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MEDICAL STAFF EXPOSURE IN ELECTROPHYSIOLOGY PROCEDURES: FIRST RESULTS DURING BIVENTRICULAR ICD IMPLANTATION



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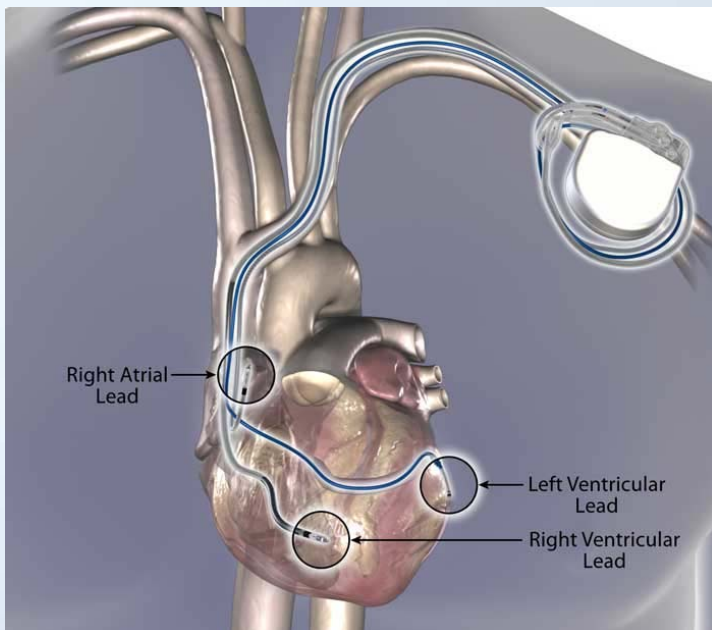




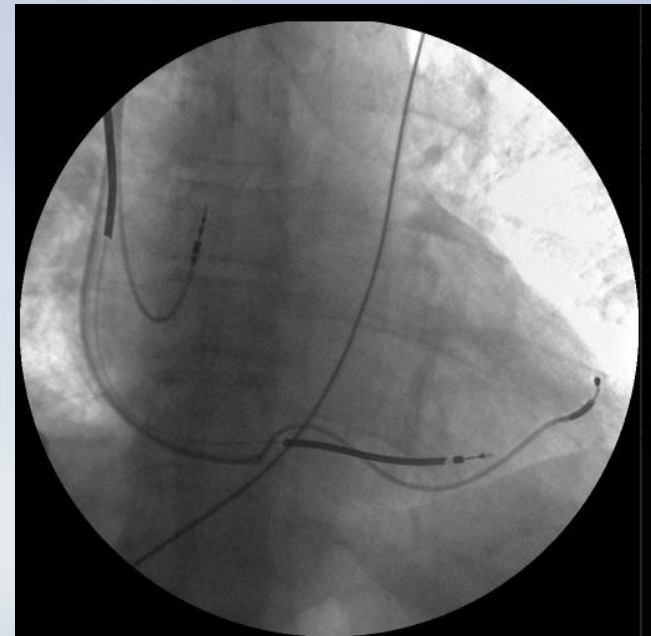
Cardiac resynchronization therapy (CRT) with BIVENTRICULAR I.C.D. (Implantable Cardioverter Defibrillator)

Cardiac resynchronization therapy (CRT) is a device-based therapy for patients with damaged heart muscles, electrical timing abnormalities, and symptomatic heart failure.

CRT is also known as biventricular pacing (bi-V pacing) and can be accomplished with either a pacemaker or an ICD. CRT is essentially a pacemaker or ICD with an extra, or third, wire or lead. The lead is placed in a very strategic place - inside a vein called the **coronary sinus**. Because the coronary sinus overlies the **left ventricle** (LV), pacing of the left ventricle can be accomplished. Ordinary pacemakers and ICDs can only pace the **right ventricle** (RV) and **right atrium** (RA). With both right and left ventricular leads, though, CRT can "resynchronize" the heart - helping to make it beat more efficiently and stronger.



