STELLA and FLASH therapy

Manjit Dosanjh

JAI Advisory Board Meeting

16 April 2026

Imperial College London

ROYAL HOLLOWAY UNIVERSITY OF LONDON

UNIVERSITY OF OXFORD

Update on STELLA and VHEE

- **STELLA** (Smart Technologies to Extend Lives with a Linear Accelerator)
  - Global multidisciplinary collaboration with CERN, Cambridge, Oxford, Lancaster, STFC, Europe, USA, Canada and ART Study (former Soviet-Union Countries funded by NNSA-DOE) under ICEC (International Cancer Expert Corps) an NGO in USA
  - One year STELLA Status and Strategy **9-10 July,** CERN
  - Linac and MLC fault analysis: Oxford, Exeter and Cambridge
  - ML and AI in speeding up treatment (Cambridge, Lancaster, Oxford) grass-roots data from Ghana and Pretoria

- **SAPPHIRE** (Supra-African Physics Partnership for Health Innovation and Radiotherapy Expansion)
  - Funded by STFC –UKRI a training grant for 2 years lead by Oxford with Cambridge and Lancaster to **train young medical/physicists in state of art radiation therapy technologies in Pretoria, South Africa and Ghana.**
  - **Visit by CEOs of STFC, IoP and APS to discuss SAPPHIRE in Accra, Ghana**
  - First Training workshop on hardware in Accra 13-17 April lead by Graeme Burt (Lancaster)
  - Second workshop on software in Pretoria, 7-11 September will be organised by Raj Jena (Cambridge)

- **VHEE FLASH Activities** (Very High Energy Electrons (50-250 MeV)
  - CLEAR Collaborations with CERN, Geneva, CLARA, Daresbury (Roberto Corsini and Deepa Angal-Kalinin groups)
  - VHEE UHDR Dosimetry and Beam Monitoring (CLEAR, UCL and Oxford LWFA (Laser Wake Field Accelerator)
  - VHEE Dose Delivery (CERN, Oxford, UViC, Canada, Magdalena Bazalova-Carter group)
  - Biological effects (HUG-Marie-Catherine Vozenin's group)

STELLA project

Smart Technologies to extend lives with linear accelerators

The Project STELLA is dedicated to:

- Expanding access to high-quality cancer treatment globally
- Transforming LINAC radiotherapy with new hardware and AI
- Reducing the cost barrier of RT and cancer care
- An enhanced training, education and mentoring program that catalyses RT implementation in the global context

STELLA – Current Status

- **MD is** the STELLA coordinator, STELLA global meeting at CERN, 9-10 **July 2025**

- **Work on-going in Developing STELLA facility at UK Universities:**
  - Design specification of the STELLA machine: hardware (accelerator, Collimator)
  - Designing an AI powered smarter radiotherapy machine: increase reliability and reduce the number of experts needed and improve uptime

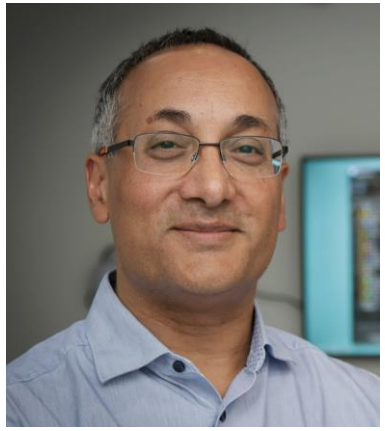
- **Impact opportunities for STELLA**
  - Presented at the Pontifical Academy in the Vatican
  - Ugo Amaldi's 90th anniversary as one of the founders

- **Armanc Karakoyun** new PDRA for MLC work at Oxford

STELLA at Vatican and CERN

Examining role of AI and ML in cancer treatment

STELLA Collaboration between Cambridge, Exeter, Oxford and CERN



Raj Jena, Cambridge

Xin (Doris) Du, Cambridge

Torsten Liebig, Royal Devon NHS, Exeter

Manjit Dosanjh, Oxford

Samuel Leadley, Oxford

Armanc Karakoyun, Oxford

UNIVERSITY OF OXFORD

UNIVERSITY OF CAMBRIDGE

NHS Royal Devon University Healthcare NHS Foundation Trust

CERN

STELLA SMART TECHNOLOGY TO EXTEND LIVES WITH LINEAR ACCELERATORS

Armanc Karakoyun | (PDRA, JAI, Oxford)

PhD in medical robotics at Heriot-Watt University (Thesis Defence: 9 April 2026)
Thesis Topic: Design, Miniaturization, and Robotic Integration of a Spiral-scanning Endoscopic Probe for Laser Ablation

MSc in AI & Robotics at Korea Institute of Science and Technology
Thesis Topic: Design and Development of Surgical Instruments for Robot- Assisted Biportal Endoscopic Spine Surgery (BESS)

Role at Oxford

- Designing and prototyping fault-resilient multileaf collimators (MLCs) tailored for medical linear accelerators in challenging environments.
- Performing computational simulations (e.g., Monte Carlo, CAD kinematic analysis) and mechanical stress tests to optimize leaf profiles and drive mechanisms, minimizing radiation leakage and ensuring long-term operational reliability.
- Collaborating with multidisciplinary international consortiums to define system requirements, integrate mechatronic components, and translate laboratory prototypes into viable, low-maintenance clinical solutions for low-resource settings.

STELLA AI and Machine Learning

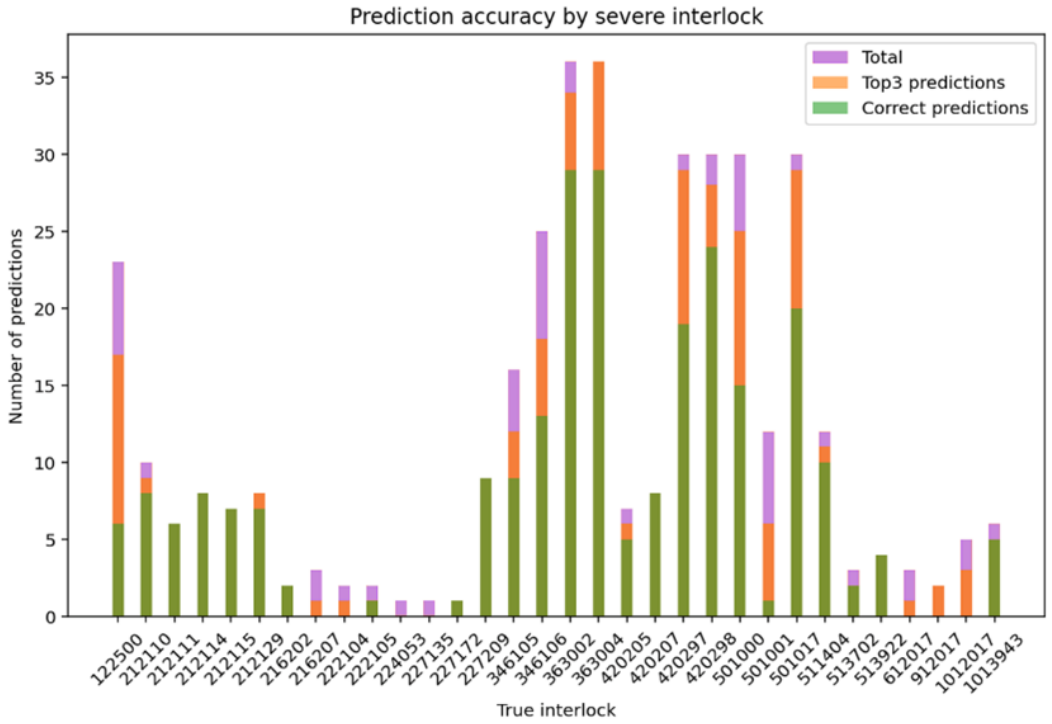
- Large language models to **read medical reports** and predict optimum treatment pathway for each patient
- Computer vision algorithms to process images and **automate production** of high-quality radiotherapy plans
- Physics informed neural networks to **enhance quality of images** produced by linacs (cone beam CT)
- **Fault prediction** from radiotherapy linac telemetry to reduce unscheduled downtime

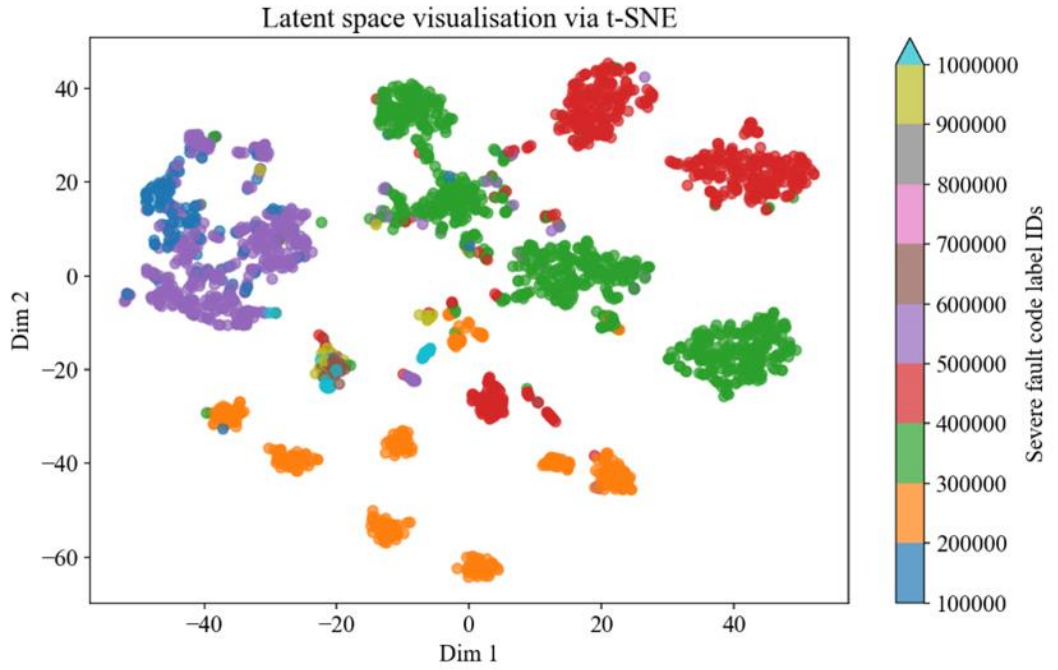
Fault Prediction in Radiotherapy Linacs

(Sam Leadley)

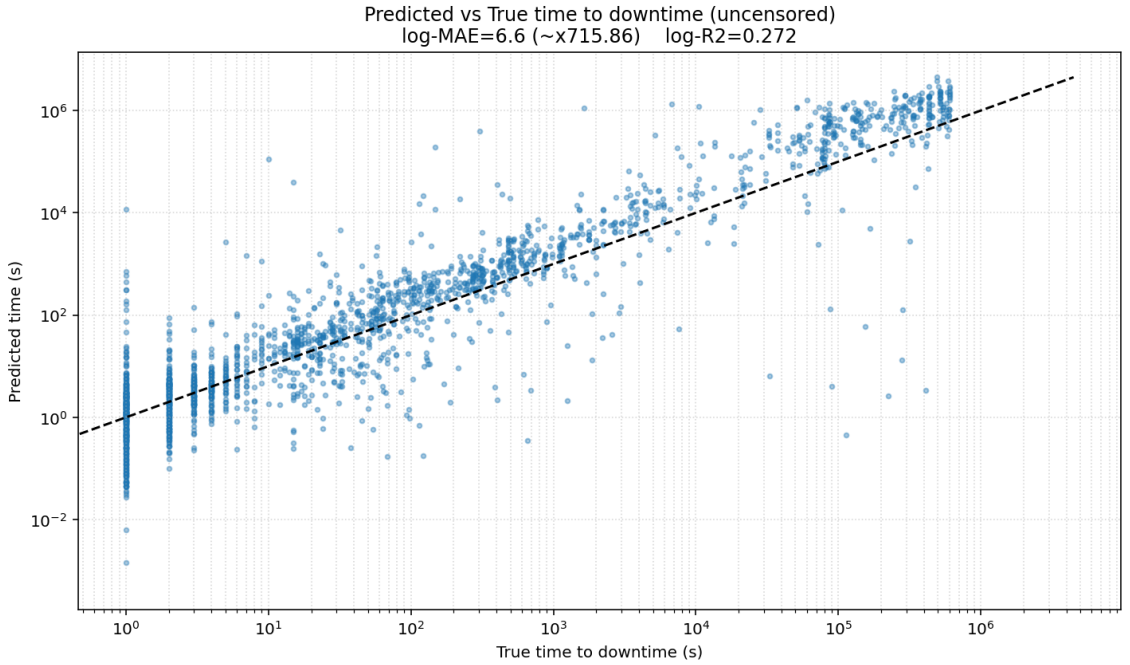
- Variational Autoencoder machine learning model can take in radiotherapy machine data and predict future machine faults
- Optimised dual-classifier model can distinguish upcoming faults with 86+% overall accuracy, including probabilistic predictions
- Collaboration with Exeter, Oxford and Cambridge hospitals
- Presented research at VHEE25' conference in Daresbury, September 2025

- Prediction with VAE model shows distinction between similar fault modes (right)

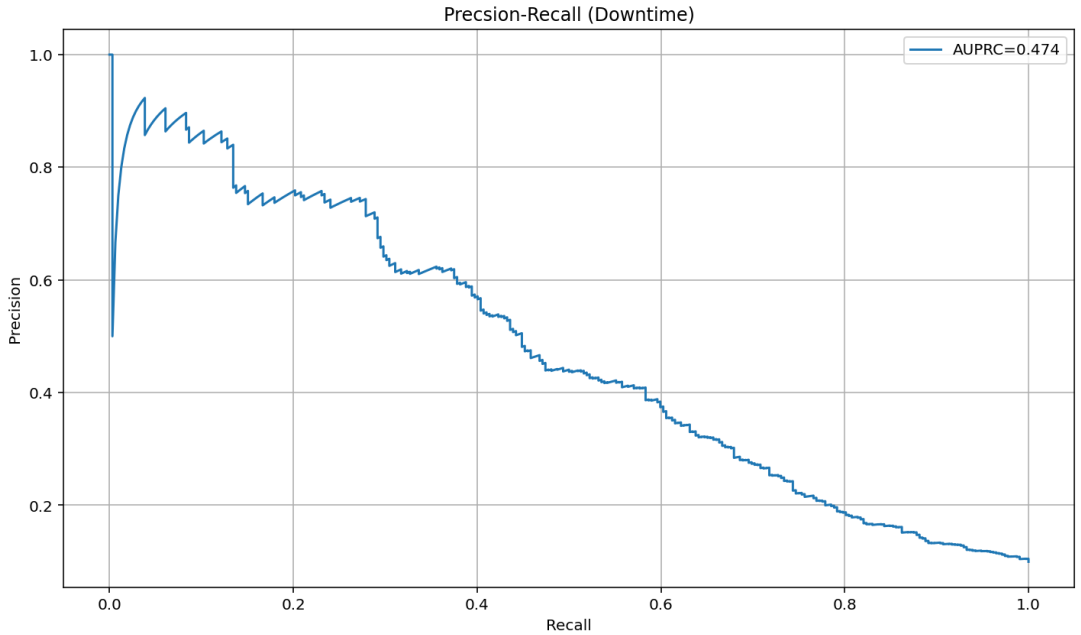




- Accuracy varies by fault mode, but remain generally high
- Correct fault mode almost always in top-3 most likely predictions



- New transformer-based method can predict time-to-downtime of radiotherapy machines

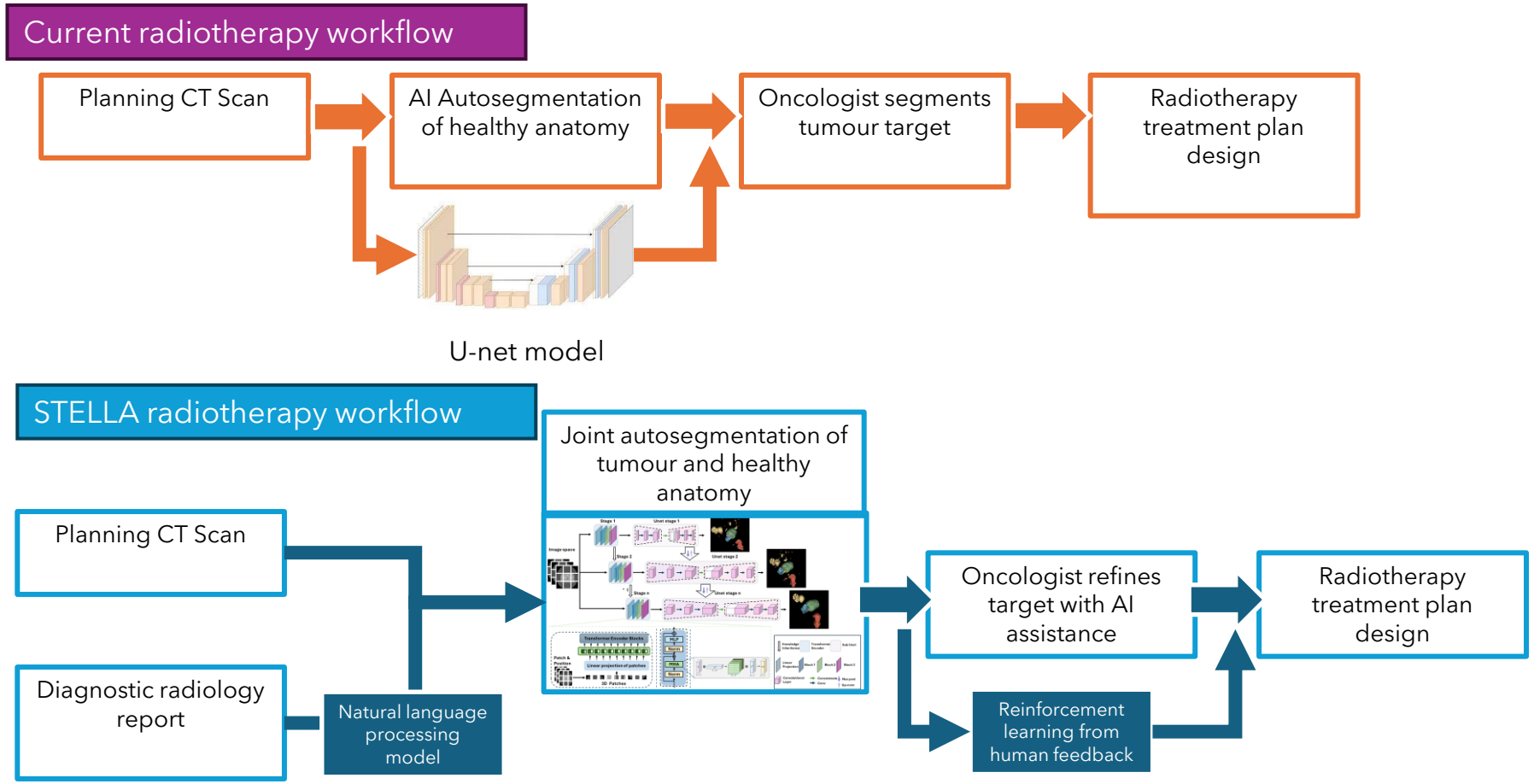


- Current model accuracies are low-medium, but with significant scope for improvement

- Focus is on prediction of downtime modes AND times.

Leveraging vision-language models to accelerate RT planning

Xin (Doris Du), Cambridge



STELLA RAGWort: Retrieval Augmented Generation for Workflow Optimisation in radiotherapy

- Hypotheses
  - Can a large language model can be trained read a **clinical referral letter** for radiotherapy?
  - Can it apply knowledge from the letter to a clinical **treatment protocol** for radiotherapy?
  - Can it determine when key **information is missing** from the referral letter?

