

CUH ProKnow



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Together
Safe
Kind
Excellent

Data Curation

To Automate or not to Automate?

Benefits:

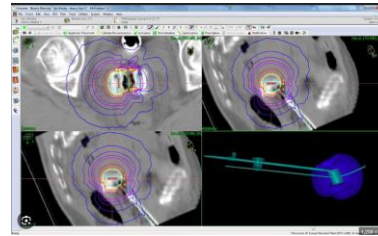
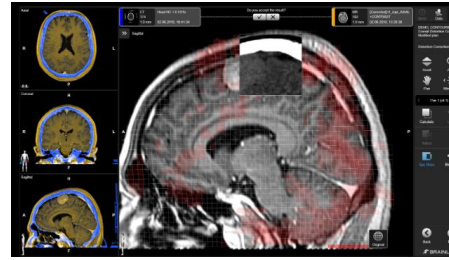
- Saves planner/checker time
- Planner/checker can concentrate on the task at hand
- Planner/checker don't have to learn a new system (logging in!!!)

Costs:

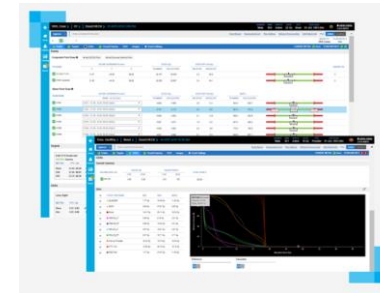
- Planner/checker never engage with the power of ProKnow
- Solution must deal with subtleties

Background

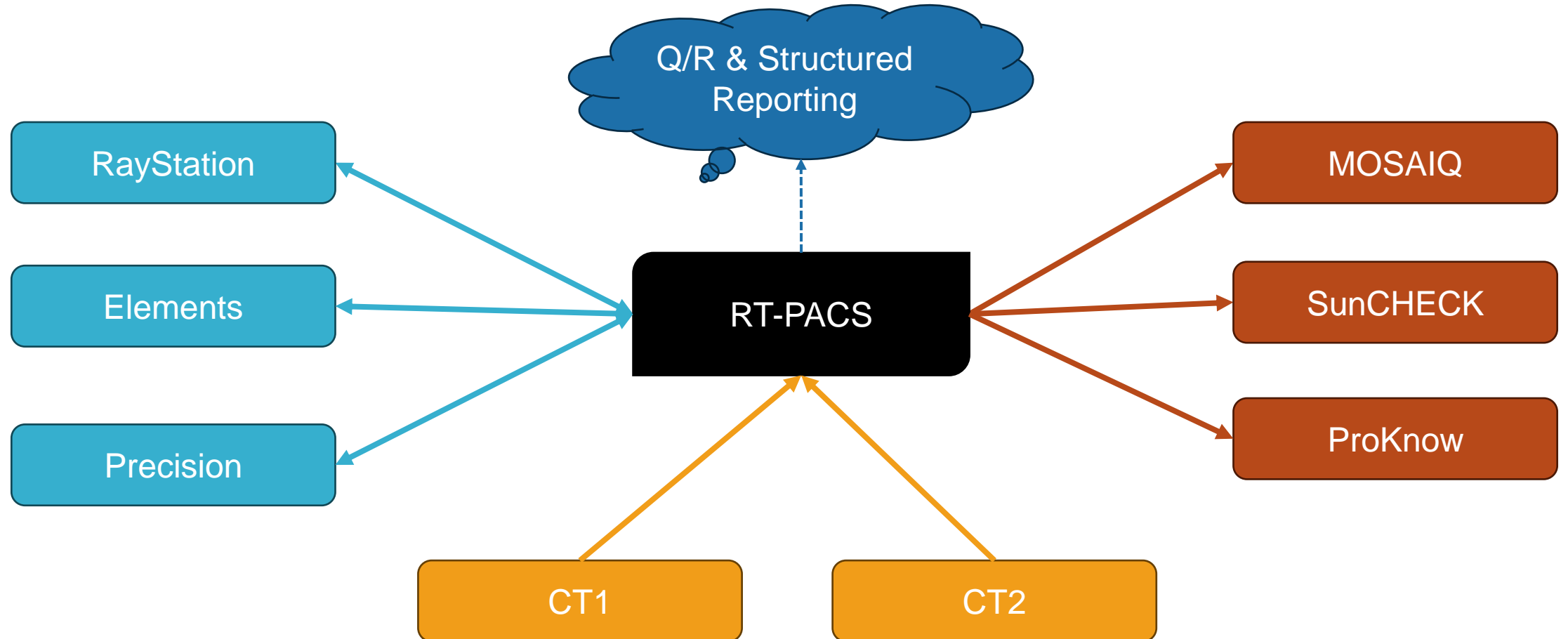
- 5 Primary planning systems
 - RayStation for C-ARM LINACs
 - Elements for SRS
 - Precision for TomoTherapy
 - Oncentra Brachy for Gynae BT
 - Oncentra Prostate for LDR
- DoseCHECK for independent dose calculation
- Smorgasbord of independent check softwares and legacy systems



Accuray
Precision®
Empower your team
with highly adaptive
radiotherapy
treatment planning
and workflows.
Centralized treatment planning for all
Accuray treatment delivery systems.



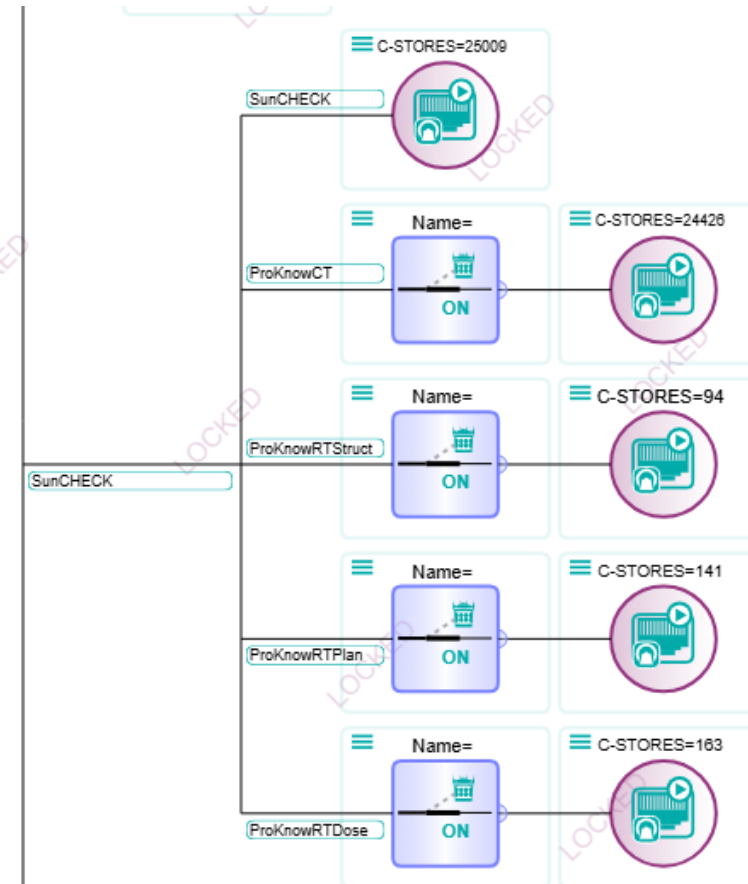
RT-PACS



Credit: Andrew Hoole

RT-PACS

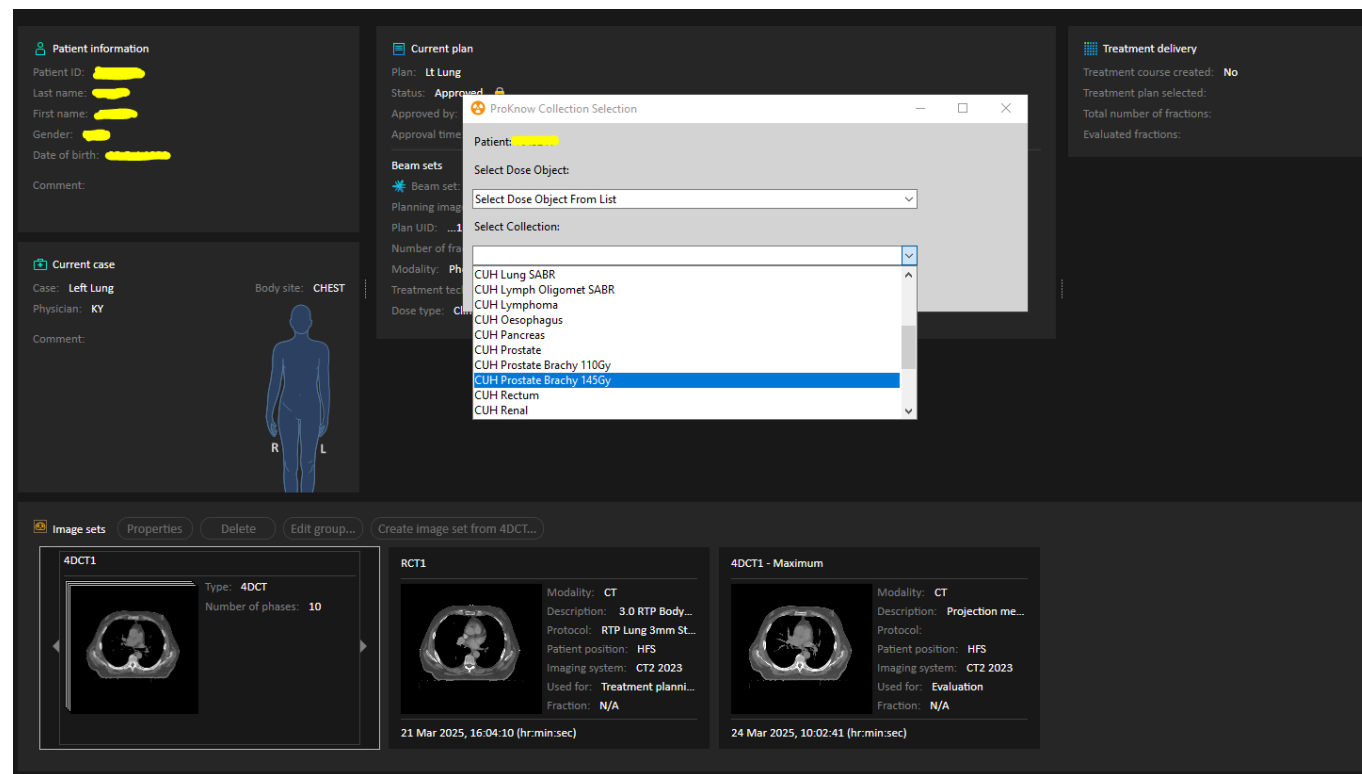
- Vendor Neural Archive
- Destination AET SUNCHECK gets streamed to ProKnow
- RTPlan
 - ApprovalStatus (300E, 0002): APPROVED
- RTDose
 - DoseSummationType (3004, 000A): PLAN



