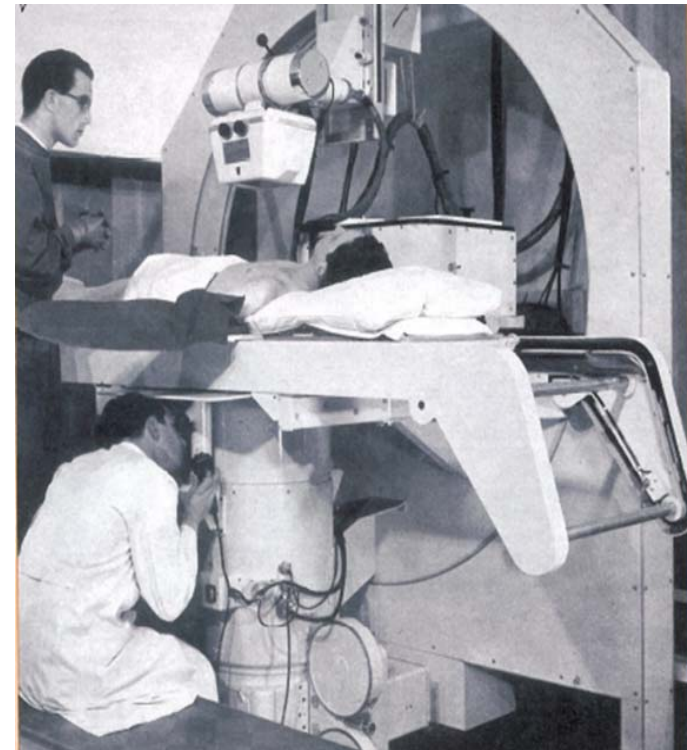


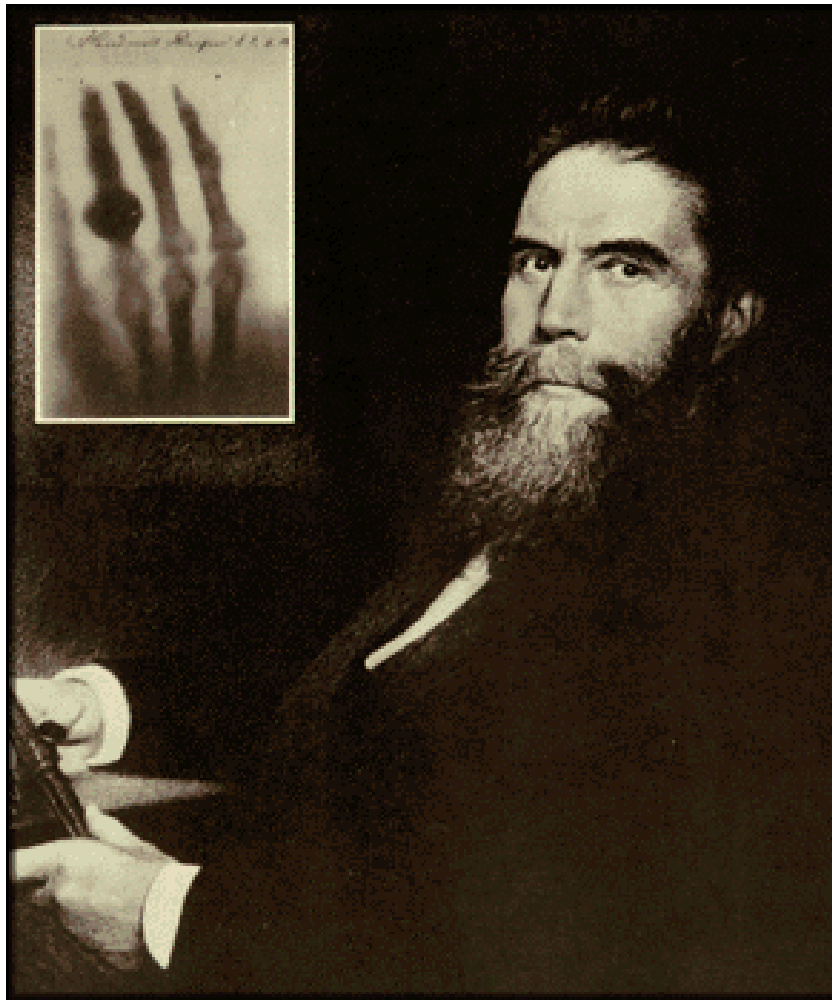
Generator, gennemlysning og digital radiologi

Emner

- Røntgenrør og –generator
- Billedforstærker og TV-kæde
- DR-receptor
- Andre digitale modaliteter
- Specielle teknikker



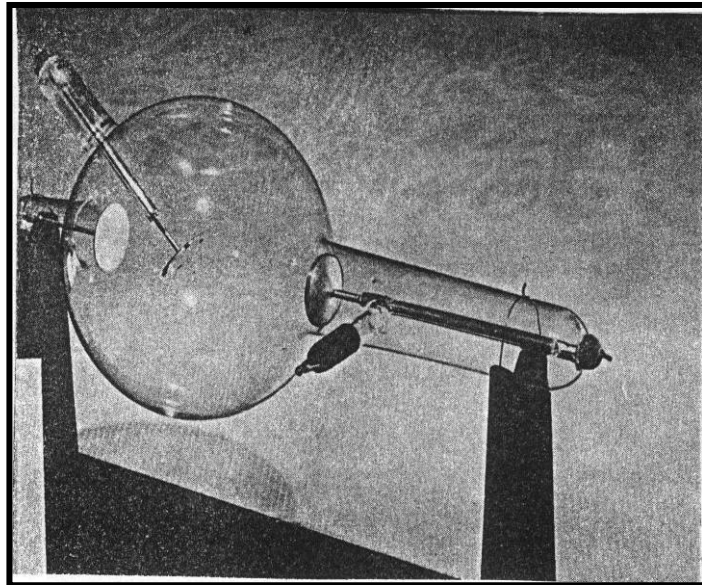
Røntgenrør og -generator



Wilhelm Röntgen opdager
røntgenstrålerne (x-ray's)
den 8. nov. 1895.

Det første billede var af
hans kone's hånd.
Eksposeringstid ca. 30 min.

Historisk tilbageblik.



C.H.F. Mueller laver
sit første røntgenrør i
1896.

Historisk tilbageblik.



British River
War.
Nilen 1896

4

Historisk tilbageblik.

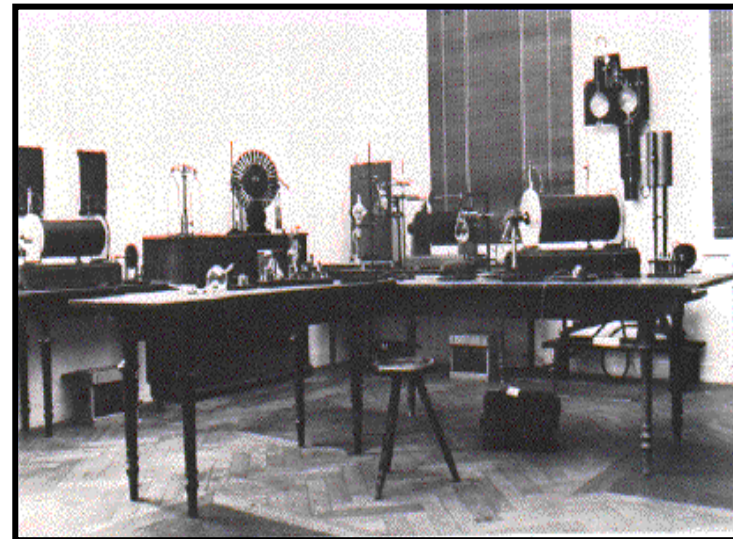
Eksponeringstider fra
Spansk-Amerikansk krig i
1898:

Hofte og hoved: 20 min.

Skulder og bryst: 10 min.

Knæ: 9 min.

Underarm og hånd: 2 min.

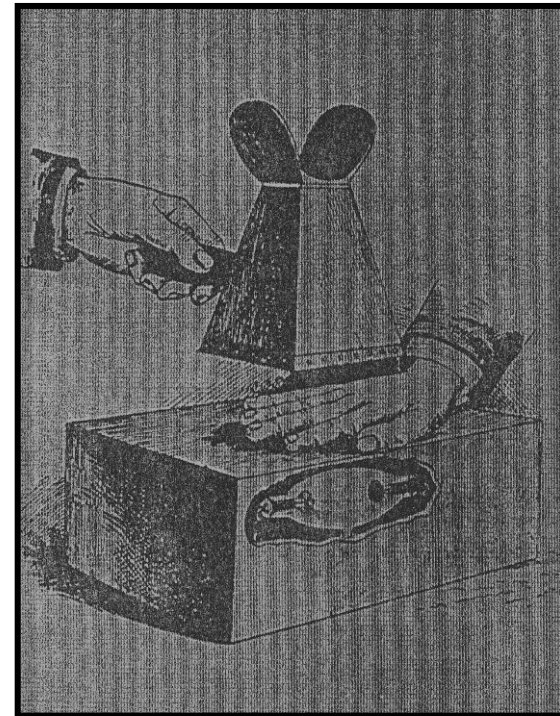


Roentgen's laboratorium.

Historisk tilbageblik.

Den 1. Stråleskade bliver rapporteret i 1896 (J. Daniel opdager at hans kollega taber håret efter at man havde bestrålet hans kranium.

Alligevel bliver det almindeligt at teste røntgenrør ved at placere sin hånd i strålingen og justere indtil man fik et godt billede.

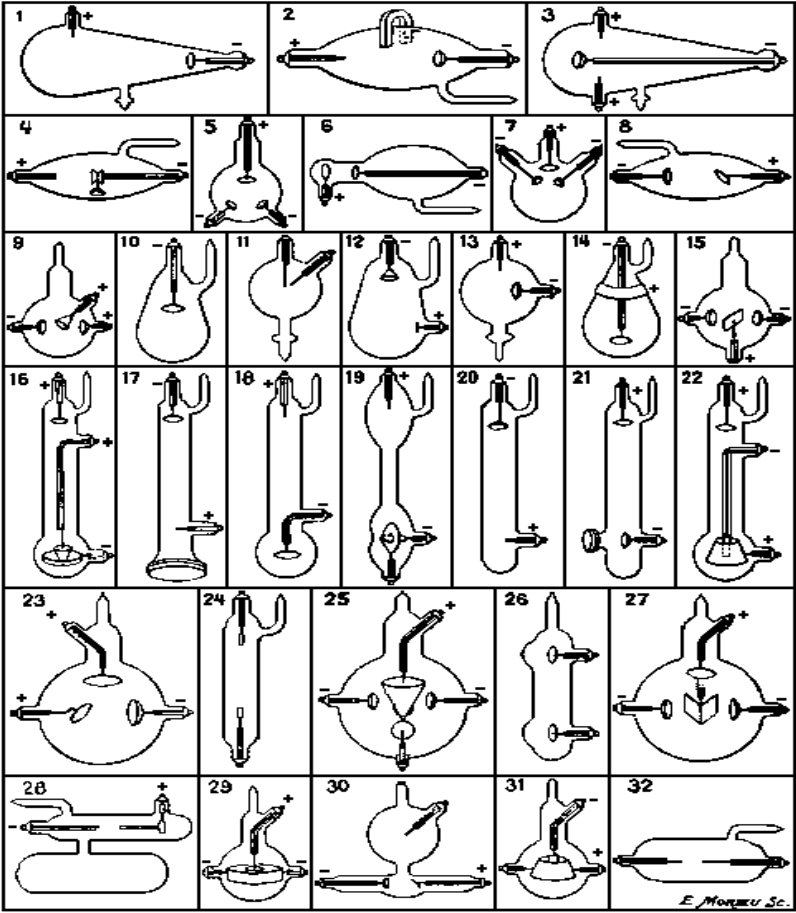


Historisk tilbageblik.

Billede af ”røntgen-
pioner” Mihran
Kassabian’s hænder
(levede fra 1870-1910)



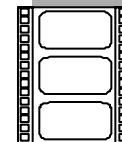
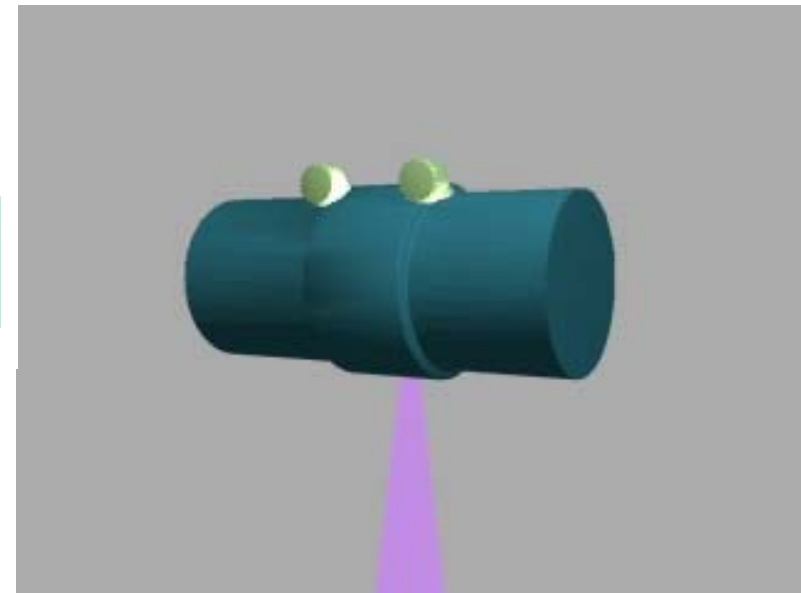
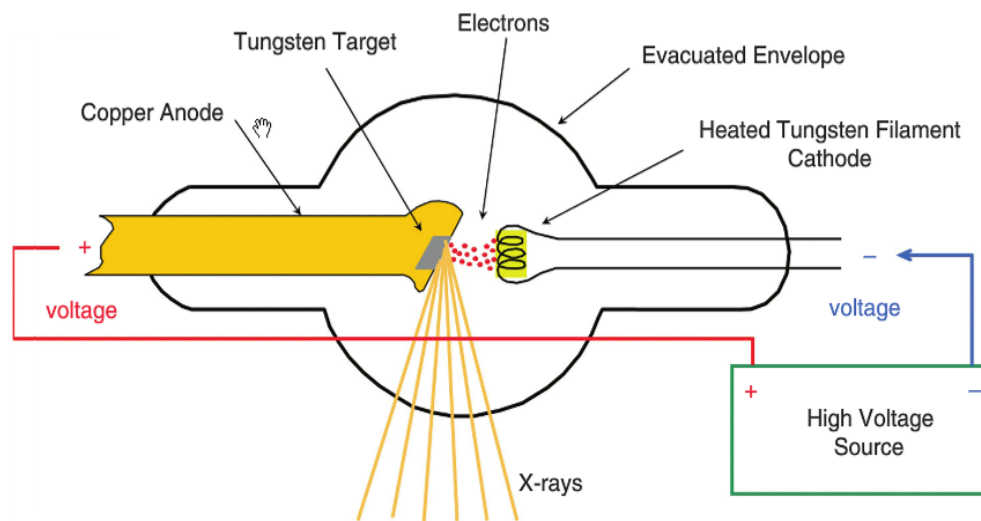
Røntgenrør.



VARIOUS TYPES OF X-RAY TUBES.

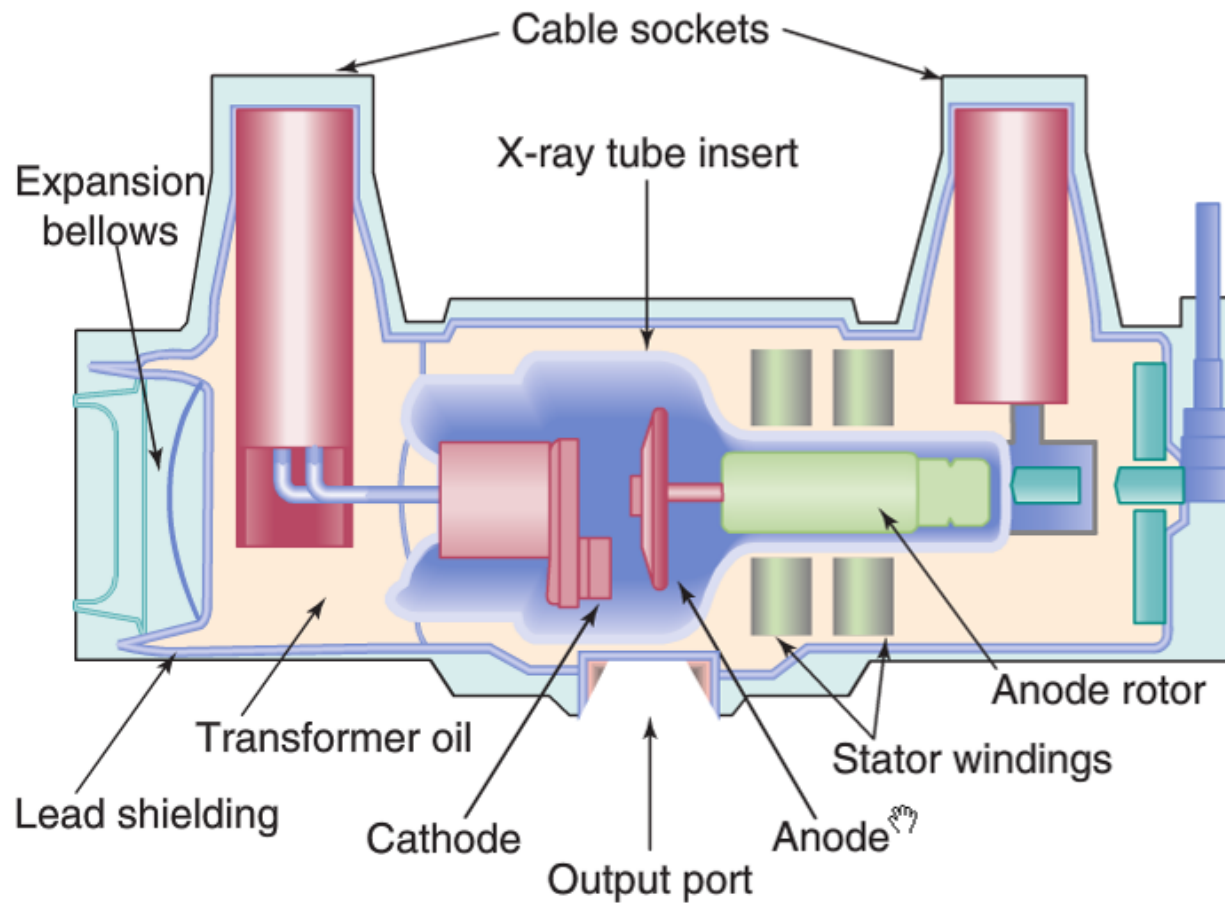
Røntgenrør.

princip.



Røntgenrør.

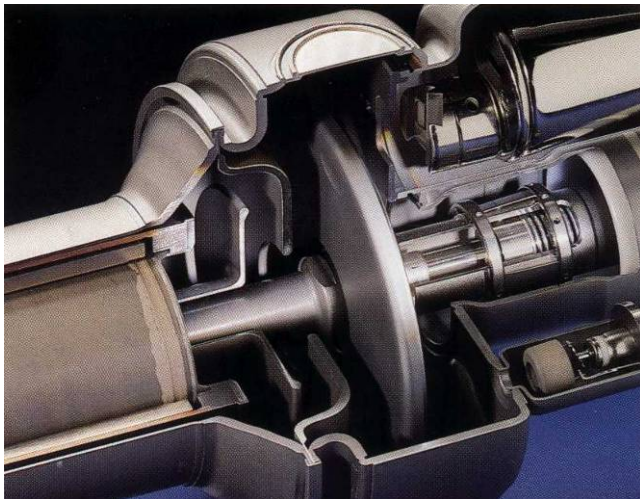
Princip.



10

Røntgenrør.

Eksempler

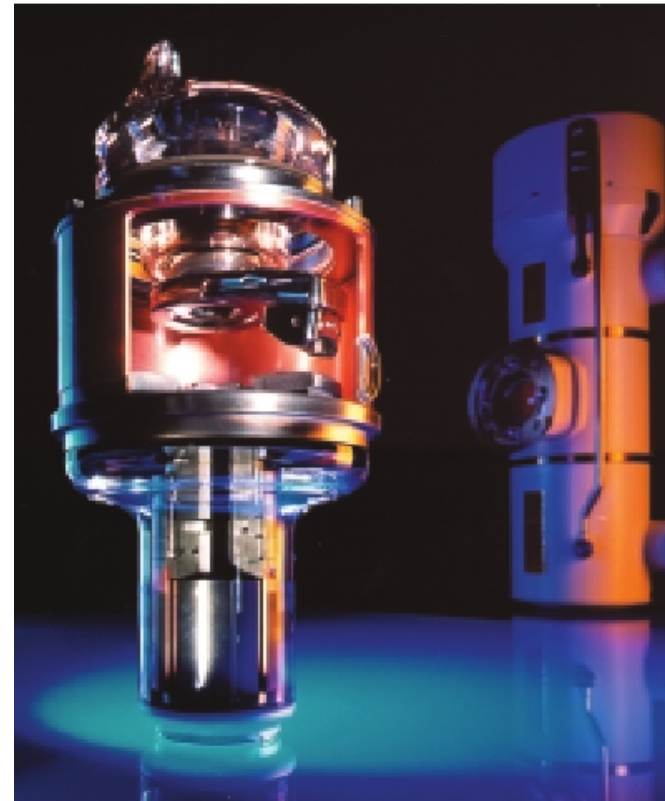
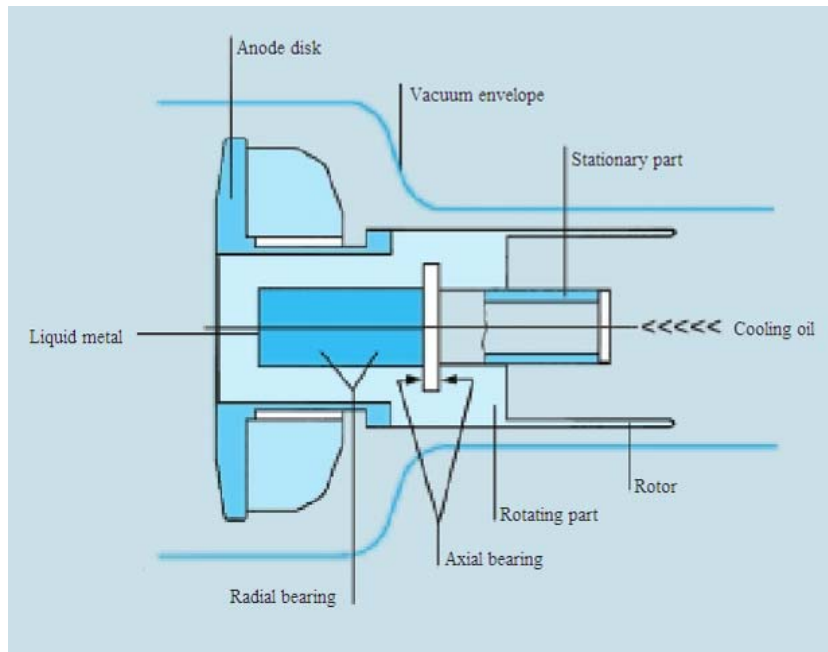


11

Røntgenrør.

Eksempler

Siemens Megalix



12

Røntgenrør.

Fokusstørrelse.

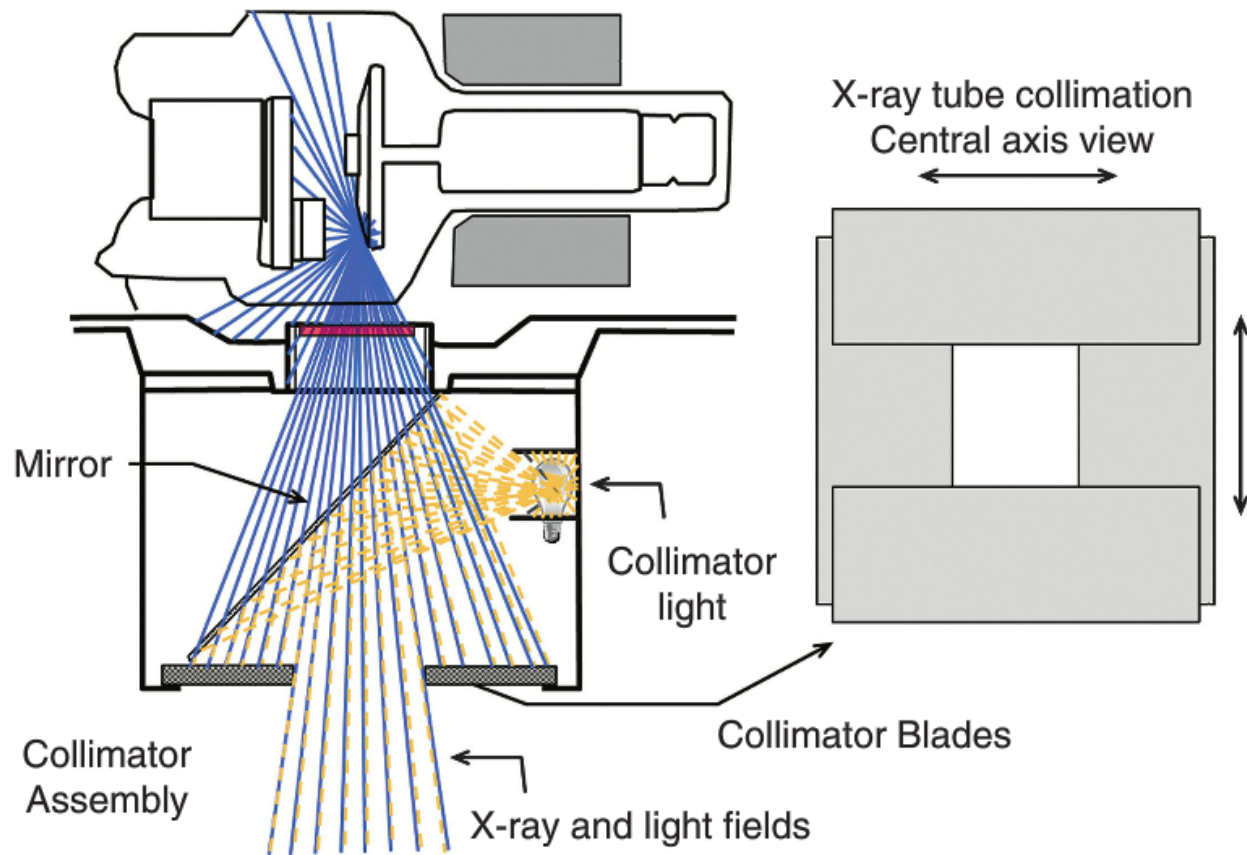
◆ Fokusstørrelse har betydning for:

- rørets belastningsevne
- røntgenbilledets skarphed

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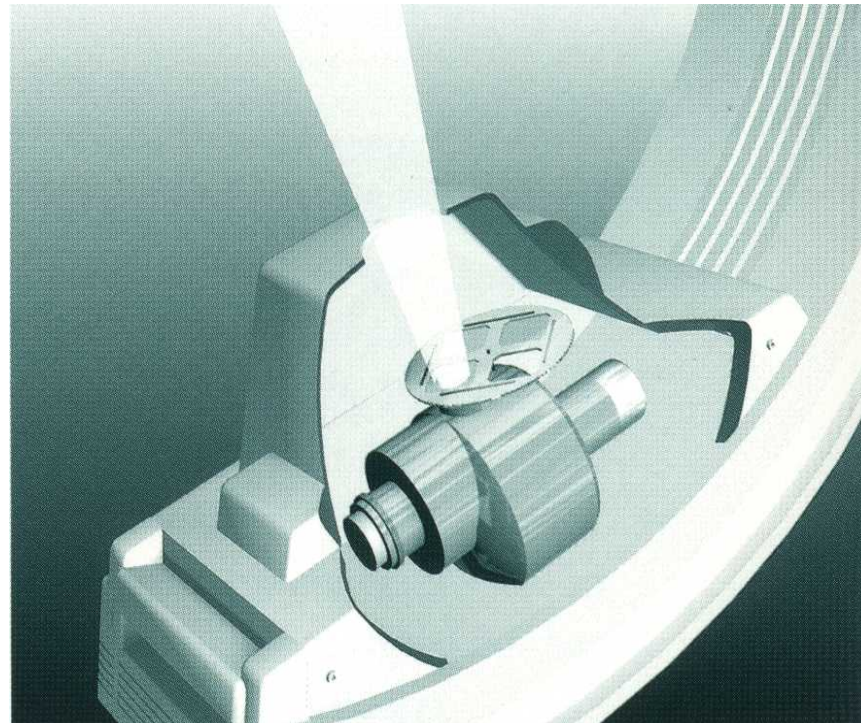
Røntgenrør.

Blænder



Røntgenrør.

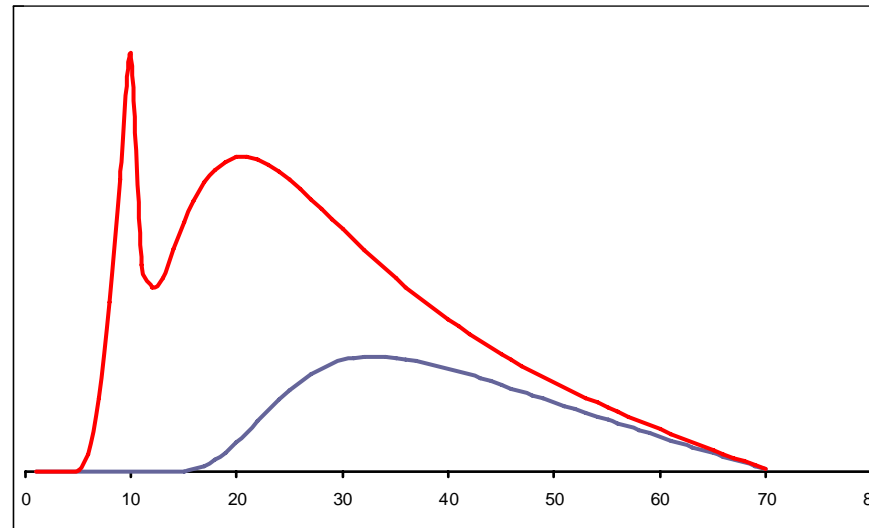
Spectral-filtrering.



Røntgenrør.

Spectral-filtrering.

- Filtrering fjerner mest af den lavenergetiske ("bløde") stråling.
 - Dette medfører at gennemsnitsenergien for den filtrerede stråling er højere end for den ufiltrerede.
 - Denne effekt kaldes "beam hardening".
 - Udover rørets egenfiltrering findes typisk et antal justerbare Cu og Al - filtere i lysvisiret.



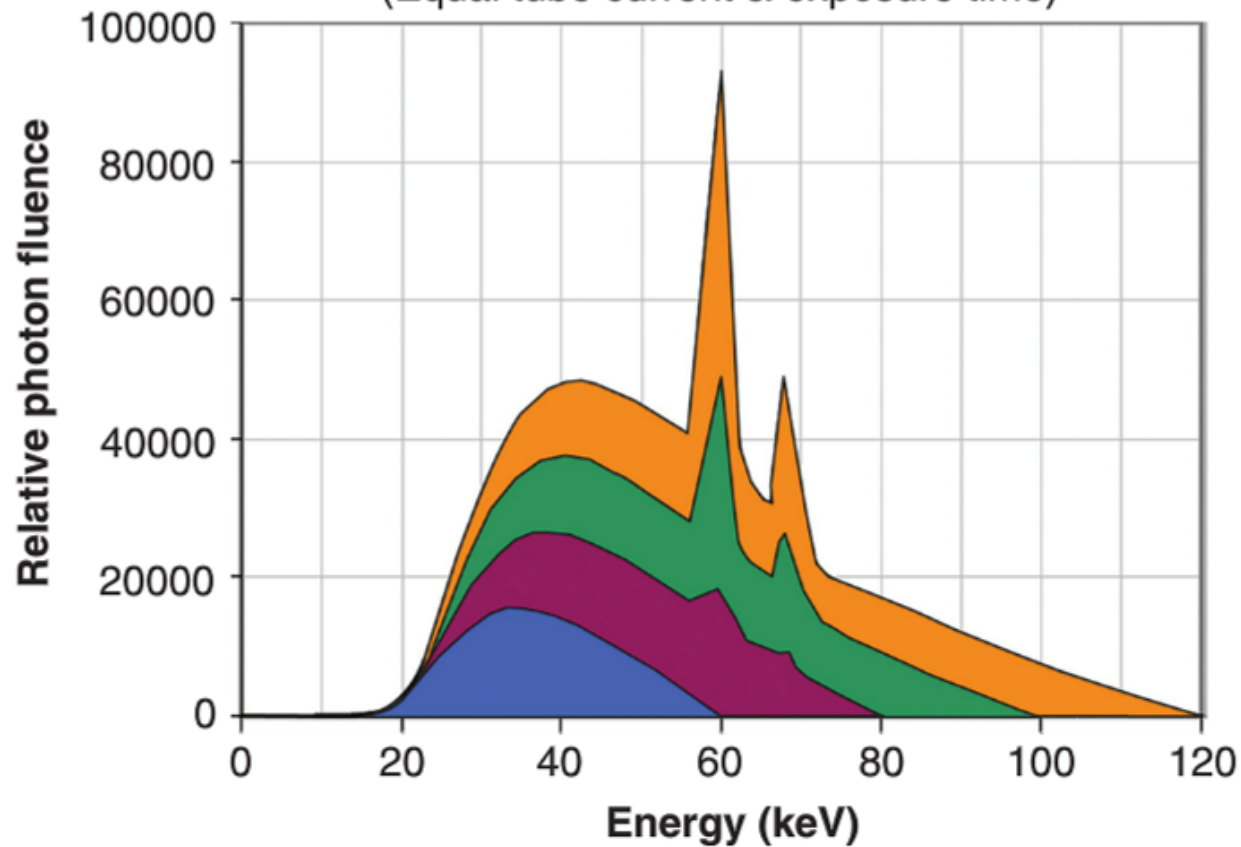
Røntgenrør.

