



Particle therapy masterclass


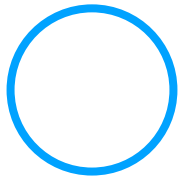
THERAPY PLANING

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- STUDENTS FROM WARSAW





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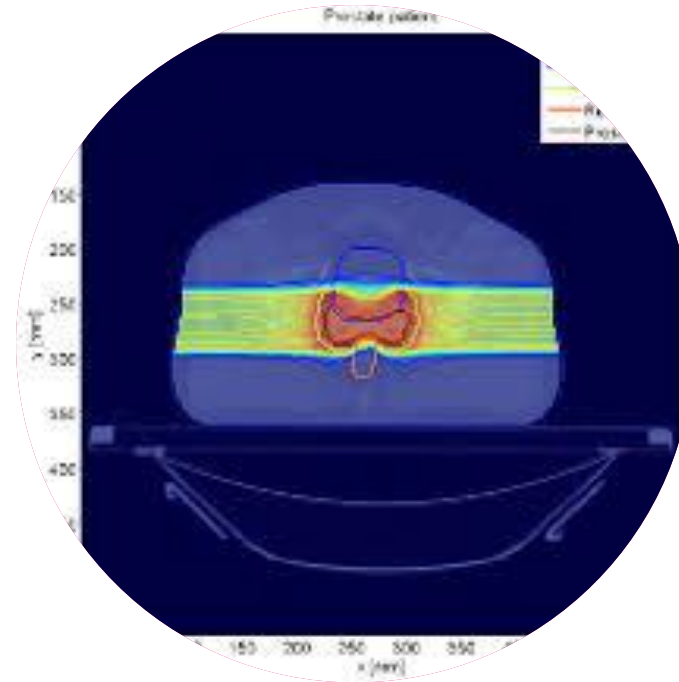
ABSTRACT

Firstly we used a phantom to understand how ionizing radiation is absorbed in the body. We compared what happens when you use one beam or a few photon beams, a proton beam or carbon ions.

Then we created various radiotherapy plans for liver patient. We used protons, carbon ions and multiple photon beams.

Our analysis was based on dose distribution in patient's body, dose volume histograms and dose statistics.

We also simulated error in patient's positioning, changing the isocenter position.





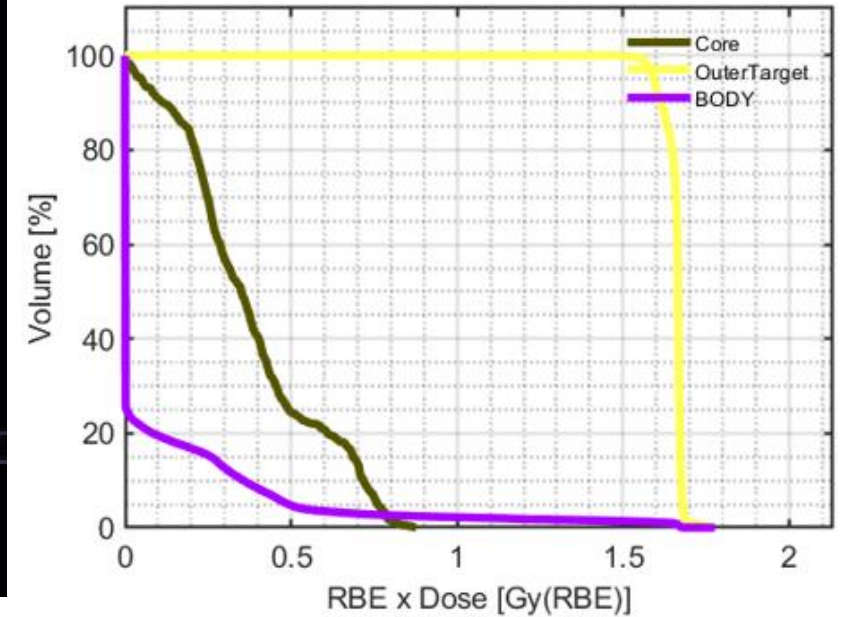
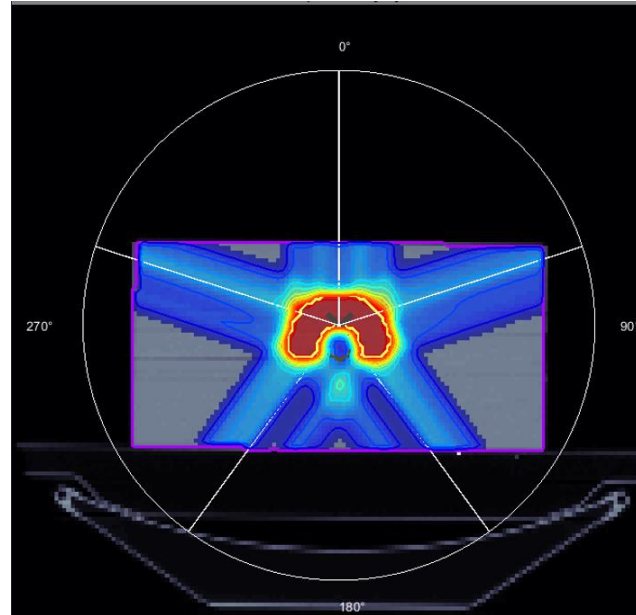
C PHANTOM

Here we compared the use of photons and protons in our phantom.

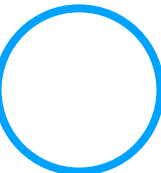
Conclusions:

Multiple photon fields create better dose distribution than single photon beam.

Protons enable us to spare healthy tissues better than photons.



Photons
gantry angles: 0 72 144 216 288



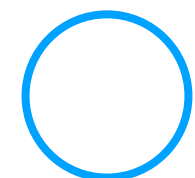


LIVER

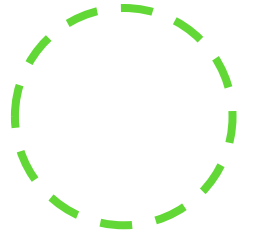


Regions of interest	
heart	OAR
spinal cord	OAR
liver	OAR
small bowell	OAR
large bowell	OAR
PTV	PTV

- We selected just a few necessary organs at risk to make our images more clear and simple

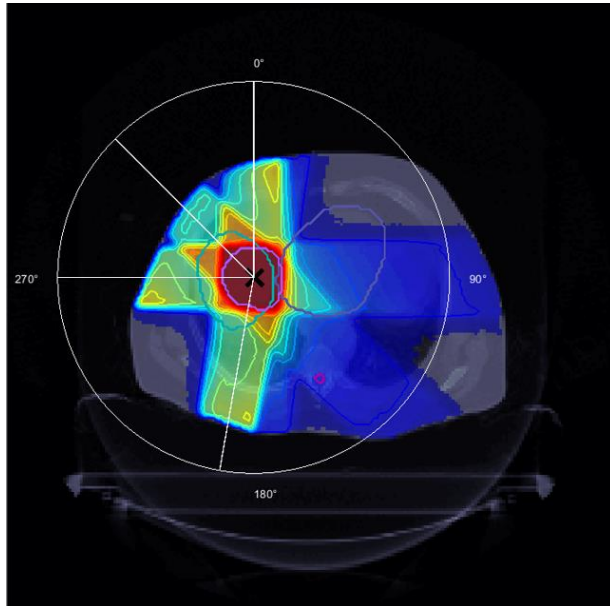


COMPARISON FOR PHOTON AND PROTON THERAPY FOR LIVER



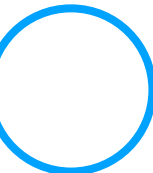
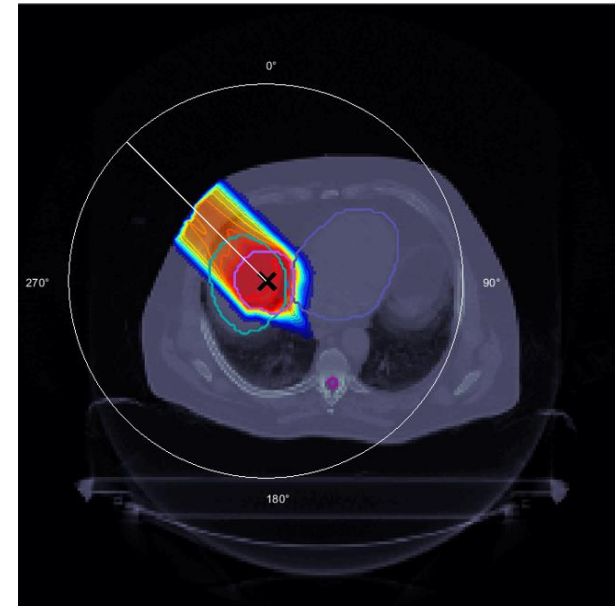
PHOTON THERAPY

Even if we can have a good dose distribution in PTV region, there are many low dose regions in the whole patient's body.



PROTON THERAPY

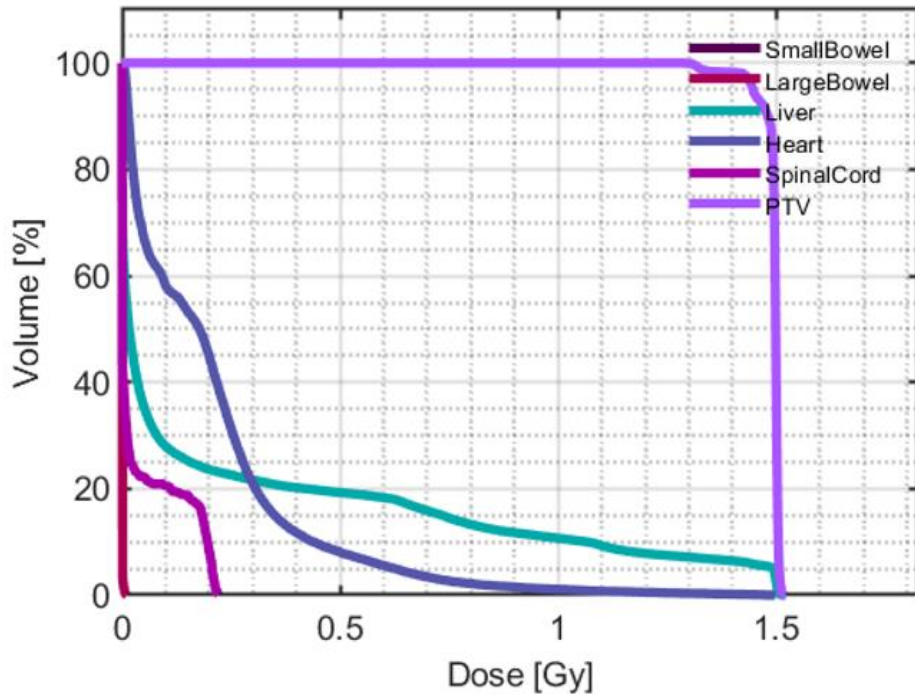
Thanks to Bragg's peak, the healthy tissues under the tumor are completely spared.



