



# La Radioterapia per Cattura Neutronica (BNCT)

Silva Bortolussi –RTD- Dipartimento di Fisica e INFN

# Il gruppo

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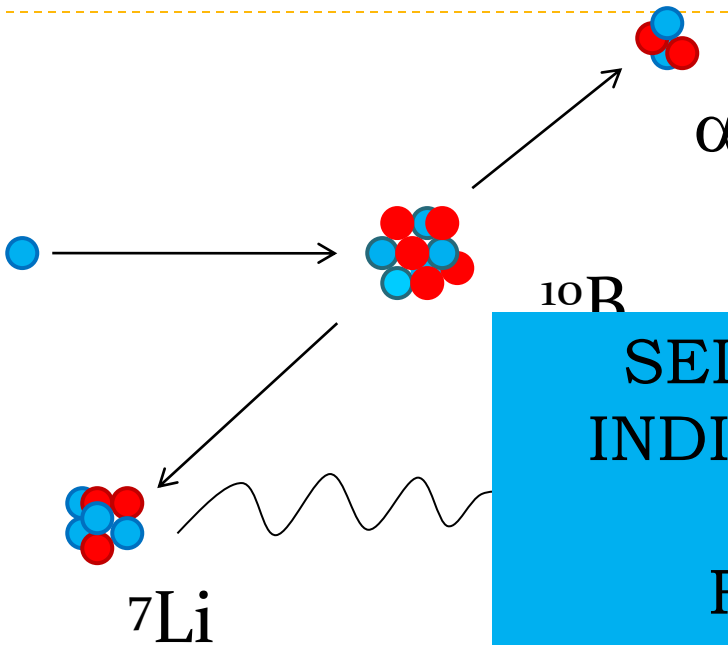
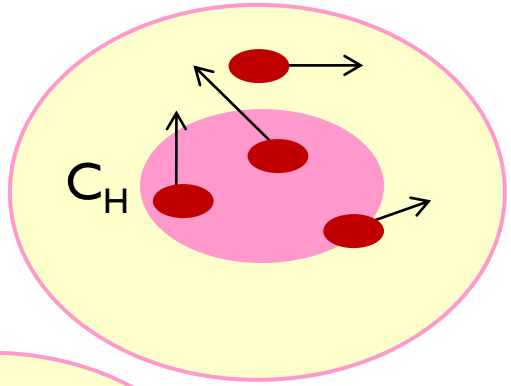
- Elio Giroletti (elio.giroletti@unipv.it)
- Piero Bruschi
- più.... Biologi, Chimici, Medici, e molte collaborazioni italiane e internazionali.

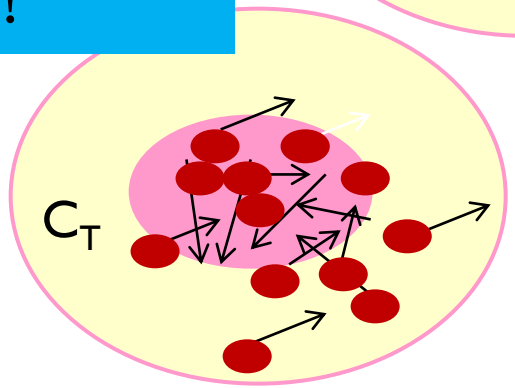
# Boron Neutron Capture Therapy




SELETTIVITA' INDIPENDENTE DAL FASCIO!

Cellula normale $D_H \propto C_H$

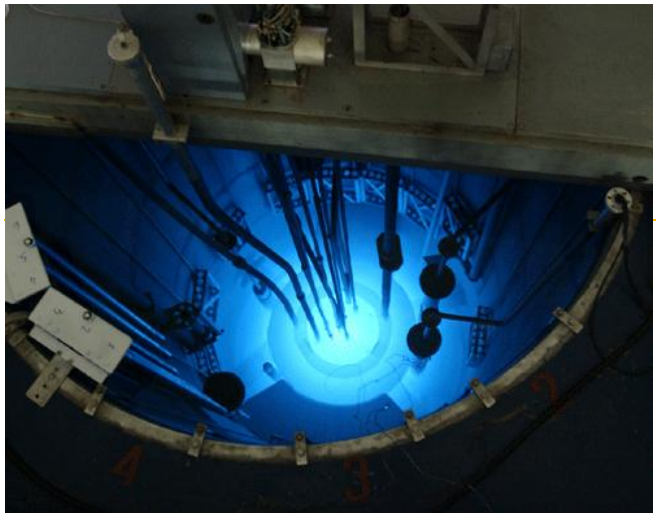


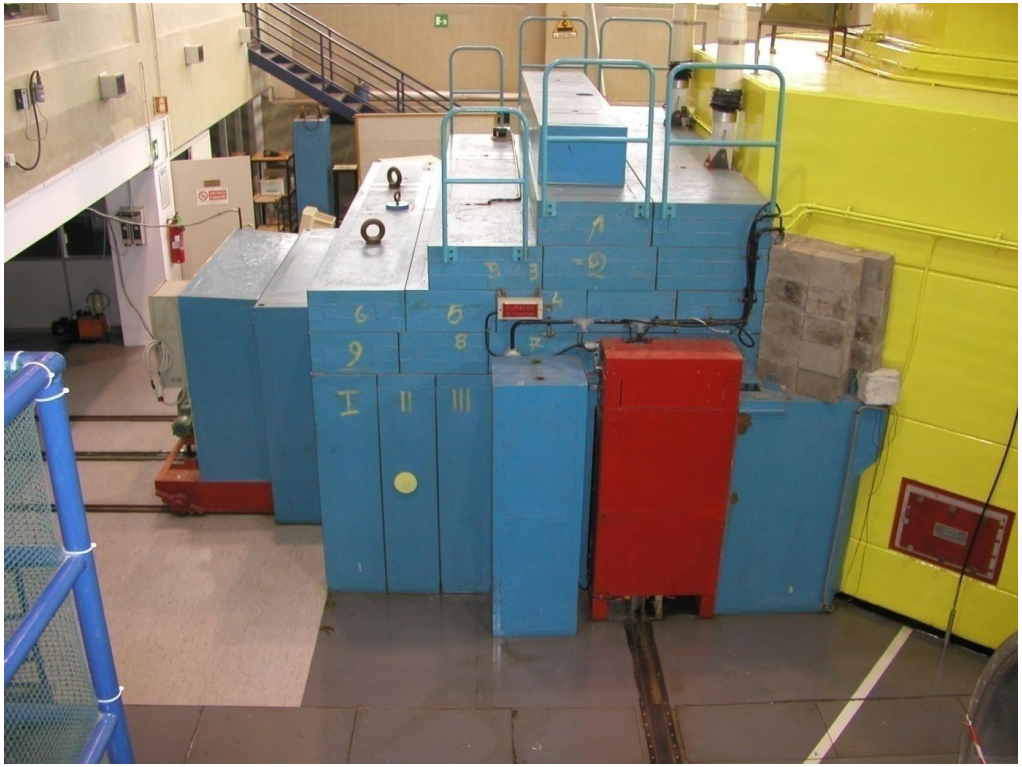




$D_T \propto C_T$

Cellula Tumorale

Il range delle particelle ad alto LET è più corto di un diametro cellulare, le cellule normali non vengono danneggiate dalle reazioni.



