2016 Radiotherapy Plan Competition: Knowledge Sharing & Better Quality

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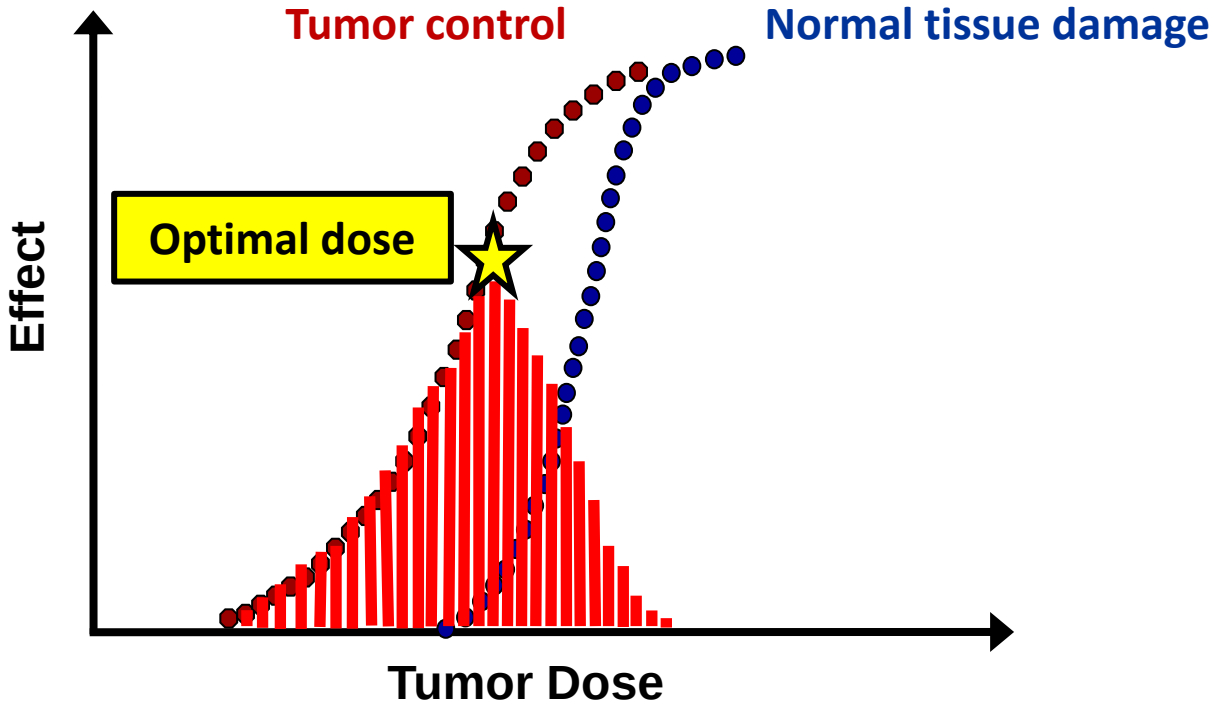
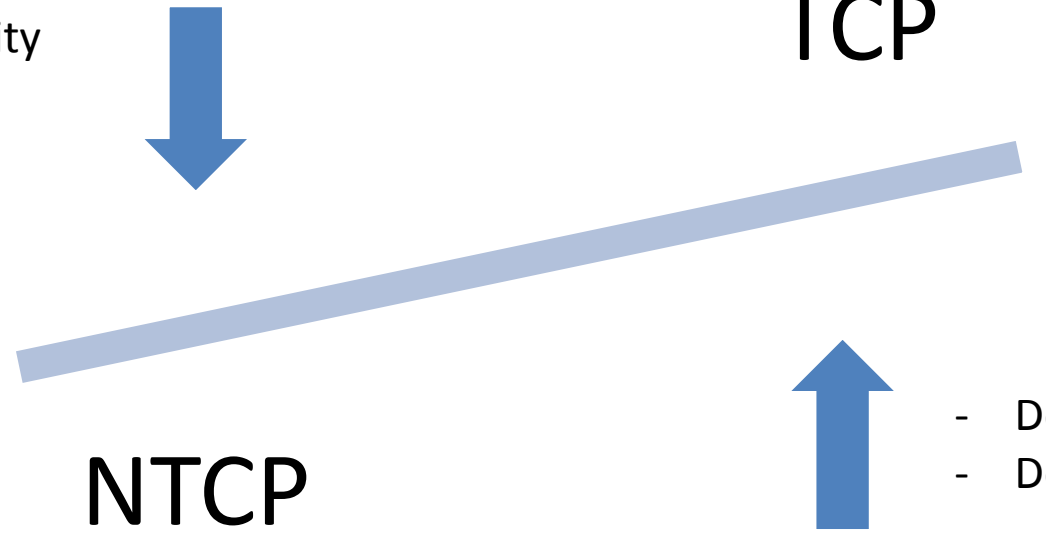
The Goal of Radiotherapy …



