Boron measurements in cells and in-vitro tissues

Worshop MAECI - MOST, Rome.

Ian Postuma

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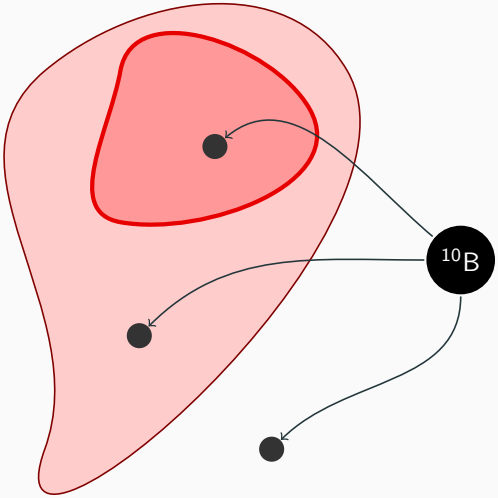
PostDoc @ INFN-PV - ian.postuma@pv.infn.it

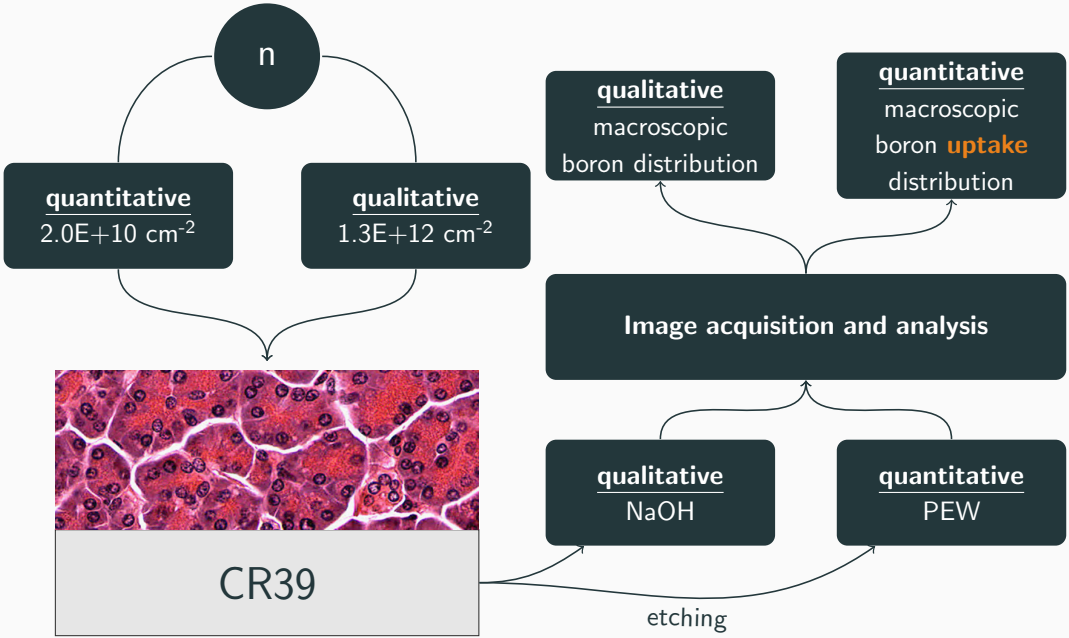
Where does ^{10}B go ?

