

DD GENERATOR FIRST TEST

Francesco, Filippo, Mattia

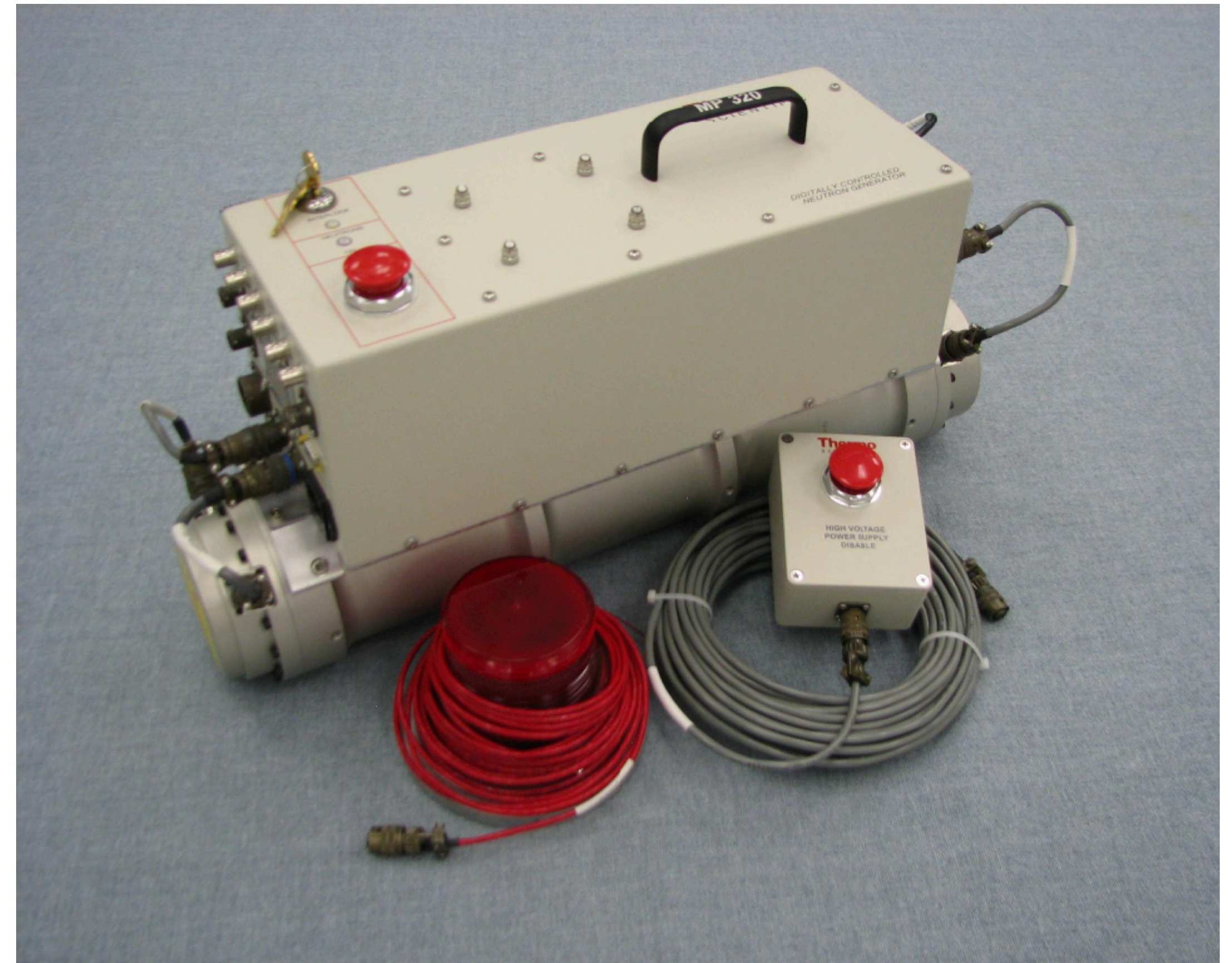
Thermo Scientific

MP320 Neutron Generator

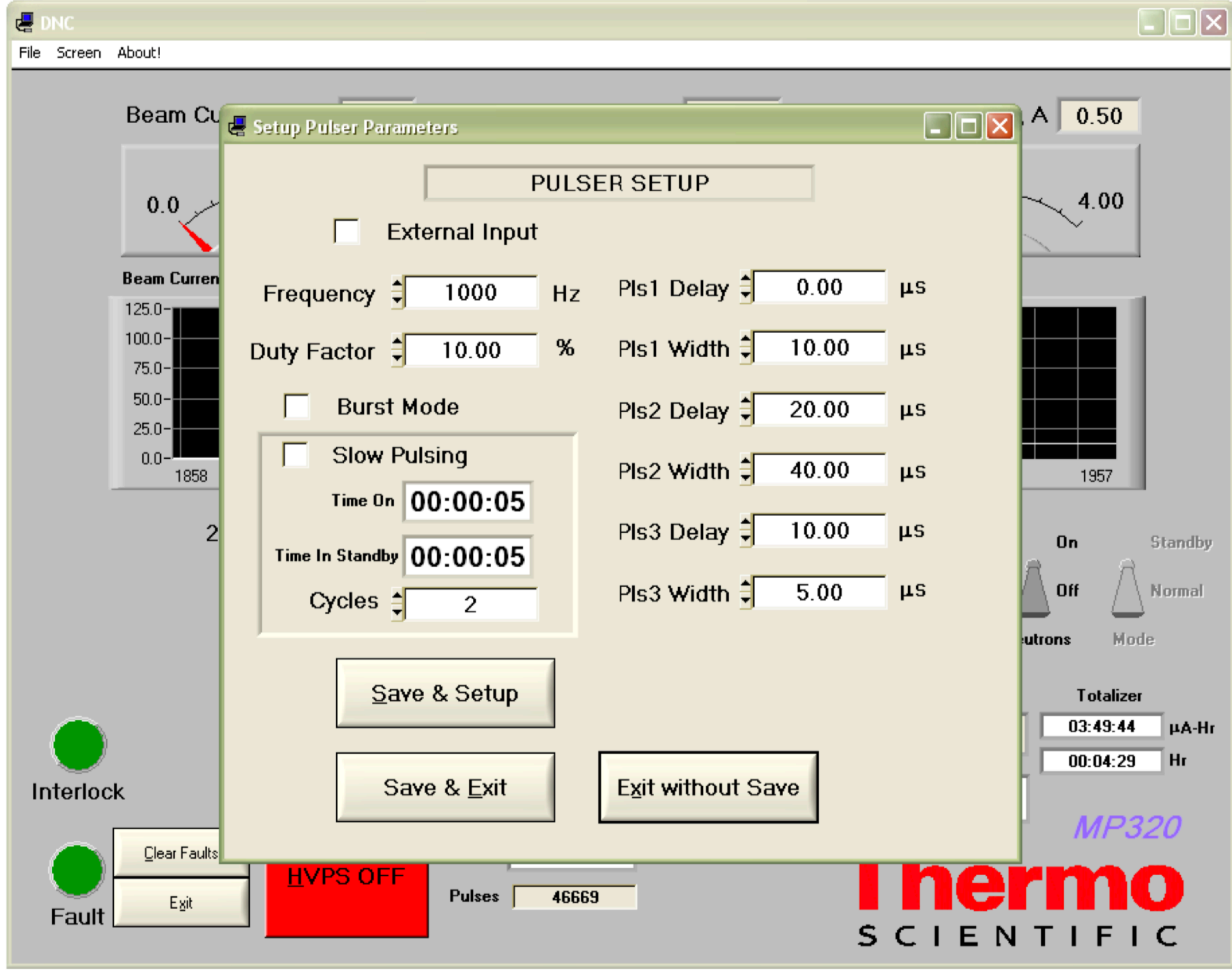
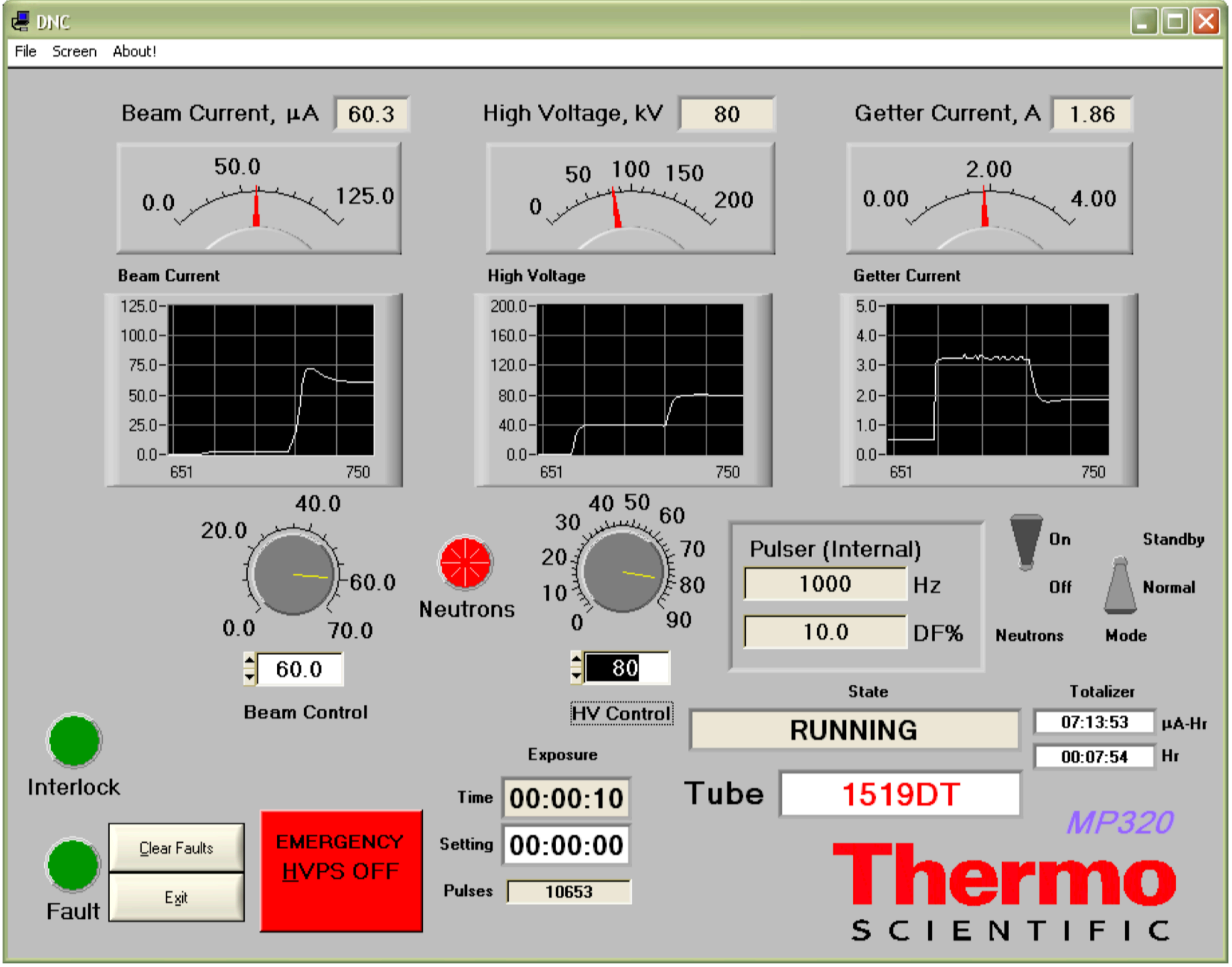
- Three configurations:
DD, DT, TT
- Two running modes:
continuous
pulsed (250 Hz ÷ 20 kHz)

DD configuration

- 10^6 neutrons per second
- Neutron energy 2 ÷ 3 MeV
intensity peak at 2.5 MeV



Parameter	Value
Neutron Energy	14.1 MeV DT or 2.4 MeV DD
Max Accelerator Voltage	90 Kv
Frequency	250 Hz to 20 kHz, continuous
Duty Cycle	5% to 100%, 5 μ sec pulse width minimum
Weight	~25 lb (11.3 kg)



Neutron output affected by several factors

Neutron output affected by:

