Generic monitoring of scan protocols in CT

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Disclaimer

– Starting from (18/10/2011)

- Visiting researcher at the University Hospitals of Leuven, Belgium

- Co-founder of qaelum NV, a spin-off company of the University Hospitals Leuven, specialized in automated quality control and patient dose monitoring

QAELUM
TOTALQUALITYMONITORING

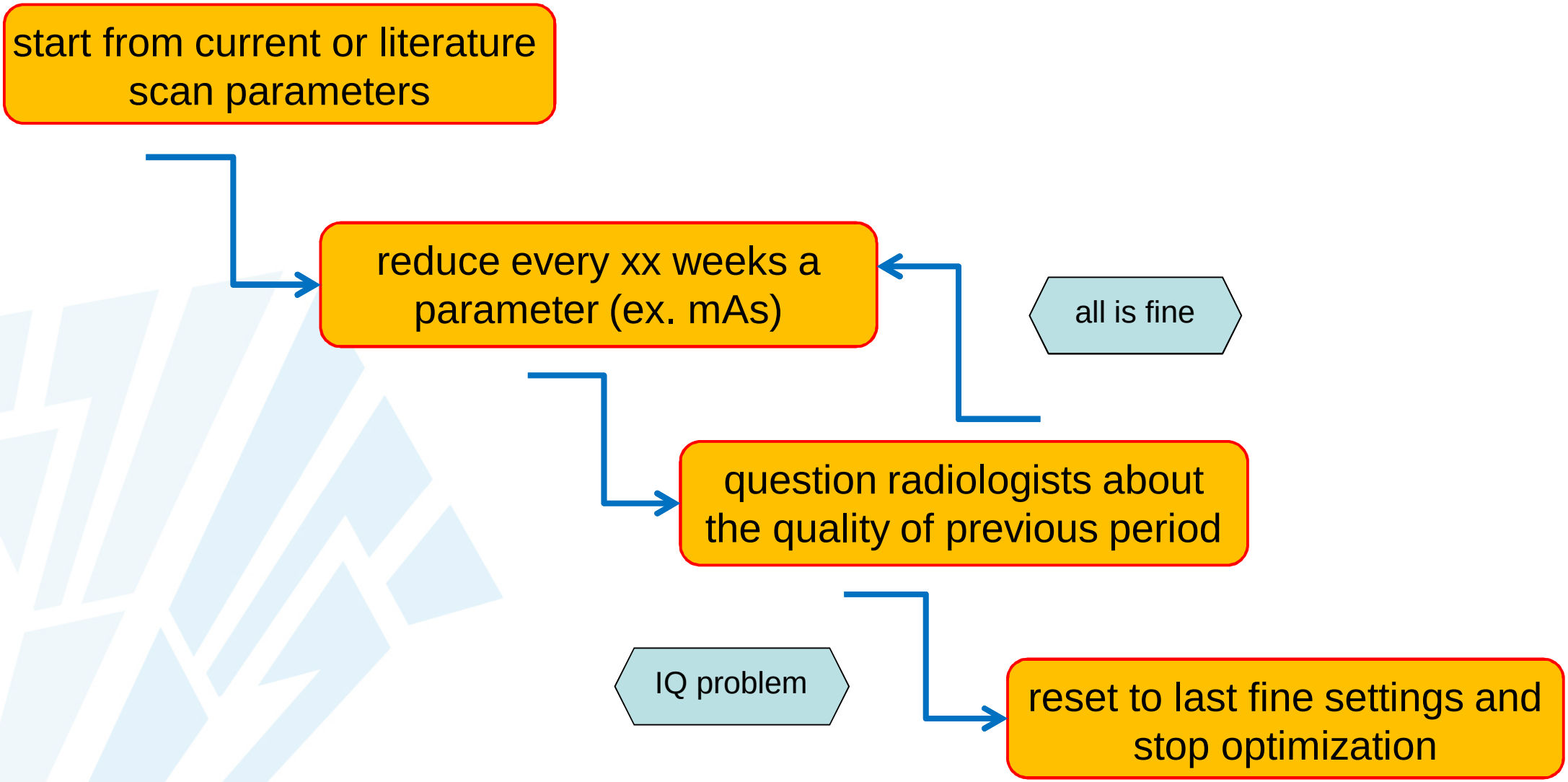
Introduction

- CT systems contain different protocols with predefined scan parameters

- predefined scan parameters come from …
  - factory defaults
  - scan parameters from literature
  - optimization studies

Optimization

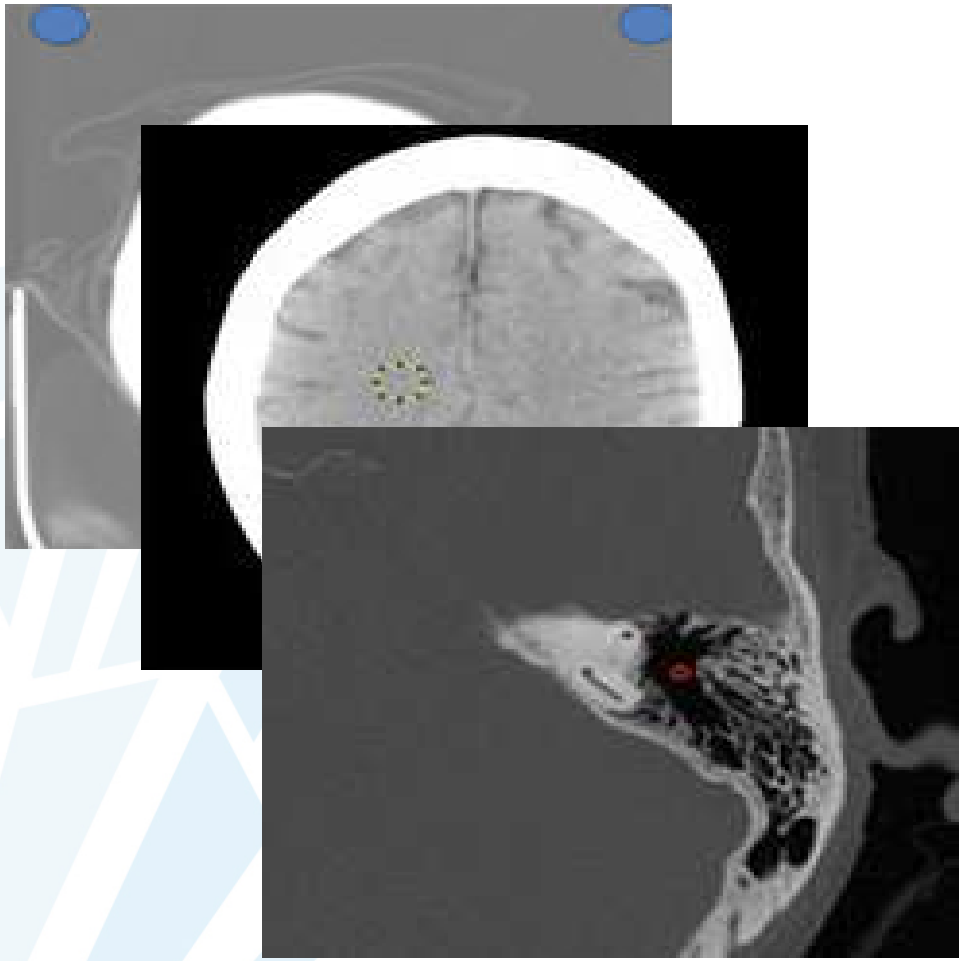
- using an iterative process …



Optimization

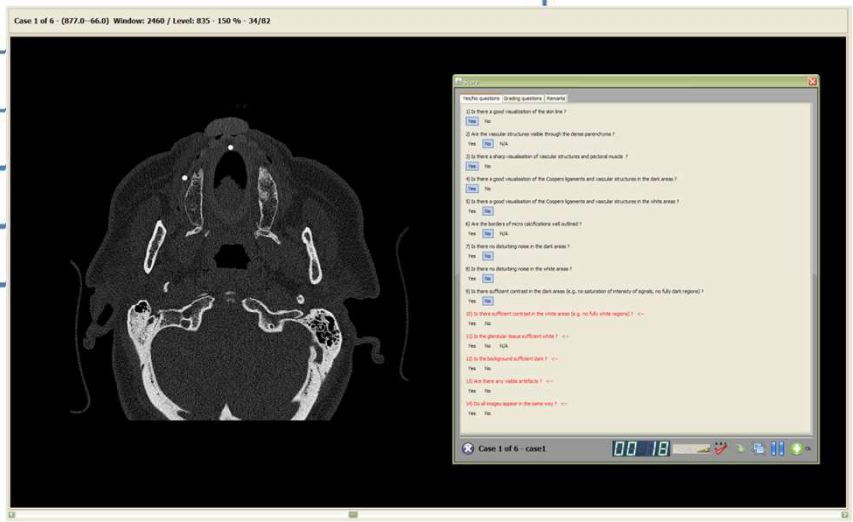
- using deceased bodies …
  - close collaboration with forensic department

anatomical measurements



observer experiments (VGA / IQC)

Brain	Petrous bone	Scores
Brainstem	Lateral mallear ligament	3 = excellent
Cerebellum	Stapedial superstructure	2 = very good
Ventricular system	Stapedial footplate	1 = good
Grey/white matter	Chochlear modiolus	0 = current standard
Chiasma opticum	Chorda tympani channel	-1 = average
Nucleus lentiformis	Vestibular aqueduct	-2 = limit
Crus posterius capsulae internae	Cochlear aqueduct	-3 = bad
Thalamus		
Arteria cerebri media		
Arteria basilaris		
Arteria vertebralis		
Global evaluation		

