Experience with automated planning in busy international clinic setting

Clínica Iram – Santiago - Chile

FM. Alejandro Cuadra.

Standard Disclaimers

- Speaker Disclousures.
  - Reflects my own opinion and not necessarily represent to IRAM.
- Conflicts of interest.
  - None.

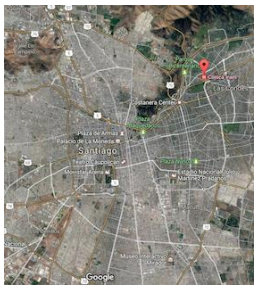
Alejandro Cuadra, MSc.

- Physicist.
  - Tarapaca`s University.
    - Pre grade
  - University of Chile.
    - Post grade in Physics.
  - Universitat Valencia, Spain.
    - Msc.Medical Physics.
- "Clínica IRAM" since 2002.
  - Quality Asurance in Radiotherapy.
  - Clinical Dosimetry Department.

Clínica IRAM.

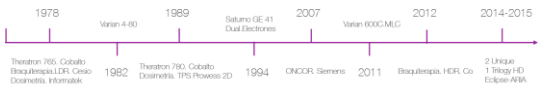
- Since 1978.
- > 3000 treatments per years.
- 15 Radiation Oncologists.
- 3 Physicists.
- 17 Dosimetrists.
  - 5 in inverse planning.
  - 12 in Linacs.
- 12 Technicians for supporting in Linacs.
- 1 engineer for service support.

Clínica IRAM.



Clínica IRAM.

Technological development Iram Clinic



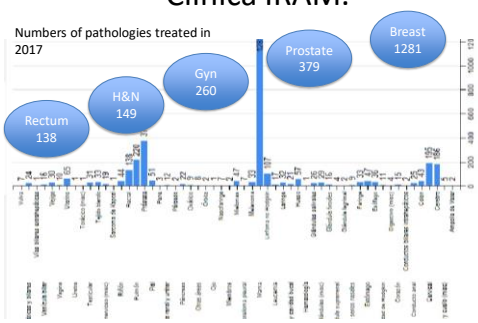
Dr. C.V. Sole, "Evolución Tecnológica Iram, Desarrollo Organizacional y Planificación Basada en Conocimiento", SOCHIRA, 2018.

Clínica IRAM.

- SRS. (1996 – 2016 change system).
  - Cone system.
    - GE Saturne 41.
    - Siemens Oncor.
  - Brain metastasis and arteriovenus malformation (AVM).
- SBRT (2016).
  - Liver.
  - Lung.
  - Oligo metastasis.
- RPM (2016 - Breath hold modality).
  - Left breast.

Clínica IRAM.

Numbers of pathologies treated in 2017



Clínica IRAM.

- Iram`s Workflow.
  - High workload by dosimetrist.
    - 7 to 10 planning per day.
    - Different level of training and knowledge.
    - Dependence of some professionals to develop more complex treatment plans.

  - Initially.
    - ID´s Contour of Structures.
    - Configuration treatment fields and optimizations process.
    - DVH evaluation.

  } Manual review

Workflow is time consuming

Clínica IRAM.

- First stage improvement.
  - Structures templates.
    - Color´s code.
    - Structure´s code.

    } Useful for next stage
  - Optimization goals for different kind of treatments.
  - Reduction of planning times.
    - Structures and optimization objectives conecting by code.
    - Reduce plannig time compare with manual process.

Clínica IRAM.

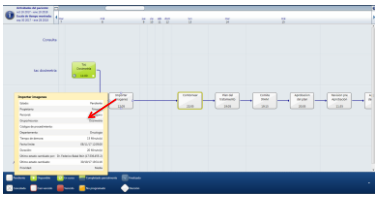
- Second stage improvement.
  - Inclusion of clinical protocol.
    - A series of clinical protocols were created according to the treatment site
    - Define PTV and OAR dose limits parameters .
    - Faster plan evaluation.
- Significant decrease in planning times.
- Clinical protocol OAR evaluation in prostate fossa.

