Adding support structures to the spherical CALO in HerdSoftware

(part 2)

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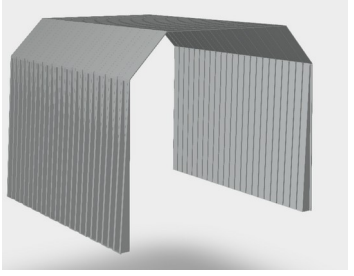
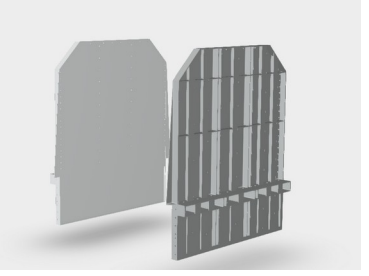
HERD CALO meeting - 9th June 2023

Status

From presentation at CALO meeting on 28th April 2023

- Full CALO implemented, no overlaps
- Still to be tested with a full simulation run
- Missing features:
  - Different trays (needed?)
  - Cover structures
  - Photodiodes
  - Distribution of GDML files
    - Big files (~ 20 MB), better avoid committing them to git repository

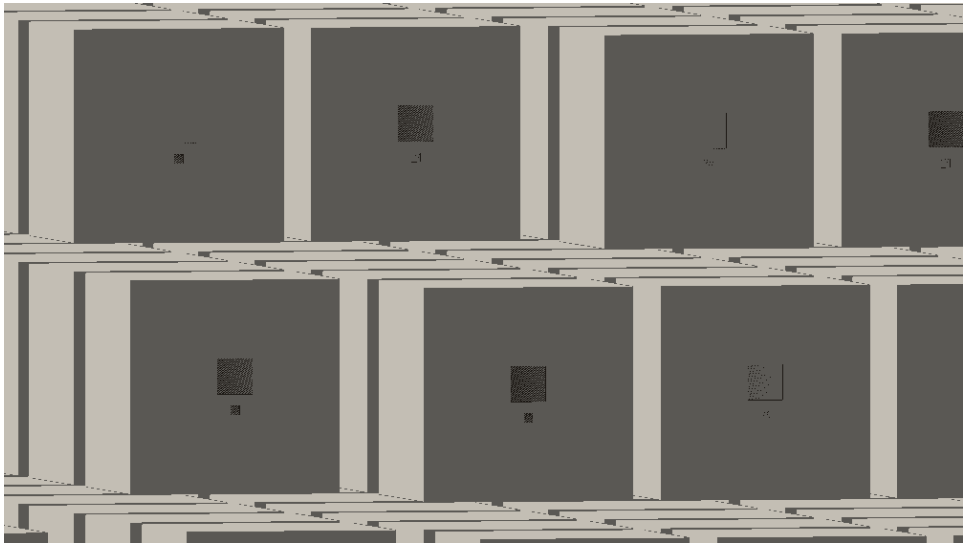




- Will be available as spherical_v3 in HerdSoftware 0.4.0

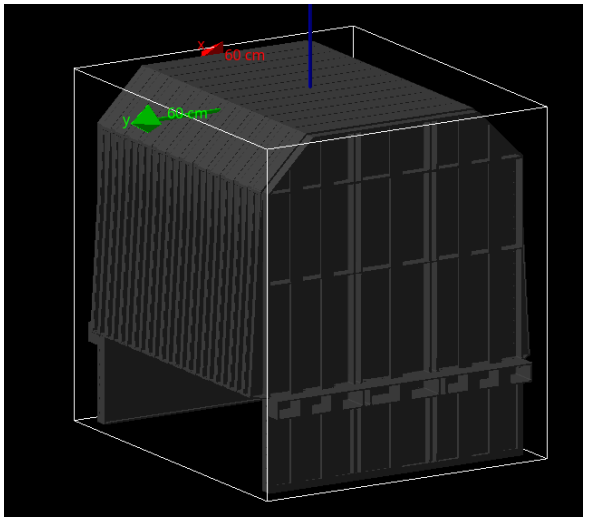
New features

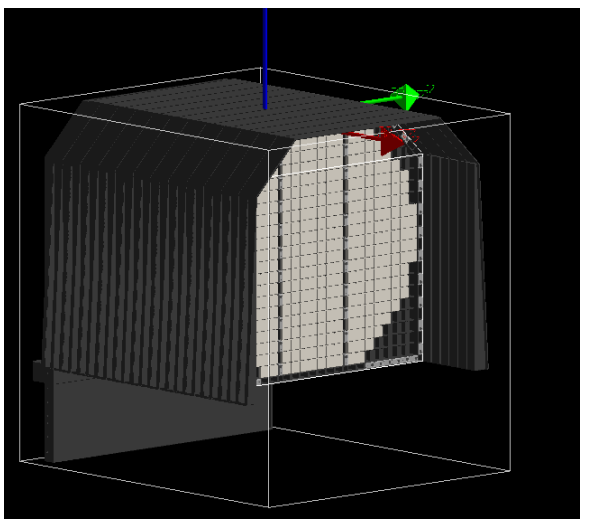
- PDs added
  - Large and small
  - Only active/depleted volume
  - Placed lightly inside the LYSO cubes
    - Easier cube placement, avoid overlaps



