

EFFECT ON THE CCRF-CEM CELLS EXPOSED TO RF/MW

- **Marinelli Fiorenzo**
- **E-mail : marinelli@area.bo.cnr.it**
- **7 Novembre 2012**
- **Institute of Molecular Genetics**
 - **CNR Bologna**



PROTOCOLLO SPERIMENTALE TEST MOBILE BADGE

- **EXPOSURE IN TEM CELL of the cells CCRF-CEM by electromagnetic field of 900 MHz in presence and without MOBILE BADGE..**
- **900 MHz telephone connected to CMD 55**
- **PROLIFERATION TEST**
- **WB analysis CASPASI Bcl2**
- **FACS analysis**

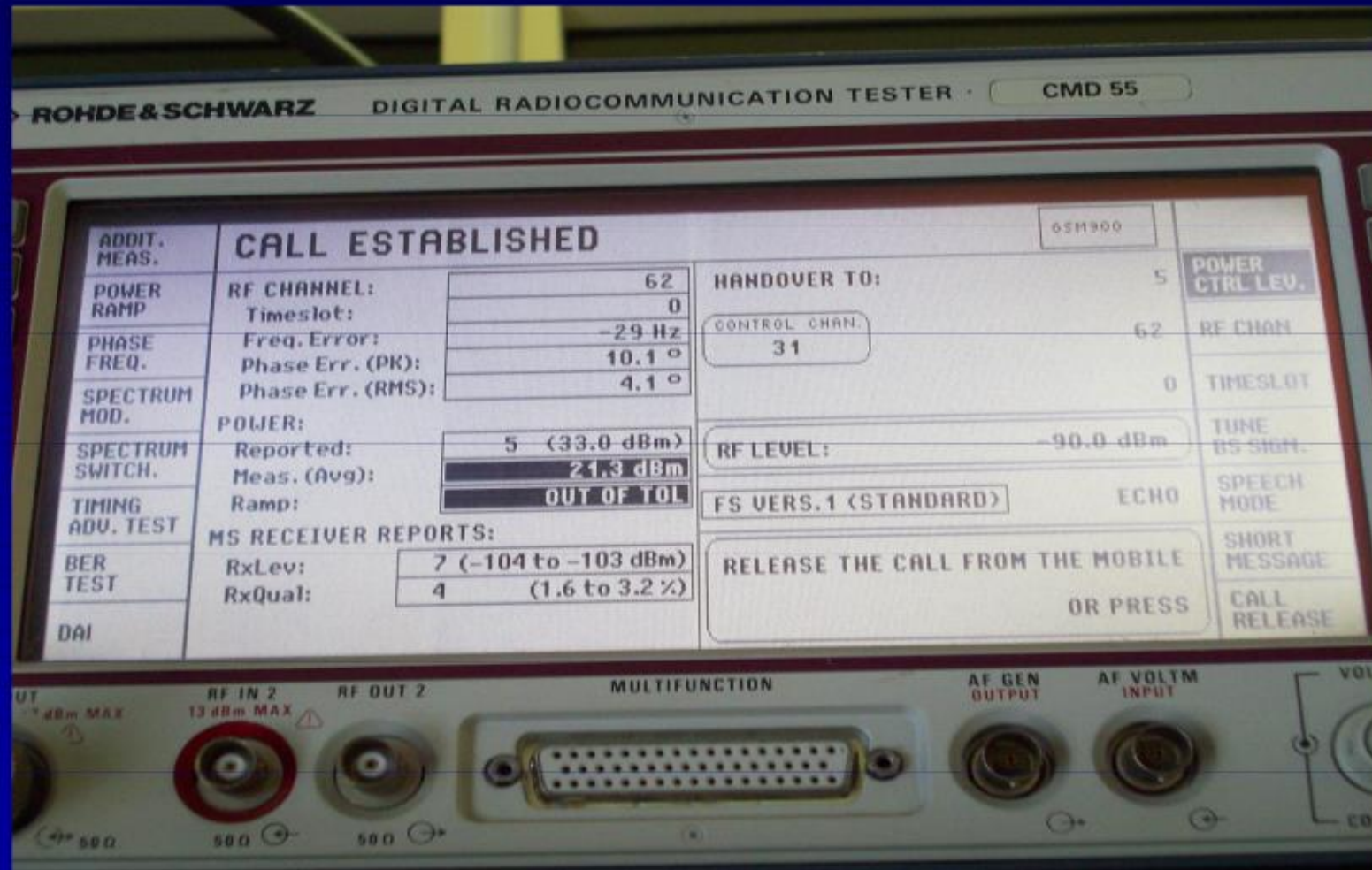
GSM PER ESPOSIZIONI



SEGNALE GSM 900 MHz IN CELLA TEM

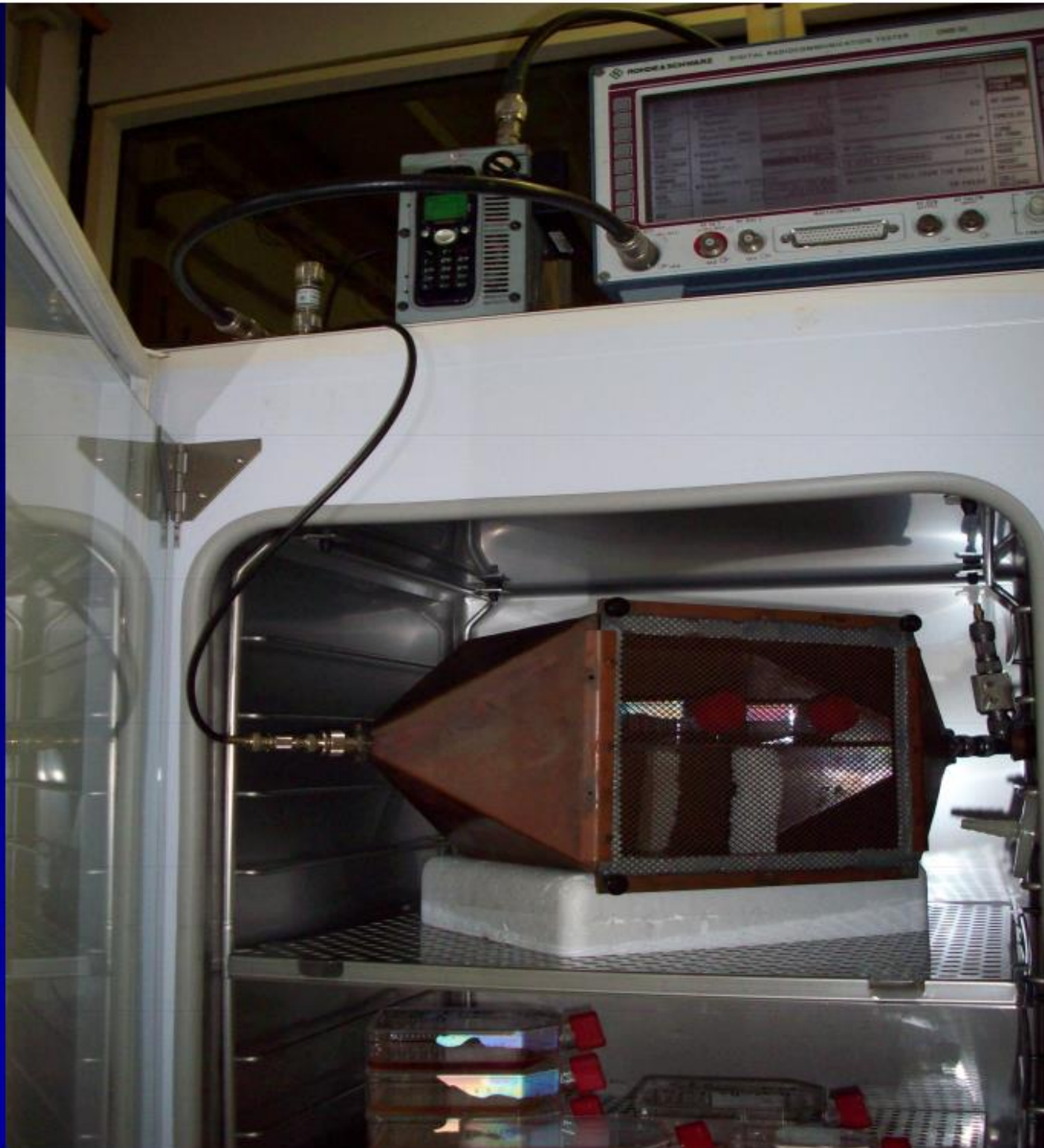


CARATTERIZZAZIONE DEL SEGNALE GSM



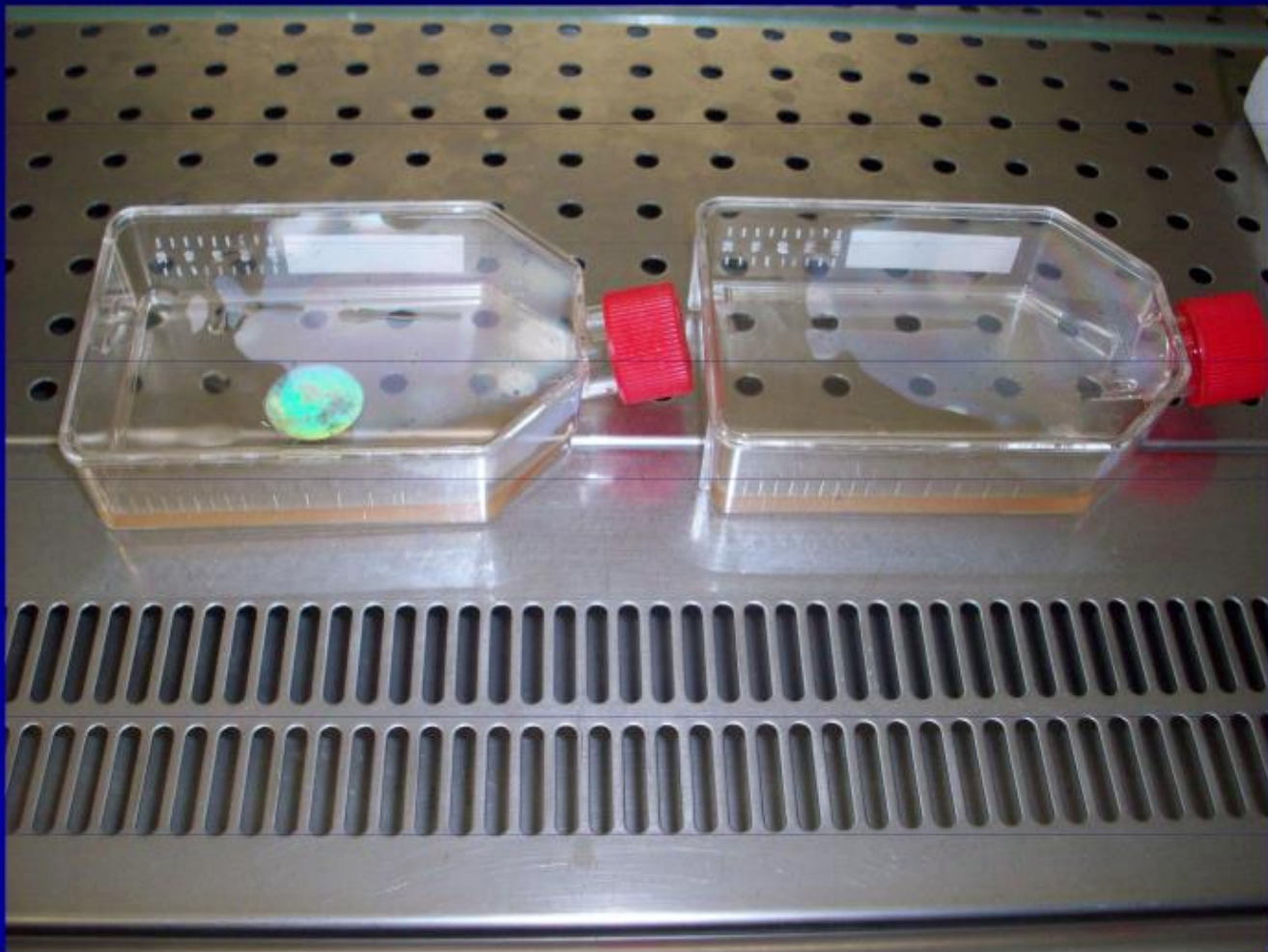