COMPARISON FOR PHOTON AND PROTON THERAPY FOR LIVER

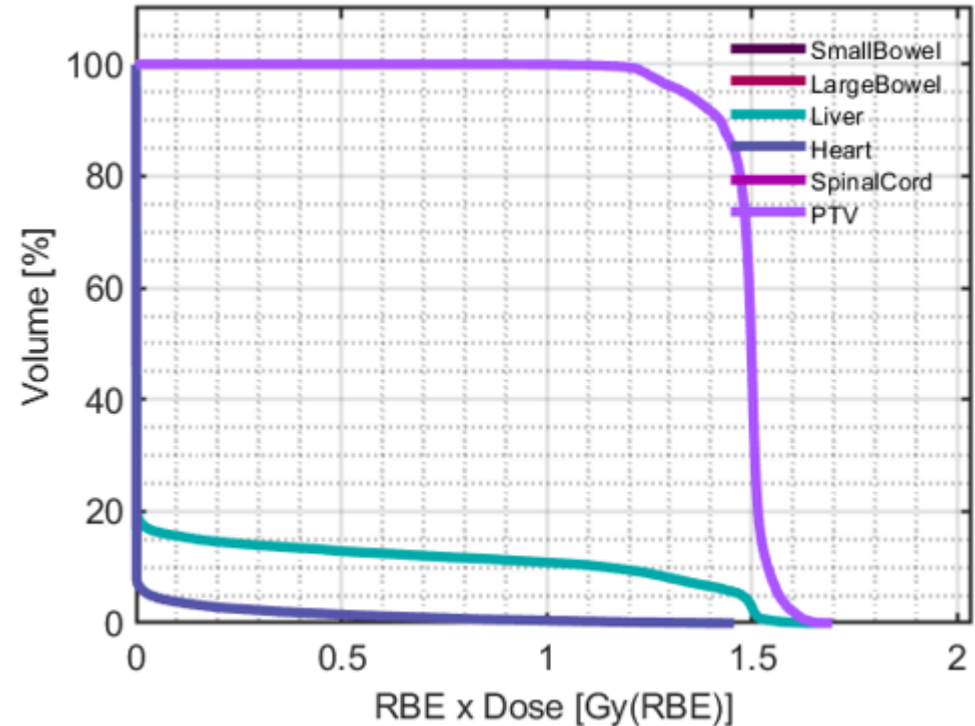
PHOTON THERAPY

DVH for photons looks better than for proton therapy. Unfortunately organs at risk receive lots of lower doses.

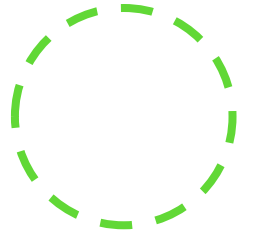


PROTON THERAPY

Organs at risk are much better spared than when we use multiple photon fields.

