An overview of the Science and Technology Facilities Council capabilities in healthcare

Barbara Camanzi
STFC Futures Health and Cancer Care Theme Leader

barbara.camanzi@stfc.ac.uk
Outline

- The Science and Technology Facilities Council
- The Futures Programme and the Healthcare Theme
- The CLASP Healthcare call
- Examples of STFC capabilities
- Summary
The Science and Technology Facilities Council
The Science and Technology Facilities Council

STFC is an independent, non-departmental public body of the Department for Business, Innovation and Skills (BIS)
Annual budget ~ £475M

http://www.stfc.ac.uk/

HM Government (& HM Treasury)

BIS Department for Business Innovation & Skills

RESEARCH COUNCILS UK

Arts & Humanities Research Council

Medical Research Council

BBSRC bioscience for the future

ESRC Economic & Social Research Council

EPSRC Pioneering research and skills

NATURAL ENVIRONMENT RESEARCH COUNCIL

Science & Technology Facilities Council
STFC sites

+ Universities across the UK
STFC large scale facilities

- At RAL:
  1. ISIS: Spallation Neutron Source
  2. Central Laser Facility
  3. Molecular Spectroscopy Facility
  4. Space Test Facility

- Diamond: synchrotron light source. At the Harwell Campus. Co-funded by STFC and Wellcome Trust
The Futures Programme
and
the Healthcare Theme
The STFC Futures Programme

- Created in January 2009
- Goal: to increase STFC impact in meeting the four global challenges (CSR 2007):
  1. Energy
  2. Environment
  3. Healthcare
  4. Security
- Challenge-led programme
- Creates opportunities = Identify unmet needs + Match them to STFC skills and expertise
The Healthcare Theme

- Challenge-led theme
- Will focus on two of DH priority areas:
  1. Cancer
  2. Dementia
- Identifies new opportunities:
  1. Top-down plus bottom-up approach to identify unmet clinical needs
  2. Match of unmet clinical needs with STFC capabilities
The CLASP Healthcare call
STFC CLASP 2014 Healthcare call

- Priority challenge areas:
  1. Radioisotopes
  2. Imaging technology
  3. Early diagnosis
  4. Medical informatics

- Funding = £1.5M

- Key dates:
  1. 20.05.14 = launch of the call
  2. Early September 2014 = deadline for outline applications
  3. April 2015 = projects starting
Examples of STFC capabilities relevant to this call
<table>
<thead>
<tr>
<th>A (non exhaustive) list</th>
</tr>
</thead>
<tbody>
<tr>
<td>Detector design, simulation and build</td>
</tr>
<tr>
<td>Space Classified design and build</td>
</tr>
<tr>
<td>Accelerator design</td>
</tr>
<tr>
<td>Clean Technology</td>
</tr>
</tbody>
</table>
Some examples

- Detectors and sensors
- Computing
- Accelerators
Detectors and sensors
Which is which?

CMS (CERN) ECAL module

PET scanner (courtesy M Partridge)

From the Higgs

To medical imaging
Detector and sensor technologies

- Germanium detectors for imaging
- Scintillating materials and photon detectors for imaging
- CMOS detectors for imaging
- CCD technologies for imaging
- CZT detectors for imaging and spectrometry
- Pixel Silicon detectors for spectrometry
- Raman spectroscopy for cancer diagnosis
- Silicon detectors for beam monitoring
- ........
Three examples from...

Nuclear physics: Ge detectors

Particle physics: fast scintillators + SiPMs

Space: Large area CMOS
Computing
Computing

- Software expertise:
  1. Monte Carlo simulations (GEANT4, etc.)
  2. Detector and system modelling (GEANT4, GATE, etc.)
  3. Computational science (chemistry, biology, etc.)

- Large scale High Performance Computing facilities:
  1. Hartree Centre
A (non exhaustive) list of global challenge projects

- Pharmaceutical design
- Computational biology
- Next generation weather and climate modelling
- Radiation damage in materials for the nuclear industry
- High energy density plasmas and nuclear fusion
- Whole device modelling of fuel cells
- Investigation of techniques for detection of contraband
An example: simulations for dose determination and imaging

- Development of an alternative method to calculate scatter correction based on GATE Monte Carlo simulations for targeted radionuclide therapy

- University of Manchester (nuclear physics group) + Christie Hospital

![Diagram showing scatter correction simulations for different radionuclides and energy levels.]

<table>
<thead>
<tr>
<th>Radionuclide</th>
<th>Energy (keV)</th>
<th>S/N Improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) $^{99m}$Tc</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(d) $^{177}$Lu</td>
<td>113</td>
<td>x5.5</td>
</tr>
<tr>
<td>(g) $^{177}$Lu</td>
<td>208</td>
<td>x6.0</td>
</tr>
</tbody>
</table>

S/N increased x5.5

S/N increased x6.0

S/N increased x6.0

Courtesy A Robinson and D Cullen
Accelerators
Accelerator expertise

- Accelerator Science and Technology Centre (ASTeC) at DL
- Cockcroft Institute in the North and John Adams Institute in the South
Accelerator technologies

- Development of alternative solutions for radioisotope production:
  1. Lasers
  2. Accelerators (cyclotrons)

- Development of new cheap and compact accelerators for radiotherapy:
  1. Non-scaling FFAGs for proton / ion radiotherapy
  2. Laser driven accelerators for proton / ion radiotherapy
  3. Laser driven accelerators for x-ray radiotherapy
Production of $^{99m}$Tc with lasers

Vulcan Petawatt beamline
Production of $^{99m}$Tc with lasers

Courtesy R Clarke
Production of $^{99m}$Tc with lasers

Clear 140 keV $^{99m}$Tc emission observed from the $^{100}$Mo (p,2n) $^{99m}$Tc reaction

Activity 8.25 kBq

Courtesy R Clarke
Summary

- STFC has a wealth of expertise to offer to healthcare and to this CLASP call
- Through the call we are keen to encourage STFC engagement with the healthcare community
- We look forward to receiving good quality proposals in: radioisotopes, imaging technology, early diagnosis and medical informatics!