

Radiobiology at Surrey's Ion Beam Centre



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Radiobiology projects



- We are a national facility and access can be obtained for interesting projects
- Repair kinetics of DSBs in lymphocyte irradiated with protons (Leeds/Imperial)
- Low-dose hypersensitivity comparison with microbeam and broadbeam (Namur)
- Radiosensitisation
 - Gold nanoparticles
 - Olaparib
- Effect of chromosome relaxation due to SAHA on high-LET DNA damage (NIRS, Japan)



Magnetic
Quadrupole
Triplet

Electrostatic
Scanning

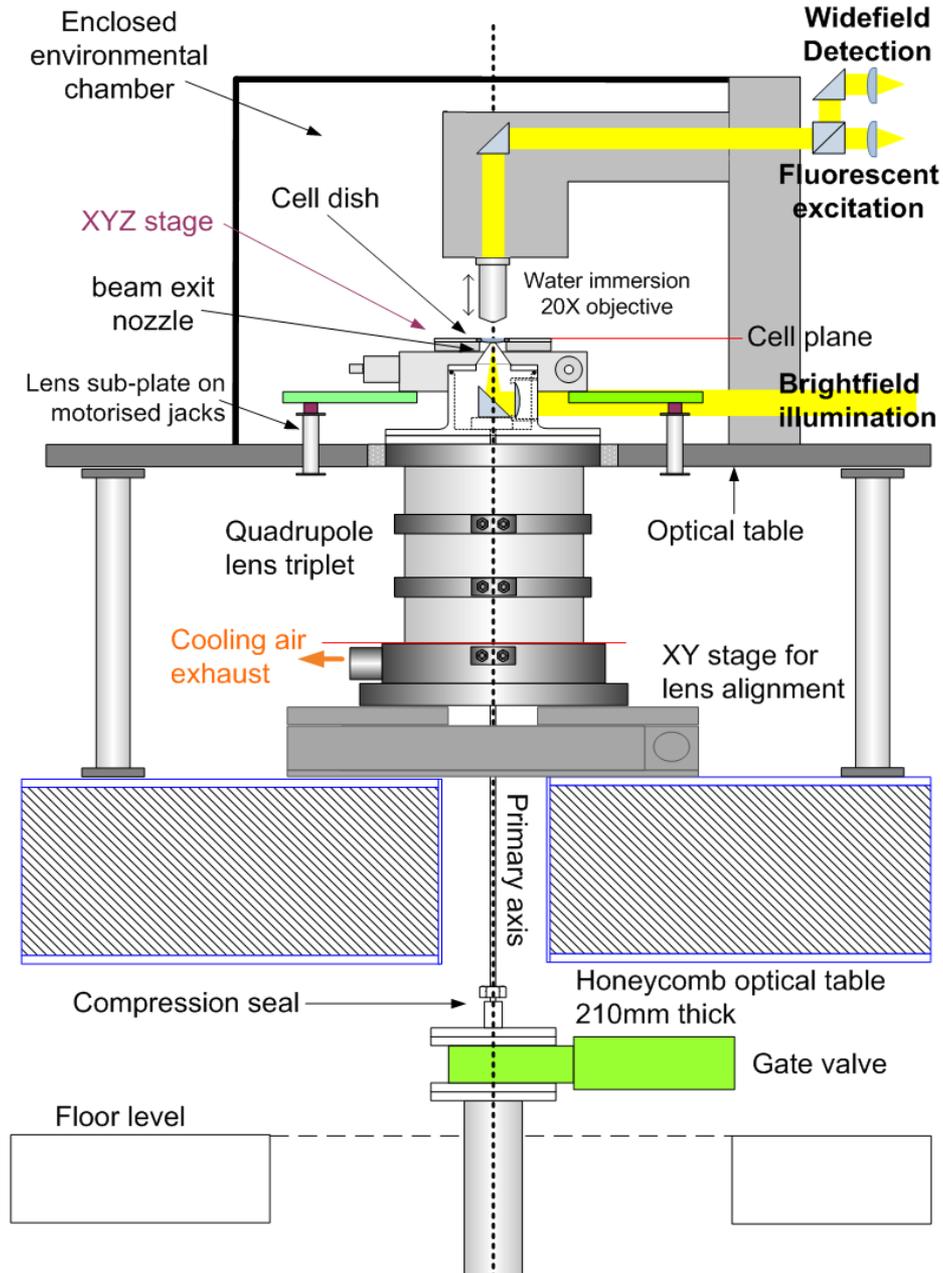
Wien Filter

Object Aperture

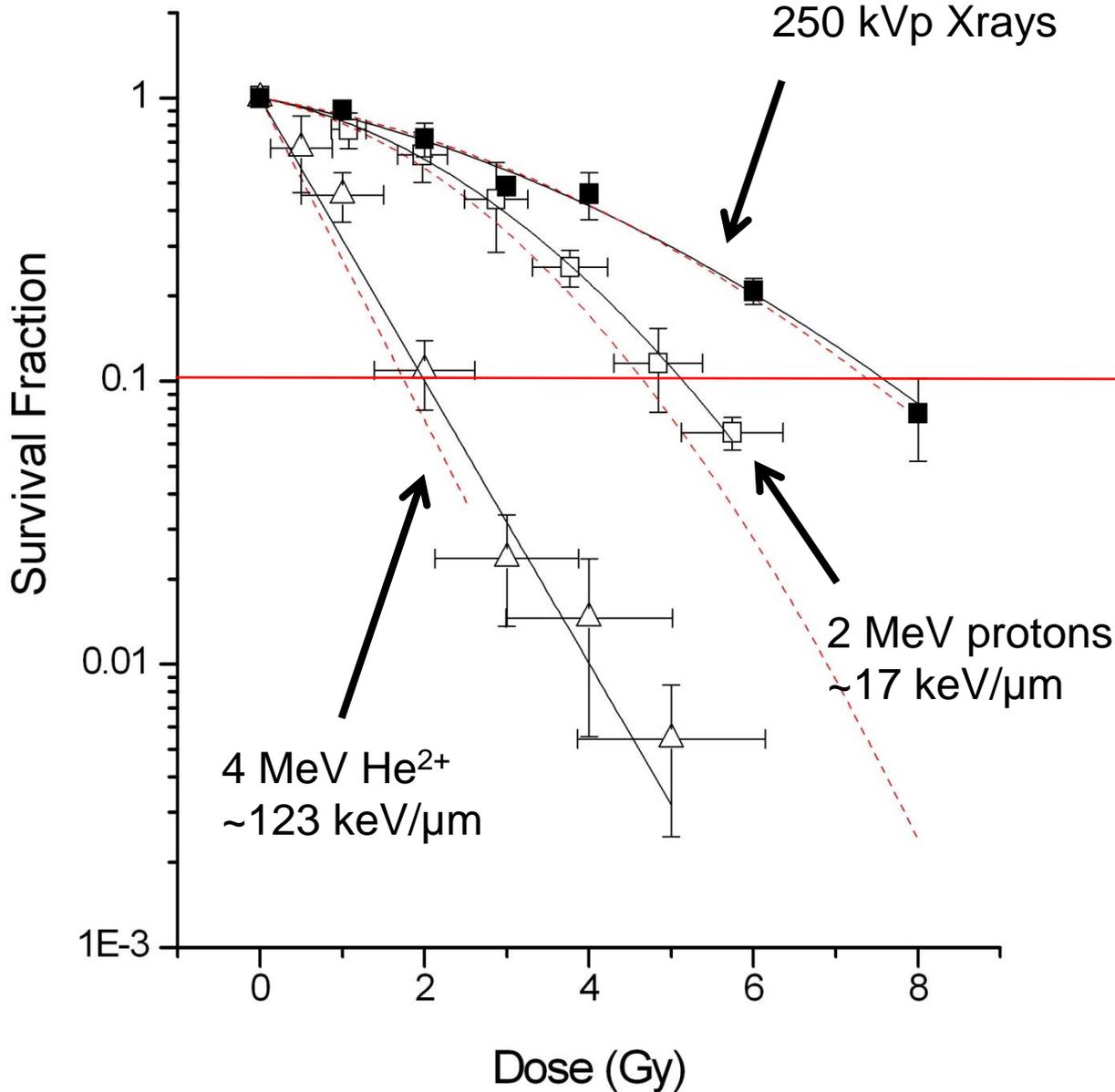
0.75m 90° bend

2 MV Tandem →

Quad Doublet
(Transport)



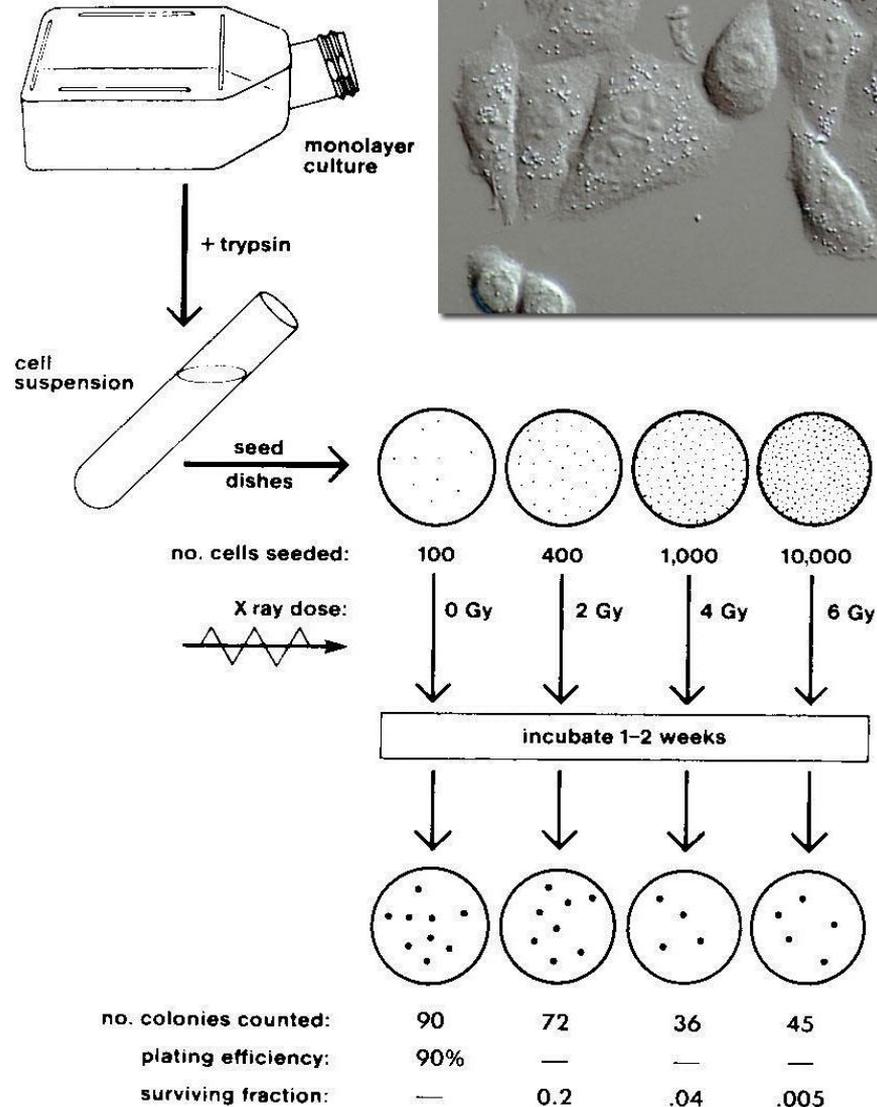
Survival curves



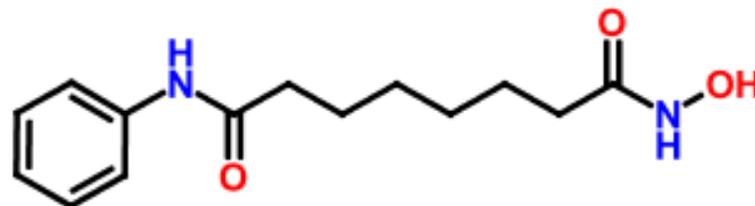
Clonogenic assay is the classical test for survival and radiosensitivity

The Relative Biological Effect (RBE) can be measured as a ratio compared to X-rays

