Latin America Contribution to JUNO

II Latin American Strategy Forum for Research Infrastructure: an Open Symposium for HECAP

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4) University of California, Irvine, California, USA

Outline:

- Historical Background
- The Collaboration
- Physics Reach
- The Location
- The Detector
- The SPMT Subsystem
- South American Contribution
- Milestones and Schedule
- Summary

Historical Background

Reactor neutrinos have been important tools to investigate the fundamental laws of nature:

- Provided the first evidence of neutrinos as a free particle (Reines and Cowan)
- Confirmed the oscillation explanation of the solar neutrino problem (KamLAND)
- Provided the first measurement of the last unknown mixing angle, θ_{13} (Daya Bay, Double-Chooz, and RENO)

South American Institutions have invested an important amount of resources in this attractive field of research over the last two decades by:

- Participating in Daya Bay (PUC-Chile)
- Participating in Double-Chooz (CBPF, Unicamp, UFABC)
- Building a neutrino laboratory at the Angra-II power plant with running experiences (Neutrinos Angra and CONNIE)

JUNO (Jiangmen Underground Neutrino Observatory) is at present the most important experiment under construction for reactor neutrinos. Participating in this project is essential to master the field.

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The JUNO Collaboration

77 Institutes
669 Collaborators

Universidade Estadual de Londrina, Londrina, Brazil (1)
Pontificia Universidade Catolica do Rio de Janeiro, Rio, Brazil (1)
Pontificia Universidad Católica de Chile, Santiago, Chile (6)
Universidad Tecnica Federico Santa Maria, Valparaiso, Chile (1)

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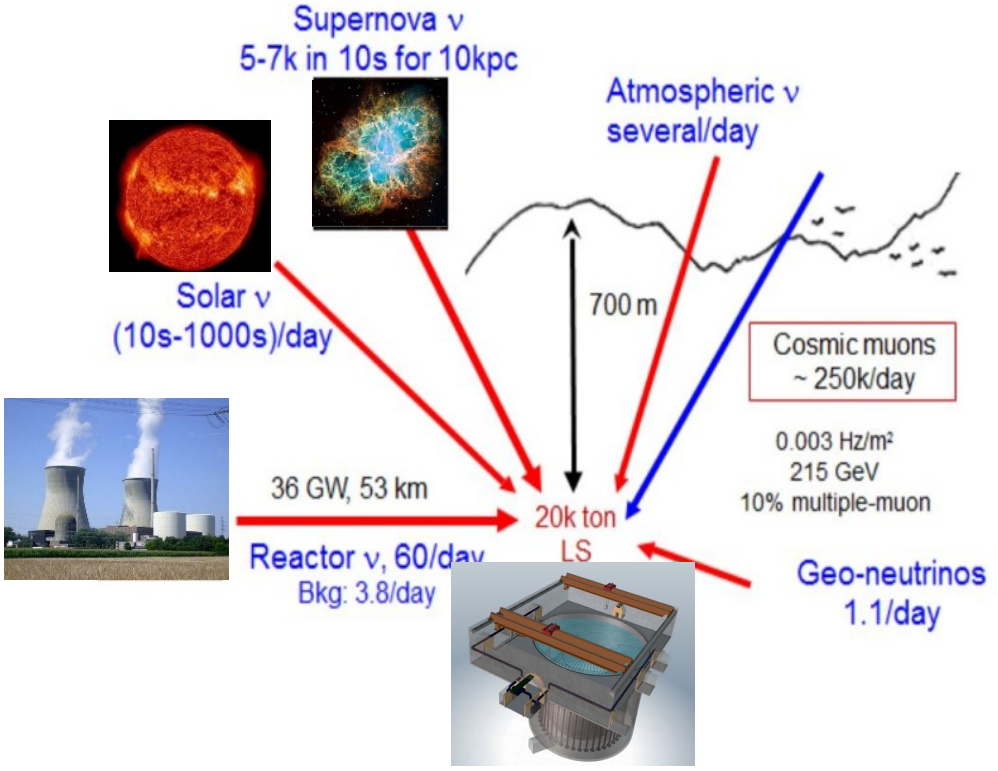
Physics

- *Determine neutrino mass ordering;*
- *Precisely measure particular oscillation parameters;*
- *Observe Supernova neutrinos, study solar neutrino, atmospheric neutrinos and geo-neutrinos;*
- *Exotic searches, proton decay;*



