



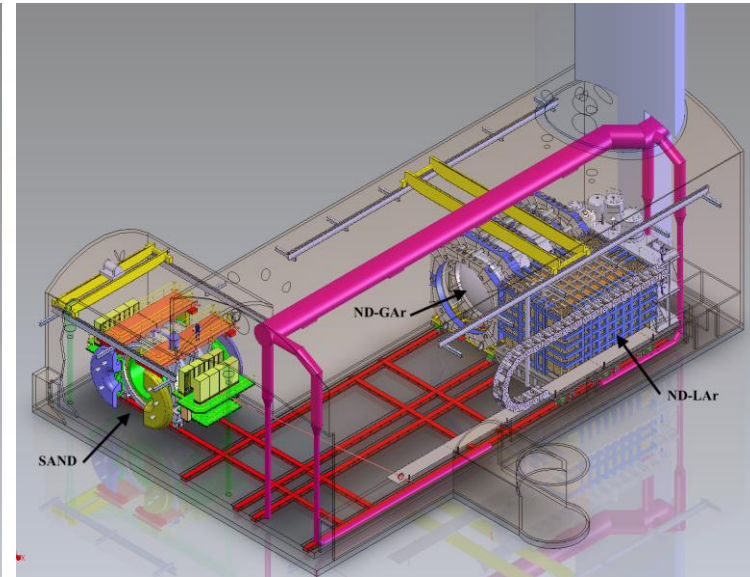
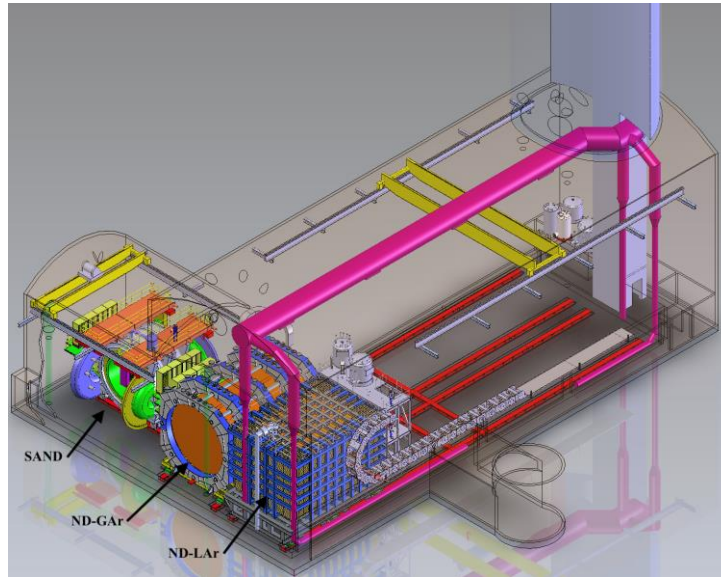
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Injection-molded scintillator for high granularity detectors: DUNE 3DST

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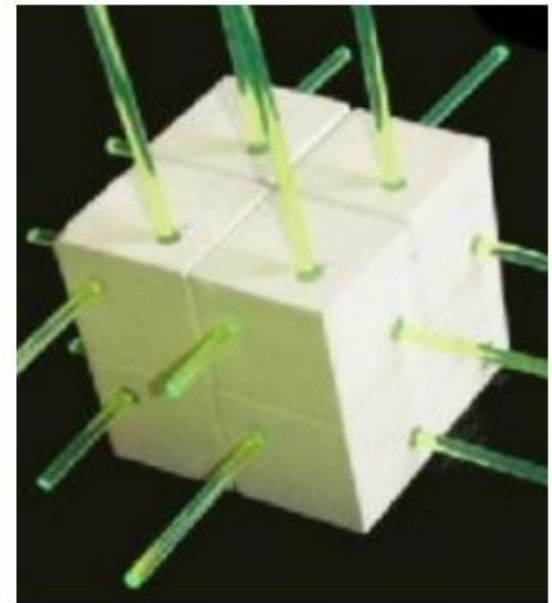
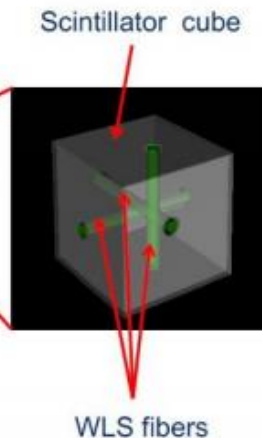
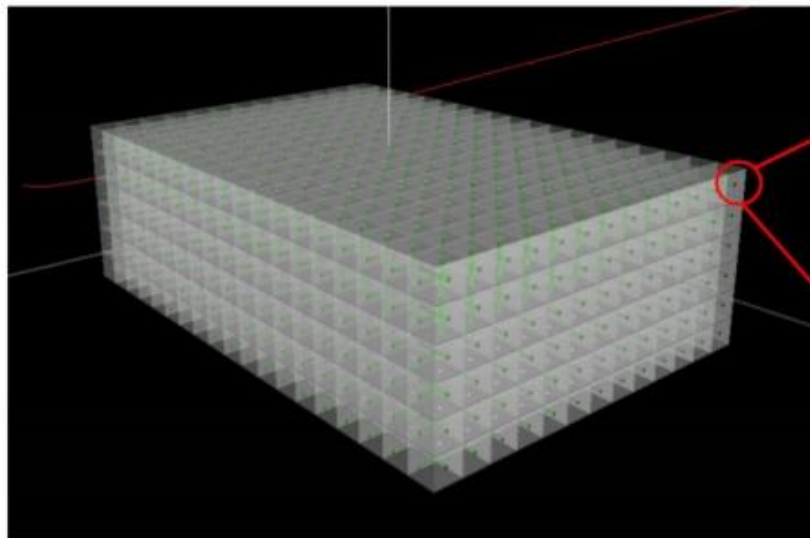
DUNE ND hall



- DUNE ND will consist of a liquid argon detector, a gas argon TPC system which will be surrounded by ECAL and inside a magnetic volume and a 3D projection scintillator tracker.
- Part of the DUNE ND system will be movable.
- DUNE aims at measuring CP violation at five sigma with this ND system.

DUNE ND : 3D projection scintillator tracker (3DST)

- Plastic scintillator detector with 1 cm x 1 cm x 1cm cubes → Fully active
- Light collected by 3 wavelength shifting fibers
- Each cube coated with TiO₂ to keep light entrapped inside the cube
- Read out by MPPC at 3 faces
- Combining with TPC and ECAL, it is named 3DST-S (3DST spectrometer).



Injection Molding for High Granularity Detectors

Injection-molded scintillator is cost-effective way to make new generation fine grained detectors. (CMS HGC Scintillator section uses ~300K tiles; DUNE 3DST 10M tiles)

Concept is to build DUNE 3DST with injection molded tiles (voxels) where all voxel processing is done during injection molding: holes, opaque white coating. Goal is to develop a small scale prototype using in-house molded voxels



Injection molding machine at Lab 5 will be used to make the voxels.

Voxel Design (mold design)

We are performing R&D to create a fully formed “voxel” for the 3DST. It will have 3 orthogonal holes and optical coating.

Advantages over machined tiles:

- Cost!! 10M * δ is a lot!
- Precision: Each voxel will be identical.
- Ease “threading” of WLS fibers...
- Uniformity: Coatings will be built-in, reduced variation
- Quality: No machined surfaces or holes so improved optical quality
- Production time: Can produce many per minute

These developments can be utilized by other new high granularity detectors.