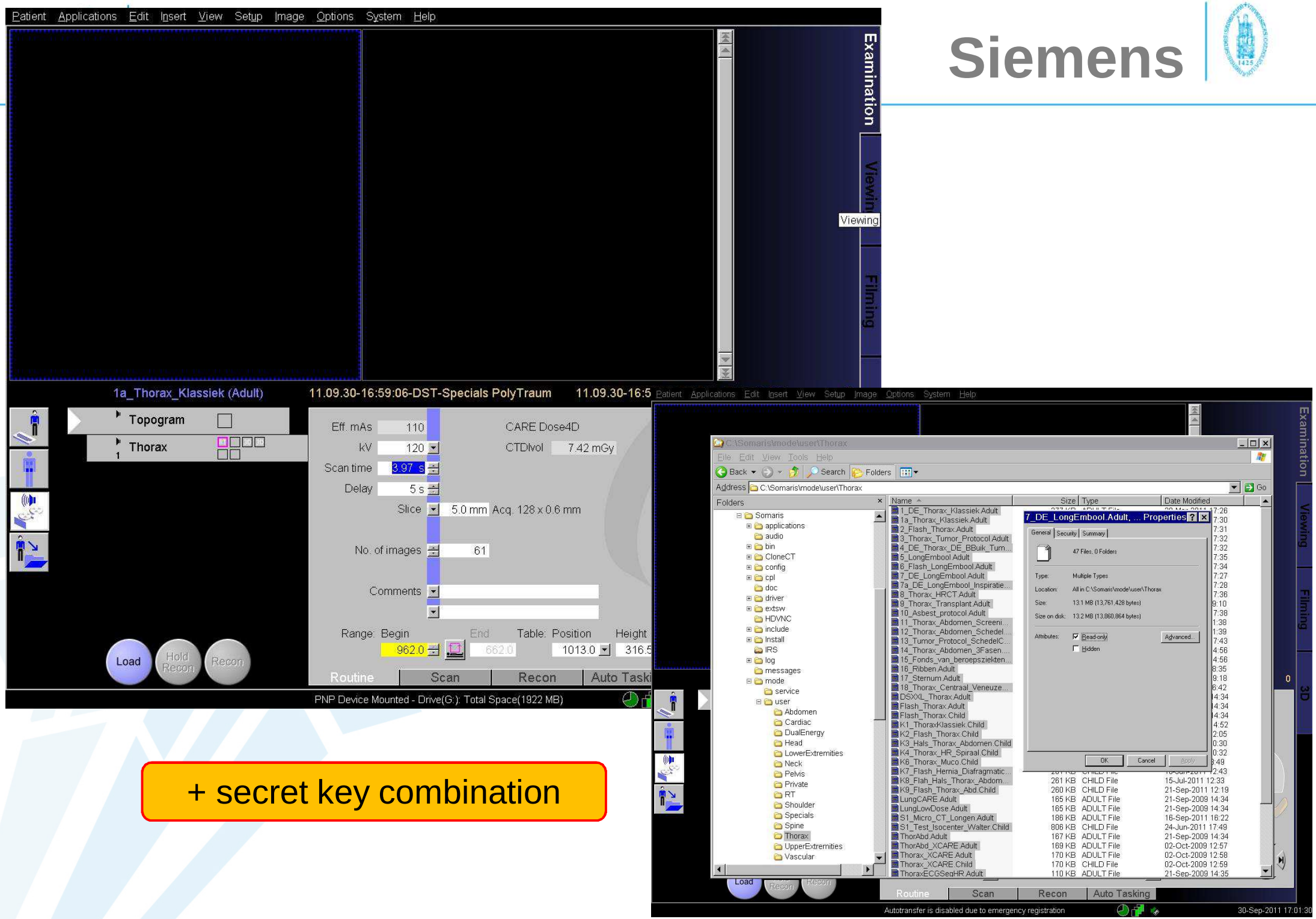


… and then the service engineer enters the room with the latest upgrade ….

… and you weren’t notified

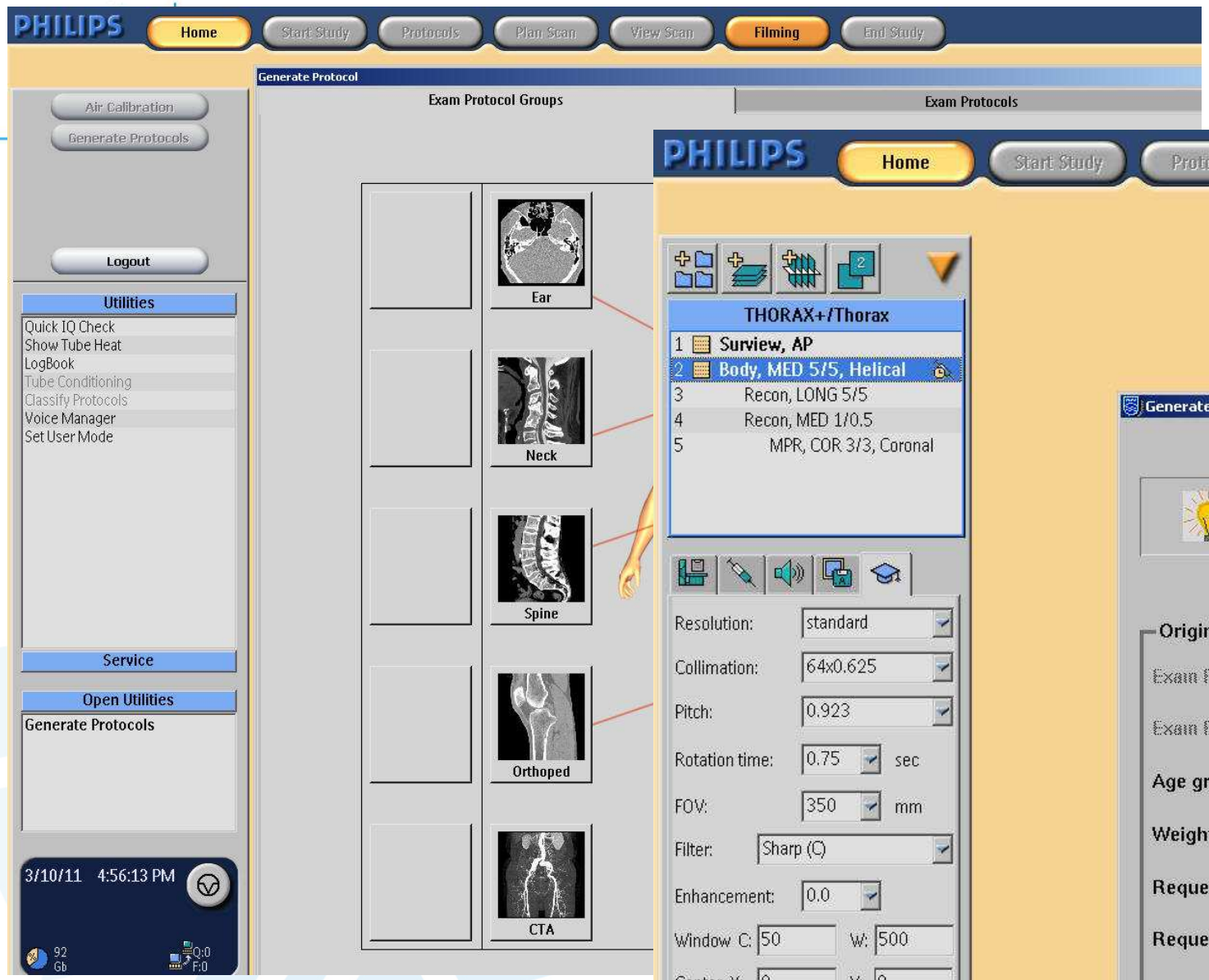
CT console security

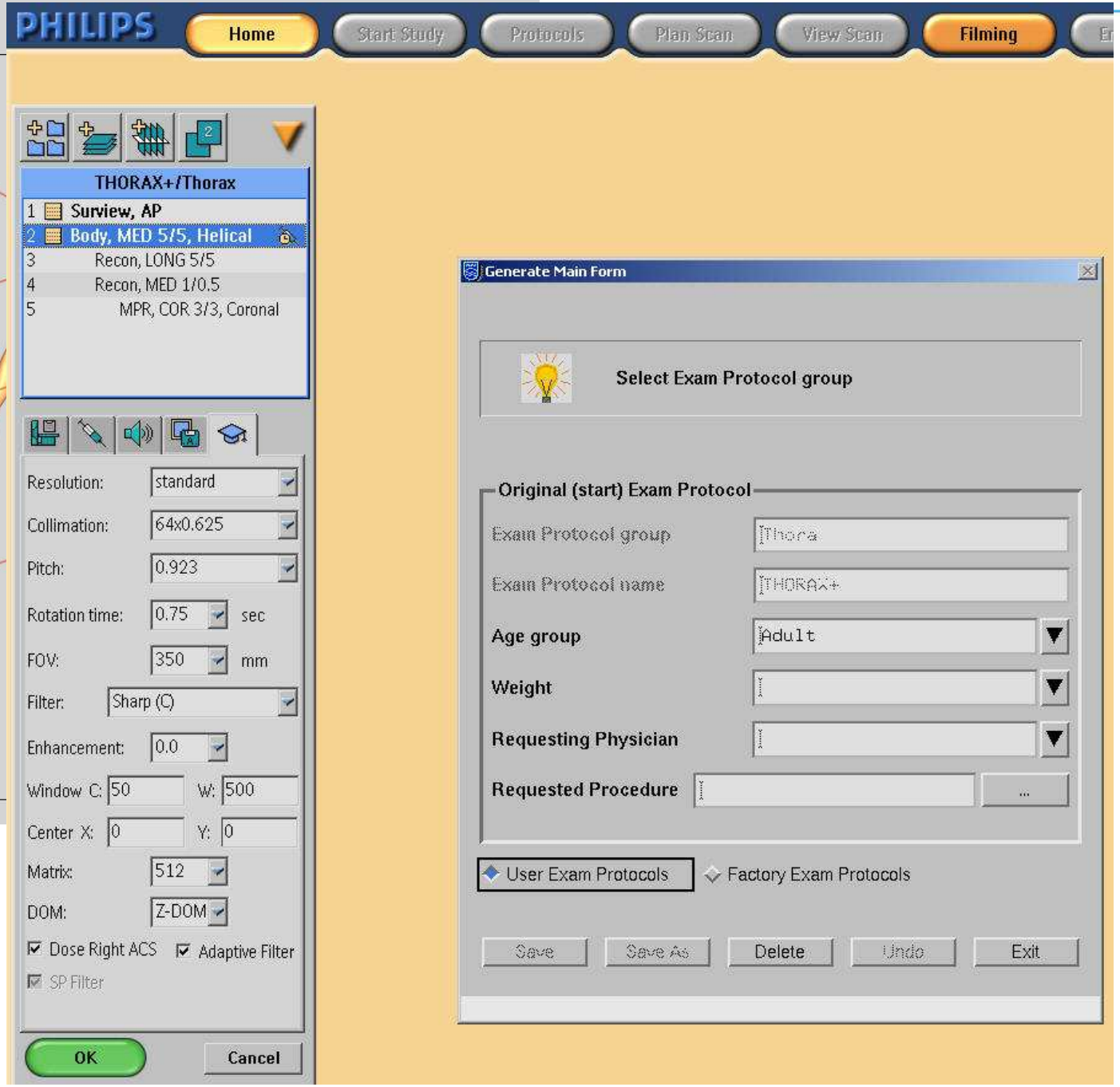
Siemens



+ secret key combination

Philips


PHILIPS
Home
Start Study
Protocols
Plan Scan
View Scan
Filming
End Study
Generate Protocol
Exam Protocol Groups
Exam Protocols
Air Calibration
Generate Protocols
Logout
Utilities
Quick IQ Check
Show Tube Heat
LogBook
Tube Conditioning
Classify Protocols
Voice Manager
Set User Mode
Service
Open Utilities
Generate Protocols
3/10/11 4:56:13 PM
92 Gb
Q:0 F:0
Ear
Neck
Spine
Orthoped
CTA


