Comparison of Full Field Digital (FFD) and Computed Radiography (CR) mammography systems in Greece

M. Kalathaki*, C.J. Hourdakis, S. Economides, P. Tritakis, N. Kalyvas, G. Simantirakis, G. Manousaridis, I. Kaisas and V. Kamenopoulou

Greek Atomic Energy Commission

Athens, Greece

* mkala@eeae.gr

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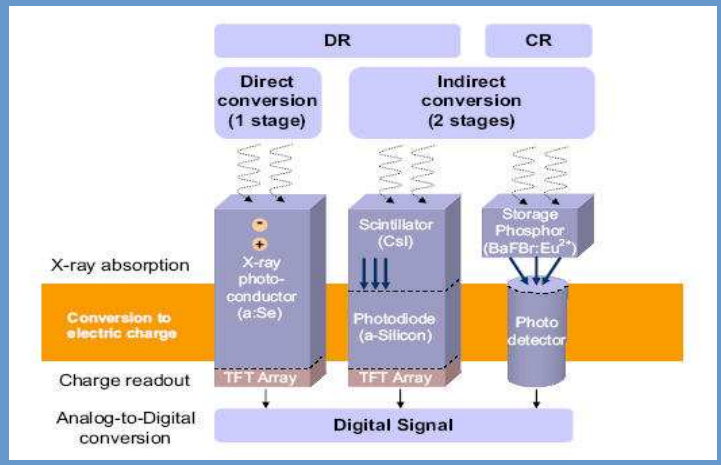
Introduction

The transition from film screen to digital mammography has been very evident the last decade in the field of early diagnosis of breast abnormalities. Digital mammography provides advantages involving improved image contrast, the potential of reduced dose, elimination of film processing, reduction of retakes and the ability to store and transfer images worldwide.

Various types of detectors have been widely used to produce digital images including flat-panel amorphous silicon detectors, amorphous selenium detectors, scintillators with charged coupled devices and photostimulable phosphor imaging plates (computed radiography).



In Greece during the last three years the use of digital imaging in the field of mammography has rapidly increased. The purpose of this study is to to evaluate and compare the performance of Full Field Digital (FFD) and Computed Radiography (CR) mammography systems in respect to dose and image quality .

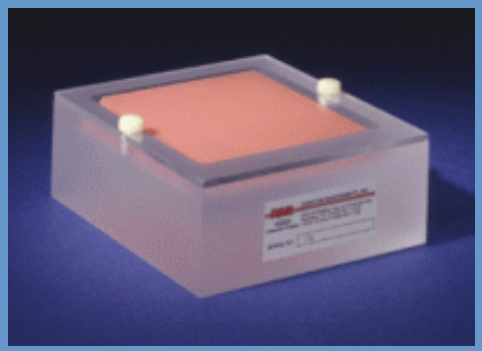
Materials & Method

- Entrance Surface Air Kerma (ESAK) measurements were performed according to the European protocol on dosimetry in mammography with appropriate dosimeter and by using a Gammex RMI 156 mammographic phantom. The measurements were conducted during the regular onsite inspections performed by the Licensing and Inspections Department of Greek Atomic Energy Commission.

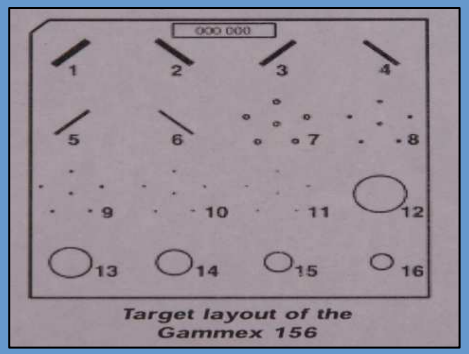
- The exposures were performed according to the clinical protocol of each laboratory for a craniocaudal view and a standard size breast.

- The image quality was assessed by the total score of resolved phantom structures incorporated in the phantom.

