

Skipper-CCD and reactor neutrinos in Argentina

February 5, 2020

Guillermo Fernandez Moroni

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

16-20 December 2019

ICAS

America/Argentina/Buenos_Aires timezone

Search...



Overview

Timetable

Contribution List

Registration

Participant List

Lodging

Invitation letter

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miguelsofiharao@gmail.com

The main goal of this workshop is to bring experimentalists and theorists together to evaluate the possibilities to develop a short baseline neutrino program using nuclear reactors in Argentina.

Financial support for lodging expenses can be provided to a limited number of participants. Applications for financial support must be addressed to fmoroni.guillermo@gmail.com before November 15th.

Venue Location

The easiest way to arrive at ICAS is by taking the train "Mitre line", that runs from Retiro (terminal train station in Buenos Aires) towards Jose Leon Suarez (be aware that there are several branches of Mitre) and getting off at station Miguelete, which is almost inside the campus of the University (and then you have just a 5 minutes walk inside campus).



Starts 16 Dec 2019, 09:00

Ends 20 Dec 2019, 17:00

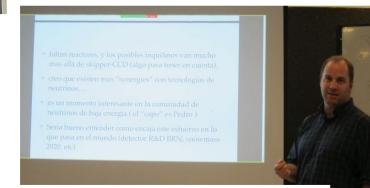
America/Argentina/Buenos_Aires



ICAS

ICAS Campus Miguelete, 25 de Mayo y Francia, C.P.: 1650. San Martín, Provincia de Buenos Aires, Argentina.

~ 25 participantes de diferentes Instituciones Argentinas, Brasil y Fermilab (USA)



E. Paolini and Carla Bonifazi

Overview (2 pages)

We propose to establish a PFC called COFI@large with headquarters at: (i) the Evanston Campus of NU, under the ‘UNESCO Chair on Fundamental and Interdisciplinary Physics for the Americas’, and (ii) COFI, ‘Colegio de Física Fundamental e Interdisciplinaria de las Américas’, in Old San Juan, Puerto Rico. We are already an international collaboration with a working scheme, where the research center-of-gravity is at NU, advanced schools and workshops take place at COFI and visitors’ programs are hosted at both locations. The COFI@large-NSF resources will allow us to expand our capabilities, especially when training PhD students, performing research and development of novel instrumentation and amount of research performed in Puerto Rico.

The PFC will be active in theoretical, computational and experimental/instrumentation research with emphasis on the intersection between dark matter and neutrino physics. These topics are at the forefront of several fields and identified as priorities for the next decade and beyond in the May 2014 report produced by the Particle Physics Project Prioritization Panel (P5) – a subpanel of the High Energy Physics Advisory Panel (HEPAP).

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We can cover most of them (Topics of this presentation)

- **New technology development for dark matter and neutrino physics:** Skipper CCD and associated technology.
- **An experiment to cover unexplored energy scales for new neutrino physics.** Skipper CCD in a nuclear reactor in Argentina.
- **Neutrino facilities to develop other technologies.** Other technologies in nuclear reactors in Argentina

