Can our Minds emit light? Mental entanglement at distance with a photomultiplier

Patrizio Tressoldi*, Luciano Pederzoli[§], Alessandro Ferrini[§], Marzio Matteoli[§], Simone Melloni[§], and John G. Kruth°

*Dipartimento di Psicologia Generale, Università di Padova, Italy

[§]EvanLab, Firenze, Italy

°Rhine Research Center, Durham, USA

Corresponding author

Patrizio Tressoldi

patrizio.tressoldi@unipd.it

Abstract

With two pre-registered confirmatory studies we aimed at investigating if focused mental entanglement (ME) by five selected participants could increase the number of photons detected every half second by a photomultiplier located at the Rhine Research Center, North Carolina, USA, approximately 7.300 km far from the participants' location.

In the first experiment, the comparisons between ten periods of five minutes of ME and ten control periods recorded before and after the ME, revealed only a difference between the control periods recorded after the ME and those recorded before the ME.

An exploratory analysis of the trend of the photons count revealed a sort of cumulative effect of ME lasting half an hour.

In the second experiment, this cumulative effect of ME was not observed.

However the comparison between the pre-ME, post-ME and the control periods in the two experiments, revealed an increase of approximately 5% of photons detected in the bursts exceeding 6 standard deviations from the average count in the post-ME periods with respect to the pre-ME and the control periods. Furthermore it was observed a correlation between the mean of photons per minute obtained in the post-ME periods of the two experiments.

We discuss how ME can generate and act on photons at distance.

Keywords: mental entanglement at distance; biophotons; photomultiplier.

INTRODUCTION

Preliminary evidence by Caswell, Dotta and Persinger (2014) and Joines, Baumann and Kruth (2012), suggest that human focused intention triggers biophotons emission that could represent the carrier of the mental entanglement (ME) with electronic apparatuses or other types of targets.
In a pilot study, for the first time, Tressoldi et al. 2014, used a photomultiplier (PMT) as detector of mind-matter entanglement. This device (see technical description in the Method section) allows to investigate whether photons can be the physical correlates of mind entanglement at distance. In that study, five participants selected for their strong commitment toward this line of research and their experience in mental control practices, mainly meditation, were able to increase of about 20 photons per minute, with respect to the control sessions, the biophotons detected by a PMT located approximately 7.300 km far from their location.
Prompted from the results of this pilot study, we conceived a pre-registered confirmatory study.

METHOD

Study pre-registration

The study was preregistered both to the KPU registry (http://www.koestler-parapsychology.psy.ed.ac.uk/Documents/KPU_registry_1010.pdf)
and the OpenScienceFramework site (https://osf.io/5npz9) before data collection.

Participants

Five selected participants, all males, were included using the same criteria of the pilot study, that is, strong motivation toward this line of research and a long experience in mental control practices, mainly meditation . Three of them participated in the pilot study. All participants were also included as co-authors.

Apparatus

The Photomultiplier (PMT; see Figure S1 in the Supplementary Material) was placed in the Bioenergy Lab of the Rhine Research Center, in Durham, NC, USA and was managed by the co-author JK. The PMT (type 56 DVP) with PMT housing (Pacific Photometric Instruments Model 62/2F - thermoelectrically cooled to near -23 degrees C) is able to measure down to 2 photons per second in the 400 to 200 nm wavelength range. Signals from the PMT are amplified by a Pacific Photometric 3A14 amplifier, and photons are counted by a photon counter (Thorn EMI GenCom

model C-10) every half second. This information is transferred to a computer in the external darkroom and the detected number of photons is recorded every half second for the duration of an experimental session.

Procedure

The research assistant, co-author PT, agreed with the co-author JK, responsible of the Bioenergy Lab, the day and the time to start and end each session. In the settled day and hour, JK activated the PMT. The duration of each session was predefined in 150 minutes and the sequence of periods of control and ME was predefined as described in Table 1. To summarize, each session lasted a total of 135 minutes and included two periods of ME, each one with a pre and post control period at the same temporal distance.

Table 1: Description of sessions including timing of segments and elapsed session.

Time Activity	**Duration**	**Elapsed Time in Session**
PMT cooling	30 minutes	0-30 minutes
Control Period	5 minutes	30-35 minutes
pre-ME	15 minutes	35-50 minutes
Mental Intention	5 minutes	50-55 minutes
post-ME	15 minutes	55-70 minutes
Control Period	5 minutes	70-75 minutes
Post-Control	15 minutes	75-90 minutes
Control Period	5 minutes	90-95 minutes
pre-ME	15 minutes	95-110 minutes
Mental Intention	5 minutes	110-115 minutes
post-ME	15 minutes	115-130 minutes
Control Period	5 minutes	130-135 minutes

Differently from the pilot study, each participant acted in his/her home connecting with the other participants via the video chat ooVoo™ . Approximately ten minute before the period of ME, the research assistant started a simple relaxation procedure to allow an emotional bonding among all the participants. During the ME period the participants were free of choosing the preferred mental strategies to influence the PMT activity even if they were suggested to imagining to enter within the PMT and trying to emit light feeling completely at ease, protected from external disturbances.

As in the pilot study, all participants were provided with some images of the Rhine Research Center, the Bioenergy Lab and of the PMT to have a representation of the site and the apparatus to be influenced.

Feedback about their performance was delivered at the end of all ten sessions.

The dependent variable was the mean of the PMT detection rate which was the only variable showing an effect of ME in the pilot study.

Ten further sessions without ME were recorded in different days to be used as control sessions.

All raw data are available on

http://figshare.com/articles/Mind_Interaction_on_a_Photomultiplier/1466749

RESULTS

Technical problems

After an inspection of the PMT detection rate trend in the first two sessions it emerged that it took approximately 70 minute to reach a baseline level. The typical trend is presented in Figure 1

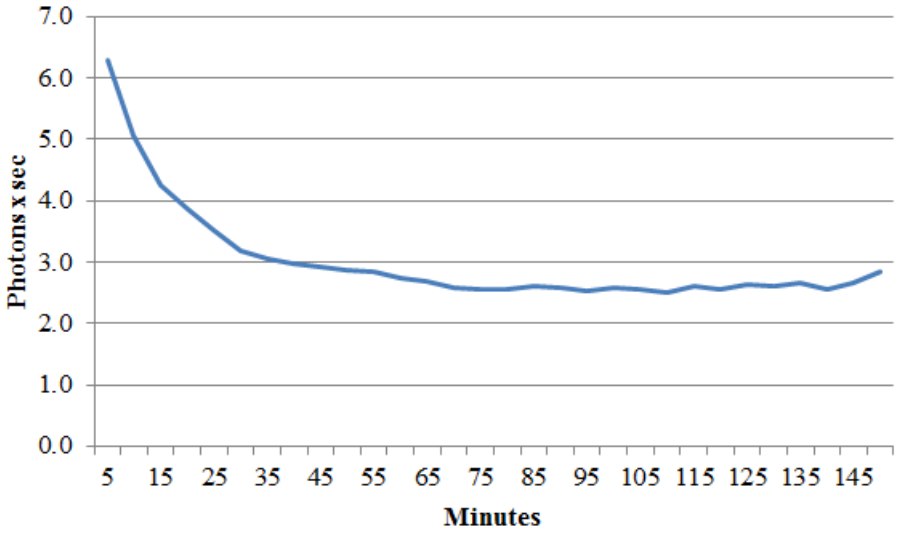

Figure 1: Typical trend of the photons/sec detection rate of the PMT averaged every 5 minutes

Consequently, the first 70 minutes of recordings were discarded and not considered in the results. Furthermore, in the three first sessions, the recording duration lasted only 120 minutes due to a technical problem. All the remaining seven experimental and all the ten control sessions lasted in total 150 minutes.