Courtesely from MEDTRONIC website

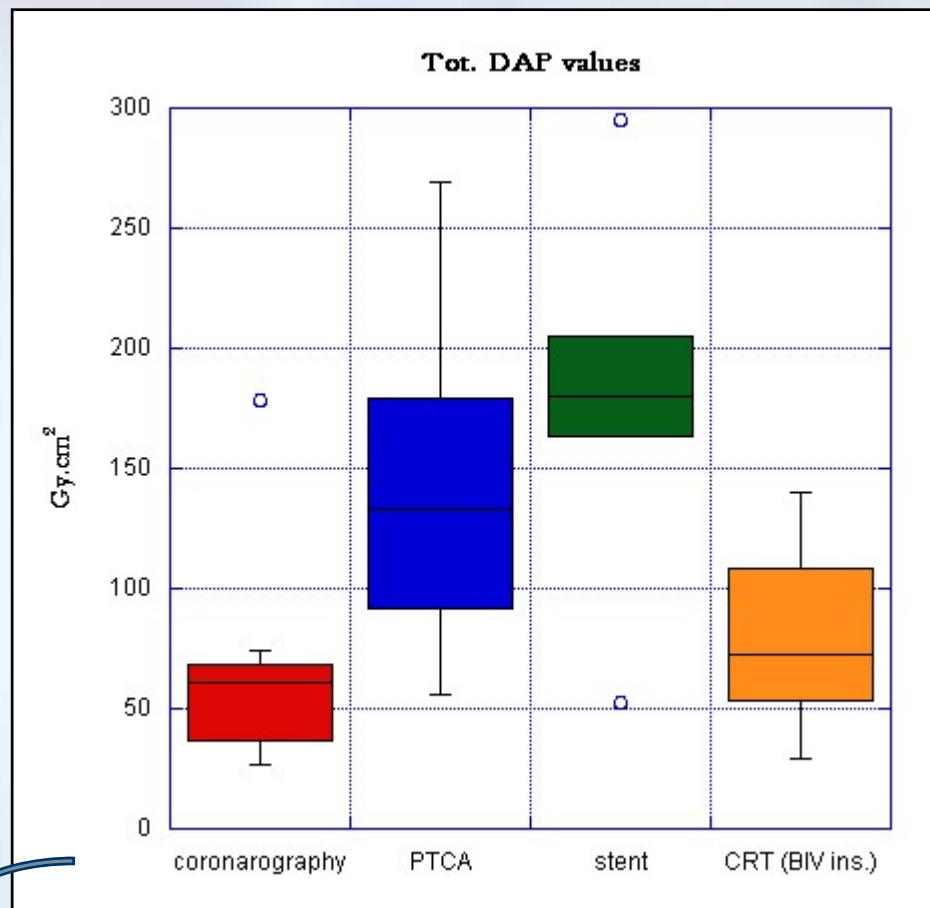


Postero-anterior view of the wires inside patient heart



Analyzing “cardiological procedures” at Sant’Orsola Malpighi University Hospital...

... in terms of total energy emitted by the X-ray tube

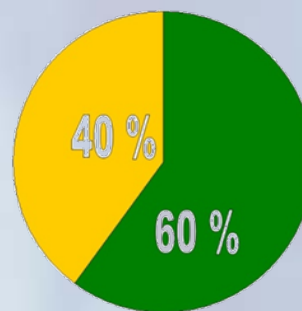


... so no great differences seems to be

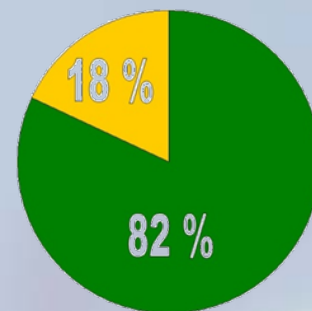
... but the distribution of this DAP values during procedures phases (i.e., graphy vs. scopy)?



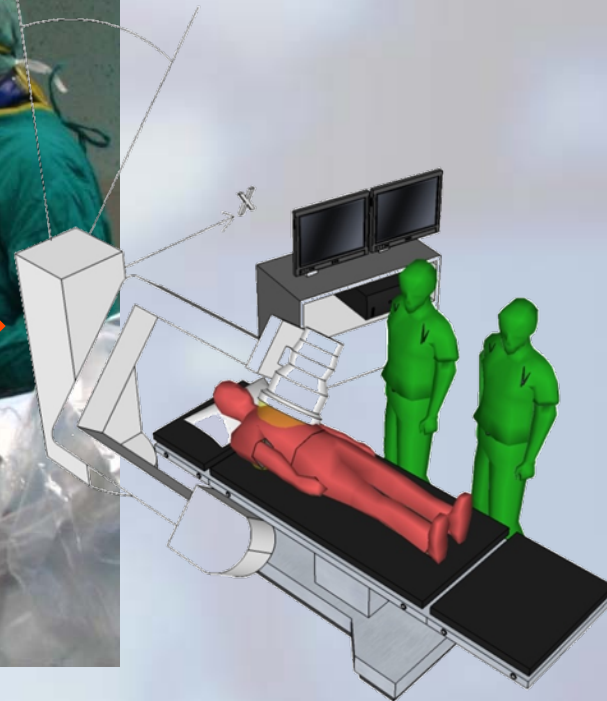
Emodynamic



CRT procedures



The Sant'Orsola Malpighi University Hospital E.P.'s room



***In order to obtain a complete description of the scenario
(i.e., correct evaluation of personal dose indexes) ...***

*... complete description of X-ray
tube parameters and geometries
during CRT procedures
(to define the source of X-ray field)*



*... complete description of staff
positions during CRT procedures
(to define the geometry)*

... and to measure staff dose ...



Our choice: measures with electronic dosimeters

Photon energy?

Sensitivity?