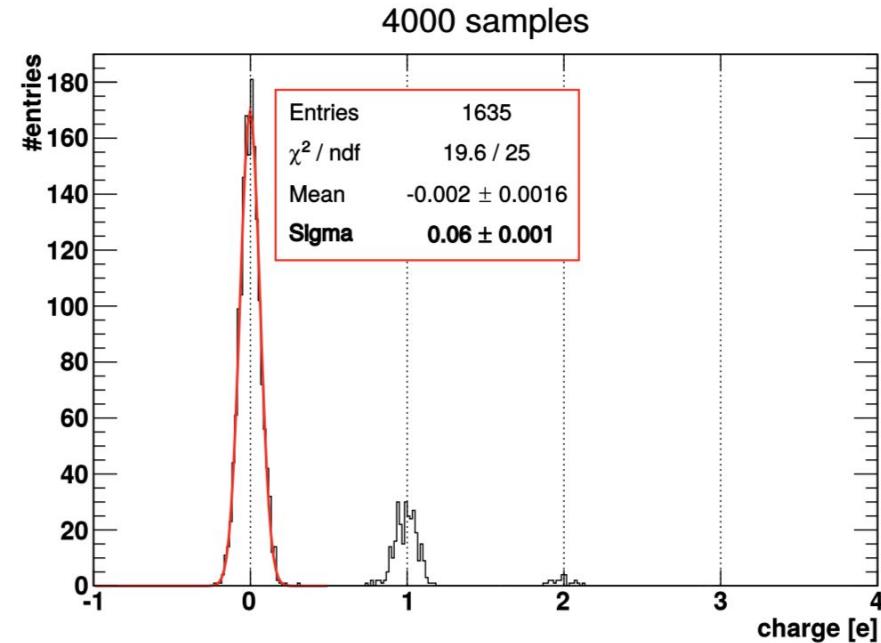
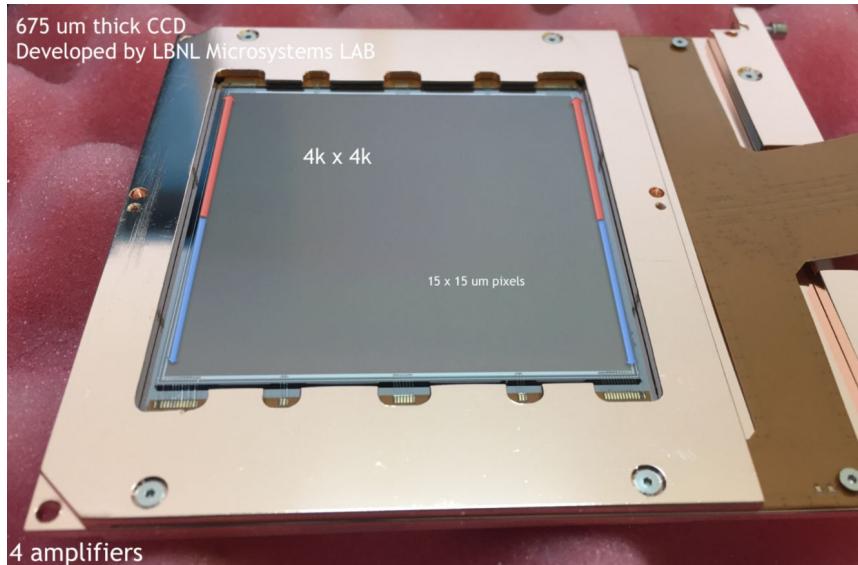
Our vision:

Build a short baseline reactor-neutrino program in Argentina

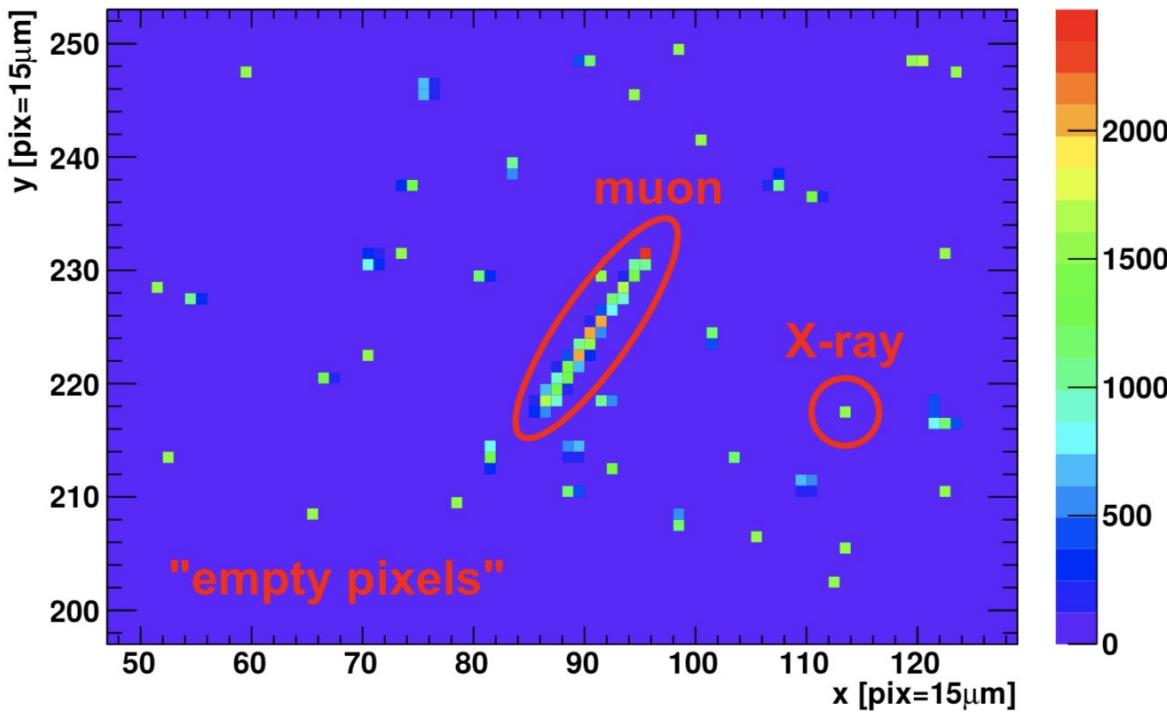
...many technologies, many reactor places, international collaboration...

Skipper CCD un sensor con tonada Argentina

Es un sensor semiconductor que colecta y mide cargas libres ionizadas. Puede estar horas sin producir ningún tipo de señal adicional de error y cuando mide la ionización lo hace sin error alguno.