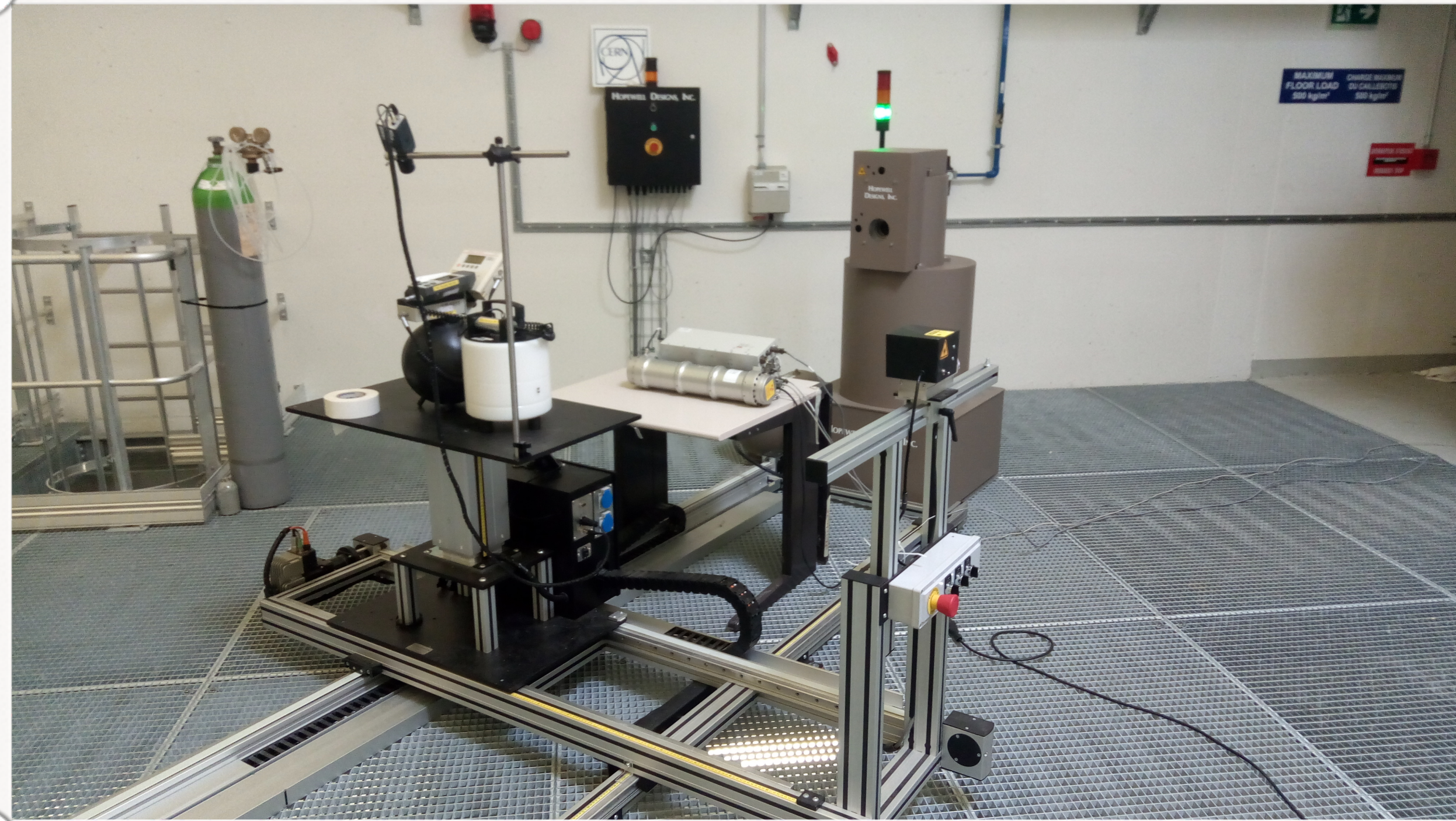
- **Beam current** (~linear fashion)
system current range: 20 ÷ 70 μA
1 μA bleed off every 20 kV HV applied
- **High voltage** ($\sim X^{3/2}$)
system voltage range: 40 ÷ 90 kV
- **Pulse width**
 - system limited to a minimum pulse width of 5 μs
 - Turn-on time affected by
duty cycle, frequency and beam current setting
 - Sharp turn-off time (solid-state switch)

*Nominal conditions: 80 kV, 60 μA
=> $1 \cdot 10^6$ n/s, DD configuration*

*Higher current - close to the limit:
device lifetime reduced*

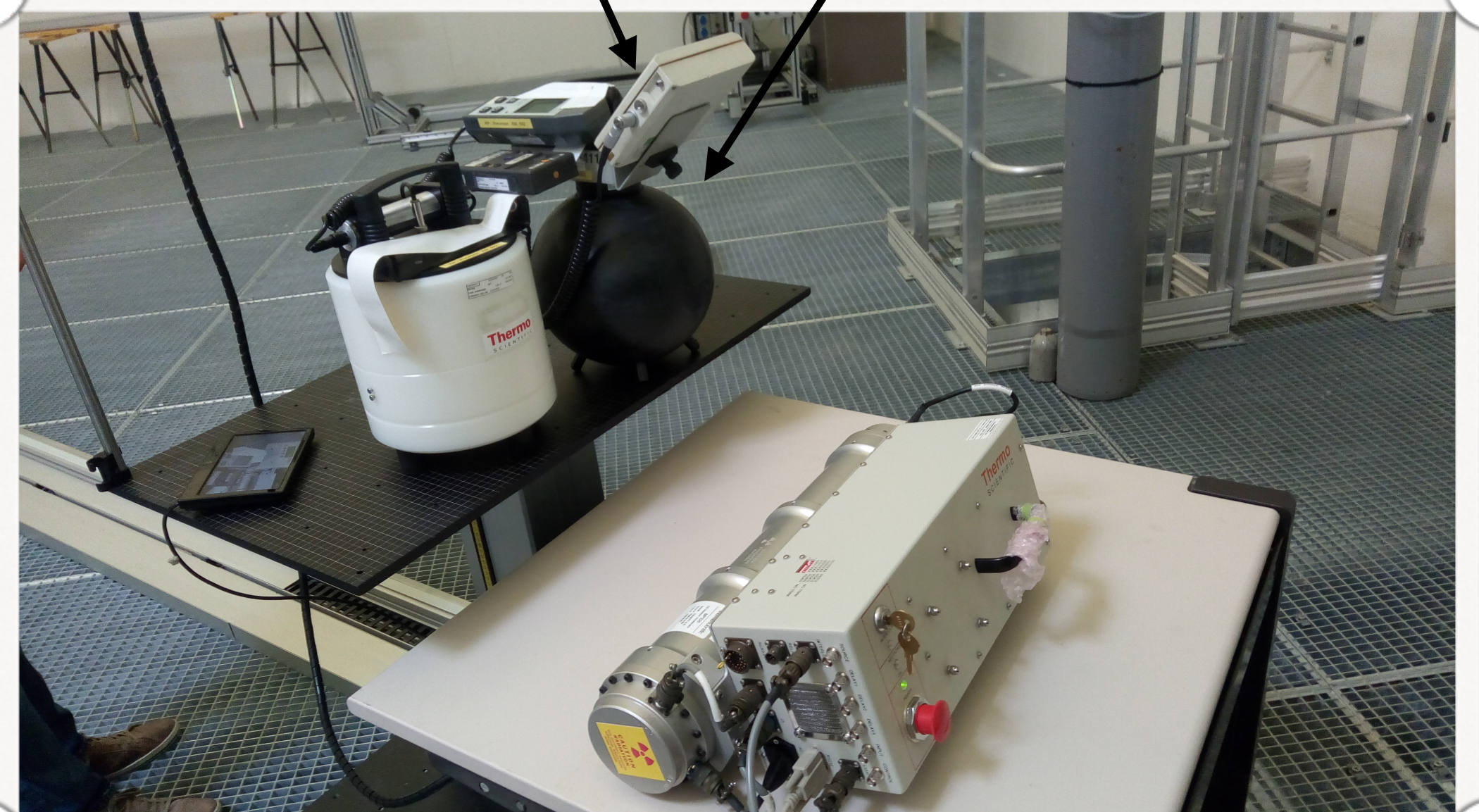
*Higher voltage - close to the limit:
greater chance of the high voltage causing
a fault condition and shutting down the system*

