PD
CONSORTIUM

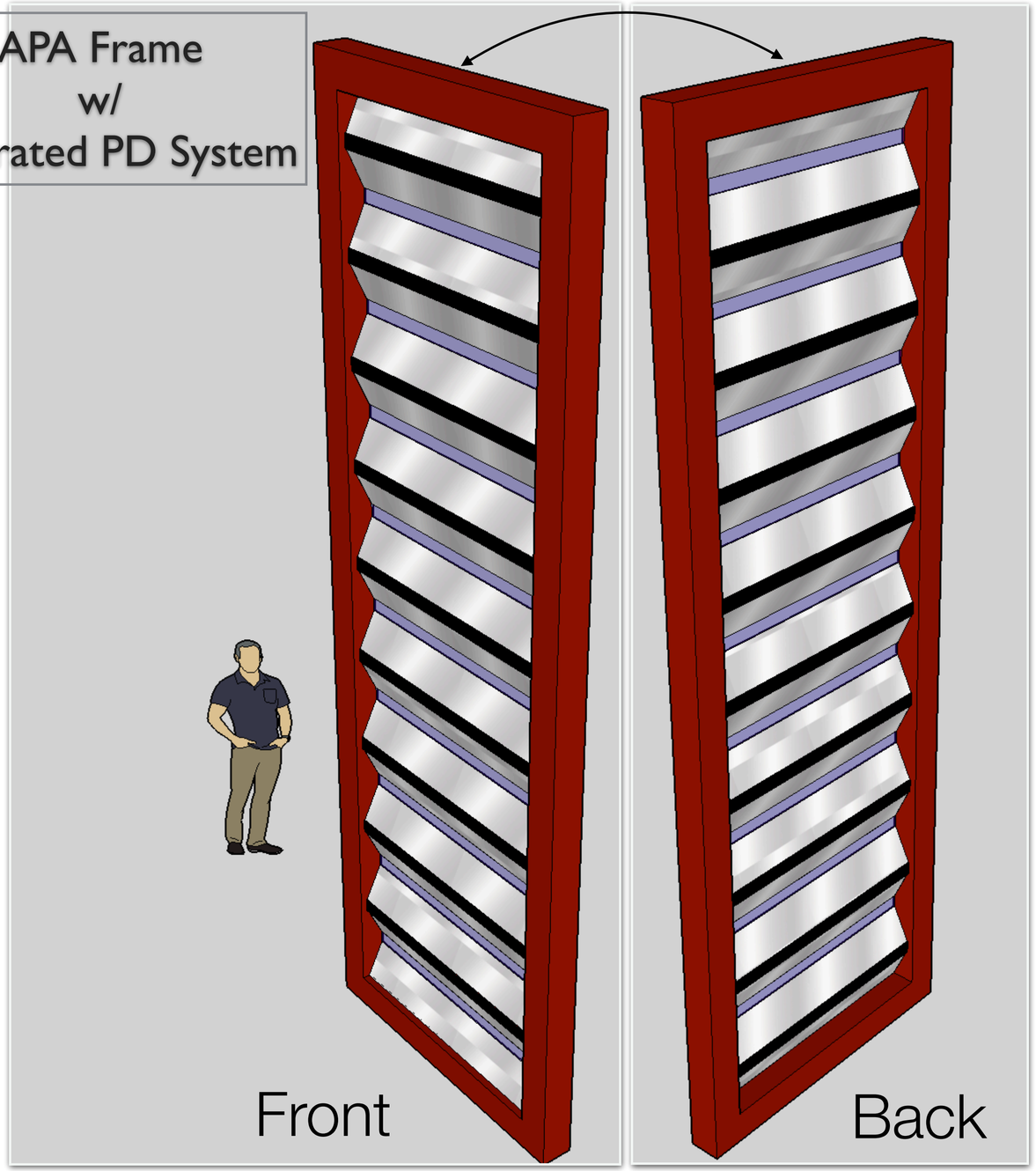
LIGHT CONCENTRATOR

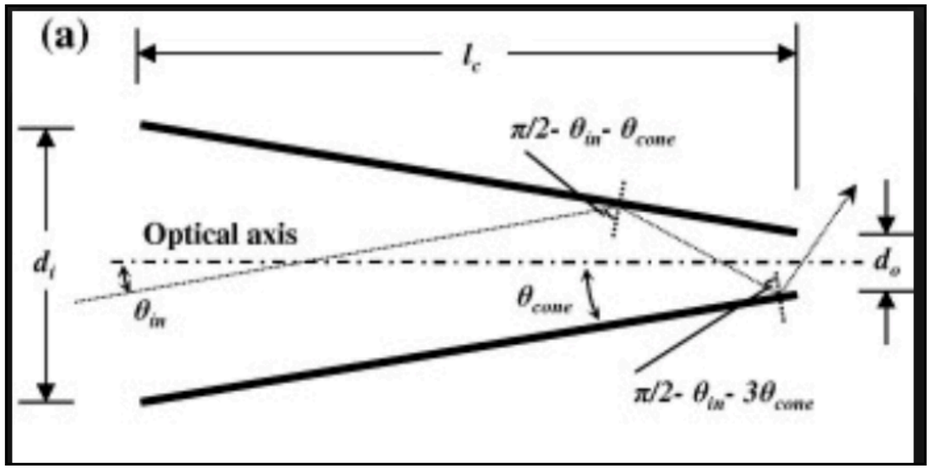
LAR PD-ACTIVE VETO

3D modeling
by Indro C.

Disclaimer: all reported here is based on preliminary personal considerations, or informal discussions among some of us - *"photo-Collector Grp"* at FNAL - no in-depth thinking have ever been put on these so far, no mechanical calculations, no MC simulations yet…

