Fermilab U.S. DEPARTMENT OF ENERGY Office of Science

Light Detection in Liquid Argon Time Projection Chambers Doped with Liquid Xenon

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GEM Preliminary Presentation

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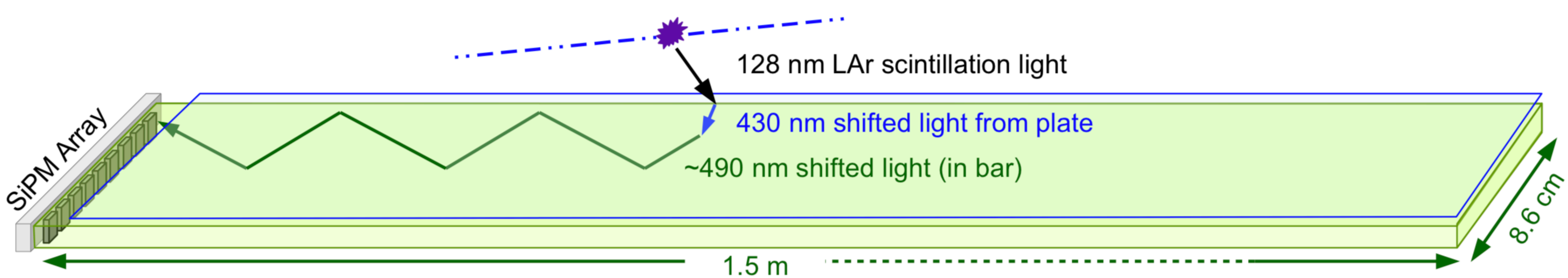
Objective

By doping the liquid argon with liquid xenon, we suspect that there will be a noticeable increase the amount of light detected by our light detection system. Through simulation we can get an idea of the, both positive and potentially negative, consequences resulting from the liquid xenon doping.

Light Detection System

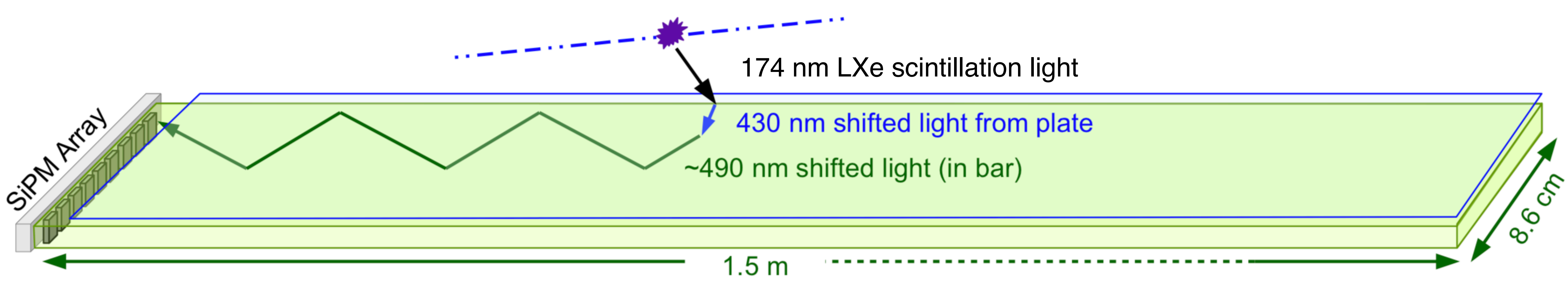
- Our light detection system is comprised of ARAPUCA's.
  - pTP film for upshifting the wavelengths of light
  - Dichroic filter that is translucent or reflective according to the wavelength
  - TPB doped acrylic fill for upshifting and trapping the light
- At the ends of the waveguides there is an array of silicon photomultipliers (SiPMs).



Light Detection System Continued

- The absorption spectra of liquid xenon corresponds to the absorption spectra of liquid argon.
- We suspect the affect this wavelength shift has on the Rayleigh scattering will translate to less light being scattered and, as a result, increase the light detection yield.

$$I_{scat} \propto 1/\lambda^4$$



Simulation

- These changes will be understood using LArSoft and ROOT to characterize the behavior of simulated light from simulated particles as they pass through virtual versions of the DUNE Far Detector (FD) with and without the addition of liquid xenon.
- In order to do this the steps are outlined in the steps below: