

Short baseline neutrino experiment in nuclear reactors using Skipper CCD in Argentina

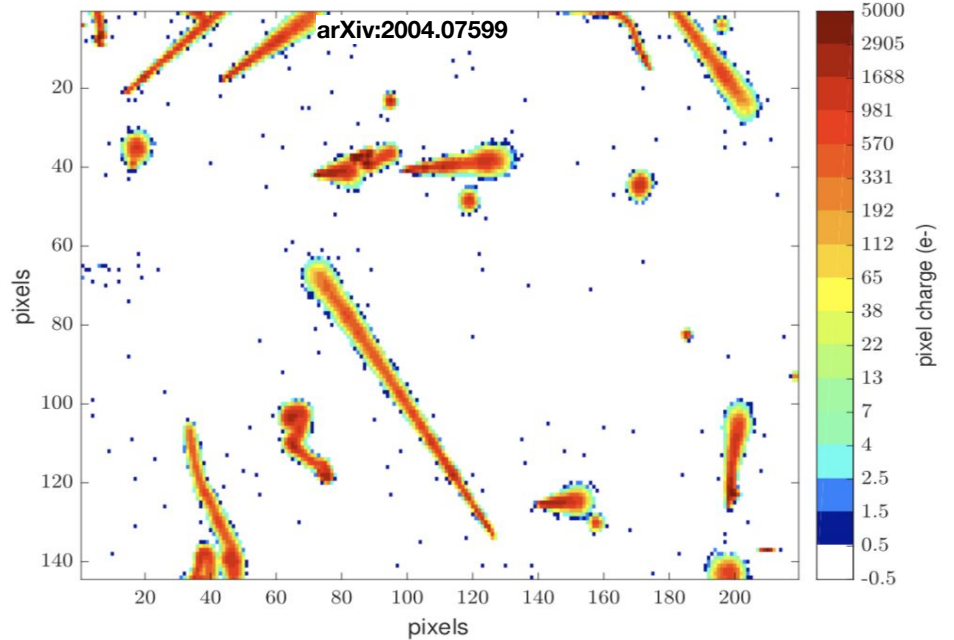
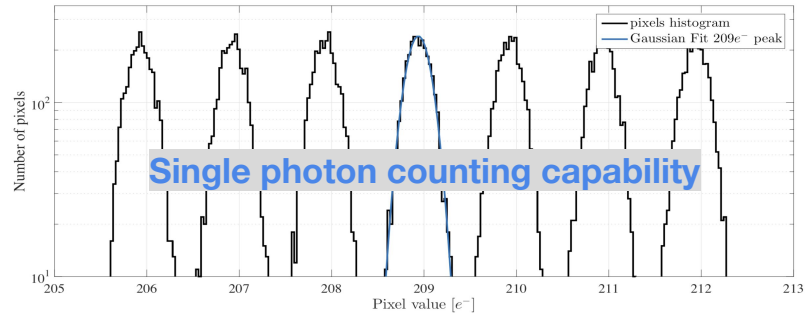
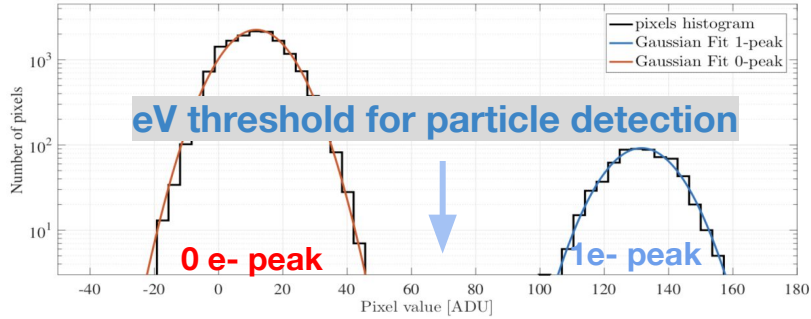
July 24, 2020

Iván Sidelnik¹ on behalf of the *vIOLETA* collaboration

¹ CONICET - Centro Atómico Bariloche- CNEA - Argentina



Skipper CCD, a new technology



Summary

- eV interaction threshold
- Single charge/single photon counting capability from 0 to 100.000 e⁻.
- It allows to scale system of thousands of these devices.

