

Mammografie

Fysische kant van de insteltechniek

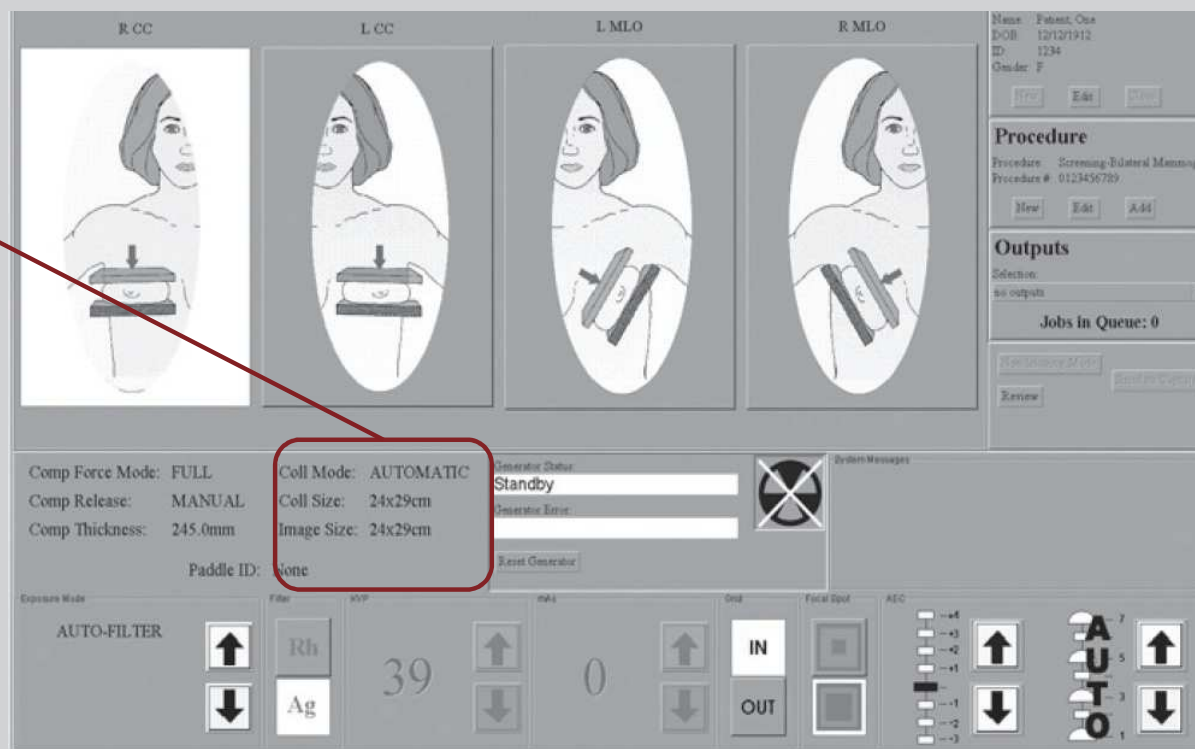
Fysische Groep
LRCB, Nijmegen

Inhoud

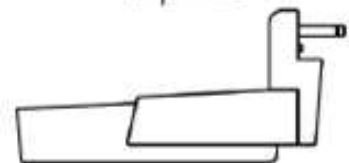
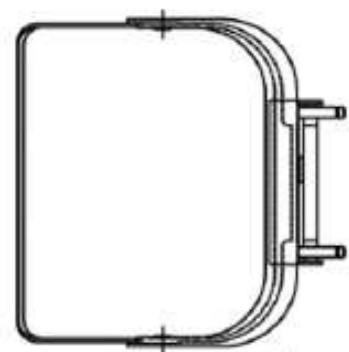


Collimatie

Collimatie



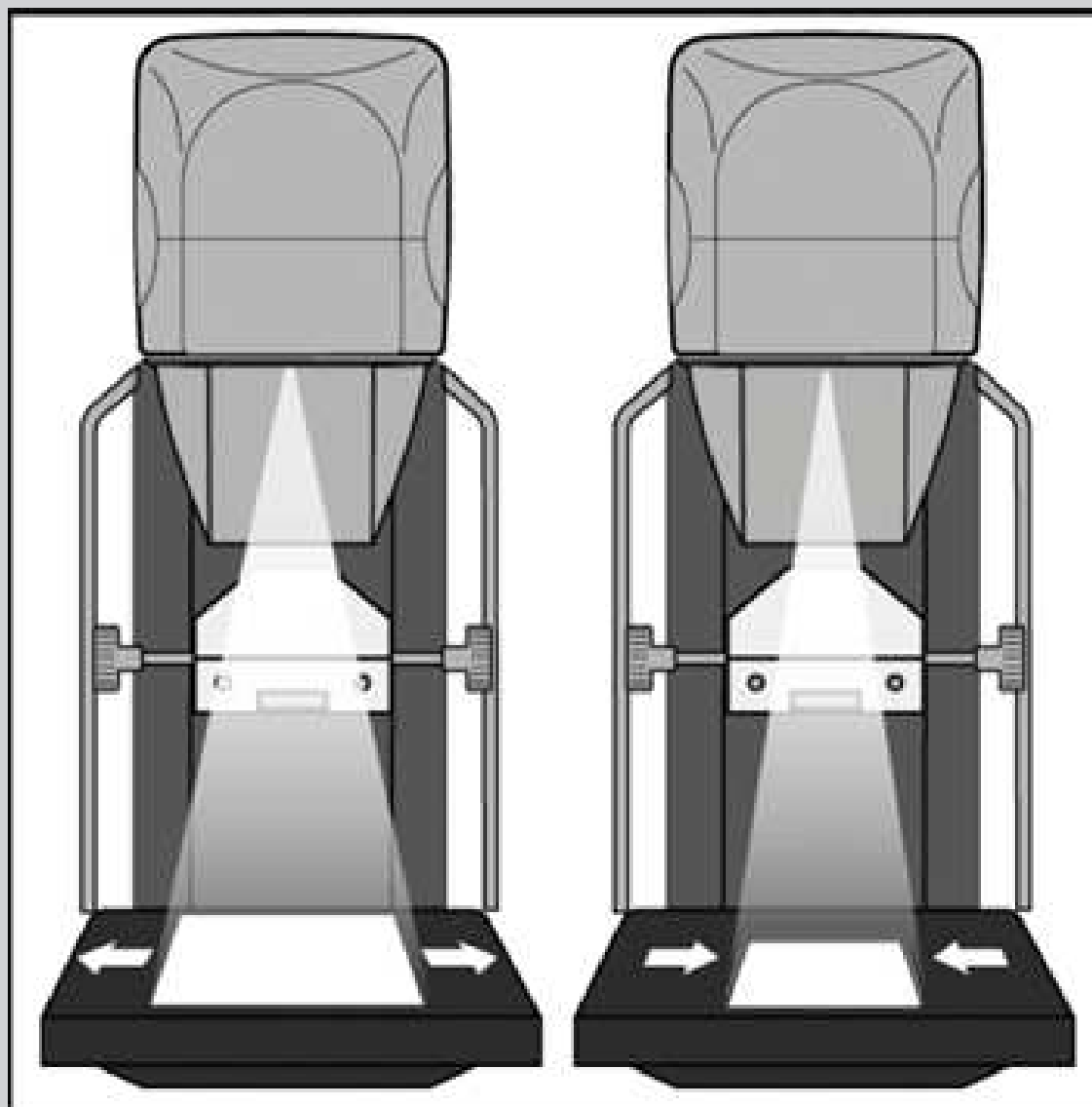
Collimatie



24 x 30 cm

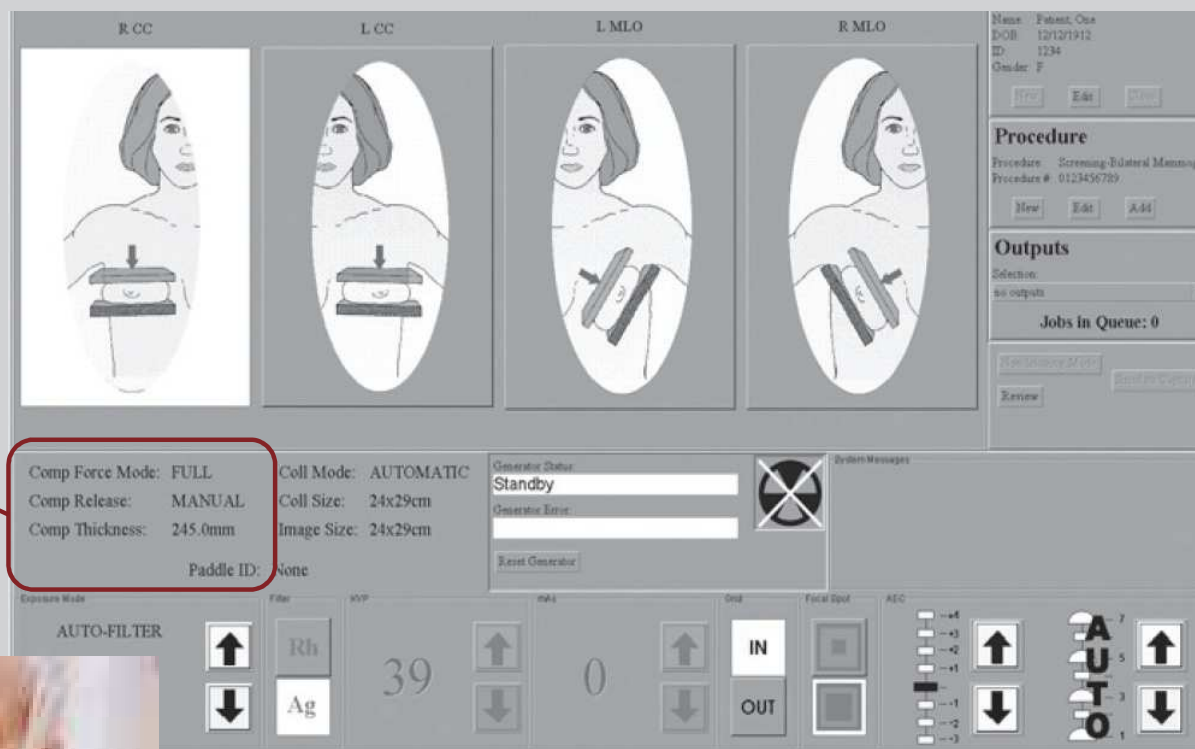


18 x 24 cm



Compressie

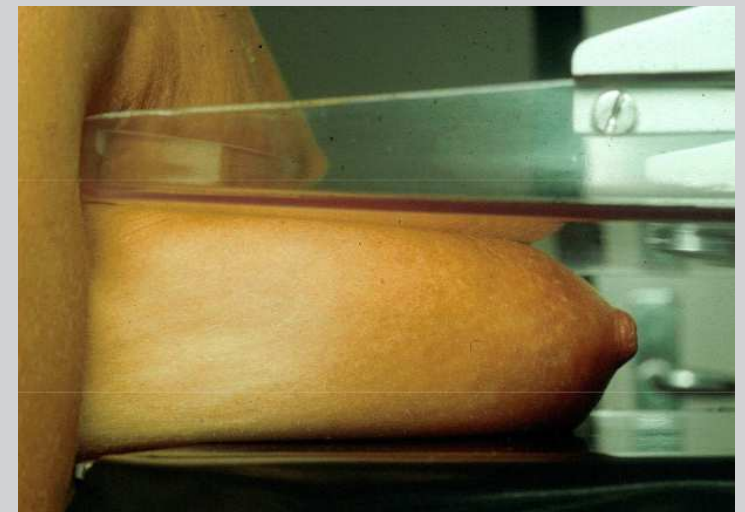
Compressie



Compressie

- Borst fixeren
- Minder onscherpte (beweging en geometrisch)
- Spreiding structuren
- Betere beeldkwaliteit
- Homogenere beeldkwaliteit
- Minder strooistraling
- Lagere dosis!

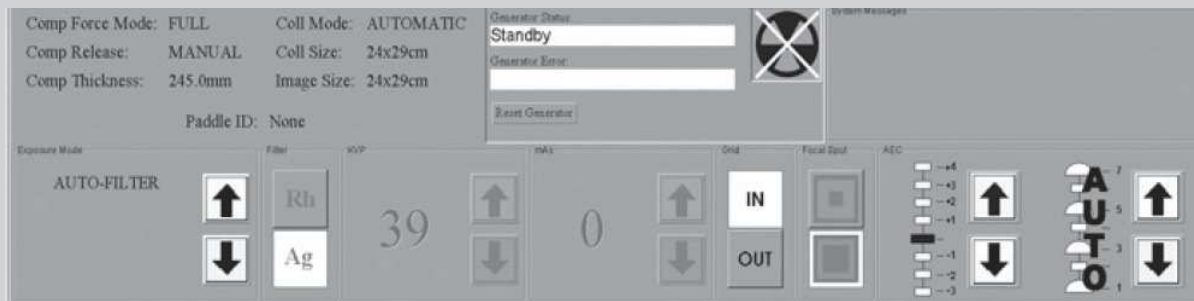
In de MLO maar ook in de CC!



Compressie

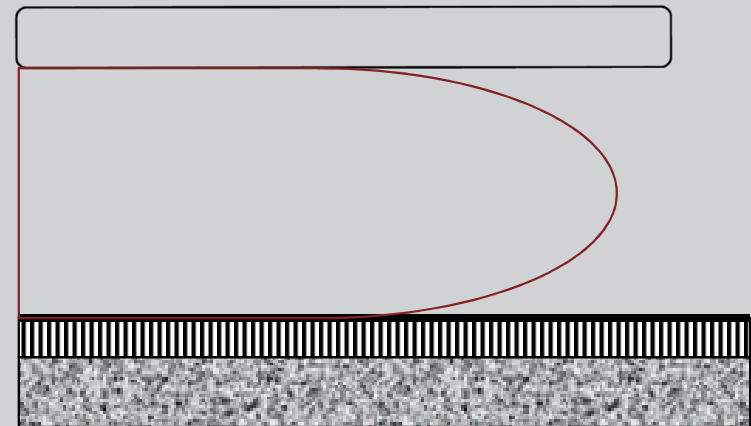
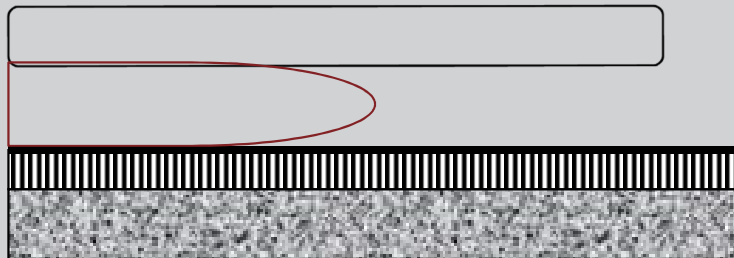
Wat weten we nu?

Gecomprimeerde borstdikte



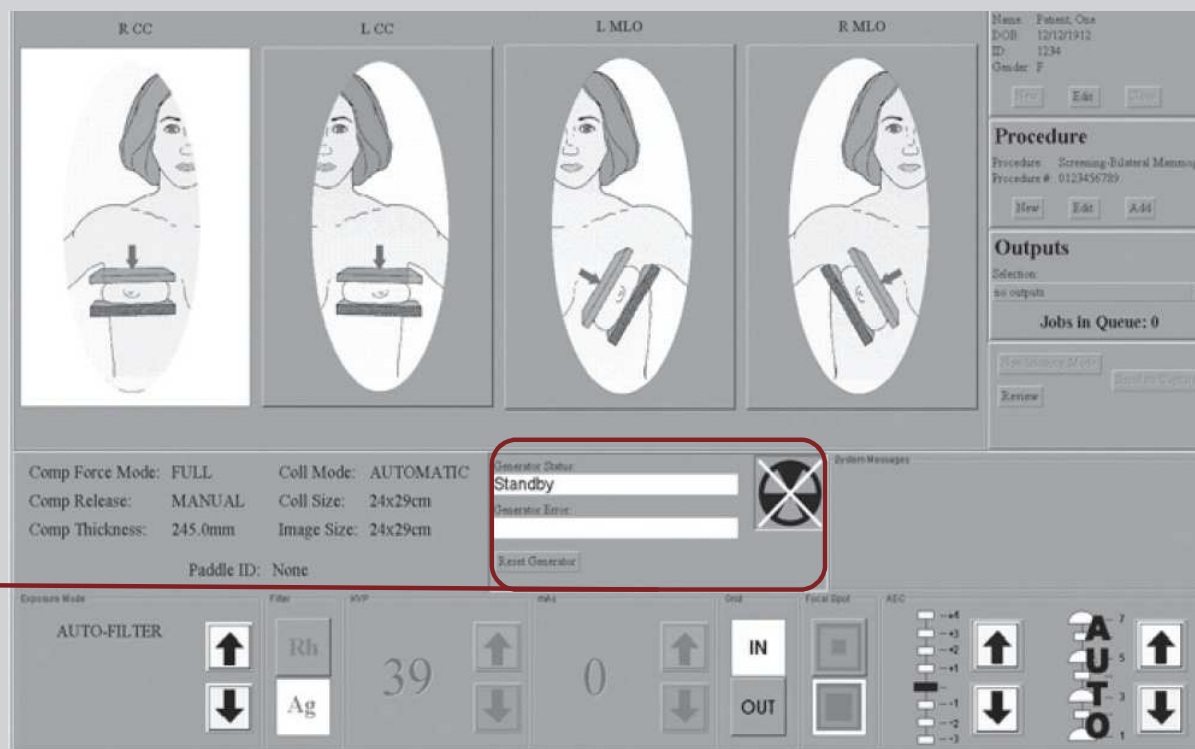
Compressie

- Gecomprimeerde dikte zegt iets over de te verwachte verzwakking
- Benodigde hardheid van de straling



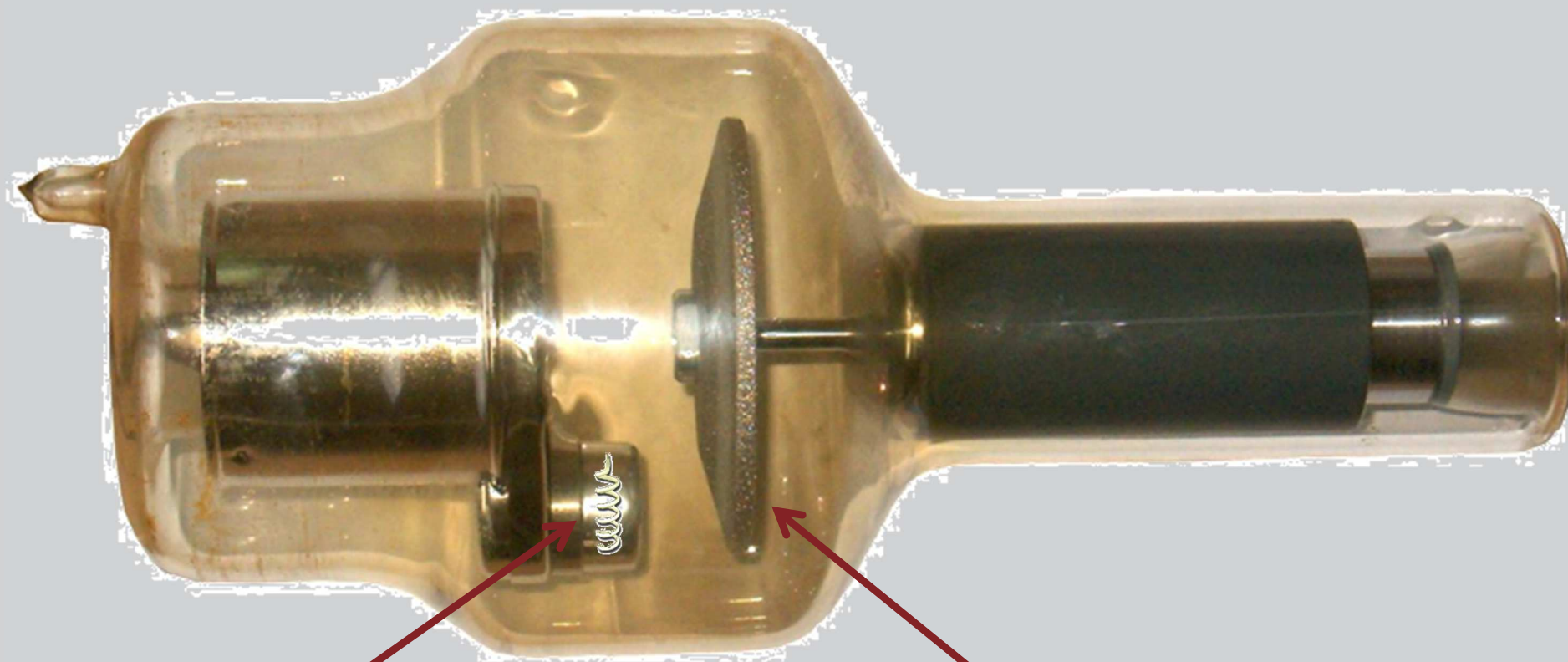
Röntgenspectrum

Opwekking
Röntgenstralen



Hoe zat dat ook al weer met die straling?

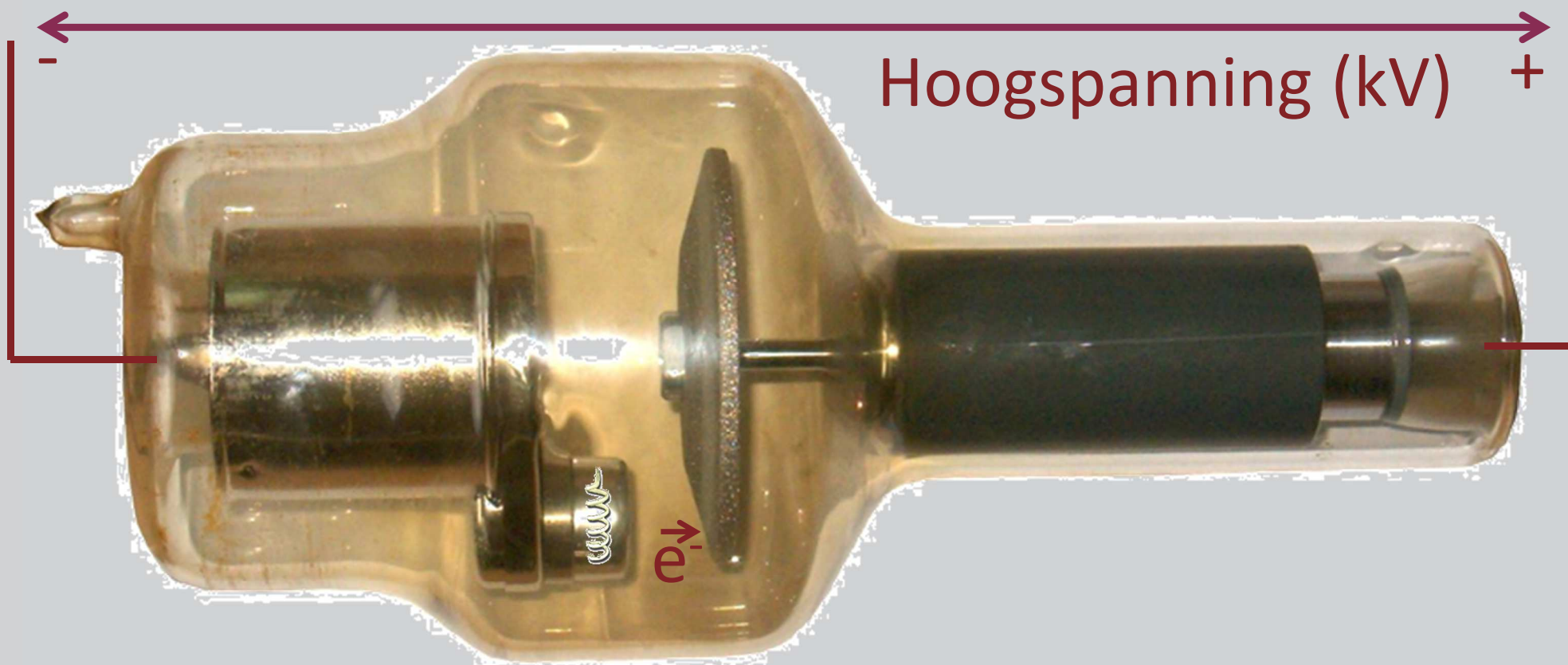
Opwekking Röntgenstralen



Kathode

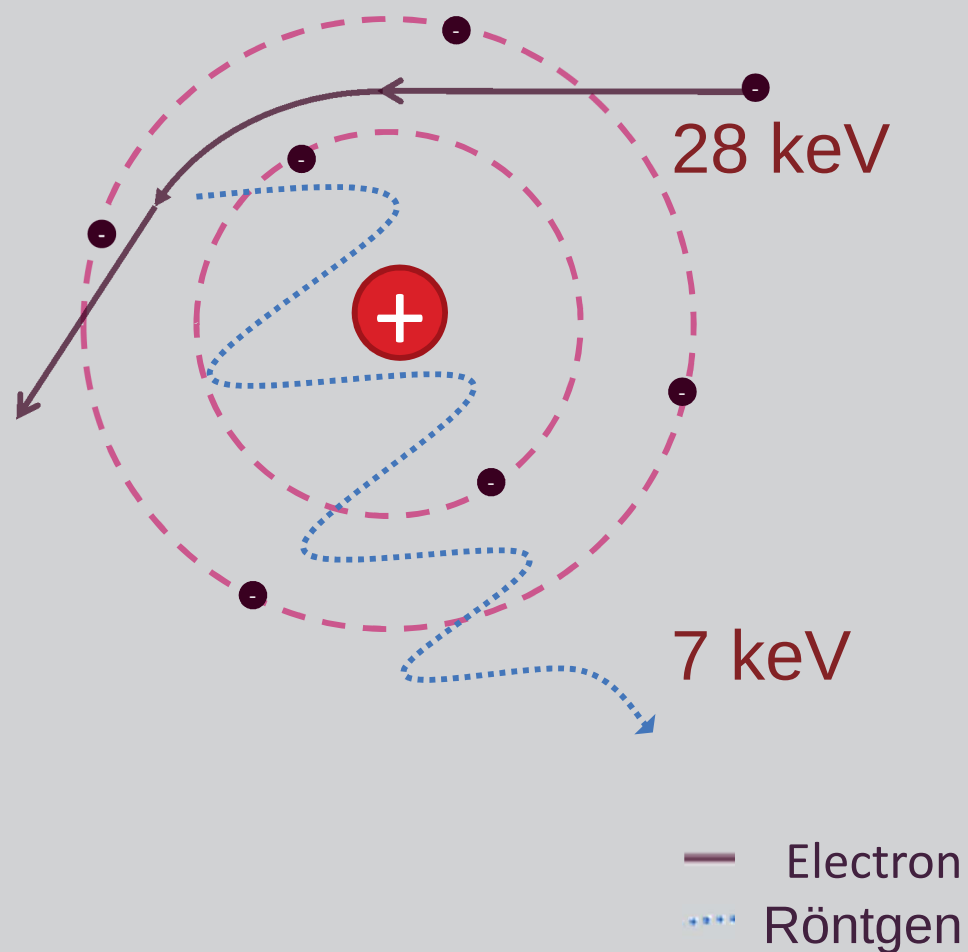
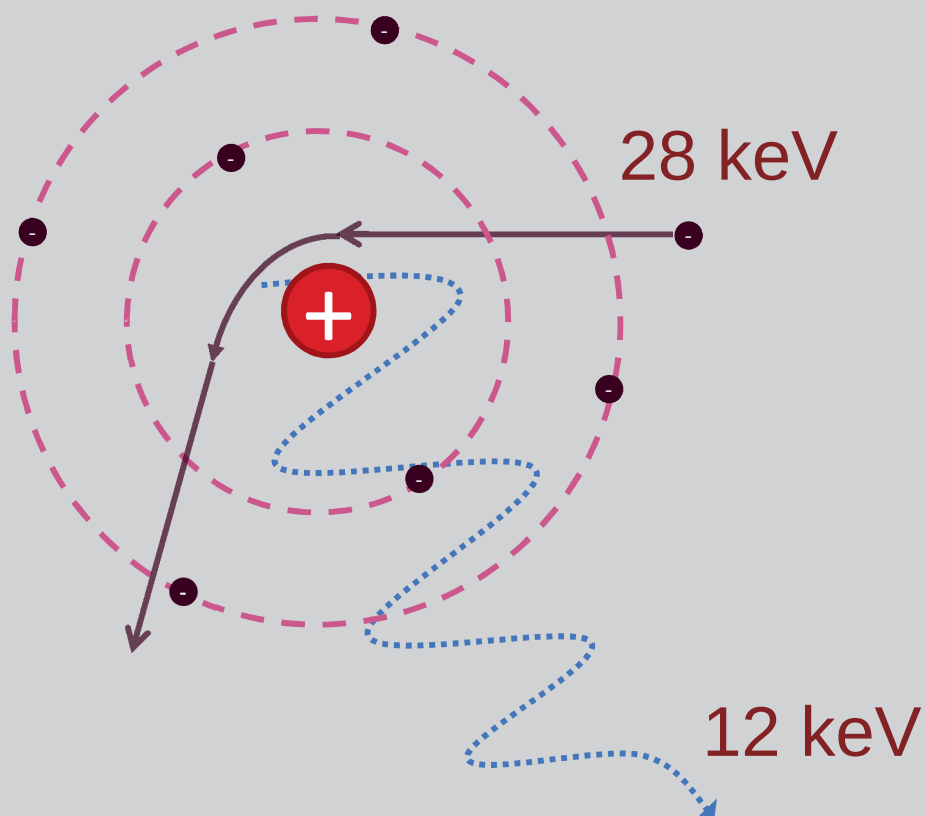
Anode

