ARDENT 4th Annual Workshop

KEVIN LOO: ESR 8, PRAGUE, CZECH REPUBLIC

CERN

MARIE CURIE ACTIONS

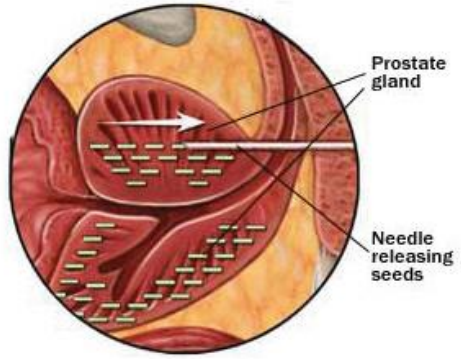
IEAP

CZECH TECHNICAL UNIVERSITY IN PRAGUE

UNIVERSITY OF WOLLONGONG AUSTRALIA

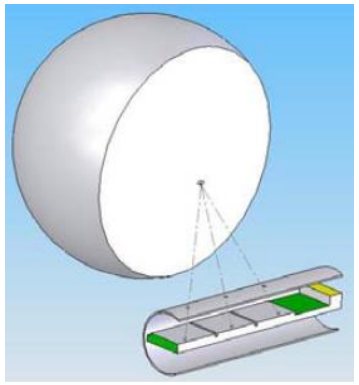
CENTRE FOR MEDICAL RADIATION PHYSICS

Research Objectives



- Application of Medipix detectors for medicine and radiation safety
- Cooperation between Centre for Medical Radiation Physics, University of Wollongong (Australia) and Institute of Experimental and Applied Physics, Czech Technical University in Prague
- Development of the ‘BrachyView’ project

Timeline

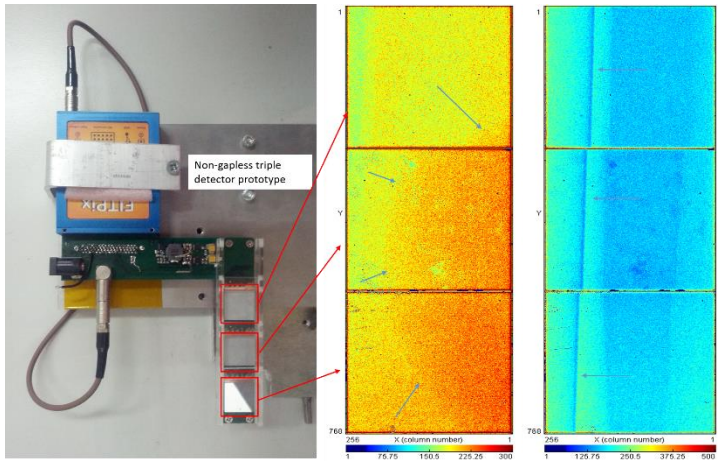


2010: Commencement of Brachy*Vision* project

2010: Simulation work done in GEANT4

2011: Training at UTEF with Medipix2.0 and Timepix detectors

2012: Ongoing work in reconstruction algorithm using single Timepix



2013: Ability for multi-modality imaging evaluated; including diagnostic imaging and CT reconstruction

2013: Commencement of ARDENT project. Employment as ESR 8 to work closely with Czech team. Feasibility studies and proof-of-concept confirmed.

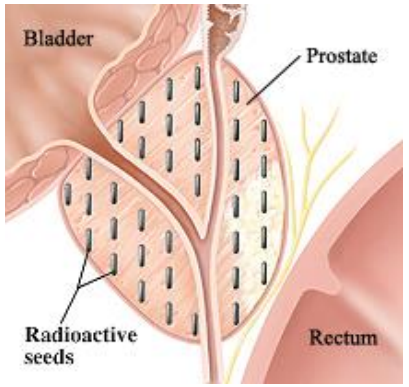
2013-14: Triple chip detector prototypes fabricated and tested. First version of 'gapless' quad detector assembled.

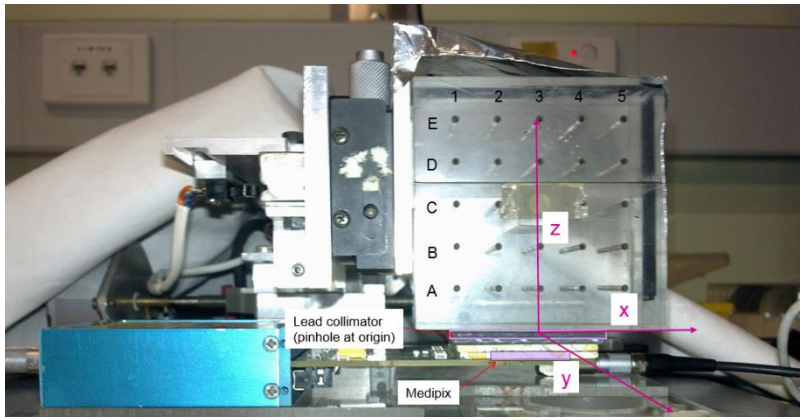
2015: 2nd version of quad detector assembled.

