Code and Data Sharing for Advanced Radiotherapy

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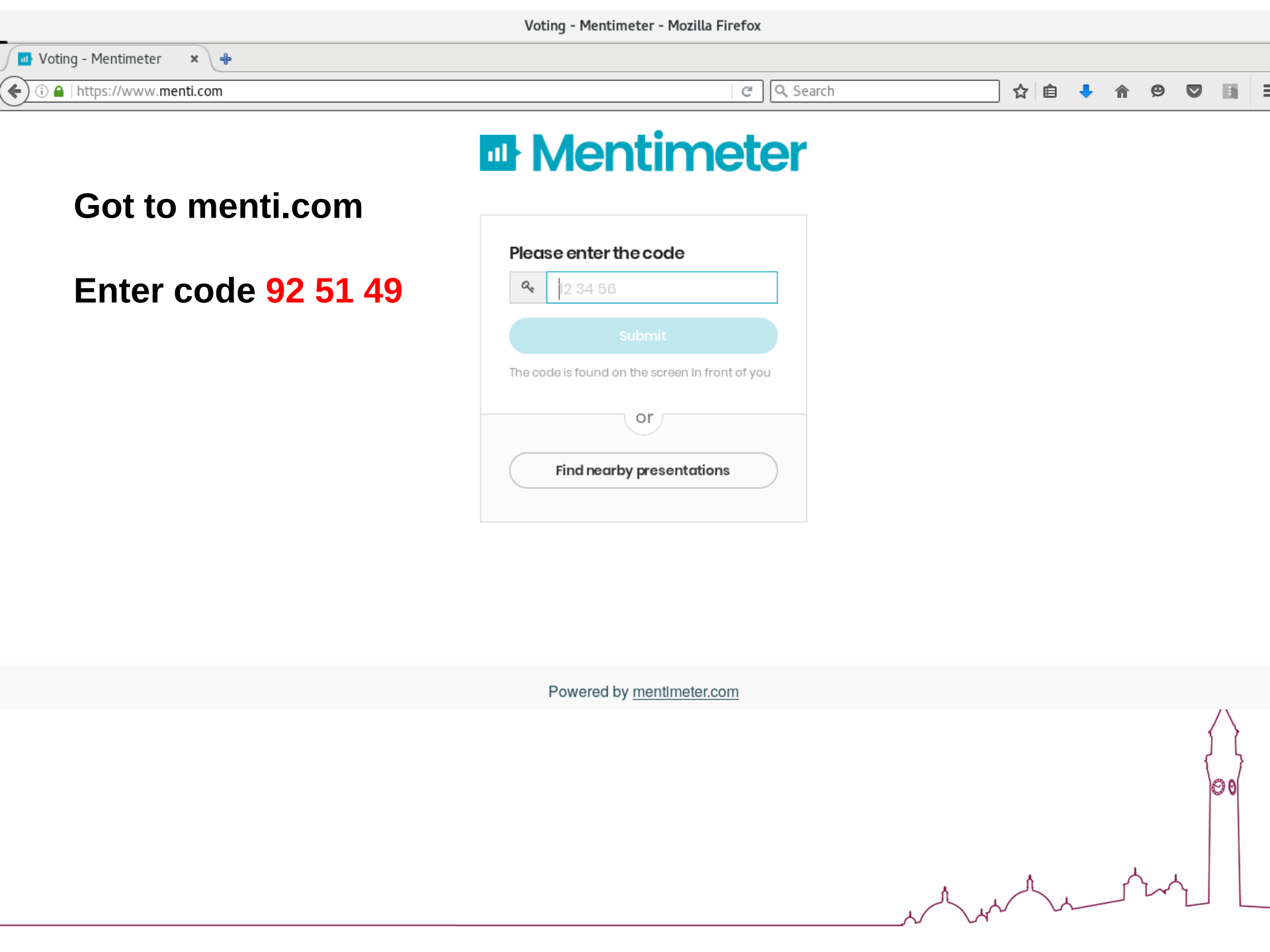
MCMA17