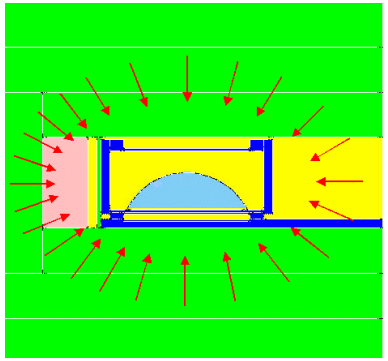


Reattore di ricerca
TRIGA Mark II
L.E.N.A. – UniPV
Unico in Italia

# Applicazioni a Pavia

TUMORI **DIFFUSI** NON OPERABILI, QUASI SEMPRE FATALI

metastasi epatiche → Autotrapianto

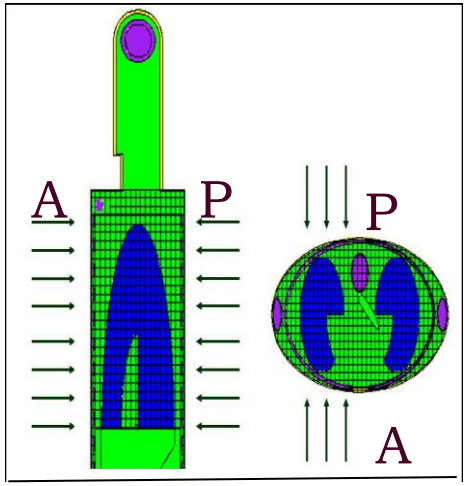


tumori polmonari

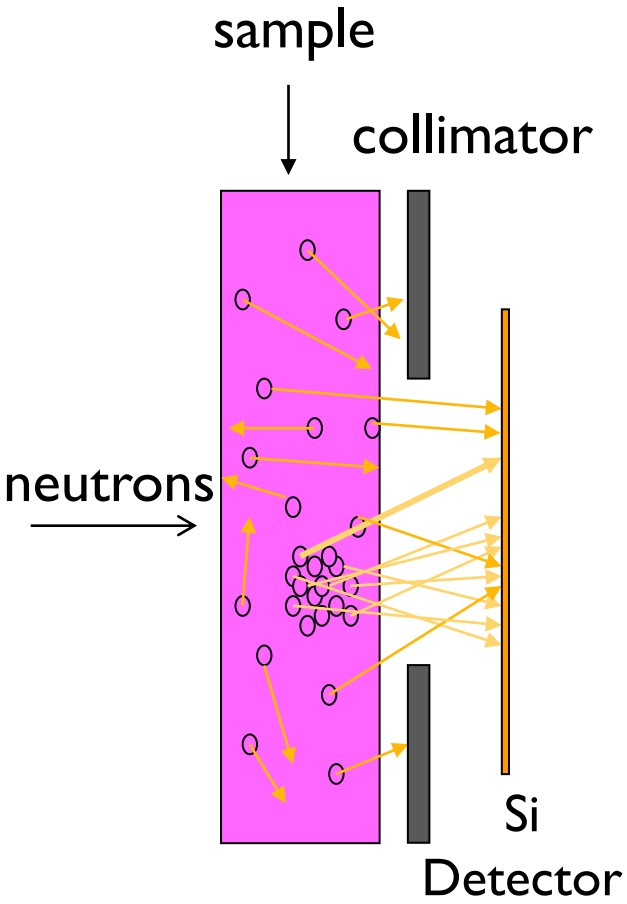
mesotelioma

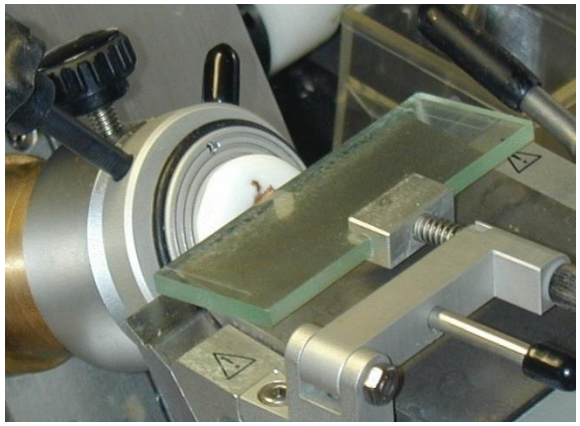