GSM -27.4 dBm





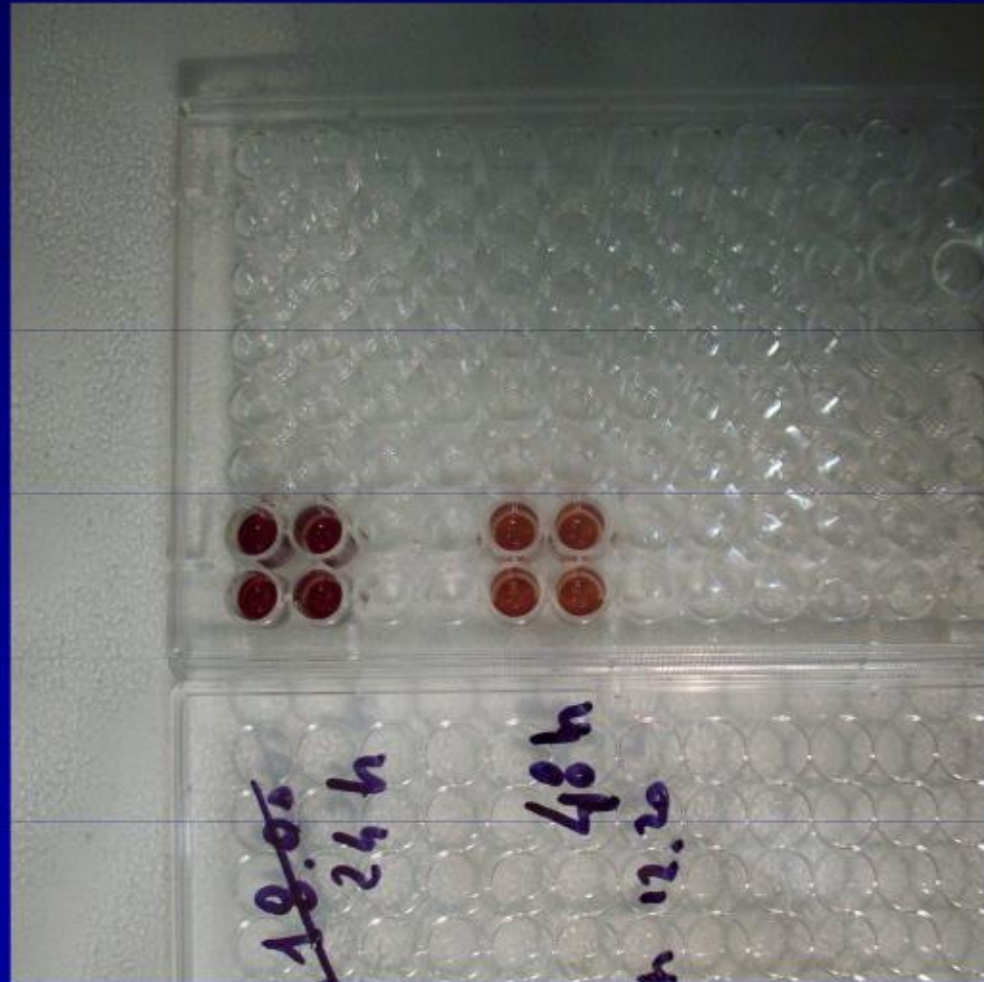








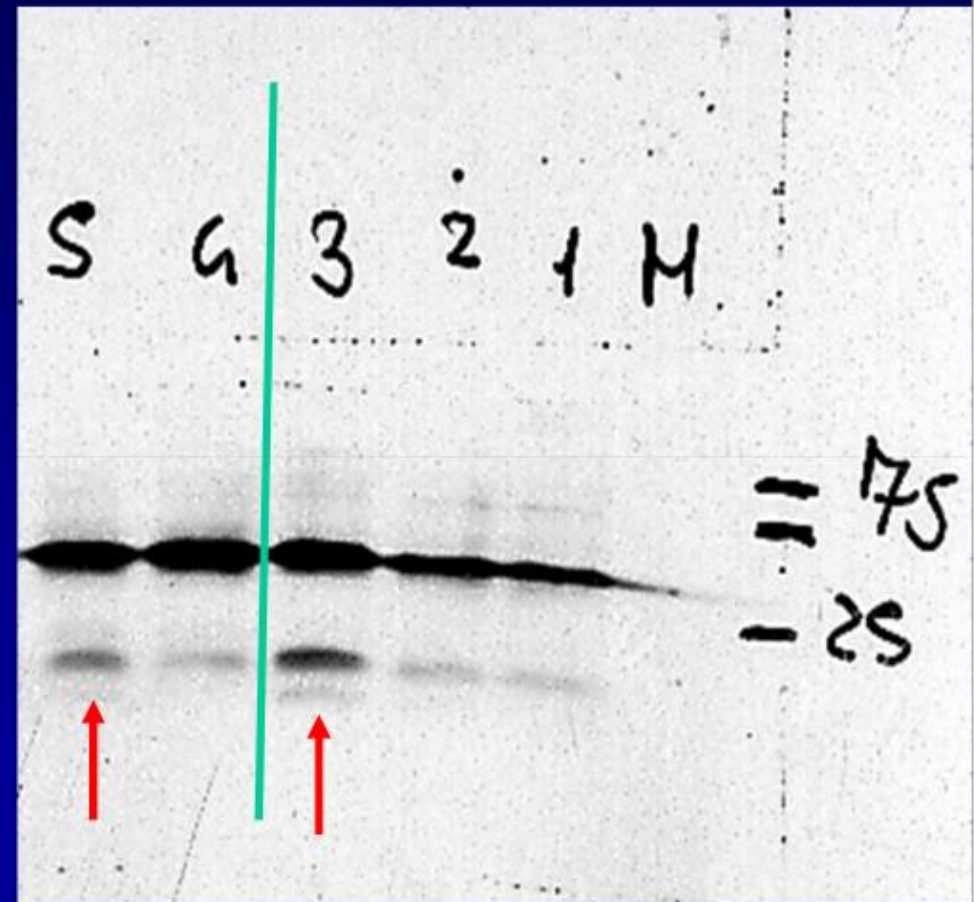
PROLIFERAZIONE CELLULARE



PRELIMINARY RESULTS WB

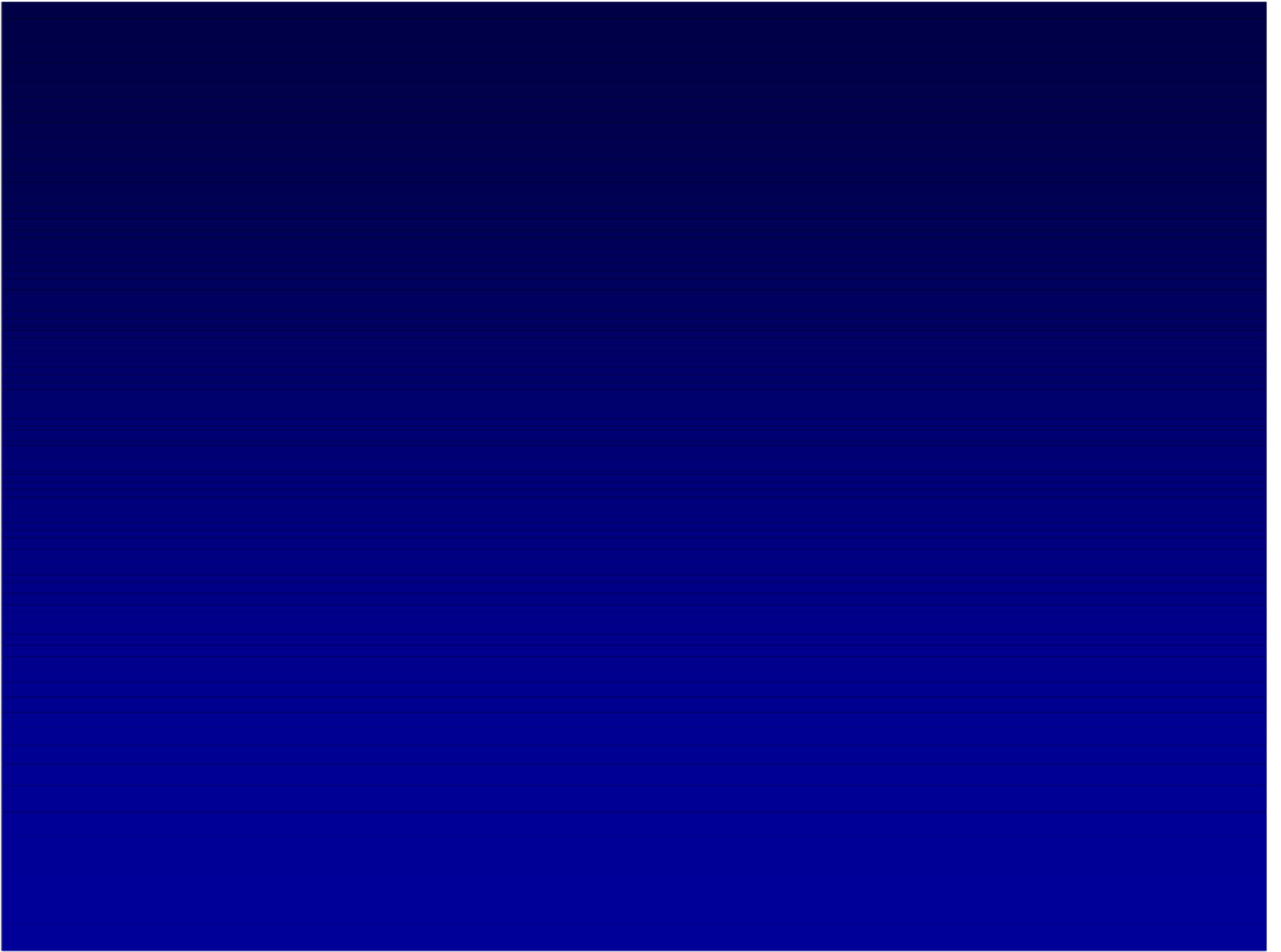
Caspasi-3

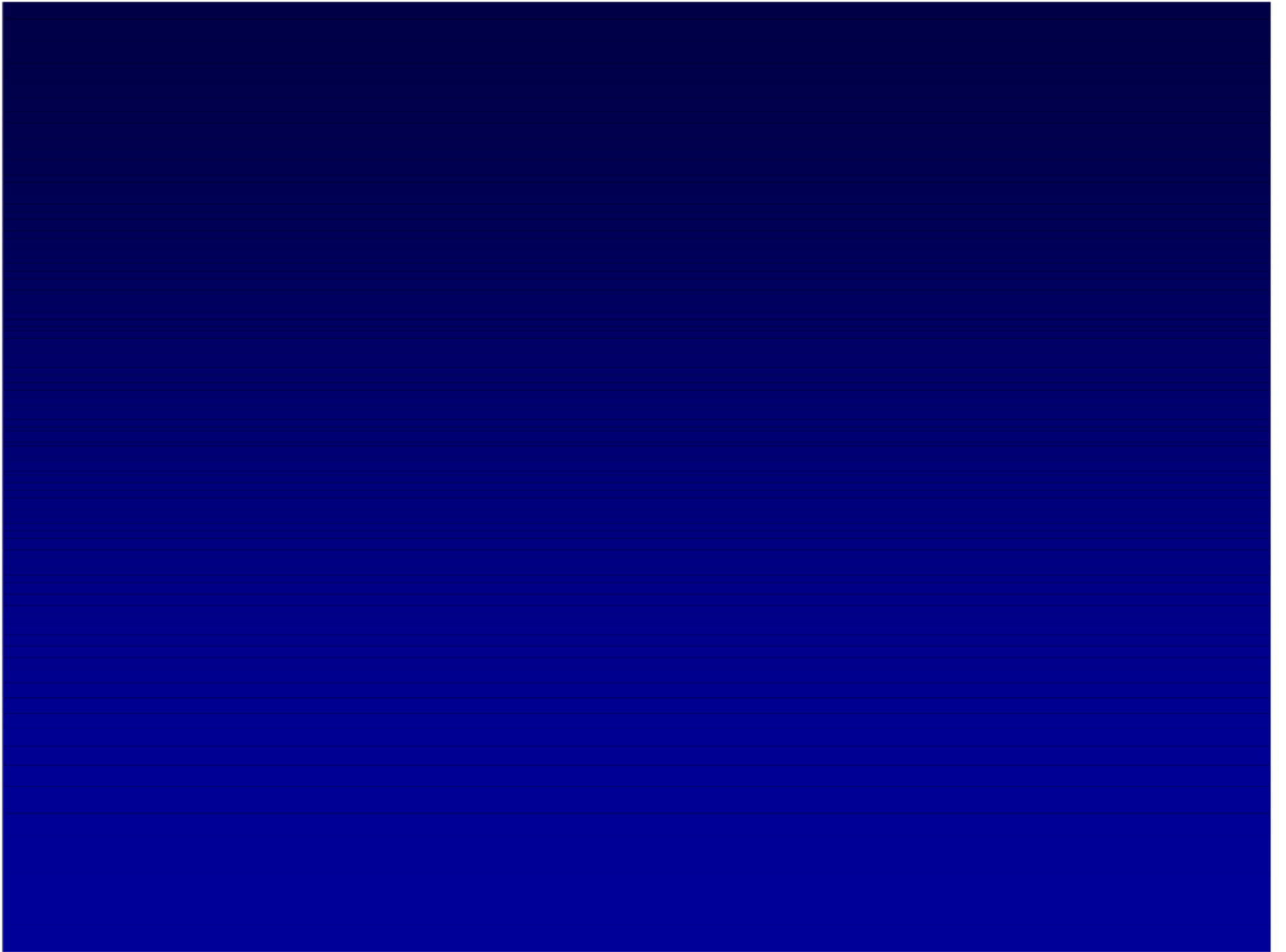
- 1- Ctrl 24h Out
- 2- E + B Exp 24h In
- 3- Exp 24h In
- 4- Ctrl 24h
- 5- Exp 24h

