



Children's Exposure to Extremely Low Frequency Magnetic Fields: A personal exposure measurement study.

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¹Benjamin Struchen, ²Ilaria Liorni, ²Marta Parazzini,
¹Stephanie Gängler, ²Paolo Ravazzani, ¹Martin Rössli

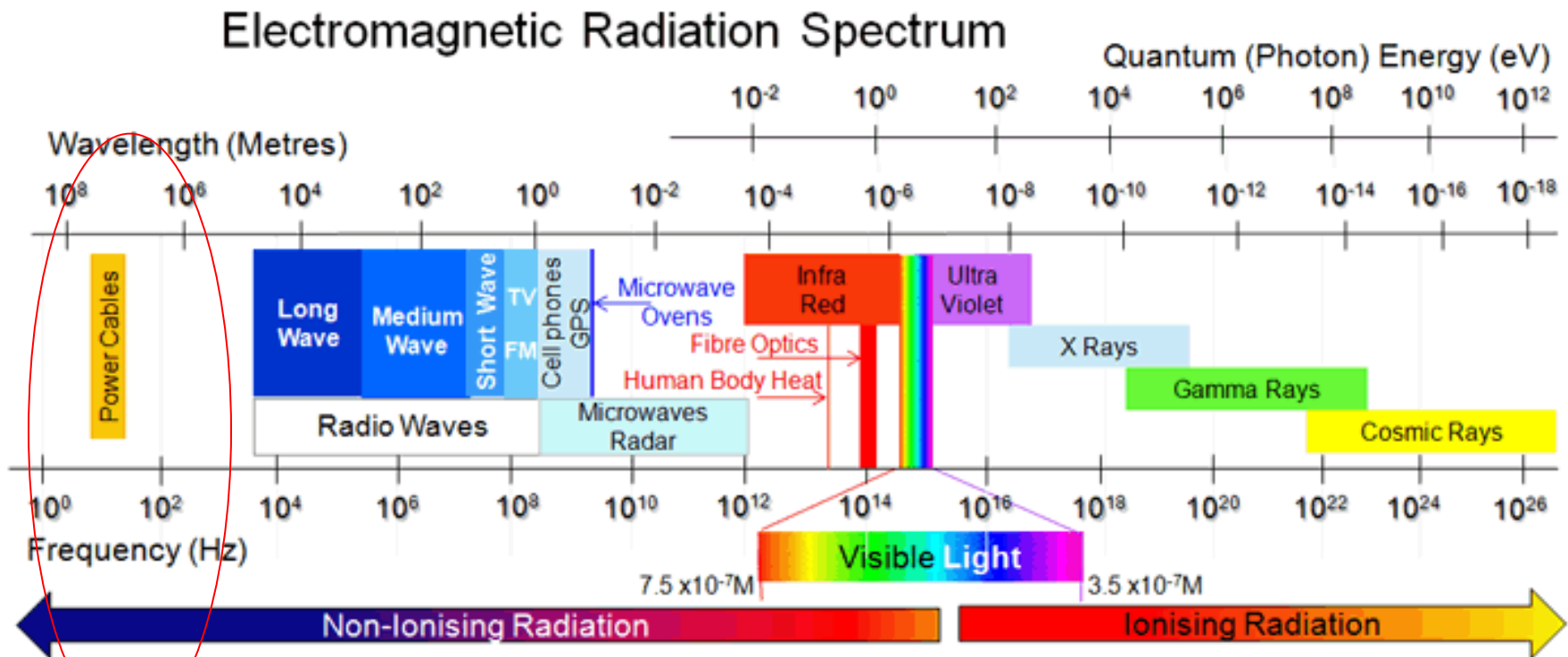
¹Swiss Tropical and Public Health Institute, Basel

²Consiglio Nazionale delle Ricerche, Istituto di Ingegneria Biomedica, Milano



Introduction

- Extremely low frequency magnetic fields (ELF-MF).





Introduction

- Epidemiological studies consistently show risk increase for childhood leukaemia for exposure to ELF-MF in the microtesla range.
- Doubling of risk for exposure $\geq 0.4 \mu\text{T}$.
- Not confirmed by biological studies.
- True association or bias?
- Childhood leukaemia is a rare disease.