Clonogenic assays



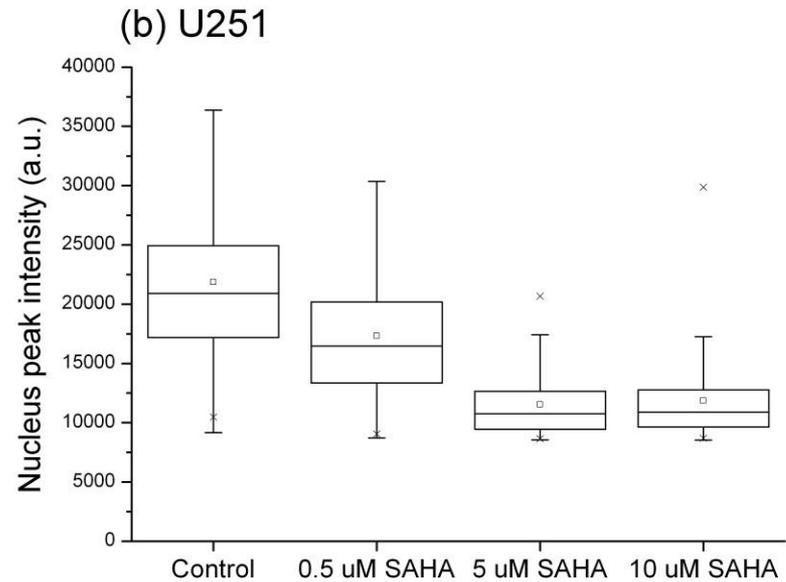
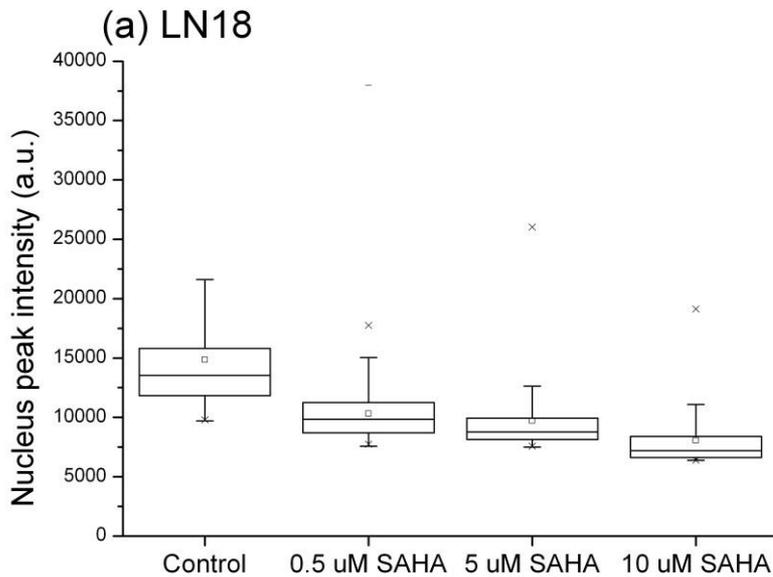
Drugs and high-LET radiation



- SAHA (Vorinostat) FDA approved for some cancers
- Can we use SAHA as a radiosensitiser?
- Will it be better with high-LET radiation?
- Can we use it to understand chromosomal architecture?

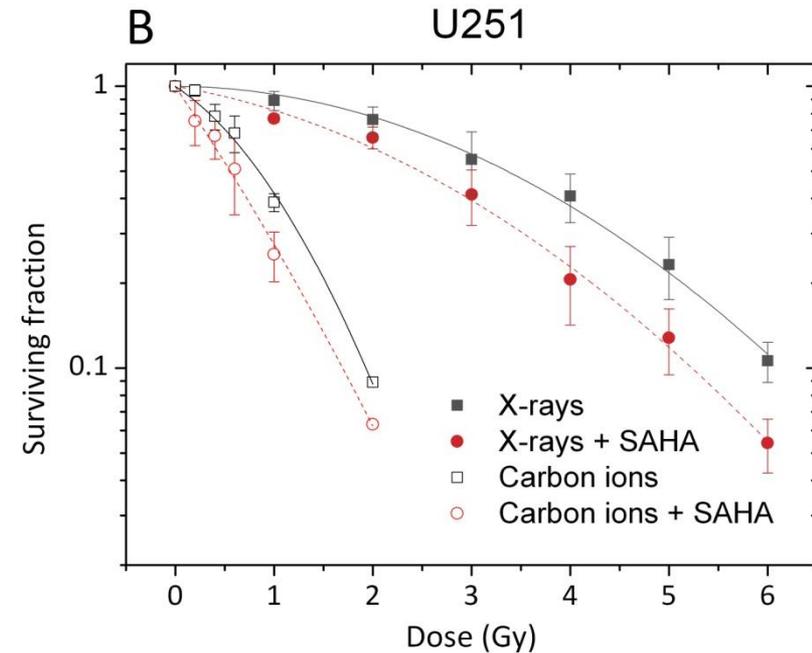
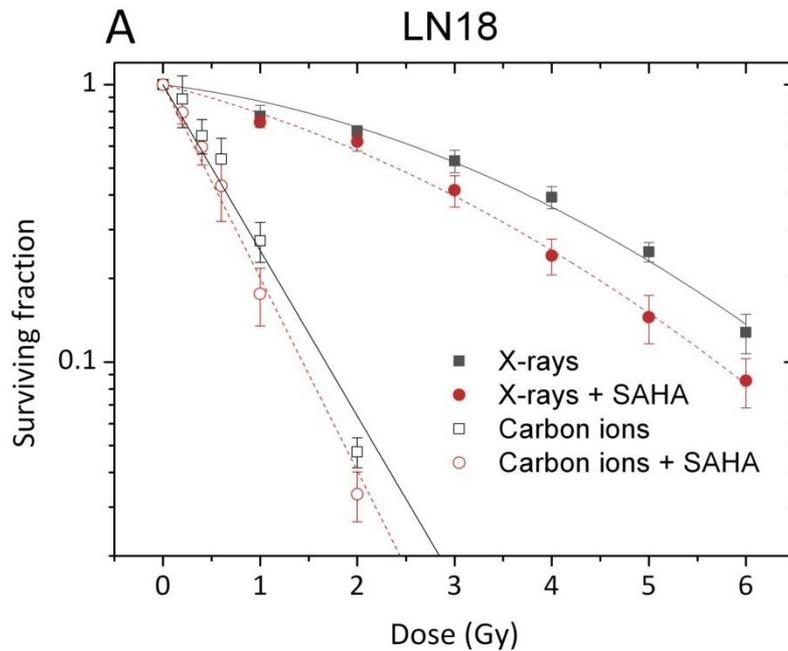
SAHA makes DNA relax

Hoescht fluorescence measured in the nucleus:



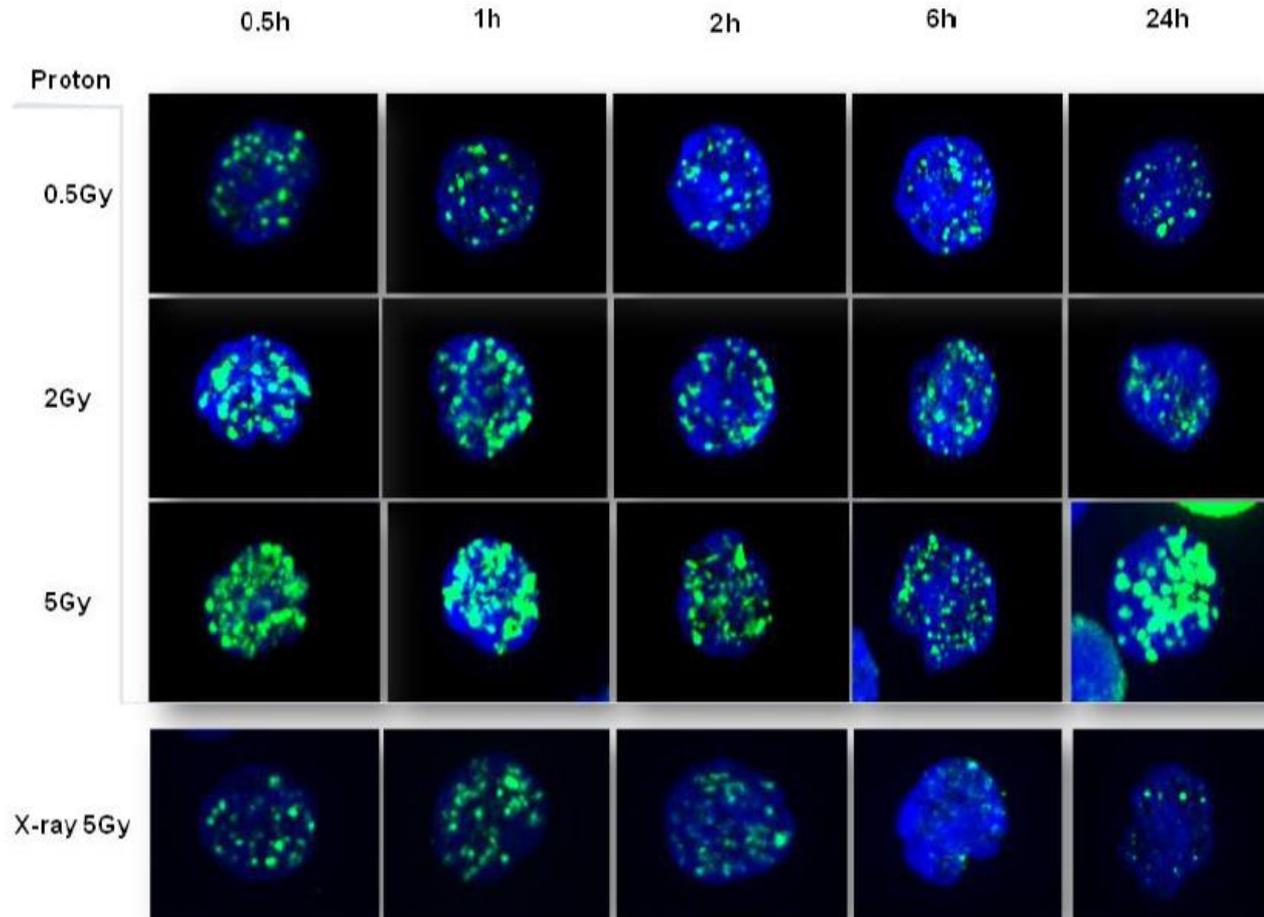
Decreasing peak intensity shows chromatin decondensation and density homogenisation due to SAHA.

SAHA makes radiation more effective