Datablad.

X-RAY TUBES	SRM 05/11	SRM 03/10	SRC 04/11	MRC 160 GS*
Cooling	oil	oil	oil	oil, direct liquid metal anode cooling and spiral groove bearing principle
Continuous tube load	700 W	700 W	750 W	2000 W
AHSC	0.8 MHU	0.8 MHU	1.0 MHU	1.6 MHU
Foci	0.5 - 1.1 mm	0.3 - 1.0 mm	0.4 - 1.1 mm	0.3 - 1.0 mm
Power	30 - 80 kW	10 - 80 kW	20 - 80 kW	20 - 100 kW
Grid switch	no	no	no	yes
SpectraBeam filter	no	no	no	yes

Røntgen-spektrum

X-ray output spectrum
(Equal tube current & exposure time)



Diagnostiske parametre:

kV

En høj spænding giver:

- Hård stråling
- Lav dosis
- Lav billedkontrast

En lav spænding giver:

- Blød stråling
- Høj dosis
- Høj billedkontrast

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Diagnostiske parametre:

mA, s og mAs

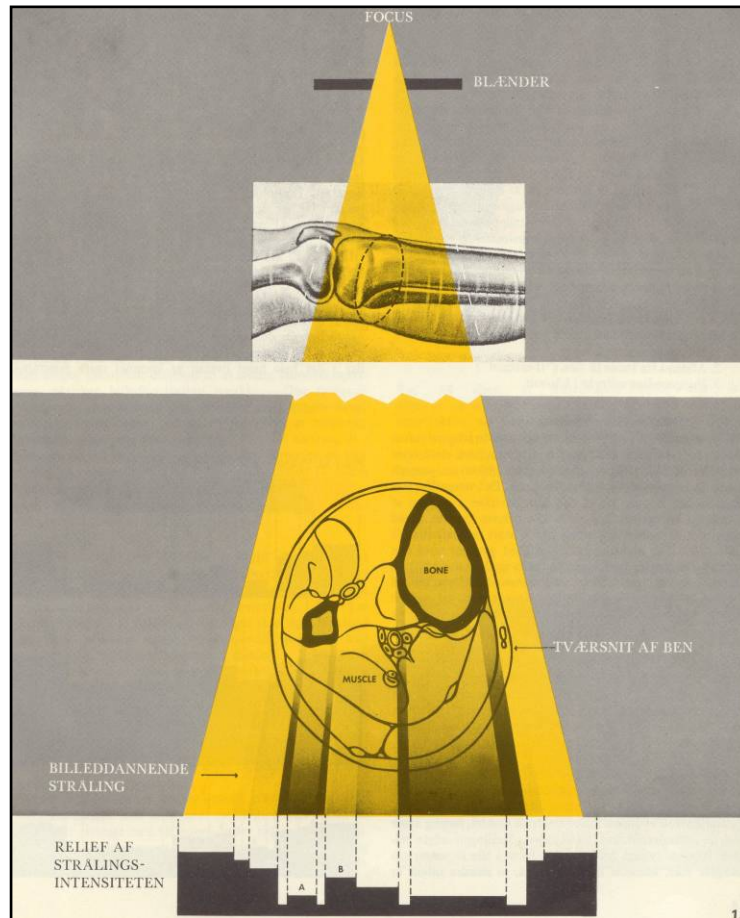
Ved en given kV er:

- mA Bestemmende for dosishastigheden (Gy/s).
Dvs. en lav mA giver lang eksponeringstid.
- mAs Bestemmende for dosis (Gy) og dermed for "filmsværtningen".

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Diagnostiske parametre:

Eksempel.



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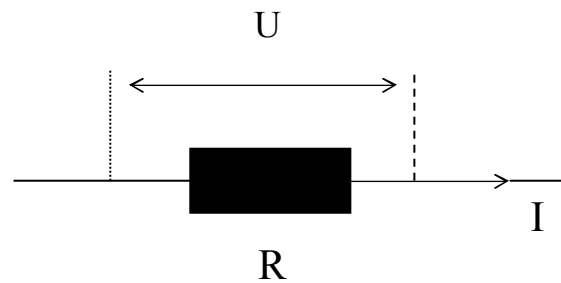
Elektricitetslære:

SI-enhed:

Spænding
(Volt)

Strøm
(Ampere)

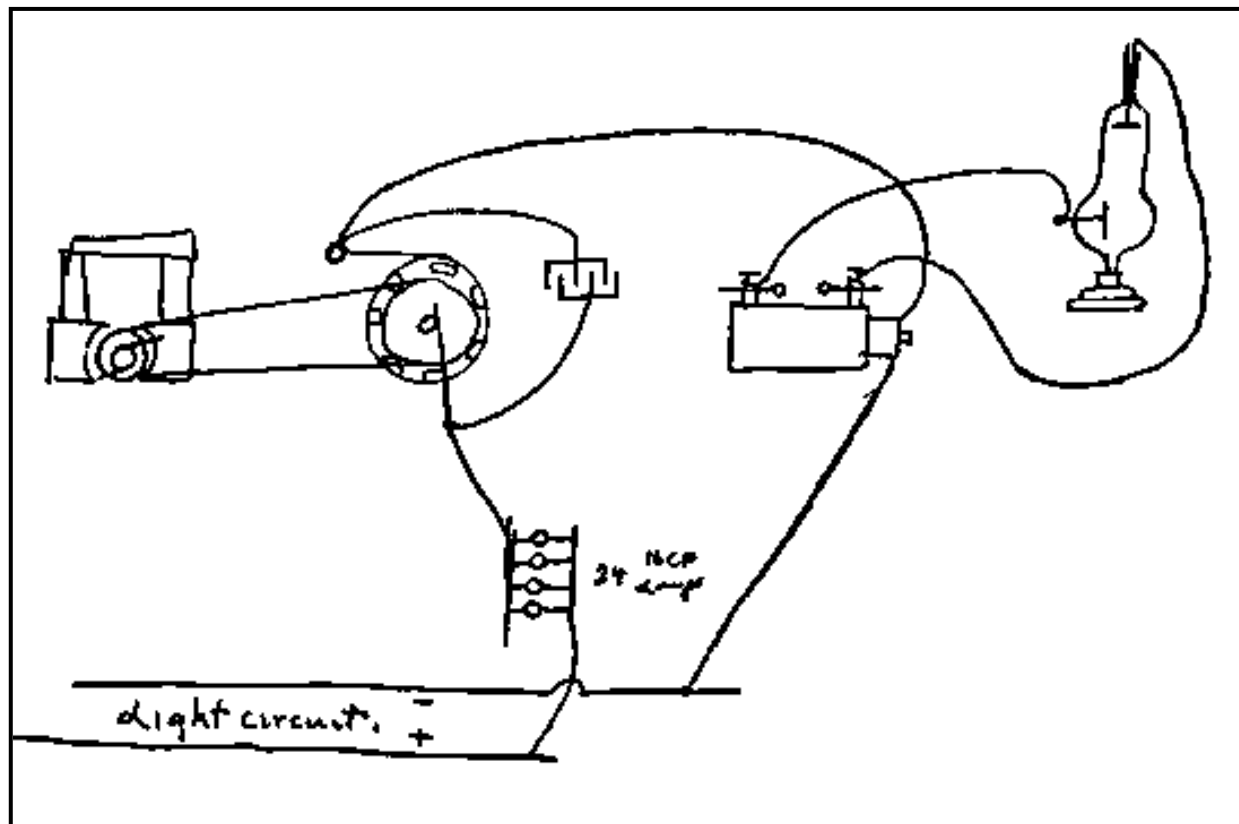
Modstand
(ohm)



Ohms lov:

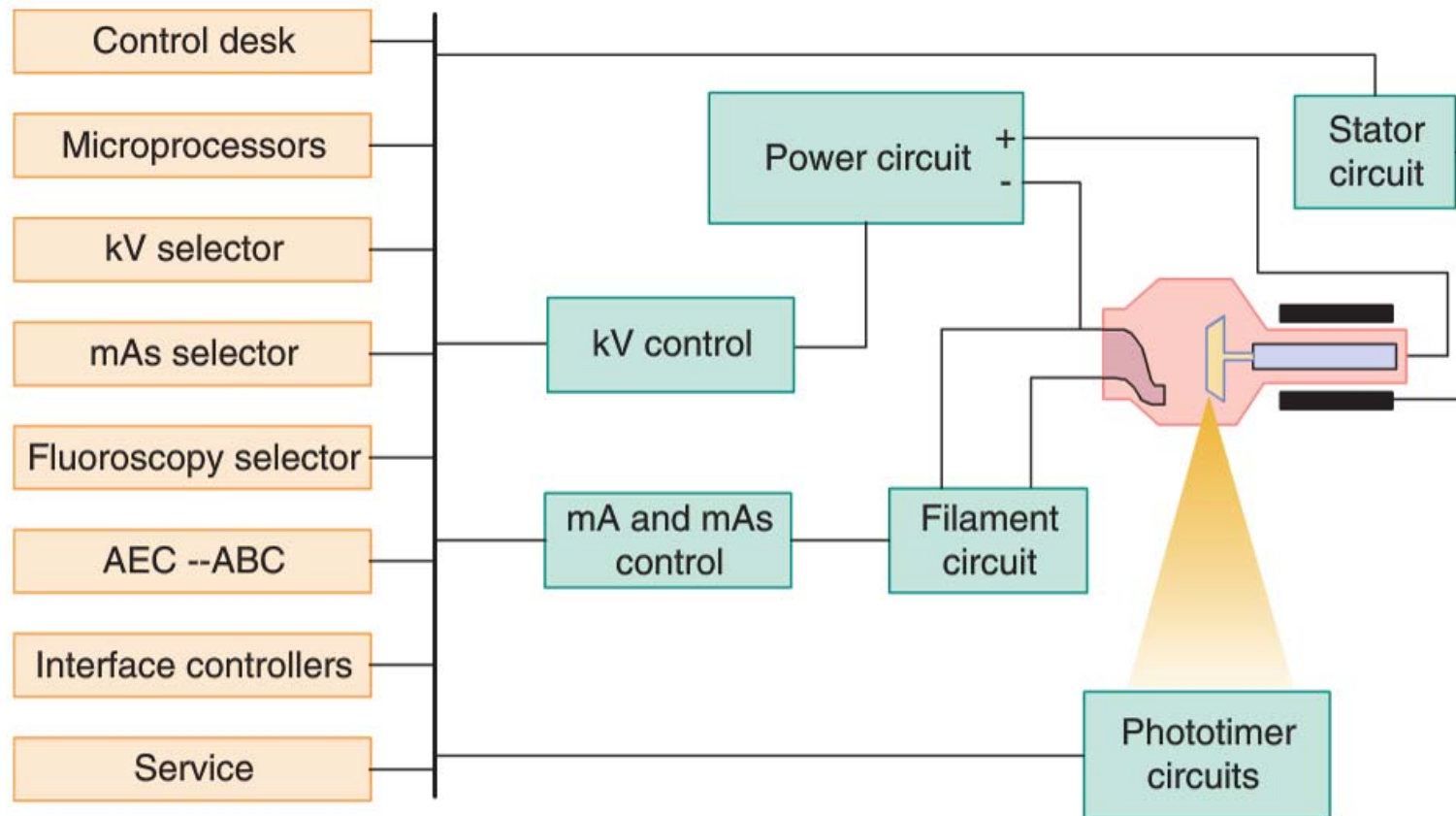
Spænding = modstand x strøm.

Røntgengeneratoren.



Røntgengeneratoren.

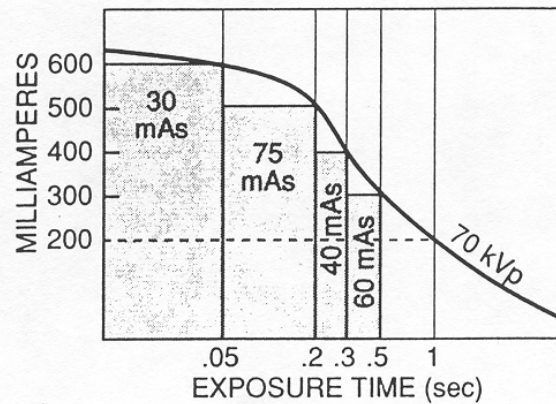
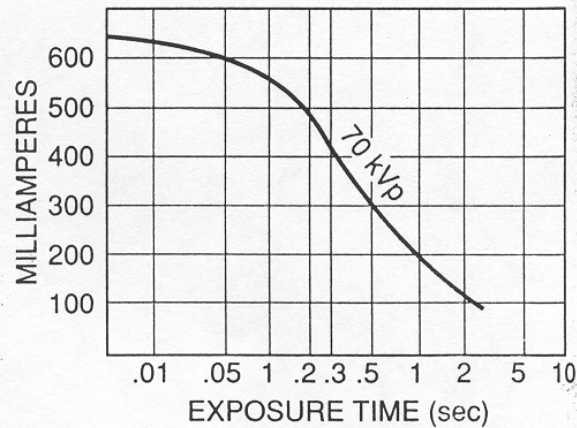
Oversigt.



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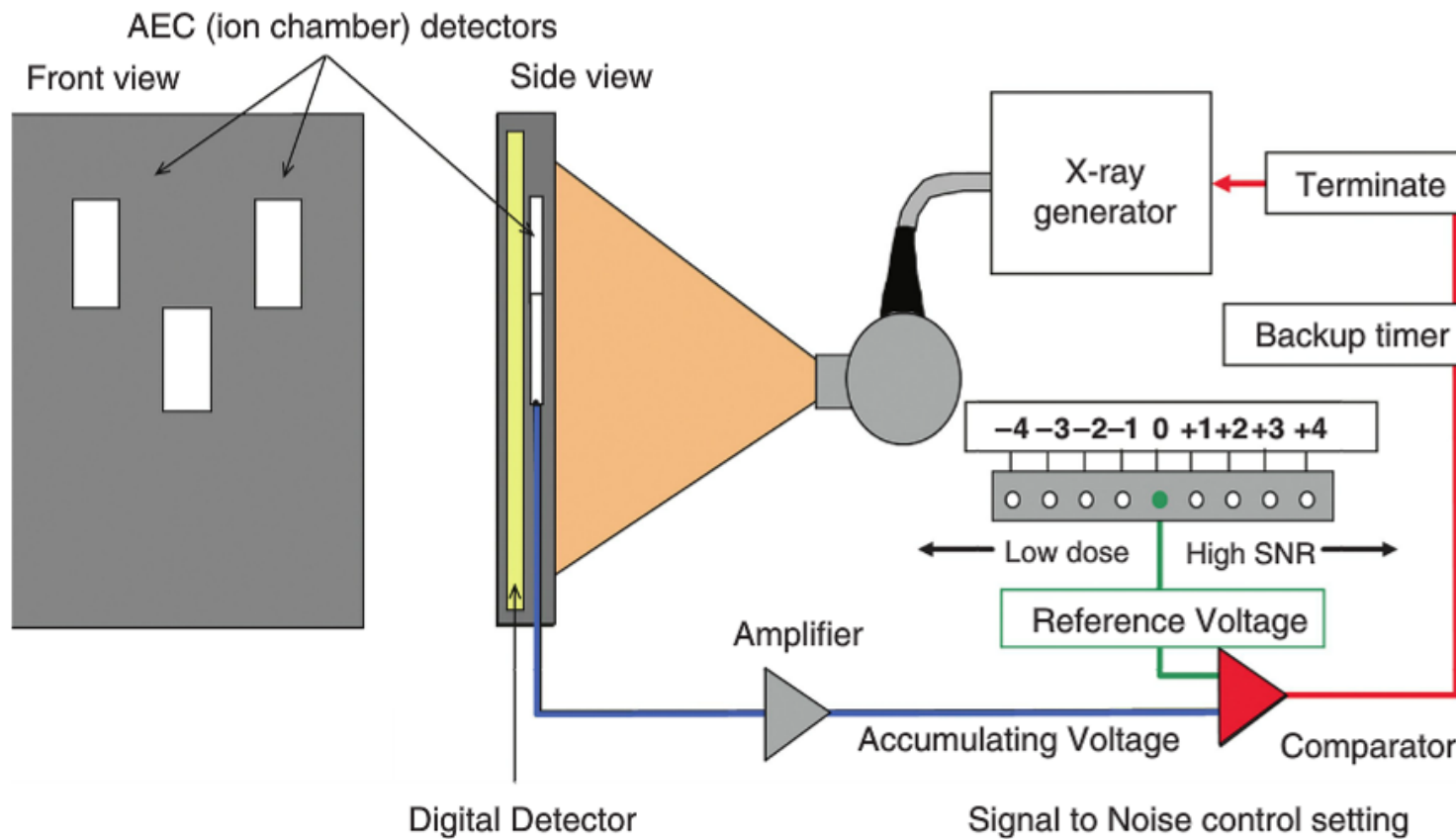
Røntgengeneratoren.

Falling Load Generator.



Røntgengeneratoren.

Electronic Timers, Switches, Phototimers



Røntgengeneratoren.

Betjeningspult



27

Røntgengeneratoren.

Betjeningspult

EKSPONERINGSKONTROL:

TYPE:	PARAMETRE:	PRINCIP:
3 PUNKT:	kV, mA, sek.	Timer og mAs meter.
2 PUNKT:	kV, mAs	mAs kobling.
1 PUNKT:	kV (+sværtningsskorrektion)	Dosis kobling (A.E.C.)
0 PUNKT:	Organprogram (+sv.korr.)	Dosis kobling (A.E.C.)

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Røntgengeneratoren.

Effekt.

EFFEKTEN: er et udtryk for hvor meget energi pr. tidsenhed (Watt=Joule/sek) vi kan trække ud af generatoren.

Effekten beregnes efter formlen:

$$\text{Effekten (kiloWatt)} = \text{Spændingen (kiloVolt)} \times \text{rørstrømmen (Ampere)} \times F$$

hvor:

F= 0,74 for en- eller topuls generatorer.

F= 0,95 for sekspulsgeneratorer

f = 0,98 for tolv- puls apparater

F= 1.0 for pulstal højere end tolv.

F= 1.0 for (DC) kondensatorapparater.

rørstrømmen = (mAs) / (1000 x eksponeringstiden (s))

Røntgengeneratoren.

Nominel effekt.

NOMINEL EFFEKT FOR RØNTGENGENERATOREN/RØNTGENRØRET.

Den nominelle effekt er den højeste elektriske effekt (i kW), som kombinationen generator/røntgenrør kan yde ved en eksponeringstid på 0,1 sek. og en rørspejnding på 100 kiloVolt. (Effekten beregnes for den største focus, der er tilsluttet generatoren).

Eks.:

Philips super 80 CP. Generator med en nominel effekt på 80 kiloWatt yder:

1000 mA ved 80 kV (= 80 kW)

800 mA ved 100 kV (= 80 kW)

630 mA ved 125 kV (= 79 kW?)

500 mA ved 150 kV (= 75 kW?)

Røntgengeneratoren.

Focal Spot Size and Typical Power Rating

Nominal X-ray Tube Focal Spot Size (mm)	Typical Power Rating (kW)
1.2–1.5	80–125
0.8–1.0	50–80
0.5–0.8	40–60
0.3–0.5	10–30
0.1–0.3	1–10
<0.1 (micro-focus tube)	<1

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Røntgengeneratoren.

Microprocessor-controlled high-frequency
X-ray generators of converter design

Output

SUPER 50 CP

630 mA at 80 kV
500 mA at 100 kV
400 mA at 125 kV
320 mA at 150 kV
Nominal power 50 kW
IEC (601-2-7/1987)

SUPER 80 CP

1000 mA at 80 kV
800 mA at 100 kV
630 mA at 125 kV
500 mA at 150 kV
Nominal power 80 kW
IEC (601-2-7/1987)

SUPER 100 CP

1000 mA at 100 kV
800 mA at 125 kV
630 mA at 150 kV
Nominal power 100 kW
IEC (601-2-7/1987)

Automatic load control

AMPLIMAT automatic exposure control
with continuous Falling Load or fixed current
Programmed exposure technique APRT
with multiprogramming
Free settings: 1-, 2- or 3-factor technique
Tube connection for 3 double-focus tubes

Thyristor timer

Quartz-controlled, minimum switching
time 1 msec.

Voltage ranges

40 kV to 150 kV for radiography
40 kV to 110 kV for fluoroscopy

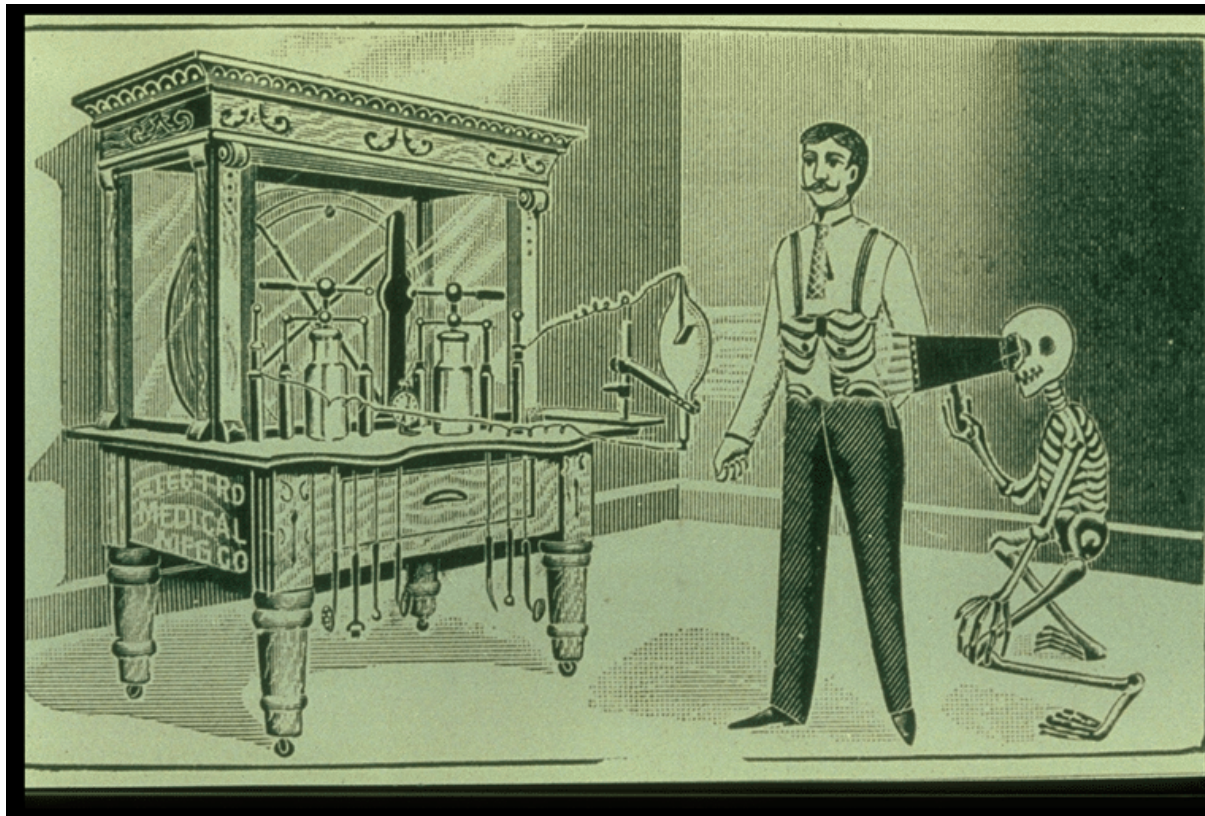
Mains compensation and connection

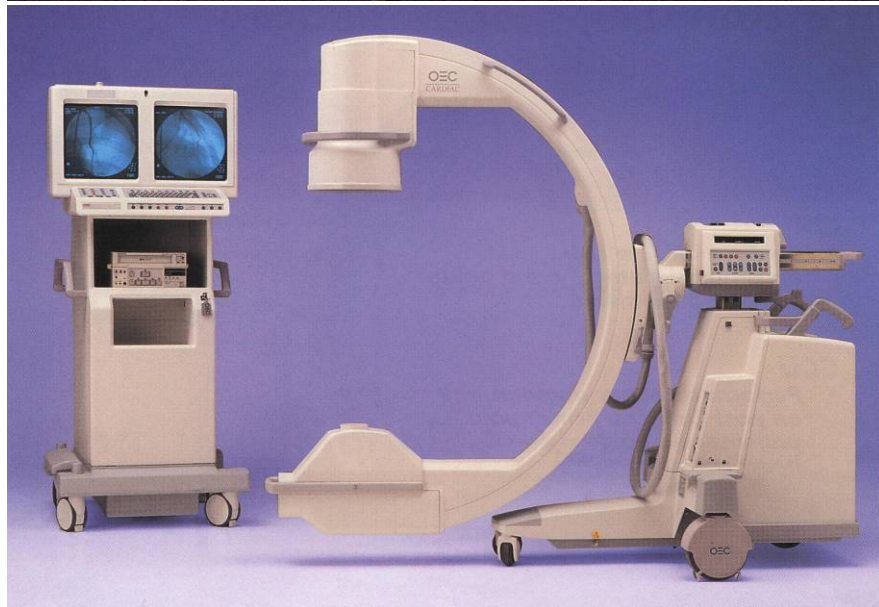
Automatic mains compensation.
3-phase connection 380 V/440 V/480 V,
50 or 60 Hz

Options

- Data display on TV monitor together
with fluoroscopic image
- Computer-corrected exposure
parameters derived from fluoroscopic
data
- Data printer for print out of
exposure parameters and area dose
product
- Automatic exposure control for
tomography
- CINEPULSE CP 1000
- Interface for universal and
peripheral angiography

Billedforstærker





Systemer

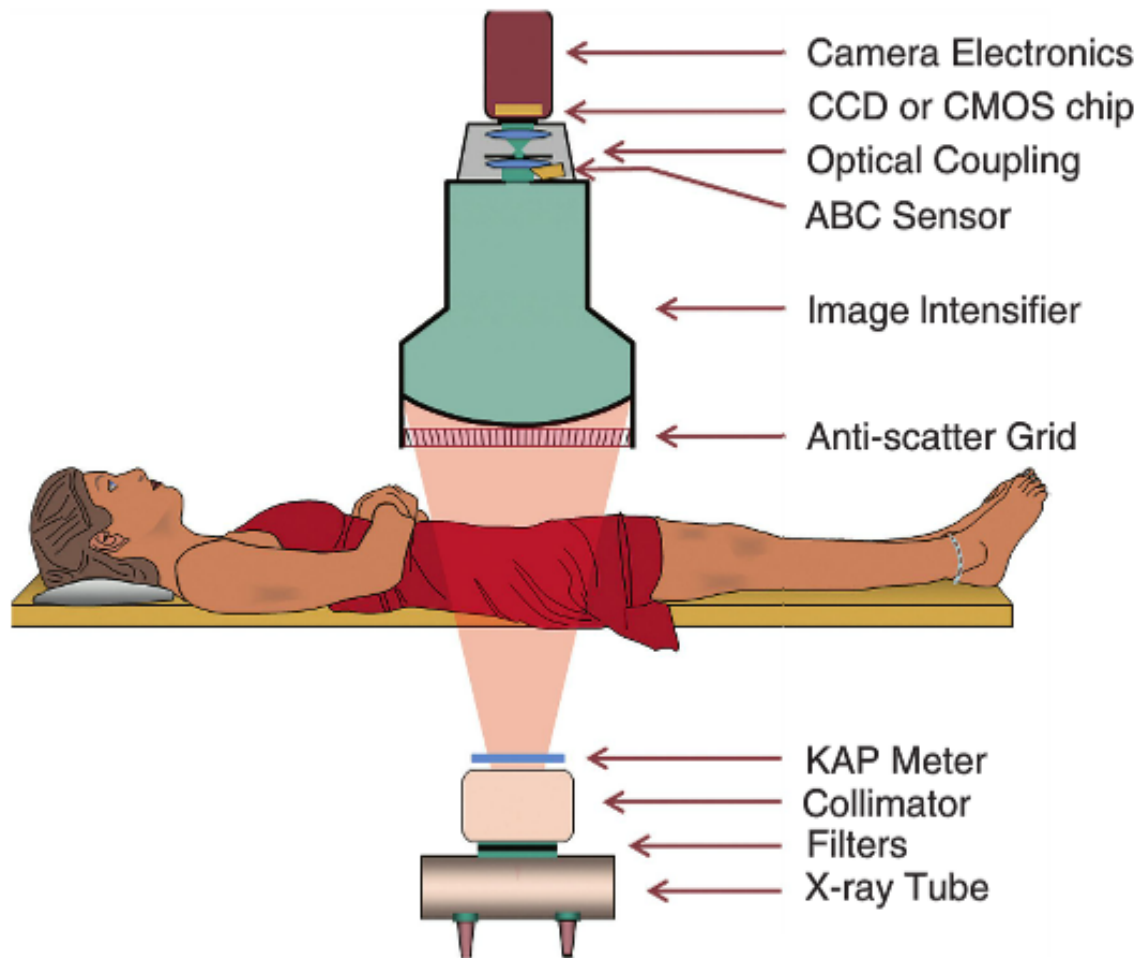


Forskellige gennemlysningsmodaliteter

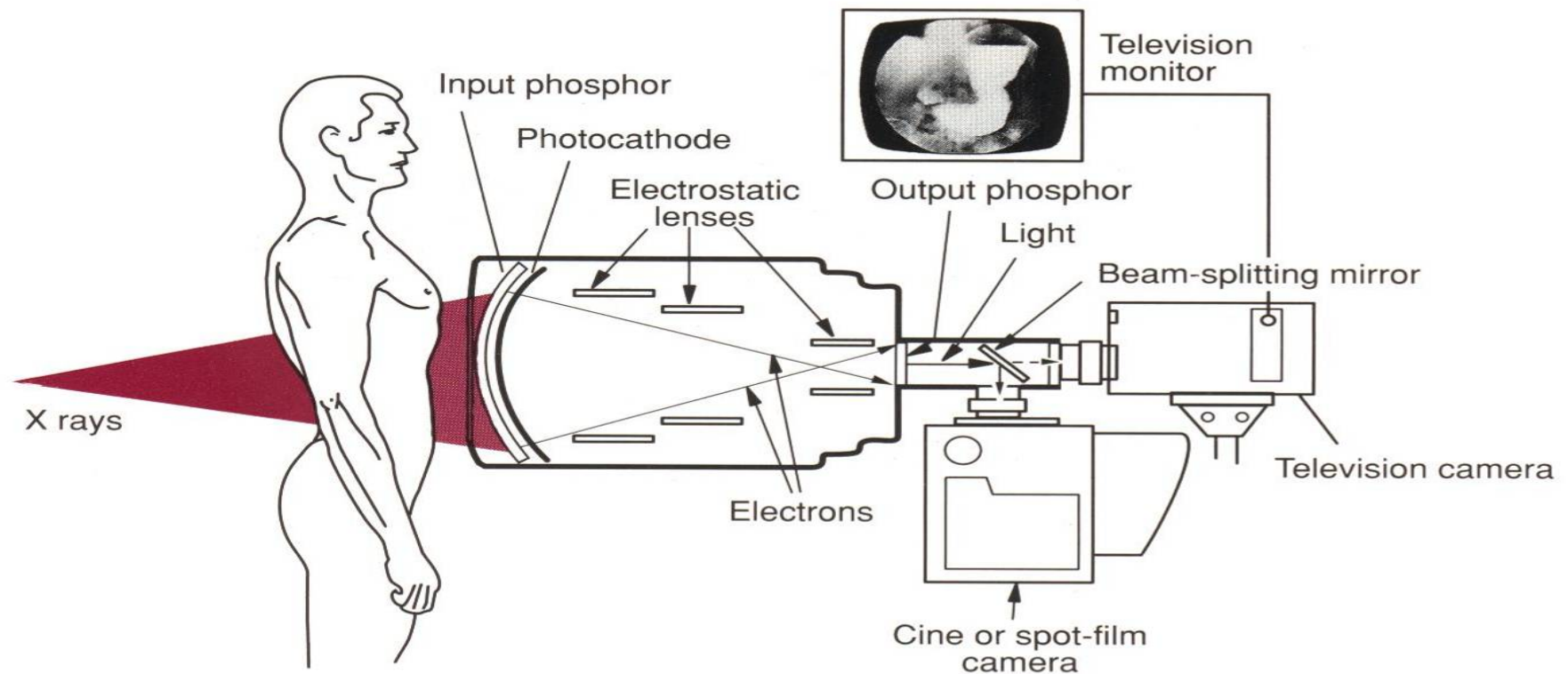
- Spot (enkelt billede)
- Kino
- Angiografi
- Rotations Angiografi (3D)
- DSA (Digital Subtraction Angiografi)
- Tomografi

