

Quality of Life and Management of Living Resources

Key Action 4 – Environment and Health

THz-BRIDGE

Terahertz radiation in Biological Research, Investigations on Diagnostics and study on potential Genotoxic Effects

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Survey on the uses of THz-radiation for the THz-
bridge consortium: Preliminary results

Submitted by:

TVL: P. Taday, Teraview Limited – Cambridge, UK

UNOTT: R. Clothier, School of biomedical Sciences, The University of
Nottingham – Nottingham, UK

The Survey "Safety issues at specific occupational sites" was carried out in the frame of the project THz-BRIDGE "Terahertz radiation in biological research, investigation on diagnostics and study on potential genotoxic effects" funded in the framework of the specific research and technological development programme "Quality of life and management of living resources" of the European Union.

The survey was designed to look at safety issues at specific occupational sites. These were defined as sites where THz sources are employed or in development. Due to the early stage of the technology these are to be mainly found in Universities or Research facilities. A questionnaire was designed by the THz bridge consortium members and made available as an on-line form via the THz bridge web site. The aim was to collect for the first time in one place a survey of all currently used terahertz sources, and obtain information on the exposure conditions to occupational workers. The questionnaire also requested information about groups' current precautions and if they perceived any risks in using THz-radiation.

As of February 2003, 18 groups had responded to the questionnaire, several of these groups had multiple THz-sources. (One of these groups was rejected as they submitted laser parameters rather than THz-parameters). A break down of the THz sources is shown in table and figure 1. 41.2% of the responses came from the European Union; the remaining contributions came from the United States, Japan and Russia. The THz-bridge consortium estimate currently that this only ten per cent of the active terahertz community. It is engaging in a more proactive approach to obtain more responses from the community.

The questionnaire was designed first to obtain information about the THz source parameters, that is, the central frequency, the average and peak power, the tuning

range, the pulse duration repetition rate. These results are summarised in table 2.

The second section of the questionnaire was concerned with the safety precautions taken by occupational workers and their perception to exposure to THz radiation. The results are summarised in table and figure 3.

Since, lasers are involved in the generation of most of the THz sources 75% of the respondents comply or are aware of current European or US safety laser safety standards. The remaining respondent did not answer the question.

The overall majority of respondents were not concerned with exposure to THz radiation and few took precautions to avoid exposure. Only two respondents expressed concerns about exposure. One was concerned with acute effects and the other of chronic effects. The later respondent is involved in the research of exposure of THz radiation to cells. The respondents who did take precaution exposure to THz-radiation were mainly from the free-electron laser (FEL) community; these groups are more concerned about exposure to x-ray radiation and as consequence those precautions there was limited exposure to THz-radiation.

Occupational workers who are exposed to terahertz radiation receive several doses a day, each lasting between a few minutes up to 20 minutes. It is not noted if these exposures are logged.

Preliminary summary

- 17 groups returned data (1 off these was rejected as they submitted laser parameters rather than THz).
- 2 groups expressed concerns of exposure to THz radiation.
- Mainly FEL groups take precaution against THz radiation this maybe to the x-ray radiation.
- It appears currently that there are no records taken of occupational workers exposure to THz radiation.

Additional work

Over the next twelve months attempts will be taken to increase the number of groups contributing to this survey.

By February 2004 it is hoped that the THz-bridge consortium will be able to make preliminary recommendations to the THz User community of precautions and safety limits of exposure to THz radiation.