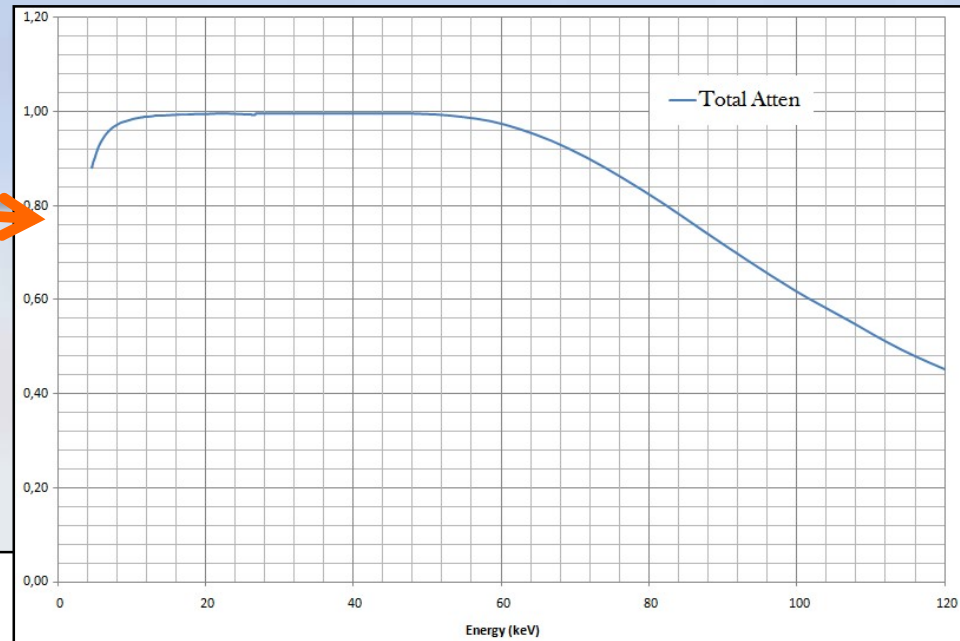
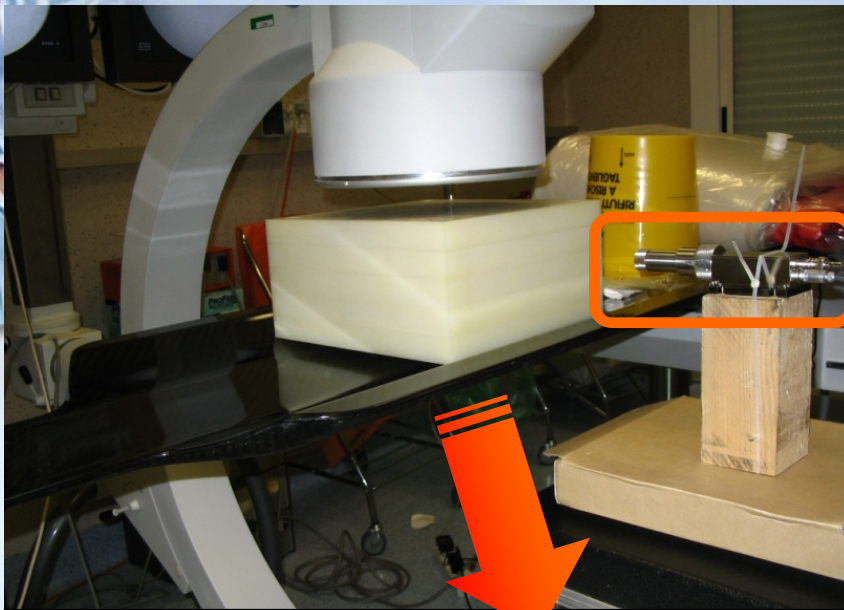
Correct estimation?