37

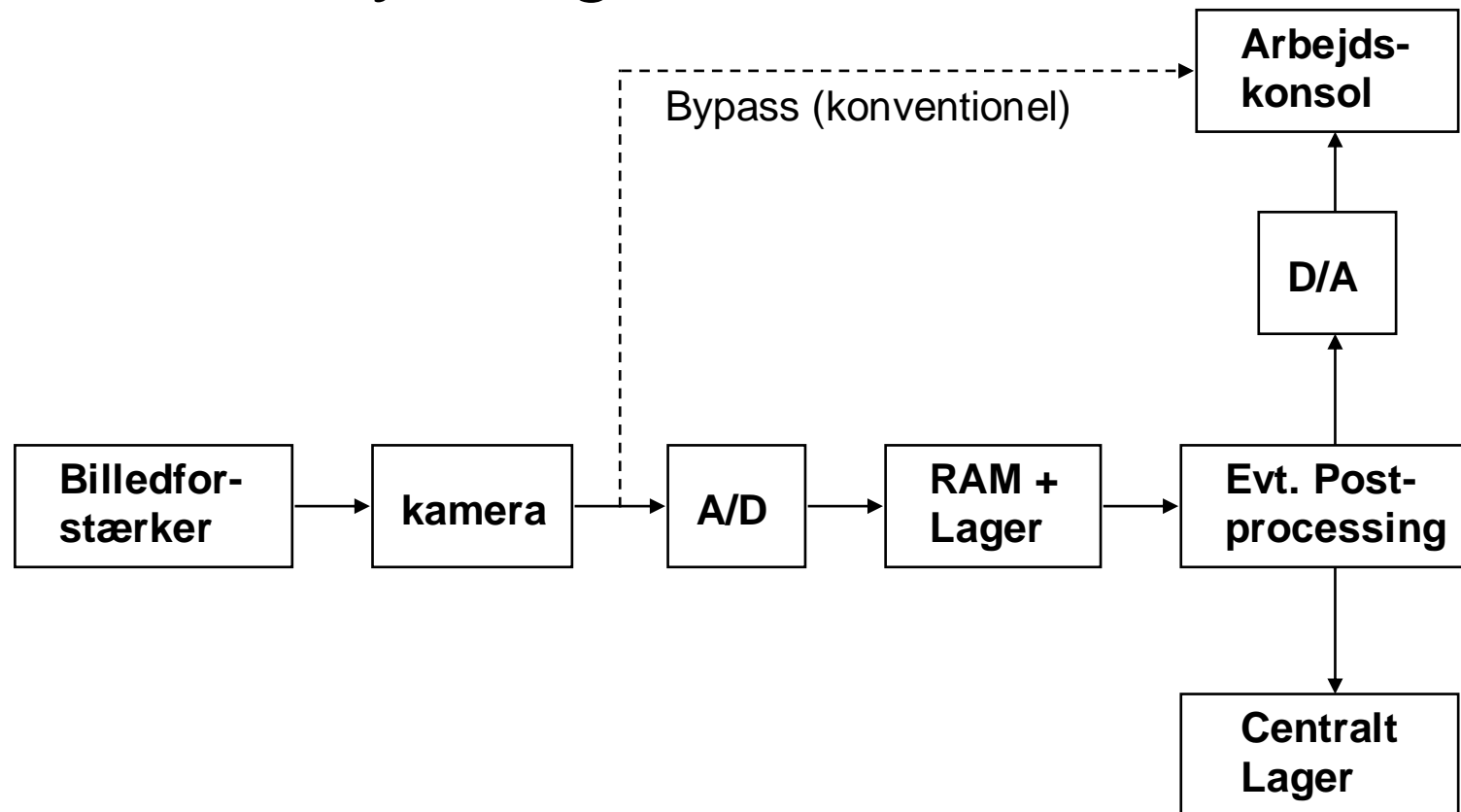
Billedforstærker-system



Billedforstærker-system

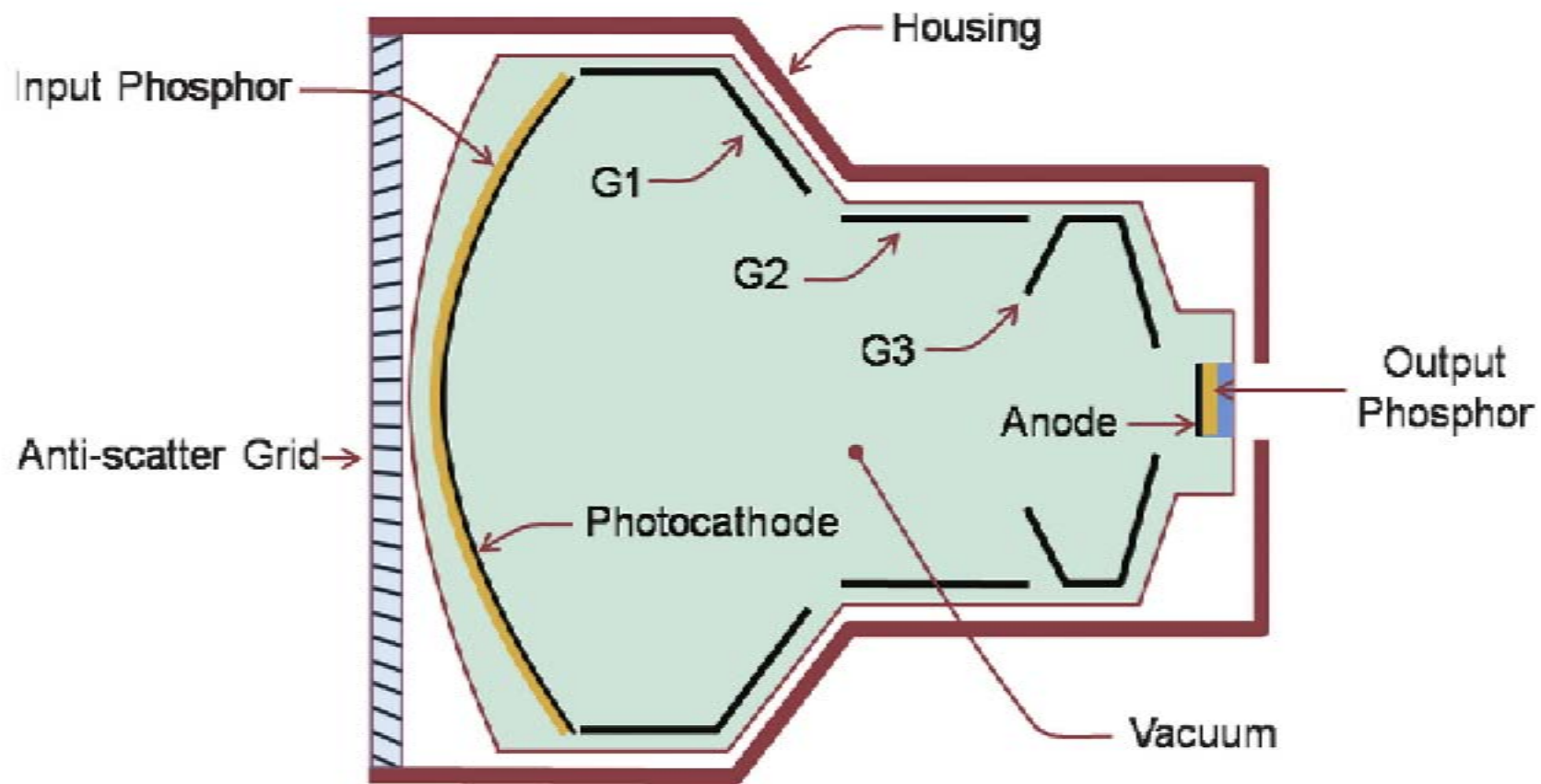


Gennemlysning



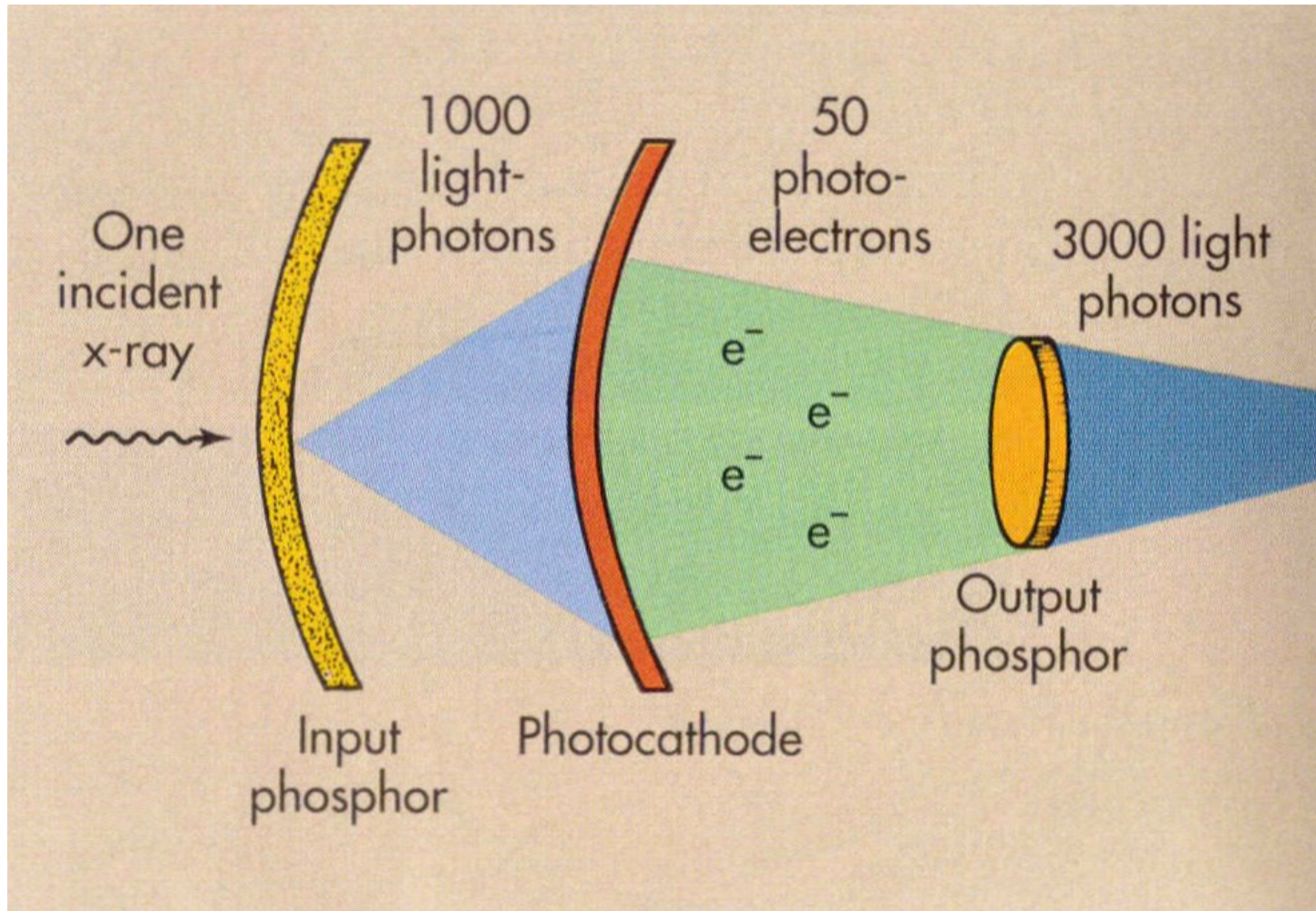
40

Billedforstærker

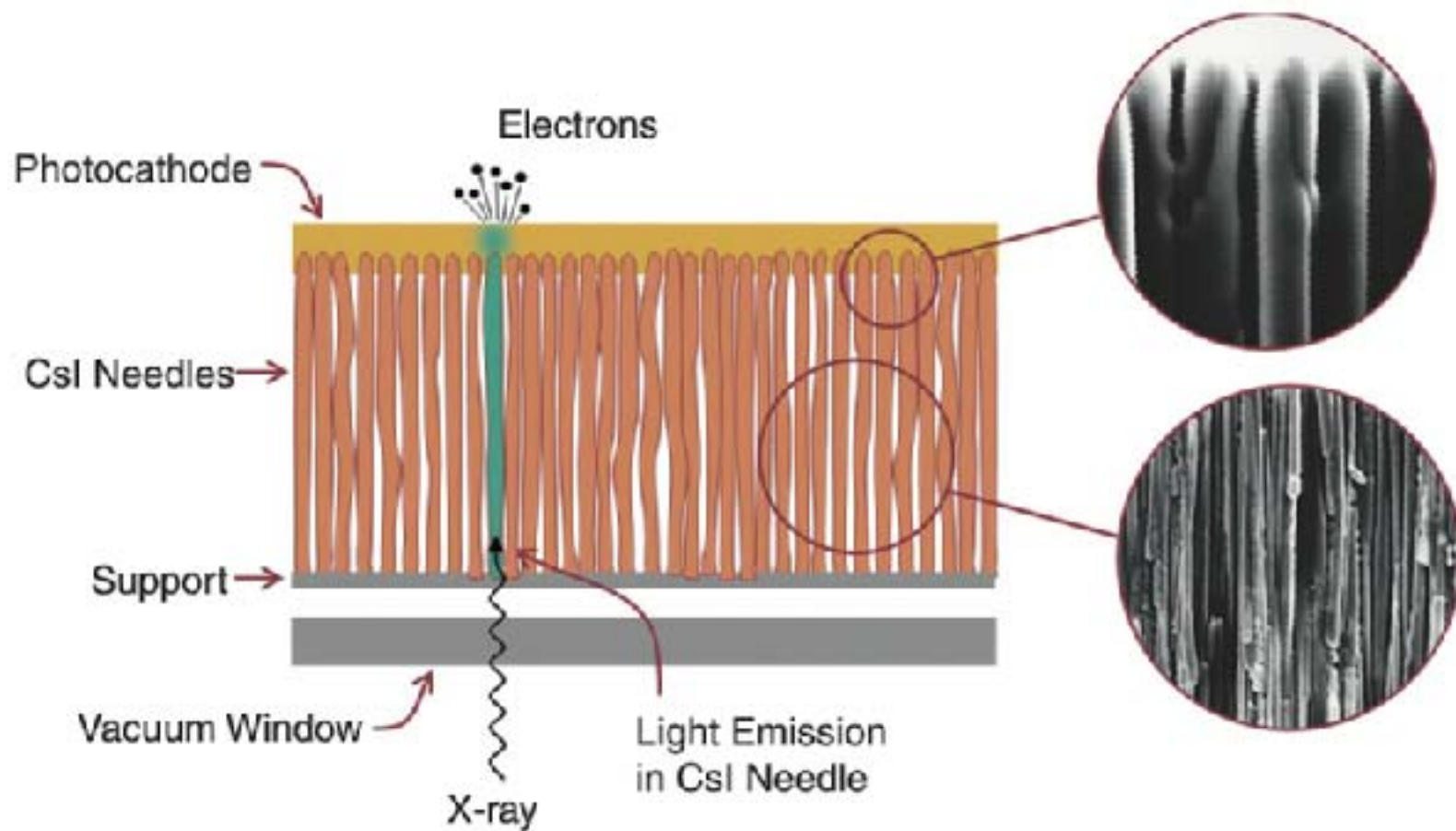


41

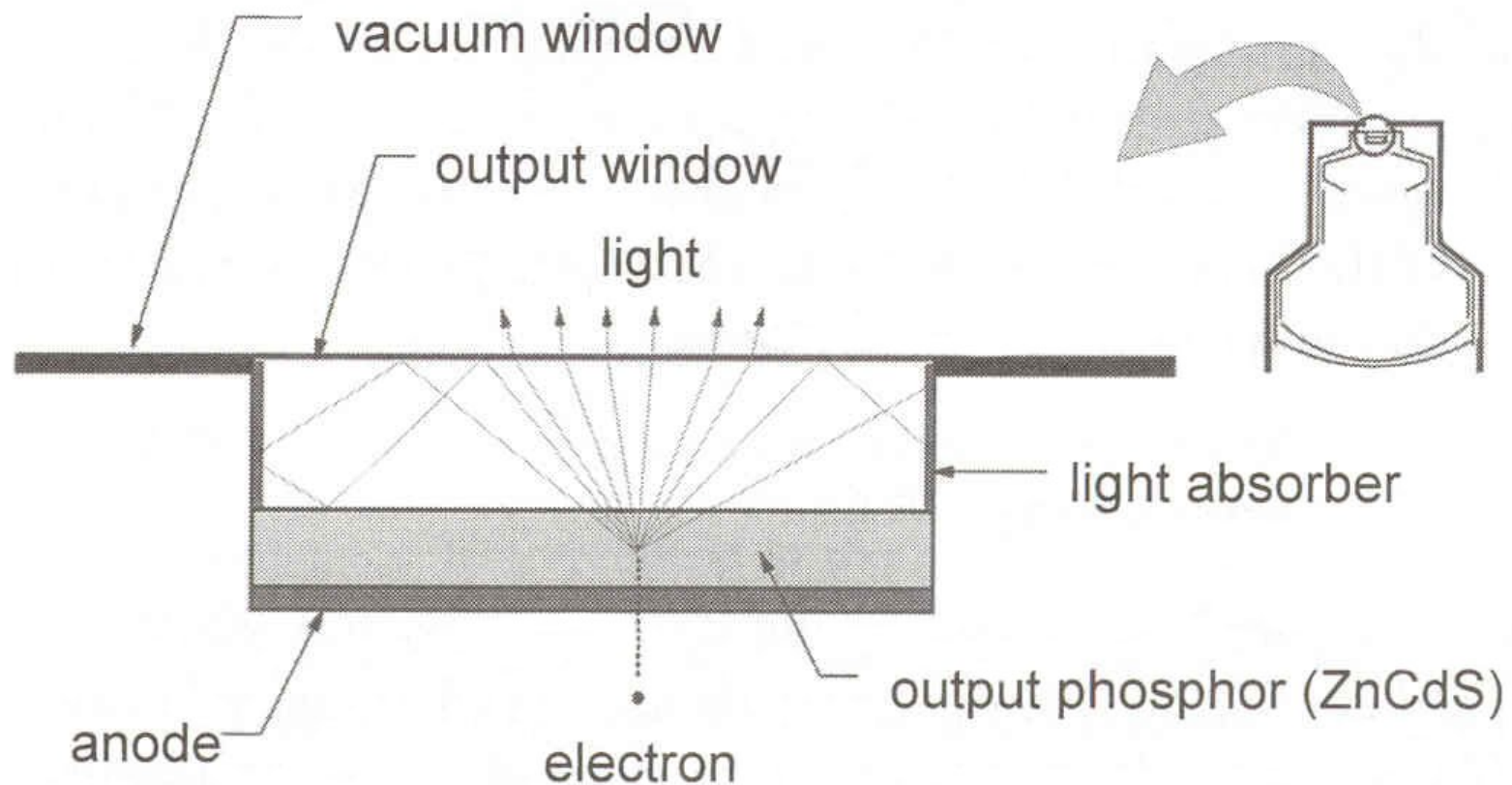
Billedforstærker



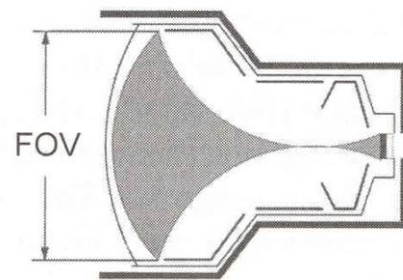
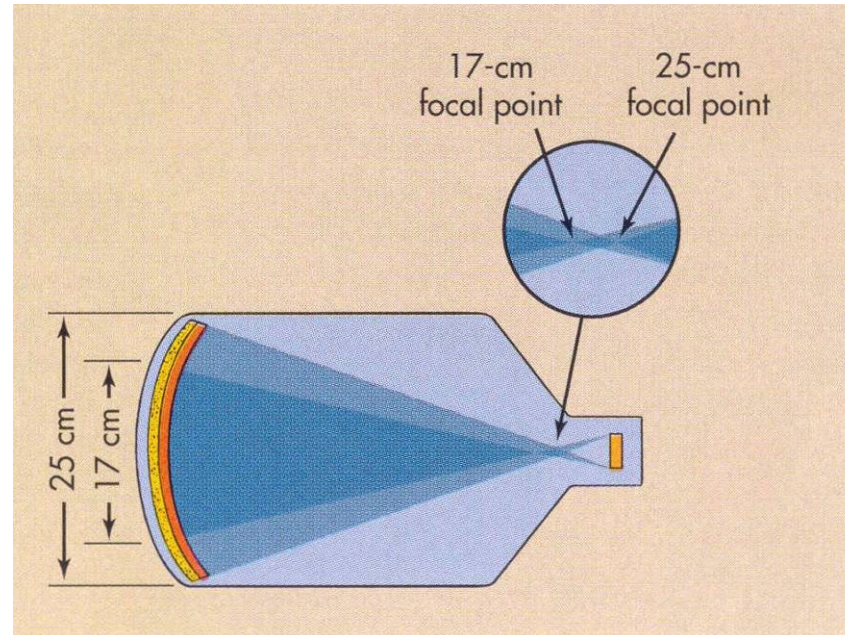
Input phosphor



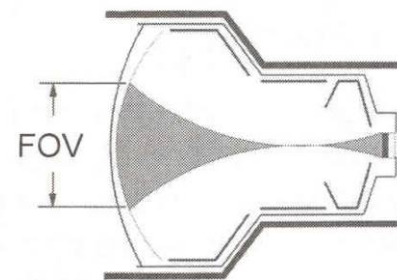
Output phosphor



Forstørrelse

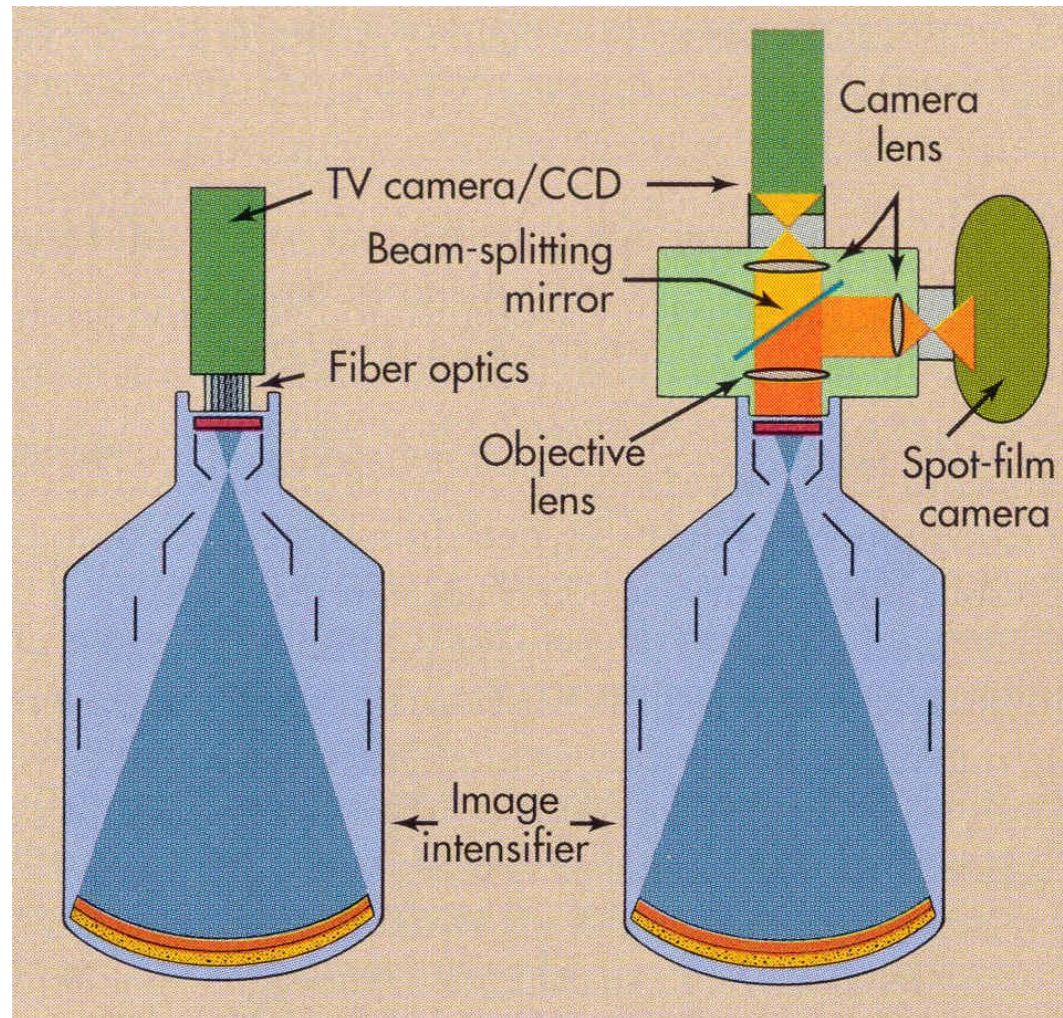


Normal Operation

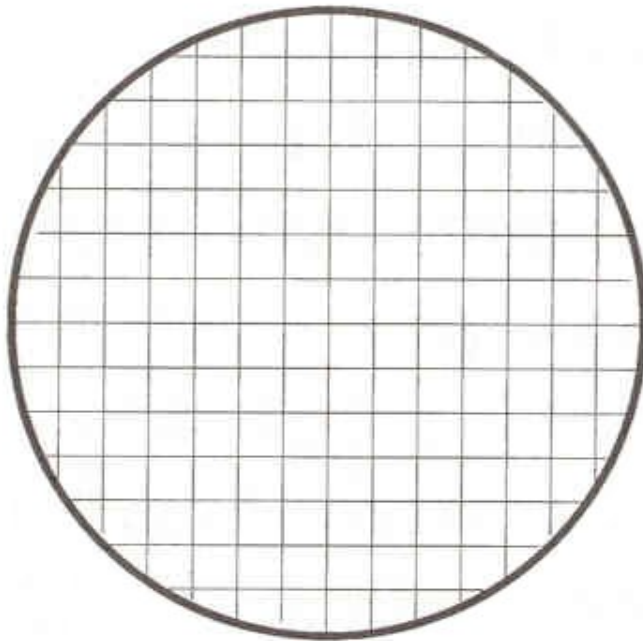


Magnification Mode

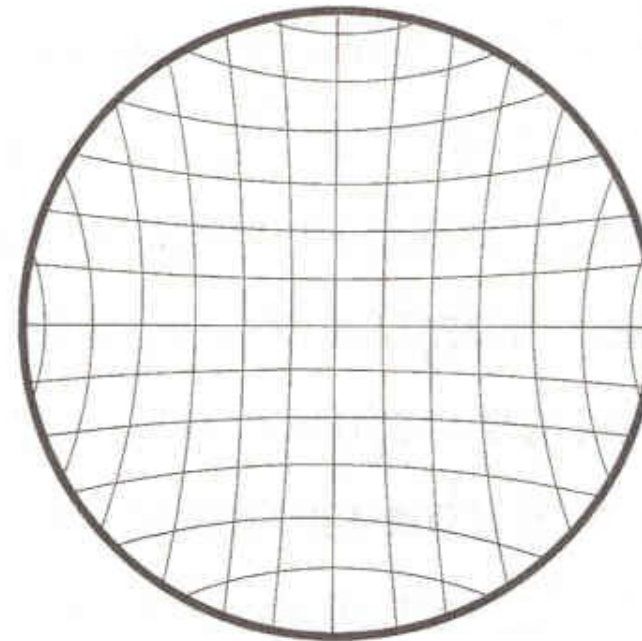
Billedforstærker



Forvrængning

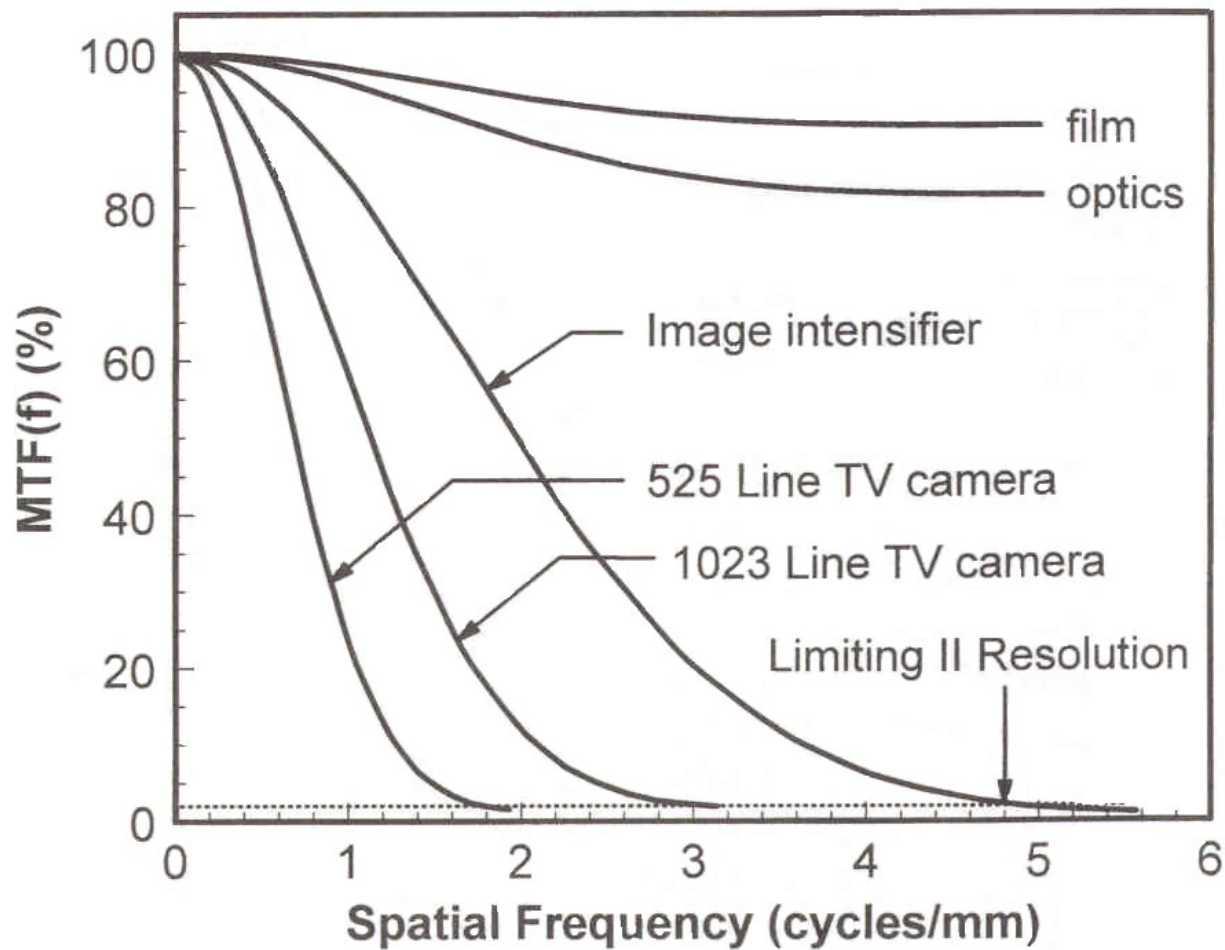


input image



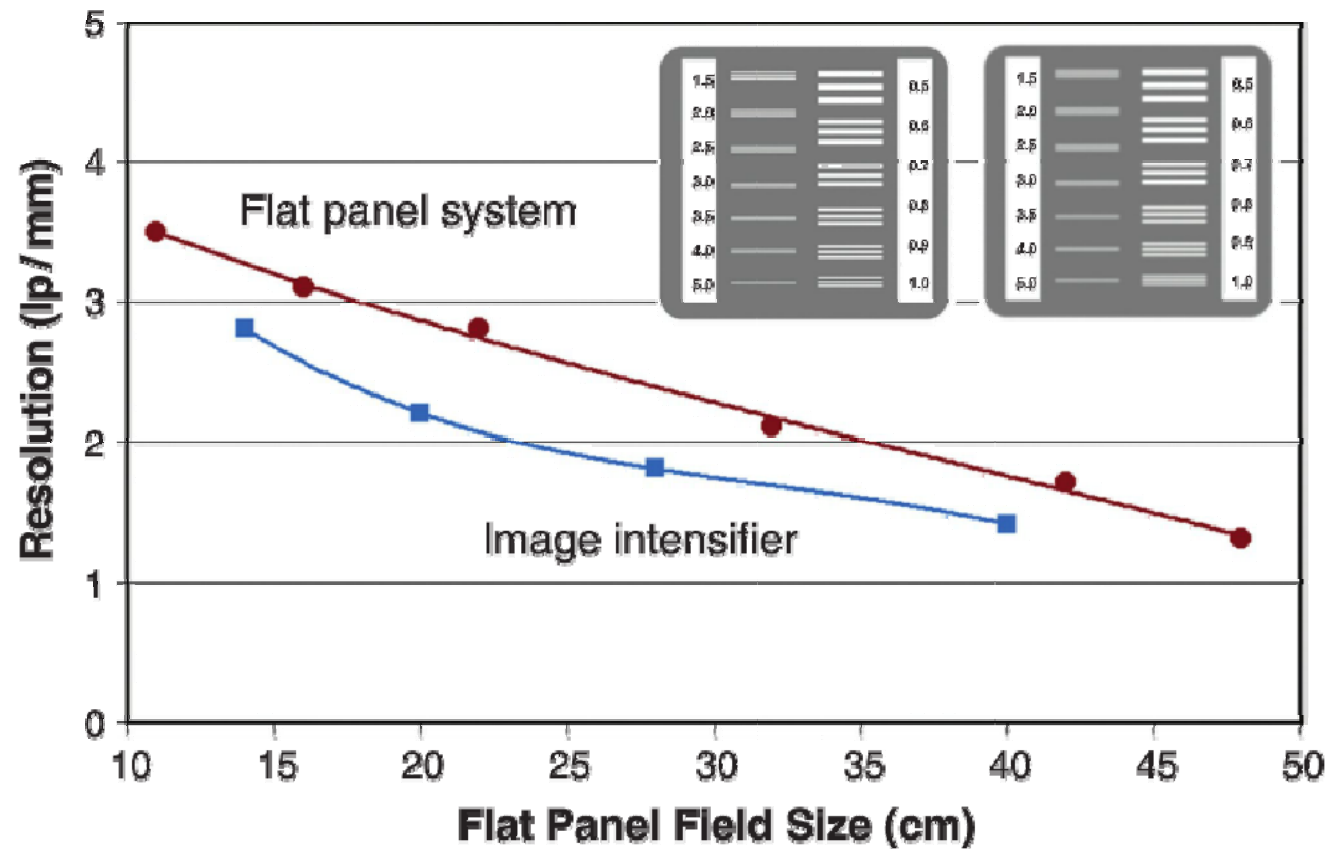
output image

Opløsning (23 cm billedforstærker)

