

# Centre for Accelerator Science Imaging and Medicine



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Centre for  
Accelerator  
Science  
Imaging and  
Medicine



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Why Daresbury Laboratory?


Expertise in

- Accelerators
- Instrumentation
- Imaging
- Pioneering techniques

Infrastructure  
& expertise  
at Daresbury

North West  
universities  
& hospitals

<-- CASIM -->



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What are the components of CASIM?


**Fourth-Generation  
Light Source (4GLS)**

- Free Electron Lasers
- IR and UV
- Spectroscopy
- Microscopy

**Proton Cyclotron**

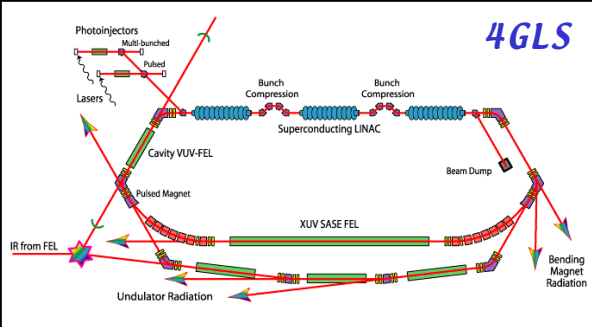
- Radioactive Beams
- Proton Therapy
- Isotope Production


**X-ray Imaging**  
Using the existing SRS



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Science Using the 4GLS

**Non-equilibrium**

- Excited States
- Molecular Fragmentation

**Life Sciences**

- Cell Metabolism
- Enzymatic Catalysis

**Imaging**

- IR Microscopy
- VUV Confocal Microscopy

**Medical Applications**

- Patient Imaging
- Laser Scalpel

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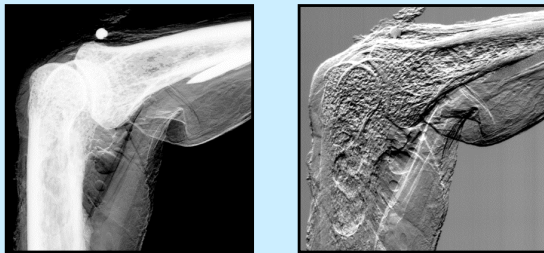
*More Science Using the 4GLS*

<b>Time-Resolved</b>	<b>Astrophysics</b>
Protein Folding	VUV Spectroscopy
Chiral Molecules	from Radioactive Beams
<b>Surface Science</b>	<b>Industrial Applications</b>
Nanostructures	Industrial Processing
Free Clusters	Surface Modification
Magnetic Materials	Micro-Machining

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*Imaging with X-rays*



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*Radioactive Beams for Science and Medicine*

**World-Class Facility**  
at the forefront of radioactive beam accelerators for nuclear physics research

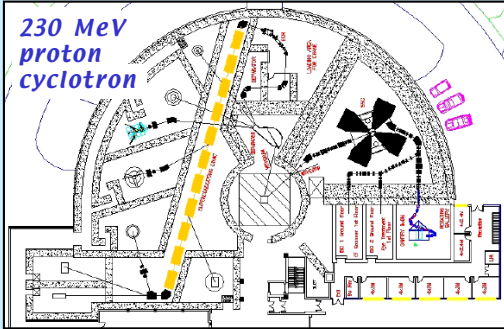
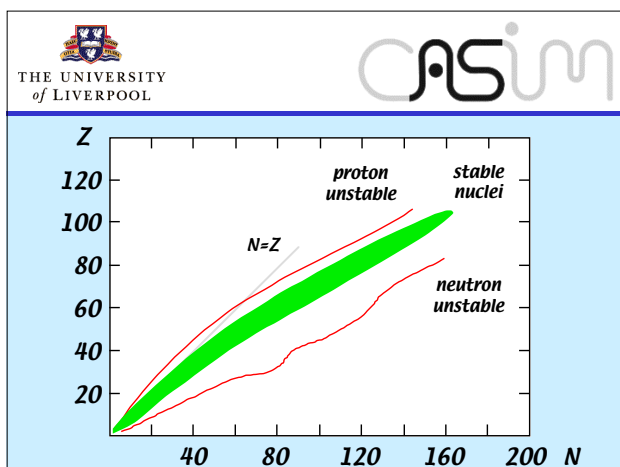
**Multidisciplinary**  
parallel beams of radioactive nuclei for materials, environmental and biomedical science, as well as nuclear astrophysics

**Proton Therapy**  
therapy and isotope production will be operated in parallel with nuclear physics

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**230 MeV proton cyclotron**

