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December 2nd, 2020

Annual evaluation report of mammography systems involved in Swiss breast cancer screening in 2020

1. Introduction

As foreseen by the Swiss Cancer Screening Federation, radiological mammography chains involved in a cantonal breast cancer screening programme are subject to an annual audit by an external and neutral staff. The Cantonal Centers responsible for breast cancer screening in French-speaking part of Switzerland have commissioned the Institute of RAdiation Physics (IRA) to carry out these audits. The Cantons of Ticino and Thurgau mandated external persons (medical physicists or radiographers) to perform these audits, under the supervision of IRA. The aim of our mandate is to verify that the status controls performed by the manufacturers comply with the requirements of the BAG R-08-02 and the European guidelines (EUREF 4.0), to ensure that the institutes perform the required weekly stability controls, and to advise the institutes for their technical choices aiming a continuous improvement of the image quality / dose ratio. Its objective, in addition to the role of verification by a neutral staff, is the comparison between the different institutes on the common basis of image quality and breast dose. It should be noted, however, that the evaluation of the image quality by a test object does not take into account any ergonomic aspects (such as positioning and compression). This measure simply makes it possible to ensure that the radiological chain is able to produce mammograms of sufficient quality for the different breast thicknesses while delivering x-ray doses below the EUREF limits. The aim of this report is to present a summary of the results of audits performed in Swiss centers in 2020.

2. Material & method

2a. Verified items

During the audit, the following elements of the radiological chain are checked:

- Check of the weekly stability controls made by the internal staff
- Check of the annual status control of the mammography chain made by the supplier
- Measure of image quality with an anthropomorphic phantom and a human observer
- Measure of the detectability of a microcalcification of diameter 0.1 mm in 32, 60 and 90 mm compressed breast thicknesses using a mathematical observer model
- Measure of the mean glandular dose (MGD) for compressed breast thicknesses of 32, 45, 60 and 90 mm
- Check of the cleanliness of diagnostic screens
- Check of the LUT curve and luminance range of diagnostic screens
- Check of low contrast detection and display artifacts

2b. Radiography of the MTM 100 phantom

Aim: Evaluate the clinical image quality (detection performance) from the image of the MTM 100 phantom (Figure 2a) simulating a 45 mm thick breast.

Description of the test

• Positioning the phantom on the bucky with its toe against the edge of the bucky.
• Selection of the image processing used clinically "Mammo CC”.
• The phantom is radiographied in the same conditions as a real mammography (AEC and compression settings).

Measures

• The image is displayed on a diagnostic screen.
• The displayed contrast and brightness of the image are adjusted.
• The number of visible microcalcifications groups, masses and filaments is evaluated by a

human observer
• The global detection score is calculated.
• The number of balls visible on both sides of the phantom at the thorax side is determined.

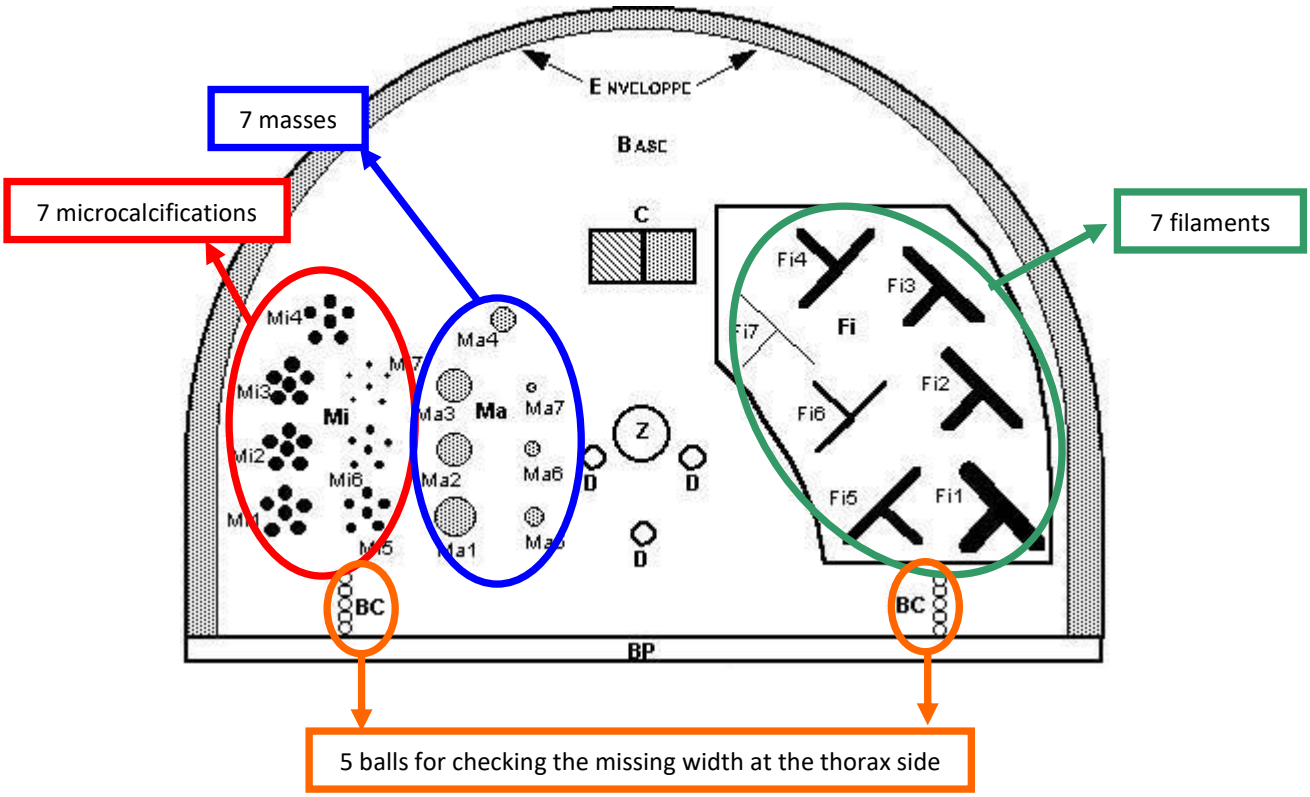


Figure 2a – MTM100 phantom

2c. Image quality – detection indices

Aim: Check the automatic exposure system works properly, check the absence of artifacts on the images, control the exposure settings and the contrast to noise (CNR) ratio.

Description of the test

• All image processings usually used in mammography are disabled (use of the Dicom "for processing" image)
• The Plexiglas block is positioned on the bucky, laterally centred. A square of aluminium 10x10x0.2 mm is put at 6 cm from the edge of the bucky, laterally centred, on the 20 mm plate (Figure 2b).
• The height of the compression plate is adjusted to the equivalent breast thickness. If needed, the plate is compressed on additional small plastic blocks (the additional plastic blocks must be outside the AEC calculation area, small blocks positioned on the left and right edges).
• The plexiglas block is radiographied using clinical mammography settings (compression and AEC selection).
• This procedure is repeated for the 30, 50 and 70 mm PMMA blocks equivalent to compressed breasts of 32, 60 and 90 mm, respectively.

Measures

• The image is displayed on a diagnostic screen. Track visually "dead pixels" and missing lines and non homogeneity areas. Assess the absence of artifacts in the image. The artifacts are sought by adjusting the width and centre of the display window.
• The Contrast to Noise Ratio (CNR) is measured in a region of interest (ROI) of approximately 5 x 5 mm in the aluminium square and outside the square (at 4 sides), and

compared to the limiting value.

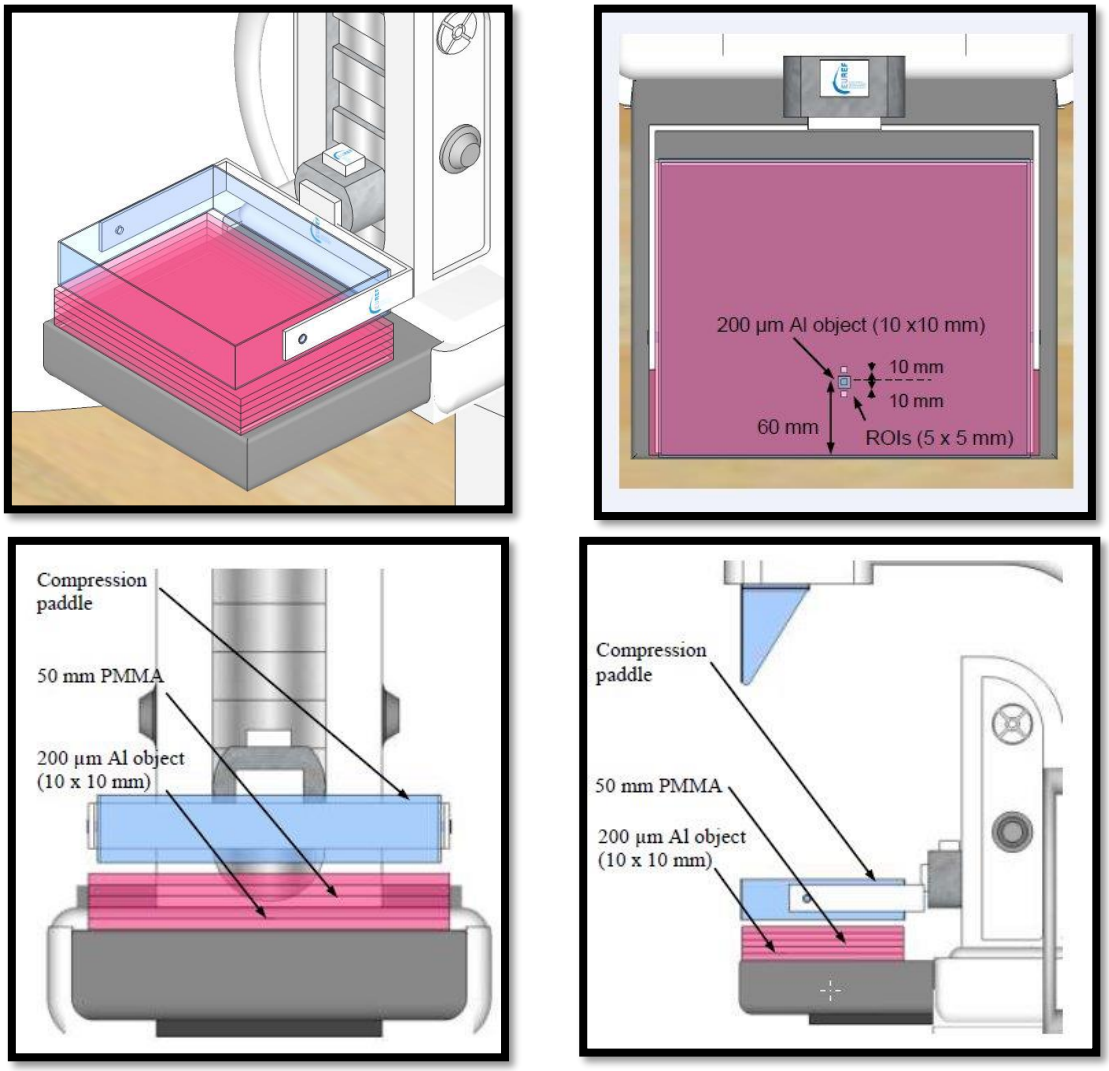


Figure 2b – Plexiglas blocks imaging

2c. Dosimetry

Aim: Ensure that the mean glandular dose (MGD) is compliant for the different breast thicknesses (32, 45, 60 and 90 mm).

Description of the test

• The dosimeter is positioned on the bucky, laterally centred, at 6 cm from the edge of the bucky (reference point at Figure 2c).
• The height of the compression plate is lowered on the dosimeter.
• The same conditions as those obtained with the MTM 100 phantom or plexiglas blocks are used, but in manual mode (kV, A/F, with the nearest mAs).

Limiting values

Breast thickness [mm]	21	32	45	53	60	75	90
Equivalent PMMA thickness [mm]	20	30	40	45	50	60	70
Limiting MGD [mGy]	**1.0**	**1.5**	**2.0**	**2.5**	**3.0**	**4.5**	**6.5**

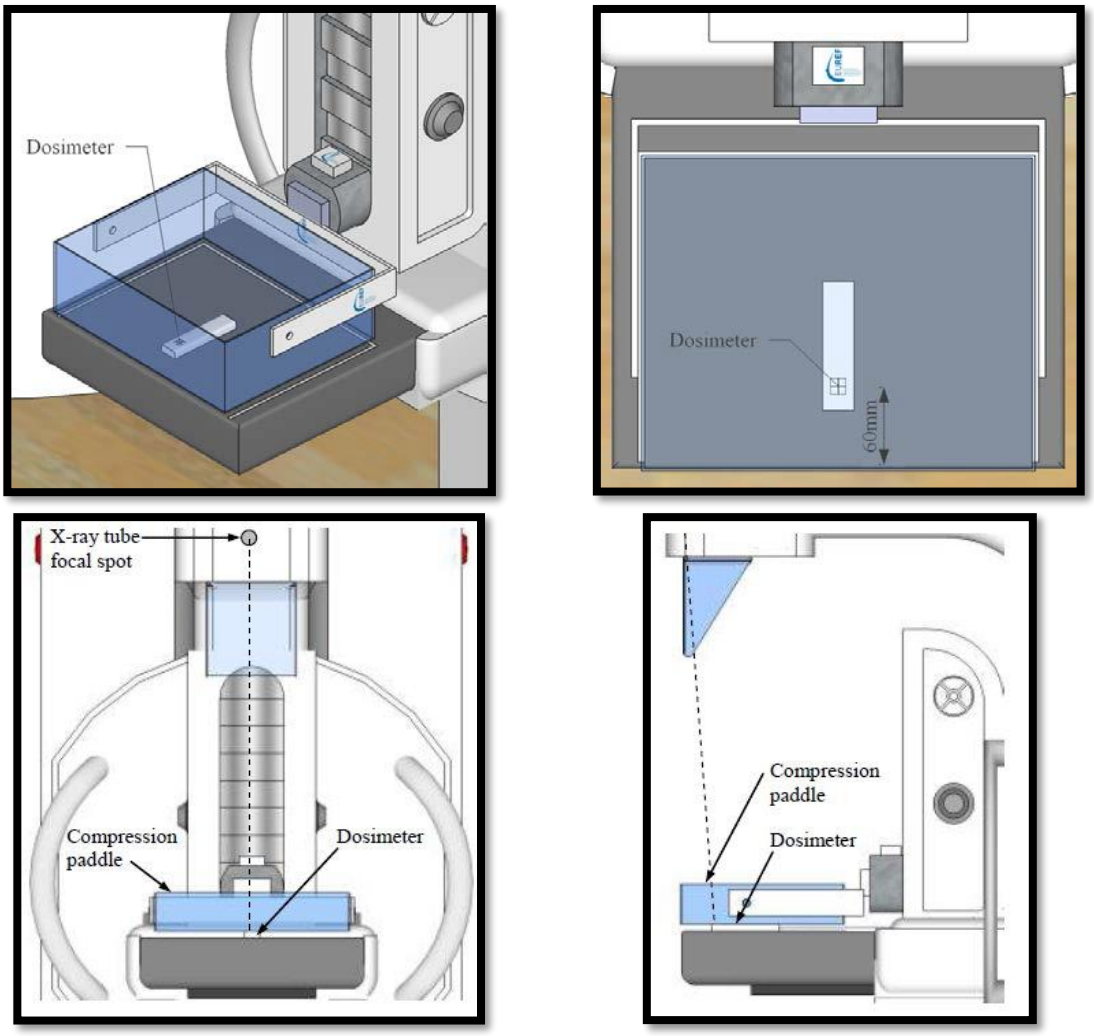


Figure 2c – Dosimetry scheme

2d. Control of the diagnostic screens

Aim: Ensure that the diagnostic screens meet the standard DICOM 3.14. The test is done by following the manufacturer's recommendations, respecting screens heating time before starting the tests.