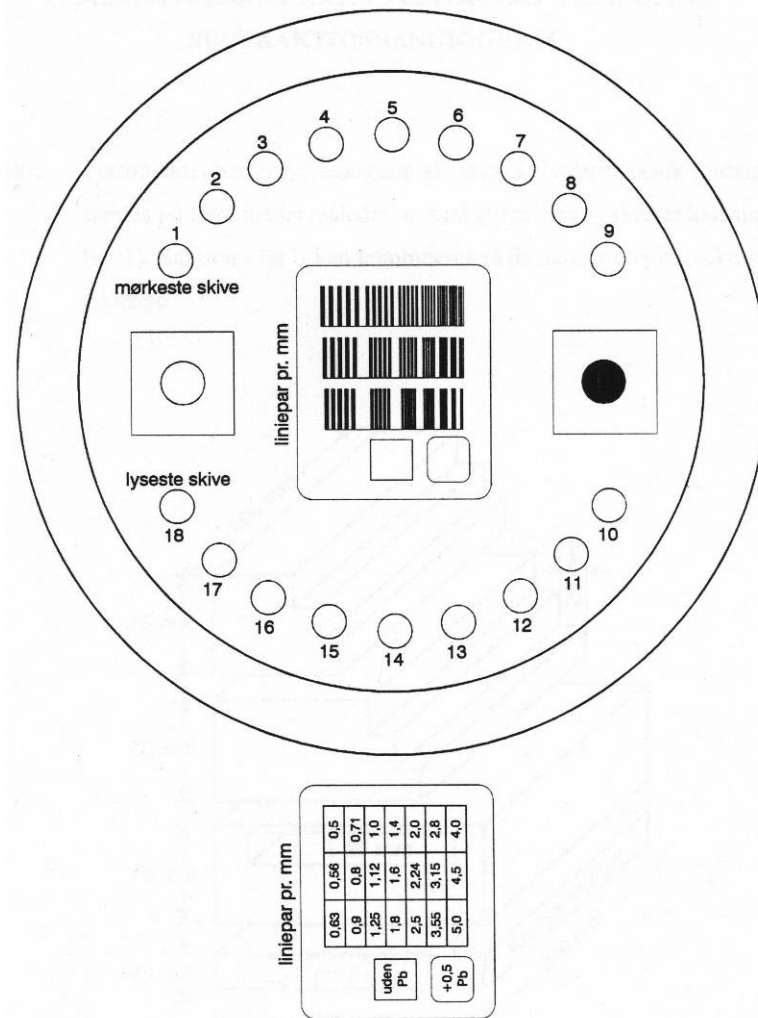


Opløsning

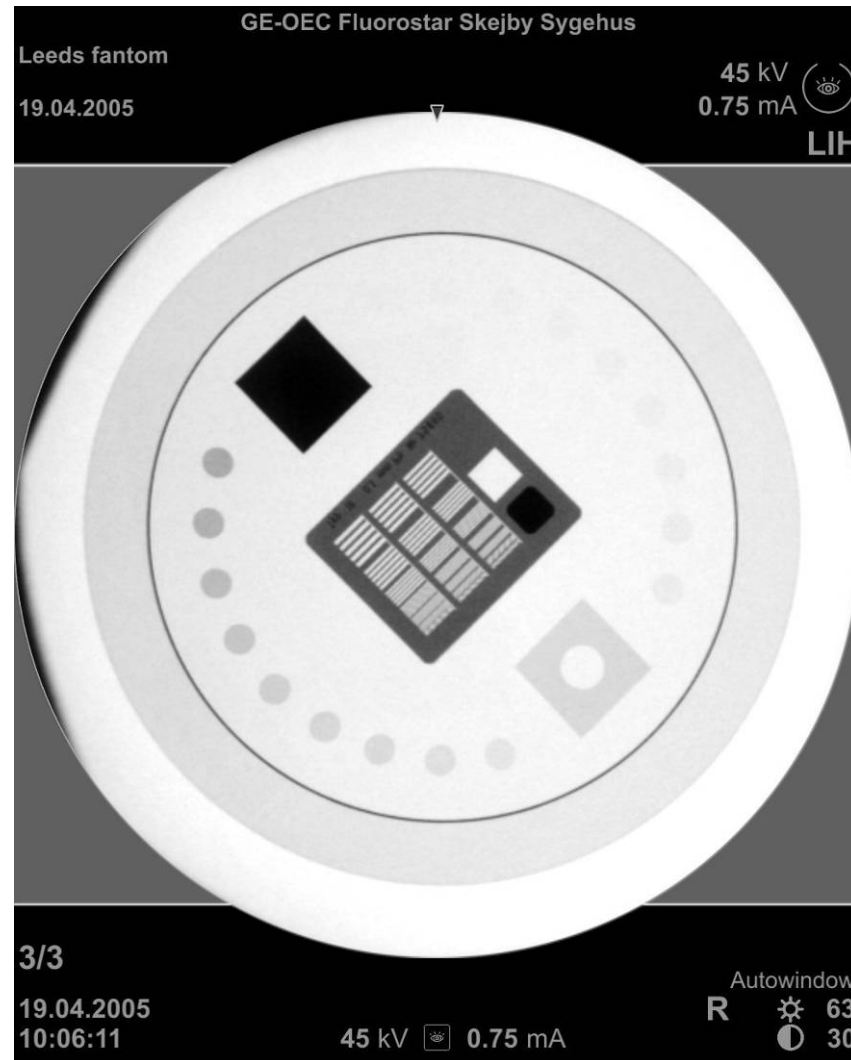
Billedforstærker vs. Flat panel



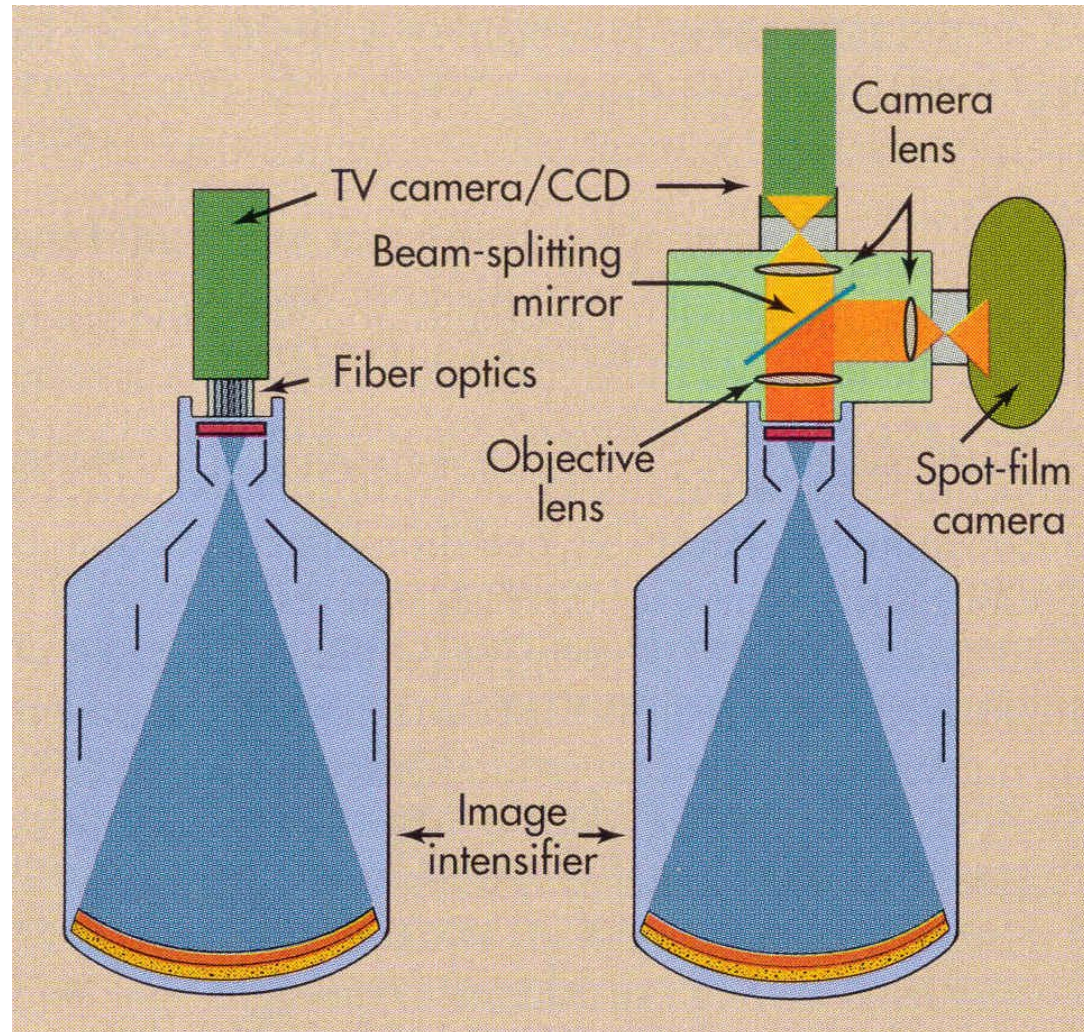
Leeds fantom



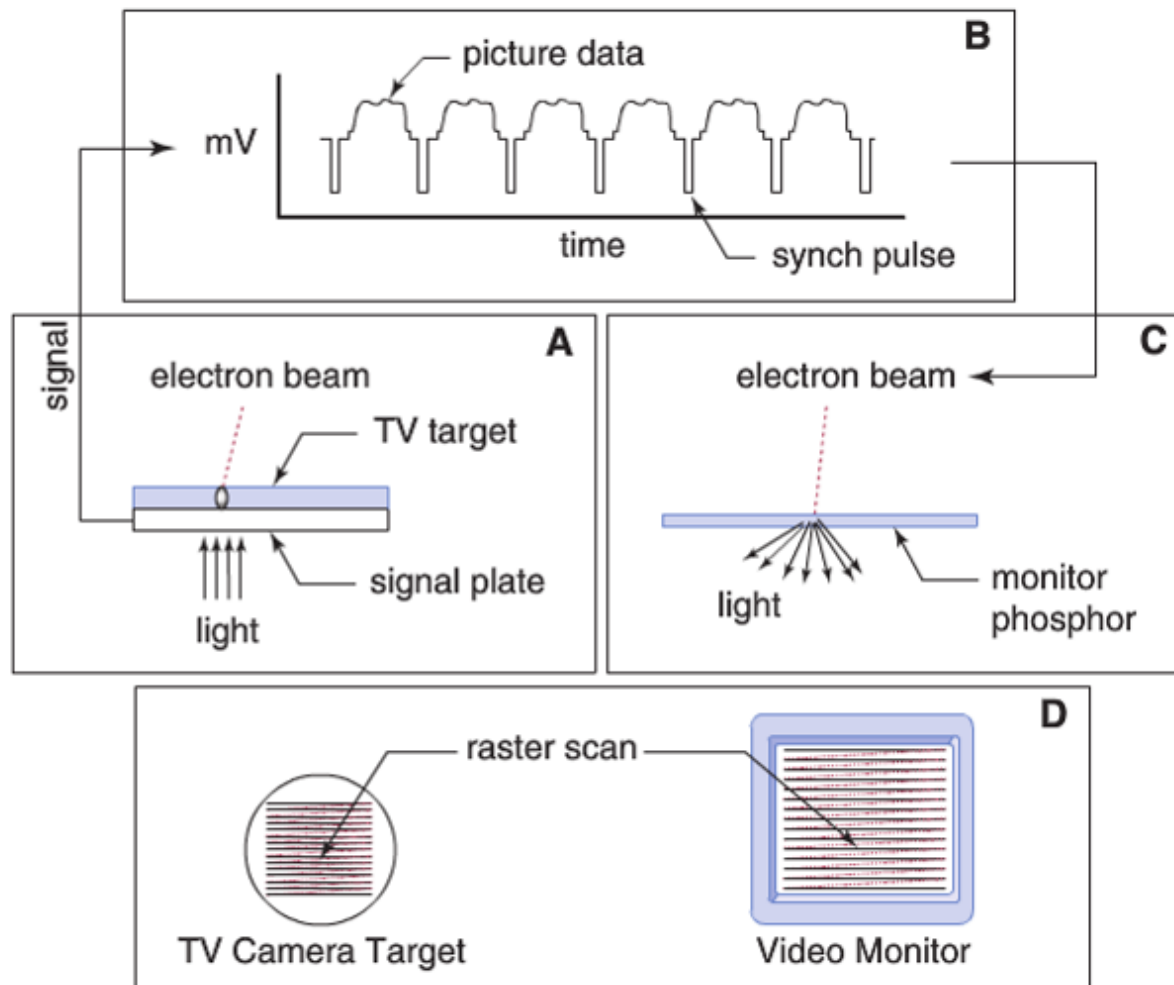
Leeds Fantom



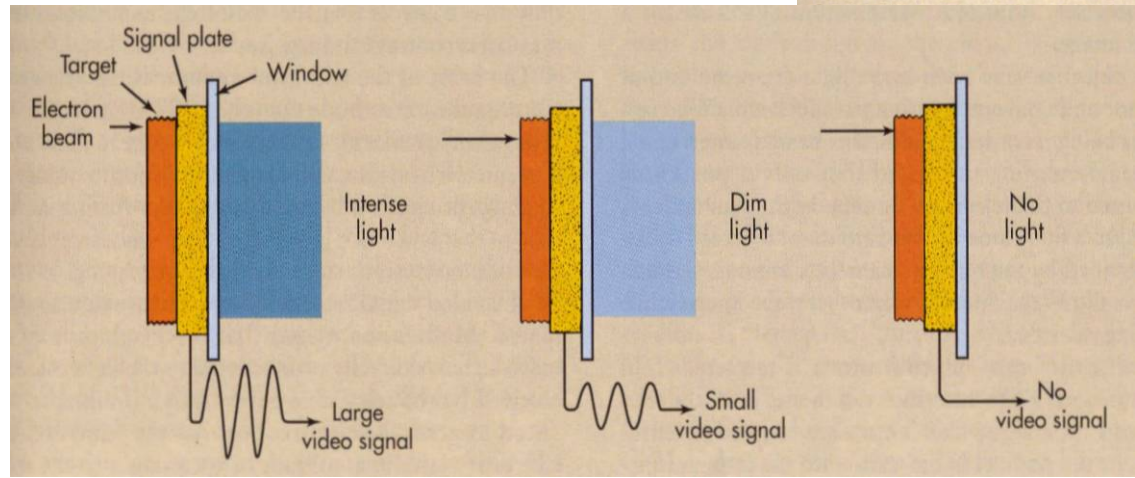
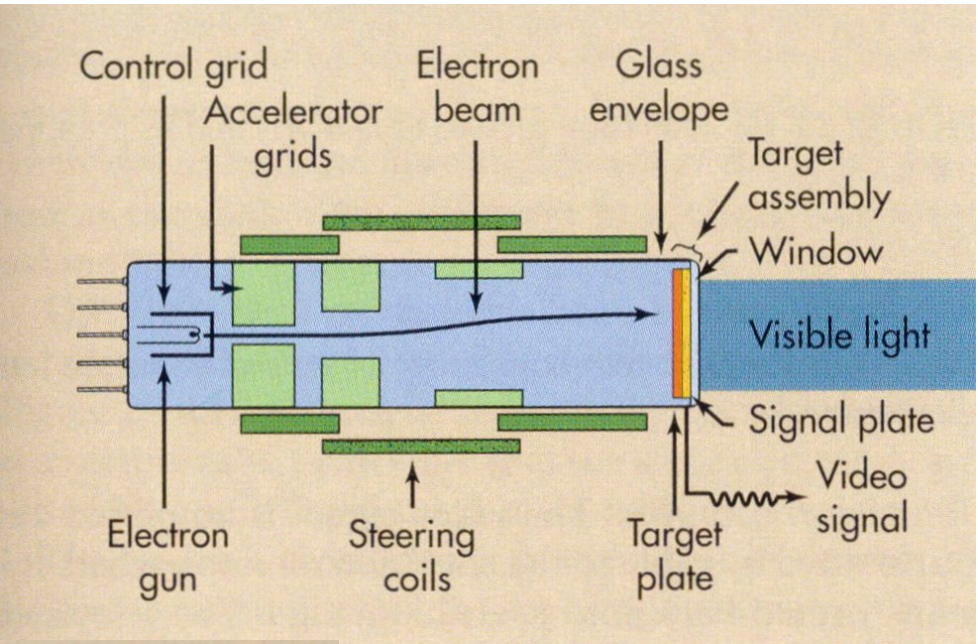
TV-kæde



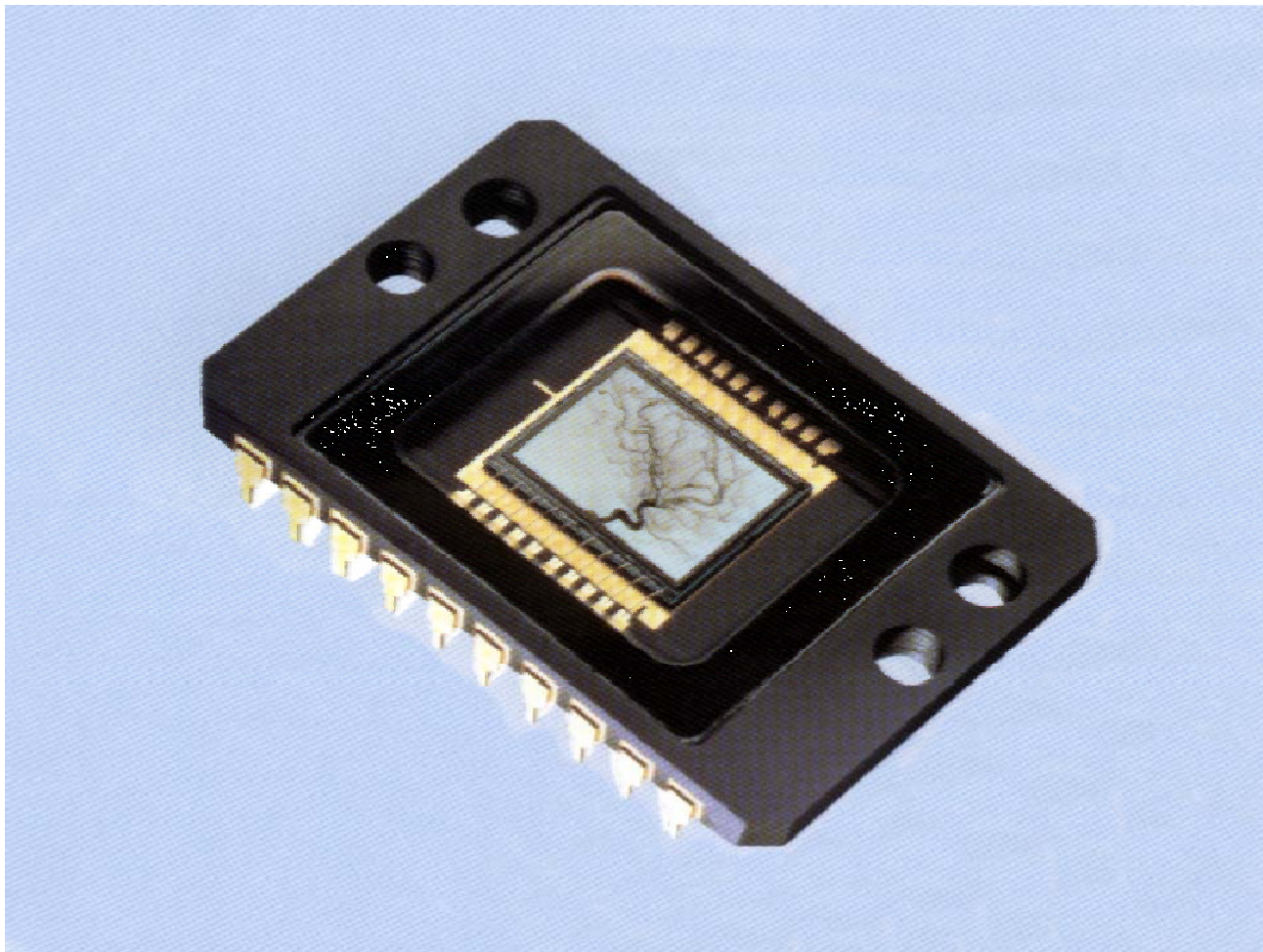
TV-system



Kamerarør



CCD-kamera

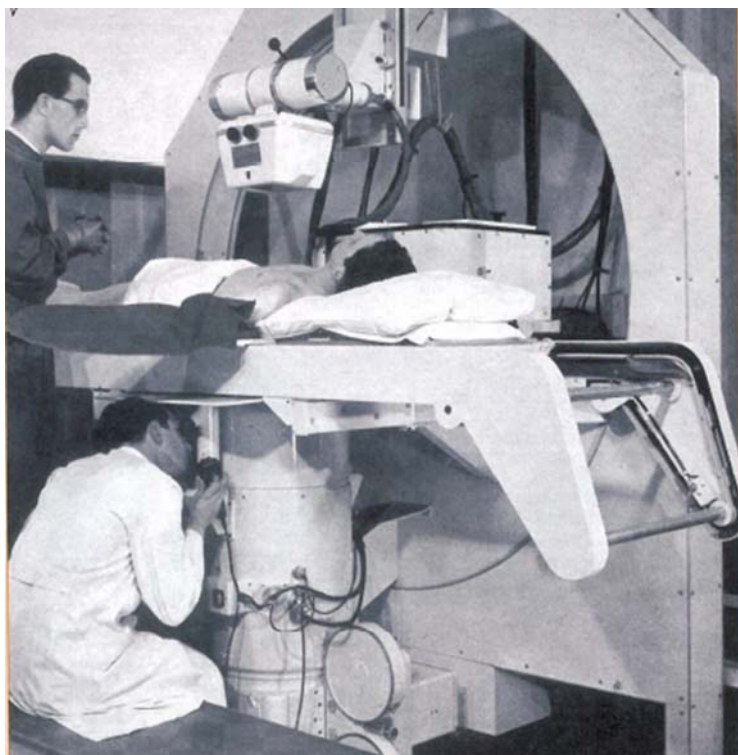


Hvad dækker DR over ?

- **Digital Radiologi** er mange ting.
 - DR – **D**igitale **R**eceptorer (eksponering og gennemlysning)
 - CR – **C**omputed **R**adiography
 - Digitalt gennemlysning – DSA (**D**igitalt **S**ubtraktions **A**ngiografi)
 - CT-skanner - **C**omputed **T**omography
 - MR(I)-skanner - **M**agnetisk **R**esonance **I**maging
 - Ultralyd

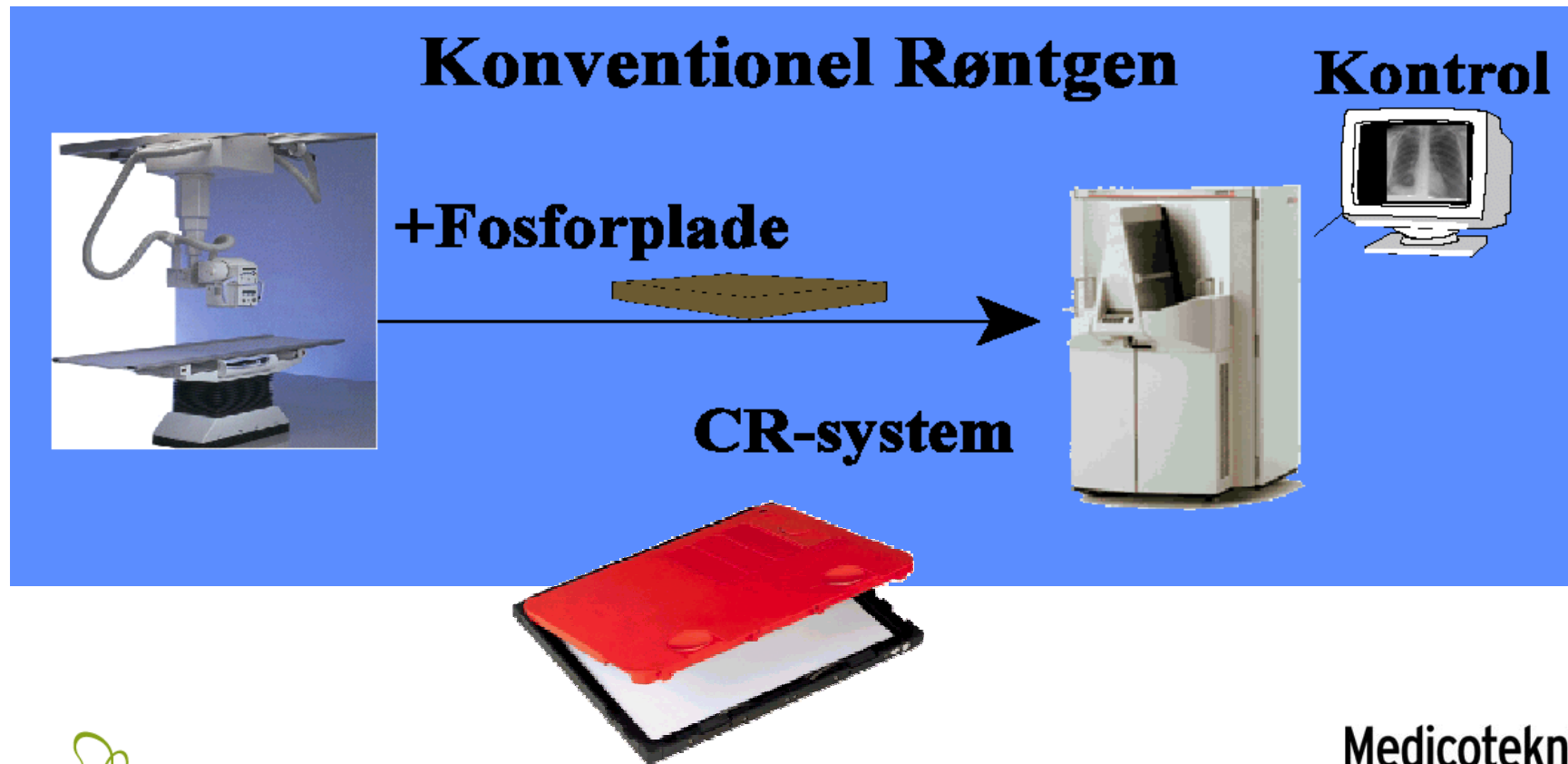
56

De forskellige teknikker.....

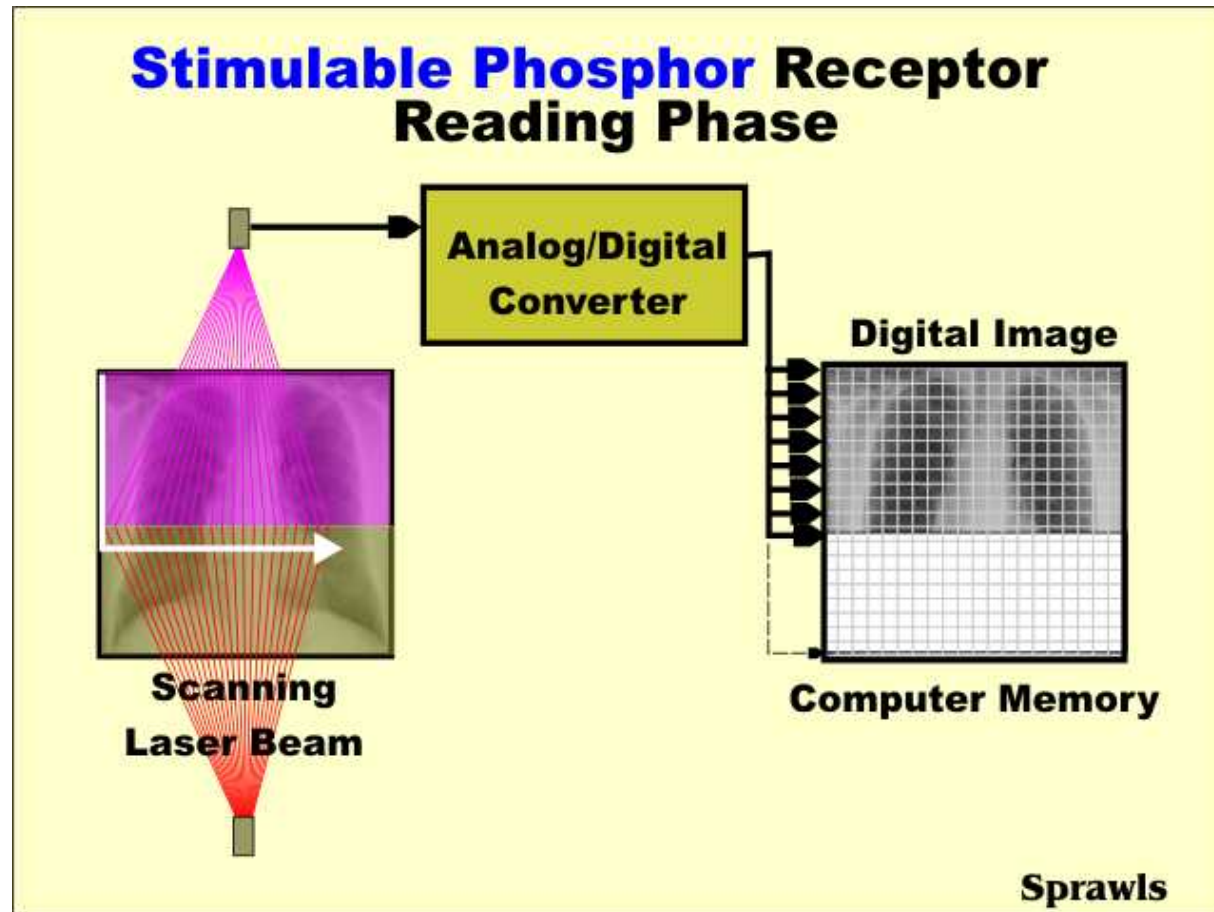


DR"State of the art".....

