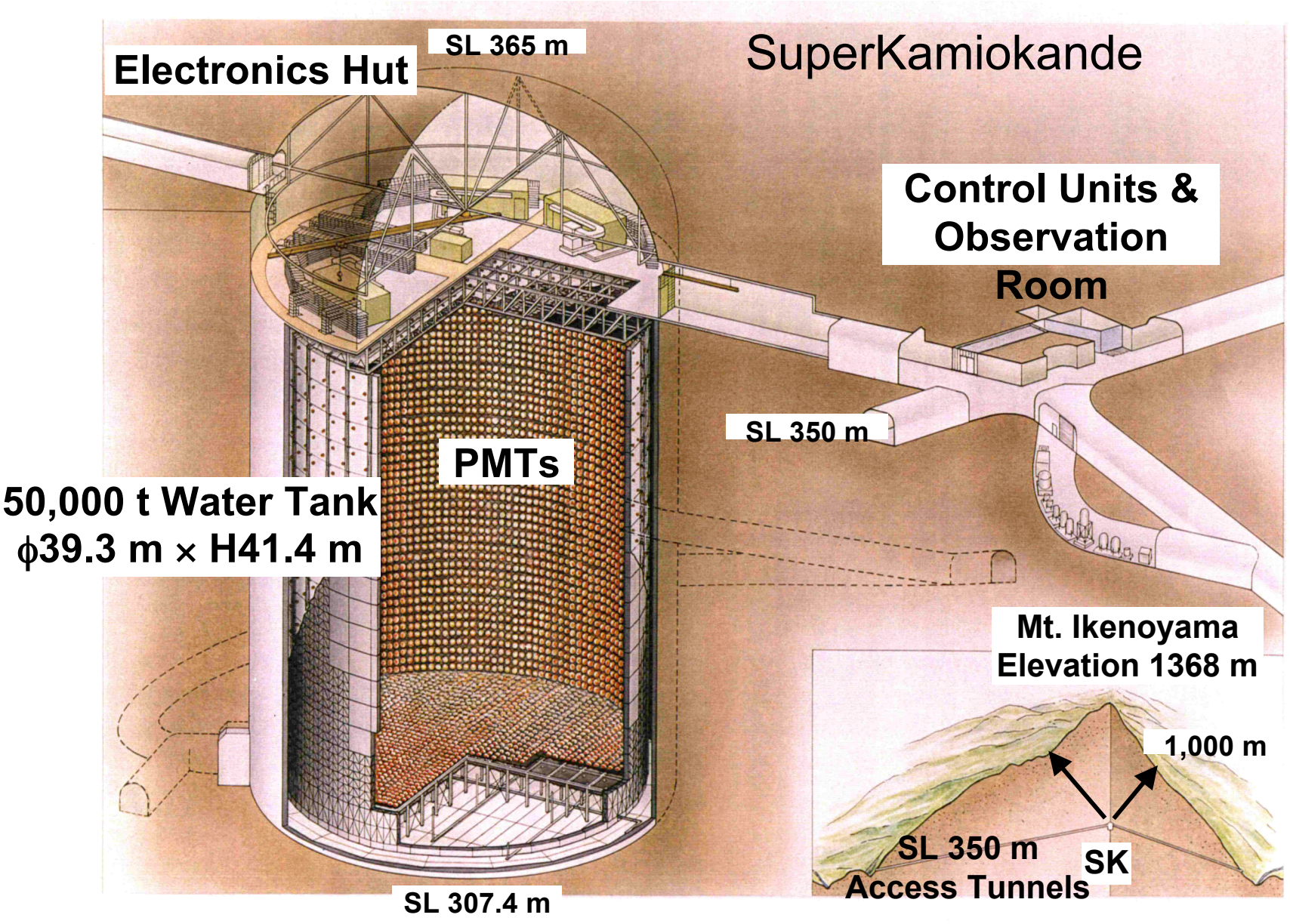
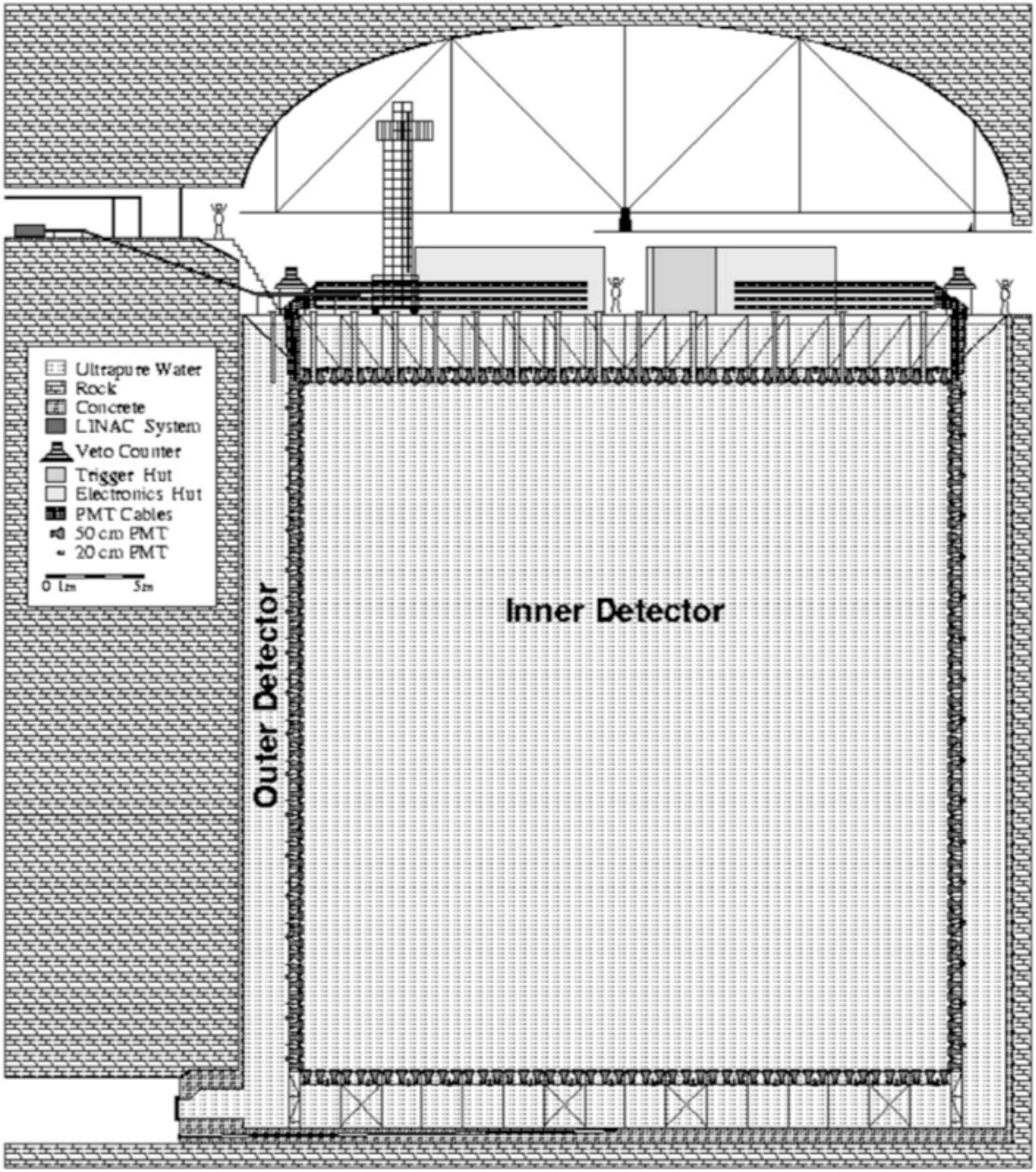
Tecnología 1: agua-cherenkov

En funcionamiento:



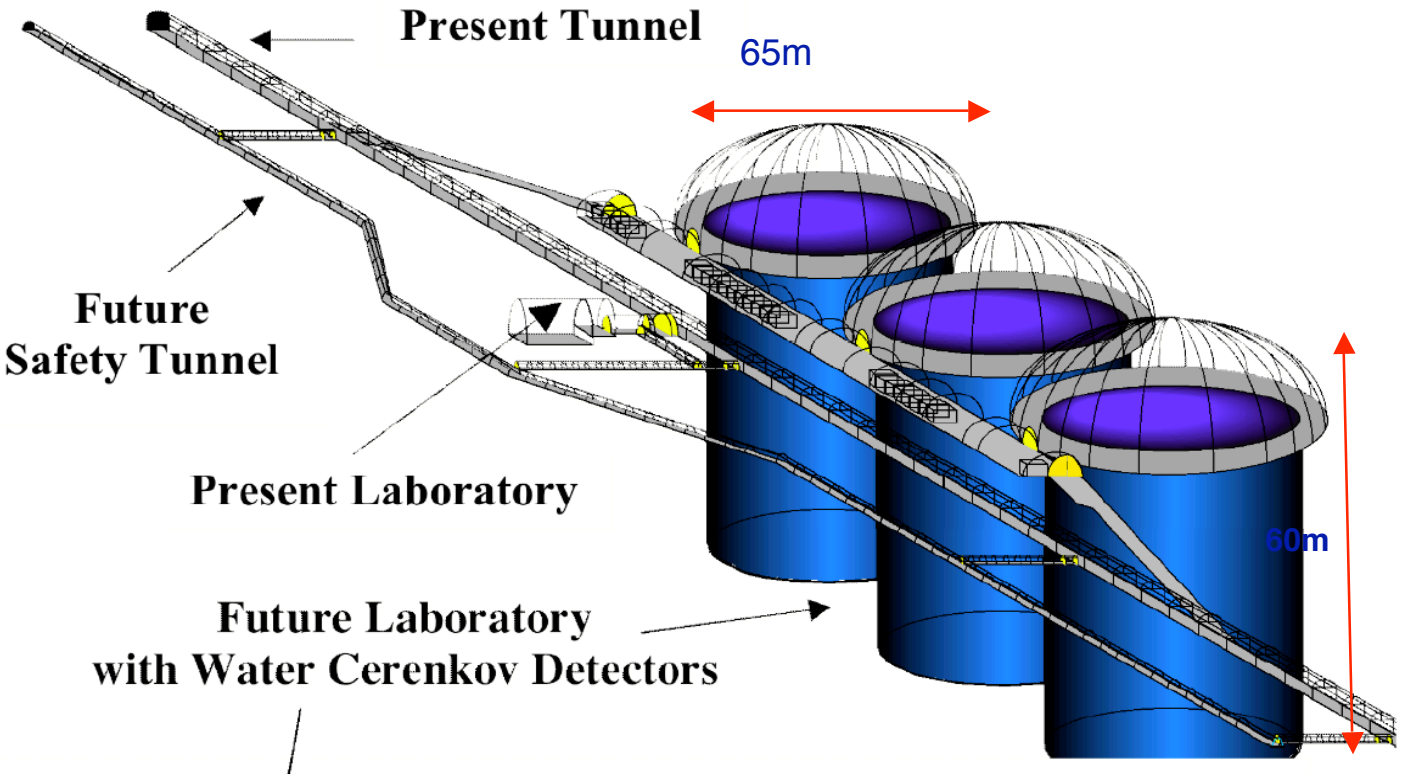
Tecnología 1:
agua-cherenkov

En funcionamiento:
SuperKamiokande



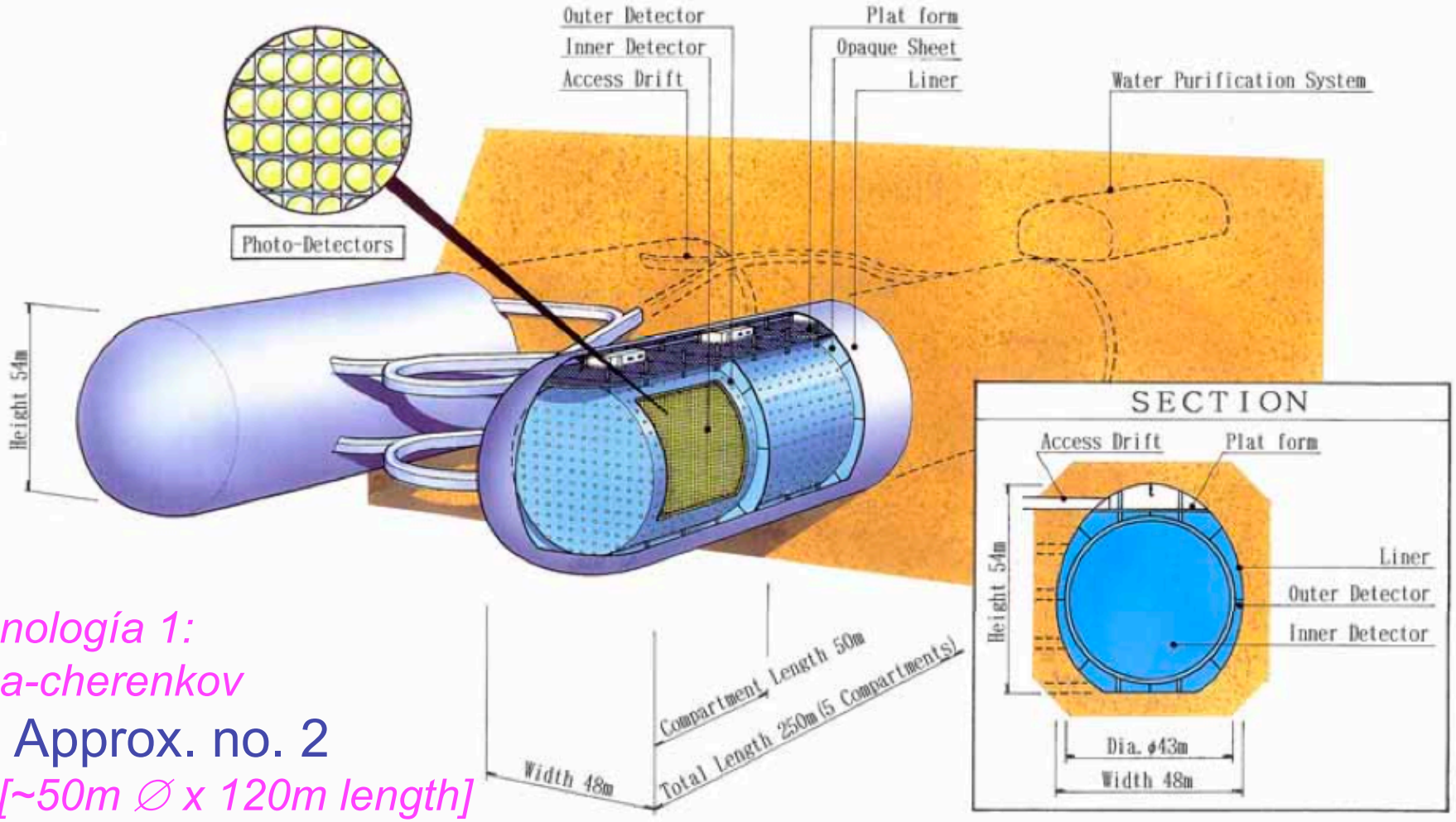
Tecnología 1: agua-cherenkov

Approx. no. 1



Baseline configuration of Hyper-Kamiokande

~1 Mton water Cherenkov detector at Kamioka



Tecnología 1:
agua-cherenkov

Approx. no. 2

2 x [~50m ∅ x 120m length]

Why this design has been chosen ?