PHILIPS
Home
Start Study
Protocols
Plan Scan
View Scan
Filming
THORAX+/Thorax
1 Surview, AP
2 Body, MED 5/5, Helical
3 Recon, LONG 5/5
4 Recon, MED 1/0.5
5 MPR, COR 3/3, Coronal
Resolution: standard
Collimation: 64x0.625
Pitch: 0.923
Rotation time: 0.75 sec
FOV: 350 mm
Filter: Sharp (C)
Enhancement: 0.0
Window C: 50 W: 500
Center X: 0 Y: 0
Matrix: 512
DOM: Z-DOM
Dose Right ACS
Adaptive Filter
SP Filter
OK
Cancel
Generate Main Form
Select Exam Protocol group
Original (start) Exam Protocol
Exam Protocol group Thora
Exam Protocol name THORAX+
Age group Adult
Weight
Requesting Physician
Requested Procedure
User Exam Protocols
Factory Exam Protocols
Save
Save As
Delete
Undo
Exit

Aim

to develop a generic solution to monitor modifications in CT scan protocols

Material and methods

- no way to be notified when parameters are modified
- regular manual evaluation ?
  → *compare against what ? print-outs ?*
  → *workload (32 CT scanners)*
- large number of protocols/scanner
- vendor specific format

561

Siemens Somatom Definition Flash
Siemens Somatom Definition AS+
Siemens Somatom Definition 16
Siemens Somatom Definition 64
Siemens Somatom Open

157

Philips Brilliance 64

115

GE Brightspeed Pro 16

Protocols (Siemens)

Protocol name	Range name	Series description	kV	kV(A	kV(B	Quality ref.	Qua	Qual	(Eff.)	(Eff	(Eff	Dose	CARE Dose	CTDIvol	Rotation	Pitc	Collimatio	Slic	Acq.	Slic	Position	No. of	Kernel/Algorithm	Window
Customized scan protocols																								
Head																								
HeadRoutine (Child)	Topogram	Topogram 0.6 T20r	120			96			96			aff	CARE Dare	0.115217	0.5	0	0.6	0.6	6×0.6mm	0.6		1	T20r standard	Topogram Head
	Head		120			190			190			an	CARE Dare4D	29.0183	1	0.8	0.6	5	128×0.6mm					
		Head 5.0 C30r																		5	5	25	C30r med.r.mooth FR	Baby Brain
HeadRoutineSeq (Child)	Topogram	Topogram 0.6 T20r	120			96			96			aff	CARE Dare	0.115217	0.5	0	0.6	0.6	6×0.6mm	0.6		1	T20r standard	Topogram Head
	HeadSeq		120			170			170			an	CARE Dare4D	31.1867	1	0	1.2	4.8	12×1.2mm					
		HeadSeq 4.8 C30r																		4.8		27	C30r med.r.mooth FR	Baby Brain
HeadSeq_XCARE (Child)	Topogram	Topogram 0.6 T20r	120			96			96			aff	CARE Dare	0.115217	0.5	0	0.6	0.6	6×0.6mm	0.6		1	T20r standard	Topogram Head
	HeadSeq_XC		120			170			170			an	CARE Dare4D	29.4567	1	0	1.2	5	32×1.2mm					
		HeadSeq_XC 5.0 C30r																		5		27	C30r med.r.mooth FR	Baby Brain
Head_XCARE (Child)	Topogram	Topogram 0.6 T20r	120			96			96			aff	CARE Dare	0.115217	0.5	0	0.6	0.6	6×0.6mm	0.6		1	T20r standard	Topogram Head
	Head_XC		120			190			190			an	CARE Dare4D	29.0183	1	0.6	0.6	5	128×0.6mm					
		Head_XC 5.0 C30r																		5	5	25	C30r med.r.mooth FR	Baby Brain
InnerEar (Child)	Topogram	Topogram 0.6 T80r	120			96			96			aff	CARE Dare	0.115217	0.5	0	0.6	0.6	6×0.6mm	0.6		1	T80r sharp	Topogram Head
	InnerEar		120			80			80			an	CARE Dare4D	9.97758	1	0.8	0.6	0.6	128×0.6mm					
		InnerEar 0.6 H60r																		0.6	0.6	67	H60r sharp FR	Inner Ear
InnerEarUHR (Child)	Topogram	Topogram 0.6 T80r	120			96			96			aff	CARE Dare	0.115217	0.5	0	0.6	0.6	6×0.6mm	0.6		1	T80r sharp	Topogram Head
	InnerEarUHR		120			80			80			an	CARE Dare4D	17.3523	1	0.85	0.6	0.6	16×0.6mm					
		InnerEarUHR 0.6 U75u																		0.6	0.6	67	U75u very sharp ASA	Inner Ear
InnerEarUHRSeq (Child)	Topogram	Topogram 0.6 T80r	120			96			96			aff	CARE Dare	0.115217	0.5	0	0.6	0.6	6×0.6mm	0.6		1	T80r sharp	Topogram Head
	InnEarUHRSeq		120			80			80			an	CARE Dare4D	18.5091	1	0	0.6	0.6	16×0.6mm					
		InnEarUHRSeq 0.6 U75u																		0.6		68	U75u very sharp ASA	Inner Ear
InnerEarZUHR (Child)	Topogram	Topogram 0.6 T80r	120			96			96			aff	CARE Dare	0.115217	0.5	0	0.6	0.6	6×0.6mm	0.6		1	T80r sharp	Topogram Head
	InnerEarUHR		120			110			110			an	CARE Dare4D	23.987	1	0.85	0.3	0.4	16×0.3mm					
		InnerEarUHR 0.4 U75u																		0.4	0.4	101	U75u very sharp ASA	Inner Ear
K1 Schedel Spiraal (Child)	Topogram	Topogram 0.6 T20r	120			96			96			aff	CARE Dare	0.115217	0.5	0	0.6	0.6	6×0.6mm	0.6		1	T20r standard	Topogram Head
	Schedel		120			190			190			aff	CARE Dare4D	29.0183	1	0.8	0.6	1	128×0.6mm					
		Schedel 1.0 H20r VOL																		1	0.5	241	H20r smooth	Cerebrum
		Schedel 1.0 Axiaal																		1	0.5	241	C60r sharp	Bone
		Schedel 3.0 Axiaal																		3	3	41	H30r medium.smooth	Cerebrum
		Schedel Bat 3.0 Axiaal																		3	3	41	H30r medium.smooth	Cerebrum
K2 SinusLowDose (Child)	Topogram	Topogram 0.6 T20r	80			96			96			aff	CARE Dare	0.0328618	0.5	0	0.6	0.6	6×0.6mm	0.6		1	T20r standard	Topogram Head
	SinusLauDare		80			50			50			an	CARE Dare4D	1.90549	1	0.8	0.6	1	128×0.6mm					
		SinusLauDare 1.0 H50r																		1	0.5	121	H50r medium.sharp	Sinuses
K3 SinusContrast (Child)	Topogram	Topogram 0.6 T20r	100			96			96			aff	CARE Dare	0.0690692	0.5	0	0.6	0.6	6×0.6mm	0.6		1	T20r standard	Topogram Head
	Sinus +C		100			50			50			an	CARE Dare4D	3.84918	1	0.8	0.6	1	128×0.6mm					
		Sinus +C 1.0 H60r																		1	0.5	121	H60r sharp FR	Sinuses
		Sinus +C WD 1.0 H30r																		1	1	61	H30r medium.smooth	Abdomen
K4 MFM (Child)	Topogram	Topogram 0.6 T20r	100			96			96			aff	CARE Dare	0.0690692	0.5	0	0.6	0.6	6×0.6mm	0.6		1	T20r standard	Topogram Head
	MFM-C		100			100			70			an	CARE Dare4D	7.69335	1	0.8	0.6	1	128×0.6mm					
		MFM-C Bat 1.0 H60r																		1	0.5	81	H60r sharp FR	Bone
		MFM-C WD 1.0 C20r																		1	0.5	81	C20r smooth FR	Abdomen
K5 Schedel MFM (Child)	Topogram	Topogram 0.6 T20r	120			96			96			aff	CARE Dare	0.115217	0.5	0	0.6	0.6	6×0.6mm	0.6		1	T20r standard	Topogram Head
	Schedel-MFM		100			190			190			an	CARE Dare4D	18.326	1	0.8	0.6	1.5	128×0.6mm					
		Schedel-MFM 1.5 H20r VOL																		1.5	1	121	H20r smooth	Cerebrum
		Schedel-MFM Bat 1.0 Axiaal																		1	0.5	241	C60r sharp	Bone
		Schedel-MFM 3.0 Axiaal																		3	3	41	H30r medium.smooth	Cerebrum
		Schedel-MFM Bat 3.0 Axiaal																		3	3	41	C60r sharp	Cerebrum
K6 Binnenoor (Child)	Topogram	Topogram 0.6 T80r	120			96			96			aff	CARE Dare	0.115217	0.5	0	0.6	0.6	6×0.6mm	0.6		1	T80r sharp	Topogram Head
	Binnenoor		120			150			80			an	CARE Dare4D	32.6632	1	0.85	0.6	0.6	16×0.6mm					
		Binnenoor 0.6 U70u																		0.6	0.3	134	U70u sharp	Inner Ear
		Binnenoor Rechts 0.6 U70u																		0.6	0.3	134	U70u sharp	Inner Ear
		Binnenoor Links 0.6 U70u																		0.6	0.3	134	U70u sharp	Inner Ear
Orbit (Child)	Topogram	Topogram 0.6 T20r	120			96			96			aff	CARE Dare	0.115217	0.5	0	0.6	0.6	6×0.6mm	0.6		1	T20r standard	Topogram Head
	Orbit		120			70			70			an	CARE Dare4D	8.73038	1	0.8	0.6	3	128×0.6mm					
		Orbit 3.0 H60r																		3	3	14	H60r sharp FR	Bare Orbita
		Orbit 3.0 H30r																		3	3	14	H30r medium.smooth	Bare Orbita
		Orbit 0.6 H60r																		0.6	0.4	101	H60r sharp FR	Bare Orbita
Sinus (Child)	Topogram	Topogram 0.6 T20r	120			96			96			aff	CARE Dare	0.115217	0.5	0	0.6	0.6	6×0.6mm	0.6		1	T20r standard	Topogram Head
	Sinus		120			50			50			an	CARE Dare4D	6.23599	1	0.8	0.6	3	128×0.6mm					
		Sinus 3.0 H60r																		3	3	21	H60r sharp FR	Sinuses
		Sinus 3.0 H30r																		3	3	21	H30r medium.smooth	Sinuses
		Sinus 1.0 H60r																		1	0.7	86	H60r sharp FR	Sinuses
		Sinus 1.0 H30r																		1	0.7	86	H30r medium.smooth	Sinuses
Neck																								
K1 Hals (Child)	Topogram	Topogram 0.6 T20r	120			96			96			aff	CARE Dare	0.115217	0.5	0	0.6	0.6	6×0.6mm	0.6		1	T20r standard	Topogram Body
	Hals		120			65			65			an	CARE Dare4D	3.59378	1	0.8	0.6	1	128×0.6mm					
		Hals WD 1.0 B40r VOL																		1	0.5	341	B40r medium	Larynx
		Hals Bat 1.0 B60r VOL																		1	0.5	341	B60r sharp	Bone
NeckRoutine (Child)	Topogram	Topogram 0.6 T20r	120			96			96			aff	CARE Dare	0.115217	0.5	0	0.6	0.6	6×0.6mm	0.6		1	T20r standard	Topogram Body
	Neck		120			65			65			an	CARE Dare4D	3.68752	1	0.8	1.2	5	32×1.2mm					
		Neck 5.0 B30r																		5	5	35	B30r medium.smooth	Baby Neck
		Neck 1.5 B60r																		1.5	1	171	B60r sharp	Baby Neck
Shoulder																								
ShoulderRoutine (Child)	Topogram	Topogram 0.6 T20r	120			164			164			aff	CARE Dare	0.197515	0.5	0	0.6	0.6	6×0.6mm	0.6		1	T20r standard	Topogram Body
	Shoulder		120			65			65			an	CARE Dare4D	3.59378	1	0.8	0.6	5	128×0.6mm					
		Shoulder 5.0 B31r																						
		Shoulder 0.75 B31r																						
		Shoulder 0.75 B60r																						
Thorax																								
Flash Thorax (Child)	Topogram	Topogram 0.6 T20r	120			185			185			aff	CARE Dare	0.115217	0.5	0	0.6							Body
	FL_Thorax			120			50			50		an	CARE Dare4D	2.77329	0.285	3	0.6							
		FL_Thorax 3.0 B30f																		3	3	51	B30f medium.smooth	Mediastinum
		FL_Thorax 3.0 B60f																		3	3	51	B60f sharp	Baby Lung
		FL_Thorax 1.5 B30f																		1.5	1	151	B30f medium.smooth	Mediastinum