Direct measure of the X-ray spectra scattered by patient

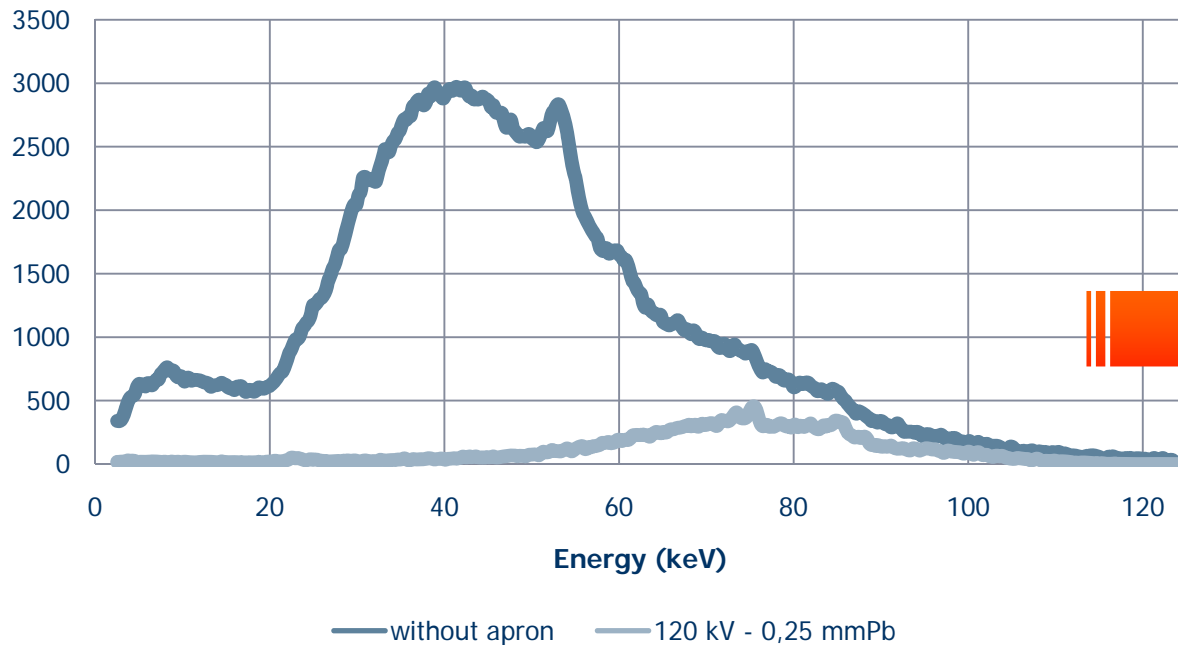
TOTAL	DAP (mGy×cm²)	54'426 (21'693 - 150'069)								
		PA			RAO			LAO		
		MEDIAN	MIN	MAX	MEDIAN	MIN	MAX	MEDIAN	MIN	MAX
Projection	DAP (mGy×cm²)	26'629	2'937	132'3 15	2'824	546	49'334	17'804	651	71'993
	DAP ptc	56,3%	-	-	6,0%	-	-	37,7%	-	-
FLUOROSCOPY	Tube Voltage (kV)	93	82	116	104	86	120	101	86	120
	Tube current (mA)	3,0	2,0	5,0	3,1	2,0	5,2	3,1	2,2	4,0
	Time (s)	630	144	2468	40	3	867	360	9	1231
	DAP (mGy×cm²)	23'378	2'937	115'7 63	1'415	86	28'271	15'891	200	64'366
	DAP ptc	57,5%	-	-	3,5%	-	-	39,1%	-	-
GRAPHY	Tube Voltage (kV)	81	63	108	91	73	110	88	72	120
	Frame number	295	27	876	119	26	968	282	20	1347
	DAP (mGy×cm²)	4'660	844	39'05 3	2'045	774	21'063	5'207	651	34'039
	DAP ptc	39,1%	-	-	17,2%	-	-	43,7%	-	-

... that determines
differences in X-ray
scattered field that
impinge on staff

AMPTEK XR100T-CdTe

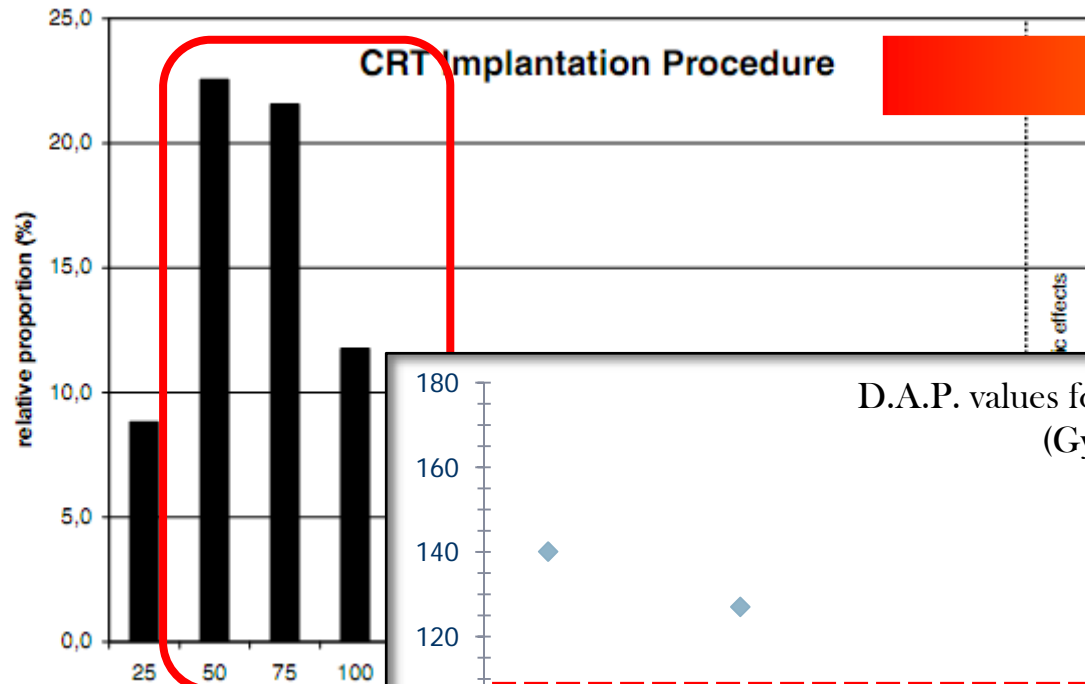


Comparison between spectra
(HV = 120 kV)



