EUROPEAN SYNCHROTRON RADIATION FACILITY

INSTALLATION EUROPEENNE DE RAYONNEMENT SYNCHROTRON

Experiment Report Form

The double page inside this form is to be filled in by all users or groups of users who have had access to beam time for measurements at the ESRF.

Once completed, the report should be submitted electronically to the User Office via the User Portal:
https://wwws.esrf.fr/misapps/SMISWebClient/protected/welcome.do

Deadlines for submission of Experimental Reports

Experimental reports must be submitted within the period of 3 months after the end of the experiment.

Experiment Report supporting a new proposal ("relevant report")

If you are submitting a proposal for a new project, or to continue a project for which you have previously been allocated beam time, you must submit a report on each of your previous measurement(s):

- even on those carried out close to the proposal submission deadline (it can be a *"preliminary report")*,
- even for experiments whose scientific area is different form the scientific area of the new proposal,
- carried out on CRG beamlines.

You must then register the report(s) as "relevant report(s)" in the new application form for beam time.

Deadlines for submitting a report supporting a new proposal

- 1st March Proposal Round - **5th March**
- 10th September Proposal Round - **13th September**

The Review Committees reserve the right to reject new proposals from groups who have not reported on the use of beam time allocated previously.

Reports on experiments relating to long term projects

Proposers awarded beam time for a long term project are required to submit an interim report at the end of each year, irrespective of the number of shifts of beam time they have used.

Published papers

All users must give proper credit to ESRF staff members and proper mention to ESRF facilities which were essential for the results described in any ensuing publication. Further, they are obliged to send to the Joint ESRF/ ILL library the complete reference and the abstract of all papers appearing in print, and resulting from the use of the ESRF.

Should you wish to make more general comments on the experiment, please note them on the User Evaluation Form, and send both the Report and the Evaluation Form to the User Office.

Instructions for preparing your Report

- fill in a separate form for each project or series of measurements.
- type your report in English.
- include the experiment number to which the report refers.
- make sure that the text, tables and figures fit into the space available.
- if your work is published or is in press, you may prefer to paste in the abstract, and add full reference details. If the abstract is in a language other than English, please include an English translation.

ESRF	**Experiment title:** Micro-beams: X-rays for pain relief	**Experiment number**: MD-779
Beamline: ID17	**Date of experiment**: From 4 to 7 and from 19 to 22 february 2014	**Date of report**:
Shifts: 18	**Local contact(s)**: Herwig Requardt, Bravin Alberto	*Received at ESRF:*

Names and affiliations of applicants (* indicates experimentalists):

Gabriele E. M. Biella*[1], Pantaleo Romanelli[2], Antonio G. Zippo*[1], Sara Nencini*[1]

