

Beam Dump outline work plan (UK perspective)

- Based on funding request to UK funding agency (PPARC (RIP 1 April)) to cover next 3 years 2007-2010
- Beam Dumps work package split into 2 tasks:
 1. Physics and simulation
 2. Material Studies and Engineering Design, Analysis and Optimisation
- Beam Dumps work package likely to be severely cut, to a level where UK leadership is not possible. Discussions underway!
- Funding status looks feasible for 1 year
- Future funding status dependent on new UK strategy for Particle Physics to be prepared by the new Science & Technology Facilities Council

Beam Dump Task 1:

Physics and simulation: Goals & milestones

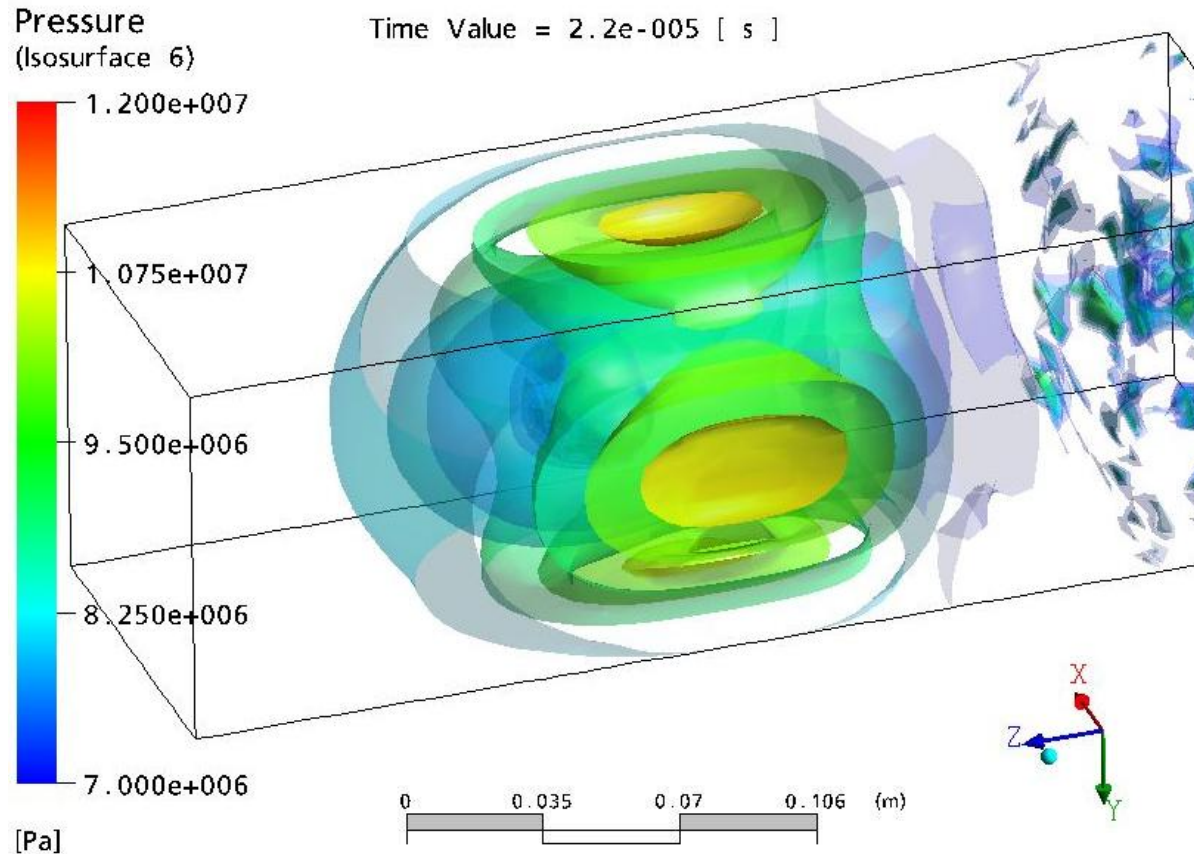
- Goal 1. Train RAs in the field of advanced physics simulation, as applied to water and gas based dumps
 - Milestones
 - **1.1.** Jul 08: RAs working with international collaborators on the linear collider beam dumps work.
 - **1.2.** Jul 09: Present energy deposition studies
 - **1.3.** Apr 10: Present shielding and activation studies
- Goal 2. Perform physics simulations of the water-based dump
 - Milestones
 - **2.1.** Apr 07-March 08. Computation of power deposition into water system dump window using particle tracking and simulation codes.
 - **2.2.** Jul 07-March 08. Computation of power deposition into water system dump window using particle tracking and simulation codes.
 - **2.3.** Apr 08-Mar 09. Computation of particle fluence and study of shielding requirements of the water dump.
 - **2.4.** Apr 09-Mar 10. Calculation of water activation.
- Goal 3. Perform physics simulations of the gas-based dump
 - **3.1.** Apr 07-Mar 08. Simulation of noble gas system scattering beam into an iron jacket, using particle tracking codes, including the use of gas pressure profiles to minimise beam dump length.
 - **3.2.** Apr 08-Mar 09. Computation of particle fluence and shielding requirements for gas dump.
 - **3.3.** Apr 09-Mar 10. Consider hybrid designs, including graphite dump for beam tail and alternative gas and absorber materials.

Beam Dump Task 2:

Material Studies and Engineering Design, Analysis and Optimisation

1. Design study of candidate window materials.
2. Design and optimisation of geometry of window for water dump in order to minimise thermal fatigue, pressure and shock wave stresses. Estimation of window lifetime with reference to radiation damage.
3. Specification, design and participation in on-line experiments using electron beams to simulate power deposition, thermal and stress wave profiles in prototype window materials
4. Design and full model of internal water circulation system within beam dump vessel using Computational Fluid Dynamic codes in order to maximise efficiency of heat transfer and minimise possibility of local boiling.
5. Outline design of remote handling systems for replacement of critical components e.g. window, de-ionising system and catalytic recombination components.
6. Specification of services requirements for all beam dump specific items.
7. Full costing of baseline design, in accordance with GDE guidelines
8. Assessment of costs for disposal of activated water and associated materials only
9. Investigation of gas dump alternative design including assessment of operating limits of window and jacket materials
10. Feasibility study of a differentially pumped windowless system
11. Simulation of heat flow through surrounding jacket to water system
12. Investigation of alternatives to iron jacket and Ar gas core in order to minimise length and cost of dump, by consideration of various material combinations e.g. Cu and refractory metals, and using higher Z noble gases.
13. Outline design of the optimised and possibly hybrid alternative design, including gas and water cooling and maintenance systems including remote handling where necessary.
14. Costing of alternative design, in accordance with GDE guidelines
15. Full comparison of alternative design with water baseline with regard to cost, technical reliability and risk assessments, including a critical assessment of preferred technology choice.
16. Study of lower power tune-up beam dumps with specification of technology choices for different powers

Shock wave generation in 18 MW water dumps: baseline technology choice



- Pressure wave in water vessel $22\ \mu\text{s}$ after a 20°C rise in temperature over $10\ \mu\text{s}$ beam pulse
- Similar to ILC beam dump parameters at shower maximum with rastered beam
- Maximum pressure = 120 bar

Next stages

- More detailed simulations of water dumps urgently required to simulate beam bunch structure and rastering effects
- Determine if shock wave generation is a show-stopper for the water dump technology
- Investigate solutions to the problem
- Investigate alternatives:
 - Gas dump (part of proposal to LC-ABD2)
 - Fluidised particle beds – New idea, feasibility study already begun
- Continue with Beam Dumps programme according to funding allocation by STFC