17th October 2017

Science & Technology Facilities Council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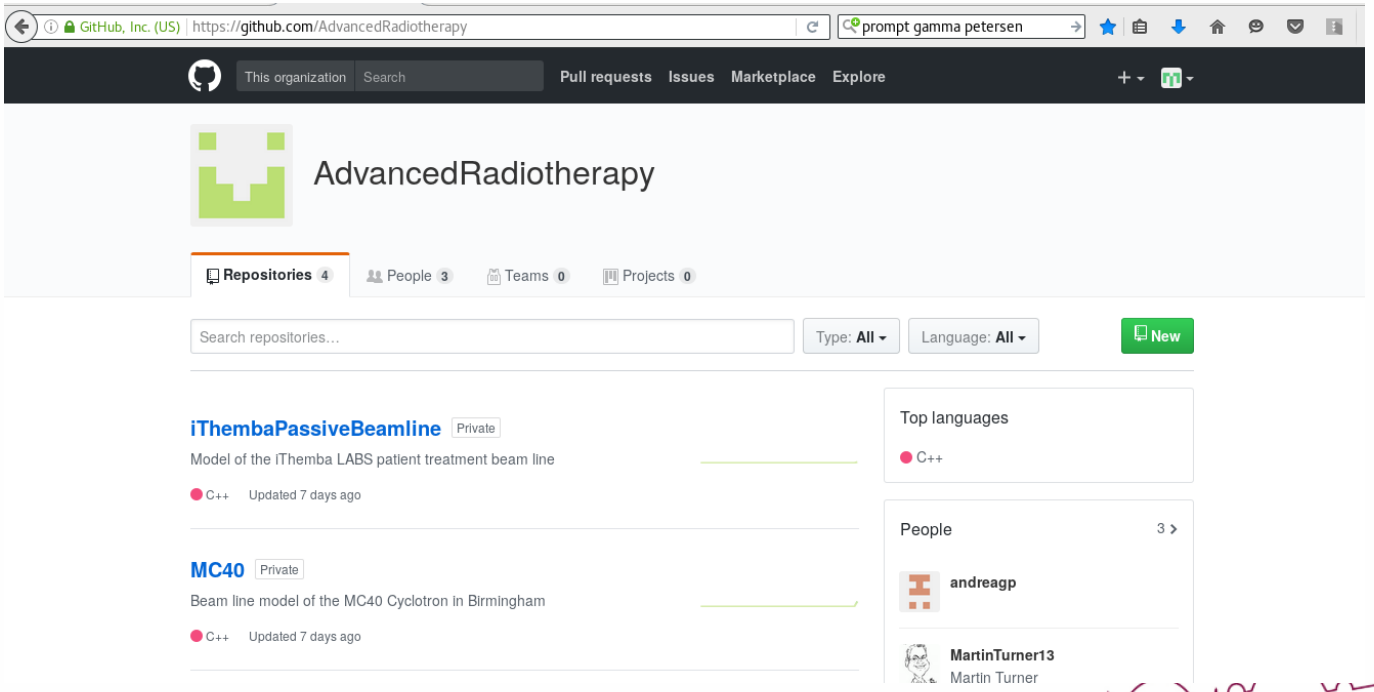
Project Overview

- Project funded in the UK by STFC Global Challenges Network+ Advanced Radiotherapy
- **Aims**:
  - To enable non MC experts to use MC code and facilitate the use of MC in a clinical environment
  - To save users time by providing models of beam lines and experimental facilities which have been validated by expert users of the facility
    - Pure Geant4, FLUKA, TOPAS, GATE…
  - Provide data to verify any code we provide is working on your system