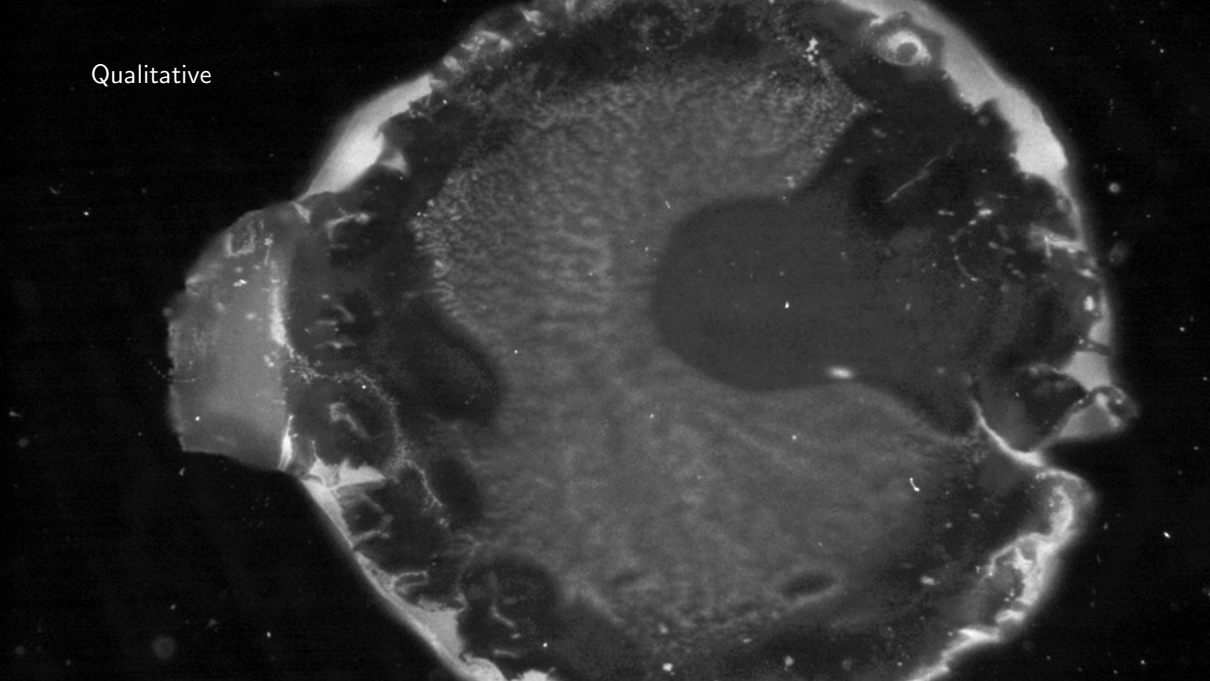
mean **uptake** ✓

inter-cellular distribution ✓

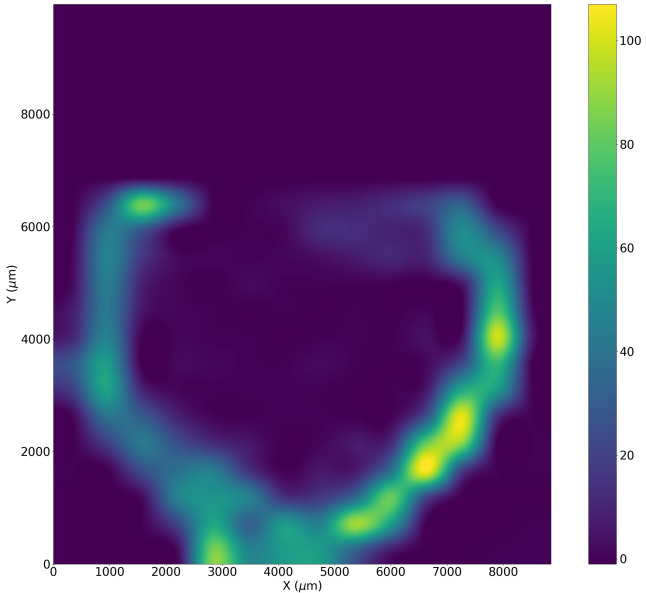
intra-cellular distribution ?



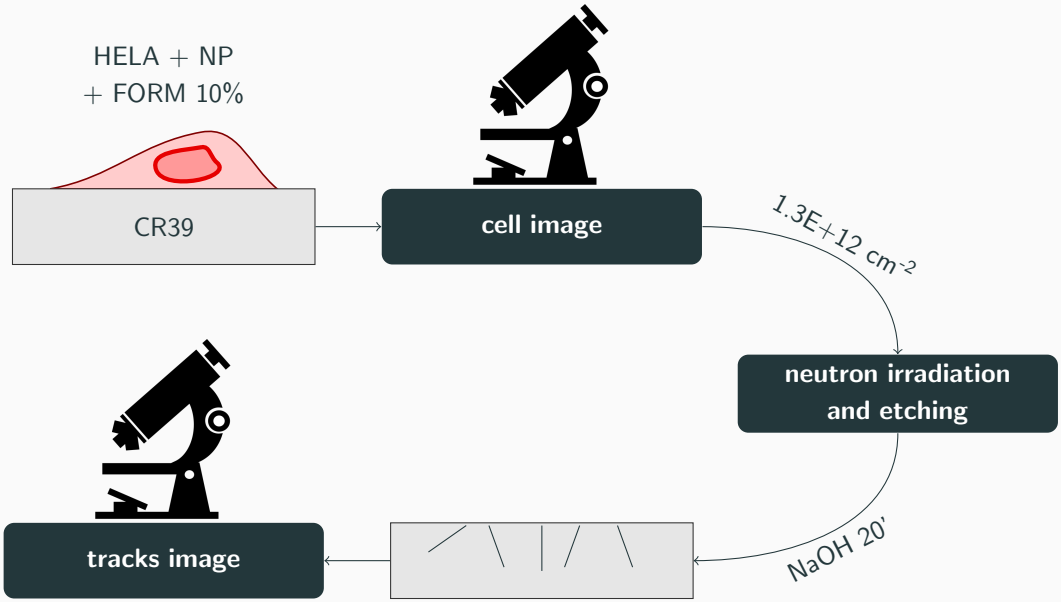

n
quantitative
2.0E+10 cm-2
qualitative
1.3E+12 cm-2
qualitative
macroscopic
boron distribution
quantitative
macroscopic
boron uptake
distribution
Image acquisition and analysis
CR39
qualitative
NaOH
quantitative
PEW
etching