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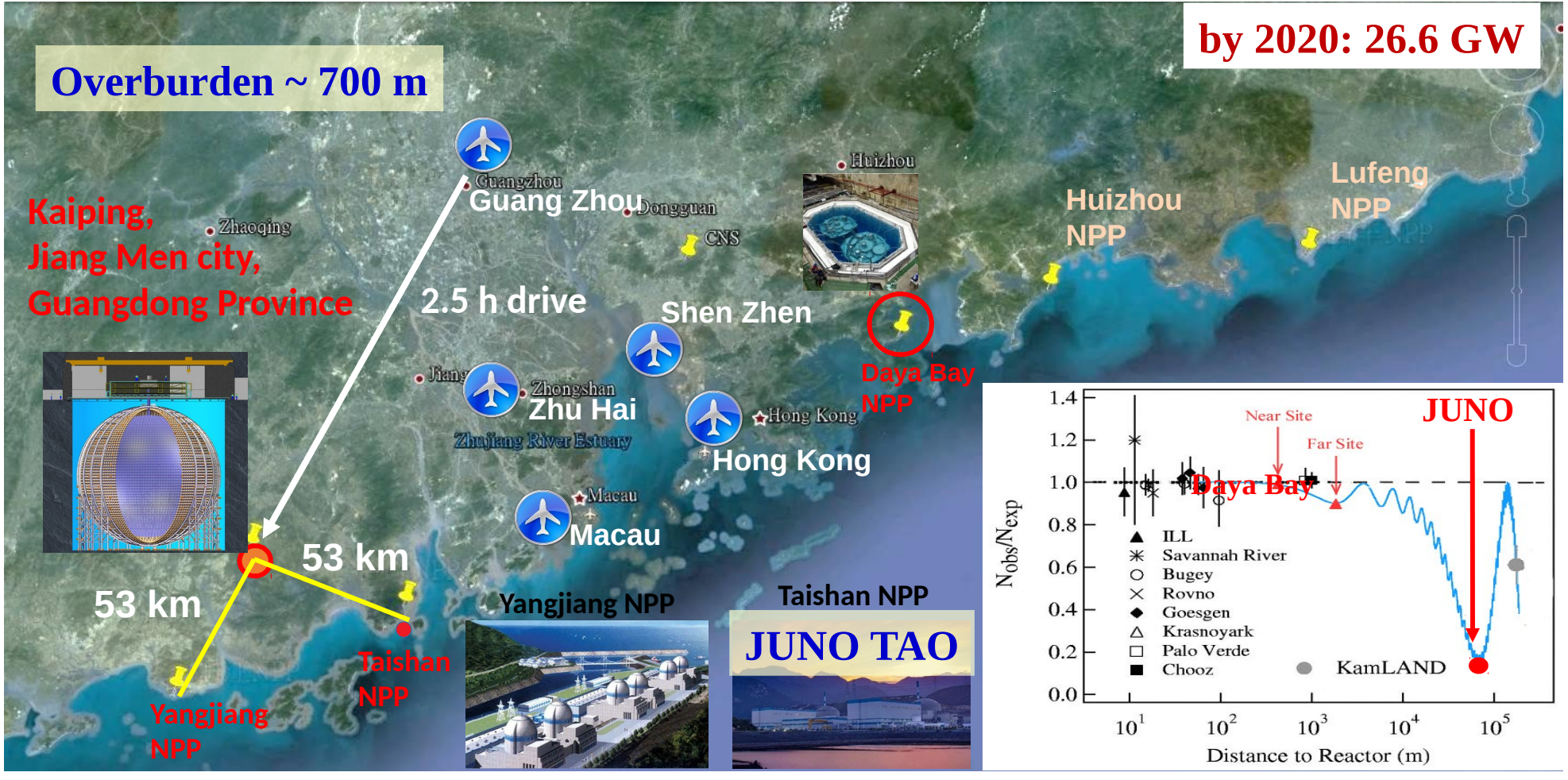
The Location