Description of the test

• The screens surface is visually checked: cleanliness, free of dust and fingerprints.
• The pattern is displayed on the screen as if it were a mammogram (Figure 2d).
• The sources of interference light (reflections on screens) are turned off and the ambient light level is set low enough for viewing.
• The pattern is displayed in its original size (100% or full screen).
• The 5% contrast in the white area 0%, and 95% contrast in the black area 100% are visually detected.
• The luminance of the squares from 0 to 100% of luminance is measured with the photometer.
• A complete visual inspection is carried out using all the information in the pattern : contrast of the squares of different brightness, resolution, uniformity and presence of distortions or artifacts

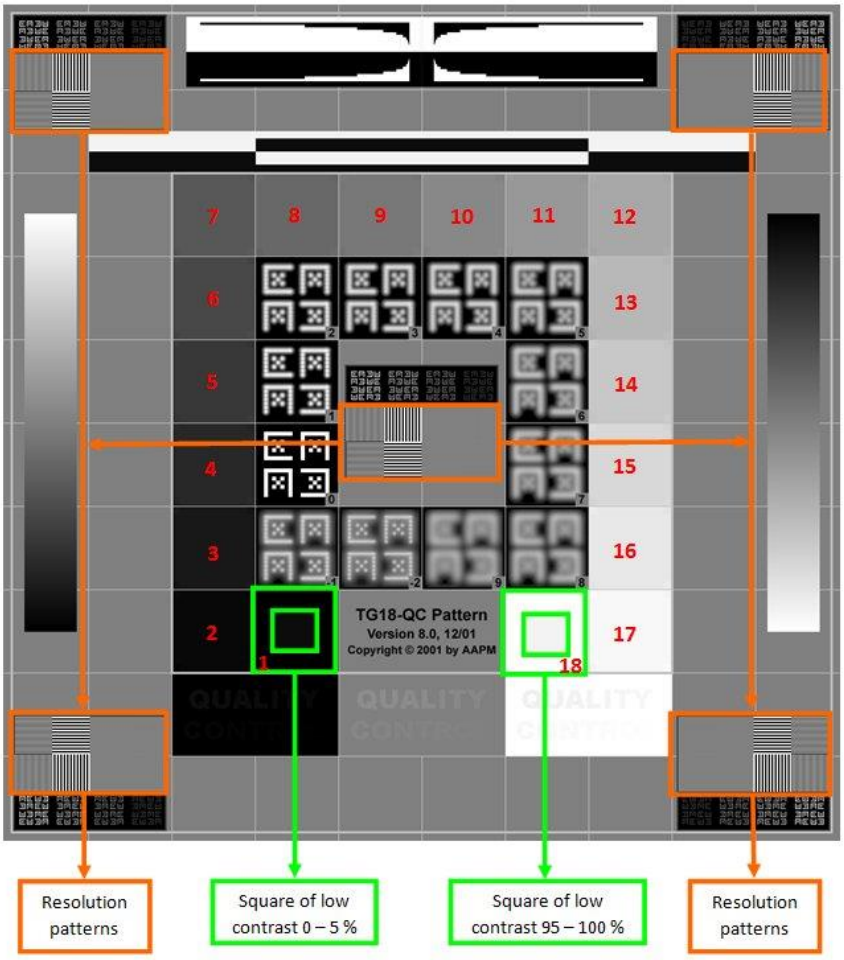


Figure 2d – AAPM TG18-QC test pattern

3. Results

3.1. State of the art

Ninety mammography systems in 78 radiology centers were audited in 2020. The IRA audited 73 systems in 63 centers in French-speaking part of Switzerland. Fourteen systems were audited in the Canton of Ticino and three in the Canton of Thurgau. Eighty-three percent are DR systems with flat panel detectors and 17% are scanning DR systems. Hologic, Siemens, Philips and General Electric mammography systems are the most popular systems and account for 91% of the audited systems for screening mammography in Switzerland (Table 1 and Figure 3a). Although digital breast tomosynthesis (DBT) is not used for screening, 51% of the audited systems could produce DBT examinations.

Table 1 – Distribution of the audited systems

	VD	GE	TI	BEJUNE	VS	FR	TG	Total
Hologic	9	8	5	4	3	7	0	**36**
Siemens	6	1	2	5	0	0	3	**17**
Philips	7	4	0	0	2	2	0	**15**
General Electric	5	4	1	1	3	0	0	**14**
IMS Giotto	0	0	6	0	0	0	0	**6**
Planmed	0	1	0	0	1	0	0	**2**
Total	**27**	**18**	**14**	**10**	**9**	**9**	**3**	**90**

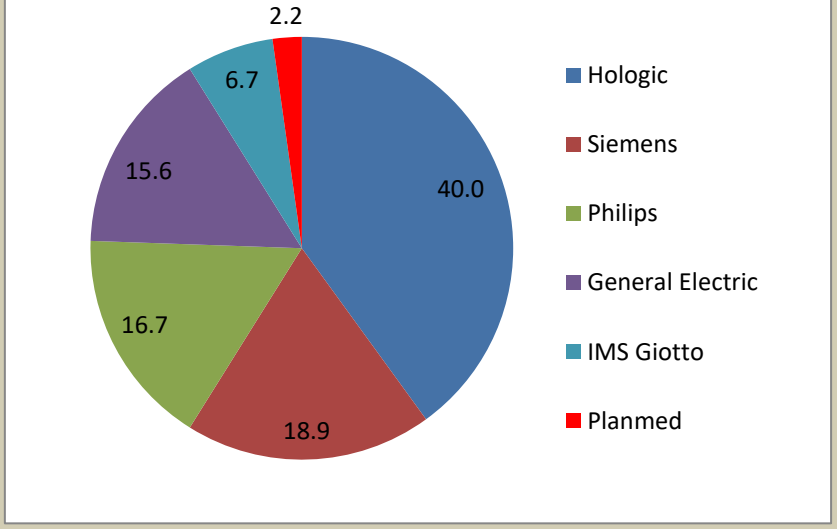


Figure 3a – Mammography systems audited in 2020

The radiological institutes are compared on the basis of their image quality scores obtained with the MTM 100 phantom (detection of masses, filaments and microcalcifications), their performances for the detection of a microcalcification of diameter 0.1 mm, and the mean glandular dose (MGD) delivered in clinical mode for 4 breast thicknesses: 32, 45, 60 and 90 mm. To facilitate the comparison between centers using the same type of detector, the tables in Annex F link the number of the controlled installation with the type of detector and the AEC setting for a 45 mm compressed breast (MTM 100 phantom).

In 2020, the auditors reported 16 non-conformities (Table 2) in 11 radiology centers (14% of the audited centers). The number of problems increased in 2020 compared to 2019, as shown in Figure 3b (only 4 problems reported in 2019), but remains within the statistical variability. Ten of the 16 problems concerned diagnostic screens in six radiology centers (difference in luminance between the left and right screens, LUT curve and surface cleanliness). A mammography system gave too high mean glandular doses, and the automatic (AEC) exposure parameters of the system had to be updated. Another mammography system gave blank lines on the images. The remainder concerns problems noted in the status annual controls and stability controls.

It should be noted that the non-compliant items were systematically mentioned in a letter addressed to the institutes, with a deadline to reach compliance defined according to the importance of the problem.

Table 2 – Non-conformities pointed out during the audits in 2020

	VD	GE	TI	BEJUNE	VS	FR	TG	Total
Maximal luminance of the screens	2	0	0	0	2	1	0	**5**
Status and stability controls	1	1	0	1	0	1	0	**4**
LUT curve of the screens	2	0	0	0	0	1	0	**3**
Cleanliness of the screens	0	0	0	1	0	1	0	**2**
Mean glandular dose	0	1	0	0	0	0	0	**1**
Artefacts (image quality)	1	0	0	0	0	0	0	**1**
Total	**6**	**2**	**0**	**2**	**2**	**4**	**0**	**16**

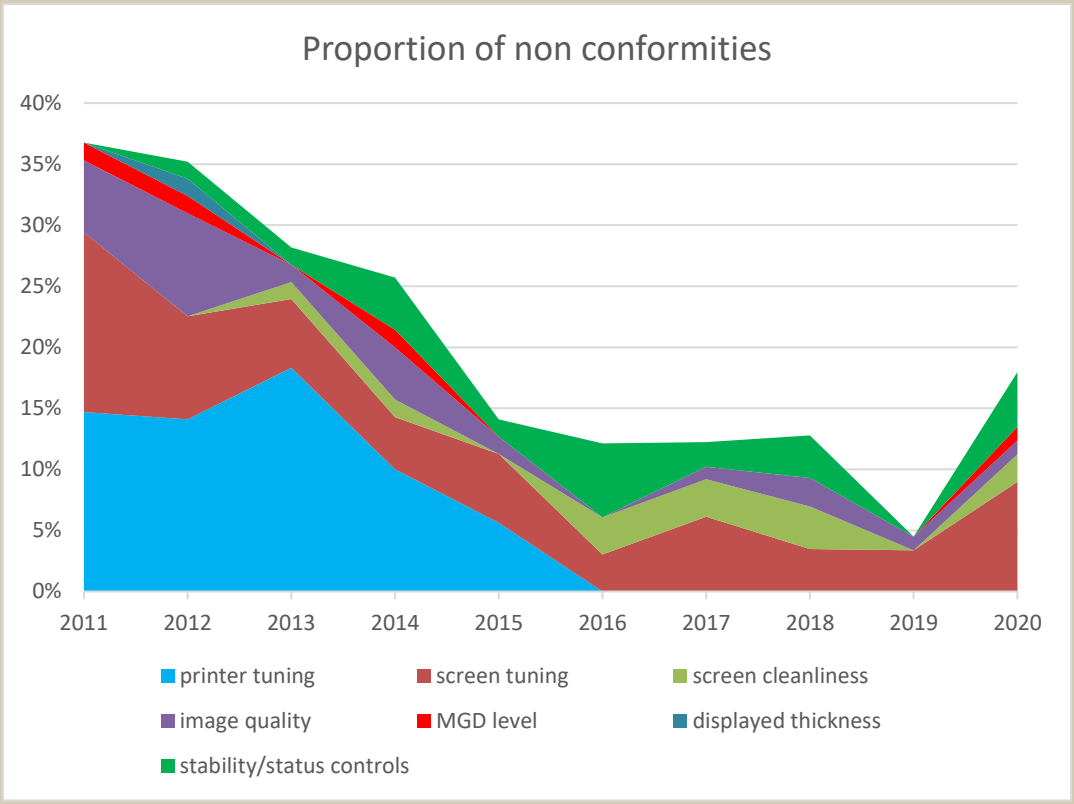


Figure 3b – Proportion of non-conformities since 2011

3.2. Radiography of the MTM 100 phantom

Figures in Annex A show the number of groups of microcalcifications, masses and filaments subjectively detectable on the diagnostic screens on the radiography of the MTM 100 phantom. This score was established from an image acquired in clinical conditions, using the full automatic exposure mode (AEC). These results are obtained by evaluation of the images under controlled reading conditions. The acceptance limit is currently set at the detection of at least 4 structures in each group (minimum score of 24). It is imperative that all centers meet these requirements.

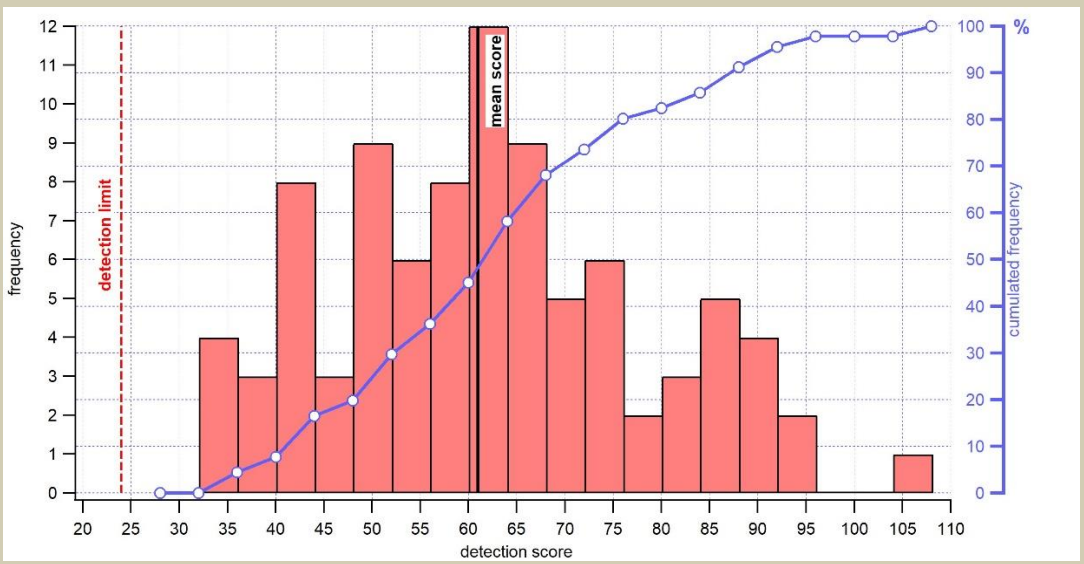


Figure 4a – Distribution of detection scores on the MTM 100 phantom

In 2020, the median score of the MTM 100 phantom was 4.5 microcalcifications, 5.5 masses and 5.5 filaments, like in 2019, with a mean detection score of 61 points (Figure 4a). This mean score is stable compared to 2019 (60 points). With a detection score of 104 points, the center N° 2 in the Canton of Thurgau achieved the best detection performance. The lowest detection scores established in radiology centers in 2020 were only 32 points. It should be noted that the detection scores must always be related to the breast dose, a dose increase should lead to a higher signal-to-noise ratio (SNR) in the images and a higher detection score.

The mean glandular dose (MGD – estimated for glandular/adipose ratio: 50/50) obtained for the MTM 100 phantom radiography is also shown in Annex A. Since the phantom is equivalent (in thickness and composition) to a compressed breast of 45 mm, the MGD must not exceed 2 mGy. The comparison in Figure 4b turns out significant differences between the systems. The highest dose was delivered by the system N° 10 in the Canton of Geneva, that was above the maximal authorized limit, at 2.32 mGy. The MGD was lowered to 1.75 mGy after compliance. With a MGD of 0.37 mGy only, the Philips installations of the centers N° 21 in the Canton of Vaud and N° 9 in the Canton of Freiburg gave the lowest dose. The average MGD for the systems audited in 2020 was 1.09 mGy (1.07 mGy in 2019).