Quality Specifiers

- Dose Conformity
- OAR Sparing

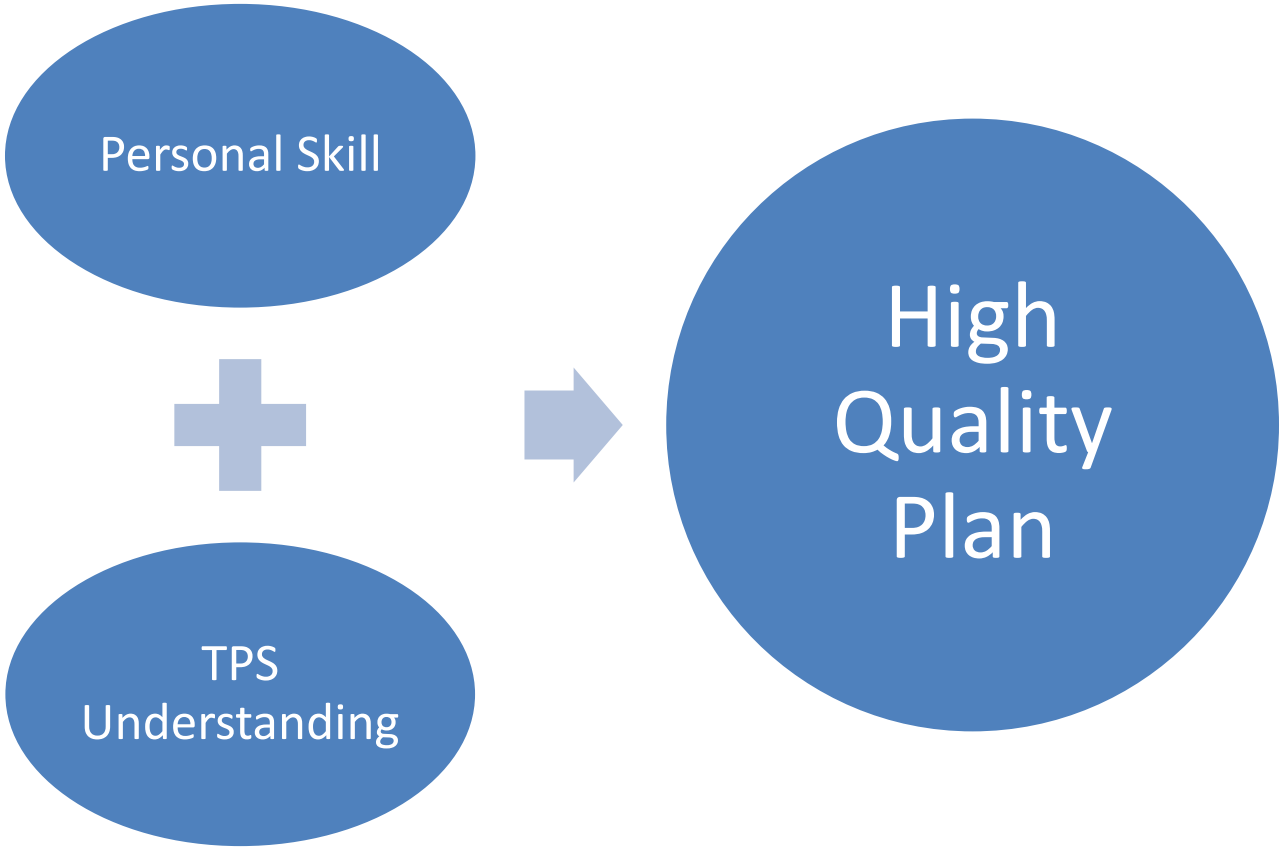


- Dose Homogeneity
- Dose Conformity

Why planning is the most important stage?

Simply …

*Patient will be treated with the generated plan, its **quality** will have a direct impact on the patient **quality of life** afterwards*


Personal Skill
TPS Understanding
High Quality Plan

What prevents planners from generating high quality plans?

The clinical criteria are achieved most of the time

but still the plan quality varies

Planners differ in skills, TPS understanding, experience, resources, exposure to others, ... etc

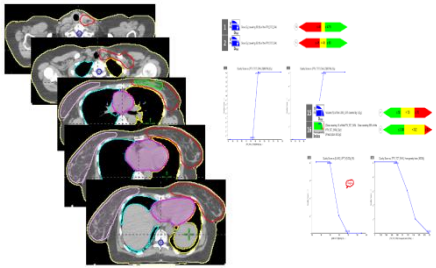
This causes plan quality to differ from planner to the other

How can we change the nature of plans‘ quality from being subjective to being objective?

Is there a way to stimulate planners worldwide to reach the max of their resources?