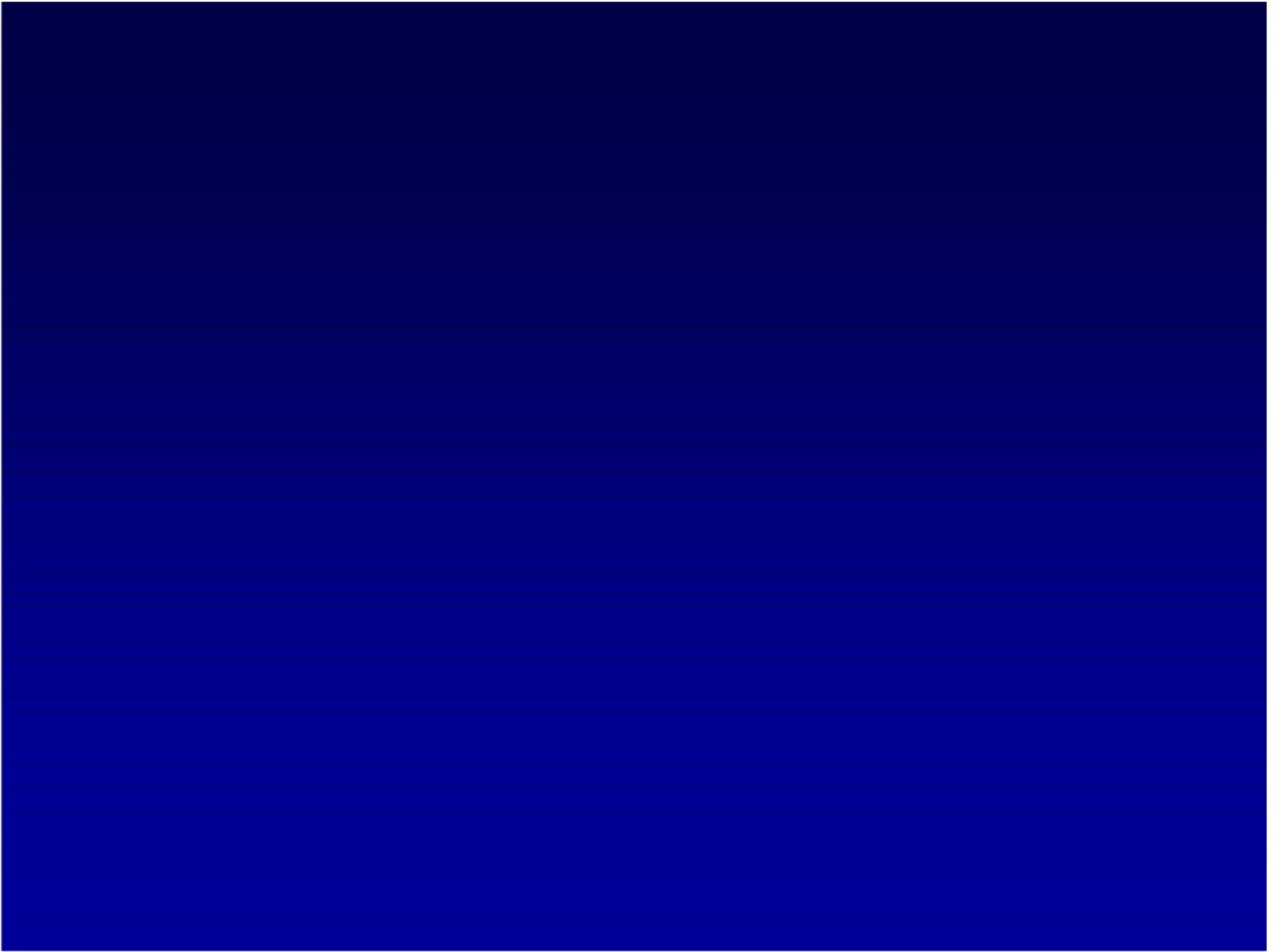


Risultati I° Esperimento WB

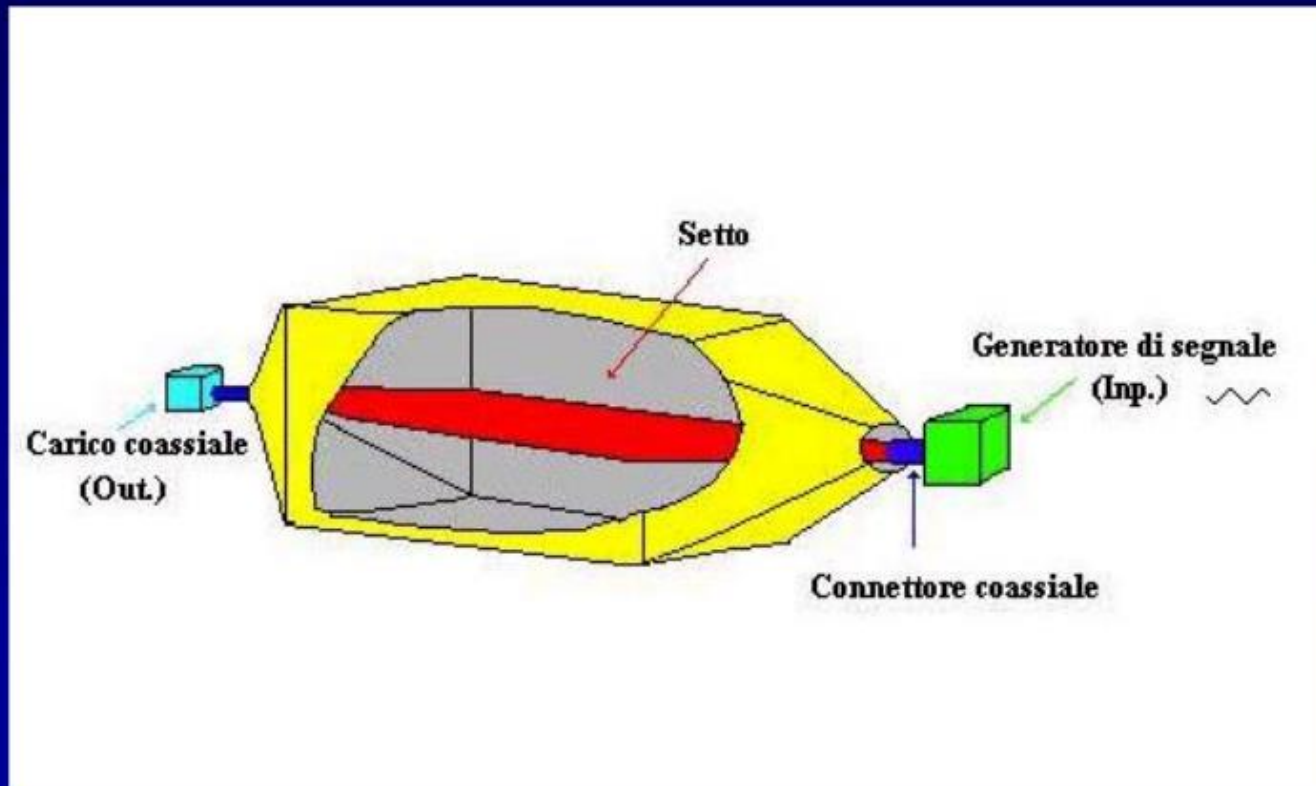
- Effetto del Badge relativo alla espressione genica della Caspasi3 che induce apoptosi nelle cellule Esposte a Segnale GSM
- .
- Da testare l'antagonista BCL2
- Quantificare le proteine espresse.







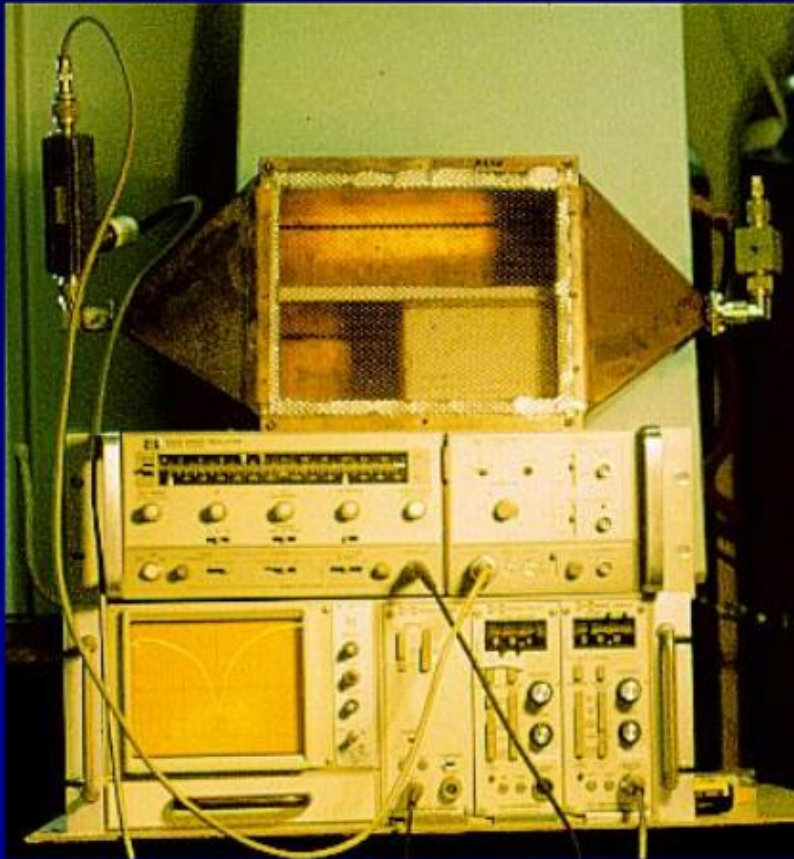