APA Frame
w/
Integrated PD System

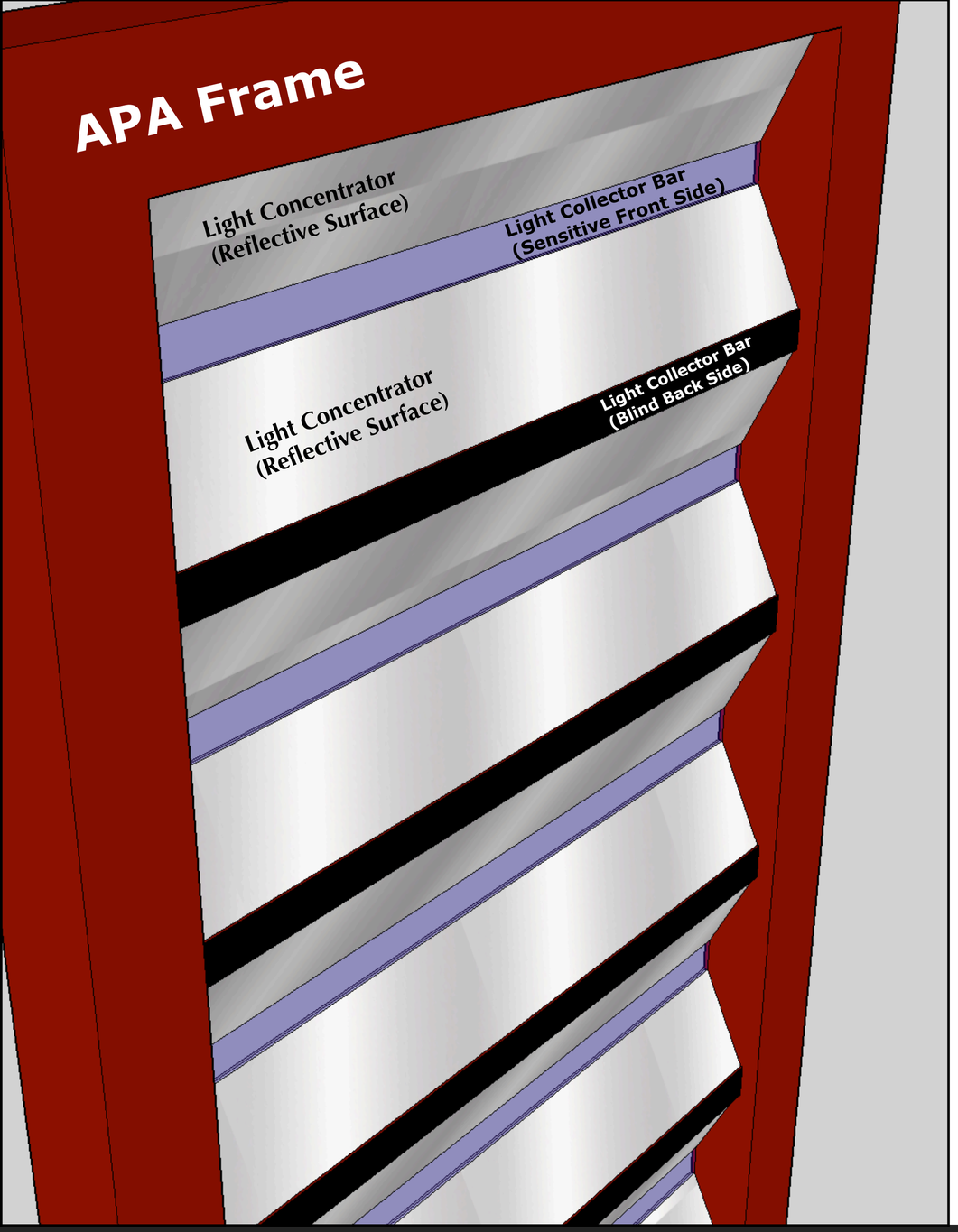




Winston cones are reflective surfaces used to concentrate light from a large area onto a smaller photo-sensitive area.

A Light Concentrator Concept can be explored for implementation in APA-PD System

(concept from discussions w/ A. Para - Aug.'17)



"Venetian Blinds"

A TWO-sided PD System
with
Light Concentrator
(tentative-conceptual design)

based on the assumption that APA frame can be modified, allowing for:

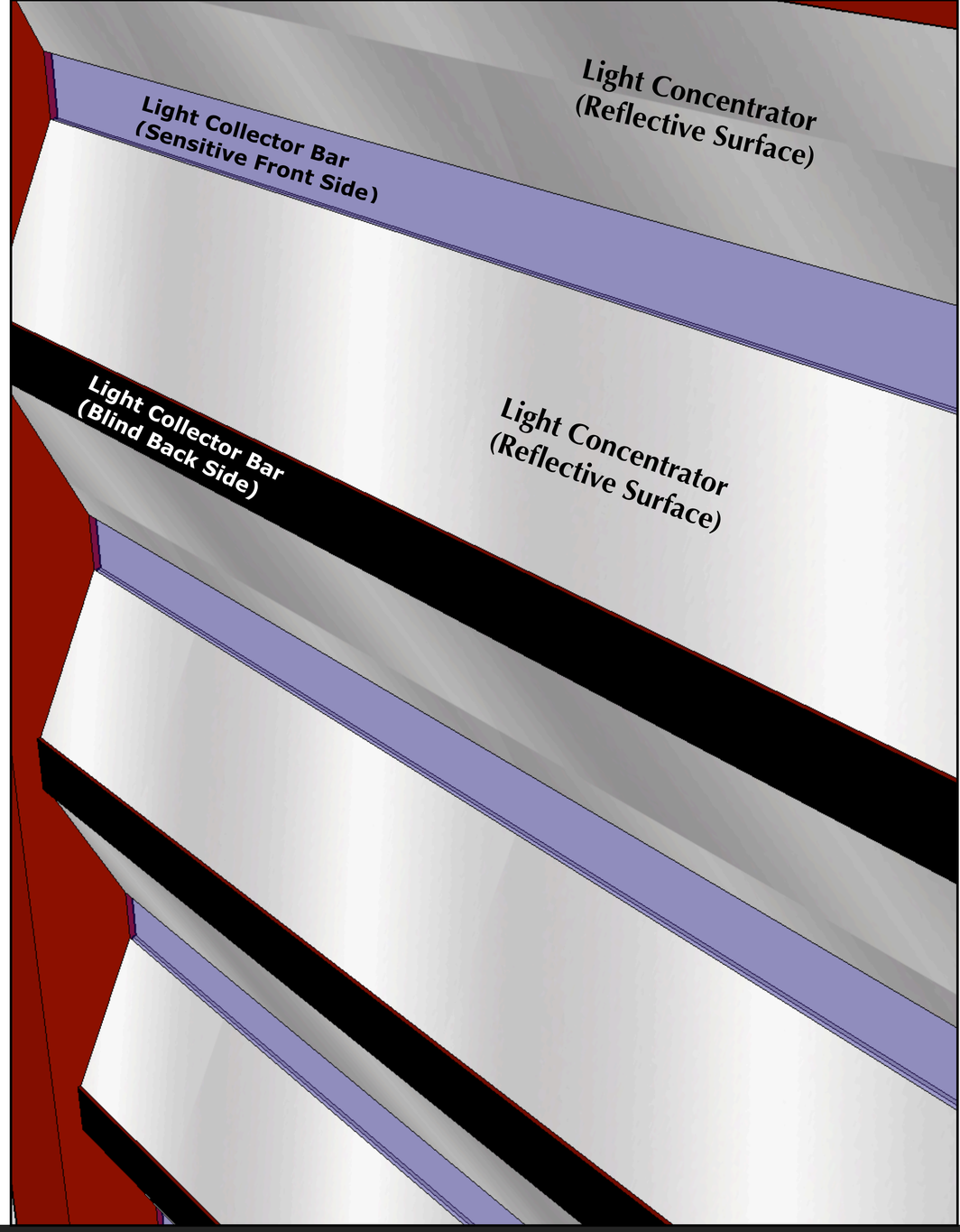
- An increased (up to x 2) n. of slots for photo-collector bars (of any type/flavor)
- The installation of Vis-light-reflective surfaces inside the APA frame - before wire winding
  - ✳ *(we assume the Cathode surface covered with wls-coated Reflector foils - Light Enhancement/Booster System)*

“Venetian Blinds”

A TWO-sided PD System with Light Concentrator

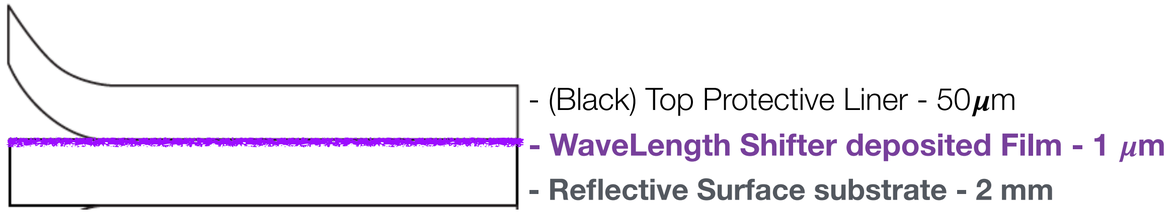
- The Venetian Blinds - Light Concentrator System optically separate the LAr Volume facing the APA at the opposite sides (diaphragm)

- Light Collector Bars are 1-side sensitive, with half of the bars looking at one LAr Volume and the other half to the opposite Volume