Reactor facilities and expertise available in Argentina

- Nuclear reactors are the largest neutrino sources on the Earth.
- Reactor neutrinos were not used in the past, because just a few technologies were able to see them. Now they are main stream in the community.
- Several groups and large experience in the operation and fabrication of nuclear reactors in Argentina.

Long history in the fabrication and operation of nuclear reactors in Argentina

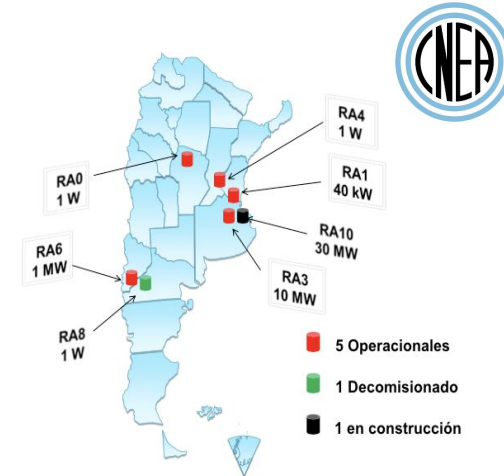


Atucha 1 started operation in 1974
Atucha 2 started in 2014



RA6 operational since 1982

Name	Research reactor			Power reactor		
	RA-6	RA-3	RA-10	Atucha I	Atucha II	Embalse
Power (MWth)	1	10	30	1179	2161	2064
Type	Pool	Pool	Pool	PHWR	PHWR	CANDU
Fuel	U ₃ Si ₂ (20%)	U ₃ O ₈ (20%)	U ₃ Si ₂ (20%)	ULE (0.85%)	Natural UO ₂	Natural UO ₂
Reactor ON/Reactor OFF	1	1	4	12	12	13
Location	Bariloche	Ezeiza	Ezeiza	Lima	Lima	Embalse Río Tercero
Status	Operational	Operational	Under Construction	Operational	Operational	Operational
Operator	CNEA	CNEA	CNEA	NA-SA	NA-SA	NA-SA

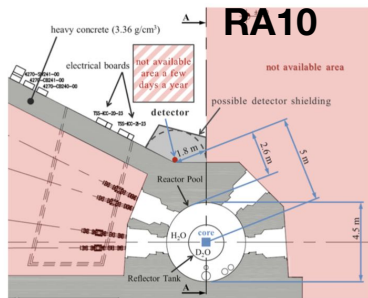
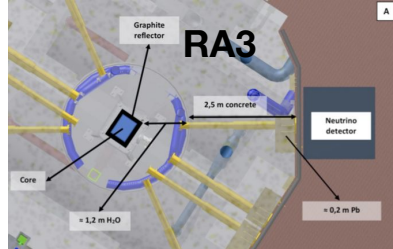


Reactor facilities and expertise available in Argentina

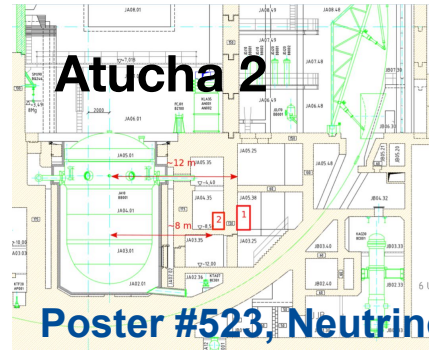
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Research reactors for Skipper R&D

- More flexible access and operation important for new developments.



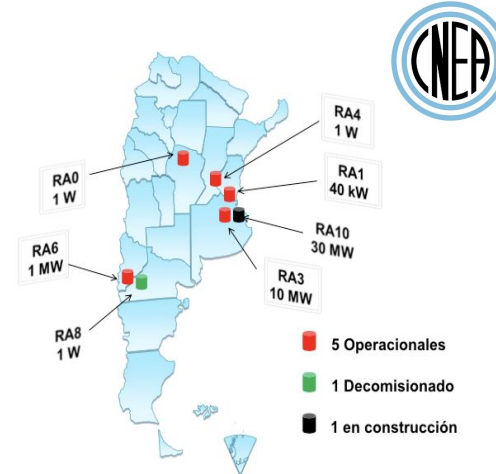
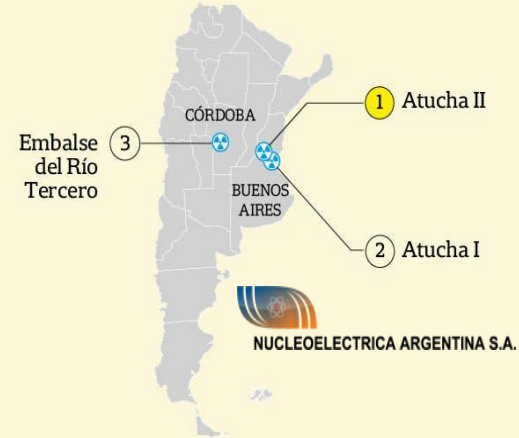
Power reactor (Atucha 2) for Skipper experiment