Opwekking Röntgenstralen



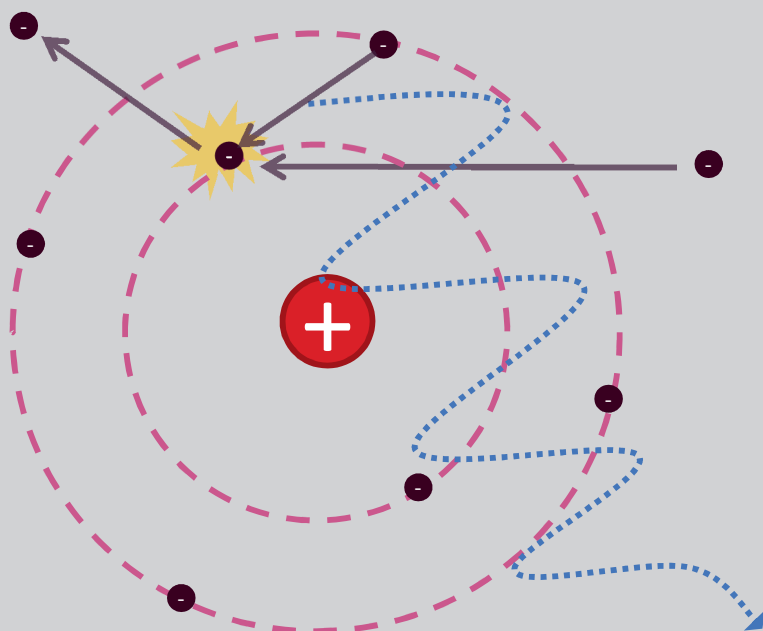
Opwekking Röntgenstralen

Remstraling



Opwekking Röntgenstralen

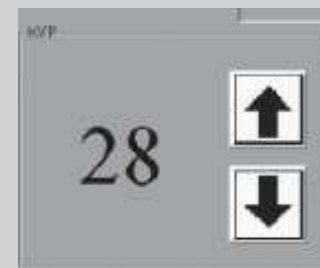
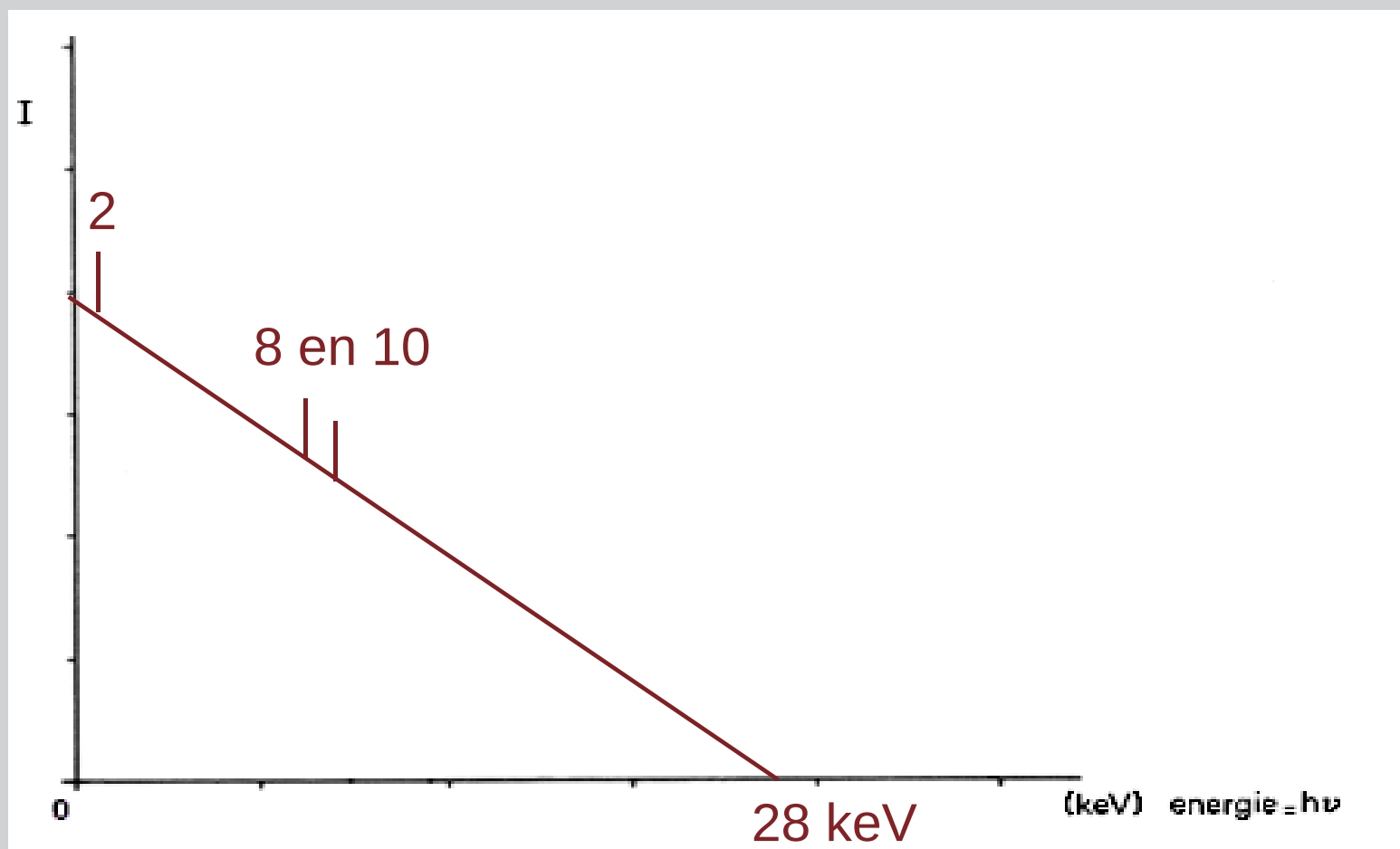
Karakteristieke straling



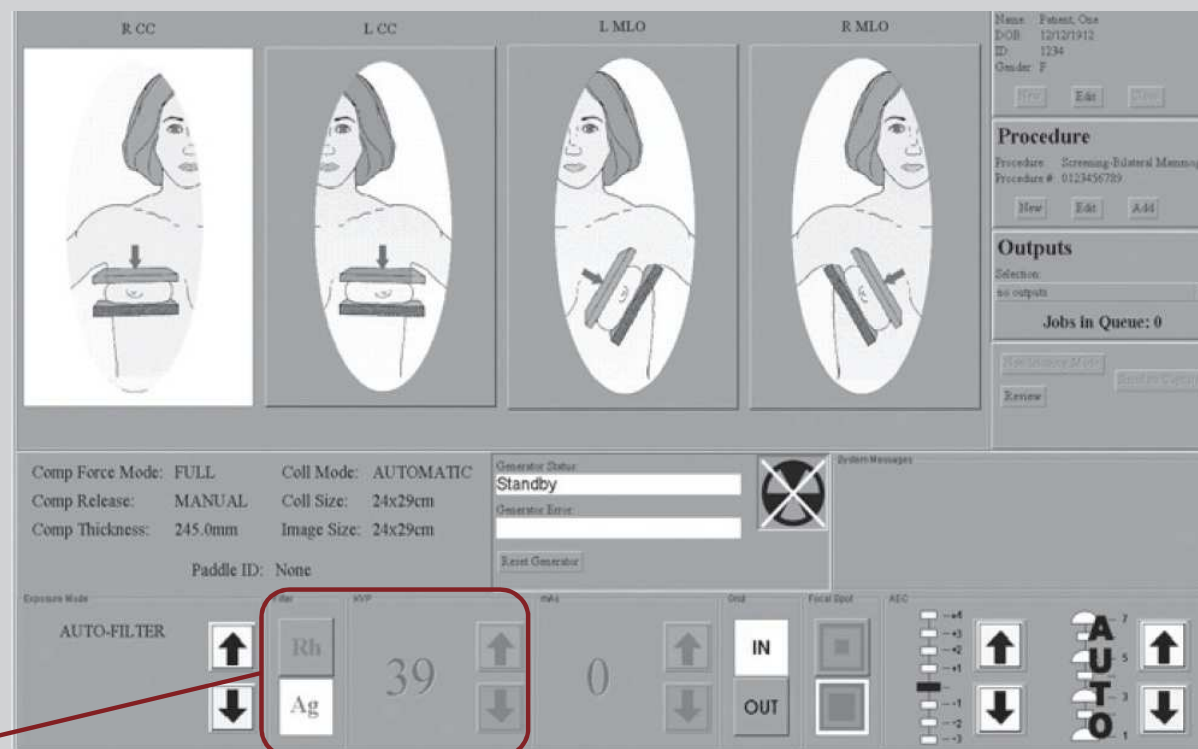
Schilovergang	Kar. fotonenergie
L-K	58,2
M-K	66,7
N-K	68,9
M-L	8,5
N-L	10,7
N-M	2,2

 Electron
 Röntgen

Opwekking Röntgenstralen



Röntgenspectrum



Röntgenspectrum

Röntgenspectrum

Zachte straling:

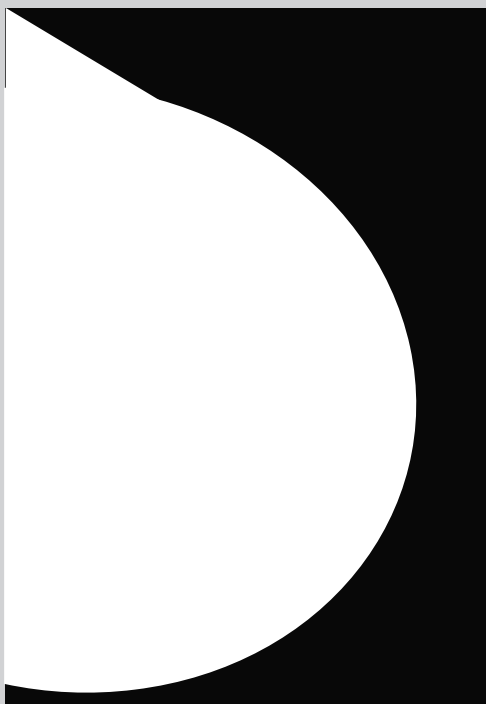
- Lager keV
- Laag doordringend vermogen

Harde straling:

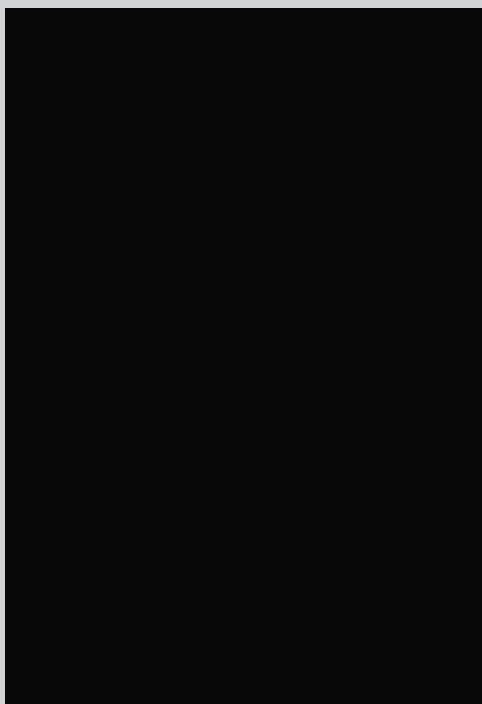
- Hoger keV
- Hoog doordringend vermogen
- Hoger kV kiezen

Röntgenspectrum

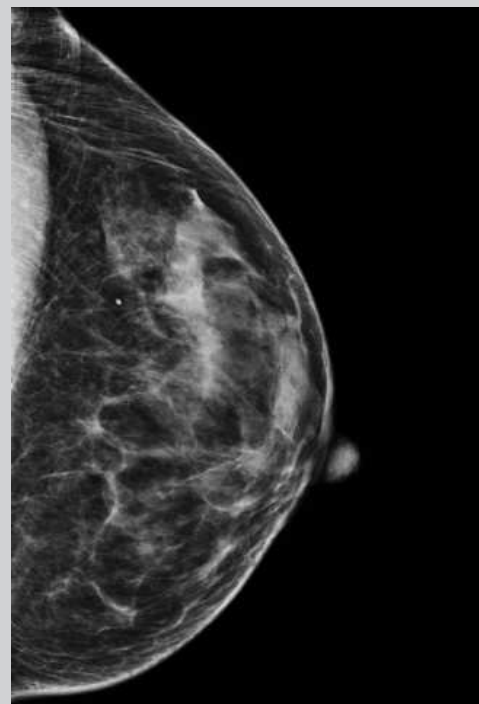
Zachte
straling



Harde
straling

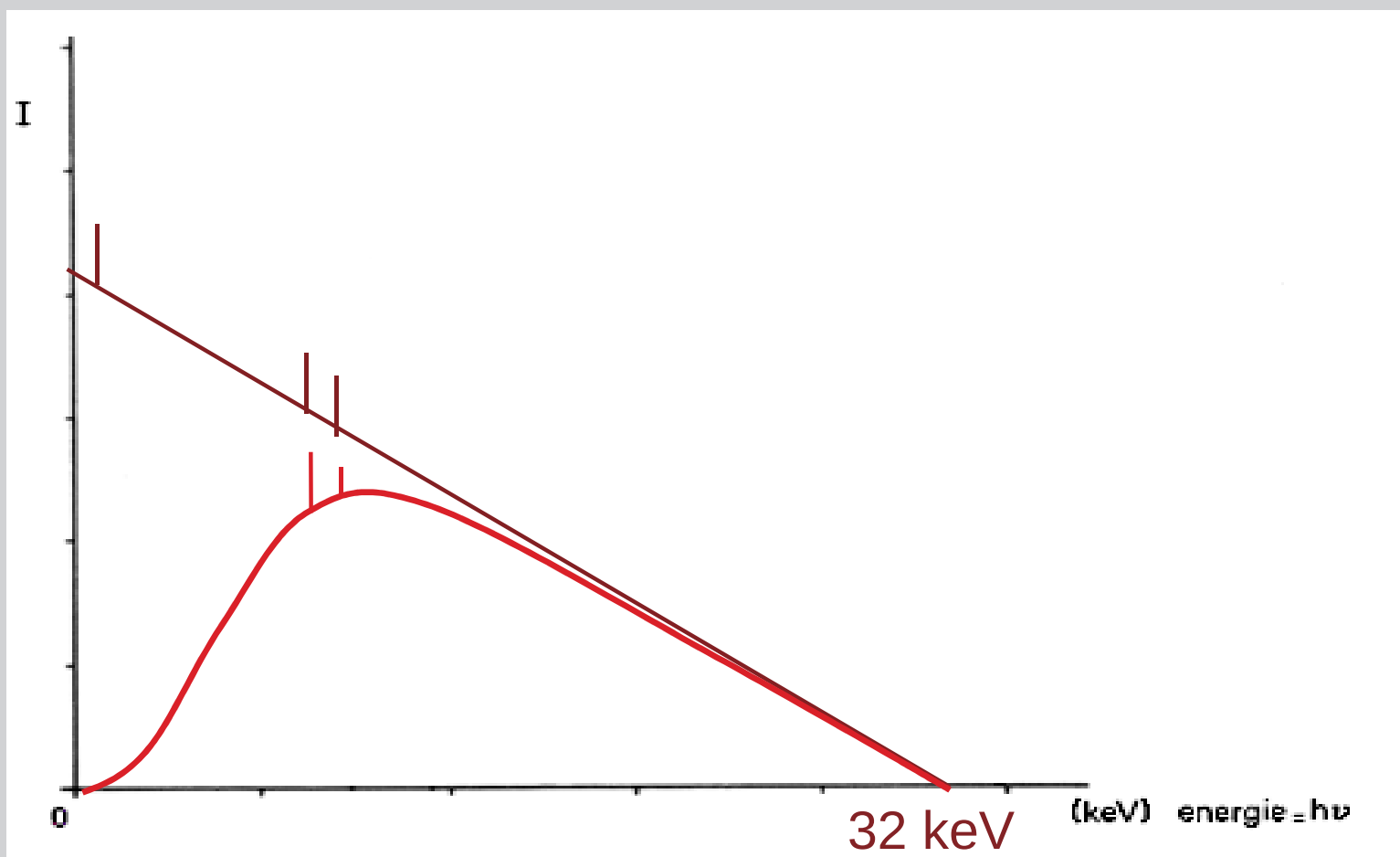


Optimaal

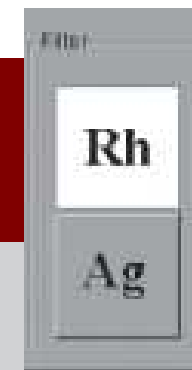


Röntgenspectrum

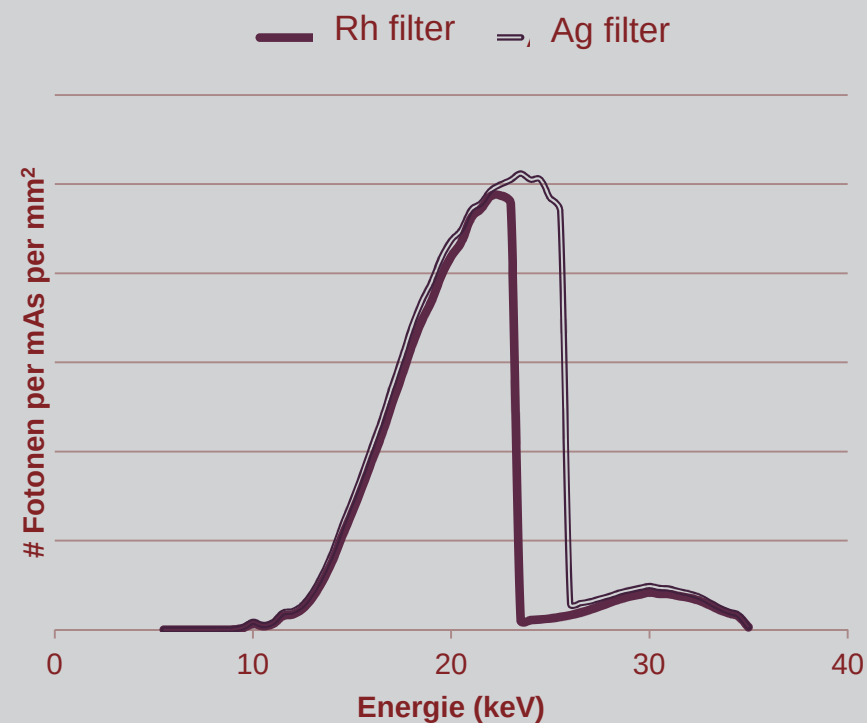
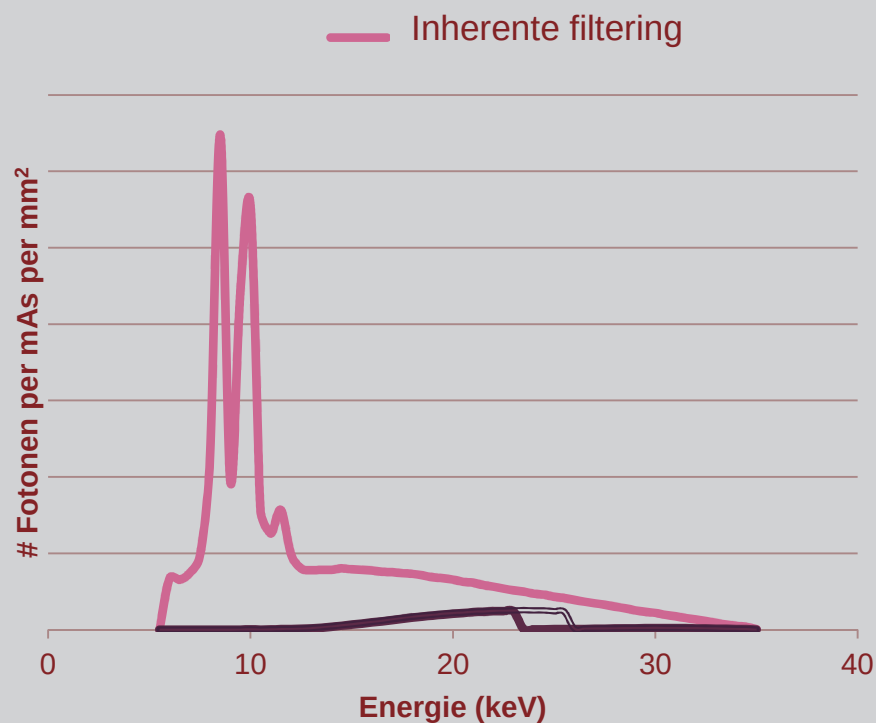
Inherente filtering



Röntgenspectrum



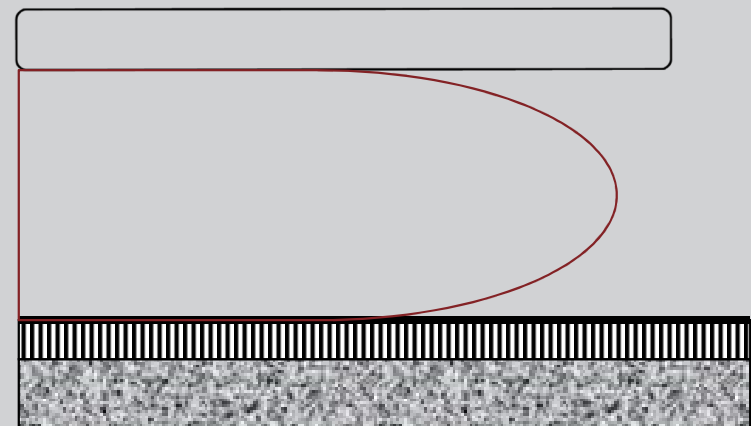
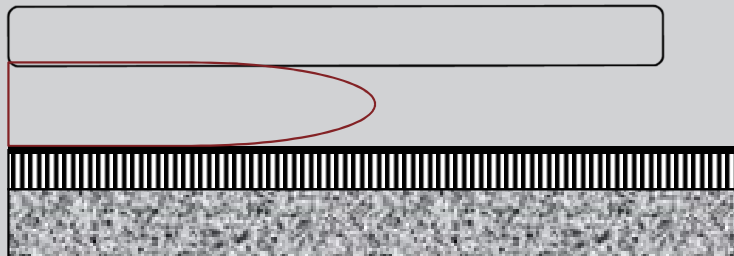
Voordraai filter



Röntgenspectrum

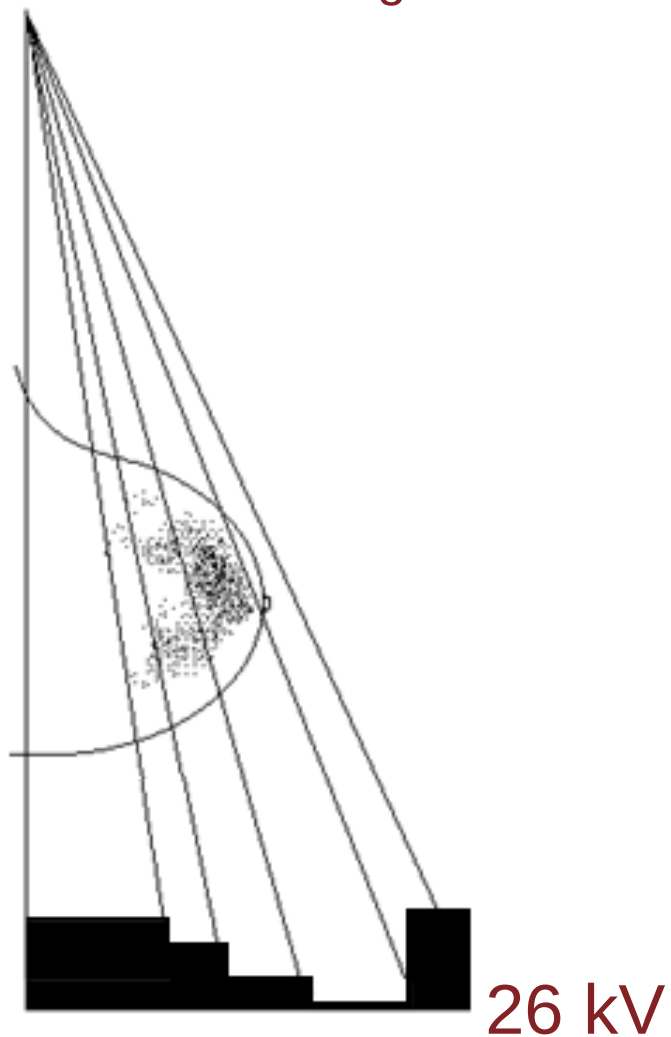
- Gecomprimeerde dikte zegt iets over de te verwachte verzwakking
- Benodigde hardheid van de straling