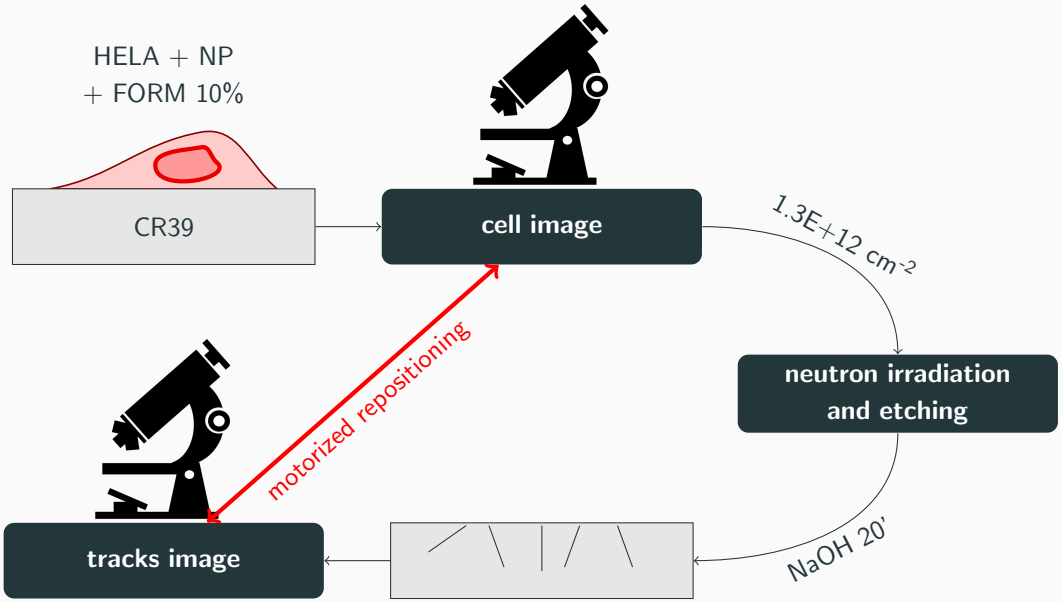

Qualitative

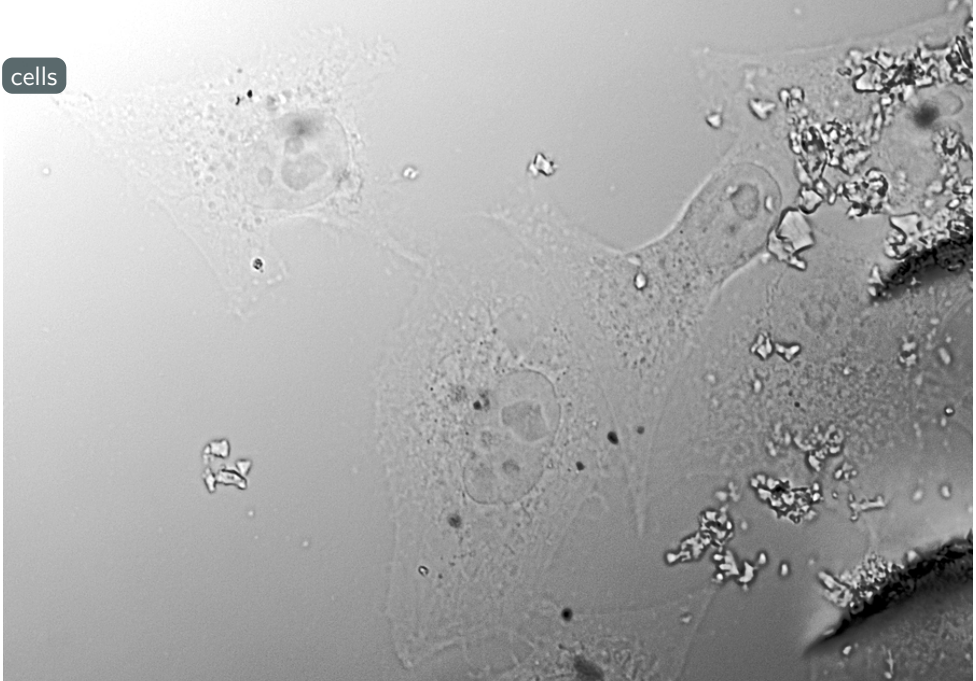
Quantitative



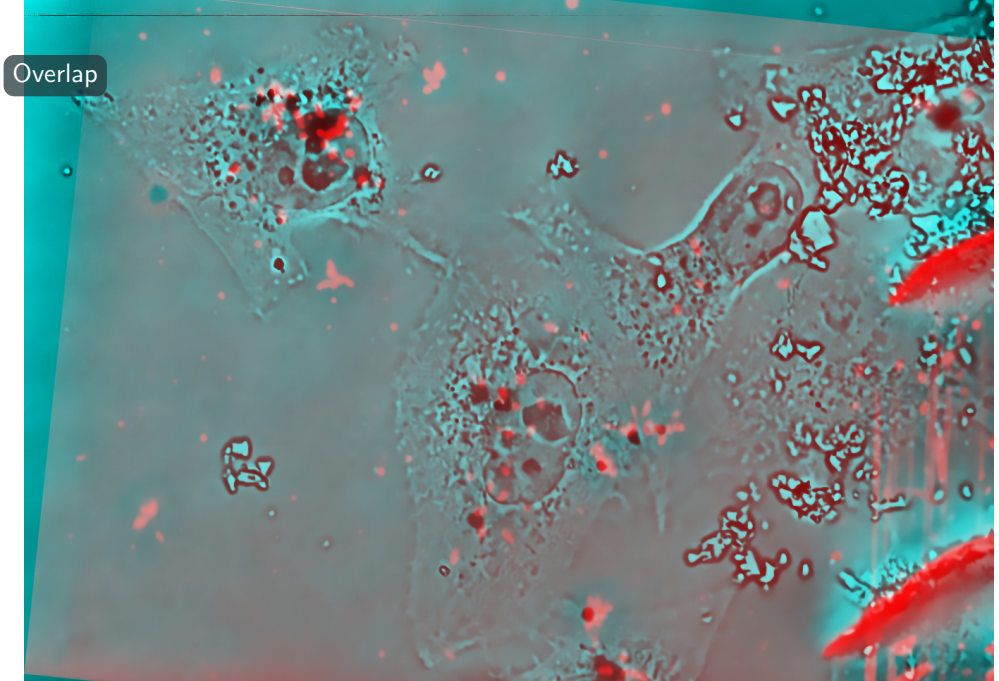
A new autoradiography approach


HELA + NP
+ FORM 10%
CR39
cell image
1.3E+12 cm-2
neutron irradiation
and etching
NaOH 20'
tracks image


HELA + NP
+ FORM 10%
CR39
cell image
1.3E+12 cm-2
neutron irradiation
and etching
NaOH 20'
tracks image
motorized repositioning