Poster #523, Neutrino 2020

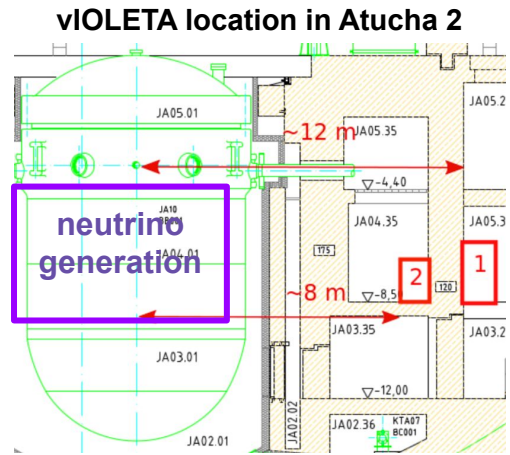
- 2 GWth power.
- Positions close to the core.
- Larger neutrino flux than.
- Less cosmic background expected.

Long history in the fabrication and operation of nuclear reactors in Argentina



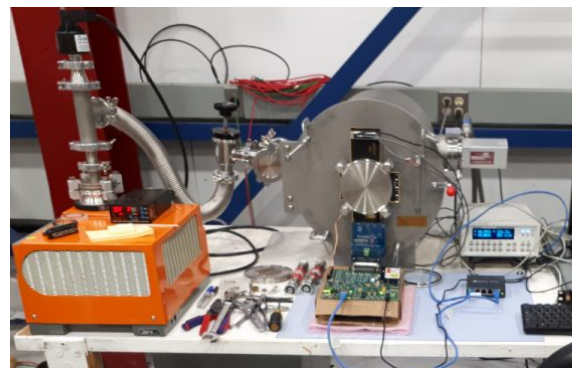
vIOLETA: Neutrino Interaction Observation with a Low Energy Threshold Array

- Multi-kilogram array of Skipper CCD experiment in a nuclear reactor.
- A new collaboration focused in the realization of a reactor neutrino experiment using Skipper CCD.
- The seed started in Argentina for the large experience in Skipper CCD and nuclear reactors.
- Nowadays it is a collaborative effort that involves many countries in America.
- Different expertise on neutrino science, several collaborators are part of the CONNIE experiment (using regular CCDs).



- 3.3 larger flux @ 12m than Angra lab.
- 7.4 larger flux @ 8m than Angra lab.

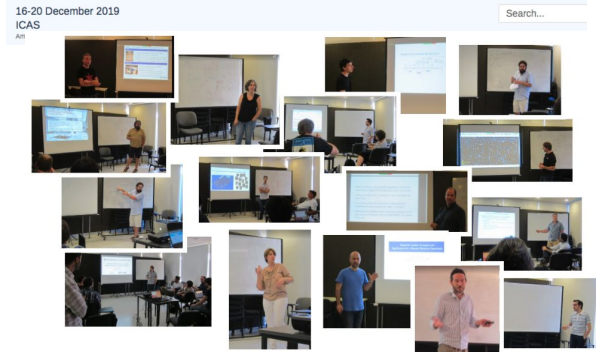
Prototype at FNAL



Background measurement campaign August 2020 @ locations in Atucha 2

Workshop in 2019, Buenos Aires (Argentina).

Workshop: Opportunity for short baseline neutrino experiments in nuclear reactors in Argentina



Weekly collaboration meetings

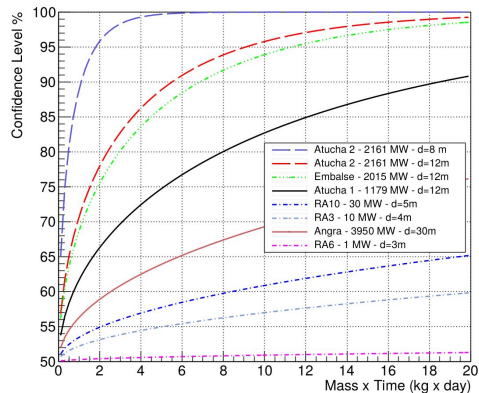


Physics goals

- We will have large sensitivity to the CEvNS channel.
- We can exploit the CEvNS channels for new physics search and SM.
- eV-threshold to access unexplored interaction energies.