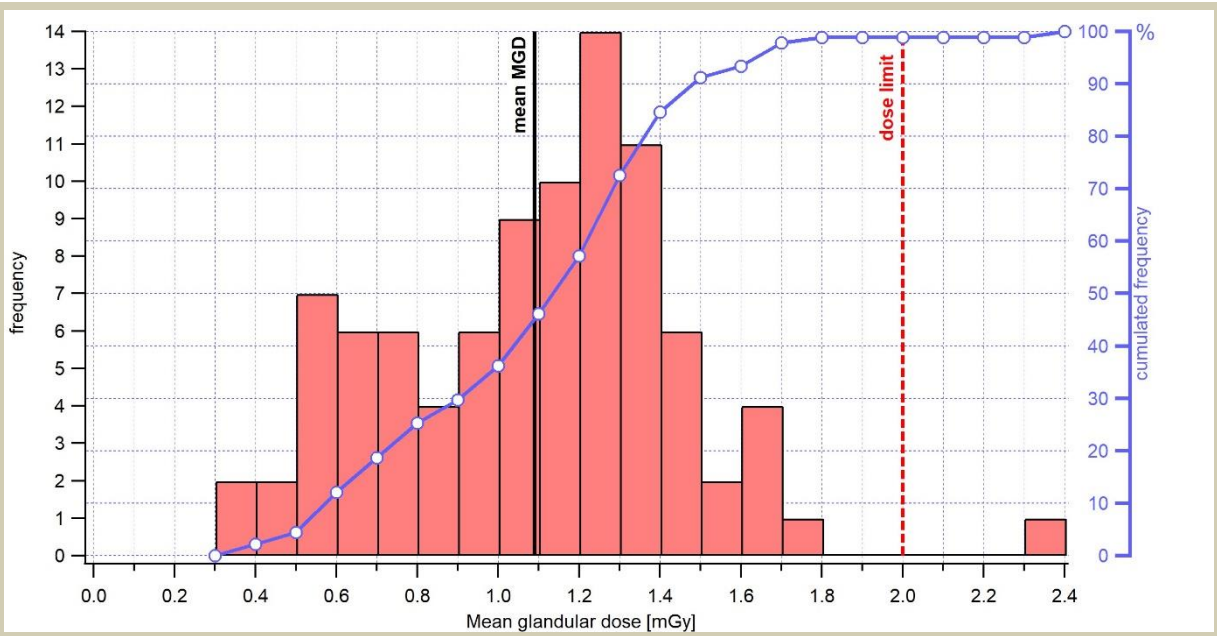


Figure 4b – Distribution of MGD for the MTM 100 phantom

3.3. Image quality / dose balance

Since 2011, all mammography systems in Switzerland have to provide at least the detection of a microcalcification of 0.1 mm in diameter with a contrast of 23% in a 60 mm compressed breast. This detection is considered sufficient if one observer in two succeeds in detecting the microcalcification with optimum reading conditions. For better reproducibility of the results, this detection is now calculated using a computer program that simulates the response of the human observer. This allows a standard detection index normalized to a value of 1. For example, a detection index of 1.2 means that the probability of detecting such a microcalcification is increased by 20% with respect to the minimum detection threshold (50% correct detection). If this index reaches 2, this means that the detection probability reaches 100%. In order to take into account the increasing difficulty of detection with the breast thickness (loss in contrast and resolution), the detection limit is adapted to the breast thickness: that is 1.1, 1.0 and 0.9 for compressed breasts of 32, 60 and 90 mm, respectively.

For a system with a given setting, the detection index depends on the dose. Annexes B to D thus represent the detection index as a function of the MGD obtained in clinical mode, for the three compressed breast thicknesses of 32, 60 and 90 mm. The MGD is the dosimetric quantity representative of the radiological risk. All mammography systems must be adjusted to meet the following dose limits: 1.5 mGy for 32 mm, 3 mGy for 60 mm, and 6.5 mGy for 90 mm. Only one center needed a corrective action for a decrease in MGD in 2020.

In 2020, the average detection indices were 1.90 for 32 mm, 1.55 for 60 mm and 1.22 for 90 mm. These detection indices are compatible compared with 2019 data (1.89, 1.52 and 1.21 respectively for the three thicknesses). Figure 5a shows the stability of the mean detection index since 2011. Most of the audited installations achieved a sufficient detection index for all breast thicknesses. Only one center needed a corrective action for a problem of image quality in 2020.

In 2020, average MGDs were 0.73 mGy for 32 mm, 1.54 mGy for 60 mm and 2.60 mGy for 90 mm, slightly higher compared to 2019 (respectively 0.71, 1.48 and 2.53 mGy in 2019 for the three thicknesses). One system exceeded the EUREF dose limits in 2020. Figure 5a shows the stability of the mean MGD since 2011. The statistical distribution of MGD in 2020 for the three breast thicknesses is shown in Figures 5b to 5d.

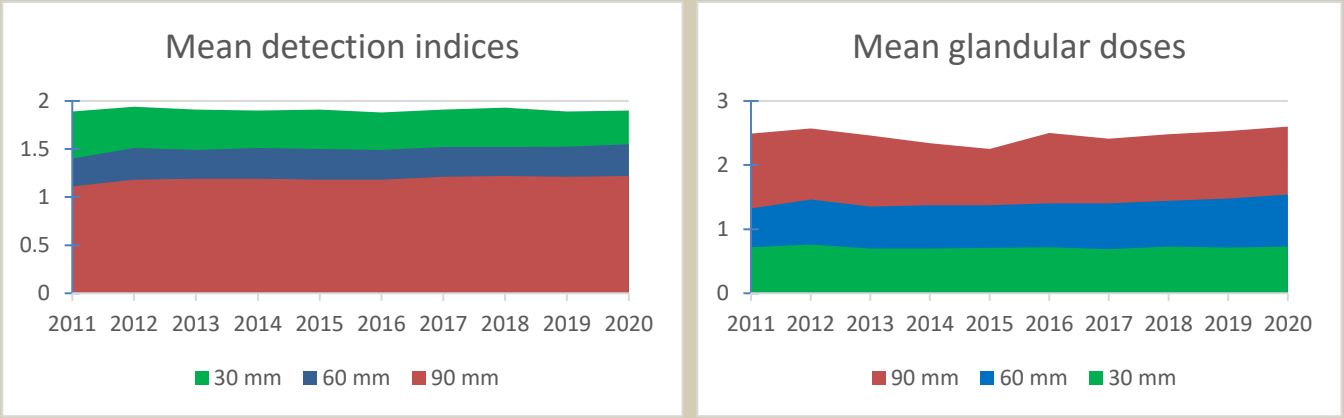


Figure 5a – Mean detection indices and MGD since 2011

The average detection indices and MGDs obtained on the systems determine four sectors in annexes B to D. With an image quality above the average and a MGD lower than the average, the systems in the upper left sector are the best. Conversely, systems in the lower right-hand sector provide lower image quality while delivering a higher-than-average dose. The settings of these systems should be optimized if possible. In the top right-hand sector are the systems which settings favor image quality at the expense of the dose. Finally, the systems of the lower left-hand sector favor low doses to the detriment of image quality.

The institute N° 16 in Geneva gave the best detection index for the thickness 32 mm, with a MGD equal to 0.55 mGy. For the 60 mm thickness, the center N° 3 in the Canton of Thurgau was the most efficient in terms of image quality, with a MGD of 2.28 mGy, 47% higher than the mean value of 1.55 mGy. Conversely, the institute N° 12 in Geneva gave the poorest image quality for this breast thickness (for a MGD of 0.54 mGy only). The installation N° 8 in the Canton of Wallis gave the best detection for the thickness 90 mm, with a MGD of 0.99 mGy, 62% lower than the mean MGD for 90 mm. At the other extremity, the center N° 18 in Geneva obtained the lowest detection index for the thickness 90 mm, with a MGD of 1.66 mGy.

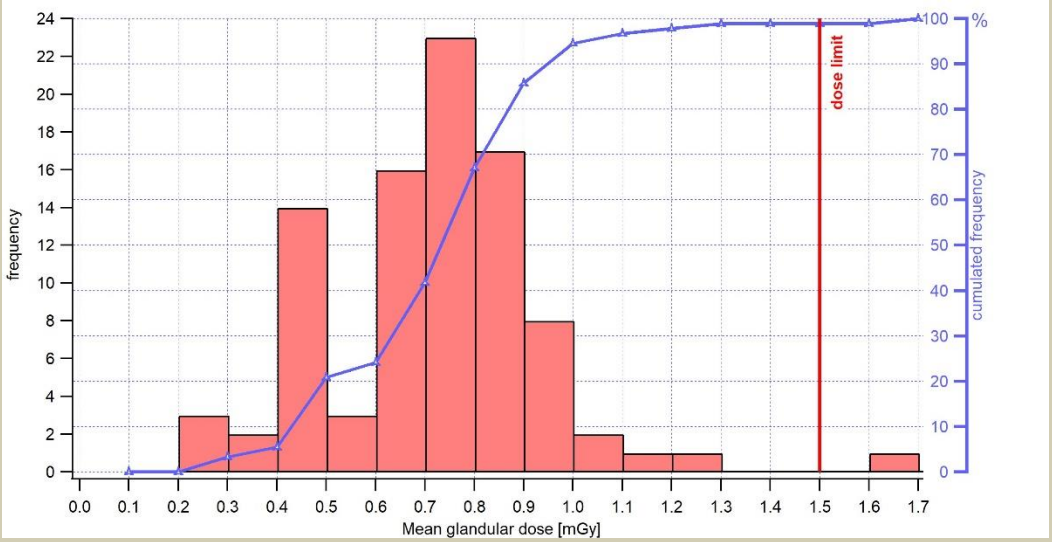


Figure 5b – Distribution of MGD for the thickness 32 mm

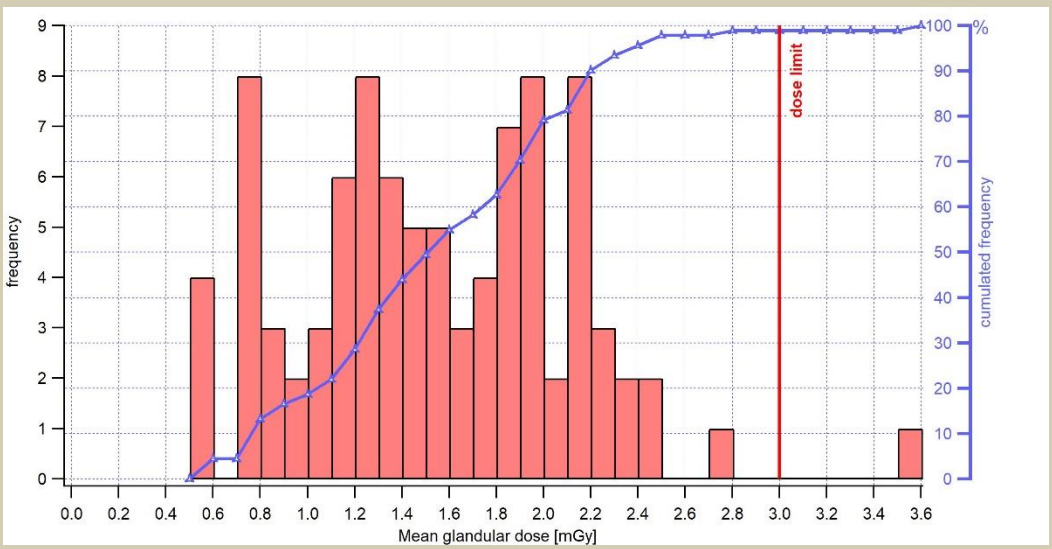


Figure 5c – Distribution of MGD for the thickness 60 mm

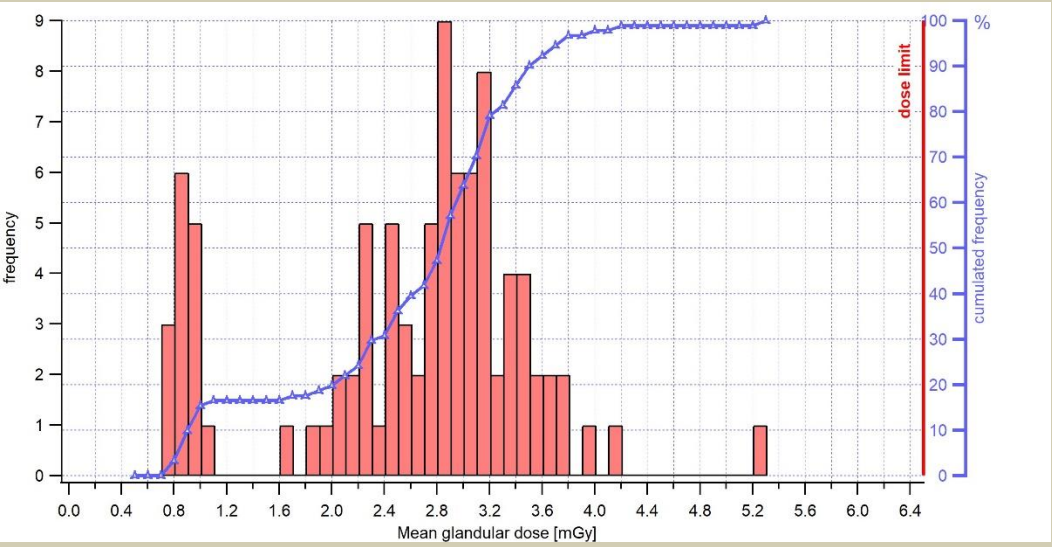


Figure 5d – Distribution of MGD for the thickness 90 mm

3.4. Diagnostic screens settings

Digital images should be displayed on diagnostic screens. The display contrast should be perceived correctly by the observer. The diagnostic screens settings must thus be adjusted to the LUT curve described in the Dicom 3.14 standard. Moreover, the range of luminance levels must be sufficient. It is therefore essential that the screens are well adjusted. If not, the contrast of displayed images will be altered. The LUT curve of the diagnostic screens should therefore not deviate more than 10% compared to the reference LUT curve, and their luminance range (ratio between white and black) must be greater than 250.

The values measured on the screens used for diagnosis in screening mammography are shown in Annex E. The centers without diagnostic screens used for the screening programme do not have any measured value for this item. In 2020, six diagnostic screens were found to be poorly tuned (only two in 2019).

3.5. Differences between mammography systems

Digital mammography systems can be used over the entire possible dose range for a given breast thickness. This is however only theoretical since these systems must provide minimal image quality for all breast thicknesses between 20 and 90 mm. The setting of the automatic exposure control (AEC) is thus of importance since it determines the balance between image quality and breast dose. Figures 6a to 6c show how the AEC reacts for the three breast thicknesses 32, 60 and 90 mm.

Generally speaking, the flat panel systems use settings similar and close to average values regardless of the breast thickness. In comparison, the Philips MicroDose systems clearly favor very low doses, for an image quality slightly below the average for the L30. The spectral imaging of the L50 SI highly improves image quality. The scanning systems give lower doses because of the absence of anti-scatter grid.