Introduction

- ARIMMORA (**Advanced Research on Interaction Mechanisms of electroMagnetic exposures with Organisms for Risk Assessments).**
- Many studies used spot measurements e.g. in the bedrooms. Lack of data about the real everyday exposure of children.
- Time-varying exposure patterns may be more biologically relevant than averaged ELF-MF exposure.
- Better exposure data necessary.
- Personal exposure measurements (pm) needed.



Aims

- Gain a better understanding of the levels and the temporal patterns of ELF-MF exposure of children in their daily life.



Methods



Control
HVPL
Transformer



25 (25)
25 (32)
25 (21)



25 (28)
25 (23)
25 (15)



Control
HVPL
Transformer

25 (25)
25 (26)
25 (25)

25 (25)
25 (16)
25 (20)





Methods

Measurement duration: 2-3 days

Study instruments:

Devices:

- EMDEX II (Broadband: 40- 800 Hz, Harmonics: 100-800 Hz), sample rate: 30 s
- GPS logger (QSTARZ)



Documents:

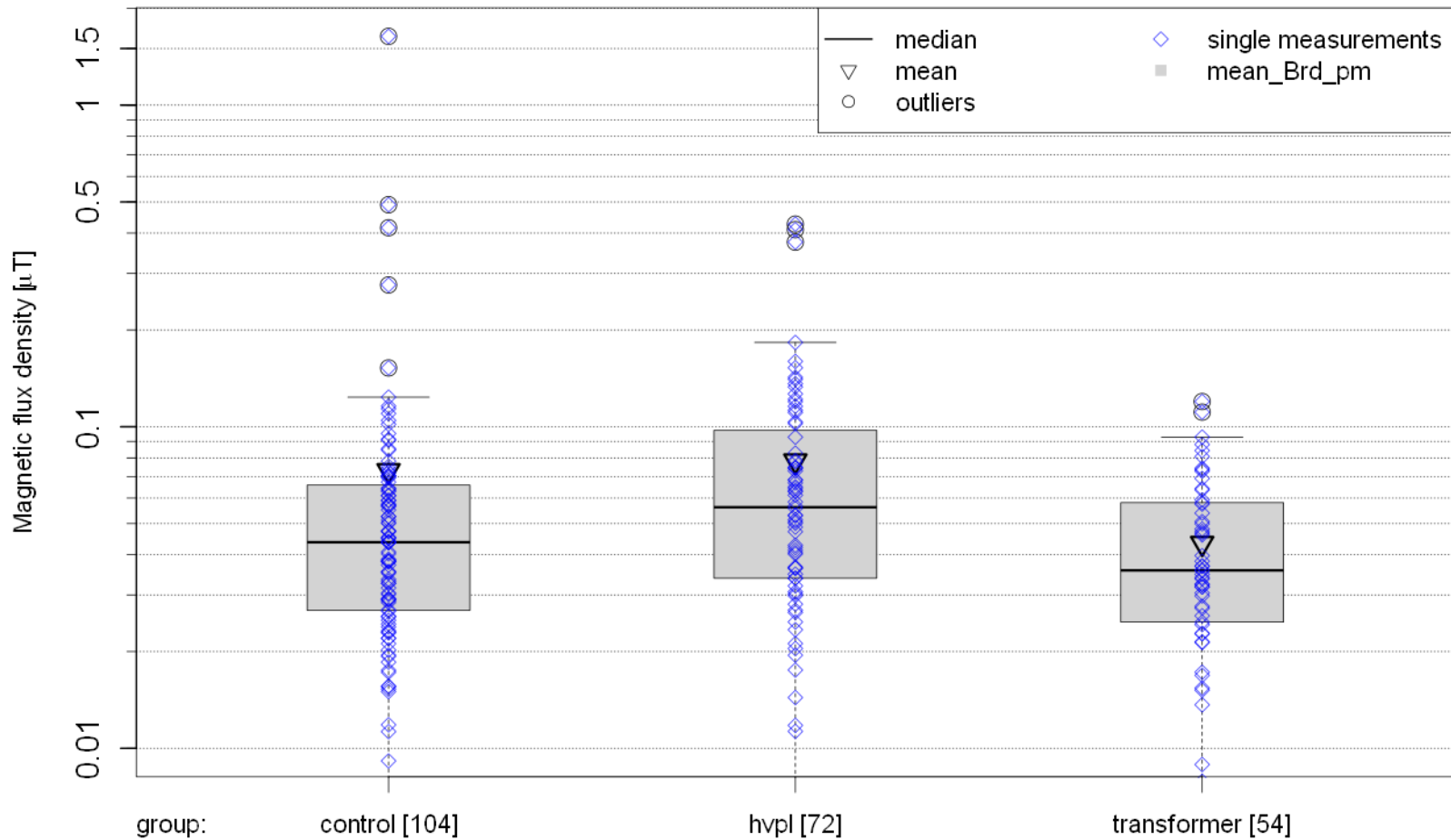
- Time-activity diary
- Questionnaire about exposure relevant factors