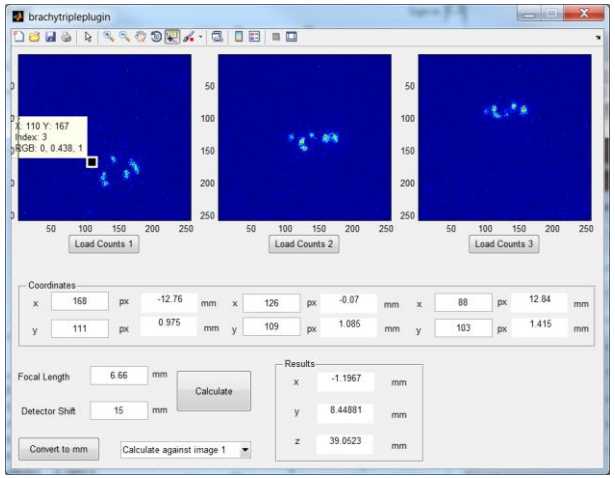
ARDENT
Advanced Radiation Dosimetry European Network Training

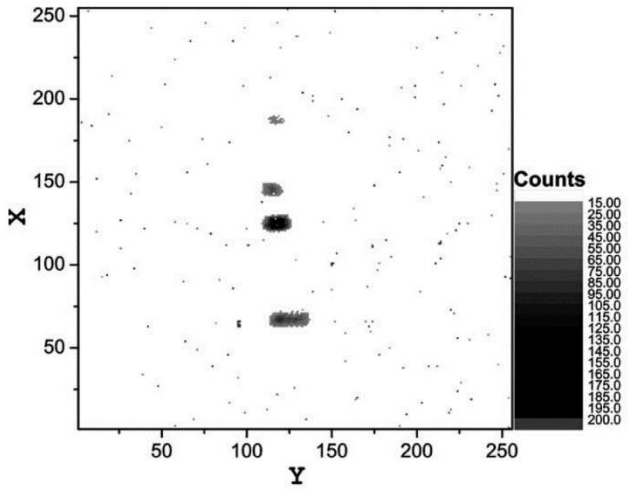
Early development: Medipix2.0

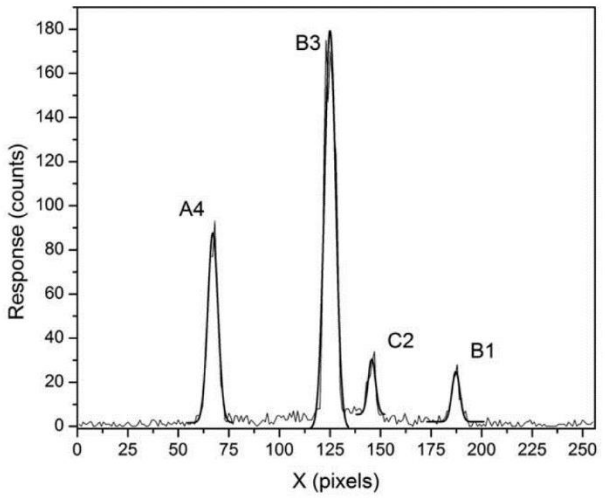
- Testing single detectors with I-125 seeds
- PMMA phantom (standard for rest of studies)
- Use motor stepper system to mimic multiple detector set-up