Credit: Andrew Hoole

Semi-automatic approach

- All approved plans (+associated DICOM entities) captured in ProKnow automatically
- Moving items to collections?
- Small RayStation script enables checker to move dose entities to target collection



Subtleties – Collections

- Filter only CUH Workspace collections
- Soft landing for National Collections
 - There are a LOT of them
 - 79 at time of writing

Workspace: RGT - Cambridge Universit... Collections NHS Showing 70 of 157 collections Create Workspace Collection

Name	Description	Type	Patients	Created At
NHS01_LUNG_SABR-6.1 <20cc 54/3	<20cc 54/3 National Collection by JB(RTD).	Organization	4	10/10/2022 3:46 PM
NHS02_LUNG_SABR-6.1 <20cc 55/5	<20cc 55/5 National Collection by SW(RTD).	Organization	29	10/10/2022 4:05 PM
NHS03_LUNG_SABR-6.1 <20cc 60/5	<20cc 60/5 National Collection by SW(RTD).	Organization	0	10/11/2022 9:06 AM
NHS04_LUNG_SABR-6.1 <20cc 60/8	<20cc 60/8 National Collection by SW(RTD).	Organization	7	10/11/2022 9:07 AM
NHS05_LUNG_SABR-6.1 20-40cc 54/3	20-40cc 54/3 National Collection by SW(RTD).	Organization	4	10/11/2022 9:13 AM
NHS06_LUNG_SABR-6.1 20-40cc 55/5	20-40cc 55/5 National Collection by SW(RTD).	Organization	28	10/11/2022 1:01 PM
NHS07_LUNG_SABR-6.1 20-40cc 60/5	20-40cc 60/5 National Collection by SW(RTD).	Organization	0	10/11/2022 1:04 PM
NHS08_LUNG_SABR-6.1 20-40cc 60/8	20-40cc 60/8 National Collection by SW(RTD).	Organization	4	10/11/2022 1:09 PM
NHS09_LUNG_SABR-6.1 40-60cc 54/3	40-60cc 54/3 National Collection by SW(RTD).	Organization	0	10/11/2022 1:11 PM
NHS10_LUNG_SABR-6.1 40-60cc 55/5	40-60cc 55/5 National Collection by SW(RTD).	Organization	8	10/11/2022 1:14 PM
NHS11_LUNG_SABR-6.1 40-60cc 60/5	40-60cc 60/5 National Collection by SW(RTD).	Organization	0	10/11/2022 1:16 PM
NHS12_LUNG_SABR-6.1 40-60cc 60/8	40-60cc 60/8 National Collection by SW(RTD).	Organization	4	10/11/2022 1:27 PM
NHS13_LUNG_SABR-6.1 60-90cc 54/3	60-90cc 54/3 National Collection by SW(RTD).	Organization	0	10/11/2022 1:30 PM
NHS14_LUNG_SABR-6.1 60-90cc 55/5	60-90cc 55/5 National Collection by SW(RTD).	Organization	1	10/11/2022 1:32 PM
NHS15_LUNG_SABR-6.1 60-90cc 60/5	60-90cc 60/5 National Collection by SW(RTD).	Organization	0	10/11/2022 1:35 PM
NHS16_LUNG_SABR-6.1 60-90cc 60/8	60-90cc 60/8 National Collection by SW(RTD).	Organization	2	10/11/2022 1:37 PM
NHS17_LUNG_SABR-6.1 >90cc 54/3	>90cc 54/3 National Collection by SW(RTD).	Organization	0	10/11/2022 1:39 PM
NHS18_LUNG_SABR-6.1 >90cc 55/5	>90cc 55/5 National Collection by SW(RTD).	Organization	2	10/11/2022 1:42 PM
NHS19_LUNG_SABR-6.1 >90cc 60/5	>90cc 60/5 National Collection by SW(RTD).	Organization	0	10/11/2022 1:44 PM
NHS20_LUNG_SABR-6.1 >90cc 60/8	>90cc 60/8 National Collection by SW(RTD).	Organization	2	10/11/2022 1:45 PM
NHS21_LiBrst_CWall_Partial_26/5	Left Breast/Chest Wall/Partial Breast, 26Gy in 5F. National Collection by JB(RTD)	Organization	436	11/23/2022 2:06 PM
NHS22_RtBrst_CWall_Partial_26/5	Right Breast/Chest Wall/Partial Breast, 26Gy in 5F. National Collection by JB(RTD)	Organization	449	11/23/2022 2:12 PM
NHS23_LiBrst_Lymph_IMC_40/15 >40yrs	Left Breast + lymph nodes (IMC), 40Gy in 15F, >40yrs. National Collection by JB(RTD)	Organization	77	11/23/2022 2:15 PM
NHS24_LiBrst_Lymph_IMC_40/15 <=40yrs	Left Breast + lymph nodes (IMC), 40Gy in 15F, <= 40yrs. National Collection by JB(RTD)	Organization	65	11/23/2022 2:18 PM
NHS25_LiBrst_Lymph_non-IMC_40/15	Left Breast + lymph nodes (non-IMC), 40Gy in 15F. National Collection by JB(RTD)	Organization	27	11/23/2022 2:21 PM
NHS26_RiBrst_Lymph_IMC_40/15 >40yrs	Right Breast + lymph nodes (IMC), 40Gy in 15F, >40yrs. National Collection by JB(RTD)	Organization	86	11/23/2022 2:24 PM
NHS27_RiBrst_Lymph_IMC_40/15 <=40yrs	Right Breast + lymph nodes (IMC), 40Gy in 15F, <= 40yrs. National Collection by JB(RTD)	Organization	13	11/23/2022 2:25 PM

Subtleties – Collections

- Setup *Organizer* scorecards

Workspace: RGT - Cambridge Universit...
Collection: CUH Breast Right

Scorecards
CUH-26Gy/5 Right-Breast/CWall/Partial
SDH Breast Organisation

Computed Custom

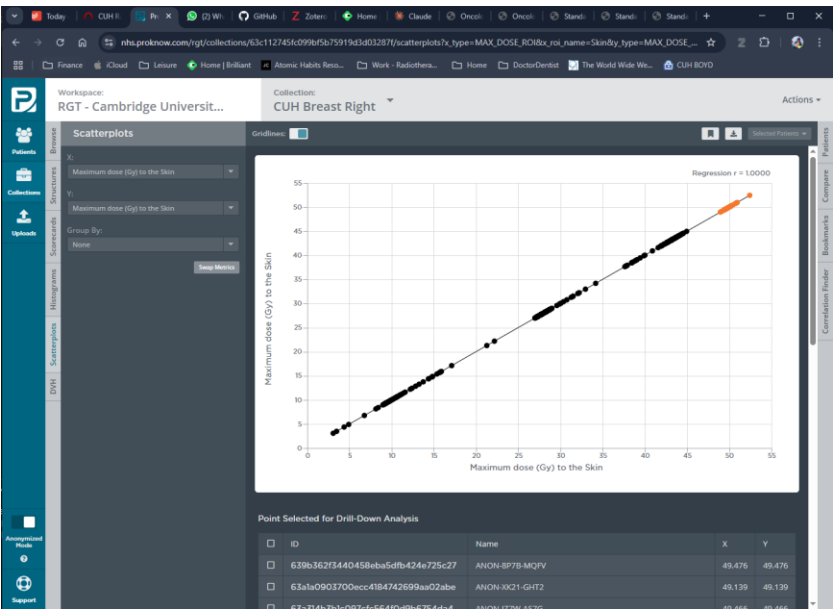
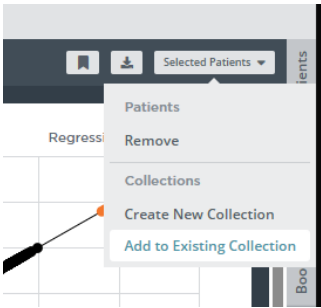
Computed Metrics

