# IAEA Remote and Automated QC for Diagnostic and Mammographic Facilities

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### Support For Remote Facilities

- In many areas of the world, medical physics support is minimal or non-existent
- Many facilities have little or no guidance to implement a quality assurance program
- Imaging devices may go for their entire useful life without ever being tested
- Quality control functions may never evaluate whether a given image is actually of adequate diagnostic quality
- Can lead to inadequate patient care and excessive radiation exposure

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#### Support For Remote Facilities

- Request from the Scientific Committee of the IAEA/WHO Network of Secondary Standards and Dosimetry Laboratories (2014)
- IAEA project
  - Implementation of a Remote and Automated Quality Control Program for Radiography and Mammography
- One Clinically Qualified Medical Physicist (CQMP) can:
  - Provide support for multiple facilities
  - Ensure consistent performance with fewer visits
- Enables radiographic facilities of any size to initiate a technologist radiographic QC program.

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#### Committee Response

- Modern technologies allow us to exploit the advantages of computer networks and processing
- Created simple and inexpensive test objects
- Created automated image analysis software
- Requires minimal staff time
- Local data collection
- Can do local or remote analysis
- Remote review of data by CQMP











ATIA S	of	tware	
		TABLE I.1: DESCRIPTION OF ATIA ICONS	
	Icon	Description	
		This will open a window to select the image. You could either click and drag it to the home page or click on a file and open it. The software will automatically recognize both types of images (mammographic or radiographic) and will place the corresponding regions of interest on the test objects. Regions can be moved if needed.	
		Performs all calculations. Results will be displayed in the lower left corner: MTF (horizontal and vertical at 50, 20 and 10%), SDNR, CNR, and d' (for two object diameters).	
	i	General information about the image, displayed as follows: Upper left cover: institution, equipment and keelingue factors. Upper right comer: window width and level Lower right comer: custor position, pixel matrix, field size Lower right corner: custor position, pixel matrix, field size	
	ŧ	Zoom in	
	Q	Zoom out	
	-)̈́̈́̈́̈́́,-	Applies predetermined window width and level settings	
	65	Reverts to original image window width and level settings	
	$\sigma^{2}$	Creates the variance map of the image	
	$\leq$	Opens a Save As window, the calculation results will be saved as a .cvs file	())
	$\otimes$	Exits the application; it will ask if you want to save results.	