	06:00	07:00	08:00	09:00	10:00	11:00
<u>At home during day</u>	■	■	■	■	■	■
<u>At home nighttime</u>						
<u>Way to school</u>						
<u>School</u>						
<u>Outdoors (mainly):</u>						
<u>travelling by car / bus</u>						
<u>travelling by train / tram</u>						
<u>Others</u>						



Results

- summary exposure measures: mean, by groups



Kruskal-Wallis test:

p-value = 0.005



Results

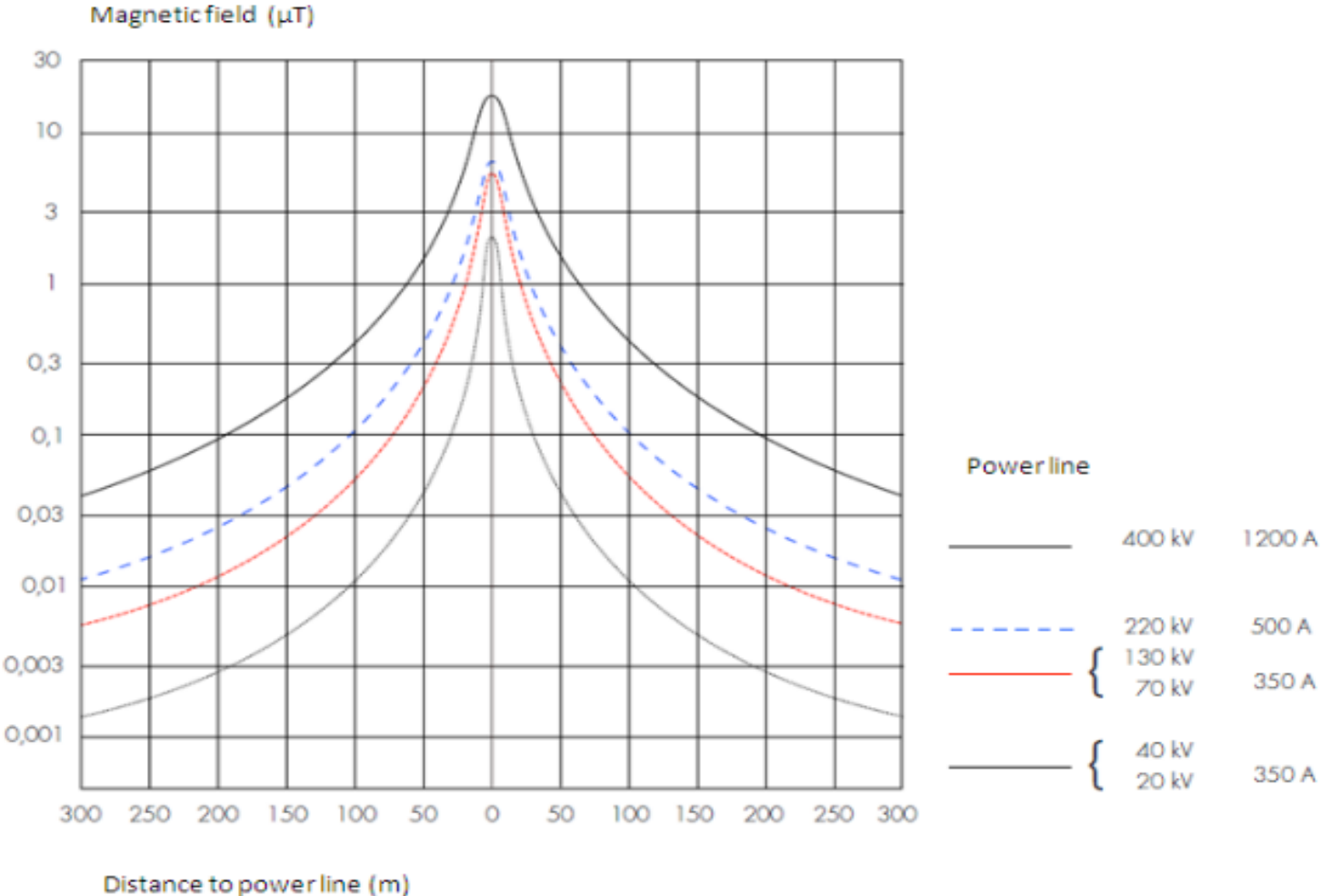
- Linear mixed models clustering for children of the same family and children

