



University Hospital
Southampton
NHS Foundation Trust

Experience of IQM at Southampton for CNS and SRS cases

04/03/2025

Laura Smith &
Mekala Chandrasekaran

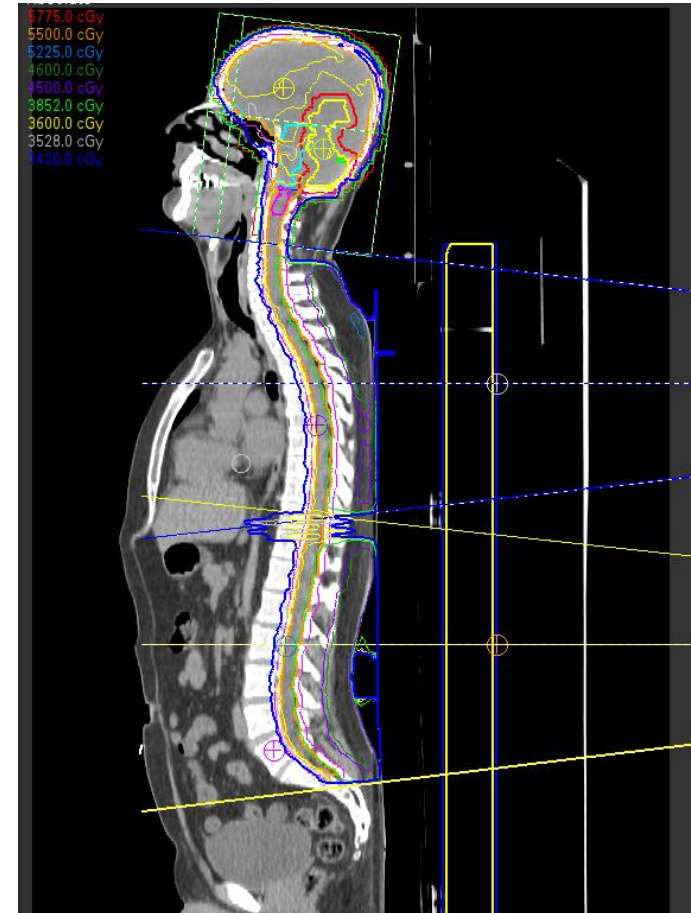
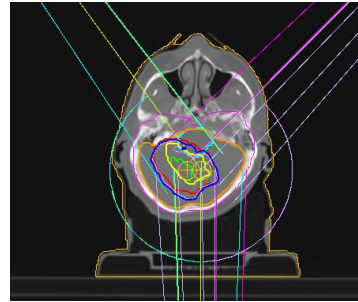
IQM for a CNS case

Case Study: CNS

- 36 Gy in 20# Craniospinal
- 19.8 Gy in 11# PF Boost

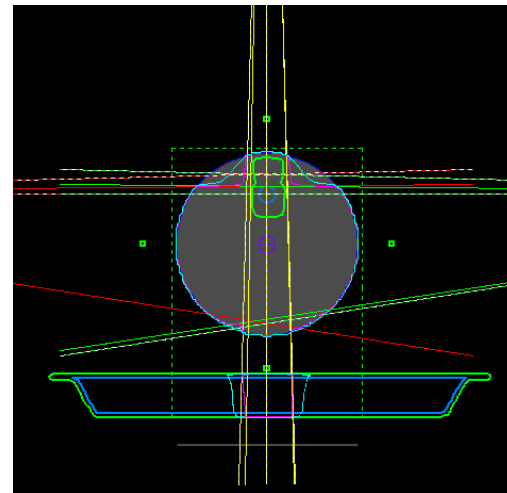
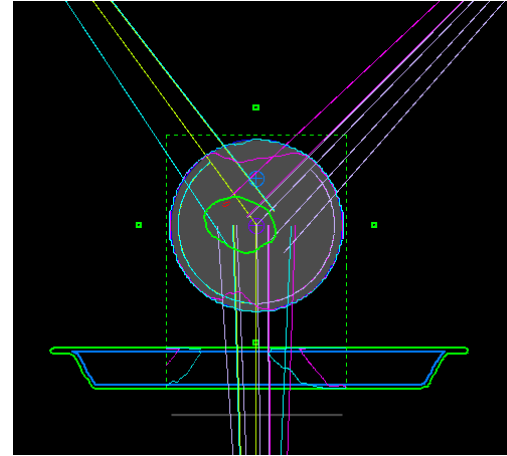
- Boost - VMAT
 - ISO_PF_Boost
 - 05Arc, 06Arc, 07 Arc, 08Arc