- How well can it perform this task compared to **trainee** oncologists?
- Can it be used as a ‘cross check’ in a physics department for **quality assurance**

- RAGWORT works in breast and head and neck cancer protocols from UNC Chapel Hill (US) and Cambridge (UK)

Coding snapshot

```python
import re
import json
import requests
from typing import Dict, List, Tuple, Optional
from dataclasses import dataclass
from enum import Enum

# ================================================
# DATA STRUCTURES
# ================================================

class Laterality(Enum):
    LEFT = "left"
    RIGHT = "right"
    BILATERAL = "bilateral"
    UNKNOWN = "unknown"

class SurgeryType(Enum):
    LUMPECTOMY = "lumpectomy"
    MASTECTOMY = "mastectomy"
    NONE = "none"
    UNKNOWN = "unknown"

class NodeStatus(Enum):
    POSITIVE = "positive"
    NEGATIVE = "negative"
    UNKNOWN = "unknown"

class MolecularSubtype(Enum):
    HR_POS_HER2_NEG = "hr+_her2-"
    HR_POS_HER2_POS = "hr+ her2+"
```

Input clinic letter

```
============================================================
UNC Breast Cancer Treatment Protocol Decision System
============================================================

📝 Enter/Paste the clinic letter (Ctrl+D or Ctrl+Z then Enter to finish):

45-year-old female

DIAGNOSIS: Left breast cancer

HISTORY:
Patient initially presented with palpable lump in left breast.
Mammogram and ultrasound showed irregular mass at 2 o'clock position
measuring 2.8 cm with suspicious axillary lymphadenopathy.

PROCEDURES:
1. Core needle biopsy of left breast mass - 02/01/2025
2. Ultrasound-guided biopsy of left axillary lymph node - 02/08/2025
3. Left modified radical mastectomy with axillary lymph node dissection - 02/22/2025

FINAL PATHOLOGY:
- Invasive ductal carcinoma, grade 3
- Tumor size: 3.1 cm
- Margins: negative (1.5 mm from deep margin)
- Lymphovascular invasion: Present
- Axillary dissection: 4/18 lymph nodes positive for metastatic carcinoma
  (2 nodes with extranodal extension)
- ER: Negative (<1%)
- PR: Negative (<1%)
- HER2: Positive (IHC 3+)
- BRCA testing: Negative

STAGING: pT2 pN2a M0, Stage IIIA

CLINICAL HISTORY:
45-year-old premenopausal woman with node-positive, triple-negative
left breast cancer status post mastectomy and axillary dissection.

PAST MEDICAL HISTORY: None
SOCIAL HISTORY: Works as teacher, lives 30 minutes from cancer center

ASSESSMENT:
Patient seen for post-mastectomy radiation therapy consultation.
Discussed indications for comprehensive nodal irradiation including
chest wall, supraclavicular, axillary, and internal mammary nodes.^Z
^Z
```

Treatment recommendation

```
============================================================
TREATMENT RECOMMENDATION
============================================================

📊 PATIENT SUMMARY:
   Age: 45
   Laterality: left
   Surgery: mastectomy
   Nodes: positive


📊 PATIENT SUMMARY:
   Age: 45
   Laterality: left
   Surgery: mastectomy
   Nodes: positive


💊 RECOMMENDED TREATMENT:
   Technique: 3D Conformal Radiotherapy
   Target: Chest Wall Only
   Fractionation: Conventional Fractionation
   Dose: 200 cGy x 25 fractions = 5000 cGy
   Boost: Yes
          Sequential boost: 250 cGy x 4 fractions = 1000 cGy (Young age)
   Bolus: No
   DIBH: Yes

🔧 SETUP INSTRUCTIONS:
   • Supine, wingboard, both arms up
   • Turn head/chin to right (opposite disease site)

📷 IMAGING GUIDANCE:
   • Weekly port films
   • SSD recorded on port days
   • VisionRT for all patients

⚠️ SPECIAL CONSIDERATIONS:
   • Left-sided with DIBH - monitor heart position

📑 PROTOCOL REFERENCE:
   Clean_DOS_PnP_PLANNING_BREAST_3DCRT_ELECTRONS_2025_12_12.pdf

💬 CLINICAL JUSTIFICATION:
   Recommendation based on UNC breast protocols.

============================================================
```

RAGWort

Collaboration Oxford Churchill Hospital

Oxford University Hospitals NHS Foundation Trust

Investigating scenarios where beam modulation is simplified:

1) to reproduce the MLC used in their Linacs and reduce the number of movement steps they are allowed to make during treatment in a systematic fashion: generating data on how reduction in MLC movement affects treatment plan quality.

2) to replace the existing MLC with a ‘virtual MLC’ which is a Python script. This will allow more complex modification of linac features including the number of leaves, maximum maximum acceleration, and the maximum travel distance permitted.

These clinical studies should inform the design constraints of the mechatronics simulation for our research work specially for Armanc.

SAPPHIRE
Supra-African Physics Partnership for Health Innovation and Radiotherapy Expansion

John Adams Institute for Accelerator Science

Project SAPPHIRE

Supra-African Physics Partnership for Health Innovation and Radiotherapy Expansion

About Project SAPPHIRE

- Funded by Africa-UK Physics Partnership programme
- Goal is to train and network together young medical/physicists in state of art radiation therapy technologies
- Partnership betrween Pretoria, South Africa (Nethwadzi) and Ghana RT centres (Hasford), Oxford (Dosanjh) with Cambridge (Jena) and Lancaster (Burt)

1. Deploy Redmine software to track MLC faults and gather data from 3 sites (Accra, Kumasi and Pretoria) and Pretoria

2. Analyze MLC mechanical faults and propose improved, more durable designs

3. Organize training workshops in Accra and Pretoria on failure modes and maintenance of LINACs

Collaborators & Team

Partners

UK-Based Institutions

University of Oxford

University of Cambridge

Lancaster University

Science and Technology Facilities Council (STFC)

Prof. Graeme Burt
Lancaster University, UK
Group leader of the RF Engineering of Accelerators

Prof. Manjit Dosanjh
University of Oxford, UK
Visiting Professor/former Senior Advisor for Medical Applications at CERN

Prof. Raj Jena

Africa-Based Institutions

Ghana Atomic Energy Commission

Korle-Bu Teaching Hospital

Komfo Anokye Teaching Hospital

Kwame Nkrumah University of Science and Technology

Steve Biko Academic Hospital

University of Pretoria

Prof. Eric Desmond Clement Kotei Addison
Komfo Anokye Teaching Hospital, GHANA
Head of Medical Physics

Dr. Hannah Naa Gogwe Ayettey Anie
Korle Bu Teaching Hospital, GHANA
Consultant Radiation/Clinical Oncologist

Mr Thulani Mabhengu
Steve Biko Academic Hospital, Pretoria, South Africa
Research co-leader, Deputy Director Medical Physics

Ms Mpho Madima
Steve Biko Academic Hospital, Pretoria, South Africa
Research and innovation associate, Medical Physics Intern

Mr Mohau Mashaba
Steve Biko Academic Hospital, Pretoria, South Africa
Research co-leader, Director Medical Physics

Ms Tshegofatso Maswabela
Steve Biko Academic Hospital, Pretoria, South Africa
Research and innovation associate, Medical Physics Intern

Prof. Surbhi Grover
University of Pennsylvania / Steve Biko Academic Hospital, USA / South Africa
Project Co-lead (International)

Prof. Francis Hasford
Ghana Atomic Energy Commission (GAEC)
Deputy Director-General, FAMPO President

Mr Lutendo Nethwadzi
Steve Biko Academic Hospital, Pretoria, South

Ms Jane Nubi
Steve Biko Academic Hospital, Pretoria, South

Ms Lebohane Ratshebaya
Steve Biko Academic Hospital, Pretoria, South Africa
Professional enabling staff, Medical Physics

International Partners

CERN – European Organization for Nuclear Research

International Cancer Expert Corps (ICEC)

Mr Nicolas Rovetto
Steve Biko Academic Hospital, Pretoria, South Africa
Research and innovation associate, Medical Physics Intern

Prof. Steinar Stapnes
CERN, Geneva, Switzerland
European Representative on the Executive Board of the International Linear Collider (ILC)Development Team

Dr Laurence Wroe
CERN, Geneva, Switzerland
Accelerator Physicist

Mrs Donna O'Brien
Strategic Visions in Healthcare, LLC and ICEC
ICEC Board member

Mrs Nina Wendling
International Cancer Expert Corps (ICEC), USA
ICEC Executive Director/Project STELLA Training lead

Visit by STFC, IoP and APS to Ghana Atomic Energy Commission

Electronic data capture and clinical tools

REDMINE – Electronic data capture for M-LINAC faults

Apply Clear Save custom query

#	Project	Tracker	Status	Priority	Subject	Assignee	Updated
622	Super- Projekt	Bug	To Do	Normal	Ticket 3		Today, 02:01 AM
621	Automation Test project	Support	To Do	Normal	Support Request Lorem Ipsum (10/50)	Henk Henkel	Today, 02:01 AM
620	Development Project	Feature	To Do	Normal	Feature development 09-50	Isabelle Faus	Yesterday, 02:00 AM
619	Super- Projekt	Bug	To Do	Normal	Ticket 3		Yesterday, 02:00 AM
618	Super- Projekt	Bug	To Do	Normal	Ticket 1		Yesterday, 02:00 AM
617	Automation Test project	Support	To Do	Normal	Support Request Lorem Ipsum (09/50)	Henk Henkel	Yesterday, 02:00 AM
616	Product: Reporting	Feature	To Do	Normal	Reporting Issue 09, Week 50	Redmine Admin	Yesterday, 02:00 AM
615	Product: Reporting	Feature	To Do	Normal	Reporting Issue 10	Redmine Admin	Yesterday, 02:00 AM
614	Product: Reporting	Feature	To Do	Normal	Reporting Issue 6	Susi Sonnenschein	Yesterday, 02:00 AM
613	Super- Projekt	Bug	In Progress	Normal	Ticket 3		08/12/2024, 10:59 PM
612	Automation Test project	Support	To Do	Normal	Support Request Lorem Ipsum (08/49)	Henk Henkel	08/12/2024, 02:00 AM
611	Super- Projekt	Bug	To Do	Normal	Ticket 3		07/12/2024, 02:01 AM
610	Automation Test project	Support	To Do	Normal	Support Request Lorem Ipsum (07/49)	Henk Henkel	07/12/2024, 02:01 AM
609	Development Project	Feature	To Do	Normal	Feature development 07-49	Isabelle Faus	07/12/2024, 01:25 AM
608	Super- Projekt	Bug	To Do	Normal	Ticket 3		07/12/2024, 01:25 AM
607	Super- Projekt	Bug	To Do	Normal	Ticket 2		07/12/2024, 01:25 AM
606	Super- Projekt	Bug	To Do	Normal	Ticket 1		07/12/2024, 01:25 AM
605	Automation Test project	Support	To Do	Normal	Support Request Lorem Ipsum (07/49)	Henk Henkel	07/12/2024, 01:25 AM
604	Product: Reporting	Feature	To Do	Normal	Reporting Issue 07, Week 49	Redmine Admin	07/12/2024, 01:25 AM