Siemens *(xml)*

Protocols (Philips)

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	Protocol	Scan Mode	Age Group	Head/Body	View Angle [deg]	Current [mA]	Scan Type	Clinical Application	Label	Position	Length [mm]	Direction	Thickness [mm]	Incremen
2	"Head STD QA/Head/Ax"	axial	adult	head	180	267	Head	none	""	*	40	Out	5	5
3	"Spine Axial/Spine"	surview	adult	body	Dual	30	invalid	invalid	""	*	600	Out	0.625	5
4	"Spine Axial/Spine"	axial	adult	body	180	333	"Lumbar Spine"	none	""	*	320	Out	2.5	2.5
5	"Neck Soft Tissue/Neck"	surview	adult	body	90	30	invalid	invalid	""	*	500	Out	0.625	2.5
6	"Neck Soft Tissue/Neck"	helix	adult	body	180	401	Neck	none	""	*	252	Out	0.9	0.45
7	"Ear Surview/Ear/Sv"	surview	adult	head	90	30	invalid	invalid	""	*	250	Out	0.625	0.45
8	"Ear Axial/Ear"	axial	adult	head	180	67	Head	none	""	*	25	Out	0.625	0.62
9	"Ear Helix/Ear/Hx"	helix	adult	head	180	67	Head	none	""	*	83.5	Out	0.67	0.33
10	"Neck Surview/Neck/Sv"	surview	adult	body	90	30	invalid	invalid	""	*	250	Out	0.625	0.33
11	"Neck Axial/Neck/Ax"	axial	adult	body	180	267	Body	none	""	*	40	Out	2.5	2.5
12	"Neck Helix/Neck/Hx"	helix	adult	body	180	66	Body	none	""	*	82.5	Out	1.5	0.75
13	"Spine Surview/Spine/Sv"	surview	adult	body	90	30	invalid	invalid	""	*	500	Out	0.625	0.75
14	Axial/Spine/Ax	axial	adult	body	180	267	Body	none	""	*	40	Out	2.5	2.5
15	"Spine Helix/Spine/Hx"	helix	adult	body	180	64	Body	none	""	*	80.55	Out	0.9	0.45
16	"Orthoped Surview/Orthoped/Sv"	surview	adult	body	180	30	invalid	invalid	""	*	250	Out	0.625	0.45
17	"Orthoped Axial/Orthoped/Ax"	axial	adult	body	180	267	Body	none	""	*	40	Out	2.5	2.5
18	"Orthoped Helix/Orthoped/Hx"	helix	adult	body	180	134	Body	none	""	*	81	Out	0.9	0.45
19	"Head Surview/Head/Sv"	surview	adult	head	90	30	invalid	invalid	""	*	250	Out	0.625	0.45
20	"Head Helix/Head/Hx"	helix	adult	head	180	192	Head	none	""	*	82.8	Out	0.9	0.9
21	"Thorax Surview/Thorax/Sv"	surview	adult	body	180	30	invalid	invalid	""	*	500	Out	0.625	0.9
22	"Thorax Axial/Thorax/Ax"	axial	adult	body	180	267	Body	none	""	*	40	Out	2.5	2.5
23	"Thorax Helix/Thorax/Hx"	helix	adult	body	180	64	Body	none	""	*	80.55	Out	0.9	0.45
24	"Abdomen Surview/Abdomen/Sv"	surview	adult	body	180	30	invalid	invalid	""	*	250	Out	0.625	0.45
25	"Pelvis Surview/Pelvis/Sv"	surview	adult	body	180	30	invalid	invalid	""	*	250	Out	0.625	0.45
26	"Pelvis Axial/Pelvis/Ax"	axial	adult	body	180	267	Body	none	""	*	40	Out	2.5	2.5
27	"Abdomen Helix/Abdomen/Hx"	helix	adult	body	180	69	Body	none	""	*	84	Out	4	2
28	"Pelvis Helix/Pelvis/Hx"	helix	adult	body	180	69	Body	none	""	*	84	Out	4	2
29	"IMPULSE RESPONSE BODY/Abdomen"	axial	adult	body	180	200	Body	none	""	*	40	Out	0.625	0
30	"IMPULSE RESPONSE HEAD/Head"	axial	adult	head	180	500	Head	none	""	*	40	Out	0.625	0
31	"Sinus Volume/Head"	surview	adult	head	180	30	invalid	invalid	""	*	200	Out	0.625	0
32	"Sinus Volume/Head"	helix	adult	head	180	128	"Sinus FB"	none	""	*	150.3	Out	0.9	0.45
33	"Facial Bone Volume/Head"	surview	adult	head	180	30	invalid	invalid	""	*	200	Out	0.625	0.45
34	"Facial Bone Volume/Head"	helix	adult	head	180	320	"Sinus FB"	none	""	*	150.3	Out	0.9	0.45
35	"Cervical Volume/Spine"	surview	adult	body	Dual	30	invalid	invalid	""	*	450	Out	0.625	0.45
36	"Cervical Volume/Spine"	helix	adult	body	180	254	"Cervical Spine"	none	""	*	303.3	Out	0.9	0.45
37	"Cervical Large/Spine"	surview	adult	body	Dual	30	invalid	invalid	""	*	450	Out	0.625	0.45
38	"Cervical Large/Spine"	helix	adult	body	180	197	"Cervical Spine"	none	""	*	304	Out	2	1
39	"Thoracic Volume/Spine"	surview	adult	body	Dual	30	invalid	invalid	""	*	600	Out	0.625	1
40	"Thoracic Volume/Spine"	helix	adult	body	180	371	"Thoracic Spine"	none	""	*	301.05	Out	0.9	0.45
41	"Thoracic Large/Spine"	surview	adult	body	Dual	30	invalid	invalid	""	*	600	Out	0.625	0.45
42	"Thoracic Large/Spine"	helix	adult	body	180	309	"Thoracic Spine"	none	""	*	302	Out	2	1
43	"Spine Survey/Spine"	surview	adult	body	Dual	30	invalid	invalid	""	*	450	Out	0.625	1
44	"Spine Survey/Spine"	helix	adult	body	180	309	"Cervical Spine"	none	""	*	302	Out	2	1
45	Pelvis/Pelvis	surview	adult	body	180	30	invalid	invalid	""	*	500	Out	0.625	1
46	Pelvis/Pelvis	helix	adult	body	180	359	Pelvis	none	""	*	402	Out	3	1.5
47	"Pelvis Large/Pelvis"	surview	adult	body	180	30	invalid	invalid	""	*				1.5
48	"Pelvis Large/Pelvis"	helix	adult	body	180	388	Pelvis	none	""	*				1.5
49	IAC/Ear	surview	adult	head	90	30	invalid	invalid	""	*				1.5
50	IAC/Ear	helix	adult	head	180	162	"IAC Temporal Bone"	none	""	*	60.73	Out	0.67	0.33
51	"IAC Volume/Ear"	surview	adult	head	90	30	invalid	invalid	""	*	200	Out	0.625	0.33

Philips *(xml)*

Protocols (GE)