It is of note that for the same mammography model, there may be some disparity in terms of parameter settings. Some systems offer several curves for adjusting the voltage (kV), the tube load (mAs) and the anode-filter combination, depending on the breast thickness, favoring dose or image quality. It may also happen that the thicknesses used for the audits (32, 60 and 90 mm) lie between two different setting thresholds. A small difference between the displayed thicknesses can thus cause the system to switch to a selection of parameters rather than another.

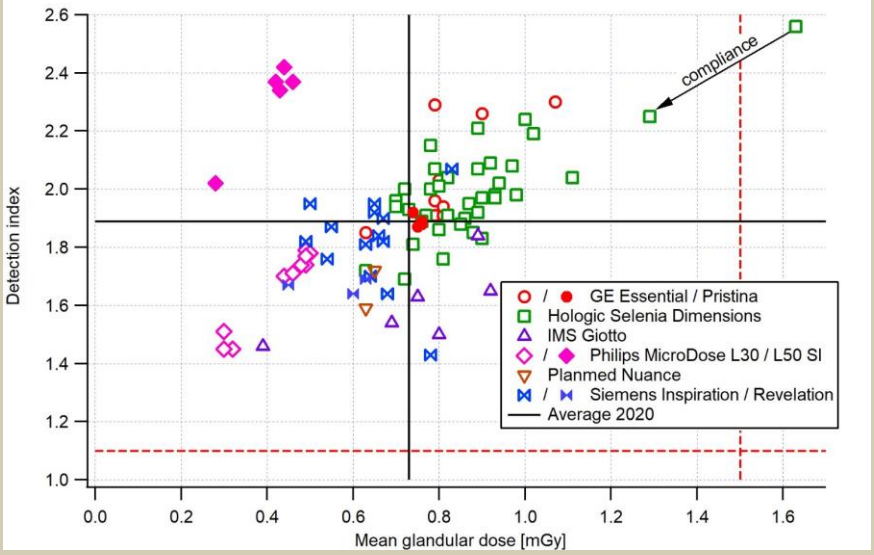


Figure 6a – Image quality and MGD for compressed breasts 32 mm

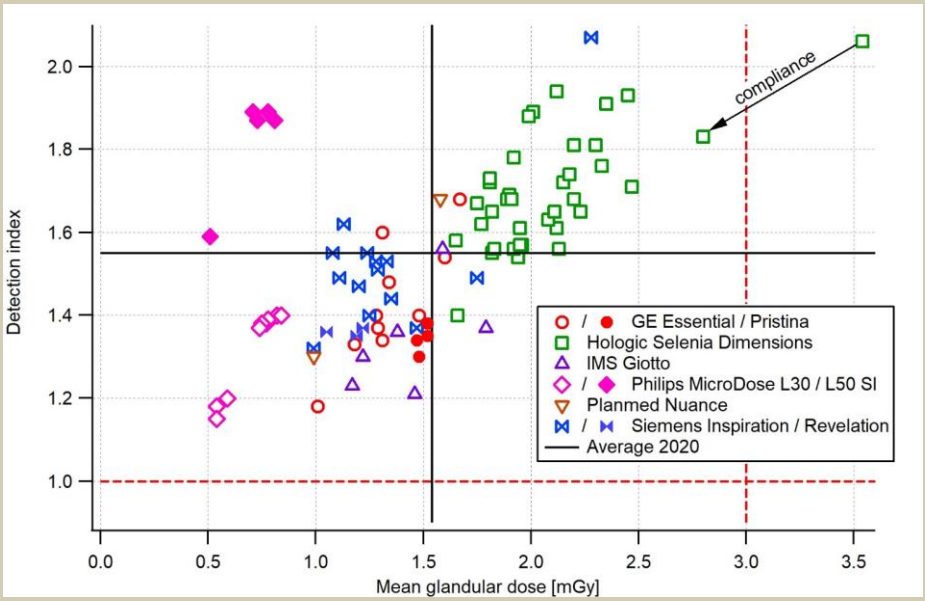


Figure 6b – Image quality and MGD for compressed breasts 60 mm

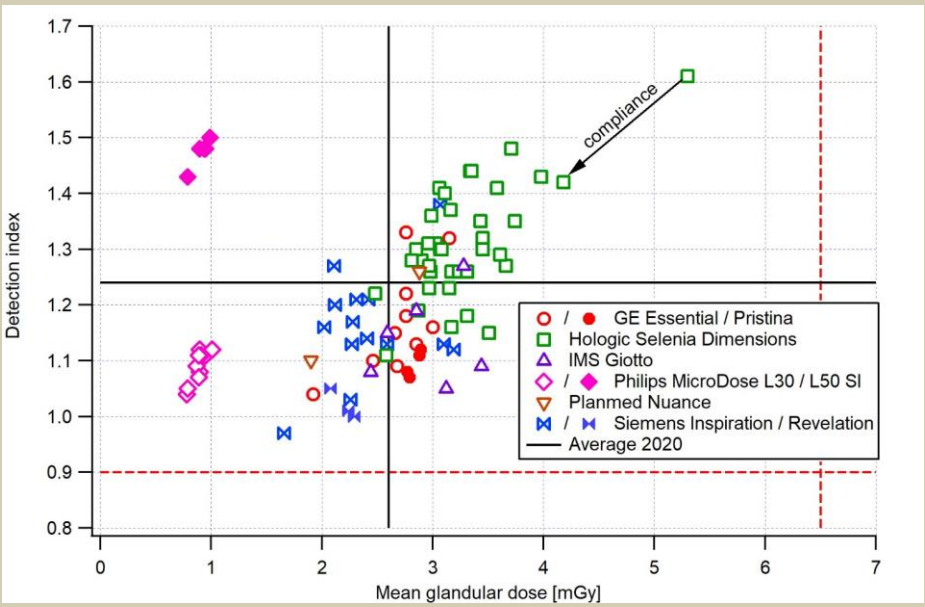


Figure 6c – Image quality and MGD for compressed breasts 90 mm

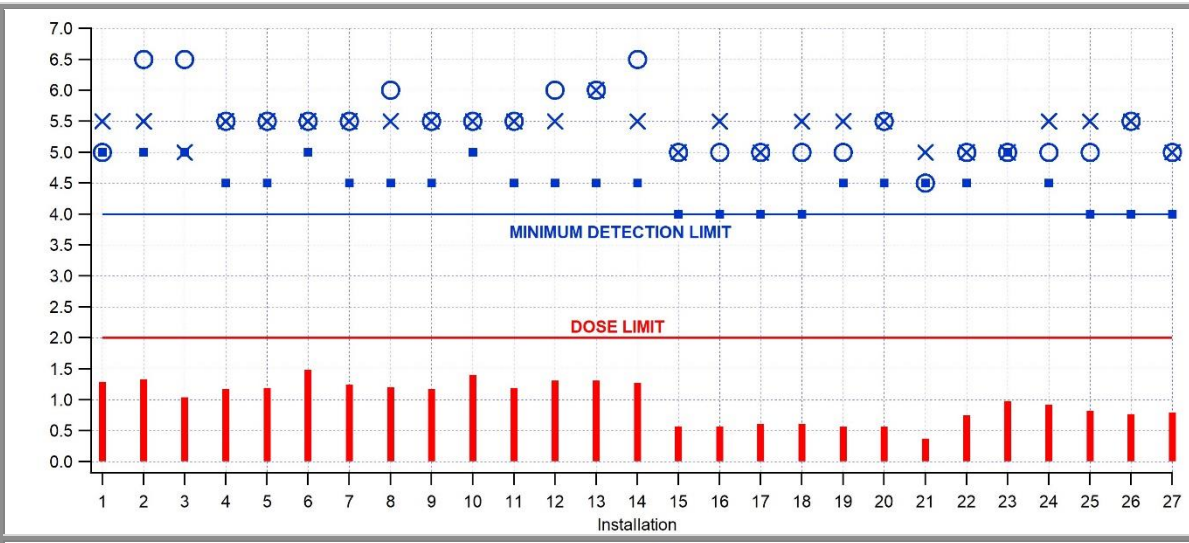
4. Conclusion

The analysis of the image quality-dose balance shows that most of the mammography systems audited in 2020 were in conformity with the European requirements on image quality and breast dose. Most of the problems regarded the luminance tuning of diagnostic screens: six diagnostic screens needed a new calibration of their display luminance. A system delivered breast doses above the limiting values and needed a new tuning of the AEC. A problem with image quality (artefact) regarded one system, and was solved quickly after having been reported during the audit. An optimization of the mammography system settings according to the thickness of the breast would still make it possible to improve the quality / dose balance. This observation is sometimes also valid for variability within the same brand or model of mammography systems.

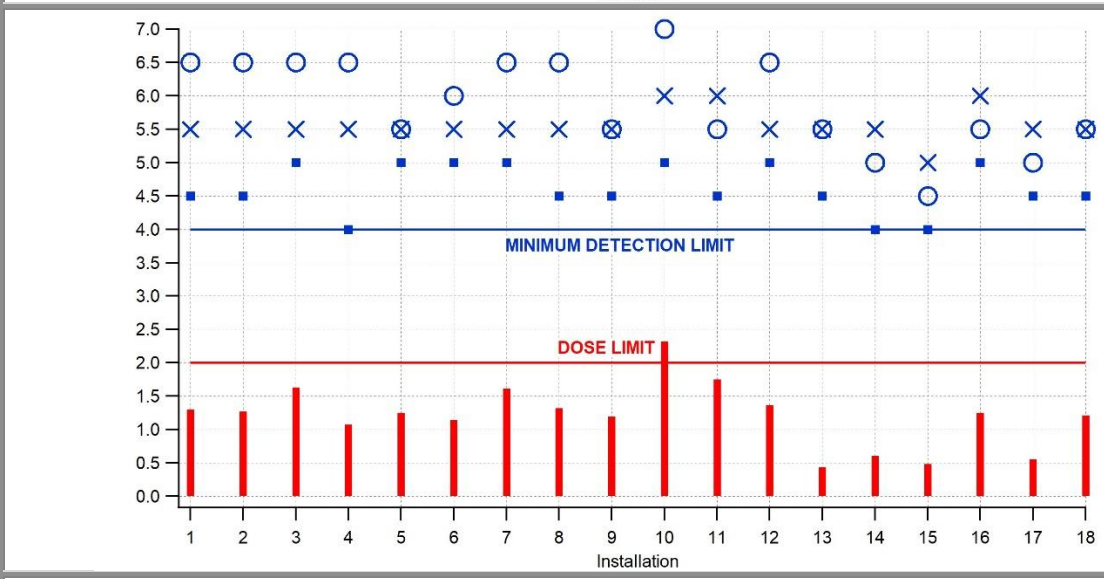
Annex A : Number of detectable structures on the MTM 100 phantom and mean glandular dose