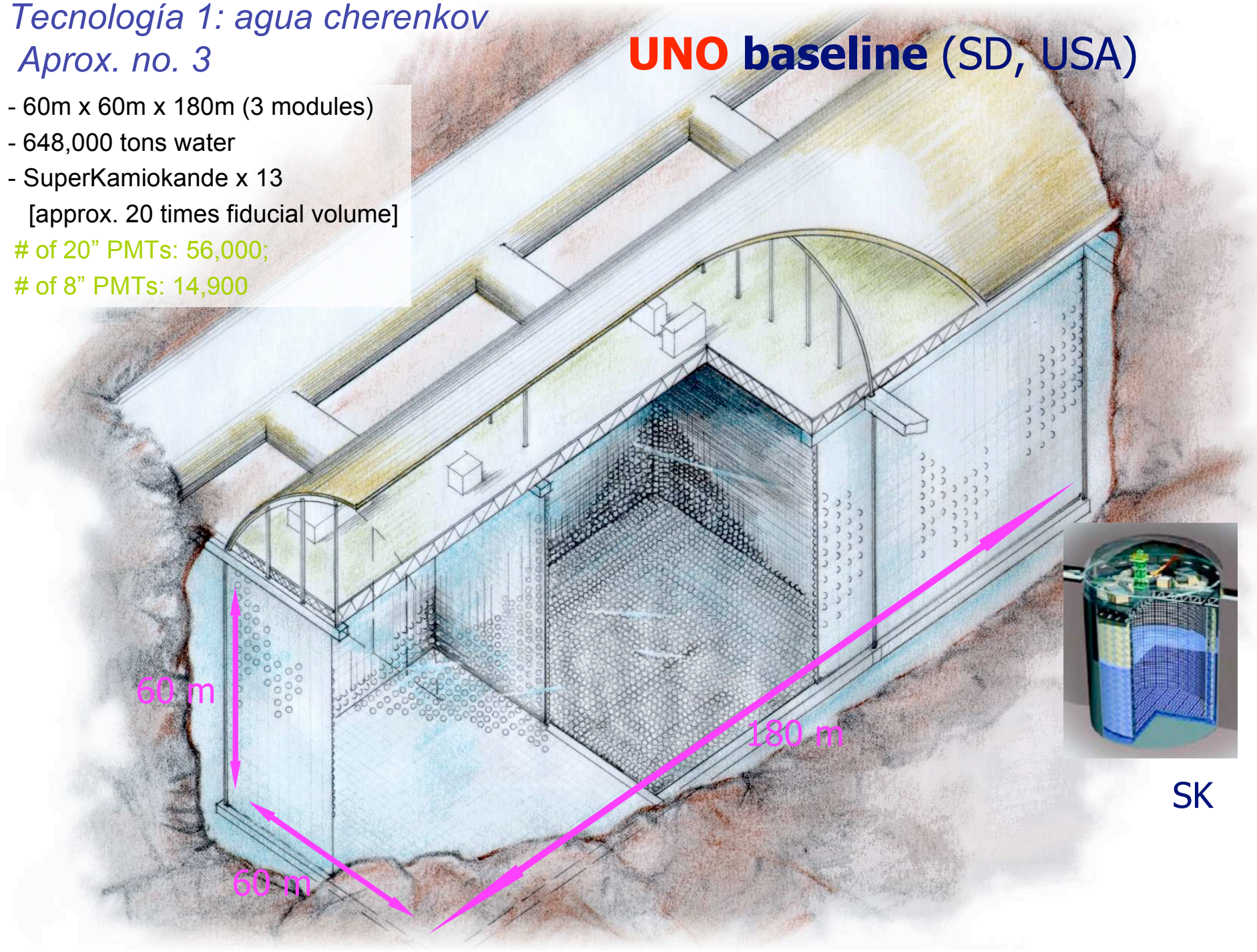
- Water depth < 50 m
  (If the present 20-inch PMT or similar one will be used.)
- Linear dimensions for light path < 100 m
- Optimization of M_{FID}/M_{TOTAL}
- Rock stability
  - Avoid sharp edges. Spherical shape is the best.
- Our solution: Tunnel-shaped cavity (optically segmented)
- Single Cavity or Twin Cavities?
  - Single Cavity
    - M_{FID}/M_{TOTAL} is better
    - Cost is lower
    - Larger area of stable rock mass needed.
  - Twin Cavities
    - Two detectors are independent. One detector is alive when the other is calibrated or maintained.
    - Both cavities should be excavated at the same time. But staging scenario is possible for the later phase of the detector construction.
- Our solution: Twin cavities

