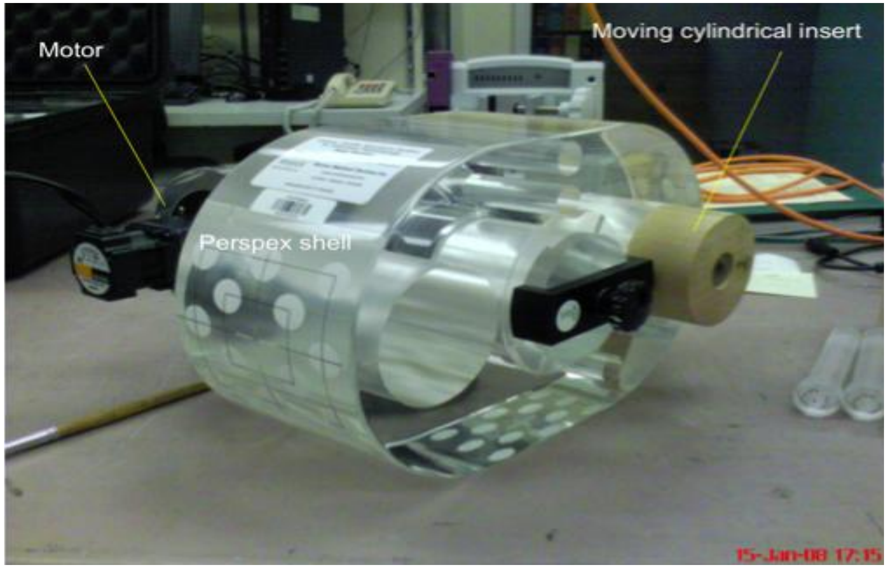
Slides courtesy Peter Greer

SABR trials in Australasia

- CHISEL (TROG 09.02): curative, early stage lung cancer; closed
- SAFRON (TROG 13.01): oligomet, factionation question; accruing
- SABR-OS: lung
- LIGHT (TROG 13.02): liver; not activated
- PROMETHEUS: prostate, accruing
- SPARK (TROG 15.02): prostate, KIM
- FASTRACK: kidney

Slides courtesy Tomas Kron

CHISEL credentialing (since 2009)