Plan Competition

Plan Competition - Concept



Download

Plan

Select Best Plans

Share Best Plans & Techniques

Through Live-webinar and shared documents

Competition Cycle

Our first plan competition

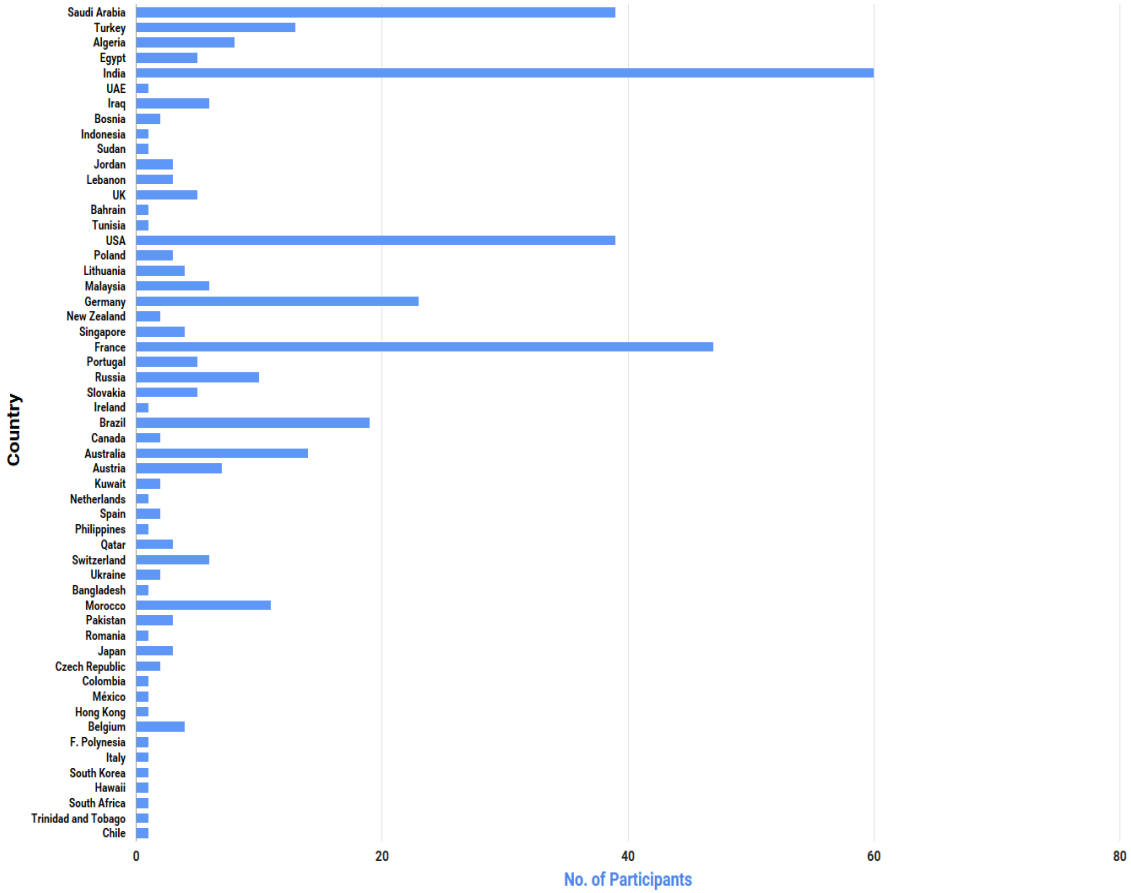
- This is not the first of its kind in the world, this is the second international competition
- There are many local competitions in few parts of the world
- ROR (Radiation Oncology Resources) initiated the first plan competition in 2011
- 2013, 2014, and 2015 Plan Challenges – Personal Experience
- Advanced skills were acquired & implemented on the day-to-day clinical cases
- We decided to initiated our competition on the national level (Inside Saudi Arabia Only)
- The idea started at KFSH&RC and patronized/supported by SOS (Saudi Oncology Society)
- Expected number of participants was 20-50 (max)
- Expanded to the Middle East, then opened worldwide

The first edition of the Radiotherapy International Plan Competition:

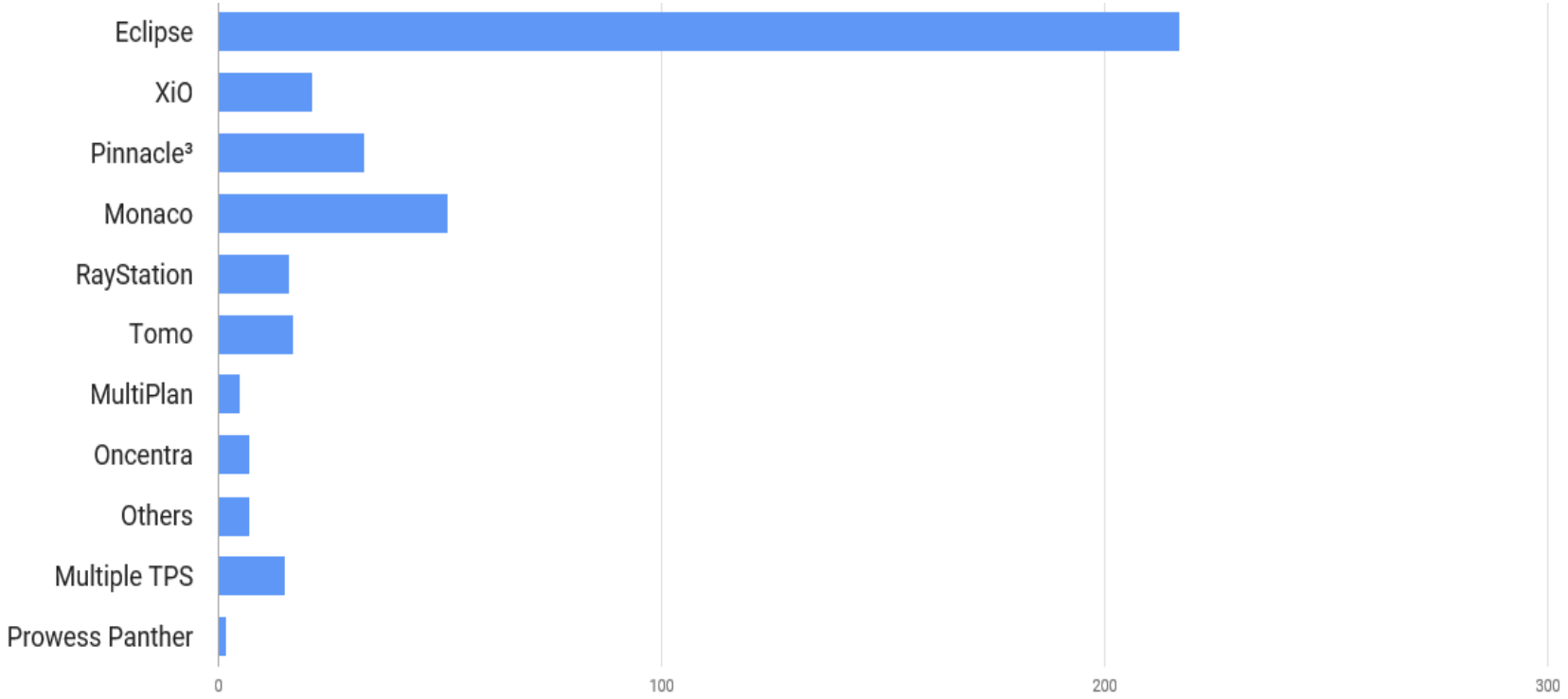
- Statistics
- Case Description & Dosimetric Criteria
- Evaluation tool
- Participants' Evaluation/Feedback
- Final Results
- What's Next
- Lessons Learned
- Acknowledgments