- microcalcifications
- masses
- filaments
- **Mean glandular dose [mGy]**

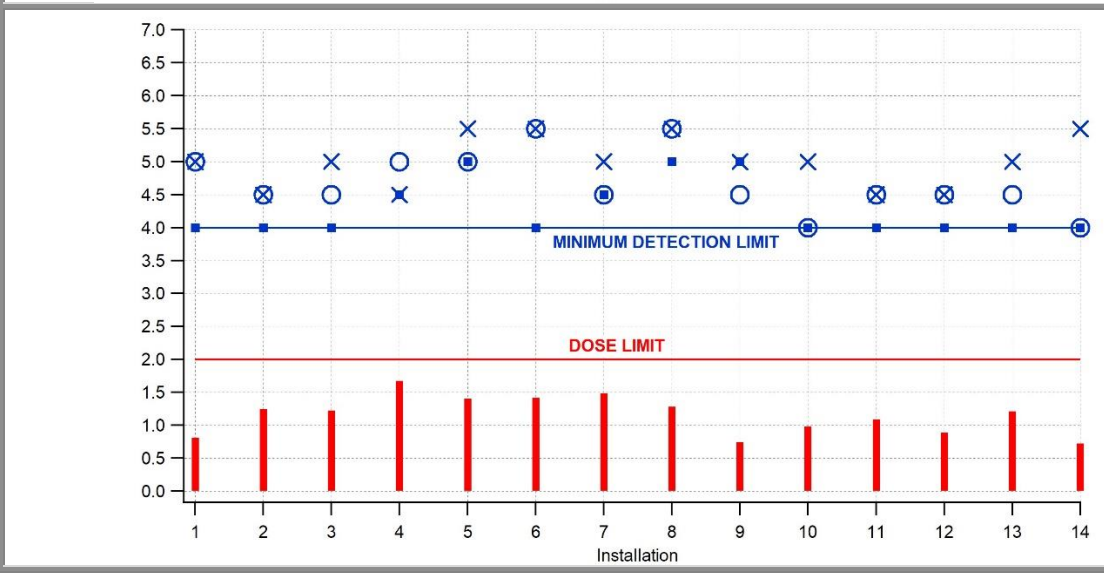
VAUD



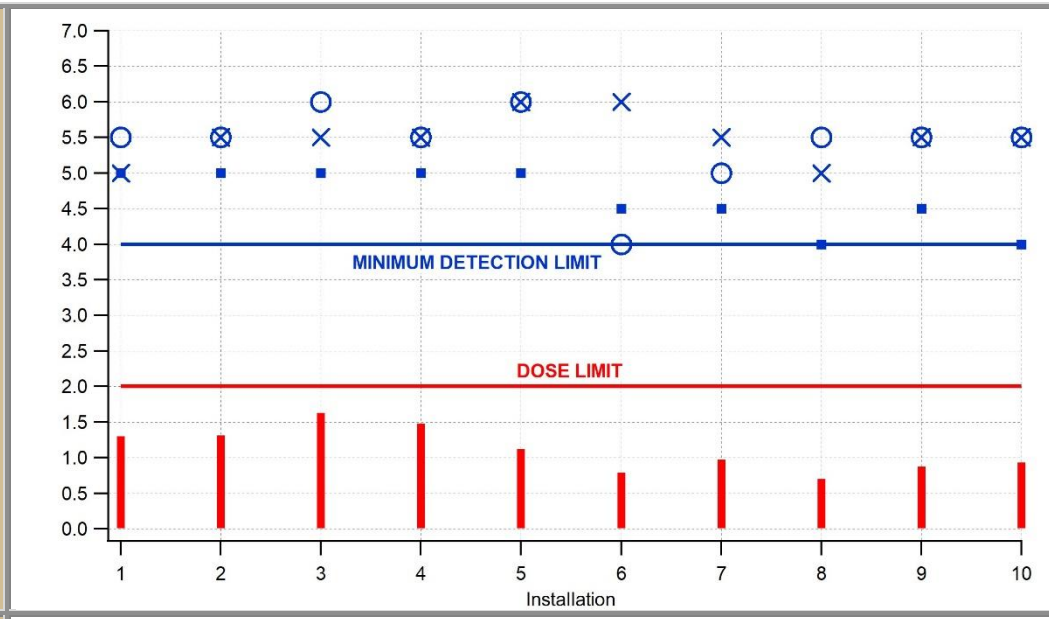
GENEVA



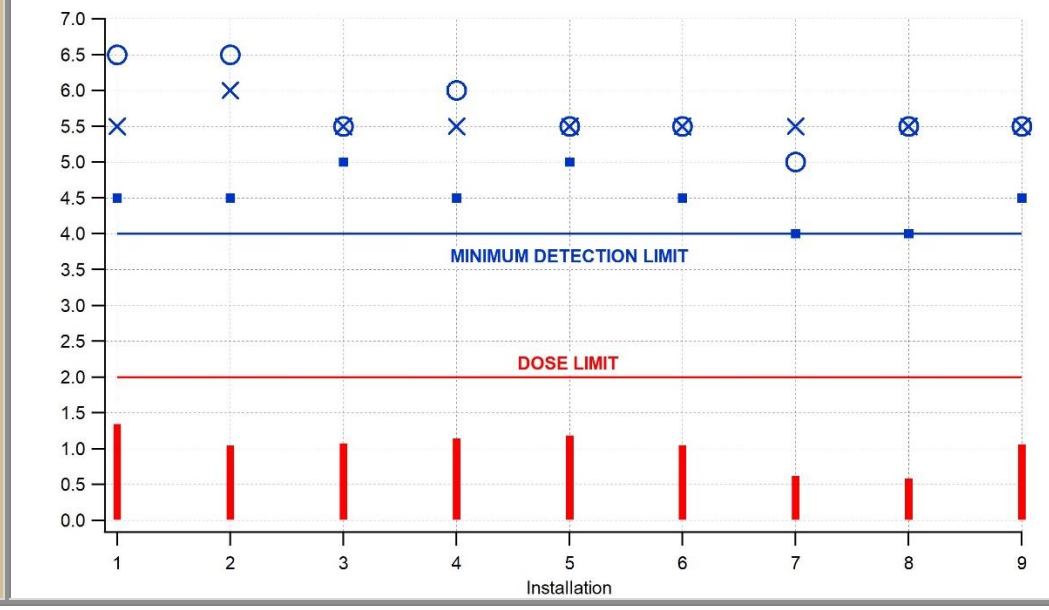
TICINO



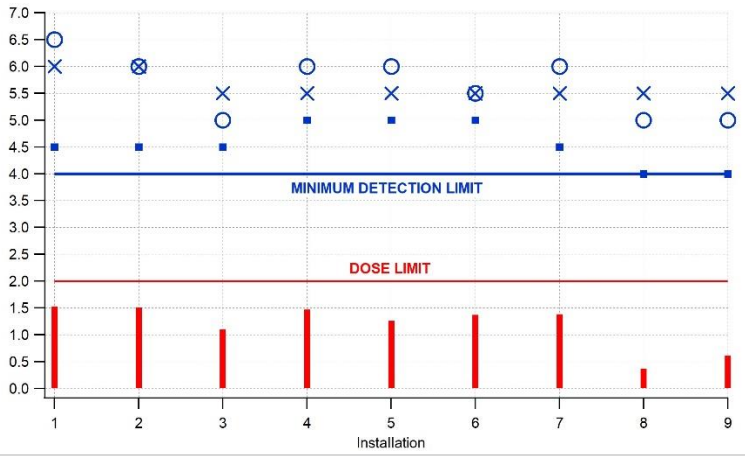
BEJUNE



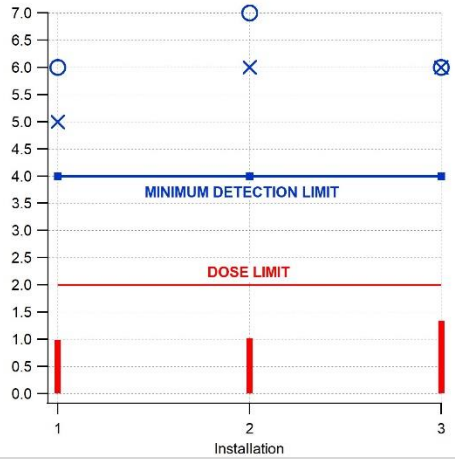
WALLIS



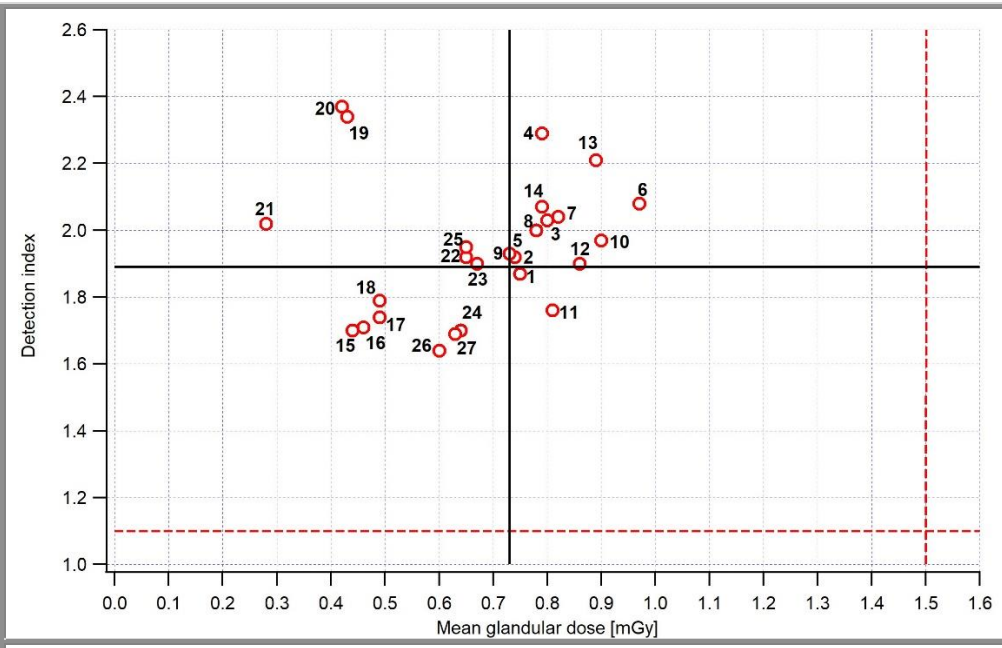
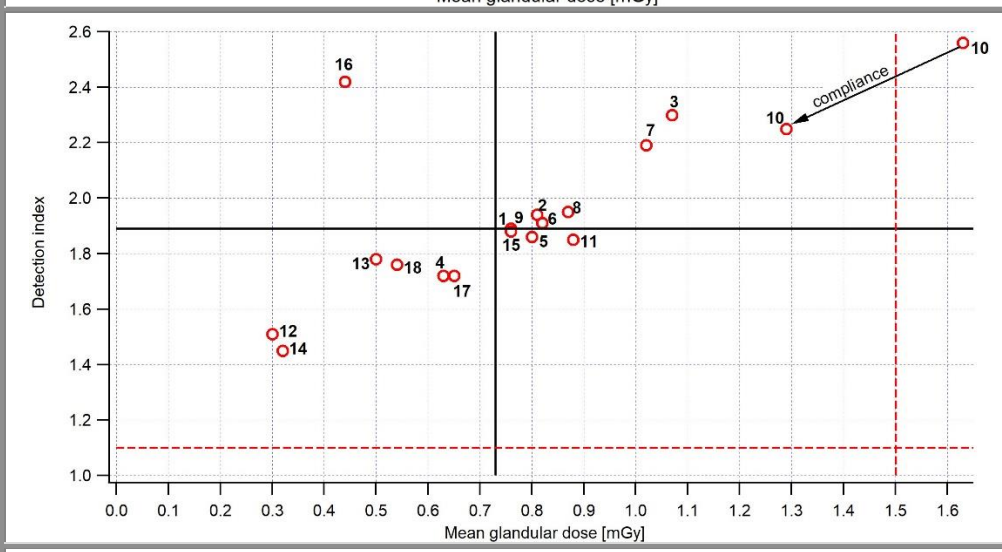
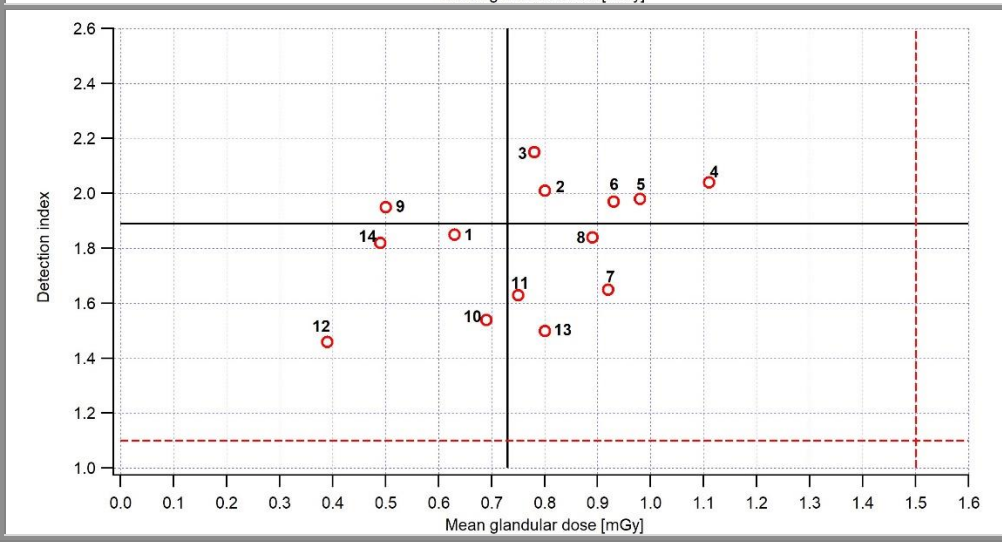
FREIBURG



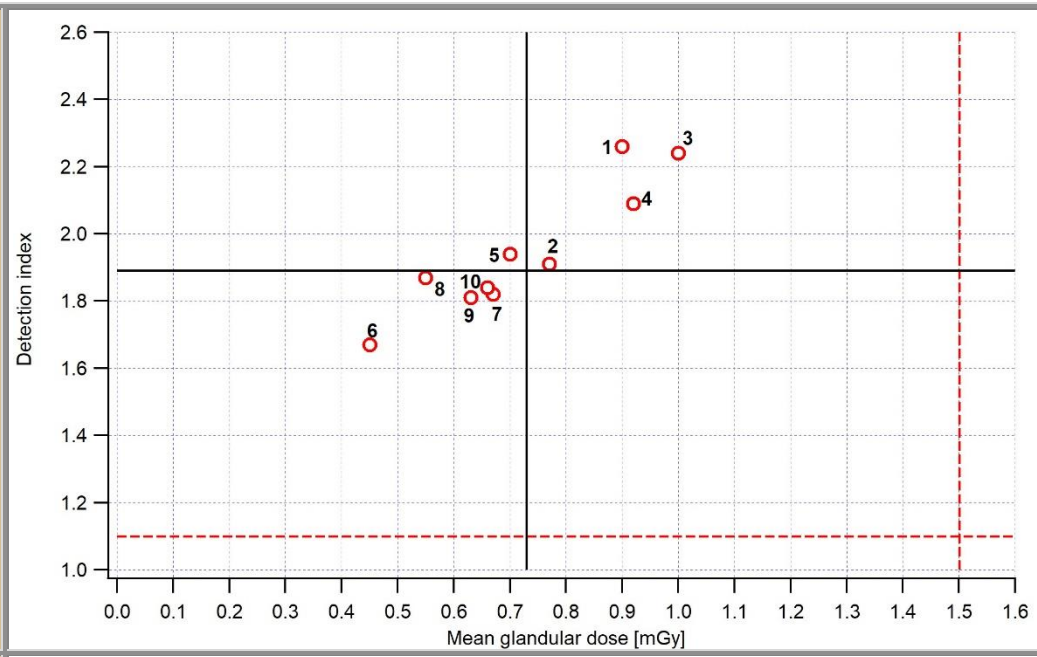
THURGAU



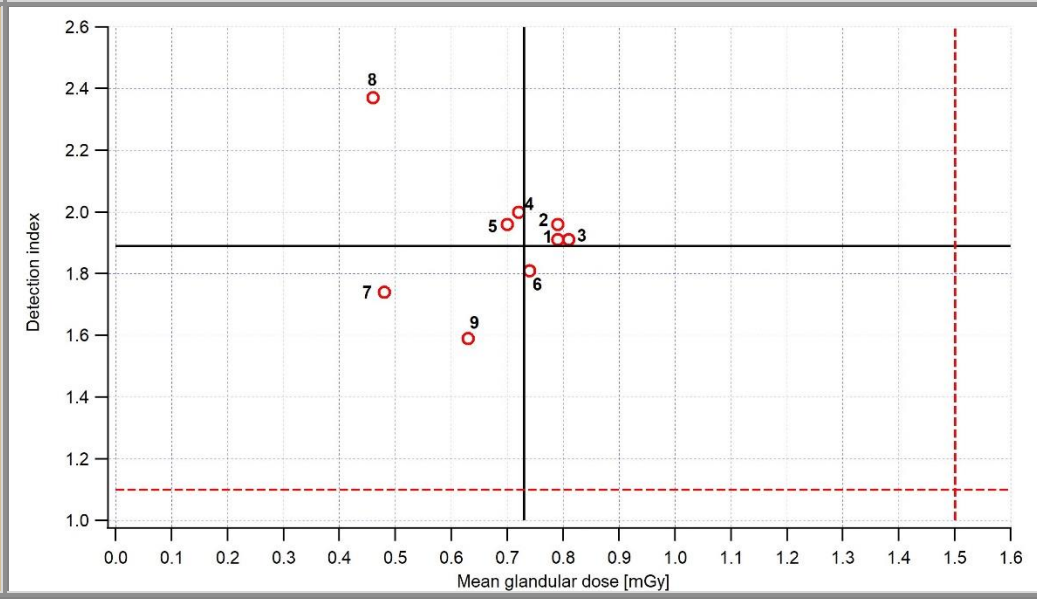
Annex B : Image quality and mean glandular dose (MGD) for a 32 mm compressed breast