- CNS - IMRT
 - ISO_Brain
 - 01R Brain (F 355°, G 270°, C 277°)
 - 02L Brain (F 5°, G 90°, C 83°)
 - ISO_Sp_Sup
 - 03P Sp_Sup (F 0°, G 180°, C 270°)
 - ISO_Sp_Inf
 - 04P Sp_Inf ((F 0°, G 180°, C 270°)



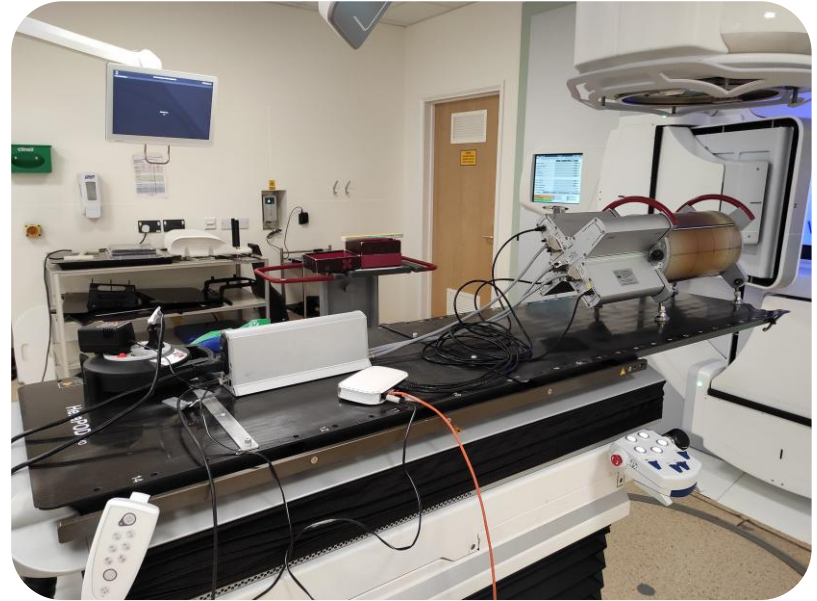
Previous Plan Verification: Delta4 Plan

- Recalculation of RT plan on phantom in TPS
- VMAT fields recalculated using clinical plan geometry, isocentric
- IMRT fields
 - Shifted isocentre
 - Brain parallel opposed fields – couch rotation removed
 - Spine fields – calculated for $G0^\circ$



Previous Plan Verification: Delta4 Setup

- Two crossing arrays of p-Si detectors
- 20 x 20 cm detection area
 - 10mm resolution
 - 5mm resolution at central 6 x 6cm
- Setup ~ 45 mins
 - Including daily output measurement

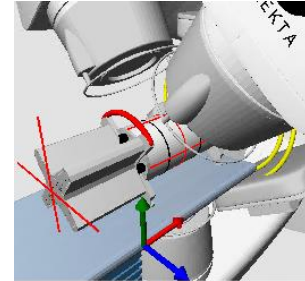


Delta4 (Scandidos, Sweden)