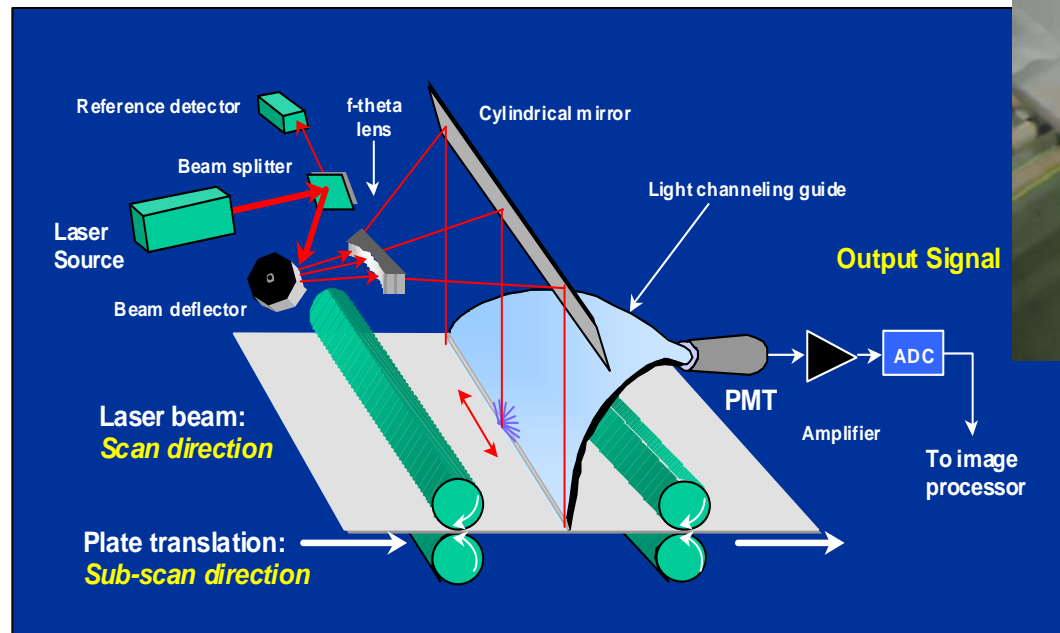
CR system



CR system



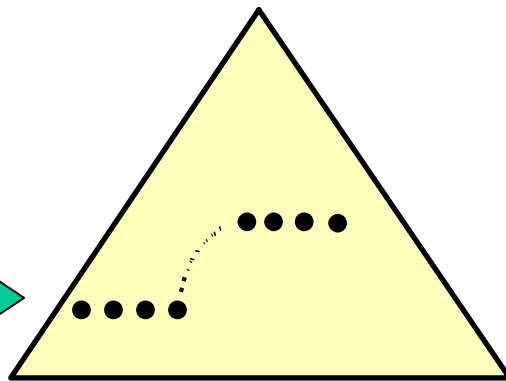
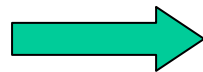
Aflæsning af en CR plade



Hvordan gemmes røntgenbilledet på CR-pladen ?

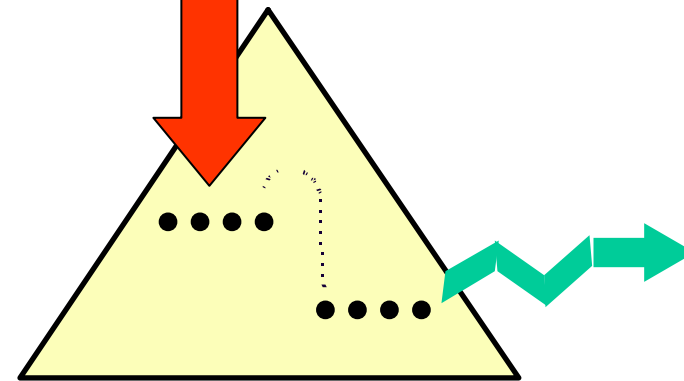
Absorption

X-ray

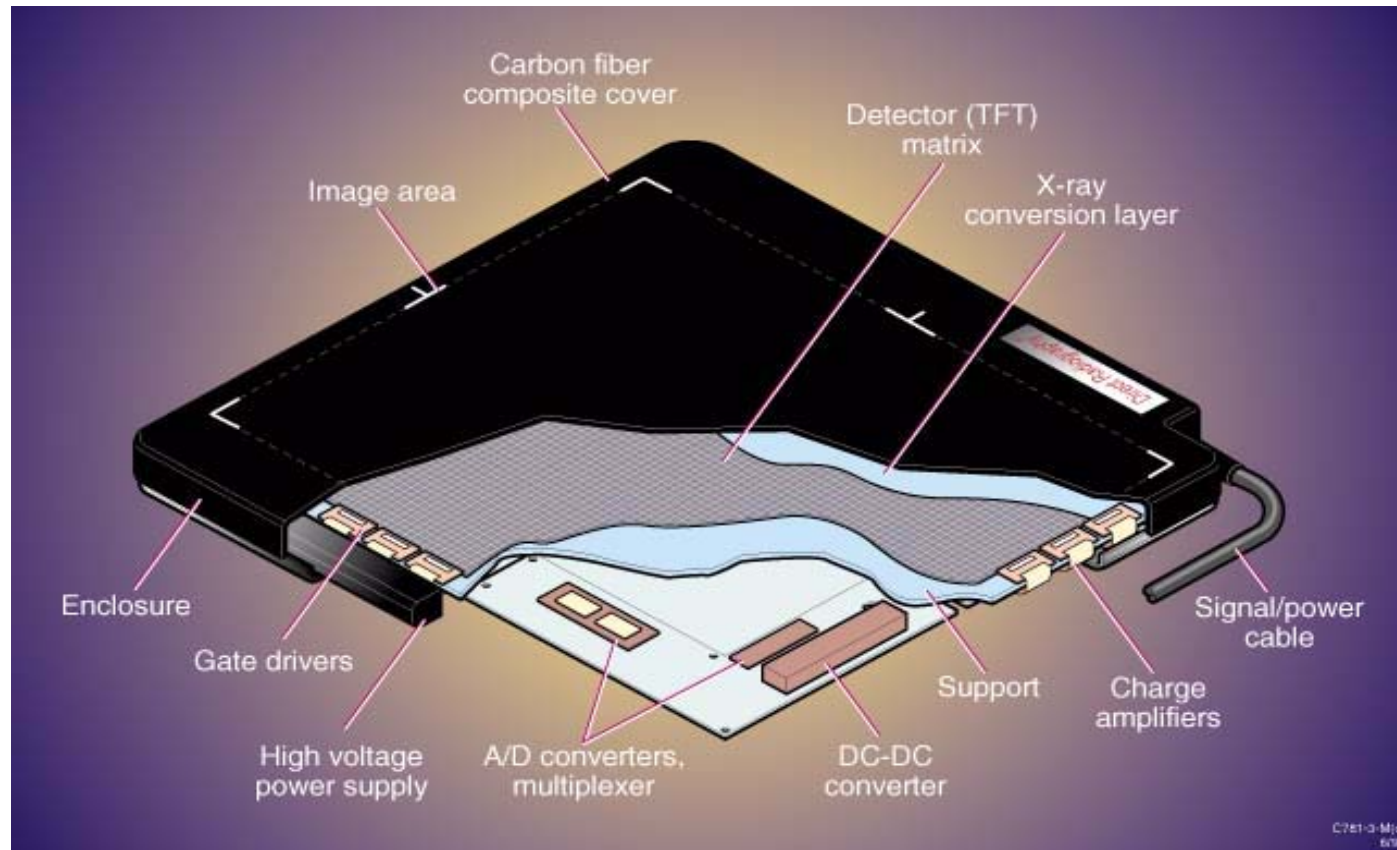


Udstråling

laser stimulation



DR



DR



flat panel array detector

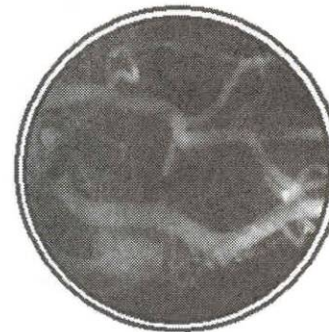
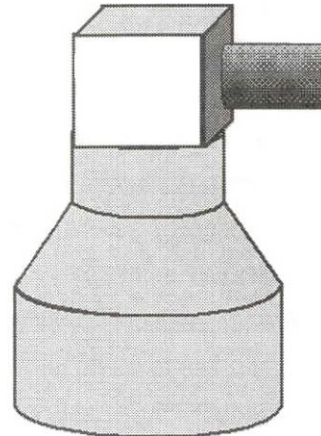


image intensifier

Digitale Receptorer

➤ Digitale receptorer

røntgenstråling → lys → CCD → elektrisk signal

→ elektrisk signal (**det mest anvendte**)

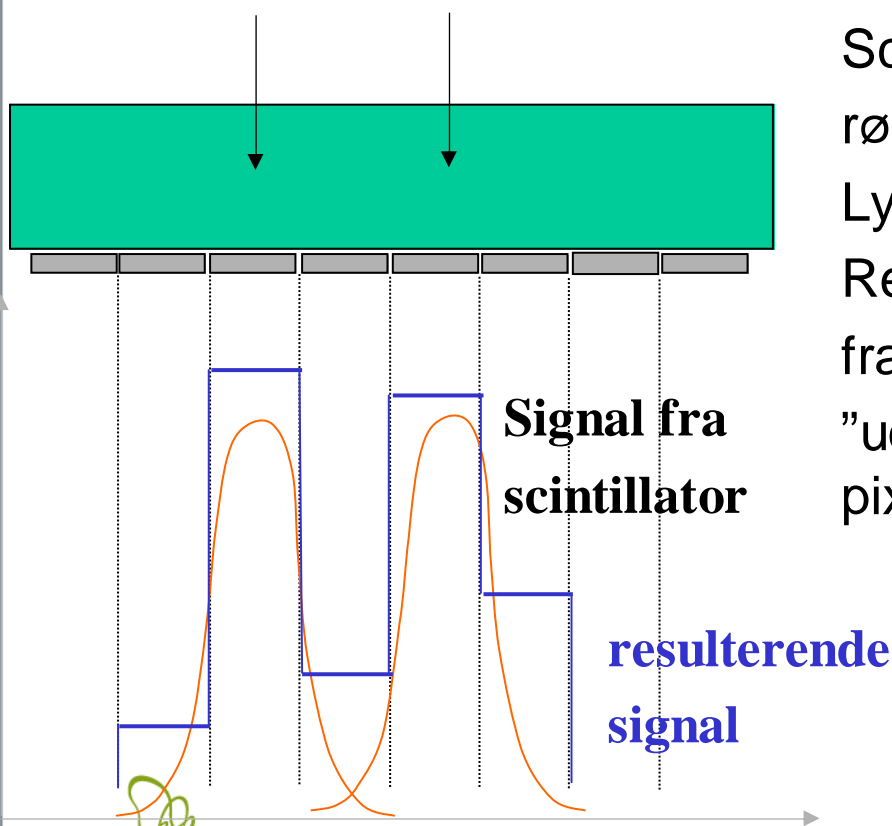
røntgenstråling → elektrisk signal ("**direkte røntgen**")

64

Digital receptor teknologi

DR – teknologier: a-Si + scintillator

røntgenfotoner



Scintillatoren konverterer røntgen til lys.

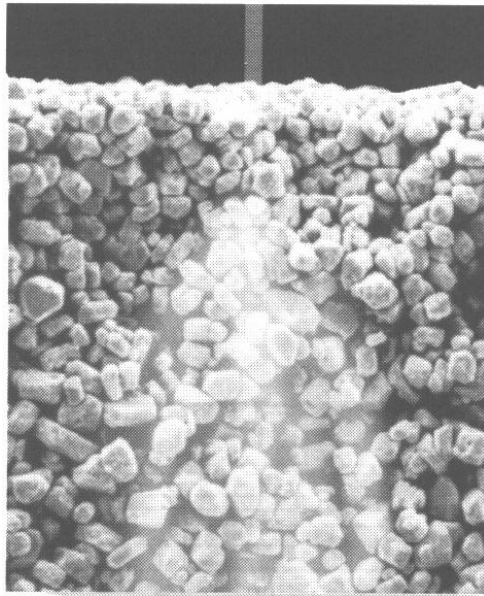
Lyset detekteres i fotodioden (a-Si).

Resultat: Høj konverteringsgrad fra røntgen til signal, men også en "udtværing" af det reelle signal over flere pixels.

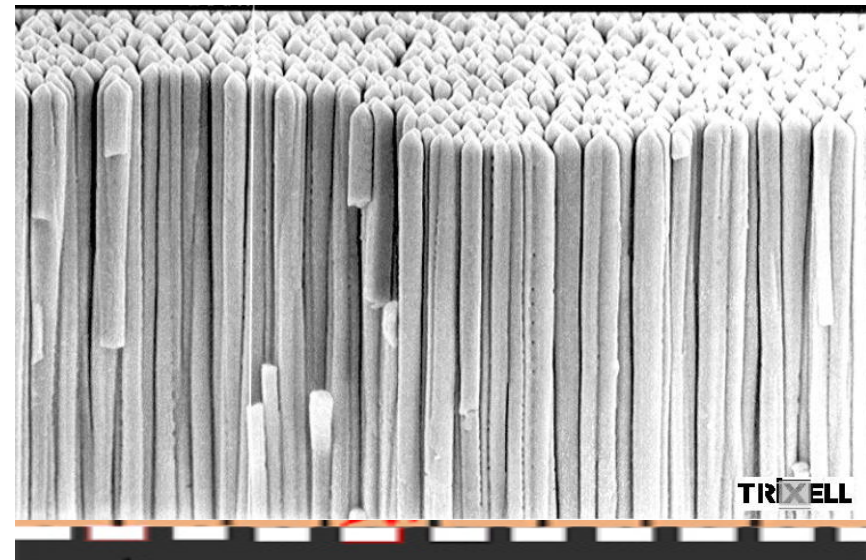
65

Krystallerne i DR

GOS
(powder phosphor)



CsI
(needle phosphor)



Indirekte Flat Panel detektorer

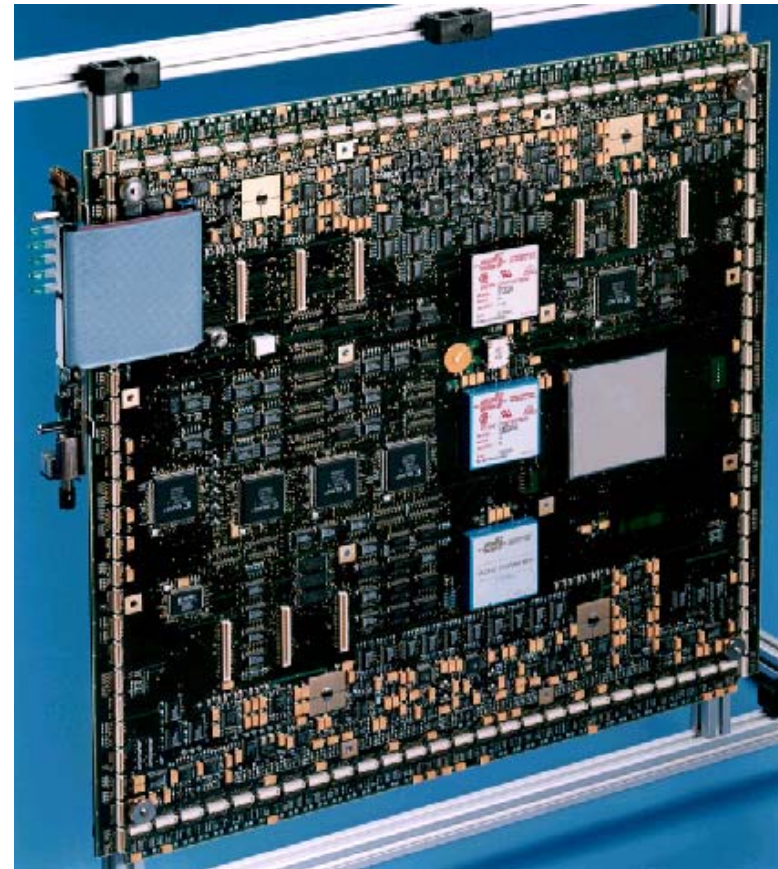
- Benyttes af
 - Trixell (Philips og Siemens)
 - Canon (Santax)
 - GE
 - Ziehm (mobil gennemlysning – Santax)

Trixell (Philips/Siemens)



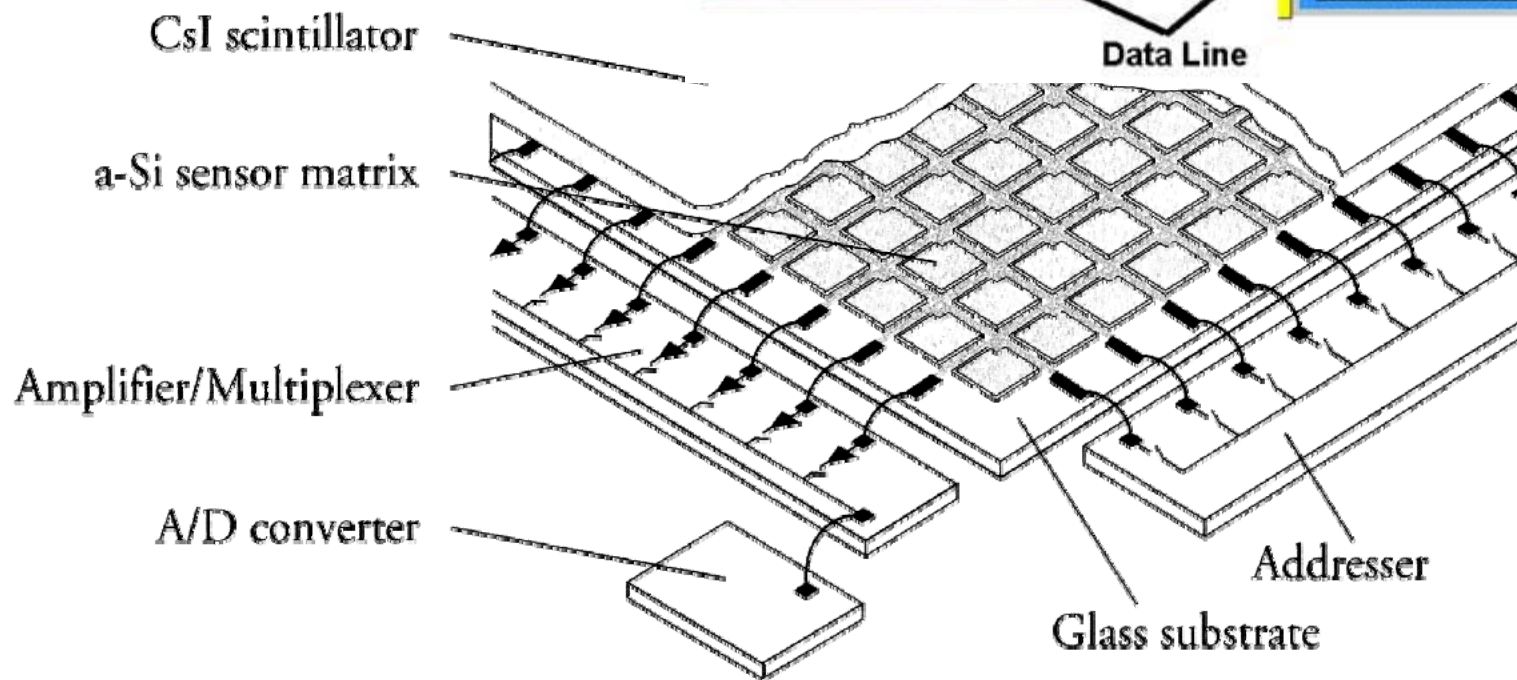
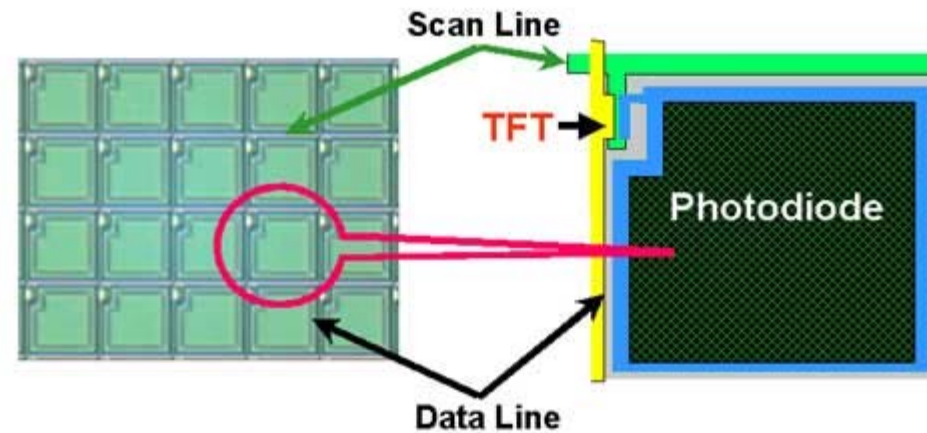
Region Syddanmark

30-09-2013



Region Syddanmark

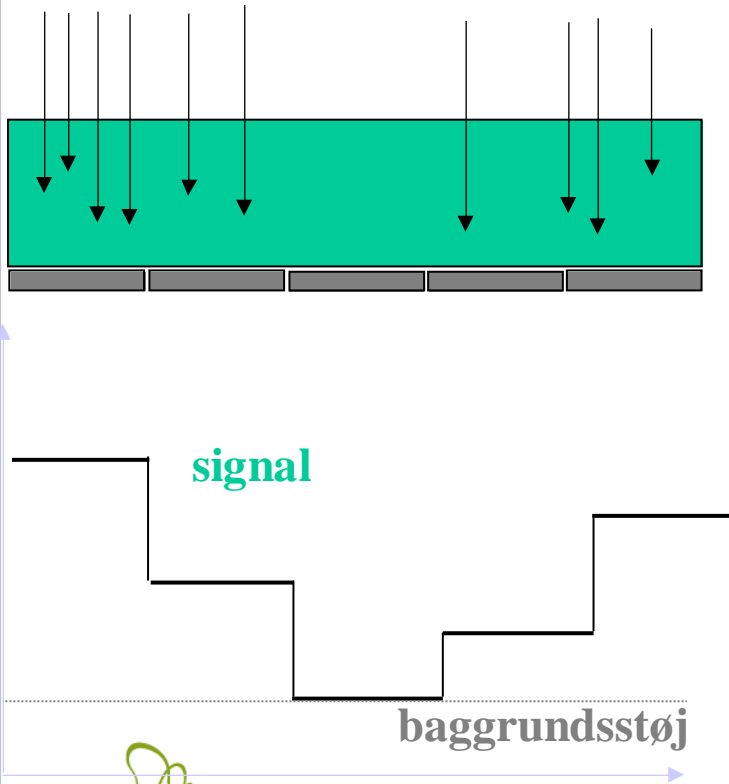
Flat Pan



Digital receptor teknologi

DR – teknologier: Selen

røntgenfotoner



Højspændingsfelt over selenpladen laver hver pixel til en selvstændig røntgendetektor.

Ladningen fra røntgenfotonernes ioniserende virkning udlæses.

Resultat: Lidt lavere konverteringsgrad fra røntgen til signal, men meget skarp gengivelse af det reelle signal.

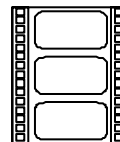
Desværre også mulighed for artefacter som f.eks. "ghosting".

70

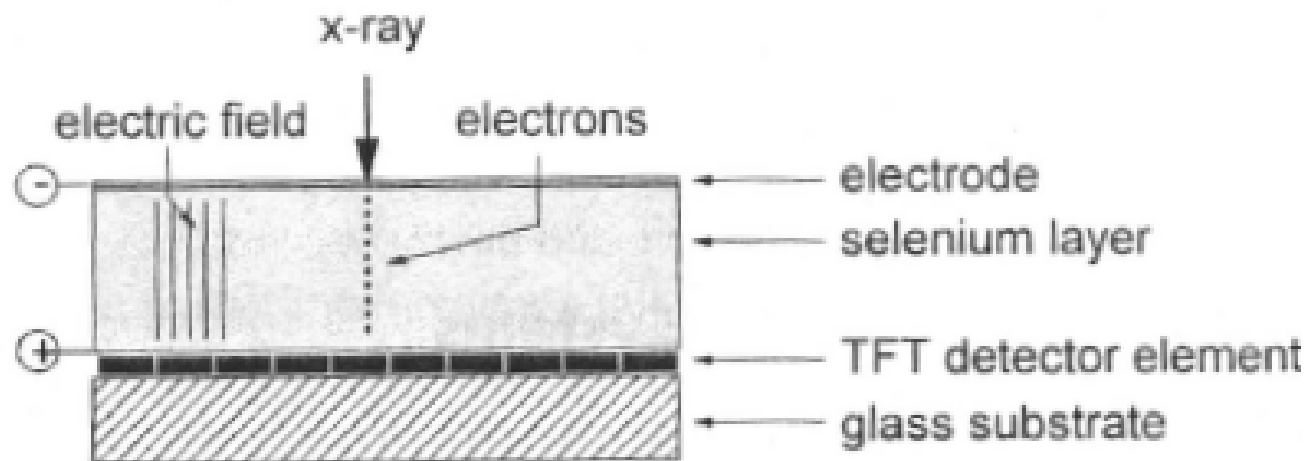
Direkte flat panel detektor



71



Direkte flat panel detektor



72

Direkte flat Panel detektorer

- Benyttes af
 - Hologic
 - Siemens (Mammografi)

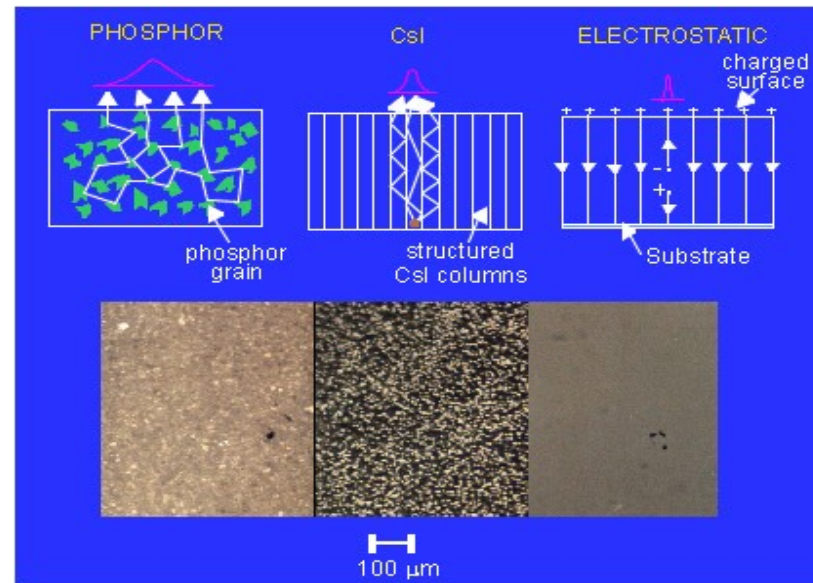
Fordele ved Direkte flat panel detektor :

God opløsningsevne

Ulemper ved Direkte flat panel detektor :

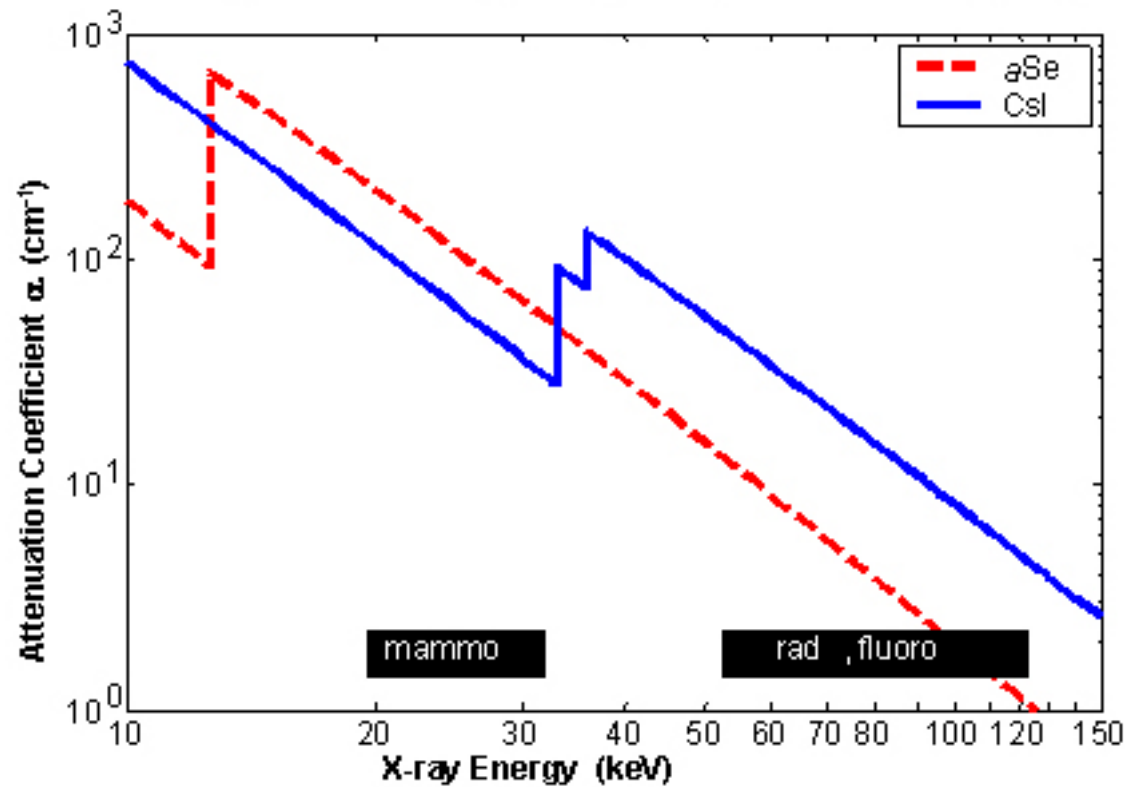
Lav detektor effektivitet (højere patient dosis)

Hvad er forskellen på de forskellige metoder ?



Selen vs. a-Si

a-Se full-field digital detector: High X-ray absorption in low energy range



Teoretisk opløsning

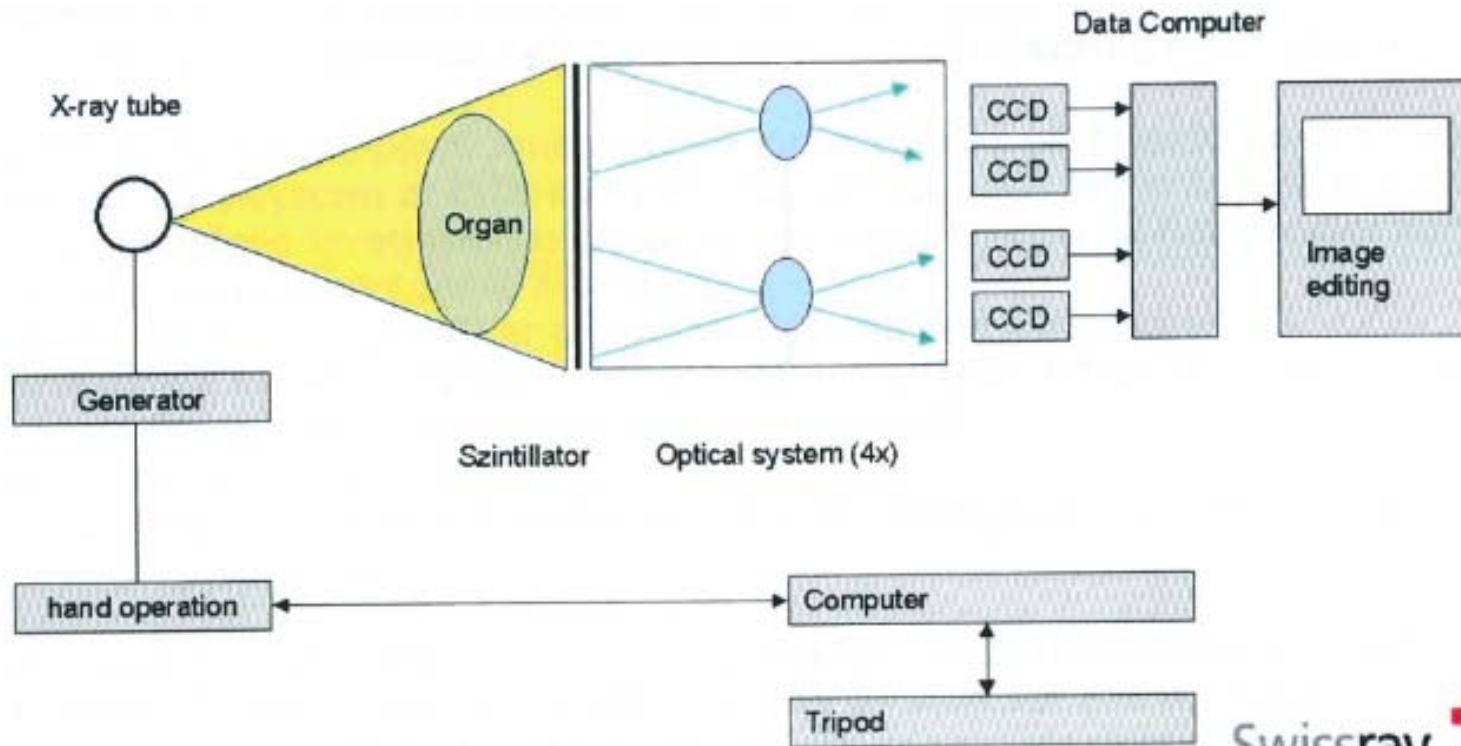
TABLE 9-1 TYPICAL LIMITING SPATIAL RESOLUTION IN FLUOROSCOPY

FOV: cm (inches)	525 LINE VIDEO LINE PAIRS/mm	1023 LINE VIDEO LINE PAIRS/mm	FLAT PANEL 0.157 mm LINE PAIRS/mm
14 (5.5)	2.7	1.4	3.2
20 (7.9)	2.0	1.0	2.8
27 (10.6)	1.6	0.7	2.5
40 (15.7)	1.3	0.5	1.8

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CCD kamera



Benyttes af



Eksponeringsautomatik.