Table 1: Breakdown of THz-sources

19	Solid state based systems
2	Free Electron Laser
3	Solid-state multiplier
2	Semiconductor Laser
2	Gas Lasers

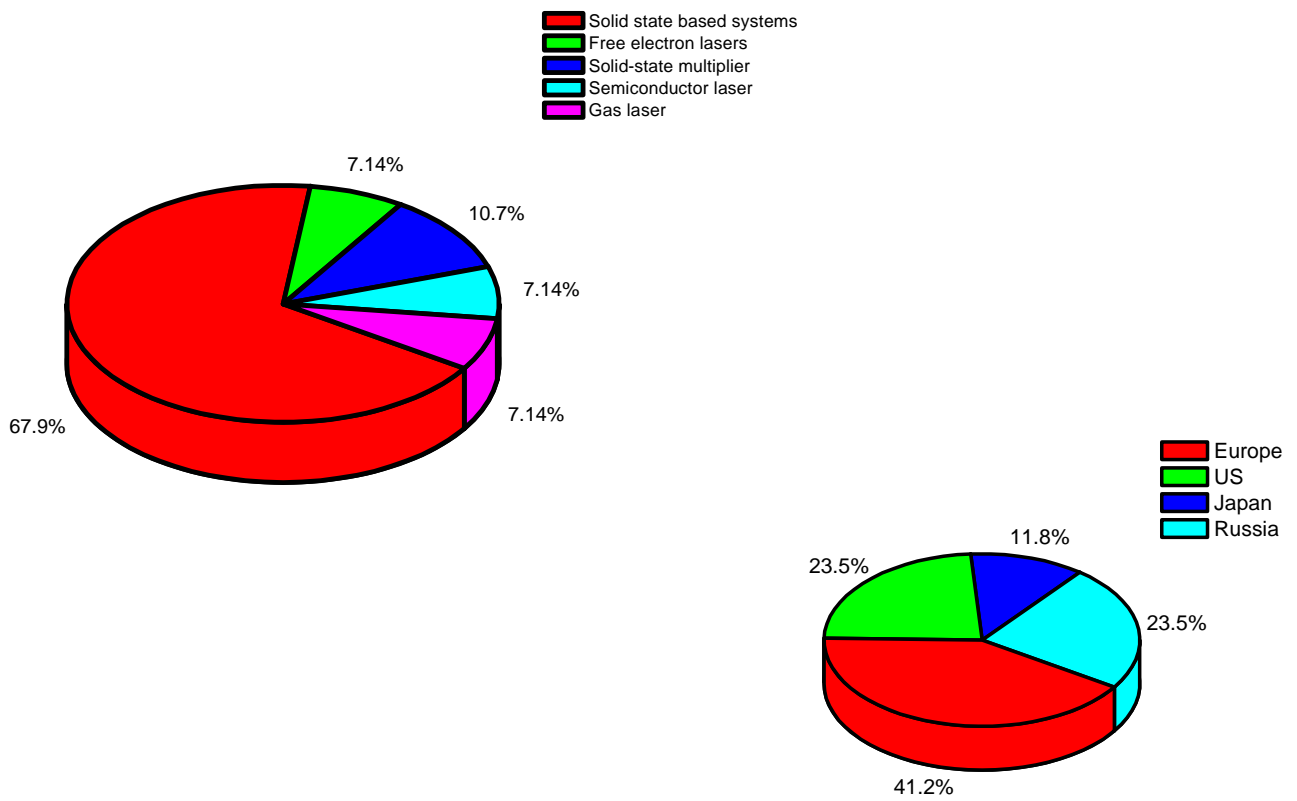


Figure 1: Chart of distribution of respondents' laboratory systems. The right-hand pie chart shows the break down of national groups.

Table 2: Summary of the THz sources parameters

Central Frequency	<300 GHz	4
	0.3 – 5 THz	20
	>5 THz	2
	Variable 0.3-33 THz	2
Average Power	<0.1 μ W	3
	0.1 - 10 μ W	7
	10– 100 μ W	4
	0.1 – 10 mW	7
	10 – 100 mW	4
Peak Powers	<1 mW	5
	1-100 mW	6
	0.1-10 W	5
	10 W – 2 kW	2
	>2 kW	1
Pulse duration	0.3 – 2 ps	12
	50 ns	1
	1-5 ms	4
	0.1 - 5 ms	4
	CW	3
Repetition rates	~80 MHz	11
	~250 kHz	
	10-1 kHz	6
	1000-10 Hz	5
	<10 Hz	2
Laser amplitude modulated	Yes	11
	No	13