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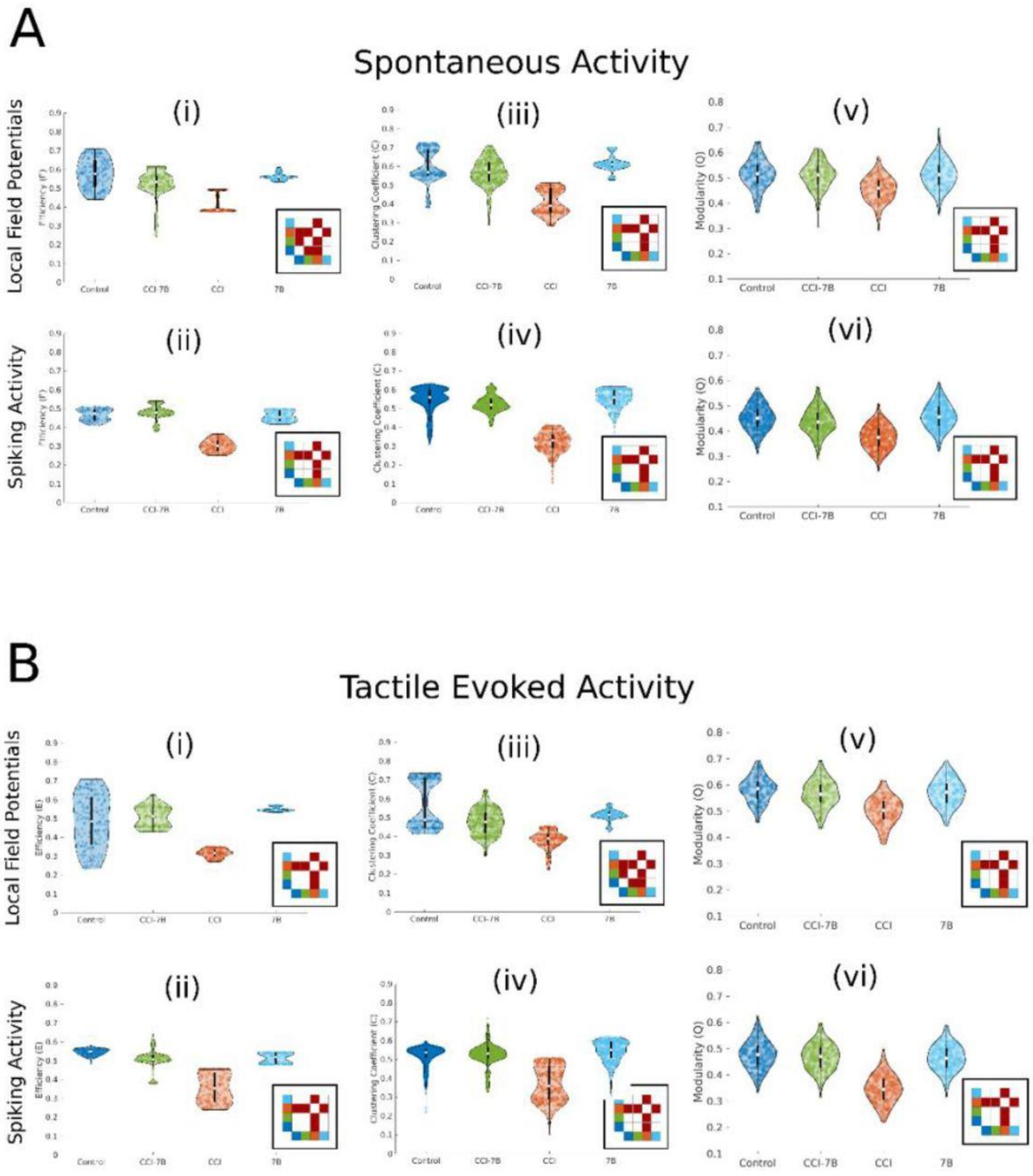
Report:

The MD-779 expriment has produced a set of consistent evidences showing the efficicacy of the *in vivo* X-ray synchrotron microbeam irradiation treatment which generated analgesia in rodent models of chronic pain (CP). The manuscript containing all obtained results (entitled “Removal of behavioural and electrophysiological signs of chronic pain by in vivo microsections of rat somatosensory cortex with parallel X-ray microbeams”) is currently under review and can be downloaded at https://doi.org/10.1101/528539 .

Summarily, in vivo high-dose X-ray microbeam transcranial irradiation of the hind-limb somatosensory cortex in a rat model of CP abolishes all the behavioral and electrophysiological signs (figure below) of CP with no detrimental effects when delivered on control animals. Spatially fractionated synchrotron-generated X-rays (with doses of 360 Grays) in form of arrays of seven quasi-parallel, laminar microbeams, 100 µm wide, and spaced 400 µm center-to-center, were delivered to a set of rats with and without a neuropathic chronic pain model. Local cuts are effective on groups of horizontal neuronal connections (fibers) with these parameters. The ablation of neurons and glial cells along the beam irradiation path becomes negligible in comparison with the efficiency of the functional segregation achieved by the modularization. In fact, the volume of the transected horizontal fibers by the sevenfold microcuts represents a tiny amount of the global cortical connections. However, it efficiently interferes on the local connectivity of the hind-limb sensory cortex fibers leaving seemingly intact all the other sensory contingents.



Caption: Functional network statistics. (A) Functional connectivity statistics (Efficiency, Clustering Coefficient, Modularity) extracted from the local field potentials (first row, i-iii-v) and spiking activity (second row, ii-iv-vi) in spontaneous state. (B) Functional connectivity statistics extracted from the local field potentials (third row, i-iii-v) and spiking activity (fourth row, ii-iv-vi) in in tactile-evoked state. The inset matrices indicate the statistical significance after Tukey post-hoc contrast test ($P < 0.05$) among groups. CCI-7B is the group of CP model animals treated with the irradiation protocol; CCI is the group of CP model animals and 7B is the group of normal animals treated with the irradiation protocol.