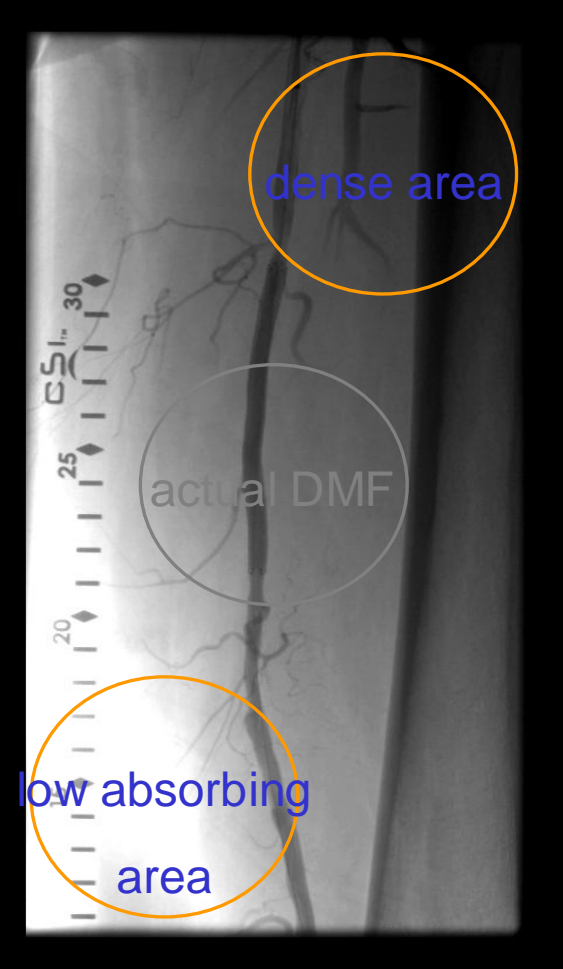
- ABC (Automatisk Brightness Control) er et reguleringskredsløb som sørger for at lyset ud af billedforstærkeren er konstant (for at bevare signal-støj forholdet).
- Dette gøres ved at ændre på dose-hastigheden.
- Ved pulset gennemlysning kan dette gøres ved at ændre på puls-bredde (d.v.s. tiden) eller puls højden (d.v.s. mA).
- Ved meget store patienter ændres evt. også den elektroniske forstærkning i videokameraet.

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Dosisautomatik

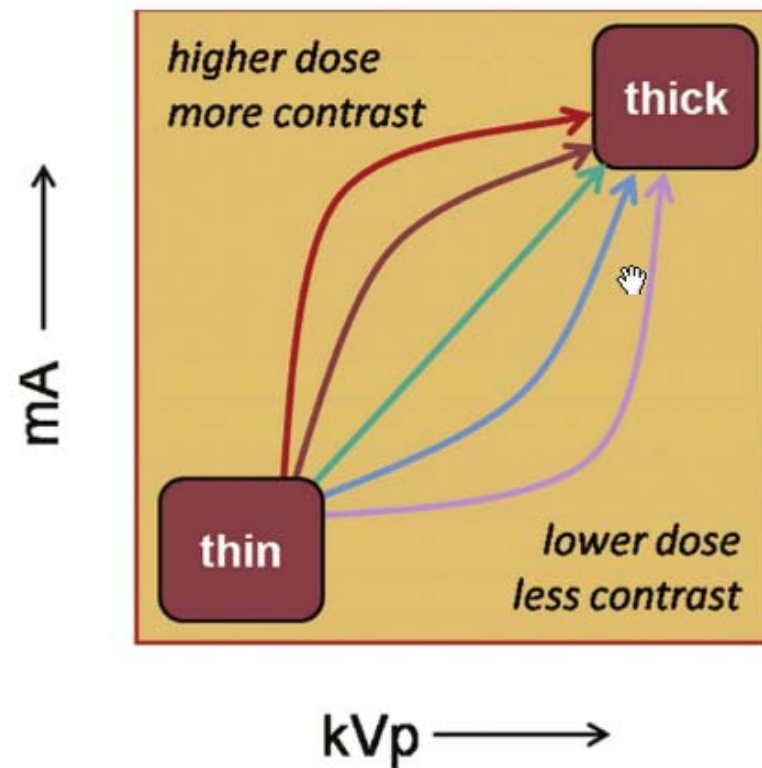
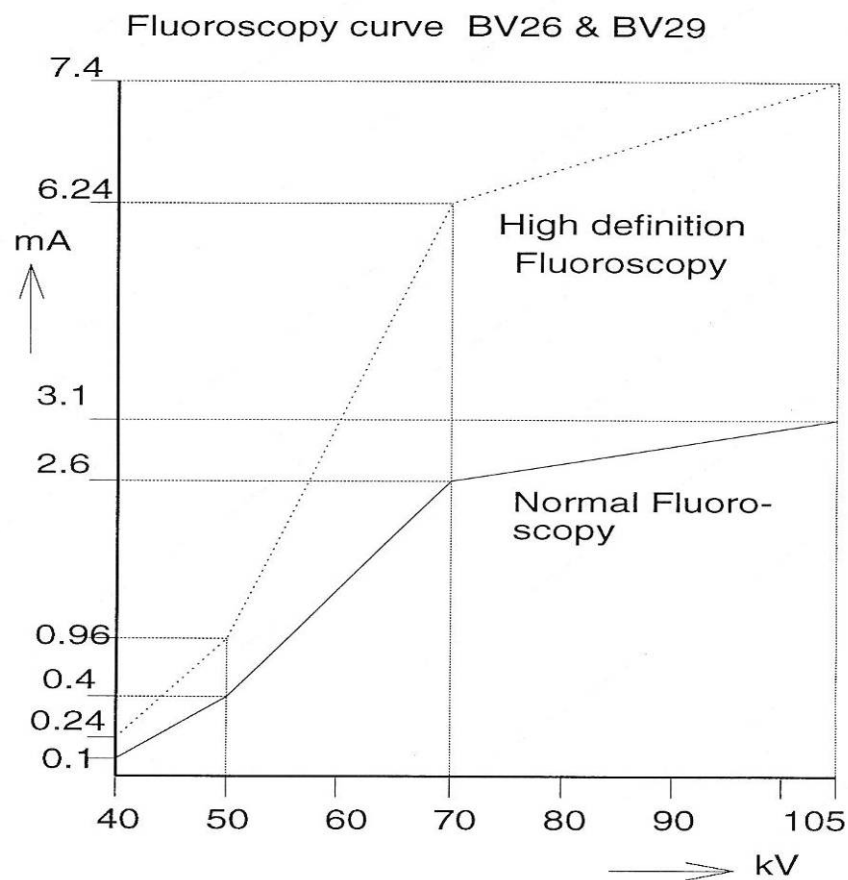


TotOcclLeg
ID: Anonymous
07-Apr-09
16:55:31
1 IMA 20 FRM 15



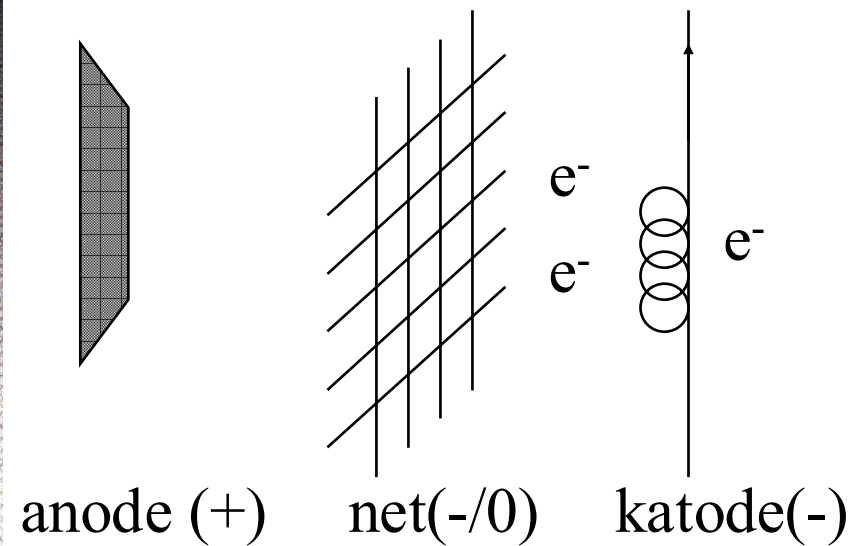
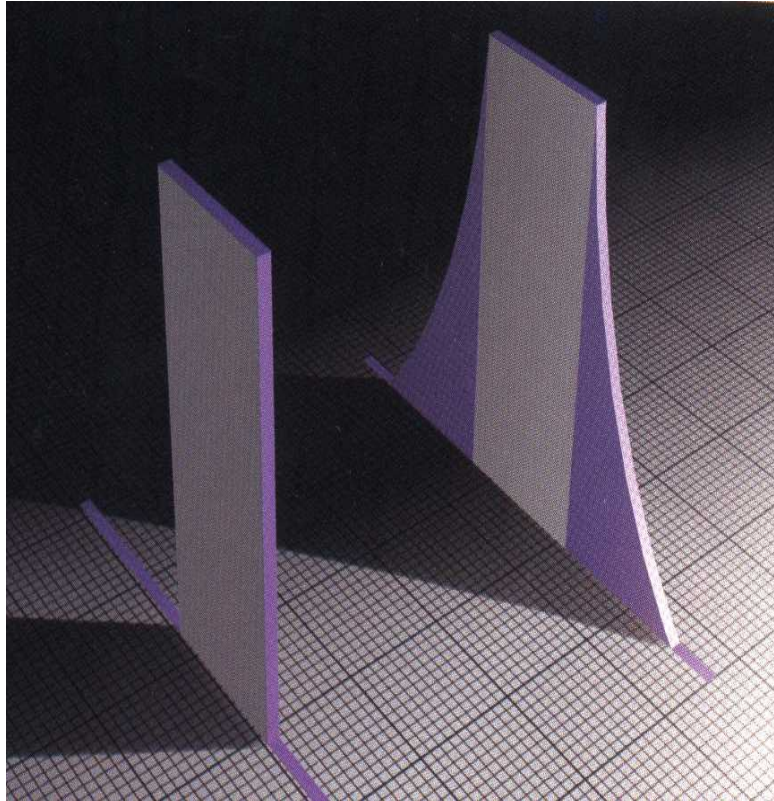
SINGLE PLANE\SINGLE A
CRA 0
LAO 0

Flouro-kurve



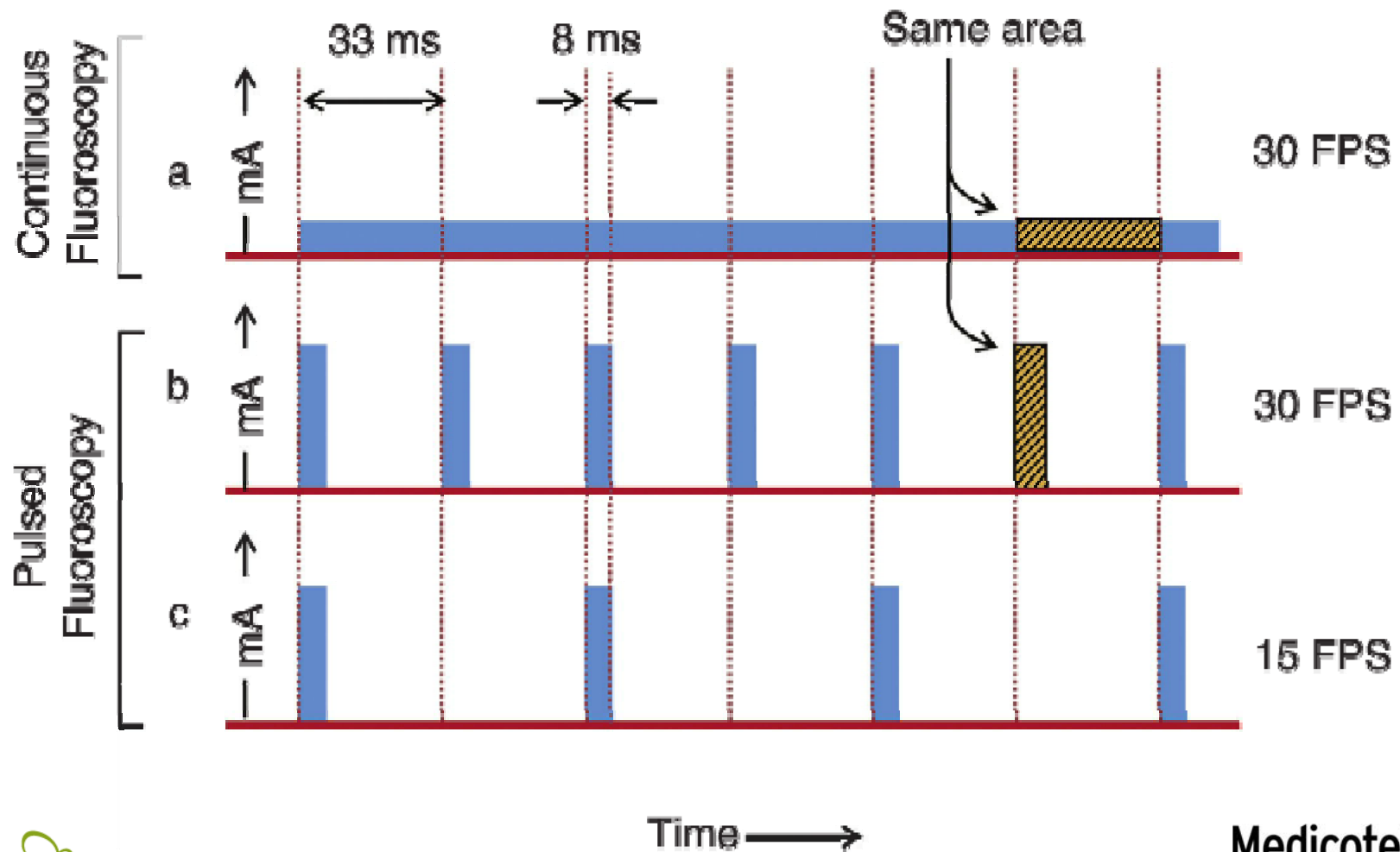
80

Pulset gennemlysning

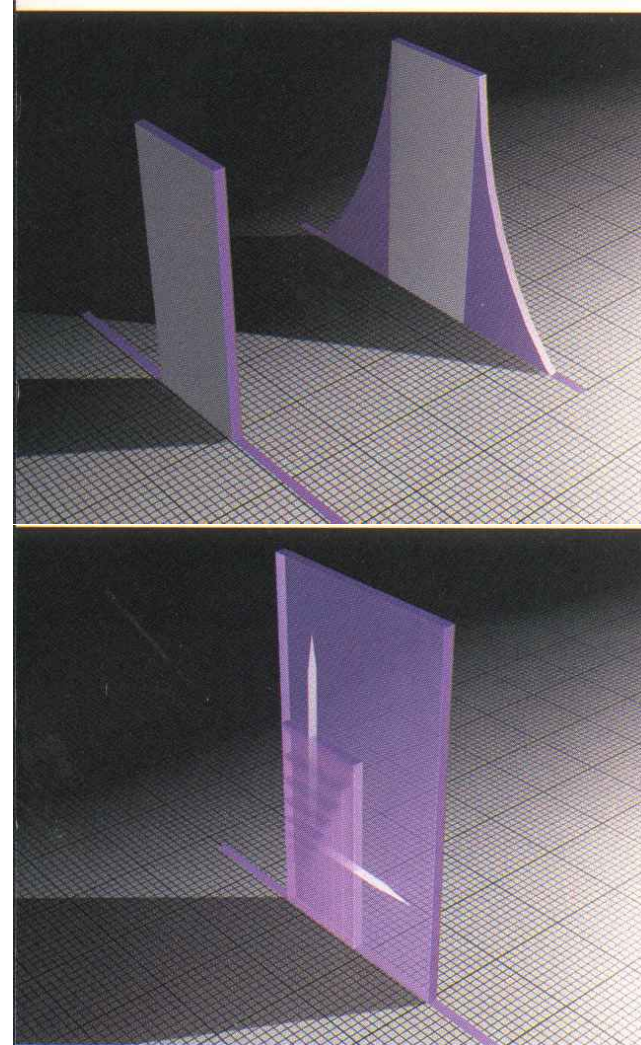
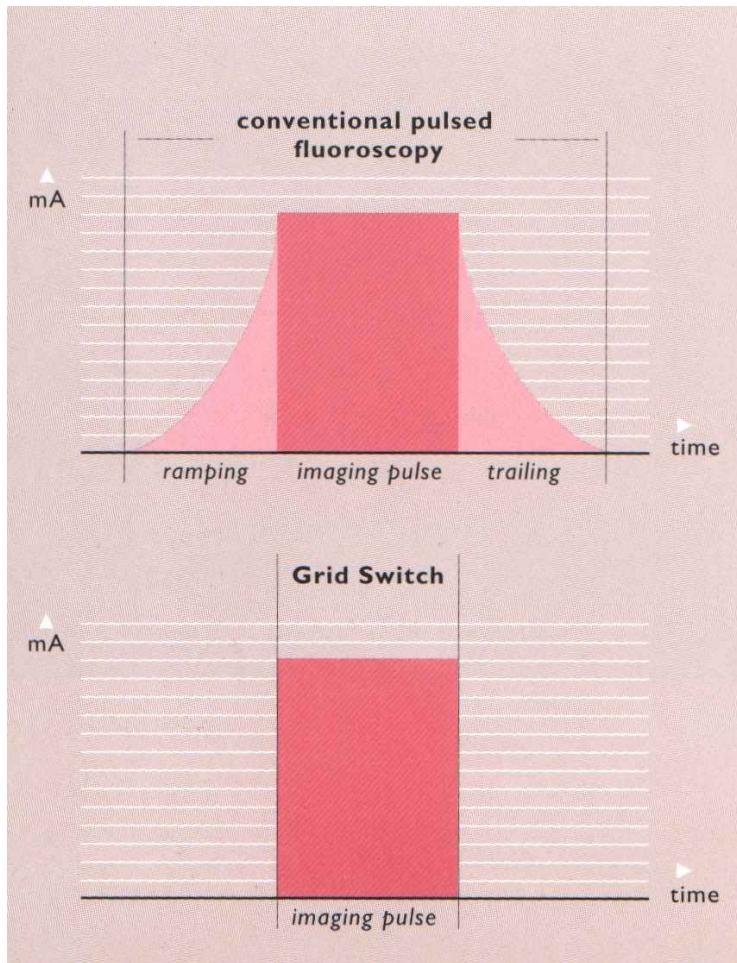


Et elektrisk net imellem katode og anode kan bruges til hurtigt at tænde og slukke for elektronstrømmen/røntgenstrålingen

Pulset gennemlysning



Pulset gennemlysning

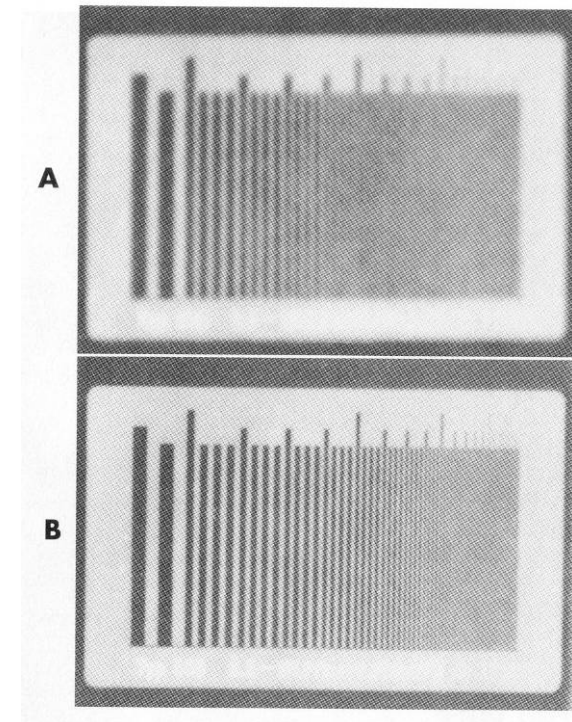
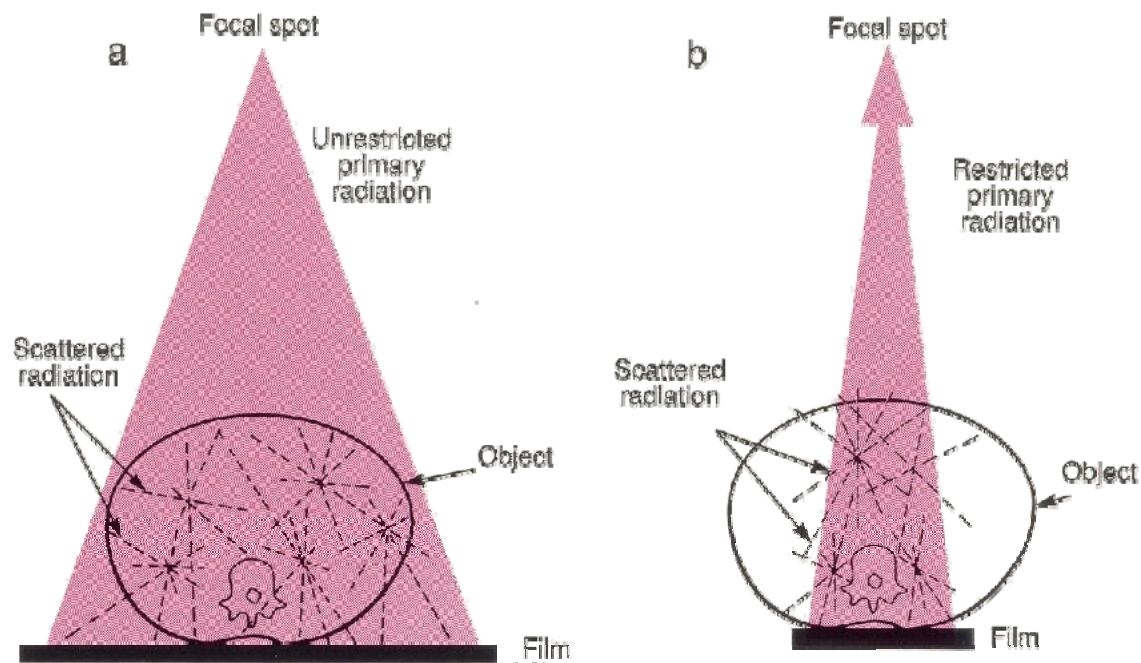


Gennemlysning vs. serieoptagelse

Gennemlysningstype	Feltstørrelse	25 cm			
	Dosisindstilling	Måling [$\mu\text{Gy/s}$]	Korrigeret Rasterfaktor 1,5	kV	X mm Cu
Kontinuert, 30fps	Høj	1,58	1,06	72	1
	Normal	1,14	0,76	71	1
	Lav	0,72	0,48	78	1
Pulsfrekvens 1, 15fps	Høj	1,62	1,08	72	1
	Normal	1,13	0,75	71	1
	Lav	0,70	0,47	78	1
Pulsfrekvens 2, 7,5fps	Høj	1,61	1,07	72	1
	Normal	1,14	0,76	71	1
	Lav	0,72	0,48	78	1

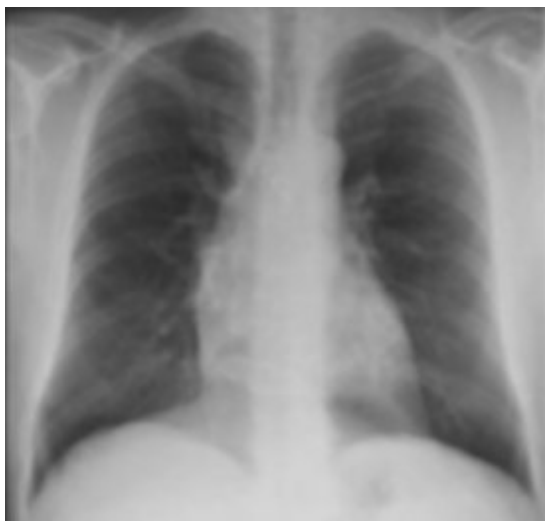
	Dose (μGy)	antal pulser	dosis pr. puls (μGy)	dosis pr. sekund
30fps	7,4	34	0,22	7,4
15fps	4,7	21	0,22	4,7
7,5fps	2,6	11	0,23	2,6

Kolimatorer (blænder)



85

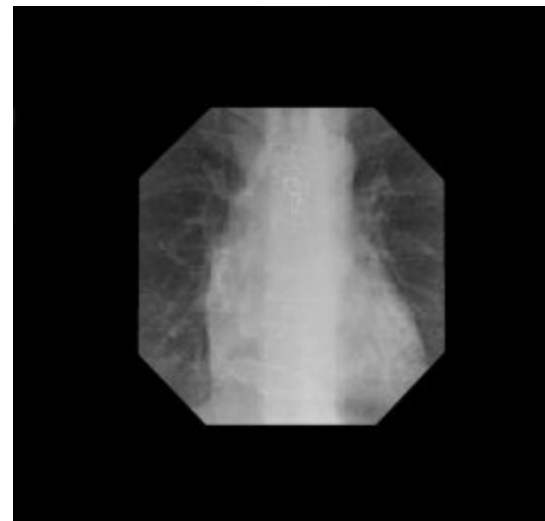
Kolimatorer (blænder)



Uden kolimering



Med parallel-kolimering



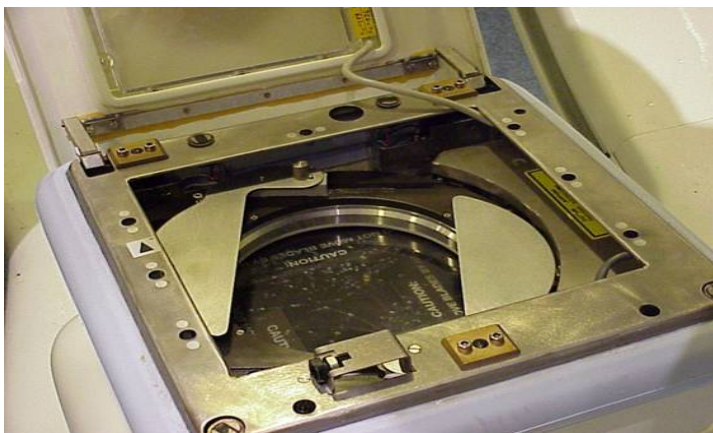
Med iris-kolimering



Vigtigt:

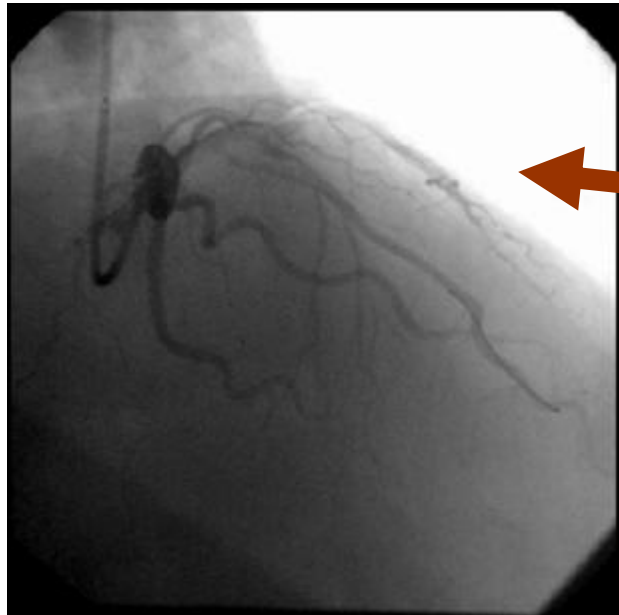
Må ikke kunne blænde ud over billedforstærkeren/detektoren!

Contour blænder

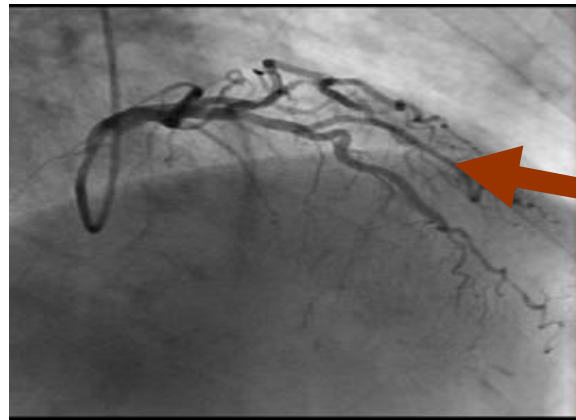


GE Advantx X ray system

Contour blænders virkning



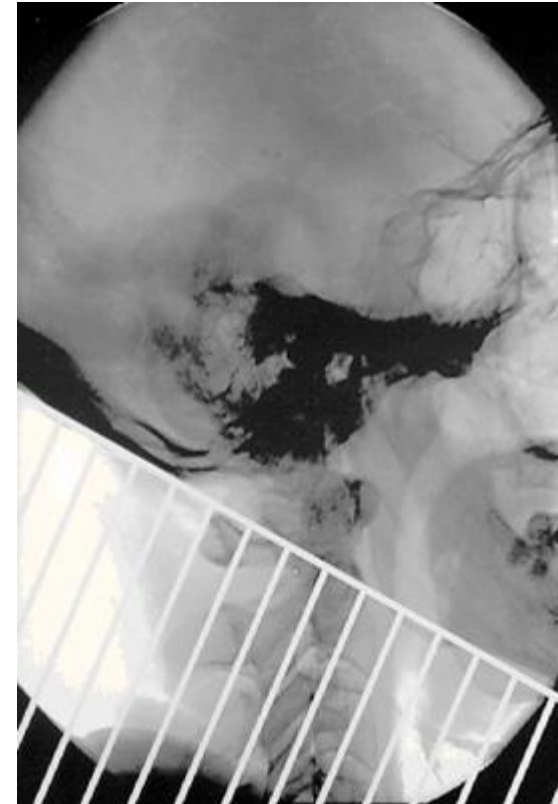
Uden brug af contour blænde. Bemærk den store kontrastforskel.



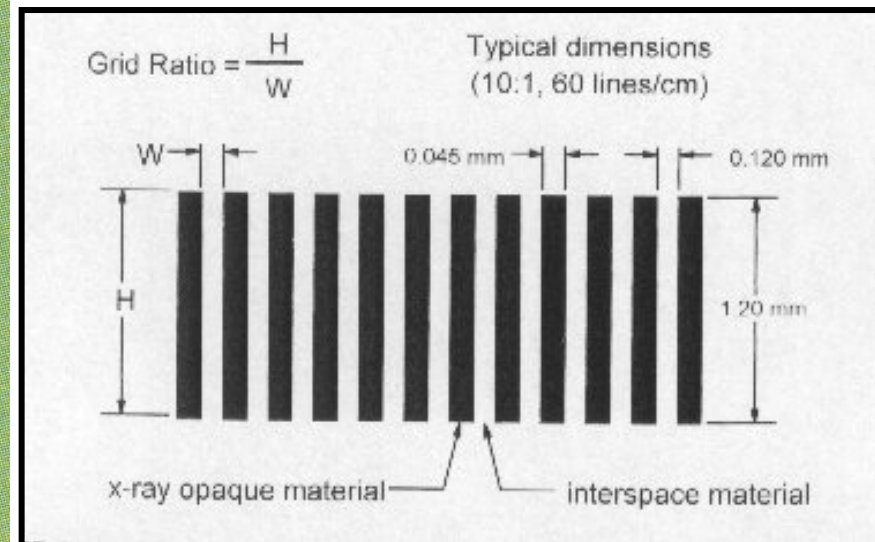
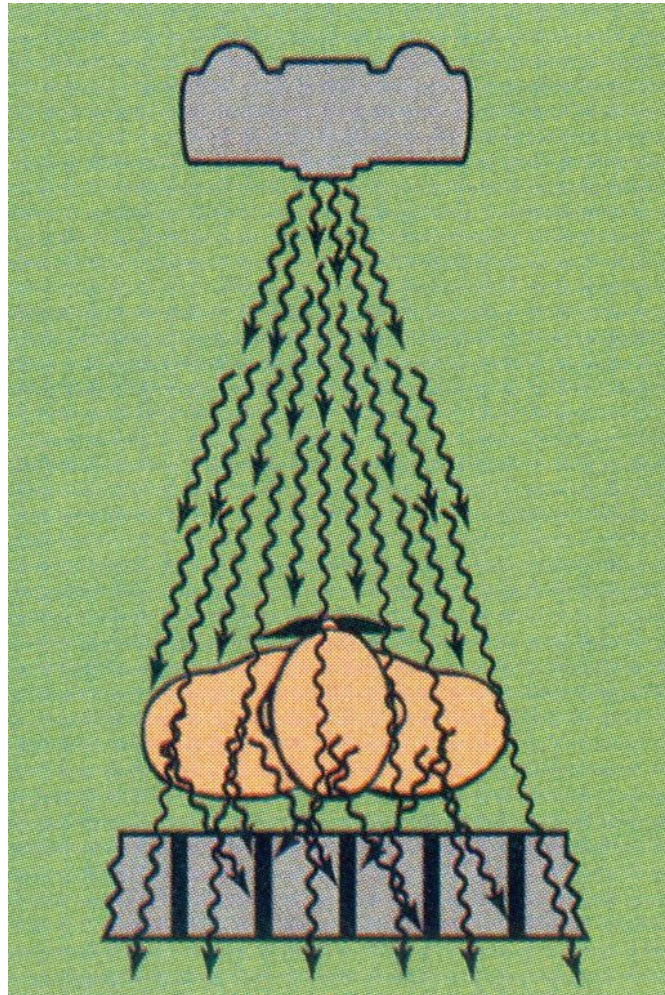
Med contour blænde

Virtuelle blænder

- Indblænding uden brug af røntgen
- Manipulation af blænderne på Last Image Hold (LIH)



Raster.