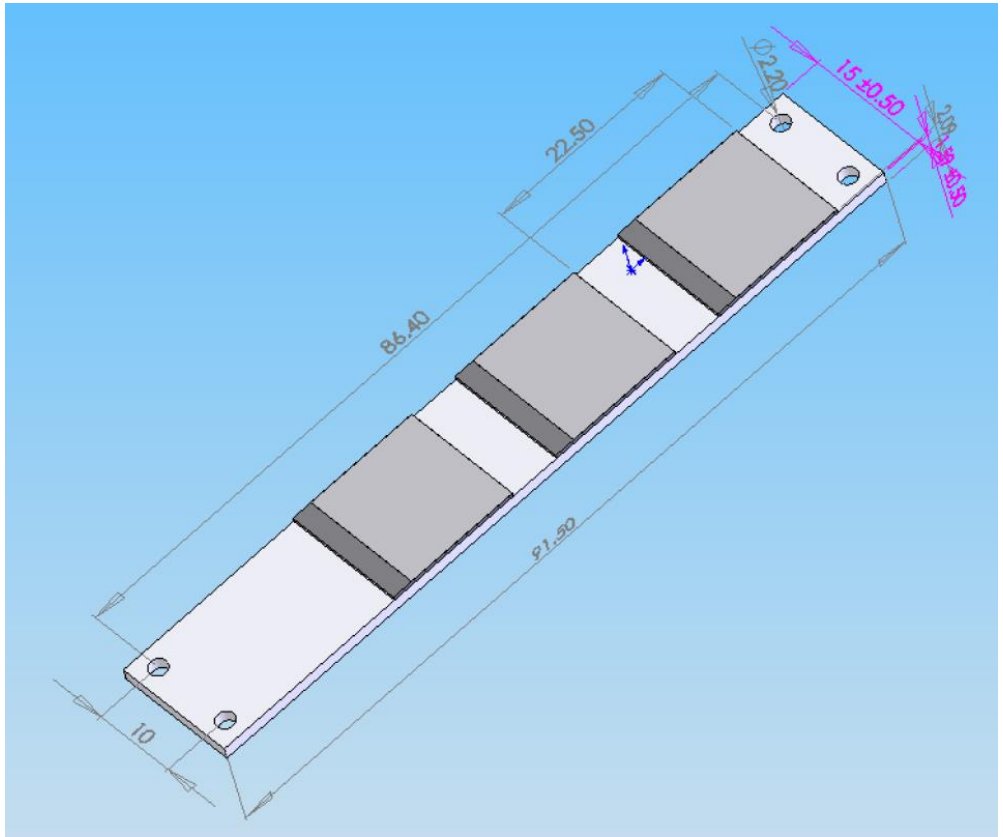


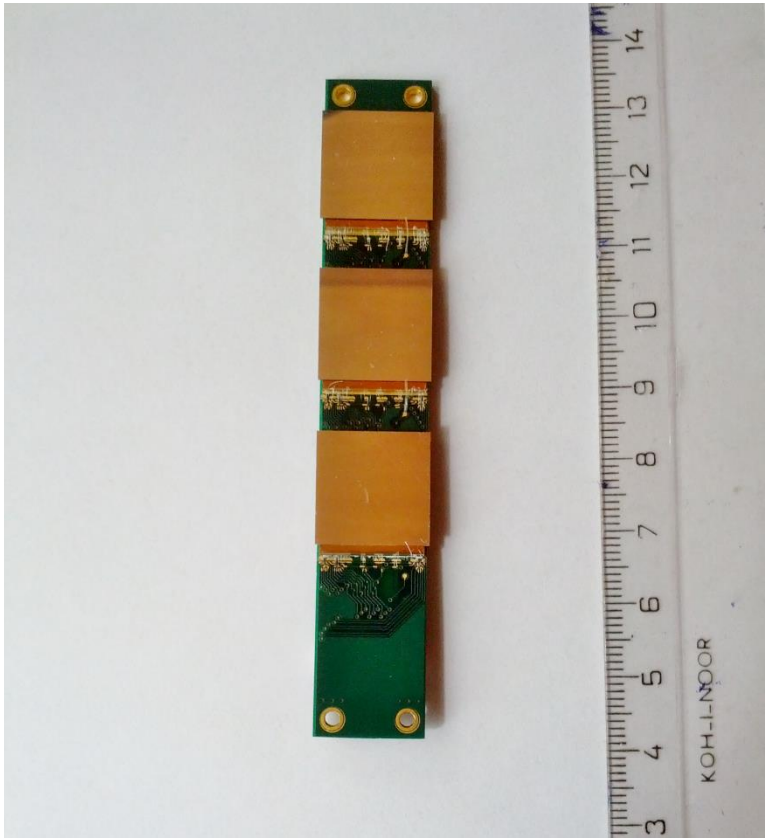




Multiple chip prototypes

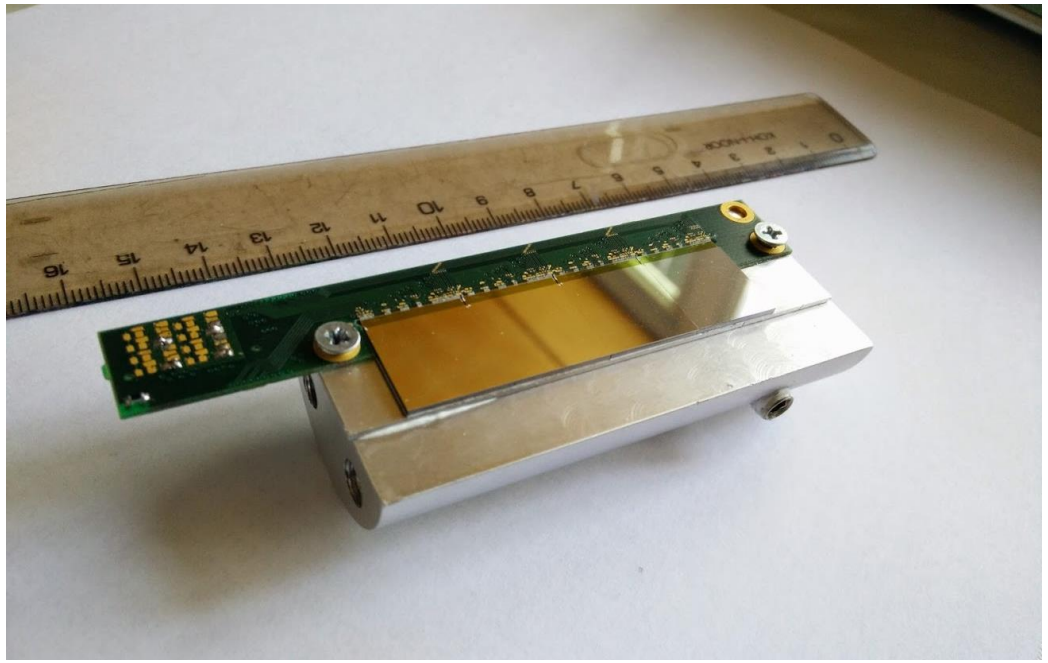
- BrachyView V1.0: Triple chip design – 3x300um Si detectors





Quad Chip

- Gapless design to maximise imaging plane surface area
- Overcome design flaws from previous work including:
  - Understanding of power supply issues
  - Communication via FITPix
- Several experimental measurements planned with hospitals in Sydney. Secondments and training of junior PhD students and Masters students imminent
  - Consultation with clinicians