	Metric	Status	Objectives
1	Maximum dose (Gy) to the Skin	<div></div>	3.1 52.4

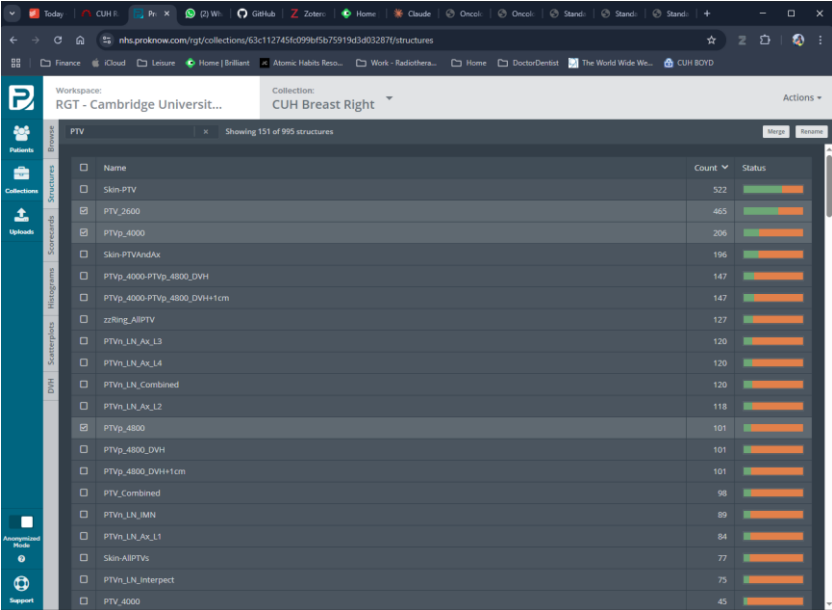
Custom Metrics

	Metric	Status	Objectives
1	*NHS - #Beams	<div></div>	1 6
2	*NHS - #Fractions	<div></div>	
3	*NHS - Approx. age at imaging [years]	<div></div>	22 98
4	*NHS - Fluence Mode	<div></div>	
5	*NHS - MeanBeamEnergy	<div></div>	6 10
6	*NHS - Modality	<div></div>	
7	*NHS - Prescriptions [Gy]	<div></div>	

Subtleties – Collections



External Max Dose [Gy]



ROI Label Frequency

Workspace: RGT - Cambridge Universit...
Collection: CUH Breast Right

Showing 797 of 797 patients with value for 'NHS - #Fractions' · Invert Filter · Clear Filter

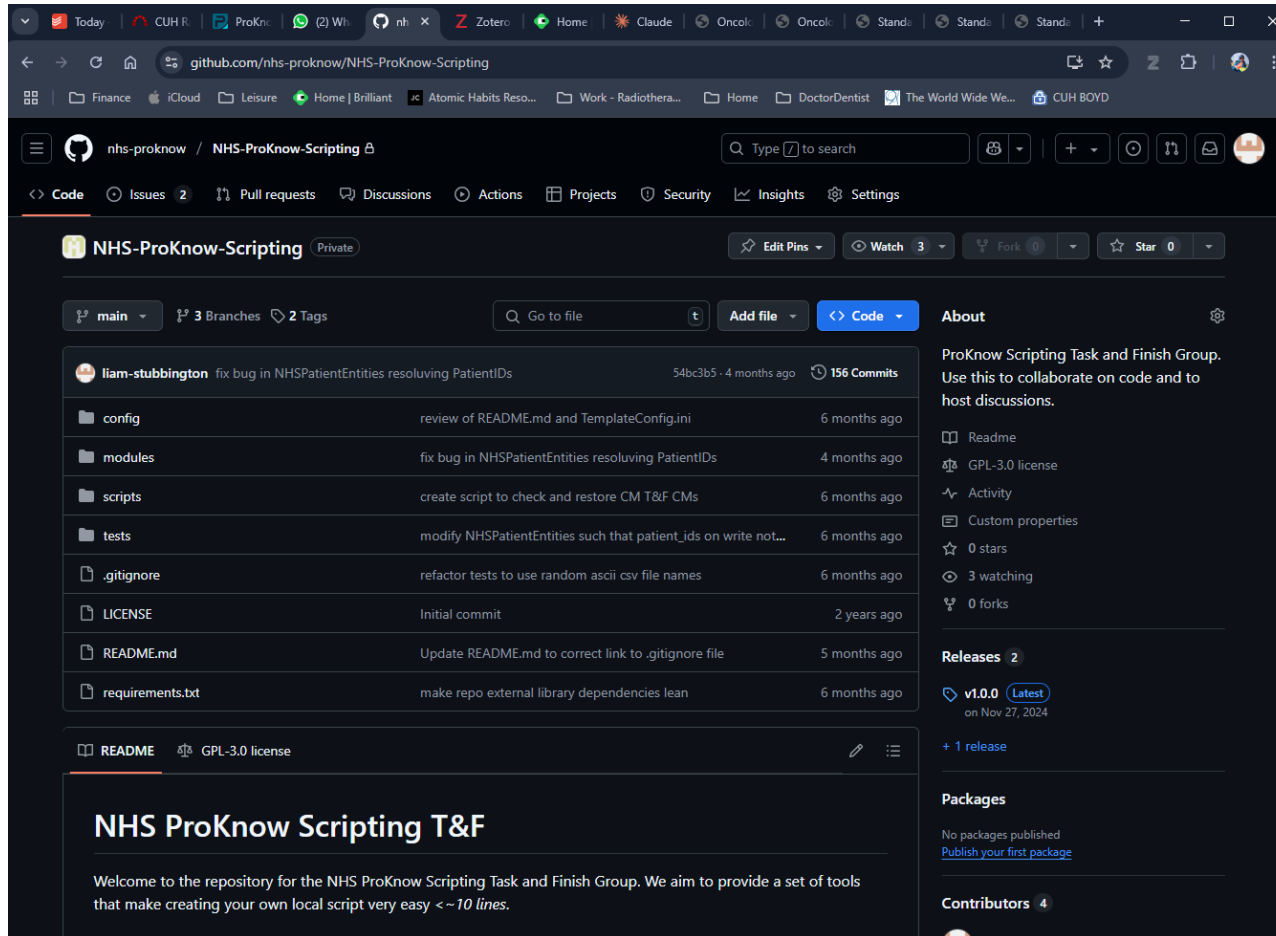
ID	Name	Type	Value
67ed065f80c0dda9f209ed7d17de2162	ANON-VPMZ-42FD	Dose	1
66867ea2efc0292d07bdb85aadfd8b36	ANON-54PG-FFDR	Dose	15
64a44a819540b1ff3277c3fa32112f1	ANON-P7ZK-4XY3	Dose	15
64b522d7d6c082e652e806b84fc48d5b	ANON-GBKS-5T06	Dose	15
67c9651fca02b3e6844e84bd76ff0a6	ANON-SC26-GH78	Dose	15
63fe1eafc6c0ef334f1f590fa808211	ANON-DVSK-9WFN	Dose	15
660169e41b00e4f1d3cdabb979998ec6	ANON-WKRX-7KDB	Dose	15
6447ee16b2c0780e9fb1f89bd344e818	ANON-F079-2CFR	Dose	15
658063104c80f92c6bf82cd500e0504	ANON-24P6-QY1C	Dose	15
6551f6352040c65bc864bffe5521d4f8	ANON-RSDW-GSSZ	Dose	15
64ad8d44b4409ab7e57bf299e9430d4	ANON-KAVY-AYZZ	Dose	15
6557a9b475403aebf370301242faeff	ANON-7BNZ-6W1G	Dose	15
65490997a84014c0fa5658d0c9c8e9f0	ANON-2K0F-MNJR	Dose	15
65683a9dcc00105208b2d52ebf637740	ANON-2190-HCPN	Dose	15
661e8fcb8c091662741ecf032378b22	ANON-J5K2-EGFC	Dose	15
659d70c737809fa77b19d52250a4373	ANON-KYQG-FCCK	Dose	15
652cf425540ee8267b5810194f769de	ANON-XT16-FDC1	Dose	15

Fractions

Subtleties – Data Cleaning

- RayStation script is an entry point for running other clean up tasks
 1. Adding Custom Metrics
 2. Removing TomoTherapy LA4 Plan
 3. DICOM Association
 4. Dose Summations

Custom Metrics

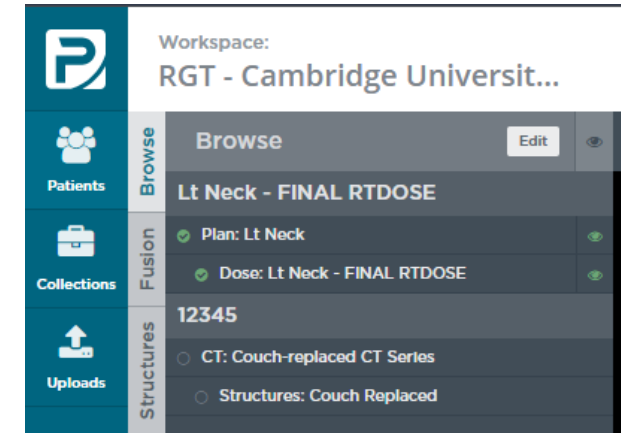


Includes (not exhaustive):

- TPS vendor
- Machine S/N (Tomo)
- #Beams
- #Fractions
- Beam model label
- FFF or cFF
- Energy
- Prescriptions [Gy]
- Age (at imaging)
- Isotopes, BT

TomoTherapy

- Only interested in the LA3 plan for *longitudinal dosimetry*
- Both LA3 and LA4 plan get sent to DoseCHECK for QA
- Couch is inserted as HU in planning image
- RT SS and CT end in different study



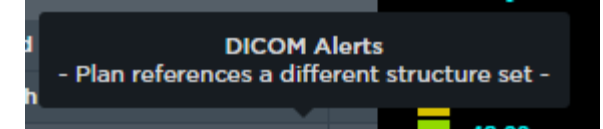
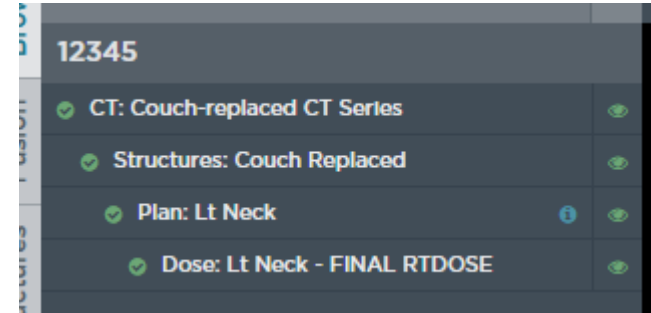
```
def delete_la4_plan_and_dose(patient: Any) -> None:
    """Deletes any LA4 plans and doses in ProKnow for a given patient.

    Parameters
    -----
    patient : Any
        ProKnow API Patient object.
    """

    plan_summaries = patient.find_entities(
        lambda x: x.data["type"] == "plan"
    )
```

DICOM Association

- ProKnow *should* automatically find reference CT Series, Structure-Set and Plan on upload through reference SOPInstanceUID attributes in DICOM header
- Not always the case



Renaming Rules

- Same DICOM object VNA UID \neq ProKnow UID???

