

# Influence des différentes technologies sur la détection des microcalcifications

Les résultats de l'enquête de l'INCa sur la détection des CCIS

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# Mammographie numérique

Différentes technologies

# Technologie CR

- ◆ Ecrans Radio-Luminescents à Mémoire (ERLM, plaques photo-stimulables) :
  - ◆ Classiques, technologie « à poudre » : PIP (en 2016, reste uniquement FUJI et PHILIPS)
  - ◆ Depuis 2012, nouvelles plaques (cristal) : technologie « aiguille » : NIP (en 2016, 100% des plaques AGFA, CARESTREAM et KONICA)

# Technologie DR

- ◊ Capteurs plans ou « Plein champ »
- ◊ Systèmes à balayage ou Compteur de photons



La détection en question ....

# Facteurs influençant la détection

- ◆ En premier lieu, le type de détecteur et ses caractéristiques physiques qui ont une influence majeure sur la détection :
- ◆ Si une structure (microcalcification, masse, ...) n'est pas présente dans l'image acquise, elle ne sera pas visible pour le radiologue : problème de détection
- ◆ Si une structure (microcalcification, masse, ...) n'est pas correctement acquise, l'image affichée ne permettra pas une caractérisation correcte

# Facteurs influençant la détection

- ◆ La qualité du traitement d'images (ou post-traitement) :
  - ◆ Après l'acquisition, un algorithme de traitement est appliqué sur l'image pour permettre l'affichage ou l'impression
  - ◆ Chaque constructeur applique son propre traitement d'image, traitement d'image qui peut faire disparaître une inclusion (non détection) ou modifier l'aspect cette inclusion (erreur de caractérisation)

# Facteurs influençant la détection

- ◆ La qualité du support de lecture (films ou écrans) et des conditions d'interprétation
- ◆ Evidemment :
  - ◆ l'expertise du radiologue
  - ◆ la courbe d'apprentissage pour les nouvelles technologies (max 6 mois)



# Les résultats de l'enquête INCa



# Enquête INCa

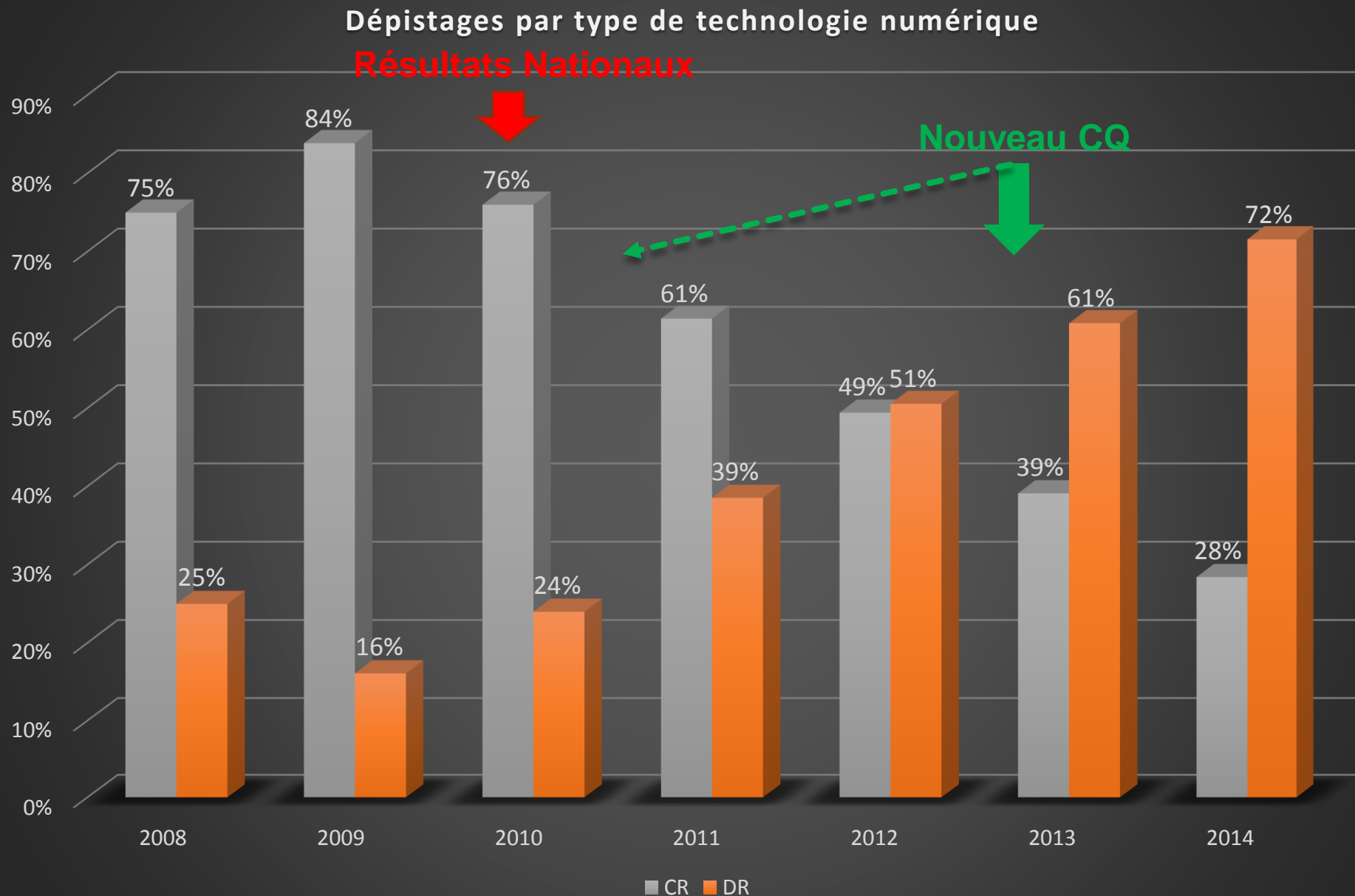
- ◊ Plusieurs enquêtes menées par l'INCa depuis l'introduction du numérique dans le dépistage
- ◊ Enquête menée entre **juillet et septembre 2015** :
  - Période de recueil : années **2013 et 2014**
  - Informations recueillies par **marques** pour les dispositifs **CR et DR** et par **type de plaques** pour les dispositifs **CR**
  - Un effectif de **83 structures de gestion** (sur 89) a répondu

# Résultats

◆ L'analyse des données porte sur :

	2008	2009	2010	2011	2012	2013	2014
Nbre examens	2 033 680	2 223 729	2 227 401	2 135 825	2 137 815	2 179 139	2 234 246

# Situation en France



## Taux de détection des cancers (%)

DR CR Total

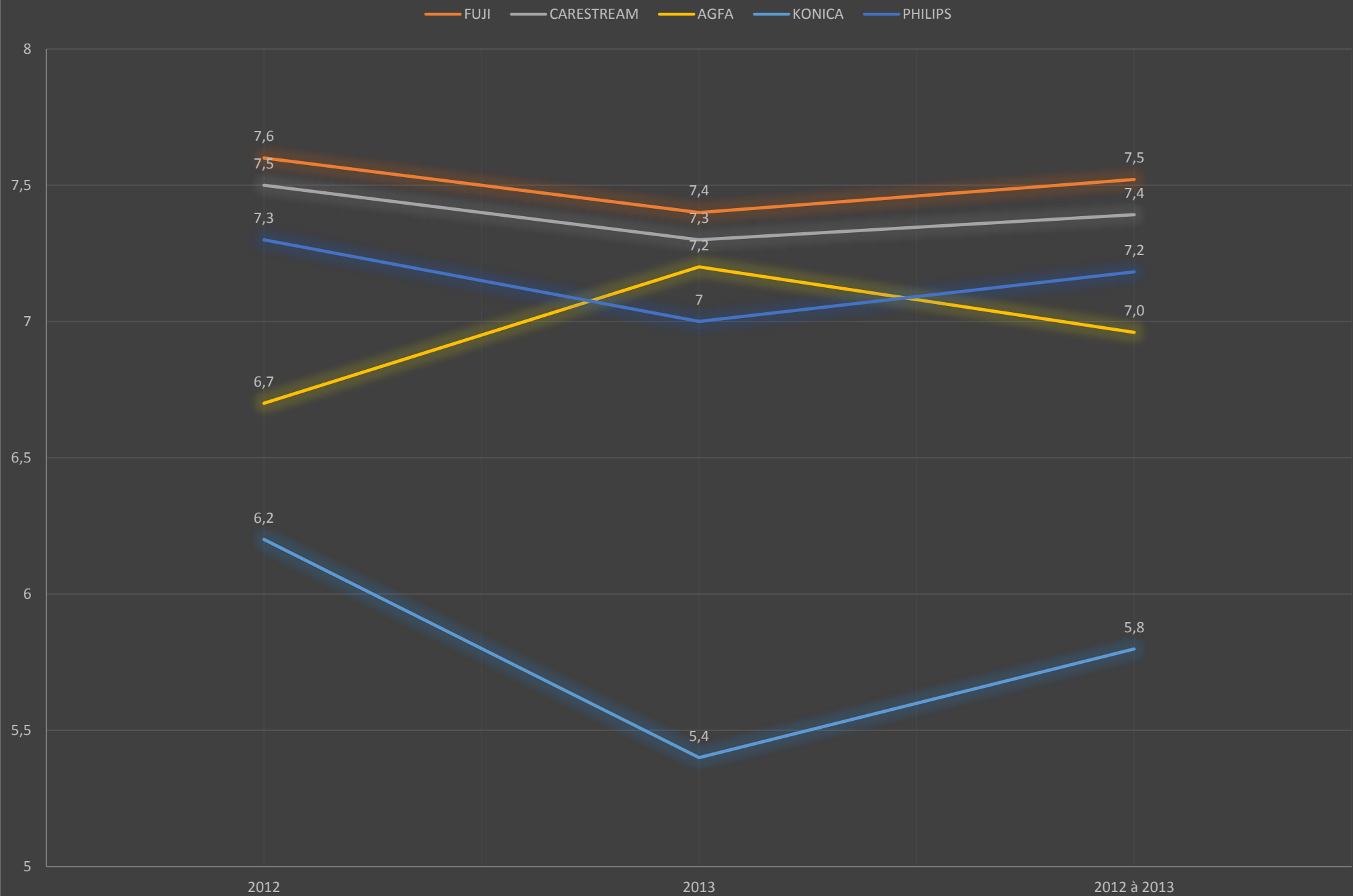


# Résultats cliniques

	2012			2013			2012-2013		
	Nbr dépistages	Cancers (%)	Nbr Cancers	Nbr dépistages	Cancers (‰)	Nbr Cancers	Nbr dépistages	Cancers (‰)	Nbr Cancers
CR									
FUJI	475 316	7,6	3629	317 646	7,4	2335	792 962	7,5	5964
CARESTREAM	179 093	7,5	1341	183 736	7,3	1341	362 829	7,4	2682
AGFA	133 640	6,7	892	137 334	7,2	994	270 974	7,0	1886
KONICA	65 615	6,2	408	68 555	5,4	370	134 170	5,8	778
PHILIPS	56 739	7,3	414	45 874	7	323	102 613	7,2	737
Total	928 814	7,3	6 795	787 336	7,1	5 598	1 716 150	7,2	12 393
DR									
FUJI	252 534	7,3	1842	354 068	7,5	2640	606 602	7,4	4482
GE	224 926	8	1806	270 902	7,7	2080	495 828	7,8	3886
HOLOGIC	205 256	8,3	1696	274 541	8	2196	479 797	8,1	3892
PHILIPS	136 745	7,2	981	150 356	7,7	1151	287 101	7,4	2132
SIEMENS	104 641	8,1	843	121 251	8,1	980	225 892	8,1	1823
PLANMED	11 630	6,5	75	14 680	6,4	94	26 310	6,4	169
IMS GIOTTO	7 840	5,4	42	16 661	7,9	131	24 501	7,1	173
Total	967 366	7,7	7 456	1 219 620	7,7	9 397	2 186 986	7,7	16 853