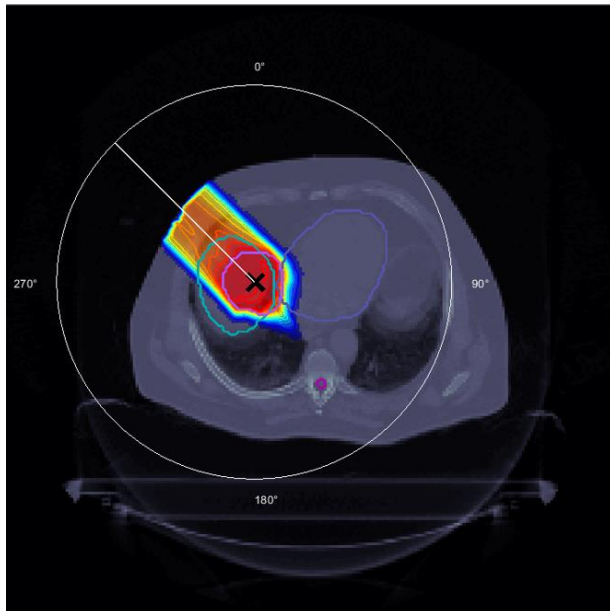


COMPARISON FOR PROTON AND CARBON ION THERAPY FOR LIVER



PROTON THERAPY

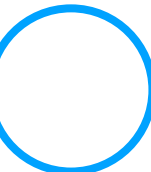
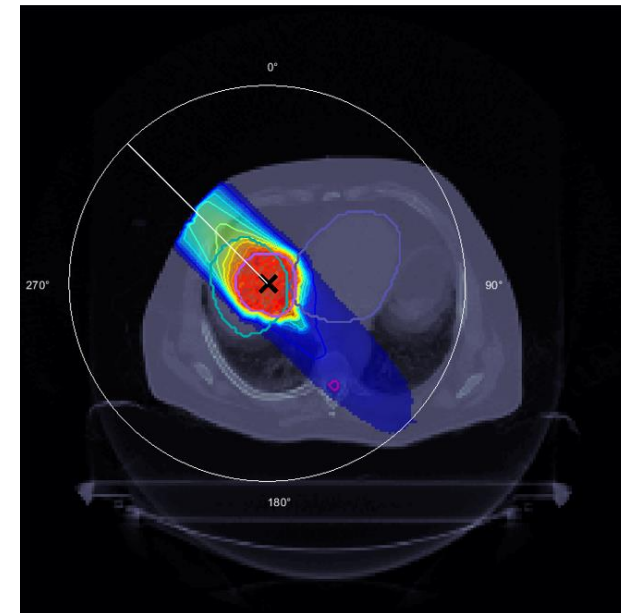
Healthy tissues and organs at risk under the PTV are really well or completely spared.



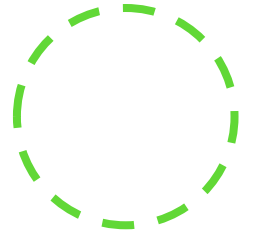
CARBON ION THERAPY