Total Participants ~ 400
From ~ 55 countries
210 Submitted Plans

Participants Per Country

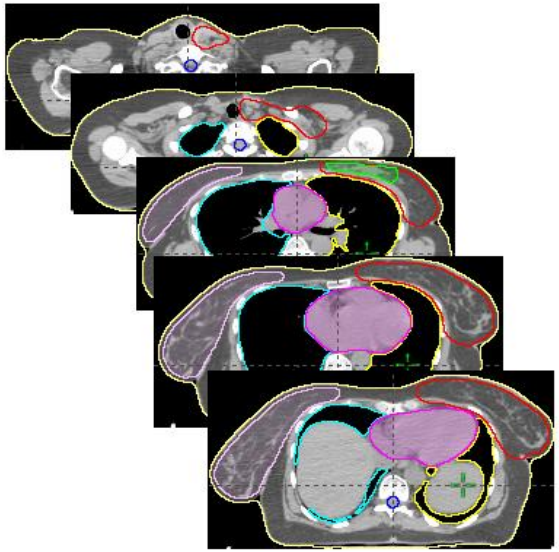


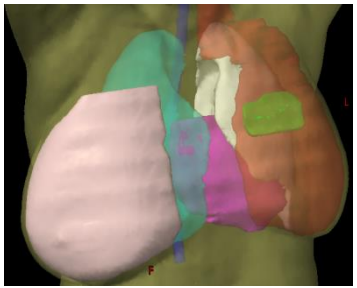
Treatment Planning Systems



Case Description

- Case diagnosis: Left Breast Cancer
- Treatment Site: Left breast with axilla and supraclavicular lymph nodes
- Target: PTV_TOT_EVAL
- Dose prescription: 50.0 Gy in 25 fr.
- Protocol followed: RTOG-1304 (Criteria squeezed more !)
- Techniques: 3D-CRT, IMRT, VMAT
- General plan criteria were set: # of fields, single isocenter, energies, … etc
- Dose calculation grid should be less than 3 mm
- PB dose calculation is not allowed to be used
- Generated plan should be deliverable (no couch/patient collision)





Evaluation Tool – Plan IQ (Sun Nuclear Corp.)

Main Features:

- Interactive GUI for all DICOM data (CT, ROI, Dose, DVH, 3D rendering, DRR, MLC segments)
- Dose calculation of ideal dose distribution (Benchmark Dose ™): Used as a pre-planning stage
- Used to generate the criteria of the plan competition based on RTOG-1304 Protocol
- It can generate numerical quality scores for Target and OAR and for the entire treatment plan
- It is compatible with all TPS and Record & Verify (R&V) systems
- When submitted plans are imported, the evaluation process takes **2-5 min per plan**

Dosimetric Criteria

IQ PlanIQ™

Plan Quality Algorithm: 2016 Dosimetric Criteria Sheet [100 Max Possible] [18 Metrics] (Page 1 of 2)

1	V (%) / D (Gy)	Dose (Gy) covering 99 (%) of the PTV_TOT_EVAL	15	≤ 45		≥ 47.5
2	V (%) / D (Gy)	Dose (Gy) covering 95 (%) of the PTV_TOT_EVAL	5	≤ 45	> 45	≥ 50
3	V (%) / D (Gy)	Dose (Gy) covering 50 (%) of the PTV_TOT_EVAL	5	≤ 52		≥ 54
4	V (cc) / D (Gy)	Dose (Gy) covering 0.3 (cc) of the PTV_TOT_EVAL	5	≤ 55		≥ 57
5	ROI $\bar{D}$ Mean (Gy)	Mean dose (Gy) inside the HEART	10	≤ 4		≥ 5
6	V (%) / D (Gy)	Volume (%) of the HEART covered by 15 (Gy)	5	≤ 15	< 20	≥ 20
7	V (%) / D (Gy)	Dose (Gy) covering 5 (%) of the HEART	5	≤ 20	< 25	≥ 25
8	V (cc) / D (Gy)	Dose (Gy) covering 0.3 (cc) of the BREAST_RIGHT	2	≤ 2		≥ 3
9	V (%) / D (Gy)	Dose (Gy) covering 5 (%) of the BREAST_RIGHT	4	≤ 2		≥ 3
10	V (cc) / D (Gy)	Dose (Gy) covering 0.03 (cc) of the SPINAL CORD	5	≤ 8	< 20	≥ 20