Röntgenspectrum heeft invloed op röntgencontrast

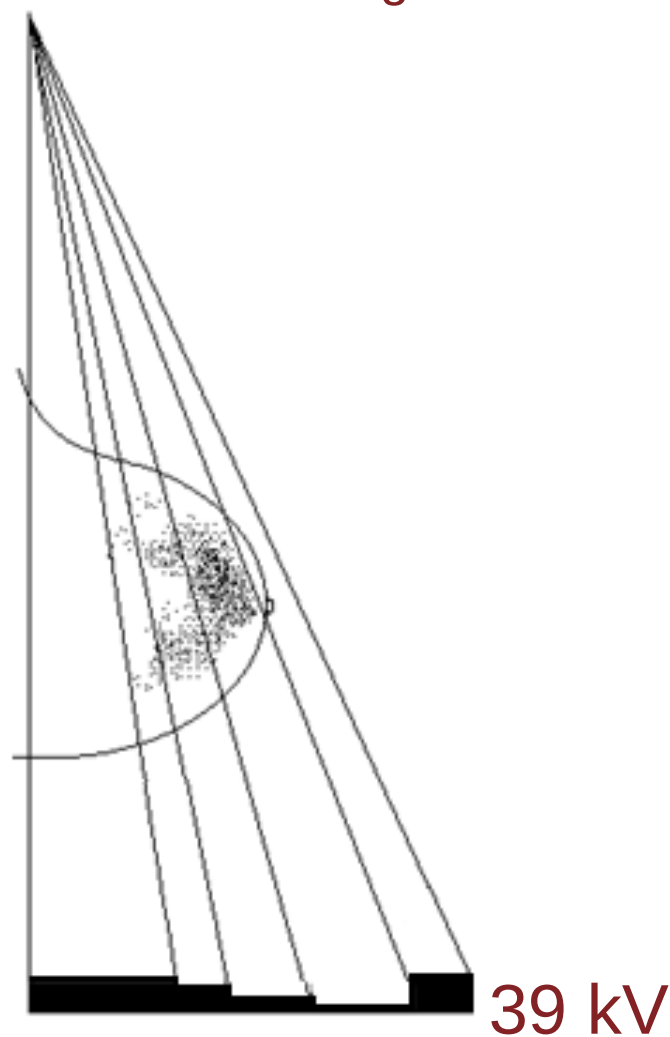


Röntgenspectrum

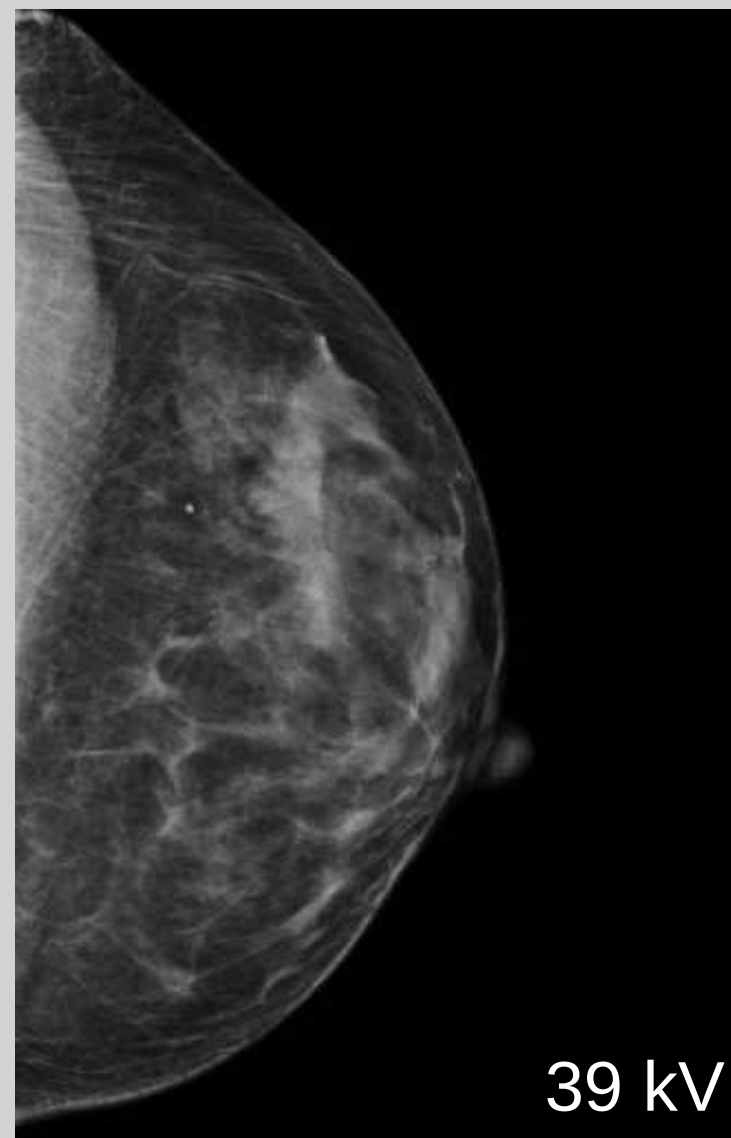
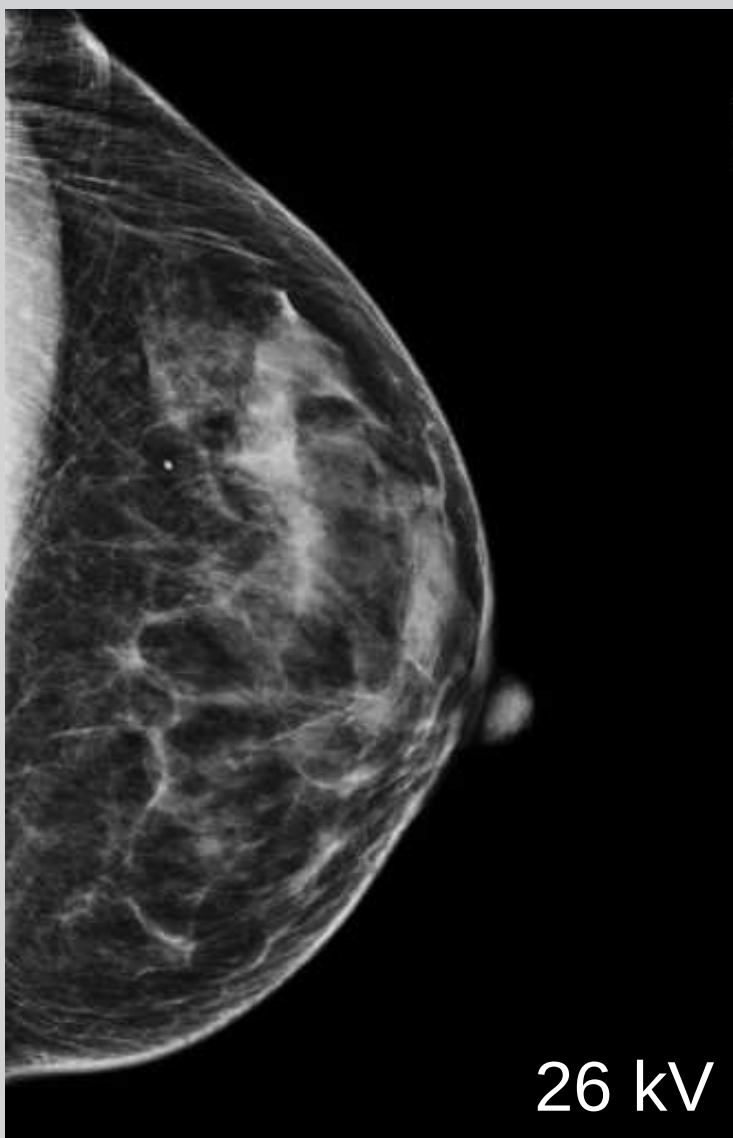
Röntgen contrast



Röntgen contrast



Röntgenspectrum



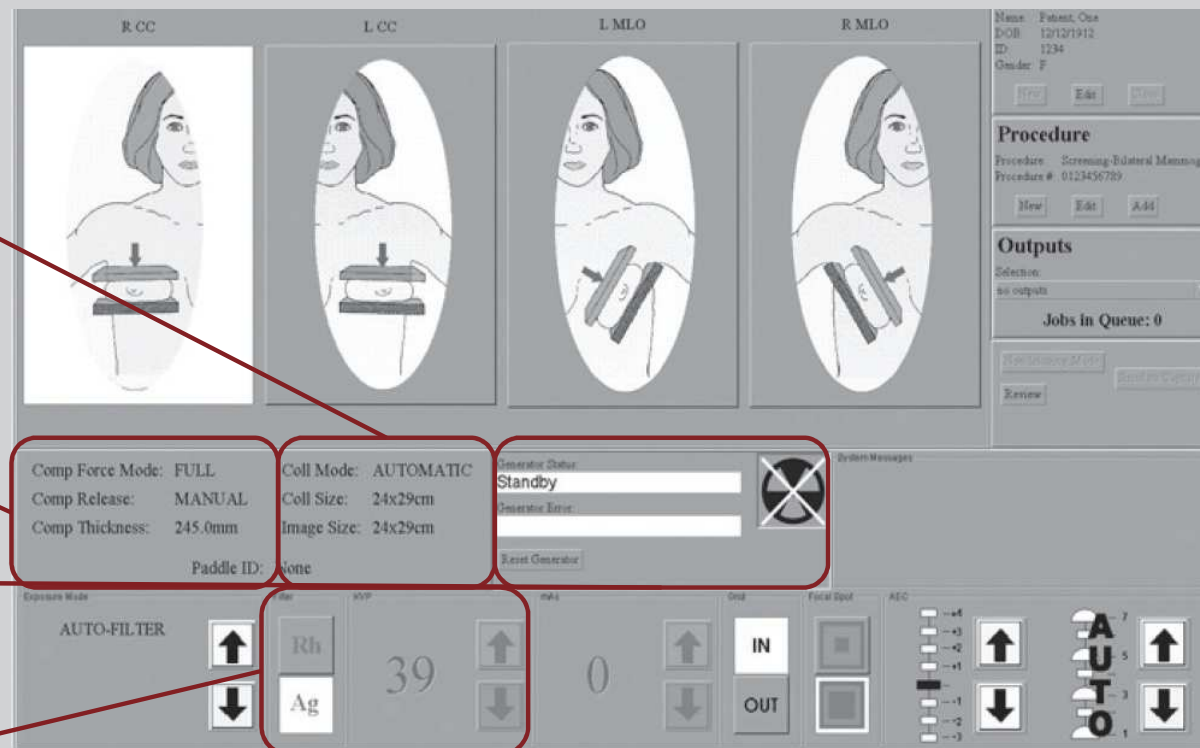
Tot nu toe:

Collimatie

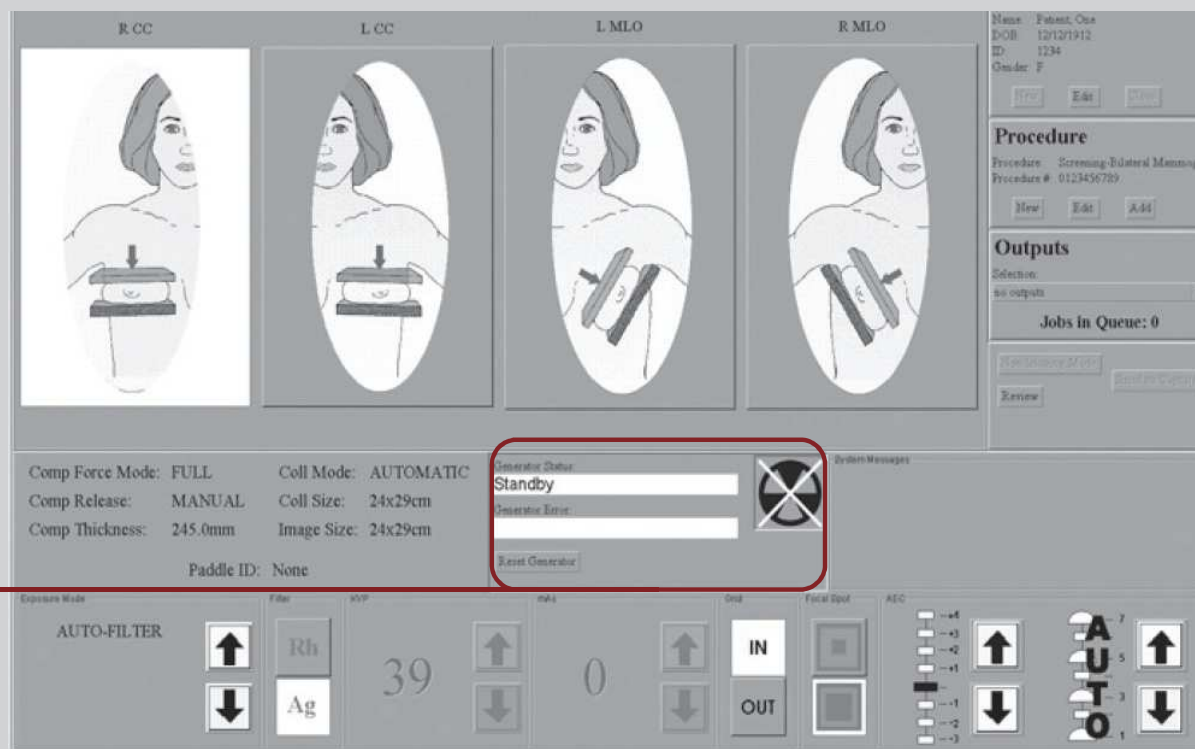
Compressie

Opwekking
Röntgenstralen

Röntgenspectrum

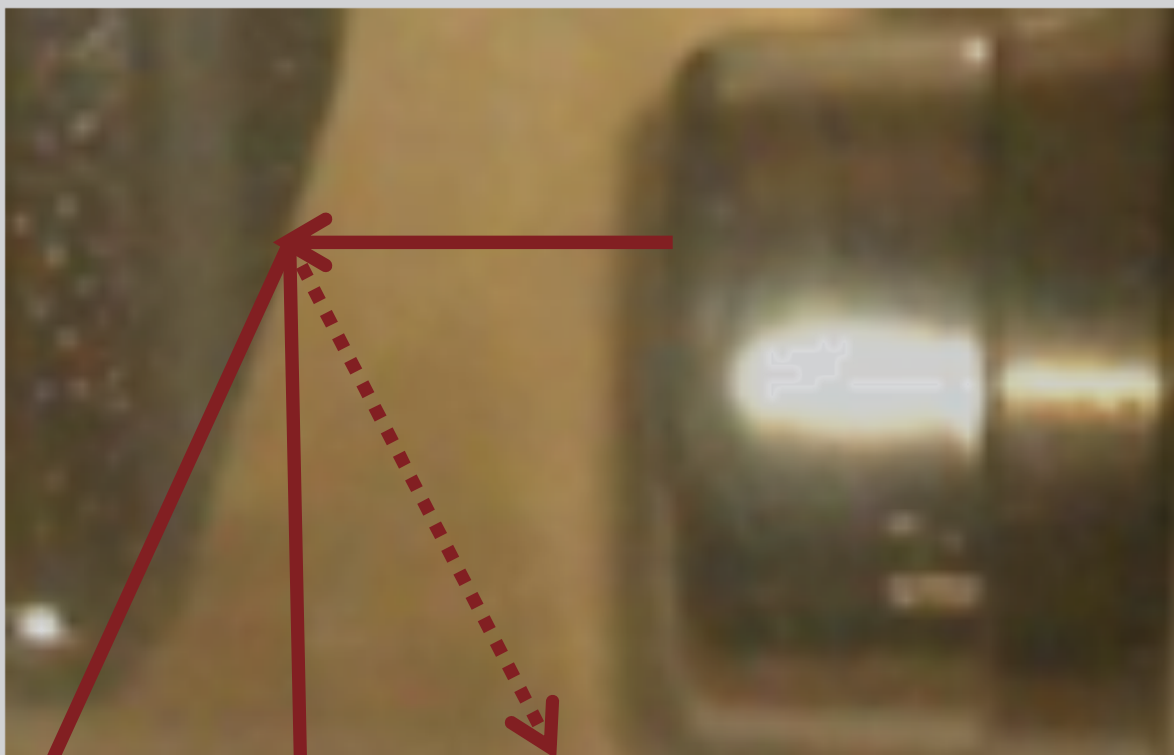


Bundelgeometrie



Bundelgeometrie

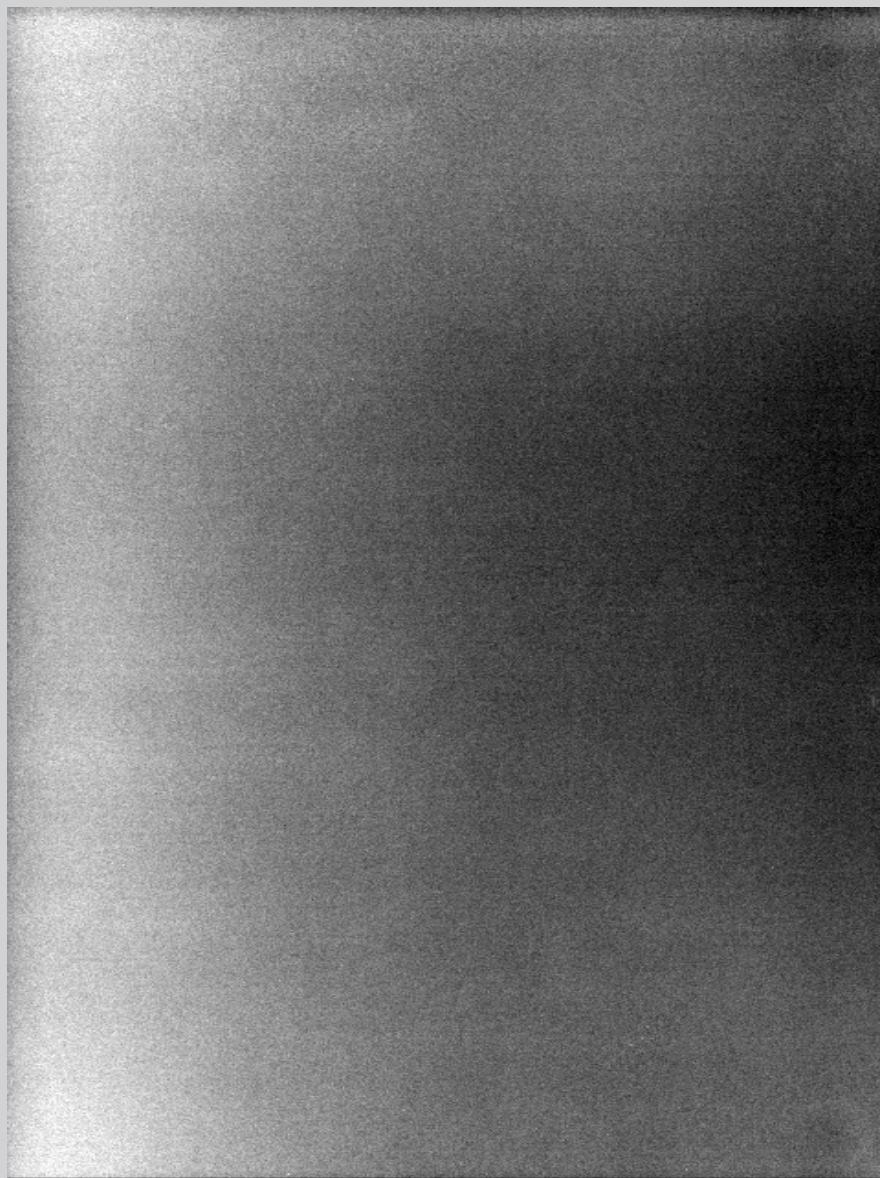
Bundelgeometrie



Tepelzijde

Thoraxzijde

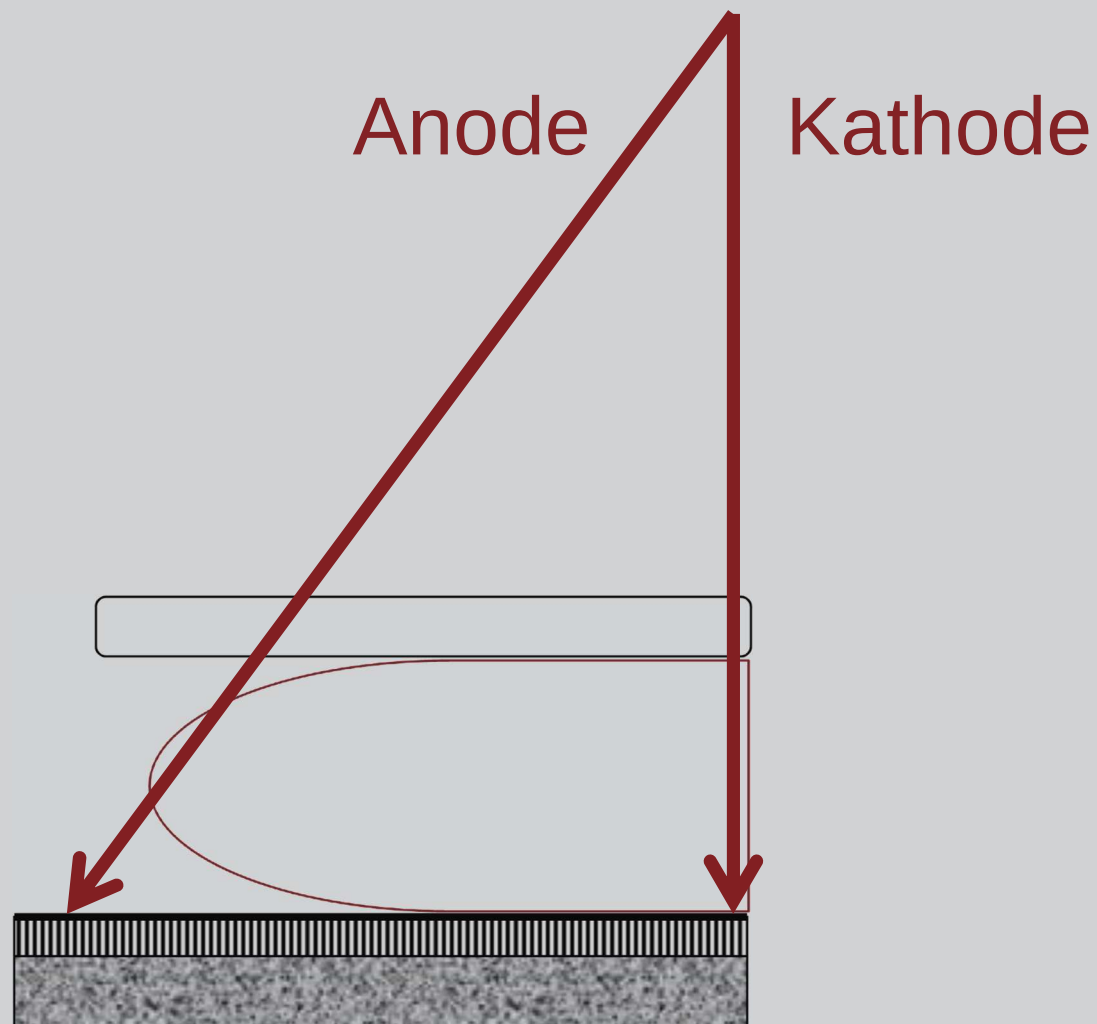
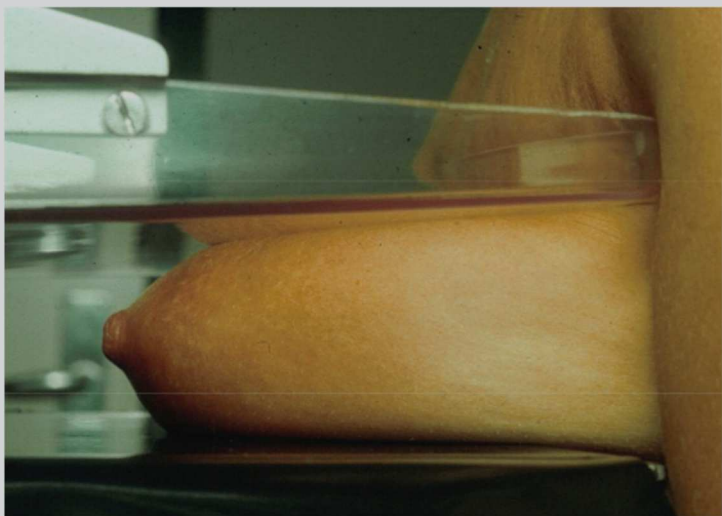
Bundelgeometrie