osteosarcoma

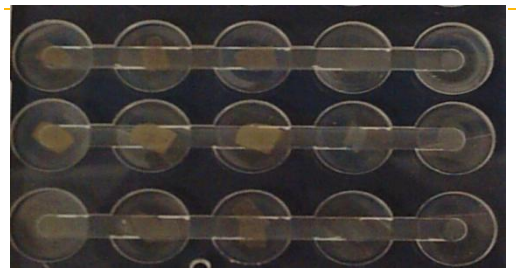
→ Fasci esterni

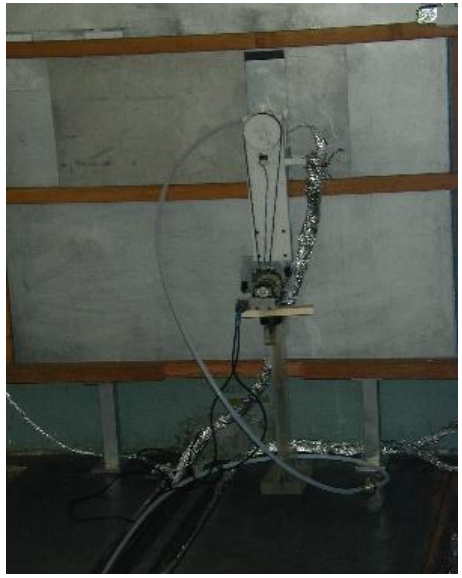


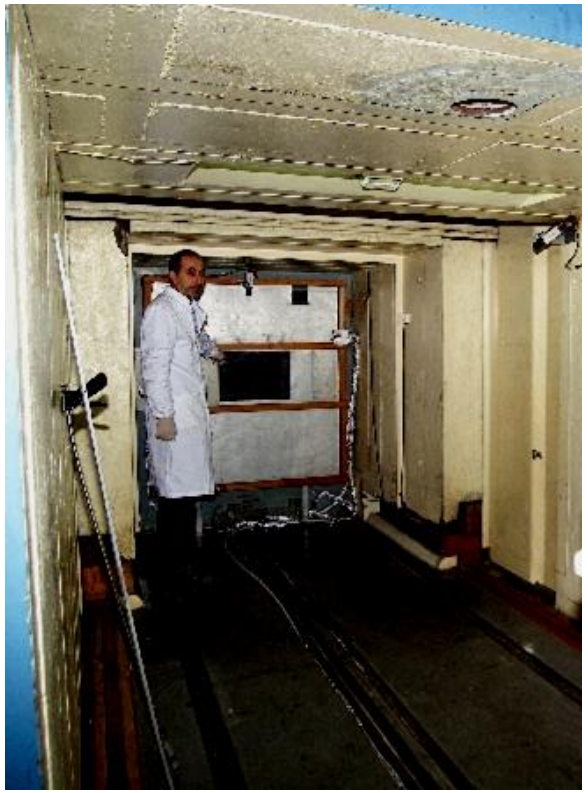
# Misura del boro con spettrometria α



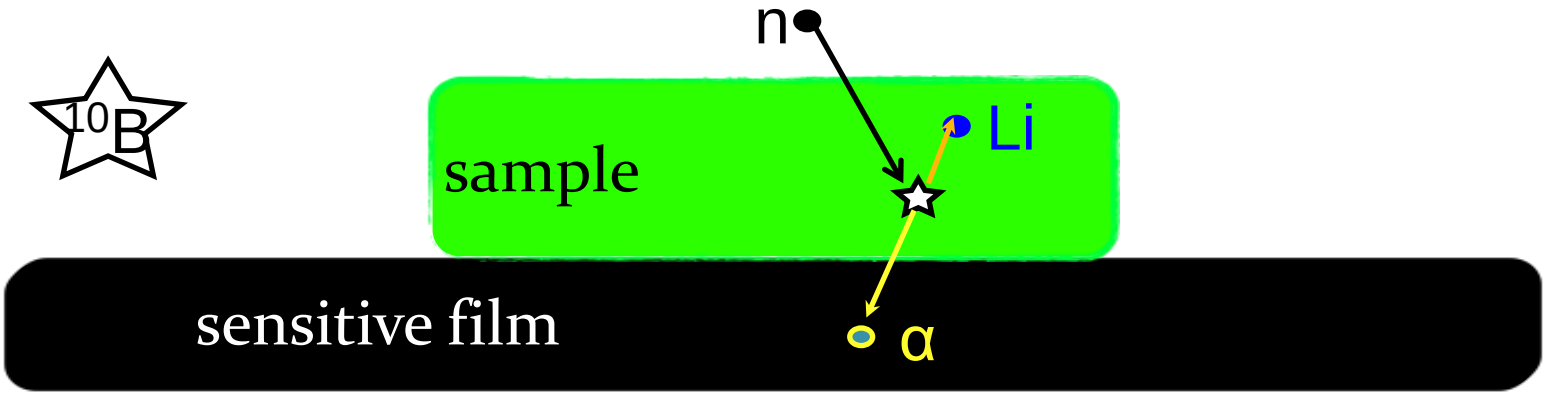




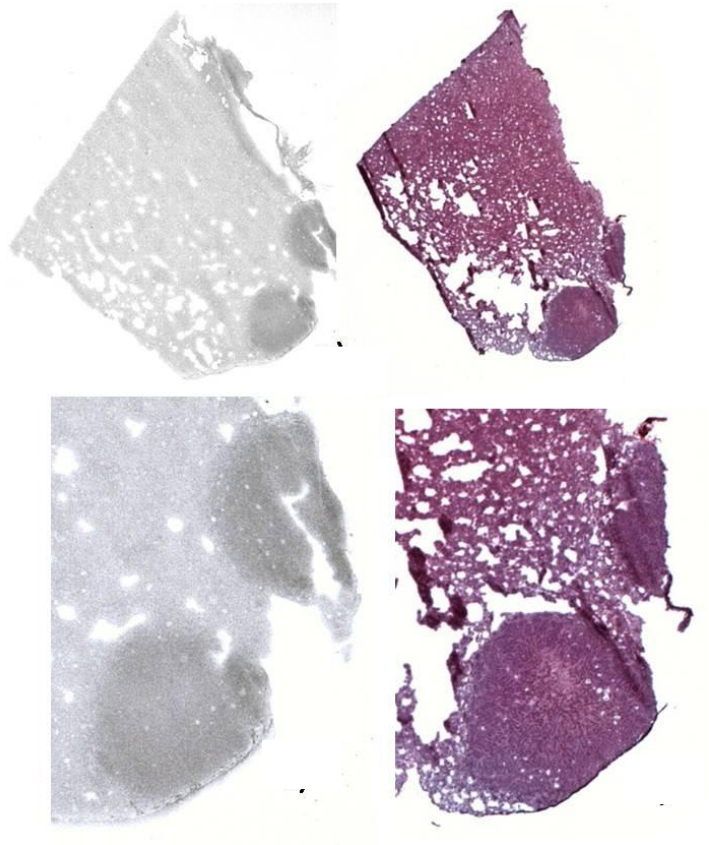


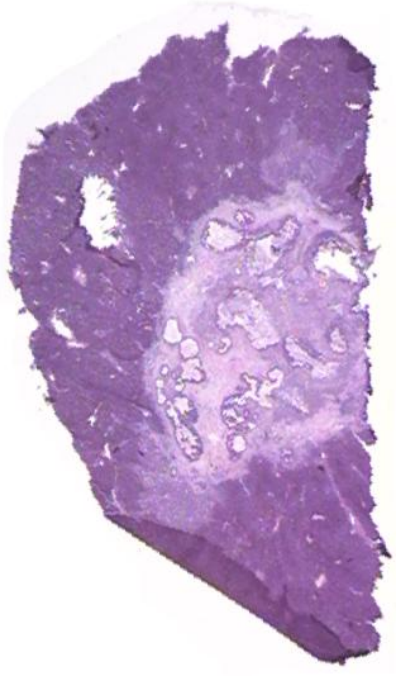
# Imaging del boro con autoradiografia neutronica