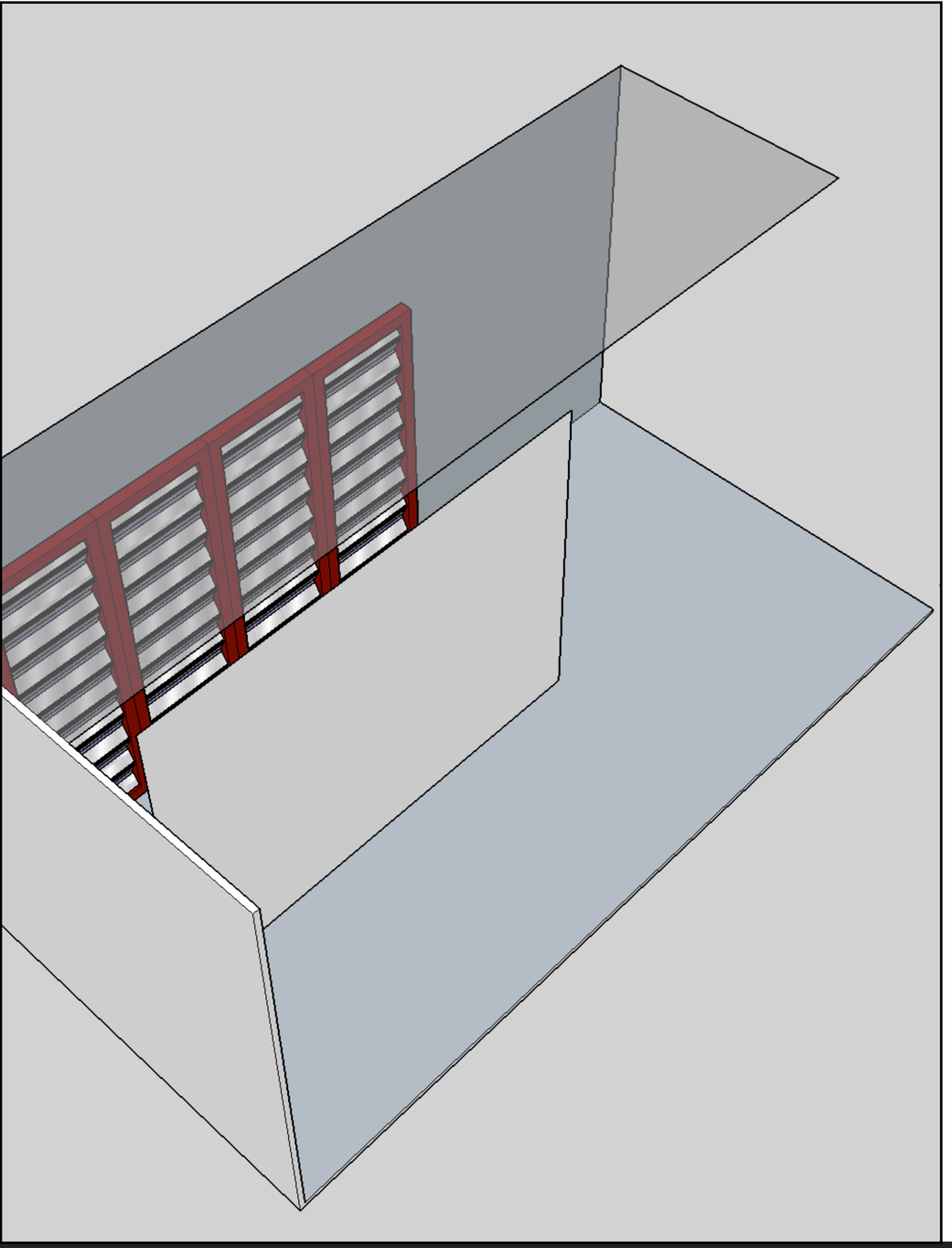


“Venetian Blinds”