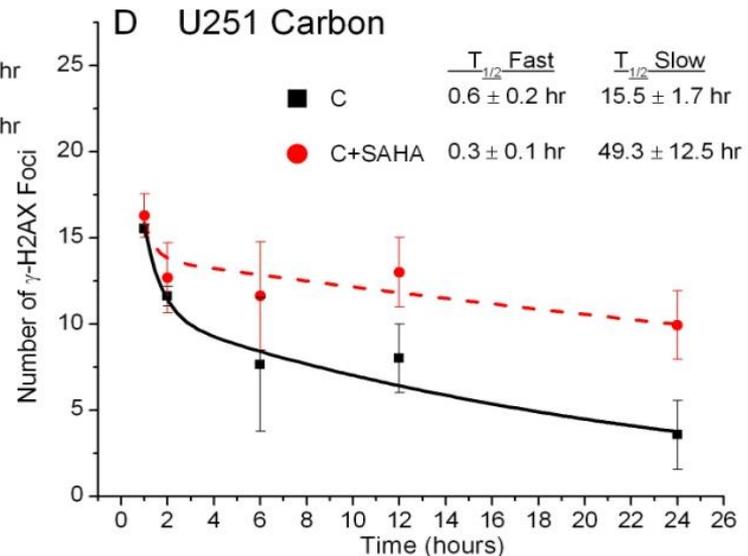
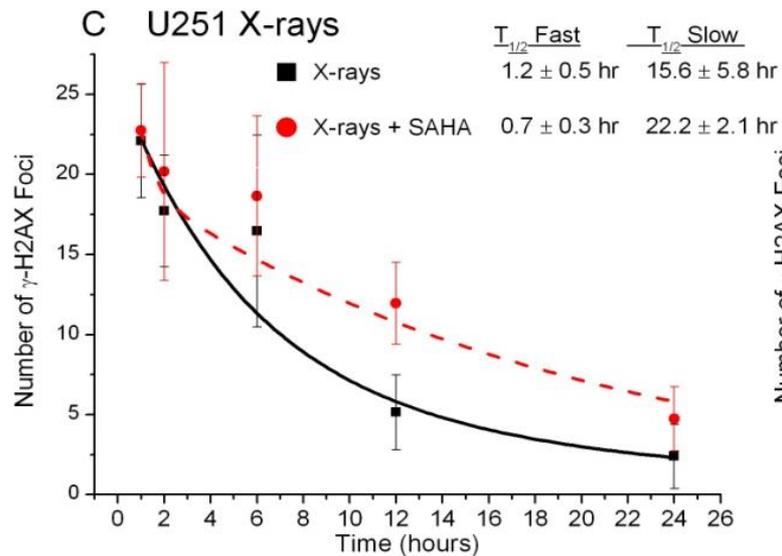
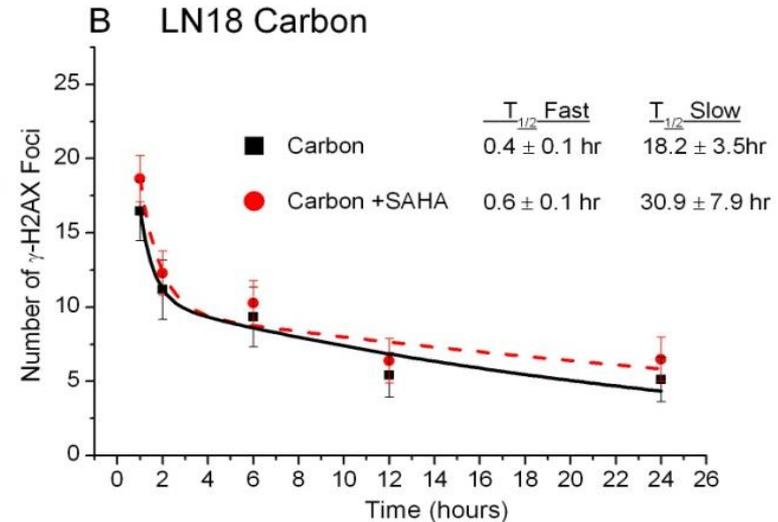
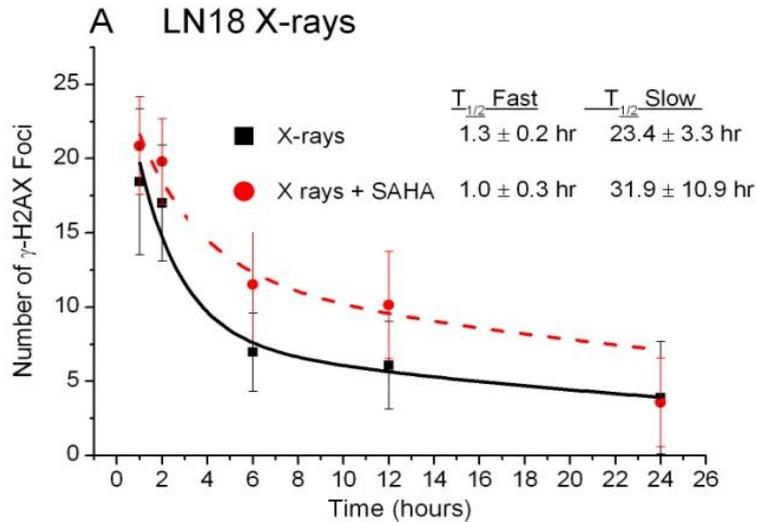
We use SAHA at a non-toxic concentration

