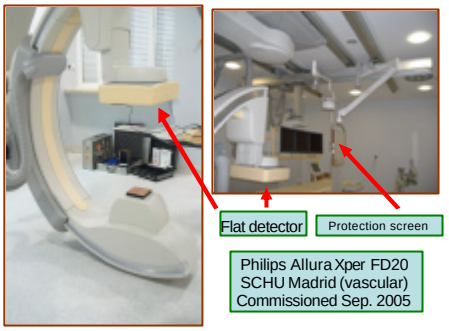
eliseov@med.ucm.es

DAP meter calibration

JM Fernandez, R Simon, C Prieto,
D Martinez and E Vano
Medical Physics Service
San Carlos University Hospital
Version 17 April 06

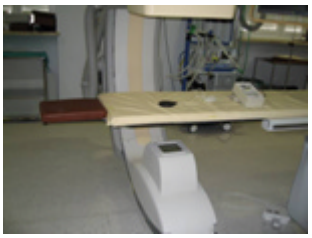


DAP CALIBRATION FACTOR

DAP meter calibration

- The calibration factor has to take into account the differences between the dose area product (DAP) displayed by the transmission chamber placed on the collimator and the DAP of the radiation impinging on the patient.
- The calibration factor is the ratio between the DAP of the radiation which actually impinges on the patient, and the value displayed by the DAP meter.

DAP CALIBRATION FACTOR



Place the ionization chamber on top of the mattress

DAP CALIBRATION FACTOR

•Build something to put 4 mm of copper sheets on top of the ionization chamber at a distance of 20-25 cm to avoid backscatter.

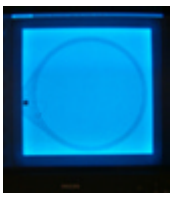
We have got a cork box for this proposal. This can be any radiotransparent thing.

eliseov@med.ucm.es

DAP CALIBRATION FACTOR

• Select the automatic fluoroscopy mode used more frequently in clinical practice. If the equipment has a device that automatically inserts copper filters, select the one which does not include anyone (typically high fluoroscopy mode).

DAP CALIBRATION FACTOR



•Select a medium field size (i.e. 23 cm) and put the chamber in the centre of the field.

•Collimate the radiation field size to include the ionization chamber and avoid direct irradiation of the image intensifier or flat panel.

DAP CALIBRATION FACTOR

• With the help of the copper sheets and the distance focus - intensifier set the voltage to 80 kV

•Maintain fluoroscopy until the system accumulates a DAP around 10 Gy cm^2

•Record the accumulated dose with the reference ionisation chamber D_{ref} and the DAP measured by the system.

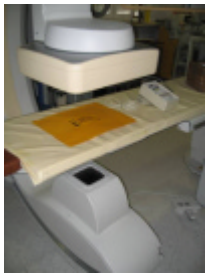
DAP CALIBRATION FACTOR

So, we have to take notes of:

- **DAP_i** Initial Dose Area Product, from the X- Ray System before irradiation
- **DAP_f** Final Dose Area Product, from the X- Ray System after irradiation
- **D_{ref}** accumulated dose, from the ionization chamber

DAP_i = 5051 mGycm^2
DAP_f = 9678 mGycm^2
D_{ref} = 19.78 mGy

DAP CALIBRATION FACTOR



If we have the possibility to measure the area with a slow film, we place it on top or in the place of the ionization chamber and irradiate it.

Be careful not to change any distance or size field

DAP CALIBRATION FACTOR
Calculating the area

WITH THE SLOW FILM

- Just calculate the area of the impressed figure

Our area was 185 cm2

It is the easiest way of not making a mistake

eliseov@med.ucm.es

DAP CALIBRATION FACTOR
Calculating the area

FROM A PHOTO OF THE MONITOR

- We have to scale from a known distance

i.e. this ionization chamber measures 9 cm diameter, so the area is 10 x 10.2 = 102 cm^2

Be careful! The field edges must appear in the monitor, if not, the area is probably bigger that the one we see.