Principal	Prescripción				Fracción Dosis [cGy]	Dosis total [cGy]	Dosis total real [cGy]
☐	PTV-T-7000	Como mucho	0.0	% recibe más de	220.0	7700.0	7596.1
☐	PTV-T-7000	Al menos	95.0	% recibe más de	190.0	6650.0	6646.0
☐	PTV-T-7000	Al menos	90.0	% recibe más de	180.0	6300.0	6720.1
☑	PTV-T-7000	Punto de referencia		recibe	200.0	7000.0	N/A
☐	CTV-T-7000	Al menos	99.0	% recibe más de	200.0	7000.0	6668.0
☐	CTV-T-7000	Al menos	99.0	% recibe más de	190.0	6650.0	6668.0
☐	PTV-T-7000	Como mucho	1.0	% recibe más de	214.0	7490.0	7363.0

Varian Medical System, Inc., Eclipse v13.6 protocolo clínico

Clínica IRAM.

- Third stage improvement.
  - Workflow implementation.
    - Define responsibilities for each activity.
    - Assigned task execution times.
    - Automation of workflow tasks.



Varian Medical System, Inc., Eclipse v13.6 workflow

Clínica IRAM.

- Standardized workflows by type of treatments.
  - Different amount of steps according to Treatment.
  - Between 3 and 7 days.

Varian Medical System, Inc., Eclipse v13.6 workflow

Clínica IRAM.

- In summary.
  - Decrease in planning times.
  - Standardization of treatment plans.
  - Increase in the number of schedules.
  - Maintain the quality standard by evaluating clinical protocols.

…… But these improvements do not replace the dependence of the experience of the Dosimetrist or Physicist in charge of the planning**……**

- **Complex inverse planning in the hands of few physicists or Dosimetrist.**

Knowledge Based planning Implementation.

- Currently there are 2 dosimetrist in training in SW and RapidArc techniques.
- Aim: achieve transversality in the management of highly complex techniques among the dosimetrist staff.
- ¿How to achieve a fast and secure ability to develop high complexity treatment plans?

Knowledge Based planning Implementation.

- Chronology
  - Early January 2016 we had the help to develop and implement rapid plan by creating our own models.
    - Hypofractionated prostate.
      - 33 patients.
  - In the middle of October 2016 an on-site training was carried out to show us in a practical way.
    - Deborah Nelson.
  - In March 2017, Kevin Moore help us to valiadate our new models and try USCD models with our patients.

Knowledge Based planning Implementation.

RapidPlan model	Number of re-plan validations	Notes
IRAM prostate	7	Used existing IRAM model, one round of filtering, new optimization objectives
IRAM APBI Left Breast	7	5-field static field sliding window
IRAM Lung (Stage III)	5	
UCSD Prostate Bed	7	
UCSD Head-and-Neck	6	Added POST NECK as avoidance to model, per IRAM institutional practices
UCSD Prostate + Pelvic Nodes	5	Unpublished UCSD model
UCSD Liver SBRT	3	Unpublished UCSD model
UCSD Lung SBRT	3	Both UCSD Right and Left Lung SBRT models loaded onto IRAM database
	Total: 48	

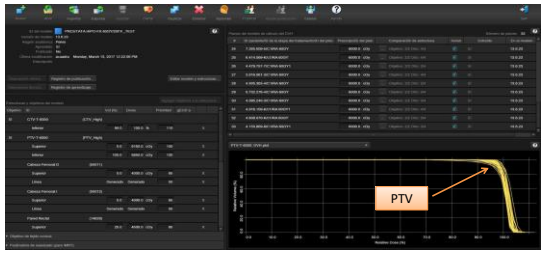
Validation IRAM models and UCSD models with IRAM´s patients; Dr. Kevin Moore

Knowledge Based planning Implementation.

- Considerarion of hypofractionated prostate model:
  - Specific model, requires few patients for optimal performance.
  - There is little variability between the structures.
  - Comparison of commonly made manual plans versus RapidPlan plans.
  - Plans calculated with the RapidPlan model were all clinically accepted.

Knowledge Based planning Implementation.