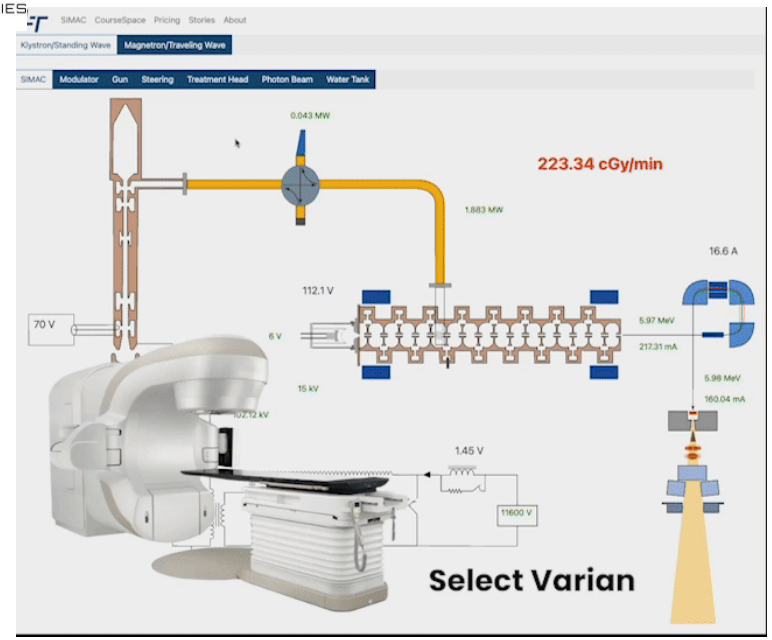
- Open-source system available to all project members
- Electronic capture of faults via tickets allows issues to be tracked and analysed easily

Raystation – plan automation via scripting

- Learn how palliative and VMAT plans are greatly accelerated through the use of scripting in Raystation

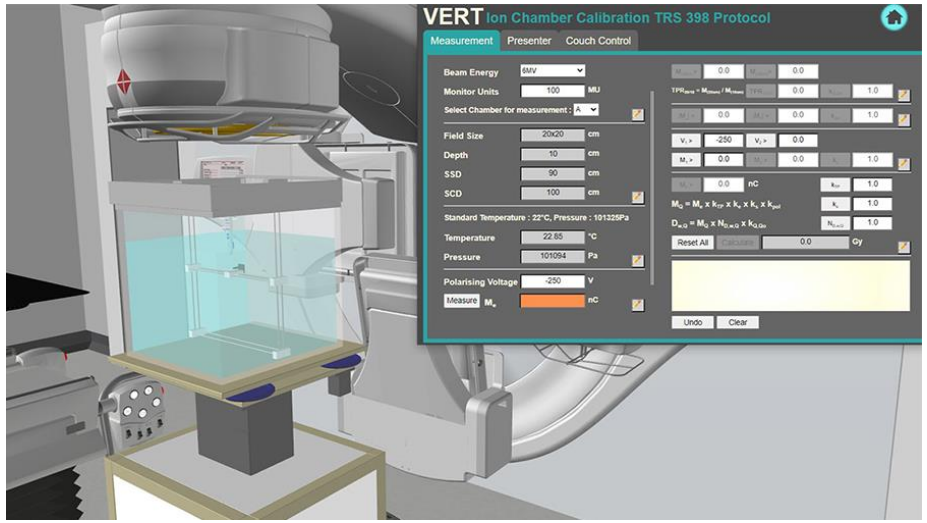
Innovative Simulation Tools

Simac – Linac simulation tool



- Simulate a wide range of M-LINAC faults
- Web based simulation tool available to all project members

VERT virtual radiotherapy machine simulation



- Practice both QA and clinical setups for VMAT treatment

Co-design of hardware focused workshop in Ghana

SAPPHIRE Supra-African Physics Partnership for Health Innovation and Radiotherapy Expansion	Mon	Tue	Wed	Thur	Fri	Sat
9am	Welcome Francis & Intro M.Dosanjh	Electron guns and Servo's M. Carlone	Beam Steering R.Apsimon	Imaging in Radiotherapy Sonwabile Ngcezu	Varian Machines Torsten / Seminar for Medical Physics students at SNAS - Univ of Ghana (Manjit & Raj)	Hospital visit (Korle Bu Teaching Hospital)
10am	Clinical guide to Radiotherapy Hannah	RF Sources G. Burt	Radiation Transport in Matter R. Apsimon	Elekta Machines J.Ikede		
11am	Intro to medical Linacs G.Burt	Modulators and Electrical J.Ikede	Dosimetry Eric Addison			
12 noon	RF accelerators G. Burt	Student Introductions	Radiation Shielding and Safety E. Addison	QA on linacs S.Tagoe	Comparisson of kV and MV imaging Taofeeq Ige	
1pm	Lunch	Lunch	Lunch	Lunch	Lunch and Visit to Tourist sites	
2pm	Beam Loading G. Burt	Practicals (Simac RF Sources and Modulators)	Practicals (Simac Beam Steering and Collimation)	Practicals (Simac)		
3pm	Practicals (Simac Beam Loading)			Tour of GAEC		
4pm					Close	
Evening	Welcome reception		Worshop Dinner (Azmera)	Talk on IAEA (Godfrey Azangwe)		

Key Objectives for SAPPHIRE

1. Increased availability of well-trained RTTs and MPs in LMICs with sufficient technical expertise.
2. Collecting and analysing real-world data from M-LINAC machines.
3. Improved designs of LINAC hardware, where key components (e.g. MLCs) are more fault tolerant.
4. Developing robust, smart LINAC systems suited for LMIC settings.
5. Maximizing uptime of LINACs in LMICs.

https://project-sapphire.org

VHEE

Progress towards FLASH radiotherapy in the clinic

VHEE Dual-Scattering Systems (Cameron)

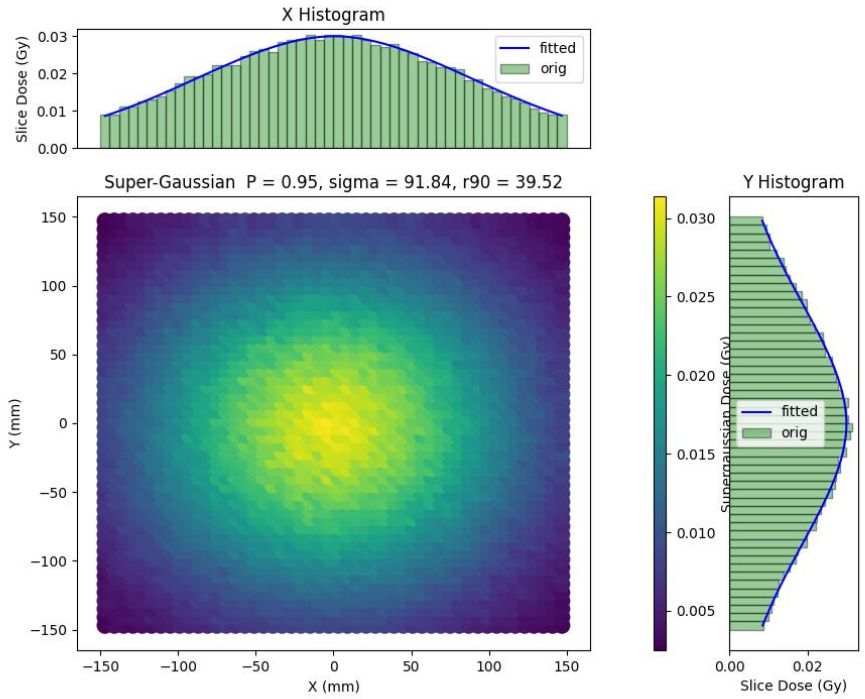
Cameron Robertson, JAI Oxford Graduate (NHS Radiotherapy Physics Trainee)

- Beam magnification and flattening for conformal VHEE Radiotherapy - passive scattering
- Modelling of flattened beams with or without collimation
- Dual-scattering foil design and optimisation at 200MeV

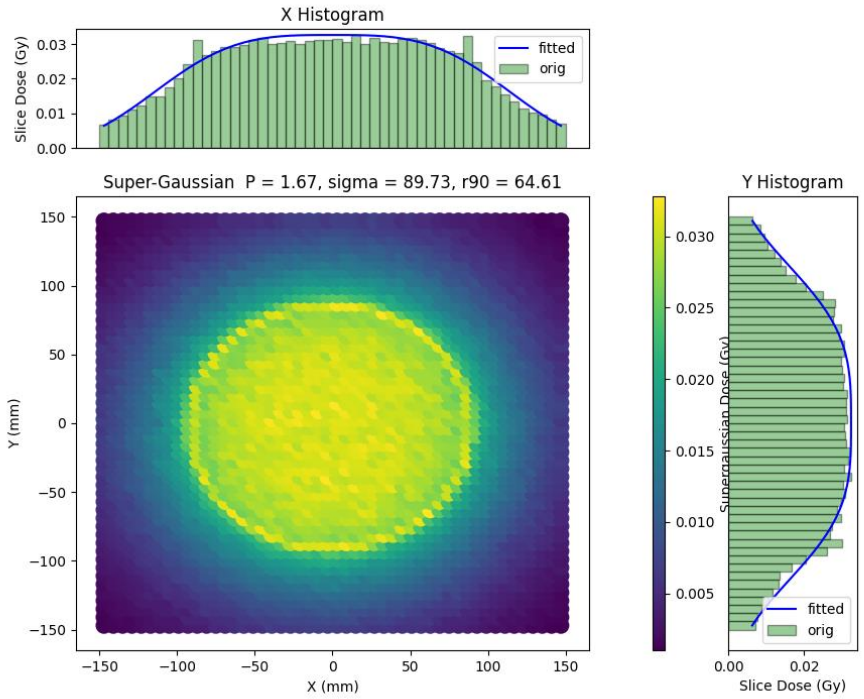
Sabrina Wang continuing on from Cameron's research