few more potential features…

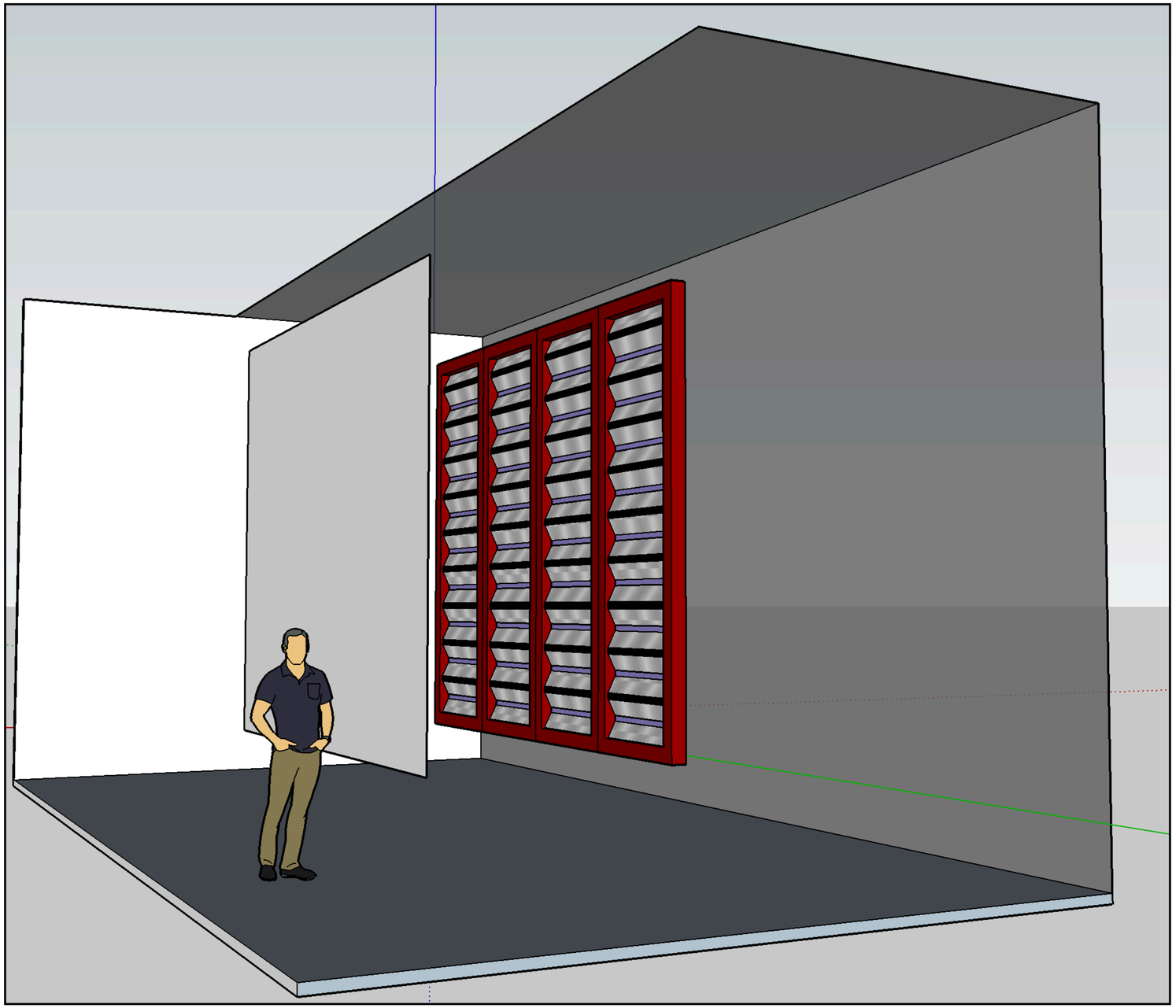


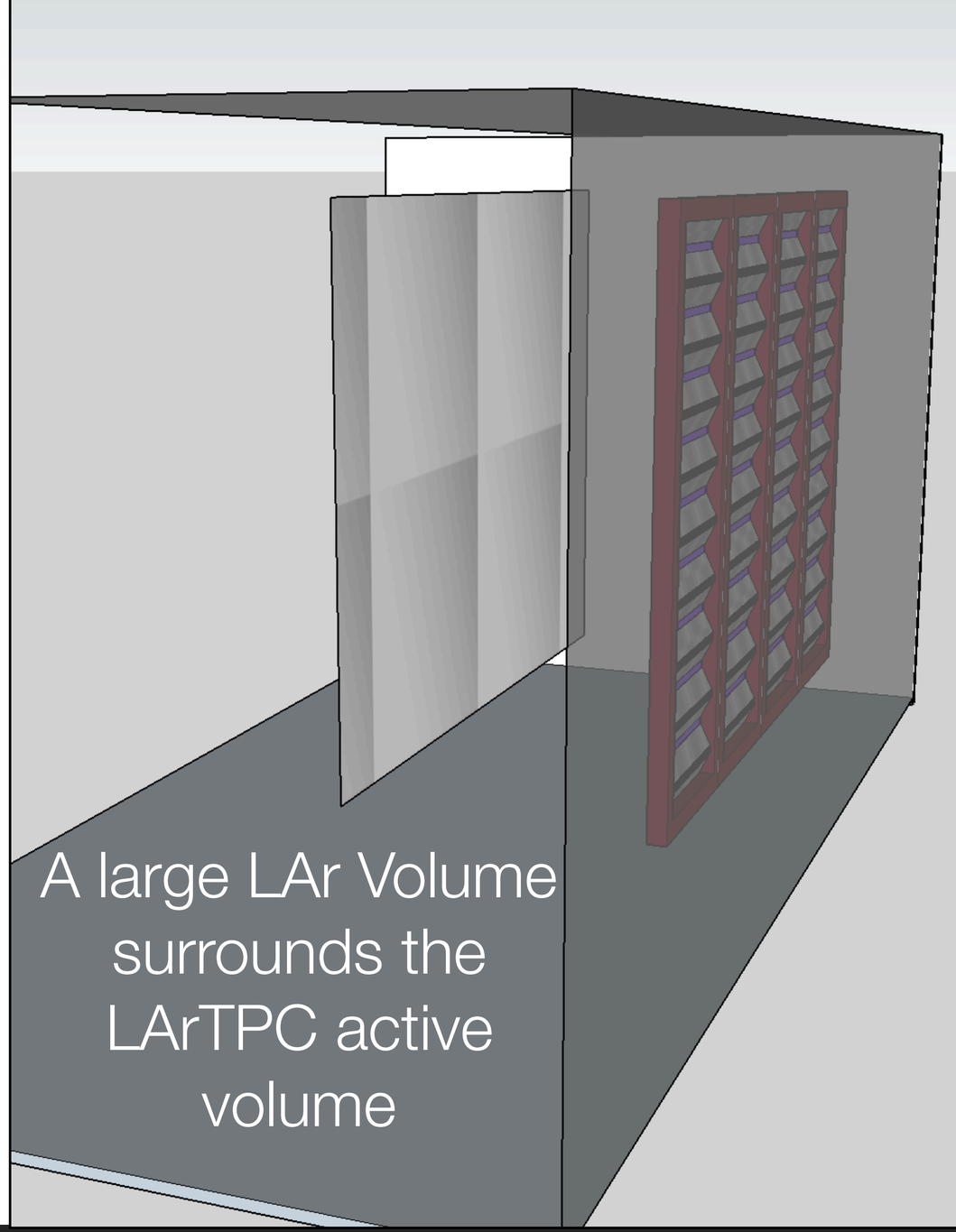
- Winston Cone angle is large (due to APA geometry constraints) - concentration efficiency is expected to be suboptimal
- To increase efficiency, the Reflective Surfaces could be wls-coated.
- A protective liner must lay over the wls-film surface during APA wire-winding - to prevent wls degradation from ambient light (mostly UV component) and be removed before APA installation (if / how to make this needs engineering head-scratching !!)
- If a method to protect surfaces is found, one can consider the option of installing the entire PD-system (active Bars and passive Reflective-wls-coated surfaces) in the APA frame before wire-winding
- Reflective surfaces can be made of either insulating material (G10 substrate with VIKUITI reflector layer) or conductive material - this may possibly replace the two metallic meshes for electrostatic separation of the wire planes on the opposite sides of the APA frame