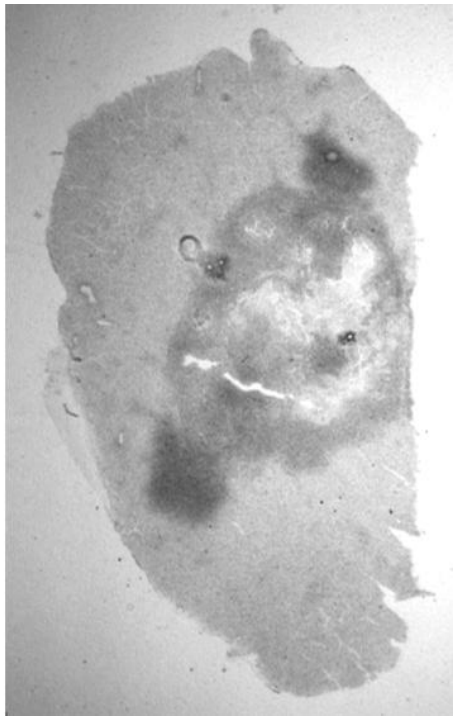
- Rivelatore sensibile a particelle cariche
- Tracce latenti rese visibili con sviluppo in soluzione NaOH a 70°C
- Ottimizzazione dell'irraggiamento a seconda del risultato da ottenere