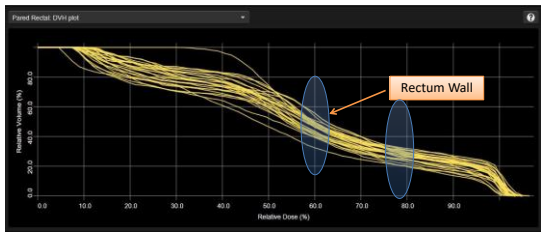
Model configuration



Varian Medical System, Inc., Eclipse v13.6, Model configuration

Knowledge Based planning Implementation.

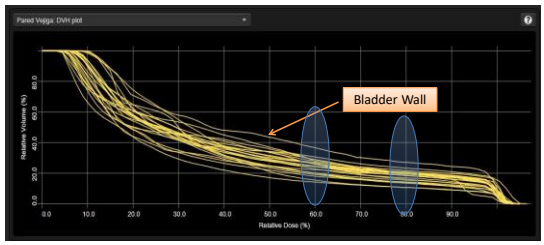
Model configuration



Varian Medical System, Inc., Eclipse v13.6, Model configuration

Knowledge Based planning Implementation.

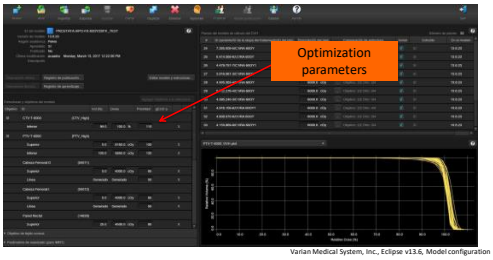
Model configuration



Varian Medical System, Inc., Eclipse v13.6, Model configuration

Knowledge Based planning Implementation.

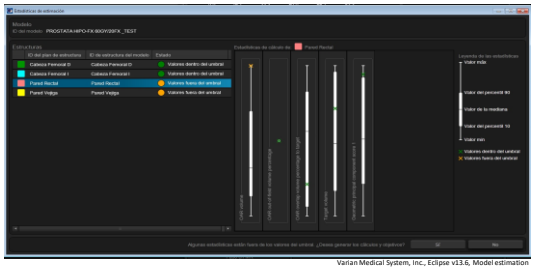
Model configuration



Varian Medical System, Inc., Eclipse v13.6, Model configuration

Knowledge Based planning Implementation.

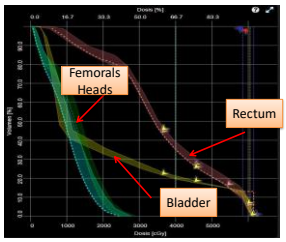
Estimation statistics



Varian Medical System, Inc., Eclipse v13.6, Model estimation

Knowledge Based planning Implementation.

DVH estimation



Varian Medical System, Inc., Eclipse v13.6, Model estimation

Knowledge Based planning Implementation.

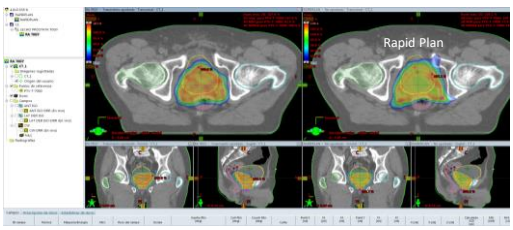
- Other models implementation in Clinica IRAM (since January 2017).
  - Prostate model 76Gy.
  - Prostate fossa70Gy.
  - Pelvis + lymph nodes.
  - Acelerated Partial breast irradiation.
  - Head and neck (data base).
  - GBM (data base).
  - Lung (validation process).
  - Rectum.

Knowledge Based planning Implementation.

- UCSD Models used in Clinica IRAM.
  - Prostate and prostate fossa.
  - Pelvis + lymph nodes.
  - Head and neck.
  - Gynecological.
  - SRS.
  - SBRT lung.
  - SBRT Liver.
- Test and compare UCSD models with local data.