EXPOSURE DEVICE TEM (transverse EM) CELL



TEM CELL 900 MHz



800-1000 MHz EXPOSURE SYSTEM



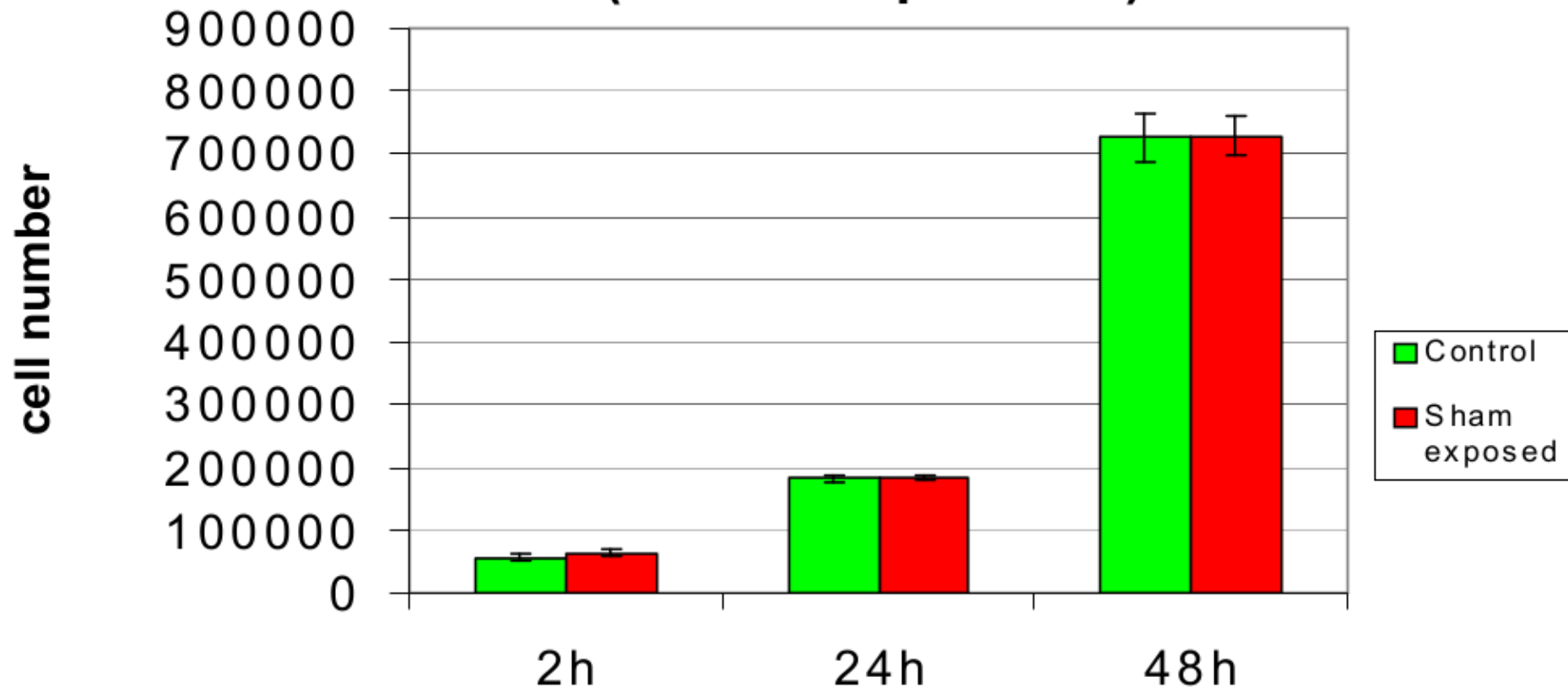
- Cella TEM
- Sweep Oscillator HP 8620 C
- Amplificatore HP 86222B RF
10 - 2400 MHz
- Accoppiatore direzionale HP
796D
- Testina bolometrica PM 10-
0328
- Rivelatore PM 1038
- Universal counter HP 5316A
- Power meter HP 431 A