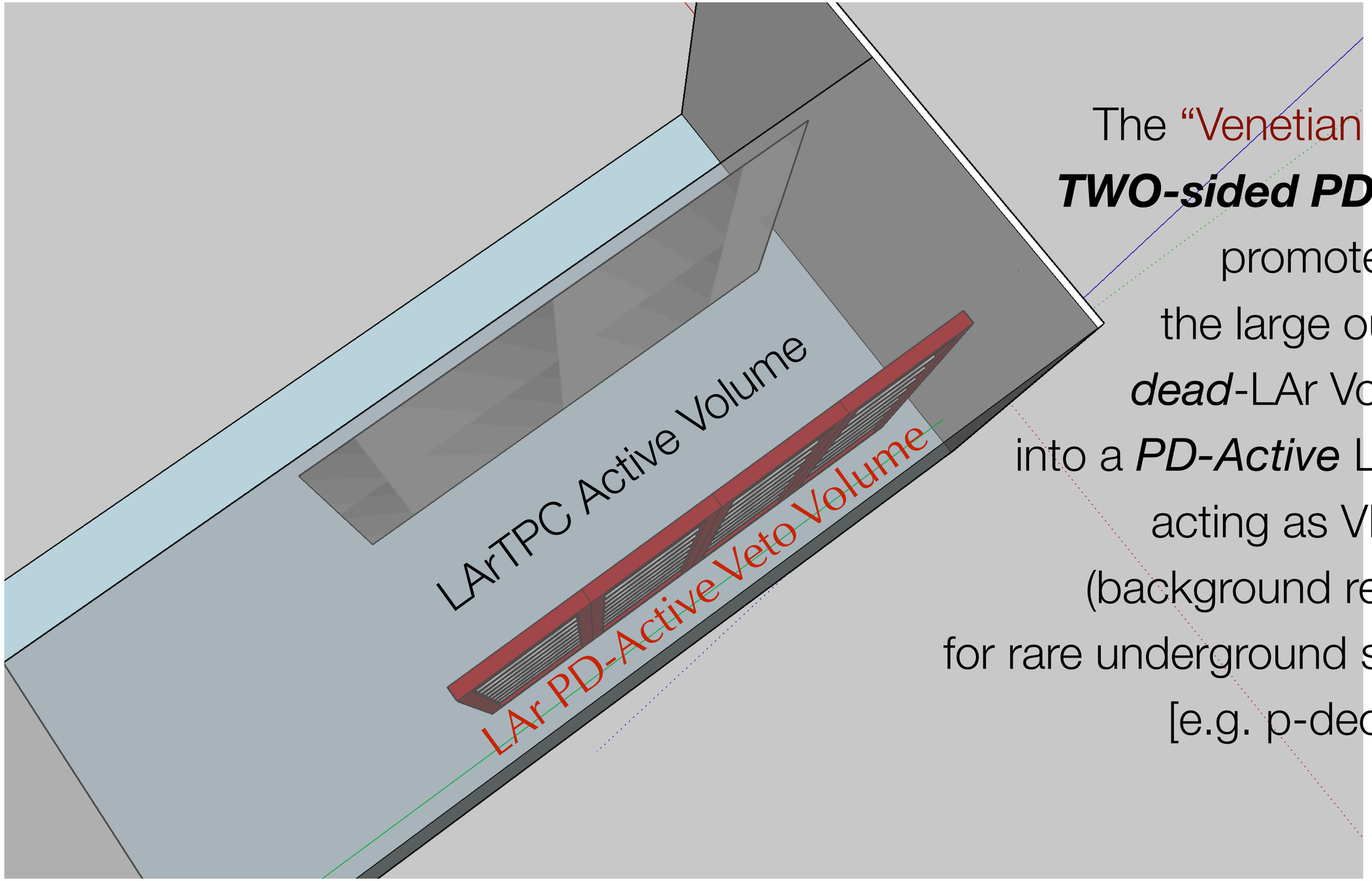
The “Venetian Blinds” PD-system for the DUNE **External APAs**

External APAs face the Cathode at one side, and the Cryostat’s long wall at the opposite side





A large LAr Volume surrounds the LArTPC active volume



The “Venetian Blinds”

TWO-sided PD System

promote

the large outer

dead-LAr Volume

into a ***PD-Active*** LAr Volume,

acting as VETO

(background rejection)

for rare underground signal searches

[e.g. p-decay]