

# Ask EuroSafe Imaging

## Tips & Tricks

### Interventional Radiology Working Group

## Interventional Series – Episode 3: Intra-Procedure: Procedure Optimization

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# Essential Steps

## 1. Pre-procedure

- Identify patients at higher risks
- Evaluate equipment performances
- Train the personnel involved

## 2. Intra-procedure

- Optimize the procedure to reduce dose
- Online dose monitoring
- Use of alert levels

## 3. Post-procedure

- Dose tracking
- Follow-up

## Fundamental Steps

1. To know the parameters which influence the dose
2. To use dose reduction tools

# Fundamental Steps

**1. To know the parameters which influence the dose**

2. To use dose reduction tools

## Factors which affect patient dose (1)

### Clinical factors

- Complexity of procedure
- Repeated procedures
- Patient size
- Target region (abdomen, thorax, pelvis etc.)

## Factors which affect patient dose (2)

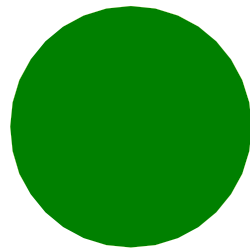
### Procedure factors

- Magnification
- Fluoroscopy pulse rate and acquisition frame rate
- Distances between patient, detector and x-ray tube
- Projection angles
- Total number of frames

## Magnification

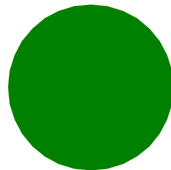
Magnification

Relative intensity



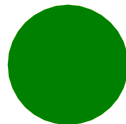
12" (32 cm)

100



9" (22 cm)

150



6" (16 cm)

200

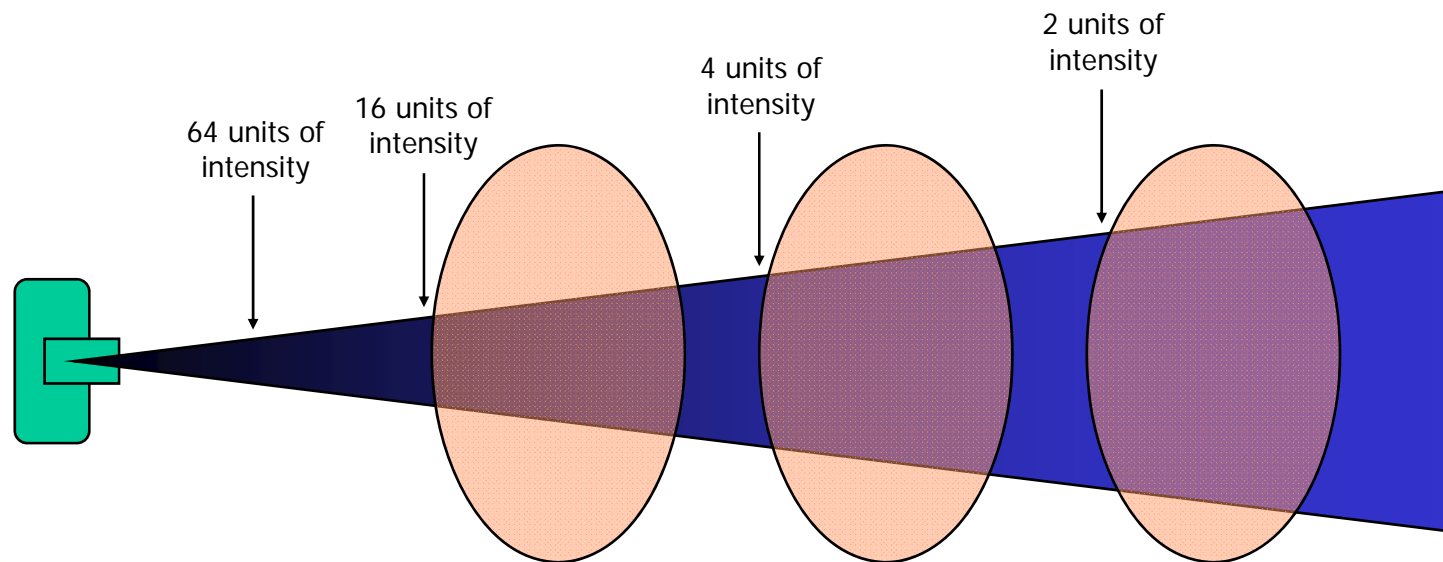


4,5" (11 cm)

