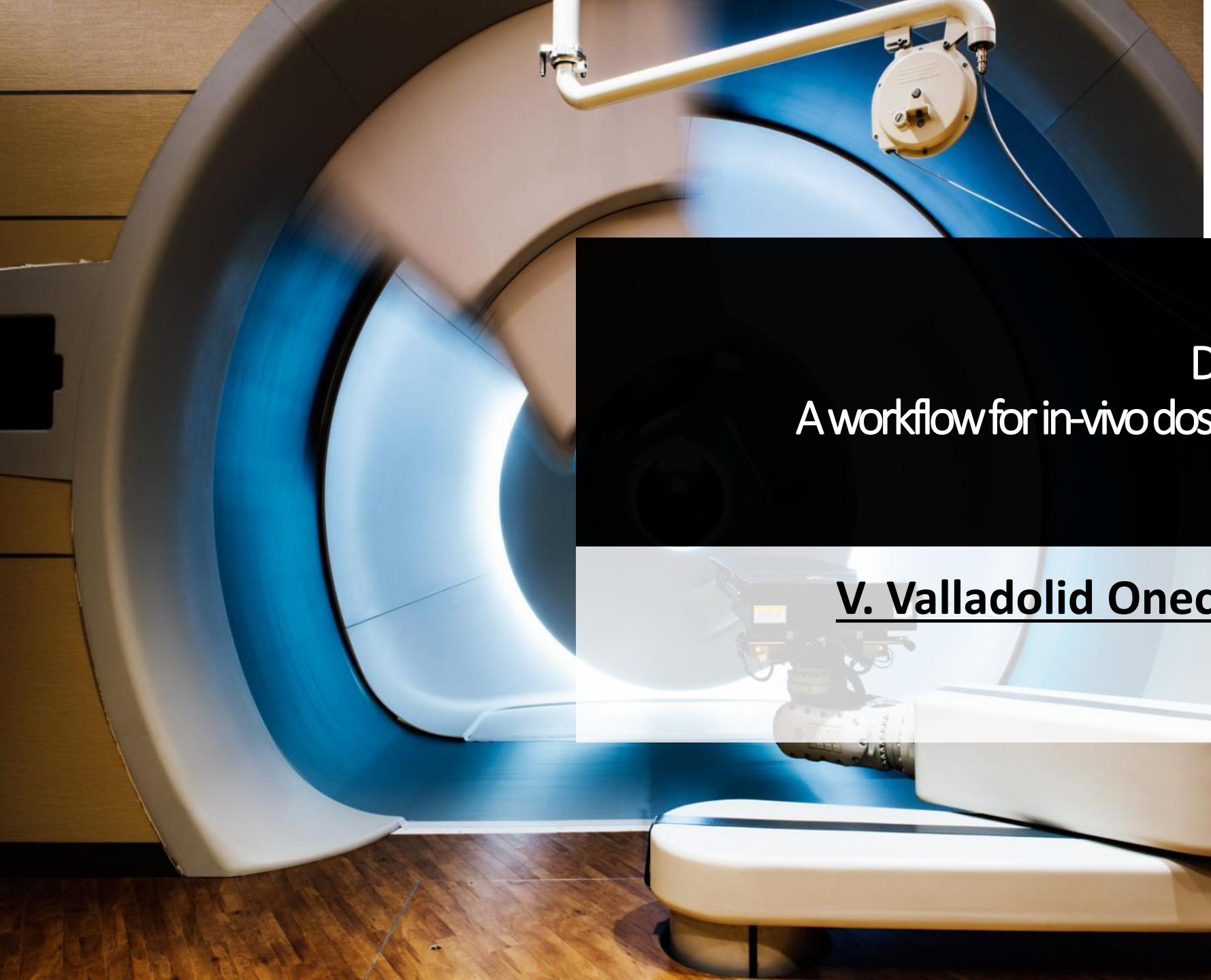
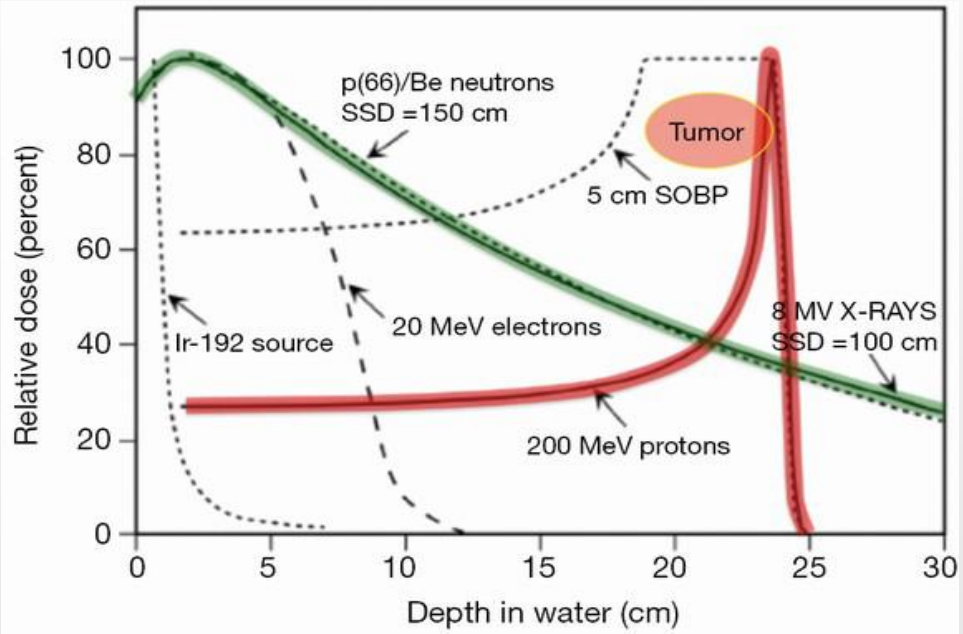