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
	ADULT HEAD 21.1 Routine Head																			
	Series 1	Scout	HeadFirst	Supine																
	AutoStore: Yes	Gating: No																		
	Scan	kV	mA	Start	End	Plane	Message	Light	Timer											
		1 120	10	S150	I50	0	0	No	No											
		2 120	10	S150	I50	90	0	No	No											
	Series 2	Axial	HeadFirst	Supine																
	AutoStore: Yes	Gating: No	SmartPrep: No	Biopsy: No																
	Series 2 Group 1 Scan Settings																			
	Group	Images	Speed	Type	Start	End	Thick	Mode	Rows	Int	Tilt	SFOV	kV	mA	Message	Light	Timer			
		1 16	2	Axial	S0.0	S37.5	2.5	4i	16	10	S0.0	Head	140	160	No	No	No			
	Series 2 Group 1 Recon 1 Settings																			
	Group	DFOV	A/P	R/L	Filter	Type	Vari	D3D	DMPR											
		1 25	A0.0	R0.0	Standard	Full	No	No	No											
	Series 2 Group 2 Scan Settings																			
	Group	Images	Speed	Type	Start	End	Thick	Mode	Rows	Int	Tilt	SFOV	kV	mA	Message	Light	Timer			
		2 16	2	Axial	S40.0	S115.0	5	2i	16	10	S0.0	Head	140	140	No	No	No			
	Series 2 Group 2 Recon 1 Settings																			
	Group	DFOV	A/P	R/L	Filter	Type	Vari	D3D	DMPR											
		2 25	A0.0	R0.0	Standard	Full	No	No	No											
	ADULT HEAD 21.2 Routine Head Auto mA																			
	Series 1	Scout	HeadFirst	Supine																
	AutoStore: Yes	Gating: No																		
	Scan	kV	mA	Start	End	Plane	Message	Light	Timer											
		1 120	10	S150	I50	0	0	No	No											
		2 120	10	S150	I50	90	0	No	No											
	Series 2	Axial	HeadFirst	Supine																
	AutoStore: Yes	Gating: No	SmartPrep: No	Biopsy: No																
	Series 2 Group 1 Scan Settings																			
	Group	Images	Speed	Type	Start	End	Thick	Mode	Rows	Int	Tilt	SFOV	kV	SmartmA	NoiseIndex	MinmA	MaxmA	Message	Light	Timer
		1 16	2	Axial	S0.0	S37.5	2.5	4i	16	10	S0.0	Head	140	No	2.8	50	200	No	No	No
	Series 2 Group 1 Recon 1 Settings																			
	Group	DFOV	A/P	R/L	Filter	Type	Vari	D3D	DMPR											
		1 25	A0.0	R0.0	Standard	Full	No	No	No											
	Series 2 Group 2 Scan Settings																			
	Group	Images	Speed	Type	Start	End	Thick	Mode	Rows	Int	Tilt	SFOV	kV	SmartmA	NoiseIndex	MinmA	MaxmA	Message	Light	Timer
		2 16	2	Axial	S40.0	S115.0	5	4i	16	20	S0.0	Head	140	No	2.8	50	200	No	No	No
	Series 2 Group 2 Recon 1 Settings																			
	Group	DFOV	A/P	R/L	Filter	Type	Vari	D3D	DMPR											
		2 25	A0.0	R0.0	Standard	Full	No	No	No											
	ADULT HEAD 21.3 Trauma Head																			
	Series 1	Scout	HeadFirst	Supine																
	AutoStore: Yes	Gating: No																		
	Scan	kV	mA	Start	End	Plane	Message	Light	Timer											

GE *(csv)*

UZ LEUVEN

Protocols

Siemens

- Protocol name
- Range name
- Series description
- kV
- kV(A)
- kV(B)
- Quality ref. mAs
- Quality ref. mAs(A)
- Quality ref. mAs(B)
- (Eff.) mAs
- (Eff.) mAs(A)
- (Eff.) mAs(B)
- Dose modulation
- CARE Dose type
- CTDIvol
- Rotation time
- Pitch
- Collimation
- Slice
- Acq.
- Slice
- Position increment
- No. of images
- Kernel/Algorithm
- Window
- API
- Comment1
- Comment2
- Auto transfer 1
- Auto transfer 2
- Auto transfer 3

Philips

- Protocol
- Scan Mode
- Age Group
- Head/Body
- View Angle [deg]
- Current [mA]
- Scan Type
- Clinical Application
- Label
- Position
- Length [mm]
- Direction
- Thickness [mm]
- Increment [mm]
- Voltage[kV]
- mAs
- mAs/Slice
- Reconstruction
- Cycle Time [sec]
- Cycles
- Scan Time[sec]
- CTDI [mGy]
- DLP[mGy-cm]
- Agent
- Trigger
- Threshold
- Route
- Concentration
- Volume
- Rate
- Voice
- Storage
- Cardiac Phase
- Pulmo Phase
- Jog
- Resolution
- Collimation [mm]
- Pitch
- Tilt[deg]
- Scan Angle [deg]
- Rotation Time [sec]
- FOV [mm]
- Filter
- Enhancement
- Window Center
- Window Width
- Center X
- Center Y
- Matrix
- DoseRight ACS
- DoseRight DOM
- Adaptive Filter
- SP Filter
- Version

GE

- Axial
- HeadFirst / FeetFirst
- Supine
- Images
- Speed
- Type
- Start
- End
- Thick
- Mode
- Rows
- Int
- Tilt
- SFOV
- kV
- SmartmA
- NoiseIndex
- MinmA
- MaxmA
- Message
- Light
- Timer
- CineDur
- DFOV
- A/P
- R/L
- Filter
- Type
- Vari
- D3D
- DMPR
- Gating: No
- AutoStore: Yes
- SmartPrep: No
- Biopsy: No

Solution

connect to CT console

copy protocol file

GLADYS *

calculate checksum

equals ?

compare

backup

groundtruth storage

convert vendor specific file to textual form

raw text diff operator

parse and interpret textual data

contextual diff operator

creation of modifications timeline

(*) *"The Automatic Analysis of Digital Images for Quality Control Purposes Made Easy with a Generic Extendable and Scriptable DICOM Router"; Jacobs et al. ; RSNA 2006*

Example (Philips)

Groundtruth protocol file

```
<Row ss:Height="13.5">
 <Cell ss:StyleID="s64"><Data ss:Type="String">&quot;Head STD QA/Head/Ax&quot
 <Cell><Data ss:Type="String">axial</Data></Cell>
 <Cell><Data ss:Type="String">adult</Data></Cell>
 <Cell><Data ss:Type="String">head</Data></Cell>
 <Cell><Data ss:Type="Number">180</Data></Cell>
 <Cell><Data ss:Type="Number">267</Data></Cell>
 <Cell><Data ss:Type="String">Head</Data></Cell>
 <Cell><Data ss:Type="String">none</Data></Cell>
 <Cell><Data ss:Type="String">&quot;&quot;</Data></Cell>
 <Cell><Data ss:Type="String">*</Data></Cell>
 <Cell><Data ss:Type="Number">40</Data></Cell>
 <Cell><Data ss:Type="String">Out</Data></Cell>
 <Cell><Data ss:Type="Number">5</Data></Cell>
 <Cell><Data ss:Type="Number">5</Data></Cell>
 <Cell><Data ss:Type="Number">120</Data></Cell>
 <Cell><Data ss:Type="Number">200</Data></Cell>
 <Cell><Data ss:Type="Number">150</Data></Cell>
 <Cell><Data ss:Type="String">concurrent</Data></Cell>
 <Cell><Data ss:Type="String">Minimum</Data></Cell>
 <Cell><Data ss:Type="Number">1</Data></Cell>
 <Cell><Data ss:Type="Number">0.75</Data></Cell>
 <Cell><Data ss:Type="Number">22.4</Data></Cell>
 <Cell><Data ss:Type="Number">89.4</Data></Cell>
 <Cell><Data ss:Type="String">none</Data></Cell>
 <Cell><Data ss:Type="String">none</Data></Cell>
 <Cell><Data ss:Type="Number">150</Data></Cell>
```

Modified protocol file

```
<Row ss:Height="13.5">
 <Cell ss:StyleID="s64"><Data ss:Type="String">&quot;Head STD QA/Head/Ax&quot
 <Cell><Data ss:Type="String">helical</Data></Cell>
 <Cell><Data ss:Type="String">child</Data></Cell>
 <Cell><Data ss:Type="String">Body</Data></Cell>
 <Cell><Data ss:Type="Number">180</Data></Cell>
 <Cell><Data ss:Type="Number">267</Data></Cell>
 <Cell><Data ss:Type="String">Head</Data></Cell>
 <Cell><Data ss:Type="String">none</Data></Cell>
 <Cell><Data ss:Type="String">&quot;&quot;</Data></Cell>
 <Cell><Data ss:Type="String">*</Data></Cell>
 <Cell><Data ss:Type="Number">40</Data></Cell>
 <Cell><Data ss:Type="String">Out</Data></Cell>
 <Cell><Data ss:Type="Number">5</Data></Cell>
 <Cell><Data ss:Type="Number">5</Data></Cell>
 <Cell><Data ss:Type="Number">120</Data></Cell>
 <Cell><Data ss:Type="Number">200</Data></Cell>
 <Cell><Data ss:Type="Number">150</Data></Cell>
 <Cell><Data ss:Type="String">concurrent</Data></Cell>
 <Cell><Data ss:Type="String">Minimum</Data></Cell>
 <Cell><Data ss:Type="Number">1</Data></Cell>
 <Cell><Data ss:Type="Number">0.75</Data></Cell>
 <Cell><Data ss:Type="Number">22.4</Data></Cell>
 <Cell><Data ss:Type="Number">89.4</Data></Cell>
 <Cell><Data ss:Type="String">none</Data></Cell>
 <Cell><Data ss:Type="String">none</Data></Cell>
 <Cell><Data ss:Type="Number">150</Data></Cell>
```

Level 1 warning
the checksum doesn't match

Example (Philips)

```
<Row ss:Height="13.5">
 <Cell ss:StyleID="s64"><Data ss:Type="String">&quot;Head STD QA/Head/Ax&quot
 <Cell><Data ss:Type="String">axial</Data></Cell>
 <Cell><Data ss:Type="String">adult</Data></Cell>
 <Cell><Data ss:Type="String">head</Data></Cell>
 <Cell><Data ss:Type="Number">180</Data></Cell>
 <Cell><Data ss:Type="Number">267</Data></Cell>
 <Cell><Data ss:Type="String">Head</Data></Cell>
 <Cell><Data ss:Type="String">none</Data></Cell>
 <Cell><Data ss:Type="String">&quot;&quot;</Data></Cell>
 <Cell><Data ss:Type="String">*</Data></Cell>
 <Cell><Data ss:Type="Number">40</Data></Cell>
 <Cell><Data ss:Type="String">Out</Data></Cell>
 <Cell><Data ss:Type="Number">5</Data></Cell>
 <Cell><Data ss:Type="Number">5</Data></Cell>
 <Cell><Data ss:Type="Number">120</Data></Cell>
 <Cell><Data ss:Type="Number">200</Data></Cell>
 <Cell><Data ss:Type="Number">150</Data></Cell>
 <Cell><Data ss:Type="String">concurrent</Data></Cell>
 <Cell><Data ss:Type="String">Minimum</Data></Cell>
 <Cell><Data ss:Type="Number">1</Data></Cell>
 <Cell><Data ss:Type="Number">0.75</Data></Cell>
 <Cell><Data ss:Type="Number">22.4</Data></Cell>
```


```
<Row ss:Height="13.5">
 <Cell ss:StyleID="s64"><Data ss:Type="String">&quot;Head STD QA/Head/Ax&quot
 <Cell><Data ss:Type="String">helical</Data></Cell>
 <Cell><Data ss:Type="String">child</Data></Cell>
 <Cell><Data ss:Type="String">Body</Data></Cell>
 <Cell><Data ss:Type="Number">180</Data></Cell>
 <Cell><Data ss:Type="Number">267</Data></Cell>
 <Cell><Data ss:Type="String">Head</Data></Cell>
 <Cell><Data ss:Type="String">none</Data></Cell>
 <Cell><Data ss:Type="String">&quot;&quot;</Data></Cell>
 <Cell><Data ss:Type="String">*</Data></Cell>
 <Cell><Data ss:Type="Number">40</Data></Cell>
 <Cell><Data ss:Type="String">Out</Data></Cell>
 <Cell><Data ss:Type="Number">5</Data></Cell>
 <Cell><Data ss:Type="Number">5</Data></Cell>
 <Cell><Data ss:Type="Number">120</Data></Cell>
 <Cell><Data ss:Type="Number">200</Data></Cell>
 <Cell><Data ss:Type="Number">150</Data></Cell>
 <Cell><Data ss:Type="String">concurrent</Data></Cell>
 <Cell><Data ss:Type="String">Minimum</Data></Cell>
 <Cell><Data ss:Type="Number">1</Data></Cell>
 <Cell><Data ss:Type="Number">0.75</Data></Cell>
```