VAUD	
GENEVA	
TICINO	

BEJUNE



WALLIS



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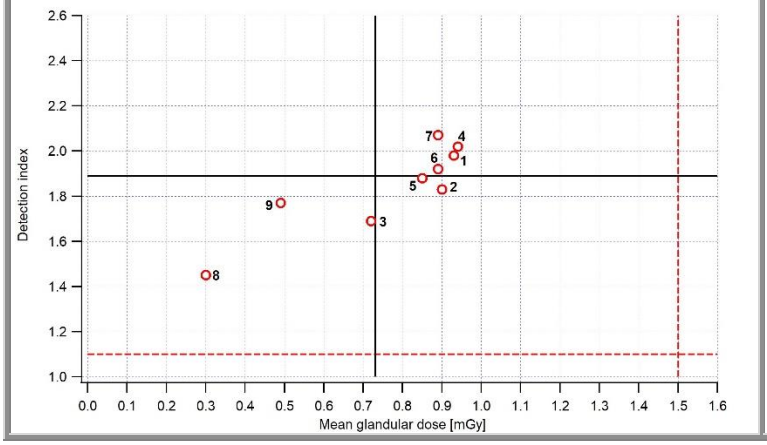
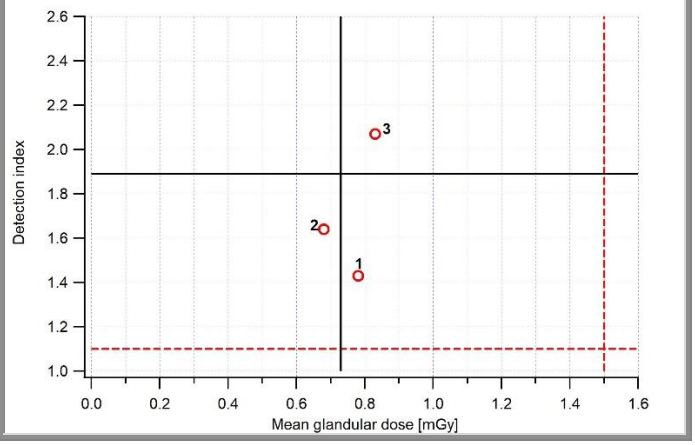
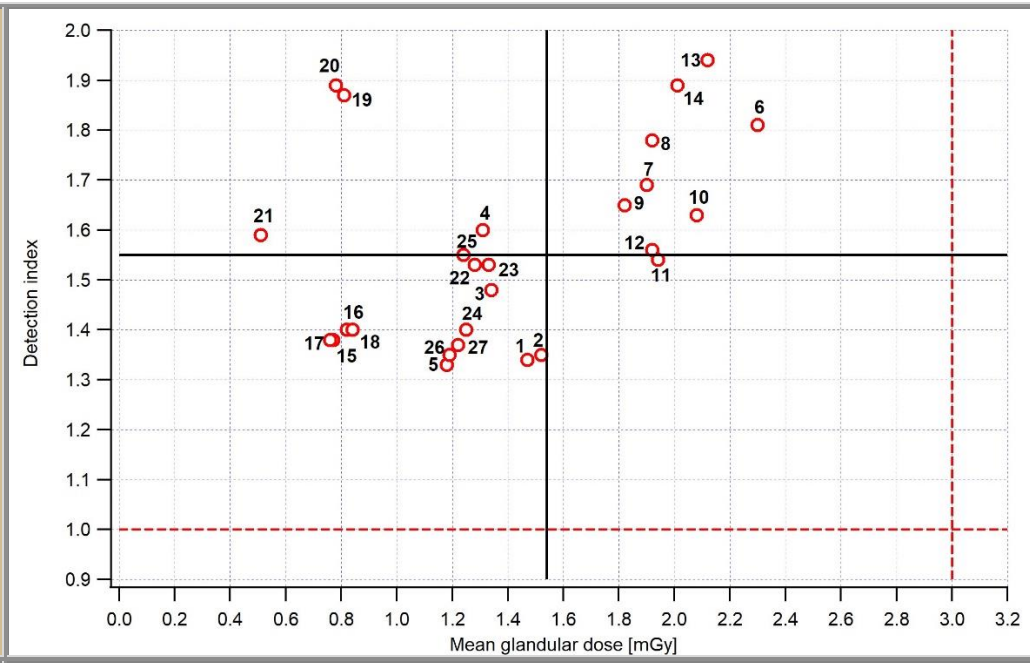
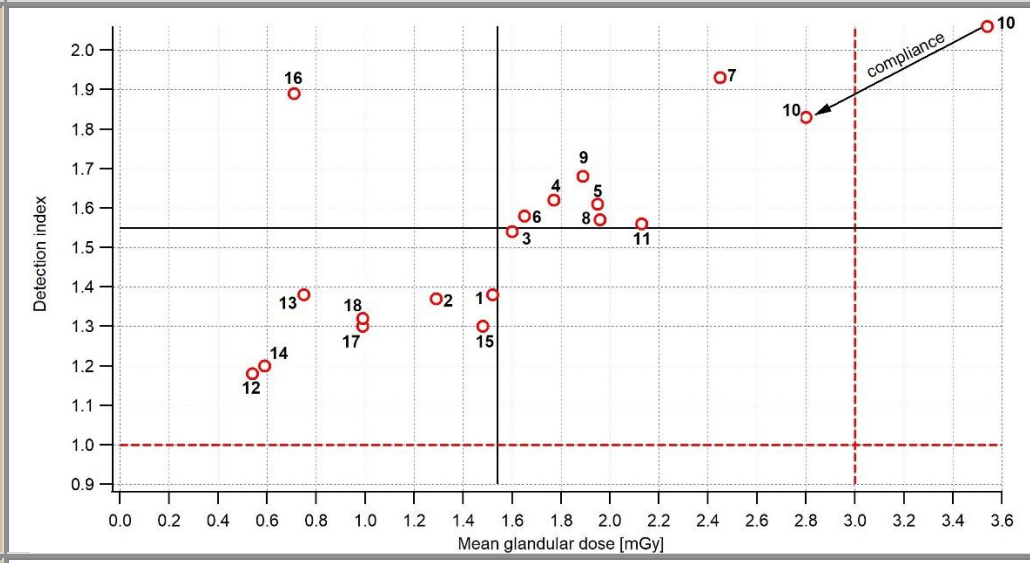
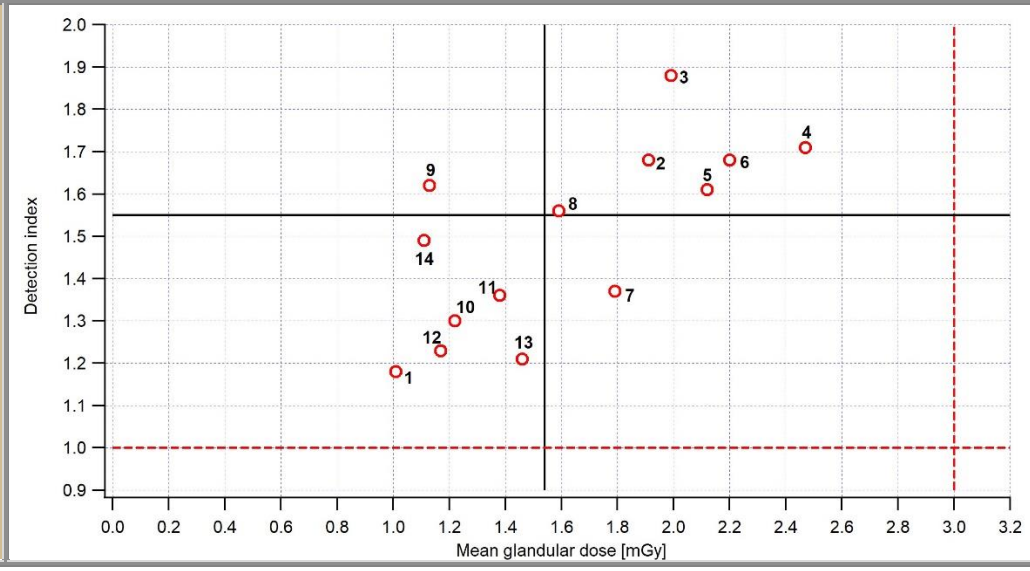


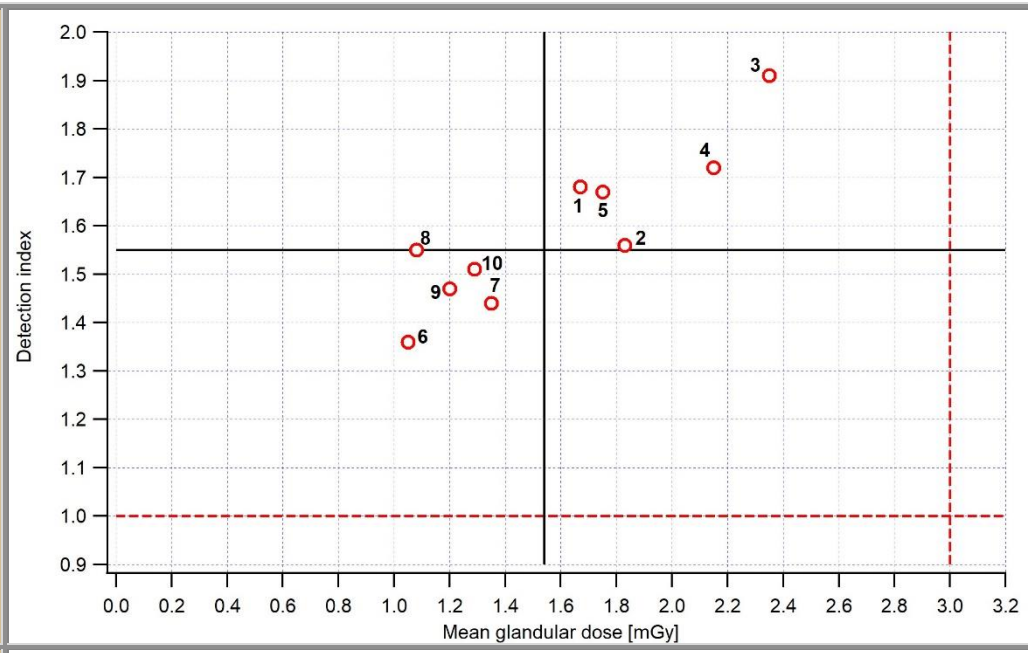
THURGAU



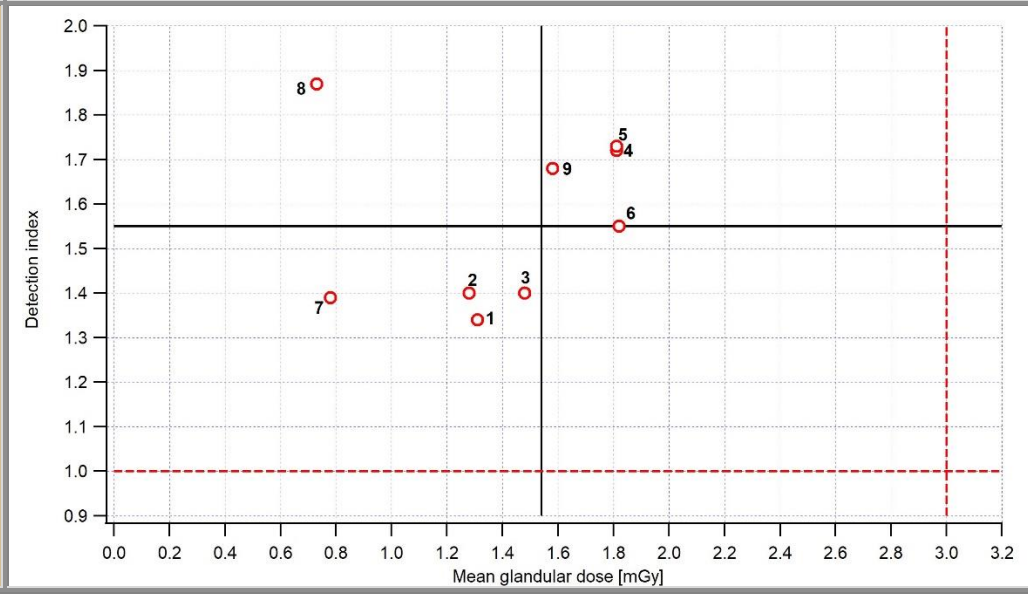
Annex C : Image quality and mean glandular dose (MGD) for a 60 mm compressed breast

