



**Velindre Cancer Centre  
Canolfan Ganser Felindre**



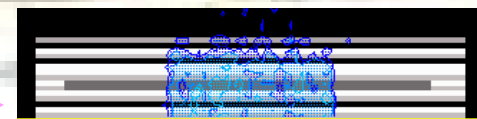
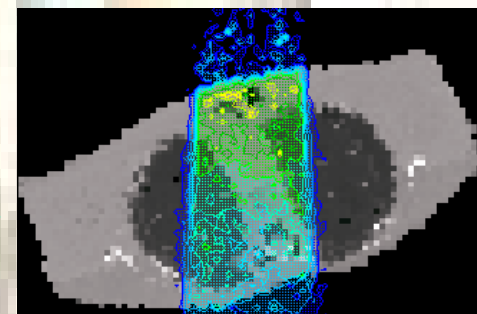
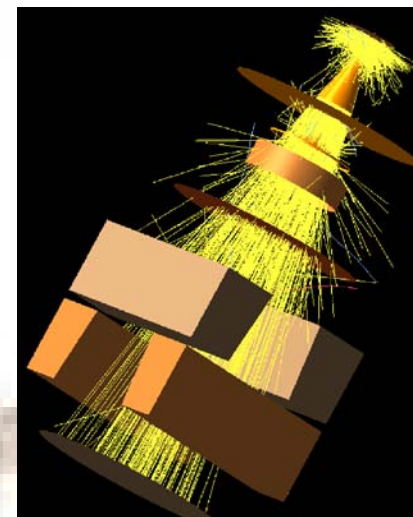
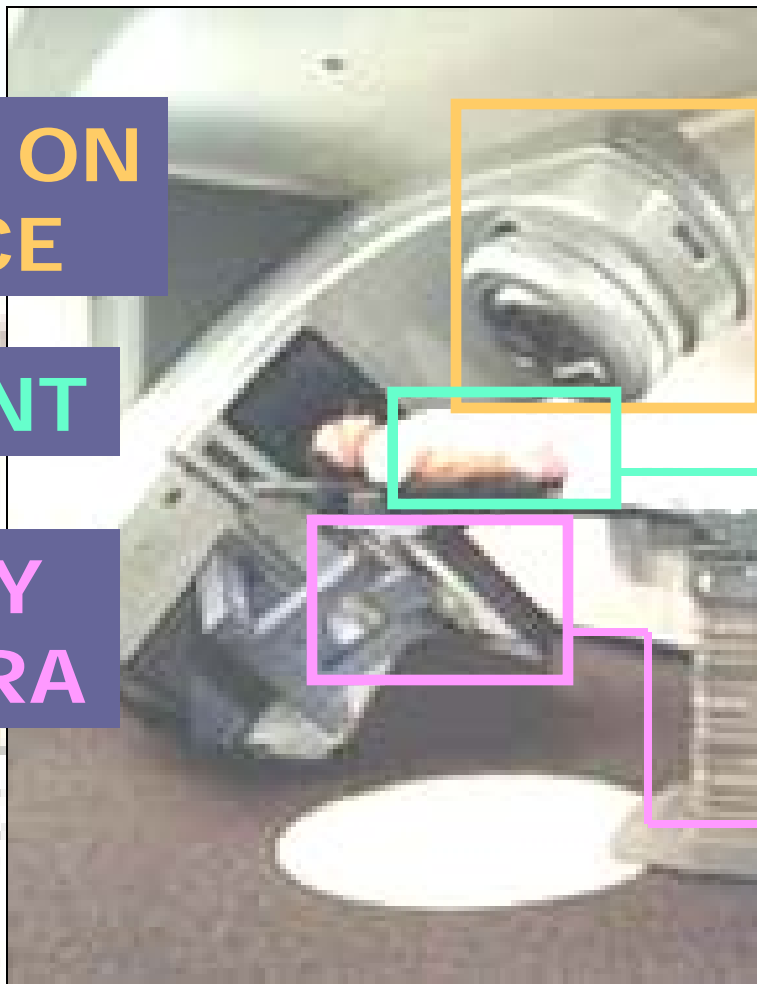
# **MONTE CARLO SIMULATIONS IN RADIOTHERAPY**