MD5	bbd392689a7ecb6e413d265018974aa3	f135c07fdec79a05cf3ea5abe88cd54f
SHA-1	1723825935b95efbc5b230e15938a9903cf68a83	516382d044788b3deadf9a57c72f6facc09c6c81
SHA-256	ebd4a1f62155d170aa66444c99d8ffe040d187e72b44d2dd8ff3dea10e3a7f99	ee47c851c451cdefdf71d6a1c55819ef3e5b02a0457e20ccf5b70cf011a7b9b0
SHA-384	c8800db4c22d95ba0539ad511516b8751c63be12e5d80f0c7461b3cf25a57541d6bb5a4becefd0890b18ae02fbc64504	ac190d31d1957699a521fbf26ab0d1aecd0b8c6ca5d2788428ff00c47b12a1340ae0346b6e64cff562f41e89c9a70ee0
SHA-512	115a7745bda9fb28164882a251633b34bb0d45059efb87b0b494736b2cdfa374d7fa841dd7357a824a3ece316dda4d26f686ae98e13c0d57661983e066cb7bee	d079195b5fbb2f70d087b4781df1fa57b0f3685b13e77ee102a09cdb57b9f606e6ecaa9ec10b1ed9377fb6eedf5fb0eaf50131628a0861b34245db187471c41a

Level 2 warning
diff operation at raw text level

Example (Philips)

```
<Row ss:Height="13.5">
 <Cell ss:StyleID="s64"><Data ss:Type="String">&quot;Head STD QA/Head/Ax&quot
 <Cell><Data ss:Type="String">axial</Data></Cell>
 <Cell><Data ss:Type="String">adult</Data></Cell>
 <Cell><Data ss:Type="String">head</Data></Cell>
 <Cell><Data ss:Type="Number">180</Data></Cell>
 <Cell><Data ss:Type="Number">267</Data></Cell>
 <Cell><Data ss:Type="String">Head</Data></Cell>
 <Cell><Data ss:Type="String">none</Data></Cell>
 <Cell><Data ss:Type="String">&quot;&quot;</Data></Cell>
 <Cell><Data ss:Type="String">*</Data></Cell>
 <Cell><Data ss:Type="Number">40</Data></Cell>
 <Cell><Data ss:Type="String">Out</Data></Cell>
 <Cell><Data ss:Type="Number">5</Data></Cell>
 <Cell><Data ss:Type="Number">5</Data></Cell>
 <Cell><Data ss:Type="Number">120</Data></Cell>
 <Cell><Data ss:Type="Number">200</Data></Cell>
 <Cell><Data ss:Type="Number">150</Data></Cell>
 <Cell><Data ss:Type="String">concurrent</Data></Cell>
 <Cell><Data ss:Type="String">Minimum</Data></Cell>
 <Cell><Data ss:Type="Number">1</Data></Cell>
 <Cell><Data ss:Type="Number">0.75</Data></Cell>
 <Cell><Data ss:Type="Number">22.4</Data></Cell>
```

```
<Row ss:Height="13.5">
 <Cell ss:StyleID="s64"><Data ss:Type="String">&quot;Head STD QA/Head/Ax&quot
 <Cell><Data ss:Type="String">helical</Data></Cell>
 <Cell><Data ss:Type="String">child</Data></Cell>
 <Cell><Data ss:Type="String">Body</Data></Cell>
 <Cell><Data ss:Type="Number">180</Data></Cell>
 <Cell><Data ss:Type="Number">267</Data></Cell>
 <Cell><Data ss:Type="String">Head</Data></Cell>
 <Cell><Data ss:Type="String">none</Data></Cell>
 <Cell><Data ss:Type="String">&quot;&quot;</Data></Cell>
 <Cell><Data ss:Type="String">*</Data></Cell>
 <Cell><Data ss:Type="Number">40</Data></Cell>
 <Cell><Data ss:Type="String">Out</Data></Cell>
 <Cell><Data ss:Type="Number">5</Data></Cell>
 <Cell><Data ss:Type="Number">5</Data></Cell>
 <Cell><Data ss:Type="Number">120</Data></Cell>
 <Cell><Data ss:Type="Number">200</Data></Cell>
 <Cell><Data ss:Type="Number">150</Data></Cell>
```

```
EQUAL
DELETE : axi
INSERT : helic
EQUAL
DELETE : adult
INSERT : child
EQUAL
DELETE : head
INSERT : Body
EQUAL
```

```
<Row ss:Height="13.5">
<Cell ss:StyleID="s64"><Data ss:Type="String">&quot;Head STD QA/Head/Ax&quot;</Data></Cell>
<Cell><Data ss:Type="String">~~axi~~helical</Data></Cell>
<Cell><Data ss:Type="String">~~adult~~child</Data></Cell>
<Cell><Data ss:Type="String">~~head~~Body</Data></Cell>
<Cell><Data ss:Type="Number">180</Data></Cell>
<Cell><Data ss:Type="Number">267</Data></Cell>
<Cell><Data ss:Type="String">Head</Data></Cell>
<Cell><Data ss:Type="String">none</Data></Cell>
<Cell><Data ss:Type="String">&quot;&quot;</Data></Cell>
<Cell><Data ss:Type="String">*</Data></Cell>
<Cell><Data ss:Type="Number">40</Data></Cell>
<Cell><Data ss:Type="String">Out</Data></Cell>
<Cell><Data ss:Type="Number">5</Data></Cell>
<Cell><Data ss:Type="Number">5</Data></Cell>
<Cell><Data ss:Type="Number">120</Data></Cell>
<Cell><Data ss:Type="Number">200</Data></Cell>
<Cell><Data ss:Type="Number">150</Data></Cell>
```

Level 3 warning
detailed overview of modifications

Example (Philips)

```
<Row ss:Height="13.5">
 <Cell ss:StyleID="s64"><Data ss:Type="String">&quot;Head STD QA/Head/Ax&quot
 <Cell><Data ss:Type="String">axial</Data></Cell>
 <Cell><Data ss:Type="String">adult</Data></Cell>
 <Cell><Data ss:Type="String">head</Data></Cell>
 <Cell><Data ss:Type="Number">180</Data></Cell>
 <Cell><Data ss:Type="Number">267</Data></Cell>
 <Cell><Data ss:Type="String">Head</Data></Cell>
 <Cell><Data ss:Type="String">none</Data></Cell>
 <Cell><Data ss:Type="String">&quot;&quot;</Data></Cell>
 <Cell><Data ss:Type="String">*</Data></Cell>
 <Cell><Data ss:Type="Number">40</Data></Cell>
 <Cell><Data ss:Type="String">Out</Data></Cell>
 <Cell><Data ss:Type="Number">5</Data></Cell>
 <Cell><Data ss:Type="Number">5</Data></Cell>
 <Cell><Data ss:Type="Number">120</Data></Cell>
 <Cell><Data ss:Type="Number">200</Data></Cell>
 <Cell><Data ss:Type="Number">150</Data></Cell>
 <Cell><Data ss:Type="String">concurrent</Data></Cell>
 <Cell><Data ss:Type="String">Minimum</Data></Cell>
 <Cell><Data ss:Type="Number">1</Data></Cell>
 <Cell><Data ss:Type="Number">0.75</Data></Cell>
 <Cell><Data ss:Type="Number">22.4</Data></Cell>
```


```
<Row ss:Height="13.5">
 <Cell ss:StyleID="s64"><Data ss:Type="String">&quot;Head STD QA/Head/Ax&quot
 <Cell><Data ss:Type="String">helical</Data></Cell>
 <Cell><Data ss:Type="String">child</Data></Cell>
 <Cell><Data ss:Type="String">Body</Data></Cell>
 <Cell><Data ss:Type="Number">180</Data></Cell>
 <Cell><Data ss:Type="Number">267</Data></Cell>
 <Cell><Data ss:Type="String">Head</Data></Cell>
 <Cell><Data ss:Type="String">none</Data></Cell>
 <Cell><Data ss:Type="String">&quot;&quot;</Data></Cell>
 <Cell><Data ss:Type="String">*</Data></Cell>
 <Cell><Data ss:Type="Number">40</Data></Cell>
 <Cell><Data ss:Type="String">Out</Data></Cell>
 <Cell><Data ss:Type="Number">5</Data></Cell>
 <Cell><Data ss:Type="Number">5</Data></Cell>
 <Cell><Data ss:Type="Number">120</Data></Cell>
 <Cell><Data ss:Type="Number">200</Data></Cell>
 <Cell><Data ss:Type="Number">150</Data></Cell>
 <Cell><Data ss:Type="String">concurrent</Data></Cell>
 <Cell><Data ss:Type="String">Minimum</Data></Cell>
 <Cell><Data ss:Type="Number">1</Data></Cell>
 <Cell><Data ss:Type="Number">0.75</Data></Cell>
 <Cell><Data ss:Type="Number">22.4</Data></Cell>
```