Doses under patient's skin above PTV are lower than when we use protons.

Bad thing is that under the tumor there are lots of low doses in healthy tissues.

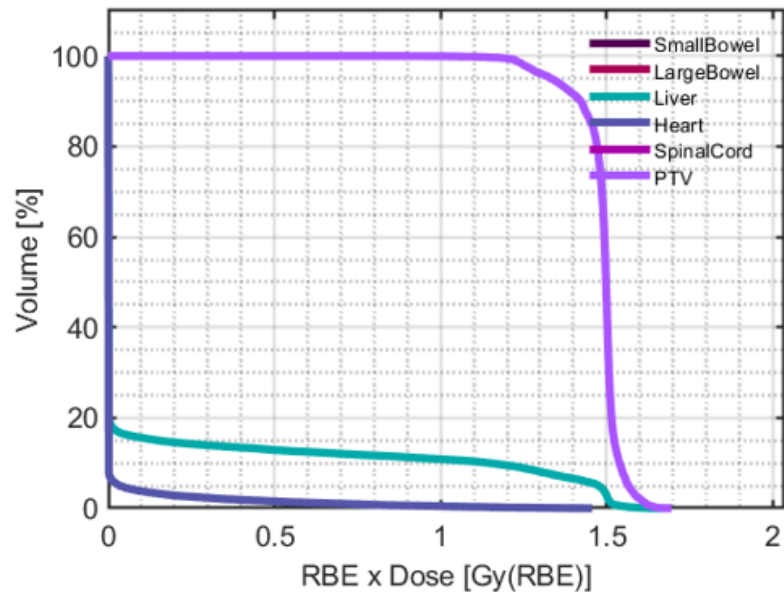


COMPARISON FOR PROTON AND CARBON ION THERAPY FOR LIVER



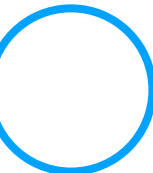
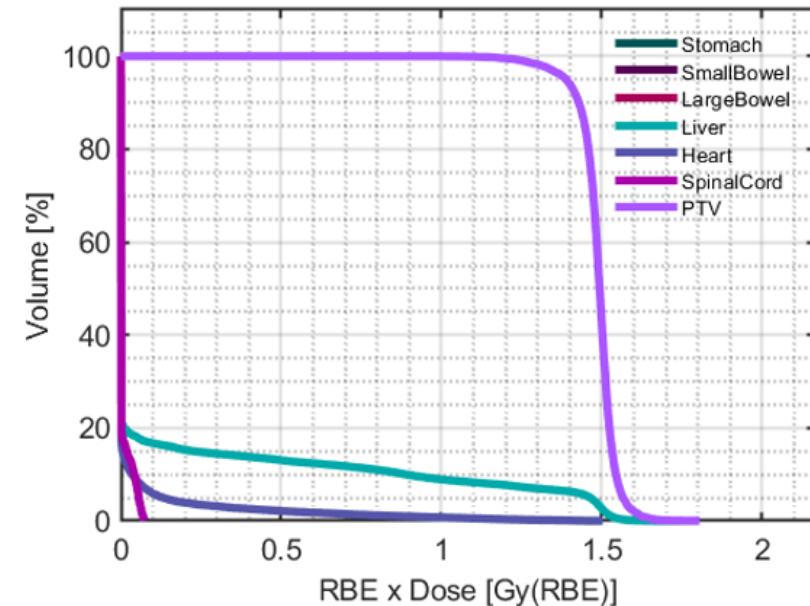
PROTON THERAPY