Detector: Berthold Neutron Dose Rate Probe LB 6411
diameter = 25 cm



Display
(read-out by a camera)

Detector
[$\mu\text{Sv/h}$]



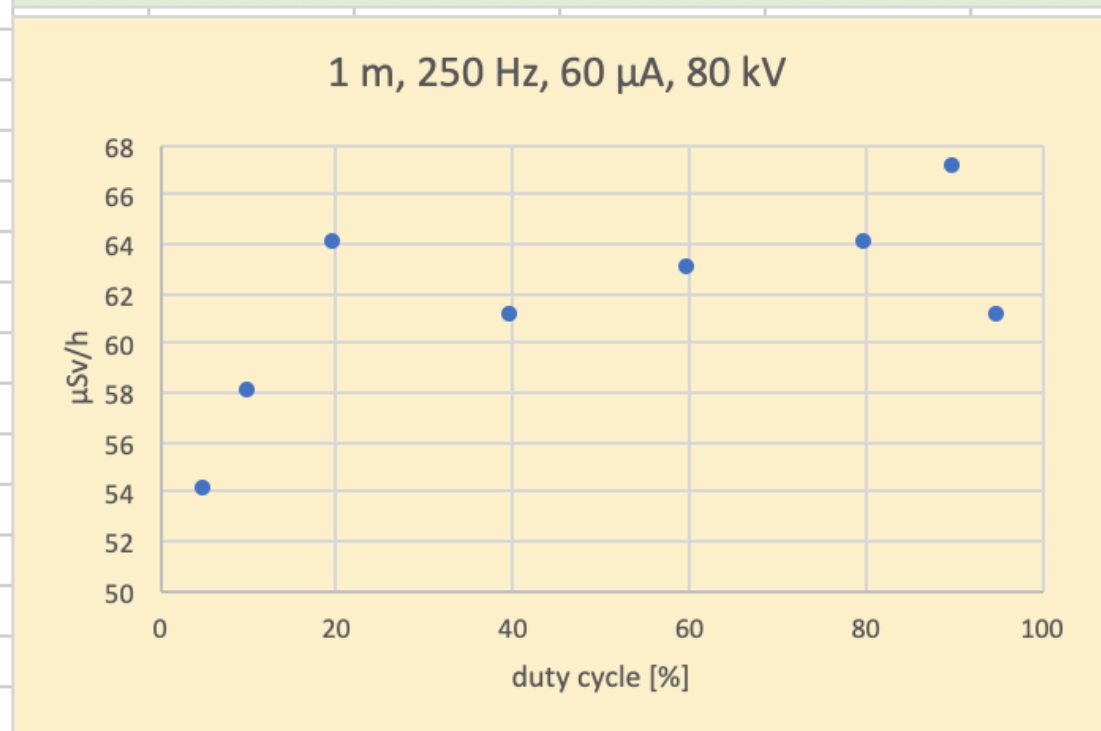