- parse vendor specific file structure in generic tree structure

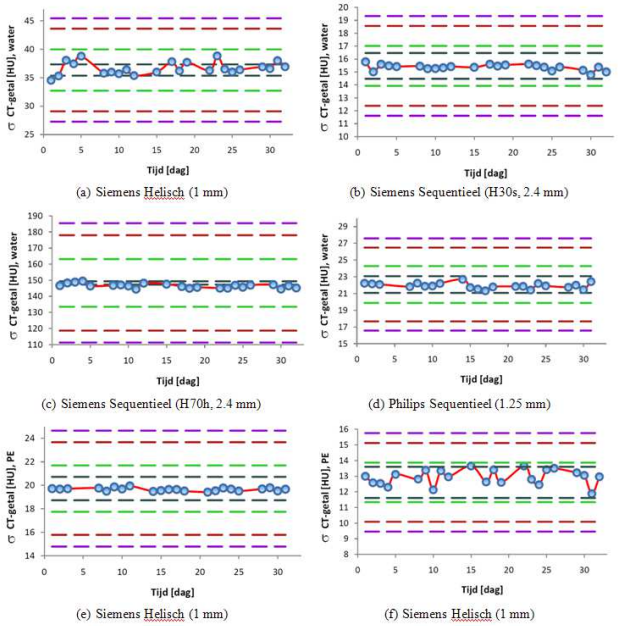
→ *protocols* → *series* → *parameters*

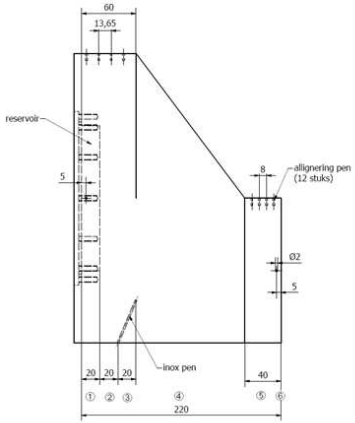
ℹ	03/10/2011 10:12:15	Siemens Somatom Flash	No scan parameters modifications found
⚠	03/10/2011 10:13:27	Philips Brilliance 64	Protocol modified ("Head STD QA/Head/Ax" ; parameter=Scan Mode ; old value=axial ; new value=helical)
⚠	03/10/2011 10:13:27	Philips Brilliance 64	Protocol modified ("Head STD QA/Head/Ax" ; parameter=Age Group ; old value=adult; new value=child)
✖	03/10/2011 10:13:27	Philips Brilliance 64	Protocol modified ("Head STD QA/Head/Ax" ; parameter=Head/Body ; old value=head ; new value=Body)

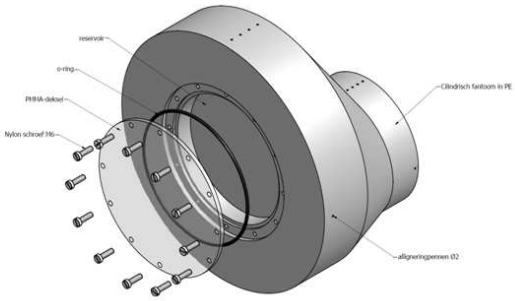
→ *mail* → *twitter* → *SMS* → *integrated QA network*

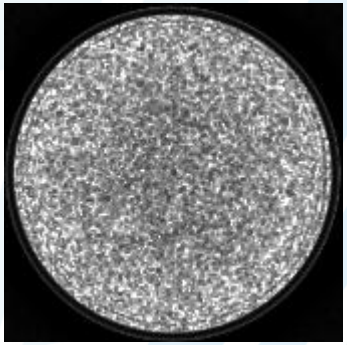
Total Quality Monitoring (CT)

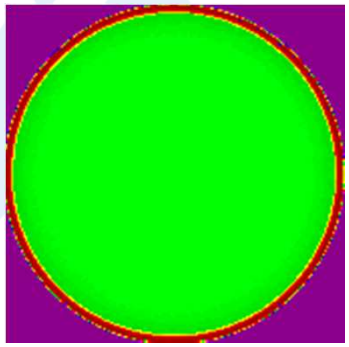
- automated daily physical-technical quality control (Level B + specific phantom)

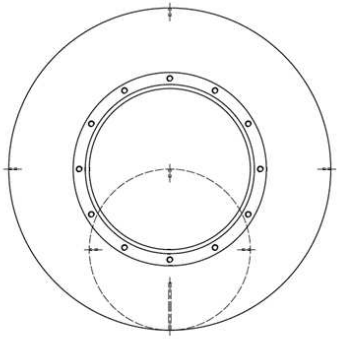








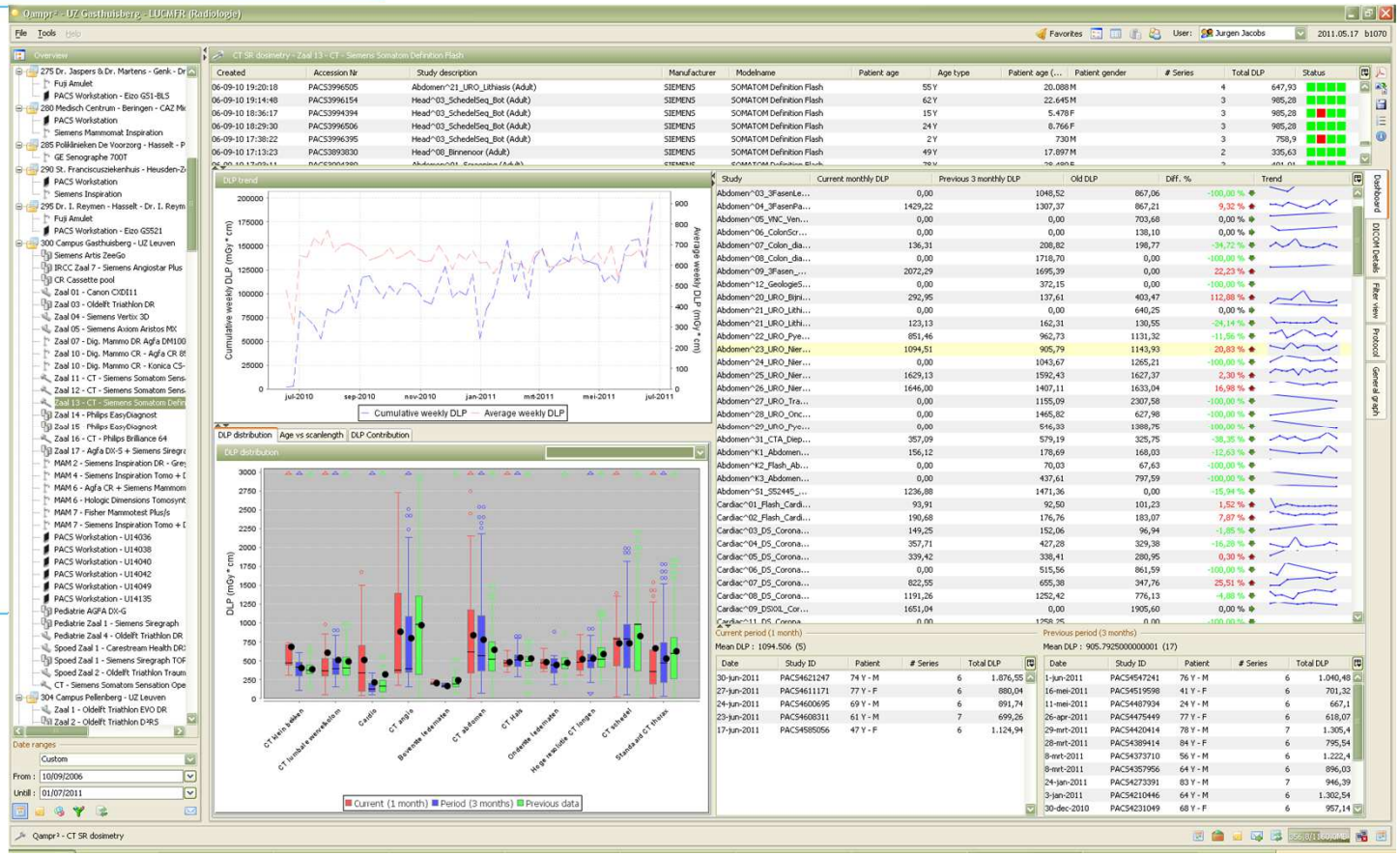




Total Quality Monitoring (CT)

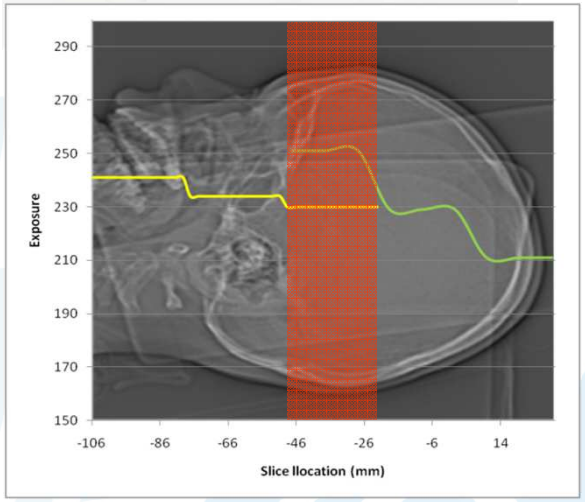
- automated daily physical-technical quality control (Level B + specific phantoms)
- continuous patient dose monitoring
  - using Structured Reports (SR), DoseReports, MPPS

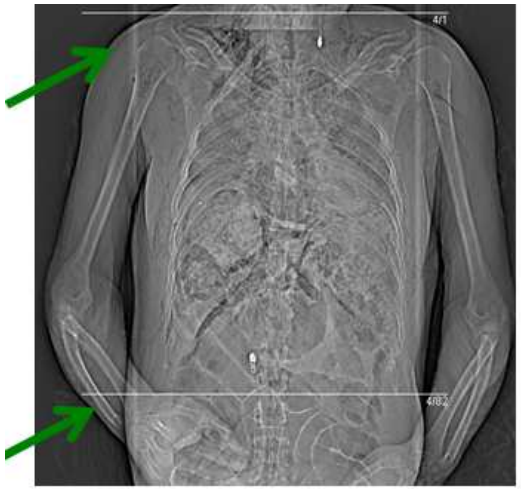
Nr	Datum	Patiënt m/v	leeftijd	gewicht	lengte	Onderzoek	Sub onderzoek	kVp	Eff. mAs	Reductie	DLP	CTDI	CTDI type
							Abdomen 5.0 B30f						
							Abdomen 5.0 B30f						
64	18/12/2009	M	31			07_Thorax_Abdomen_Screening	Abd Scr 5.0 B30f						
							Thorax Med 5.0 B30f						
65	18/12/2009	M	78			01_Screening	Abdomen 5.0 B30f						
66	18/12/2009	M	50			07_Thorax_Abdomen_Screening	Thorax Med 5.0 B30f						
							Abd Scr 5.0 B30f						
67	18/12/2009	F	59			01_Screening	Abdomen 5.0 B30f						
68	18/12/2009	M	76			05_AngioAorta_3Fasen	Art(ax-sag-cor) 3.0 B30f						
							Abdomen -C 5.0 B30f						
							Ven(ax-sag-cor 3.0 B30f						
69	18/12/2009	F	43			30_CTA_Diep_Flap_Borstrecon	Blanco 5.0 B30f						
							Arterieel 1.0 B30f						
							Arterieel 2.0 Coronaal						
70	17/12/2009	M	77			05_AngioAorta_3Fasen	Art(ax-sag-cor) 3.0 B30f						
							Ven(ax-sag-cor 3.0 B30f						
							Abdomen -C 5.0 B30f						
71	17/12/2009	F	46			07_Thorax_Abdomen_Screening	Abd Scr 5.0 B30f						
							Thorax Med 5.0 B30f						
72	17/12/2009	F	46			07_Thorax_Abdomen_Screening	Abd Scr 5.0 B30f						
							Thorax Med 5.0 B30f						
							Basis 2.4 H30s						
							Hersenen 9.0 H30s						
73	17/12/2009	M	41			05_AngioAorta_3Fasen	Abdomen -C 5.0 B30f						
							Ven(ax-sag-cor 3.0 B30f						
							Art(ax-sag-cor) 3.0 B30f						