Dictionary Dose Reconstruction: A workflow for in-vivo dose verification in proton therapy.

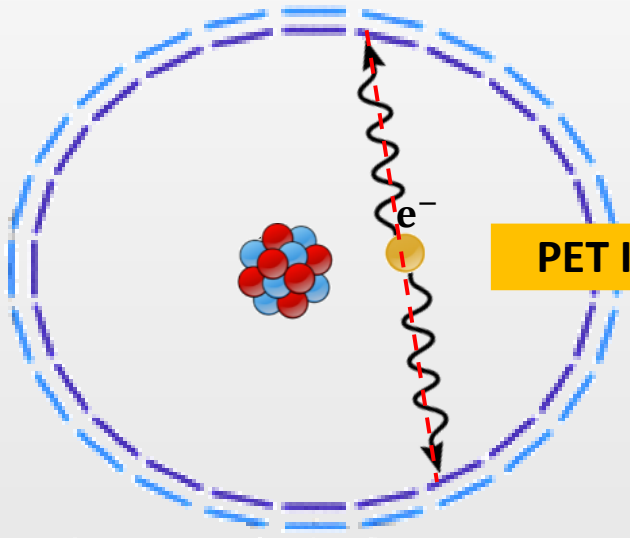
V. Valladolid Onecha, P. Galve, L.M. Fraile, S.España, J.M.Udías.

Proton therapy

- Proton radiotherapy exhibits higher conformity of the dose distribution compared to photon / electron radiotherapy.
- This arises from the dose distribution of heavy charged particles (red), which is characterized by a peak at the end of the range (Bragg Peak).
- Dose concentrated at the tumor. No dose beyond the edge distal to the beam entrance. Lower dose in healthy tissues.

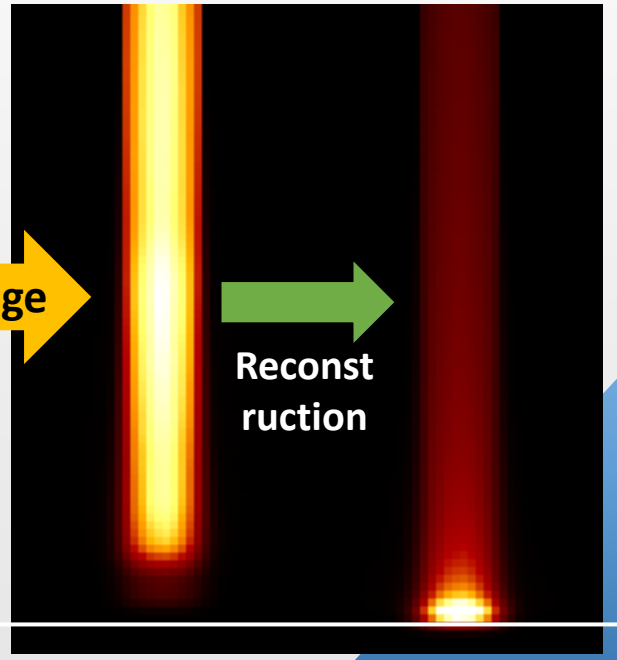


H.Diap et Al, Can proton beam therapy be clinically relevant for the management of lung cancer?,doi: 10.3978/j.issn.2218-676X.2015.08.15