- The distributions of ESAK and total score (image quality) were plotted and a statistical analysis (two sample t-test) was also performed to evaluate the significance of the outcomes.



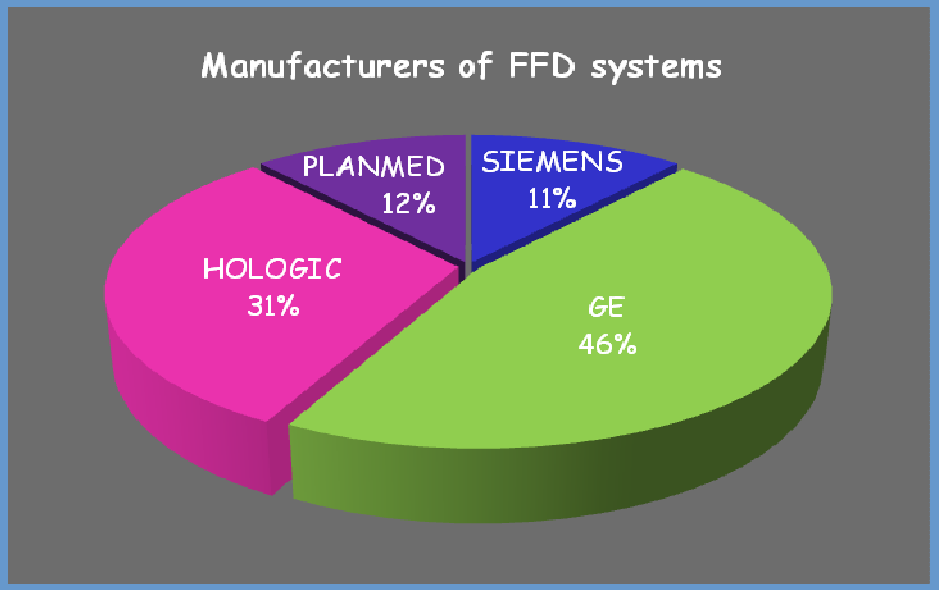
Gammex RMI 156 Mammographic phantom

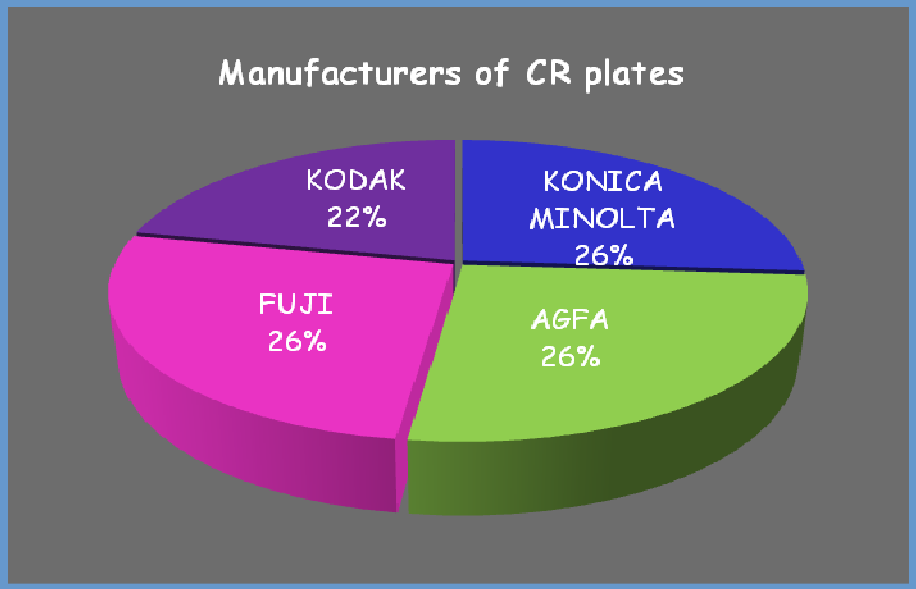


Incorporated structures in RMI 156 phantom

Results

- **52** mammography systems of various manufacturers were evaluated in terms of ESAK and image quality
  - 50% of which involved FFD systems and
  - 50% CR modalities.