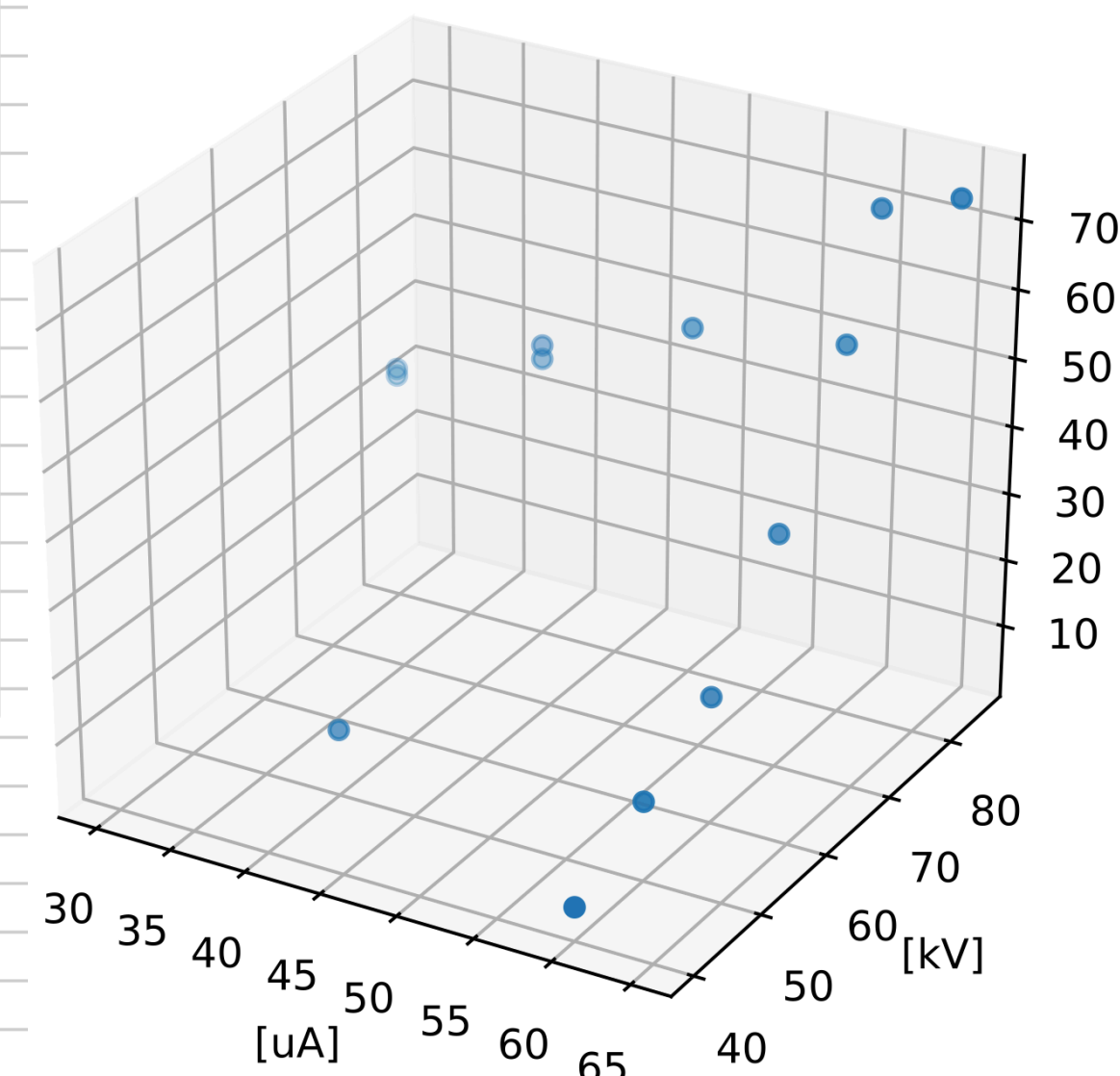
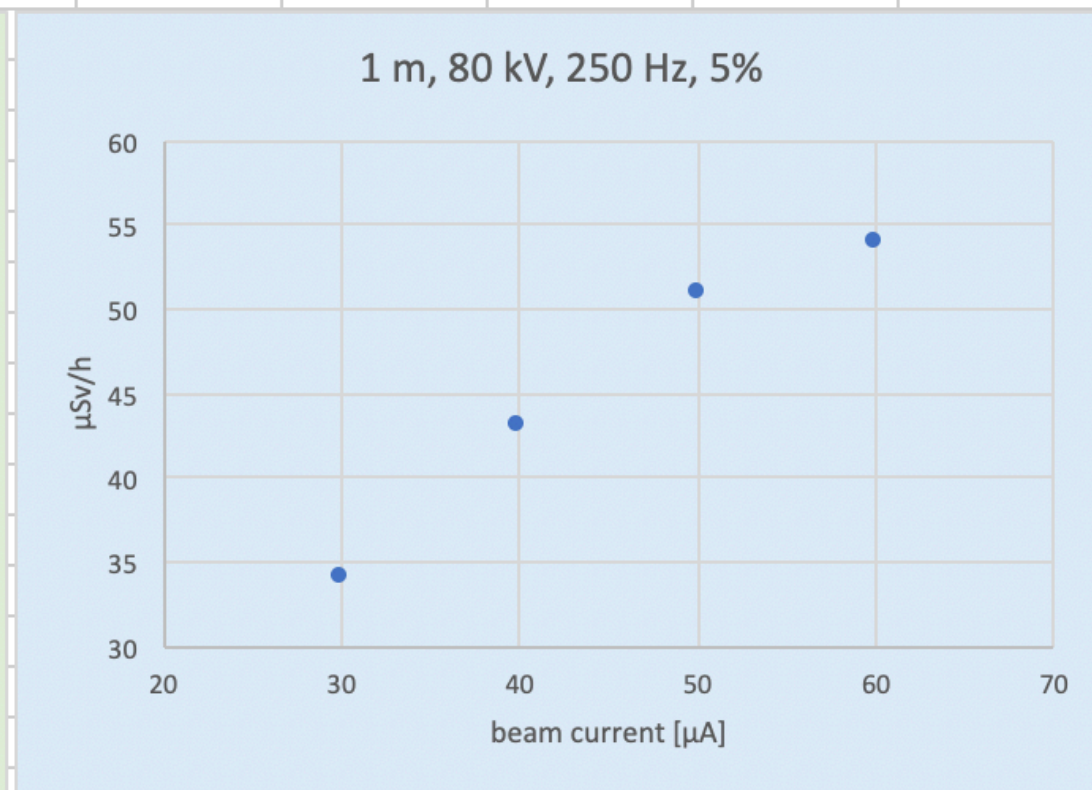
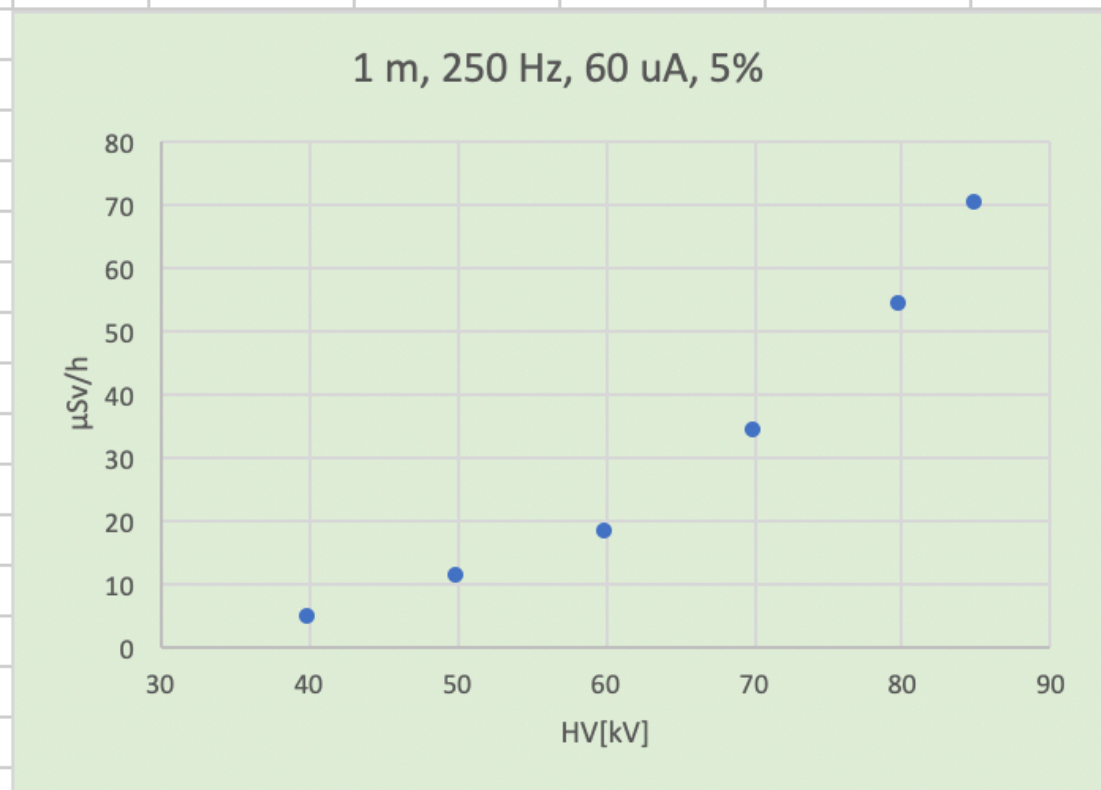
An operator reported measurements and comments
for the different measurement scans

