



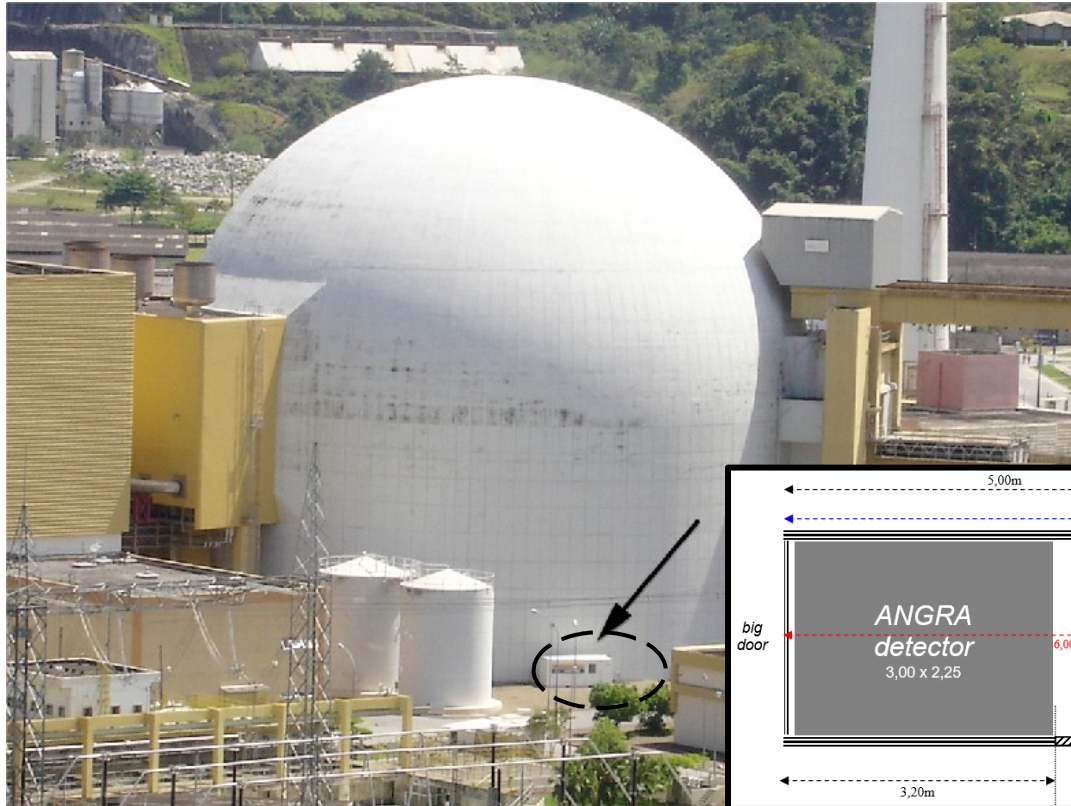
# Safeguards Application of Reactor Neutrinos: the Angra-II case

**Nu Tools Mini-Workshop for the Applied Antineutrino Technology Community**

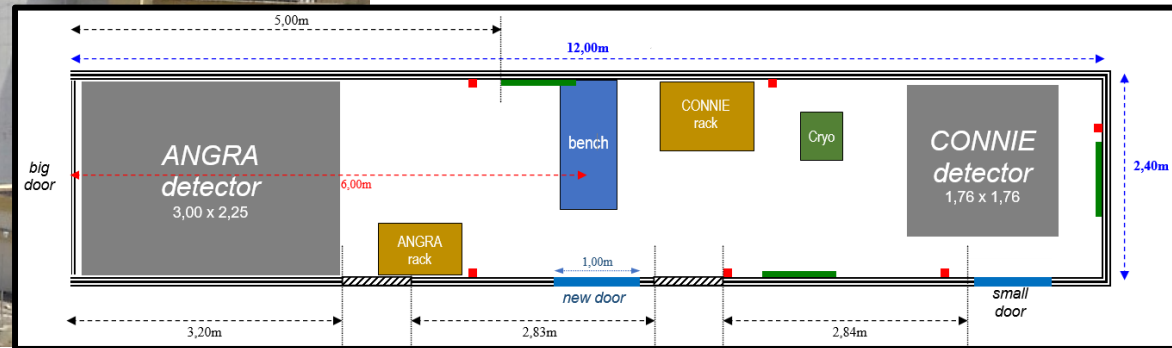
July 24, 2020

Pietro Chimenti ([pietro.chimenti@uel.br](mailto:pietro.chimenti@uel.br)),  
on behalf of the Neutrinos Angra Collaboration.