VAUD	
GENEVA	
TICINO	

BEJUNE



WALLIS



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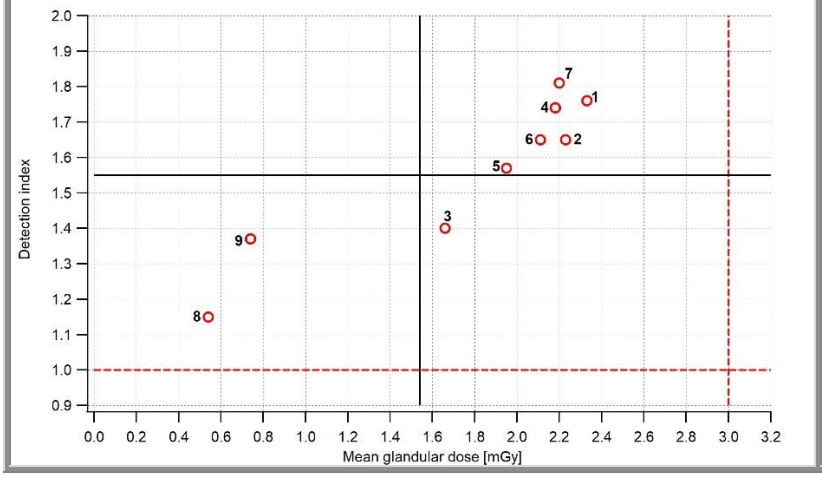
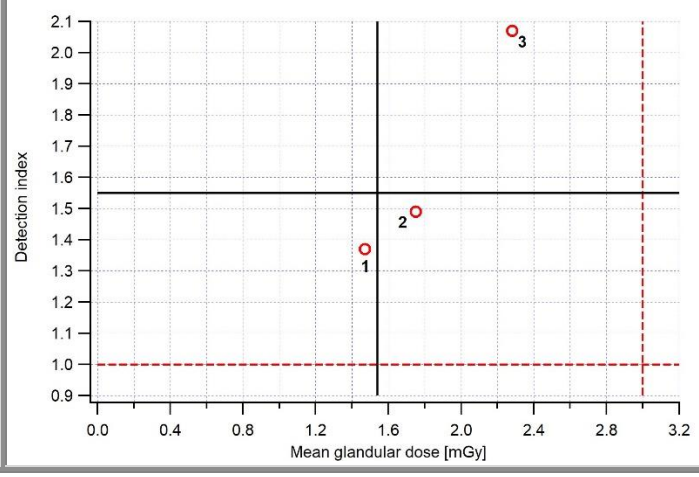
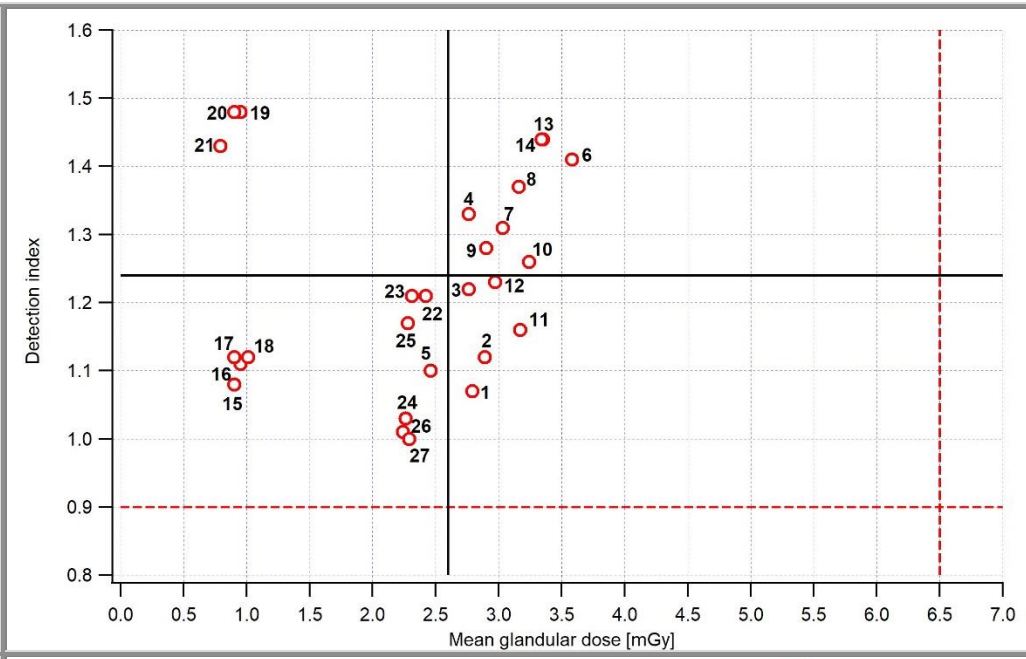
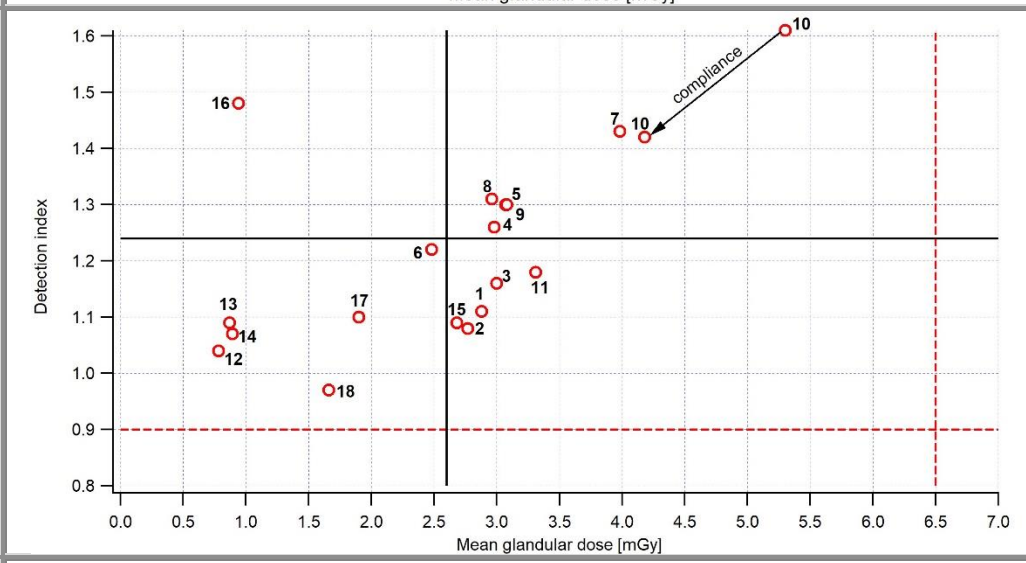
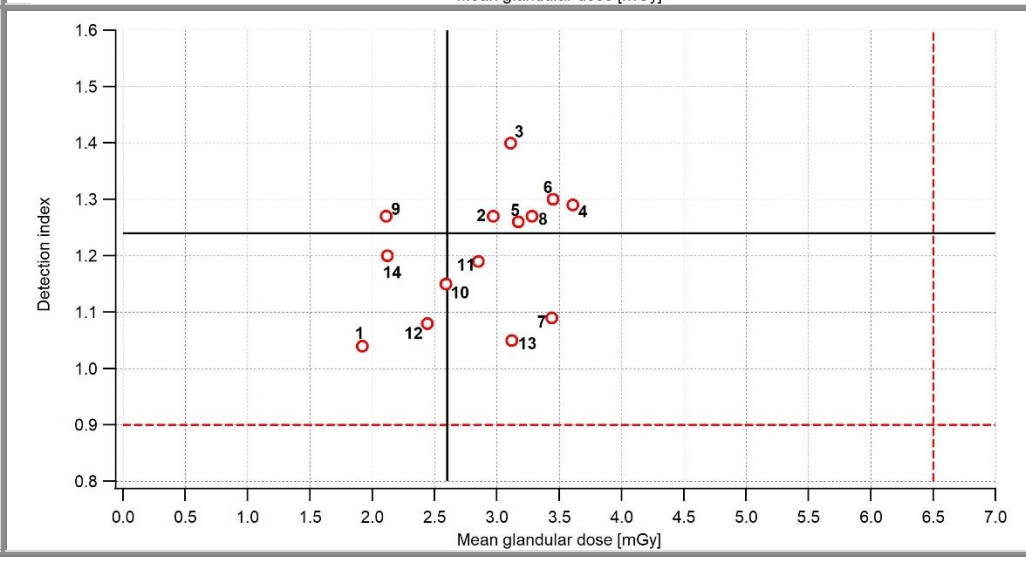


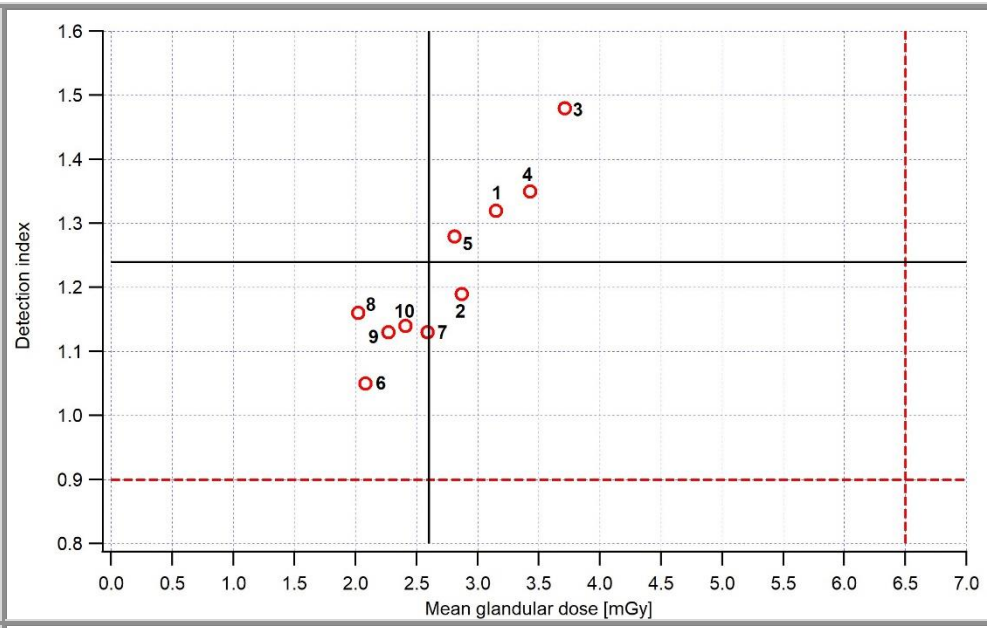
THURGAU



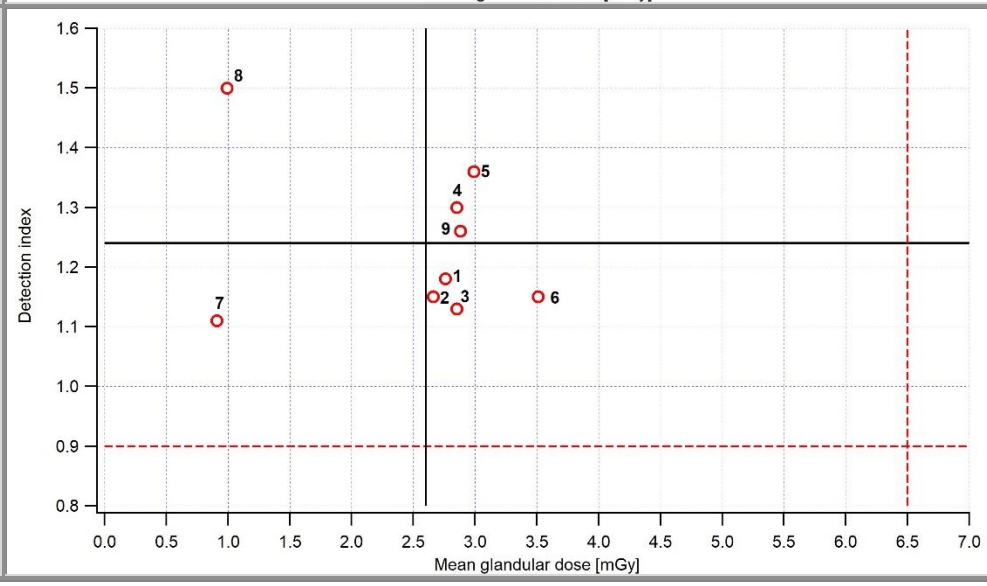
Annex D : Image quality and mean glandular dose (MGD) for a 90 mm compressed breast

VAUD	
GENEVA	
TICINO	

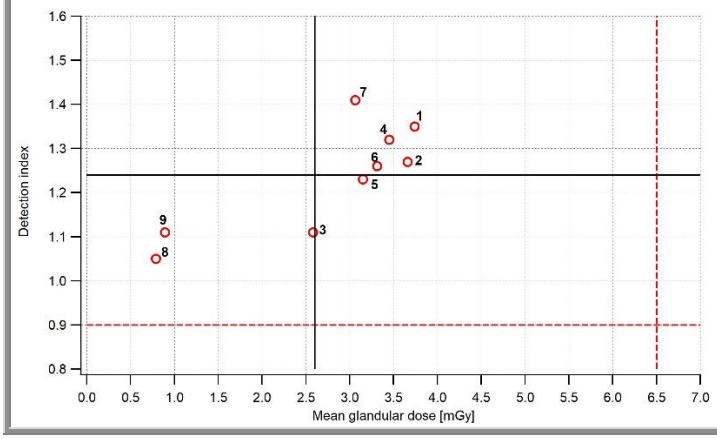
BEJUNE



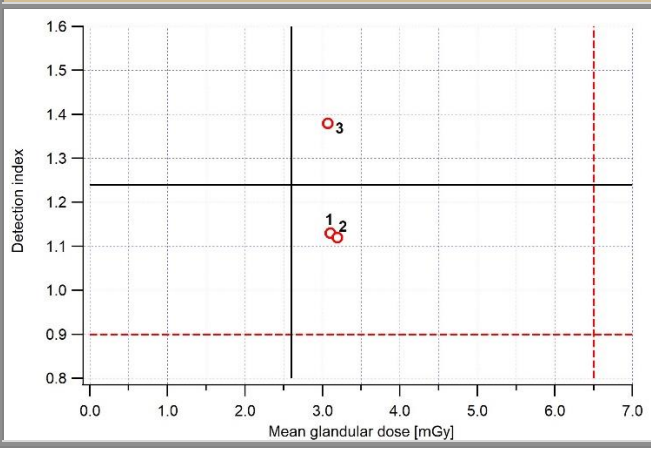
WALLIS



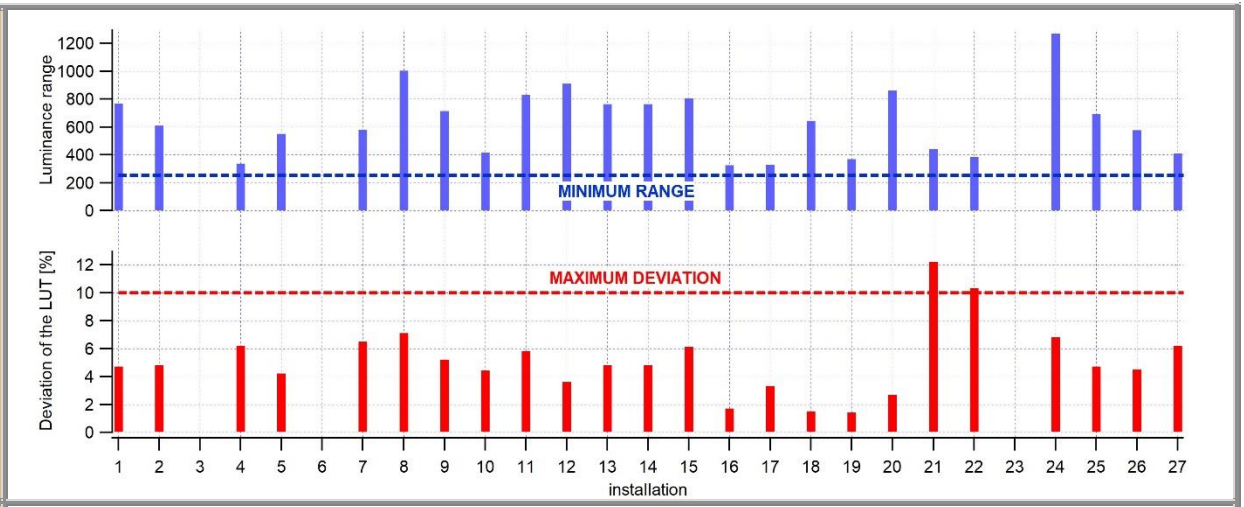
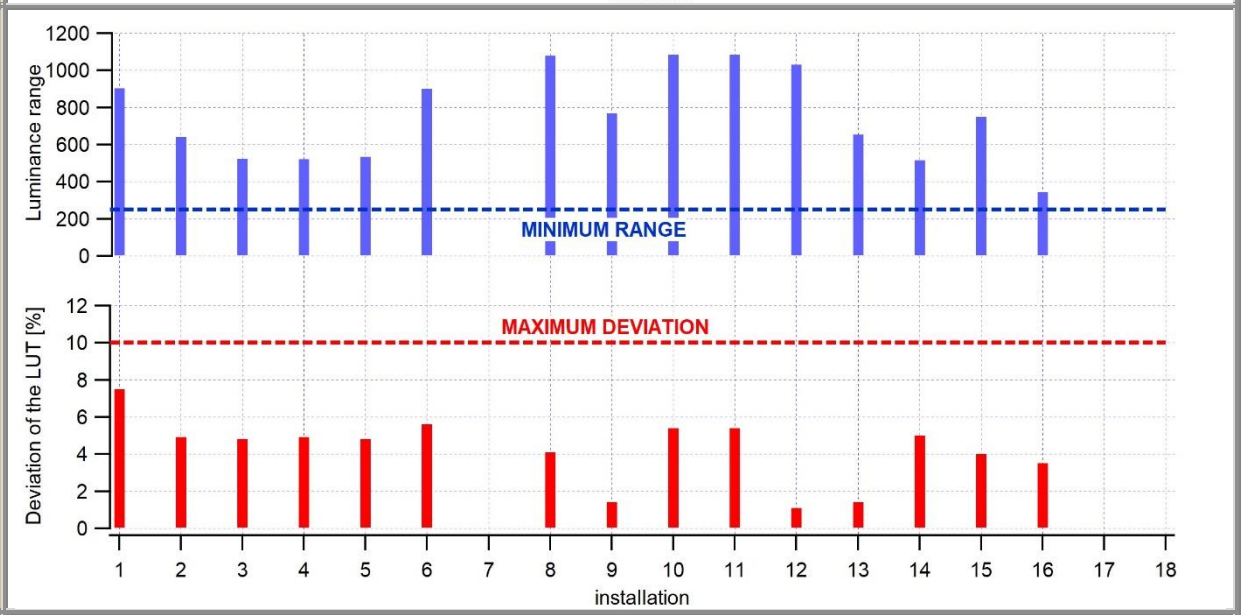
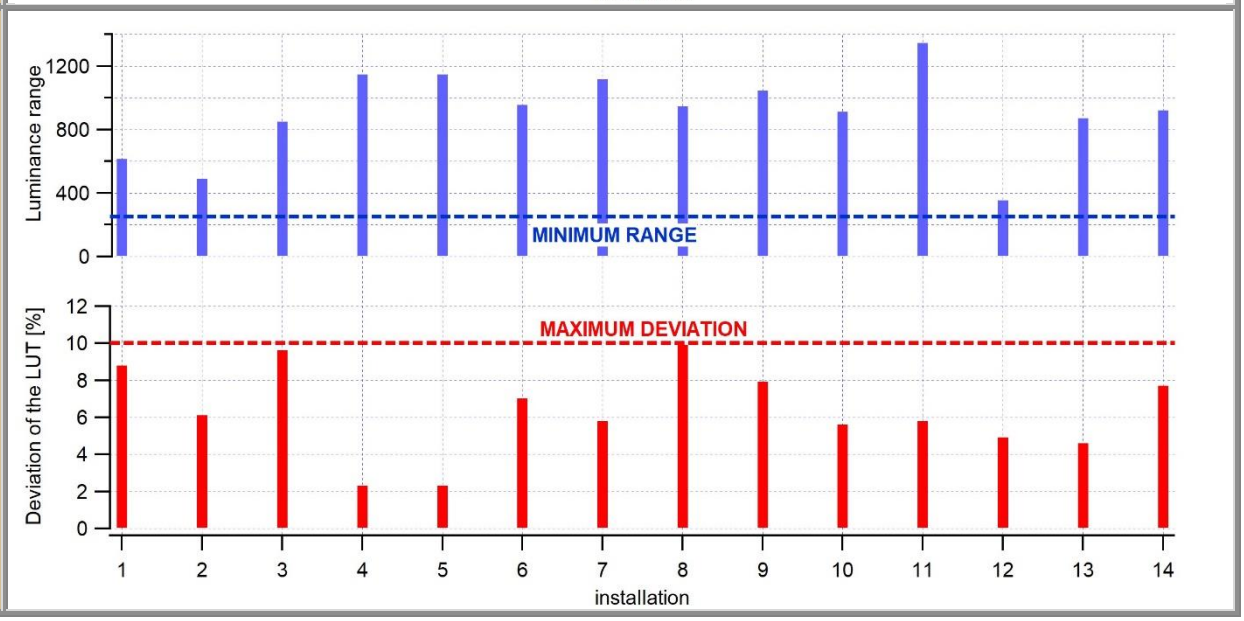
FREIBURG



