

Neutron Scattering Models of Computer Hardware using MCNP6



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Motivation

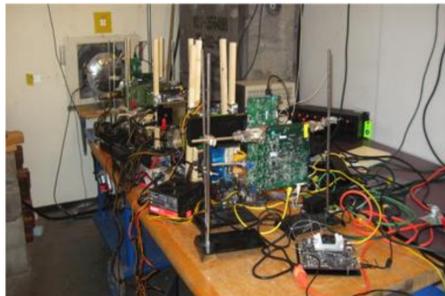
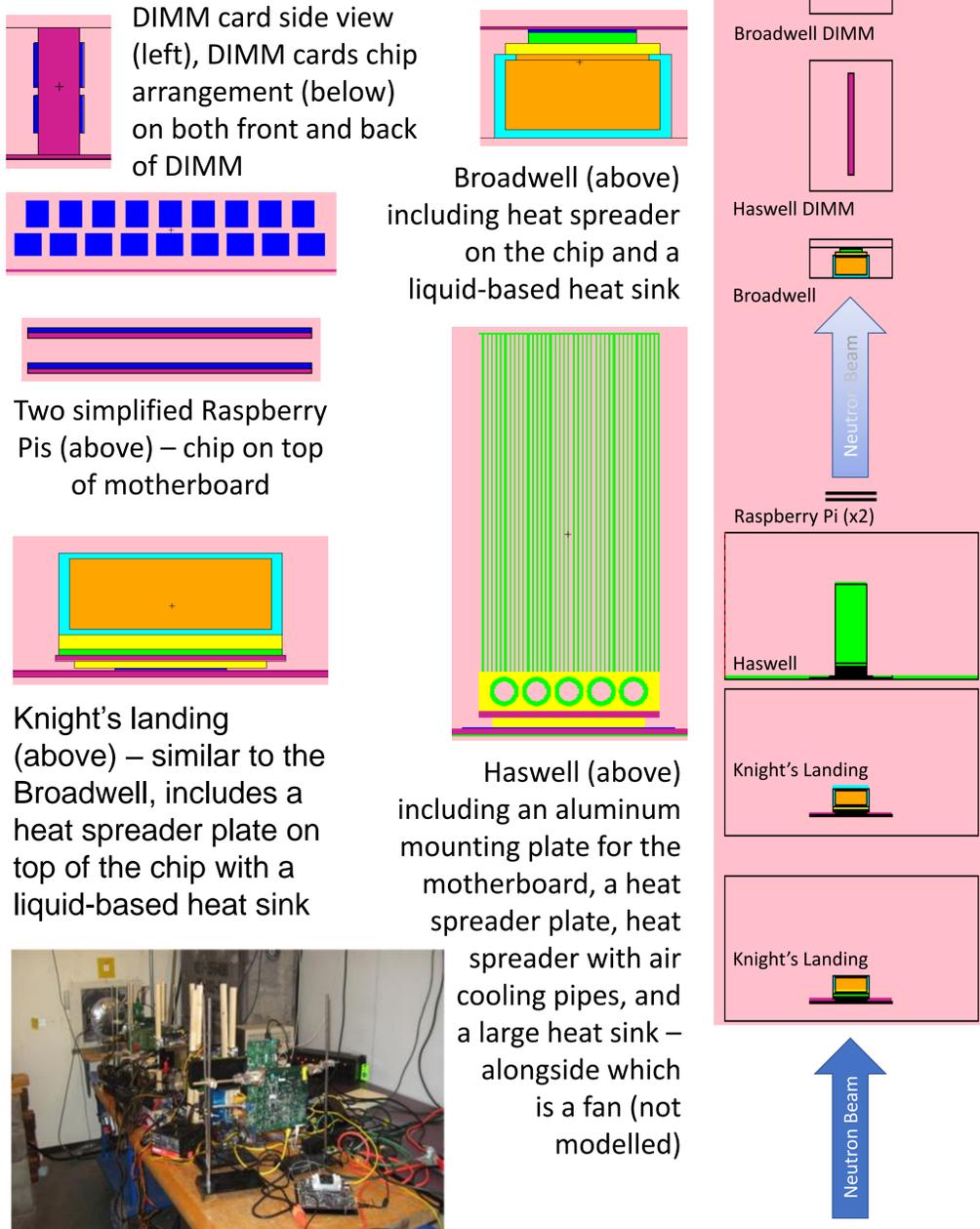
- Cosmic radiation, including high-energy neutrons, bombard the Earth's surface 24/7
- Neutron collisions with CPUs and other computer hardware cause bits to flip and can increase a computer's error rates.
- Vendors determine the estimated error-rate of CPUs from natural radiation by placing them in the ICE-House neutron beam at LANSCE.

