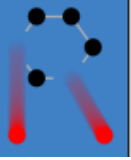
RaDIATE Collaboration

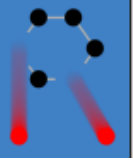
Radiation Damage In Accelerator Target Environments



New collaboration

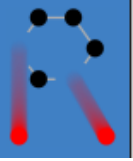
Key result from 1st PASI workshop at Fermilab, January 2012

http://www-radiate.fnal.gov/index.html



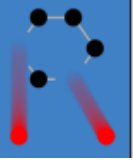
RaDIATE Objectives

- As proton accelerator particle sources (target facilities) become increasingly powerful, there is a pressing need to better understand and predict the radiation response of structural window and target materials. The RaDIATE Collaboration will draw on existing expertise in related fields in fission and fusion research (which has, to date, not been co-ordinated well with the work of the accelerator communities) to formulate and implement a research programme that will apply the unique combination of facilities and expertise at participating institutions to a broad range of high power accelerator projects of interest to the collaboration. The broad aims are threefold:
- to generate new and useful materials data for application within the accelerator and fission/fusion communities;
- to recruit and develop new scientific and engineering experts who can cross the boundaries between these communities;
- to initiate and coordinate a continuing synergy between research in these currently disparate communities, benefitting both proton accelerator applications in science and industry and carbon-free energy technologies.



RaDIATE Initial Scope

- The following materials have been identified as being of particular interest for targets and beam windows:
- Graphite (and Carbon-Carbon Composites) for existing and future neutrino facility targets
- Beryllium for beam windows and future neutrino facility targets
- Tungsten with or without tantalum cladding for spallation neutron source targets and muon production targets
- The ultimate ambition is to be able to predict operating lifetimes for as many of the above materials as possible in terms of integrated proton fluence for the high energy proton accelerator parameter space (e.g. temperature, dose rate, duty factor, dynamic stress) while accepting that such predictions are inherently challenging and may not be expected to be applied to safety critical items.
- For some of these materials, (graphite, structural steels), there is a long history of use in nuclear fission applications and a large body of research on irradiation effects due (mostly) to low-energy neutrons. For others (beryllium, tungsten) there is a more limited and recent body of work directed at fast neutron environments (e.g. fusion reactors; CCFE have just equipped their JET reactor with a tungsten / beryllium wall system). The immediate tasks are to assess existing knowledge and how it might be applied to these new irradiation environments and to determine what new research will be most effective.



RaDIATE Status

- Monthly meetings (2 so far)
- MOU
  - Agreed informally between all participants. Awaiting DoE signature
- Scoping study underway by NNL/Oxford (c/o Steve Roberts/Materials for Fission & Fusion Power Group)
  - Initial report on Beryllium on website (Colin English/Barry Jones/NNL)
  - Graphite report underway (Graham Hall/Manchester)
- **'PASI' Post-doc recruitment at Oxford underway**
  - To work on beryllium & beryllium alloys
- Hope to include tungsten research in future (seek funding by ESS)
  - Testing of samples of ISIS targets by David Armstrong (MFFP) underway
- University of Manchester now part of URA
- NNUF (National Nuclear User's Facility) at Culham
  - £5M this year
  - £10M earmarked next year