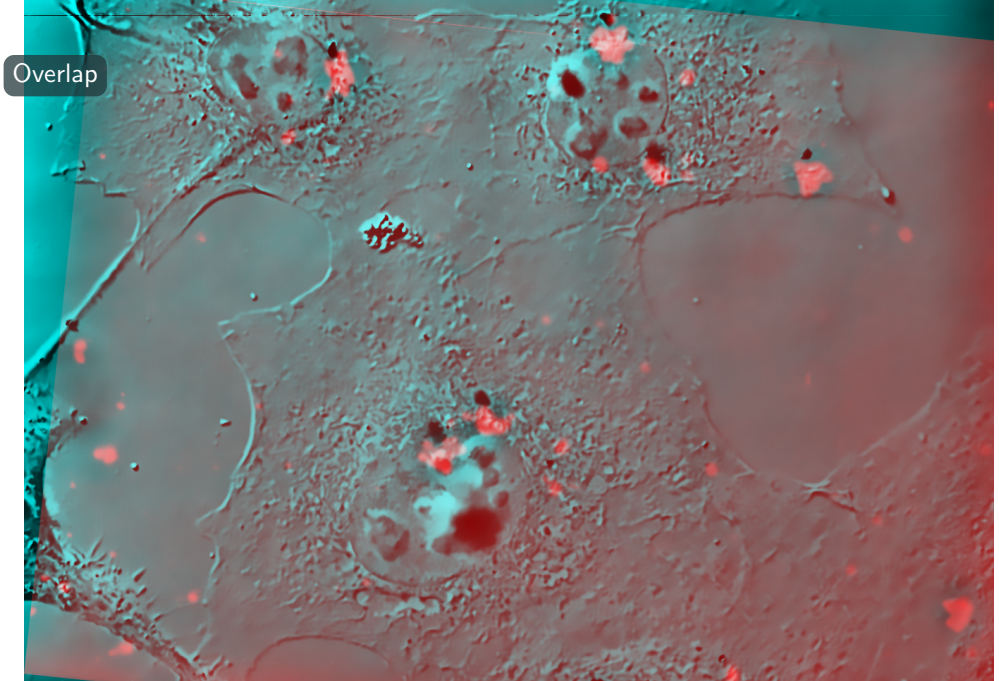

cells

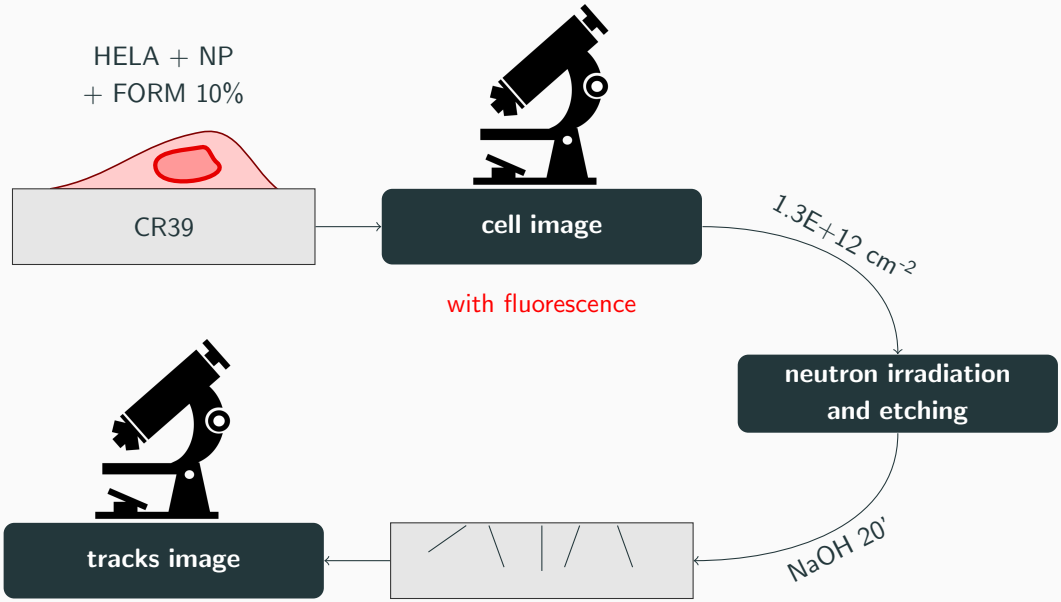

tracks

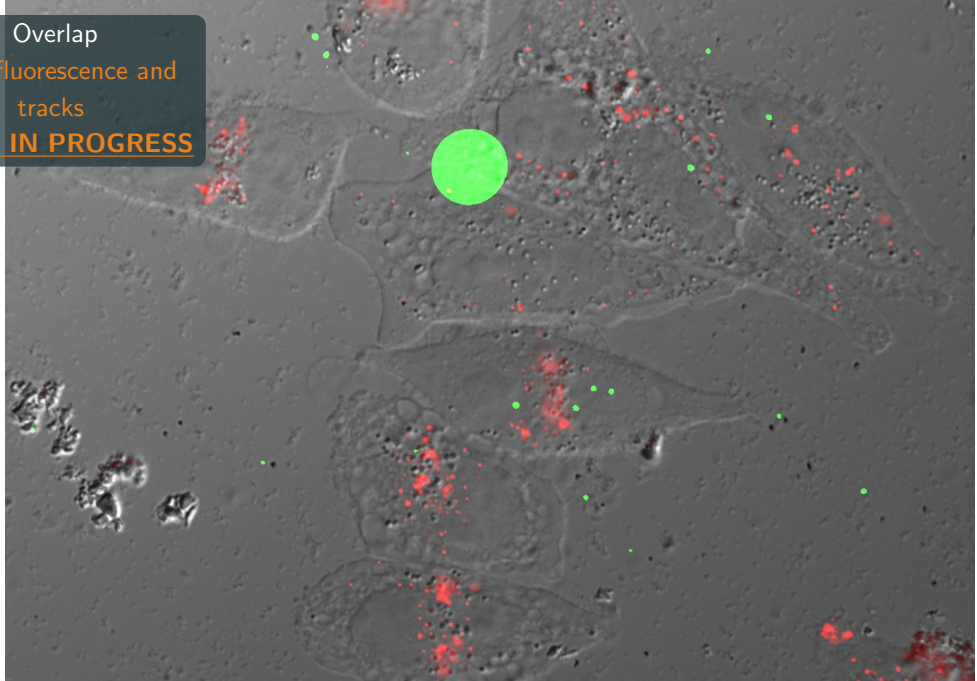

Overlap


cells


tracks


Overlap


HELA + NP
+ FORM 10%
CR39
cell image
with fluorescence
1.3E+12 cm-2
neutron irradiation
and etching
NaOH 20'
tracks image