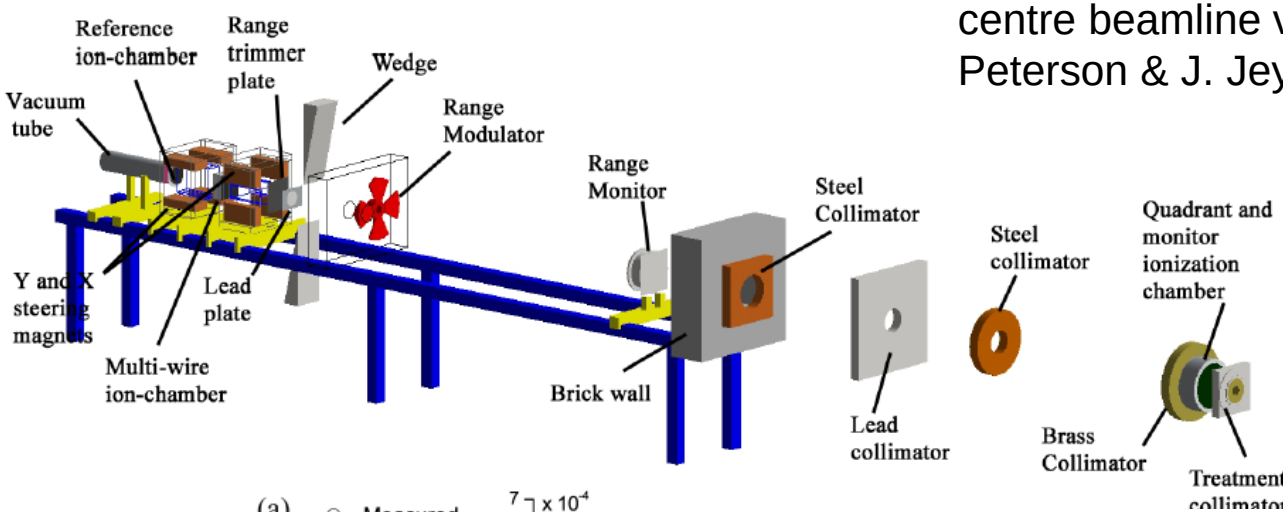
Project Overview

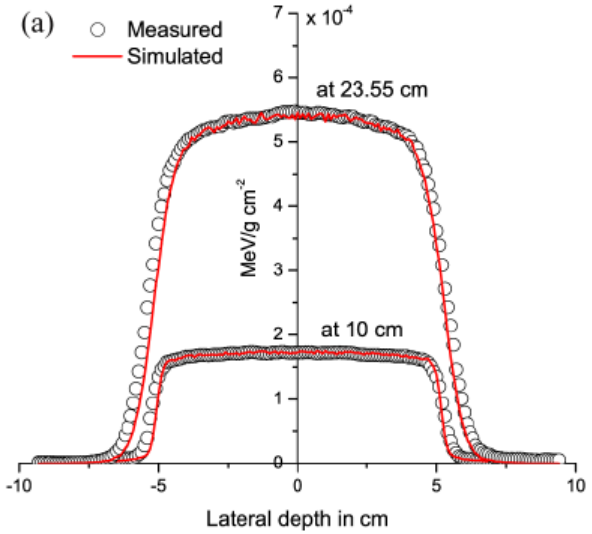
- Host code and data on UCL github
  - Currently set to private, will change soon
  - Pull requests will be possible but no push
  - Instructions on how to run simulations and expected results in README.md files

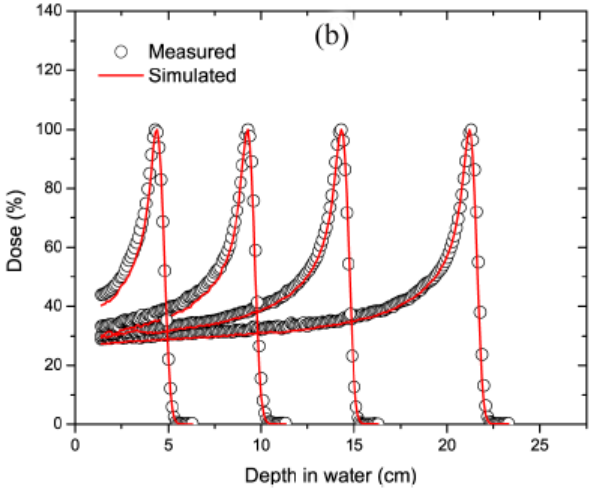


Case Study 1: iThemba Beam line and proton CT

Geant4 implementation of iThemba proton centre beamline validated by experts (S. Peterson & J. Jeyasugiththan) at UCT