Code

- Consists of the 3 sections – surfaces, cells, and data.
 - Surface cards shape all geometry
- ```
303 RPP -3.3 3.3 -3.8 3.8 0.24 0.28 $ Composite Chip
```
- Cell cards define each piece of the geometry
- ```
3311 1004 -0.92 -307 -308 fill=34 u=333 imp:n=1 $ Heat sink
```
- Data cards define the materials, radiation source(s), tally counters, etc.
- ```
sdef pos=0 0 1 erg=14.0 $ Neutron source
```

## Hardware Models

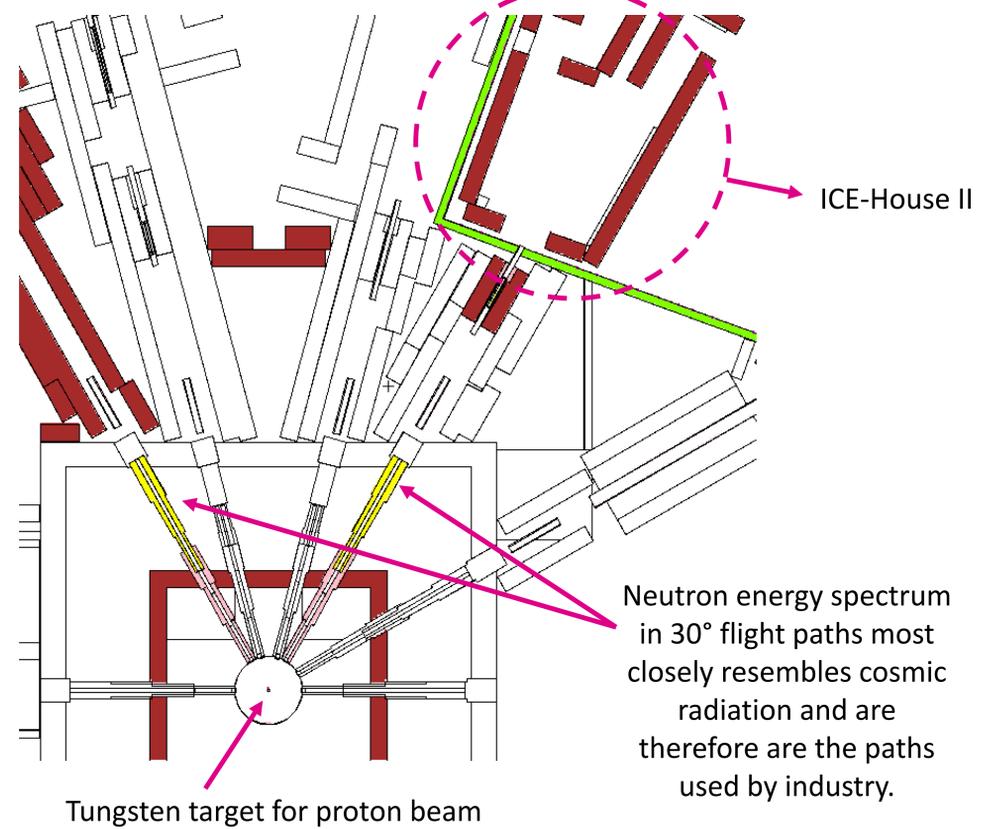
- MCNP6 has a rudimentary plotter program built in to generate models of the input files...



|                        |         |                        |          |         |                            |     |
|------------------------|---------|------------------------|----------|---------|----------------------------|-----|
| Fiberglass motherboard | Si Chip | Copper (Heat Spreader) | Aluminum | Plastic | Water-Propylene Glycol mix | Air |
|                        |         |                        |          |         |                            |     |

## Beam Model

- This MCNP model, originally developed by Victor Gavron using MCNPX, is shared by users of the WNR facility for a variety of purposes including testing/development of shield for new or modified experiments. For this project it was used to create an accurate representation of the neutron beam-line when entering into the ICE-Houses.



## Future Applications

- These files have been written out to be as user-friendly as possible so as to allow the models to be handed off to vendors using the LANSCE ICE-House(s) and then be modified to suit their individual needs. This allows them to get more accurate models of CPU lifetime and efficiency when compared with experimental results.