“Simple Heat”
Thermal Modeling of X-ray Heat Load

Rich Hilliard,
Tompkins Cortland Community College,
CHESS
Heat Loading

- Destroys samples
- Degrades equipment
- Disrupts experiment
- Laue Diffraction
- ERL: higher HL densities
“Is HE Li U M necessary?”

Interface: Optics & Cooling
- Skip the empirical
- Automate to save time

Water
v.
Liquid Nitrogen

Tuesday, June 25, 2013
Always remember to check that total power = power absorbed + power transmitted. If it does not, sign of a deep error in computation. Now abbreviated as $p = a + t$.

Version 1.0
The centipede has been caught! This error turned values of source_flux from $10^{12}$ to $10^{-21}$, due to a `=` instead of a `==` in region_filtered flux.

Version 1.1
Interpolation guard is now implemented. The previous implementation did not work well, working on now. Created a new class and refunction to deal with this error.

Version 1.2
A speed boost was added while filtering (instead of using a sequential search to find mu values, a binary search is now used in python from 300s to 5s).

Version 2.0
Multiprocessing added. This update later included "overdrive", where if half the cores are finished, a new dispatch occurs. It cut by a factor of N, now it is cut by 1.5N (N=number of cores).

There were a series of numerical errors, which included errors in $p = a + t$, when multiple slices were implemented. There was a difference in power values when the slices were (100,10)mm,(110)mm,(10,100)mm, or (10)mmx11. This was due to reference errors, and fixed by using deepcopy.

The write_slice_to_table function was rehauled, in order to implement changes as due to rectangle_grid.

There are still some index naming errors, these are of low priority and will be fixed in next release.

Inner loop optimization has been added. This cuts down on less indexing.

Memory errors are present, for a 102x102 matrix (100x100 with lip), the source_flux array is about 396 MB. Broke my laptop. Need big machine.

Version 2.1
There were several unnecessary deep copies of s_flux that have been removed.
In the filter_flux function, s_flux gets edited and destroyed, cannot be recovered.
Attempted numpy handling, does not work on laptop. Will use unofficial binaries.
Fixed a series of bugs, finally got good results. The density is finally a smooth function, while the power is properly discontinuous. This was due to the composition of two bugs, not changing the width and height of cells in build?matrix, and a series of other computation errors.

Version 2.1.2
Mathematica output
Fixing the "both" dialog in adv other optimizations/tests

Version 3.0
Importing and Exporting run data
Importing and Exporting source data

"Simple Heat"
Richard Hilliard
Tompkins Cortland Community College
SRCCS 2013

Tuesday, June 25, 2013
<table>
<thead>
<tr>
<th>i.d. / bending magnet</th>
<th>filter(s)</th>
<th>region</th>
</tr>
</thead>
<tbody>
<tr>
<td>[XOP]</td>
<td>radiation spectrum</td>
<td>heat load</td>
</tr>
<tr>
<td>project</td>
<td>mirror</td>
<td>output</td>
</tr>
</tbody>
</table>
Optics

http://www.nature.com/nmat/journal/v4/n1/fig_tab/nmat1282_F2.html

Tuesday, June 25, 2013
an undulator spectrum
flux thru multiple filters
Energy absorptions (deposition) by position

Brick Matrix

Cornell University
Cornell High Energy Synchrotron Source

“Simple Heat”
Richard Hilliard
Tompkins Cortland Community College
SRCCS 2013
Reflection / Projection

$\theta = 90^\circ$

$\theta \neq 90^\circ$
Simple Heat

Richard Hilliard
Tompkins Cortland Community College
SRCCS 2013

Output

File: block_vol-2
“Publishability”

• Integration of the existing code (Debug, multiple platforms)
• Finish GUls
• Output formatting features
• User procedure
• SPECTRA
Acknowledgements:
Jim Savino, Aaron Lyndaker, Ben Oswald, Ron Huang