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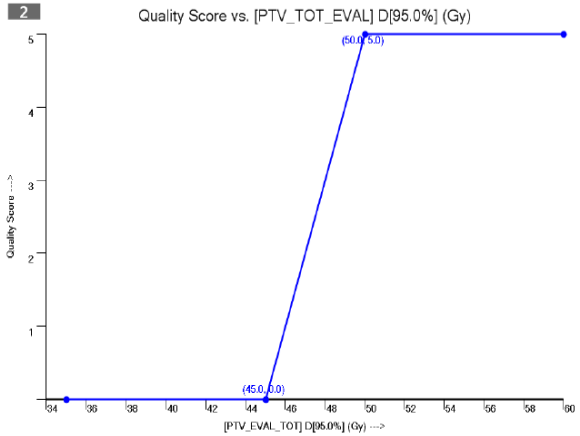
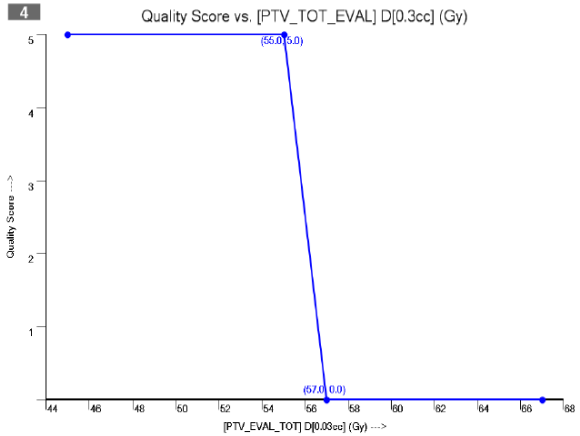




Evaluated Plan

Plan Quality Algorithm Summary | Plan Quality Score Calculation

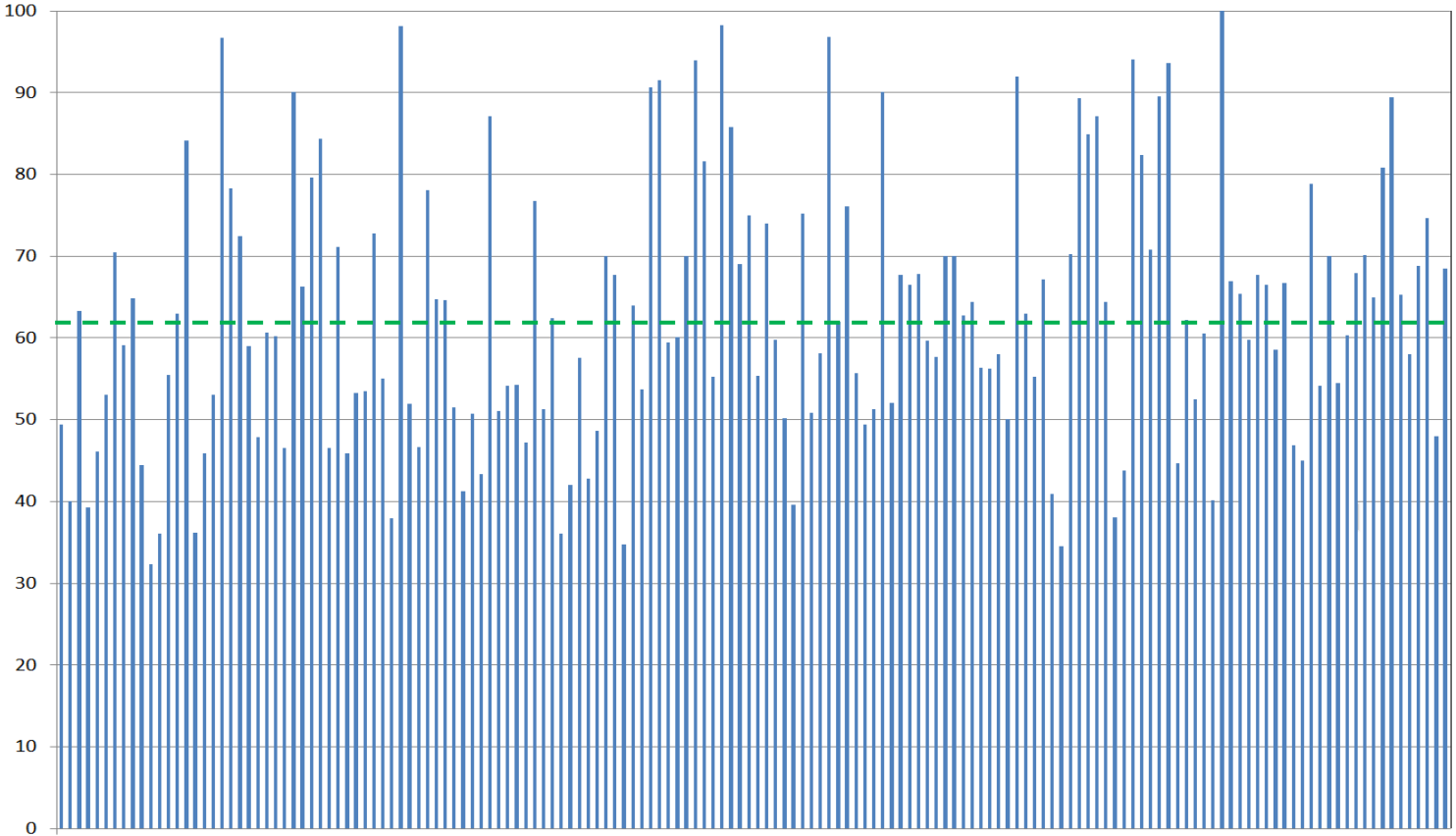
Raw PQM / Max PQM	PQM (%)	APQM (%)	Pass/Fail	Settings	Add to Distribution(s)
90.70 / 100.00	90.7%	---	---	Grace 0.00 % MORE	#PQM %PQM %APQM PQM% APQM% Metric