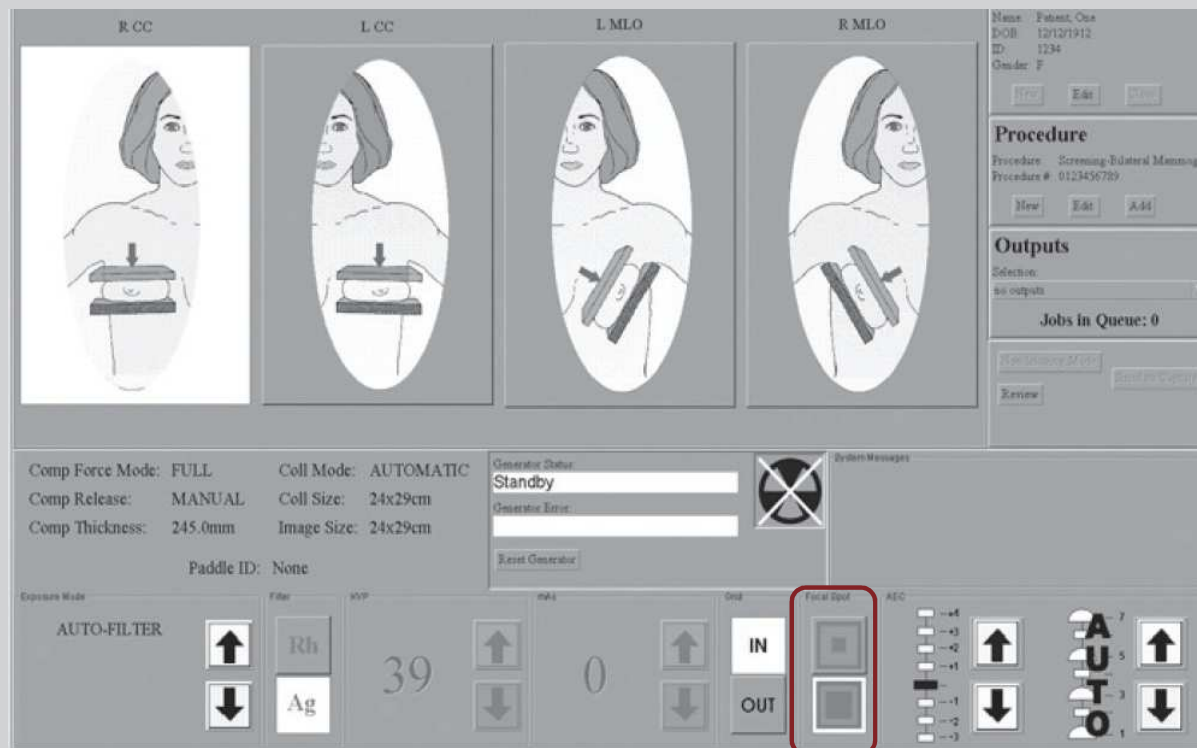
Tepelzijde

Thoraxzijde

Bundelgeometrie

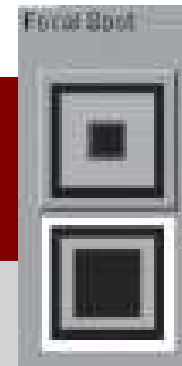


Bundelgeometrie

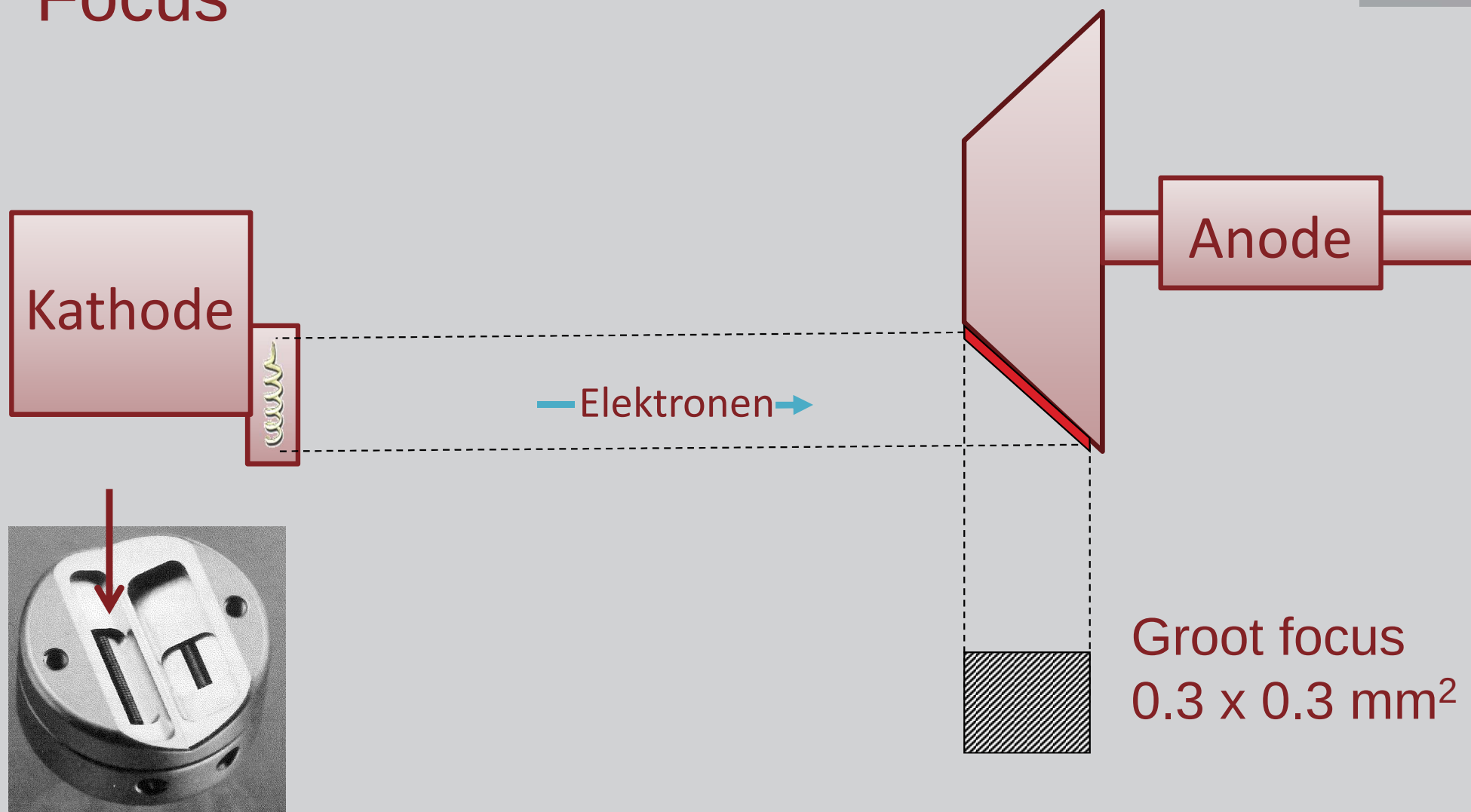


Focus

Bundelgeometrie



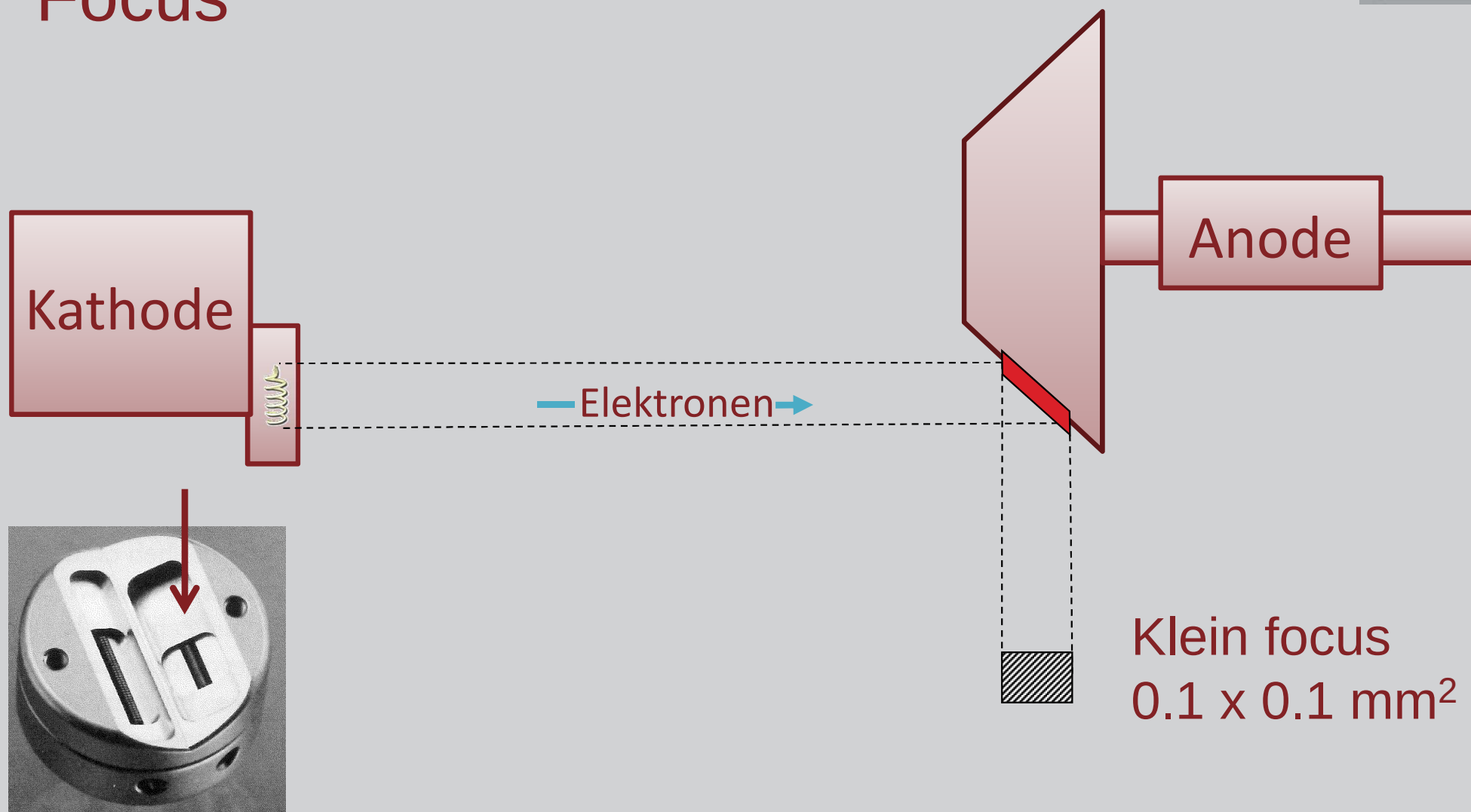
Focus



Bundelgeometrie

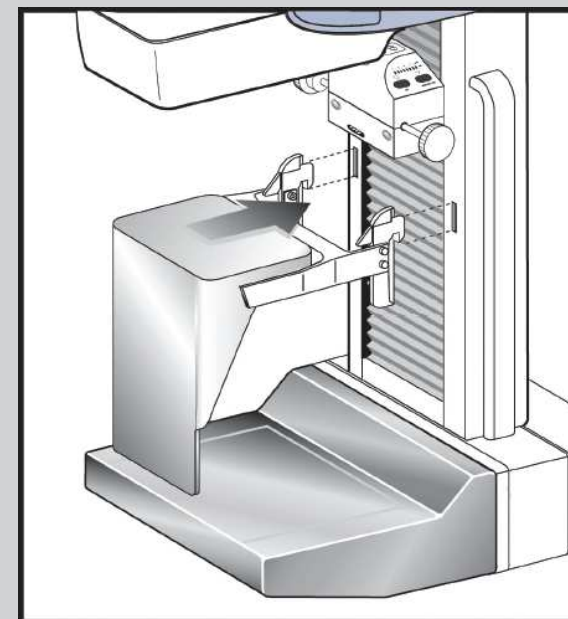
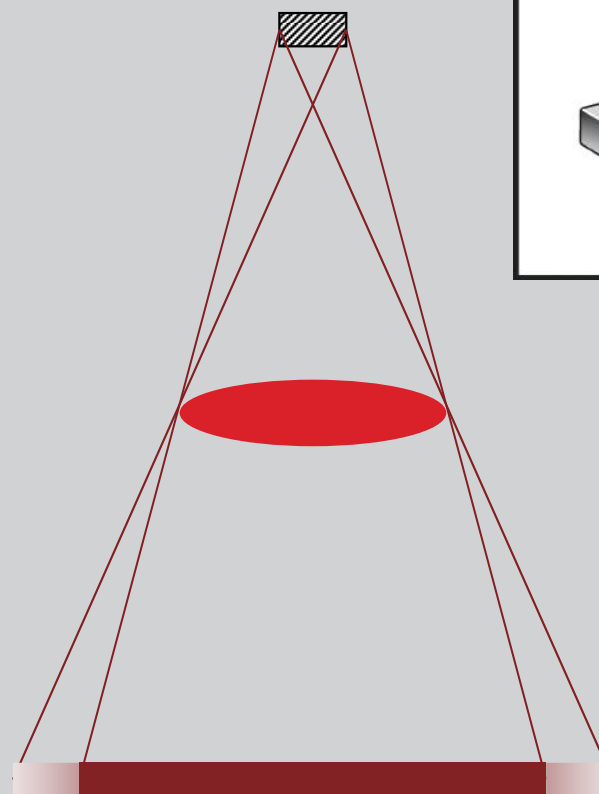
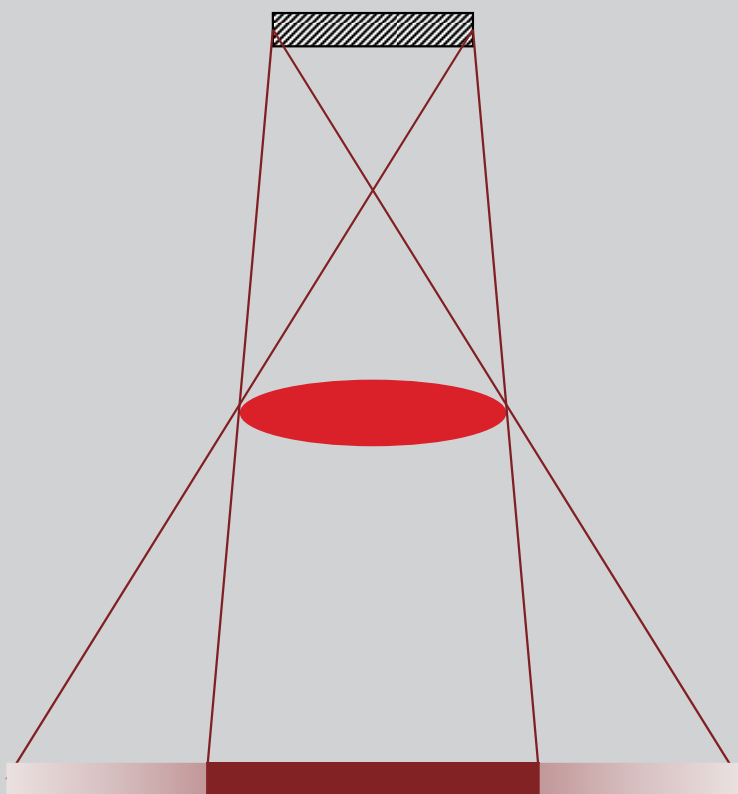


Focus



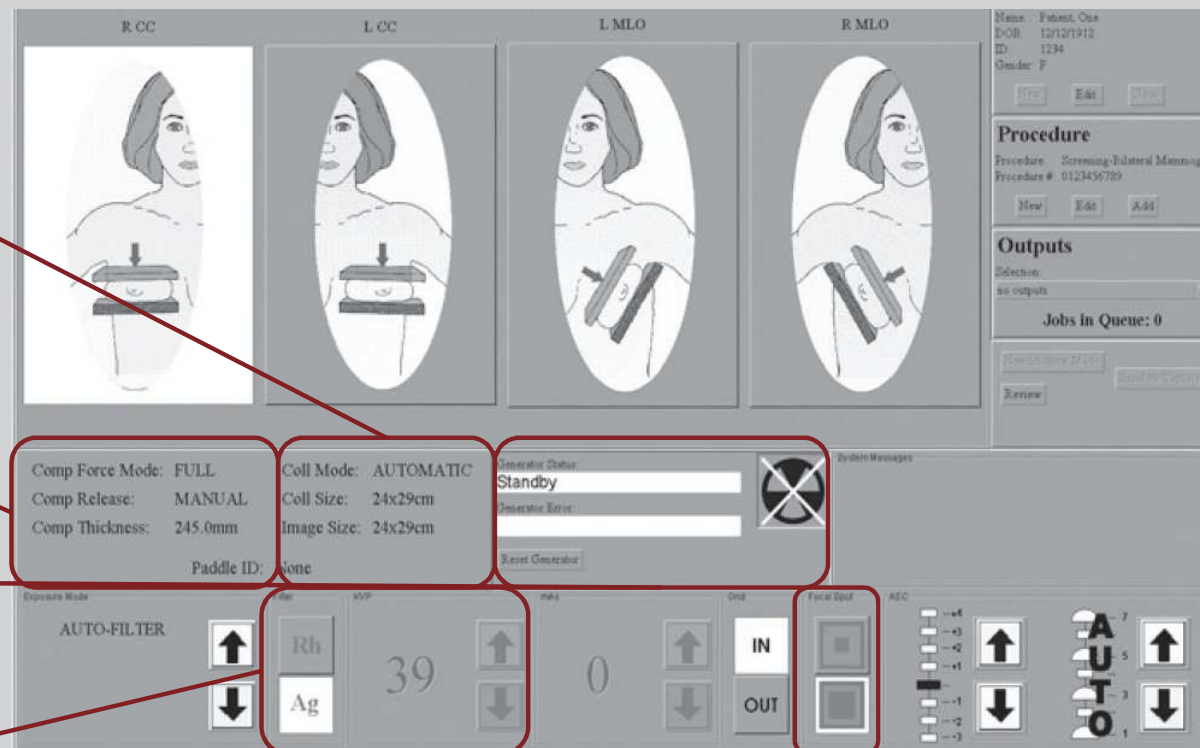
Bundelgeometrie

Focus



Tot nu toe:

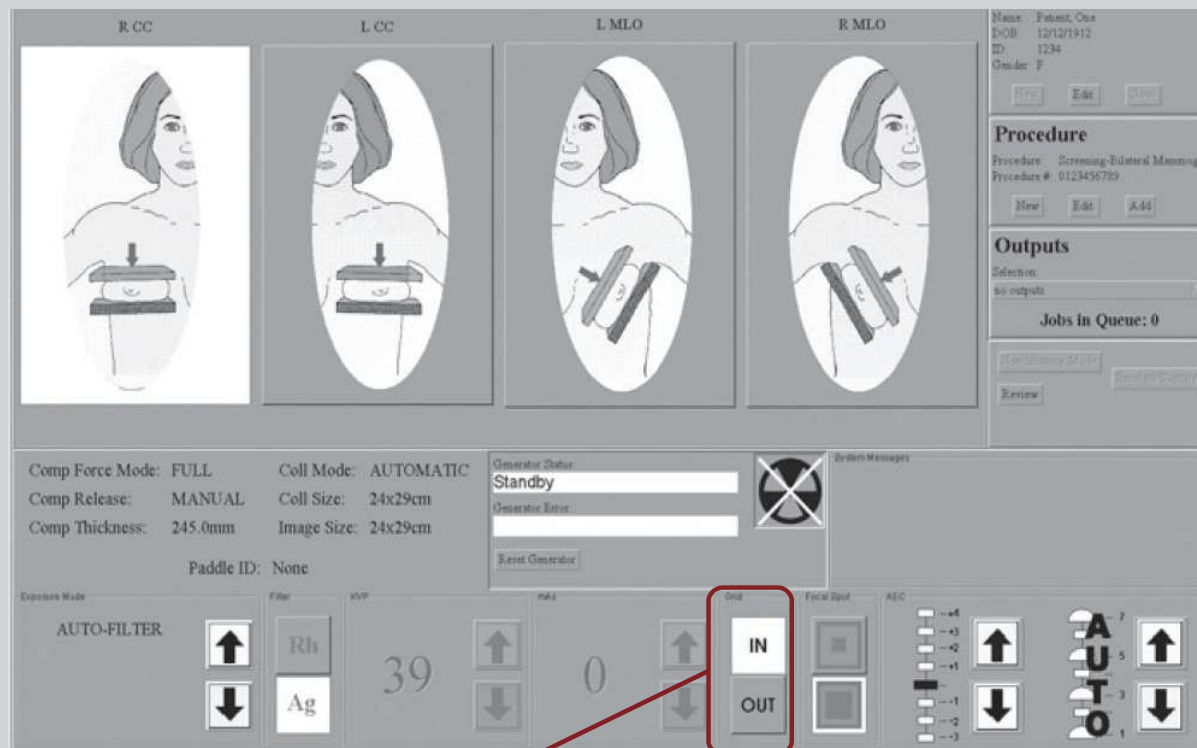
Collimatie
 Compressie
 Opwekking
 Röntgenstralen



Röntgenspectrum

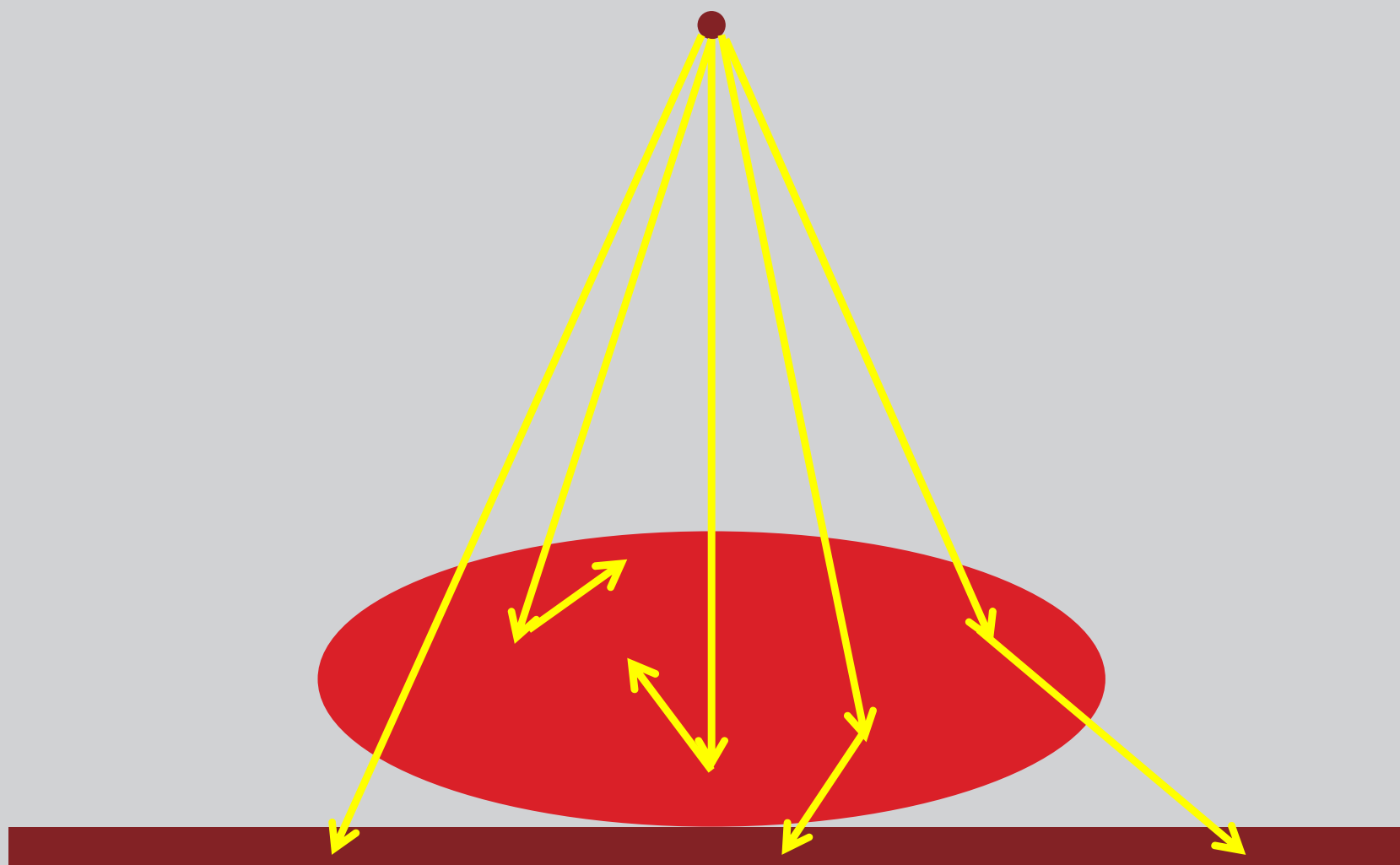
Focus

Strooistraling

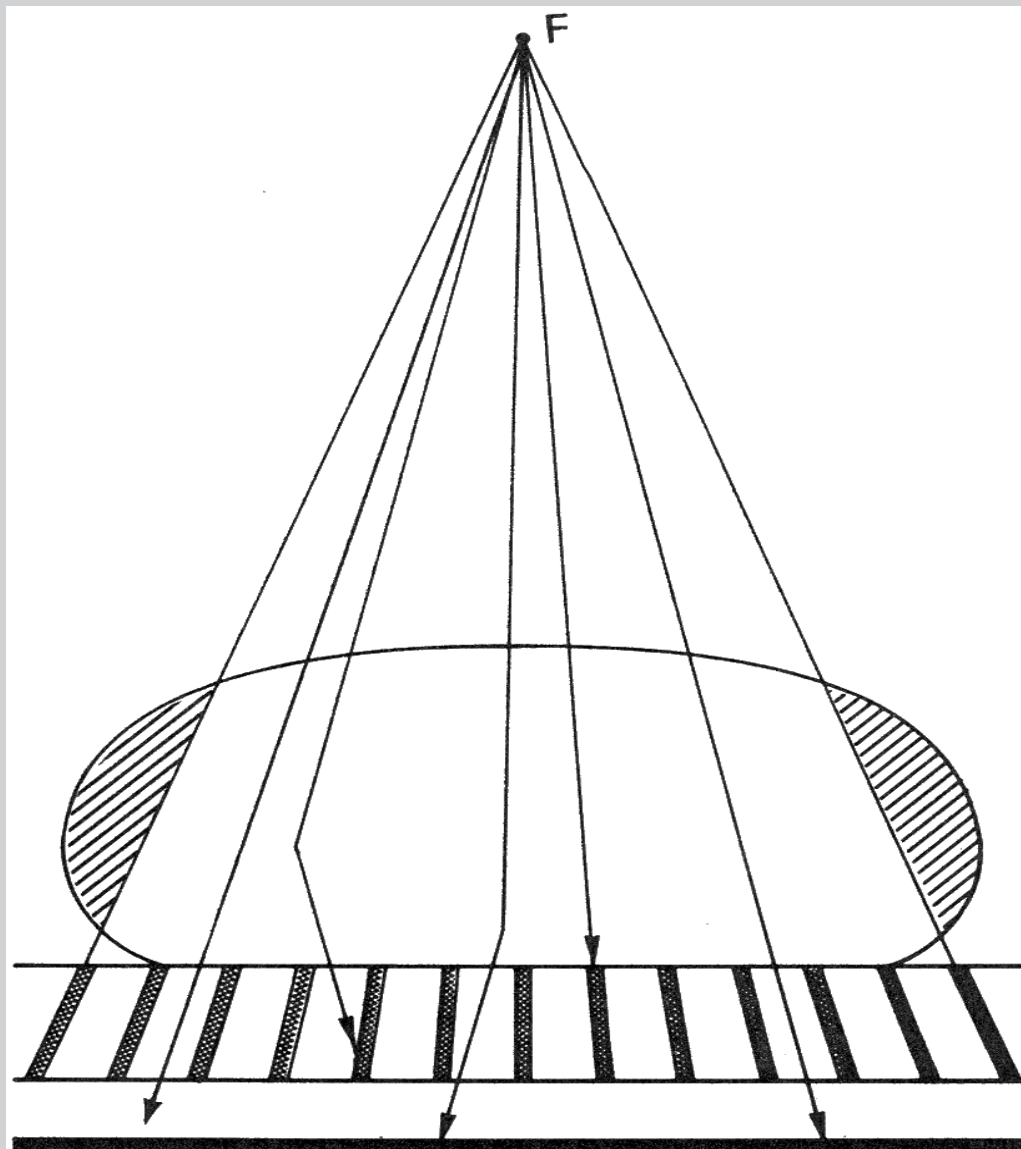


Rooster

Strooistralenrooster

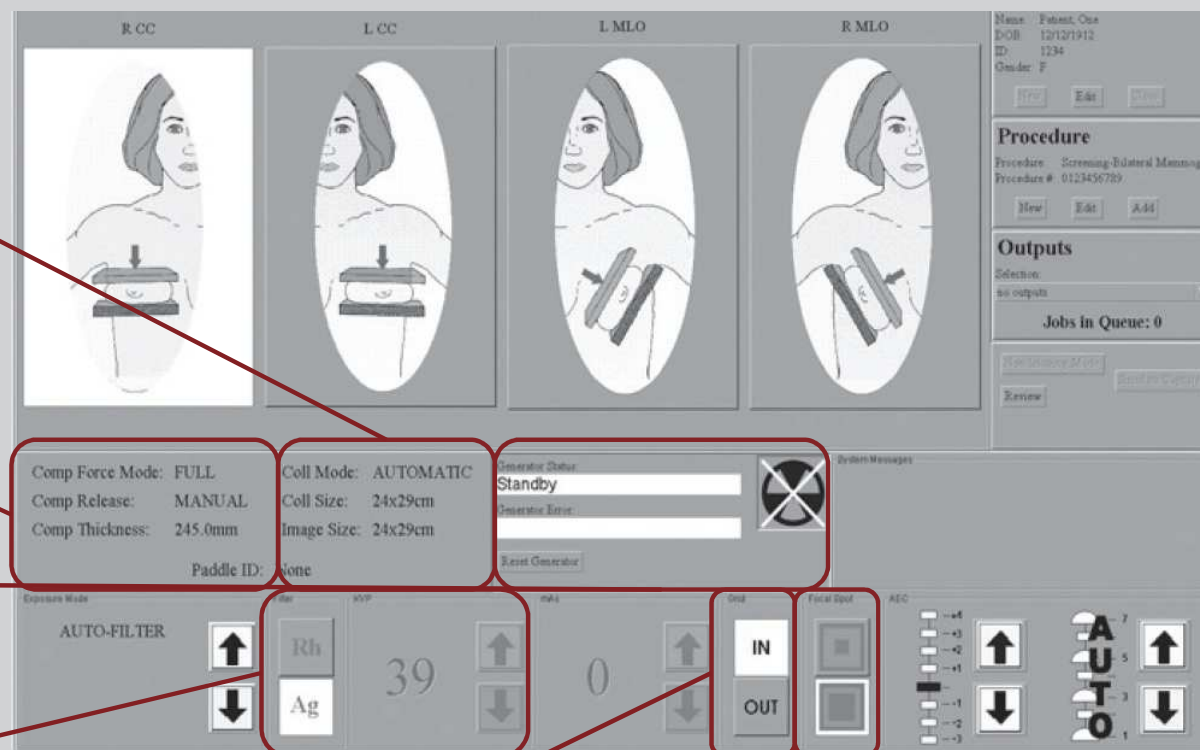


Strooistralenrooster



Tot nu toe:

Collimatie
 Compressie
 Opwekking
 Röntgenstralen

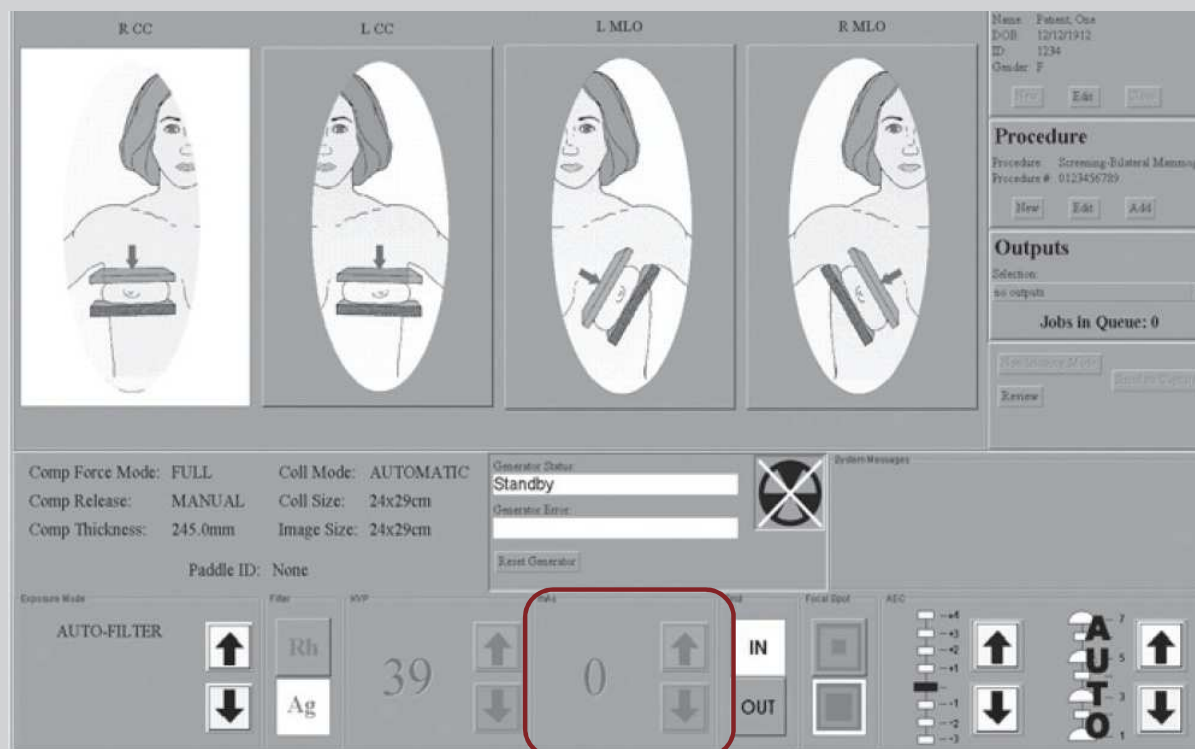


Röntgenspectrum

Rooster

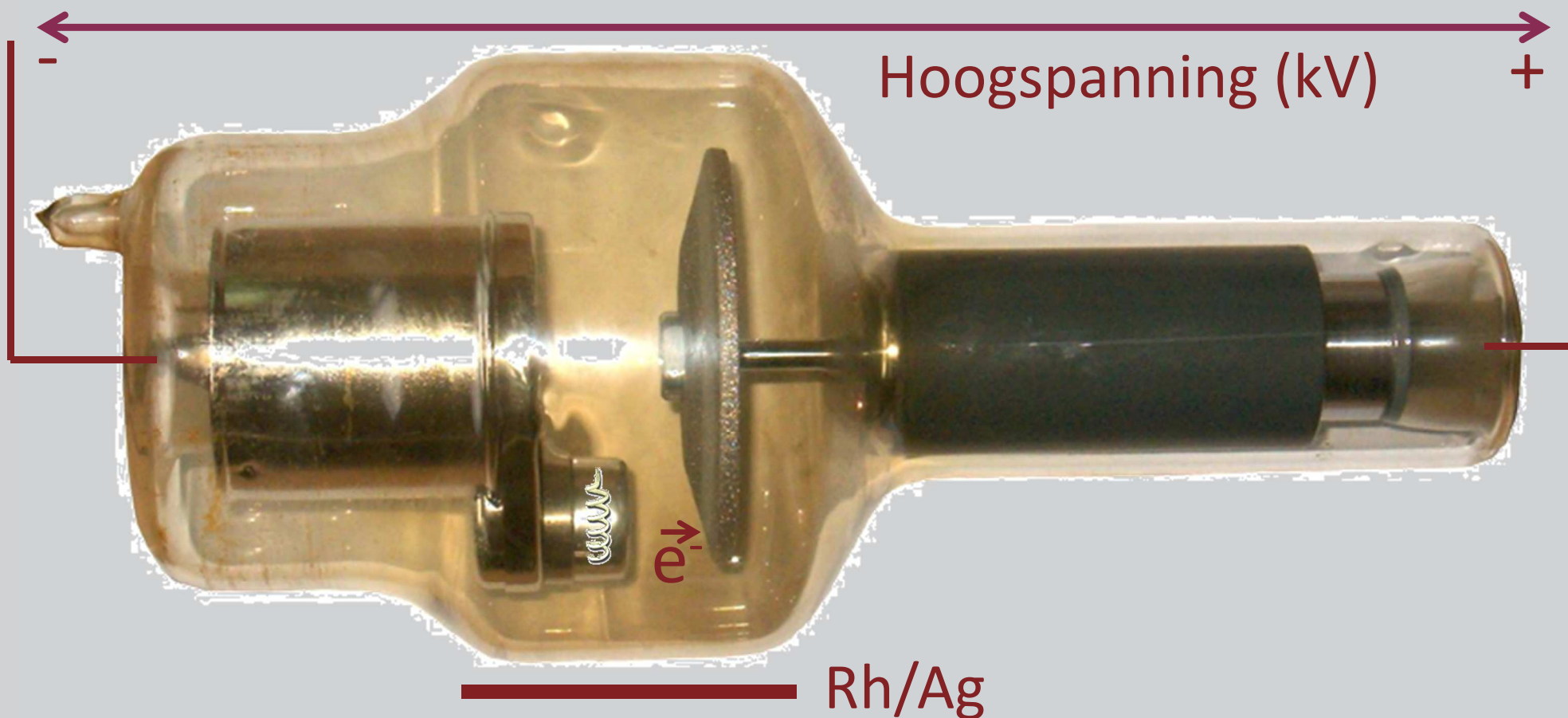
Focus

Belichting



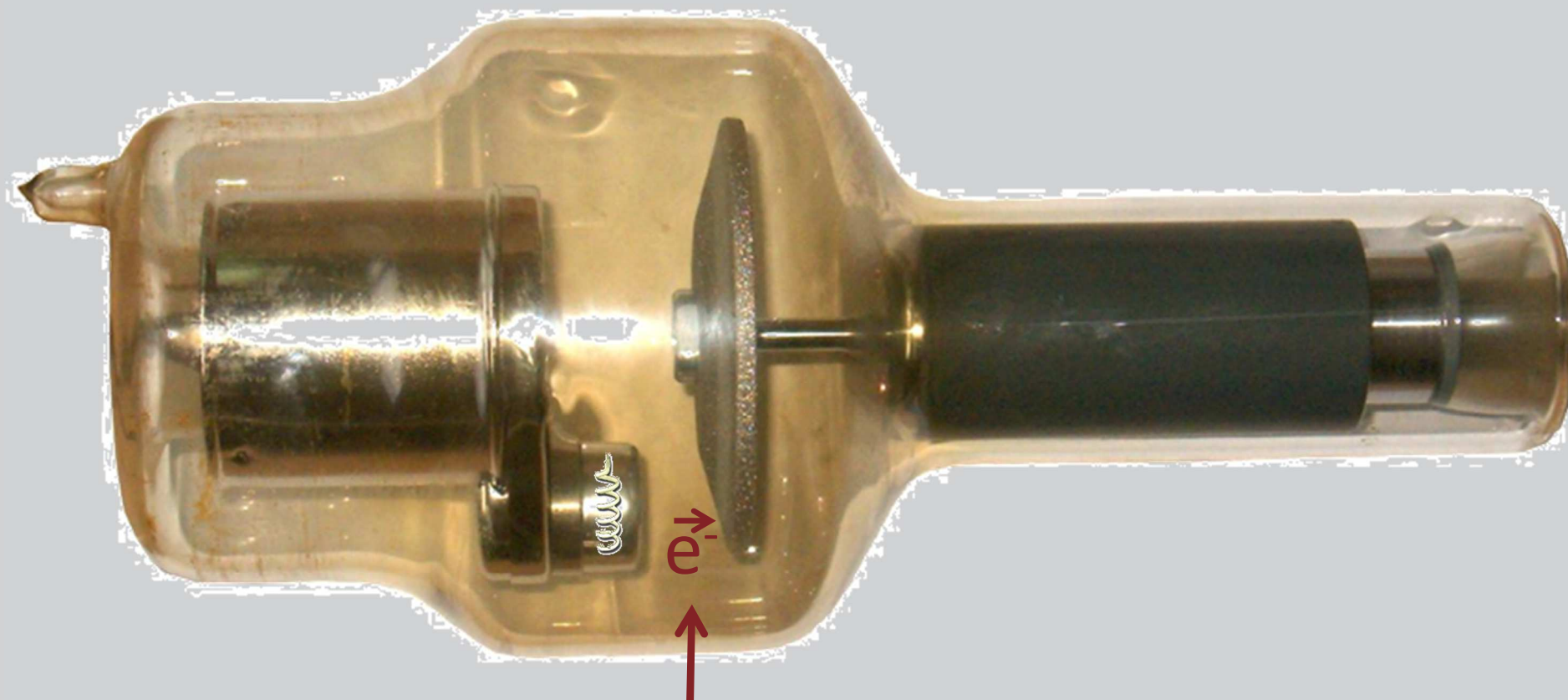
Belichting

Belichting



Röntgenspectrum -> doordringend vermogen & contrast

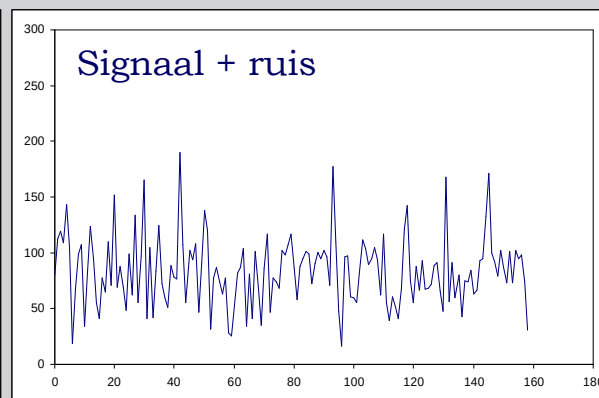
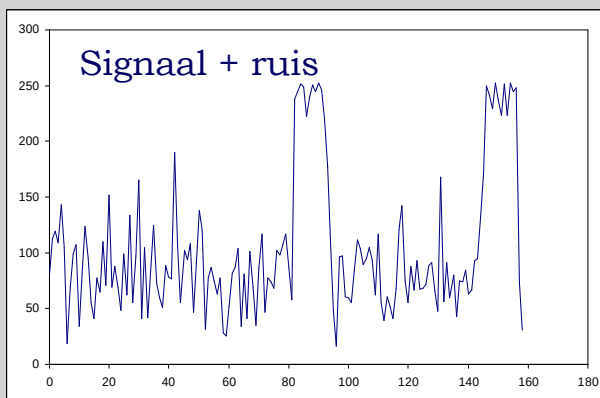
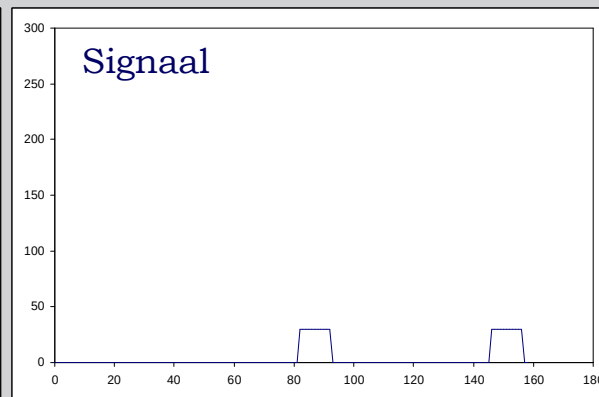
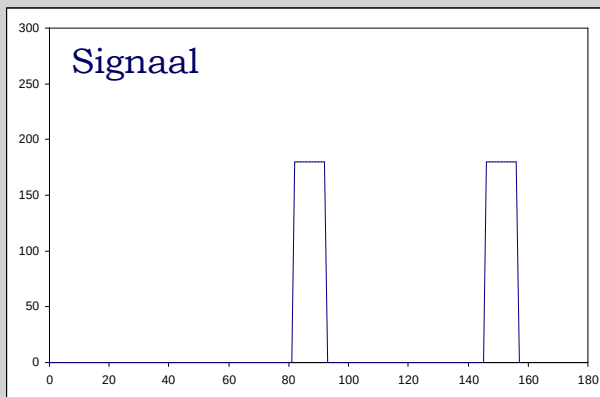
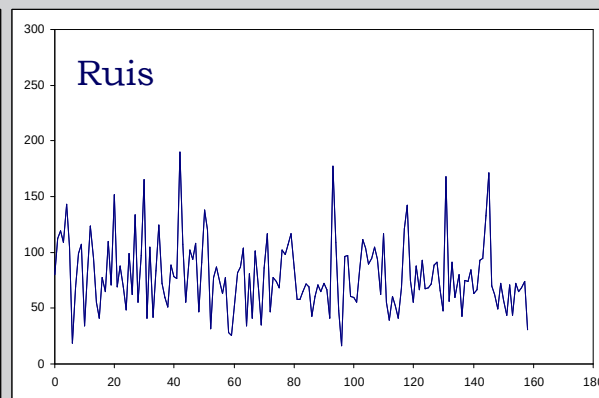
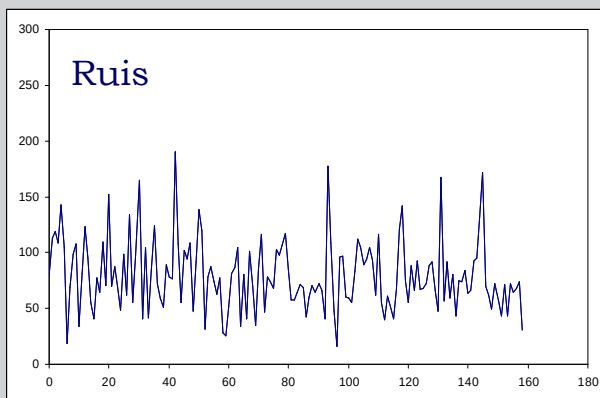
Belichting



$\text{mA} \times \text{s}$

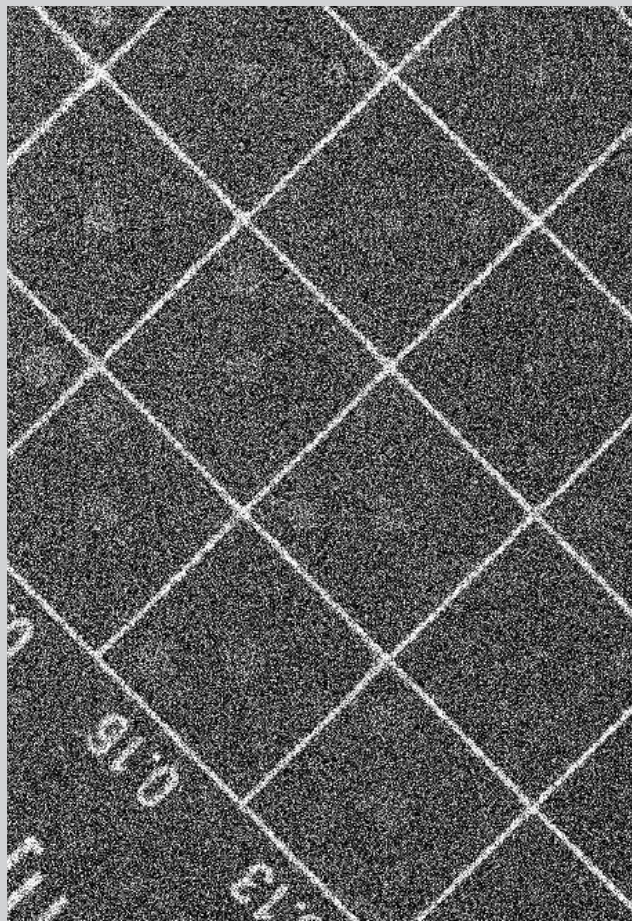
mAs $\rightarrow$ hoeveelheid röntgenquanten

Belichting

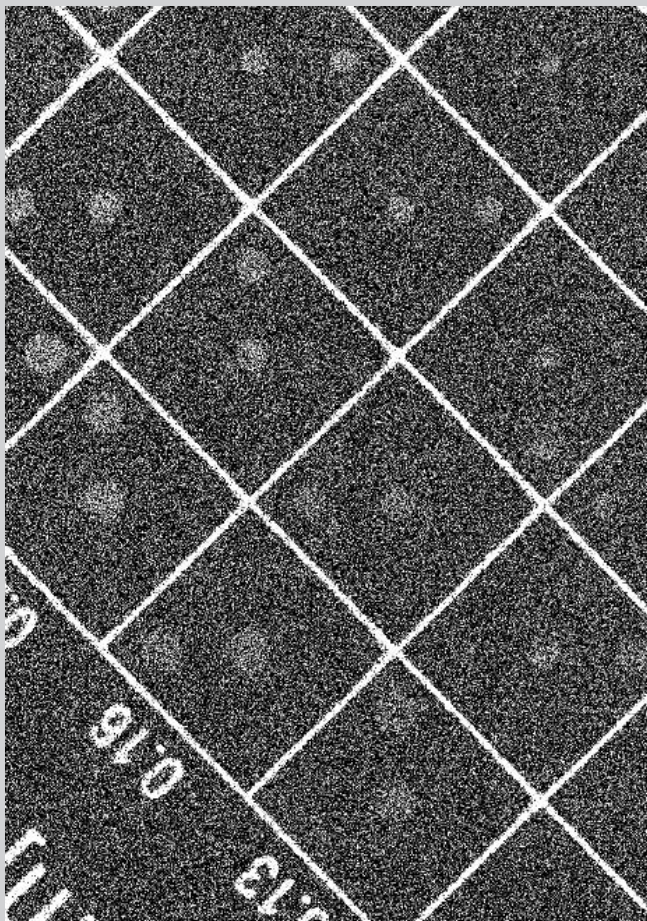


Belichting

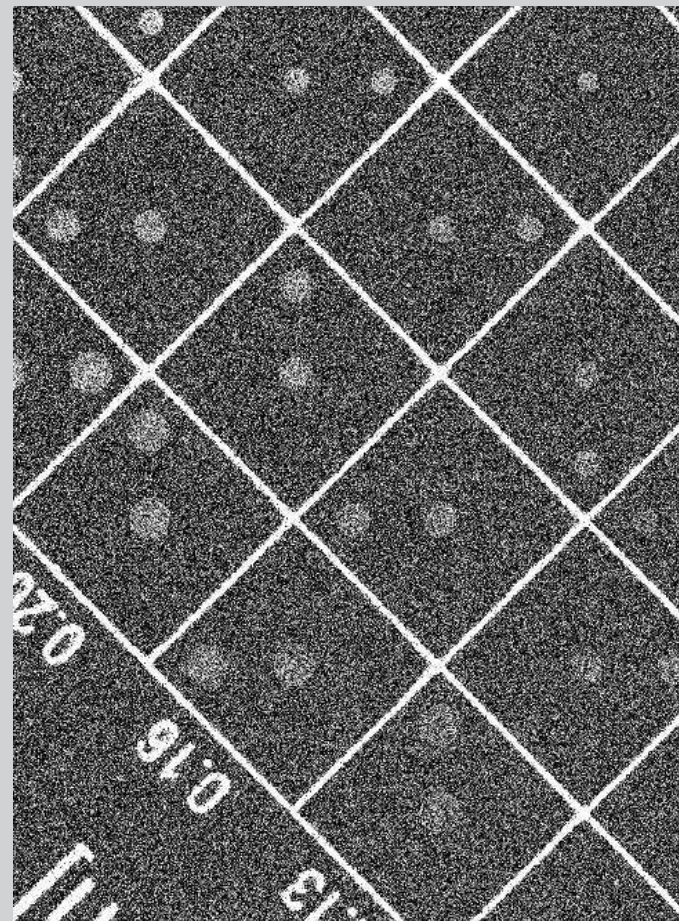
1/3 x dosis



2/3 x dosis



1x dosis



Belichting

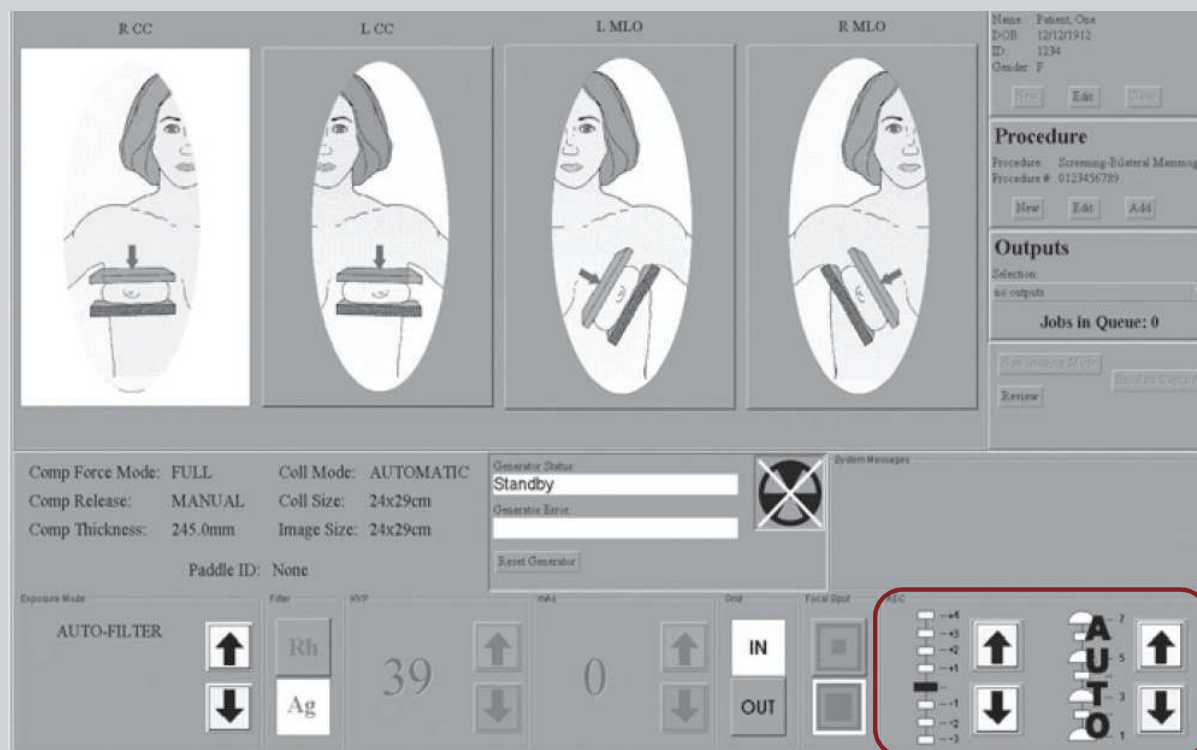
Spectrumkeus -> doordringend vermogen
en contrast

voldoende röntgenquanten -> SNR

Door:

- juist kV en filter keus
- juiste mAs-waarde

Belichtingsautomaat



Belichtings-
automaat

Belichtingsautomaat

Bij 3.6 cm gecomprieeerde borstdikte...

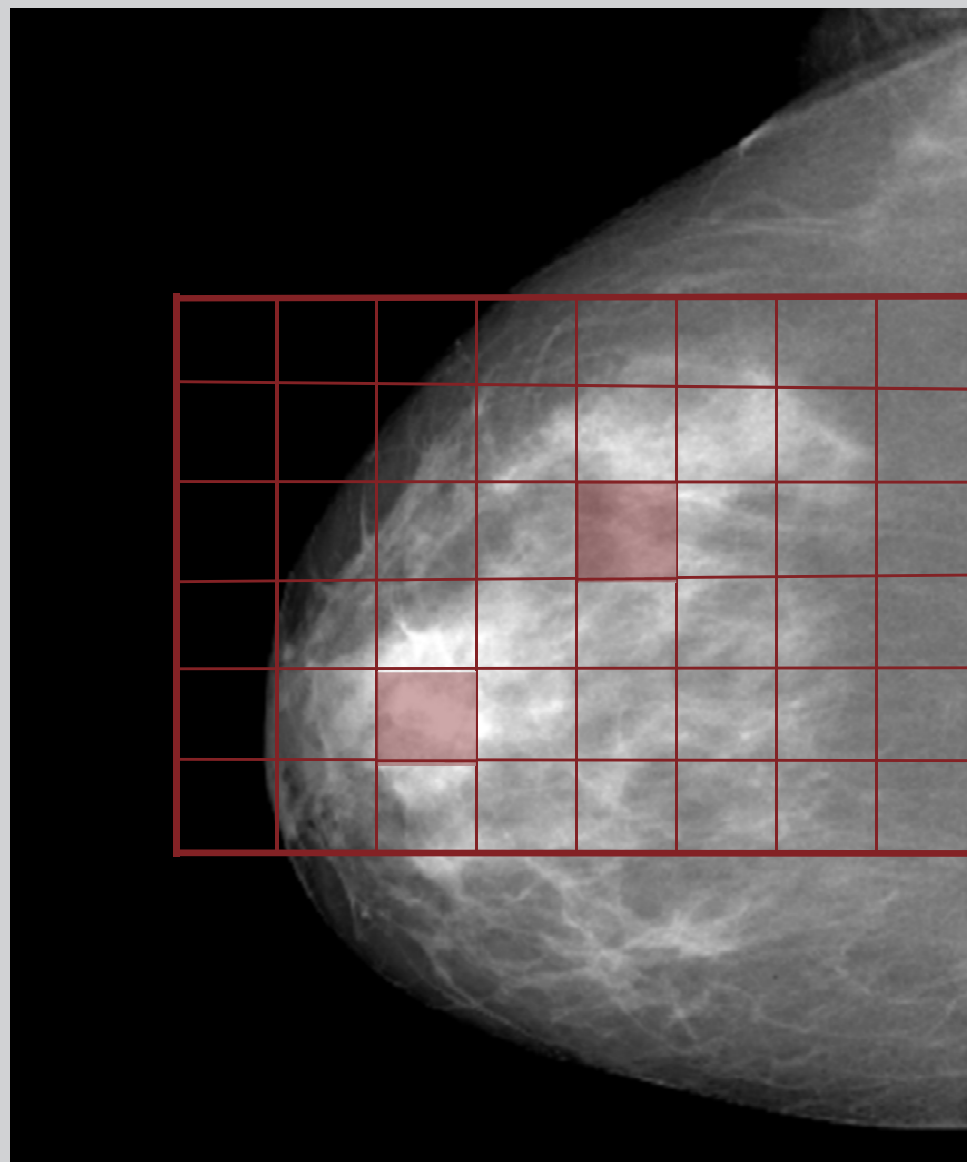
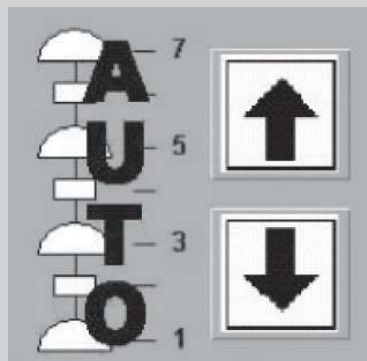


...is 26 kV en Rh filter een logische keus.