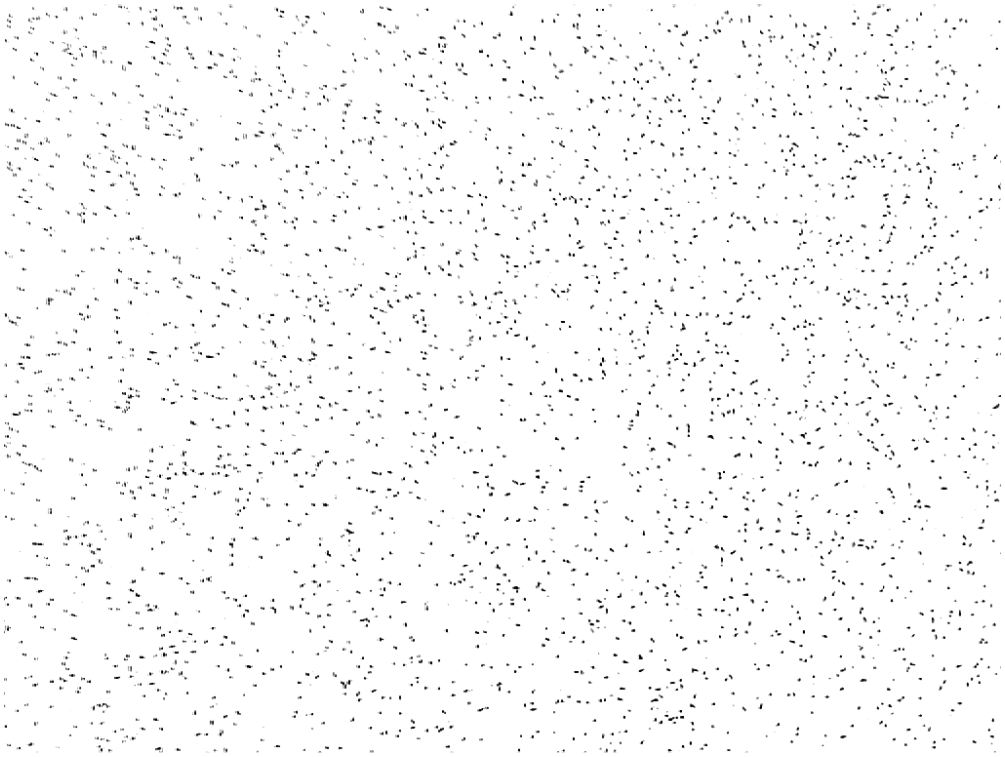
# Imaging - analisi qualitativa

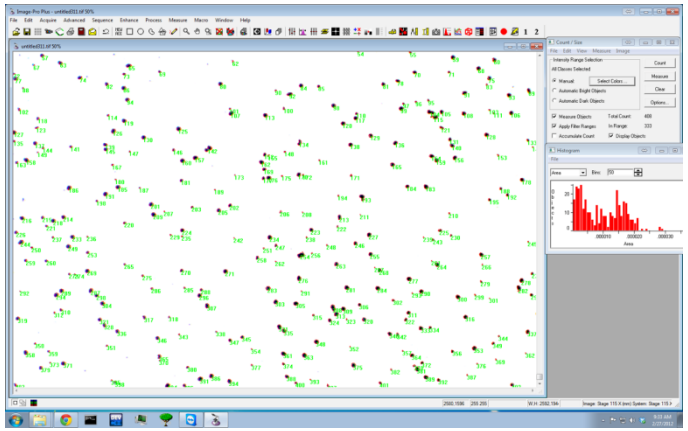


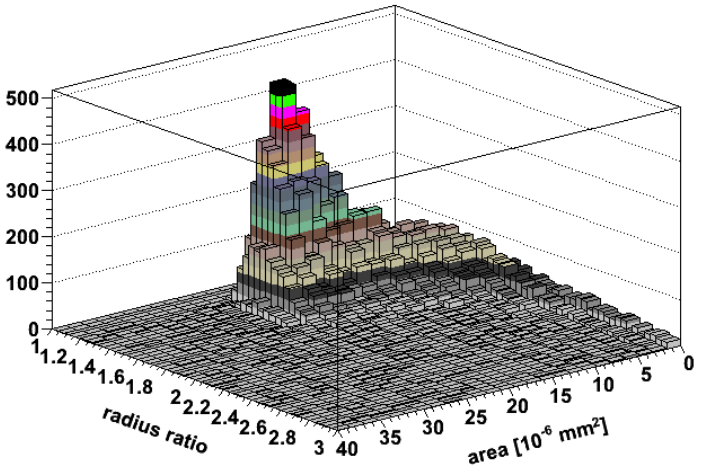




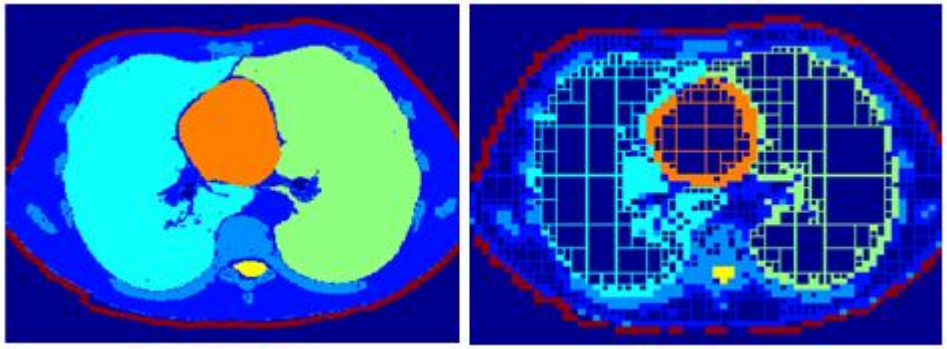
# Autoradiografia quantitativa



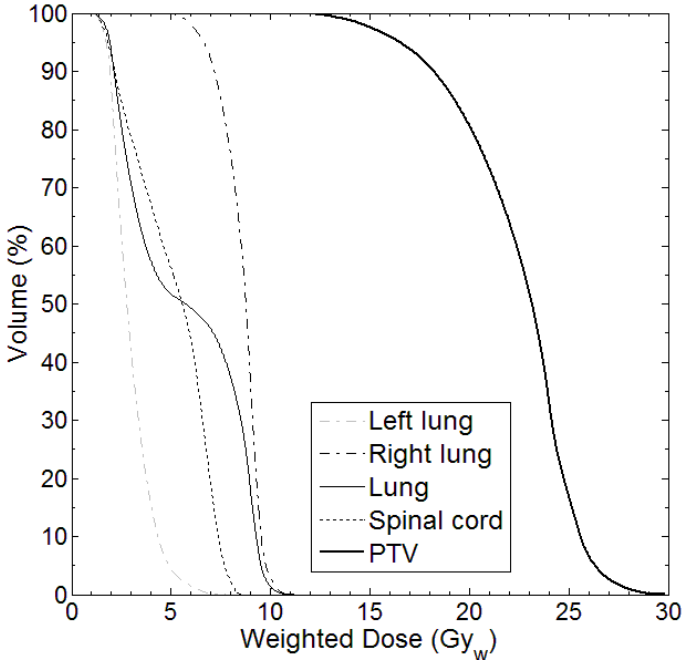


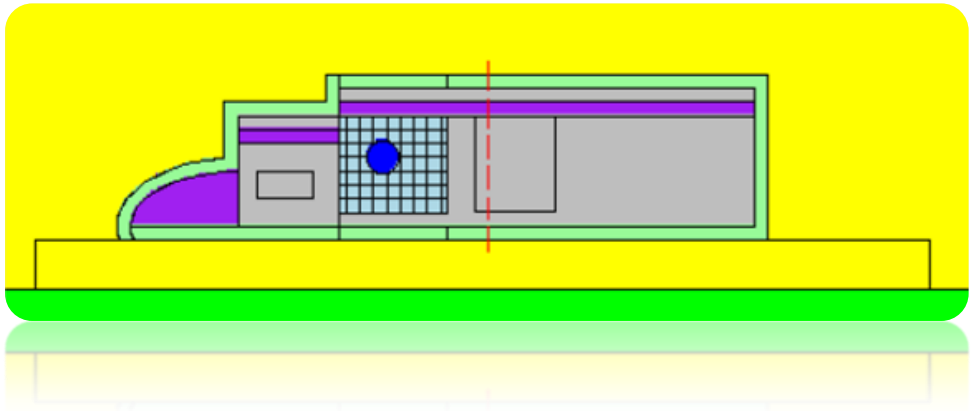


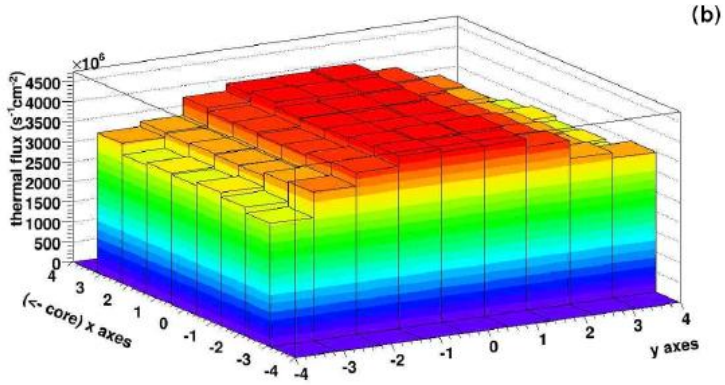
# Dosimetria computazionale e treatment planning