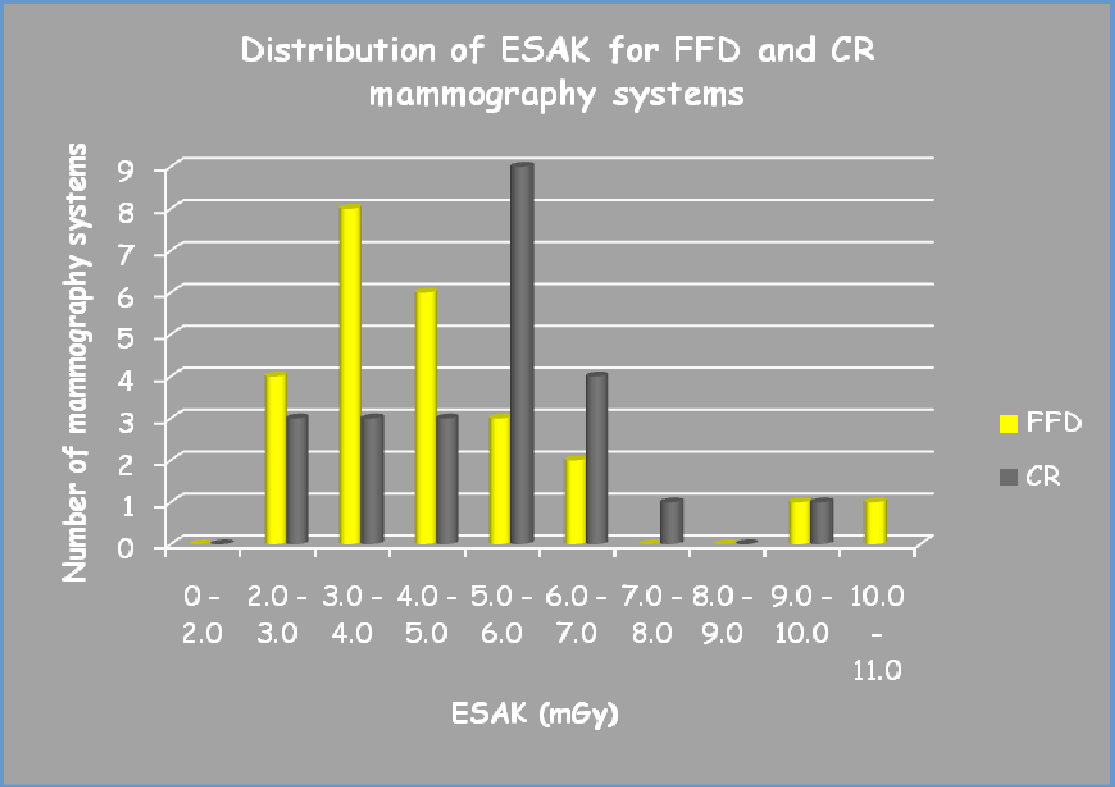


Results

ESAK measurements

- The **ESAK** values for the FFD systems ranged from **2.04 mGy** to **10.27 mGy** with a **mean value** of **4.59 ± 1.93 mGy**

- The **ESAK** values for the CR systems ranged from **1.91 mGy to 9.34 mGy** with a **mean value** of **5.0 ± 1.78 mGy**

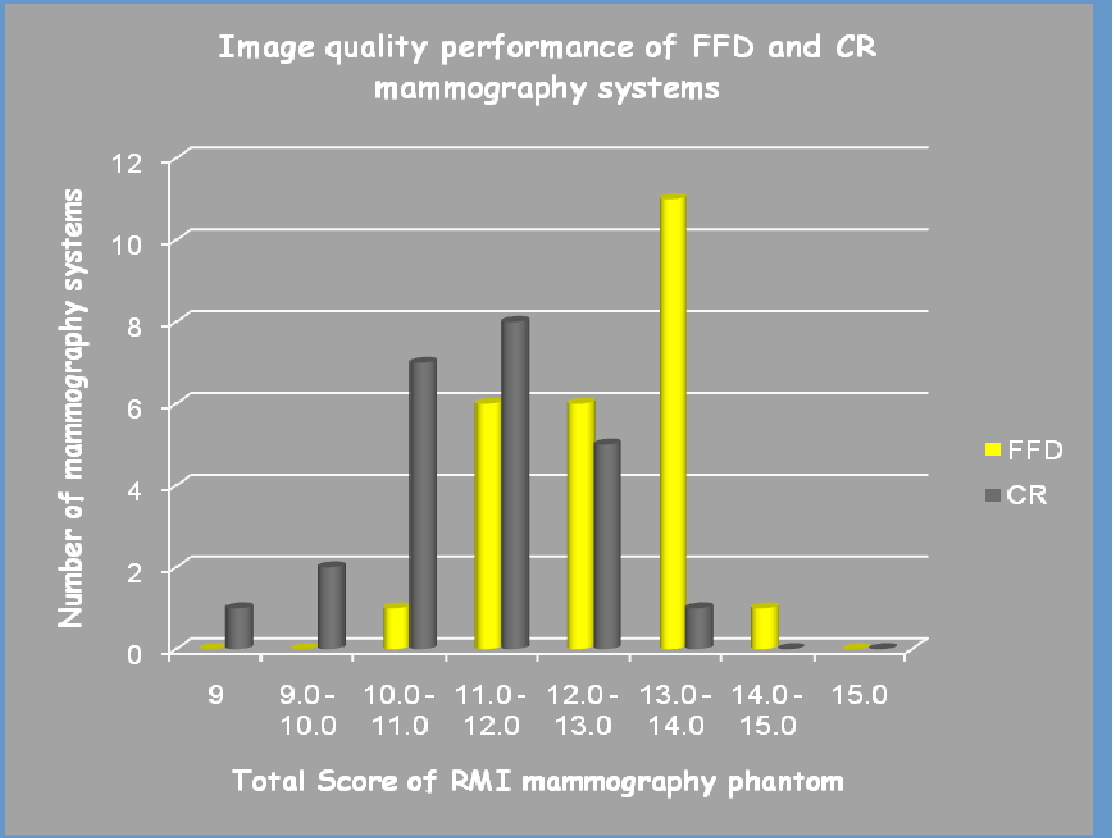


Results

Image Quality Evaluation

- The evaluation of **image quality** for **FFD** systems indicated a range of **total score** between **11.0 – 14.5** with a **mean value of 13.04 ± 0.89**