Tecnología 1: agua cherenkov
Aprox. no. 3

UNO baseline (SD, USA)

- 60m x 60m x 180m (3 modules)
- 648,000 tons water
- SuperKamiokande x 13
  [approx. 20 times fiducial volume]

# of 20” PMTs: 56,000;
# of 8” PMTs: 14,900



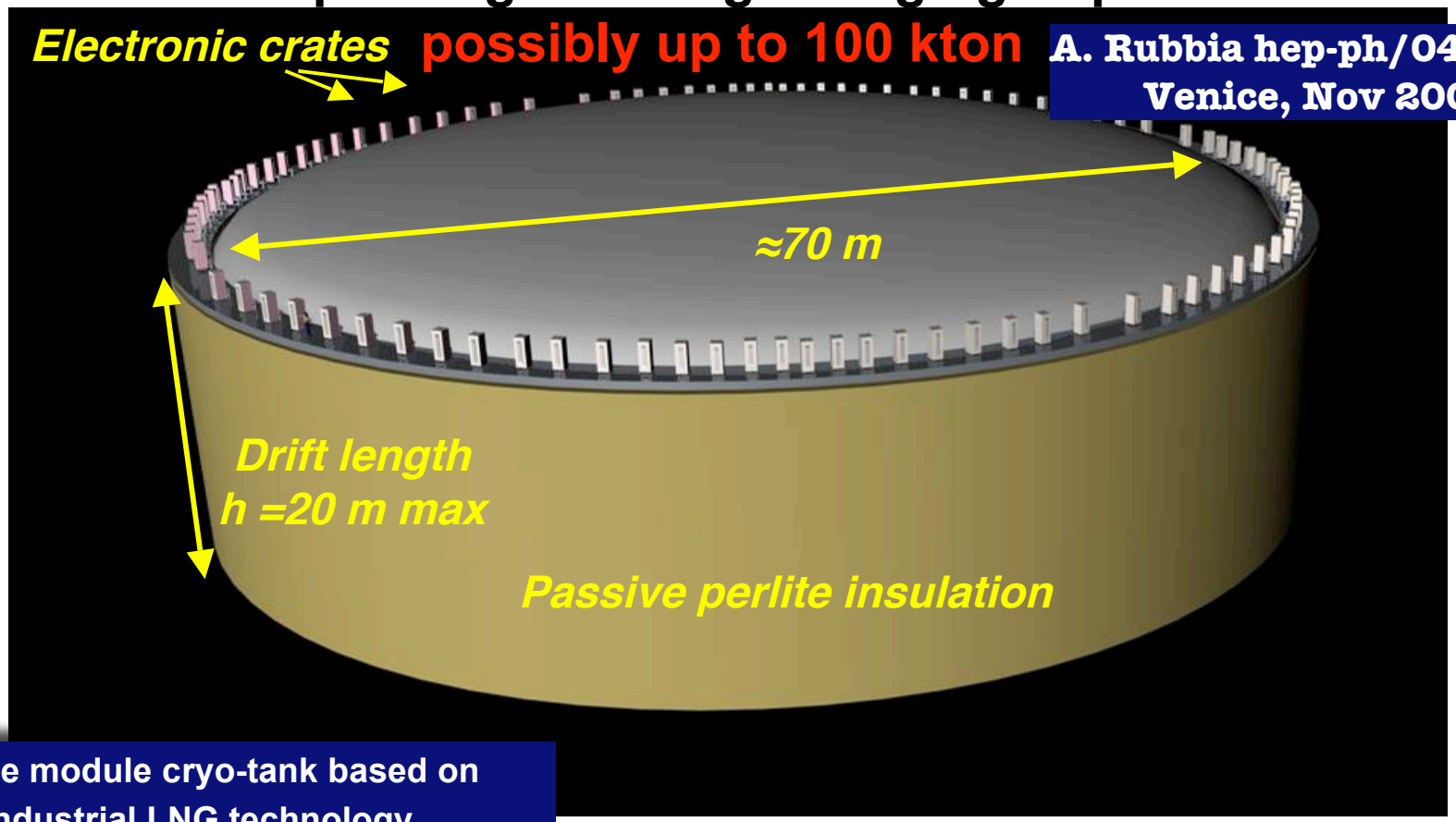
SK

Rational for **UNO baseline**

- Topology and Size
  - –Light attenuation length limit in pure water: ~80 m at 400 nm
  - –PMT pressure limit: ~6 atm (60 m of water)
  - –Largest possible width of underground cavity: ~60 m
  - ⇒ **Single largest active module size: ~ 60m x 60m x 60m**
- PMT (photocathode) coverage
  - Need relatively high coverage (~ 40%) for low energy physics (solar and SRN), and 6 MeV γ detection from $p \rightarrow K^{+}\nu$; and 5-10 MeV γ from neutral current excitation oxygen
  - Need fine granularity for LBL ν_e appearance experiments to reject π^0 background
- Number and size of the modules for a fixed fiducial volume
  - Module size ⇓ detector cost ⇑
    - Larger surface area to fiducial volume ratio - requires more PMTs
    - Smaller fiducial to total volume ratio
    - Need more access drifts and auxiliary/service space