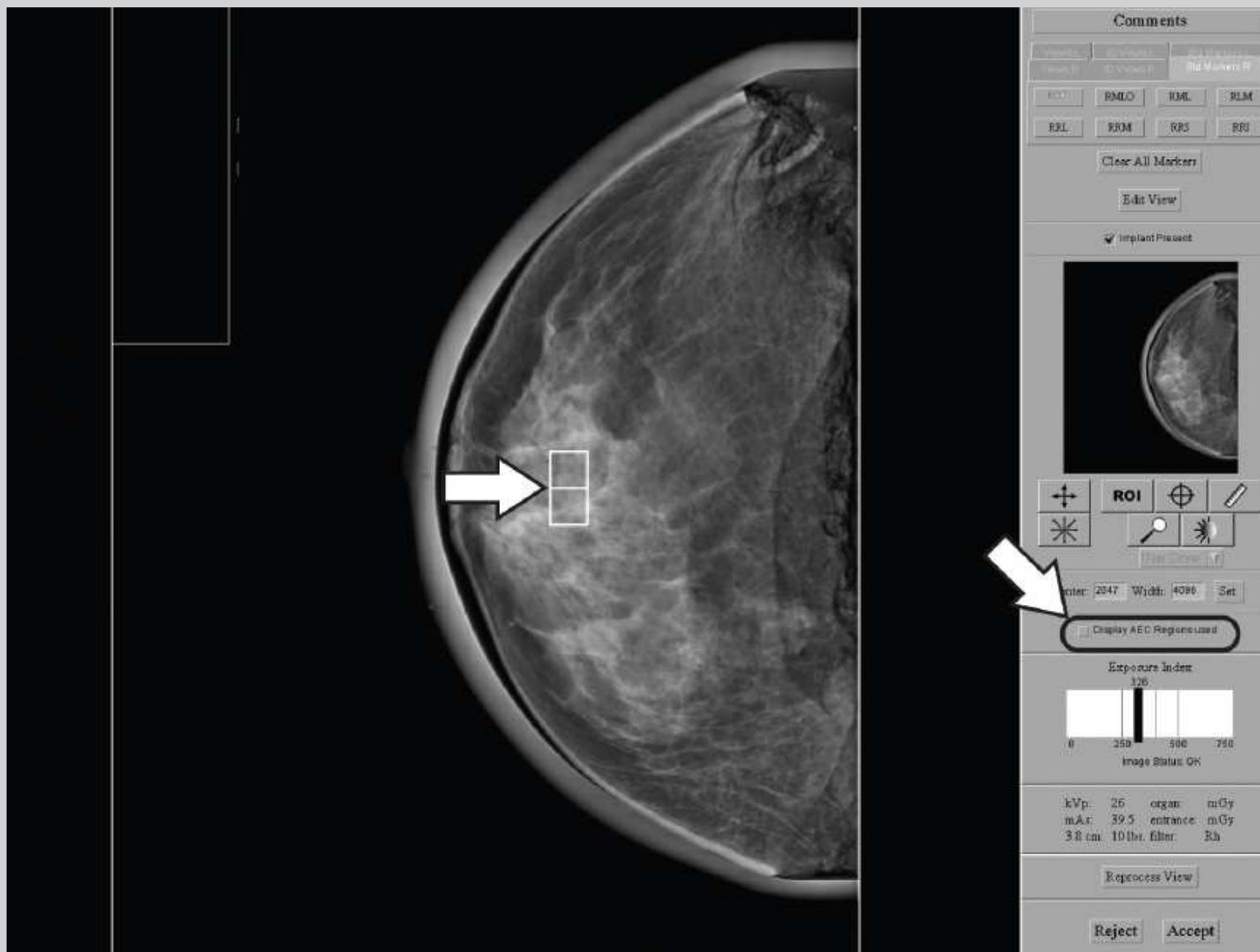
Belichtingsautomaat

Pre-exposie

Meest verzwakkende
deel bepaald
uiteindelijke mAs

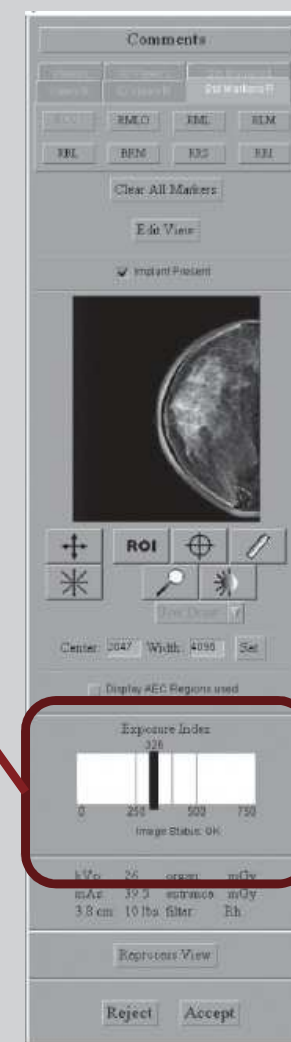
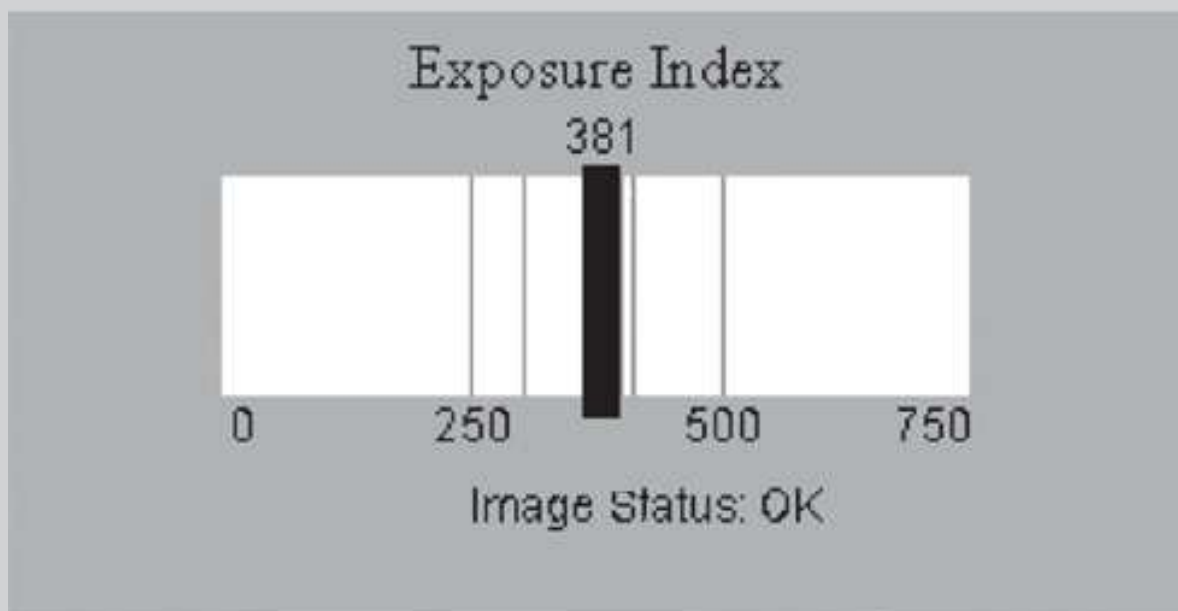


Belichtingsautomaat



Belichtingsautomaat

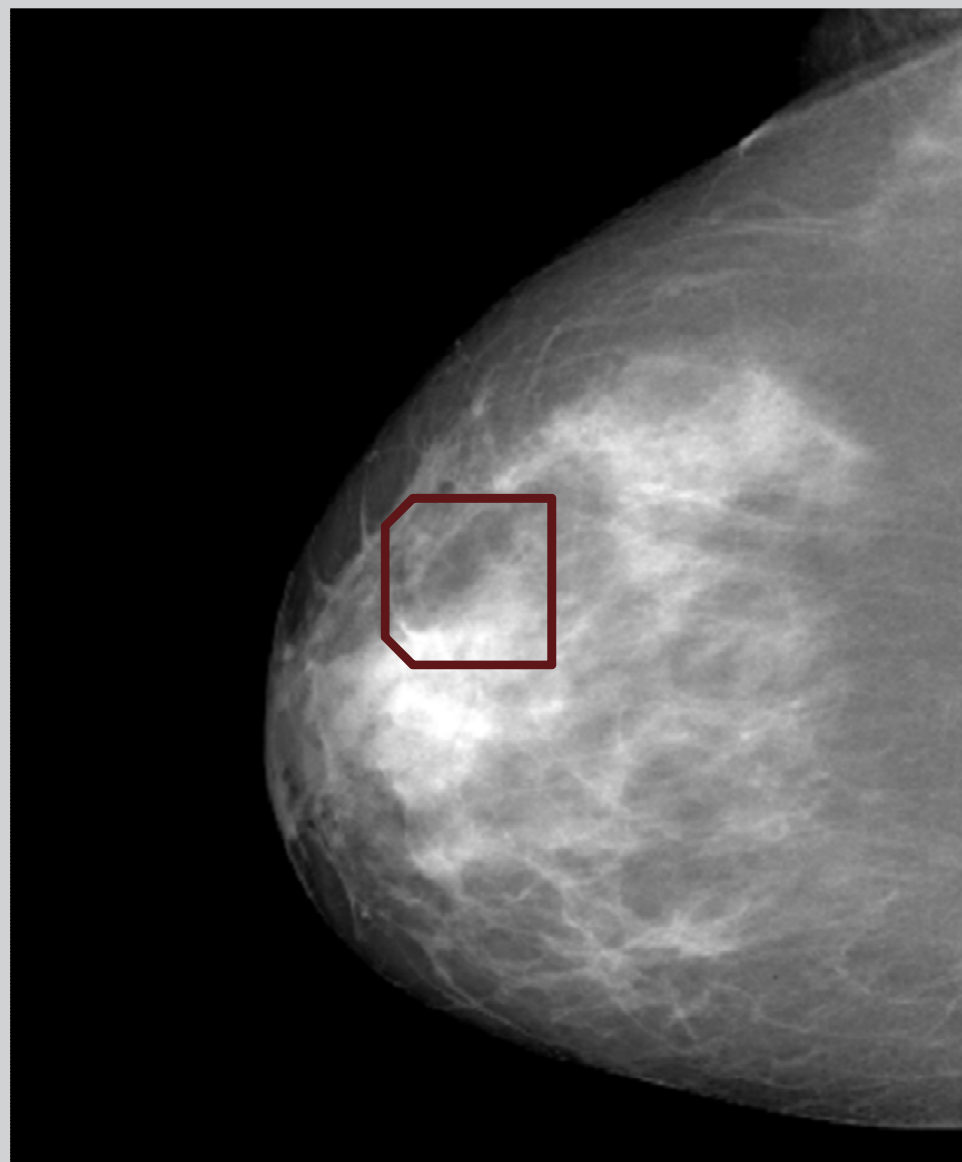
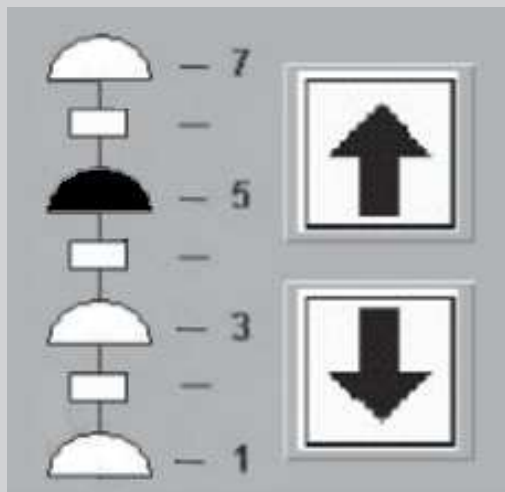
Exposie index is indicatie voor de belichting.



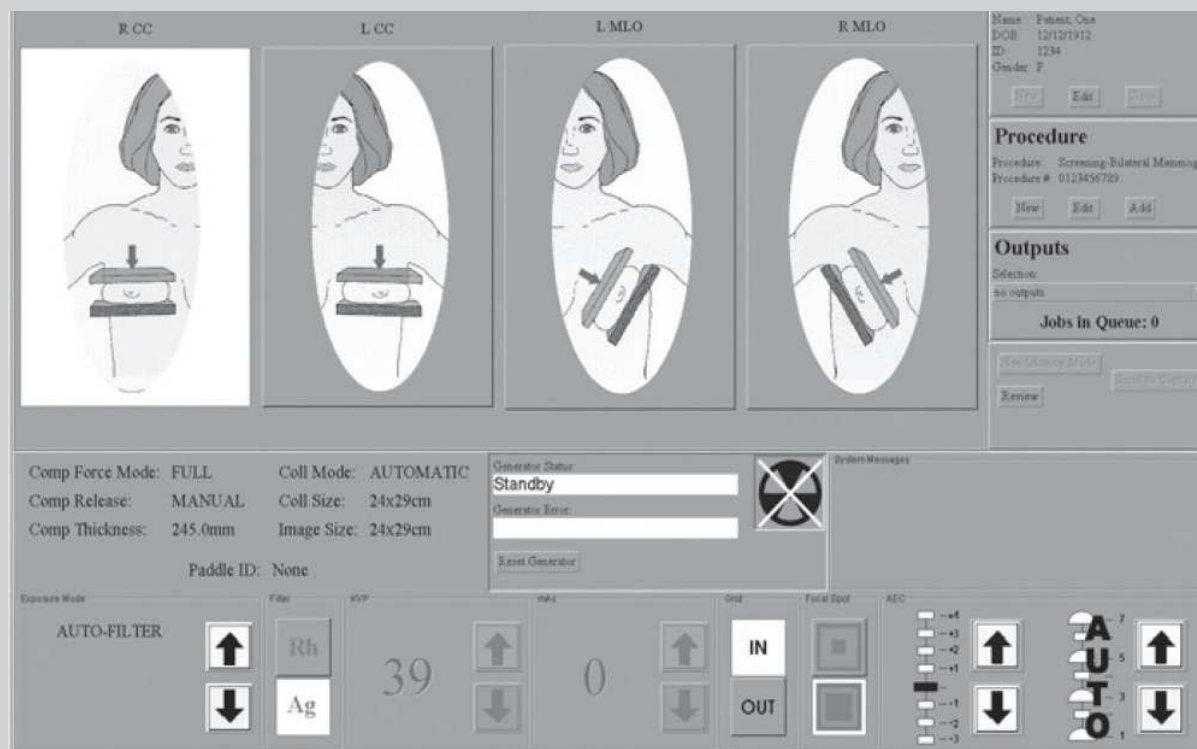
Belichtingsautomaat

Pre-exposie

Jij bepaalt waar hij
afslaat.

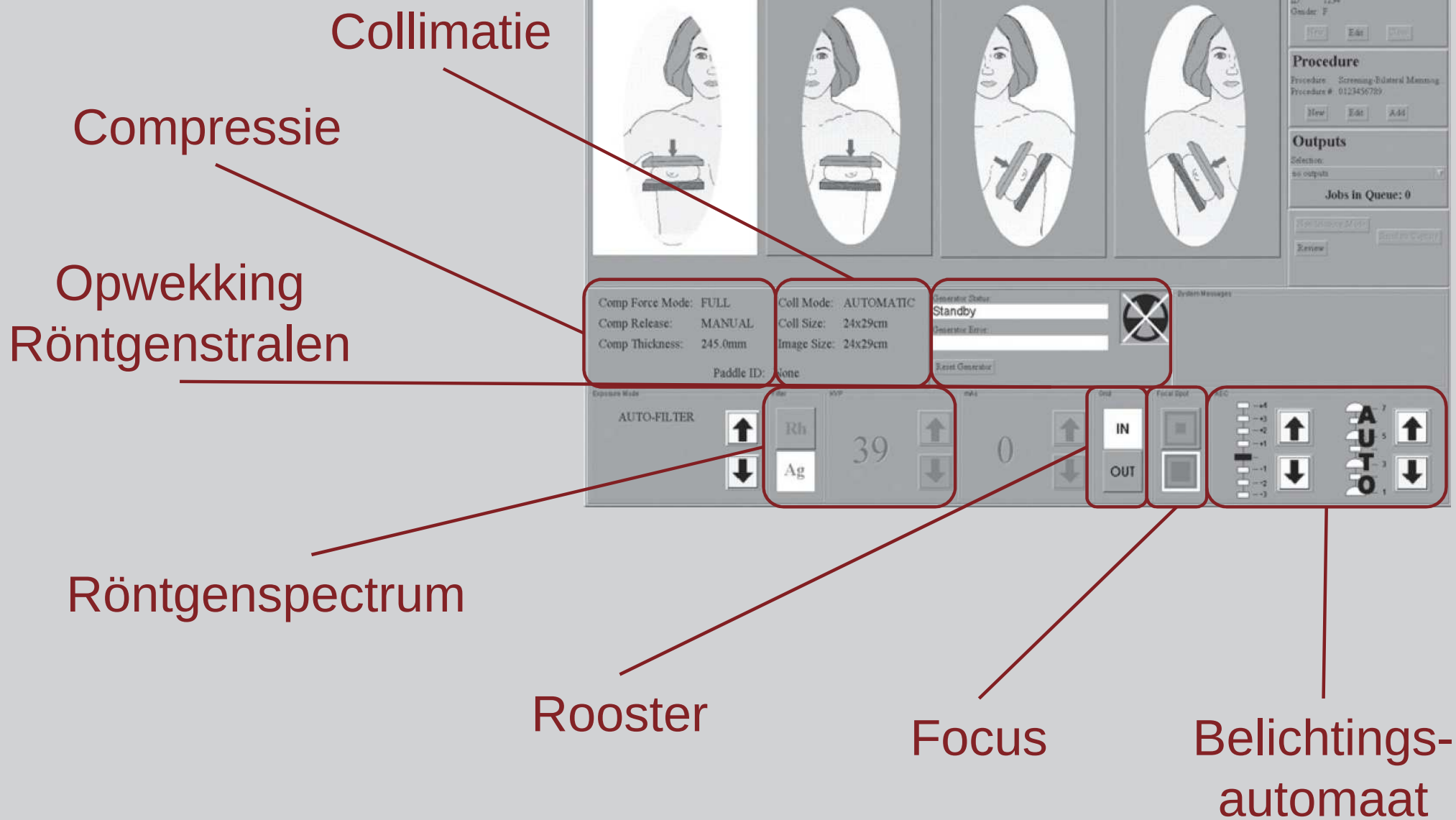


Belichtingsautomaat

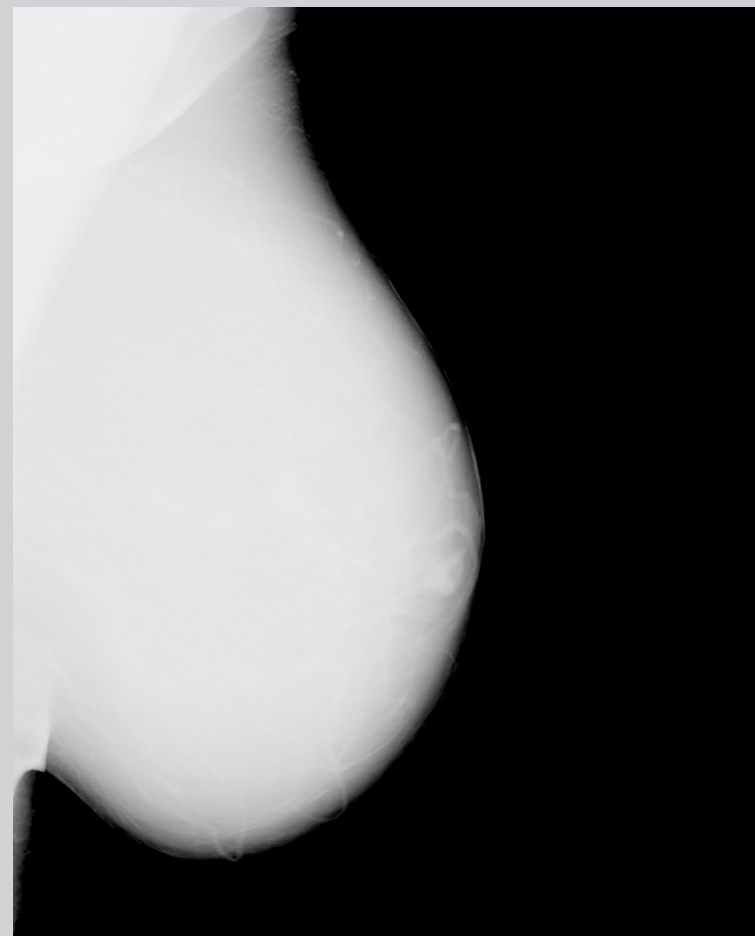


Vier opnamen van het mammogram
 Wees kritisch op de uitschieter

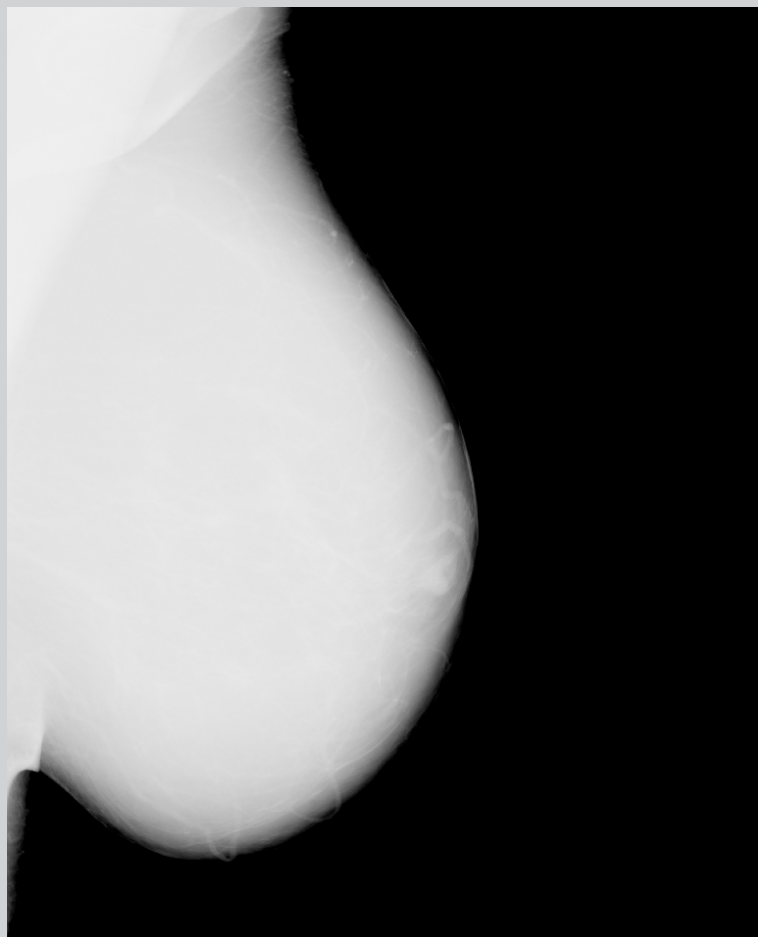
Tot nu toe:



Beeldbewerking

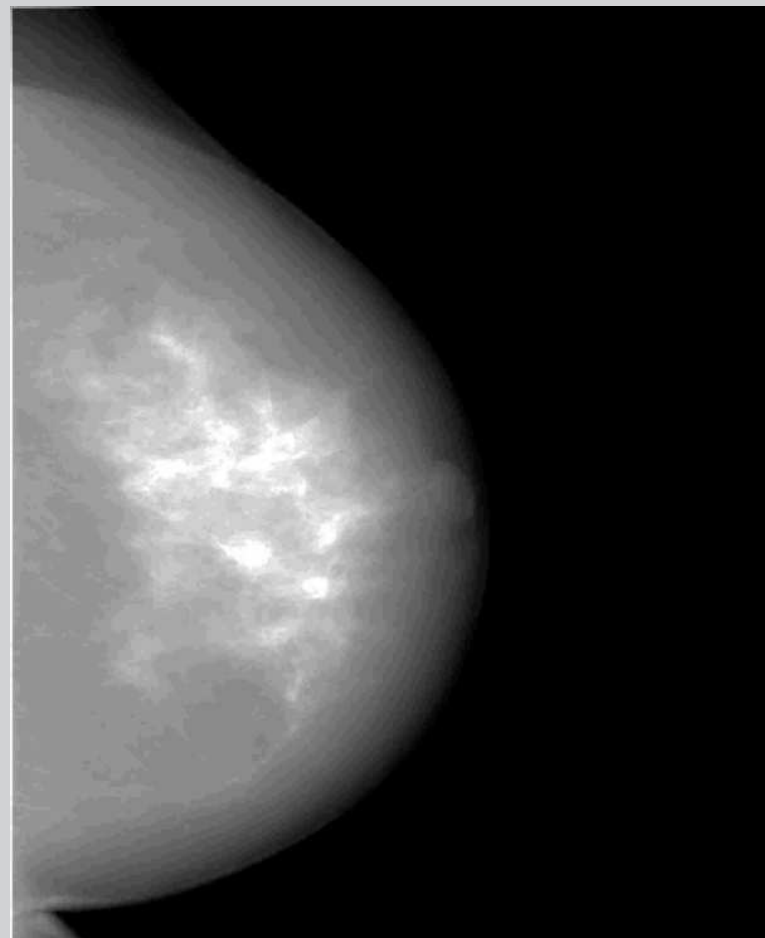
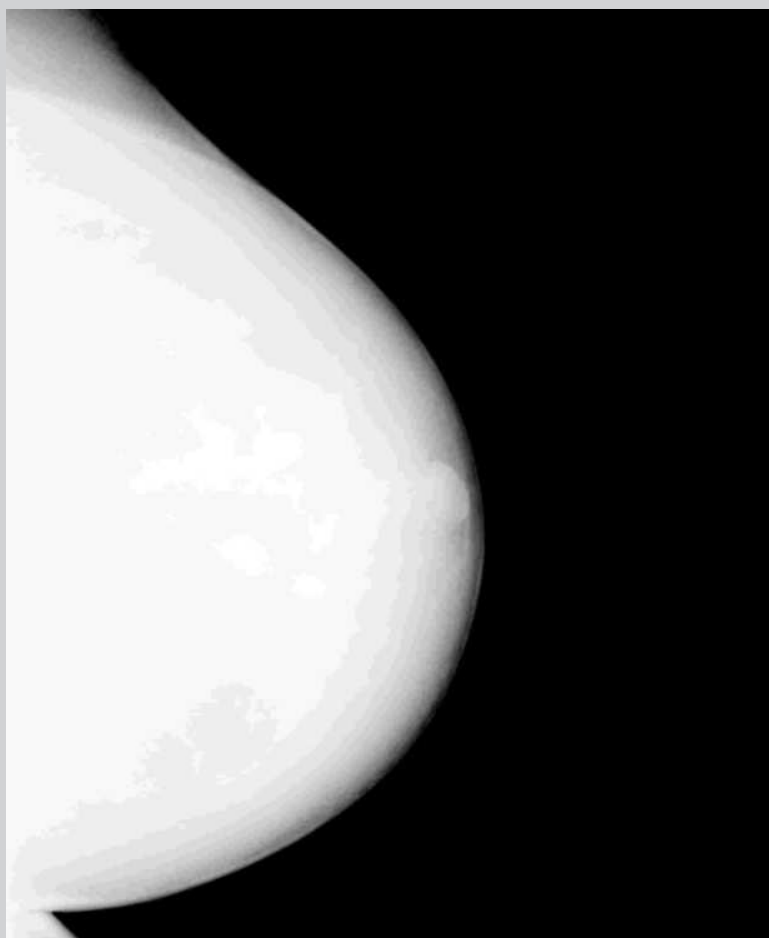