Plan Quality Metric Component	Objective(s)	Result		Raw Score	Max Score	Performance	PlanIQ Adjusted Performance
[PTV_TOT_EVAL] D[99.0%] (Gy)	> 45 [≥ 47.5]	48.9786		15.00	15.00	100.0%	
[PTV_TOT_EVAL] D[95.0%] (Gy)	> 45 [≥ 50]	50.0197		5.00	5.00	100.0%	
[PTV_TOT_EVAL] D[50.0%] (Gy)	< 54 [≤ 52]	51.7084		5.00	5.00	100.0%	
[PTV_TOT_EVAL] D[0.3cc] (Gy)	< 57 [≤ 55]	55.8967		5.00	5.00	100.0%	
[HEART] Mean dose (Gy)	< 5 [≤ 4]	3.6480		10.00	10.00	100.0%	
[HEART] V[15.0Gy] (%)	< 20 [≤ 15]	4.0744		5.00	5.00	100.0%	
[HEART] D[5.0%] (Gy)	< 25 [≤ 20]	11.7497		5.00	5.00	100.0%	
[BREAST_RIGHT] D[0.3cc] (Gy)	< 3 [≤ 2]	3.5311		0.00	2.00	0.0%	
[BREAST_RIGHT] D[5.0%] (Gy)	< 3 [≤ 2]	1.8840		4.00	4.00	100.0%	
[SPINAL CORD] D[0.03cc] (Gy)	< 20 [≤ 8]	7.7333		5.00	5.00	100.0%	
[LUNG_RIGHT] V[5.0Gy] (%)	< 6 [≤ 3]	0.3853		5.00	5.00	100.0%	
[LUNG_LEFT] Mean dose (Gy)	< 15 [≤ 9]	9.6947		4.83	5.00	96.5%	
[LUNG_LEFT] V[20.0Gy] (%)	< 20 [≤ 15]	14.4608		5.00	5.00	100.0%	
[LUNG_LEFT] V[10.0Gy] (%)	< 40 [≤ 30]	27.9120		5.00	5.00	100.0%	
[LUNG_LEFT] V[5.0Gy] (%)	< 70 [≤ 50]	55.5863		3.16	4.00	78.9%	
[PTV_TOT_EVAL] Homogeneity Index [50.0Gy]	< 0.2 [≤ 0.08]	0.1113		3.71	5.00	74.3%	
[PTV_TOT_EVAL] Conformation Number [47.5Gy]	> 0.6 [≥ 0.9]	0.8880		5.00	5.00	100.0%	
Global Max Location (ROI)	[CTV_LUMPECTOMY]	Elsewhere		0.00	5.00	0.0%	
Total [18 Metrics]				90.70	100.00	90.7%	

Evaluation Forms
&
Responses

Results

Results



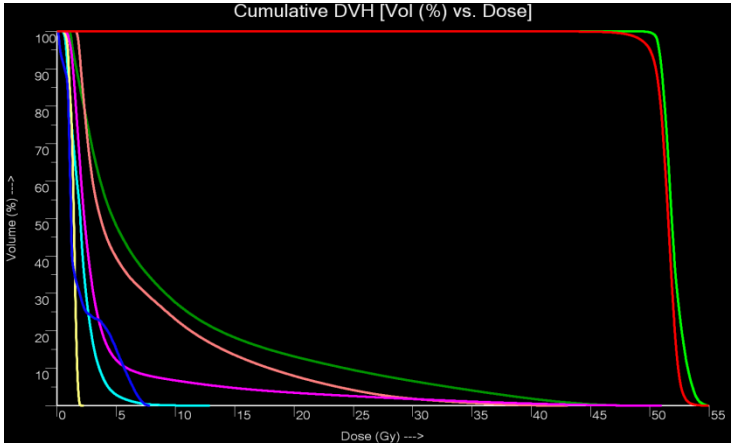
N=180
Average = 62.69
STD = 16.04

1

98.2
100

Hugues Mailleux

- Job Title: Medical Physicist
- Hospital: Institut Paoli-Calmettes
- Years of Experience: 20
- Technique: VMAT
- TPS: RayStation
- Country: France

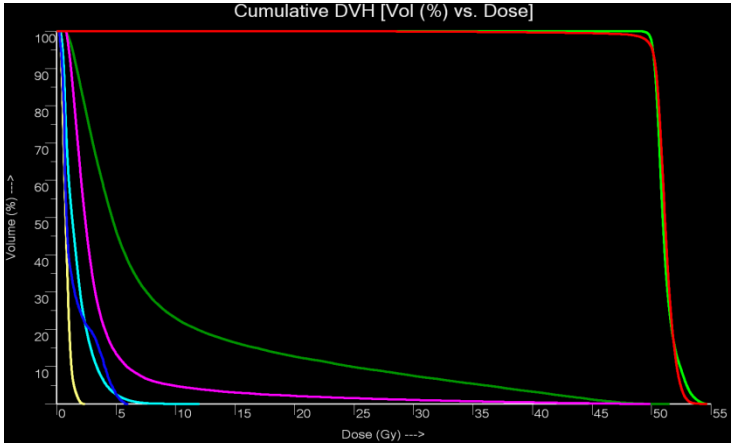


2

98.1
100

Fazal Khan

- Job Title:Proton Dosimetrist
- Hospital: Massachusetts General Hospital
- Years of Experience: 7
- Technique: VMAT
- TPS: RayStation
- Country: USA