Overlap
cells, fluorescence and tracks
WORK IN PROGRESS

IN CONCLUSION

irradiation protocol and cell growth are set

To do:

machine learning to count tracks

re-positioning system has to be optimized

SEM images are under investigation

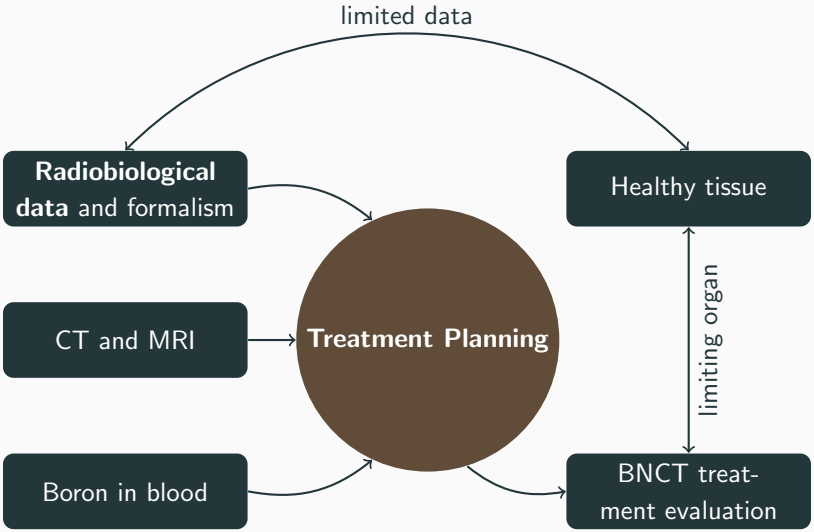
EPISKIN™

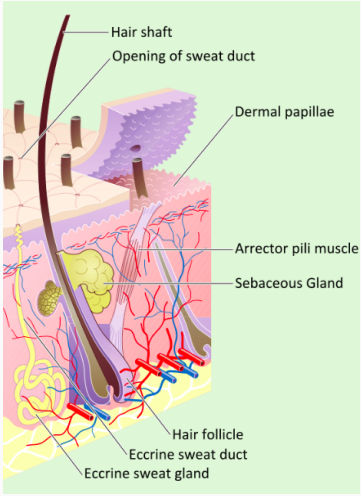
in-vitro

experimental data

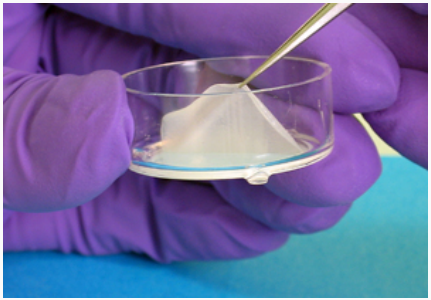
in-vivo

Radiobiological data and formalism: CBE/RBE, T/N ratio, isoeffective...


limited data
Radiobiological data and formalism
CT and MRI
Boron in blood
Treatment Planning
Healthy tissue
limiting organ
BNCT treat-ment evaluation

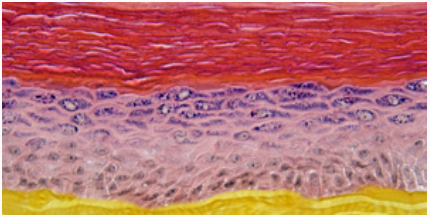


- Skin can be a **limiting organ** when irradiating thorax or limbs regions;
- **RBE and CBE** factors are available;
- ^{10}**B uptake** models for BPA are available;
- limited data on radiobiological endpoint different from cell death, consequently **complications are difficult to predict**;
- in-vitro and in-vivo models are **not exhaustive**.



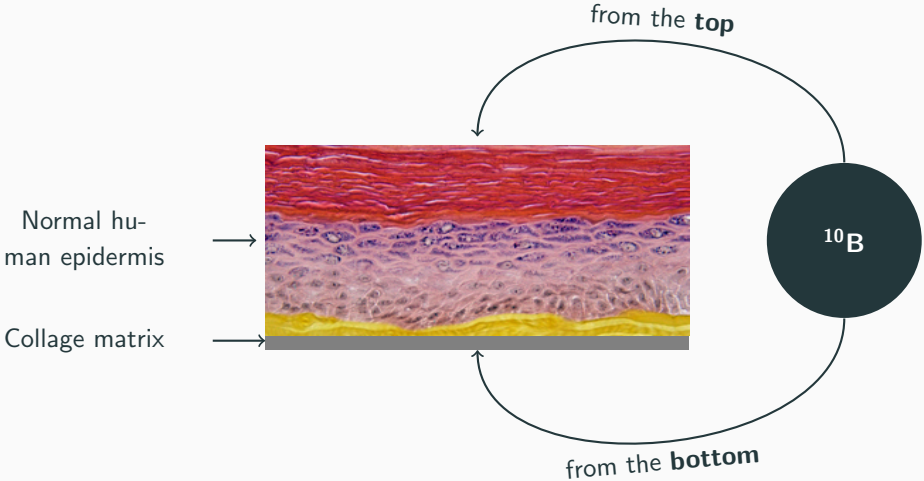
we want to propose an alternative model to evaluate the limiting dose to the skin by using **Episkin™**