    - typically excavation costs for drifts are more expensive than for large volume excavation
  - Module size ⇓ Energy Containment ⇓
    - especially crucial in atm nu studies, such as L/E study
  - Module size ⇓ Pattern Recognition Capability (with same PMT cov.) ⇓
  - ⇒ **Keep the module size as large as possible**

Tecnología 2: argón líquido

Giant Liquid Argon Charge Imaging ExpeRiment



Single module cryo-tank based on industrial LNG technology

Tecnología 3: centelleador líquido

DETECTOR LAYOUT

Cavern
height: 115 m, diameter: 50 m
shielding from cosmic rays: ~4,000 m.w

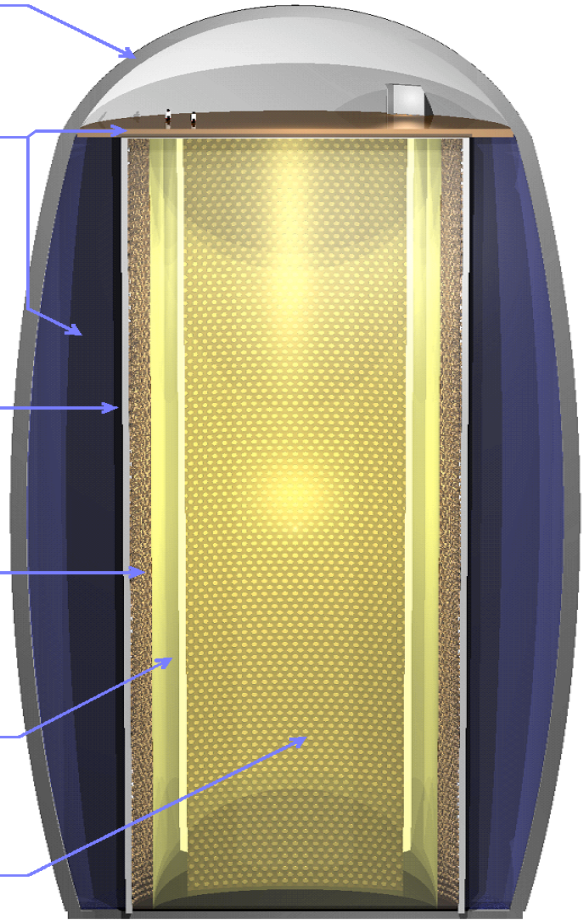
Muon Veto
plastic scintillator panels (on top)
Water Cherenkov Detector
1,500 phototubes
100 kt of water
reduction of fast
neutron background

Steel Cylinder
height: 100 m, diameter: 30 m
70 kt of organic liquid
13,500 phototubes

Buffer
thickness: 2 m
non-scintillating organic liquid
shielding external radioactivity

Nylon Vessel
parting buffer liquid
from liquid scintillator

Target Volume
height: 100 m, diameter: 26 m
50 kt of liquid scintillator



vertical design is favourable in terms of rock pressure and buoyancy forces