



Simulations

Path to CD2 / CD3

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Goals

Scope of Work



Simulation Goals by CD-2/3b

- **Target date is February 2016 (both are combined)**
 - **CD-2: Final detector design**
 - **CD-3b: Ready for all procurement**
- **Simulation software**
 - **Consolidate array of tools available**
 - **Streamline distribution / installation / usage**
 - **Functional integration into Analysis Framework**
 - **Demonstrate ability to run simulation through entire chain (“data challenge”)**
- **Simulation studies**
 - **Quantify all relevant backgrounds**
 - **Complete light simulations to the point that key geometries can be frozen**
 - **Update sensitivity reach / fluctuations analysis**



Simulation Software

- **LZSim Framework**

- **Split up GEANT, LUX, LZ and NEST**
 - Requires significant resources. Interest at SLAC
 - While we're at it, major clean-up of the code
- **NEST integration into GEANT (?)**
 - NEST team already looking into this
- **Converge on codebase repository(ies) usage**
 - LUXSim: SVN. LZ: github. NEST: ? - How to mix?
- **Integrate with GAUDI / implement LZ data format output when defined**
 - First data challenge: 2017
 - Provide one-easy-step package for running sims anywhere (à la VM)
- **Have LZSim installed and running at several clusters from participating institutions**
- **Organize a coherent data file storage system for sims output**
 - Effort started with storage at NERSC. Access, mirroring, hierarchy, to be worked out.

- **LZSim Capability**

- **Implement full S1+S2 data production. Include complex electric field definitions.**
 - Include latest NEST updates, chiefly from LUX data → See Matthew's talk on 4/23
- **Automatic update of geometry from CAD files**
 - Long shot. Existing effort ongoing → See Carl's talk on 4/23



Backgrounds

- **Update background model** → See Paolo's talk(s) on 4/21
 - **Add new detector parts, complete detailed background table**
 - Joint effort with 1.10
 - Converge on final word for PMTs (activities and event rates)
 - **Implement “normalized background volumes” map to support detector design decisions**
 - Further discussion day 3, session 4A
 - Next 1.5 call dedicated to that (highest priority)
 - **Improve multiple scatter rejection code for energy-deposit-only sims**
 - Cross-check with S1+S2 sims, now available to run
 - **New decay chain generator and spontaneous fission rejection capability**
 - **Tackle less-obvious backgrounds**
 - Gamma-X and other exotic categories
 - Cross-check external rock backgrounds effect on LS and Xe
 - Double beta decay background at high energy

- **Veto efficiencies**
 - **Outer Detector** → See Scott H's talk on 4/22
 - Geometry review / update (acrylic in particular)
 - More detailed neutron studies from real fiducial background
 - Include fission neutron coincidence cuts
 - **Xenon skin** → See Jeremy's talk on 4/22
 - Work on geometry detail, optimal reflector arrangement
 - Light generation vs energy in skin region + light collection
 - Distribution of energy depositions from main background sims



Light Simulations

- **Need to integrate the latest best fit for optical parameters from LUX, into LZ**
 - Numbers now available (Vic)
 - Re-run critical simulations with these
- **Need final PMT arrays layouts**
 - That is informed by light collection vs layouts (Vladimir, Tom)
 - Particular attention to wall events position reconstruction
- **Need final xenon skin PMT + reflector geometry**
 - Create detailed geometry (Jeremy)
 - Find optimal PMT and reflector placement for light collection and threshold
 - Close the loop with 1.5 engineering

Software

- Codes and files must be unified and more open for everyone
- Temporary solution NERSC [/project/projectdirs/lz](#)

=> The sooner Gaudi comes the better it is... but some physics requirements cannot wait

Background Results documentation

- Unified template format slides (*Background Essentials LZ*)

<https://drive.google.com/drive/folders/0By5fsgVyD-m2YVI0c2QwQUFYQ1U/0B78hucv6TzbjzJzS2dHX0k5Szg>

(as example) <https://docs.google.com/presentation/d/1OEKR5dtQtUZPsOA1Uh8SGLmFJj59JJJoGWD9wHsP0rmM/edit#slide=id.p>

- Background table (and/or Information repository) as “look at me”

<https://docs.google.com/spreadsheets/d/1YQAUy9dbBwefGNuRnWeX4z3rxWjbmF30nNUPXD6Q25I/edit#gid=1281889176>

Background specific task list

<https://docs.google.com/spreadsheet/cc?key=0Ar8hucv6TzbjdHJCeDhKYmRNS3JCVGo1NnBNSkdQZ0E#gid=6>

Will be implemented also with the specific “normalized background volumes” map