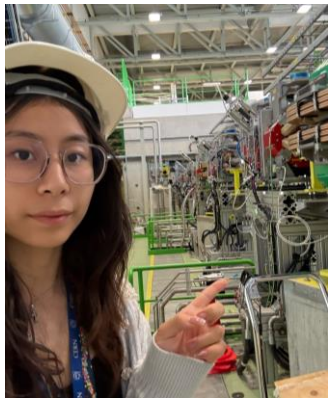
- Replacing the pre-scatterer in a dual-scattering system with quadrupoles to reduce photon contamination
- TOPAS and RF-Track simulation of 4 quadrupole lattice + scatterer system

Dual-scattering system



Quad-scattering system



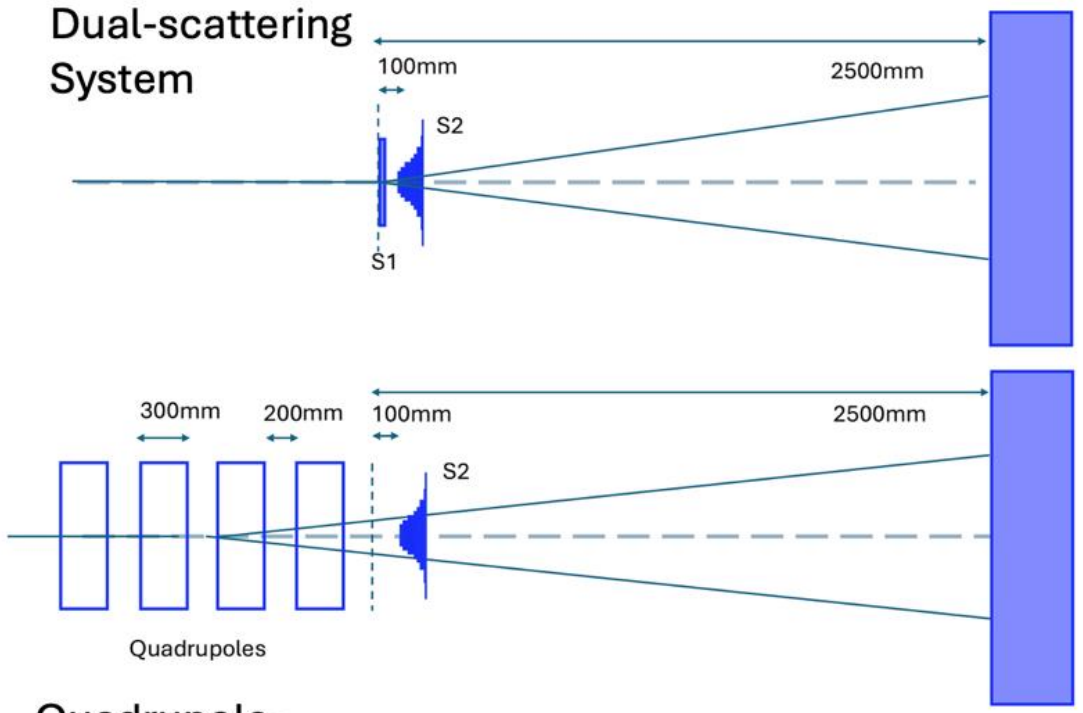


S. Wang
JAI Oxford 2nd year DPhil

Awarded John Adams Prize for her 1St year work

Sabrina's Project: building on previous research

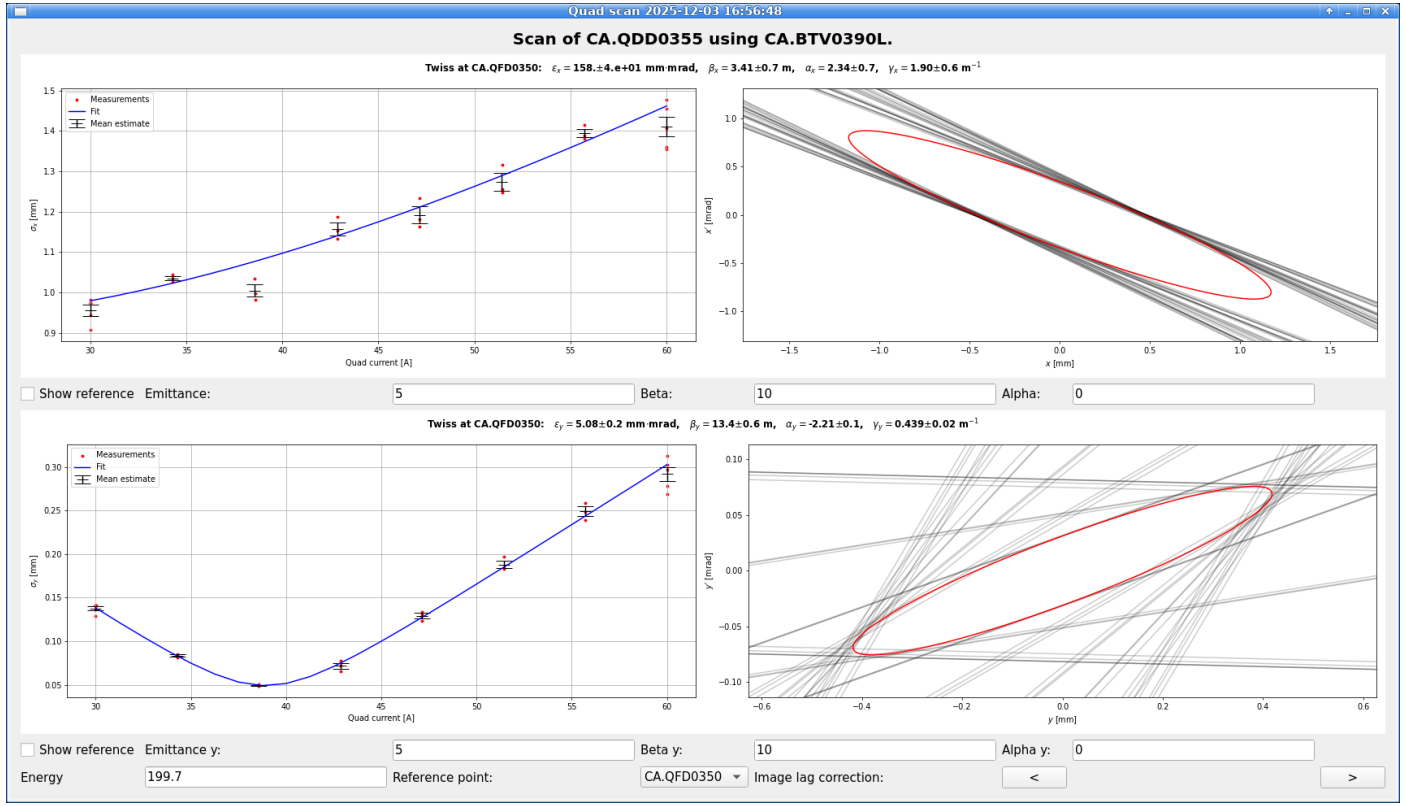
- Homogeneous beam production for clinical translation of VHEE/FLASH
- Developing sophisticated simulation modelling and design optimisation
  - Building off previous JAI research on dual-scattering foils for VHEE,
- Studies on novel quadrupole-scattering systems for reducing photon production
- Experimental studies at CLEAR and CLARA facilities



Quadrupole-scatterer System

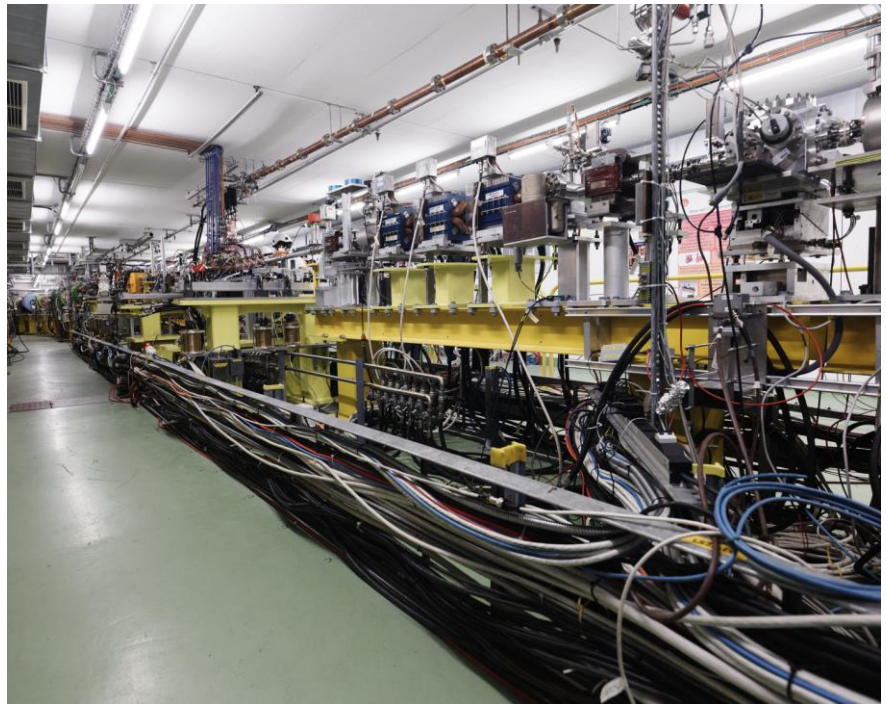
LTA at CERN: CLEAR Facility Studies

- Studies for optimisation of CLEAR dual-scattering foil
  - **Quadrupole scans** for input to RF-Track/TOPAS simulations to study dependence on transverse parameters
- Design of scattering foils for CLEAR second beamline
  - Coverage of larger samples for FLASH/UHDR studies
  - Potential testbed for quad-scattering foil studies