300

## Source to Patient Distance

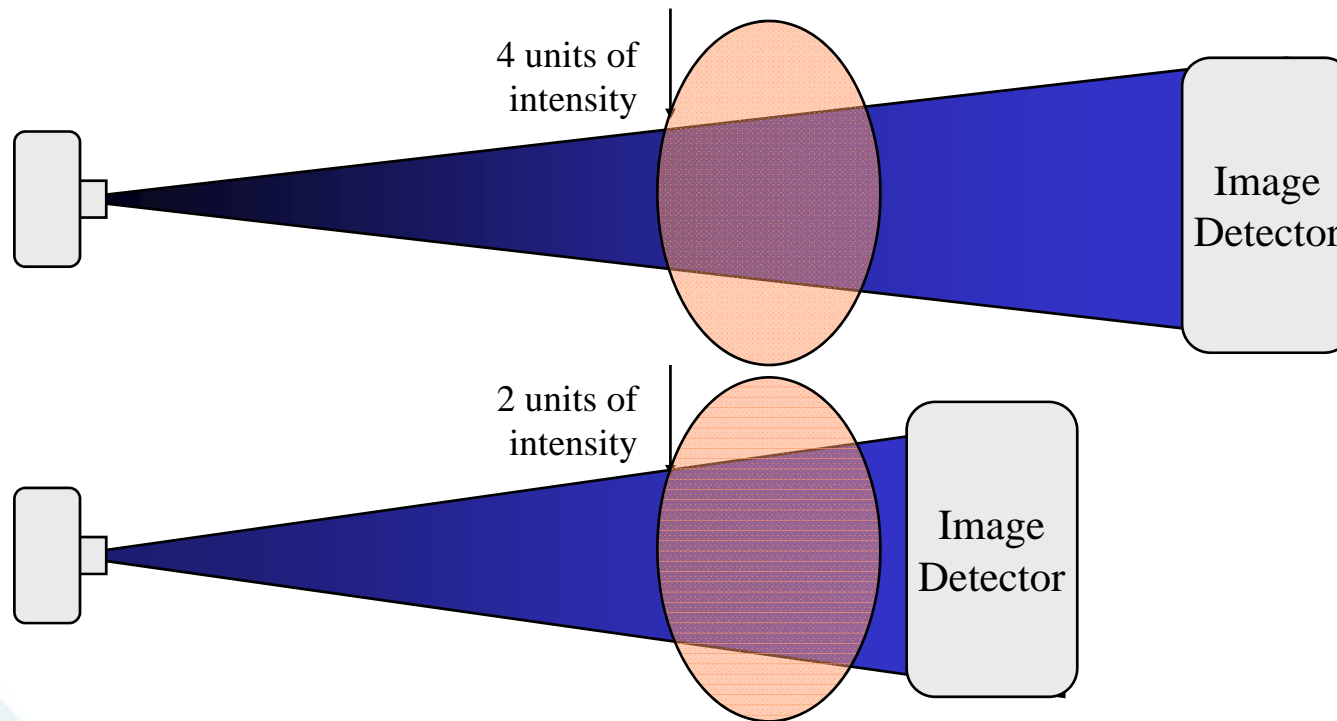
- According to the *inverse square law* the x-rays intensity decreases quickly with the distance.