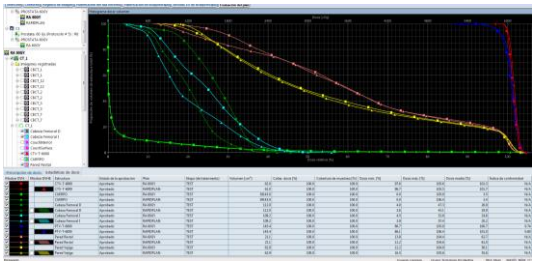
Knowledge Based planning Implementation.

IRAM Prostate model Hypofractionated



Varian Medical System, Inc., Eclipse v13.6 external plan beam

Knowledge Based planning Implementation.



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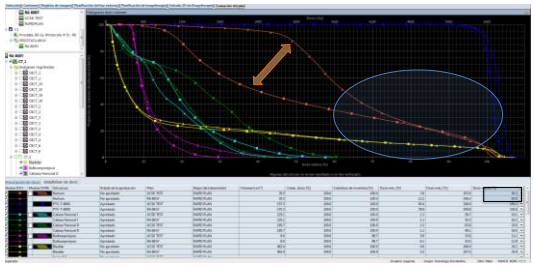

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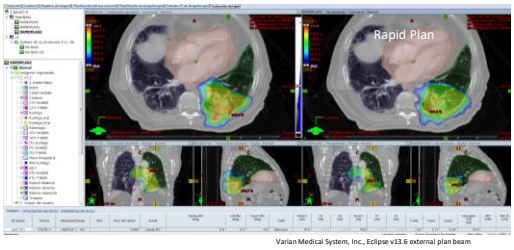
Knowledge Based planning Implementation.

IRAM Lung model Stage III



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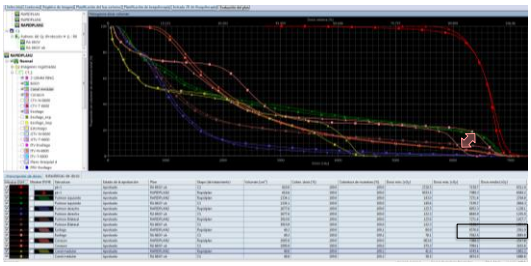
Knowledge Based planning Implementation.



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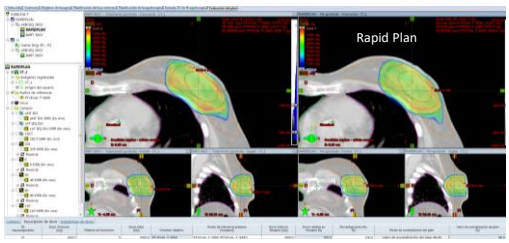
Knowledge Based planning Implementation.

Accelerated Partial Breast Irradiation model



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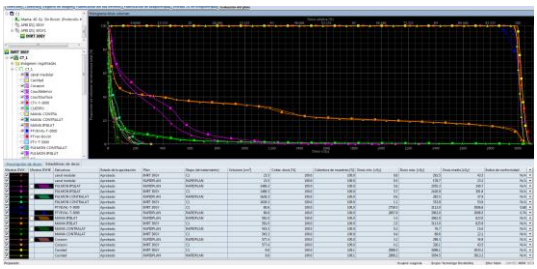
Knowledge Based planning Implementation.



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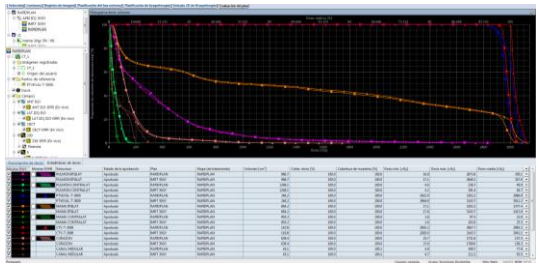
Knowledge Based planning Implementation.



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Knowledge Based planning Implementation.