Target variable: Mean ELF-MF exposure

Explanatory variables:

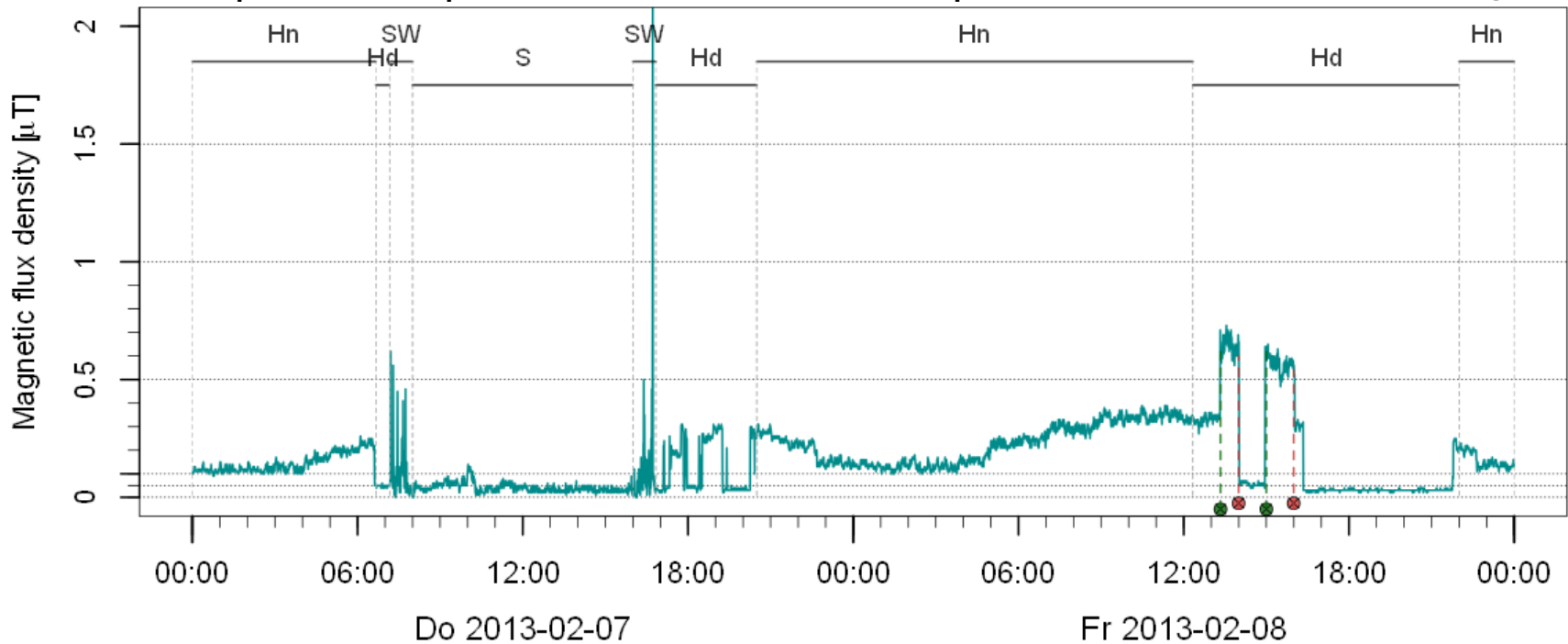
	Estimate	Pr(> t)	
(Intercept)	0.110	0.004	
group HVPL	-0.002	0.904	
group transformer	-0.018	0.380	➔ no sign. effects
season winter	-0.010	0.365	
gender male	-0.014	0.308	
country IT	-0.001	0.915	
urbanity "urban"	-0.014	0.482	
age	-0.001	0.665	