Beeldbewerking

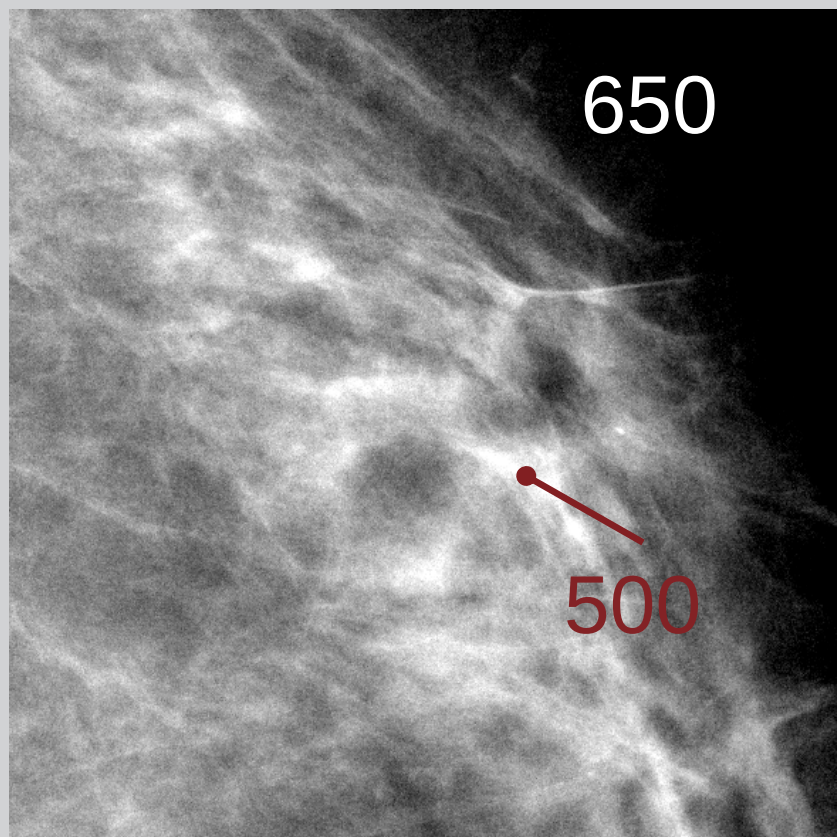


Beeldbewerking

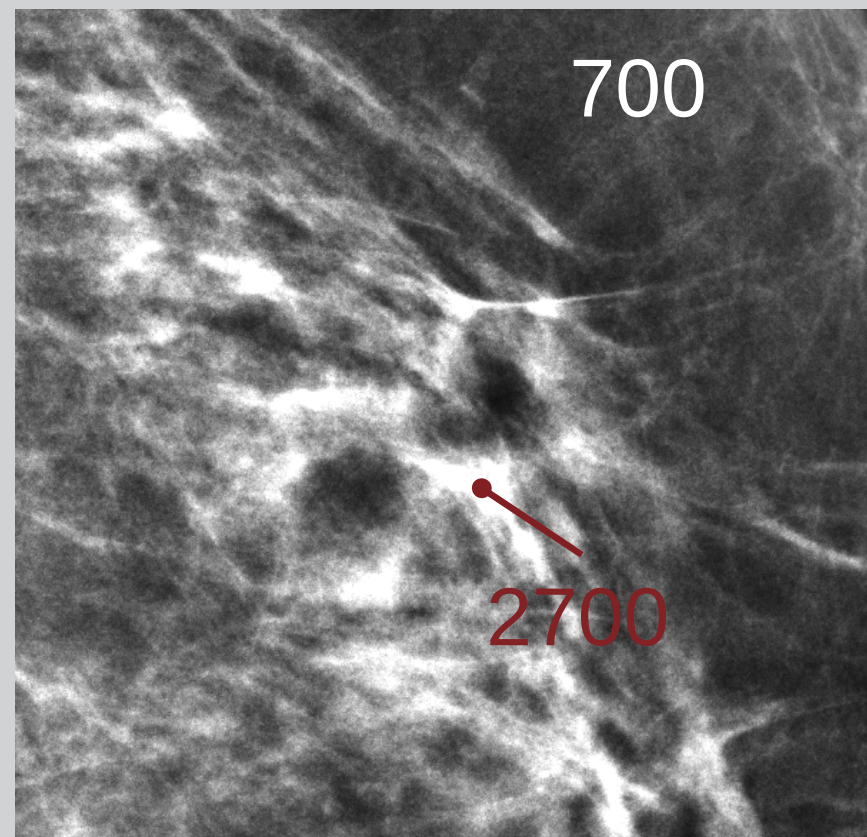
Logaritmische schaling



Beeldbewerking



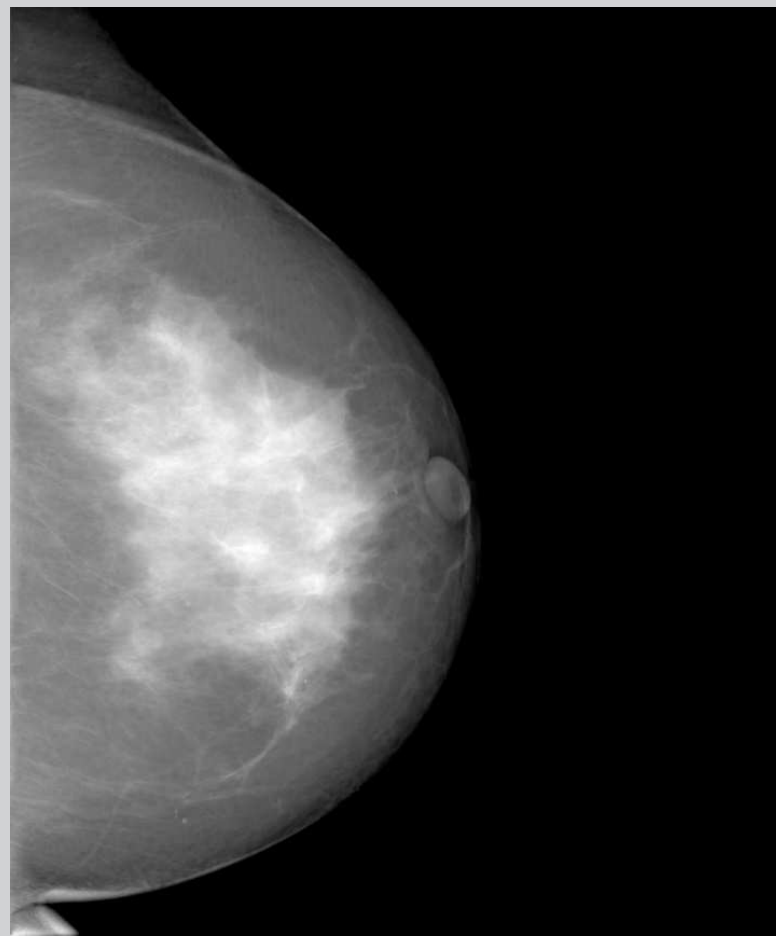
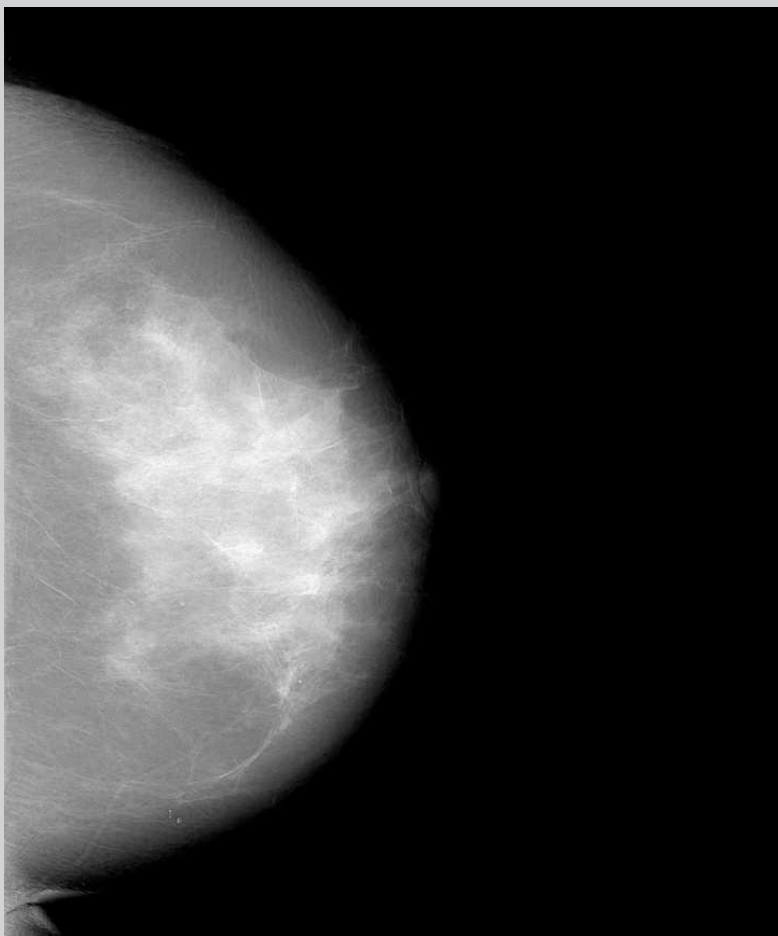
Lineair verband tussen
dosis en pixelwaarden



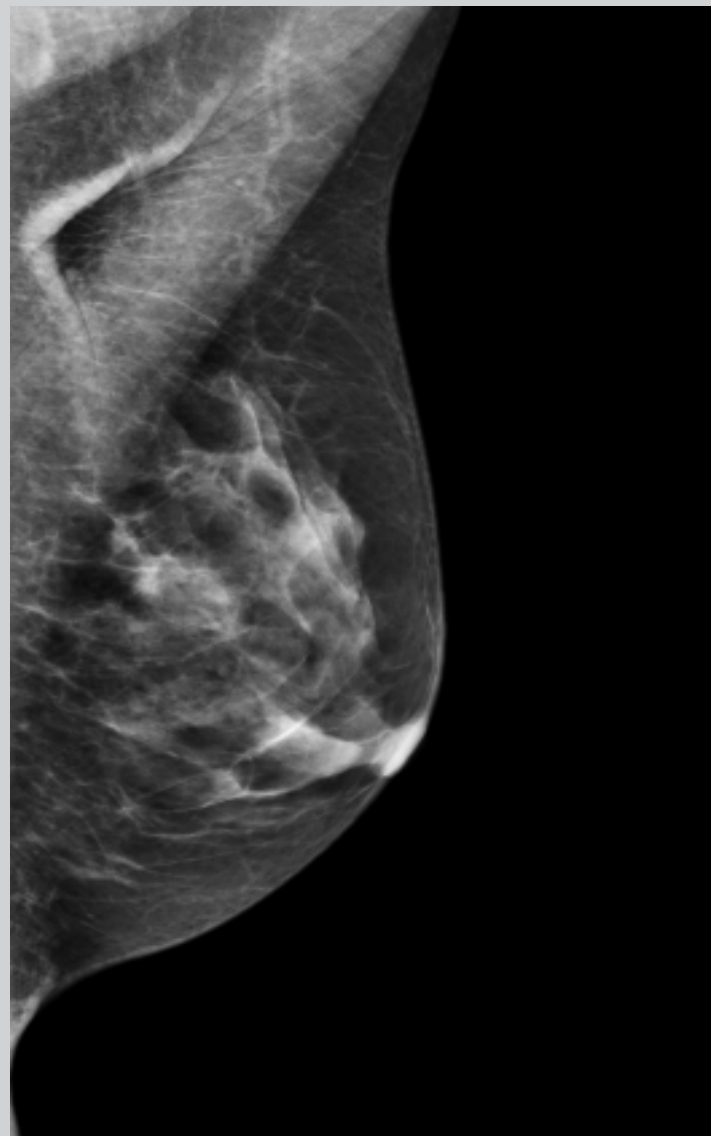
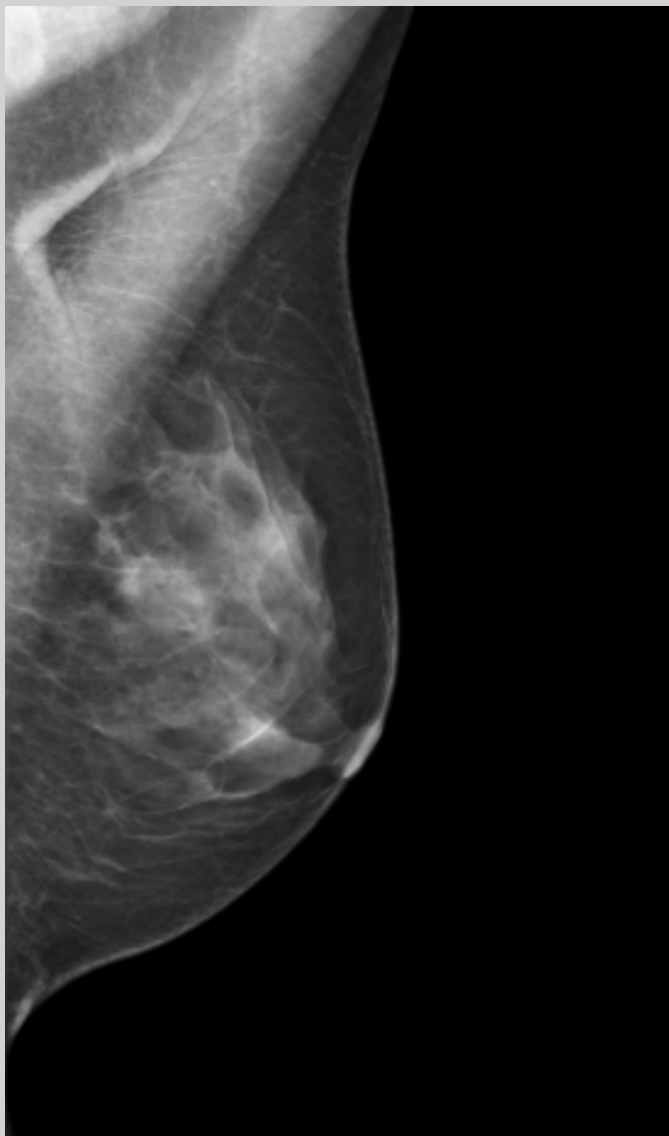
De waarden zijn
omgedraaid en
logaritmisch geschaald

Beeldbewerking

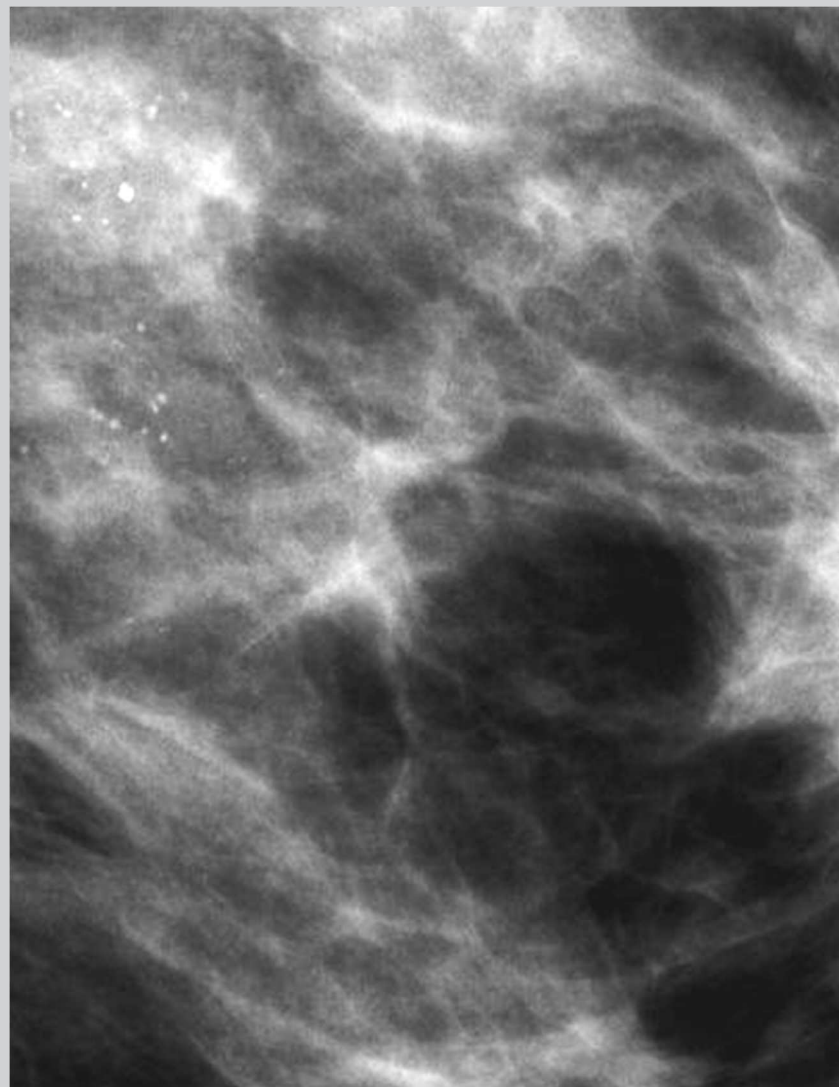
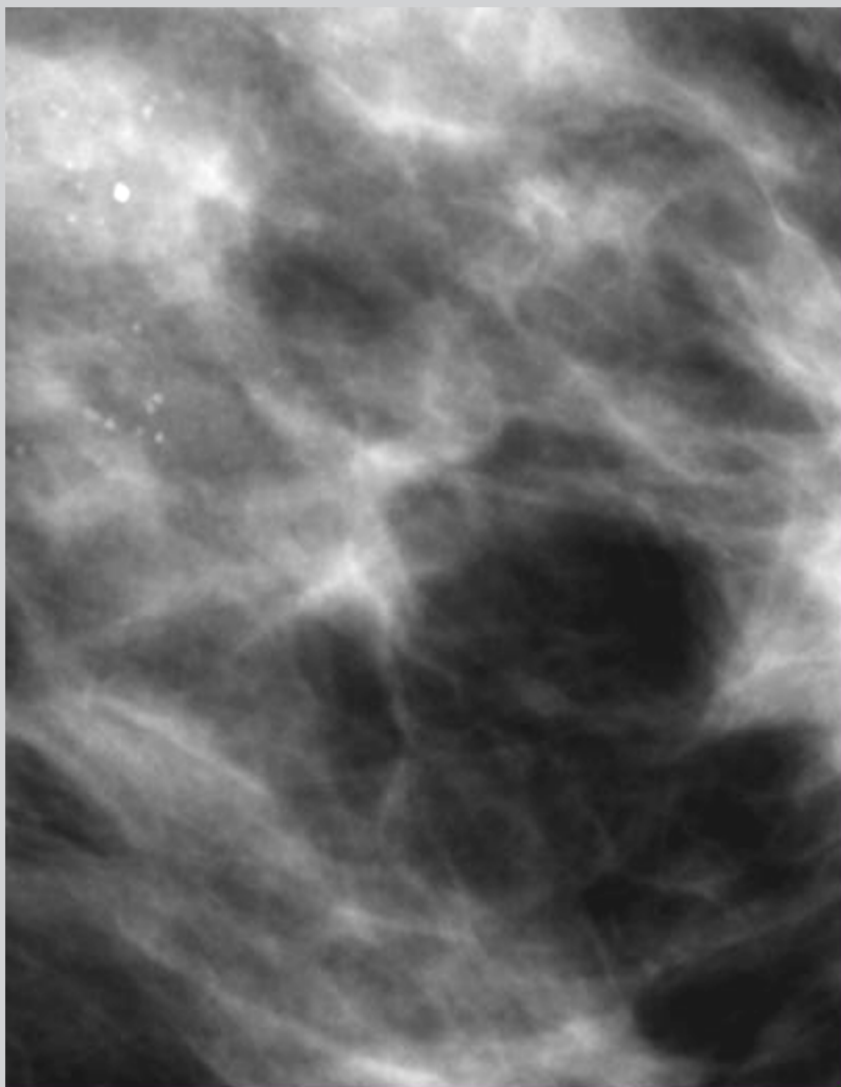
Borstrand compensatie



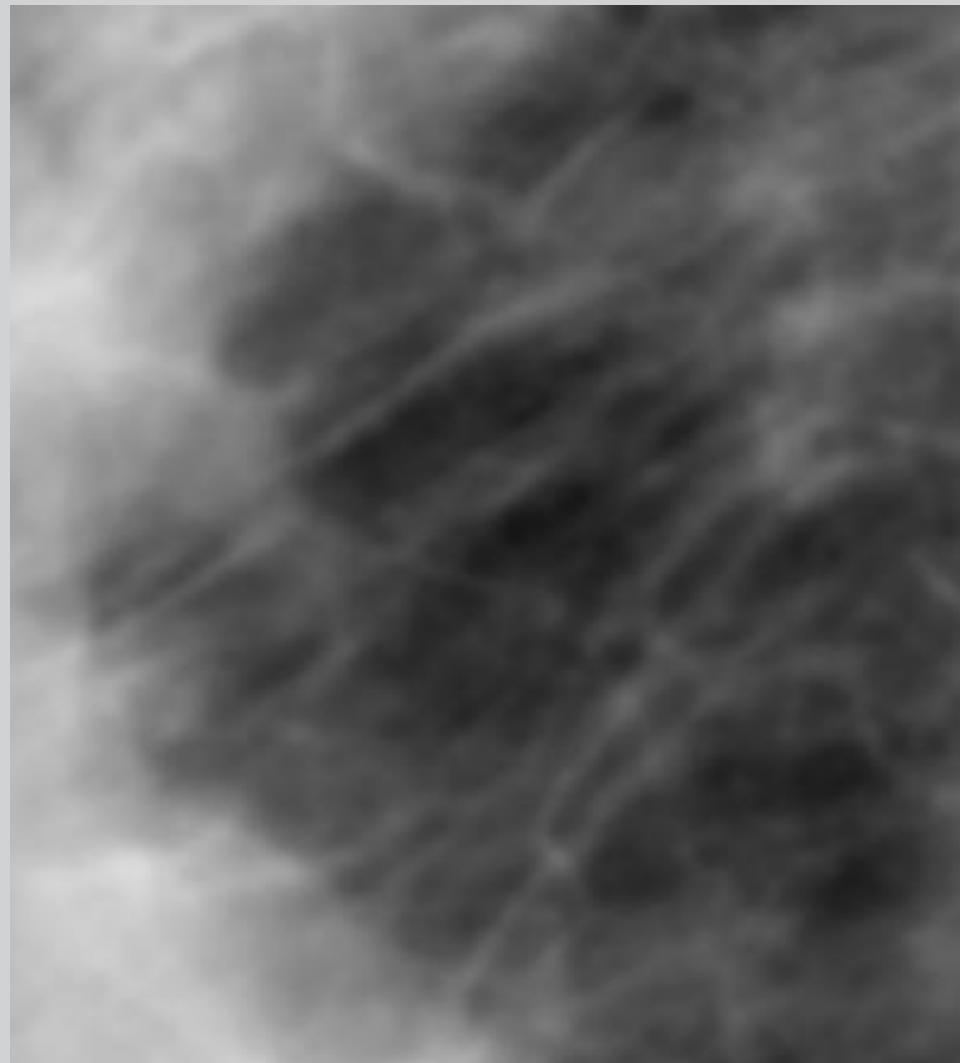
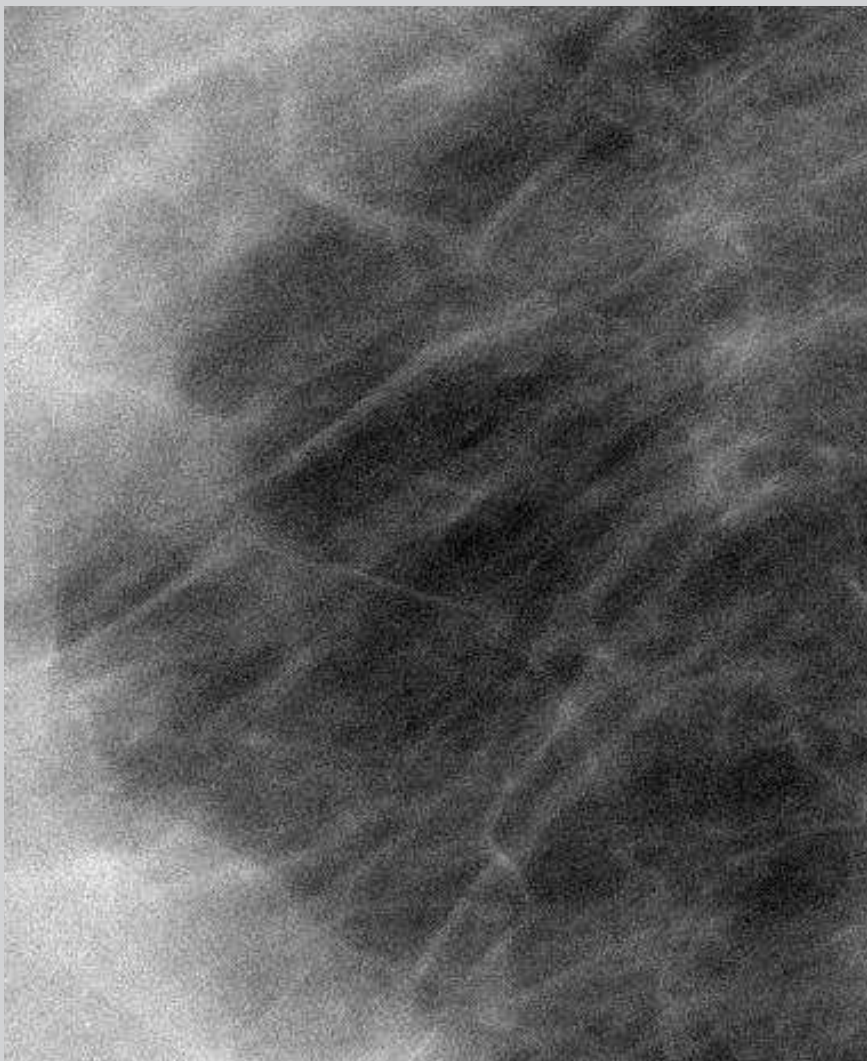
Beeldbewerking