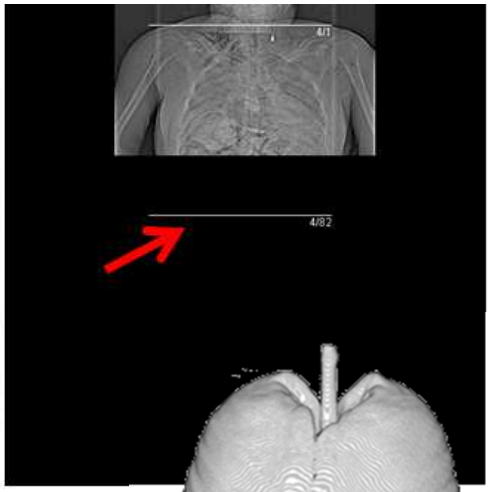


Total Quality Monitoring (CT)

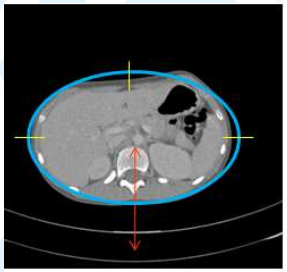
- automated daily physical-technical quality control (Level B + specific phantom)
- continuous patient dose monitoring
- correct scanner usage quality control (ethical usage)
  - overscan, scan overlap, correct protocol usage, blind scanning, patient positioning, …







overscanned region



vertical

horizontal

Total Quality Monitoring (CT)

- automated daily physical-technical quality control (Level B + specific phantom)
- continuous patient dose monitoring
- correct scanner usage quality control (ethical usage)
- CT protocol management
  - online overview of best practices

Chest Routine (date!!)

Indication for Chest Routine (maybe omit??)

General: Patient positioning: supine, arms above head. Instruct patient to hodl breath during the entire scan. For patient less than xx kg use pediatric protocol. Etc…(e.g. info on extra reconstructions needed).

Contrast Information: Oral: no one; IV: only if indicated by radiologists

Topogram: PA 512 STOP scan when trough lungs (important information to avoid overscan!)

Scanning parameters

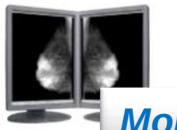
SIEMENS	Sens-16	Sens-64	F-128
Scan Type	Spiral	Spiral	Spiral
Rotation Time (s)	0.5	0.33	0.28
Collimation	16 x 0.75	64 x 0.6	128 x 0.6
Pitch	1.1	0.9	0.9
Feed (mm/rot)	*13.2*	*17.8*	*34.6*
kVp	120	120	120
Quality ref. mAs	180	180	180
CARE Dose4D	ON	ON	ON
API	Inspiration	Inspiration	Inspiration
Prep Delay (s)	20	20	24
Min. Retro (mm)	*0.75*	*0.6*	*0.6*
CTDI (mGy)	*14.04*	*14*	*12.16*
Base Protocol	*ThoraxRoutine*	*ThoraxRoutine*	*ThoraxRoutine*

	RECON 1	RECON 2	RECON 3	RECON 4 (optional)*
Series description	Chest Routine	HiRes Chest	MIP Chest	Thin Nodule
Type	Axial	Axial	S/PO-MIP Thies	Axial
Start	Top of Lungs	Top of Lungs	Top of Lungs	Above Nodule
End	Bottom of Lungs	Bottom of Lungs	Bottom of Lungs	Below Nodule
Angle	None	None	None	None
Image Order	Craniocaudal	Craniocaudal	Craniocaudal	Craniocaudal
Kernel	B40	B46	B50	B40
Slice (mm)	5	1.5	20	2
Increment (mm)	5	1.5	10	1
FOV (mm)	Patient	Patient	Patient	150
:-Q-D	---	---	---	---
Network	IAU and Rad	IAU and Rad AID3 if 3D needed	IAU and Rad	IAU and Rad

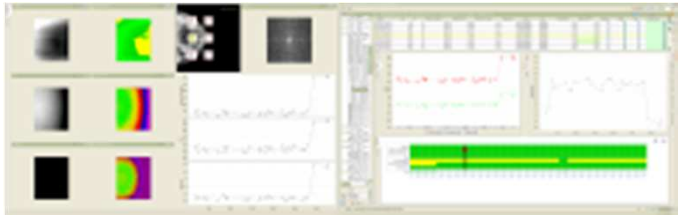
QA Network

digital mammography

viewing station



MoniQA



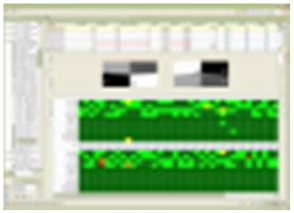
Local data overview

GLADYS

data analysis

local hospital

data overview



FTP / E-mail

supervision center

CT, general radiology, interventional radiology, MRI, NM, …

data storage

local hospital

Discussion

- monitoring of scan protocols is important
  - to detect unauthorized modifications
  - to detect accidental upgrades by service personnel
  - to make sure that optimization efforts are used in the field
- detection of modified scan parameters could also be done retrospectively using continuous patient dose monitoring of your CT system
  - analyze used scan parameters of each study
  - compare with default settings

Discussion

- we developed a generic monitoring system to detect modifications pro-actively
  - Siemens, GE, Philips
  - uses vendor specific conversion tools
- solution fit in whole range of quality assurance tools
  - CT
    - automated constancy checks
    - continuous patient dose monitoring
    - correct scanner usage quality control (ethical QC)
  - mammography, general radiology, interventional radiology, viewing devices, ….
- solution fit in a distributed quality assurance network

Thank you

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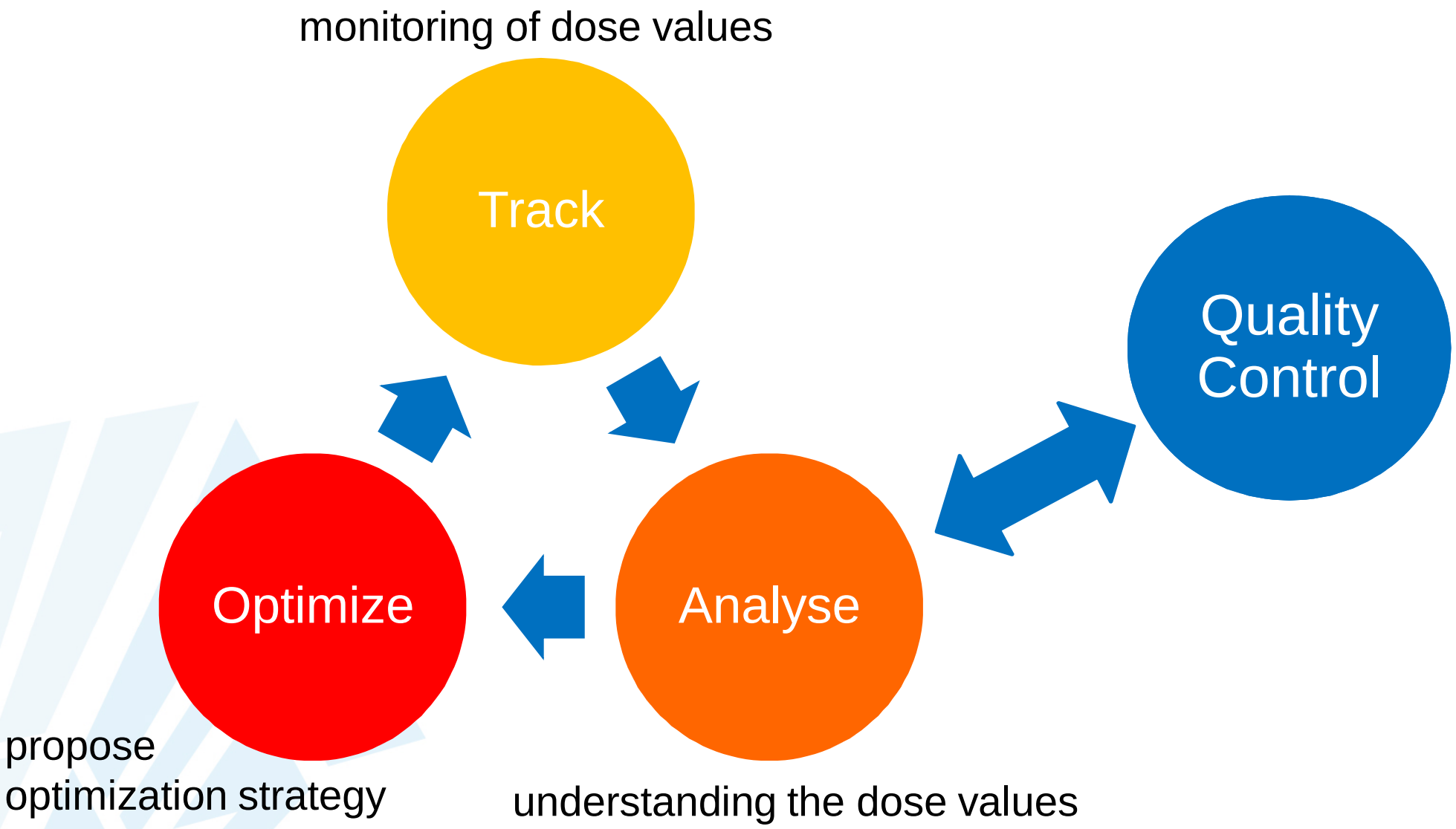
Patient radiation dose monitoring



TQM: Total Quality Monitoring