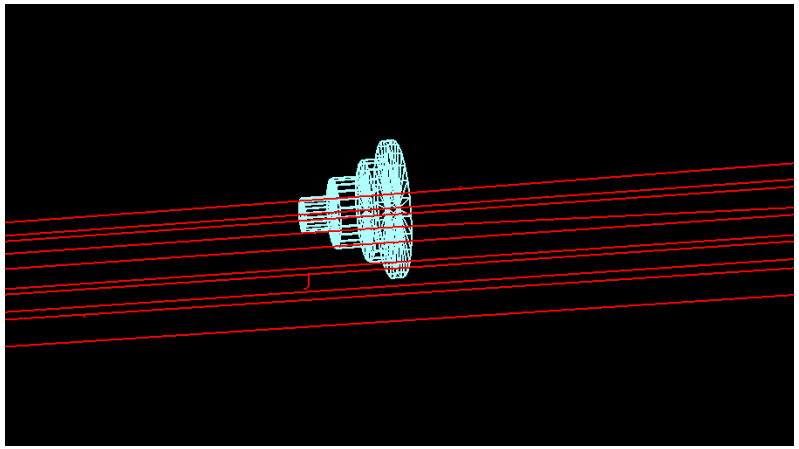
CLEAR Accelerator and Beam Parameters (CERN Linear Electron Accelerator for Research)

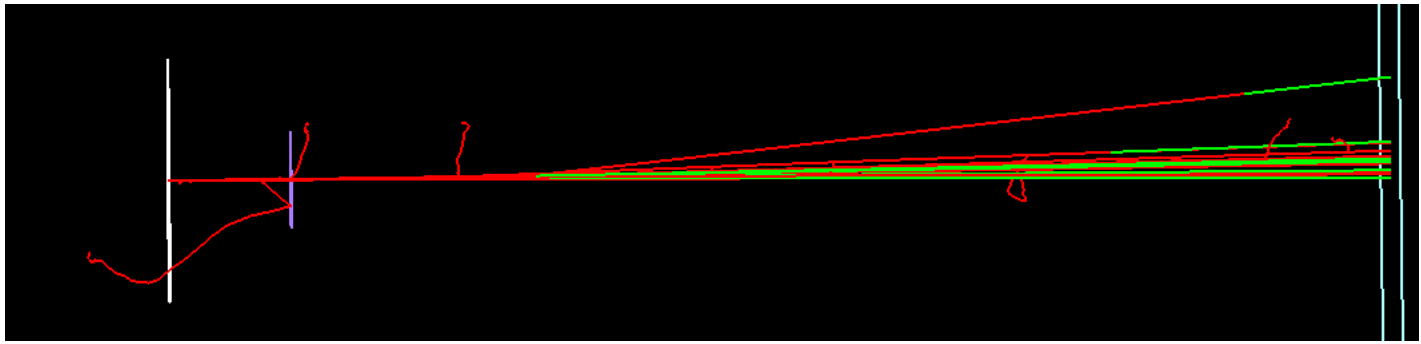
Parameter	Value
Energy	**60 – 220 MeV**
Energy spread	< 0.2 % rms (< 1 MeV FWHM)
Bunch length	**0.1 – 10 ps RMS**
Bunch charge	10 pC – 1.5 nC
Normalised emittance	3 – 20 µm
Bunches per pulse	1 – 200
Max. charge per pulse	**86 nC**
Repetition rate	**0.833 – 10 Hz**
Bunch spacing	1.5 or 3.0 GHz



Computational and Design Studies

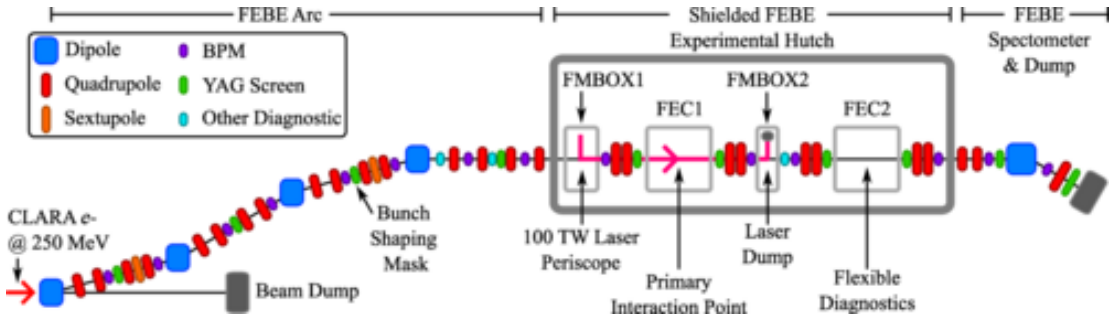
- Development of optimiser for uniform beam production
  - Capable of rapid foil design for arbitrary initial beam, setup/facility constraints
- RF-Track used for rapid simulations during automated optimisation
- TOPAS Monte Carlo for verification





CLARA: FEBE Specifications

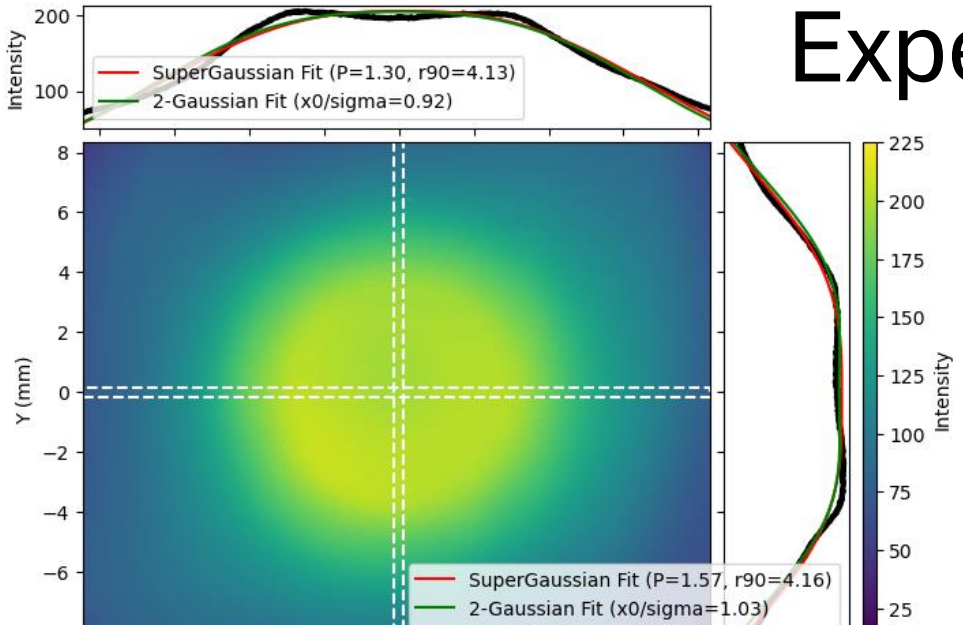
- Capable of hosting a wide range of experimental programmes
- Beam energy up to **250 MeV**
- Flexibility in delivered beam parameters and charge structure
- In-air hutches for experiment installation (and additional diagnostics if required)

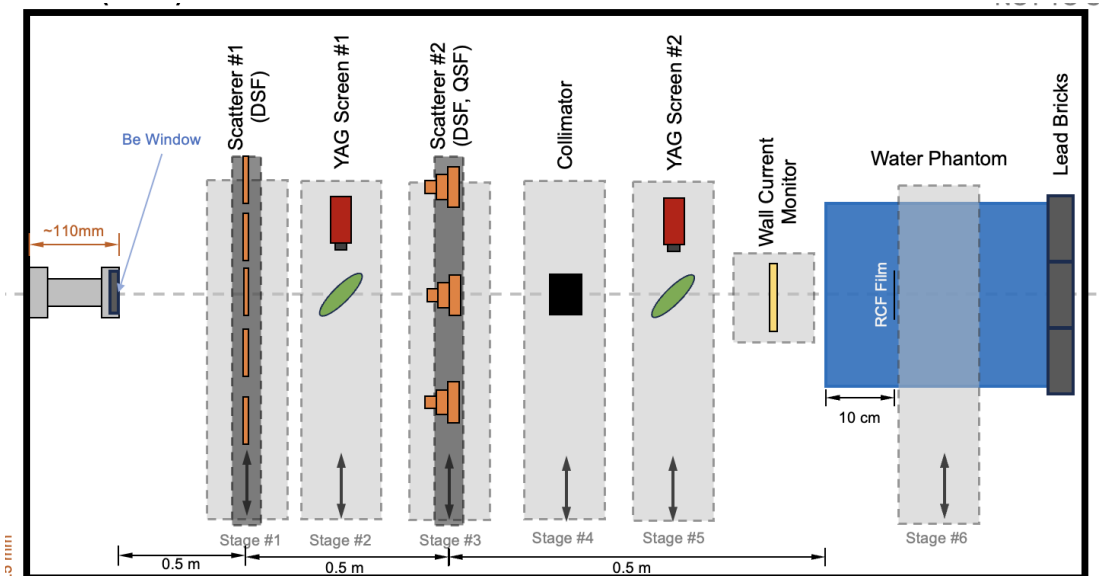


	Commissioning		Machine development	
Parameters	**High charge**	**Low charge**	**High charge**	**Low charge**
Charge (pC)	250	5	250	5
σ_t (fs)	100	50	≤ 50	$\ll 50$
σ_x (μm)	100	20	50	~ 1
σ_y (μm)	100	20	50	~ 1
σ_E (%)	< 5	< 1	1	0.1
$\varepsilon_{N,x}$ (μm rad)	5	2	< 5	< 1
$\varepsilon_{N,y}$ (μm rad)	5	2	< 1	< 1