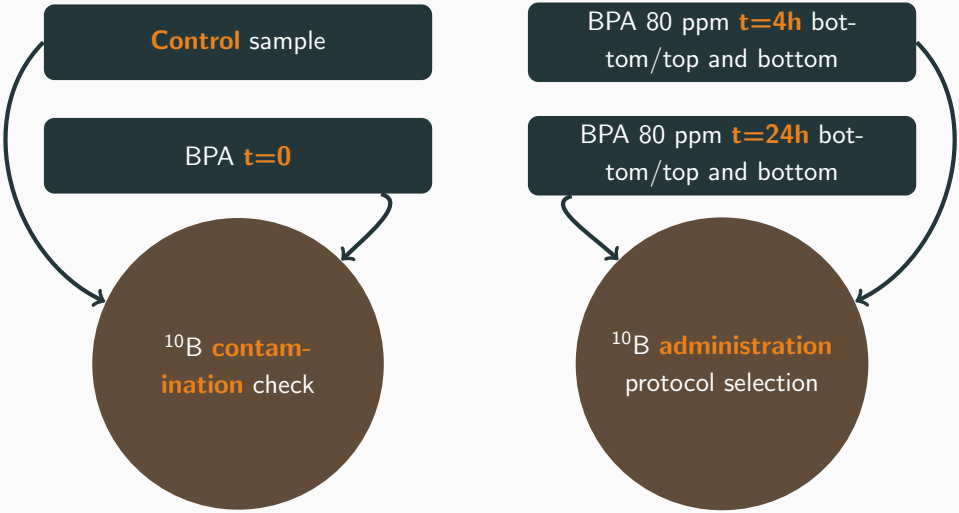
An *in-vitro* reconstructed human epidermis from normal **human keratinocytes.**



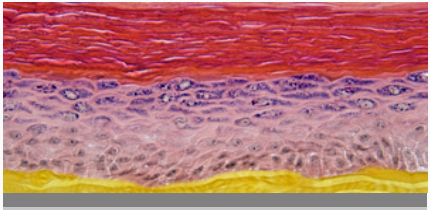
Materials and Methods

it is necessary to explore the **uptake of BPA** in EpiSkin^{TM}.



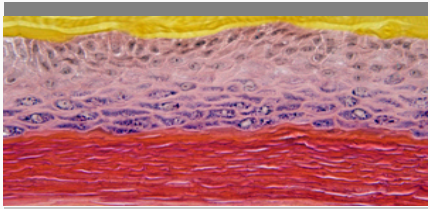

Control sample
BPA t=0
^{10}B contamination check
BPA 80 ppm t=4h bottom/top and bottom
BPA 80 ppm t=24h bottom/top and bottom
^{10}B administration protocol selection

