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# #139 REDUCTION OF RADIOTOXICITY BY ULTRA-HIGH DOSE RATE PROTON THERAPY

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## 1- Introduction

■ Electron beams are widely used for Ultra-High Dose Rate Radiotherapy (UHDR-RT) studies.

■ The novelty of UHDR-RT using protons still requires a lot of knowledge of the parameters involved in its response.

■ **Protons** : -Spread a little along the trajectory.  
 -Have a precise targeting.

**What are the requirements that allow obtaining a protective effect using proton UHDR-RT ?**

## 2- Materials and Methods

### ■ Zebrafish embryos



No experimental authorization is required      Statistical power      Fast beam structure investigations

### ■ Irradiation at 28 hpf

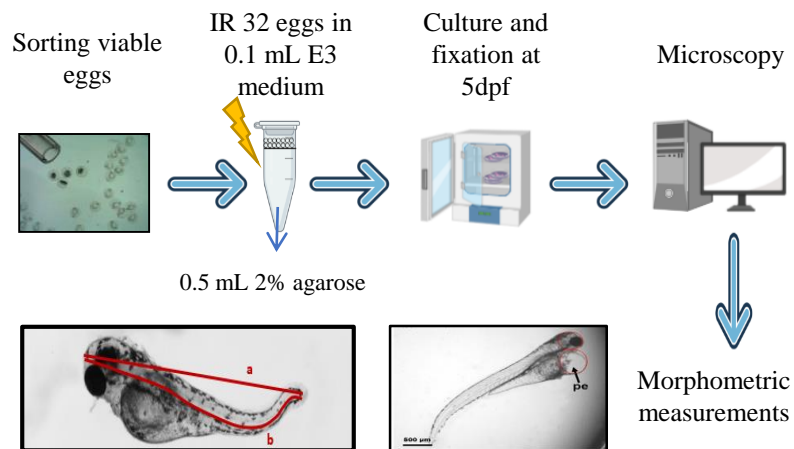
Plateau of 68 MeV protons



Conventional dose-rate  
**12 Gy/min**

Ultra-high dose-rate  
**8-9 kGy/sec**

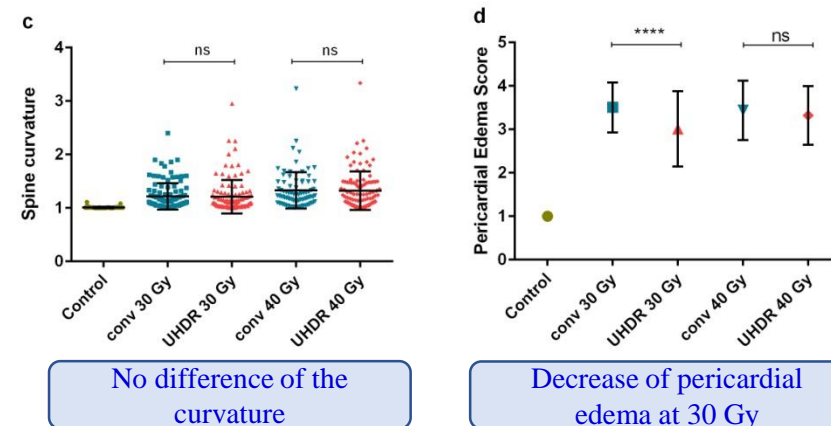
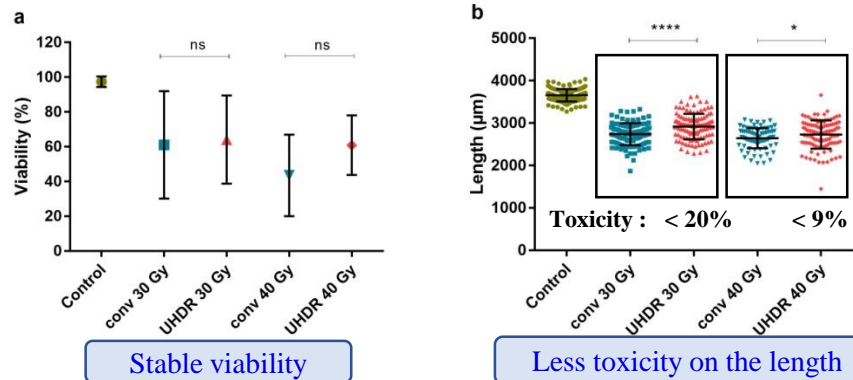
### ■ Protocol



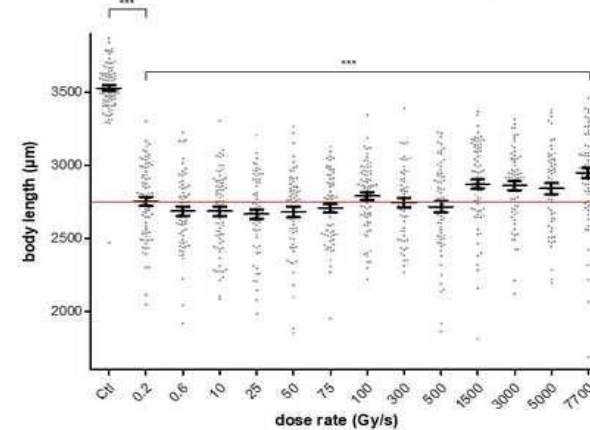
a: Distance (from head to tail)  
 b: Length of the body  
 b/a: Curvature of the tail  
 Scoring pericardial edema

## 3-Results

### ■ Effect of proton UHDR-RT on the morphology of zebrafish embryos vs conv RT :



### ■ Effect of the mean dose-rate on the protection of zebrafish embryos :



**Significant protection at 7700 Gy/s.**

## 4- Conclusion

- A protection in body length after proton UHDR-RT was demonstrated with the zebrafish embryonic model.
- This model allows to study rapidly several parameters allowing a better understanding of proton UHDR-RT.