New features

- Full cover added
  - GDML files
- Top cover and end plates
- Several issues:
  - Inconsistent CAD design (e.g. open surfaces)
  - Overlaps
  - Partially due to STEP → GDML conversion?
  - Solved manually:
    - Re-draw of some pieces
    - Addition of empty safety margins between elements





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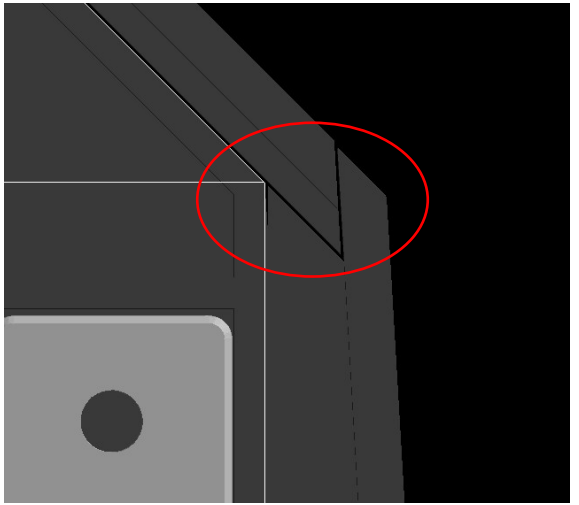
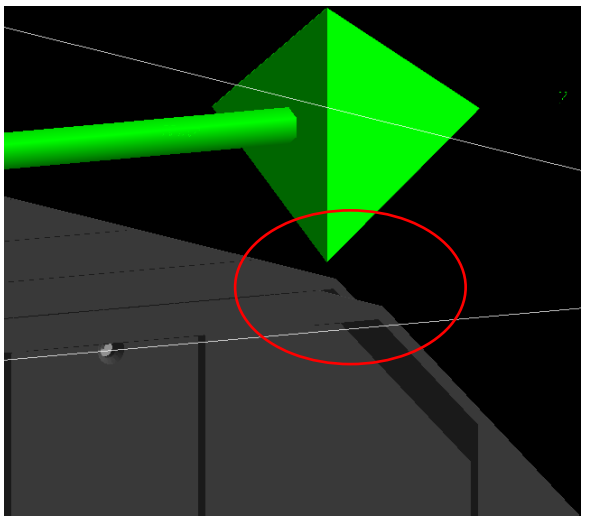
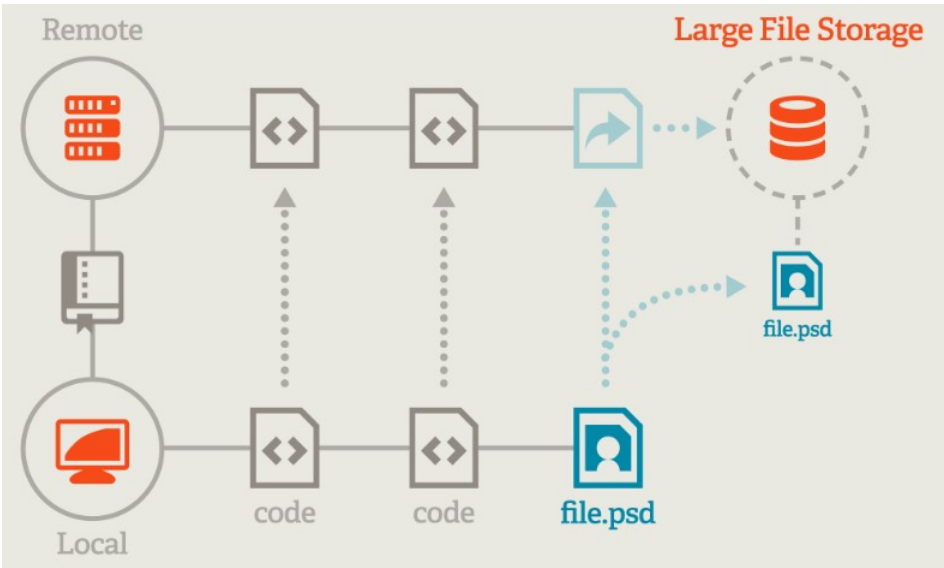




New features

- Distribution of GDML files via Git LFS
  - https://git-lfs.com/
  - Management and versioning of large (binary) files with Git
  - Optimized for repo size and network traffic
- Compression of GDML files with zstd
  - Further lowers disk and network usage
  - Automatic decompression done by Cmake
  - Not a Git LFS feature, but implemented in HerdSoftware
- Gitlab HERD instance configured for working with LFS
  - S3 backend



Tests

- No overlaps detected by the automatic G4 geometry check
  - Limited accuracy, should be repeated with greater accuracy (→ a lot of computing time, ~ days)
  - Small overlaps in passive elements should not be a big issue
- Simulation run with 10k geantinos (→ pure tracking):
  - spherical: 2 s
  - spherical_v3: 20 s
  - 10x slower than CALO without support structures

Status

- Code and tooling (→ Git LFS, zstd compression) are ready
- Need to revise some details
  - Materials, density etc.
  - Verify the readout of MC data
- Increased run time is not sustainable for real-world usage
  - Use this realistic implementation to validate approximate ones
  - Simplify the geometry to gain in computation speed
    - Not in this software release cycle
  - Warning for future applications of this approach based on GDML files extracted from CAD