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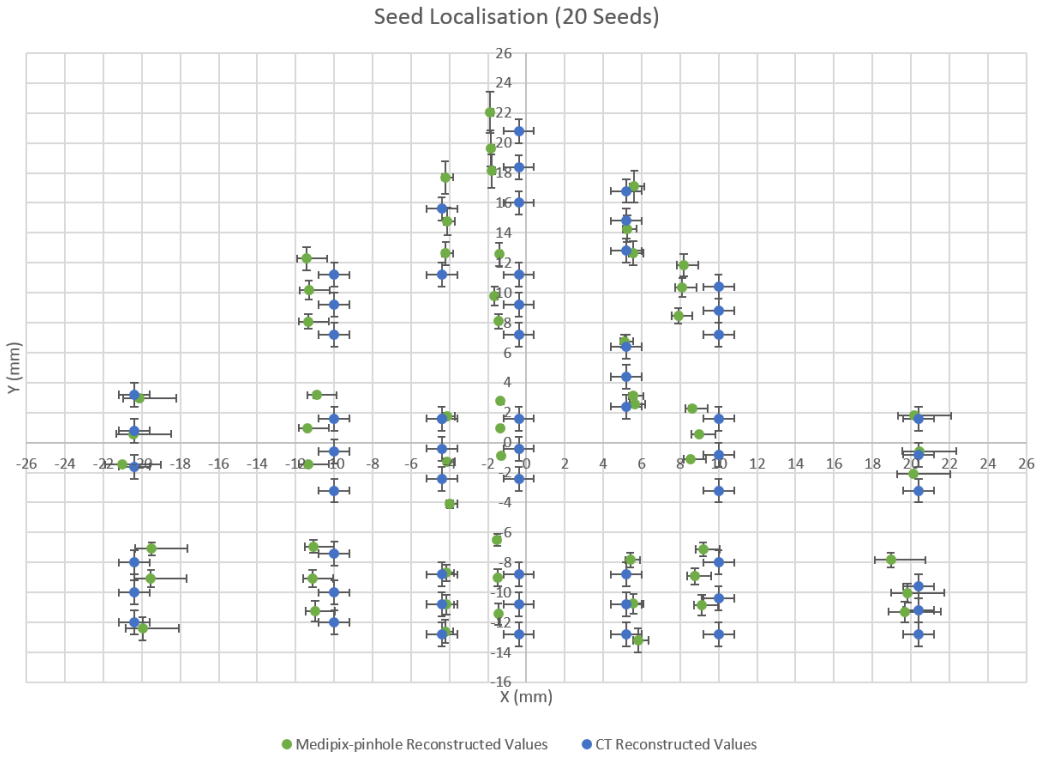