**Raster
Flat panel system
Siemens Axiom**

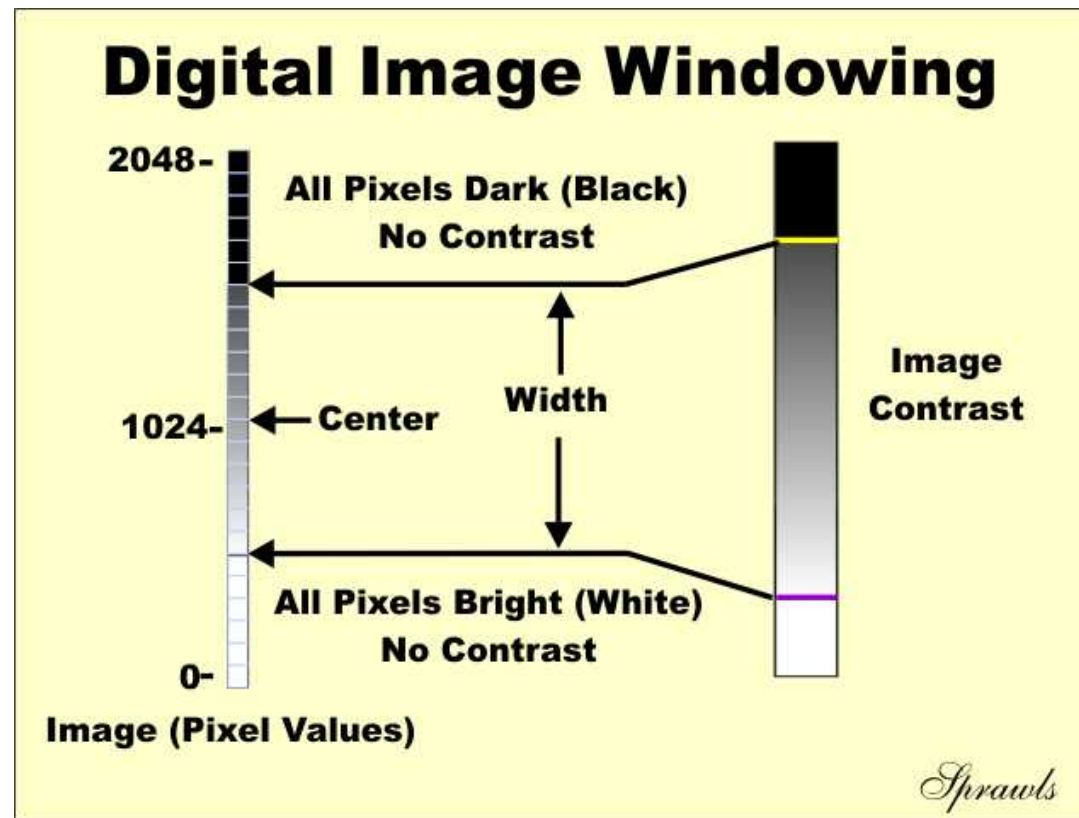


Billedkvalitet

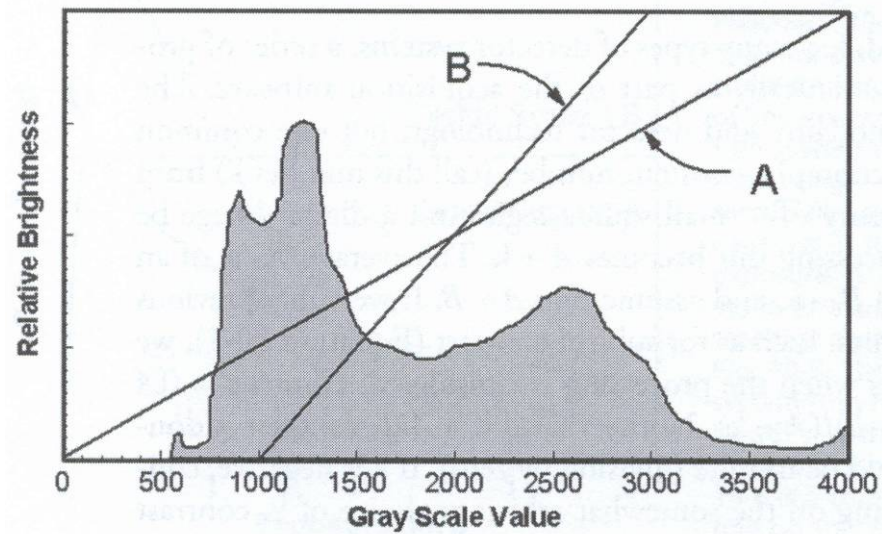
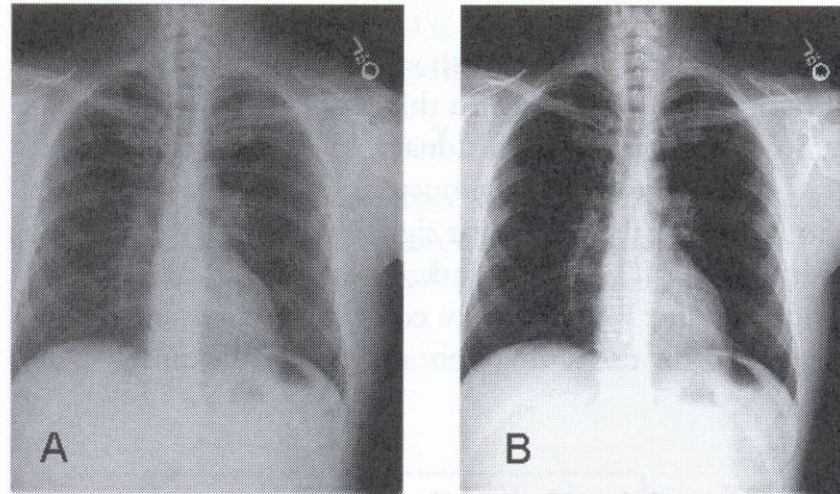
- Windowing
- Støj
- Dynamik
- Over/Undereksposering
- Døde pixels

Windowing

- Proces hvor man vælger en del af det totale pixel område i billedet og afbilder det over hele spektret, fra hvid til sort.



Window - Level

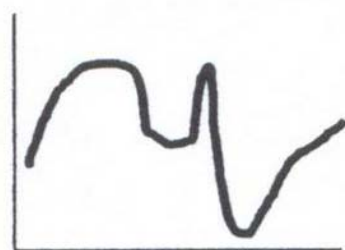


Støj



Støj i billedet

+



Signalet fra vores eksponering

=



Det totale signal

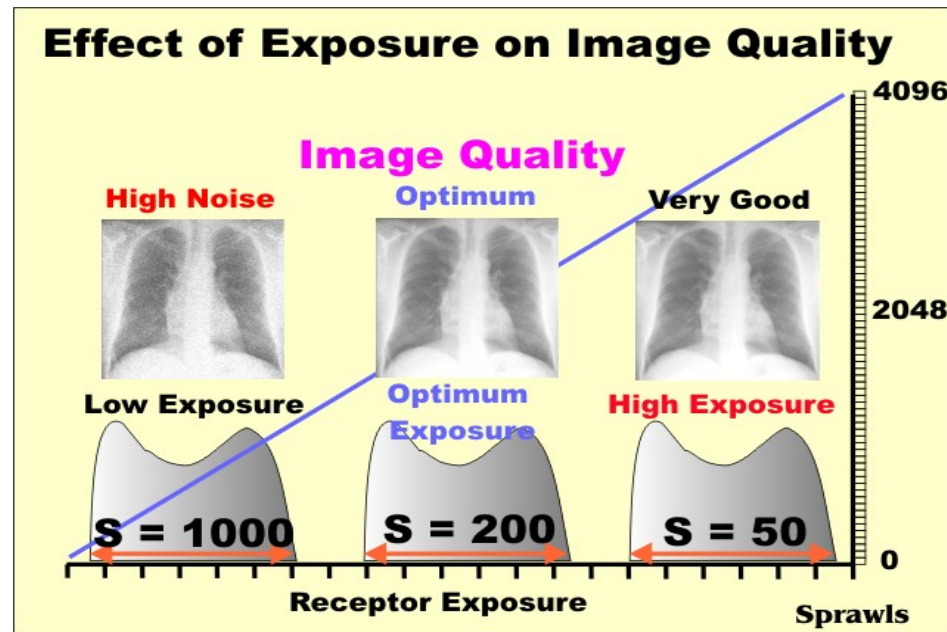
96

Jo mindre eksponeringssignalet er (mindre dosis)



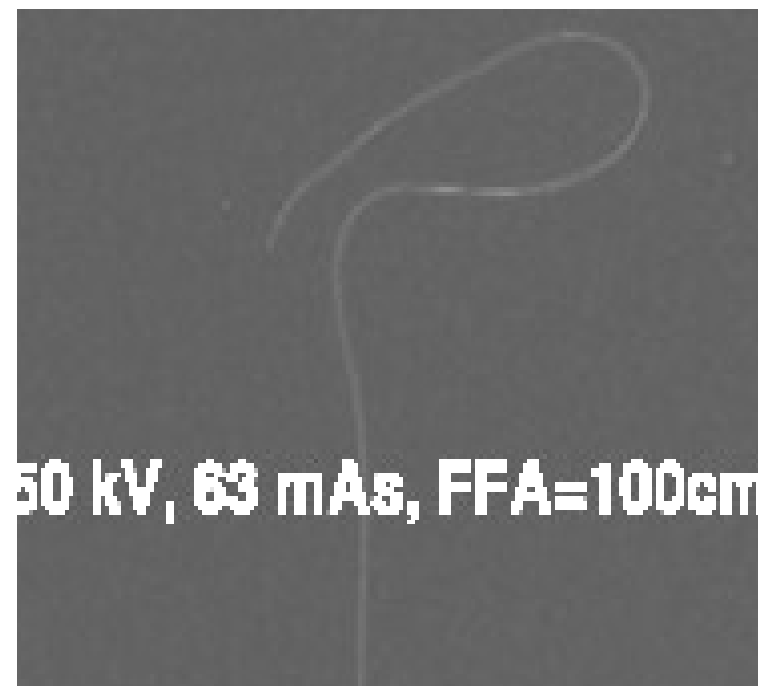
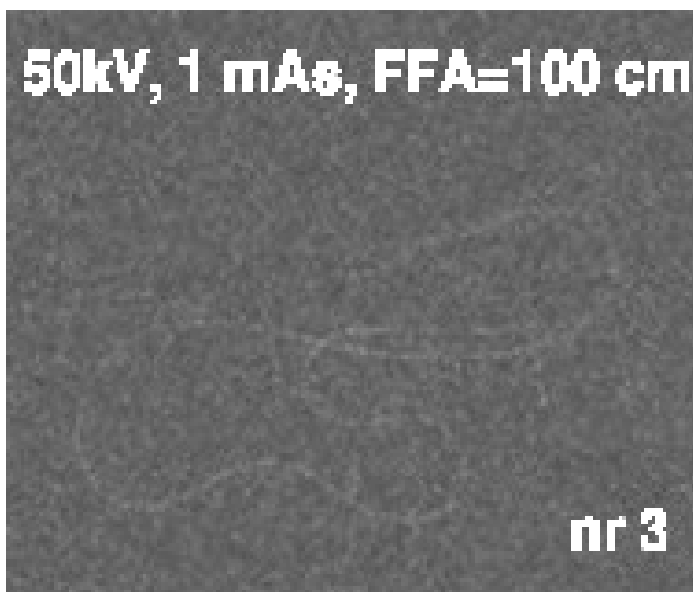
jo mere indflydelse har støjen på vores digitale røntgenbillede

Støj og billedkvalitet



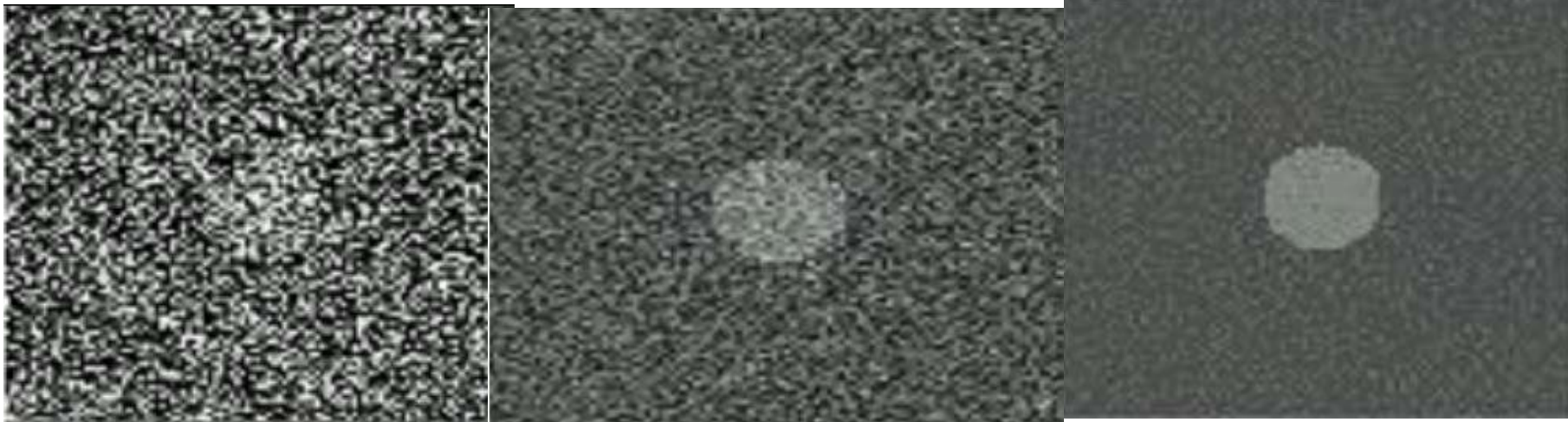
97

Støj



98

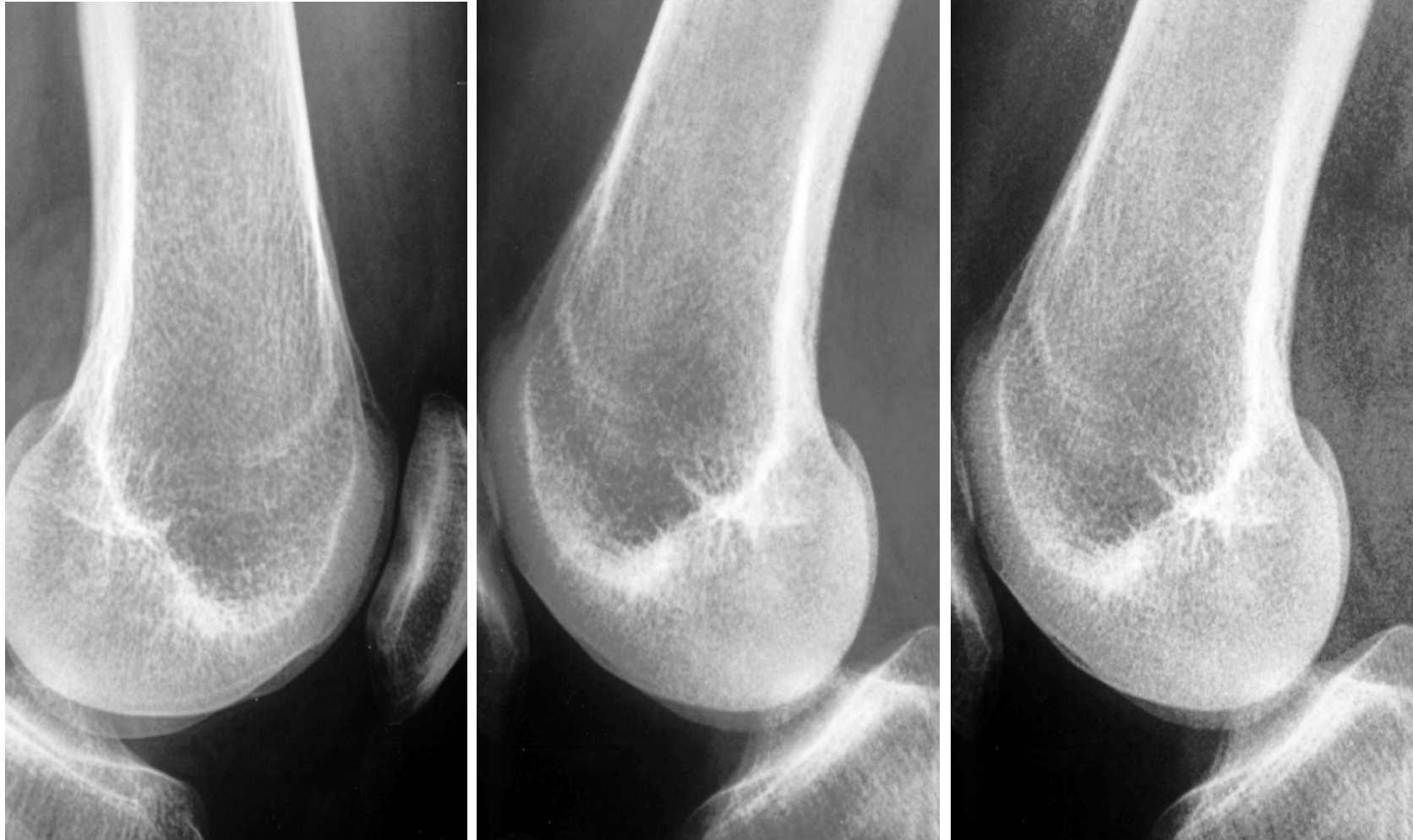
Støj



99

60 kV, 25 mAs
+ grid

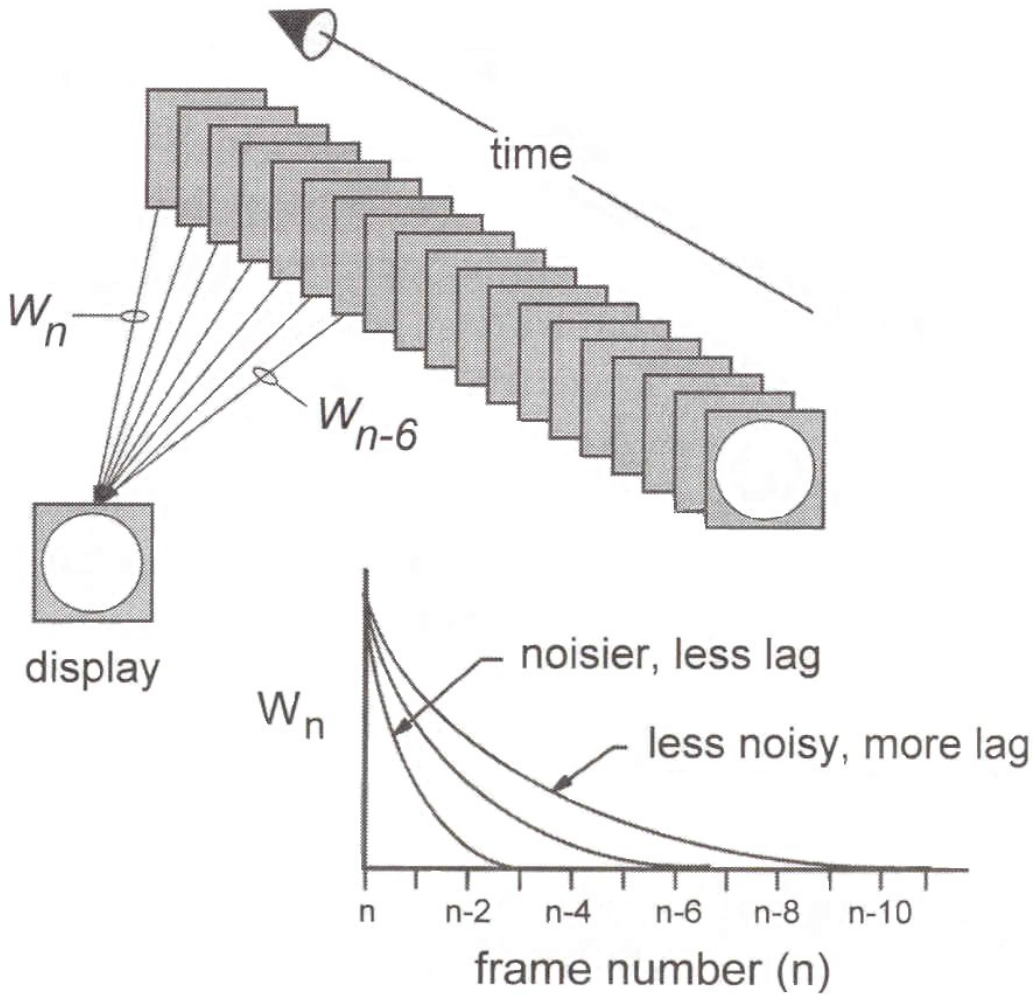
Støj reduktion



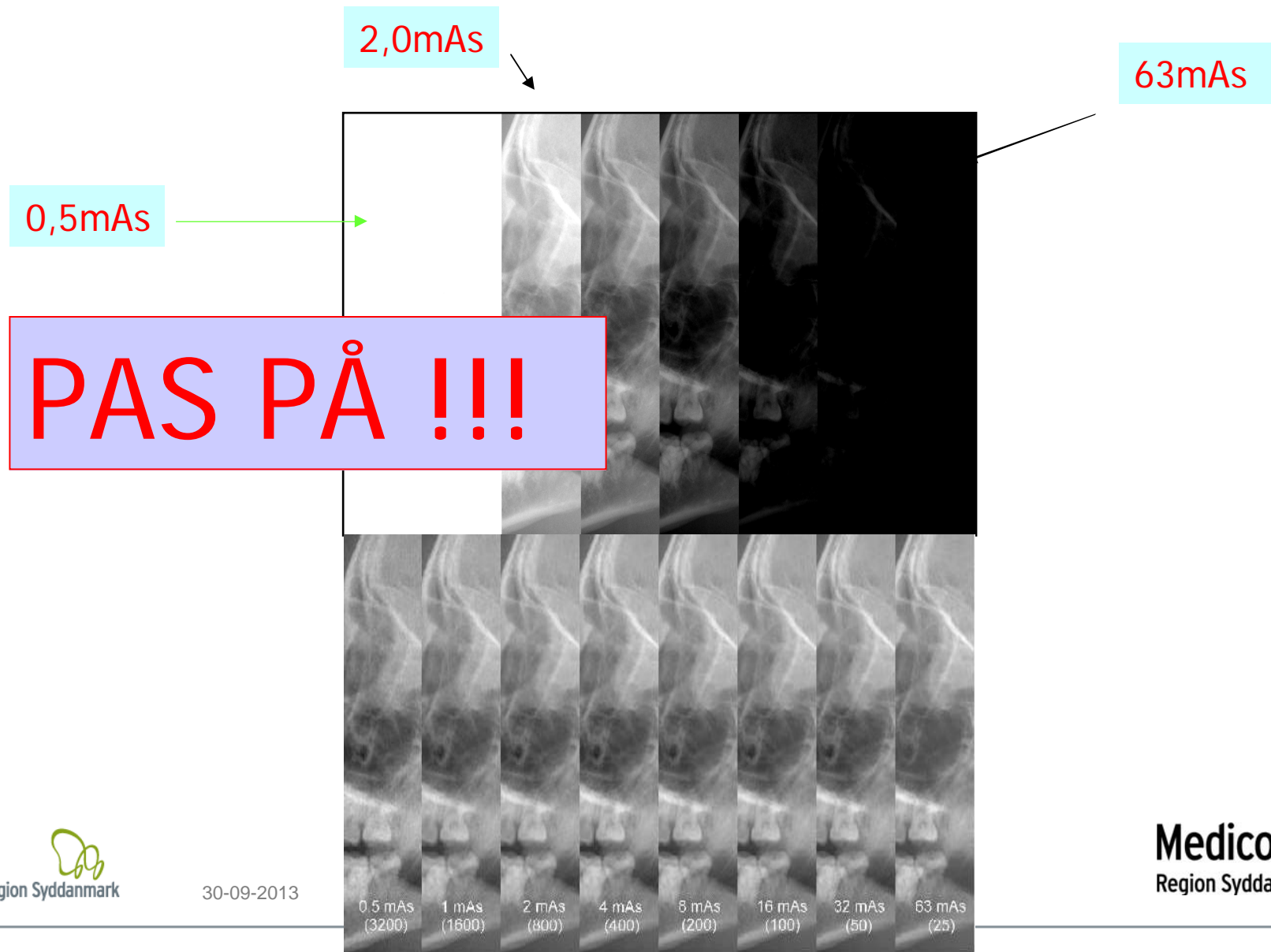
underexposed **1/8** dose
+ **noise reduction**

Medicoteknik
NO noise reduction

Støjreduktion



Dynamikken i billedet (Dynamik Range)



Over/Under - Eksponering

50 kV og 100 mAs

50 kV og 10 mAs

50 kV og 1 mAs



Over/Under - Eksponering

1mAs



10mAs



100mAs



Døde pixels



105

Teknikker

- Kantforstærkning
- Dual Energy
- Billedsammensætning
- Digital Mammografi
- DSA – Digital subtraktions angiografi
- 3D – Rotationsangiografi
- Swingteknik

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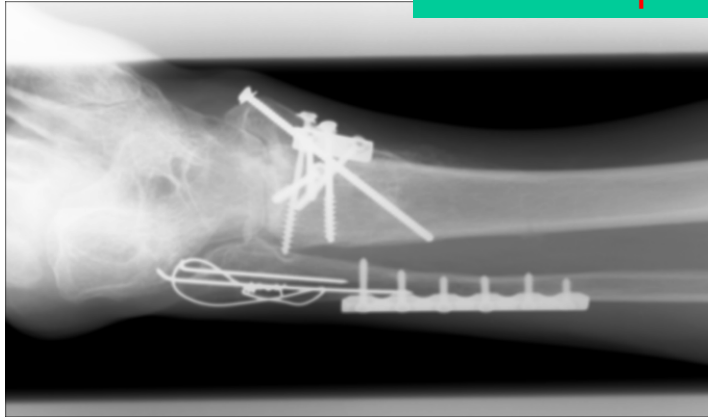
Kantforstærkning



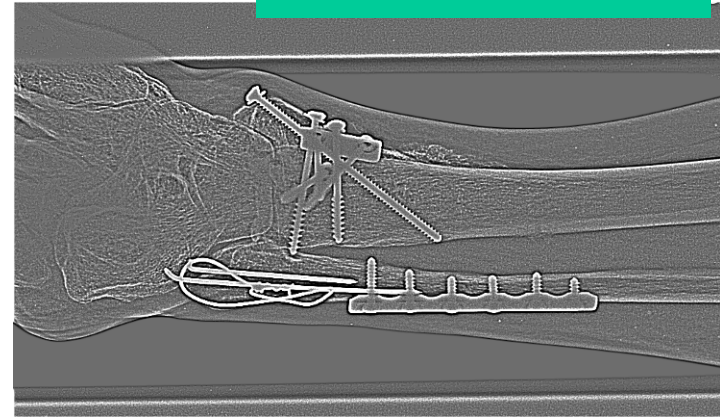
107

Metode til at lave kantforstærkning

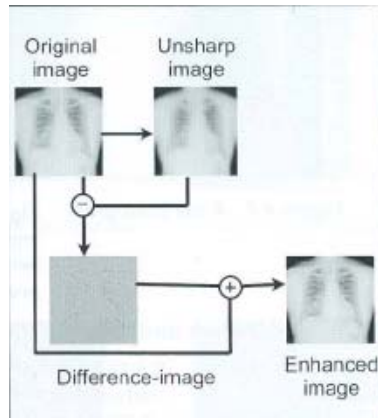
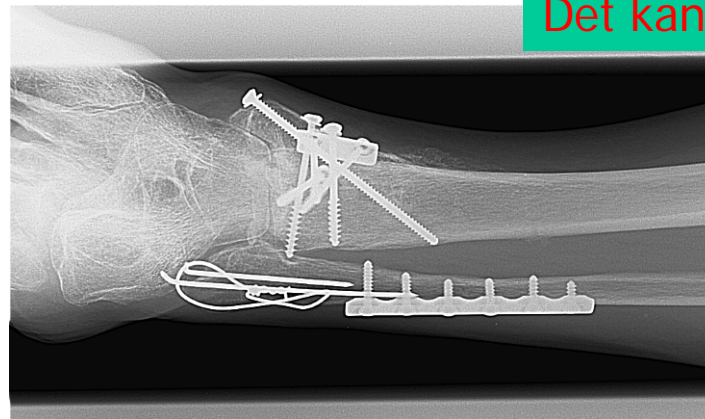
Det uskarpe billede



Subtraktionsbilledet



Det kantforstærkede billede



Dual Energy

PAS PÅ

2 eksponeringer.

