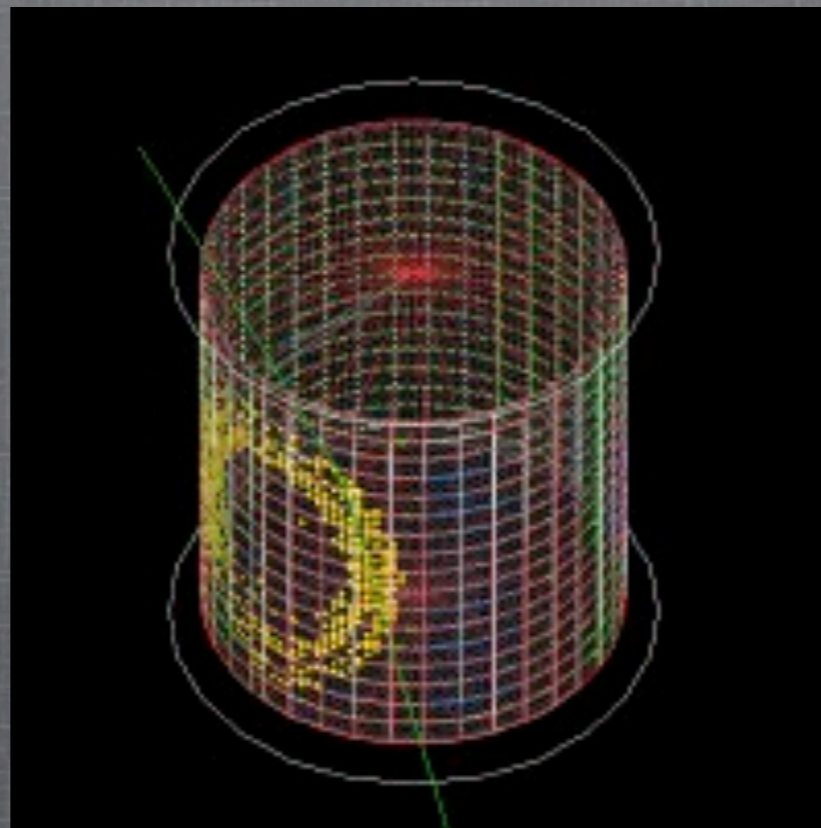


WCSIM

The Water Cherenkov SIMulator



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NNN Water Detector Satellite Meeting

October 27, 2015

ABOUT WCSIM

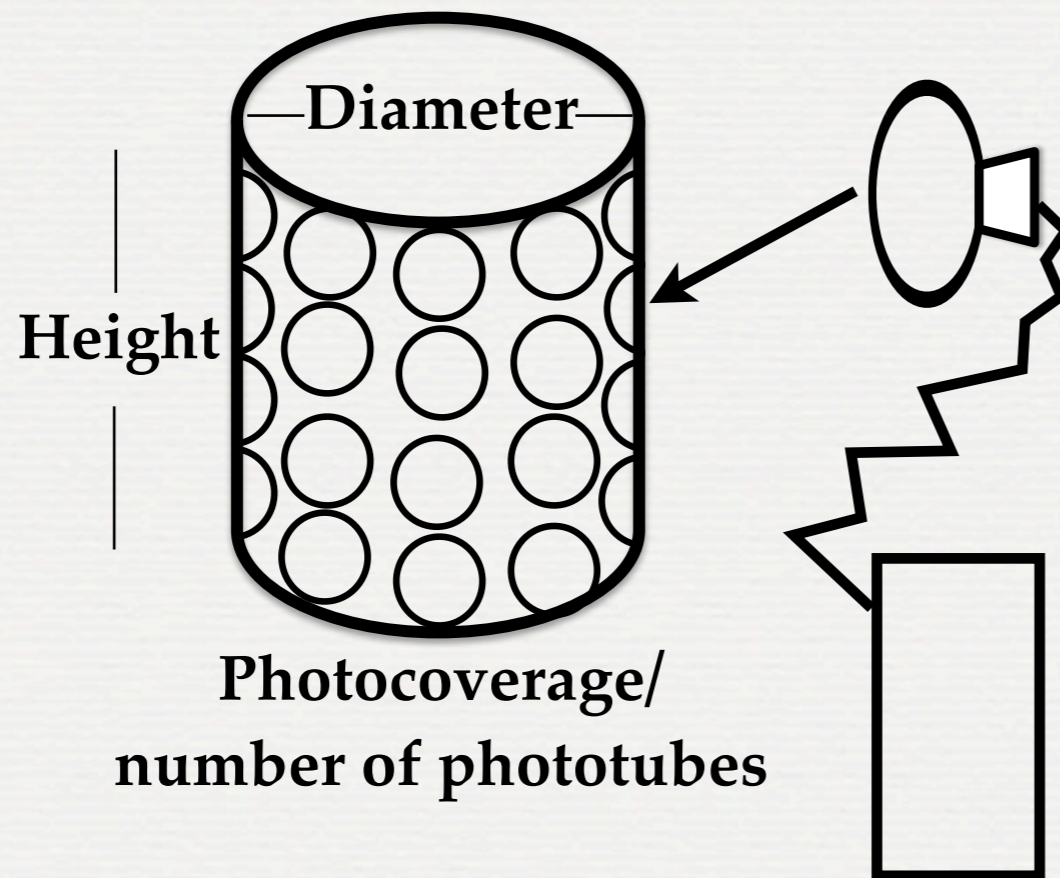
- MC software package that uses the Geant4 framework
- Designed to be flexible, allow users to specify detector components and geometry. New configurations can be easily tested.
- Set up for cylindrical detectors, though other shapes (like the egg-shaped Hyper-K design) have been successfully implemented
- Open-source and available for download at <https://github.com/WCSim/WCSim>

