

## **PROPOSAL TO USE FERMILAB PARALLEL COMPUTATION FACILITY**

### **1. Project : Development of new target material for high energy proton beam**

For High intensity, multi-megawatt proton accelerator facilities, such as the proposed Project X at Fermilab, the targetry requirements for the Project X experimental program range from 1 GeV, 1 MW, CW proton beam on a high-Z target (possibly liquid metal) to 120 GeV, 2.3 MW, pulsed proton beam on a low-Z target. It is intended to carry out thermal stresses in few selected materials to predict their long term mechanical structural integrity and service life time owing to extreme energies and radiation damages. Simulations are to be carried out by Finite element packages. Developing appropriate material model and damage model to accurately predict the physical behavior is another challenge.

### **2. The proposed work-flow that will run on the cluster:**

Since simulations are highly non-linear and the degrees of freedom could be order of millions, a simulation on parallel computation architecture is demanded. Most commercial softwares like ANSYS, ABAQUS are prohibitively expensive when it comes to parallel computation. They charge few hundreds of thousand dollar per year for 500 CPUs.

So it is proposed to use open source code FEM software, **FrontISTR**, developed by The university of Tokyo which has been in use in scientific community for over a decade. I have been using this software for past 6-7 years during my PhD and post doc research in various research institutes and University in Japan. I could successfully install and run on different kinds of PC clusters and on K-Supercomputer (Largest supercomputer of Japan).

If it can be installed on any of the Fermilab PC clusters, it will be a huge cost savings for future simulations.

### **3. Expected job sizes (it could be as simple as the number of parallel**

I would be using about 1000-4000 CPUs. So about 128-512 nodes

### **4. How long are the cluster resources required for (days, weeks, years)**

It is required for 3 years. But I would not be running the simulations continuously. So the usage is sparse. One simulation may take up to 24 hours. Initial smaller simulation may require less than one hour.

### **5. Disk space for volatile and non-volatile data**

If possible 1 Terabyte

### **6. Name of project supervisor or PI.**

Robert Zwaska