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*Nuclear Physics*

**Fundamentals**  
Neutron "skin"  
Superheavy island of stability


**Standard Model**  
Nuclear decay sensitive to weak interactions

**Astrophysics**  
Supernovae nucleosynthesis controlled by radioactive nuclei

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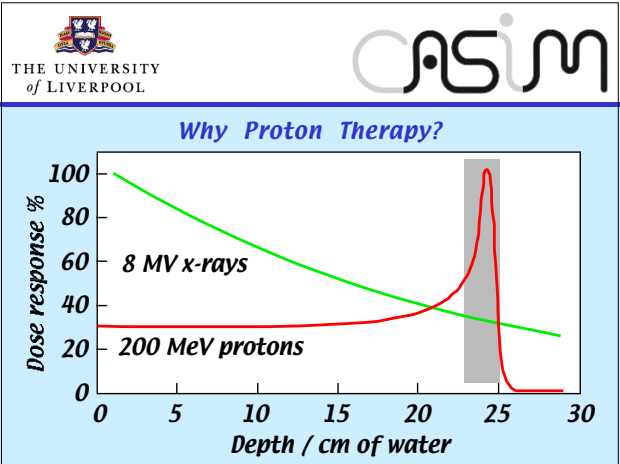
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*Proton Beams for Medicine*


**Cancer Therapy**  
Controlled doses of radiation to tumours  
Depth varies with energy  
60-100 MeV for tumours within a few cm of the surface  
> 150 MeV for tumours deep within the body  
Eye therapy room and gantry room  
Need to assess efficacy of protons vs modulated x-rays

**Isotope Production**  
radioactive “tumour-seeking” tracers

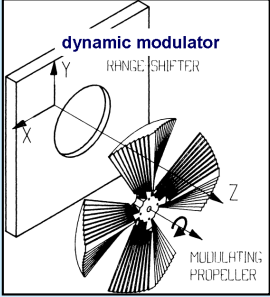




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*Modulating Range*



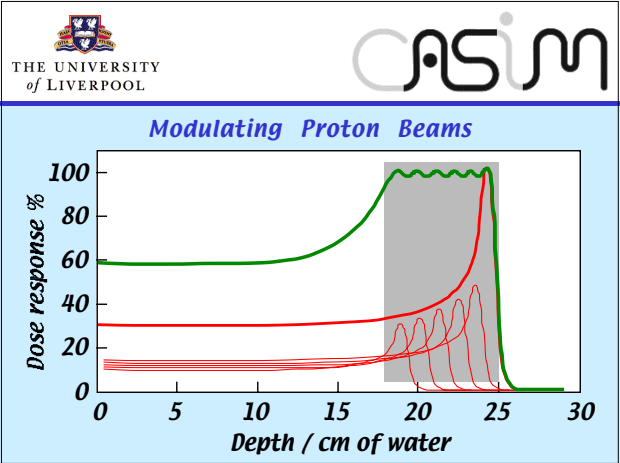
dynamic modulator  
RANGE SHIFTER


Perspex absorber

Varying thickness


Modulates energy  
and hence range  
of proton beam

MODULATING PROPELLER

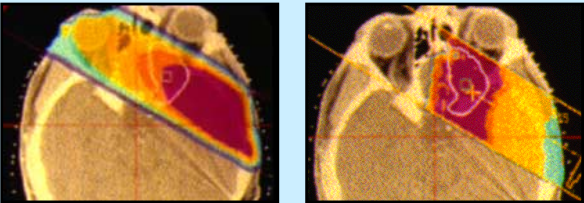




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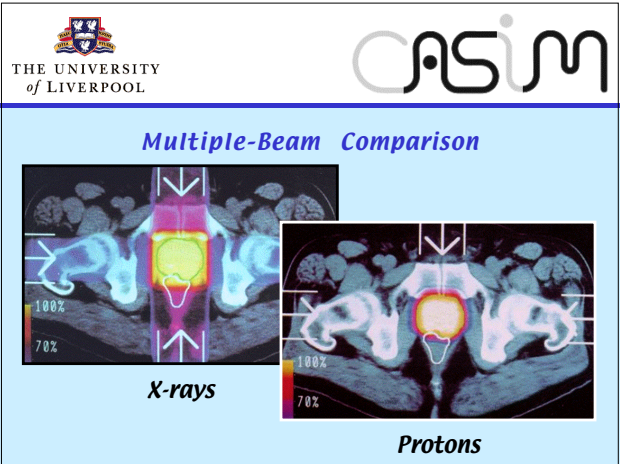
*Comparison of X-rays to Protons*



X-rays

Protons

Images from Northeast Proton Therapy Center, MGH Boston, USA



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**Funding of CASIM**

*Office of Science & Technology  
via the Research Councils*

*National Health Service*

*NW Development Agency & Industry*

*EU or other international funding*

**Status of CASIM proposal**

**March 2001**  
*Stephen Byers, Secretary of State, DTI  
gave support, subject to scientific review*

**December 2001**  
*Final business case --> OST and DH*

**Final Design 2002; Construction 2003-2008**

**[www.casim.ac.uk](http://www.casim.ac.uk)**