RADIOTHERAPY PHYSICS  
RESEARCH & DEVELOPMENT

**RADIATION  
SOURCE**

**PATIENT**

**X-RAY  
CAMERA**



**COMPUTER MODELING**

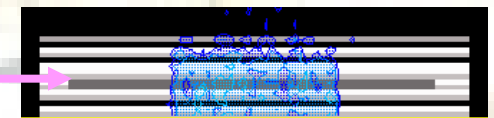
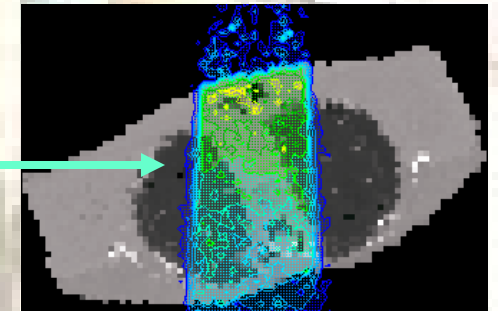
**RADIATION:**  
electrons, photons, ...

interact with

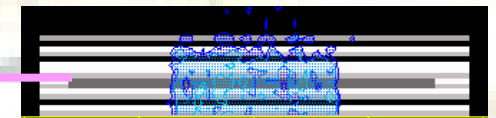
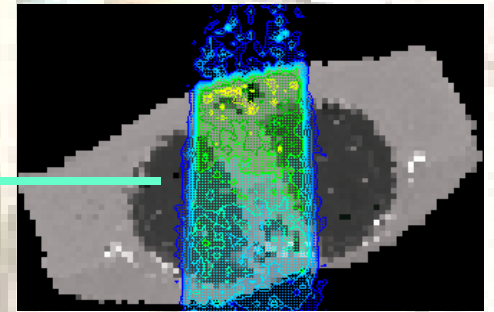
**BODY:**  
bone, lung, soft tissue, ...

cast "*shadow*"