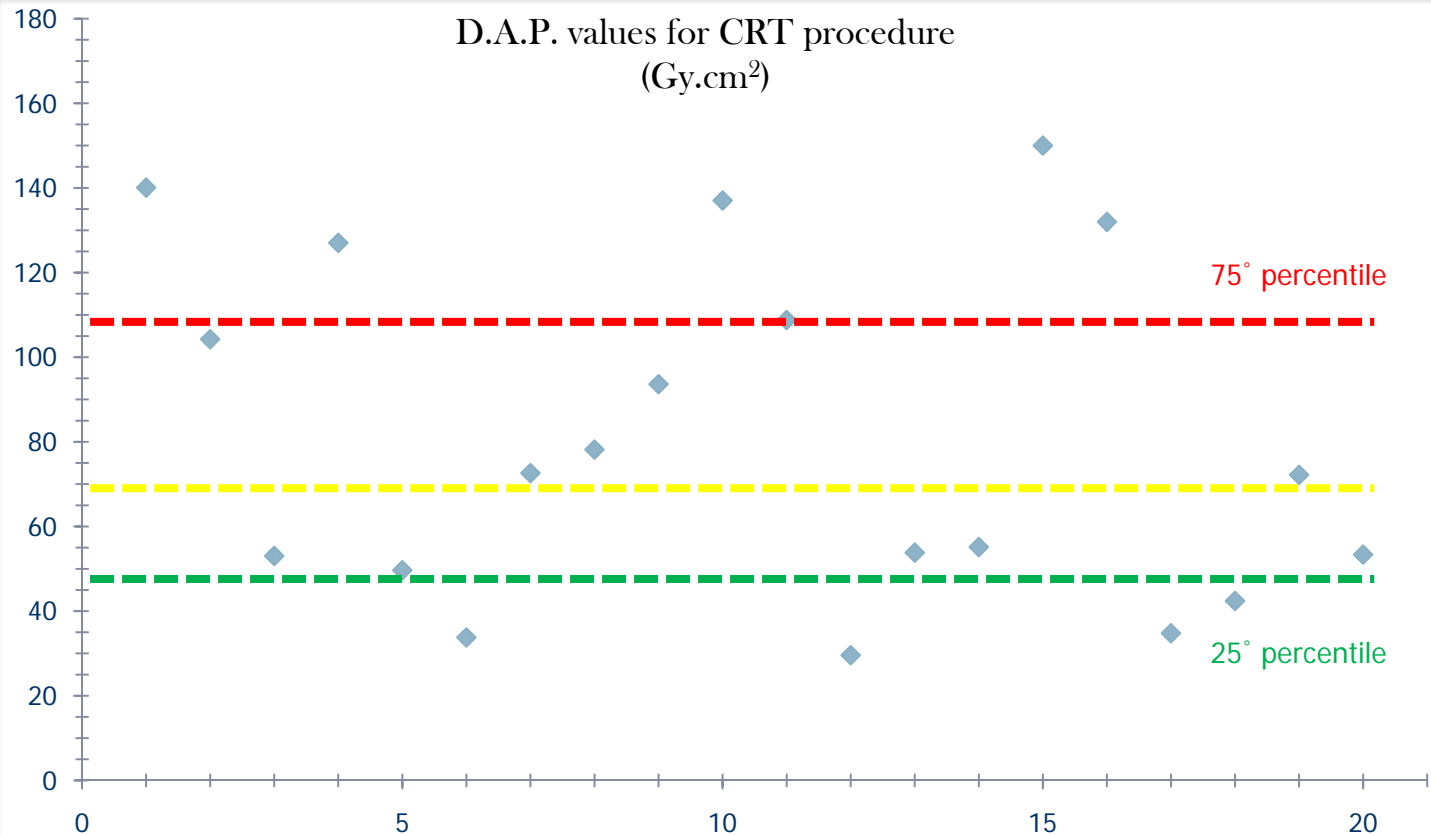
... calculated
Hp(10) ratio
of ~ 45

First of all: literature data for CRT procedures?



Radiation Exposure of Implantation and Up Devices

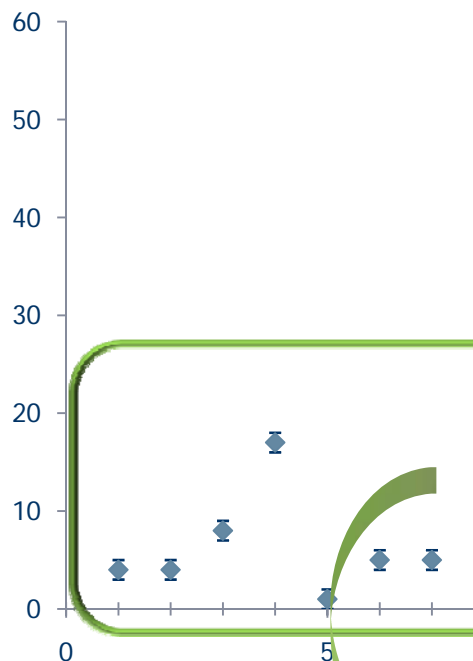
CHRISTIAN BUTTER, M.D.,* THO
KLAUS NEUMANN, M.D.,† HANS