Series Description					Modality	I..	Series Date
TomoTherapy Couch Replaced Structure Set					RTSTRUCT	1	05 Feb 2025
I..	X	Y	F..	Image UID			
1	0	0	1	1.2.840.114358.3058.20250205112801335.1			
Couch-replaced CT Series					CT	126	05 Feb 2025
I..	X	Y	F..	Image UID			
1	512	512	1	1.2.840.114358.14038002613686.20250205113954.2817400417494.1			

Image Set

Modality: CT
Description: Couch-replaced CT Series
Patient Position: Head First Supine (HFS)
Axial Slices: 126 (3.00 mm spacing)
Resolution: 512 x 512
Maximum Value: 26711 HU
Minimum Value: -1024 HU
X: -275.00 to 274.89 (ΔX : 1.07) mm
Y: -136.50 to 241.50 (ΔY : 3.00) mm
Z: -274.89 to 275.00 (ΔZ : 1.07) mm
UID: 1.2.840.114358.14038002613686.20250205113954.2817400417494

Structure Set

Number of Structures: 69
Description: Couch Replaced
Label: Couch Replaced
Name: Couch Replaced
UID: 2.16.840.1.114460.4.1745501586.28672.2644711735.4210065163.6181

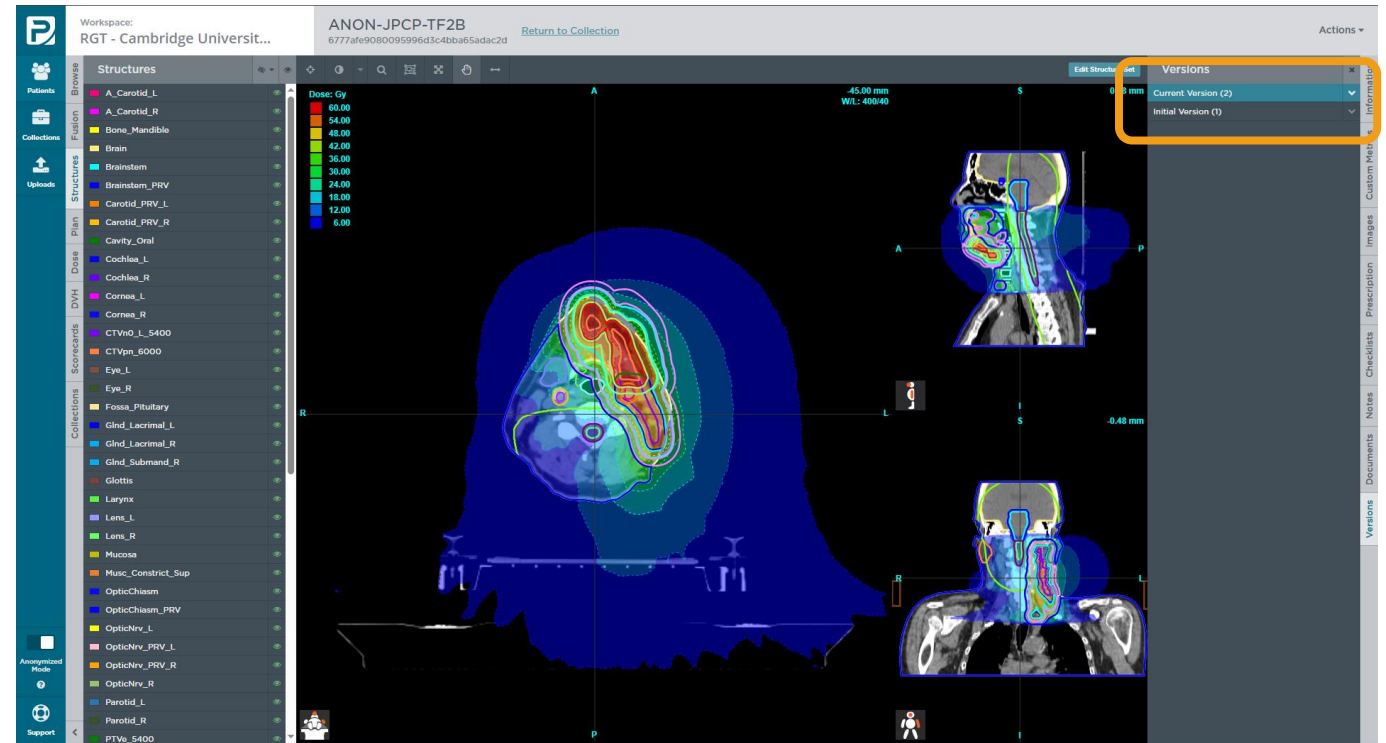
Renaming Rules

- ProKnow renaming rules change structure set on upload
- A LOT of renaming rules
- UID gets changed for DICOM compliance

Rule
If the structure name is one of (case insensitive) ("2CM_RIND", "BODY-PTVEXP20", "ext-ptvadd2cm", "PTV_2CM_RIND"), then rename to "Body-PTVExp20".
If the structure name is one of (case insensitive) ("Bile Duct", "BileDuct", "BILEDUCT_COMMON", "Common Bile Duct", "COMMON_BILE_DUCT", "Common_BileDuct", "CommonBileDuct", "V BileDuct"), then rename to "BileDuct_Common".
If the structure name is one of (case insensitive) ("BLADDER", "V Bladder"), then rename to "Bladder".
If the structure name is one of (case insensitive) ("BONE_MANDIBLE", "Mandible", "MANDIBLE", "Mandible_Bone", "Mandibule", "V Mandible"), then rename to "Bone_Mandible".
If the structure name is one of (case insensitive) ("Bowel large", "Bowel_L", "BOWEL_LARGE", "Large Bowel", "LARGE BOWEL", "LARGE_BOWEL", "LargeBowel", "V Bowel Large"), then rename to "Bowel_Large".
If the structure name is one of (case insensitive) ("BAG_BOWEL", "bowel bag", "bowel sac", "Bowel_Bag", "BowelBag"), then rename to "bag_bowel".
If the structure name is one of (case insensitive) ("BowelSpace", "SPC_BOWEL"), then rename to "Spc_bowel".
If the structure name is one of (case insensitive) ("Bowel Small", "Bowel_S", "BOWEL_SMALL", "Small Bowel", "SMALL BOWEL", "Small_Bowel", "SmallBowel", "V Bowel Small"), then rename to "Bowel_Small".
If the structure name is one of (case insensitive) ("Brachial Plexus", "Brachial_Plexus", "BRACHIALPLEXUS", "BrachialPlexus"), then rename to "BrachialPlexus".
If the structure name is one of (case insensitive) ("33_LT_brachplex", "Brach Plexus LFT", "Brachial Plex Lt", "Brachial plexus L", "Brachial Plexus Lt", "BRACHIAL_PLEXUS_LEFT", "BRACHIALPLEX_L", "BrachialPlexus Lt", "BrachialPlexus_L", "BrachialPlexusLt", "L Brachial plex", "L_BRACHIAL_P", "L_BrachialPlex", "Lt Brachial Plexus", "V BrachPlexLt"), then rename to "BrachialPlex_L".
If the structure name is one of (case insensitive) ("33_RT_brachplex", "Brach Plexus RHT", "Brachial Plex Rt", "Brachial Plexus R", "Brachial Plexus Rt", "BRACHIAL_PLEXUS_RIGHT", "BRACHIALPLEX_R", "BrachialPlexus Rt", "BrachialPlexus_R", "BrachialPlexusRt", "R Brachial plex", "R_BRACHIAL_P", "R_BrachialPlex", "Rt Brachial Plexus", "V BrachPlexRt"), then rename to "BrachialPlex_R".
If the structure name is one of (case insensitive) ("BRAIN", "V Brain", "Whole Brain"), then rename to "Brain".

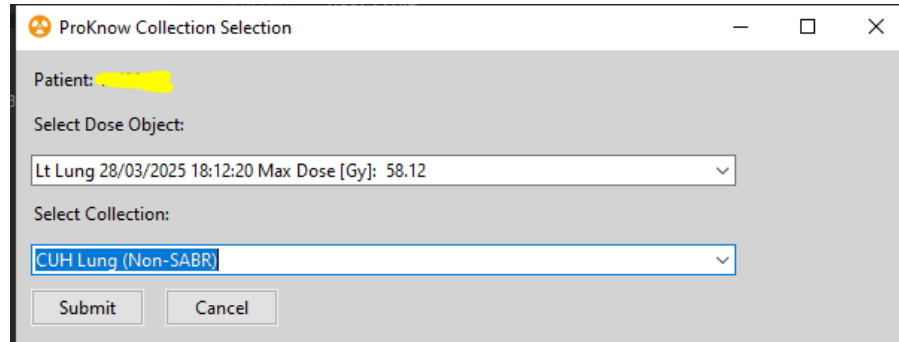
Structure Set Versions

- Fortunately, the original structure set UID is still embed in ProKnow in the *original version* of the structure set
- Original SOPInstanceUID not accessible through UI, but **CAN** be obtained through scripting
- Provides a link back to the plan, dose etc.



Summary

- Semi-automated workflow for ProKnow data curation at CUH
 - DoseCHECK data is automatically forwarded via DICOM router
 - RayStation script:
 - Entry point for further data cleaning e.g. TomoTherapy, DICOM association
 - Checker moves dose entity to local collection
 - Local collections are filtered and added to National collections as instructed



The screenshot shows a window titled "ProKnow Collection Selection". It contains the following fields and controls:

- Patient:** A text field with a yellowed-out patient ID.
- Select Dose Object:** A dropdown menu showing "Lt Lung 28/03/2025 18:12:20 Max Dose [Gy]: 58.12".
- Select Collection:** A dropdown menu showing "CUH Lung (Non-SABR)".
- Buttons:** "Submit" and "Cancel" buttons at the bottom.