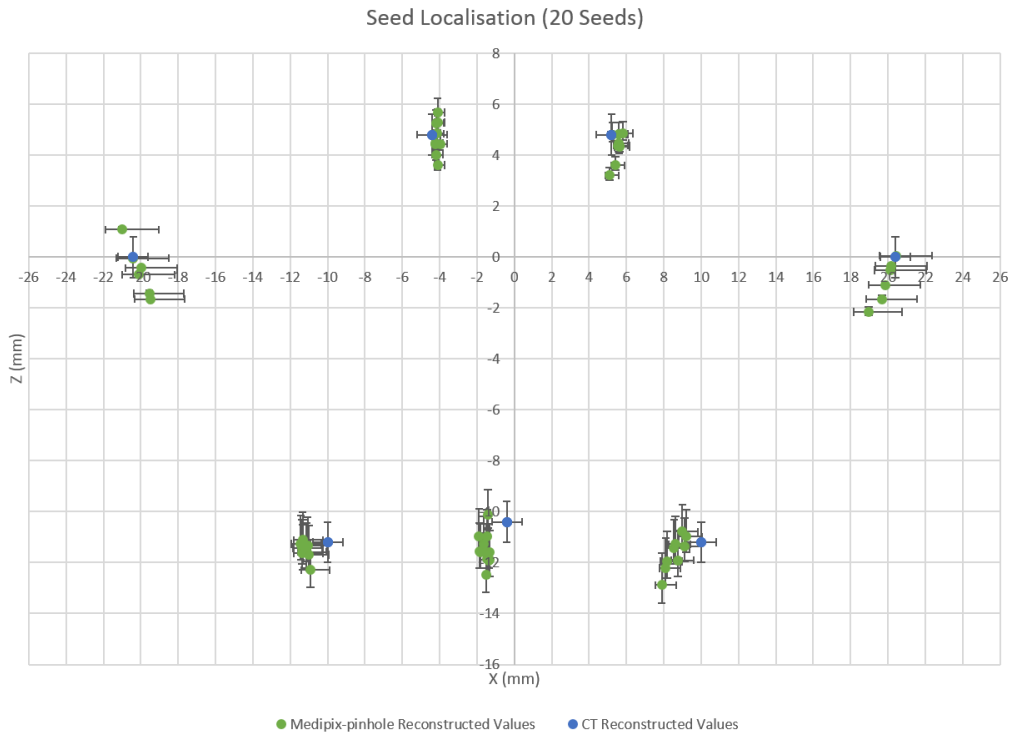
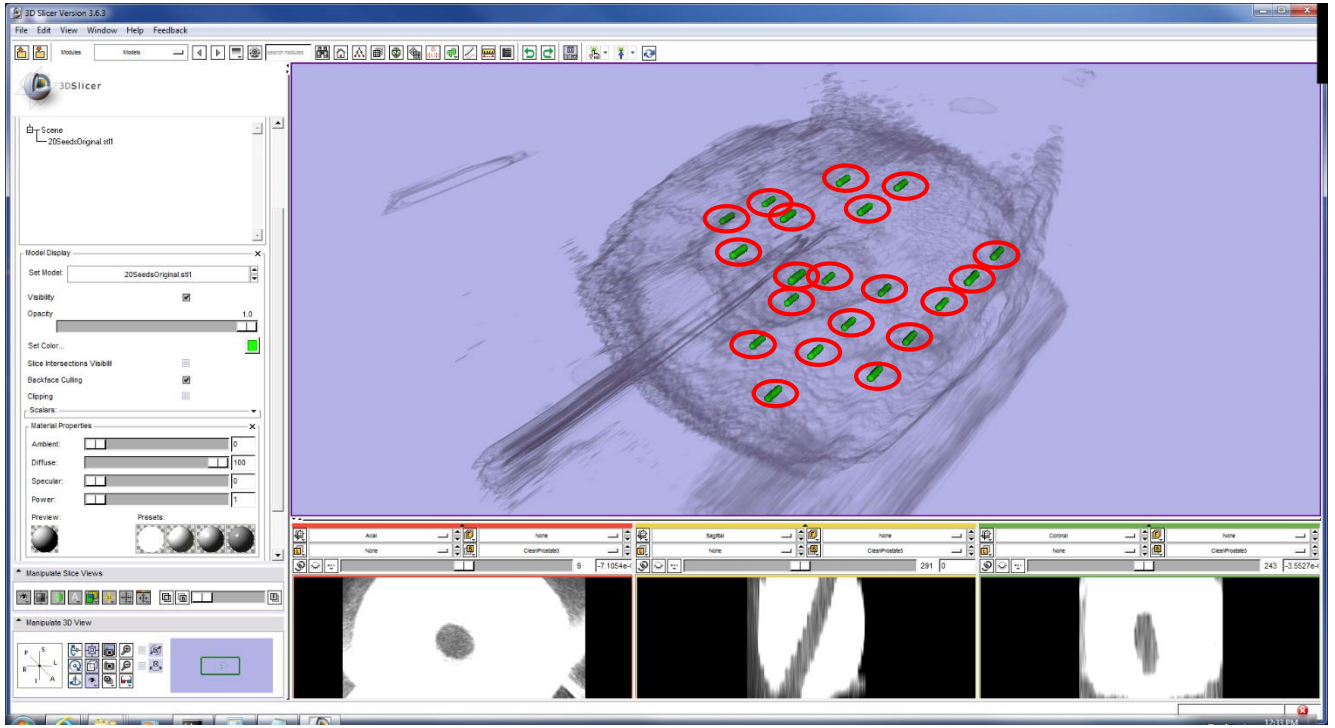
Major Findings & Recommendations