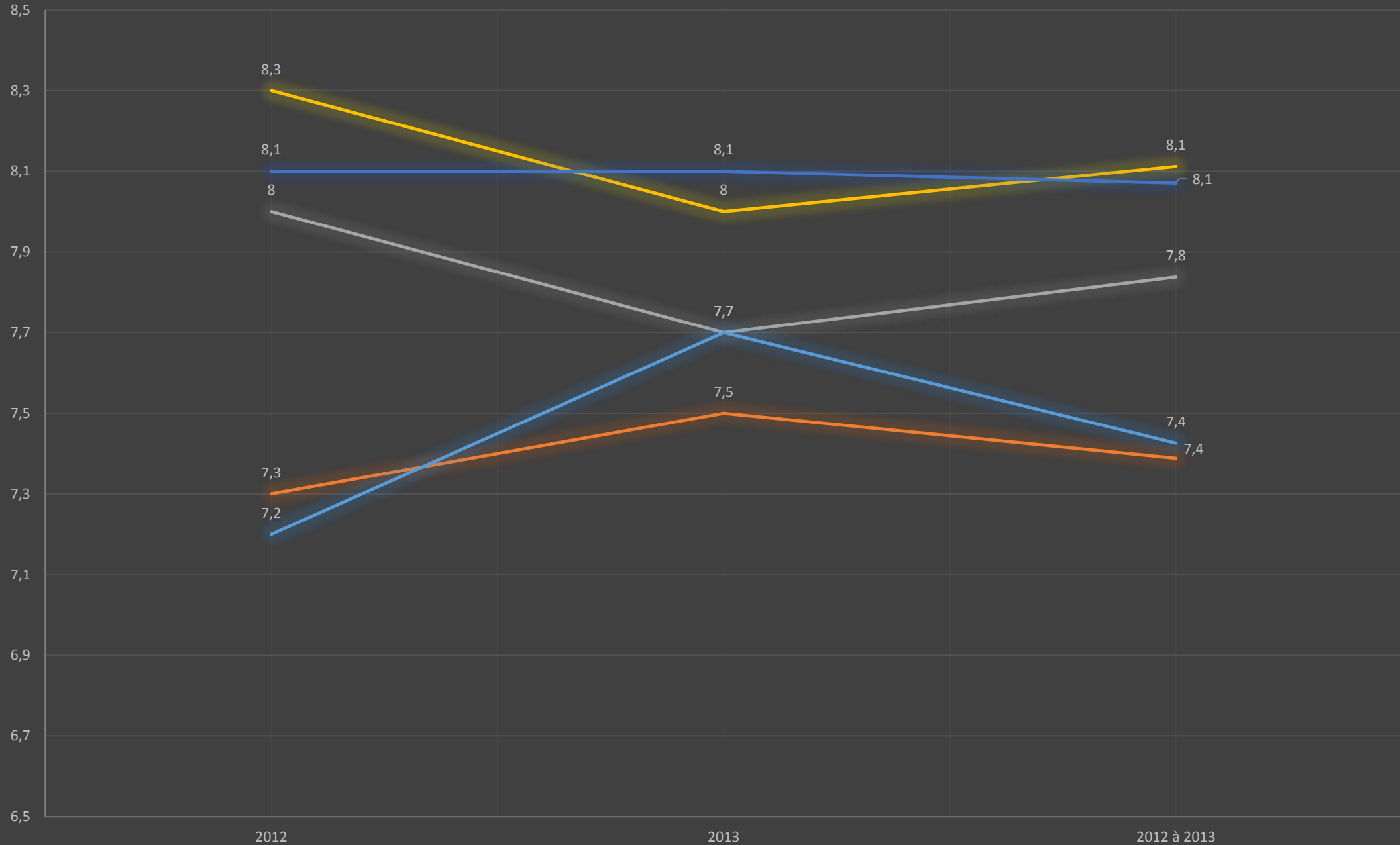


Taux de détection des cancers par type de système CR (‰)



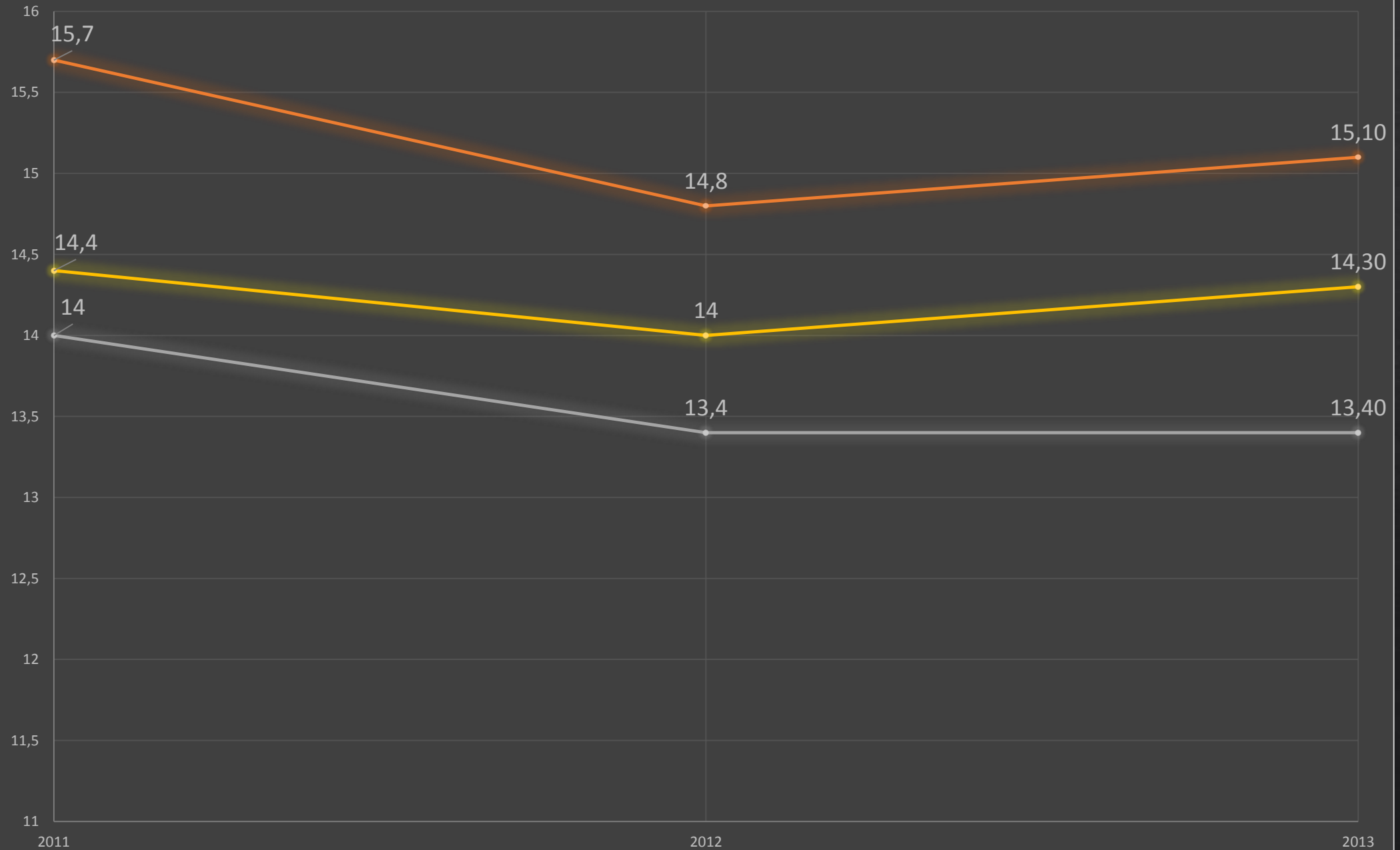
## Taux de détection des cancers par type de système DR (%)

FUJI GE HOLOGIC PHILIPS/SECTRA SIEMENS



Proportion des CCIS (%)

DR CR Total

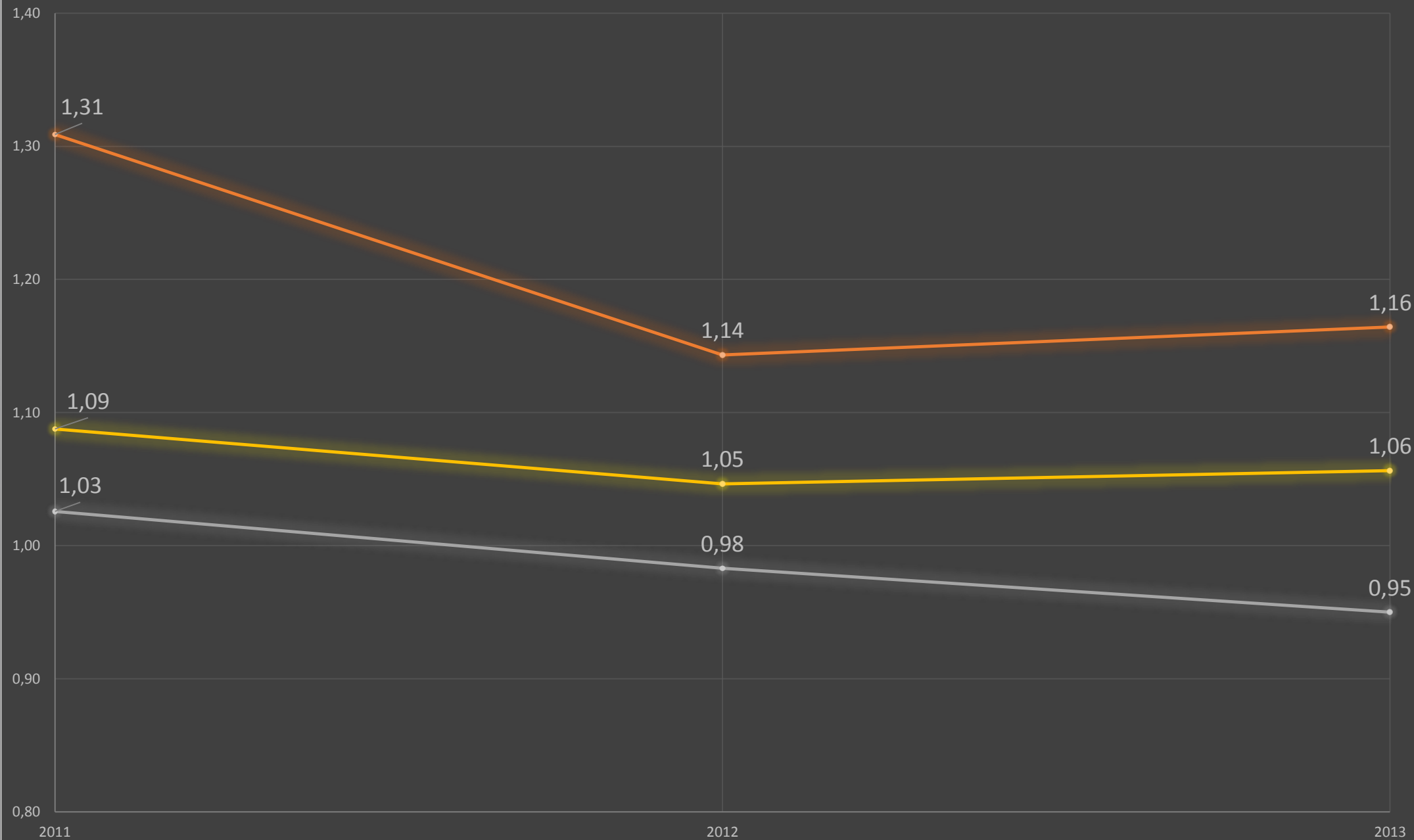


# Enquête INCa

- ◇ Depuis 2008, la proportion globale de CCIS est **d'environ 14%**
- ◇ La proportion la **plus élevée** est celle correspondante aux technologies numériques **DR**
- ◇ Au cours de l'année **2014**, on relève des **variations** de proportions de CCIS de **12,1 à 16 %** en fonction des différentes marques **CR**, et de **12,6 à 16 %** en fonction des marques **DR (pour les marques réalisant + 100 000 examens)**

# Taux de CCIS (‰)

DR CR Total



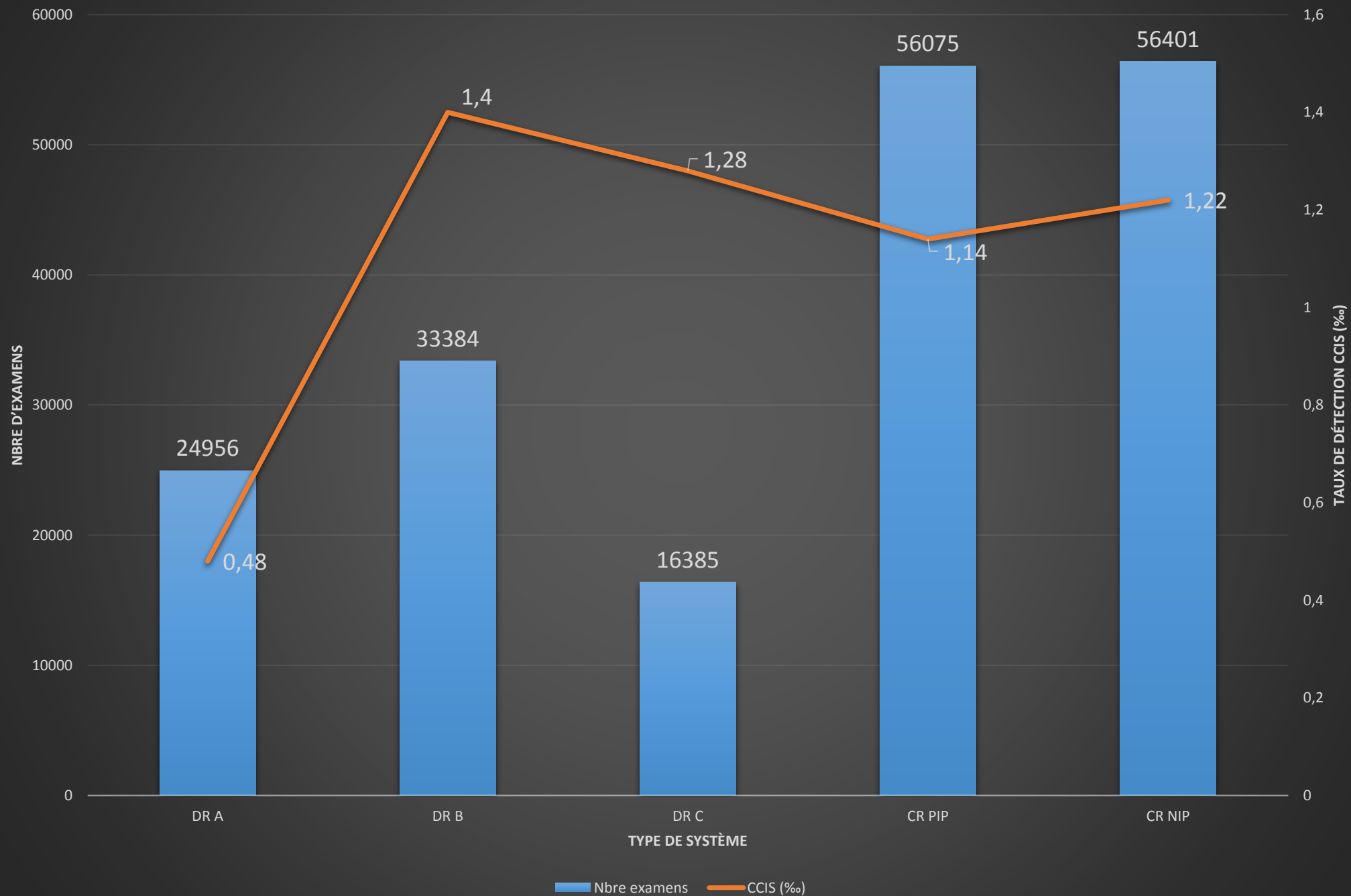


# Les résultats des Bouches du Rhône pour les CCIS

# Résultats des Bouches du Rhône pour les CCIS

- ◆ Matériels DR les plus utilisés (3 constructeurs), plaques CR PIP et NIP
- ◆ Années 2011 à 2014
- ◆ Programme de dépistage des cancers du sein ARCADES
- ◆ Etude réalisée par Dr B. Séradour

Taux de détection des CCIS par constructeur dans les Bouches du Rhône (2011-2014)



# Les publications

Contrôle Qualité et détection

# Medical Physics 2012

## Effect of image quality on calcification detection in digital mammography

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TABLE I. Reader-averaged JAFROC and ROC FoM and reader-averaged LLF at a NLF equal to 0.1 for all six image qualities. Image qualities 1 and 2 are clinical images processed with both Hologic and Agfa Musica-2 image processing. Image qualities 3–6 are simulated image qualities from the original clinical images.

	Image quality	Image processing	Reader-averaged FoM (95% confidence intervals)		Reader-averaged LLF at NLF of 0.1
			JAFROC	ROC	
1	Normal dose DR	Hologic	0.83 (0.78, 0.88)	0.91 (0.87, 0.94)	0.70
2	Normal dose DR	Agfa (Musica-2)	0.84 (0.80, 0.88)	0.91 (0.87, 0.95)	0.72
3	Half dose DR	Agfa (Musica-2)	0.68 (0.60, 0.75)	0.82 (0.77, 0.86)	0.47
4	Quarter dose DR	Agfa (Musica-2)	0.52 (0.43, 0.62)	0.70 (0.65, 0.75)	0.27
5	Normal dose CR	Agfa (Musica-2)	0.63 (0.56, 0.70)	0.79 (0.74, 0.84)	0.42
6	Half dose CR	Agfa (Musica-2)	0.55 (0.45, 0.64)	0.70 (0.65, 0.76)	0.30

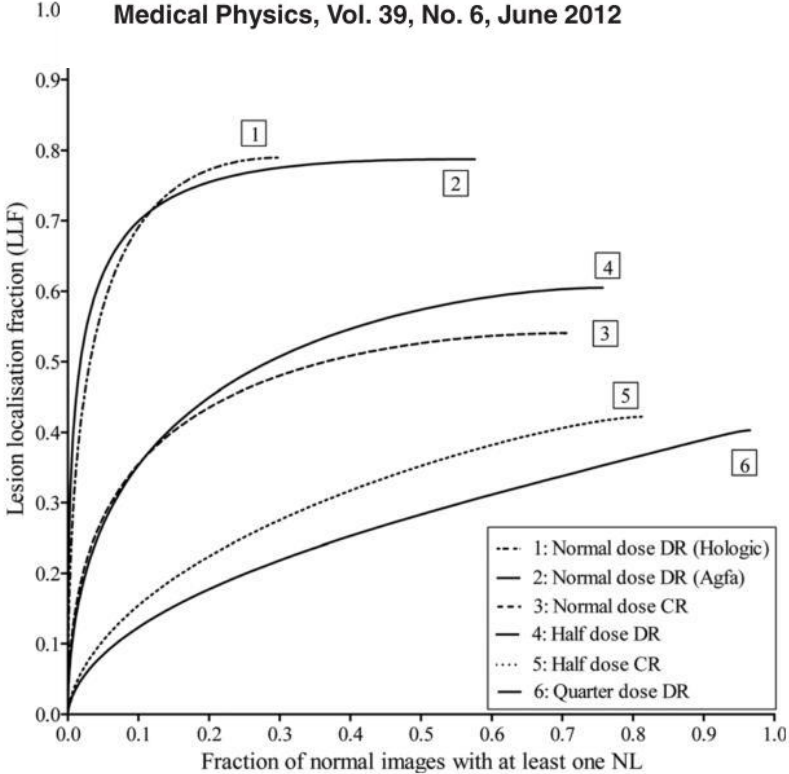


FIG. 7. Reader-averaged AFROC curves showing performance at all six image qualities.

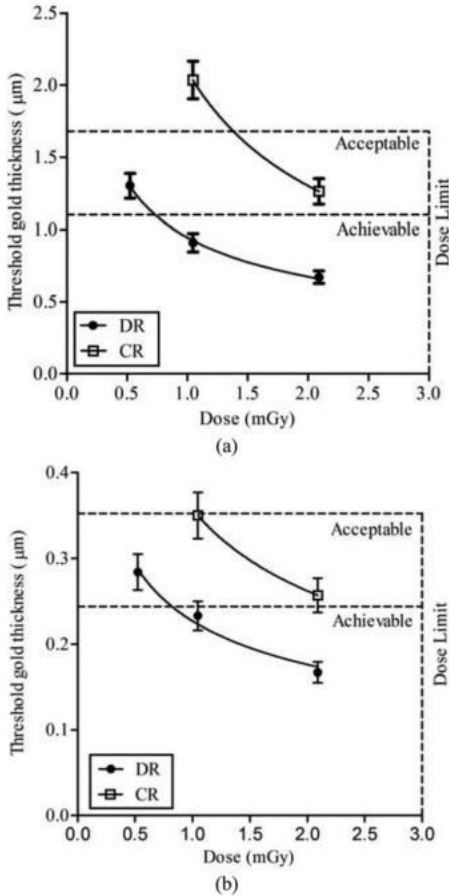


FIG. 9. Threshold gold thickness at five different image qualities: DR at normal, half, and quarter dose levels shown with disc points, and CR at normal and half dose levels shown with square points: (a) 0.1 mm gold disc diameter and (b) 0.25 mm gold disc diameter. Acceptable and achievable standards as set in the European protocol (Ref. 15) are also shown along with dose limit for a breast thickness equivalent to 50 mm PMMA.

corresponds to the change in calcification detection found in this study.

We have shown that a good physical performance measured using the CDMAM phantom was matched to good performance in the observer study. This would imply that CDMAM-determined threshold gold thickness is a good predictor of microcalcification detection. All image qualities apart from half dose CR passed the minimum acceptable image quality standard as set in the European protocol,<sup>12</sup> for both the 0.1 and 0.25 mm gold disc diameters (Fig. 9). However, statistical analysis demonstrated significant differences in detection between several image quality pairs (Fig. 8). When considering the optimal use of x-ray imaging technology in breast cancer screening it is important to consider both risk and benefits. These results provide some data from which to estimate the risks and benefits of using greater or lower radiation dose levels. For example, it would seem to be unwise to operate equipment at relatively low dose levels as the reduction in radiation risk may be more than offset by a reduction in cancer detection. Similarly, these results suggest that the use of better quality detectors may improve cancer detection at the same dose levels. Such considerations are likely to lead to a revision of the standards in the European Guidelines to ensure adequate detection of calcifications. One option would be to require that systems be as good as or better than the achievable image quality level to optimize calcification detection while meeting existing dose limits. It is expected that most modern DR system could meet such a standard.