DNA break repair kinetics foci formation assays

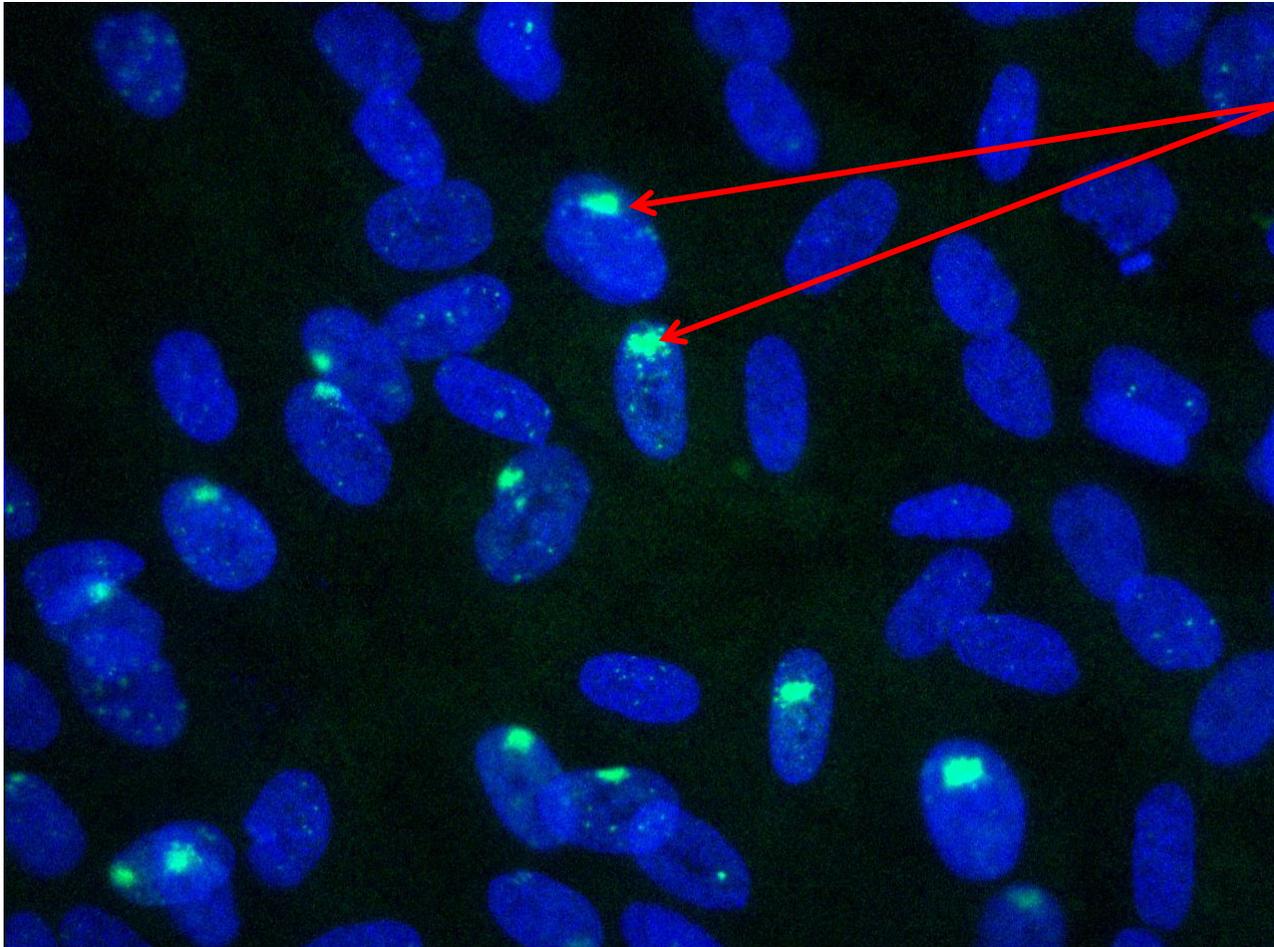


γ H2AX assay

SAHA slows DSB repair



Microbeam Irradiations

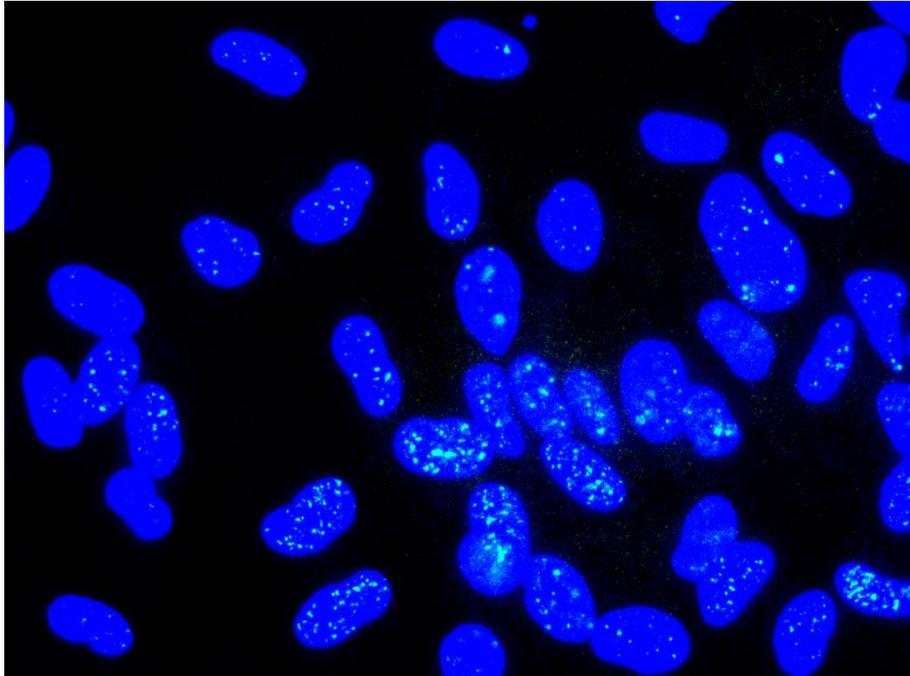


γ -H2AX staining here
(2 Gy ~ 50 particles at
3 MeV)