- Highly accurate positioning checked against clinical CT scan
- Ultra-functional, multi-modality imaging achieved
- Incorporate DVH data and TG43 protocols for full dosimetric analysis
- Further development and refining of pinhole design and geometrical factors
- Implement software and hardware development




Seed Localisation (20 Seeds)
Z (mm)
X (mm)
Medipix-pinhole Reconstructed Values
CT Reconstructed Values


3D Slicer Version 3.6.3
File Edit View Window Help Feedback
3DSlicer
Scene
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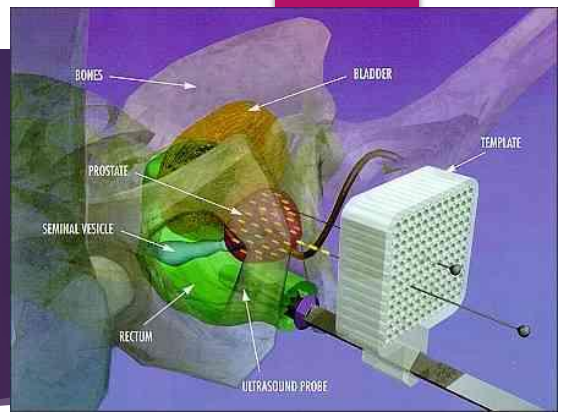
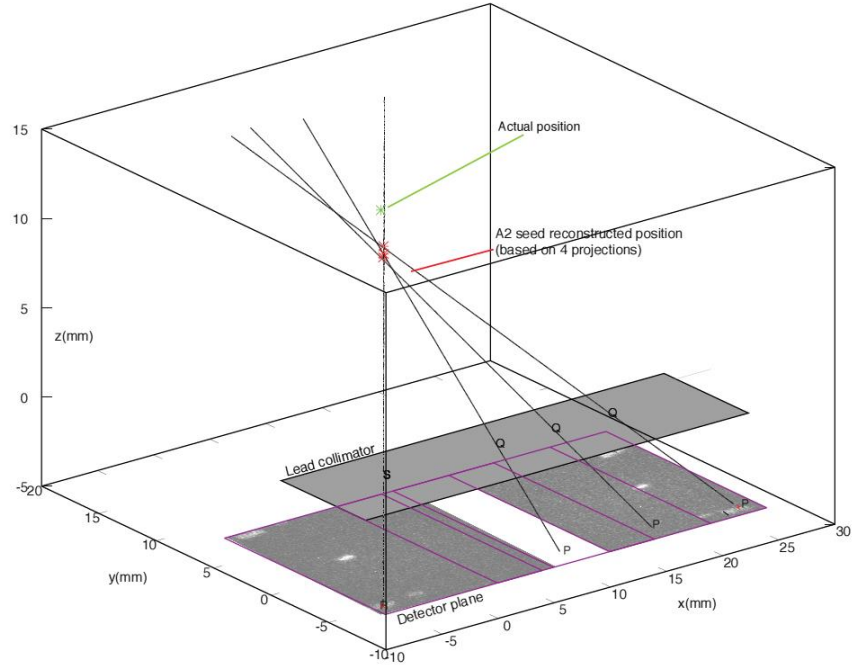
Presets:
Manipulate Slice Views
Manipulate 3D View

BrachyView highlights



- Accurate reconstruction of seed position in 3D and in real-time, meeting requirements for brachytherapy practitioners
- Investigation of CT reconstruction and soft tissue diagnostic imaging techniques
- Industry buzz
  - 2014 European BrachyPhys Task Group (ESTRO) meeting "Further potentials for high quality brachytherapy in the future"
  - The American Brachytherapy Society meeting in Houston also recognised BrachyView as one of the important highlights of the year out of all brachytherapy projects in development.