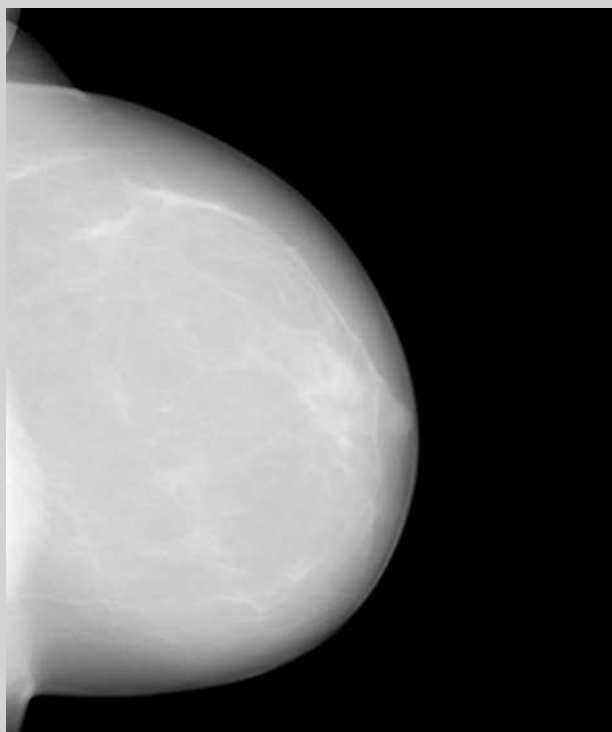
Beeldbewerking



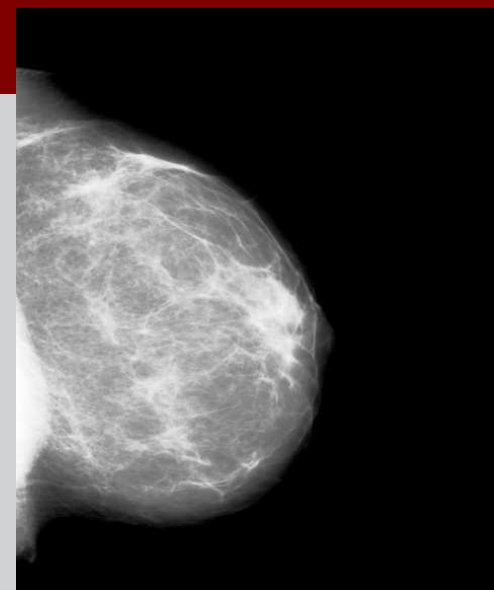
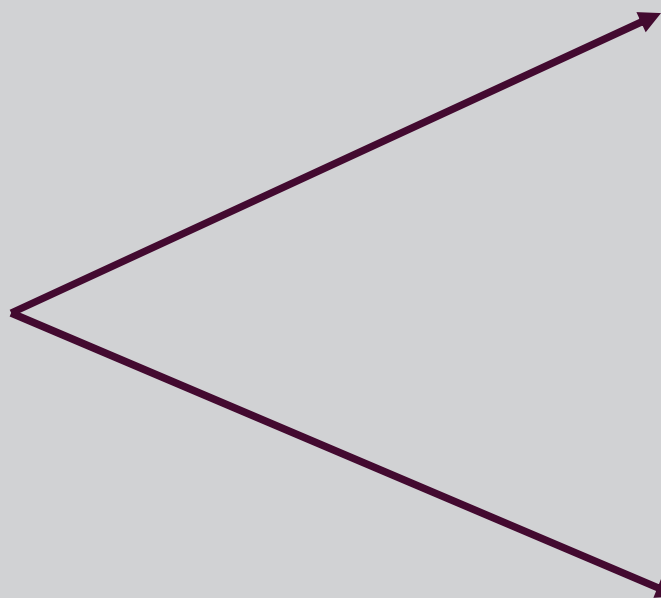
Beeldbewerking



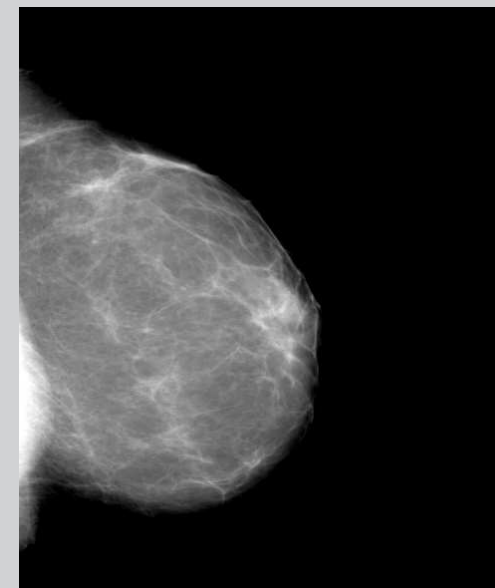
Beeldbewerking



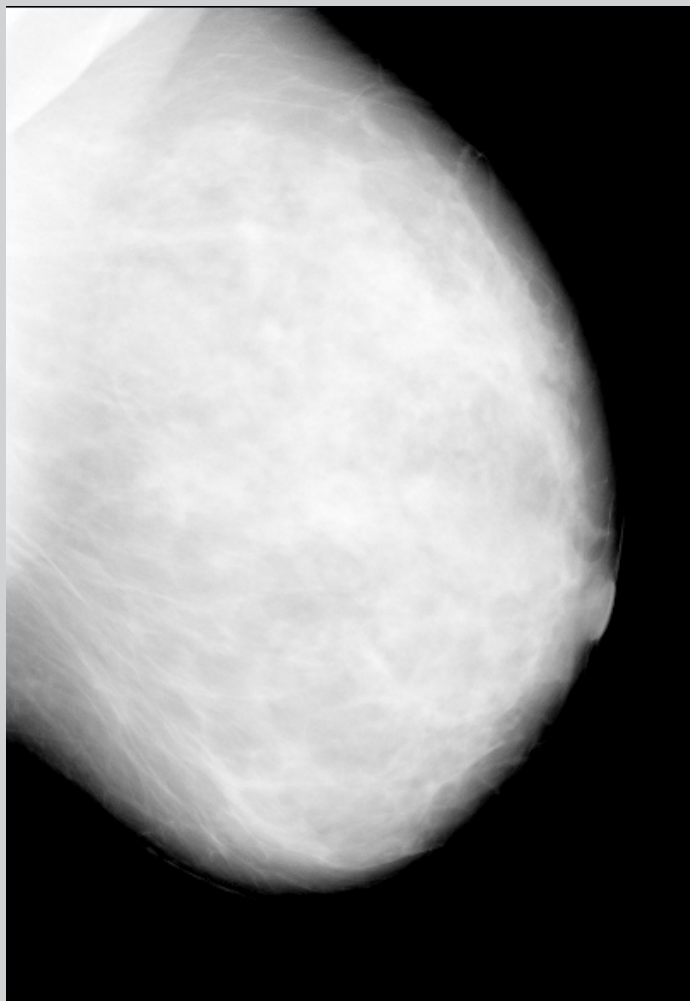
Beeldbewerking 1



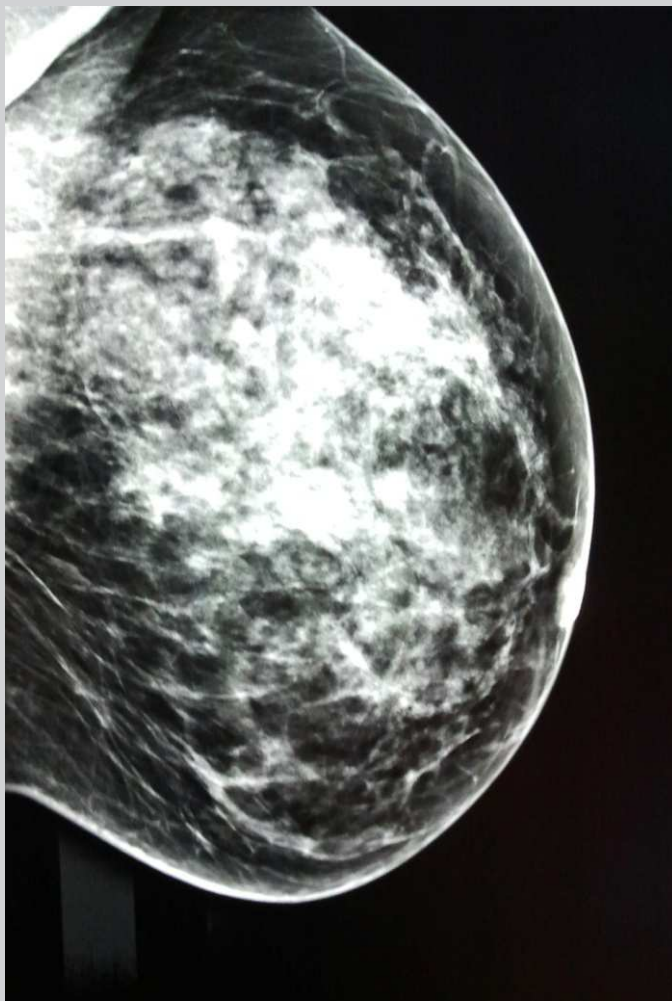
Beeldbewerking 2



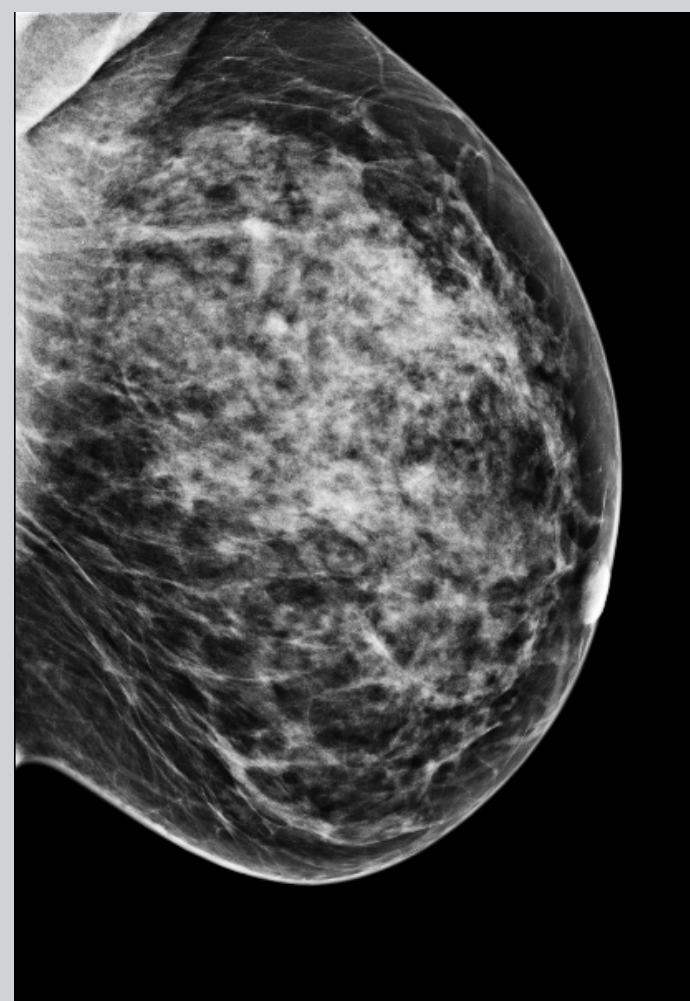
Beeldbewerking



Onbewerkt beeld



Bewerkt beeld op
acquisitiestation

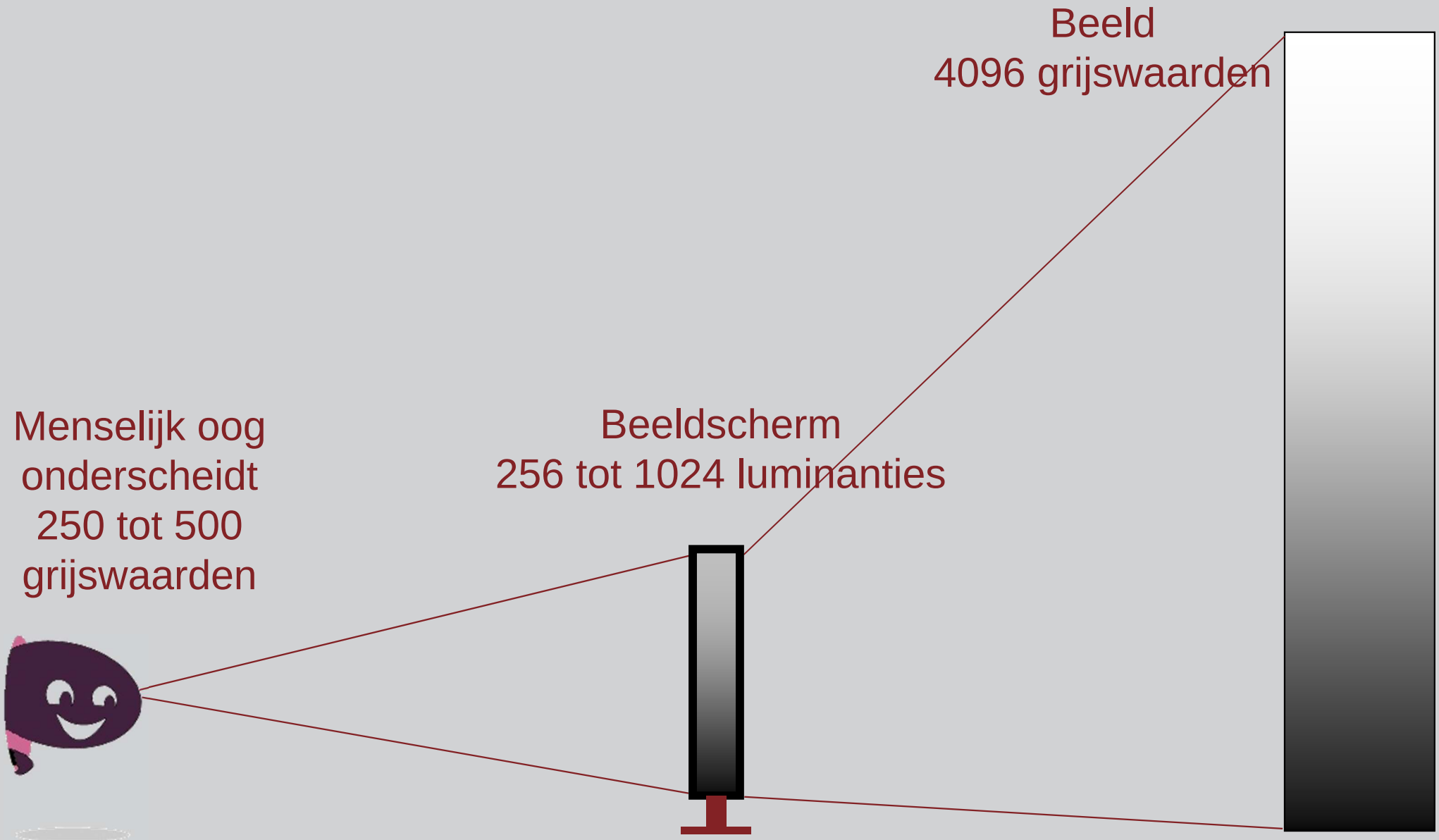


Bewerkt beeld op
bekijkstation

Beeldweergave



Beeldweergave

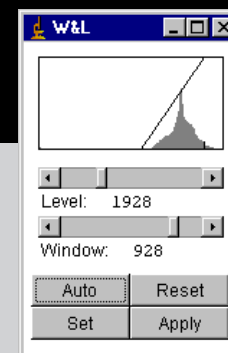
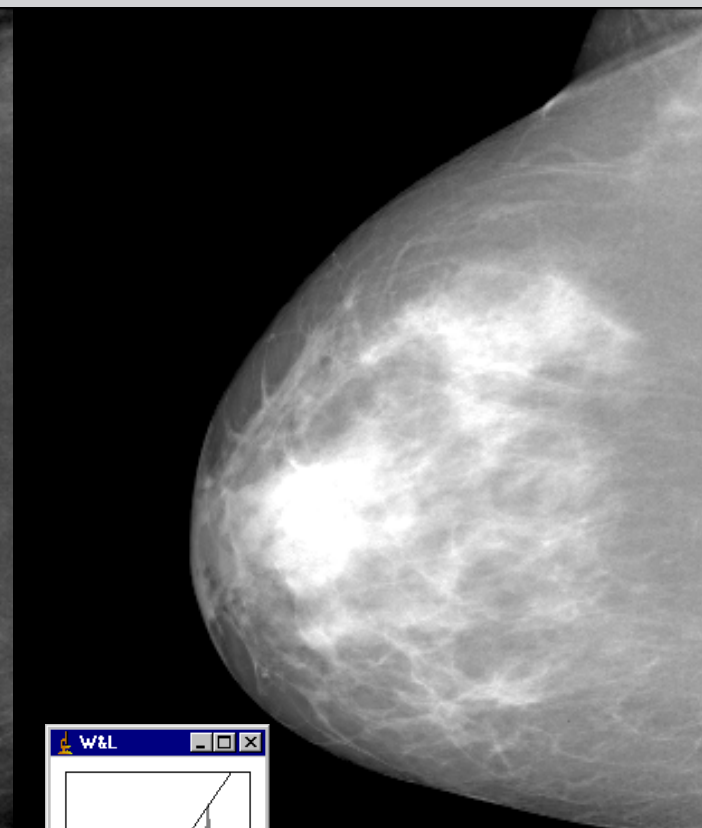
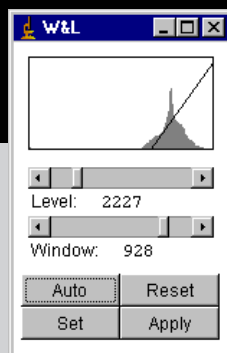
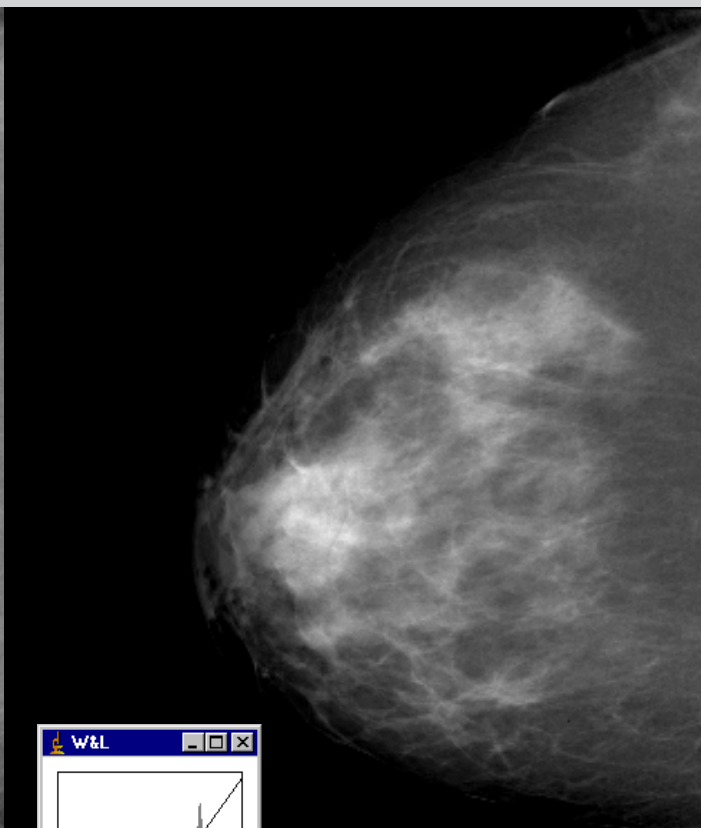
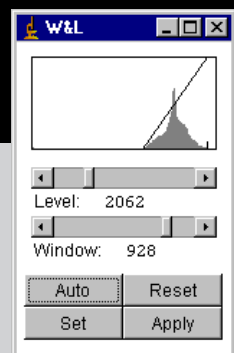
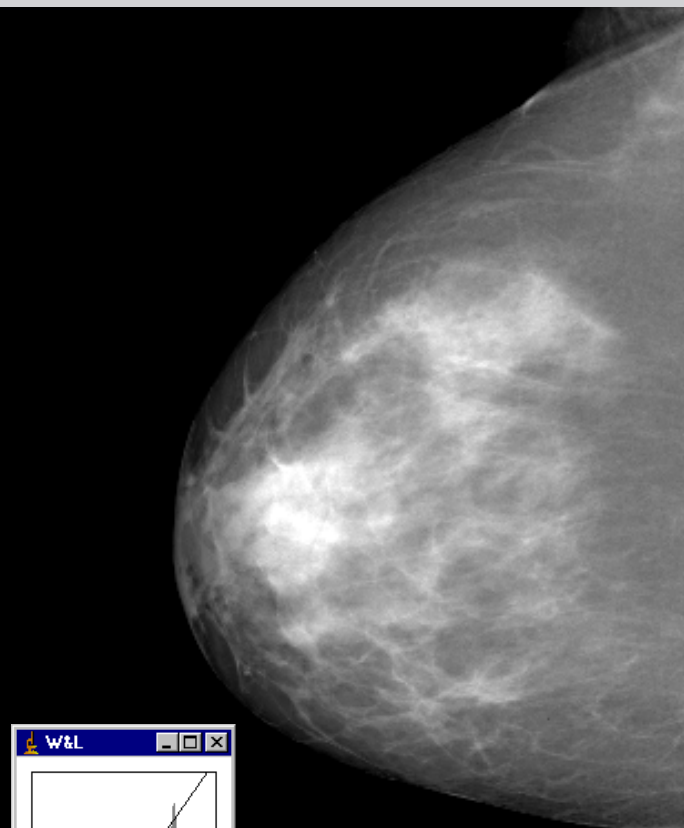


Beeldweergave

Standaard beeld:
optimale weergave

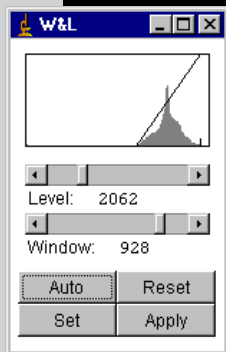
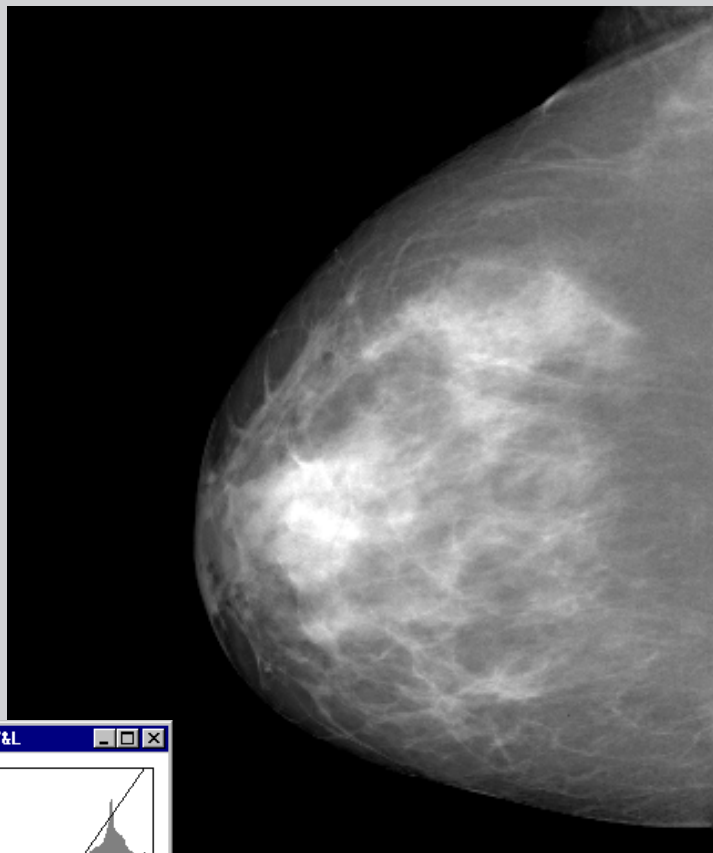
Level verhogen:
zwarting wordt hoger

Level verlagen:
zwarting wordt lager

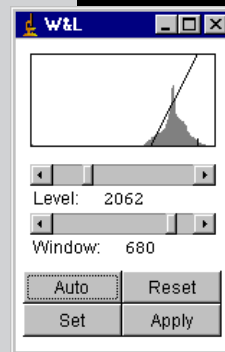
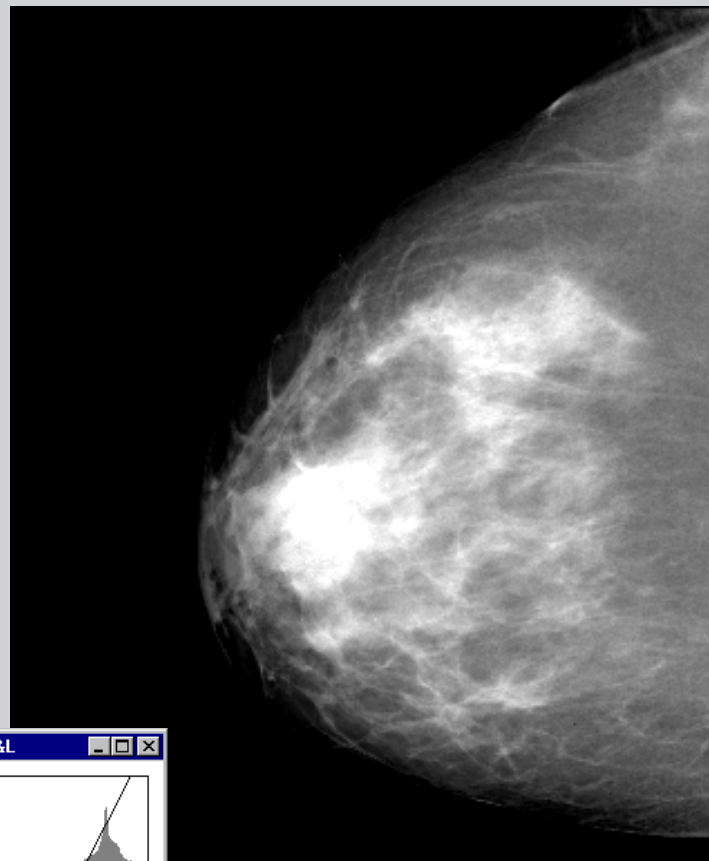


Beeldweergave

Standaard beeld:
optimale weergave



Window verkleinen:
contrast wordt hoger



Beeld informatie

<0008,0020> DA [20100115]	# 8, 1	StudyDate
<0008,0060> CS [MG]	# 2, 1	Modality
<0008,0068> CS [FOR PRESENTATION]	# 16, 1	PresentationIntentType
<0010,0010> PN [Anonimised0001]	# 14, 1	PatientsName
<0018,0015> CS [BREAST]	# 6, 1	BodyPartExamined
<0032,1030> LO [SCREENING]	# 10, 1	ReasonForStudy
<0018,7060> CS [AUTO_FILTER]	# 12, 1	ExposureControlMode
<0018,7062> LT [LORAD AUTO AEC]	# 14, 1	ExposureControlModeDescription
<0018,1191> CS [TUNGSTEN]	# 8, 1	AnodeTargetMaterial
<0018,7050> CS [RHODIUM]	# 8, 1	FilterMaterial
<0018,11a0> DS [58.0]	# 4, 1	BodyPartThickness
<0018,11a2> DS [102.00191]	# 10, 1	CompressionForce
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<0018,1152> IS [81]	# 2, 1	Exposure
<0018,1150> IS [808]	# 4, 1	ExposureTime
<0040,0316> DS [0.00978]	# 8, 1	OrganDose
<0018,1200> DA [20100112]	# 8, 1	DateOfLastCalibration
<0018,1201> TM [085053]	# 6, 1	TimeOfLastCalibration
<0018,7001> DS [31.29]	# 6, 1	DetectorTemperature