Our study has two main limitations. Only calcification clusters were inserted and not other radiological features such as masses. The relationship between image quality and detection may differ for various radiological features, and so investigating both microcalcification and mass detection is important. Also the calcifications inserted were all malignant. Introducing benign calcification clusters would allow any difference in recall (i.e., the interpretation of the feature as well as detection) between the different image qualities to be assessed.

## V. CONCLUSIONS

Significant differences were found between detection of subtle calcification clusters in CR and DR images at the same dose level. There was also a significant reduction in detection with reduced dose for both CR and DR images. There was no significant difference in detection between the two image processing algorithms investigated.

When relating the results of the observer study to the measured threshold gold thicknesses for 0.25 and 0.1 mm gold disc diameters, a smaller threshold gold thickness correlated with better performance in the observer study. This is an important new finding and demonstrates that threshold gold thickness measurements using a CDMAM phantom relate to calcification detection. However, when relating measured threshold gold thickness measurements to European standards for mammographic image quality, image qualities with significantly poorer calcification detection

rates still gave better performance than the current minimum acceptable standard. This suggests that the current EU standards may need revising.

## ACKNOWLEDGMENTS

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# Medical Physics 2012

## V. CONCLUSIONS

- Significant differences were found between detection of subtle calcification clusters in CR and DR images at the same dose level. There was also a significant reduction in detection with reduced dose for both CR and DR images.
- There was no significant difference in detection rates between CR and DR images at same dose level. This was investigated.
- When relating gold disc diameters, a smaller threshold gold thickness correlated with better performance in the observer study. This is an important new finding and demonstrates that threshold gold thickness measurements using a CDMAM phantom relate to calcification detection.
- However, when relating measured threshold gold thickness measurements to European standards for mammographic image quality, image qualities with significantly poorer calcification detection rates still gave better performance than the current minimum acceptable standard. This suggests that the current EU standards may need revising.

## Comparative performance of modern digital mammography systems in a large breast screening program.

Yaffe MJ<sup>1</sup>, Bloomquist AK, Hunter DM, Mawdsley GE, Chiarelli AM, Muradali D, Mainprize JG.

### + Author information

#### Abstract

**PURPOSE:** To compare physical measures pertaining to image quality among digital mammography systems utilized in a large breast screening program. To examine qualitatively differences in these measures and differences in clinical cancer detection rates between CR and DR among sites within that program.

**METHODS:** As part of the routine quality assurance program for screening, field measurements are made of several variables considered to correlate with the diagnostic quality of medical images including: modulation transfer function, noise equivalent quanta,  $d'$  (an index of lesion detectability) and air kerma to allow estimation of mean glandular dose. In addition, images of the mammography accreditation phantom are evaluated.

were lower with DR. These results were consistent with previous findings in the authors' program that the breast cancer detection rates at sites employing CR technology were, on average, 30.6% lower than those that used DR mammography.

the noise equivalent quanta,  $d'$ , and the phantom scores were higher, while the failure rates associated with low signal-to-noise ratio and high dose were lower with DR. These results were consistent with previous findings in the authors' program that the breast cancer detection rates at sites employing CR technology were, on average, 30.6% lower than those that used DR mammography.

**CONCLUSIONS:** While the clinical study was not large enough to allow a statistically powered system-by-system assessment of cancer detection accuracy, the physical measures expressing spatial resolution, and signal-to-noise ratio are consistent with the published finding that sites employing CR systems had lower cancer detection rates than those using DR systems for screening mammography.



# Radiology 09/2013

816 000 mammography, 688 000 femmes, 50-74 ans, entre 2008 et 2009, dépistage



## Full Text

### Digital Compared with Screen-Film Mammography: Performance Measures in Concurrent Cohorts within an Organized Breast Screening Program

*Radiology* September 2013 268:3 684-693; Published online May 14, 2013,

Cancer detection with digital mammography that involves direct radiography technology was similar to that with screen film mammography in women aged 50-74 years; however, for computed radiography, the risk of cancer detection is significantly lower—by 21%—among all screening techniques.

# Comparison of Direct Digital Mammography, Computed Radiography, and Film-Screen in the French National Breast Cancer Screening Program

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Jacques Estève<sup>2</sup>

**OBJECTIVE.** The purpose of this article was to compare the performance of digital mammography using hardcopy image reading against film-screen mammography in a French national routine population-based screening program with a decentralized organization. The French context offered the opportunity to examine separately computed radiography and direct digital mammography performances in a large cohort.

**MATERIALS AND METHODS.** The study includes 23,423 direct digital mammography, 73,320 computed radiography, and 65,514 film-screen mammography examinations performed by 123 facilities in Bouches du Rhône, France, for women 50–74 years old between 2008 and 2010. We compared abnormal mammography findings rate, cancer detection rate, and tumor characteristics among the technologies.

**RESULTS.** Abnormal finding rates were higher for direct digital mammography (7.78% vs 6.11% for film-screen mammography and 5.34% for computed radiography), particularly in younger women and in denser breasts. Cancer detection rates were also higher for direct digital mammography (0.71% vs 0.66% for film-screen mammography and 0.55% for computed radiography). The contrast between detection rates was stronger for ductal carcinoma in situ. Breast density was the main factor explaining the differences in detection rates. For direct digital mammography only, the detection rate was clearly higher in dense breasts whatever the age (odds ratio, 2.20). Except for grade, no differences were recorded concerning tumor characteristics in which the proportion of high-grade tumors was larger for direct digital mammography for invasive and in situ tumors.

**CONCLUSION.** Direct digital mammography has a higher detection rate than film-screen mammography in dense breasts and for tumors of high grade. This latter association warrants further study to measure the impact of technology on efficacy of screening. The data indicate that computed radiography detects fewer tumors than film-screen mammography in most instances.



# Digital compared to screen-film mammography: breast cancer prognostic features in an organized screening program

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**Abstract** Our previous study found cancer detection rates were equivalent for direct radiography compared to screen-film mammography, while rates for computed radiography were significantly lower. This study compares prognostic features of invasive breast cancers by type of mammography. Approved by the University of Toronto Research Ethics Board, this study identified invasive breast cancers diagnosed among concurrent cohorts of women aged 50–74 screened by direct radiography, computed radiography, or screen-film mammography from January 1, 2008 to December 31, 2009. During the study period, 816,232 mammograms were performed on 668,418 women, and 3,323 invasive breast cancers were diagnosed. Of 2,642 eligible women contacted, 2,041 participated (77.3 %). The final sample size for analysis included 1,405 screen-detected and 418 interval cancers (diagnosed within 24 months of a negative screening mammogram). Polytomous logistic regression was performed to evaluate the

association between tumour characteristics and type of mammography, and between tumour characteristics and detection method. Odds ratios (OR) and 95 % confidence intervals (CI) were recorded. Cancers detected by computed radiography compared to screen-film mammography were significantly more likely to be lymph node positive (OR 1.94, 95 %CI 1.01–3.73) and have higher stage (II:I, OR 2.14, 95 %CI 1.11–4.13 and III/IV:I, OR 2.97, 95 %CI 1.02–8.59). Compared to screen-film mammography, significantly more cancers detected by direct radiography (OR 1.64, 95 %CI 1.12–2.38) were lymph node positive. Interval cancers had worse prognostic features compared to screen-detected cancers, irrespective of mammography type. Screening with computed radiography may lead to the detection of cancers with a less favourable stage distribution compared to screen-film mammography that may reflect a delayed diagnosis. Screening programs should re-evaluate their use of computed radiography for breast screening.



## Digital Compared with Screen-Film Mammography: Measures of Diagnostic Accuracy among Women Screened in the Ontario Breast Screening Program.

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#### Abstract

**Purpose** To compare measures of diagnostic accuracy between large concurrent cohorts of women screened with digital computed radiography (CR), direct radiography (DR), and screen-film mammography (SFM). **Materials and Methods** This study was approved by the University of Toronto Research Ethics Board; informed consent was not required. Three concurrent cohorts of women aged 50-74 years who were screened from 2008-2009 in the Ontario Breast Screening Program with SFM (487 334 screening examinations, 403 688 women), DR (254 758 screening examinations, 220 520 women), or CR (74 140 screening examinations, 64 210 women) were followed for 2 years or until breast cancer diagnosis. Breast cancers were classified as screening-detected or interval on the basis of the woman's final screening and assessment results. Interval cancer rate (per 10 000 negative screening examinations), sensitivity, and specificity were compared across the cohorts by using mixed-effects logistic regression analysis. **Results** Interval cancer rates were higher, although not significantly so, for CR (15.2 per 10 000; 95% confidence interval [CI]: 12.8, 17.8) and were similar for DR (13.7 per 10 000; 95% CI: 12.4, 15.0) compared with SFM (13.0 per 10 000; 95% CI: 12.1, 13.9). For CR versus SFM, specificity was similar while sensitivity was significantly lower (odds ratio [OR] = 0.62; 95% CI: 0.47, 0.83; P = .001), particularly for invasive cancers detected at a rescreening examination, for women with breast density of less than 75%, for women with no family history, and for postmenopausal women. For DR versus SFM, sensitivity was similar while specificity was lower (OR = 0.92; 95% CI: 0.87, 0.98; P = .01), particularly for rescreening examinations, for women aged 60-74 years, for women with breast density of less than 75%, for women with a family history, and for women who were postmenopausal. **Conclusion** Given the 38% lower sensitivity of CR imaging systems compared with SFM, programs should assess the continued use of this technology for breast screening. © RSNA, 2015.



# th Screen- Measures of long Women Breast vidence that uperior to for Cancer

and pre- and perimenopausal  
(2,4). The area under the ROC

National Cancer Institute-funded Breast Cancer Surveillance Consortium (BCSC), with a cancer detection rate of 4.8 (3895 of 816232) in the OBSP versus a rate of 4.3 (8774 of 2001691) in the BCSC per thousand women screened (1,9) during a comparable time frame (2008–2009 for the OBSP and through 2009 for the BCSC). Reported sensitivities for all three cohorts were lower than those reported in the United States, with the BCSC reporting a sensitivity of 84.9% and the Canadian cohort sensitivities ranging from 70.9% (95% confidence interval [CI]: 66.7%, 74.8%) for CR to 80.2% (95% CI: 79.0%, 81.4%) for DR. These differences are most likely attributable to the difference in screening interval in Canada. More cancers would be expected to manifest as interval cancers in the 2-year interval between screening examinations in Canada compared with the numbers manifesting in the 1-year interval between screening examinations in the United States. This same trend in lower sensitivity is also seen in the BCSC data as screening intervals lengthen (10).

Importantly, CR performed the worst of all systems included in the OBSP study in terms of sensitivity and interval cancer rates. The authors attribute their results to the physical imaging performance metrics of CR mammography, with CR having a lower modulation transfer function, noise equivalent quanta, signal difference to noise ratio, and phantom image scores than DR (1,11).

Specificity in all three cohorts also differed from that in the BCSC, which reported a specificity of 90.3%, while in the OBSP, specificity ranged from 92.8% (95% CI: 92.7%, 92.9%) for DR to 93.8% (95% CI: 93.6%, 93.9%) for CR. Again, the differences in specificity

are most likely attributable to the longer screening intervals in Canada, with more false-positive results identified when screening is performed more frequently, as it generally is in the United States. The higher specificity of CR again could be attributed to the differences in its physical performance metrics, leading to the detection of fewer benign lesions compared with DR.

Despite these differences in screening performance between the Canadian and U.S. cohorts, given the differences in physical characteristics of the CR and DR systems, it is this writer's judgment that the comparisons between CR and DR are highly likely to be reproducible in a U.S. patient cohort screened at yearly intervals. Such a study could be readily easily undertaken by a large screening consortium such as the BCSC, and I hope that group will consider evaluating their results for similar patient cohorts in the United States.