Reflection

- What's gone well?
 - Saves planner/checker time in a high patient throughput department
 - Fun and engaging
- What hasn't?
 - Haven't completely lost the administrative burden
 - Low engagement
 - We are still not using ProKnow for audits

Local Audits

Elekta -> Varian

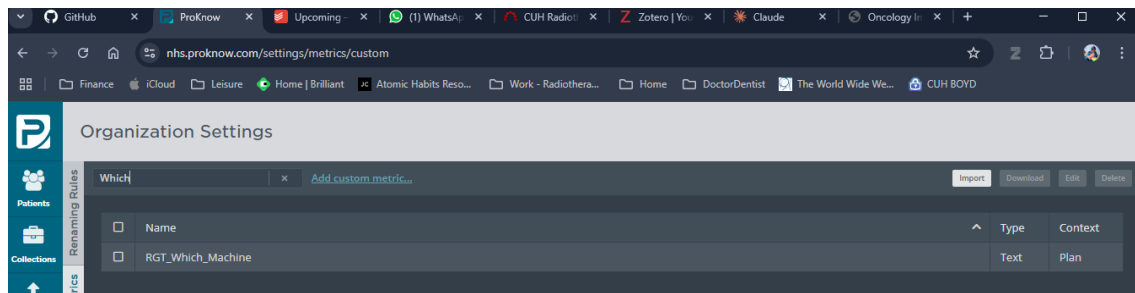


MLC Parameter	Agility	TrueBeam	TrueBeam STx
Number (per bank)	80	60	60
Leaf width [cm]	0.5	1	0.25, 0.5
Max tip difference [cm]	20.0	15	15
Max out of carriage difference [cm]	20.0	15	15
Minimum leaf position [cm]**	-15.0	-20.1	-20.1
Maximum leaf position [cm]**	+20.0	+20.1	+20.1

- Not all Agility leaves have the same ROM
- TrueBeam STx has 0.25 cm projection across central 32 leaves
- IEC 61217 Coordinates, X2 bank
- **No comparison of IGRT capabilities**

Elekta -> Varian

- Beam naming convention
- Custom Metric based on machine class



```
def get_machine_from_dose_entity(
    plan_entity: Any) -> str:
    """Returns machine class string from a ProKnow
    CollectionPatientSummary object.

    Matching is based on first character of first beam in referenced
    plan entity.

    Parameters
    -----
    plan_entity : Any
        ProKnow API plan entity item.

    Returns
    -----
    str
        TrueBeam, TrueBeamSTx, Agility
        None if not found.
    """

    plan_delivery_analysis = plan_entity.get_delivery_information()
    zeroth_beam = plan_delivery_analysis['beams'][0]
    zeroth_beam_name = zeroth_beam["name"]

    if zeroth_beam_name.startswith("E"):
        return "Elekta Agility"
    elif zeroth_beam_name.startswith("V"):
        return "Varian TrueBeamSTx"
    elif zeroth_beam_name.startswith("M"):
        return "Varian TrueBeam"
    else:
        nhs_ce.logger.error(
            (
                "Patient: %s plan entity %s has "
                "unresolvable beam name: %s"
            ),
            plan_entity.patient_id,
            plan_entity.id,
```

Breast RT

EofE RTN Study Day 16/05/2025

Computed Custom

Download Edit

Computed Metrics

	Metric	Status	Objectives
1	Volume (%) of the PTV_2600 covered by 24.70 (Gy)	<div><div></div></div>	<div><div></div><div>9.95</div></div>
2	Dose (Gy) covering 50.00 (%) of the PTV_2600	<div><div></div></div>	<div><div></div><div>27.1</div></div>
3	Volume (%) of the PTV_2600 covered by 27.30 (Gy)	<div><div></div></div>	<div><div></div><div>5.7</div></div>
4	Volume (%) of the PTV_2600 covered by 27.82 (Gy)	<div><div></div></div>	<div><div></div><div>2</div></div>
5	Dose (Gy) covering 0.50 (cc) of the PTV_2600	<div><div></div></div>	<div><div></div><div>28.6</div></div>
6	Volume (%) of the Heart covered by 6.50 (Gy)	<div><div></div></div>	<div><div></div><div>5</div></div>
7	Volume (%) of the Heart covered by 1.30 (Gy)	<div><div></div></div>	<div><div></div><div>25</div></div>
8	Volume (%) of the Lung_R covered by 7.80 (Gy)	<div><div></div></div>	<div><div></div><div>15.17</div></div>
9	Mean dose (Gy) to the Heart	<div><div></div></div>	<div><div></div><div>0.5 1 1.5 2</div></div>

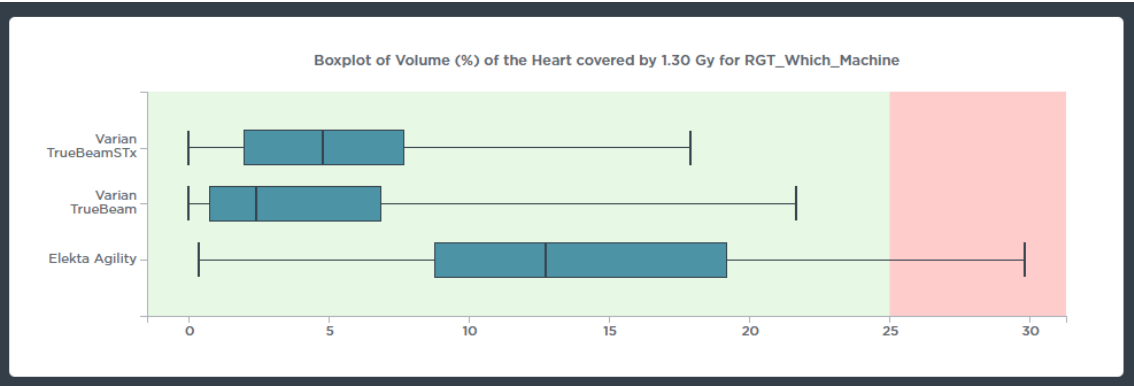
Custom Metrics

	Metric	Status	Objectives
1	*NHS - #Beams	<div><div></div></div>	<div><div></div><div>4 6</div></div>
2	*NHS - #Fractions	<div><div></div></div>	
3	*NHS - Approx. age at imaging [years]	<div><div></div></div>	<div><div></div><div>28 87</div></div>
4	*NHS - Fluence Mode	<div><div></div></div>	
5	*NHS - MeanBeamEnergy	<div><div></div></div>	<div><div></div><div>6 8</div></div>
6	*NHS - Prescriptions [Gy]	<div><div></div></div>	
7	*NHS - TPS	<div><div></div></div>	
8	RGT_Which_Machine	<div><div></div></div>	

Left Breast Heart Dose

- Statistically significant difference in Volume of Heart covered by 1.30 Gy in favour of TrueBeam

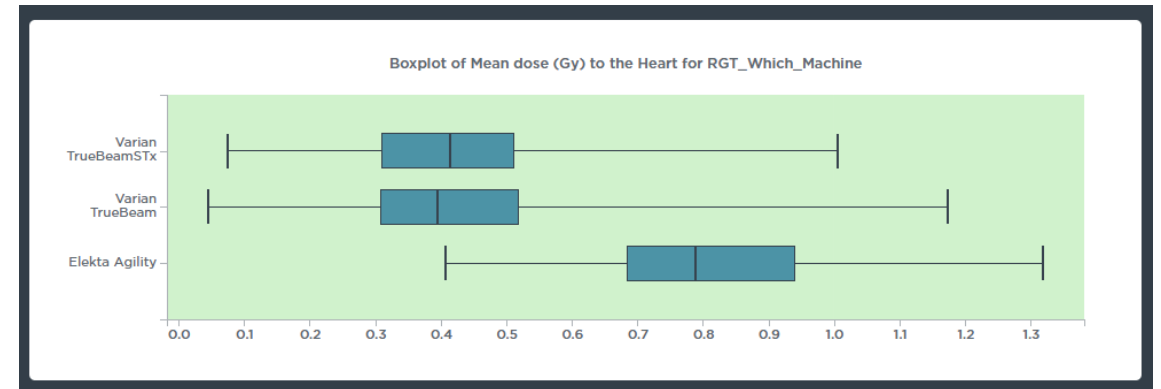
t-Test: Two-Sample Assuming Unequal Variances		
	Agility	TrueBeam
Mean	13.98911902	4.060630838
Variance	51.67419728	16.87636427
Observations	90	119
Hypothesized Mean Difference	0	
df	132	
t Stat	11.7336711	
P(T<=t) one-tail	1.60214E-22	
t Critical one-tail	1.65647927	
P(T<=t) two-tail	3.20428E-22	
t Critical two-tail	1.978098842	



Left Breast Heart Dose

- Heart mean dose also statistically significant

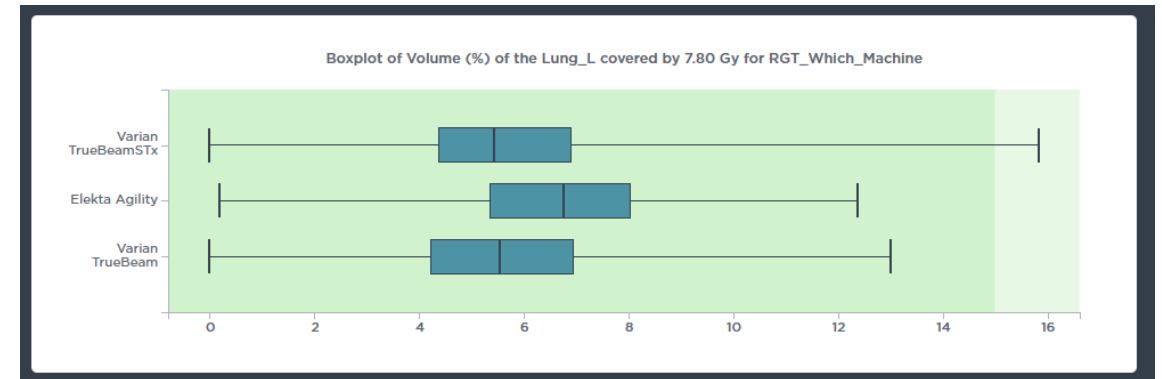
t-Test: Two-Sample Assuming Unequal Variances		
	Agility	TrueBeam
Mean	0.808044502	0.424842114
Variance	0.028031001	0.027466569
Observations	90	119
Hypothesized Mean Difference	0	
df	191	
t Stat	16.45589812	
P(T<=t) one-tail	9.074E-39	
t Critical one-tail	1.652870547	
P(T<=t) two-tail	1.8148E-38	
t Critical two-tail	1.97246199	