PMT mean detection rate

In the Figure 2 we report the means of photons detected by the PMT in the control and the ME periods. The raw data are reported in the Supplementary Material.

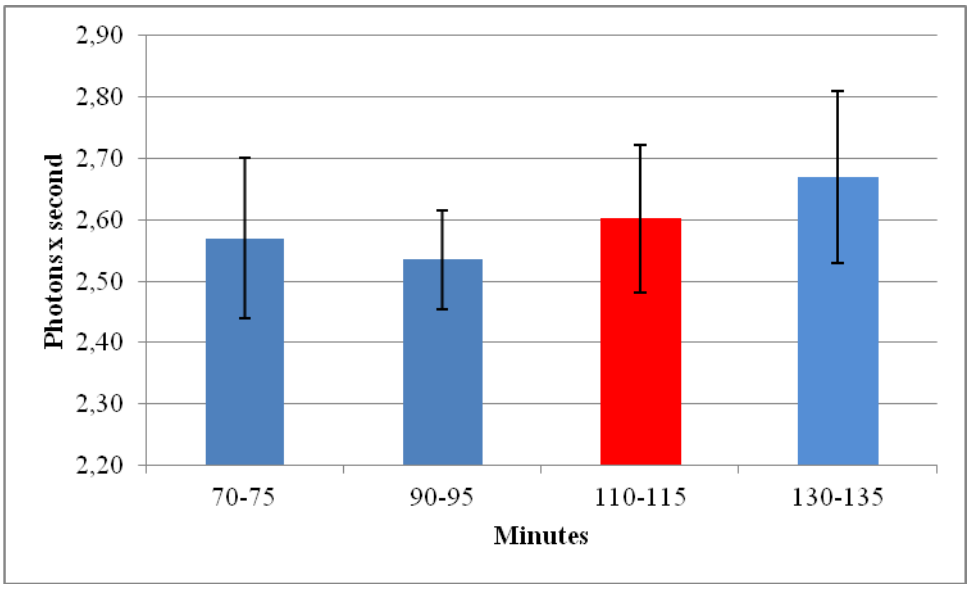

Figure 2: Means photons/sec with corresponding 95% confidence intervals[1] detected during the control (blue bars) and ME (red bar) periods.

Confirmatory Analysis

Control and ME periods comparisons.

In Table 2 we present the comparisons between the means of photons detected in the control and the ME periods.

Table 2: Paired *t*-test, standardized effect size *d* (ES) with corresponding 95% confidence intervals and BayesFactor[2] ($BF_{H1/H0}$) of the comparison between the ME and the control periods.

Comparison	Paired t-test	*ES* [95%CI]§	$BF_{H1/H0}$
Control-pre* vs ME	-.63	-.18 [-.89,.47]	.83
Control-post vs ME	.71	.20 [-.45,.87]	.84
Control-post vs Control-pre	2.03	.59 [-.07,1.26]	1.27

*=averaging the 70-75 and 90-95 control periods; §=Hedges' *g* estimated by using "bootES" package (Kirby and Gerlanc, 2013) with 5000 resamples.

[1] Obtained from 5000 samples with a bootstrap procedure.
[2] Calculated with the BayesFactor software (Morey and Rouder, 2014).

Contrary to the expectations, there were no substantial differences between the ME and the control periods prior the ME ones. Furthermore it was observed a higher mean of recorded photons in the post-ME[3] with respect the pre-ME periods even if the ES estimate is quite imprecise and the BF does not suggest a clear superiority of the post-ME vs the pre-ME periods.

Exploratory analysis

In order to more carefully analyze the trend of the photons detection rates in the experimental sessions, with respect to the control ones, we plotted the means averaged every five minutes from the minutes 70-75 up the end of the recording time, omitting the last 10 minutes, when the co-author JK entered the PMT room to monitor the session as it ended. These plots are presented in Figure 3. A similar comparison with an average every 60 seconds, is presented in the Supplementary Material.

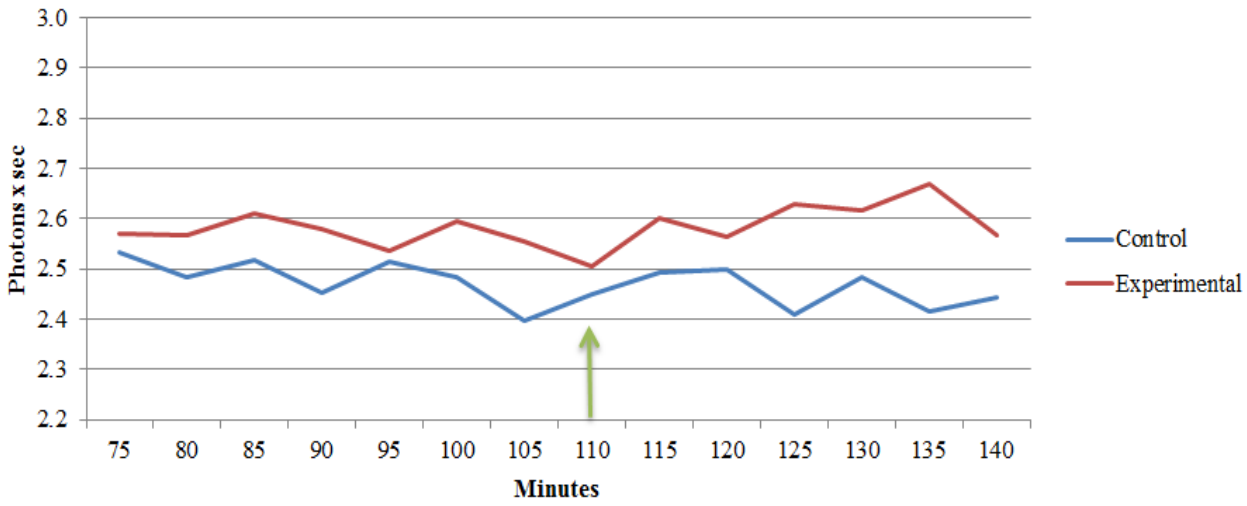

Figure 3: Plots of the number of photons averaged every five minutes, in the ten control and in the ten experimental sessions. The green arrow indicates the start of the five minutes of ME.