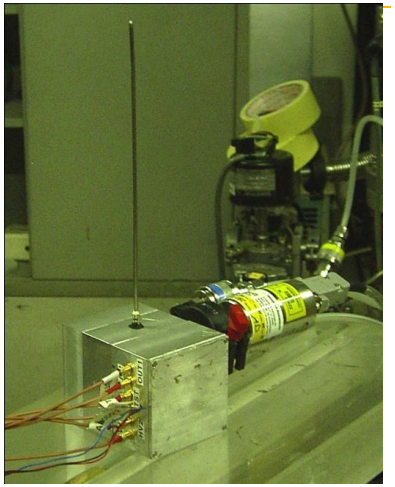
*courtesy of Ruben O. Farias*

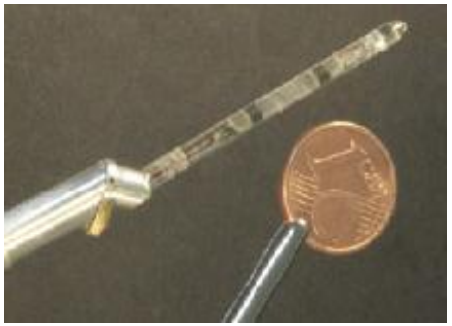


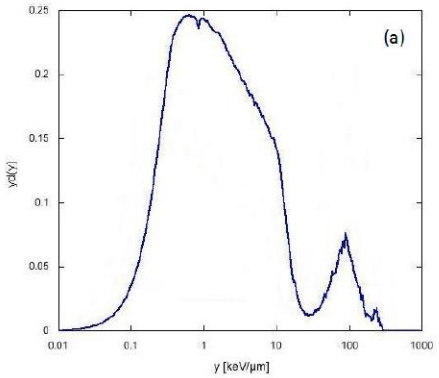



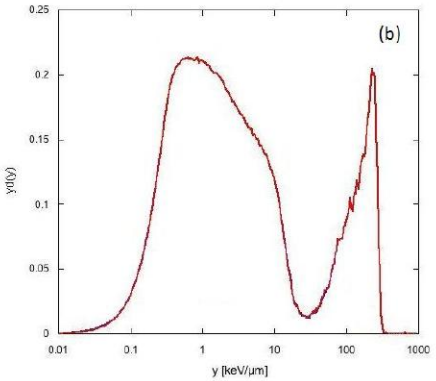


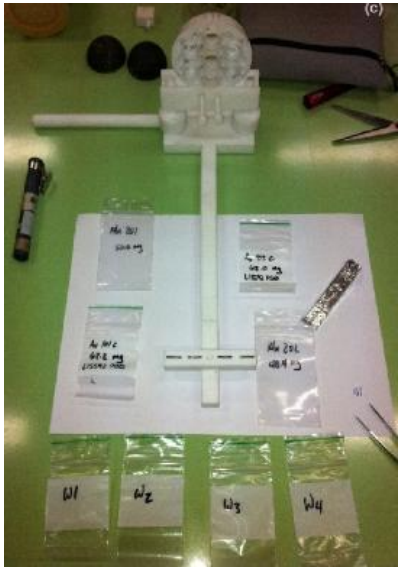
# Micro e Macro-Dosimetria sperimentale

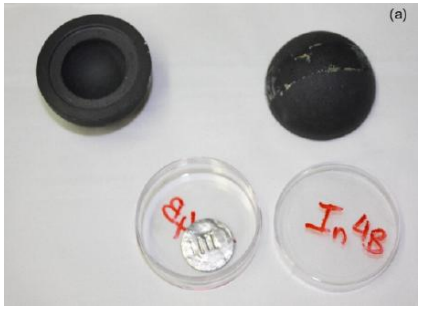


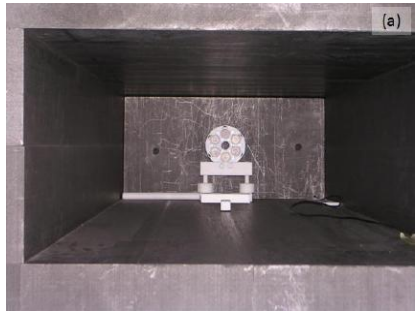






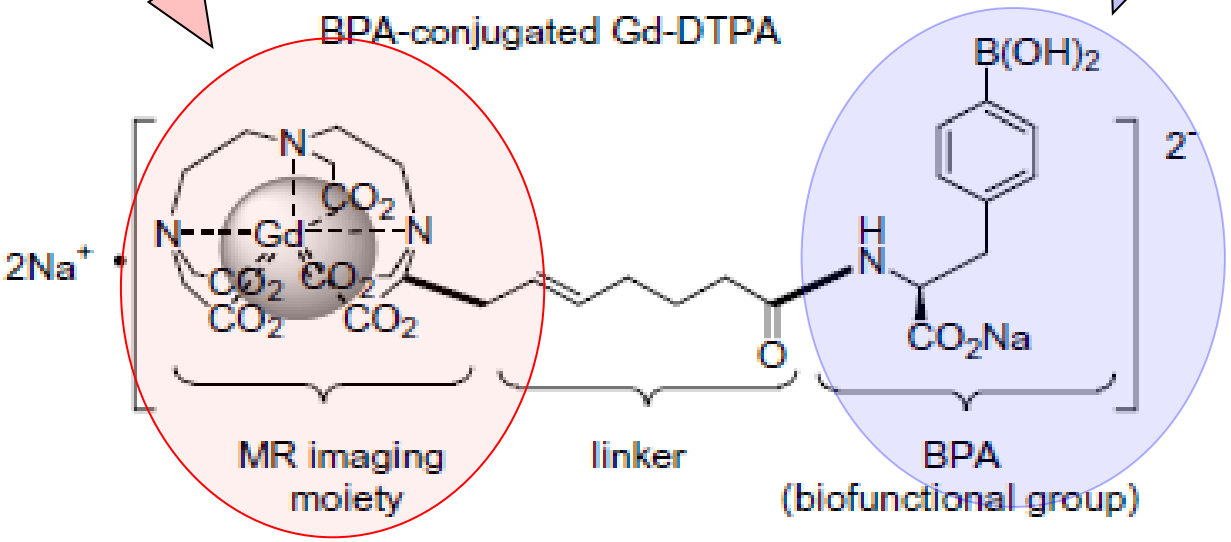



# Test di composti borati marcati per MRI

In collaborazione con il gruppo NMR del Dipartimento!

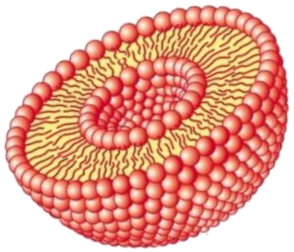
*MRI PROBE*

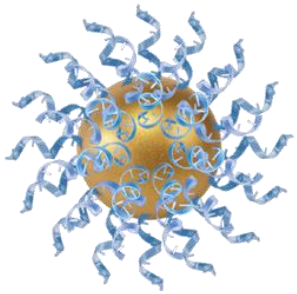
*BORON AGENT*

# Test di nuovi composti borati – *in vitro* e *in vivo*

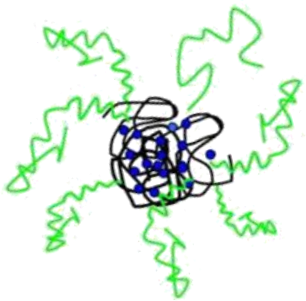
Liposomi caricati con carbo-zuccheri





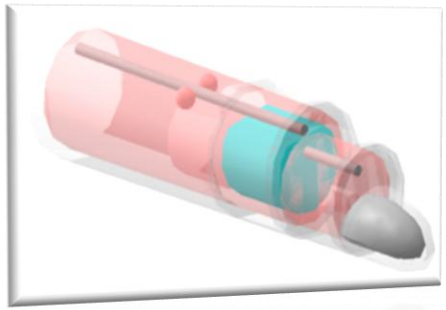
Nanoparticelle d'oro funzionalizzate con B