Case Study: CNS – Delta 4 Measurements

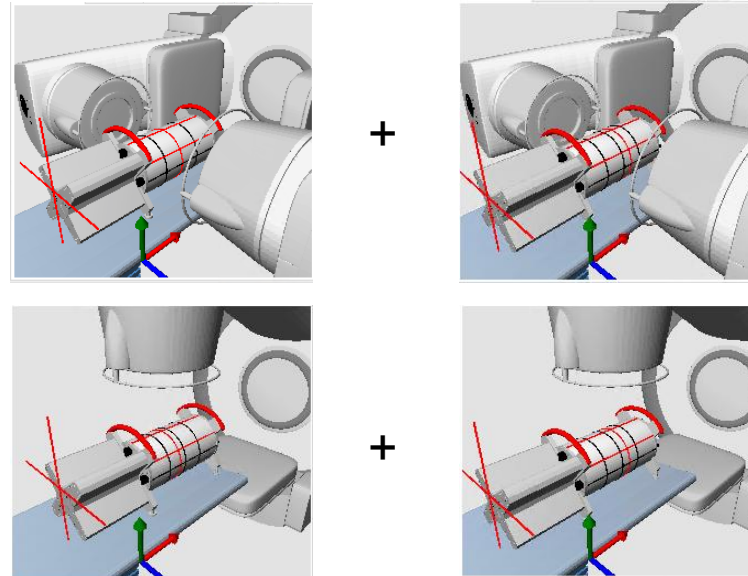
VMAT Boost – No Shifts

- 05Arc, 06Arc, 07Arc, 08Arc



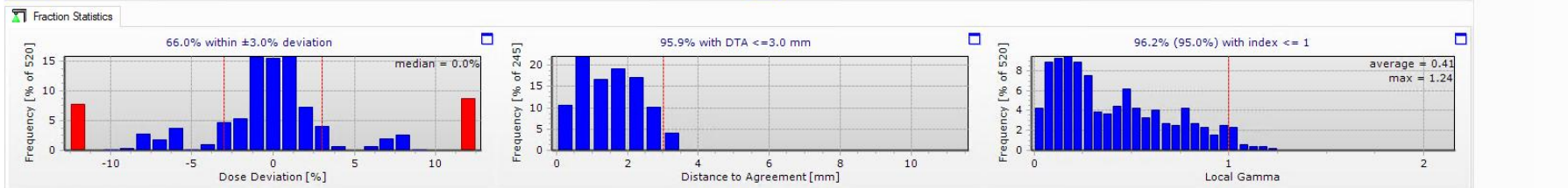
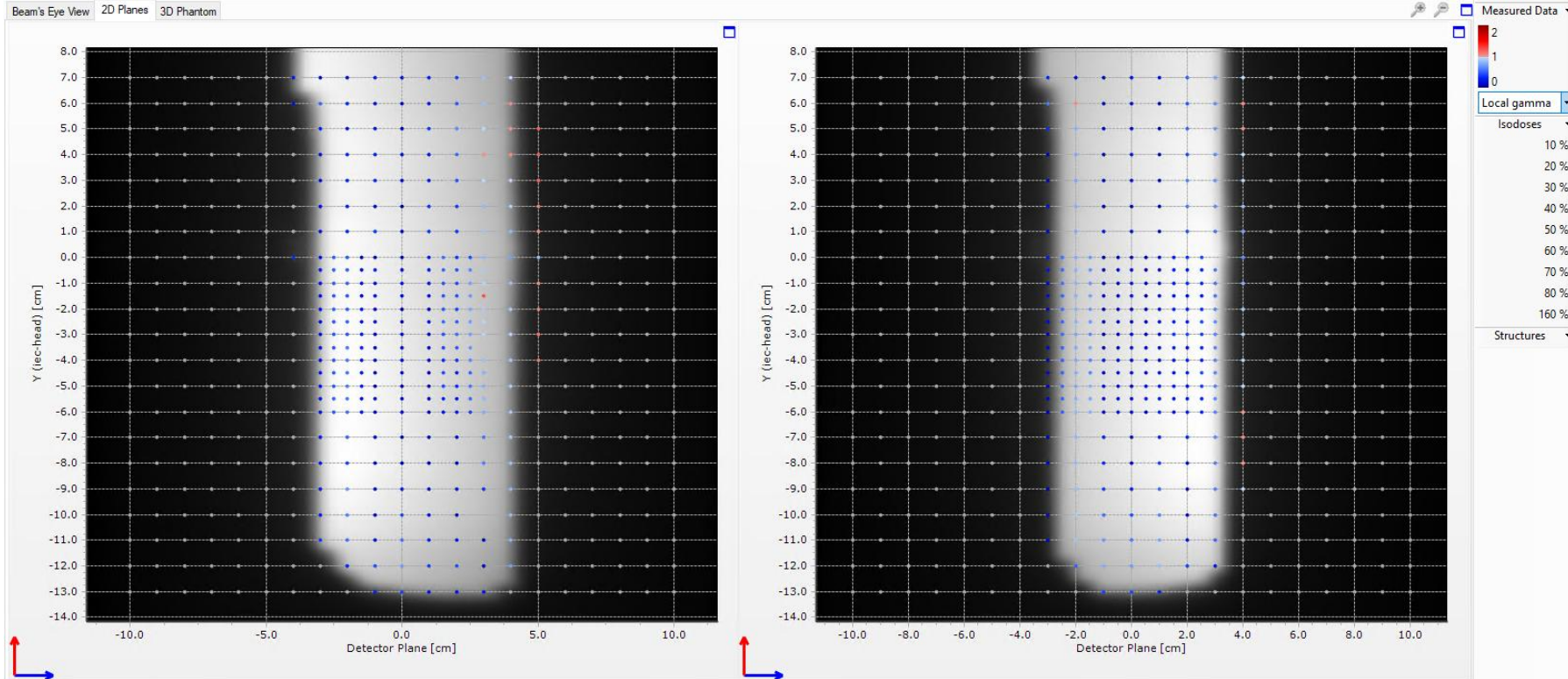
IMRT Fields