The differences between the experimental and the control sessions from minute 75 to the end of the recording period are visualized in Figure 4.

[3] The post-ME periods also contain the 5 min ME periods.

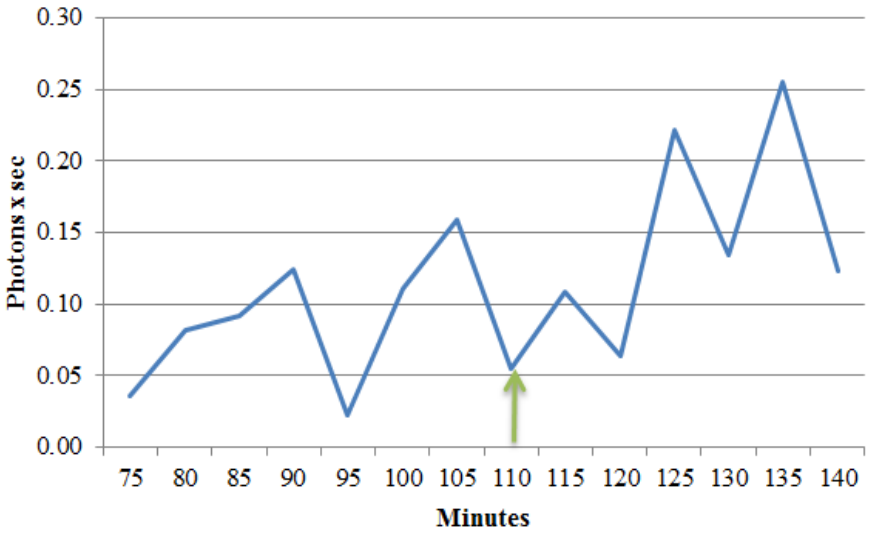

Figure 4: Plots of the photons/sec differences between the ten control and the ten experimental sessions. The green arrow indicates the start of the five minutes of ME.

From a statistical point of view, the differences between the period prior and after the ME are presented in Table 3.

Table 3: Descriptive statistics of differences between the control and the experimental sessions in the number of photons/sec detected during the 40 minutes before and the 40 minutes after the ME with the effect size and BayesFactor (BF) of their comparison.

Period		Mean (SD)	ES [95%CI]	$BF_{H1/H0}$
Pre-ME	n.40	.09 (0.117)	.37 [.07,.70]	2.7*
Post-ME	n.40	.16 (0.159)		

*=setting effect size r = 0.3

DISCUSSION

With respect to the pre-registered confirmatory hypotheses, the present experiment did not confirm an increase in the number of photons detected during only the ME periods with respect to the pre and post ME ones of the same length, as observed in the pilot study. Differently, an unexpected increase of photons count was observed after the ME periods with respect those recorded in the pre-ME ones.

Among the other differences, all experimental sessions were performed by a small group of participants instead of single participants and the first 70 minutes of the recorded data were discarded from the analyses because of the cooling effect on the PMT.

The comparison between the control and the experimental sessions rule out that this difference may be due to an anomaly in the PMT functioning. However it is not clear why this effect is not immediate as a consequence of the ME, starting at minute 110 and ending at the minute 115, but it appears to cumulate like a sort of "avalanche effect" for at least half an hour. Unfortunately there are no previous research and no clear hypotheses to refer to for an explanation of this phenomenon. Given that the difference between the pre and post ME periods was detected in an exploratory way, we devised a new pre-registered confirmatory experiment wherein the length of the ME period will be identical, 5 minutes, and performed by the same small group of four or five participants, but with the following differences with respect to the present one:

a) the experimental and control sessions will be recorded on the same day to have a more strict control on the potential functioning differences of the PMT;

b) the ME period will be activated after a period of 40 minutes of the PMT functioning stabilization, fixed in 80 minutes;

c) the recording of the PMT activity after the ME period will last 60 minutes overall (with the 5 minutes of ME included);

d) the operator responsible of the PMT functioning will know which session is experimental or control only at the end of the experiment.

To summarize, in each of the ten days dedicated to the experiment, the PMT will be activated for a total of 280 minutes (PMT cooling: 80 minutes; pre ME: 40 minutes; ME and post ME: 60 minutes; control: 100 minutes). The assignment of the experimental and the control sessions (after the first 120 minutes or after the first 220 minutes) will be randomized.

The confirmatory hypothesis is the replication of the post ME effect with respect to the control conditions and a difference between the pre and post ME periods in the experimental sessions.

SECOND PRE-REGISTERED EXPERIMENT

METHOD

Study pre-registration

The study was preregistered to the KPU registry (http://www.koestler-parapsychology.psy.ed.ac.uk/Documents/KPU_registry_1012.pdf) before data collection.

Participants

The same selected participants participated to this second experiment.

Apparatus

The same apparatus used in all previous experiments was used.

Procedure

As defined in the experiment pre-registration, the first 80 minutes of the PMT functioning were considered necessary for its stabilization obtained after the cooling process. The mean of photons/sec observed in the ten sessions is presented in Figure 5.

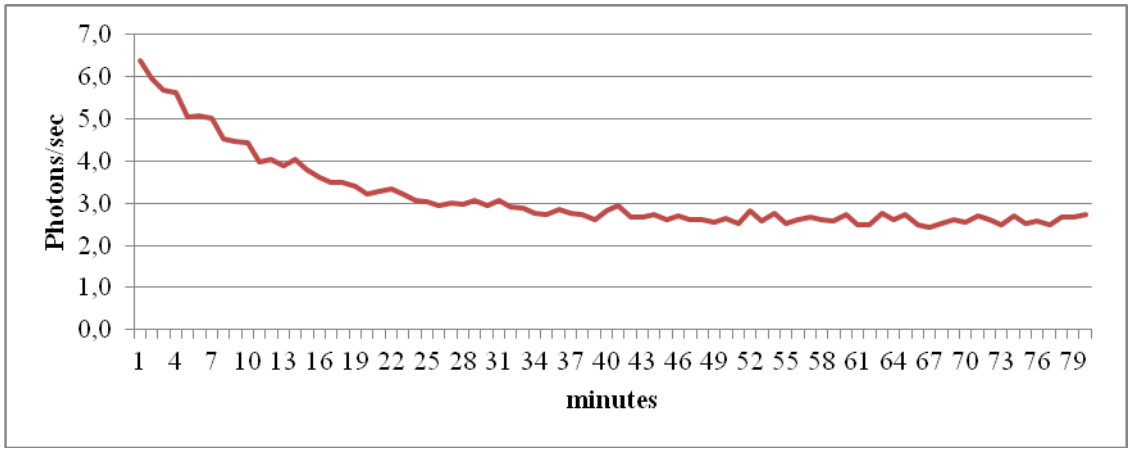

Figure 5: Trend of the photons/sec detection rate during the period of the PMT cooling.

