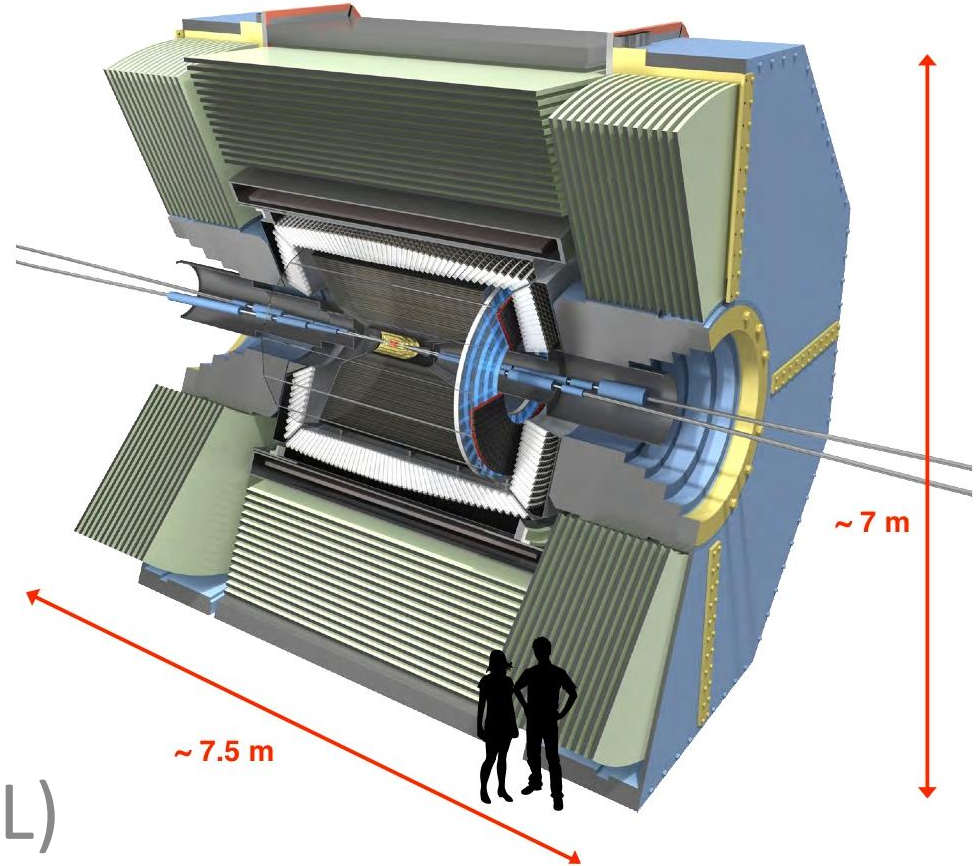




# Belle II Offline Software and the HSF

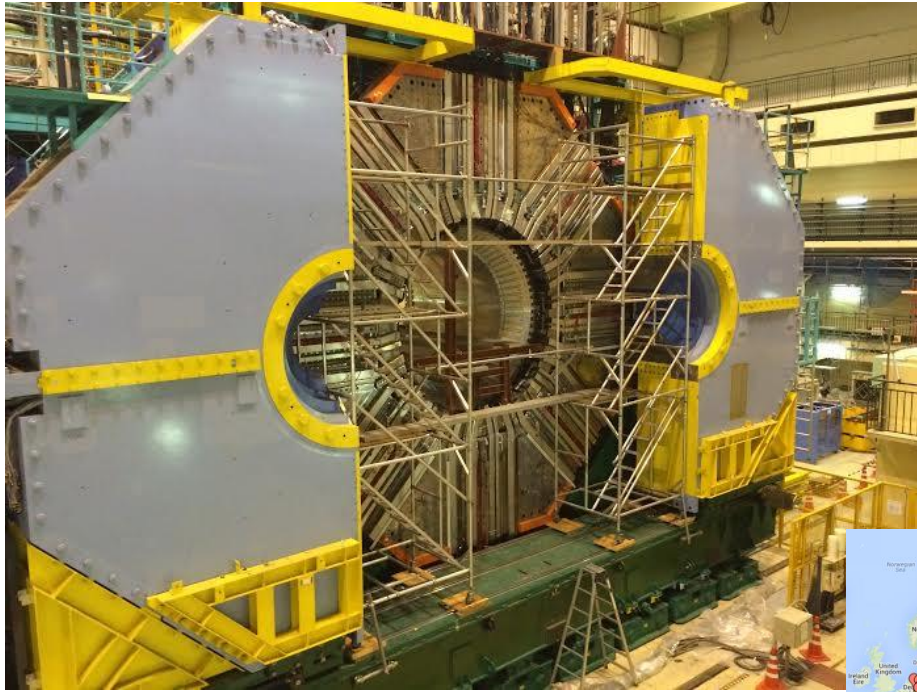


Lynn Wood (PNNL)