The Detector

Calibration room

Liquid Scintillator Filling room

Top Tracker

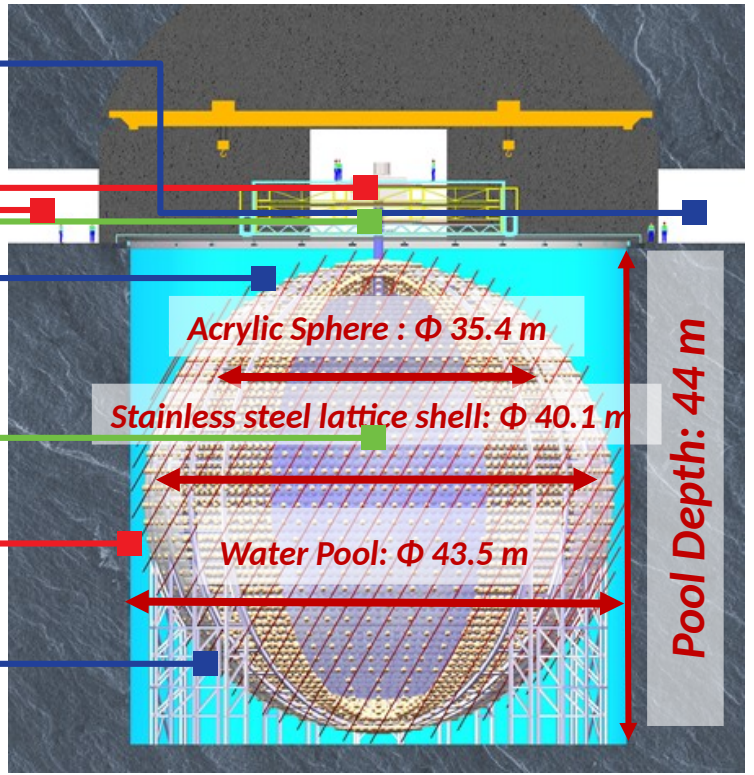
Pure water room

Earth Magnetic Field shielding coils

Central detector:
- *Steel structure*
- *Acrylic Sphere*
- *20 kton LS*

PMT:
- *17600 20'' PMTs*
- *25600 3'' PMTs*
- *77.5% Coverage*

VETO:
40 kton pure water
2400 20'' PMTs



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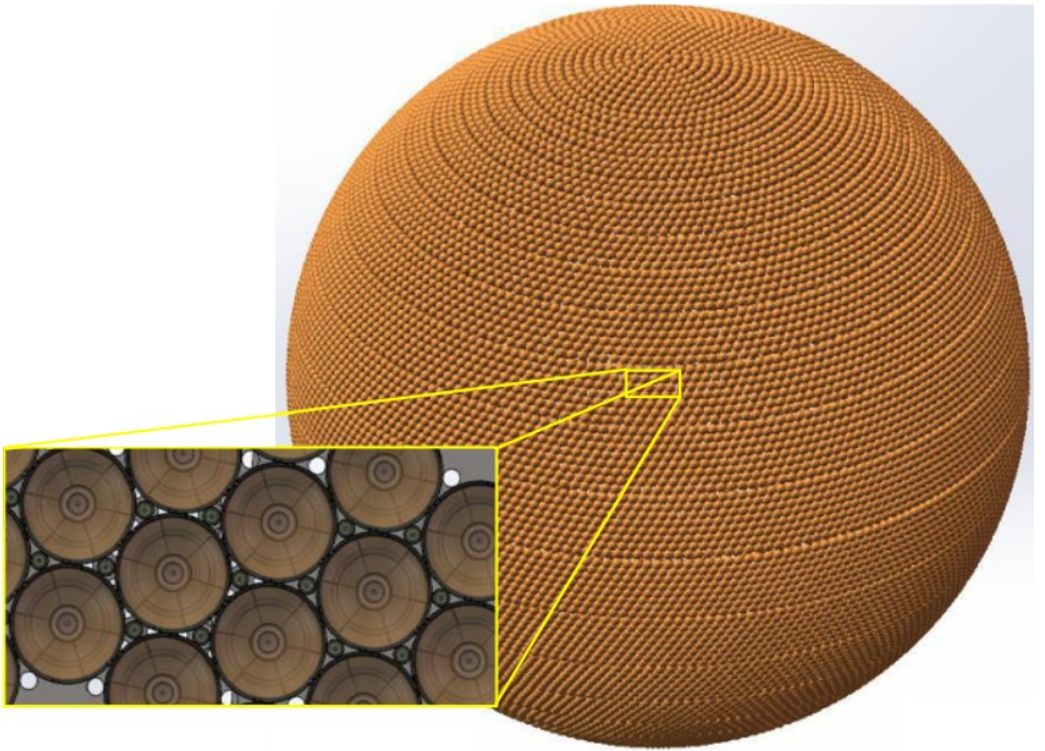
The SPMT Subsystem

Small PhotoMulTipliers (SPMT):

Improve the energy scale precision, in particular, the coupling of non-linearity and non-uniformity.