In the meantime, I encourage those who are currently using CR for screening mammography to consider converting to DR.

**Disclosures of Conflicts of Interest:** E.D.P. Activities related to the present article: disclosed no relevant relationships. Activities not related to the present article: is a party to contracts for research activities from Fuji Medical, Philips, and Koning. Other relationships: disclosed no relevant relationships.


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Etta D. Pisano, MD



# Breast cancer detection rates using four different types of mammography detectors

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## Abstract

**Objective** To compare the performance of different types of detectors in breast cancer detection.

**Methods** A mammography image set containing subtle malignant non-calcification lesions, biopsy-proven benign lesions, simulated malignant calcification clusters and normals was acquired using amorphous-selenium (a-Se) detectors. The images were adapted to simulate four types of detectors at the same radiation dose: digital radiography (DR) detectors with a-Se and caesium iodide (CsI) convertors, and computed radiography (CR) detectors with a powder phosphor (PIP) and a needle phosphor (NIP). Seven observers marked suspicious and benign lesions. Analysis was undertaken using jackknife alternative free-response receiver operating characteristics

weighted figure of merit (*FoM*). The cancer detection fraction (CDF) was estimated for a representative image set from screening.

**Results** No significant differences in the *FoMs* between the DR detectors were measured. For calcification clusters and non-calcification lesions, both CR detectors' *FoMs* were significantly lower than for DR detectors. The calcification cluster's *FoM* for CR NIP was significantly better than for CR PIP. The estimated CDFs with CR PIP and CR NIP detectors were up to 15 % and 22 % lower, respectively, than for DR detectors.

**Conclusion** Cancer detection is affected by detector type, and the use of CR in mammography should be reconsidered.

## Key Points

- The type of mammography detector can affect the cancer detection rates.
- CR detectors performed worse than DR detectors in mammography.
- Needle phosphor CR performed better than powder phosphor CR.
- Calcification clusters detection is more sensitive to detector type than other cancers.

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# The relationship between cancer detection in mammography and image quality measurements

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PHYSICA MEDICA, APRIL 2018

## Purpose

To investigate the relationship between image quality measurements and the clinical performance of digital mammographic systems.

## Methods

Mammograms containing subtle malignant non-calcification lesions and simulated malignant calcification clusters were adapted to appear as if acquired by four types of detector. Observers searched for suspicious lesions and gave these a malignancy score. Analysis was undertaken using jackknife

Images of  
four detectors  
FoMs using  
was significant

## Results

The detected  
gradient of the

### Conclusions

There is a strong link between the clinical effectiveness of mammography for the task of detecting calcification clusters and the image quality measurement and standards in the European Guidelines. There is a weak link for non-calcification lesions. Systems operating at the minimum acceptable limit for image quality may have unacceptably low cancer detection rates and in the light of this evidence, the European image quality standards should be reviewed with a view to raising them.

relationship between FOMs and threshold gold thickness for the 0.25 mm diameter disk was significantly different from zero for calcification clusters ( $p = 0.027$ ), but not for non-calcification lesions ( $p = 0.11$ ). Systems performing just above the minimum image quality level set in the European Guidelines for Quality Assurance in Breast Cancer Screening and Diagnosis resulted in reduced cancer detection rates compared to systems performing at the achievable level.

## Conclusions

The clinical effectiveness of mammography for the task of detecting calcification clusters was found to be linked to image quality assessment using the CDMAM phantom. The European Guidelines should be reviewed as the current minimum image quality standards may be too low.

# Evaluation en France

- En utilisant les images réalisées lors des CQE en 2014 et 2015.
- Sur des systèmes conformes en dose.



# Evaluation en France

- 10 installations par marque et type
- 16 images CDMAM par système
- Utilisation du logiciel EUREF CDMAM Analyser V1.55 ([www.euref.org](http://www.euref.org))
- 10 doses par marque



phantom  
type • 3.4  
Serial nr :  
1210

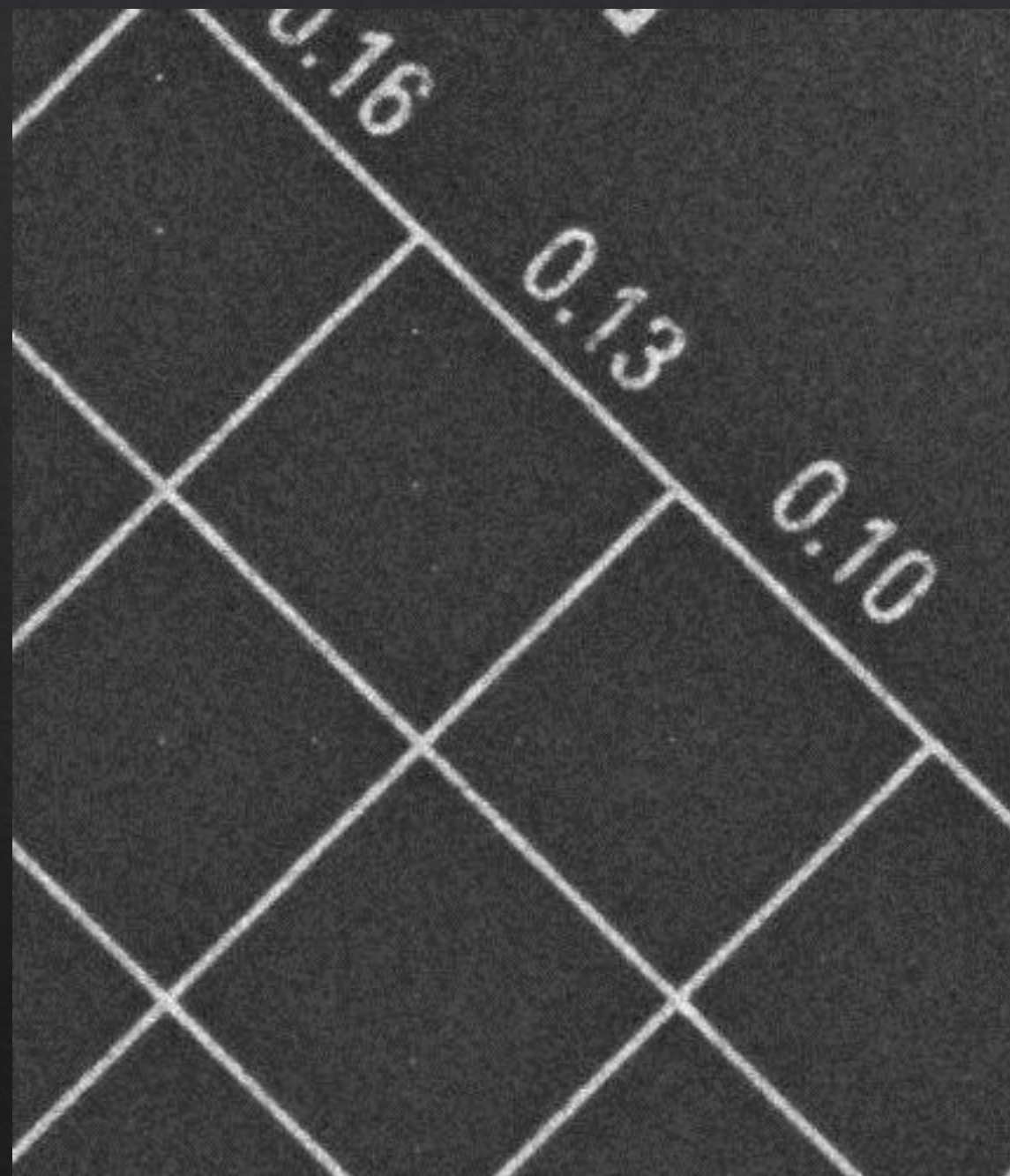
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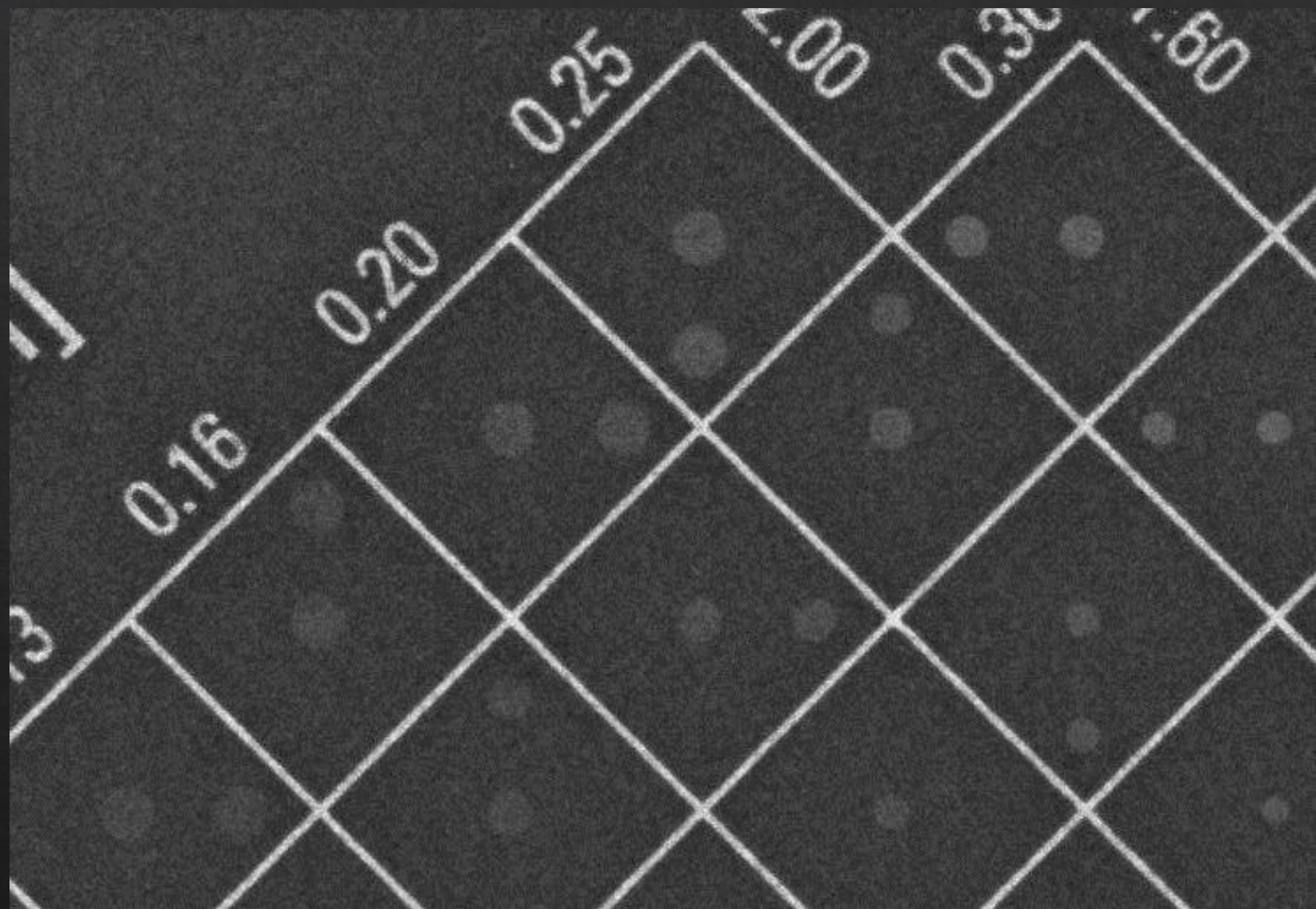
diameter [mm]

artinis  
Medical Systems  
www.artinis.com  
diameter [mm]

gold thickness [um]