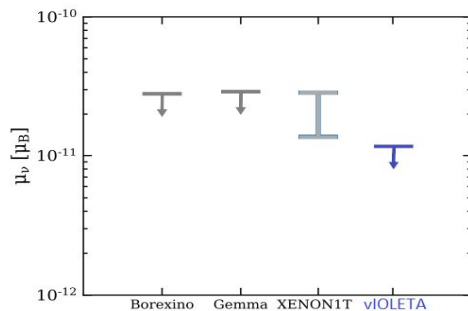
CEvNS detection

- Sensitivity to CEvNS process in a few days taking in to account both research and power argentinian reactors.

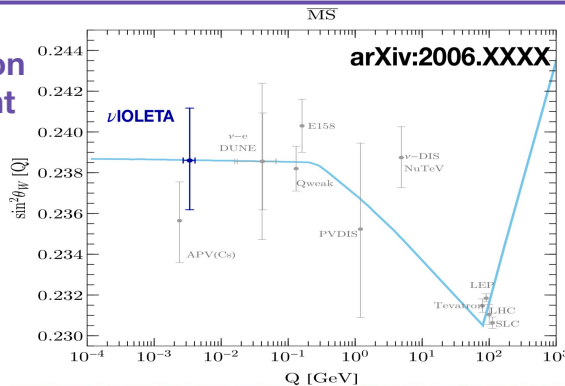


Poster #523
Neutrino 2020

Neutrino magnetic moment search

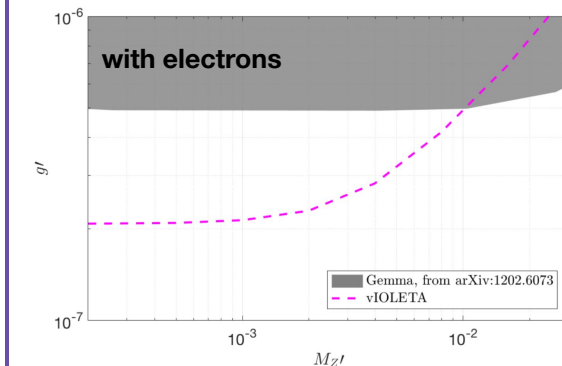
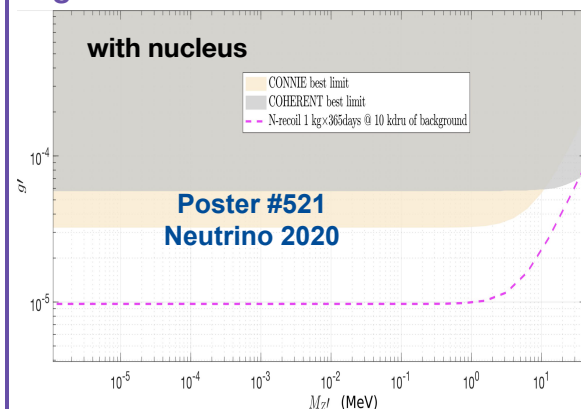


High precision measurement of the SM



Poster #508
Neutrino 2020

Light vector mediated interactions



- Will set new limits on new neutrino interaction from light mediators that are not accessible from accelerators experiments.
- Will set new limits on dark photons interactions (gB-L)
- Necessary for new low mass Dark Matter searches

Conclusions and final remarks

- **Development of new Skipper CCD technology in Latin America associated with Fermilab.**
- **A lot of expertise in house in different branches related to neutrino science.**
- **Nuclear reactors available in Argentina for neutrino experiment.**
- **Direct and fluent relation with research and nuclear reactor operators and people from the plant.**
- **There is an encouragement in use research reactors for experiments**
- **Very good reception and predisposition from people of the power plant to work with us.**
- **We have a unique opportunity in Latin America to generate a long term program with high scientific impact 100% in Latin America:**

Nuclear reactor neutrinos + low threshold sensors.