WHAT WCSIM DOES

- Constructs detector according to user inputs
- Generates the particles (either using Geant particle gun or user defined vector file)
- Propagates and tracks the particles using Geant
- Simulates the photodetector and trigger / digitizer functions
- Outputs a ROOT file with raw hit info (from photodetector) and processed info (after trigger / digitizer)

BUILDING A DETECTOR

Some simple user-defined variables



Type of phototube

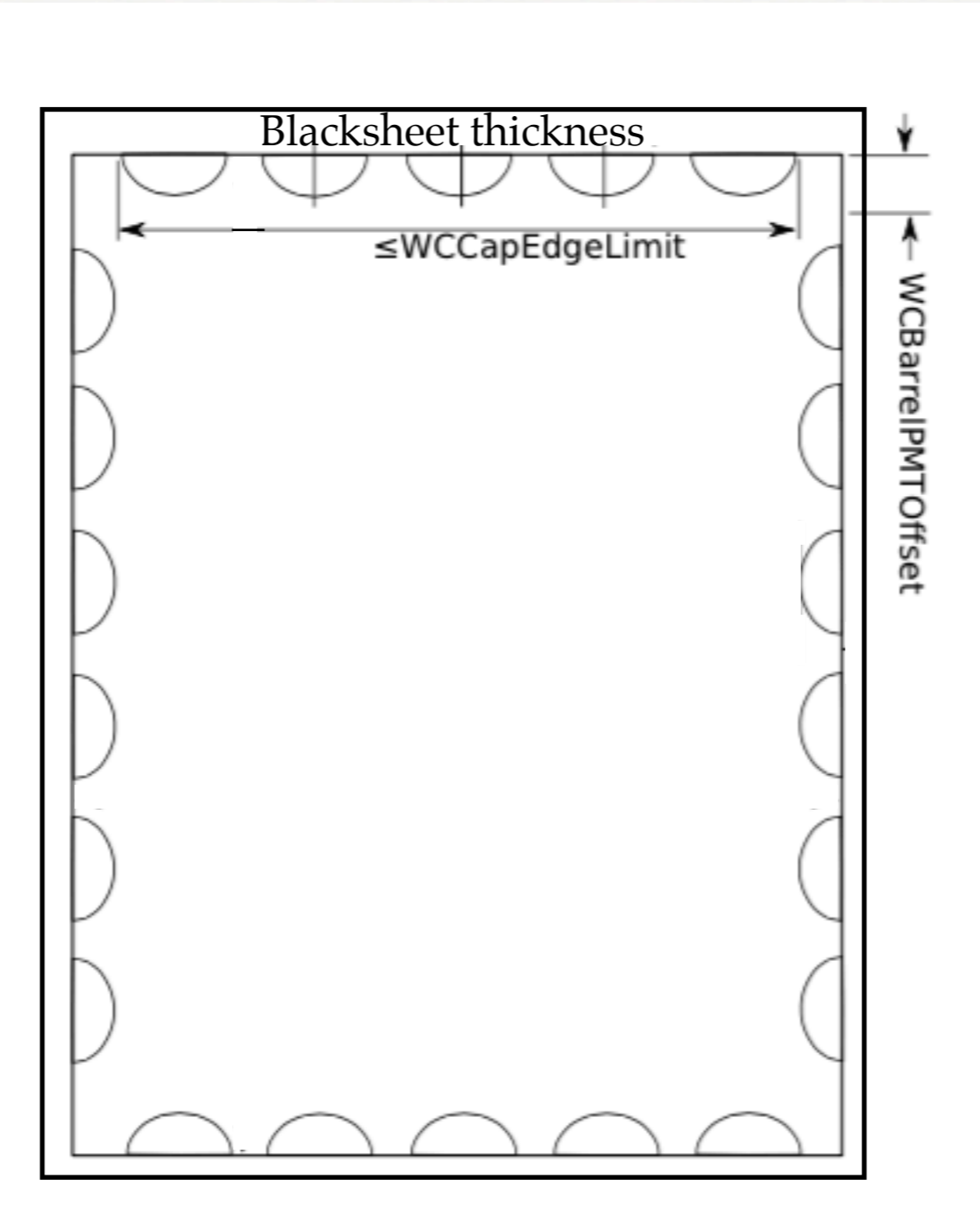
- PMT (8" / 10" / 20")
- HQE PMT (10" / 12")
- Hybrid Photodetector (HPD)
- Box and Line
- Easy to add your own!