Left Breast Ipsilateral Lung

- What about the lung volume in the treatment field? V7.8Gy [%]

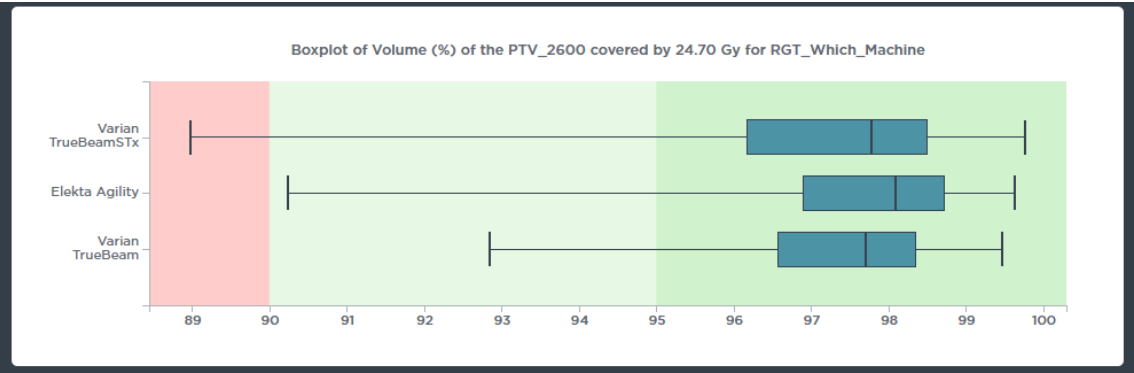
t-Test: Two-Sample Assuming Unequal Variances		
	Agility	TrueBeam
Mean	6.611917156	5.581726901
Variance	4.959961116	4.771257337
Observations	154	120
Hypothesized Mean Difference	0	
df	258	
t Stat	3.840145394	
P(T<=t) one-tail	7.73946E-05	
t Critical one-tail	1.650781102	
P(T<=t) two-tail	0.000154789	
t Critical two-tail	1.969201386	



Left Breast Coverage

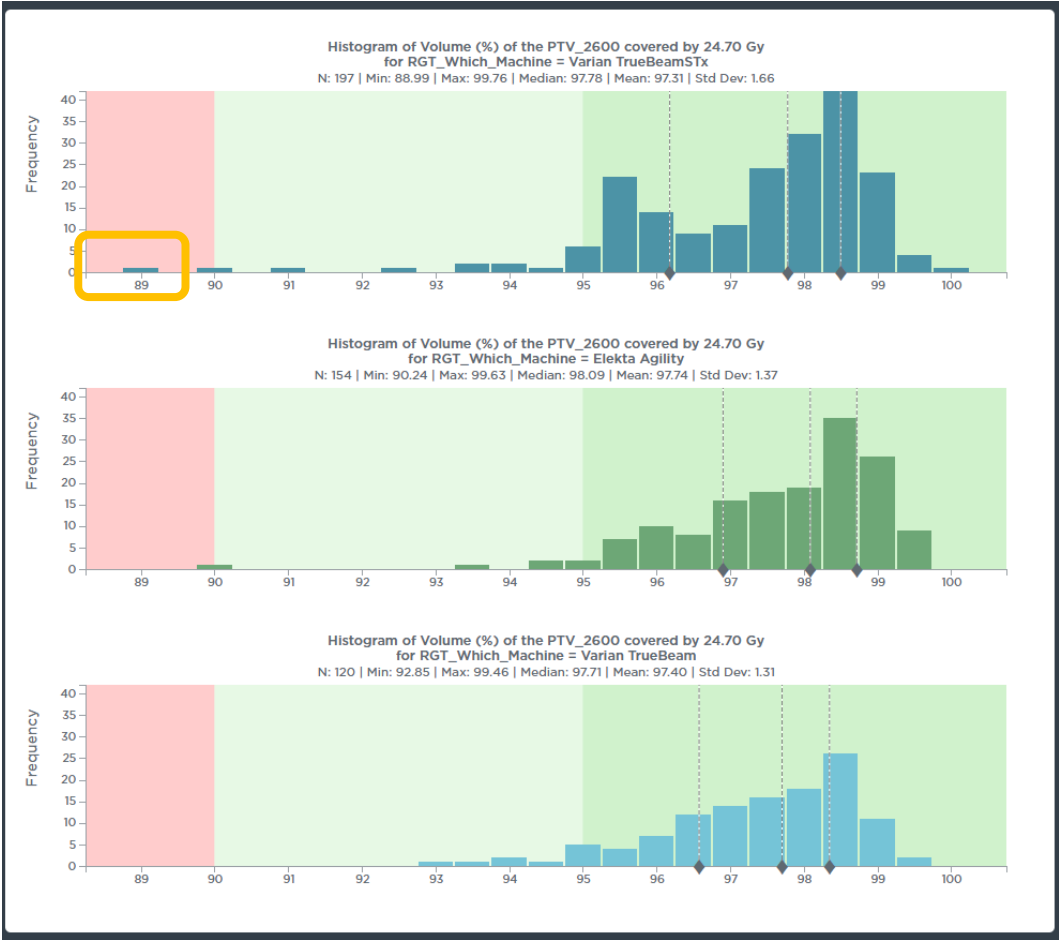
- Volume of PTV_2600 covered by 95% isodose

t-Test: Two-Sample Assuming Unequal Variances		
	Agility	TrueBeam
Mean	97.73565609	97.40030085
Variance	1.89811365	1.717397006
Observations	154	120
Hypothesized Mean Difference	0	
df	261	
t Stat	2.054764222	
P(T<=t) one-tail	0.020448643	
t Critical one-tail	1.650712727	
P(T<=t) two-tail	0.040897285	
t Critical two-tail	1.969094724	



Left Breast Coverage

- What happened here?



Why?

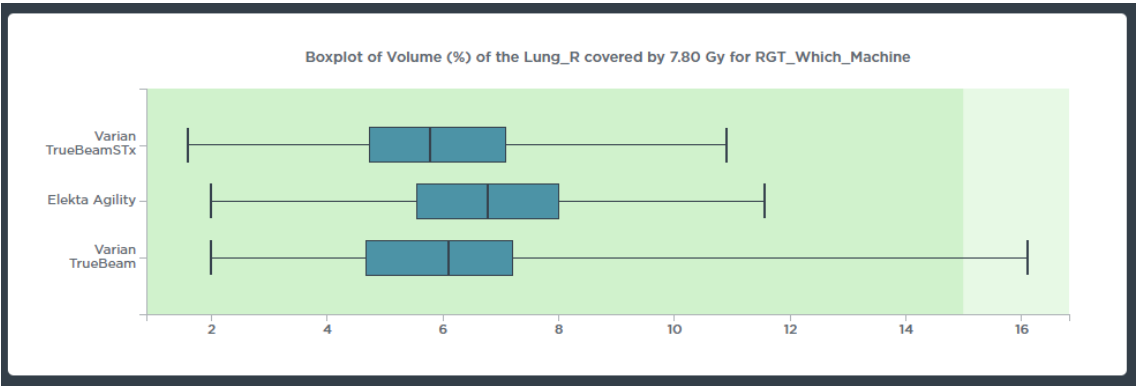
- Recap:
 - Statistically significant reduction in OAR doses for Left sided 26 Gy/5#s breasts on TrueBeam
 - Modest reduction in PTV coverage at 95% isodose
- Confounding variables
 - More complex cases may end up on Agility (not true anymore)
 - Beam model and dose calculation
 - New TrueBeams have AlignRT to support DIBH
 - DIBH pre-dates TrueBeams
 - Used for left sided breasts when tolerated