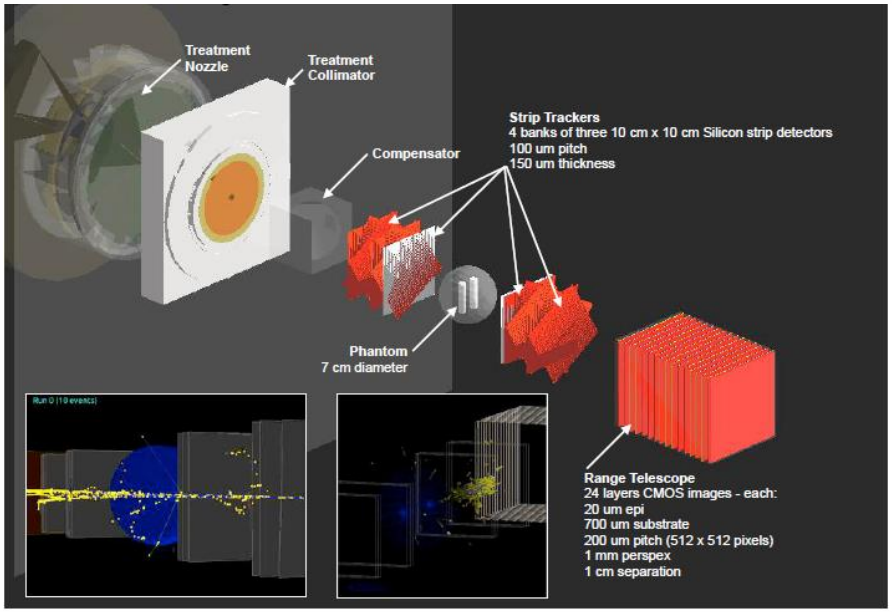




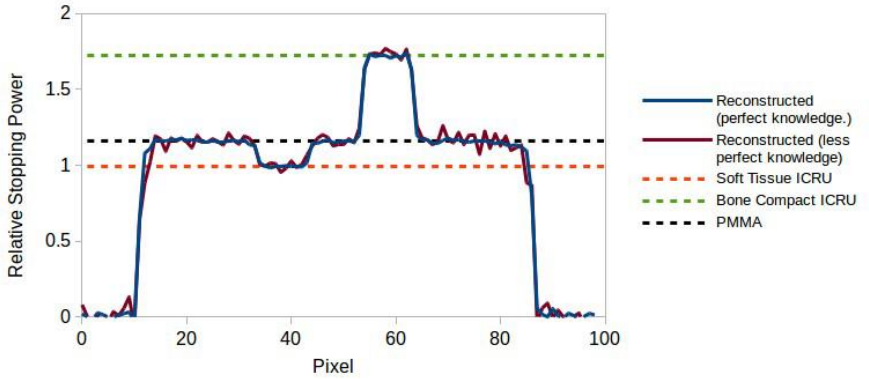
Small ionisation chamber in water tank for beam QA

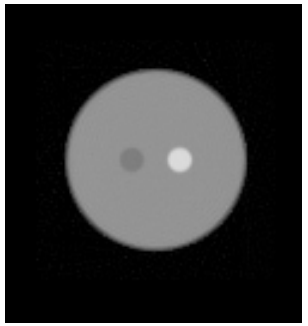
Case Study 1: iThemba Beam line and proton CT

Donated to PRaVDA to help optimise proton CT which would be tested at iThemba LABS