PET Image

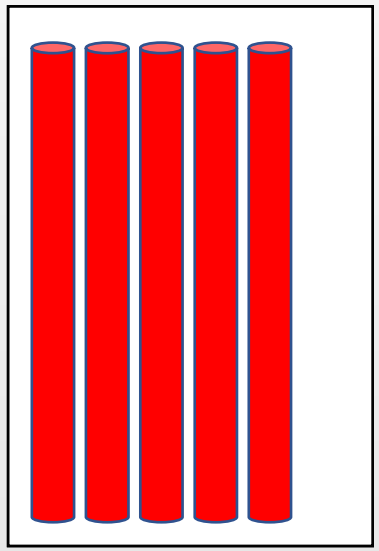
PET activation Dose

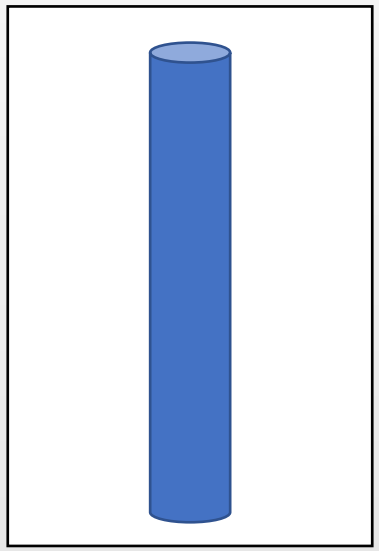


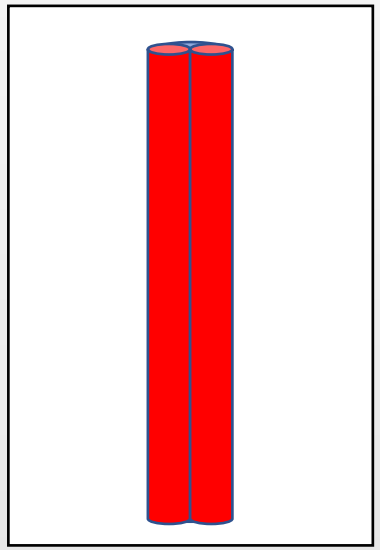
Range 100 MeV

Motivation y Objectives

- The main objective is to develop a workflow able of reconstructing doses from PET activation images
- A new method totally based in MC simulations has been developed for this purpose.
- The main idea of our method is to build a data base of dose and activation previously calculated with a highly realistic MC simulation. This is the intensive computing part and can be performed 24 hours in advance, for instance
- This database contains the many pencil beams that could populated the treatment volume.