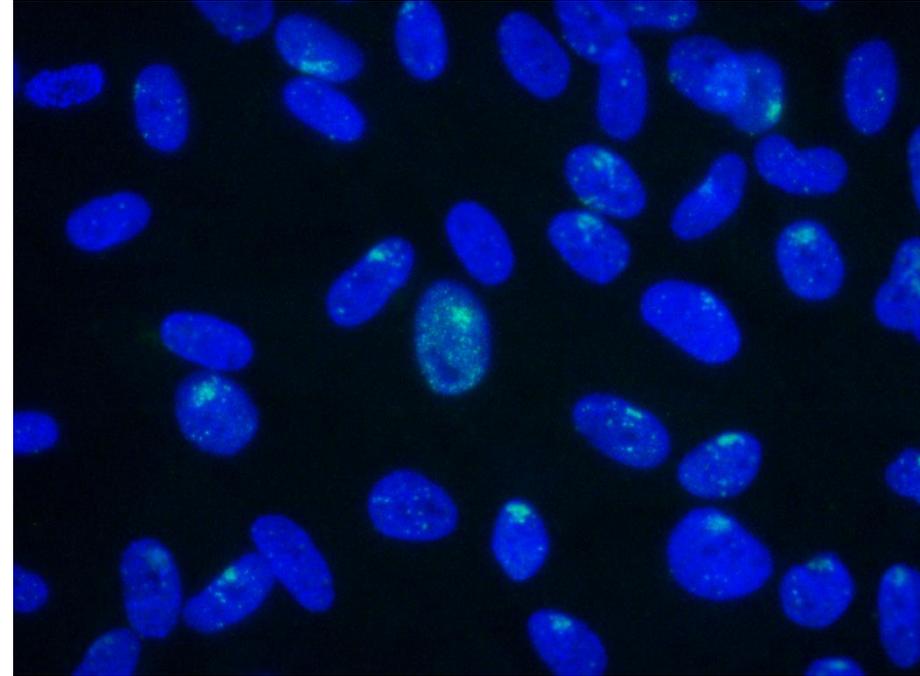
30 mins repair time

Microbeam Irradiations – 2 hours

control – 2 hours

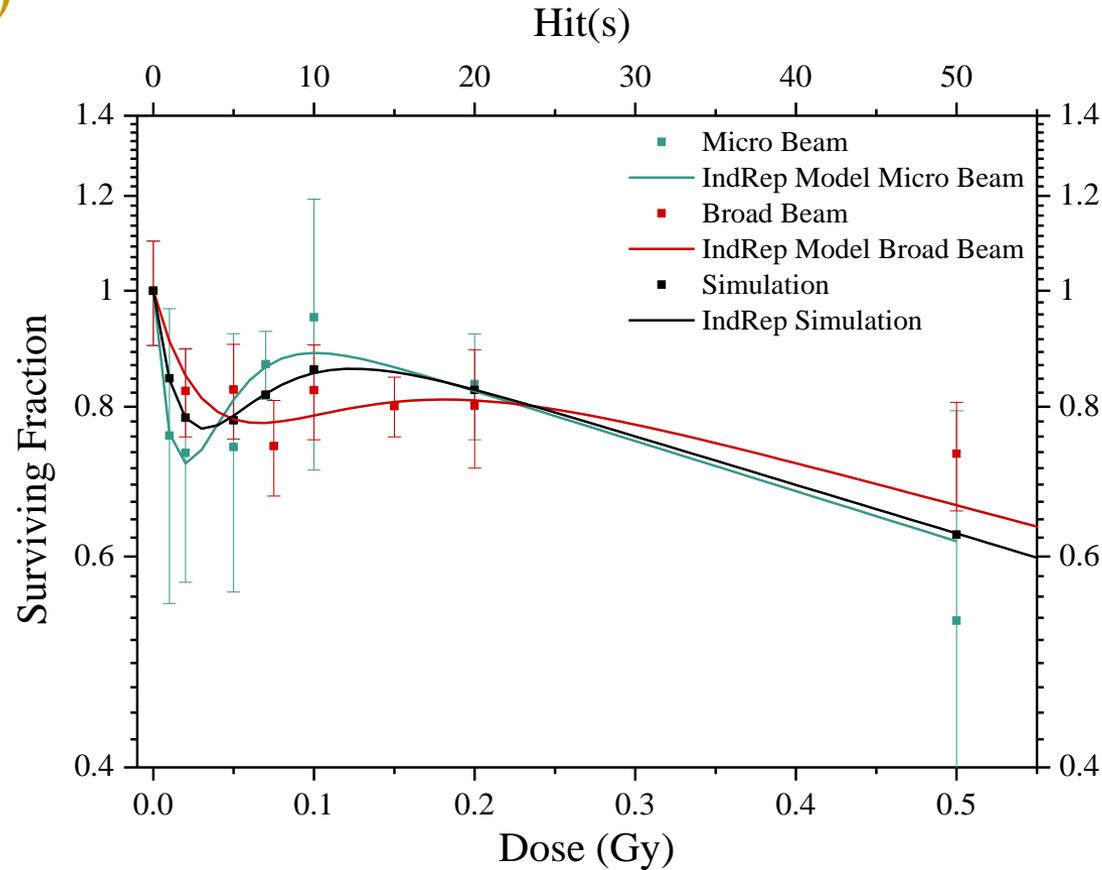


SAHA – 2 hours

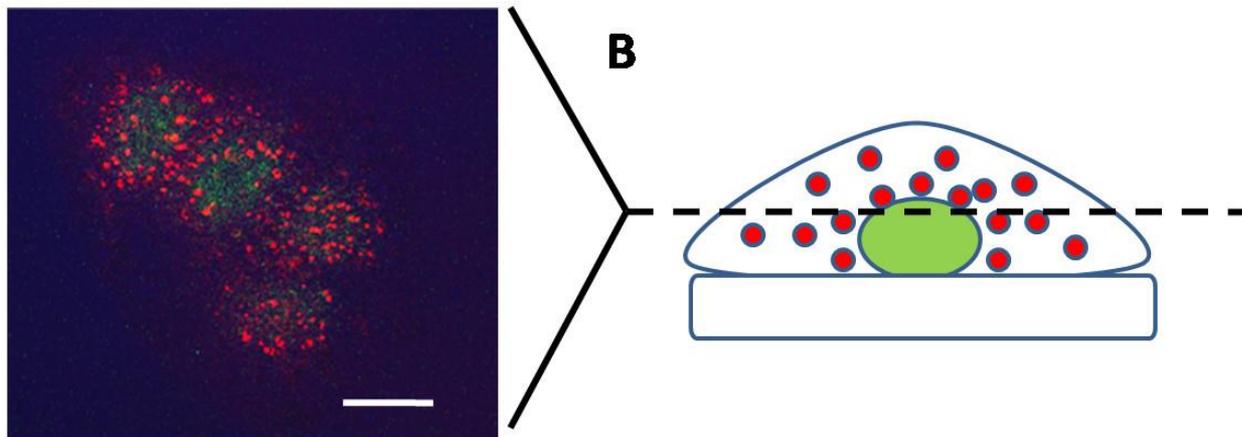
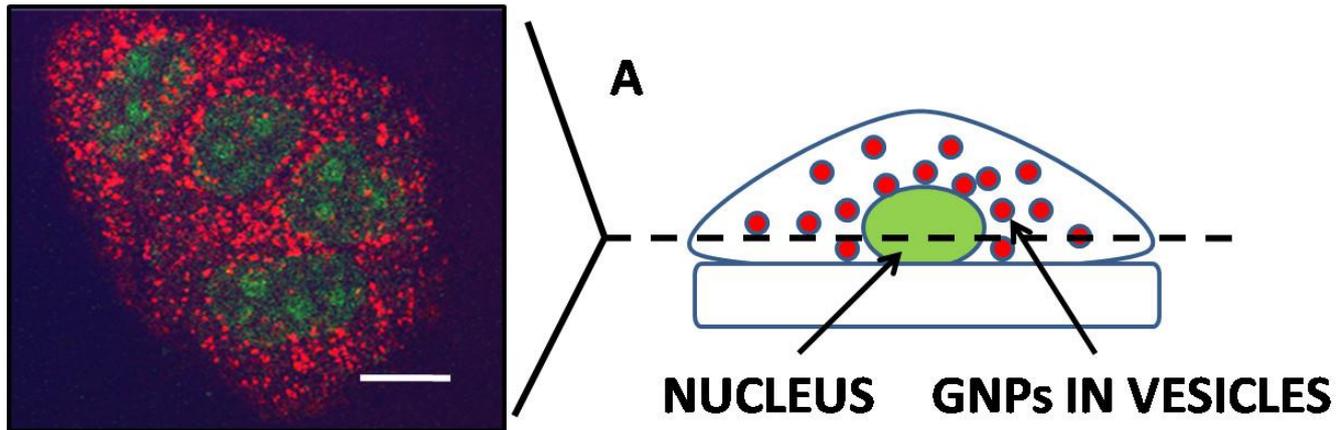