As observed in the first experiment, the PMT stabilizes its functioning approximately after 45 minutes from the outset of the cooling process. Our choice to use a longer period before the start of the control and experimental sessions increases the guarantee that during these periods there were no artifacts.

The periods of the PMT functioning reserved to the experimental and the control sessions were defined randomly by using the randomization facilities available on the www.random.org website. For our purposes, the decision on when to choose the first or the second part of the recording period as experimental session, was obtained simply randomizing a sequence of 1 and 2, corresponding respectively to the first and the second part. This randomization yielded the following sequence: 1 2 2 1 2 1 1 2 1 2. To reduce possible experimenter effects, the co-author JK, responsible of the Bioenergy Lab, were kept blind to this sequence.

The five minutes of ME started always after 40 minutes from the start of the first or second control periods, corresponding to the 120-125 and 220-225 minutes respectively.

The ME procedure was identical to that applied in the first experiment. Participants received a feedback about the performance only at the end of all ten sessions after the examination of the data.

RESULTS

Raw data inspection: after the inspection of the raw data, session six, showed an anomalous increase in the number of detected photons in its second part, corresponding to a control session. These data are presented in the Figure S3 in the Supplementary Material. We then decided to eliminate the whole session and add another one.

Confirmatory hypotheses: The number of photons detected by the PMT in the 5 min of ME plus the 35 minutes after the ME, will outperform those detected in the 40 minutes before the ME.

These differences will hold subtracting the number of photons in the corresponding 80 minutes of the control sessions.

Exploratory hypotheses: check if the above differences hold for shorter periods: 5, 10, 15, 20, 25 minutes and longer periods:35, 40, 45, 50, 55, 60 minutes.

The means of the photons/sec recorded in the ten experimental and ten control sessions are presented in Figure 6 and their difference (experimental minus control) in Figure 7. The green arrow, indicates the start of the five minute of ME.

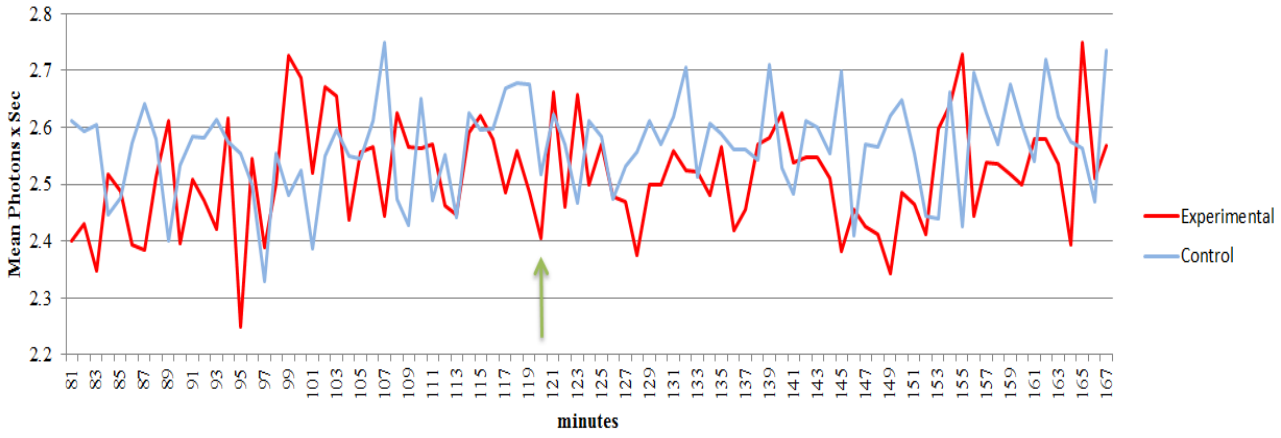

Figure 6: Means of photons/sec detected in the experimental and control sessions. The green arrow indicates the start of the five ME period.

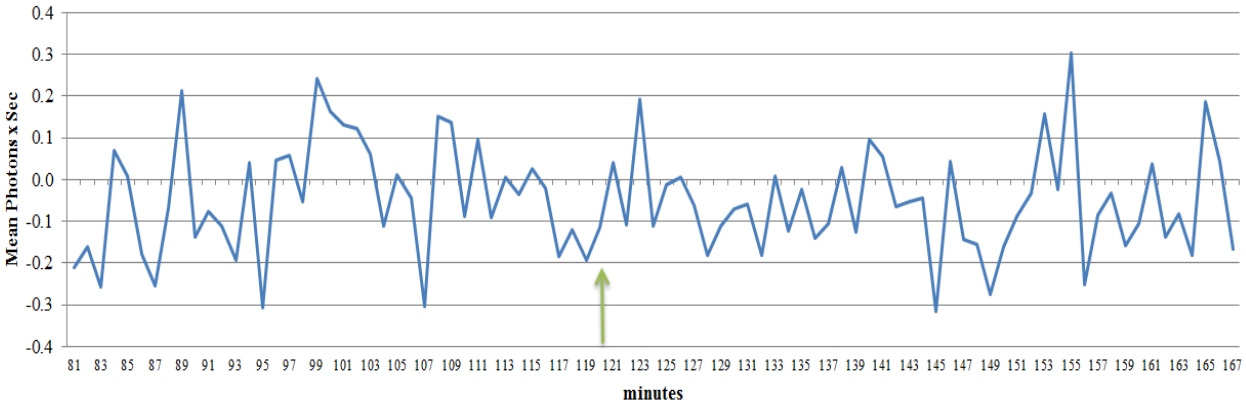

Figure 7: Means of photons/sec of the difference between experimental and control sessions.

From a visual inspection, no differences between the pre and post ME periods are present. The descriptive statistics reported in Table 4, confirm this situation.

Table 4: Descriptive statistics of differences (experimental minus control) of the number of photons/sec detected during the 40 minutes before and the 40 minutes after the ME.

Period	Experimental sessions	Difference between Experimental and Control Sessions
	Mean (SD)	Mean (SD)
Pre-ME	2.51 (.1)	-.04 (.14)
Post-ME	2.51 (.07)	-.06 (.12)

SD = Standard Deviation

Comment

The results of the second experiment did not confirm the effects observed in the first one. There are not sign of effects of ME on the PMT. The effects observed in the exploratory analyses in the first experiment, seem to have vanished when recording the control and experimental sessions on the same days and randomizing their order.

Is our hypothesis of an increase of photons count caused by the ME completely wrong or have we misinterpreted the action of ME on photons?