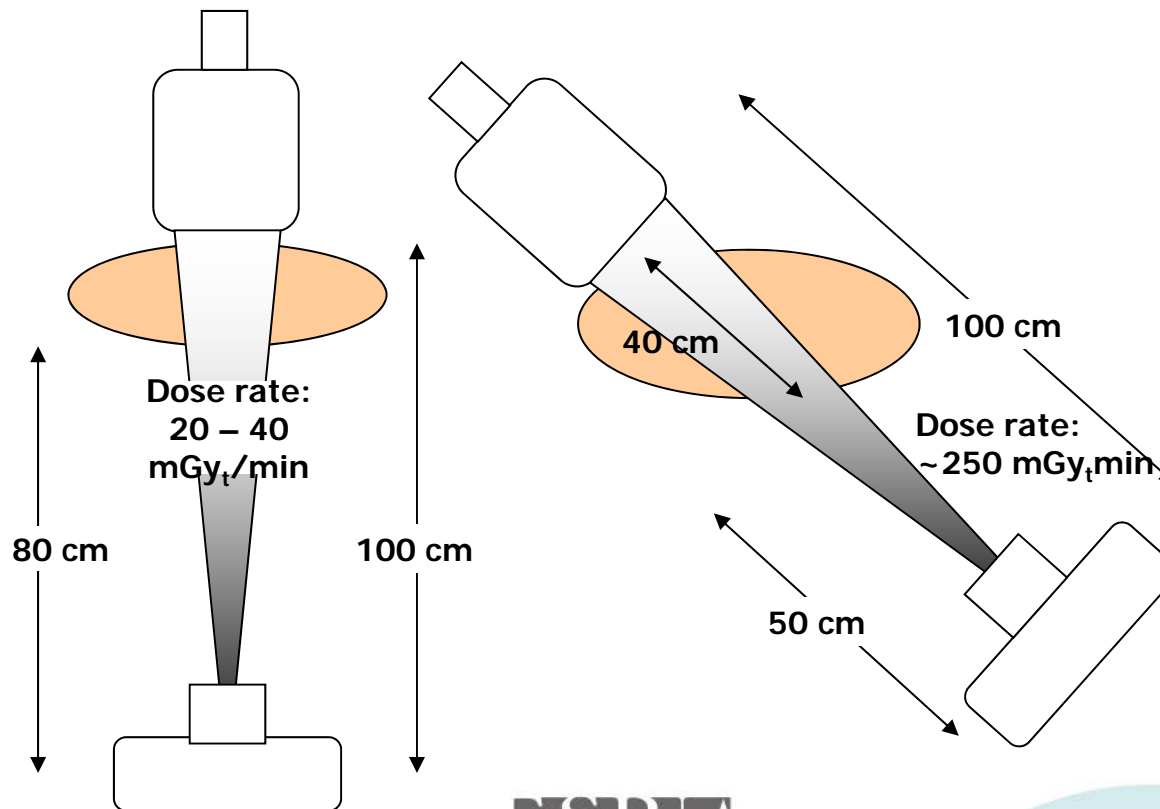
## Source to Detector Distance

- For the same reason, the dose at the entrance of the patient increases when the image detector is kept far.



## Angular Projections

- ❑ The dose at the entrance of the patient increases for angular projections due to increased diameter of body mass which has to be penetrated.



## Angular Projections

- Entrance exposure rate for some common projections.

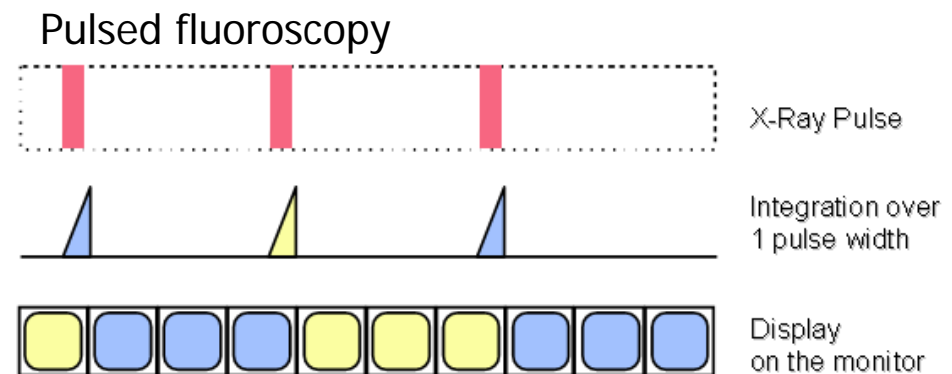
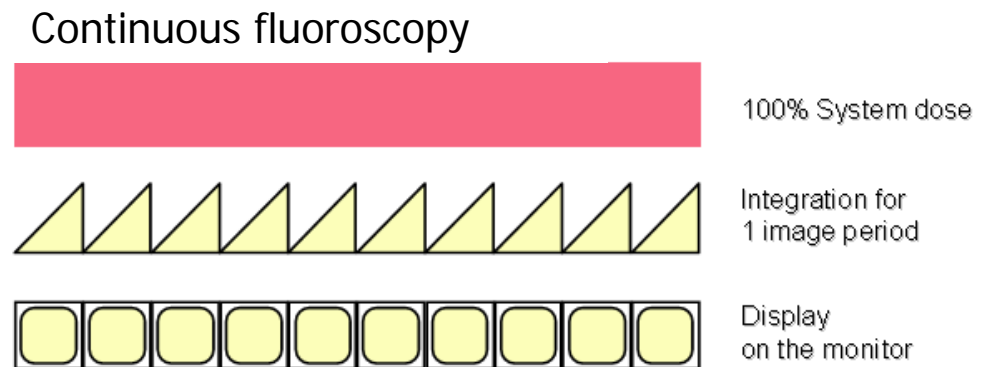
Angiographic Projection	Fluoro Rate (R/min)	Cine Exposure Rate (R/min)
AP	3.1	38.8
RAO 30°	1.9	20.3
LAO 40°	2.0	21.6
LAO 40°, Cran 30°	8.0	99.1
LAO 40°, Cran 40°	9.9	123.6
LAO 40°, Caud 20°	2.9	34.1