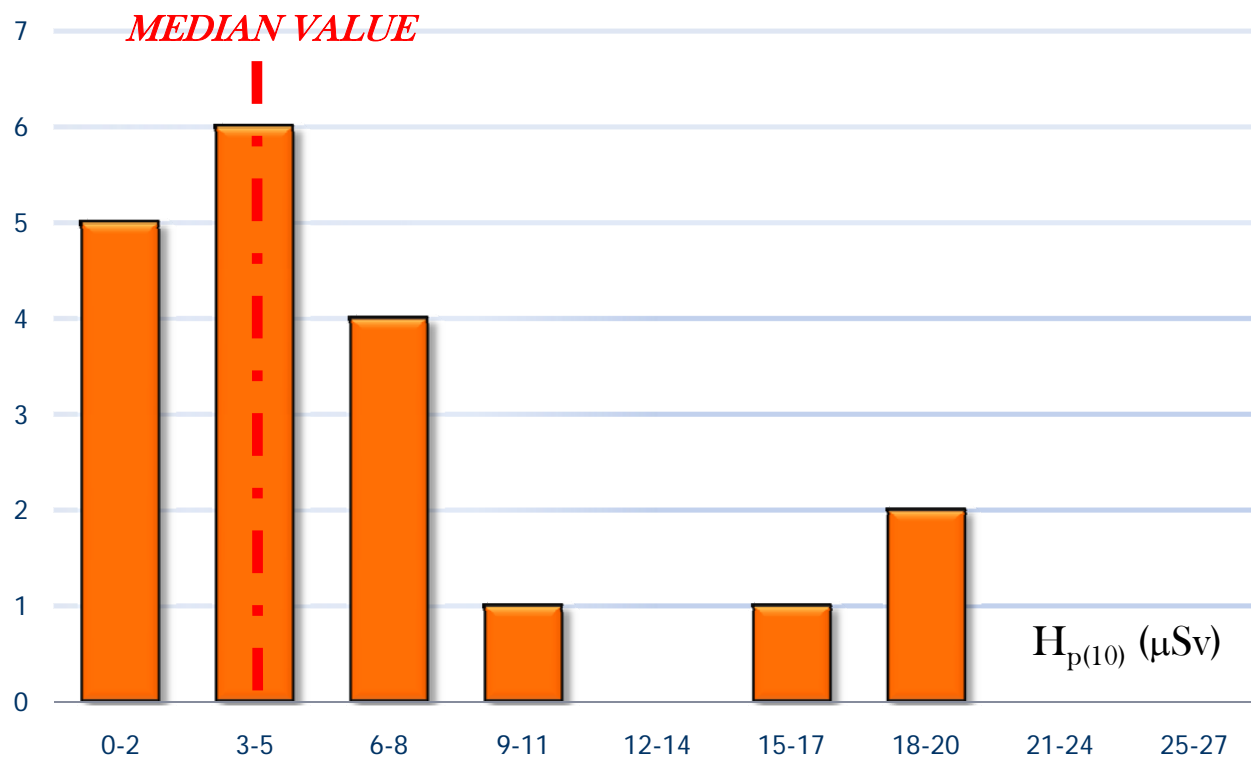
First evaluation: direct measure of $H_p(10)$ with electronic dosimeters