Matrix on CR39



CR39

Episkin^{TM} on CR39



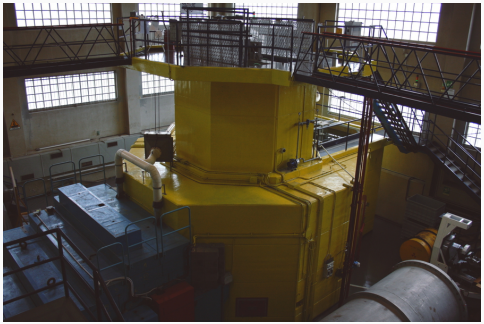
CR39

Qualitative neutron autoradiography

Quantitative neutron autoradiography

Quantitative neutron autoradiography

TC 30' at 2kW



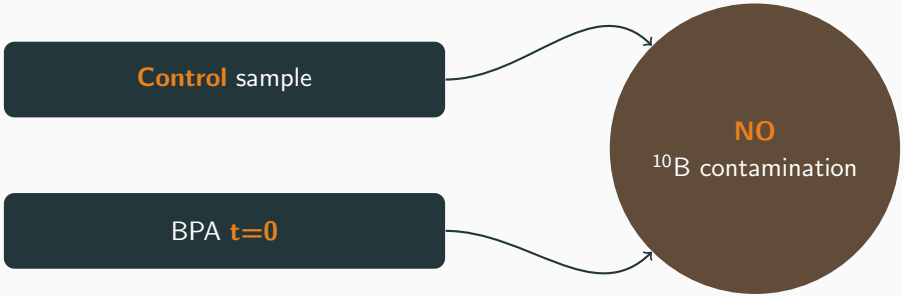
TC 2h at 250kW

Qualitative neutron autoradiography

10' in PEW at 70°C

20' in NaOH 6.25M at 70°C

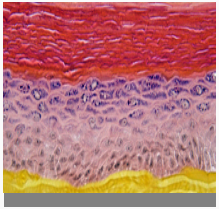
RESULTS


Control sample
BPA t=0
NO
^{10}B contamination

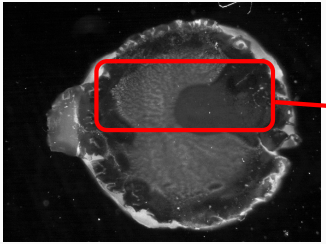
CR39

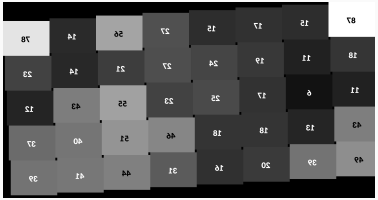
CR39

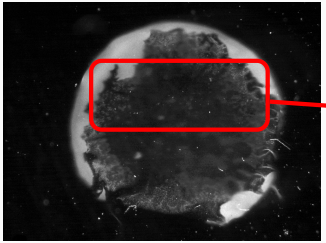
bottom/top
exposure



bottom exposure

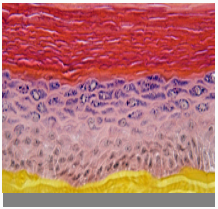


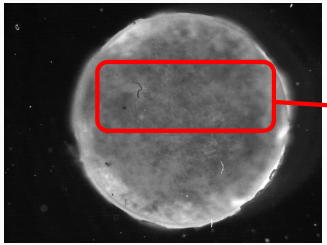


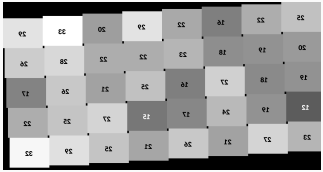


	2h	**4h**	18h	24h	48h
^{10}B (ppm)	1.4	**25**	5	30	35
err (%)	200	**20**	200	200	200

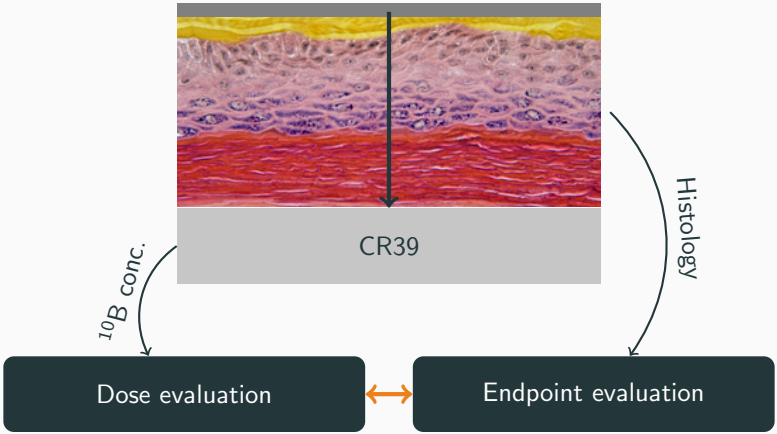
bottom/top exposure 4h 80ppm BPA







Can boron be trapped in the *collage matrix ?*
Can we quantify its effect on the ^{10}B concentration measurement ?



CONCLUSIONS

Episkin™ BPA treatment protocol was set

bottom/top exposure for 4h with 80ppm of BPA

THANKS

I. Postuma[1], D. Shu[2], C. Ferrari[3], L. Cansolino[3], P. Dionigi[3,4], P. Sommi[5], D. Ferraro[5], Greta Di Martino[6], U. Anselmi Tamburini[6], V. Ricci[5], S. Bortolussi[1,7], N. Protti[1], S. Fatemi[1], C. Magni[1,7], S. Altieri[1,7]

1. Istituto Nazionale Di Fisica Nucleare (INFN), Unit of Pavia, Italy
2. Nanjing University of Aeronautics and Astronautics (NUAA), Nanjing, China
3. Department of Clinical-Surgical, Diagnostic and Pediatric Sciences, University of Pavia, Italy
4. IRCCS S. Matteo Foundation, Pavia, Italy
5. Department of Molecular Medicine, University of Pavia, Italy
6. Department of Chemistry, University of Pavia, Italy
7. Department of Physics, University of Pavia, Italy