There is no dose absorbed in spinal cord – it's fully spared thanks to the fact that under the PTV there is no dose (Bragg peak)



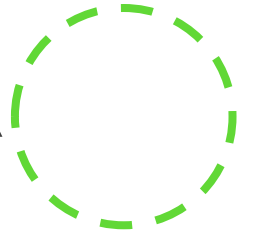
CARBON ION THERAPY

DVH looks similar to the one on the left. Unfortunately spinal cord gets low doses because carbon's Bragg peak is more expressed.





HOUSTON, WE HAVE A PROBLEM – ERROR IN PATIENT'S POSITIONING



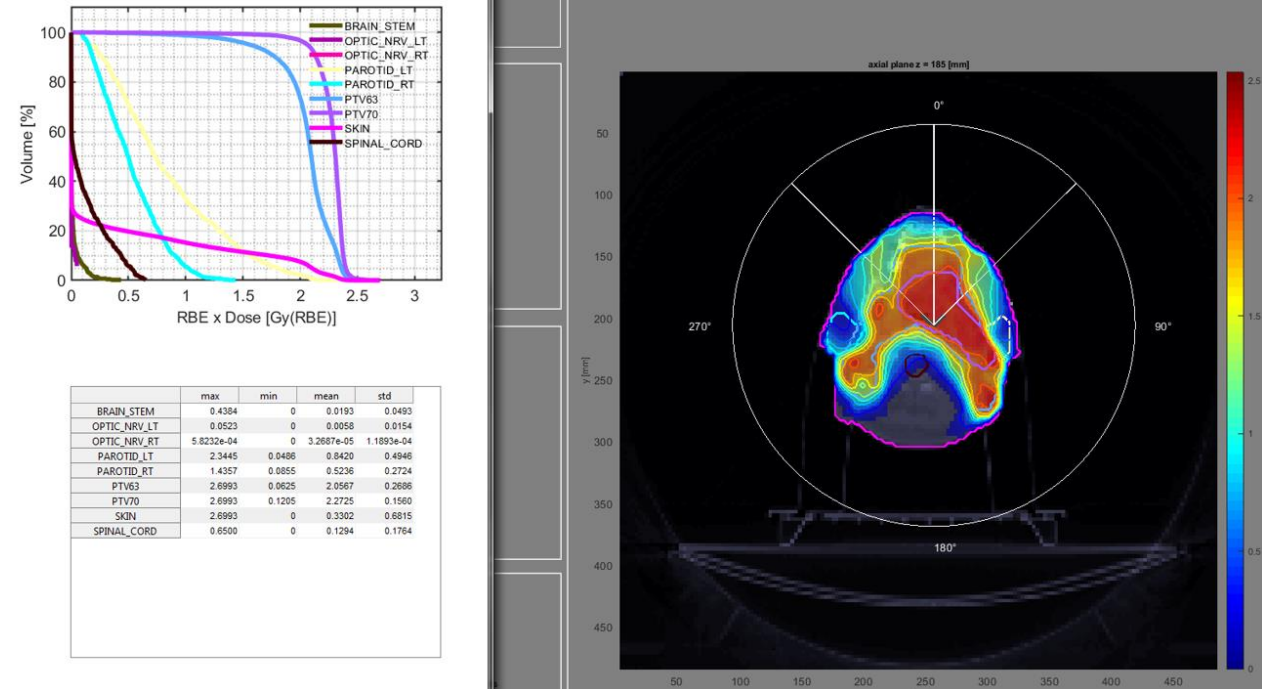
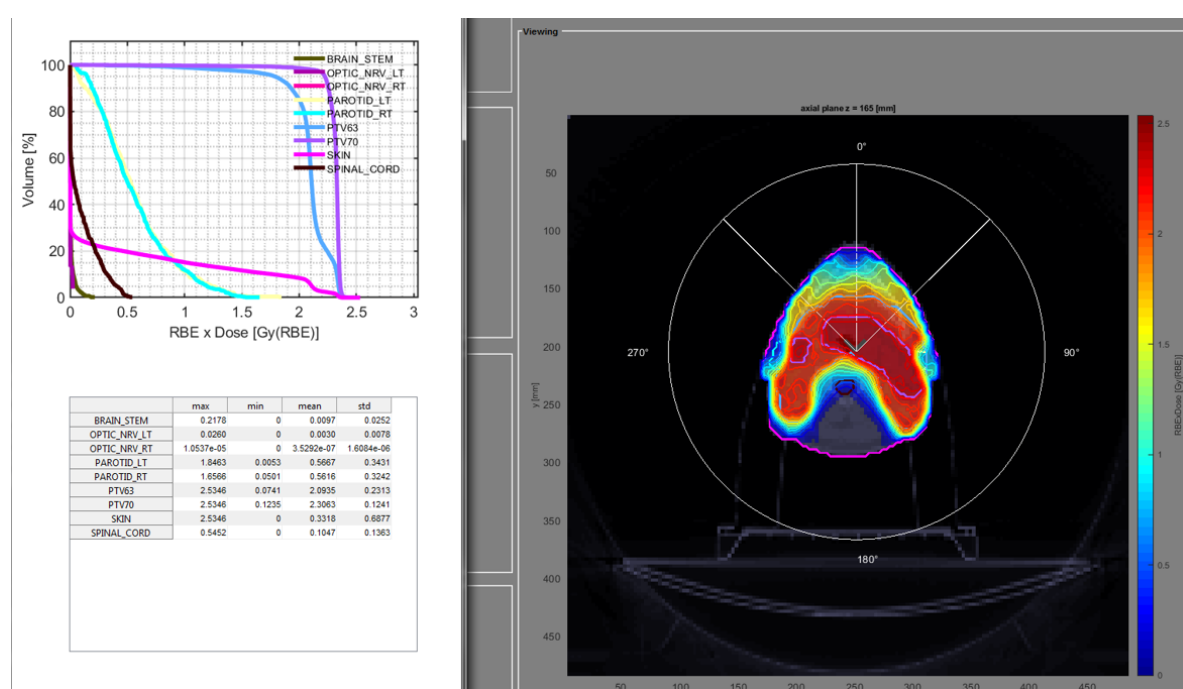
PROPER POSITIONING

We have the best achievable dose distribution.

AN ERROR – ISOCENTER CHANGED

Dose distribution worse for PTV, higher mean doses in organs at risk.

We cannot achieve the goal of the therapy.



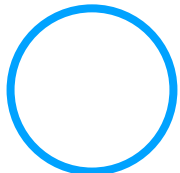



CONCLUSION

When we use a few photon fields we get better dose distribution than when using a single beam.

Proton and carbon therapy thanks to the Bragg peak can spare organs at risk and other healthy tissues while still creating a good dose distribution in PTV region.

The difference between carbon and proton is that below PTV there is almost no dose when we use protons. When we use carbon, there are some low dose regions under PTV. But when using carbon we have lower doses under patient's skin than when using proton therapy.



A decorative graphic featuring a thick pink arc that curves across the top and sides of the page. In the top left, there is a dashed orange circle. In the top right, there is a dashed green circle. A small yellow dot is located on the left side of the pink arc. A small cyan dot is located on the right side of the pink arc. In the bottom right, there is a solid blue circle. The text "Thank you for your attention" is centered in a large, black, sans-serif font.

Thank you
for your
attention