TEMPERATURE CONTROL

hours	T1 (CONTROL FLASK)	T2 (EXPOSED FLASK)	T3 (INCUBATOR)
2	37.01	37.01	37.00
24	37.00	37.00	37.00
48	37.00	37.00	37.00

SHAM EXPOSURE

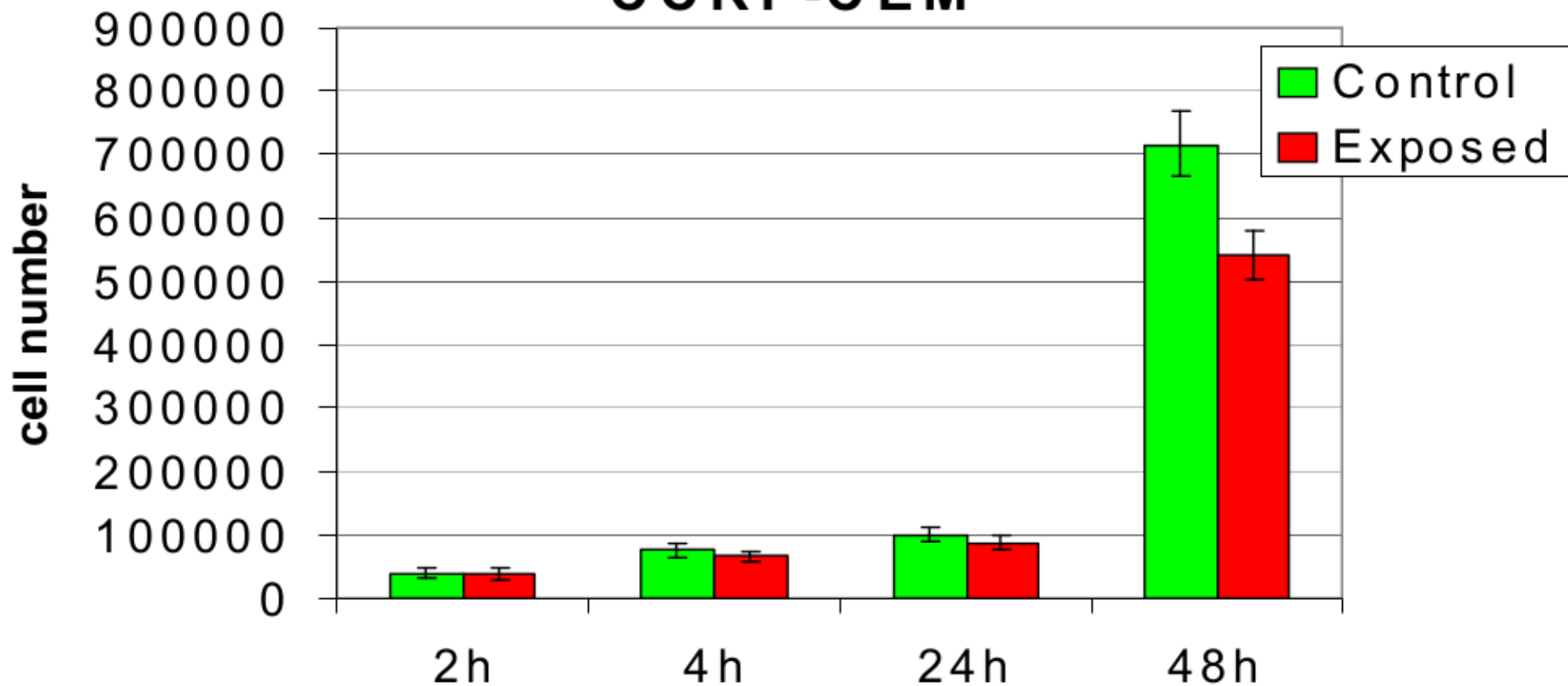
Test di proliferazione in cellule CCRF-CEM (sham exposure)