OBTAINING THE DAP CALIBRATION FACTOR

Now we have all the necessary data, just replace in the formula:

$$f = \frac{AD \cdot Area}{DAP_f - DAP_i}$$

$$f = \frac{4.46\,mGy\_185cm^2}{(2361\_1304)mGy\_cm^2} = 0.78$$

INITIAL CHARACTERISATION OF THE SYSTEM

INITIAL CHARACTERISATION OF THE SYSTEM

- Place the ionization chamber on top of the matress
- Put some PMMA to support the weight of another 20 cm on top of it without crushing the ionization chamber

INITIAL CHARACTERISATION OF THE SYSTEM

- Place 20 cm of PMMA on top of this.
- Select the geometry to have the middle of the PMMA thickness in the isocenter.
- Place the chamber in close contact with the PMMA

INITIAL CHARACTERISATION OF THE SYSTEM

- Maintain 5-6 cm between the PMMA and the entrance of the image intensifier or flat panel detector.
- verify that the chamber is fully included in the selected field size.
- Take note of ALL the relevant distances

eliseov@med.ucm.es

INITIAL CHARACTERISATION OF THE SYSTEM

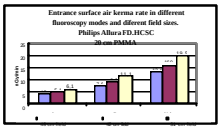
•FLUOROSCOPY MODES:

Take note of the ***dose rate*** and radiographic technique

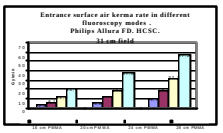
•ADQUISITION MODES

Take note of the accumulated dose and the number of images made during the irradiation and obtain the ***dose per image***

INITIAL CHARACTERISATION OF THE SYSTEM. EXAMPLES.

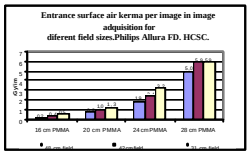


Variation of the entrance surface air kerma with the field size in different fluoroscopy modes



Variation of the entrance surface air kerma with PMMA thickness in different fluoroscopy modes.

INITIAL CHARACTERISATION OF THE SYSTEM. EXAMPLES.



Entrance surface air kerma in different PMMA thickness and field sizes in image adquisition

Commissioned at the SCUH Madrid on September 2005

MPPS (Modality Performed Procedure Step) working on 18 October 2005 Philips Allura XPER – FD20

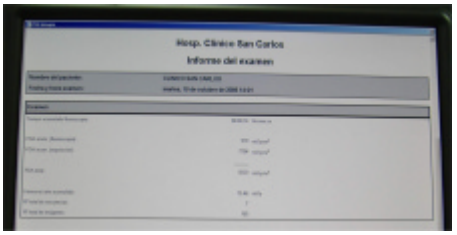
Table 32: N-SET MPPS Request Identifier: Radiation Dose Module

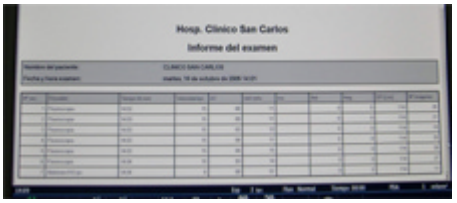
Attribute Name	Tag	Note
Image Area Dose Product	0018,115E	
Total Time of Fluoroscopy	0040,0300	
Total Number of Exposures	0040,0301	
Entrance Dose	0040,0302	in dGy
Entrance Dose in mGy	0040,8302	in mGy

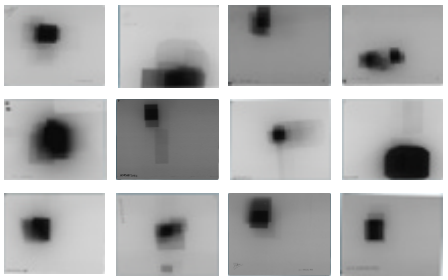
MPPS (Modality Performed Procedure Step) working on 18 October 2005 Philips Allura XPER – FD20

- Operation Received = N-CREATE
- (0008,0060) : Modality: XA
- (0010,0010) : Patient's Name: CLINICO SAN CARLOS
- (0010,0020) : Patient ID : 1234
- (0018,115E) : Image Area Dose Product: 82.23
- (0040,0250) : Performed Procedure Step End D: 18/10/2005
- (0040,0251) : Performed Procedure Step End T: 14:05:01
- (0040,0300) : Total Time of Fluoroscopy: 14
- (0040,0301) : Total Number of Exposures: 11
- (0040,0302) : Entrance Dose: 1
- (0040,0340) : Performed Series Sequence:
- (0040,8302) : Entrance Dose in mGy: 75.461433

eliseov@med.ucm.es







Examples of slow films (Kodak EDR2) used to audit skin dose distribution during interventional vascular procedures