**SNAPSHOT:**  
real-time report



MONTE CARLO SIMULATION



**COMPARE  
WITH  
DOCTOR'S  
PRESCRIPTION**

**VIRTUAL  
DOSE**

**COMPARE  
WITH  
TREATMENT-  
TIME  
SNAPSHOT**

**VIRTUAL  
SNAPSHOT**

**TREATMENT VERIFICATION**

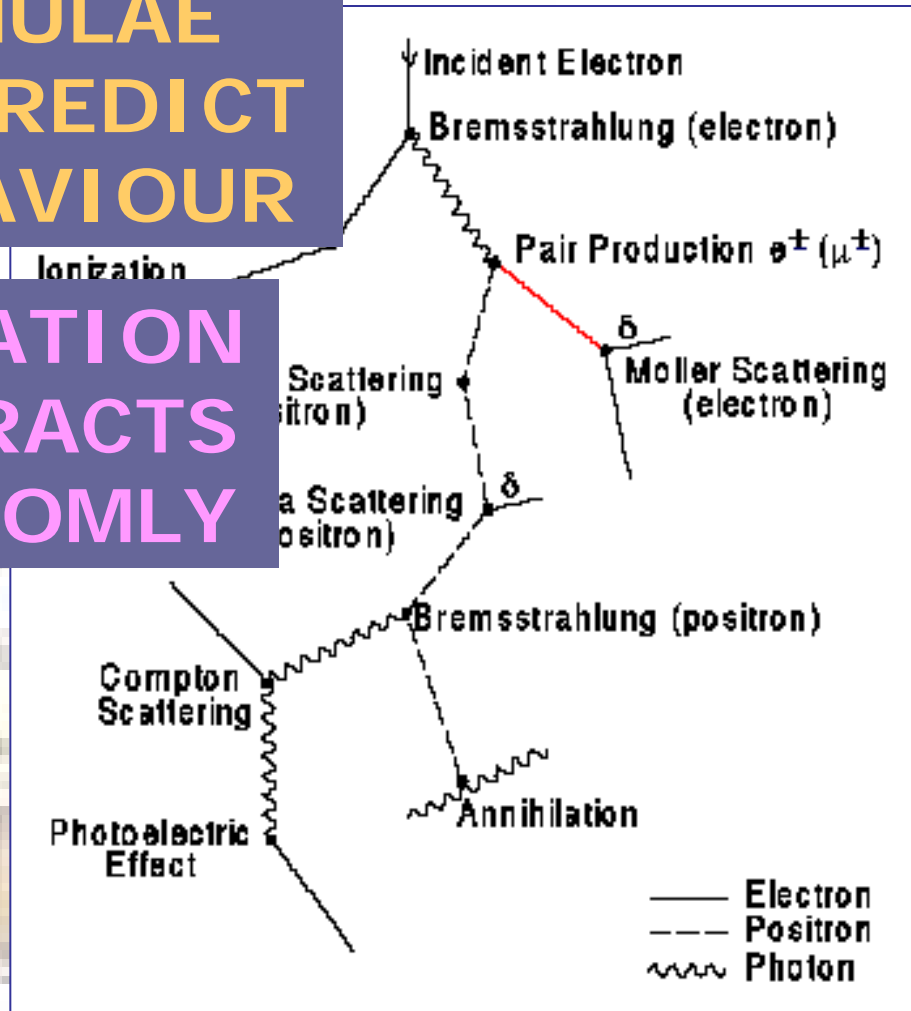
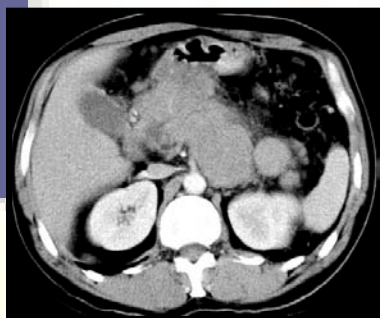
# PHYSICS FORMULAE CAN'T EXACTLY PREDICT RADIATION BEHAVIOUR

... because

## RADIATION INTERACTS RANDOMLY



## EACH PATIENT BODY DIFFERS



## WHY MONTE CARLO?

**"THROW DICE"  
AT EACH POINT  
TO DECIDE  
WHAT HAPPENS  
NEXT**



**REPEAT WITH  
TRILLIONS OF  
PARTICLES  
ENTERING THE  
BODY**

HOW MONTE CARLO WORKS

let many computers  
work on the same job  
simultaneously



simulation per patient can  
take WEEKS on 1 computer!

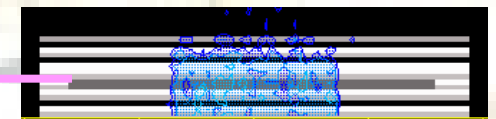
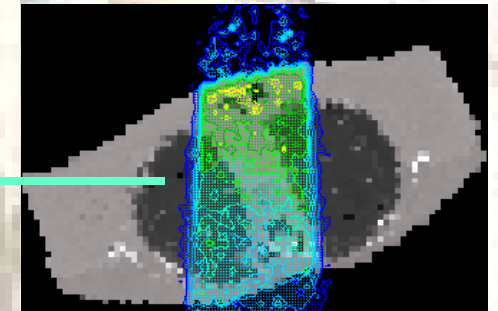
repeat with  
TRILLIONS of  
particles

HOW IS MONTE CARLO DONE?