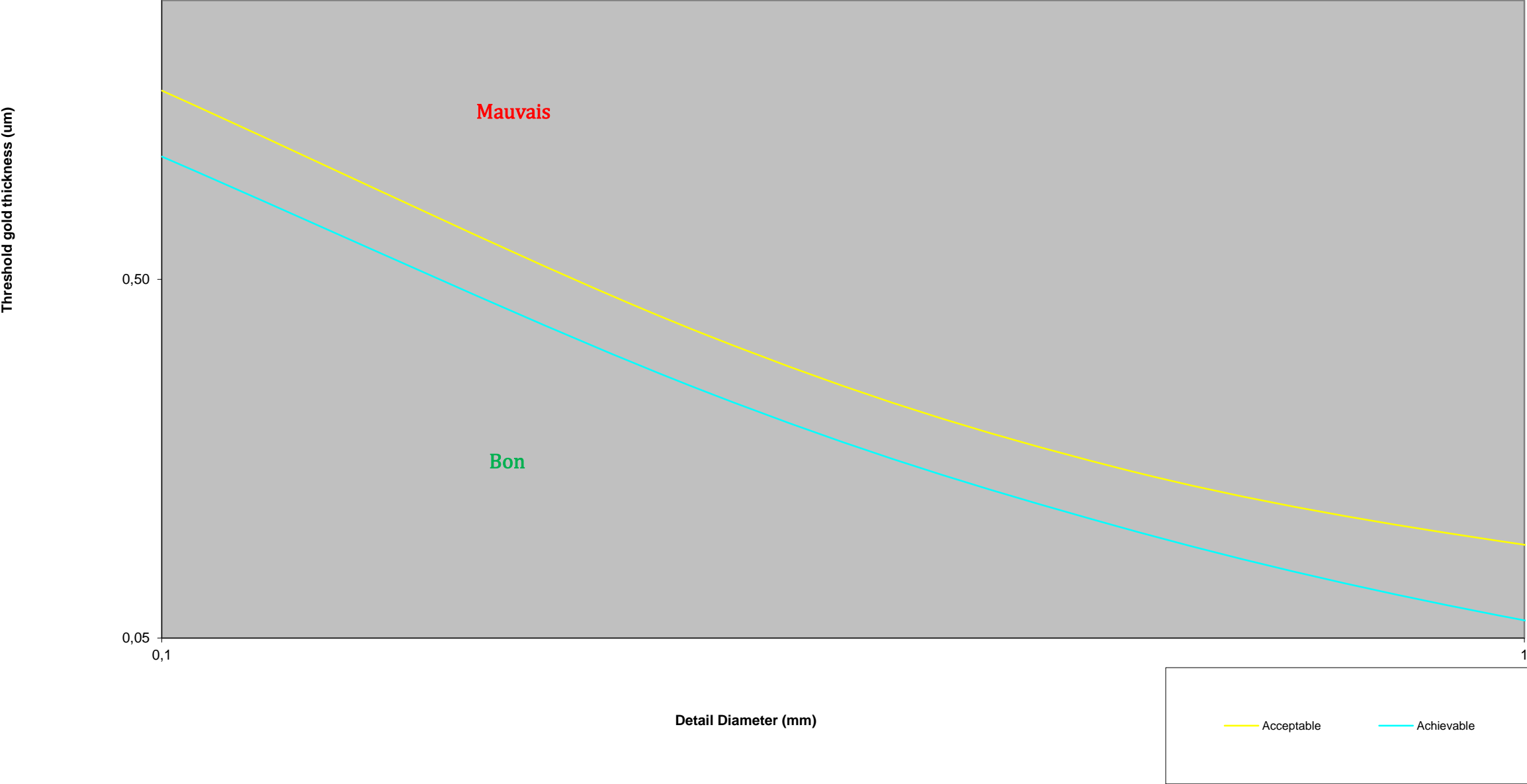




# Introduction

CDMAM

Predicted Threshold Contrast Measurements

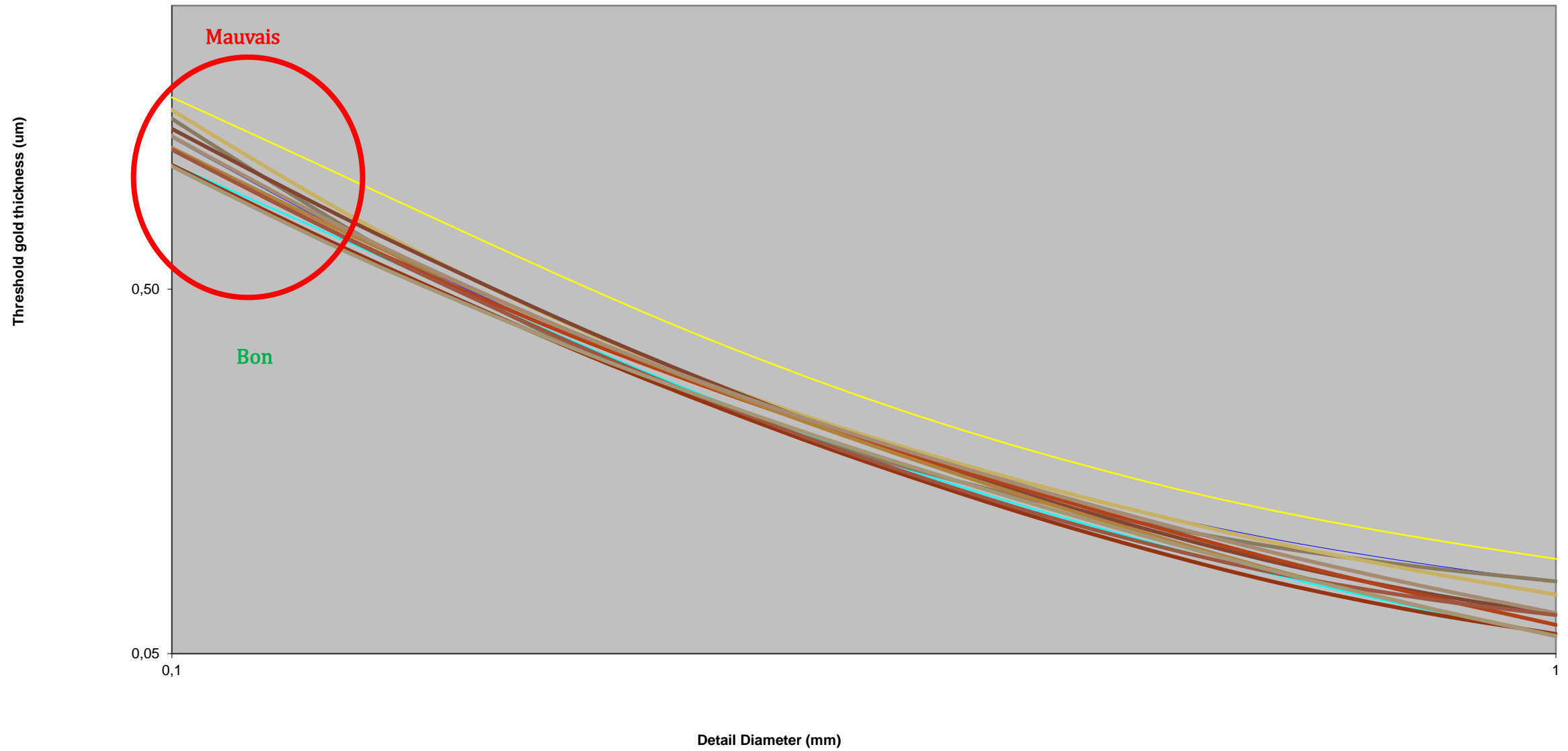




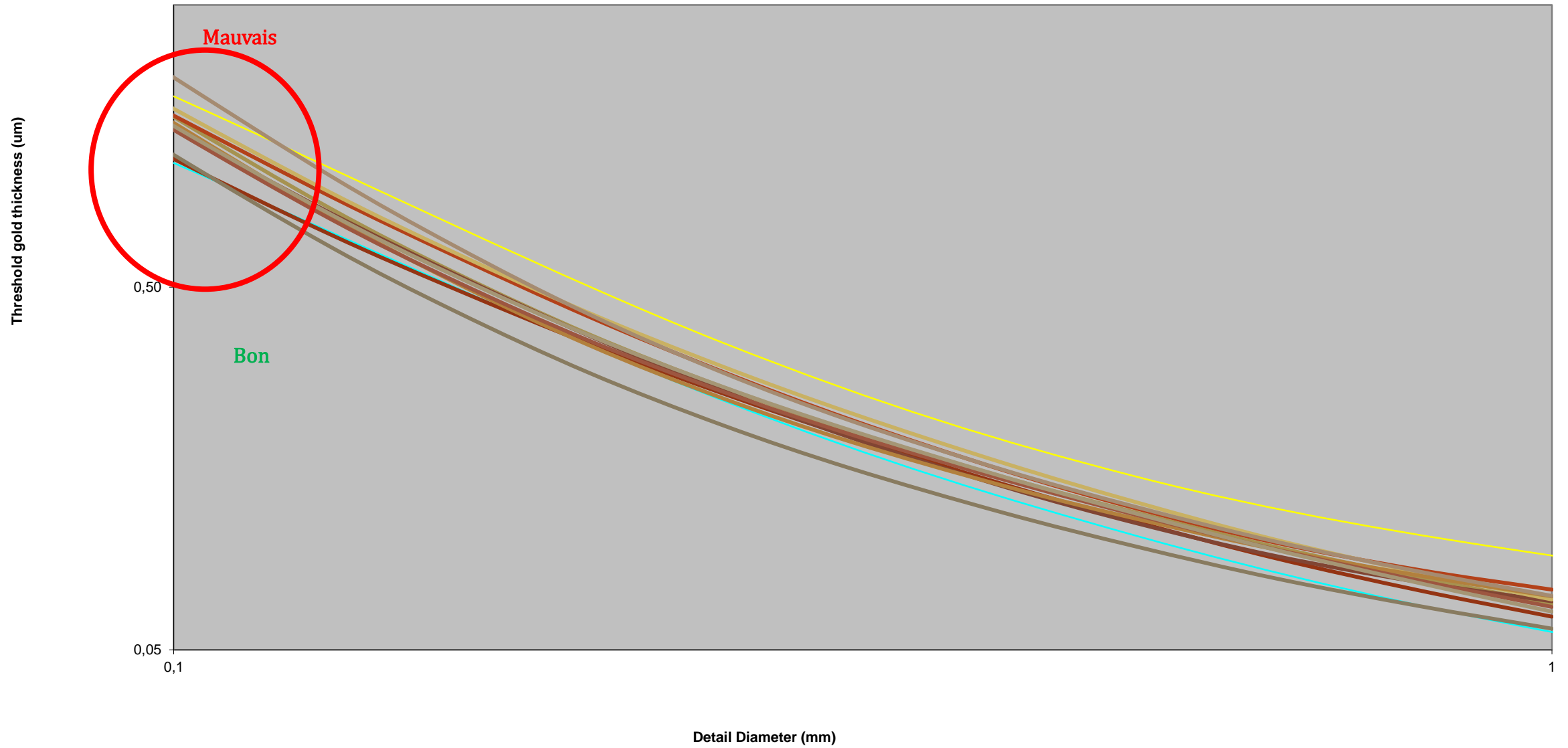
# Résultats pour les systèmes CR

## CDMAM

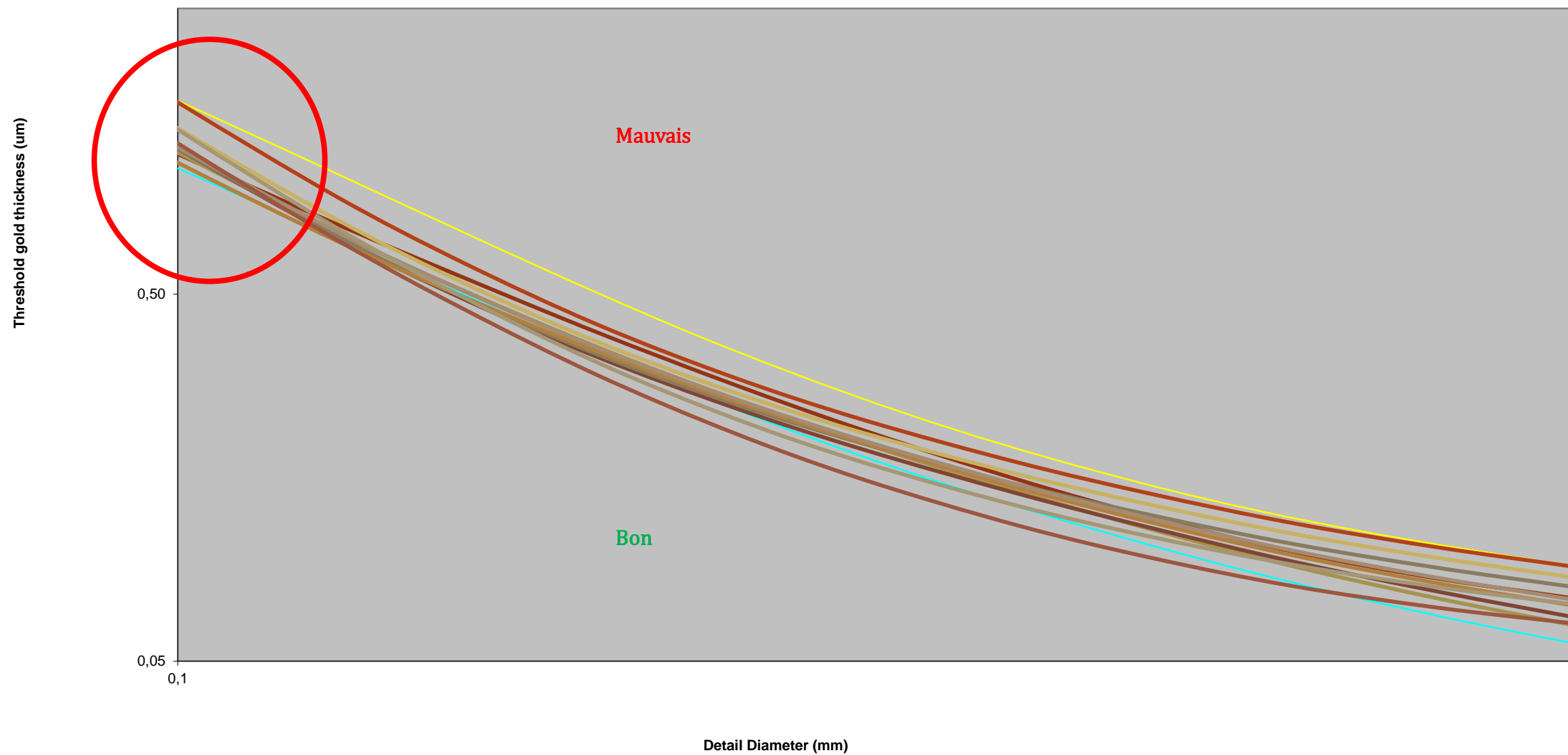