Belle II DB Co-convenor



# The Belle II Experiment



*Exploring the flavor and heavy quark sectors of the Intensity Frontier*

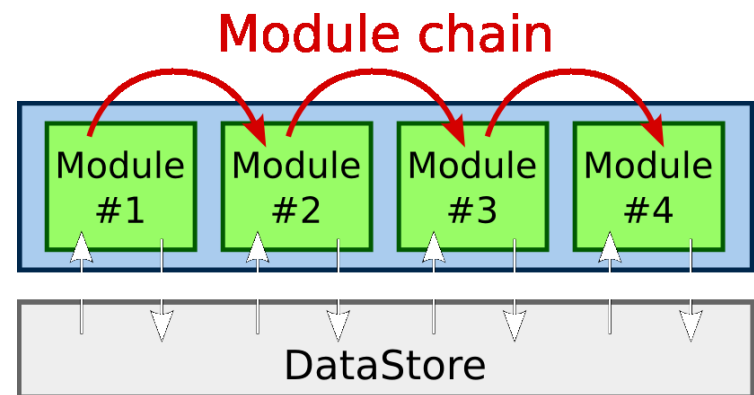
KEKB design luminosity:  $8 \times 10^{35} / \text{cm}^2 / \text{s}$   
(40 x Belle luminosity)

Lifetime integrated luminosity:  $50 \text{ ab}^{-1}$



# Belle II Offline Software

- External tools: boost, geant4, root, EvtGen, Genfit...
- Belle II software framework: **basf2**
  - C++, python steering files for config
  - Data shared via DataStore
  - Parallel event processing
  - I/O: ROOT trees, seqroot
- Code development tools: scons, redmine, doxygen, nightly builds...
- Validation: scripts included in package source
- 280k lines of code, ~70 active developers (including many students)





# Belle II's View of the HSF

*In general terms, what should the HSF be and do, and what should it not be and do? What should its main areas of focus be?*

Belle II is in the middle of its software development phase. Large parts have been written already, but a lot of work still has to be done. **We have to make sure that the Belle II software stays maintainable and follows the advances in technology.**

**The HSF may help us to exploit synergistic effects with other HEP experiments, to train our developers, and to support their careers.**

# Status of Software re: HSF

## Project hosting infrastructure, building and testing infrastructure

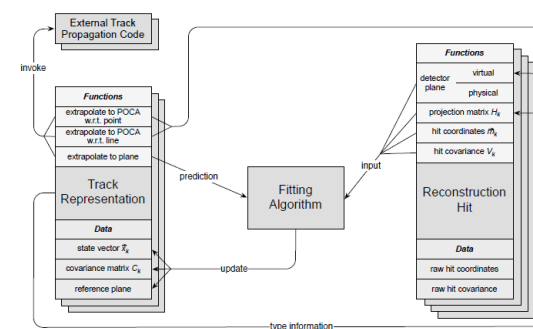
- Already set up for Belle II.
- **We can contribute our experience with the tools to the HSF.**
- Possibly relevant for **GenFit\*** (in sourceforge).

## Software repositories and package managers

- Several external software packages used by Belle II via hand-written Makefiles.
- **Open to better solutions!**

## Teams for certification and integration

- Currently no push to make Belle II software public.
- May be relevant for **GenFit?**



*GenFit: an experiment-independent framework for track reconstruction for particle and nuclear physics*  
[\[http://arxiv.org/abs/0911.1008\]](http://arxiv.org/abs/0911.1008)





# Status of Software re: HSF

## Access to computing resources on many platforms/architectures

- Useful to check **portability** (as a measure of code quality) and to prepare **binary distributions** for users (currently limited by resources).
- Very interested in optimizations.

## Access to software development tools

- Could be useful, if the number of used tools is kept reasonable.
- Coverity was used to check the Belle II software, but we had limited access to the results (CERN account required).

## Training in software technologies and tools

- Belle II developers have very different levels of experience and skills. **Training would be very useful.**



# Status of Software re: HSF

## Support for IP and licensing issues

- Licensing issues were discussed initially → code was not made public.
- If a **good solution** could be found with the help of the HSF this would be appreciated.

## Peer reviews

- We had a review of the tracking software by David Brown and Markus Elsing in June 2013 and got very useful feedback. Further reviews of our code would be welcome.
- Challenging to find reviewers; networking would help significantly.
- **Belle II could also provide code reviewers for other experiments.**
- **Strongly suggest including CS professionals on reviews.**



# Status of Software re: HSF

## Access to scientific software journals

- Not considered seriously so far, but might be useful.

## Task forces or “SWAT” teams to solve specific issues

- Probably not for issues in the Belle II software directly, but maybe for issues in one of the **external packages**.

## Consultancy for new experiments or projects

- Not so relevant now any more, but would have been nice when we started. **Was useful for our database development (see talk).**
- Decisions are often influenced by the background and preferences of the involved people.





# What Can Belle II Bring?

*What can you and/or your project bring to the HSF? Do you see potential to form new collaborations via the HSF, e.g. through parts of your projects becoming common software efforts?*

- **We can bring in the experience with the tools and methods we use in the Belle II software development.** Whether parts of the software can be extracted and provided as useful tools is questionable.
- **GenFit2 (whose development was driven by Belle II) could be a good project for the HSF.**
- **At this time, Belle II could participate in workshops and provide code reviewers.**
- **Belle II is very interested in seeing where the HSF goes...**