## Pulsed Fluoroscopy

❑ Pulsed fluoroscopy can be used as a method to reduce radiation dose, particularly when the pulse rate is reduced.

❑ Pulsed fluoroscopy does not mean that dose rate is lower compared with continuous fluoroscopy!!

❑ Dose rate depends of the dose per pulse and the number of pulses per second.



# Fundamental Steps

1. To know the parameters which influence the dose

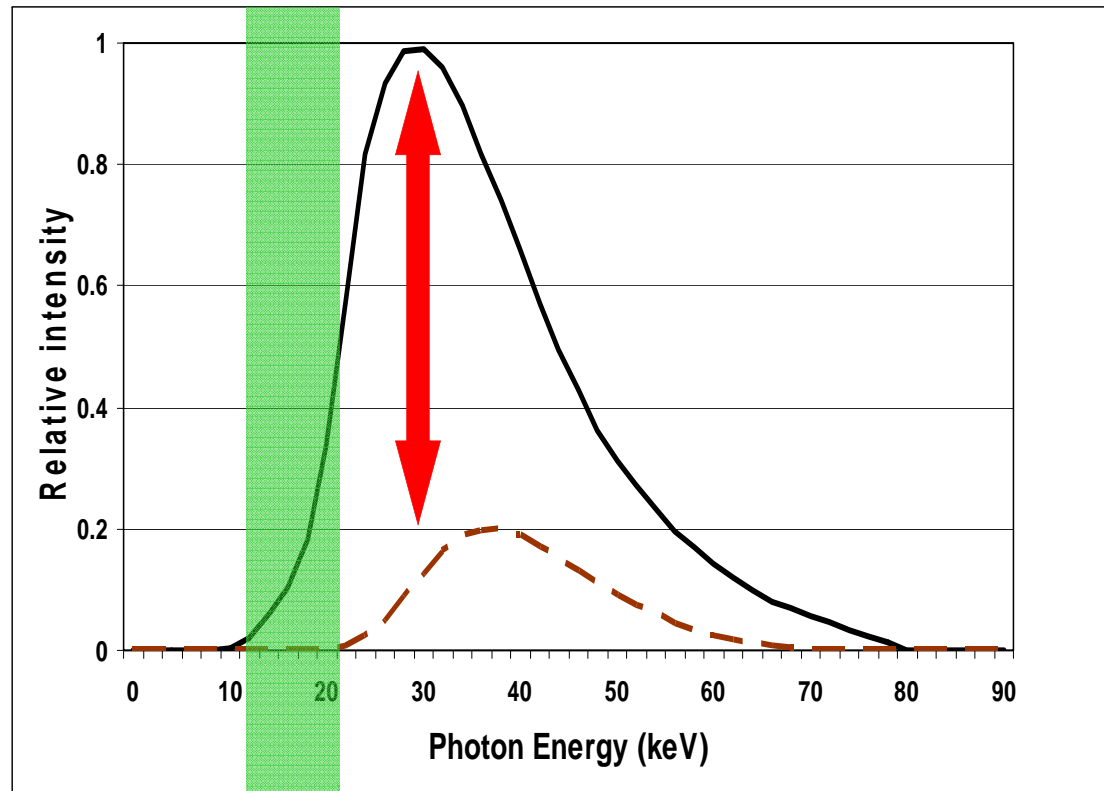
**2. To use dose reduction tools**

## Dose Reduction Tools

- Added filtration