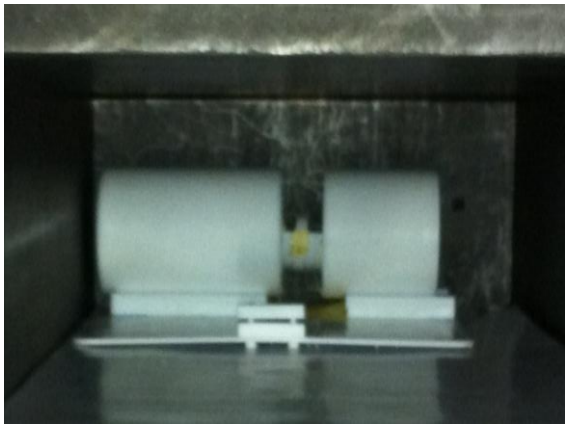
Nanoparticelle polimeriche



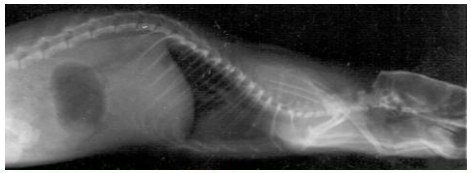
# Test di efficacia e di tossicità *in vivo I*

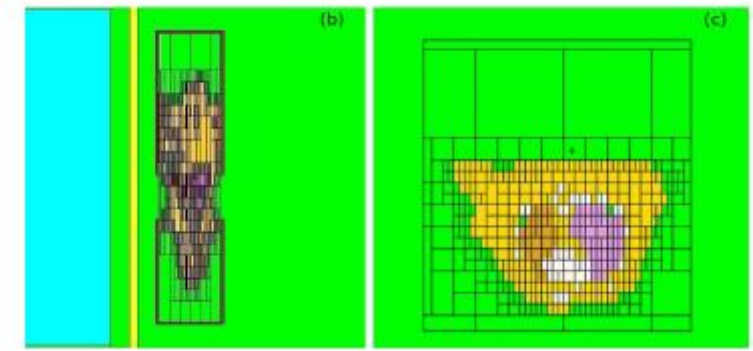
Simulazione geometrica di ratto

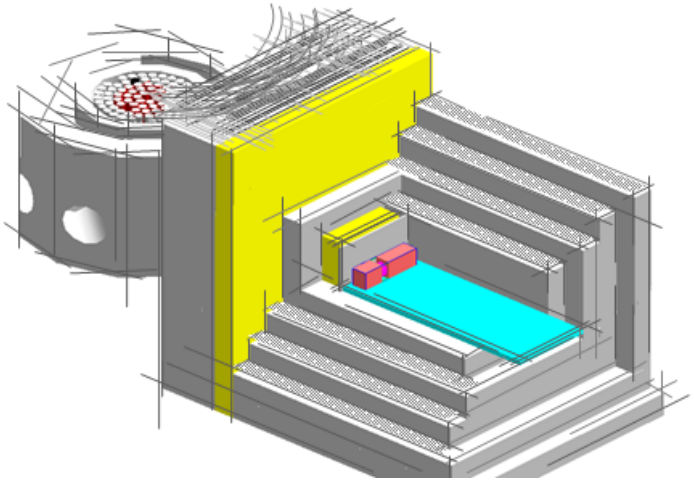




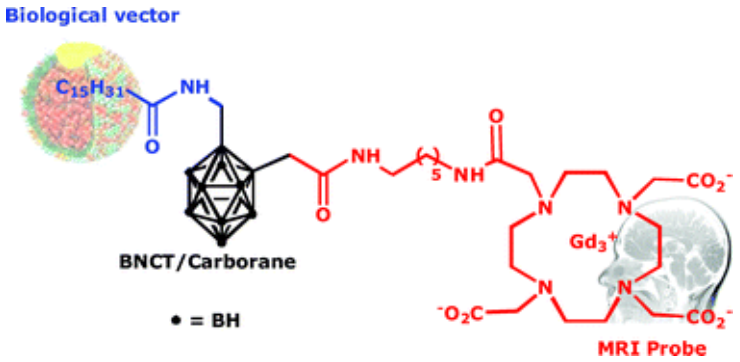
Simulazione a voxel per TPS

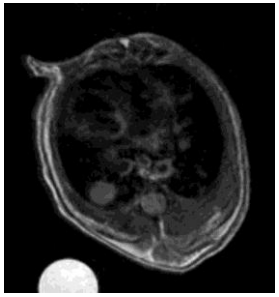


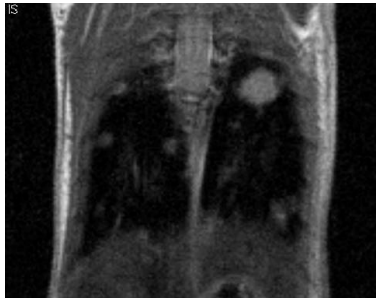


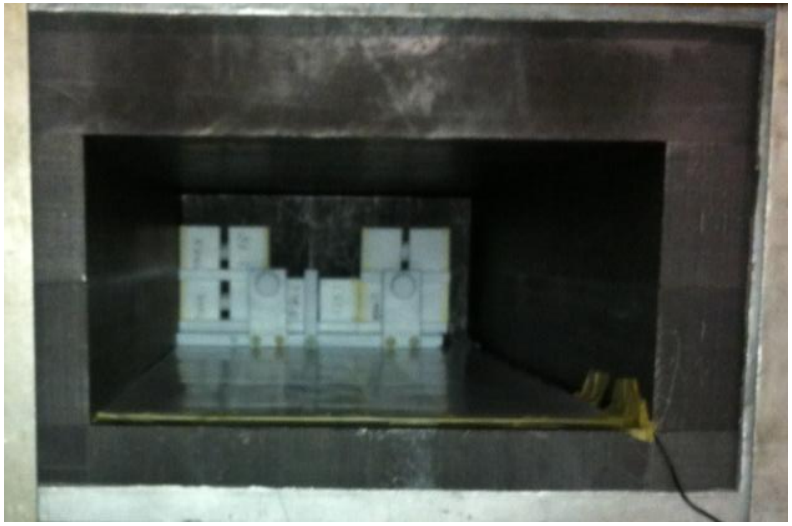



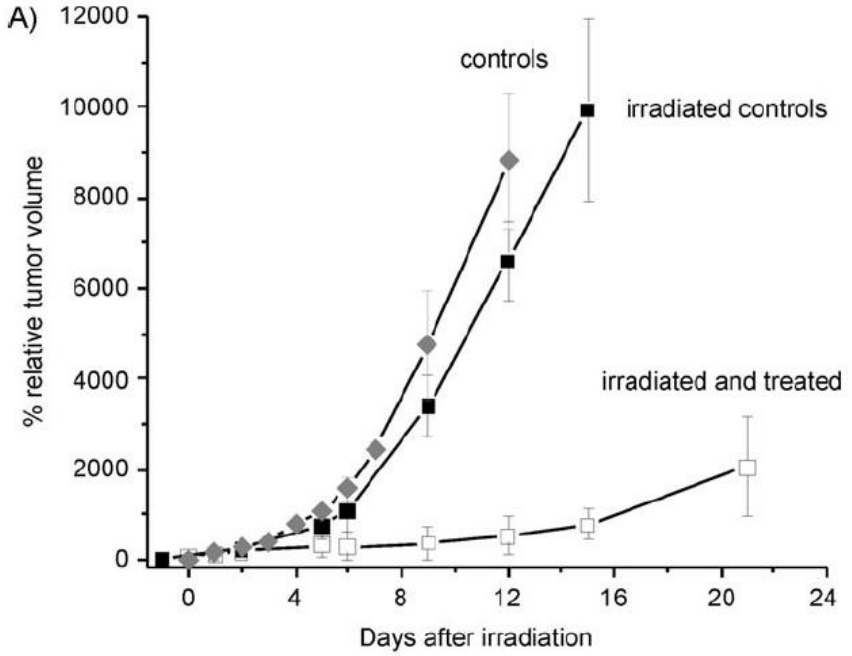
# Test di efficacia e di tossicità *in vivo II*









# Modellizzazione/simulazione di danno cromosomico e morte cellulare da radiazioni ionizzanti

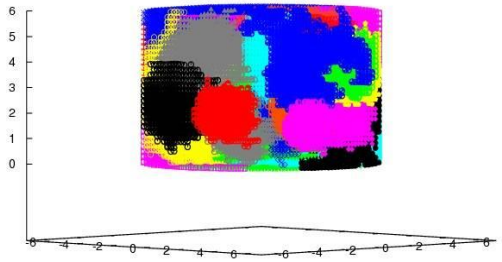

*francesca.ballarini@unipv.it*


studio dei meccanismi d'induzione di aberrazioni cromosomiche e morte cellulare in seguito a irraggiamento con diversi tipi di radiazione (raggi X e $\gamma$, protoni, particelle $\alpha$, ioni C e Fe…)