1 m, 250 Hz

	uA	kV	Hz	%	uSv/h	
	60	40	250	5	4.2	- fluctuations
	60	50	250	5	11	- OK
	60	60	250	5	18	- OK
	60	70	250	5	34	- OK
	60	80	250	5	54	
	60	85	250	5	70	- OK
MAX	65	85	250	5	74	- OK

	uA	kV	Hz	%	uSv/h	
	30	80	250	5	34	- OK
	40	80	250	5	43	- OK
	50	80	250	5	51	- OK
	60	80	250	5	54	- OK
MIN	40	50	250	5	9	- OK

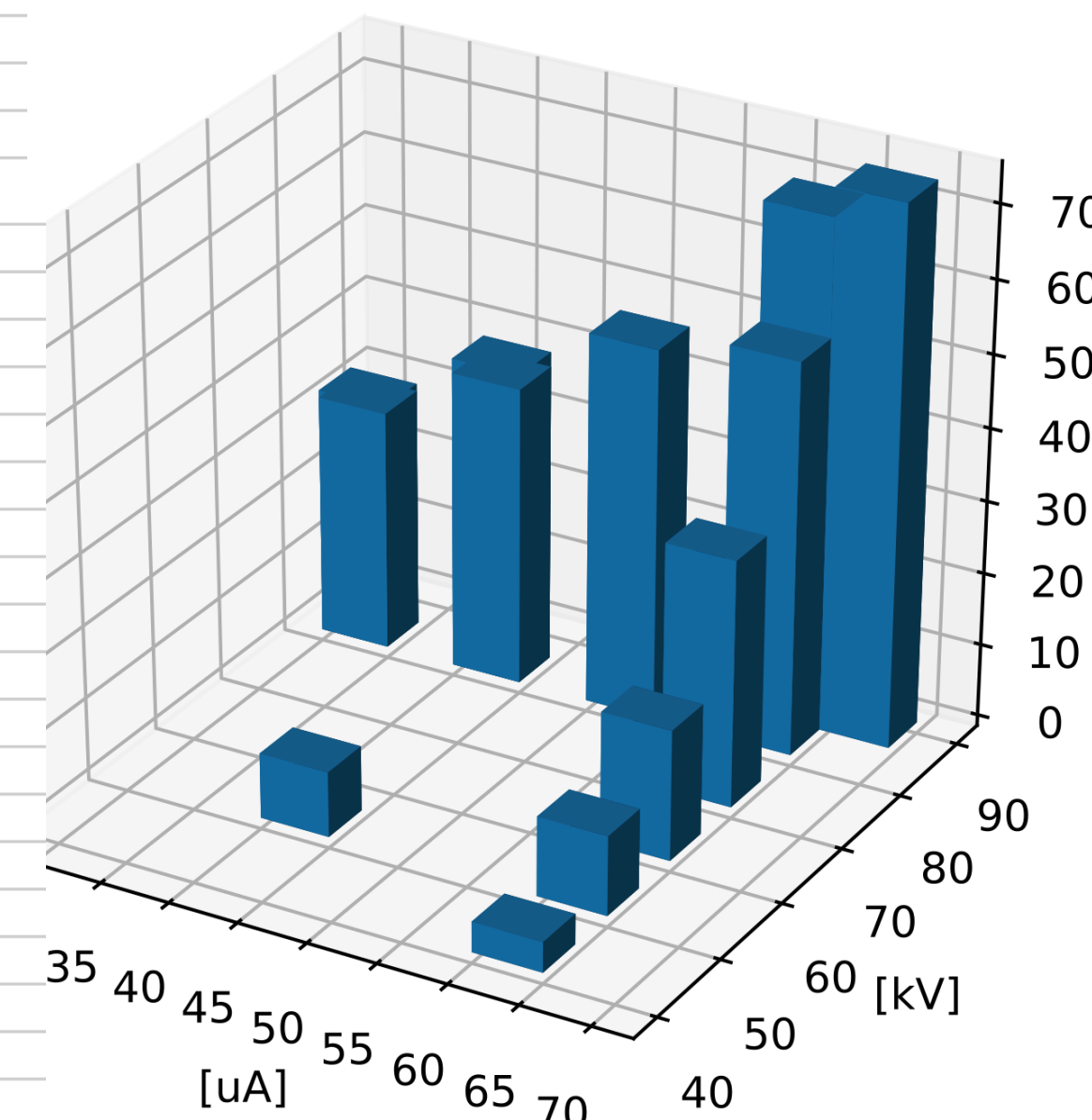
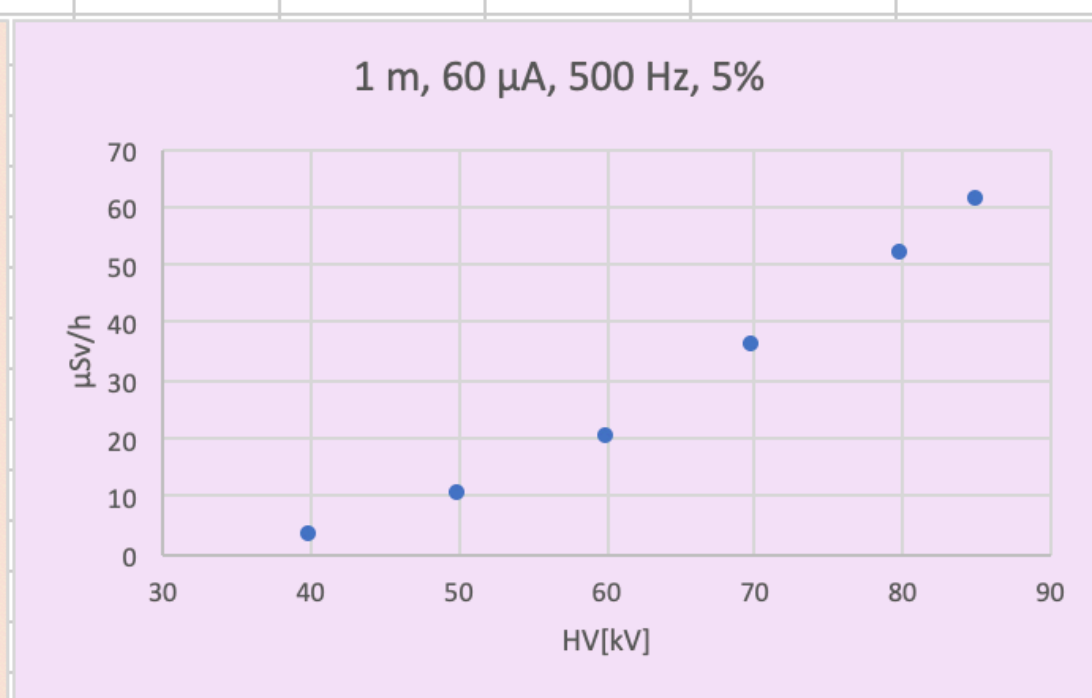
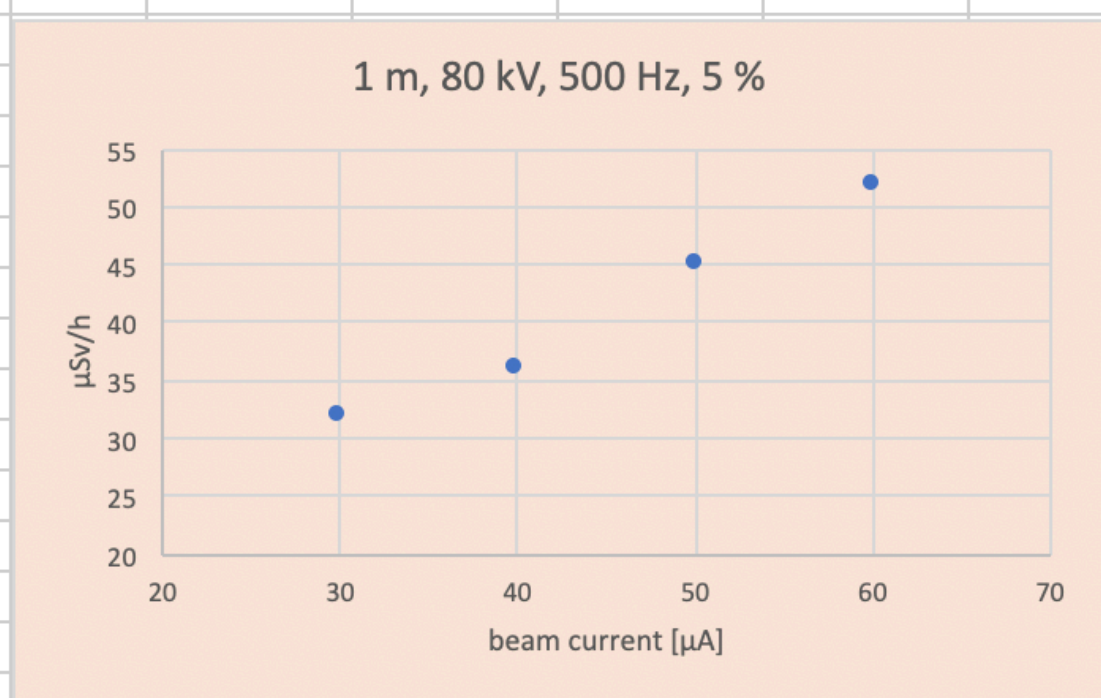
	uA	kV	Hz	%	uSv/h	
	60	80	250	5	54	- OK
	60	80	250	10	58	- OK
	60	80	250	20	64	- OK
	60	80	250	40	61	58 - 64 - fluctuations
	60	80	250	60	63	- OK
	60	80	250	80	64	- OK
	60	80	250	90	67	70 - 64 - signal decreasing
	60	80	250	95	61	63 - 58 - same