- 01 and 02
 - No shift
 - 6cm Ant Shift
- 03 and 04
 - 6cm Ant shift
 - ± 3 cm Long shift



- Total measurements = 4 (VMAT) + 8 (IMRT) ~ **1 hour 30 minutes**

Case Study: CNS – Delta 4 Analysis



Case Study: CNS – Delta 4 Summary

- Pre-measurement prep ~ 30 minutes
- Setup ~ 45 minutes
- Measurements ~ 1 hour 30 minutes
- Post-measurement report generation and export ~ 10 minutes
- **Total ~ 3 hours**

Current Plan Verification: IQM

- Transmission detector
- Spatially sensitive
- Simplicity – wireless and automated
- IQM Plan Prep ~ 1 minute
 - Export RTPlan to IQM Server
 - Automatic reference calculation
- Setup Time ~ 10 mins
 - Inc. daily output factor



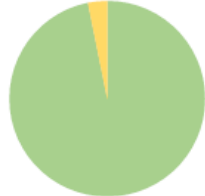
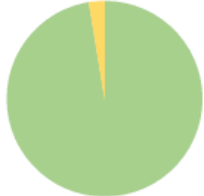
IQM (iRT Systems GmbH, Germany)

Case Study: CNS – IQM Measurements

- IQM application syncs with opening patient in R&V
- No shifts or setup variations
- Live alerts for watch / action level
- Measurements ~ 15 minutes

Case Study: CNS – IQM Results

- Automatic PDF/csv reports generated
- Final cumulative signal deviation [%]
- Segment- by-segment [%]

VMAT Calculated Reference				
Field(s) with ID(s) 05, 06, 07, 08 was/were compared against a reference calculated on 28-Feb-2025 at 12:46				
Cumulative Results:			Segment-by-Segment Results:	
				
Cumu. Watch SPR	97%	Pass	SbS Watch SPR	97%
Cumu. Action SPR	100%	Pass	SbS Action SPR	N/A
Final Cumu. Deviation	+0.1%	Pass		N/A

Field-by-Field Evaluation of Measurement Results:

Field ID	Session #	Beam Energy [MV]	Gantry Angle Span [°]	Field MU/ Ref. Type Fraction	Final Cumu. Dev [%]	Segment-weighted Pass Rate [%]				Field Result	
						Cumu. Watch	Cumu. Action	SbS Watch	SbS Action		
01	1	6	270.0	98.5	C	-1.1	100	100	100	100	Pass
02	1	6	90.0	98.5	C	-1.4	100	100	100	100	Pass
03	1	6	180.0	346.2	C	0.3	100	100	100	100	Pass
04	1	6	180.0	328.8	C	-1.1	100	100	100	100	Pass
05	1	6	180.0-324.0	79.4	C	0.3	90	100	96	N/A	Watch
06	1	6	44.0-179.0	99.8	C	-0.3	90	100	97	N/A	Watch
07	1	6	179.0-44.0	90.4	C	0.4	83	100	100	N/A	Watch
08	1	6	324.0-180.0	54.8	C	-0.4	84	100	96	N/A	Watch

Applied Tolerance Levels

Applied to Session 1		
	Watch [%]	Action [%]
Static/StepNShoot IMRT Calculated Cumulative (constant)	± 2.8	± 6.3
Static/StepNShoot IMRT Calculated Segment by Segment (constant)	± 7.0	± 14.0
VMAT Calculated Cumulative (constant)	± 2.5	± 6.3
VMAT Calculated Cumulative (short)	± 2.5	± 6.3
VMAT Calculated Segment by Segment (constant)	± 15.0	--
Cumulative Signal Pass Rate	95	95
Segment by Segment Signal Pass Rate	95	95

Case Study: CNS – IQM Summary

- Pre-measurement prep ~ 1 minute
- Setup ~ 10 minutes
- Measurements ~ 15 minutes
- Post-measurement report generation and export ~ Automated
- **Total < 26 minutes**

Case Study: CNS – IQM Summary

- IQM provides time efficient verification for multi-isocentre plans where phantom-based verification is time consuming and challenging
- Estimated saving per CNS ~ 2.5 hours
- IQM enables to cover entire 40 x 40cm radiation treatment field – eliminates need for shifting phantom for complex cases
- Automated plan preparation and PDF exports

Thank you for listening!