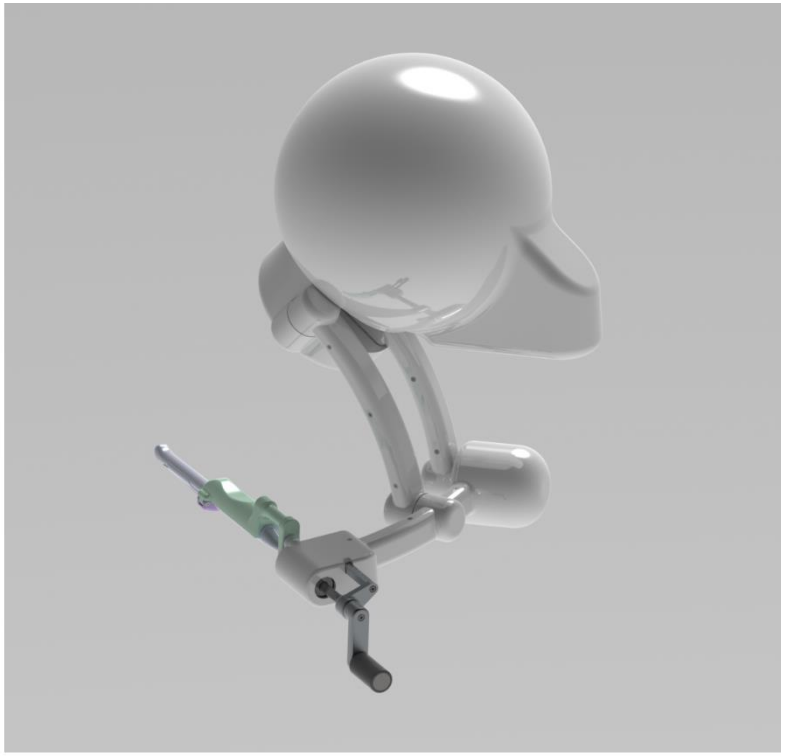


ESTRO
European SocieTy for
RADIOTHERAPY
& ONCOLOGY

ABS
American
Brachytherapy
Society

Vision & Comments

- Developments in prostate brachytherapy continue to pursue robot-assisted impantation guidance, as well as the burgeoning field of intraoperative dynamic dose planning
- BrachyView focuses on the latter and answers many questions that clinicians have
- At the moment, the field is split 50-50 on which philosophy to aim for regarding treatment planning. With a tool like BrachyView, the debate may be swung more clearly in one direction



University of Western Ontario

Conferences and Training

- IEEE NSS-MIC, Seattle, USA: 8-15 November 2014
  - Attended 1 Day short course: "Image Quality in Adaptive and Multimodality Imaging" hosted by the University of Arizona and the Center for Gamma-ray Imaging.
- Business and Administration Internship, IBA Dosimetry USA
  - Memphis, Tennessee
  - January 19 – February 13
  - Experience in logistical analysis and financial reportage
  - Included attending installation and QA of LINACs and technician training at two different hospitals:
    1. St Thomas Rutherford Hospital (Murfreesboro, TN)
    2. Maury Regional Hospital (Columbia, TN)

Planned Conferences and Training

- 4th Annual Workshop: Neutron Dosimetry and Radiobiology, Prague, June 22-26
- ESTRO Research Masterclass in Radiotherapy Physics, Prague, September 3-6
- WE-Heraeus Physics School on "Ionizing Radiation and Protection of Man", Bad Honnef, 3 - 14 August 2015
- IEEE Engineering in Medicine and Biology Society, Milan, August 25-29
- Imaging reconstruction short course or Biology for Imaging Scientists short course at IEEE NSS-MIC October 31-November 7
- Basic Clinical Radiobiology (endorsed by ESTRO), Brisbane, November 21-24
- Looking for Business, Commercialisation and Knowledge Tran recommendations?
- Possible training secondment with MSKCC

ESTRO School

San Diego California
Town and Country Hotel
31 October - 7 November
IEEE NPSS NUCLEAR & PLASMA SCIENCES SOCIETY

Memorial Sloan-Kettering Cancer Center

SAID BUSINESS SCHOOL

Outreach Activities

- 2013-2015: several invited international talks.
- Talk to IBA Dosimetry in Memphis
- Organising with schools around 4th Annual ARDENT Workshop
  - Gymnázium Botičská (Czech technical high school)
  - Riverside High (Prague international high school)
  - Bulli High (Australian public high school. Europe trip organised by CMRP, UOW)