Results



Results – single measurements

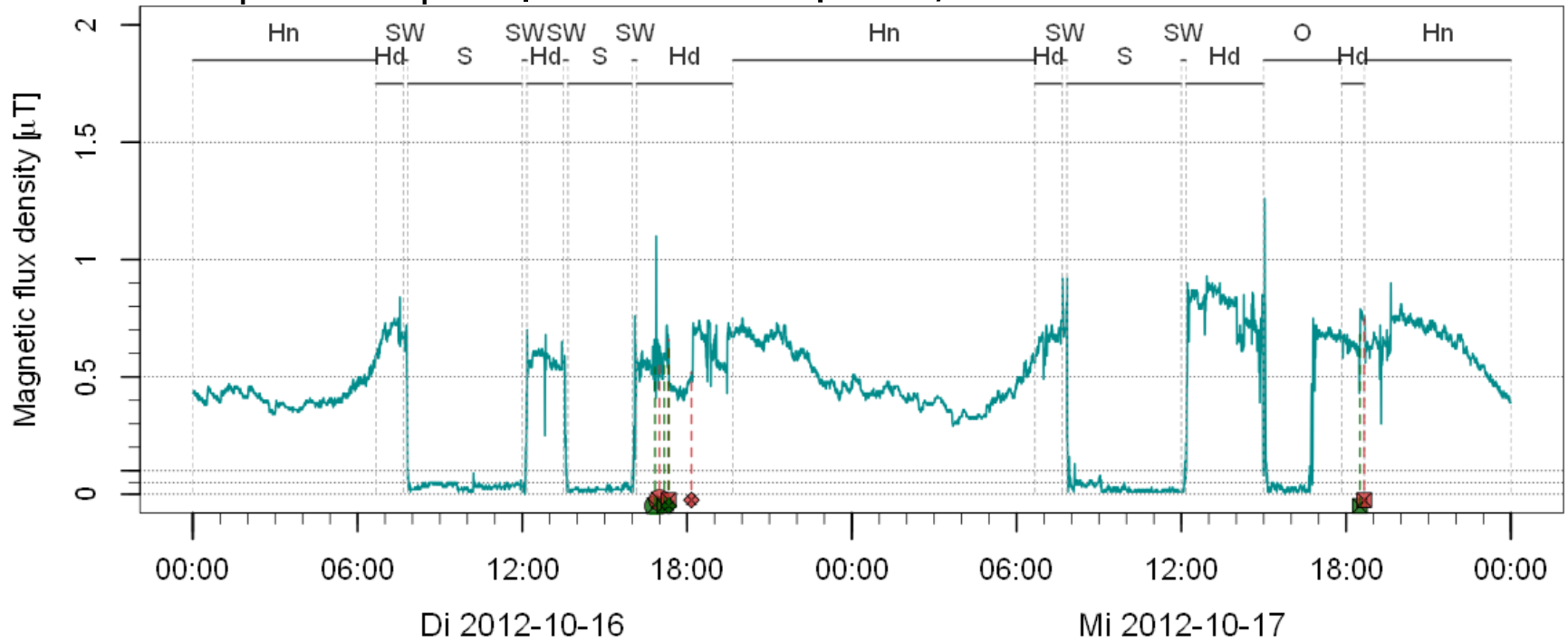
mean pm = 0.16 μT ; mean bedroom = 0.26 μT | Transformer Group CH









Measurements	 Broadband (40 - 800 Hz)	Activities	Hd: At home	Tcb: Travelling by car/bus	Devices	 start
			Hn: At home (nighttime)	Ttt: Travelling by train/tram		 stop
		S: School	D: Others		 computer	
		SW: Way to School	N: No information			
		O: Outdoors (mainly)	E: Exposimeter not near child			