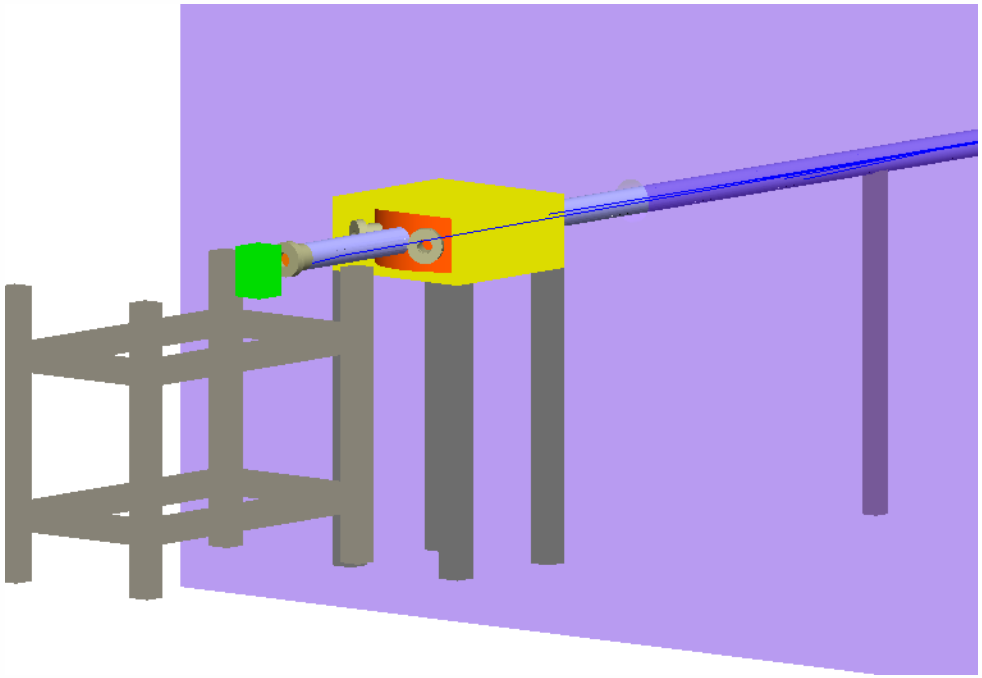
Members of PRaVDA could focus on just simulating their device…