Other projects

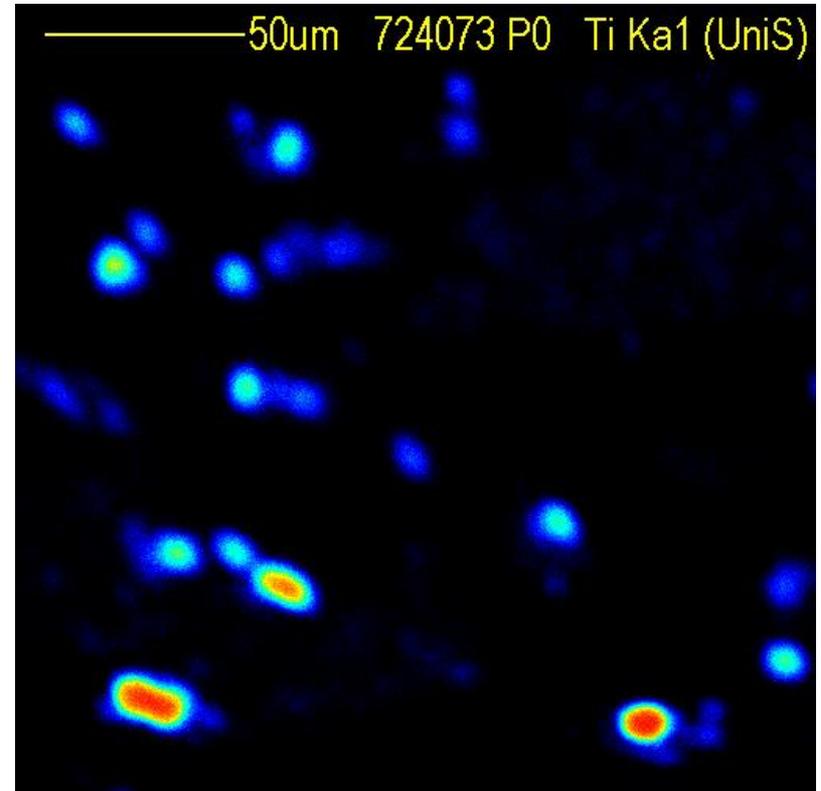
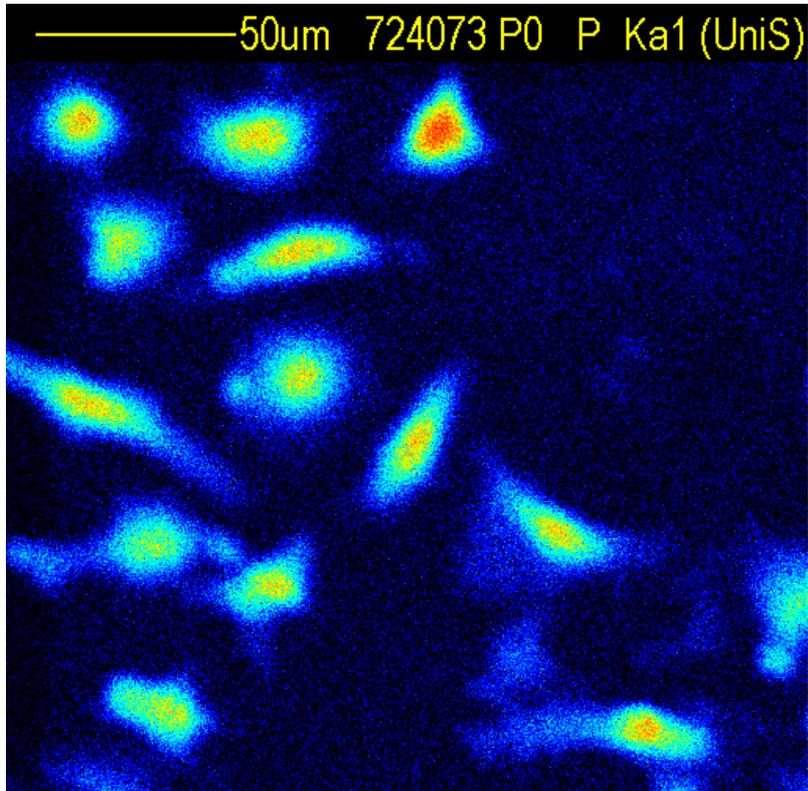
Comparing microbeam (exact number of particles) to broadbeam (Poisson distributed)



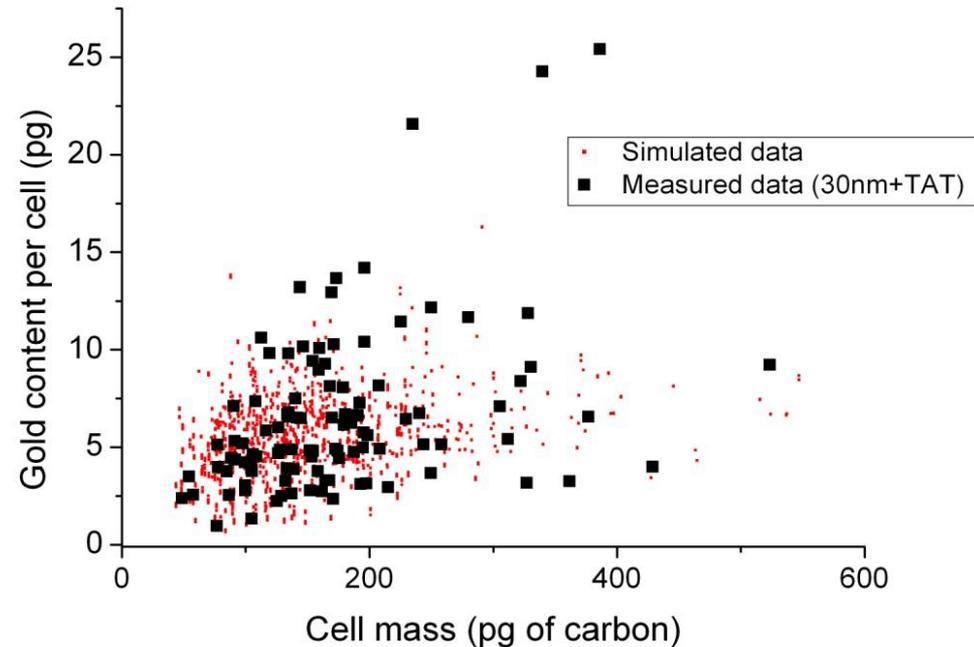
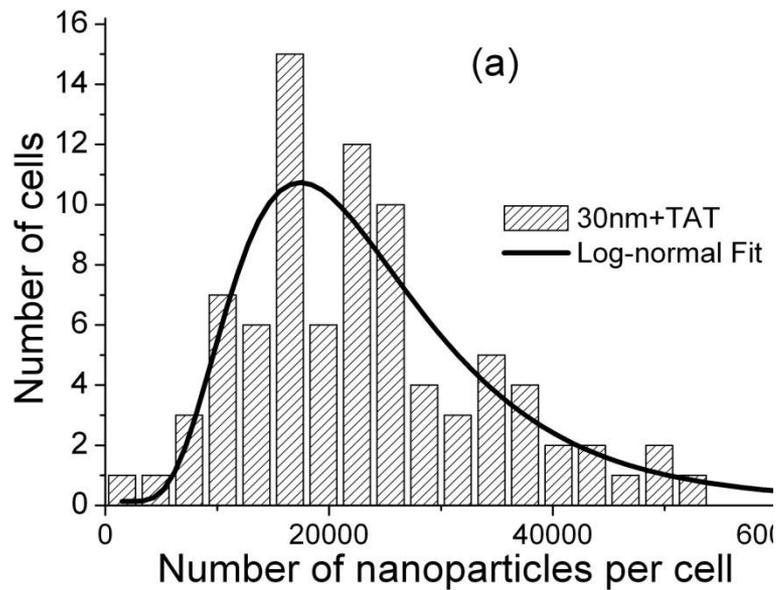
Counting and irradiating NPs inside cells



Mapping NPs in cells



How many NPs per cell?



Jeynes *et al.* (2013) *Analyst*

Conclusions

- We work with a wide range of researchers including clinicians, biologist, chemists and physicists
- Do come and talk to us if you have interesting problems/projects you think we can help with

Thanks for listening!!