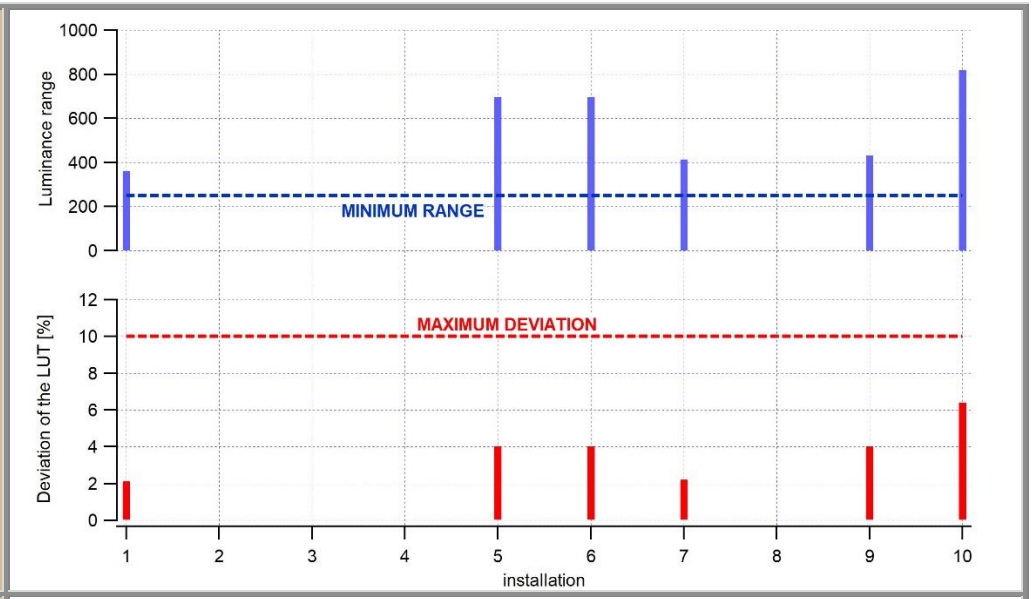
THURGAU



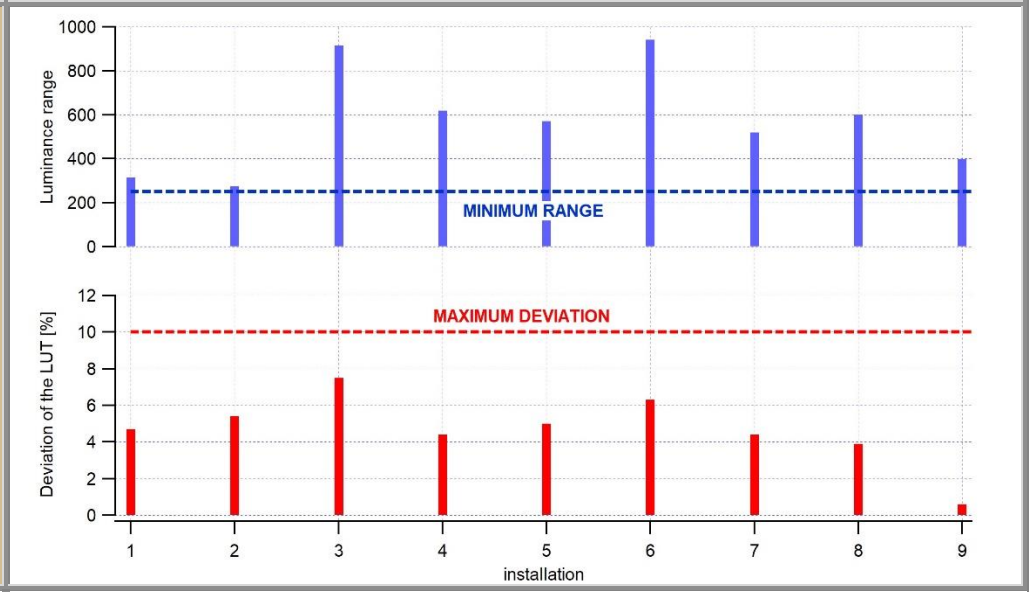
Annex E : Luminance range and deviation of the LUT curve of diagnostic screens

VAUD	
GENEVA	
TICINO	

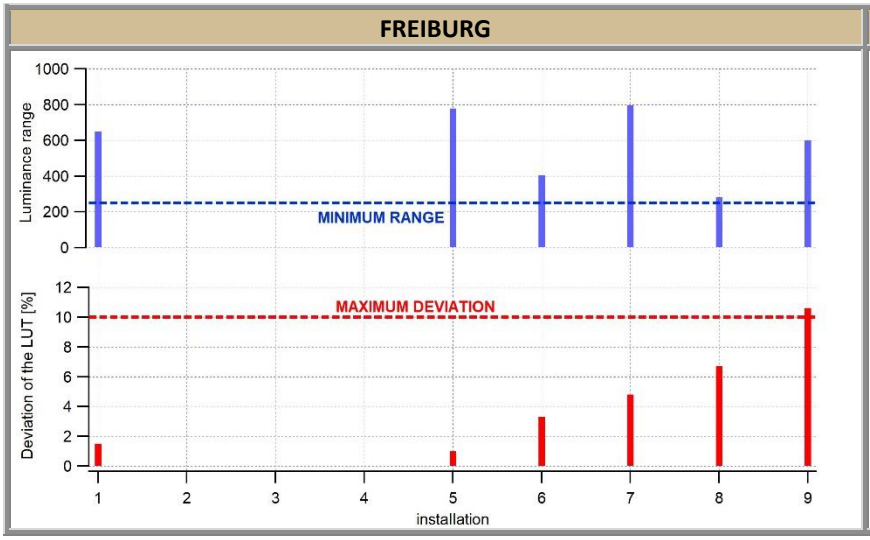
BEJUNE



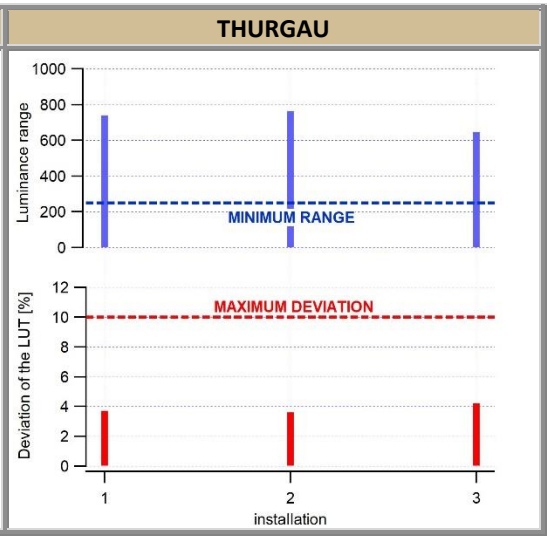
WALLIS



FREIBURG



THURGAU



Annex F : List of mammography systems

Vaud			
Number	**System**	**AEC setting (45 mm)**	
		kV	**A/F**
1	GE Senographe Pristina	34	Rh/Ag
2	GE Senographe Pristina	34	Rh/Ag
3	GE Senographe Essential	29	Rh/Rh
4	GE Senographe Essential	29	Rh/Rh
5	GE Senographe Essential	27	Mo/Rh
6	Hologic Selenia Dimensions	28	W/Rh
7	Hologic Selenia Dimensions	28	W/Rh
8	Hologic Selenia Dimensions	28	W/Rh
9	Hologic Selenia Dimensions	28	W/Rh
10	Hologic Selenia Dimensions	28	W/Rh
11	Hologic Selenia Dimensions	28	W/Rh
12	Hologic Selenia Dimensions	28	W/Rh
13	Hologic Selenia Dimensions	28	W/Rh
14	Hologic 3Dimensions	28	W/Rh
15	Philips Microdose L30	32	W/Al
16	Philips Microdose L30	32	W/Al
17	Philips Microdose L30	32	W/Al
18	Philips Microdose L30	32	W/Al
19	Philips Microdose L50 SI	32	W/Al
20	Philips Microdose L50 SI	32	W/Al
21	Philips Microdose L50 SI	29	W/Al
22	Siemens Inspiration	28	W/Rh
23	Siemens Inspiration	28	W/Rh
24	Siemens Inspiration	28	W/Rh
25	Siemens Inspiration	28	W/Rh
26	Siemens Revelation	28	W/Rh
27	Siemens Revelation	28	W/Rh

Geneva			
Number	**System**	**AEC setting (45 mm)**	
		kV	**A/F**
1	GE Senographe Pristina	34	Rh/Ag
2	GE Senographe Essential	27	Mo/Rh
3	GE Senographe Essential	27	Mo/Rh
4	Hologic Selenia Dimensions	28	W/Rh
5	Hologic Selenia Dimensions	28	W/Rh
6	Hologic Selenia Dimensions	28	W/Rh
7	Hologic Selenia Dimensions	28	W/Rh
8	Hologic Selenia Dimensions	28	W/Rh
9	Hologic Selenia Dimensions	28	W/Rh
10	Hologic Selenia Dimensions	28	W/Rh
11	Hologic Selenia Dimensions	28	W/Rh
12	Philips Microdose L30	28	W/Al
13	Philips Microdose L30	32	W/Al
14	Philips Microdose L30	32	W/Al
15	GE Senographe Pristina	32	Rh/Ag
16	Philips Microdose L50 SI	34	W/Al
17	Planmed Nuance	32	W/Ag
18	Siemens Inspiration	30	W/Rh

Ticino			
Number	**System**	**AEC setting (45 mm)**	
		kV	**A/F**
1	GE Senographe Essential	28	Rh/Rh
2	Hologic Selenia Dimensions	28	W/Rh
3	Hologic Selenia Dimensions	28	W/Rh
4	Hologic Selenia Dimensions	28	W/Rh
5	Hologic 3Dimensions	28	W/Rh
6	Hologic Selenia Dimensions	28	W/Rh
7	IMS Giotto	27	W/Ag
8	IMS Giotto Class	28	W/Ag
9	Siemens Inspiration	28	W/Rh
10	IMS Giotto Class	28	W/Ag
11	IMS Giotto Class	28	W/Ag
12	IMS Giotto Class	30	W/Ag
13	IMS Giotto Class	27	W/Ag
14	Siemens Inspiration	28	W/Rh

BEJUNE			
Number	**System**	**AEC setting (45 mm)**	
		kV	**A/F**
1	GE Senographe Essential	29	Rh/Rh
2	Hologic Selenia Dimensions	28	W/Rh
3	Hologic Selenia Dimensions	28	W/Rh
4	Hologic Selenia Dimensions	28	W/Rh
5	Hologic Selenia Dimensions	28	W/Rh
6	Siemens Revelation	28	W/Rh
7	Siemens Inspiration	28	W/Rh
8	Siemens Inspiration	28	W/Rh
9	Siemens Inspiration	28	W/Rh
10	Siemens Inspiration	28	W/Rh

Wallis			
Number	**System**	**AEC setting (45 mm)**	
		kV	**A/F**
1	GE Senographe Essential	27	Mo/Rh
2	GE Senographe Essential	28	Rh/Rh
3	GE Senographe Essential	29	Rh/Rh
4	Hologic Selenia Dimensions	28	W/Rh
5	Hologic Selenia Dimensions	28	W/Rh
6	Hologic Selenia Dimensions	28	W/Rh
7	Philips Microdose L30	32	W/Al
8	Philips Microdose L50 SI	32	W/Al
9	Planmed Nuance	30	W/Ag

Freiburg			
Number	**System**	**AEC setting (45 mm)**	
		kV	**A/F**
1	Hologic Selenia Dimensions	28	W/Rh
2	Hologic Selenia Dimensions	28	W/Rh
3	Hologic Selenia Dimensions	28	W/Rh
4	Hologic Selenia Dimensions	28	W/Rh
5	Hologic Selenia Dimensions	28	W/Rh
6	Hologic Selenia Dimensions	28	W/Rh
7	Hologic Selenia 3Dimensions	28	W/Rh
8	Philips Microdose L30	29	W/Al
9	Philips Microdose L30	32	W/Al

Thurgau			
Number	**System**	**AEC setting (45 mm)**	
		kV	**A/F**
1	Siemens Inspiration	30	W/Rh
2	Siemens Inspiration	28	W/Rh
3	Siemens Inspiration	28	W/Rh