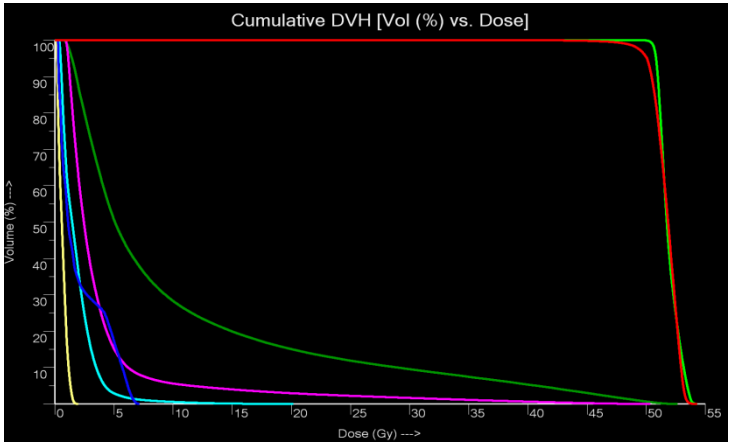


3

96.8
100

Mikel Byrne

- Job Title: Medical Physics Specialist
- Hospital: ROC Wahroonga
- Years of Experience: 7
- Technique: VMAT
- TPS: RayStation
- Country: Australia

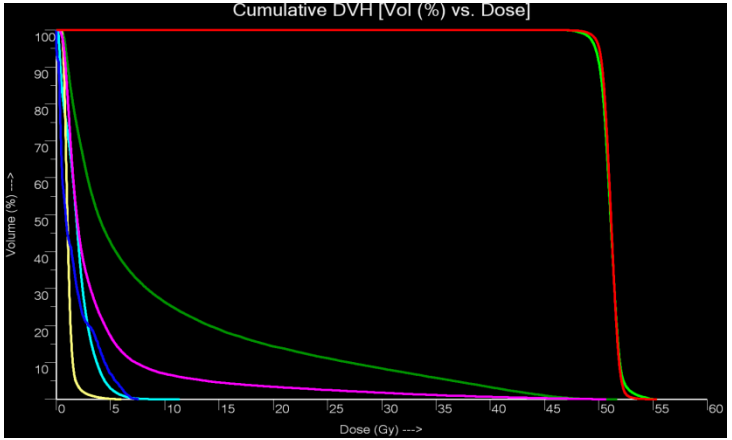


4

96.7
100

Cameron Ditty, MSc, DABR

- Job Title: Senior Physicist Specialist
- Hospital: RaySearch Americas
- Years of Experience: 13
- Technique: VMAT
- TPS: RayStation
- Country: USA



5

95.4
100

Khodri Mustapha

- Job Title: Medical Physicist
- Hospital: ORLAM
- Years of Experience: 23
- Technique: VMAT
- TPS: Raystation
- Country: France

6

94.6
100

Simon Heinze

- Job Title: Medical Physicist SSRMP
- Hospital: Kantonsspital Sr. Gallen
- Years of Experience: 5
- Technique: VMAT
- TPS: Tomotherapy
- Country: Switzerland

7

94.0
100

Timothee Ruef

- Job Title: Medical Physicist
- Hospital: Pôle d’imagerie et cancérologie du Pont St Vaast
- Years of Experience: 3
- Technique: VMAT
- TPS: Pinnacle
- Country: France

8

93.9
100

Ludovic Michon

- Job Title: Medical Physicist
- Hospital: CRT Versailles
- Years of Experience: 6
- Technique: VMAT
- TPS: Pinnacle
- Country: France

9

93.6
100

Saad Aldelaijan

- Job Title: Medical Physicist
- Hospital: King Faisal Specialist Hospital & Research Centre
- Years of Experience: 3
- Technique: VMAT
- TPS: Eclipse
- Country: Saudi Arabia

10

92.0
100

Perumal Murugan

- Job Title: Medical Physicist
- Hospital : Sri Shankara Cancer Hospital & Research Centre
- Years of Experience: 8
- Technique: VMAT
- TPS: Eclipse
- Country: India

11

91.5
100

Le Bourhis Julien

- Job Title: Medical Physicist
- Hospital: Centre Clinique de la Porte de Saint Cloud
- Years of Experience: 4
- Technique: VMAT
- TPS: Pinnacle
- Country: France