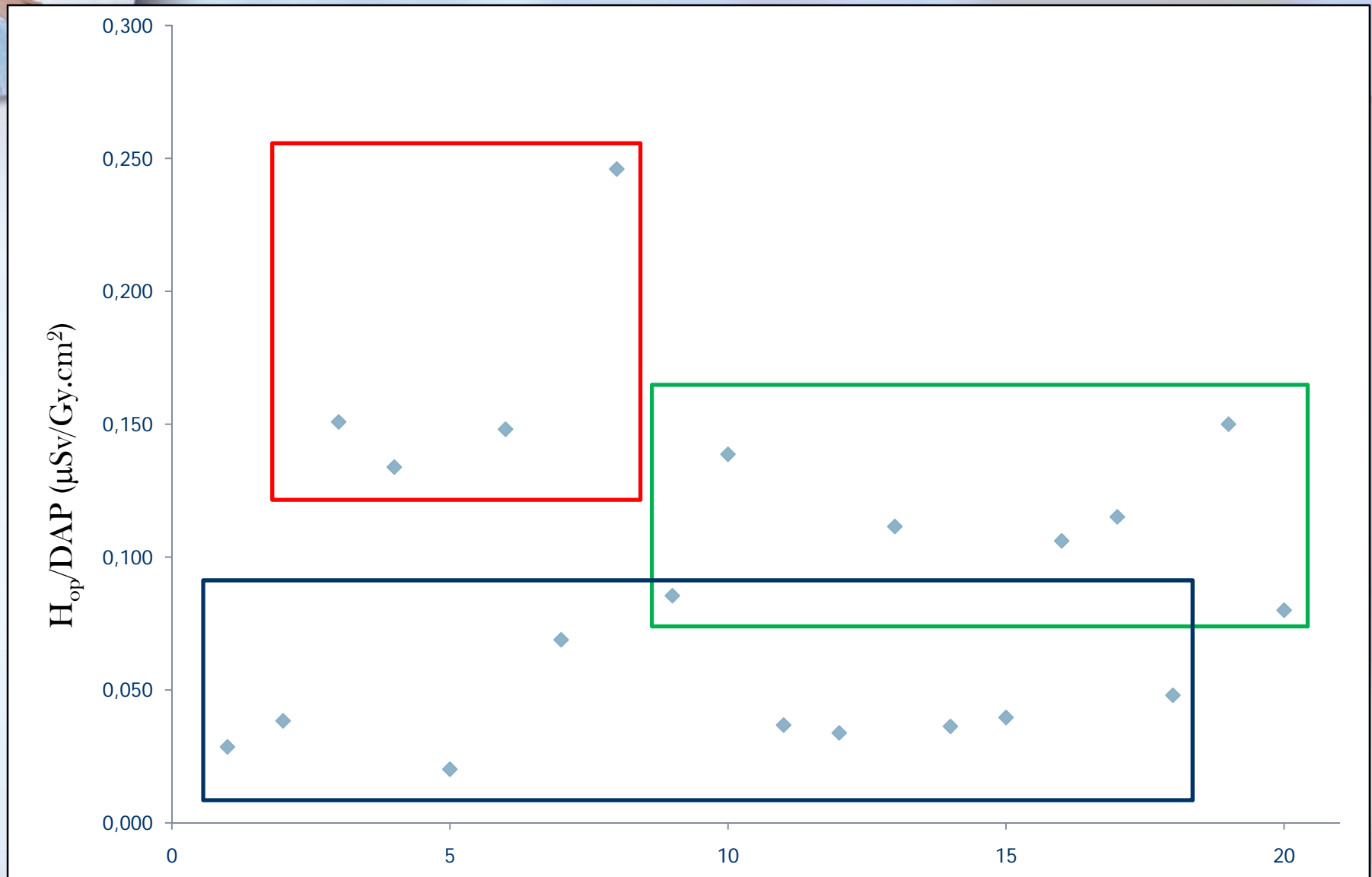
$H_p(10) \text{ I}^\circ (\mu\text{Sv})$



Frequency of Dose Value
(population = 19 cases)



Trying to compare values between cardiologists...

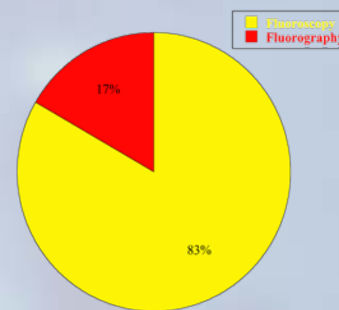
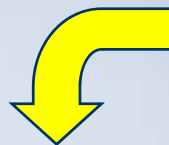
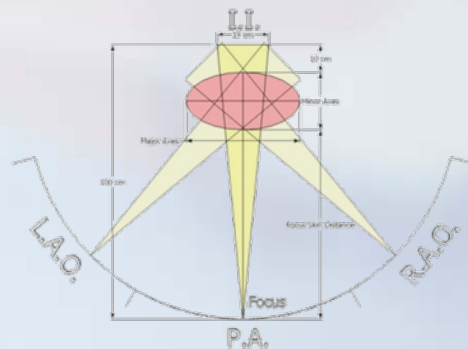




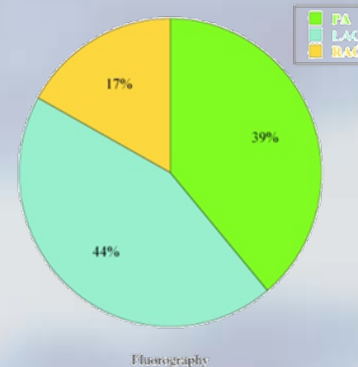
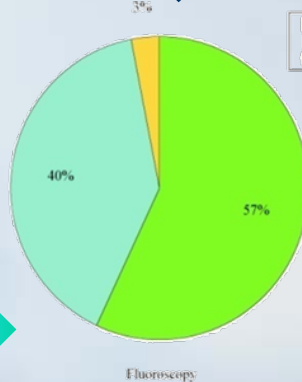
“Deconvolving” the procedures...