Gymnázium Botičská

Riverside School Prague

ABC Illawarra visit another location

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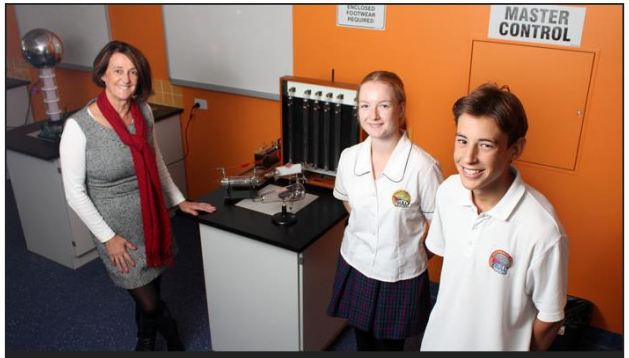
12 May, 2015 3:33PM AEST

A European science excursion to discover the big bang for Bulli students

By Justin Huntsdale

While most high school science trips are made to the local planetarium or wind farm, eight Bulli High School students will travel to Switzerland in June where scientists are studying the 'God particle' at the Large Hadron Collider.



Bulli High School science teacher Robyn Lang will travel with Year 11 students Evie Jaye and Brayden Clark and six other students to tour the Large Hadron Collider in Switzerland in June. (ABC:Justin Huntsdale)

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CAMPUS NEWS

UOW > Newsroom > Campus News > Science students make pilgrima...

13/05/2015

SCIENCE STUDENTS MAKE PILGRIMAGE TO PINNACLE OF PHYSICS WORLD

Teaching student Zac Gorton poised to visit the Large Hadron Collider in Geneva.

Twenty-one-year-old Zachary Gorton (pictured above) has always had an inquisitive nature. As a child he wanted to know how everything worked – from why volcanoes erupt to how motors run. But it wasn't until he encountered an extraordinary physics teacher in high school that his fascination for the topic really started.

After studying engineering for a year, the Campbelltown local found a way to combine his love of science with his desire to mentor the next generation of curious minds.

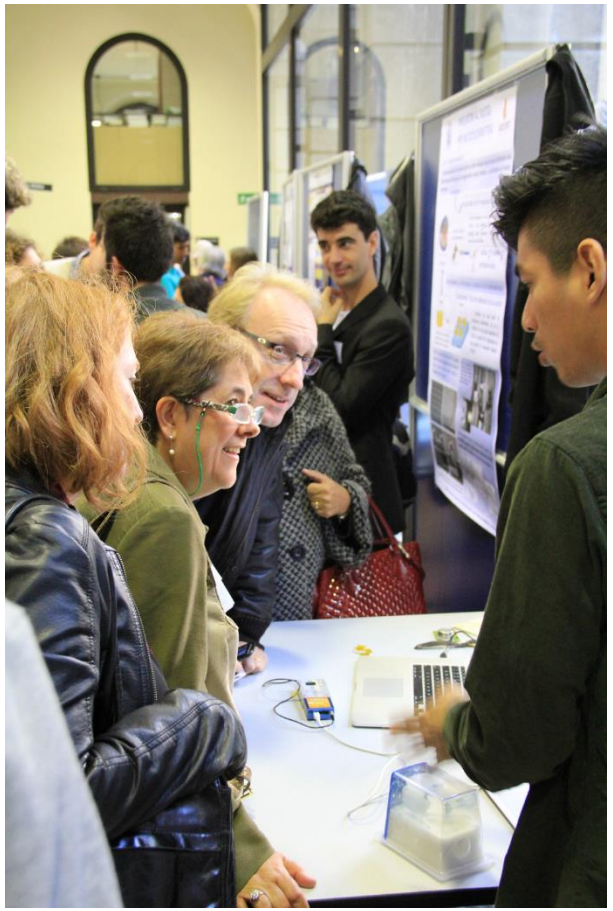
"For me school was always a safe place where I loved to be with my friends and teachers. The thought of being able to be on the other side of that, creating a great environment at school for kids and the opportunity to mentor them, really connected with me."

Now in his third year of a Bachelor of Science Education at UOW (majoring in physics), Zac has been awarded a travel scholarship from the School of Education to accompany eight students from Bulli High School to visit the largest particle physics laboratory in the world – the Large Hadron Collider.

The Large Hadron Collider at the European Organisation for Nuclear Research (CERN) in Geneva has already confirmed the existence of the Higgs Boson, the 'God particle', which is thought to give mass to other particles, and could now prove the existence of parallel universes and show that the Big Bang did not happen.

Future Plans

- **GRADUATE!!**
- Consult with supervisors on career trajectory
- The USA? Europe? Australia?
- Possible outcomes
  - Continue in medical physics research
  - Science communication and outreach work



Thank you for a truly unique experience! Questions?