Results - single measurements

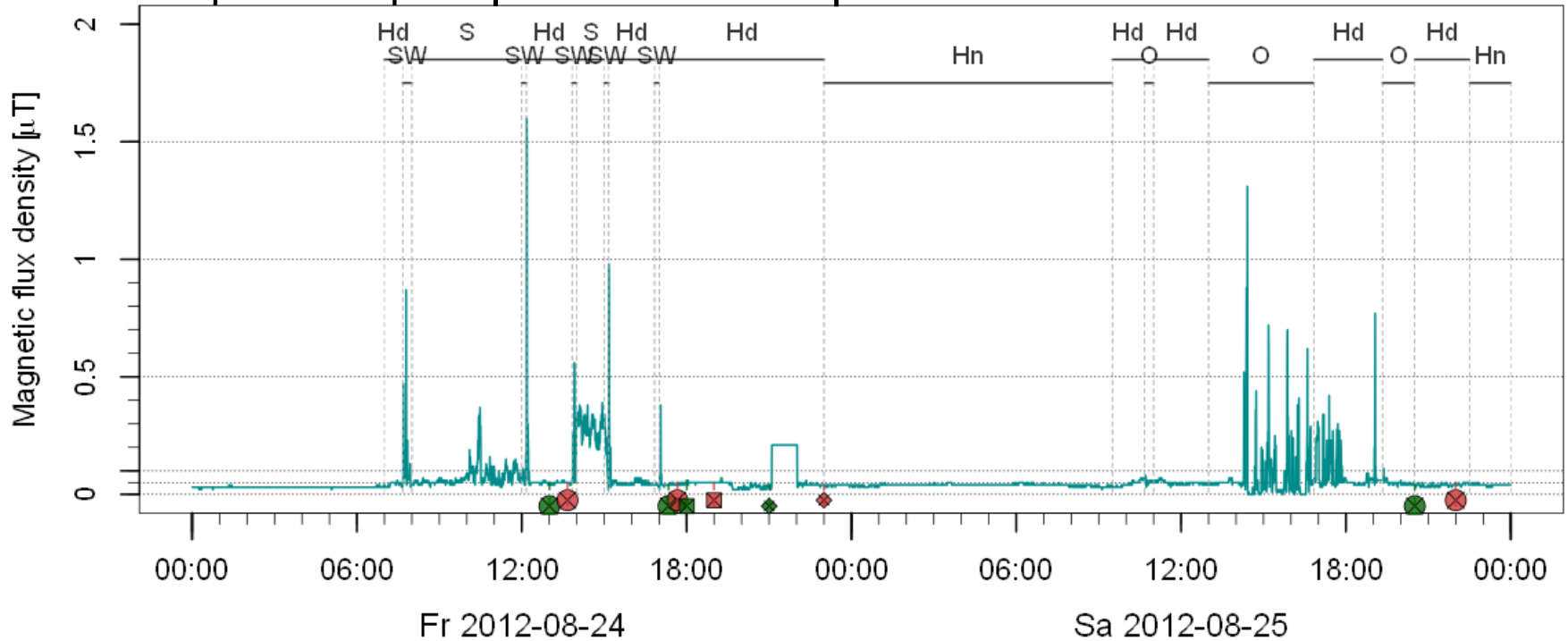
mean pm: 0.41 μT | HVPL Group CH; $\sim 15\text{m}$ from HVPL



Measurements	 Broadband (40 - 800 Hz)	Activities	Hd: At home	Tcb: Travelling by car/bus	Devices	 start
			Hn: At home (nighttime)	Ttt: Travelling by train/tram		 stop
		S: School	D: Others		 Staubsauger	
		SW: Way to School	N: No information		 E.Gitarre	
		O: Outdoors (mainly)	E: Exposimeter not near child		 computer	

Results - single measurements

mean pm: 0.06 μT | Control Group CH



Measurements	— Broadband (40 - 800 Hz)	
	Activities	<p>Hd: At home</p> <p>Hn: At home (nighttime)</p> <p>S: School</p> <p>SW: Way to School</p> <p>O: Outdoors (mainly)</p> <p>Tcb: Travelling by car/bus</p> <p>Ttt: Travelling by train/tram</p> <p>D: Others</p> <p>N: No information</p> <p>E: Exposimeter not near child</p>
	Devices	<p>— start</p> <p>— stop</p> <p>○ Computer</p> <p>□ Stereoanlage</p> <p>◇ Beamer</p>



Conclusions

- Preliminary results
- Exposure of Children living or attending school within 200m of HVPL or living in building with built-in transformer often seem to not have significantly higher mean ELF-MF exposures than children form a control group
 - Rapid decline of magnetic field with distance
 - ‚Dillution‘ effect of children not always being at home or school may further diminish group differences
- Hypothesis: Bedroom measurements may be likely to overestimate the exposure range of personal measurements



Outlook

- Completion of personal measurements
- In depth analysis of (further) summary measures
- Analysis of time-location patterns of measurements



Acknowledgements

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Arimmora