BIOLOGICAL EFFECTS

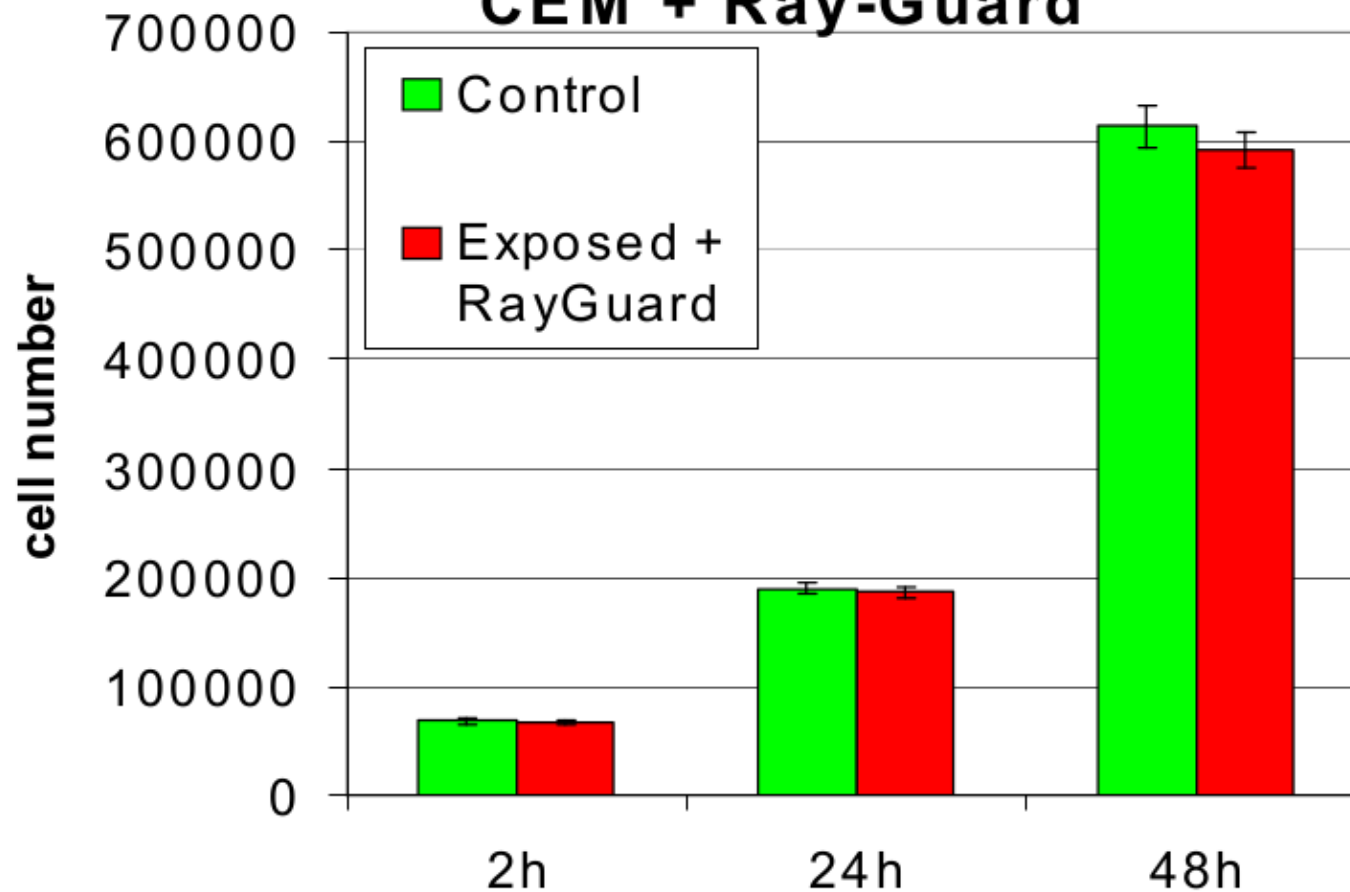
PROLIFERATION TEST

Test di proliferazione in cellule
CCRF-CEM



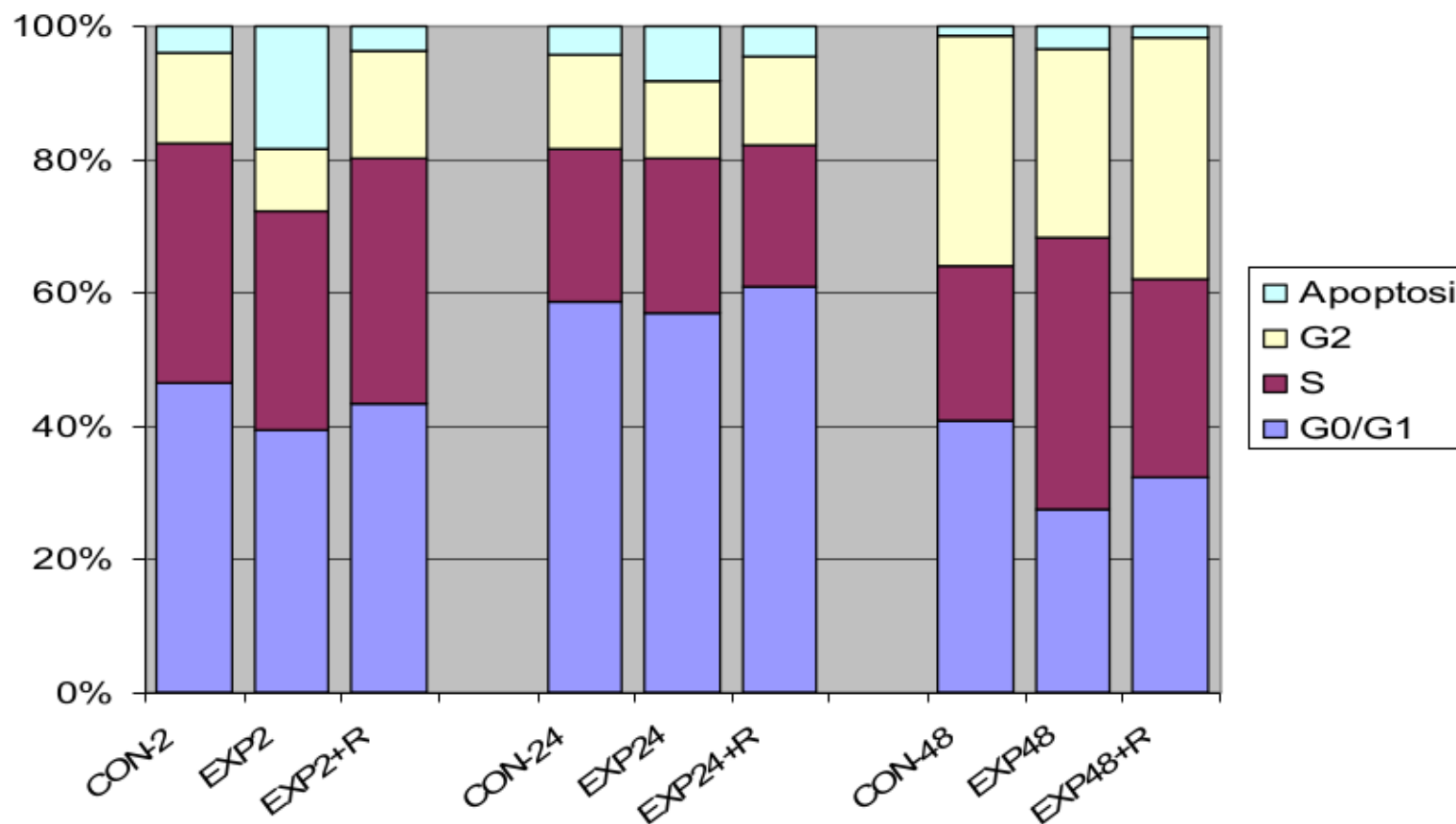
EMF and RAY-GUARD

Test di proliferazione in cellule CCRF.
CEM + Ray-Guard



% OF CELL IN G0/G1, S, G2/M and APOPTOSIS IN CELL CYCLE PHASES

CCRF-CEM FACS Analysis



2 HOURS 900 MHz EXPOSURE

	G0/G1 (Quiescence)	S (DNA synthesis)	G2/M (mythosis)	APOPTOSIS
CONTROL	45.75	35.55	13.42	3.89
NIR EXPOSED	38.5	32.38	9.13	18.07
NIR EXPOSED + RAY-GUARD	42.43	36.2	15.83	3.75

24 HOURS 900 MHz EXPOSURE

	G0/G1 (Quiescence)	S (DNA synthesis)	G2/M (mitosis)	APOPTOSIS
CONTROL	56.31	21.95	13.79	4.3
NIR EXPOSED	54.82	22.15	11.09	7.89
NIR EXPOSED + RAY-GUARD	58.31	20.15	12.98	4.22

48 HOURS 900 MHz EXPOSURE

	G0/G1 (Quiescence)	S (DNA synthesis)	G2/M (mitosis)	APOPTOSIS
CONTROL	40.05	22.60	33.97	1.37
NIR EXPOSED	26.68	39.83	27.62	3.38
NIR EXPOSED + RAY-GUARD	31.74	29.35	35.39	1.7