- Collimation
- Last image hold

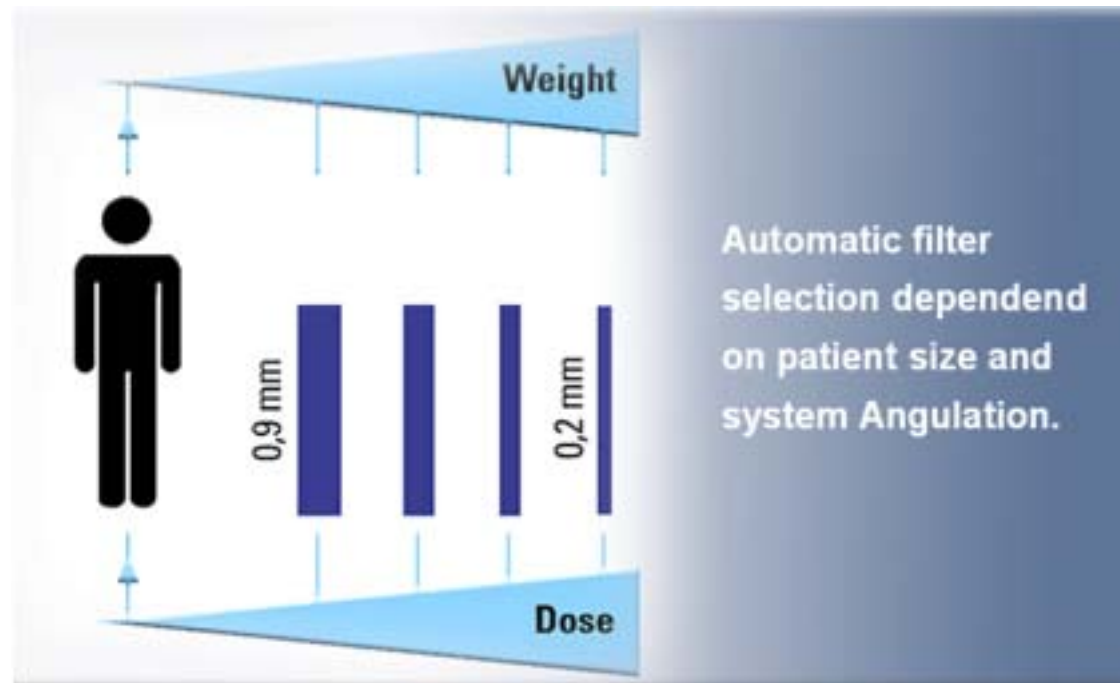
## Added Filtration

- ❑ Added filtration reduces the number of low energy photons in the x-ray beam and, as a consequence, patient skin dose.



## Added Filtration

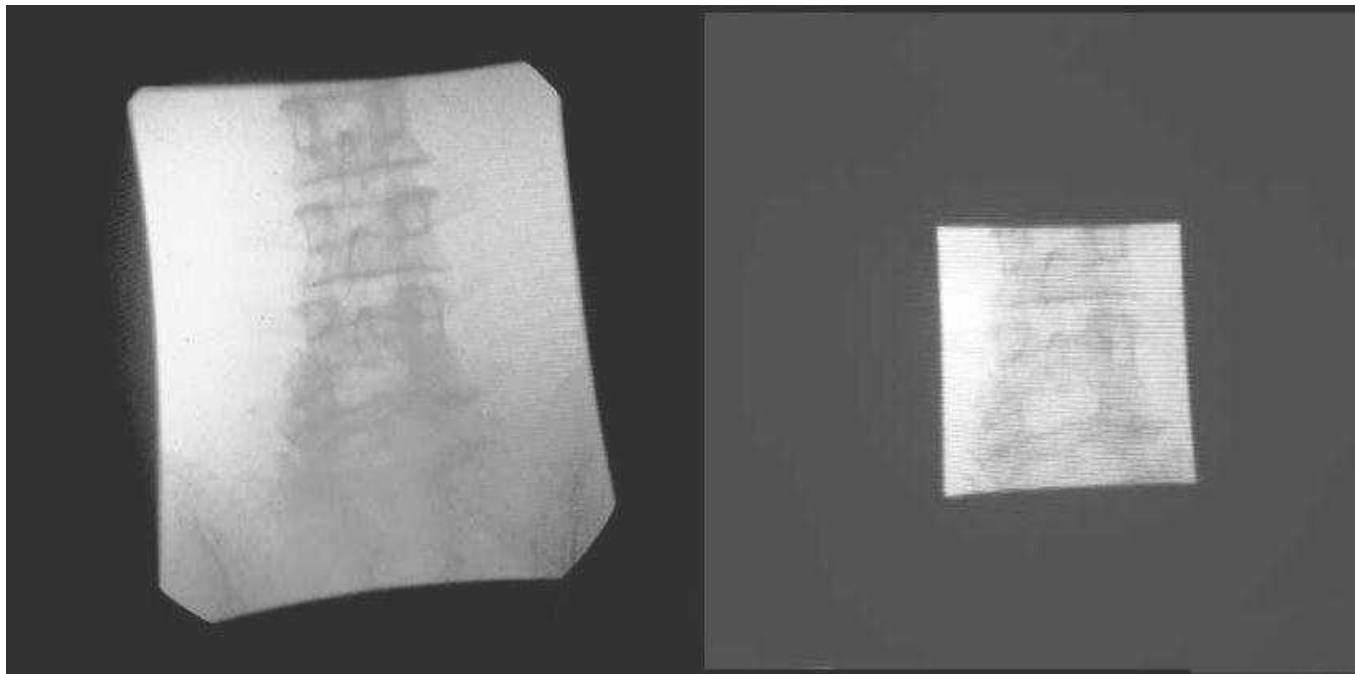
- ❑ Modern equipment provides variable filters to be automatically included in the beam based on the attenuation (i.e.: patient thickness and angulation) to maintain the dose as low as possible without reducing image quality.