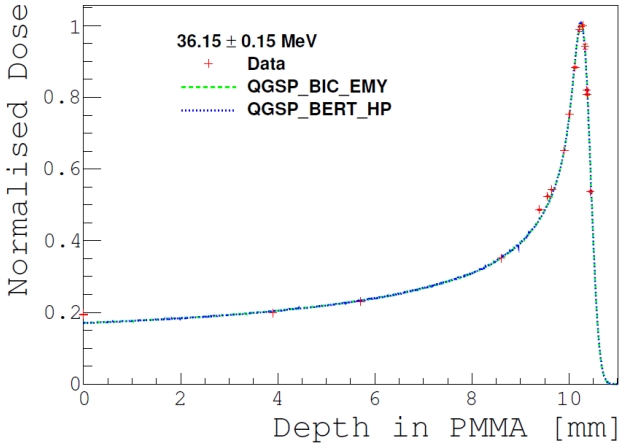


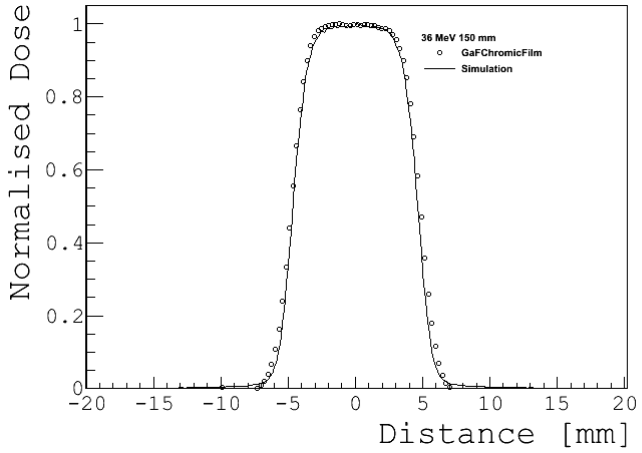


.. and making proton CT of test phantoms

Case Study 2: Birmingham MC40 Medical Beam line

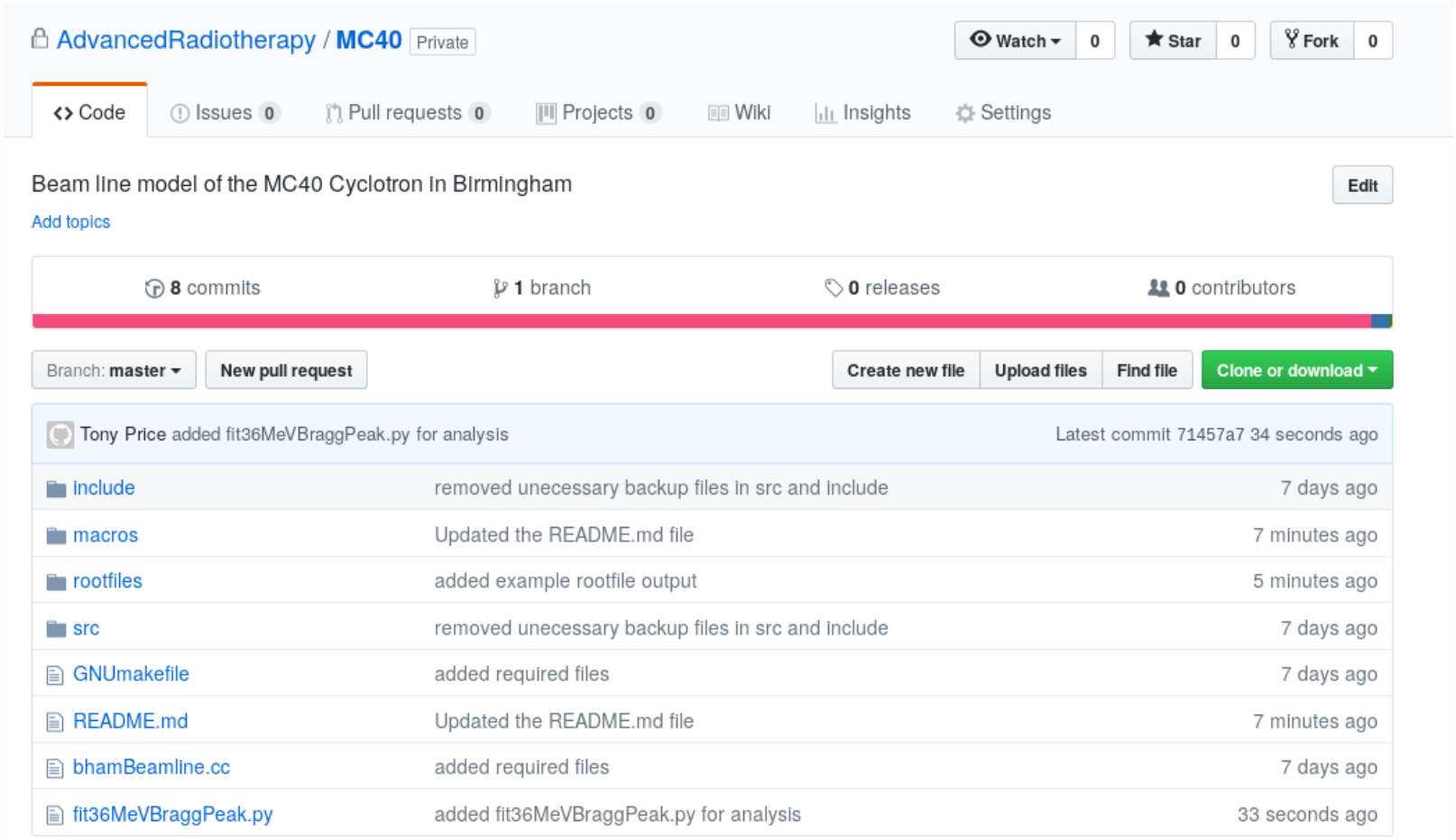






Geometry fully implemented and beam parameters for 29 MeV and 36 MeV beams optimised. See poster or talk to me for more details