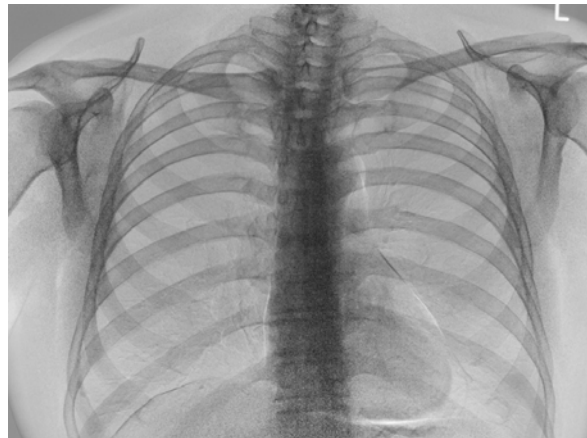
Ekstra patientdosis kontra Diagnostisk sikkerhed

Høj kV



Standard billede

Lav kV



Skellet billede

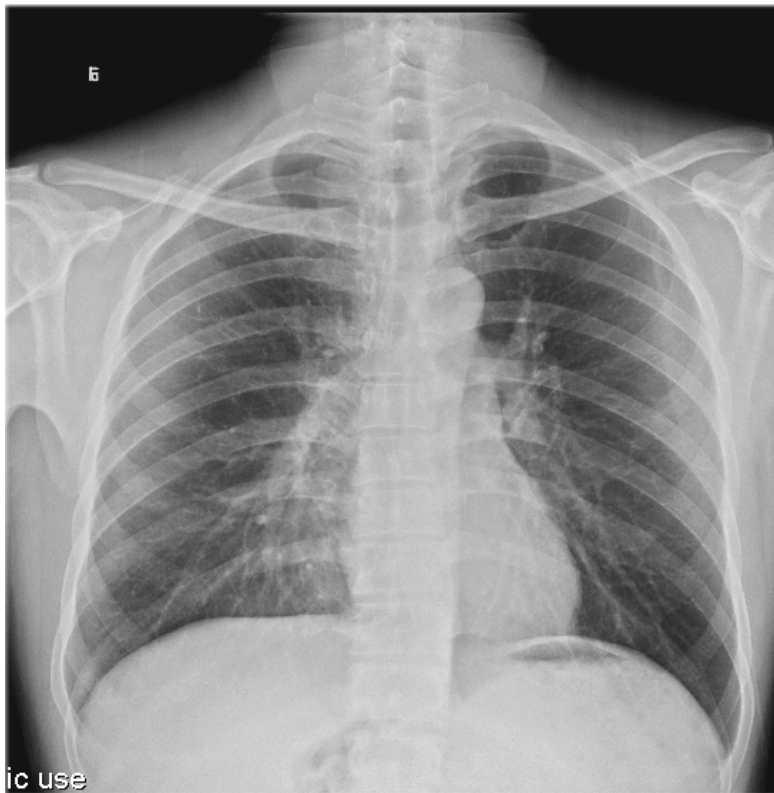
Subtraktion af de
2 billeder



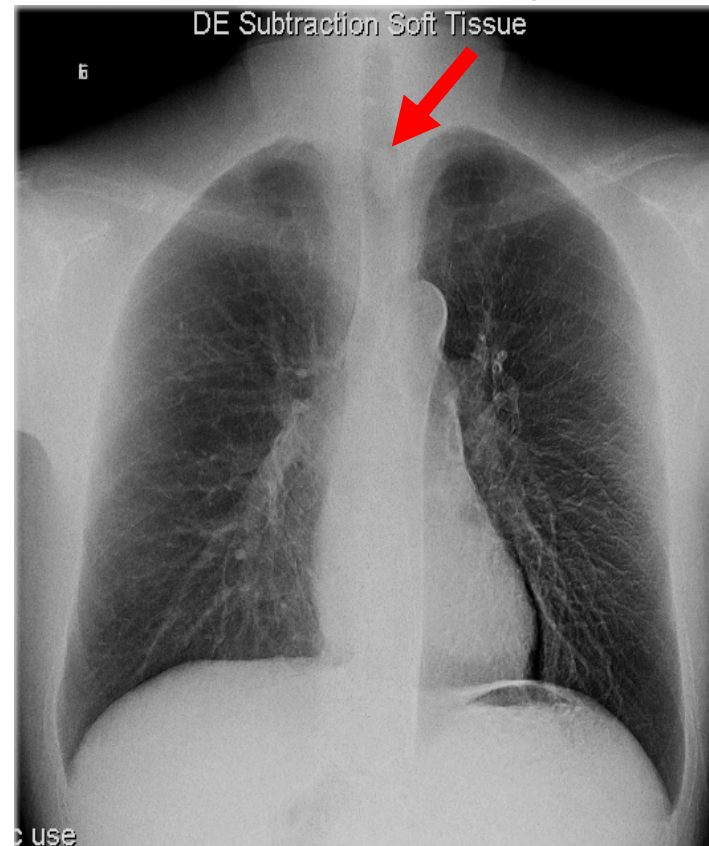
Fremhæver bløddelene

Dual Energy

Patienten klagede over smerter når m/k skulle synke



Standard billede



Med Dual Energy

110

Dual Energy

Uden Dual Energy

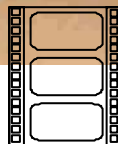


Med Dual Energy



Fremhæver bløddele uden knogler

Billedesammensætning (f.eks. Scoliose)



Samlet billede

Digital Mammografi

- Mammografi er en af de sidste områder der er blevet digitaliseret. Hvorfor ?
- Manglende **spatial opløsning**

- **Spatiale opløsning**

Gammeldags film:	12-20 lp/mm
Nogle CR-systemer:	12 lp/mm (teoretisk)
DR systemer:	
Fuji	10 lp/mm
Siemens, Sectra, GE, Philips og Hologic:	ca. 6 lp/mm

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Digital Mammografi

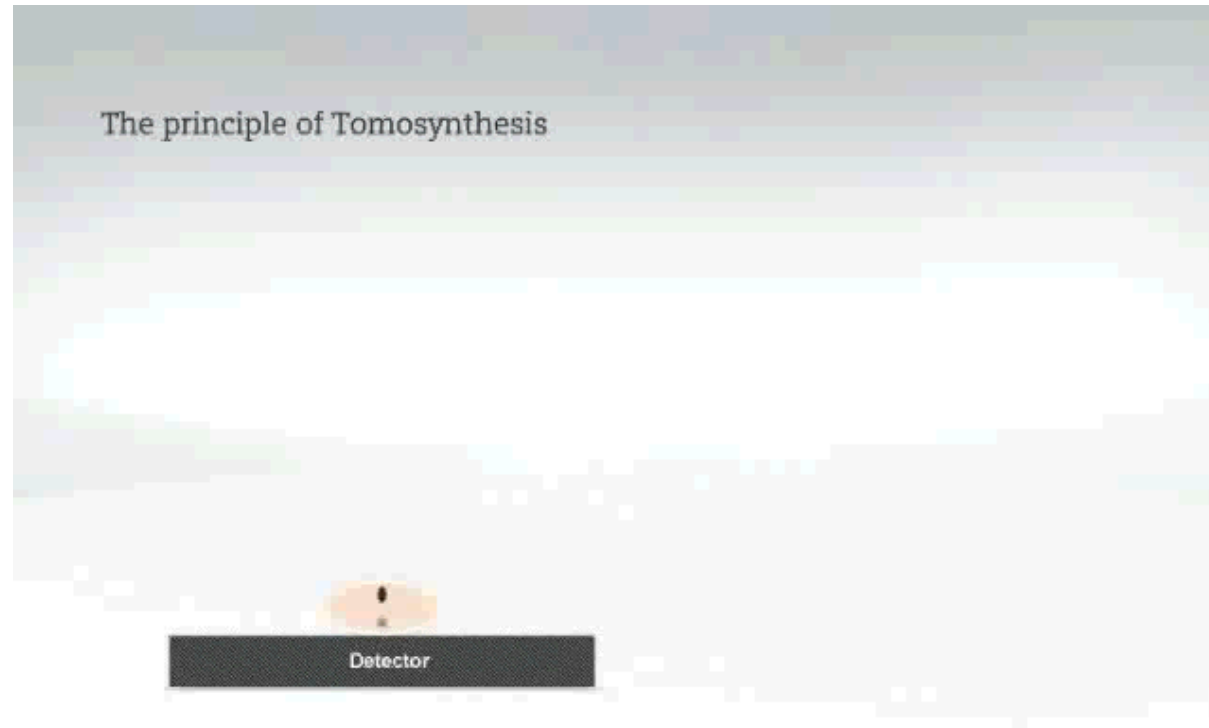
- Hvor meget fylder et digitalt mammografi billede?

40-60Mb

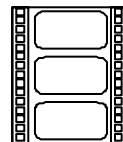
(Til sammenligning så fylder et DR/CR billedet typisk 5Mb)

- Hvad er fordelene ved DR mammografi?
- Fantastisk lavkontrastfølsomhed (ligesom ved alt andet DR teknik)
- Samt alle de andre DR fordele.

Tomosynthesis



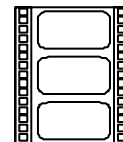
115



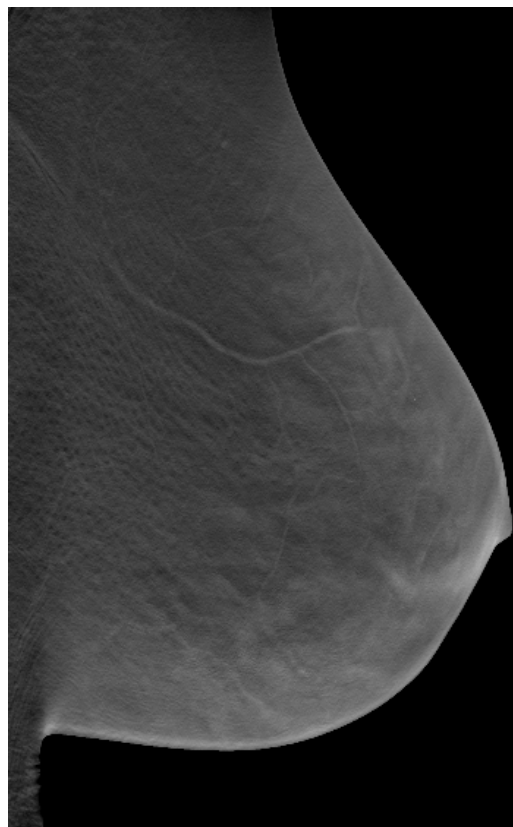
Tomosynthesis



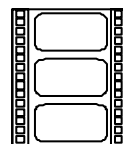
116



Tomosynthesis



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Tomosynthesis

Der udføres 25 projektioner (dvs. 25 "skud")

Almindeligt røntgenbillede : 1 projektion.

Der benyttes ikke 25 gange meres dosis, men væsentlig mere dosis.

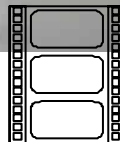
Der skal være en stor diagnostisk gevinst for, at man skal henvise til en Tomosynthese undersøgelse.

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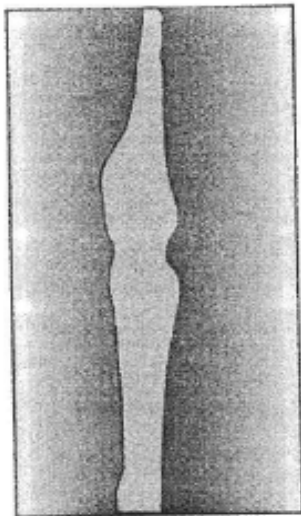
DR gennemlysningsrum



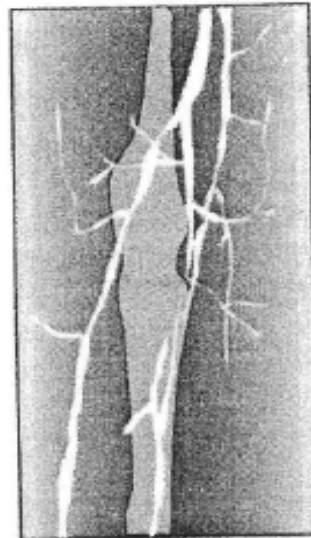
119



DSA (Digital Subtraktions Angiografi)



"Masken"



"Efter kontrasten"



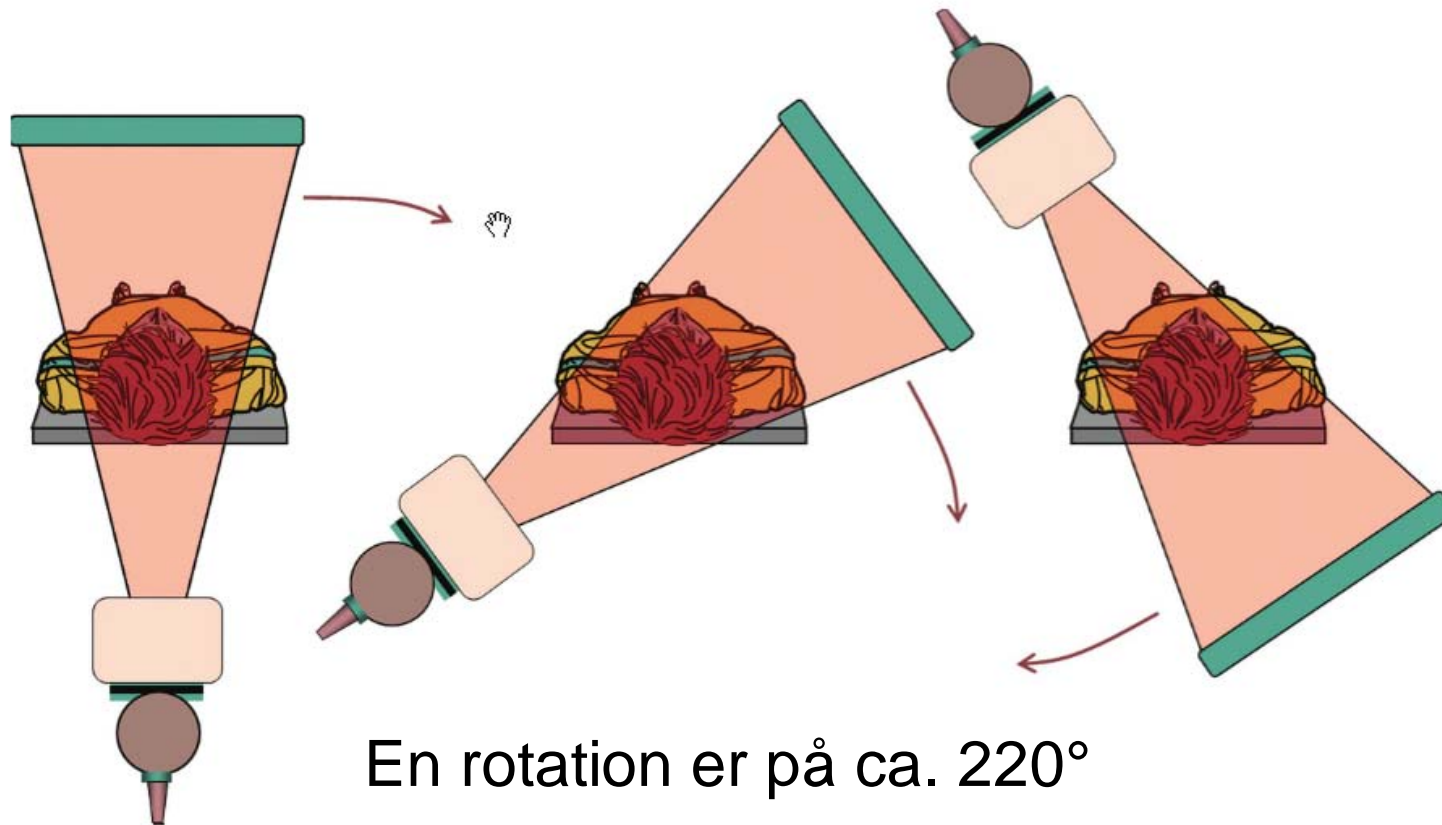
"Subtraktions billedet"

DSA (Digital Subtraktions Angiografi)



121

Rotationsangiografi

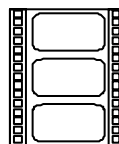


En rotation er på ca. 220°

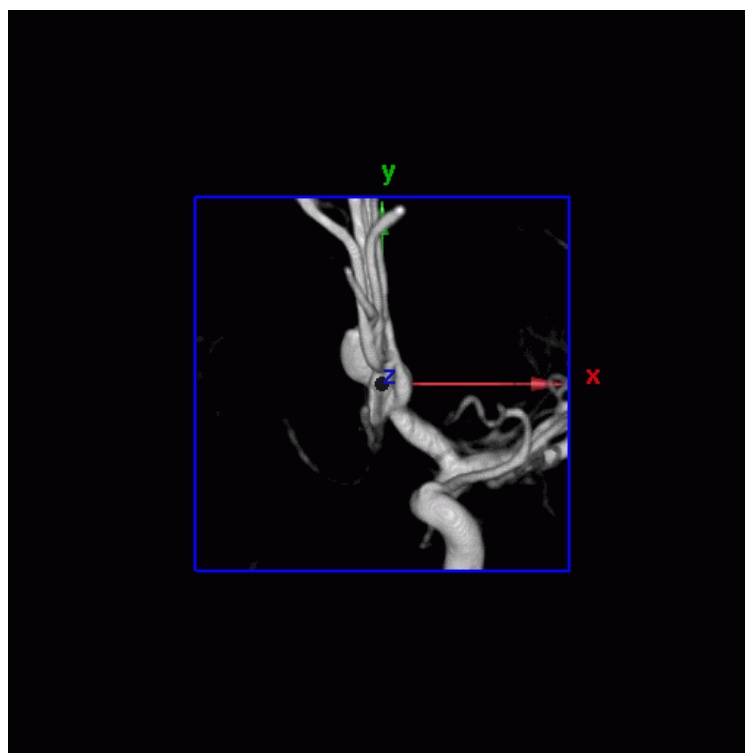
Digital angiografi



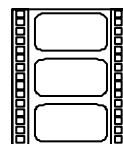
123



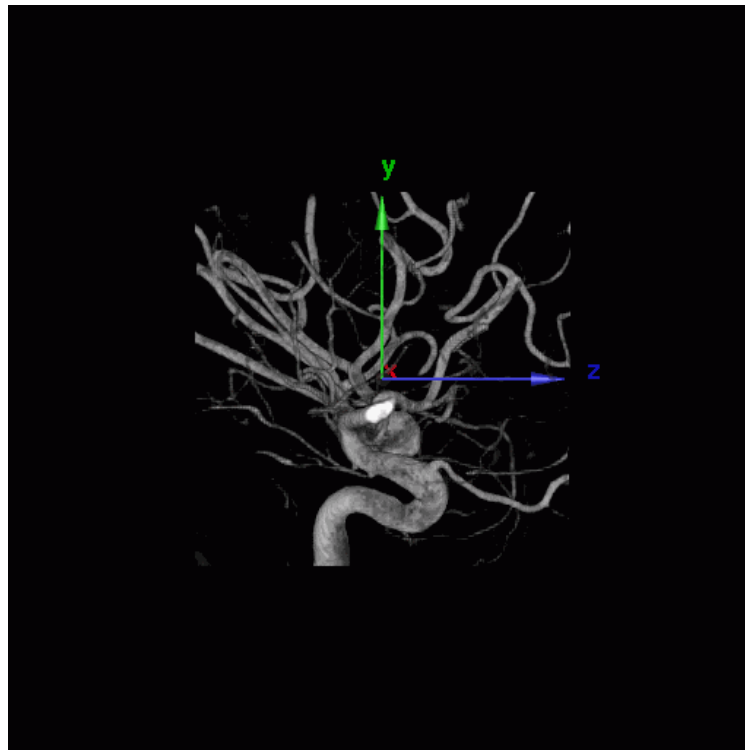
Mulighed for 3D rekonstruktioner



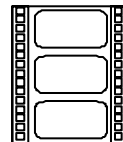
124



Mulighed for 3D rekonstruktioner



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Kort om teknikken bag 3D rotationsoptagelse

Eksempel

- C-buen roterer omkring patienten, med denne placeret isocentrisk mellem rør og receptor
- Der roteres 135 grader (Ziehm) til 140 –190 grader (Siemens)
- Under rotationen tages 110 (Ziehm) til 50/100 (Siemens) snapshot/projektioner
- Ved CT lignende teknikker bruges data fra alle snapshot/projektioner til at₂₆ rekonstruere et 3D billede af det afbillede objekt.



Konklusioner fra et eksempel

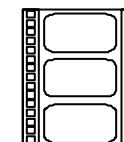
- 3D rotationsoptagelse udført på mobile gennemlysere har formentlig potentiale til at erstatte tilsvarende CT-scanninger
- En 3D rotationsoptagelse resulterer i samme strålebelastning for personalet som mellem 12 og 140 sekunders gennemlysning (Siemens)
 - Tilsvarende tider på Ziehm Vision FD 3D var ca. 2 gange større
- En 3D rotationsoptagelse estimeres til at give en effektiv dosis på mellem 0,040 mSv og 0,110 mSv (Siemens)
 - Estimatet er forbundet med en del usikkerheder
 - Med væsentlige usikkerheder taget i betragtning og i den mest dosistunge opsætning, vil en 3D rotationsoptagelse næppe overskride 0,5 mSv.
 - Tilsvarende estimer af effektiv dosis på Ziehm Vision FD 3D var ca. 3 gange større
- Den tilsvarende CT undersøgelse resulterer i en effektiv dosis i omegnen af 3,5 mSv (patienter på 60 kg.)

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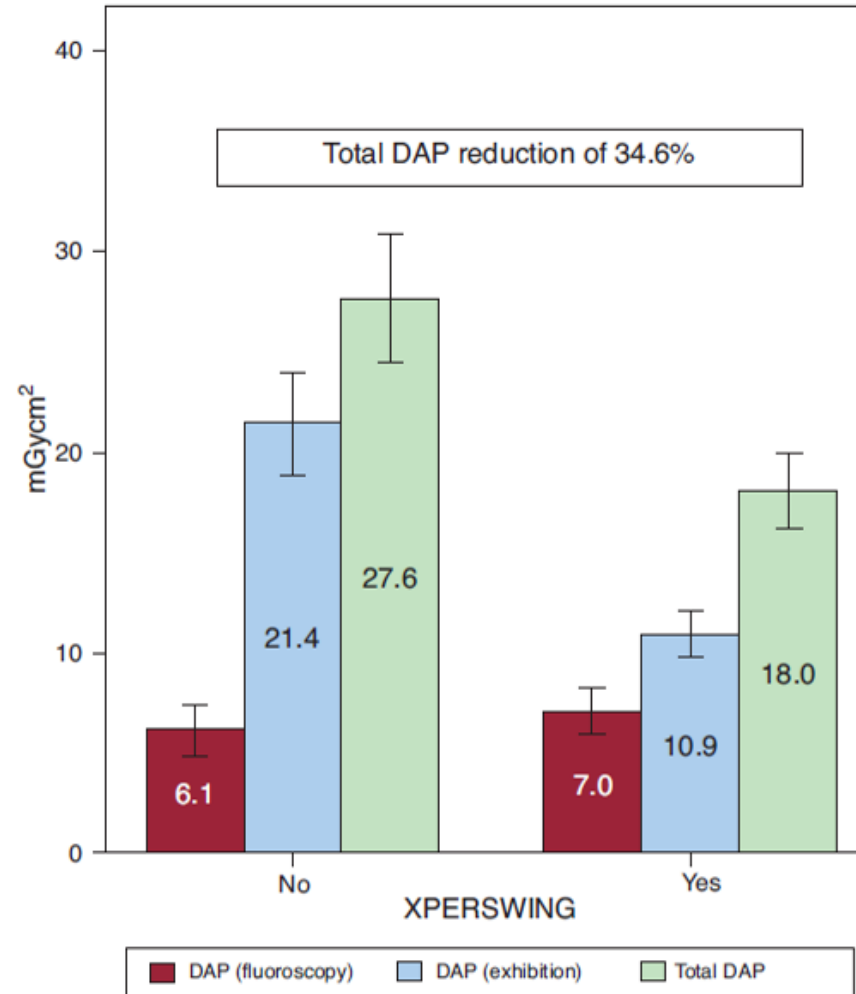
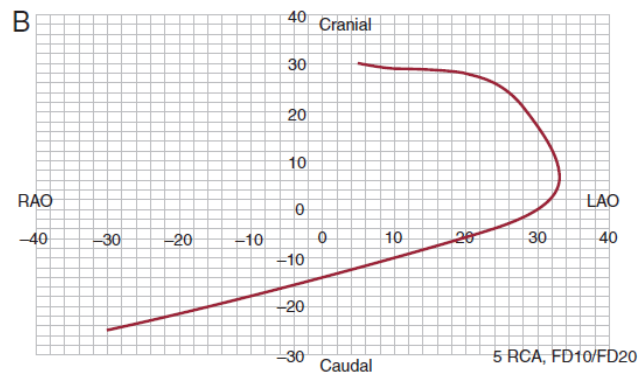
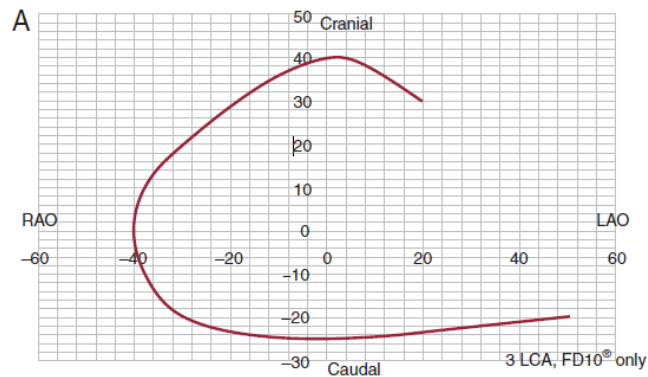
Swingteknik



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Swingteknik



Swingteknik

Bemærk!

Table 2
Diagnostic Results

	Conventional Angiography	XPERSWING	P
<i>Diagnostic coronary angiography</i>			
Patients	52	52	
Contrast volume, mL	93.1 (41.7)	50.9 (14.7)	<.0001
DAP, mGycm ²	27.6 (11.5)	18 (6.4)	<.0001
Kerma, mGy	458.8 (184.8)	210.7 (83.9)	<.0001
Fluoroscopy duration, min	3 (2.1)	3.1 (1.6)	.72
Procedure time, min	5.5 (2.4)	6.5 (2.5)	.02
Procedure time, last 50 patients, min	5 (2.1)	5.5 (2.4)	.19
<i>Diagnostic and therapeutic coronary angiography (total)</i>			
Patients	29	28	
Total contrast volume, mL	335.1 (192.1)	238.5 (114.4)	.02
Total DAP, mGycm ²	110.01 (90.78)	90.20 (63.90)	.34
Total Kerma, mGy	1860.3 (1473.8)	1277.8 (864.9)	.07

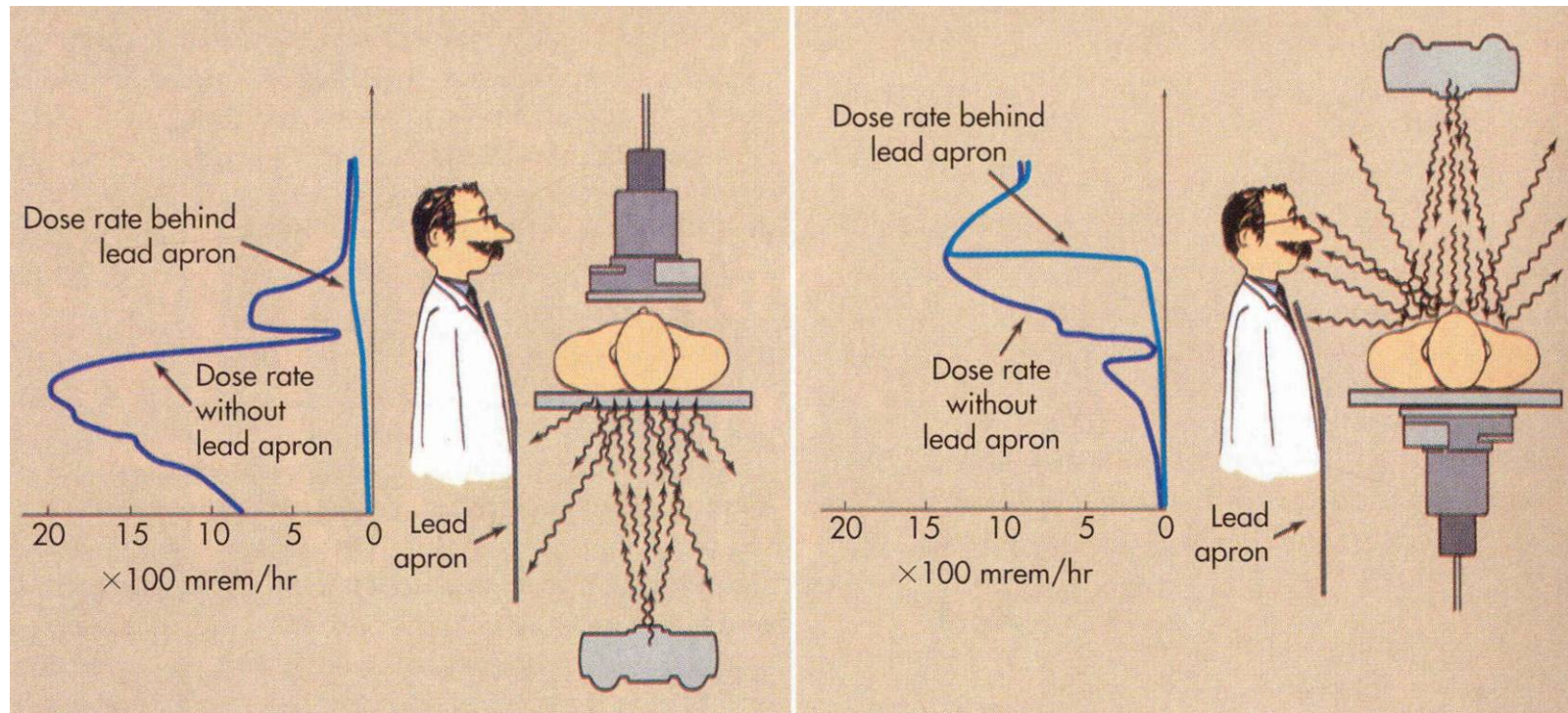
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Analyse software

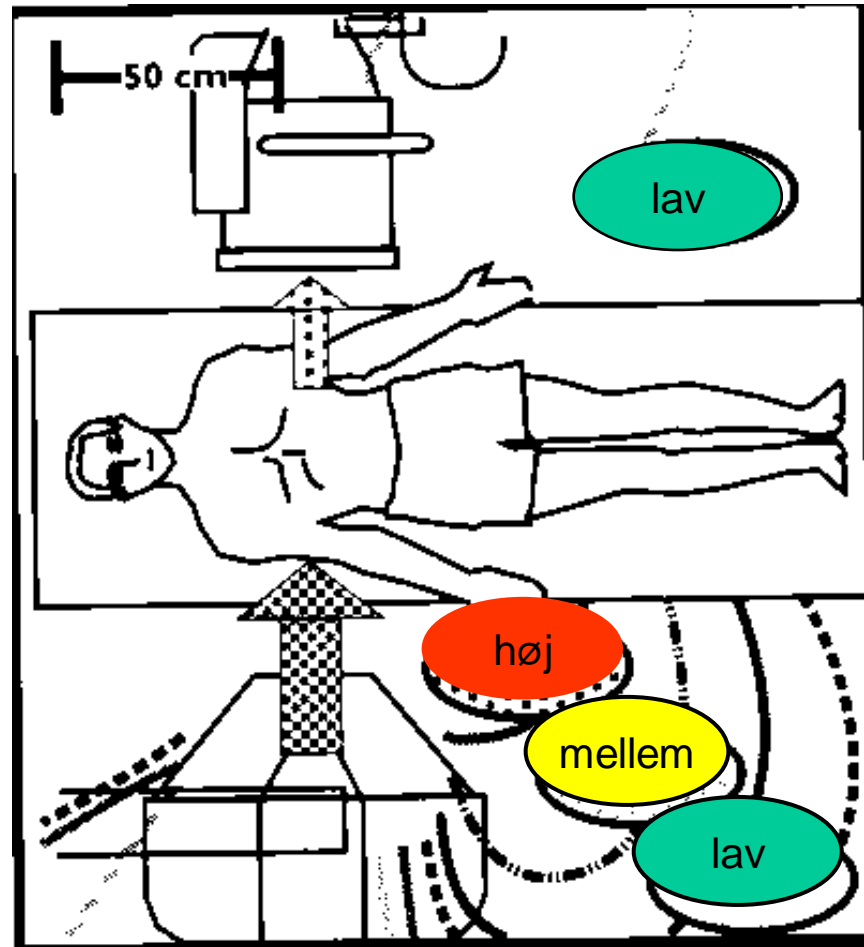
- Ejection Fraktion Analysis
- Quantitative Coronary Analysis
- Left Ventricular Analysis
- Quantitative Vascular Analysis
- Flere?

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Spredt stråling



Spredt stråling



DoseAware



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DICOM

Digital Imaging and Communications in Medicine

Det er en protokol (Standard) der gør, at alle modaliteter kan snakke sammen.

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Altså en Siemens CT-skanner kan printe billeder ud på en Fuji printer, og billederne kan blive gemt i et AGFA Pacs system

DICOM

- Alle leverandører garanter at de "snakker" DICOM
- Men der er mange dialekter !
- God ide at sammenligne leverandørenes **Dicom Conformance Statement**

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Den "digitale" radiolog

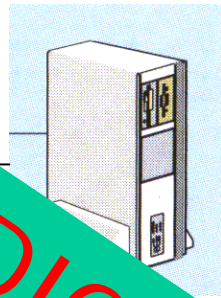


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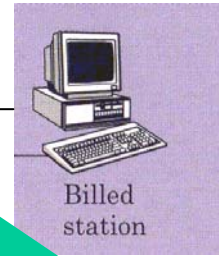
Den digitale konference.



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RIS server

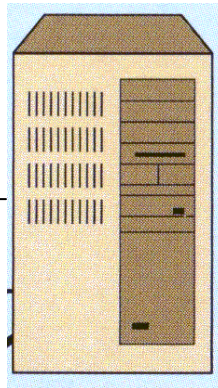


Billed station

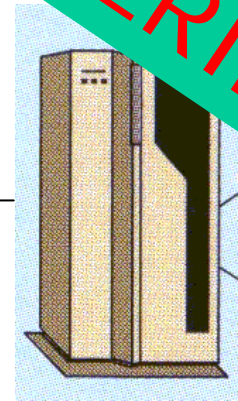


Den digitale røntgenafdeling

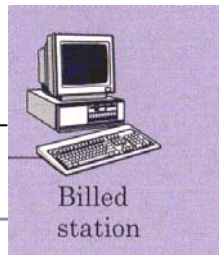
lager



PACS server



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Billed station

Medicoteknik
Region Syddanmark

...AND YOU THINK YOU HAVE STRESS..



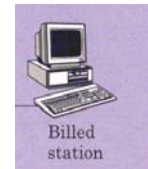
DET DIGITALE MARERIDT

Almindelig setup med arbejdsstationer

KAG rum



KAG



Mamma

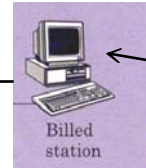


Tynde Klienter

KAG rum



KAG Applikations server



Kardiologisk hjemme
arbejdsplads

KAG