SPMTs almost always work at single photoelectron (SPE) mode for inverse beta decay (IBD) events, thus providing a linear reference to large photomultipliers (LPMT)

25600 3'' PMTs contracted to HZC



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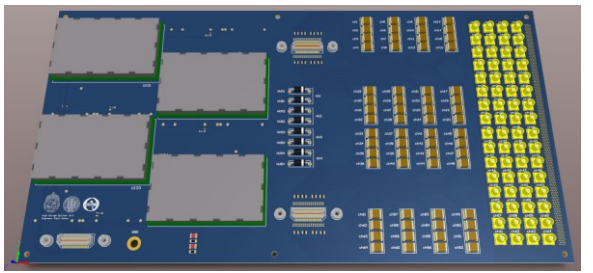
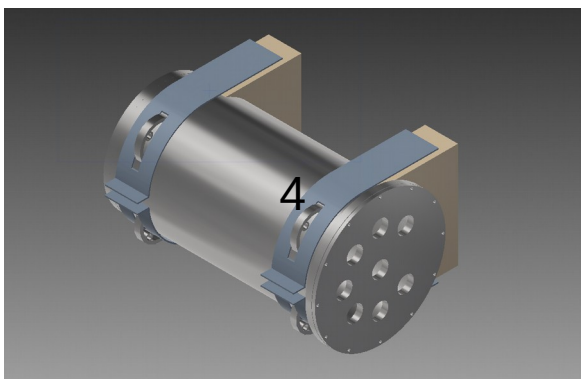
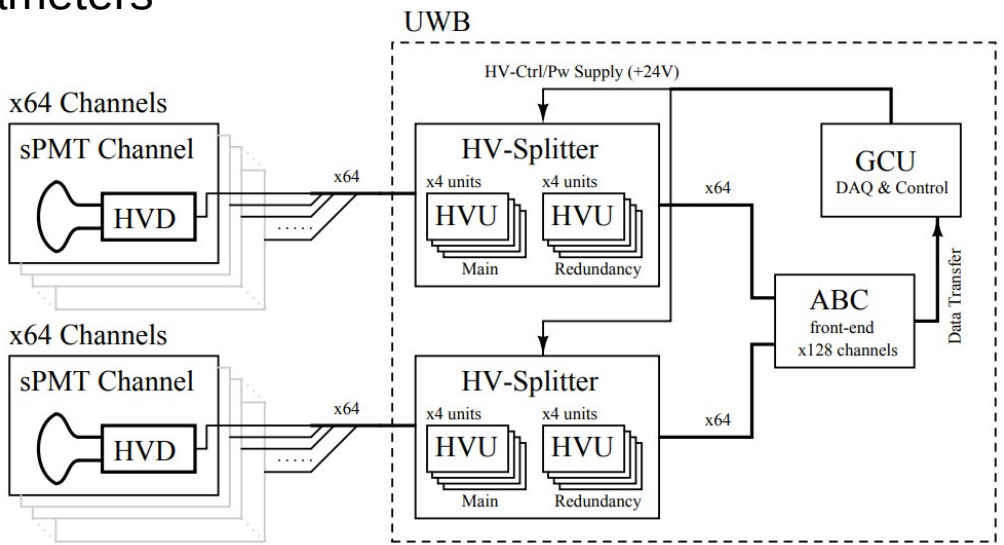
South American Contribution

SPMT Hardware:
- HV-Splitter
- Under Water Box

Simuation and Analysis:
- Electronic simulation
- Analysis of “Solar” Oscillation Parameters
- Explore physics potential of JUNO







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Milestones and Schedule

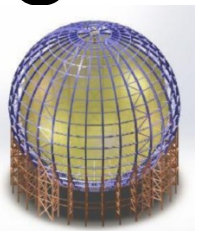
2014
- International collaboration established;

2015
- PMT production line setup
- CD parts R&D
- Civil construction start

2016
- PMT production start
- CD parts production start
- Yellow book published

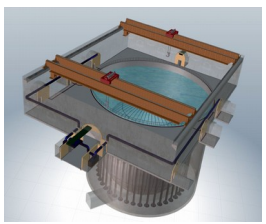
2017
- PMT testing start
- TT arrived

2018
- PMT potting
- Start delivery of surface building
- Start production of acrylic sphere



2019-2021
- Electronics production starts
- Civil construction and lab preparation completed
- Detector construction

2022
- Detector ready for data taking



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Conclusions

- JUNO is in process of being recognized by RENAFAE
- Partially funded by CNPq, FAPERJ and ANID (formerly known as CONICYT)

- A Large Liquid Scintillator Detector has been an experimentalist dream at least since the 80s… its about to come true
- The participation of South American institutions will be very fruitful
- The project is being executed in a timely and elegant way
- Join us! 

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