1 m, 500 Hz

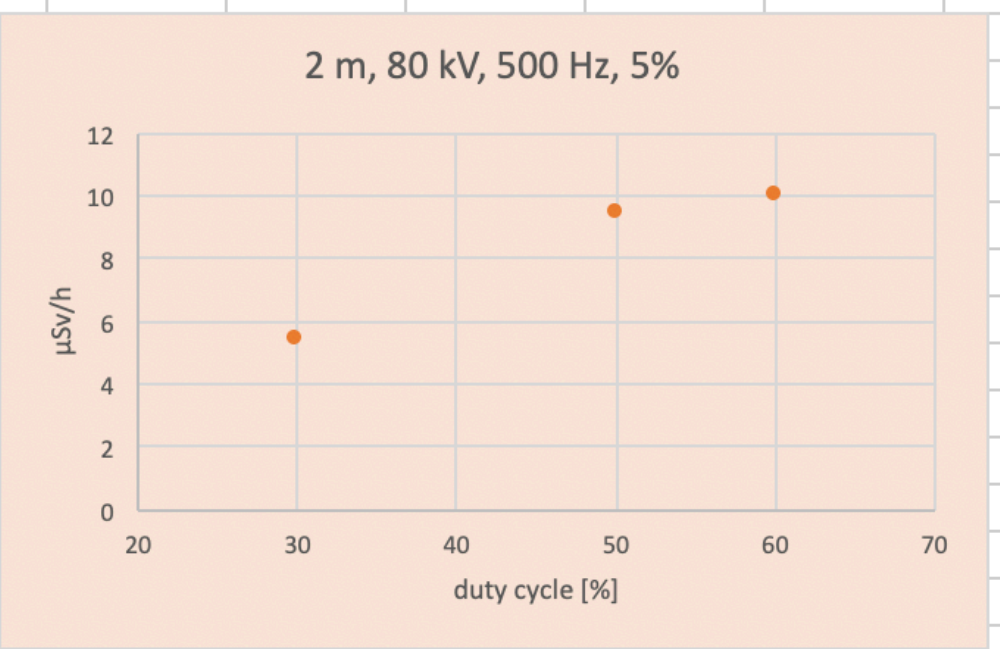
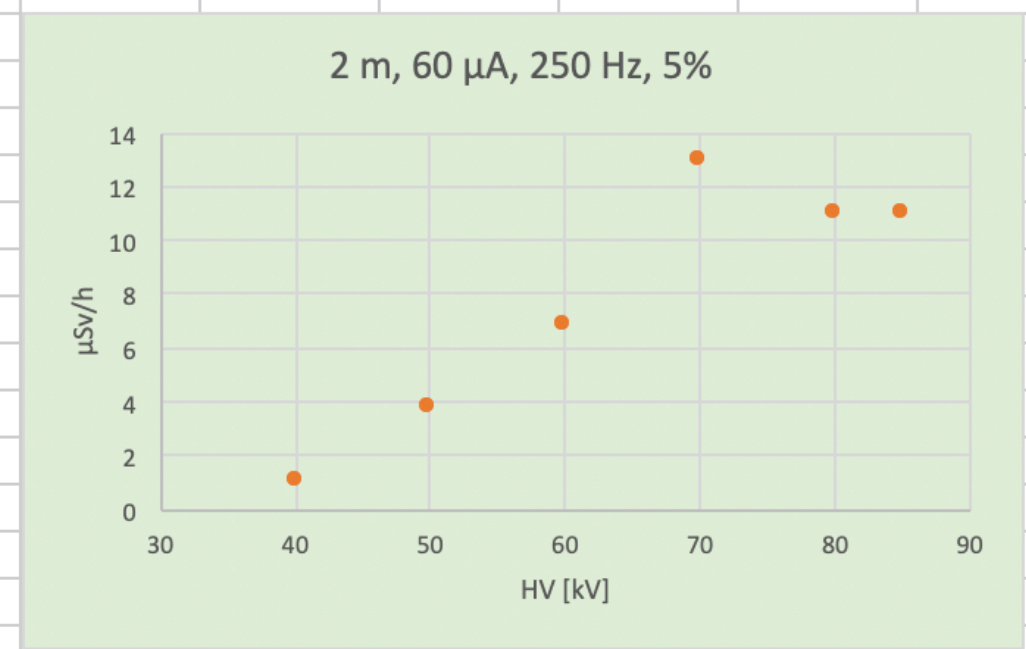
	uA	kV	Hz	%	uSv/h	
	60	80	500	5	52	
	30	80	500	5	32	
	50	80	500	5	45	
	40	80	500	5	36	