Predicted Threshold Contrast Measurements système A (NIP)



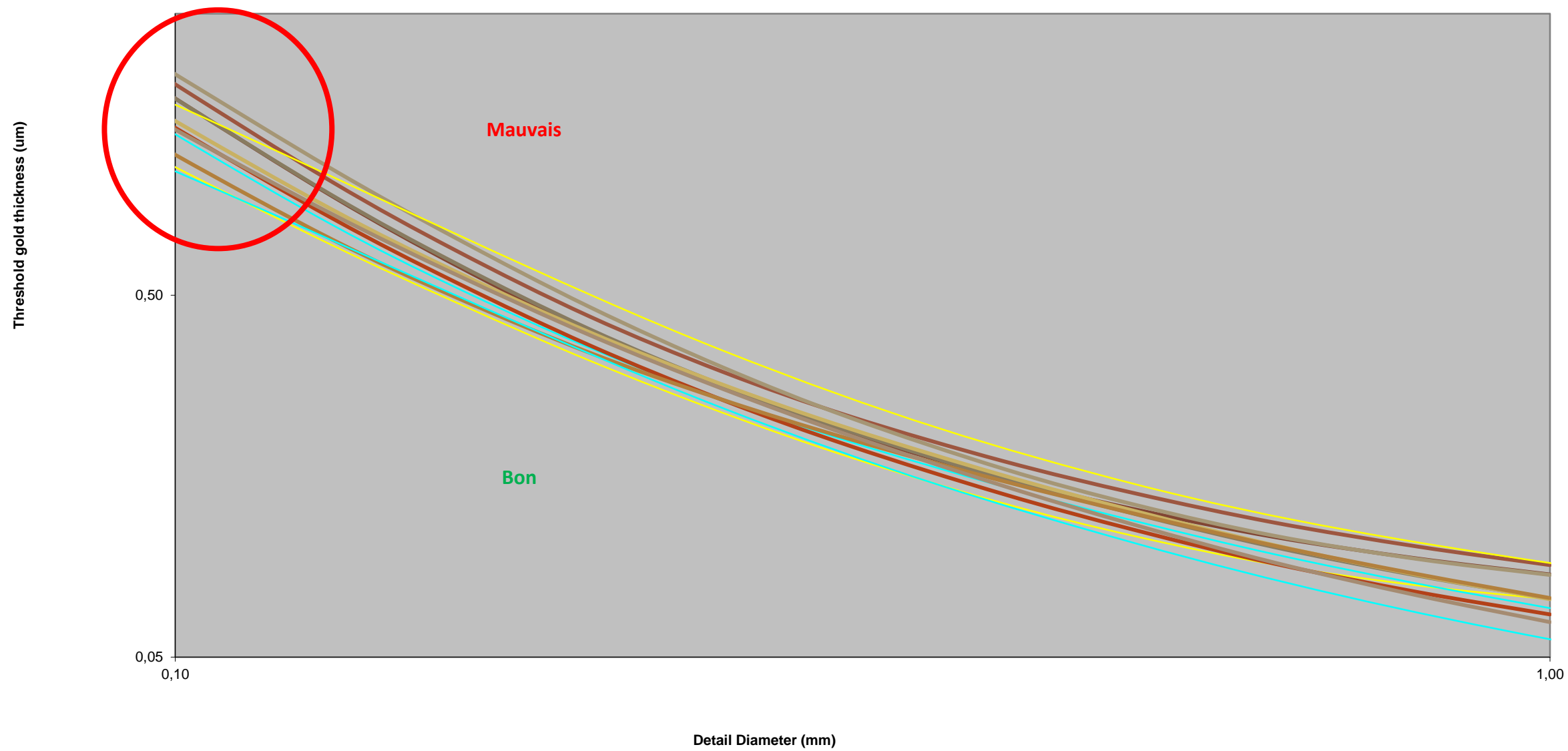
Predicted Threshold Contrast Measurements système B (NIP)



Predicted Threshold Contrast Measurements système C (NIP)



Predicted Threshold Contrast Measurements système D (PIP)