# The Laboratory



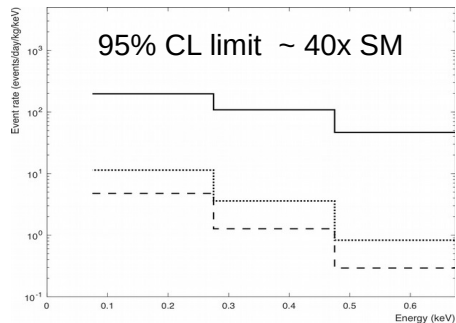
- Two experiment currently running:
- Neutrinos Angra (Gd-loaded Water Cherenkov, IBD)
  - Connie (CCDs, coherent elastic)



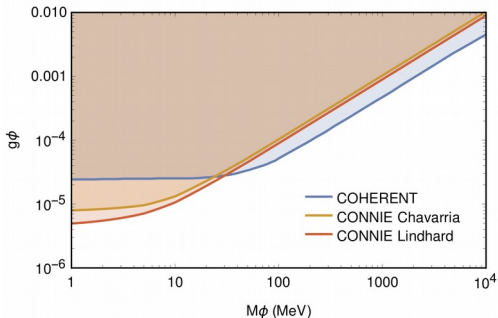


# CONNIE Results

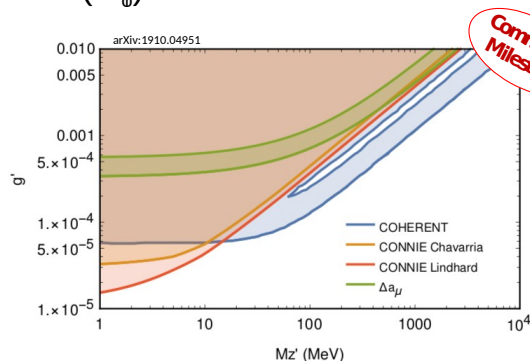
Phys. Rev. D 100 (2019) 092005



JHEP 04 (2020) 054



- First results from 2016-2018 run, 47.6 g.
- Energy spectrum in Reactor On (2.1 kg-day) vs Reactor Off (1.6 kg-day).
- Limit on CE $\nu$ NS event rate.
- Event rates in the lowest-energy bin yield limits on non-standard neutrino interactions: Light vector ( $Z'$ ) and scalar ( $\phi$ ) mediators.
- We obtain the most stringent limits for low mediator masses  $M_{Z'}$  ( $M_\phi$ ) < 10 MeV.



First competitive BSM constraint from CE $\nu$ NS at reactors!

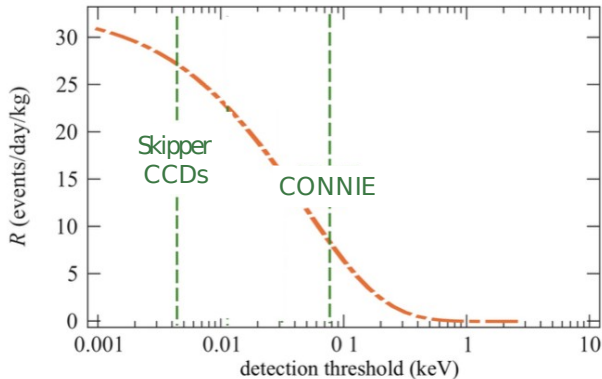
Despite background  $\sim 40$  times above CE $\nu$ NS signal.

Raimund Strauss, Neutrino 2020

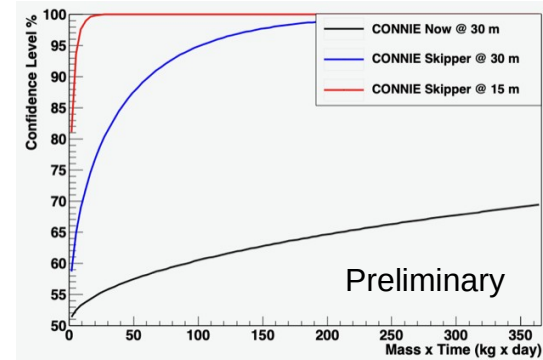


# Perspectives for CONNIE

- Preparing a publication of new 2019-2020 data (better signal-to-noise ratio).
- Plans to upgrade CONNIE with new Skipper CCDs.
  - Install at the current experiment location in 2020-2021.
  - Investigating the possibility of going inside the reactor dome.
- Skipper CCDs allow to reduce the CONNIE energy threshold to 7 eV.
- Preliminary projections show improved sensitivity and an increase of up to 6 times in the neutrino rate.



JHEP 04 (2020) 054, Skipper from  $\nu$ OLETA



# Our experience

- We have successfully created a Latin American research facility **with the cooperation of the power plant operator.**
- Other similar experiences in Latin America are following.
- Neutrinos Angra and Connie are successfully and routinely operated remotely.
- The facility has boosted Latin American science using nuclear reactors.
- The only serious requirement from the power plant operator is: be safe!
  - **No flammable material (i.e. no organic liquid scintillator) in the vicinity of the reactor!**
  - **WbLS with Cherenkov/scintillation discrimination is at present the best option (my opinion).**

**We acknowledge the cooperation and continuous assistance of Eletronuclear staff,  
*essential to run the lab***

*Thanks to Carla Bonifazi for the slides about CONNIE!*