Interest of Spanish Groups in Hyper-Kamiokande
L. Labarga (UAM) [Spanish IBR representative]

Spain and the Japanese neutrino program:
- Kamiokande, ~1983 → 1996
- Super-Kamiokande, ~1996 →
  - $\nu_s$ are massive,
  - search for $p$- decay
  - search for SN relic neutrino SuperK-Gd
UAM joins in 2008

next: Hyper-Kamiokande, ~2026 →
- Origin of $\nu$ mass, anti-/matter asymmetry
- $\nu$ astrophysics: Supernovae, DSNB, others
- proton decay, Grand Unification
UAM since beginning

✓ Strong contribution from Canfranc U. Laboratory
✓ Possibility to increase participation in future:
  - DIPF (San Sebastián) “confirmed”
  - USC (S. Compostela), IFAE (Barcelona), …? “maybe”

with neutrino beams:

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opening the door to CP violation
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T2HK
T2K
IFIC
K2K
KEK
JPARC

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Spain & Super-Kamiokande: since 2008
funding mostly from EU, UAM, Japan

PMT-gain variation with time at different PMT groups

Nickel SK-IV data: gain [fitted 1 p.e. peak] vs. time

neutron-tag in oscillation analyses

Radio-purity campaign at Spanish Canfranc Underground Laboratory for SuperK-Gd

Excellent Gd$_2$(SO$_4$)$_3$ achieved, within specifications within experimental limits; Now preparing for mass production screening.
Current activities of Spain in Hyper-Kamiokande
funding from EU, UAM, Japan

- Relatively large UAM contribution to project proposal just approved
- working on simpler/cheaper approach to anti-implosion covers for the PMTs
- Already V1, V2 designed, prototypes made in Spain; tested in Spain & Japan
  
  Hydrostatic pressure tests of V1 at Kamioka
  V1
  
  V2.2 successfully tested at former Japan Microgravity Center facility
  V2.2
  
  → go to V3, it implies as well acrylic window modification
  
  V2.0
  Hydrostatic pressure tests at Spain for V2
Potential Action Items for Spain in Hyper-Kamiokande

- short-medium term:
  - to continue our R&D on low cost PMT cover (T. Aratz ...)
  - now: iterations to optimize flangeless acrylic dome designs, fabricated in Japan and/or Italy (Kuraray Tr. Co., Evonik ...).
  - summer 19: 3rd testing campaign (V3) in Spain and Japan
  - Near future: refinement of flangeless, lower-weight and lower-complexity stainless steel cover body
  - radio-purity screening campaigns at Canfranc Underground Laboratory, LSC (large experience with SK-Gd)
  - R&D on attachment system PMT-Cover-Structure
  - Exploring low-radioactivity glass providers in Europe, through Spanish glass-makers and screening facilities in the LSC. Option to build the PMT bulbs too?

- mass production; in all cases is XY000 items (maximum ~40000):
  - anti-implosion cover for PMT
  - ancillary mechanical parts for PMT-Cover-Structure
  - DAQ etc. electronic boards (for the time being only production)