Looking at the raw data recorded in the ten pre-ME, post-ME and control periods in the two experiments, all lasting 40 minutes for a total of 4800 data each, in the post-ME periods we observed an increase of bursts of photons at approximately half of the sessions. This characteristic appears less frequent in the pre-ME and control periods.

These data, related to experiment 1, are presented in Figure 8a,b and c. The analogue data related to experiment 2 are presented in the Figure S4a,b and c in the Supplementary Material.

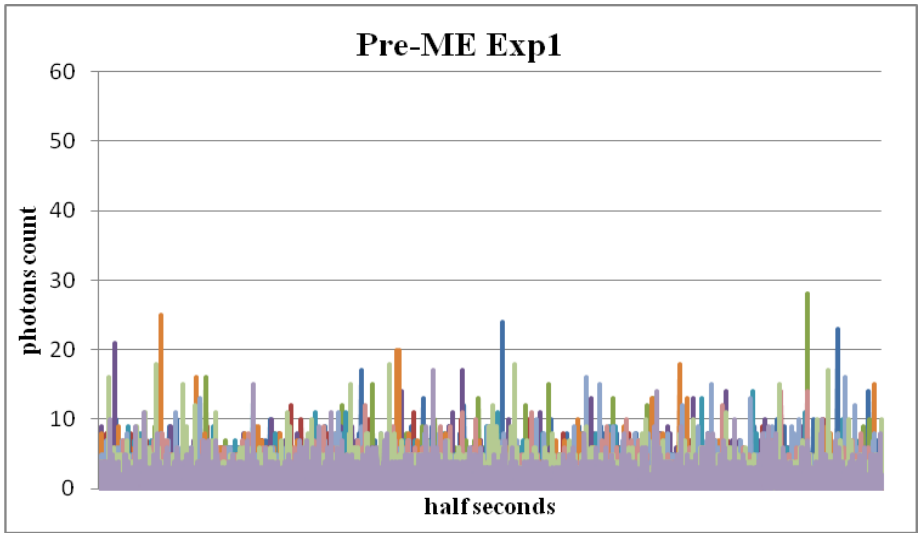

Figure 8a: Means of photons/half second recorded in the pre- ME periods.

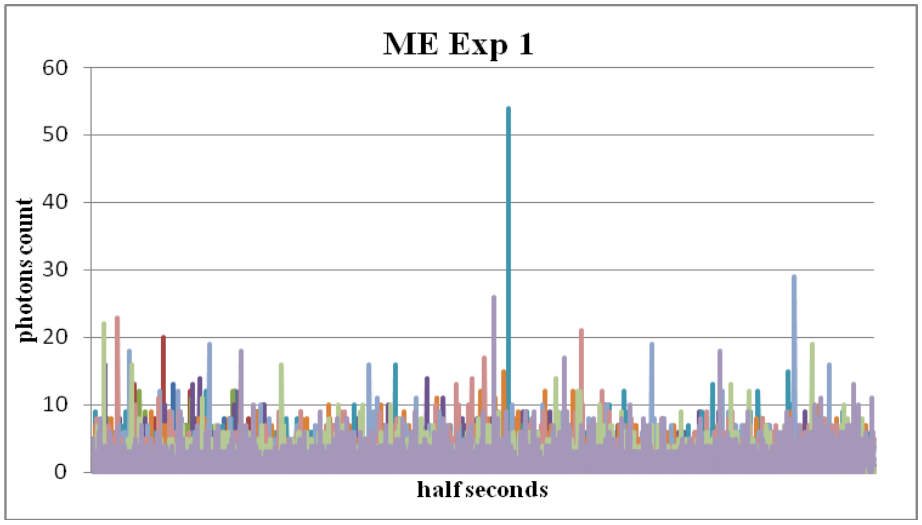

Figure 8b: Means of photons/half second recorded since the start of ME.

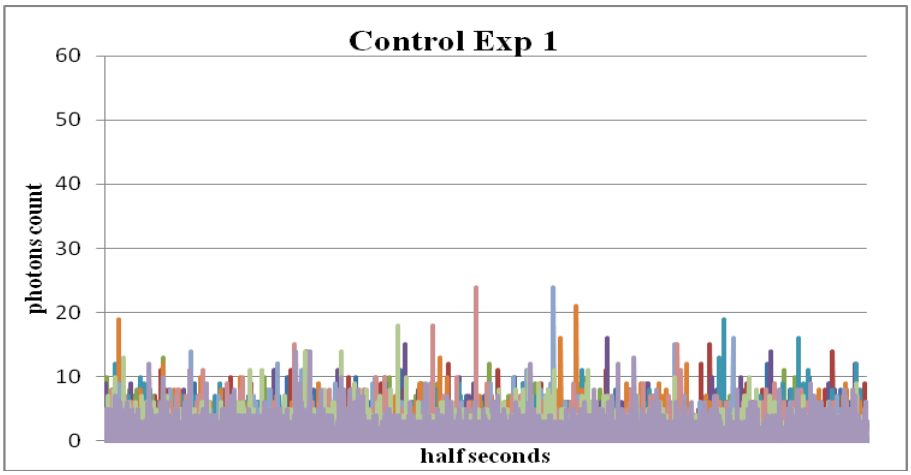

Figure 8c: Means of photons/half second recorded in the control periods.

We then decided to count all burst of photons exceeding 6σ the average photons counted in the two experiments across all conditions and their total number of photons. The means and standard deviations of photons were M=1.3; SD=1.5 and M=1.25; SD=1.5 respectively for the first and second experiment. Rounding to 11 the 6σ deviation, 456 bursts of this type were counted in the two experiments, corresponding to a 0.15% of the total bursts. The number of these bursts with their corresponding photons and percentages observed in the twenty sessions of the two experiments are reported in the Table 5, divided for the Pre-ME, ME (plus post-ME) and Control periods.

Table 5: Bursts above 6σ with their number of photons and their percentages in the pre-ME, post-ME and control periods of the two experiments.

	Exp1		**Exp2**		**Tot**			
Period	n.>6σ	n.phot	n.>6σ	n.phot	n.>6σ	n.phot	%>6σ	%phot
Pre-ME	79	1113	68	952	147	2065	32.2	32.8
ME	89	1290	78	1081	167	2371	36.6	37.6
Control	64	858	78	999	142	1857	31.1	29.5

The estimation of the effect sizes of the comparisons between the ME vs Pre-ME and ME vs Control periods, is presented in Table 6 with their corresponding Bayes Factors (BF) estimated with the Morey (2014) applet.

Table 6: ES d, using probit method and BFs estimation of the comparisons of the percentages of photons bursts >6σ and their total count (n.phot) observed in the different periods.