## Collimation

- ❑ Collimation can be used to reduce the total area exposed and to acquire an image only of the details of interest for the procedure.

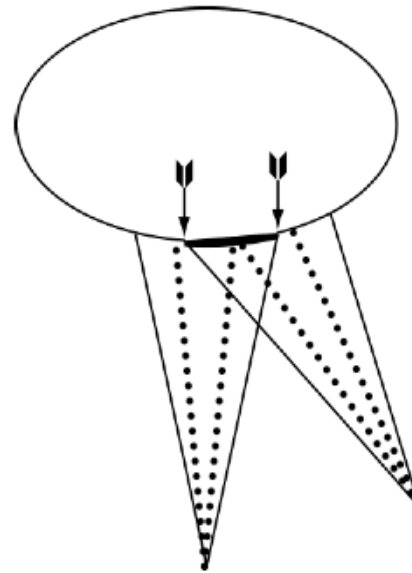


## Collimation

### Benefits:

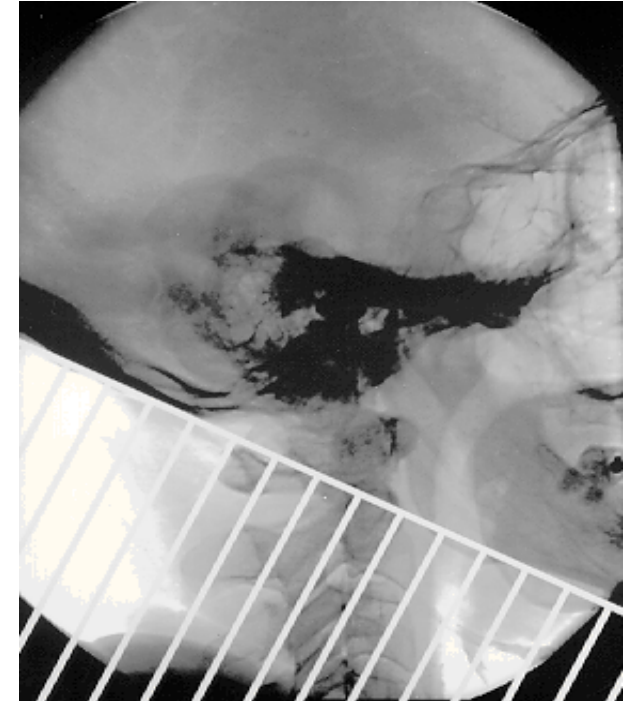
- ❑ Less volume irradiated → lower stochastic risk
- ❑ Reduced scattered radiation →
  - ❑ Better contrast
  - ❑ Lower operator dose

The possible overlapping of different fields from different projections is also reduced.



## Last image hold and stored fluoro

- ❑ Modern equipment allow to hold the last image acquired on the screen. The frozen image is used to virtually move the table, select the FOVs, position the collimators and insert the wedges without the use of fluoroscopy.
- ❑ Moreover it is possible to reduce the number of DSA series in favour of the fluoroscopy mode and storing fluoroscopic sequences with an considerable decrease of patient dose.



## Next Steps

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