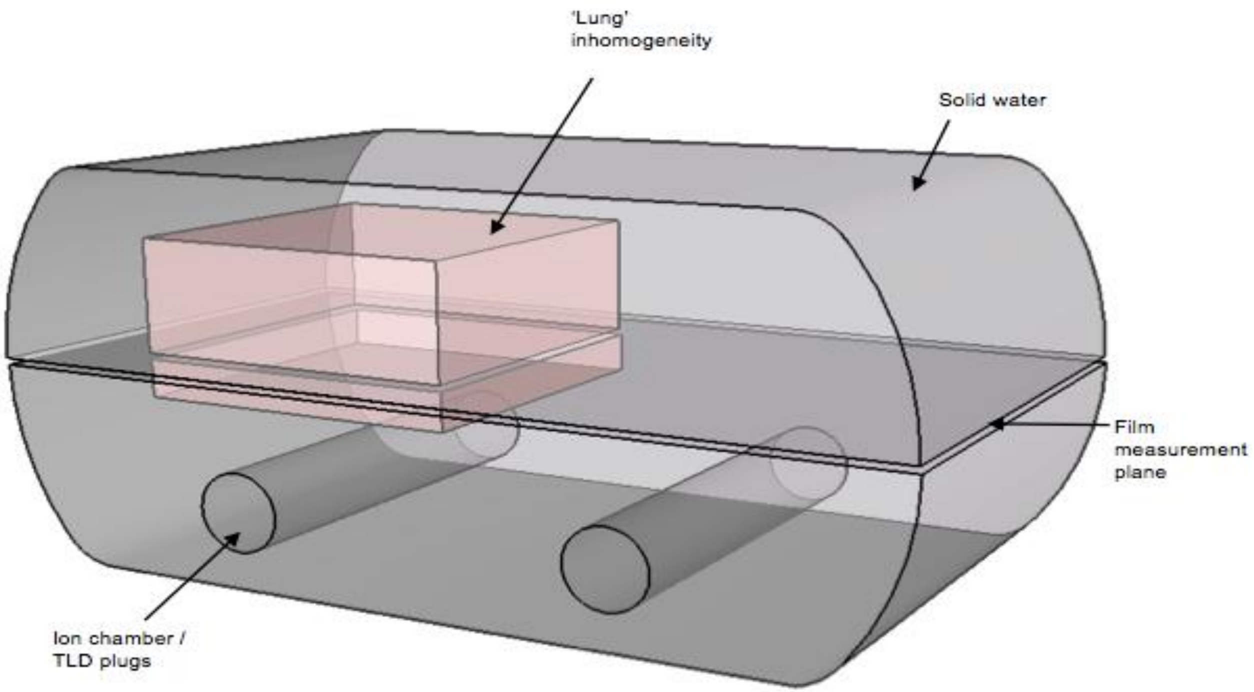


Details on process:
Hardcastle et al 2014
Kron et al 2011

- Ion chamber + radiochromic film
- Perspex phantom
- Lessons learned:
  - Perspex problematic (CT to ED)
  - Motion not informative (would require a lot more work to pinpoint problems)
  - Inhomogeneity essential
  - Smaller field size needed ($5x5cm^2 \rightarrow 3x3cm^2$)

New design

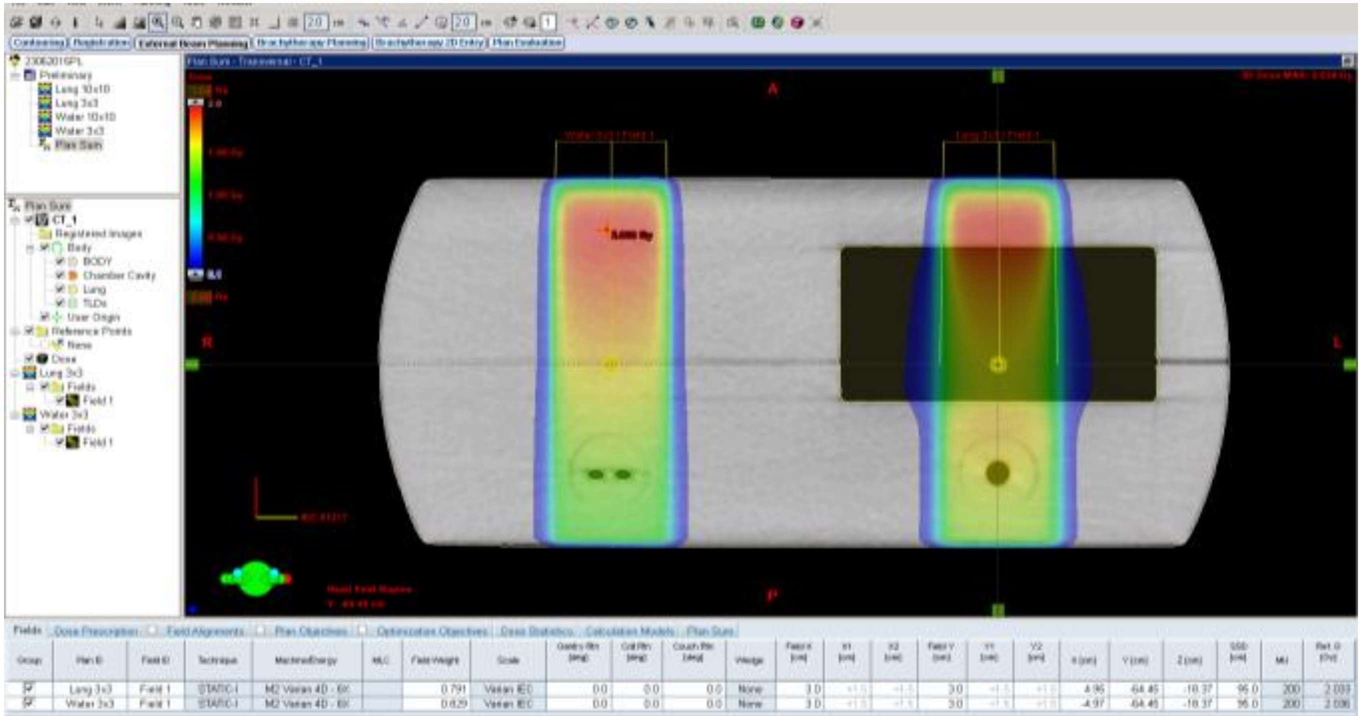
20x10x12cm^3
(wxhxd)