Figures from Snedden et al (2024), Phys. Rev. Accel. Beams **27**, 041602

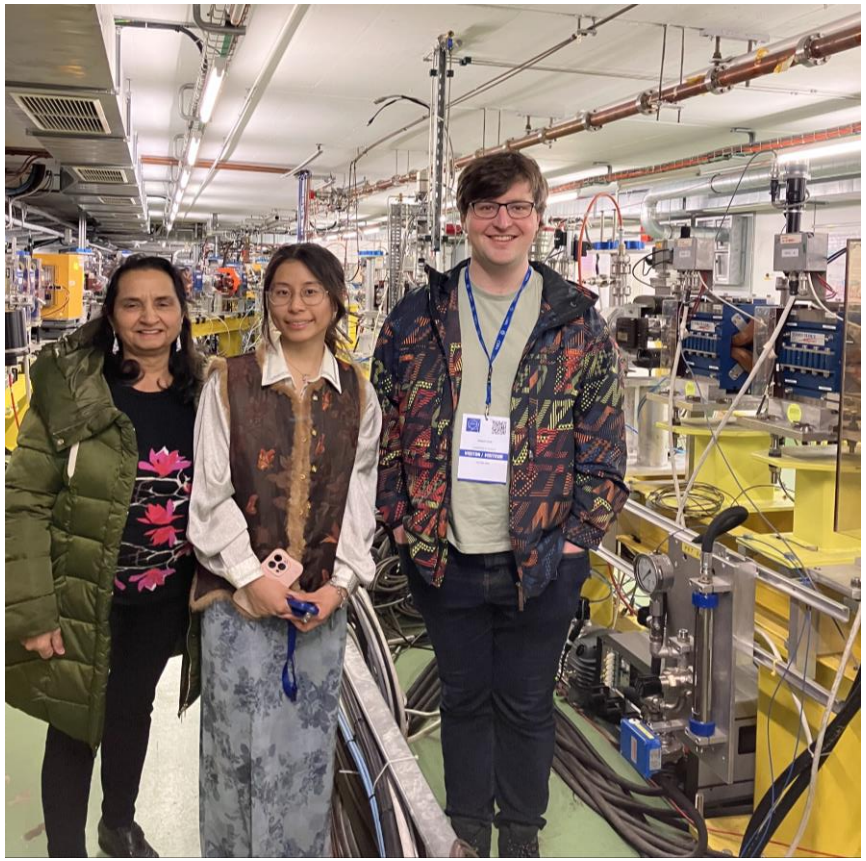
Experimental programme at CLARA

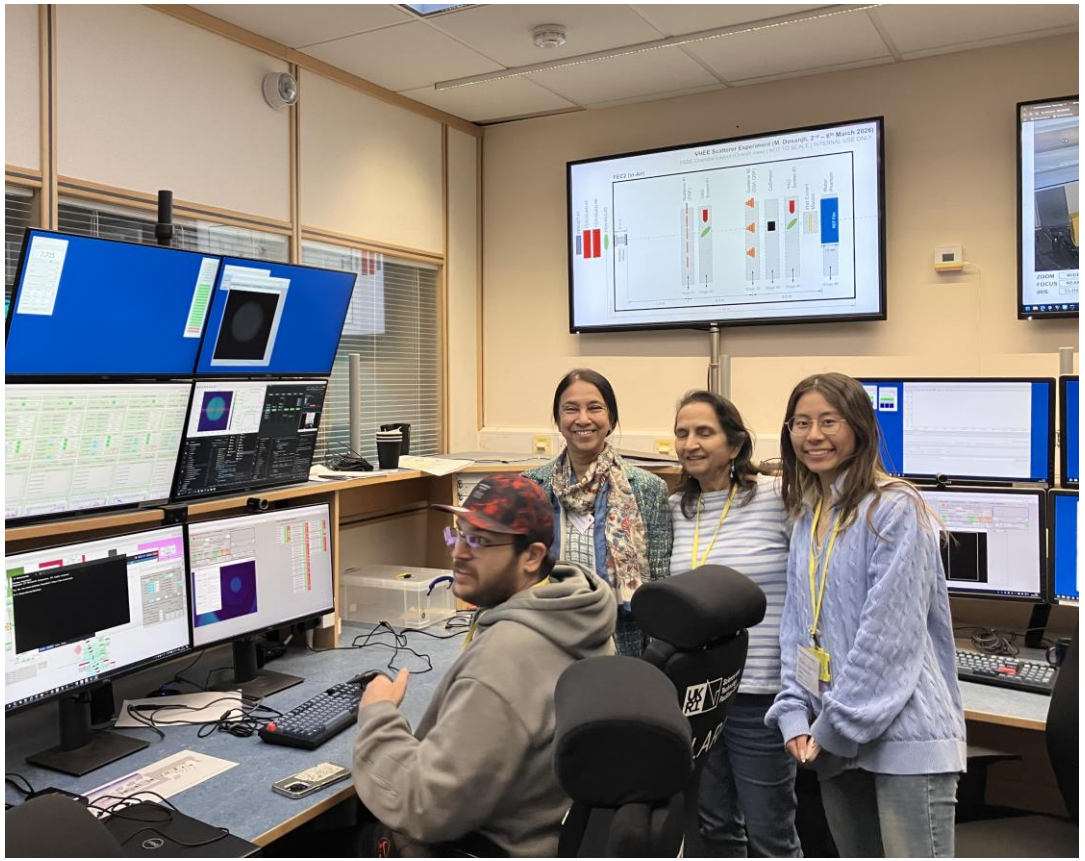




- Dual and quad-scattering systems designed and manufactured within FEC2
  - Flexibility of design space and operating team expertise to ensure installation accurate to simulations
- Beam uniformity for all systems demonstrated at 250 Mev and 200 MeV
- Radiochromic film and YAG data acquired, with analysis in progress

From CLEAR to CLARA





VHEE UHDR (Ultra High Dose Rates) Beam Dosimetry

Dr Bateman won IOP Medical Physics Group PhD Prize for his work on developing new dosimetry measurement techniques by creating a novel detector using silica fibres that can monitor the radiation beam pulse-by-pulse, at dose rates needed for FLASH.

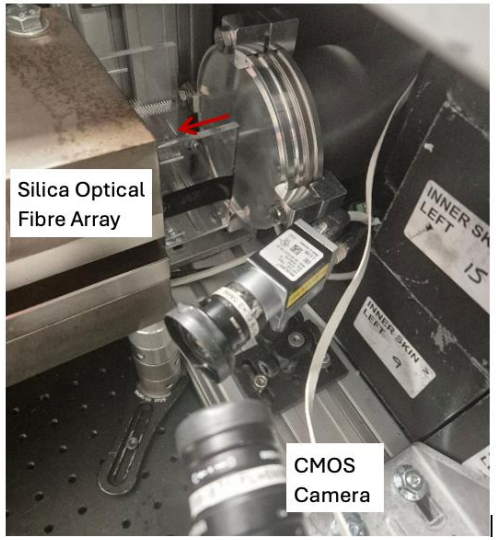
VHEE UHDR Beam Dosimetry @ Oxford

- Started collaboration with Simon Hooker's group where we are using the expertise and fibre optic monitor for VHEE UHDR dosimetry at CLEAR for initial dosimetric characterisation of Oxford LWFA (Laser Wake Field Accelerator) beam.
- MPhys student (Emma Stratford) is working on characterising fibre array detector using Monte Carlo simulations and preparations for initial measurements at Oxford LWFA
- Initial measurements planned to be taken soon.

J. Bateman
JAI Oxford Graduate
(Now postdoc at UCL)

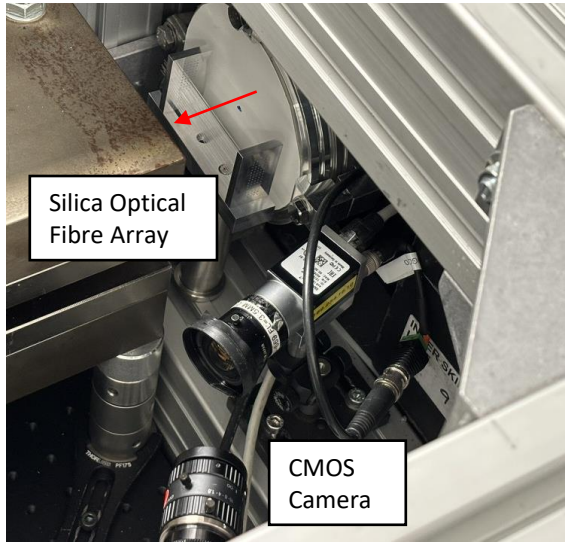
E. Stratford
Oxford MPhys 4th year

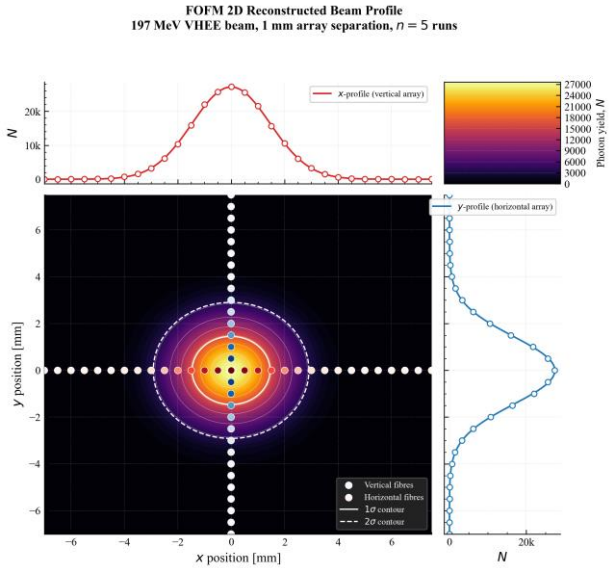
L. Feder
Oxford PDRA

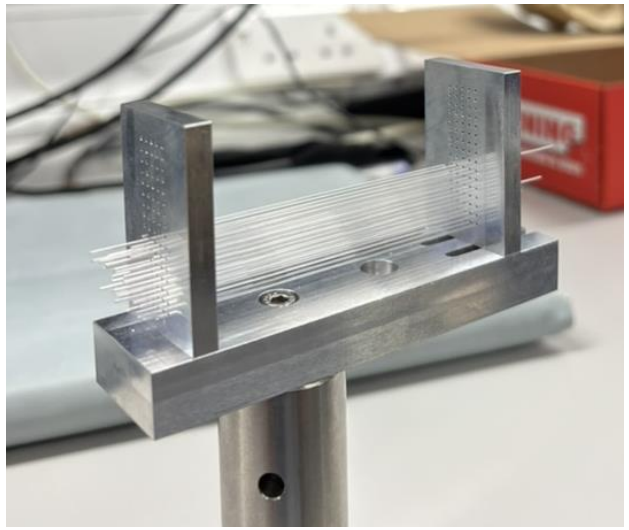


VHEE UHDR Beam Dosimetry @ Oxford

- Continuing collaboration with Simon Hooker's group for initial dosimetric characterisation VHEE beams from Oxford LWFA (Laser Wakefield Accelerator) beam, using fibre array beam monitor (developed at Oxford + CLEAR) and film dosimetry.
- MPhys student (Nimisha Bica) is using Monte Carlo simulations to characterise a fibre array detector (FOFM) for real-time beam profile and dose monitoring for VHEE beams, in preparation for the first experimental measurements at Oxford LWFA.
- Initial measurements planned to be taken soon.