Comparison	>6σ ES[95% CI]	>6σ $BF_{H1/H0*}$	n.phot ES[95% CI]	n.phot $BF_{H1/H0*}$
Pre-ME vs ME	.11 [.02,.20]	.2	.13 [.04,.22]	$2.1x10^4$
ME vs Control	.15 [.06,.24]	.37	.22 [.13,.31]	$7.8x10^6$

Priors: μ1-μ2=0; σ1-σ2=1

Comment

In the ME periods, for each half second, there is an increase of approximately 4% of bursts exceeding 6σ the average count with respect to the pre-ME and control periods, with an increase of 5% of their photons. The comparisons with respect to the number of photons detected in the burst

exceeding 6σ show a strong statistical support of the superior effect of the post-ME periods with respect the Pre-ME and the control one, see ES and BF values.

To further control if the ME effects are specific to the >6σ bursts, we compared the percentages of photons detected in the three conditions for bursts of 1 photon onward. These percentages are presented in Figure 9.

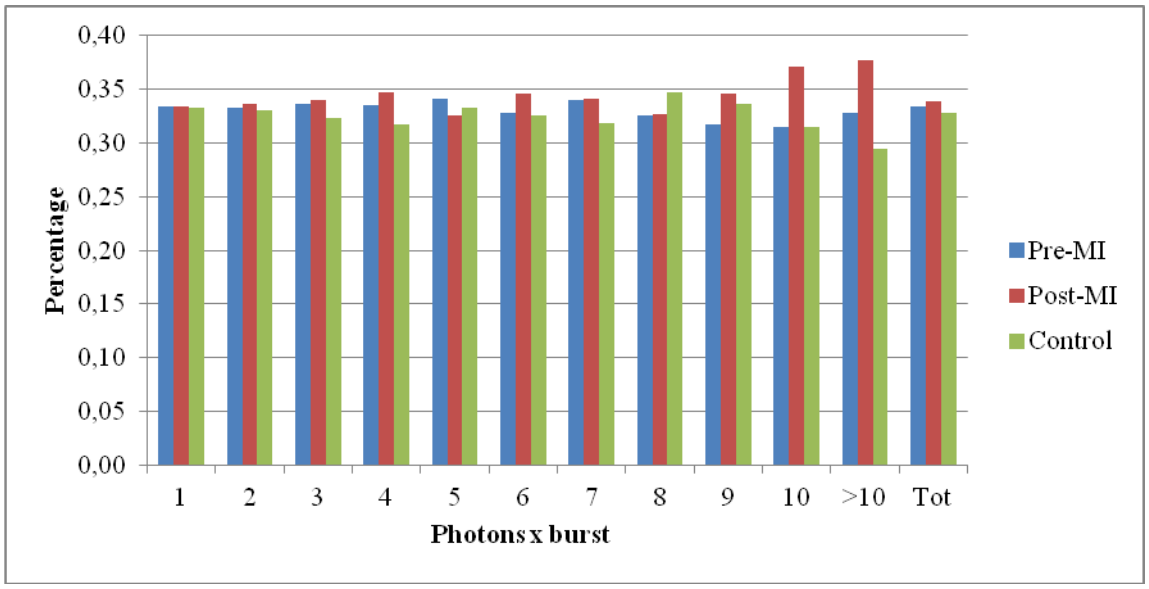

Figure 9: Percentages of photons detected in the three conditions, for each type of burst.

Looking at the Figure 9, it emerges clearly that ME effects seem to manifest with bursts of 10 or more photons. If this phenomenon is a general characteristic of ME or specific to the action of our participants, it will remains an open question until new replications of the current experiment will be carried out with new participants. The statistical comparisons related to the percentages of photons detected in the bursts >10 photons/half second are reported on Table S2 in the Supplementary Material.

Another potential effect of ME could be a sort of "regulatory action" on photons, increasing the pattern of their emission.
To check this hypothesis we correlated the means for each of the 40 minutes of the pre-ME, post-ME and control data of the two experiments. If ME acts like a sort of "pattern regulator", we should observe a correlation only in the post-ME data and not in the pre-ME and control data.

In Table 4, we show these correlations with their 95% CIs and posterior probability High Density Interval (HDI) of the linear regression, estimated with the Jags-Ymet-Xmet-Mrobust.R function included in Kruschke (2014).

Table 7: Correlations and their 95% CIs and HDIs, between the data of Experiment 1 and Experiment 2.

Data	Pearson's correlation [95% CI]*	95%HDI§
Pre-ME	-.084 [-.40,.23]	-.12.06
ME	**-.39 [-.64,-.06]**	**-.33,-.04**
Control	-.11 [-.41,.27]	-.12,.07

*= obtained with 10000 bootstrap samples; §= standardized beta linear regression coefficient.

Even if of a small magnitude, the ME data between the two experiments show a correlation even if negative. There are no sign of correlation between the pre-ME and the control data.

Discussion

Have we demonstrated the possibility of increasing the number of photons detected at approximately 7300 km of distance by using the ME of a small group of selected participants? Probably yes, in particular if we refer to the number of photons detected in the burst exceeding 6σ the average rate of photons detection, but we must admit to have achieved this goal through a circuitous path. Only after a pilot and two pre-registered studies, now we have a clearer idea on how to measure the effects of ME on a PMT. Apart the finding that for the detection of small variations in the photons count with our PMT it was necessary to cool it for at least 40 minutes, we have had to abandon some naïve hypotheses on how ME could increase the photons count at distance. One first naïve hypothesis was that ME effects, if any, should be detected simultaneously on the PMT and lasting only for its duration. Our results, show that it is not so. These effects seem to appear even after a delay of approximately 20-30 minutes. At present we have no ideas about its causes. We can only exclude that the participants continued their ME after the planned five minutes.
In the literature we retrieved only one study which reported a similar "delayed effect of meditation" on the 2-hexanol gas concentration of cucumber slices (Takagi et al. 2015).
A second naïve hypothesis was that ME could enhance the photons count linearly or with a constant effect. This was not the case. Our results show that ME acts increasing the bursts of photons

exceeding more than 6σ those detected on average every half second. In other words, it seems that ME induces very fast burst of light of approximately 20 photons/sec equivalent to an energy estimated in 65 eV[4], a non-trivial energy, with some regularity.

The photocount shows a clear Poisson distribution that, according to some authors (Cifra, Brouder, Nerudová and Kučera, 2015), is a sign of coherent but also of a classical, non-quantum nature of light.

Can these small effects be due to external causes, for example experimenter or geomagnetic influences? This possibility was present in the first experiment because the experimenter acting on the PMT knew which periods were assigned to ME and the control ones. Furthermore, control periods were recorded in different days with respect the ME ones. These two potential causes were eliminated in the second experiment keeping blind the experimenter acting on the PMT about when the ME was applied and recording the control periods on the same days.

