# The Radiation Planning Assistant (RPA)

*Automation and Standardization of Planning, Plan Evaluation and System Testing through Advanced Programming in Treatment Planning Systems, AAPM 2018*

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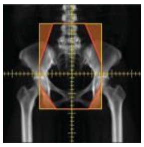
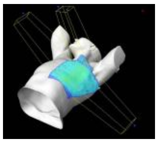
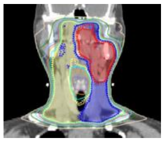

## Conflicts of Interest

- Funded by NCI UH2 CA202665
- Additional funding from Varian Medical Systems
- Equipment and technical support provided by:
  - Varian Medical Systems
  - Mobius Medical Systems
- Other, not related projects funded by NCI, CPRIT, Varian, Elekta

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## Specific goals of the Radiotherapy Planning Assistant (RPA)

- Generate high quality treatment plans that are:
  - Generated from scratch in less than 30 minutes.
  - Internally QA'd in an automated fashion within the system.
- Limit need for the radiation oncology physician to:
  - Delineate the target (location).
  - Provide the radiation prescription.
  - Approve the final plan.
- Limit need for medical physicist to:
  - Check final plan
- Create a system that can be used by an individual with:
  - A high school education.
  - ½ day of training (online and video) on the RPA itself.
  - (dosimetrists still needed for unusual/complex cases)

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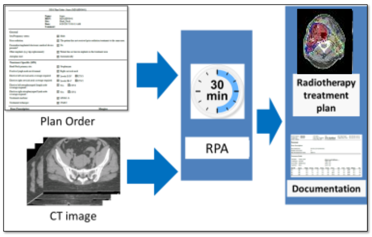
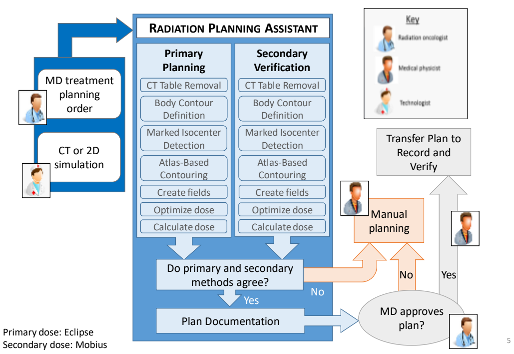
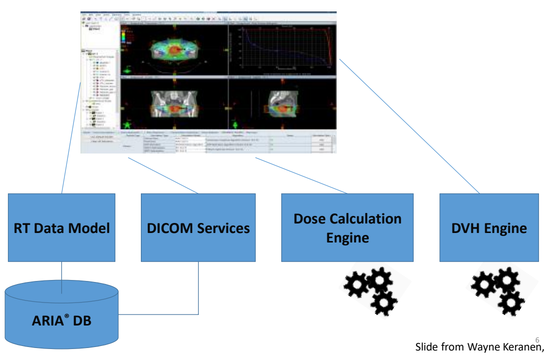
# General philosophy

- Take advantage of Eclipse, but avoid the need for the user to actually use Eclipse
- Use Eclipse functions whenever possible (API)
- Combine with purpose-written tools
- Many functions (e.g. contouring) happen before sending to Eclipse (dicom)
- Others use API
- Internal verification for everything
- Work closely with eventual users
- Deploy at MDACC whenever possible
  - (although project aimed at supporting cancer treatments in low- and middle-income countries)

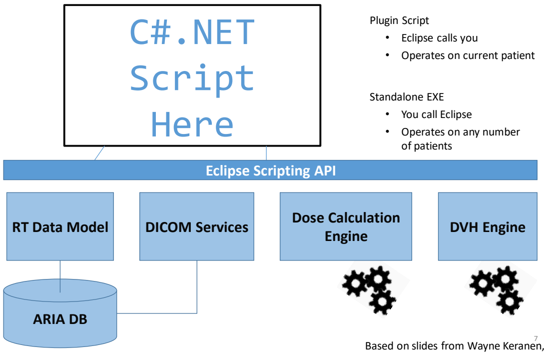



Primary dose: Eclipse
Secondary dose: Mobius




Slide from Wayne Keranen, Varian




Plugin Script
- Eclipse calls you
- Operates on current patient

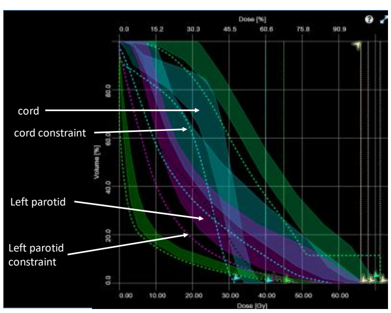
Standalone EXE
- You call Eclipse
- Operates on any number of patients