N. Bica
Oxford MPhys student

J. Bateman
JAI Oxford Graduate, postdoc at UCL

L. Feder
Oxford PDRA

M. Dosanjh

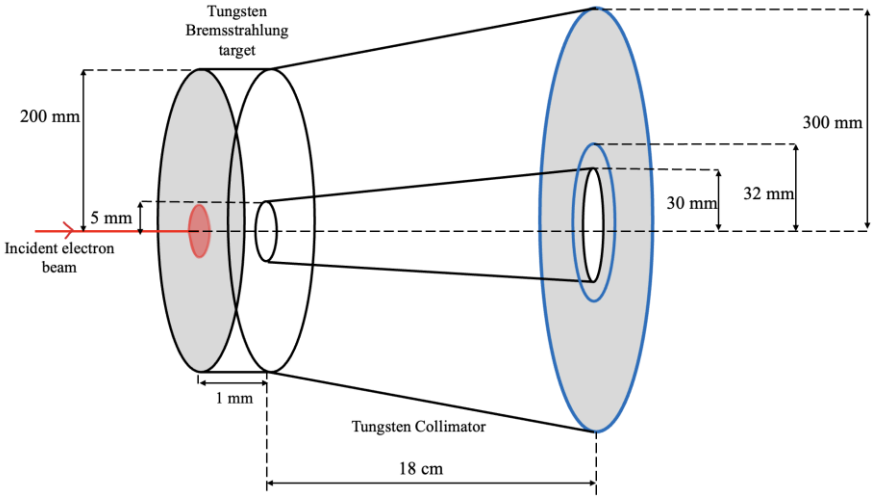
Simulations for a Dual-Modality Beam Generation Device for FLASH-RT

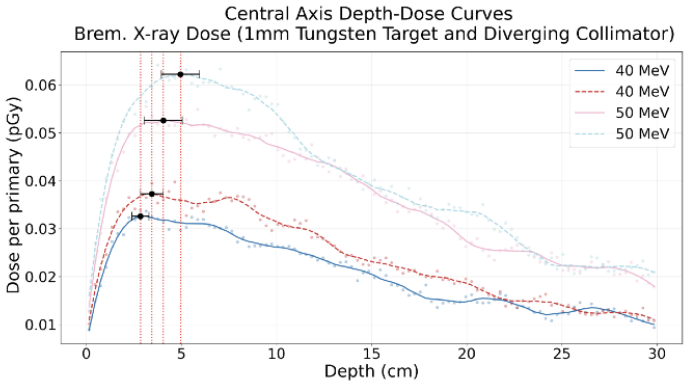
- TOPAS simulations of photon and electron beams in 20-200 MeV range for different target designs.
- Evaluating dose characteristics before and after collimation for photon-only and dual-modality beams.
- After setting FLASH requirements, assessing thermal loading on the bremsstrahlung target.

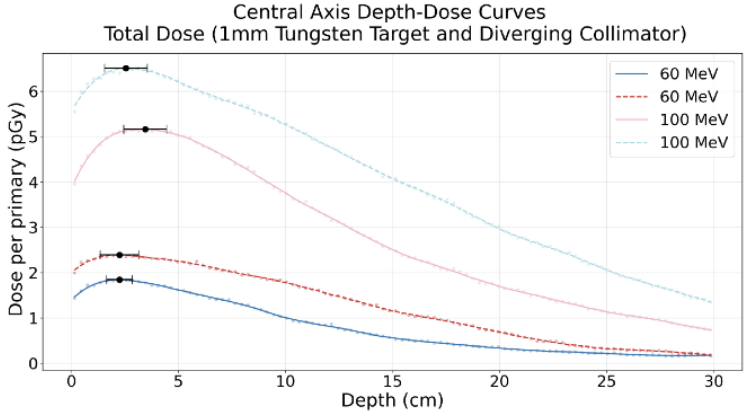
S. Martin
Oxford MPhys

M. Dosanjh

A. Gerbershagen







In summary

Training

Train the next generation of medical physicists and technologies in the Global South

SAPPHIRE
(STELLA)

Access

Design and develop next generation hardware and software to make radiotherapy accessible

STELLA

Innovate

Develop technology that makes FLASH radiotherapy a reality in the clinic

VHEE
CLEAR
CLARA

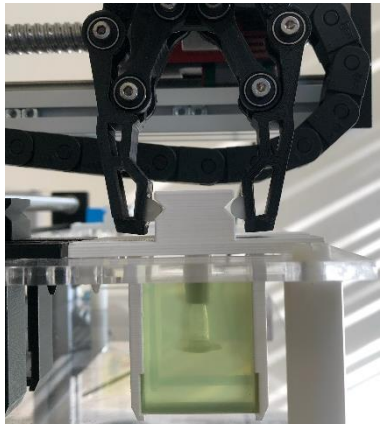
students and early career researchers are key

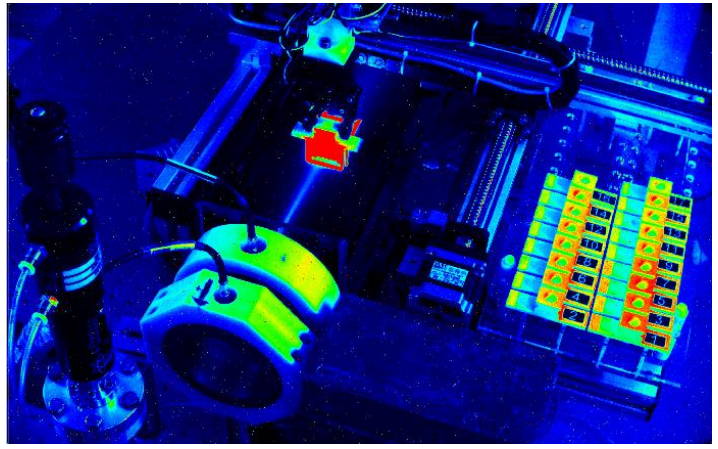
SAPPHIRE Accelerator Training workshop in Accra,13-16 April 2026

LiRR lab UNIGE Collaboration

VHEE FLASH Radiobiology and Physico-Chemistry Experiments

- VHEE FLASH Radiobiology Studies: Investigating Mechanisms Behind the FLASH Effect.
- Water Radiolysis: Measurement of ROS generation in water following FLASH and CONV-RT.
- DNA Damage Assessment: Plasmid irradiations to quantify radiation-induced DNA lesions.
- Zebrafish Embryos as Biodosimeters: Modelling normal tissue sparing post-FLASH-RT.
- Cell Irradiation Studies: Comparative analysis of normal and cancerous cell responses.
- Manuscript currently under review.



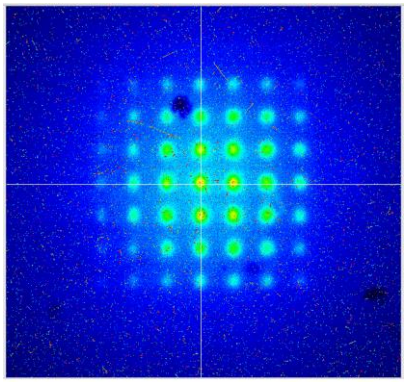


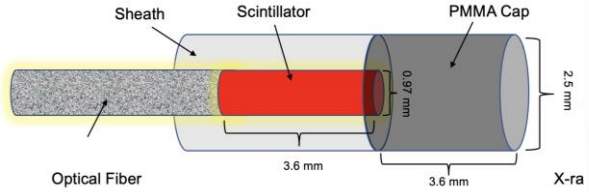
Prof. M. C. Vozenin
Head of Radiobiology and Radio-oncology, HUG, Geneva

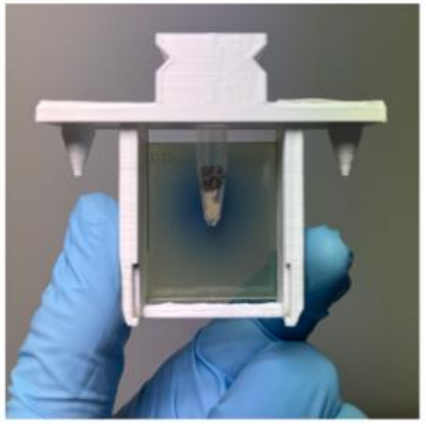
University of Victoria Collaboration

VHEE Spatial Fractionation – Scintillator Dosimetry – Drosophilae Biodosimeters

- VHEE Spatial Fractionation using tungsten GRID collimator.
  (paper published in Phys. Med. Bio.)
- VHEE UHDR Real-time dosimetry using plastic scintillator-coupled fibres at MedScint™ CCD spectrometer.
  (paper published in IEEE Sensors)
- *In vivo* radiobiology studies on drosophila melanogaster larvae as biodosimeters to investigate VHEE RBE and FLASH mechanisms/parameter space.







Prof. M. Bazalova-Carter
Head of XCITE Lab, UVic, Canada