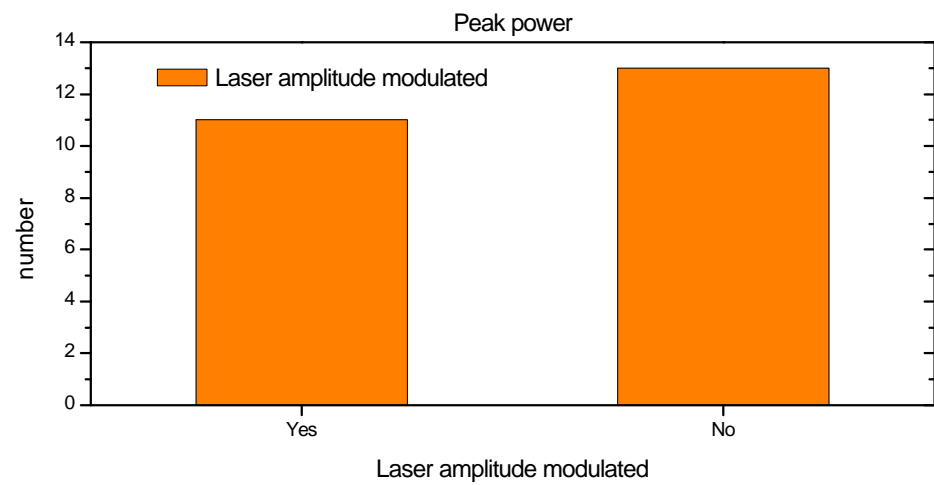
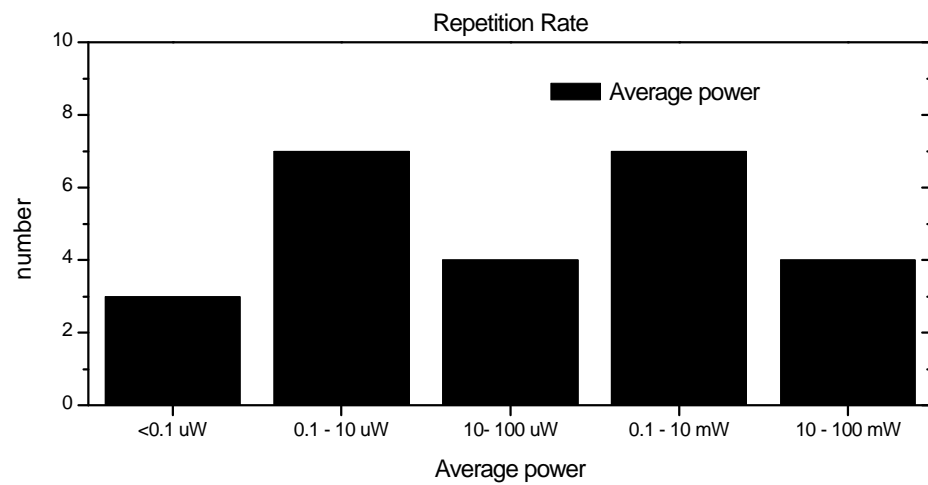
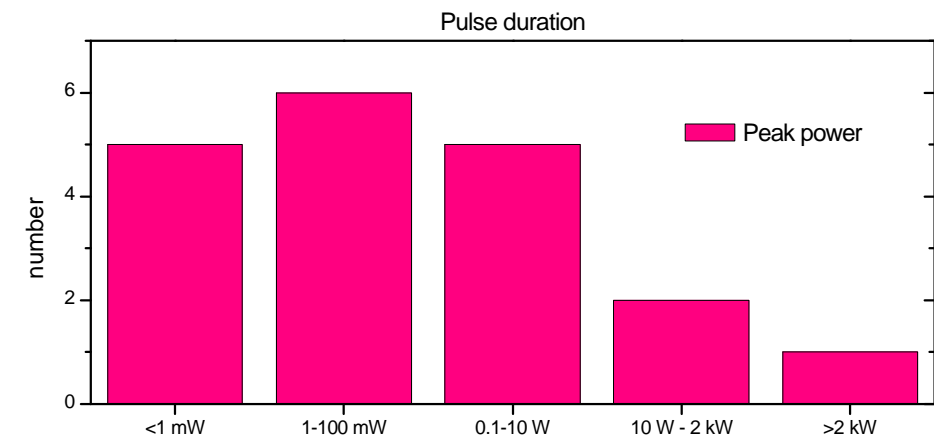
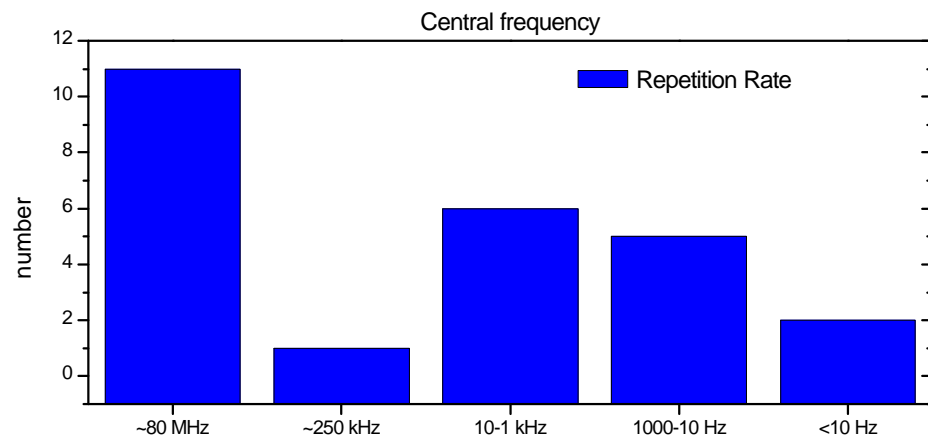
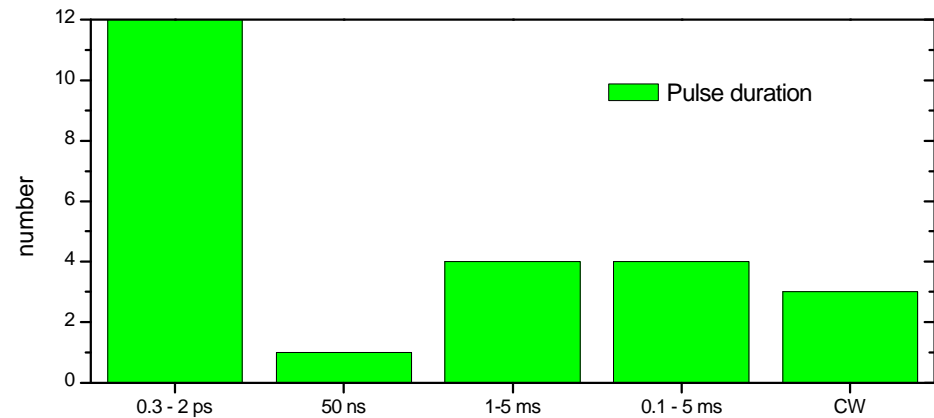
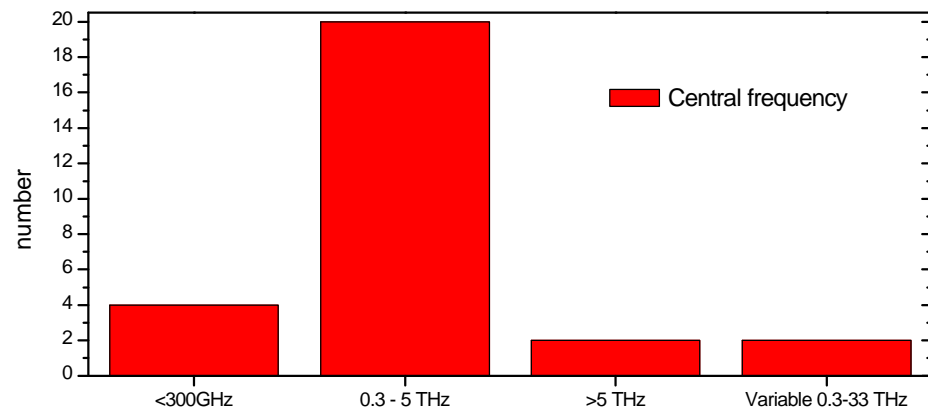


Table 3: Concerns and precautions of exposure of THz radiation to occupational workers

Regulations	ANSI-Z-136-1	6
	EN60825-1	6
	ENV50166-2	1
	No return	5
Precautions	None	5
	Apparatus encased in glass	1
	Enclosed in box	1
	Lead shield	2
	No return	8
Occupational workers exposed to THz-radiation	Yes	7
	No	10
Do you have any concerns?	No	15
	Yes	2
	Acute effects	1
	Chronic effects	1
	No returns	2
Number of personnel exposed	1 to 3	6
	4 to 7	3
Duration	Less than 6 minutes	5
	6 to 20 minutes	2
	No return	2
Frequency	Several times a day	5
	Several times per week	0
	Several times per month	2
	No return	2