Case Study 2: Birmingham MC40 Medical Beam line



Case Study 2: Birmingham MC40 Medical Beam line

MC40 Cyclotron Model

Validated with Geant4.10.1 on Ubuntu 12.04. Tested and working on CentOS7 and SLC6 with Geant4.10.2.p03

Also requires ROOT (https://root.cern.ch)

To build:

1. source relevant thisroot.sh and geant4make.sh
2. change to /bhamBeamline
3. type 'make'

To run a Bragg peak to test against validation data type

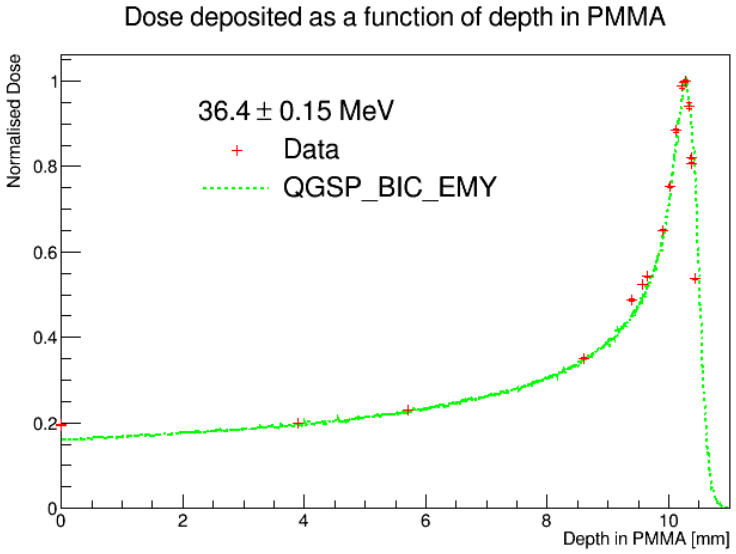
```
'bhamBeamline macros/braggpeak.mac'
```

This will simulate 10k primaries and output a file called rootfiles/braggpeak.root

To analyse the data simply run

```
'python fit36MeVBraggPeak.py"
```

This will scale the Bragg Peak to data obtained with Ionisation chambers



Once results are replicated you can then add your experiment to the beamline! Easy!

Case Study 3 – Clatterbridge Cancer Centre

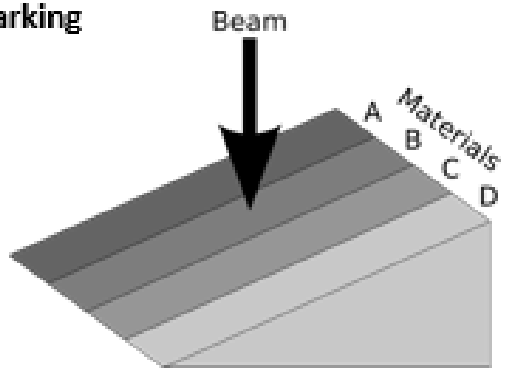
- Many experiments performed at CCC in the UK in the build up to NHS proton facilities opening
- Many users therefore need to model the beamline to accurately simulate their experiments
- Currently many users are (have) modelling the beamline…
  - UCL
  - NPL
  - Manchester University
  - Royal Berkshire Hospital
- We want to add a single validated model for all to use!

Case Study 4 – STFC Global Challenged Network+ Advanced Radiotherapy Phantom

Physical and software phantoms for proton therapy

- Need to verify Monte Carlo simulations not only in water but also in additional materials:
  - Dose distributions simulated in the water used for the tuning will always fit measurements in water
  - Need additional benchmarking in non-water materials

Aim: Standard phantom design for MC benchmarking



Picture courtesy: Adam Aitkenhead

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Slide borrowed from Carla's talk yesterday

Proposed to host such a phantom in a single place for all users

We intend on making available to all users via github when ready

Increased exposure for your work

Increased citations

Decrease time wasted by others

Contact us and donate now!

t.price@bham.ac.uk