Coming soon (on the development branch, will be in the next release): Choose your digitizer and trigger scheme.

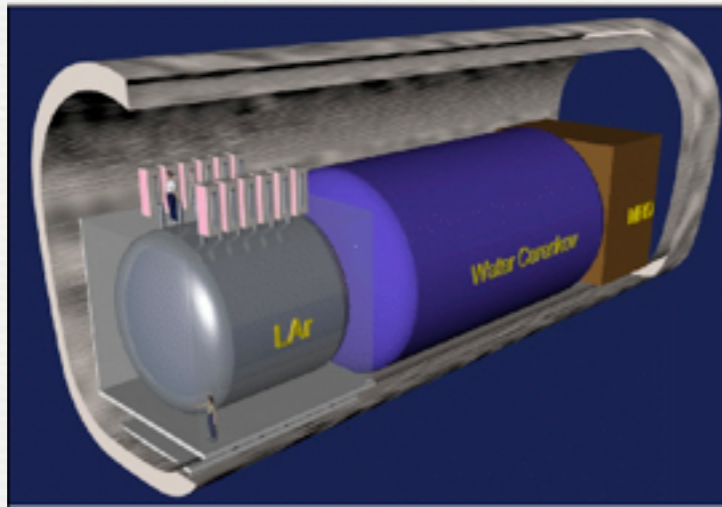
- Initially available: SKI electronics
- Future release: SKIV
- Easy to add your own!

BUILDING A DETECTOR

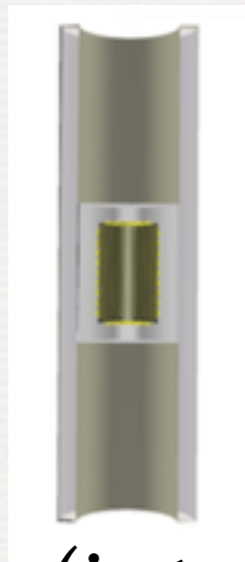
Also some more advanced options



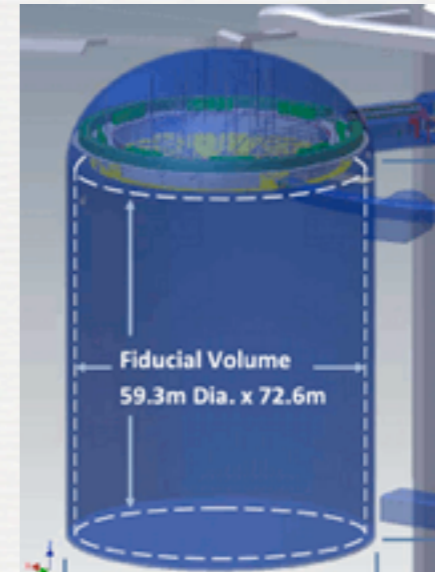
WCSIM IN ACTION



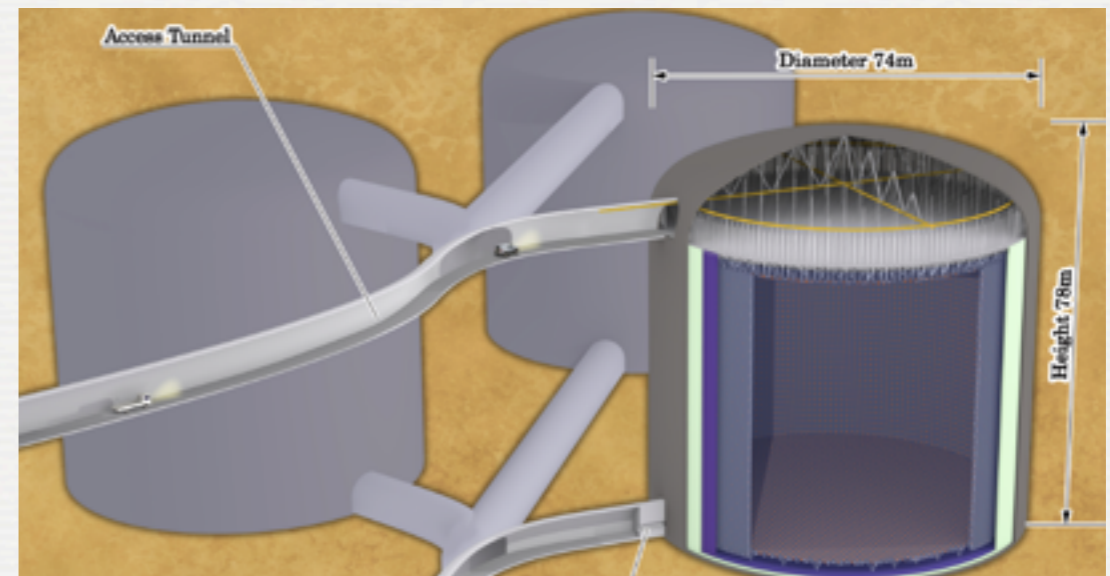
(formerly proposed) T2K 2km
- originally developed for this



NuPrism (intermediate
detector for Hyper-K)