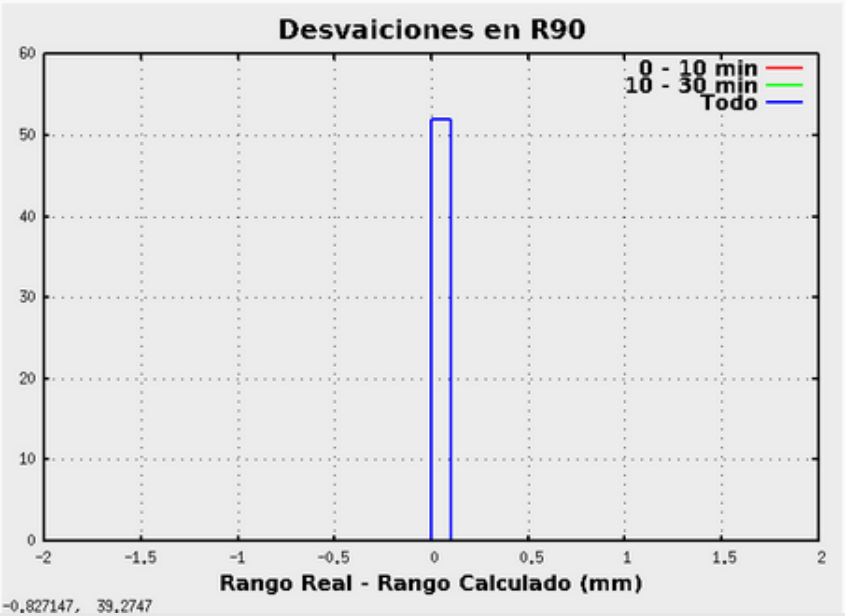


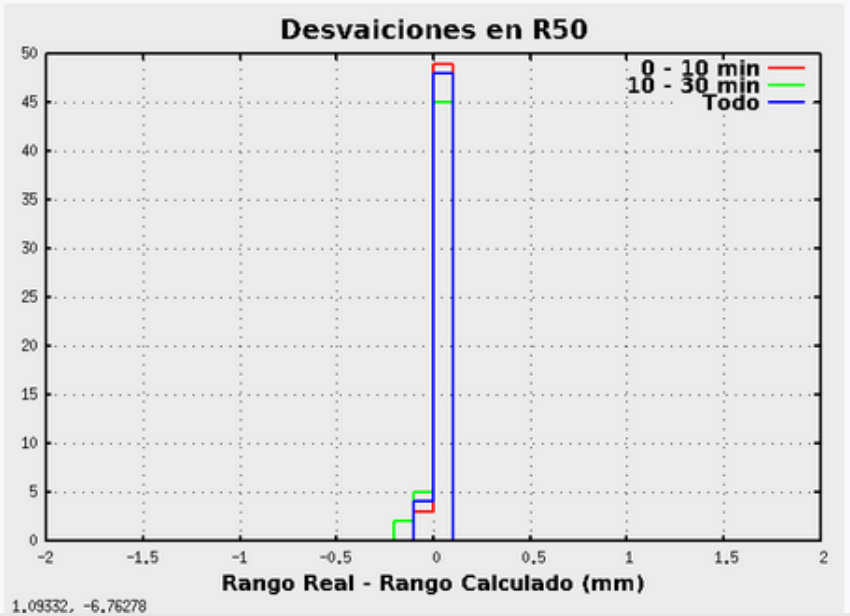
Mini Beam - Dose

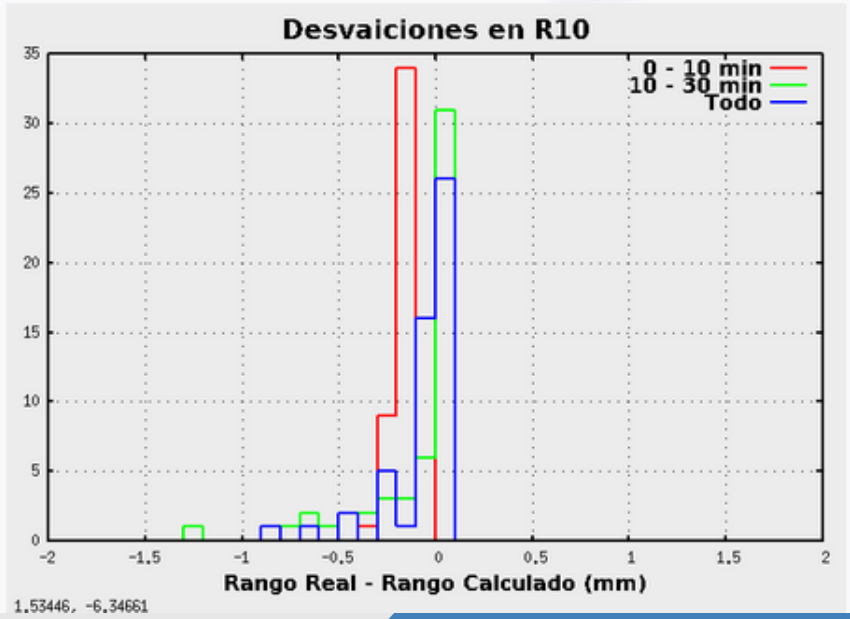
Activation

- Clinical Pencil Beam - 180 MeV.
- Two different realistic scenarios.
- Real Dose Delivery.

Actis Mini Beam 1.8 Gy			
	0-10 min	10-30 min	Todo
Cuentas ($\cdot 10^4$)	1499	702	2852
Chi2 - Dose	0.46	0.60	0.55







Conclusions

- A new method able of reconstructing doses from PET activation images has been developed.
- This method provides millimetric resolution reconstructing pencil beams activation and it also reconstructs more complex images with better resolution than the used in clinical treatment.
- It makes it possible to identify possible errors compared to what was planned.
- It has been proven that the results obtained from identical activations but associated with different doses are very similar, so it is not necessary to use very high doses to generate good results.
- The time this program takes to obtain results is less than 20 seconds.
- All this proves the potential viability of clinical use of this method.