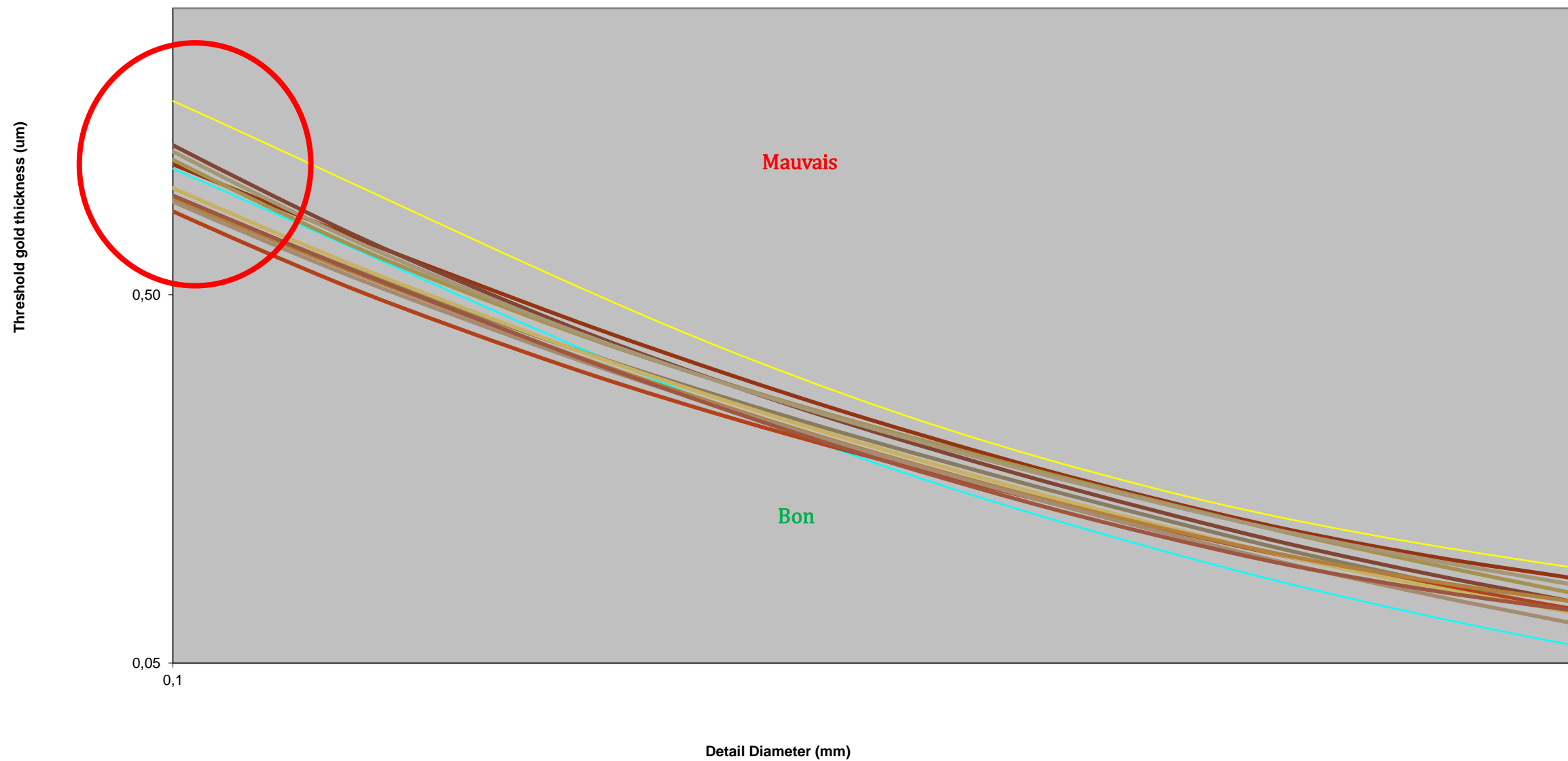


# Résultats pour les systèmes DR

## CDMAM



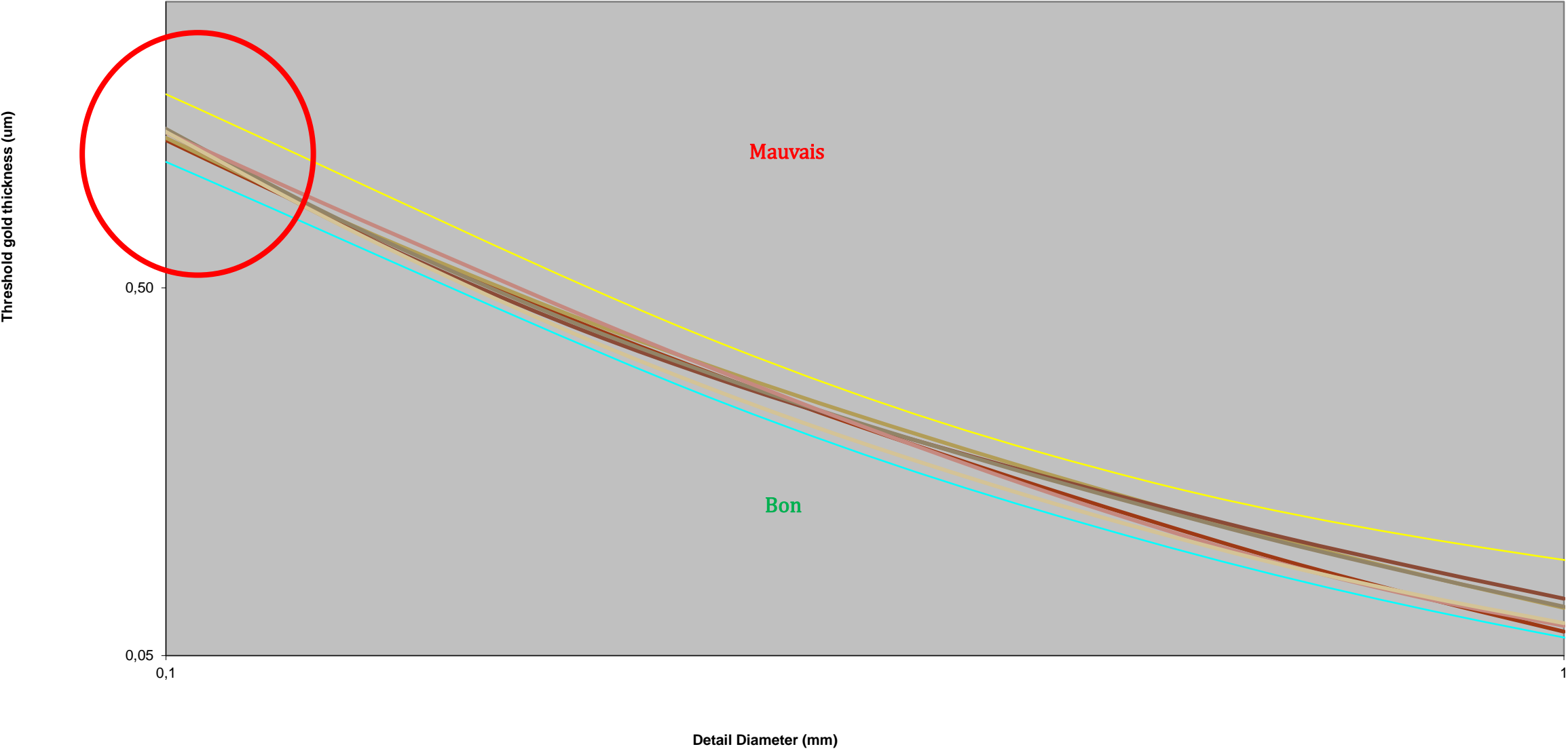
Predicted Threshold Contrast Measurements système F1



Predicted Threshold Contrast Measurements système F2



Predicted Threshold Contrast Measurements système G

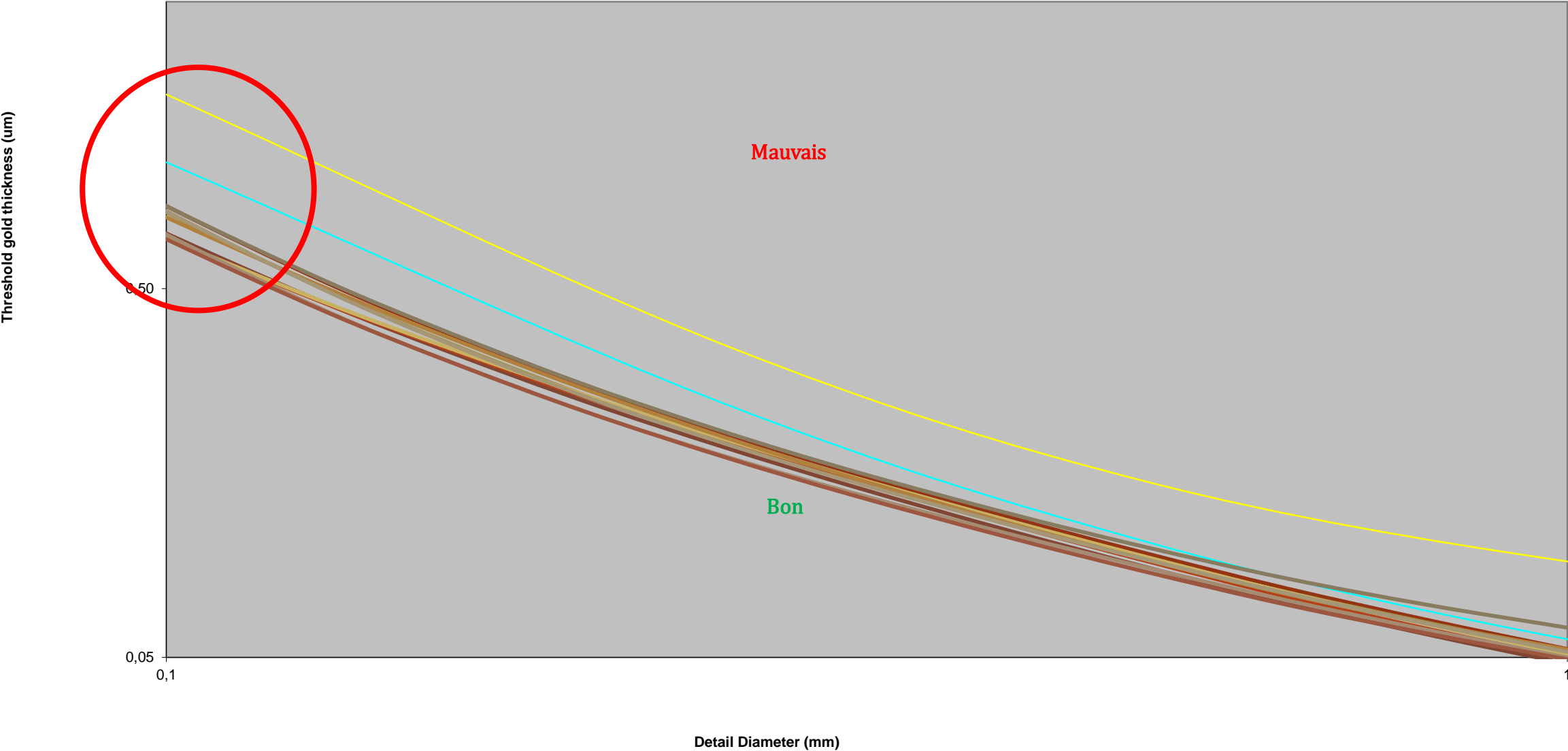


Predicted Threshold Contrast Measurements système H

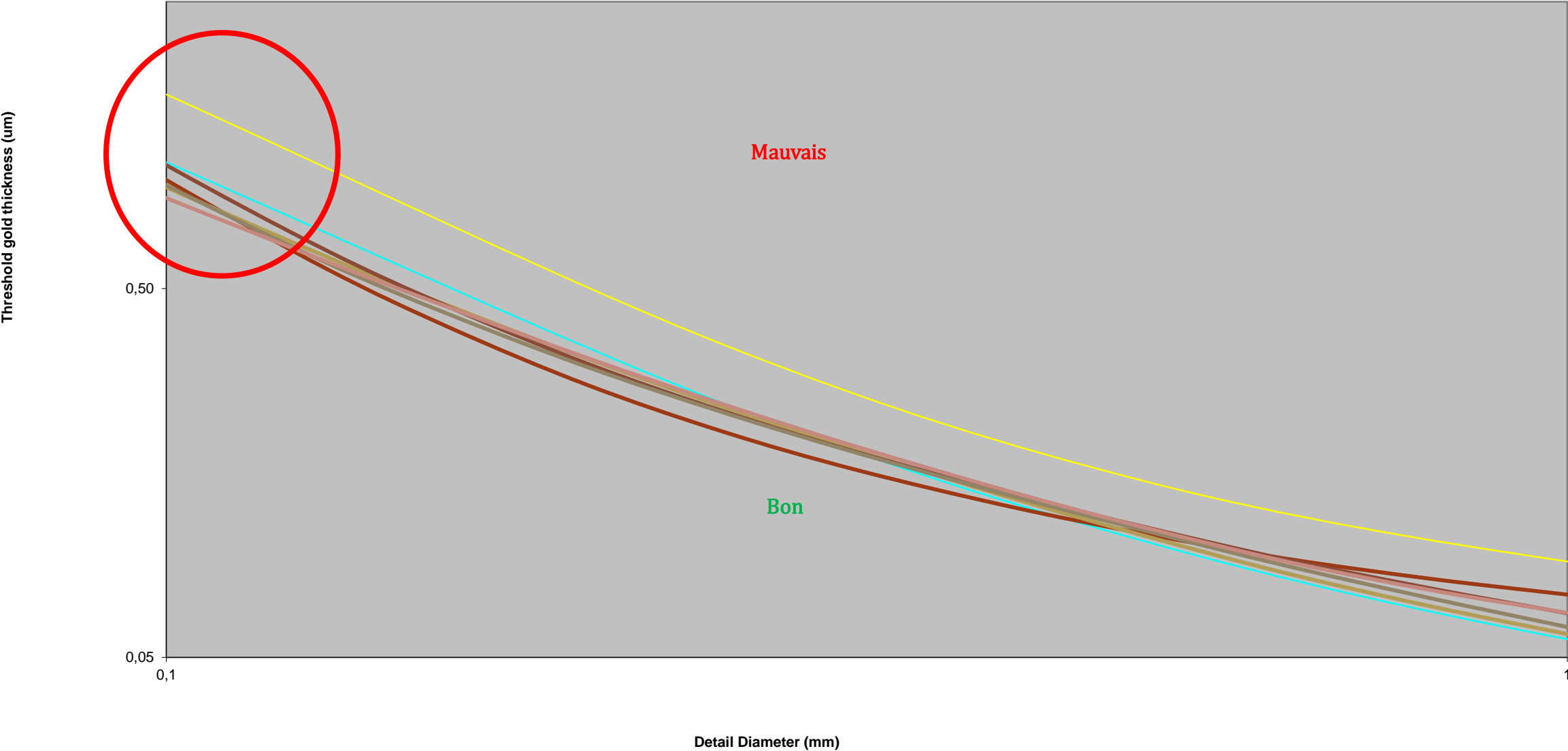




Predicted Threshold Contrast Measurements système I



Predicted Threshold Contrast Measurements système J



# Conclusions



# Conclusion

- ◆ Ecart entre les différents systèmes important
  - ◆ En Dose
  - ◆ Et en Qualité image (détection)

# Conclusion

- ◆ Infériorité des CR sur les DR
- ◆ Infériorité des CR PIP sur les CR NIP
- ◆ Dans une même marque, sur 2 modèles DR différents, variations importantes en terme de qualité image
- ◆ Variation importante de la détection en fonction des systèmes DR

# Conclusion

- ◆ Le type de détecteur a un impact direct sur la détection des CCIS



Merci pour votre attention