Based on slides from Wayne Keranen, Varian

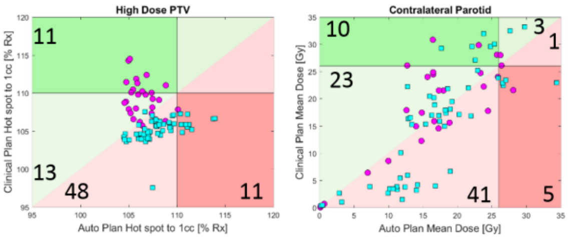
## Detailed Project Highlights: Head & Neck Autocontouring


## Detailed project highlights: Plan Optimization

- Physician-drawn GTV
- Automatically contoured normal tissue and CTVs
- Supplement with autocontoured planning structures
- Isocenter at target center
- Collimator size/angle based on targets
  - 30° and 330° collimator angles, symmetric fields, 18cm max
  - 90° collimator angle
- WUSTL Rapid Plan Model
- Population Constraints (weights etc.)
- Normalize such that all PTVs receive ≥98% of prescribed dose to 95% volume



## Detailed Project Highlights: Head & Neck Plan Quality




- RPA generated plans are of high-quality, comparable to manually generated plans in target coverage and normal tissue sparing
- Unacceptable plans are nearly always easily identifiable – and flagged to the user

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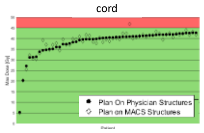
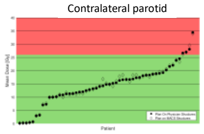
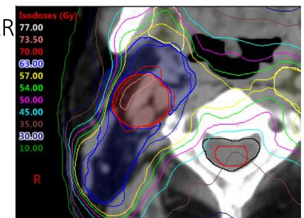
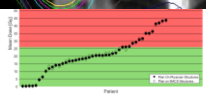
## Dosimetric impact of OAR



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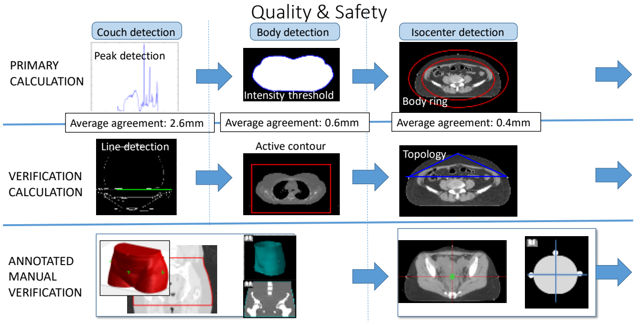
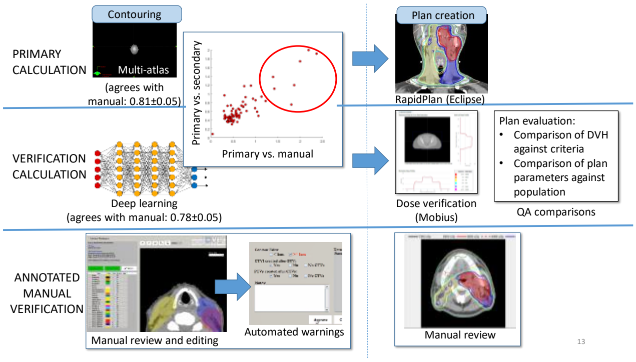
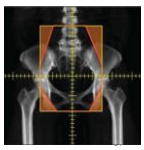
## Detailed Project Highlights: Use of Multiple Algorithms to Ensure Plan Quality & Safety






## Radiation Planning Assistant (RPA) Project Summary: August 2018

- Automatic radiation planning promises to increase availability of radiation therapy worldwide by:
  - Reducing the planning burden
  - Reducing staff shortages
  - Increasing the quality and efficiency of radiation plan creation
- Integrated in-house tools (e.g. autocontouring) with Eclipse and Mobius:
  - API
  - Dicom import/export
  - JSON objects
- The RPA successfully generates acceptable, treatable radiation plans for:
  - Cancers of the uterine cervix (4-field box)
  - Cancers of the head/neck (VMAT)
- Key components of the RPA are being used clinically in the USA:
  - Autocontouring of head/neck normal tissues
  - Autogeneration of cervical cancer field borders
- Aiming to deploy clinically early in 2019



Principal Investigators:
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- Beth Beadle, MD/PhD – radiation oncology (Stanford)

MD Anderson Cancer Center, Houston
- Joy Zhang, PhD – algorithms and integration
- Rachel McCarroll – H&N algorithms
- Kelly Kisling, MS – GYN, breast algorithms
- Carlos Cardenas – deep learning
- Jinzhong Yang, PhD - atlas segmentation
- Peter Balter, PhD – radiation physics
- Ann Klopp, MD/PhD – GYN planning
- Anuja Jhingran, MD – GYN planning
- Simona Shaitelman, MD – breast
- David Followill, PhD – audits/deployment
- James Kanke and dosimetry team

Commercial Partners
- Varian Medical Systems
- Mobius Medical Systems

Primary Global Partners: AFRICA

Stellenbosch University, Cape Town
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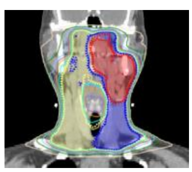

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