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	BD	Mean	SD	SDNR	CNR		Horz (/mm)	3.28816	5.63792	6.78695		D=0.1mm	0.946535
517.757	9.37546	603.046	11.4611	7.44162	8.14579		Vert (/mm)	3.03059	5.22295	6.22297		D=0.25mm	5.61484
Understal			Masteral			NINIDO					DICONTRO		
/mm N	ATE		/mm	MTE		/mm	Horz	Vort	Red		Name	Key	Value
0	1		0	1		0	0.000125278	0.000125278	0.000125278		InstitutionName	(0008)0080)	BCH - Medical
0.25	0.833661		0.25	0.832787		0.0390625	0.000115656	2.24E-05	4.18E-05		InstitutionalDep	(0008 1040)	
0.5	0.82889		0.5	0.820191		0.078125	2.33E-05	2.35E-05	1.26E-05		StationName	(0008 1010)	BRMDIGMA1
0.75	0.811111		0.75	0.802593		0.117188	7.41E-06	1.52E-05	5.97E-06		PatientName	(0010)0010)	Physicist^IAEA
1	0.789136		1	0.76808		0.15625	8.58E-06	5.72E-06	4.44E-06		DeviceSerialNu	(0018 1000)	2.07925E+11
1.25	0.758549		1.25	0.747806		0.195313	1.14E-05	6.91E-06	4.44E-06		PlateID	(0018 1004)	
1.5	0.733664		1.5	0.720351		0.234375	1.03E-05	4.08E-06	4.58E-06		TargetExposure	(0018 1412)	
1.75	0.701382		1.75	0.680429		0.273438	1.32E-05	2.60E-06	4.12E-06		DeviationIndex	(0018 1413)	00170001
2 25	0.600097		2 25	0.04/789		0.3125	3.200-00	5.462-06	4.22E.06		Modelity	(0008)0020)	20170001
2.25	0.604347		2.20	0.58484		0.331303	5.06E-08	3.94F-06	2.82F+00		PresentationInte	(0008)0068)	FOR PROCESS
2.75	0.577808		2.75	0.534315		0.429688	5.94E-06	6.06E-06	3.84E-06		Manufacturer	(0008)0070)	GE MEDICAL S
3	0.536613		3	0.506679		0.46875	4.65E-06	3.81E-06	3.48E-06		FieldOfViewDim	(0018 1149)	306
3.25	0.504297		3.25	0.452101		0.507813	2.79E-06	3.56E-06	3.30E-06		ExposureTime	(0018 1150)	1560
3.5	0.476147		3.5	0.42888		0.546875	3.36E-06	3.30E-06	3.38E-06		XRayTubeCurre	(0018 1151)	62
3.75	0.435		3.75	0.390455		0.585938	2.65E-06	4.73E-06	3.22E-06		ImagerPixelSpa	(0018 1164)	0.1
4	0.40436		4	0.359069		0.625	5.02E-06	2.47E-06	3.79E-06		AnodeTargetMa	(0018 1191)	RHODIUM
4.25	0.368092		4.25	0.316631		0.664063	2.72E+06	3.3/E-06	2.905-00		Manufacturer	(0008/0070)	GE MEDICAL S
4.5	0.307366		4.0	0.263211		0.703125	2.80E-08	4 11E-08	3.00E+06		FilterMaterial	(0018/2050)	BHODIUM
5	0.282717		5	0.223459		0.78125	3.58E-06	3.38E-06	3.01E-06			(**************************************	
5.25	0.239269		5.25	0.197154		0.820313	4.74E-08	3.99E-06	3.25E-06		Exposure	(0018)1152)	97
5.5	0.219112		5.5	0.154517		0.859375	3.33E-06	2.94E-06	3.07E-06		ImageAndFluor	(0018 115e)	
5.75	0.184468		5.75	0.139868		0.898438	1.90E-06	2.91E-06	3.13E-06		EntranceDoselr	(0040 8302)	8.961
6	0.155545		6	0.115876		0.9375	2.81E-06	3.54E-06	3.09E-06				
6.25	0.132594		6.25	0.0980751		0.976563	2.58E-06	2.38E-06	2.91E-06				
6.5	0.117274		6.5	0.0774483		1.01563	2.35E-06	2.12E-06	3.09E-06				
0.75	0.100943		0.75	0.0583053		1.00409	2.62E-08	4.81E-08	3.22E-06 2.99E-08				
7.25	0.0644179		7.25	0.040792		1.13281	3.60E-06	5.62E-06	3.29E-06				
7.5	0.057844		7.5	0.0385595		1,17188	2.11E-06	3.40E-06	2.90E-06				
7.75	0.0432149		7.75	0.0368796		1.21094	4.25E-06	4.81E-06	2.97E-06				
8	0.0362725		8	0.043147		1.25	4.05E-06	1.28E-06	3.26E-06				







### Variance Map

- ATIA also allows for easy visualization of artifacts
- Variance map
  - Thumbnail images of the variance of small ROIs in the original image
  - Enhance the appearance of the artefacts
  - Images are color-coded
    - Each color represents a predetermined percentage deviation from the variance in a reference position.
  - Variance map thumbnails are very small and easily transmitted







# Conclusion

- IAEA program allows a CQMP and the local technologist to remotely monitor clinical performance remotely and with minimal time investment per unit
- Technologists can be easily trained to acquire the images
- Must ensure that system is optimized before starting the program
  - d' provides insight regarding the clinical performance
- Radiographic QC can be easily performed on a regular basis.

