Chicago Fusion Team Members

- **Students:**
  - Alex Ballmer (1\textsuperscript{st} year UG)
  - Ben Walters (2\textsuperscript{nd} year UG)
  - Dan Gordon (4\textsuperscript{th} year UG)
  - Jason DiBabbo (4\textsuperscript{th} year UG)
  - Kevin Brandstatter (4\textsuperscript{th} year UG)
  - Lauren Ribordy (Highschool)

- **Advisor:**
  - Ioan Raicu (IIT/Argonne)

- **Others:**
  - William Scullin (Argonne), Ben Allen (Argonne), Cosmin Lungu (1\textsuperscript{st} year UG)
  - Andrei Dumitru (1\textsuperscript{st} year UG), Adnan Haider (1\textsuperscript{st} year UG), Dongfang Zhao (4\textsuperscript{th} year PhD), Tonglin Li (6\textsuperscript{th} year PhD), Ke Wang (5\textsuperscript{th} year PhD), Scott Krieder (4\textsuperscript{th} year PhD)
Hardware, Software, and Sponsors

- 6 node cluster with IB 56Gb/s * 2 (36-port IB switch)
- 2x Intel Xeon E5-2699 v3 (Haswell) 18-core CPUs @ 2.3 GHz (on dual socket Supermicro system)
- 10 Nvidia K40 GPUs (2 per node on 5 nodes)
- 128 GB RAM per node
- ~3TB of SSD storage
- Software: CentOS 7, Slurm, Warewulf, GPFS, MVAPICH2, Intel MPI, CUDA
- Sponsors:
  - Intel, Mellanox, NVIDIA, and Argonne National Lab.
What We’ve Learned

- Automating processes will save your life
- Stateless provisioning is priceless
- The wonders of resource management (Slurm is still tempermental)
- How to (not) break electrical circuits and how to solder circuits
- Older hardware (e.g. SSD drives) are not worthwhile due to issues in reliability
- The error-prone process of managing a computing cluster
- How to tune the OS, storage, network, and HPC apps
Our Biggest Challenge

- Change in complete architecture and software 5 weeks before
  - Chasis ➔ challenged us in low level support for power management
  - CPUs ➔ Ivy bridge to Haswell
  - GPUs ➔ K20 to K40
  - Network ➔ 40Gb/sec Ethernet to 56Gb/sec Infiniband
  - OS ➔ CentOS to Warewolf
  - MPI ➔ OpenMPI to MVAPICH2

- Hardware arrived unassembled 10 days before we shipped (overnight)

- Allowed team only a few days to debug the new environment and tune the code

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Thanks!

- A big thanks to the SC14 and its organizers
- Our steadfast advisor Ioan Raicu
- Our tireless helper from Argonne (William Scullin, Ben Allen)
- And Wanda (Argonne) who made it possible for us to ship a 1500 lb crate overnight
- Without them, our cluster would never have reached the epic proportions of awesomeness it has