UCSD Prostate model, modified optimization parameters

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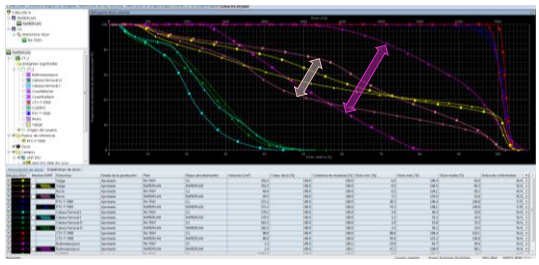
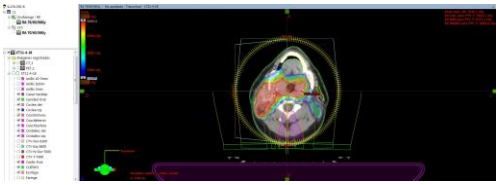
Knowledge Based planning Implementation.



Knowledge Based planning Implementation.

USSD Head and Neck model.



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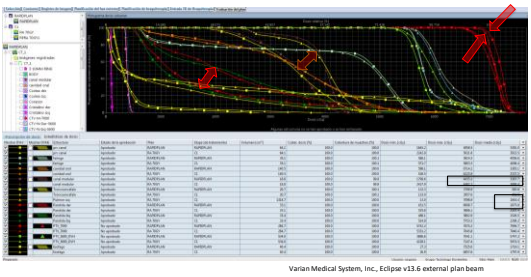
Knowledge Based planning Implementation.



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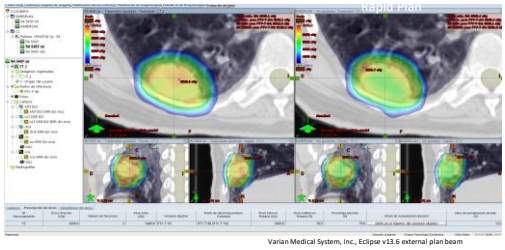
Knowledge Based planning Implementation.

UCSD SBRT Lung model.



Varian Medical System, Inc., Eclipse v13.6 external plan beam

Knowledge Based planning Implementation.

Knowledge Based planning Implementation.

- Creating a model.
  - At least 20 patients to create a models knowledge-based planning.
    - More complex models require more patients.
  - Validate the model with plans already calculated.
  - Decrease planning time.
  - Improve consistency.
  - Expand current IMRT and VMAT opportunities with minimal impact on current staffing levels.
- Preliminary results.
  - Minimize training time of new staff.

Preliminary results

Prostate Hypo	Manual plan	RapidPlan™.
Clinical evaluation	Optimal	Optimal
User	Advance	Minimal training
Time planning	60 min.	30 min.
Key features	Variability in dose distribution	Consistency in dose distribution

2018	Hypo	Prostate and Prostate Fossa.	Prostate + Limph
Nº planning	41	37	119 (15)
Nº optimization	1	1	1 or (2)
Time (min)±	30	30	45

Preliminary results

Head and Neck	Manual plan	RapidPlan™.
Clinical evaluation	acceptable	Optimal
User	Advance	Minimal training
Time planning	4 hrs.	30 - 45 min.
Key features	High heterogeneity in diferent dose levels.	Consistency in dose distribution

2018	Head and Neck
Nº planning	55
Nº optimization	1 (2)
Time (min)±	45 (70)

Preliminary results

APBI	Método Manual	RapidPlan™.
Clinical evaluation	Optimal	Optimal
User	Advance	Minimal training
Time planning	60 min.	25 min.
Key features	dependence on beam geometry	fewer optimizations

2018	APBI
Nº planning	86
Nº optimization	1
Time (min)±	25

Preliminary results

2018	Rectum	Gyn
Nº planning	108 (15)	123 (10)
Nº optimization	1 (2)	1 (2)
Time (min)±	35	40

Conclusions.

- General considerations
  - Change in the technological platform at Clínica IRAM allowed the development of high precision radiotherapy.
  - Automated Clinical Protocols -RapidPlan- improve security and decrease planning time.
  - Accelerate the learning curve of dosimetrist.
  - RapidPlan can allow clinics to reduce variability in treatment planning to achieve greater consistency, efficiency and quality in patient care.

Clínica IRAM
Expertos en oncología

Thanks for your attention

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