Right Breast Ipsilateral Lung

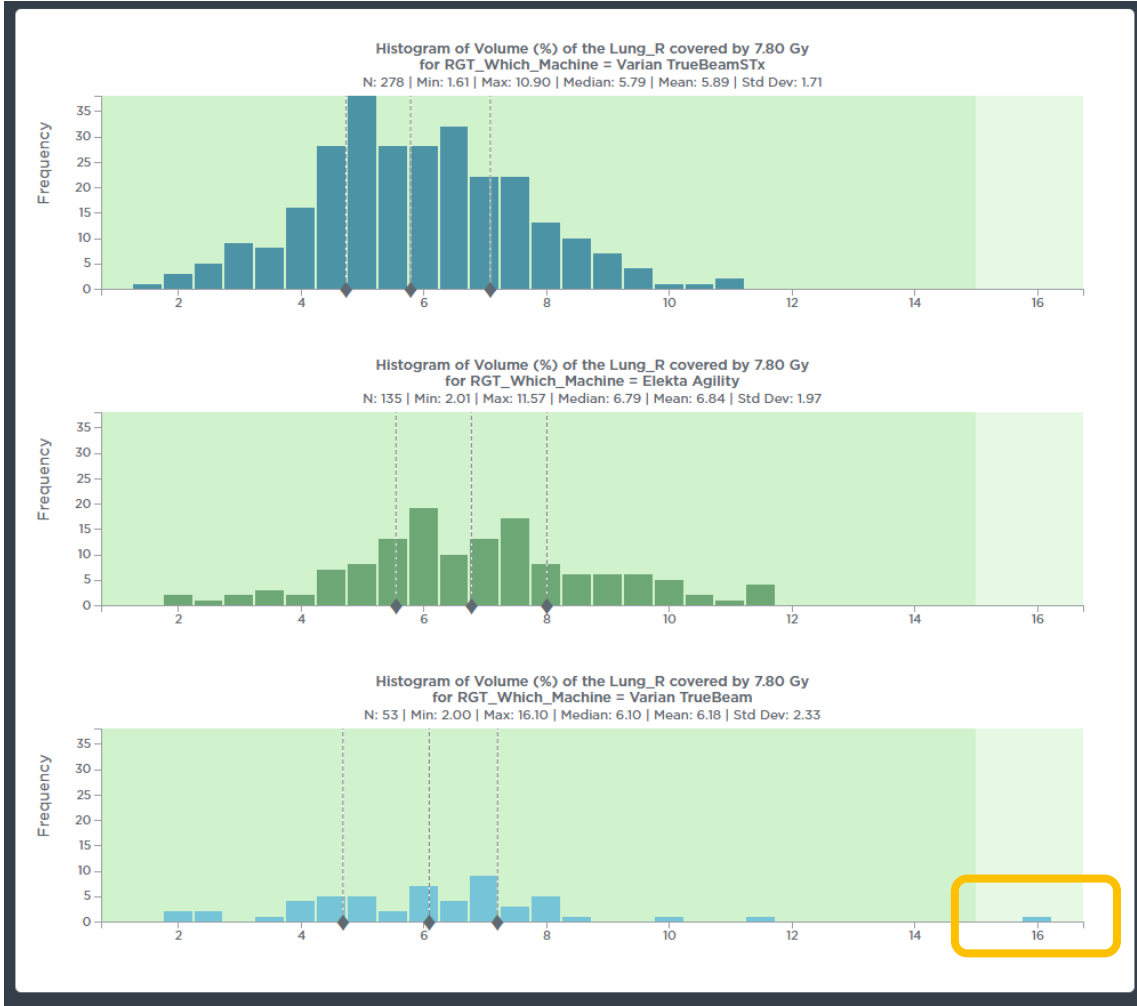
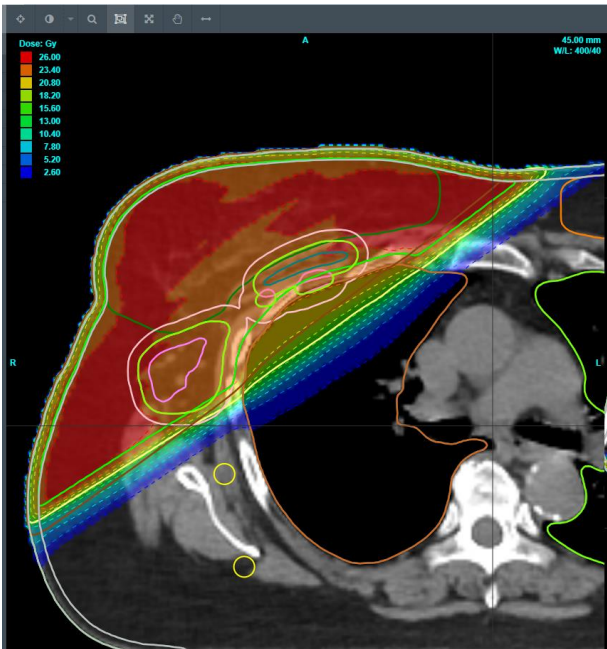
- What about the lung volume in the treatment field? V7.8Gy [%]

t-Test: Two-Sample Assuming Unequal Variances		
	Agility	TrueBeam
Mean	6.835347594	6.178773846
Variance	3.903161863	5.52371742
Observations	135	53
Hypothesized Mean Difference	0	
df	82	
t Stat	1.79945095	
P(T<=t) one-tail	0.03781294	
t Critical one-tail	1.663649184	
P(T<=t) two-tail	0.07562588	
t Critical two-tail	1.989318557	



Right Breast Ipsilateral Lung

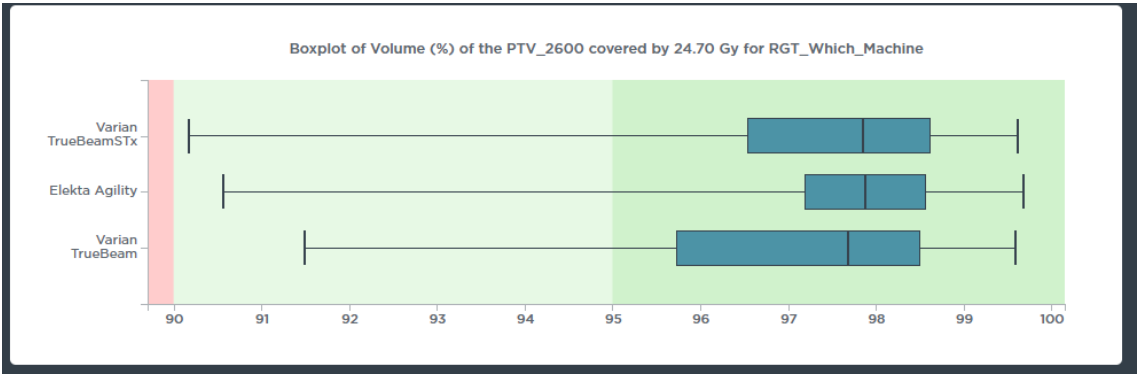
- What happened here?



Right Breast Coverage

- Volume of PTV_2600 covered by 95% isodose

t-Test: Two-Sample Assuming Unequal Variances		
	Agility	TrueBeam
Mean	97.75390405	97.10974467
Variance	1.357466739	3.621328653
Observations	135	53
Hypothesized Mean Difference	0	
df	68	
t Stat	2.300829469	
P(T<=t) one-tail	0.012236828	
t Critical one-tail	1.667572281	
P(T<=t) two-tail	0.024473655	
t Critical two-tail	1.995468931	

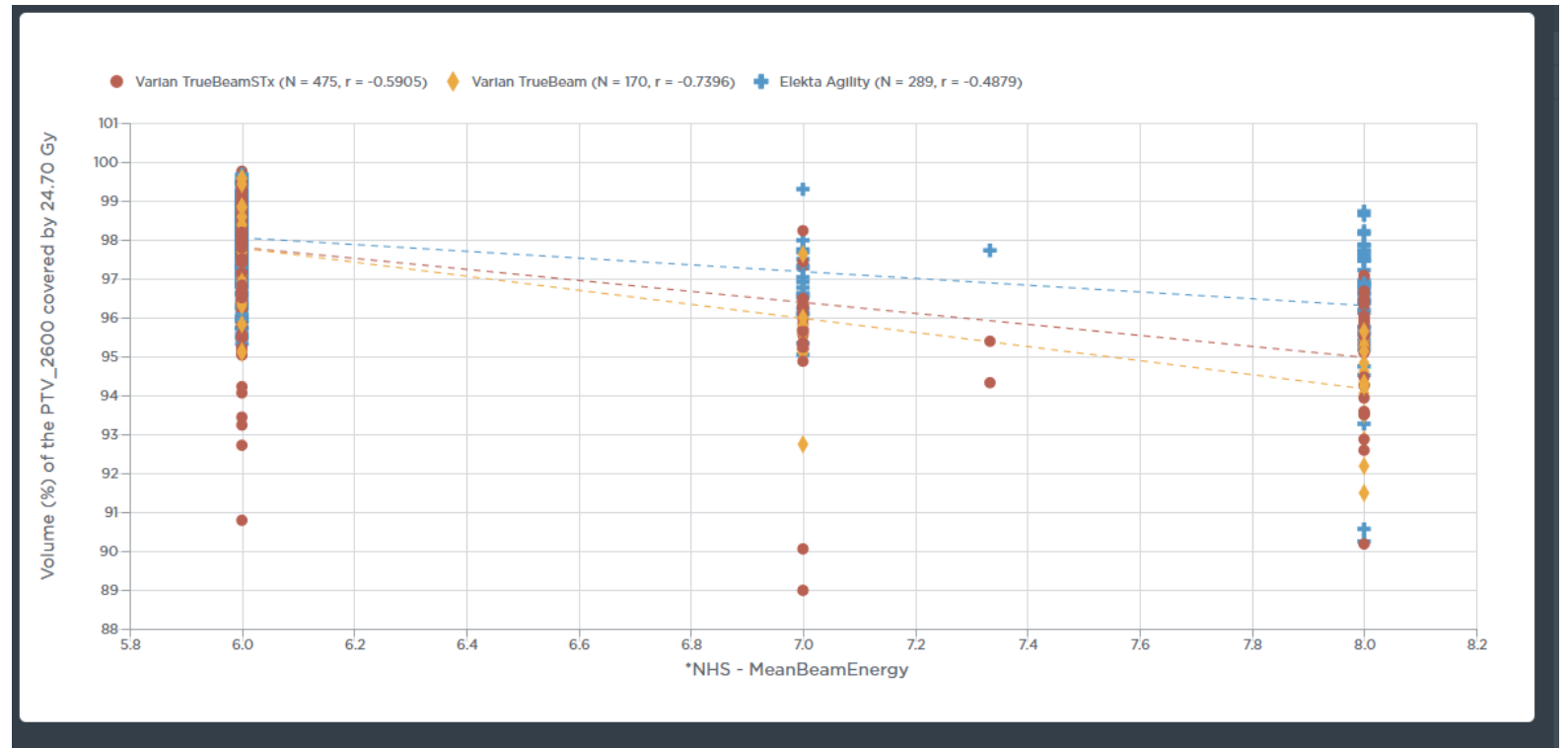


Recap

- On both left and right sided breasts 26 Gy/5#s comparing Agility and TrueBeam
 - Statistically significant reduction in OAR doses on TrueBeam
 - Modest reduction in PTV_2600 coverage at 95% isodose
- Why?