Is it possible to replicate these experiments? The only limitations are the availability of a good PMT and some very selected participants. If replicated independently, it can support the hypothesis that human mind can entangle with a predefined target at distance by way of photons. It is clear that these bio- or mental-photons cannot be transmitted as classical photons given the many obstacles between the participants and the detector. The only plausible explanation is that they are generated in the proximity of the detector entangled with the participants. Furthermore, the possibility to measure the energy of these biophotons, may give some suggestions about how human mind can be entangled at distance with biological and physical targets as demonstrated for example by the studies with biological systems, e.g. plants, cell cultures, etc. (Roe, Sonnex and Roxburgh, 2015) and with random number generators (Bösch, Steinkamp and Boller, 2006).

[4] Estimating an average wavelength of 380 nm, 1 photon = 3.26 eV

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SUPPLEMENTARY MATERIAL

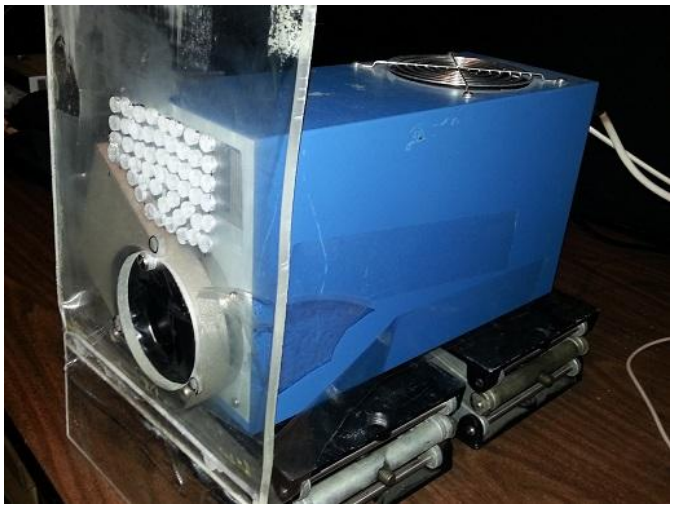


Figure S1: Image of the PMT

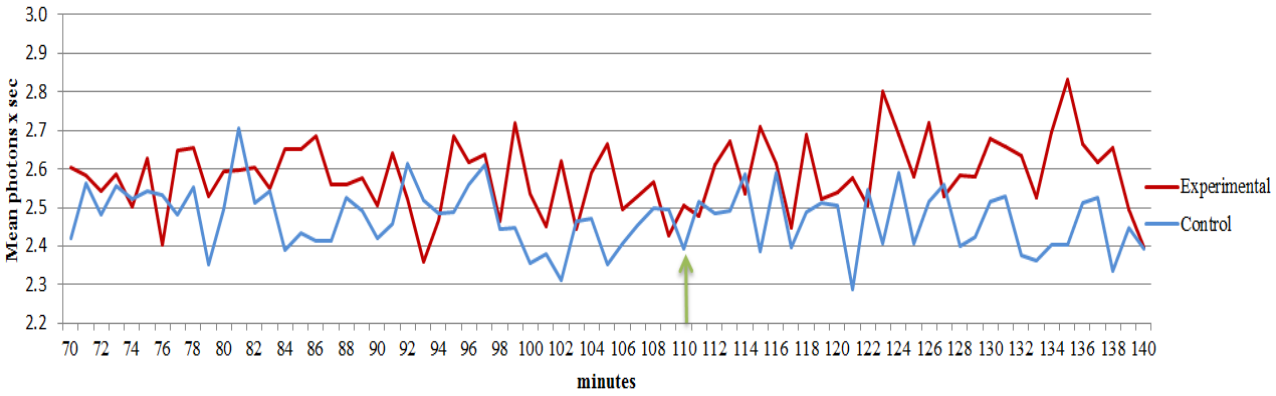


Figure S2: Plots of the number of photons averaged every minute in the ten control and the ten experimental sessions. The green arrow indicates the start of the five minutes of ME.

Raw data of Experiment 1

Session	Control 70-75	Control 90-95	Average pre	ME 110-115	Control 130-135
1	2.38	2.44	2.41	2.38	2.66*
2	2.43	2.49	2.46	2.77	2.66*
3	2.36	2.74	2.55	2.68	2.66*
4	2.38	2.24	2.31	2.74	2.32
5	2.65	2.47	2.56	2.32	2.90
6	2.92	2.52	2.72	2.79	2.79
7	2.75	2.65	2.70	2.43	2.51
8	2.72	2.56	2.64	2.95	2.67
9	2.81	2.65	2.73	2.49	2.67
10	2.30	2.58	2.44	2.49	2.82