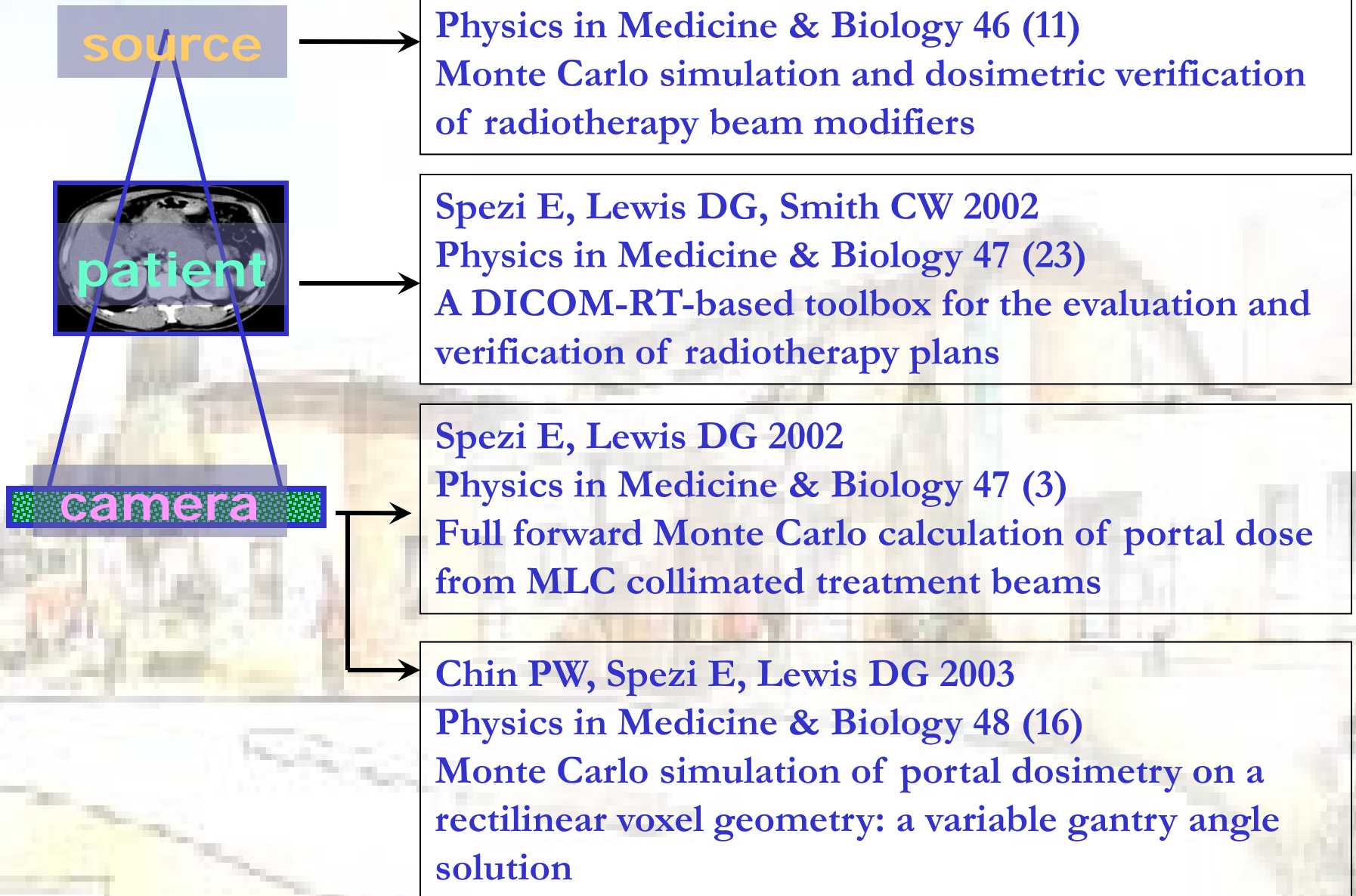


**PREDICT PATIENT  
DOSE BEFORE ACTUAL  
TREATMENT**

**VERIFY DELIVERY  
AFTER ACTUAL  
TREATMENT**



CLINICAL USE



SCIENTIFIC PUBLICATIONS



## Acknowledgement

**Thanking Cancer Research  
Wales & Yr Ysgol Uwchradd  
Tregaron for research funding .**