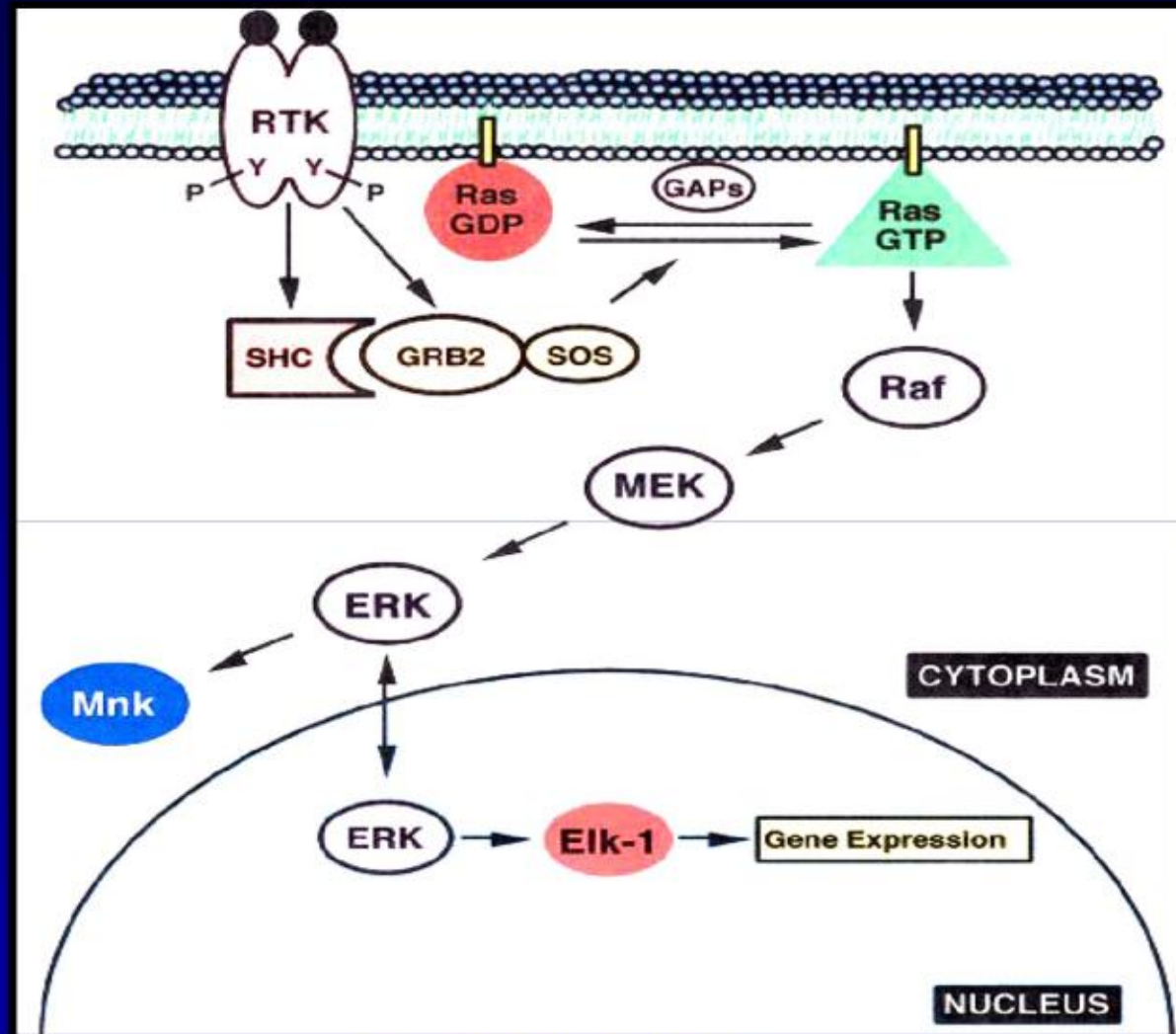
CONCLUSIONS 1

- 1. Short exposure time (2 and 24 hours) at 900 MHz and 4.8 V/m electromagnetic fields induce apoptotic response in CEM cells. This effect has been strongly reduced by the presence of the RAY-GUARD device inside the TEM cell during exposure.**
- 2. Longer exposure time (48 hours) induces selection of tumorigenic clones, which show an higher level of DNA synthesis and a reduction of resting cells. The RAY-GUARD reduce the cycling cells and increase the resting quiescent cells. Moreover the apoptotic effect of NIR exposure is neutralized by the RAY-GUARD device**

CONCLUSIONS 2

- 3. The biological effects induced by electromagnetic field are not related to the thermal effect.**
- 4. The electromagnetic fields can activate the cell cycle genes (i.e. RAS proto-oncogene) involved in the DNA synthesis control.**
- 5. Should their expression be controlled by RAY-GUARD?**

RAS SIGNALING



from Vojtek AB and Der CJ,
JBC 273 n.32:19925-19928

WB ANALYSIS

H-RAS EXPRESSION

- **1,3,5,7 SAMPLES=**
CONTROL CELLS
2,4,24,48 hs



- **2,4,6,8 SAMPLES=**
EXPOSED CELLS
2,4,24,48 hs

Power Density	Reported Biological Effects	References
0.168 - 1.053 $\mu\text{W}/\text{cm}^2$	Irreversible infertility in mice after 5 generations of exposure to RFR from "antenna park"	Magras & Xenos, 1997
0.16 $\mu\text{W}/\text{cm}^2$	Motor function, memory and attention of school children affected (Latvia)	Kolodynski, 1996
0.2 - 8 $\mu\text{W}/\text{cm}^2$	Two-fold increase in childhood leukemia / RFR exposure to AM/FM towers	Hocking, 1996
1.0 $\mu\text{W}/\text{cm}^2$	Whole body microwave irradiation of male mice caused a significant effect on the immune system	Fesenko, 1999
1.0 $\mu\text{W}/\text{cm}^2$	Irradiation (5 hours) with low-power microwaves stimulates the immune potential of macrophages and T cells	Novoselova, 1999
1.3 - 5.7 $\mu\text{W}/\text{cm}^2$	Two-fold increase in leukemia in adults from AM RF exposure	Dolk, 1997
~2-4 $\mu\text{W}/\text{cm}^2$	Direct effect of RFR on ion channels in cells/opening of acetylcholine channels	D'Inzeo, 1988
4-10 $\mu\text{W}/\text{cm}^2$	Visual reaction time in children is slowed//lower memory function in tests	Chiang, 1989
5 - 10 $\mu\text{W}/\text{cm}^2$	Impaired nervous system activity	Dumansky, 1974
10 $\mu\text{W}/\text{cm}^2$ (0.0027 W/Kg SAR)	Changes in active avoidance conditioned reflex (behavioral change) after 0.5 hour exposure	Navakatikian, 1994
10-20 $\mu\text{W}/\text{cm}^2$	Increase in micronuclei (abberant DNA form) found in workers chronically exposed to microwaves at 1250-1350 MHz.	Garaj-Vrhovac, 1995
10 - 25 $\mu\text{W}/\text{cm}^2$	Changes in the hippocampus of the brain	Belokrinitsky, 1982
30 $\mu\text{W}/\text{cm}^2$ (0.015 W/Kg SAR)	Immune system effects - elevation of PFC count (antibody-producing cells)	Veyret, 1991
50 $\mu\text{W}/\text{cm}^2$	An 18% reduction in REM sleep (important to memory and learning functions)	Mann, 1996
100 $\mu\text{W}/\text{cm}^2$	Changes in immune system function	Elekes, 1996
100 $\mu\text{W}/\text{cm}^2$ (0.027 W/Kg SAR)	A 24% drop in testosterone after 6 hours exposure	Navakatikian, 1994

THE RESEARCH GROUP

Prof. Maurizio Brizzi (Univ.-Bo)

- **Ing. Amb. Giovanni Ciccotti (Cnr-Bo)**
 - **Dr. Caterina Cinti (Cnr-BO)**
 - **Ing. Fabrizio Guidi (Univ.-Roma)**
 - **Dr. Dario La Sala (Ior-Bo)**
 - **Dr. Fiorenzo Marinelli (Cnr-Bo)**
- **Prof. Massimo Scalia (Univ.-Roma)**
- **Dr. Massimo Sperini (Univ.-Roma)**
 - **Dr. Carmela Trimarchi (Cnr-PI)**
- **Dr. Goliardo Tomassetti (Cnr-Bo)**

REMARKS

- **It is hardly possible to transfer these results automatically to humans.**
- **We do not know if the Ray-Guard can protect efficiently the organisms.**
 - **We suppose it! As we obtained preliminary results on human lymphocytes**

New experimental aims on normal lymphocytes

1. Exposure of healthy donor lymphocytes to RF/MW 900 MHz in presence of Ray-Guard device.
2. Analysis of the electromagnetic field effect on cell cycle in presence of Ray-Guard device.

New proposal research

- Ray-Guard effect on modulation of cell cycle genes expression in CCRF-CEM cells exposed to NIR, such as oncogenes (i.e.Ras) and onco-suppressor genes.