	uA	kV	Hz	%	uSv/h	
	60	40	500	5	3	
	60	50	500	5	10	
	60	60	500	5	20	
	60	70	500	5	36	
	60	85	500	5	61	
	60	80	500	5	52	
MAX	65	85	500	5	68	



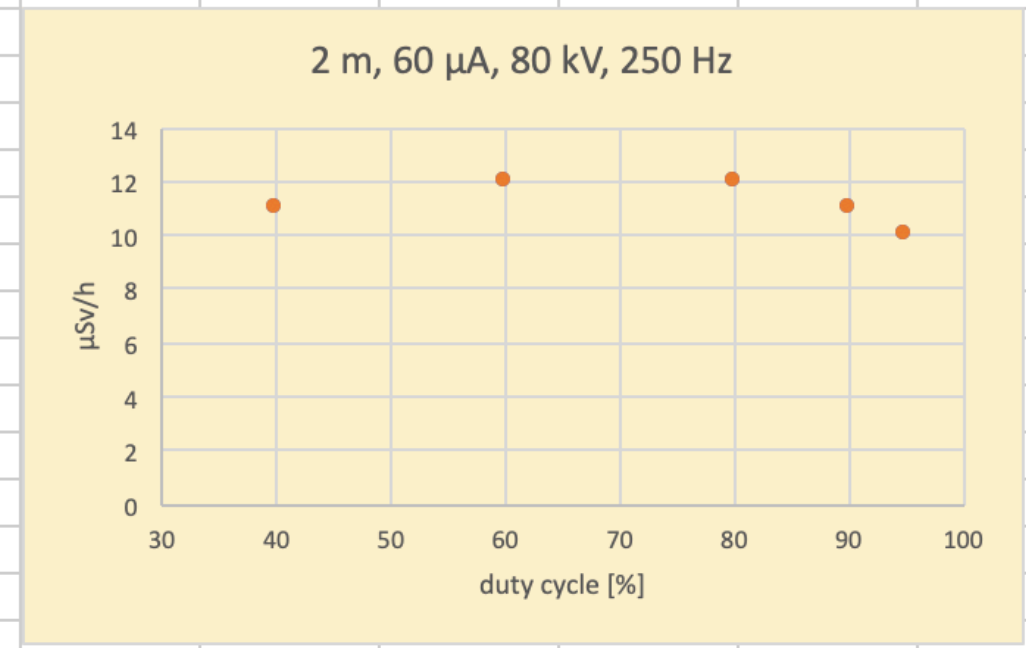
2 m, 250 Hz

uA	kV	Hz	%	uSv/h	notes
60	40	250	5	1	1 - 0.6, 1 - 1.2 - trop petit
60	50	250	5	3.8	3.3 - 4.4 - fluctuations
60	60	250	5	6.8	7.5 - 6.8 - 6.5 - fluctuations
60	70	250	5	13	- fluctuations
60	80	250	5	11	- OK
60	85	250	5	11	- OK



2 m, 250 Hz

uA	kV	Hz	%	uSv/h	notes	
60	80	250	20	11	- OK	
60	80	250	40	11	- one big fluctuation 0-20-11	
60	80	250	60	12	- OK	
60	80	250	80	12	- OK	
60	80	250	90	11	- OK	
60	80	250	95	10	- OK	
MAX	65	85	250	5	14	- OK



2 m, 500 Hz

uA	kV	Hz	%	uSv/h	notes
60	80	500	5	10	- OK
50	80	500	5	9.4	10-8.9 - fluctuations
30	80	500	5	5.4	- OK

1 m, 250 Hz

uA	kV	Hz	%	uSv/h	notes	
60	40	250	5	4.2	- fluctuations	
60	50	250	5	11	- OK	
60	60	250	5	18	- OK	
60	70	250	5	34	- OK	
60	80	250	5	54	- OK	
60	85	250	5	70	- OK	
MAX	65	85	250	5	74	- OK

uA	kV	Hz	%	uSv/h	notes
60	80	250	5	54	- OK
60	80	250	10	58	- OK
60	80	250	20	64	- OK
60	80	250	40	61	58 - 64 - fluctuations
60	80	250	60	63	- OK
60	80	250	80	64	- OK
60	80	250	90	67	70 - 64 - signal decreasing
60	80	250	95	61	63 - 58 - same

1 m, 500 Hz

uA	kV	Hz	%	uSv/h	notes
60	80	500	5	52	
30	80	500	5	32	
50	80	500	5	45	
40	80	500	5	36	