- perché la morte cellulare è l'effetto più importante per qualunque tipo di radioterapia (incluse l'adroterapia e la BNCT).
- perché le aberrazioni cromosomiche sono legate sia alla morte cellulare, sia alla conversione della cellula in cellula tumorale.

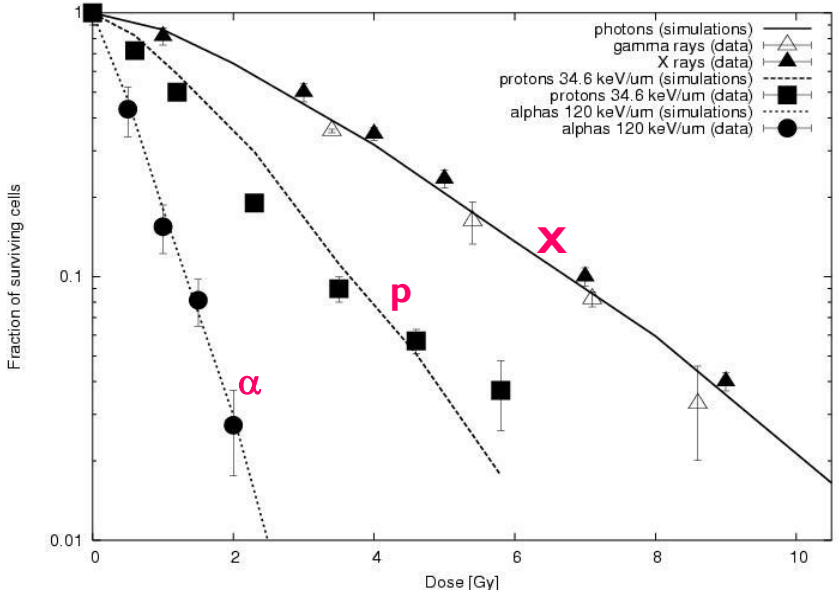
Sviluppo e applicazione di un modello/codice Monte Carlo "home-made", basato sull'ipotesi che i danni "clusterizzati" al DNA portino ad aberrazioni cromosomiche, e che alcune aberrazioni cromosomiche portino a morte cellulare. In parallelo, collaborazioni con gruppi sperimentali.


nucleo cellulare simulato

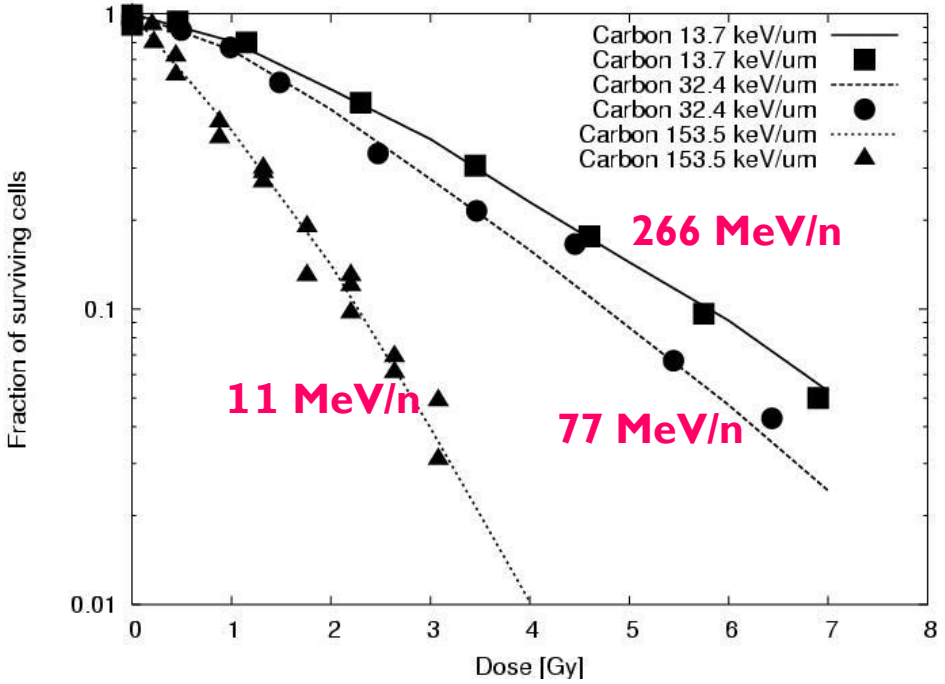


*le linee sono simulazioni, i punti sono dati sperimentali per confronto*

sopravvivenza cellulare da fotoni, p e α




sopravvivenza cellulare da ioni C (fasci GSI, in ambito adroterapico)



Grazie per l'attezione!

http://www.bnct.it