Rank	Name	Score	Work Place	Country	Technique	TPS	Linac
1	Hugues Mailleux	98.2	Institut Paoli-Calmettes	France	VMAT	RayStation	Elek-Versa
2	Fazal Khan	98.1	Mass. Gen. Hospital	USA	VMAT	RayStation	Elek-Agility
3	Mikel Byrne	96.8	ROC-Sydney	Australia	VMAT	RayStation	Var-TrueB
4	Cameron Ditty	96.7	RaySearch - America	USA	VMAT	RayStation	Elek-Versa
5	Mustapha Khodri	95.4	ORLAM	France	VMAT	RayStation	Var-Clinac
6	Simon Heinze	94.6	Kantonsspital Sr. Gallen	Switzerland	Helical-IMRT	TOMO	TOMO
7	Timothee Ruef	94	Pôle d'imagerie et cancérologie du Pont St Vaast	France	VMAT	Pinnacle	Elek-Versa
8	Ludovic Michon	93.9	CRT Versailles	France	VMAT	Pinnacle	Elek-Versa
9	Saad Aldelaijan	93.6	KFSH&RC - Riyadh	Saudi Arabia	VMAT	Eclipse	Var-TrueB
10	Perumal Murugan	92	Sri Shankara Cancer Hospital & Research Centre	India	IMRT	Eclipse	Var-TrueB
11	Le Bourhis Julien	91.5	Centre Clinique de la Porte de Saint Cloud	France	VMAT	Pinnacle	Elek-Versa
12	Laurent Tantôt	90.6	Hôpital Maisonneuve-Rosemont	Canada	VMAT	RayStation	Elek-Infinity
13	Craig Koontz	90.1	Comprehensive Cancer Centers of Nevada	USA	VMAT	Pinnacle	Var-21iX
14	Nguyen Daniel	90.1	ORLAM - MACON	France	VMAT	RayStation	Var-Clinac
15	Vanessa Magliari	89.4	Rush-Copley	USA	IMRT	Eclipse	Var-TrueB
16	Rolf Wiehle	89.3	Klinik für Strahlenheilkunde, Uniklinik Freiburg	Germany	VMAT	Eclipse	Var-Clinac
17	Julien Rolland	87.1	Chicas	France	VMAT	RayStation	Elek-Versa
18	Jansen Mendez	87.1	Makati Medical Center	Philippines	Helical-IMRT	TOMO	TOMO
19	Dmytro S Synchuk	84.4	Ukrainian Center of Tomotherapy	Ukraine	Helical-IMRT	TOMO	TOMO
20	Brett Sloman	84.1	Elekta	USA	VMAT	Monaco	Elek-Versa
21	Rui Silva	82.4	Lenitudes Medical Center	Portugal	VMAT	Monaco	Elek-Versa
22	Luke Mackowiak	81.6	Monongahela Valley Hospital	USA	VMAT	Monaco	Elekta
23	Vaclav Bednar	80.8	Svet zdravia, a.s.	Slovakia	3D-CRT	Eclipse	Var-Clinac

How to make use of these best plans?

- Best plans will be evaluated carefully and summarized in a document and approved by every planner from the top list, then sent to all participants
- Planners who are interested, will be able to evaluate the level of their improvement through a follow-up plan. This follow up plan will be generated based on their implementation of the guidelines of best plans.

Prizes/Certificates

- Five prizes will be distributed for the highest scores from every geographic region
- Top 3 will have special prizes
- Top 5 will have a special certificate
- These will be shipped beginning of next week
- Softcopy of the certificates will be placed in the DropBox folder of every participant next week

Example of Management Support & Appreciation

Hi Ahmad,
Firstly, congratulations on the success of your plan challenge competition! One of my physicists, Mikel Byrne, has been contacted to provide a photo for the competition. I was wondering if it was possible to find out where he comes in the competition as we would like to organise a congratulatory gift for him to coincide with the release of the results.

We are very lucky to have him as part of our wonderful physics team. Mikel Byrne has developed this protocol himself for clinical use with breast patients within our department and we are so proud of his achievements in this plan challenge

Once again, congratulations on a fantastic effort putting the competition together!

Kind Regards

Joanne Burgess — Site Manager
Prof Yang Wang — Director of Physics
Radiation Oncology Centres – Wahroonga
The Sydney Adventist Hospital – Sydney, Australia

Lessons Learned

- Lessons Learned
  - The need for many plan competitions worldwide is so demanding
  - A dedicated inter-active website with database is a must
  - More time needs to be given to finish the plan
  - Better advertising is required: MP/MD societies, vendors, others to notified earlier and avoid holidays to ensure more participants
  - Online tool to allow planners to calculate their scores before submission
  - Organization should not be dependent on one person
  - International referees: we will committee establish a committee in the plan competition that will include professional members from the Middle East and Europe and USA and other countries, to make it truly international not only by participants, but also organization

What's Next?

- Live-webinars will continue as per the schedule provided on the website
- A document will be compiled that includes guidelines to achieve good plans
- A follow up plan competition will be performed to measure the level of improvements
- Sharing the knowledge will be made much easier through interactive online sessions
- A dedicated website will be ready for the next competition
- The competition will be announced and advertised earlier
- An online tool to calculate the scores before submitting the final plans
- Frequent formal educational sessions will be conducted after every competition
- International organizations will be contacted for professional recognition
- A one-day dedicated event for planning can be arranged during international meetings

Acknowledgments

- All participants who made the first edition of our plan competition a story of success
- Saudi Oncology Society (SOS), represented by Dr. Adnan Alhebshi, for their financial and professional support
- King Faisal Specialist Hospital & Research Centre, represented by my boss ☺ Dr. Belal Moftah, for giving me the opportunity to announce the competition in ICRM-2016
- All Saudi national societies provided help in sharing and participating in this competition
- Sun Nuclear Corp for providing us with a Demo Plan IQ software license and their continuous support (Special thanks to Mr. Antonino Giallombardo)
- Dr. Noha Jastaniyah and Dr. Mahmoud Irfan Rana for contouring the LT Breast Case
- Dr. Waleed Al-Najjar and Dr. Shada Ramahi for their valuable directions and suggestions
- **Christine Higby**: The experienced chief dosimetrist in the US who helped us in this competition and will have a major roll in the coming proceedings, through webinars and online-educational sessions

The plan competition is all about
sharing the knowledge for better quality

Share the competition with your colleagues
Let us make the next competition reach thousands

Thank you :)