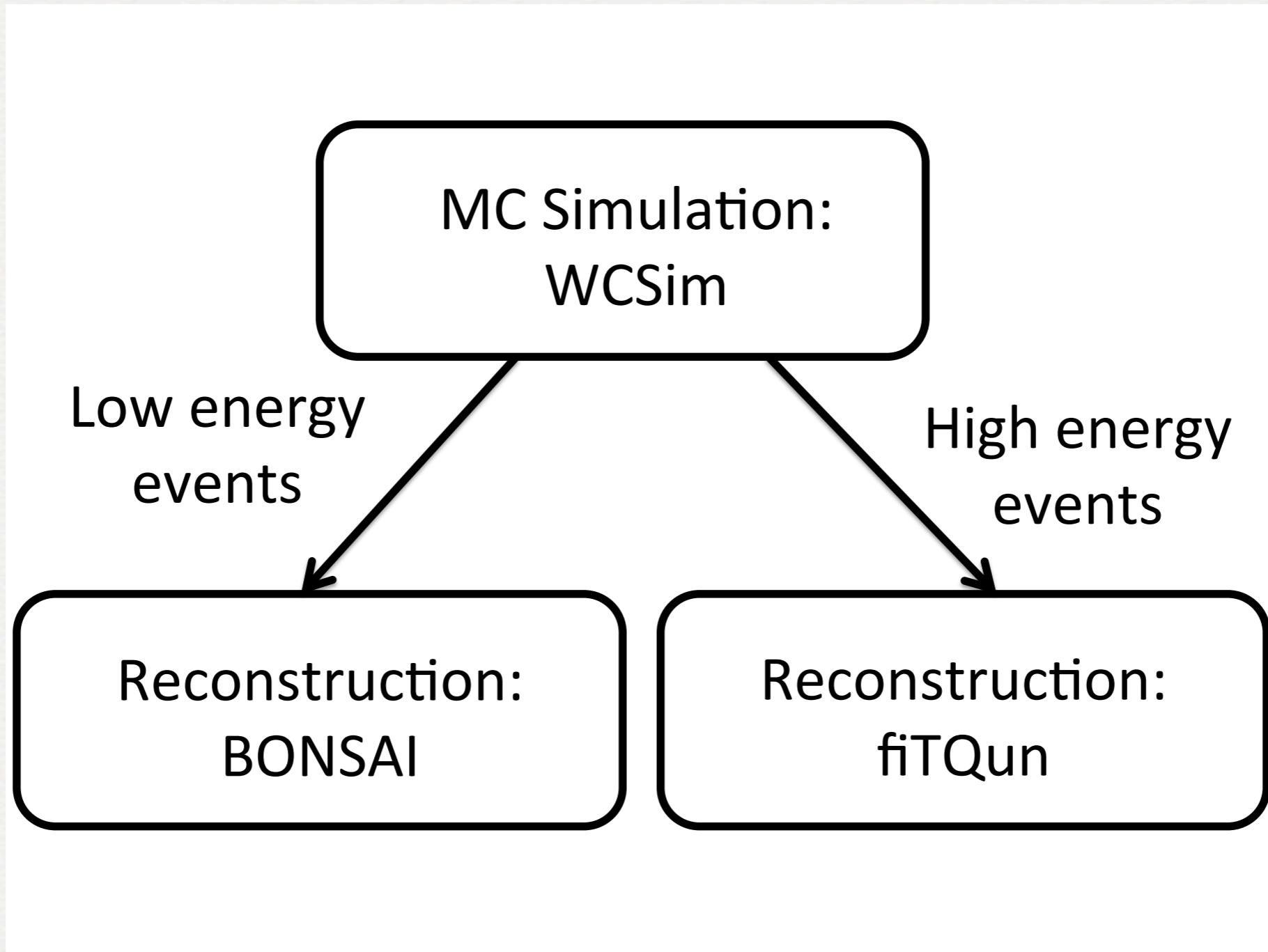
(formerly proposed)
LBNE water option



Hyper-K far detectors

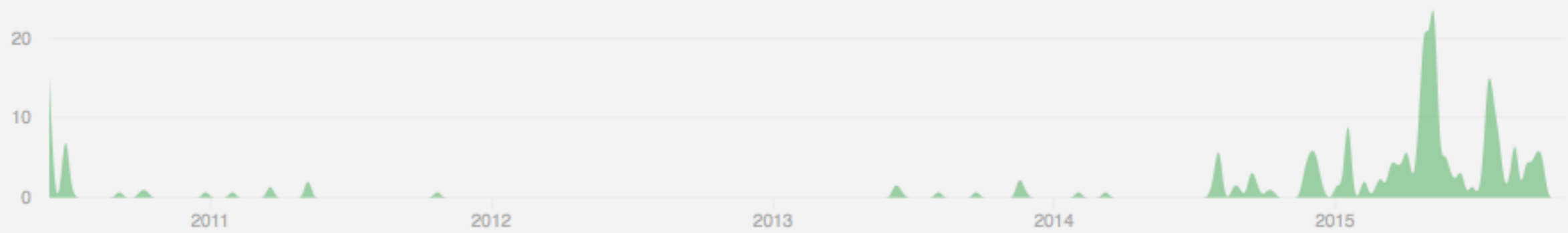
WCSIM IN ACTION

WCSim in the software flow for Hyper-K



CURRENT MANPOWER

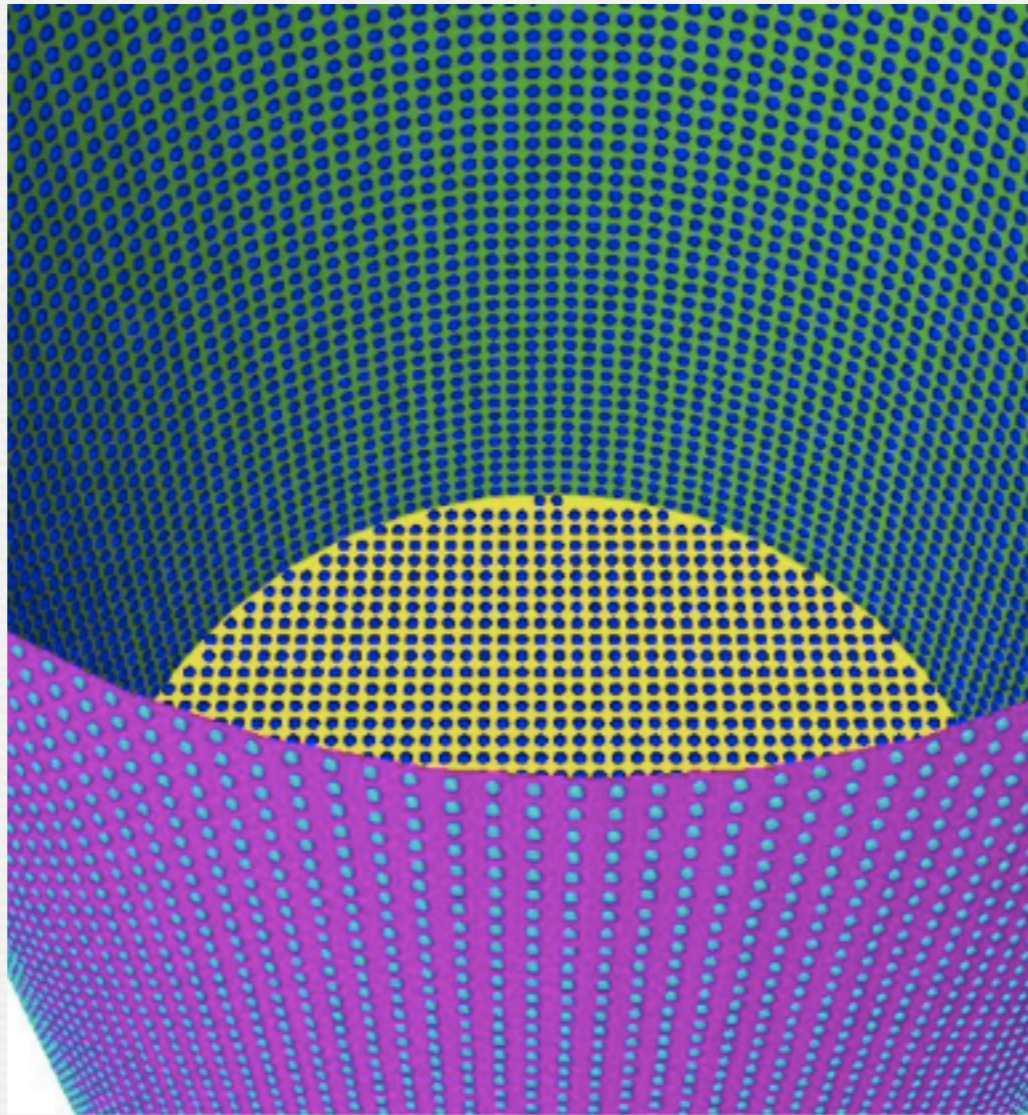
- This is the MC for Hyper-K, so much of the recent work has been from people associated with that collaboration. This year has been the most active to-date for code development.



- Currently have active developers in Canada, UK, US, and Japan (~10 people who contribute to the main development branch, at least a few more on the NuPrism branch)
- We always welcome new developers! If you use WCSim and develop a new feature, we would love to know about it.

FUTURE DEVELOPMENT

Implementing an Outer Detector



Goal is to have the same flexibility as the inner detector (flexible photocoverage, phototube type, OD thickness, etc)

FUTURE DEVELOPMENT

- Make more realistic photodetector model (after-pulsing, for example).
- Implement SKIV electronics, other digitizers (FADC, for example), triggers (SK low and high energy trigger).
- Verifying / studying the Gd model used in Geant4 and possibly improve on it if the finding is that it's too crude.

CONCLUSIONS

- WCSim is a very flexible MC code for (cylindrical) water Cherenkov detectors
- This is the MC code that has been adopted by the Hyper-K collaboration.
- WCSim is still actively under development. New features become available with each release.
- If you want to use WCSim or have an idea for a new feature, we would love to hear from you! Find us on GitHub at <https://github.com/WCSim/WCSim>.