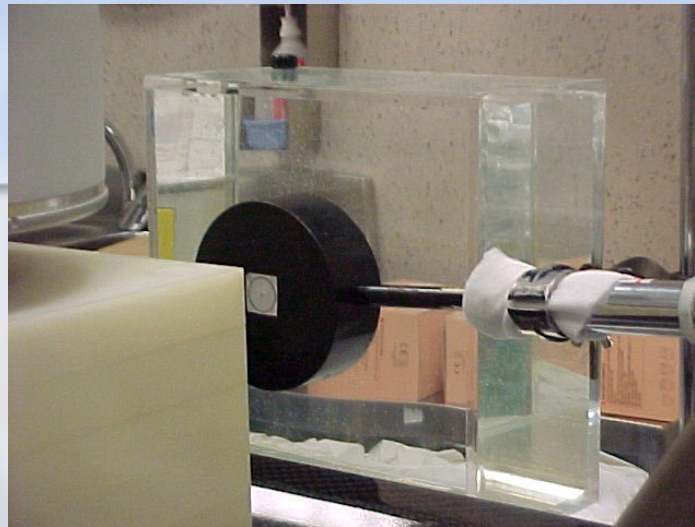
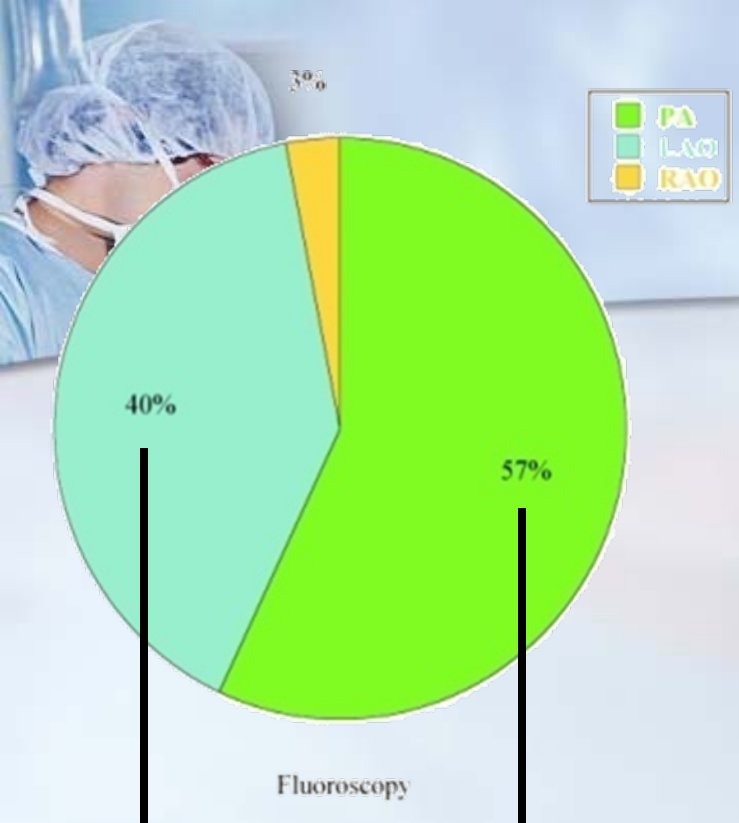


a complete description of the irradiation geometry on patient (to define the scattering field that impinge on staff)



a complete description of the CRT phases (graphy vs. scopy)





0,142 $\mu\text{Sv}/\text{Gy}\cdot\text{cm}^2$

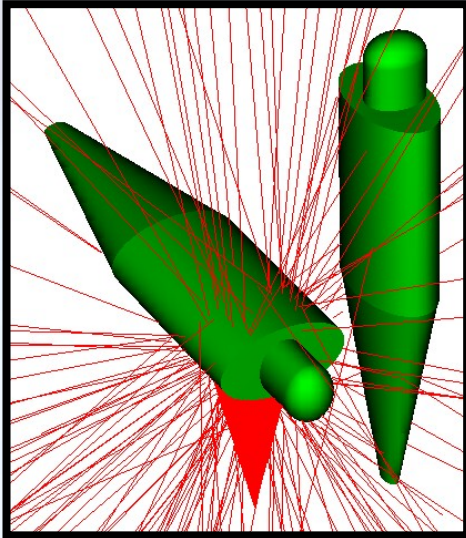
0,170 $\mu\text{Sv}/\text{Gy}\cdot\text{cm}^2$

Future works ...

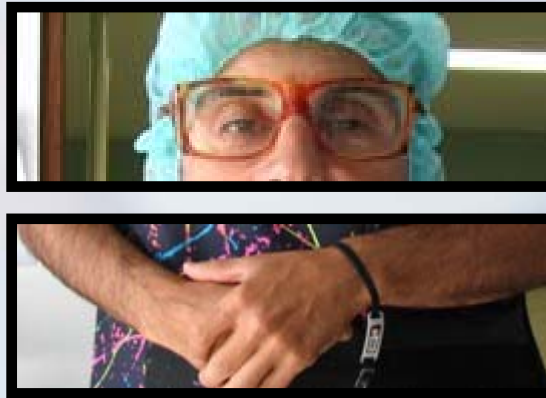


Future works ...

1



2



3

*A “concerned
involvement” of
electrophysiologists,
some suggestions...*

Eye and hand?

~ 0.1 mSv and ~1.1 mSv
... “very first data” ...

THANK YOU for ATTENTION!!!