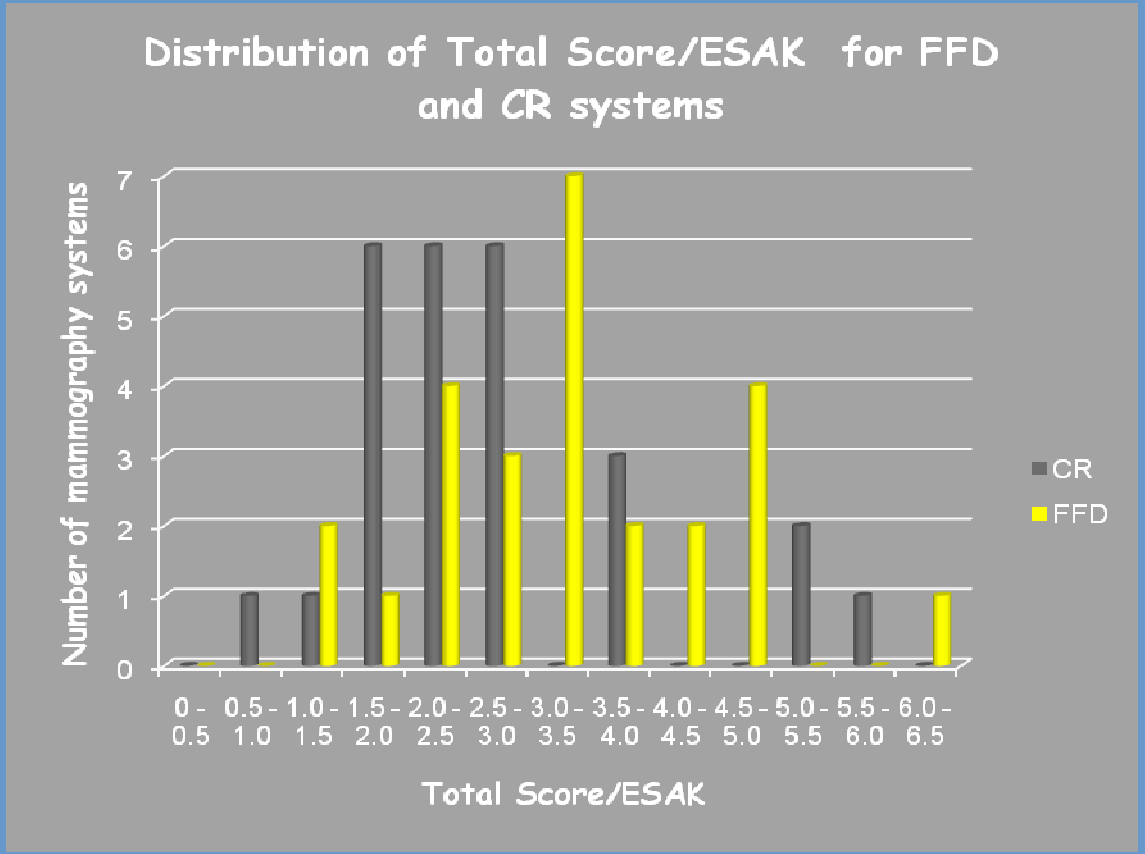
- The evaluation of **image quality** for **CR** systems indicated a range of **total score** between **9.0 – 13.5** with a **mean value of 11.54 ± 1.06**



Results

Ratio of total score over ESAK

- The **ratio of total score** (image quality) **over ESAK** was also calculated indicating:
  - a range between **1.07 – 6.32** with a **mean value of 3.27 ± 1.18** for **FFD** systems
  - a range between **0.96 – 5.76** with a **mean value of 2.69 ± 1.20** for **CR** systems



Results

Table 1: Results of two independent samples t-tests

	Mean (mGy)	St. deviation	t - score	Significance (2-tailed)
t-test for ESAK				
FFD	5.003	1.9344	0.808	0.4165
CR	4.587	1.7802	0.808	0.4165
t- test for total score				
FFD	13.04	0.894	-5.524	0.000
CR	11.54	1.058	-5.524	0.000
t-test for ratio of total score over ESAK				
FFD	3.269	1.176	-1.775	0.082
CR	2.685	1.967	-1.775	0.082

Conclusions

- Statistical analysis indicated that FFD systems provided a statistically significant better image quality than CR systems. Comparison of the mean ESAK values showed that FFD systems provided slightly lower doses than CR without however indicating a statistical significance at a 5% confidence level. This was also the case for the ratio of total score over ESAK for FFD and CR systems.
- Moreover, 98 % of all systems examined (both FFD and CR) met the image quality requirements of Gammex RMI 156 phantom (minimum total score of 10).
- In addition, 85 % of all systems examined (both FFD and CR) yielded a dose below the national DRL for mammography examinations.
- Finally, it was observed that the main problem for most of the systems exceeding the national DRL was the non-optimum adjustment and use of the dynamic range of the detectors providing unnecessary higher exposures than clinically needed.

Greek Atomic Energy Commission

P.O BOX 60092

Ag. Paraskevi 15310, Greece

T: + 30 210 650 6700

F: + 30 210 650 6748

E: info@eeae.gr

http://www.gaec.gr