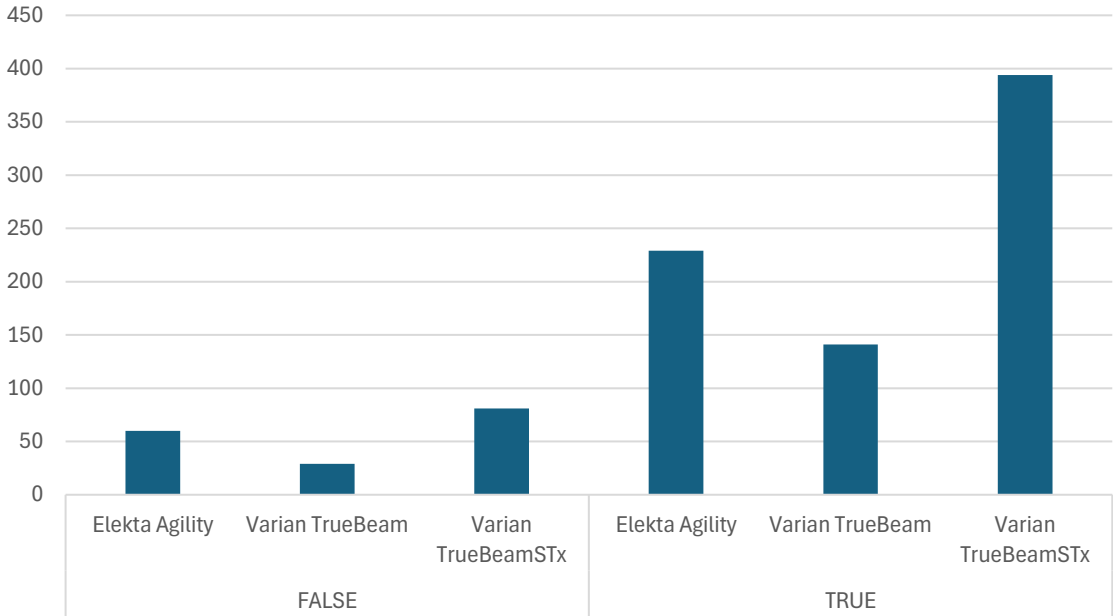
Combined Breast Data

- Pooled breast data using the compare collections feature
- Grouped by treatment machine and mean energy



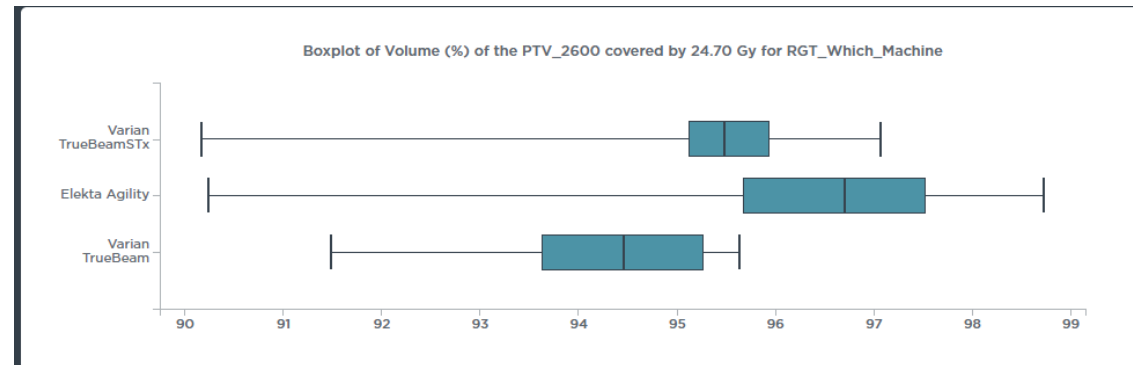
Combined Breast Data – Energy Mix

Observations			
	<u>Elekta Agility</u>	<u>TrueBeam</u>	<u>Row totals</u>
<u>10X</u>	60	29	89
<u>No 10X</u>	229	141	370
<u>Col totals</u>	289	170	459
Expected			
	<u>Elekta Agility</u>	<u>TrueBeam</u>	
<u>10X</u>	56.03703704	32.96296296	
<u>No 10X</u>	232.962963	137.037037	
Chi-Square			
	<u>Elekta Agility</u>	<u>TrueBeam</u>	
<u>10X</u>	0.280262417	0.476446109	
<u>No 10X</u>	0.067414473	0.114604605	
	SUM	0.938727604	
	P-Value	0.332605284	



10X Beams Only - Coverage

- Pooled Breast Data
- Plans with 10X tangent beams
- Statistically significant difference in coverage when using 10X on Agility beam model

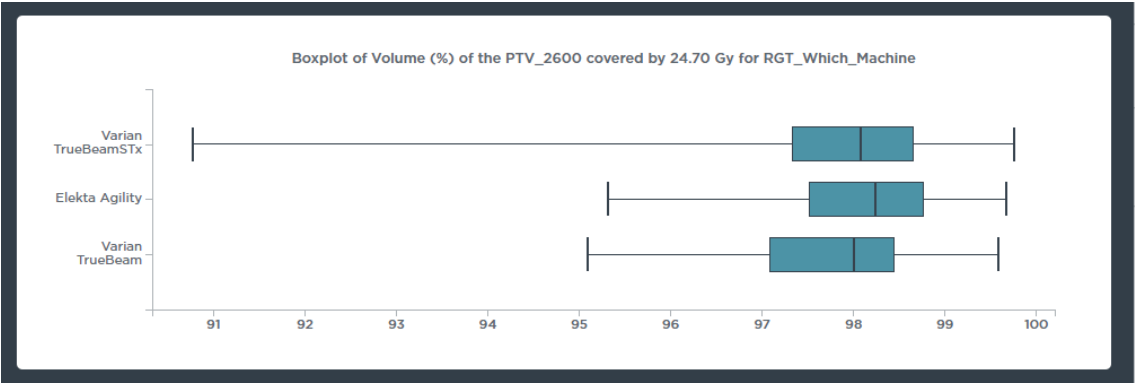


t-Test: Two-Sample Assuming Unequal Variances		
	Agility	TrueBeam
Mean	96.35774901	94.26601934
Variance	3.170622737	1.507019086
Observations	41	16
Hypothesized Mean Difference	0	
df	40	
t Stat	5.050646383	
P(T<=t) one-tail	5.03695E-06	
t Critical one-tail	1.683851013	
P(T<=t) two-tail	1.00739E-05	
t Critical two-tail	2.02107539	

6X Beams Only - Coverage

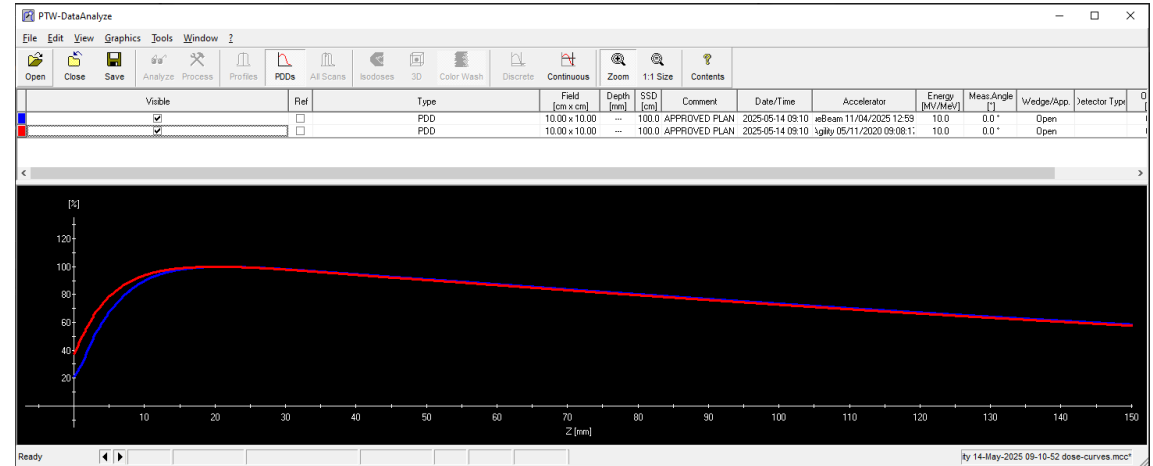
- What about the 6X case?
- Also statistically significant, but is it clinically significant?

t-Test: Two-Sample Assuming Unequal Variances		
	Agility	TrueBeam
Mean	98.0596574	97.79591245
Variance	0.937966865	0.983110645
Observations	229	141
Hypothesized Mean Difference	0	
df	291	
t Stat	2.506933906	
P(T<=t) one-tail	0.006361735	
t Critical one-tail	1.650106758	
P(T<=t) two-tail	0.012723471	
t Critical two-tail	1.968149554	



Beam modelling

- TrueBeam Blue, Agility Red
- TrueBeam 10X harder beam
- Consider increasing 6X SMLC beam weighting to top-up coverage when using 10X tangents on TrueBeam
- Uniform margins for structures via scripting would be helpful



	R100 [mm]	R80 [mm]	R50 [mm]	Ds [%]	D100 [%]	SSD [cm]	Field Size [cm x cm]	Curve Type
	21.01	80.90	183.62	24.64	73.54	100.0	10.00 x 10.00	PDD
	20.89	78.75	179.91	42.52	72.73	100.0	10.00 x 10.00	PDD

Summary

- Talked through semi-automated approach to ProKnow data collection @ CUH
 - DICOM forwarding + small script in RayStation to help with local collection assignment
 - National collections are populated as and when...
- Audited simplest breast fractionation 25Gy/5#s
 - Compared TrueBeam & Agility plan quality
 - Statistically significant reduction in OAR dose on TrueBeam
 - Confounded by introduction of SGRT
 - Statistically significant reduction in coverage at the 95% level on TrueBeam
 - 10X worse than 6X

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