Dosimeters

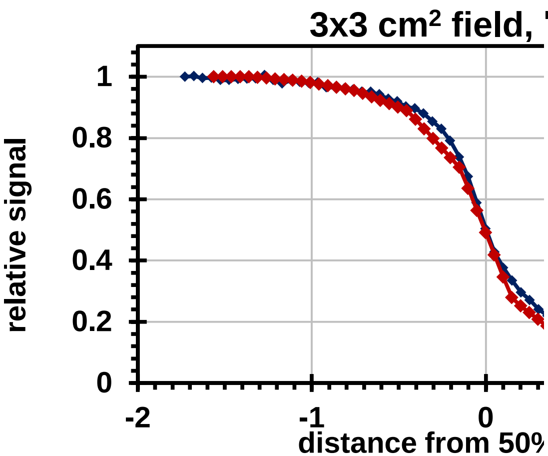
- Ion chamber plug for commissioning
- For sending to centres just radiochromic film and TLD

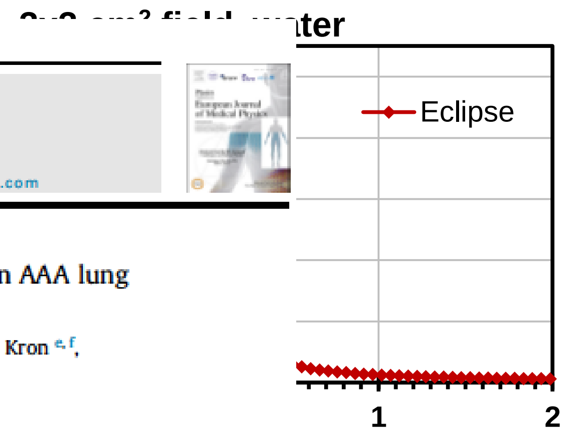
Dose calculation in Eclipse AAA



Preliminary Film results 3x3cm^2 field

- Lung (cork)
- Water (solid)





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Original paper

National dosimetric audit network finds discrepancies in AAA lung inhomogeneity corrections

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ABSTRACT

This work presents the Australian Clinical Dosimetry Service's (ACDS) findings of an investigation of systematic discrepancies between treatment planning system (TPS) calculated and measured audit doses. Specifically, a comparison between the Anisotropic Analytic Algorithm (AAA) and other common dose-calculation algorithms in regions downstream (≥ 2 cm) from low-density material in anthropomorphic and slab phantom geometries is presented. Two measurement setups involving rectilinear slab-phantoms (ACDS Level II audit) and anthropomorphic geometries (ACDS Level III audit) were used in conjunction with ion chamber (planar 2D array and Farmer-type) measurements. Measured doses were compared to calculated doses for a variety of cases, with and without the presence of inhomogeneities and beam-modifiers in 71 audits. Results demonstrate a systematic AAA underdose with an average discrepancy of 2.9 ± 1.2% when the AAA algorithm is implemented in regions distal from lung-tissue interfaces, when lateral beams are used with anthropomorphic phantoms. This systemic discrepancy was found for all Level III audits of facilities using the AAA algorithm. This discrepancy is not seen when identical measurements are compared for other common dose-calculation algorithms (average discrepancy −0.4 ± 1.7%), including the Acuros XB algorithm also available with the Eclipse TPS. For slab phantom geometries (Level II audits), with similar measurement points downstream from inhomogeneities this discrepancy is also not seen.

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Plan to utilise phantom early next year for TROG 13.01 SAFRON