*****=missing values changed with the mean of the remaining values

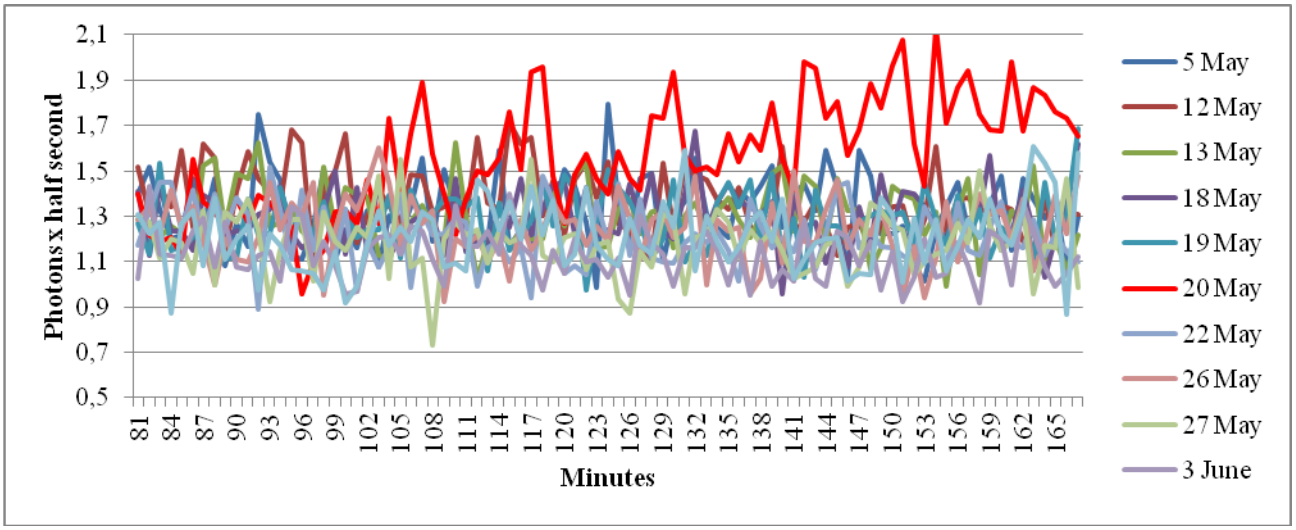
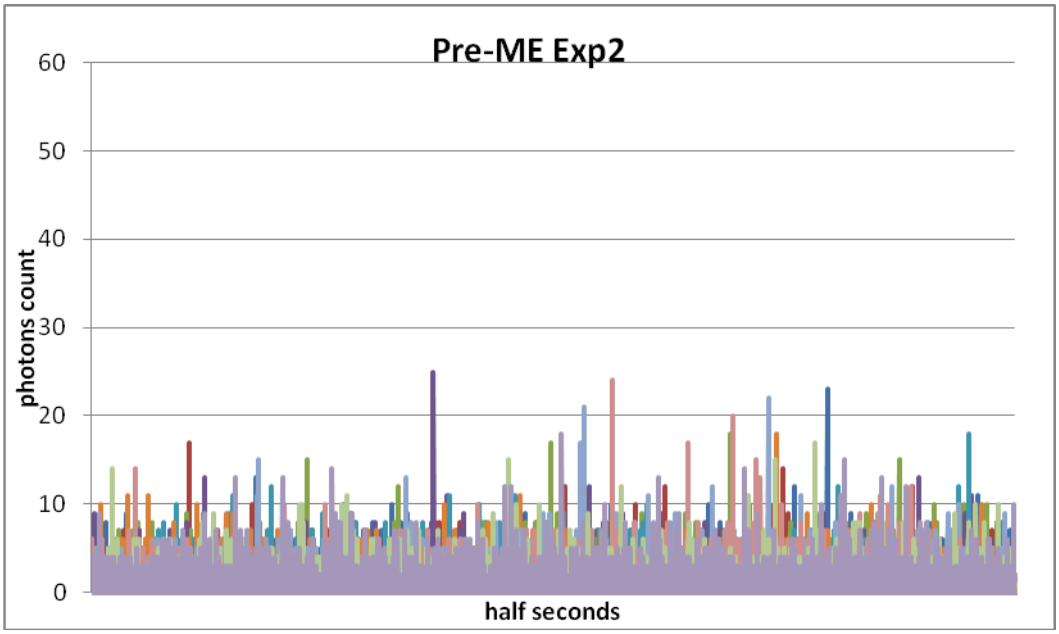
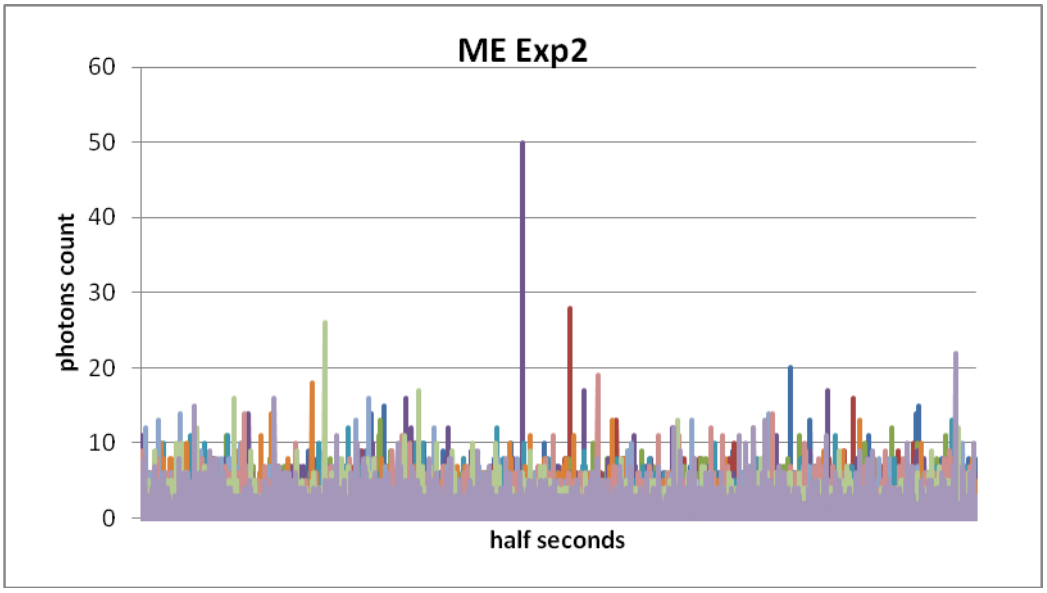


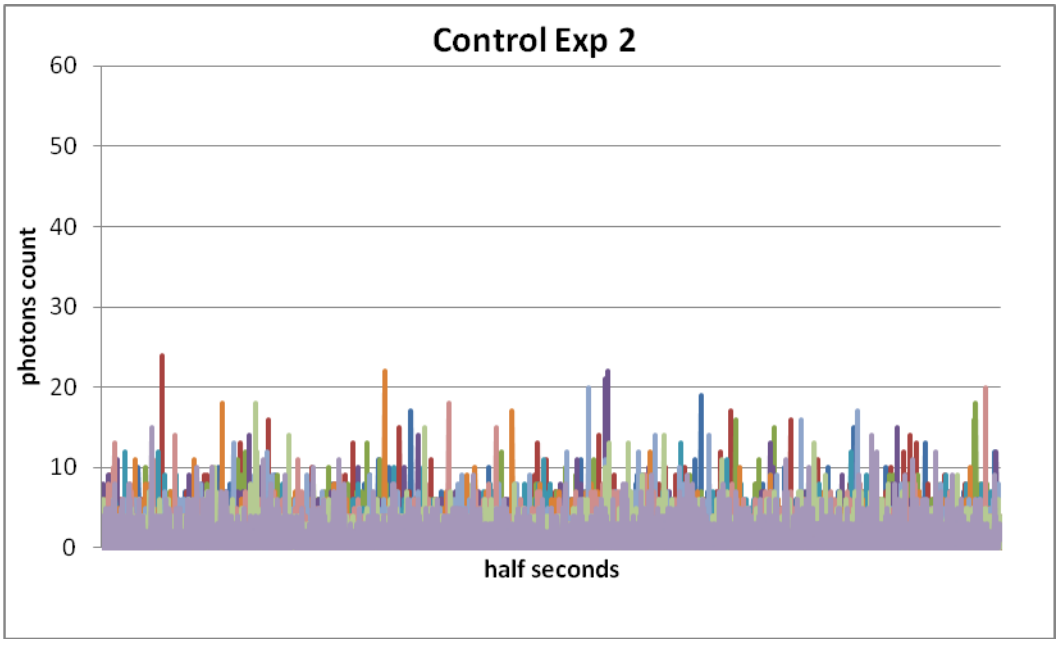
Figure S3: Trend of the raw data of the control sessions. The session recorded on 20th of May (red line), show a clear anomalous increase in the number of photons recorded.



FigureS4a: Means of photons/half second recorded in the pre- ME periods.



FigureS4b: Means of photons/half second recorded since the start of ME.



FigureS4c: Means of photons/half second recorded in the control periods.