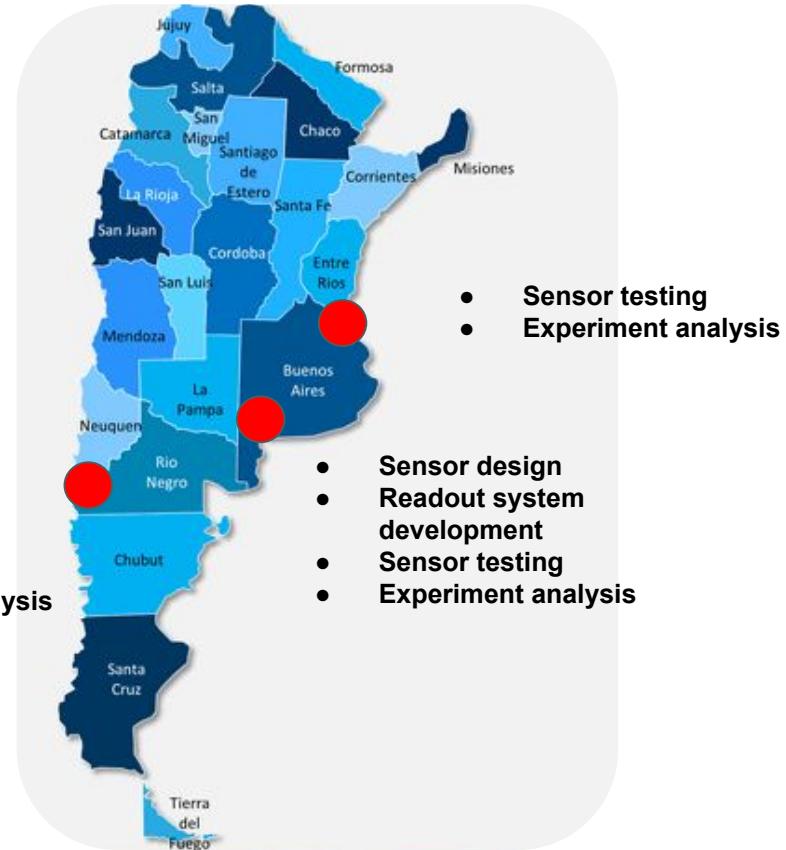
Output data from the Skipper CCD



Skipper CCD un sensor con tonada Argentina

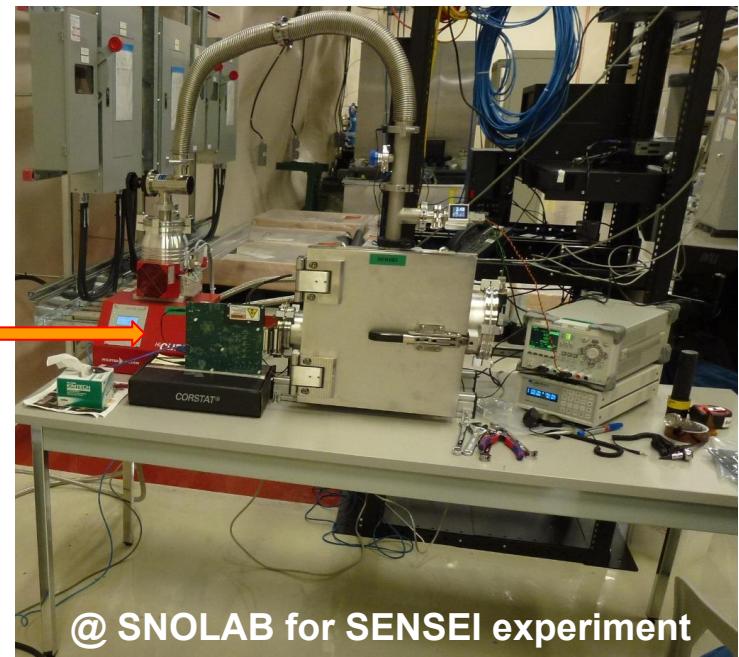
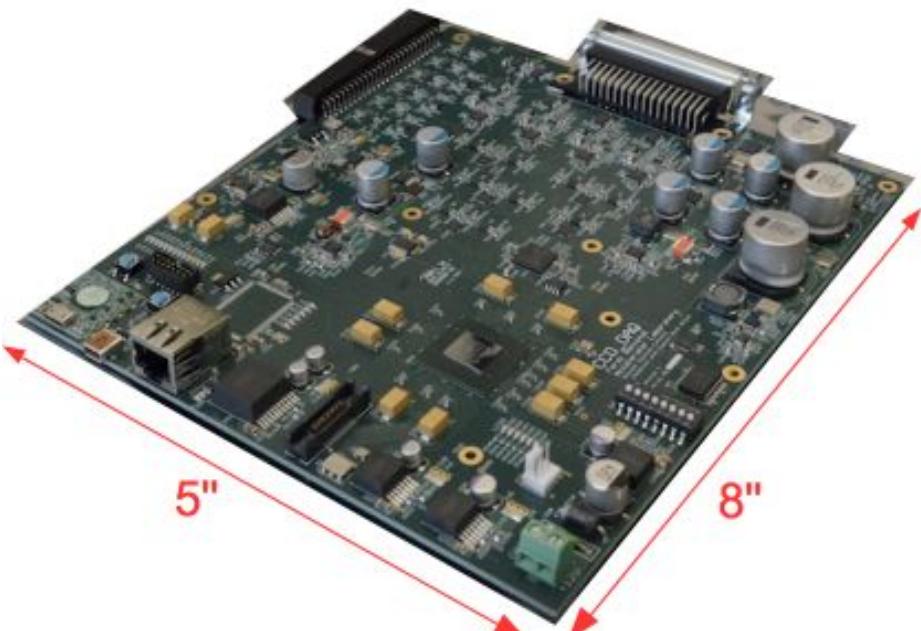
Mucha experiencia sobre estos sensores en Argentina

- Sensor design
- Readout system development
- Sensor testing
- Experiment analysis



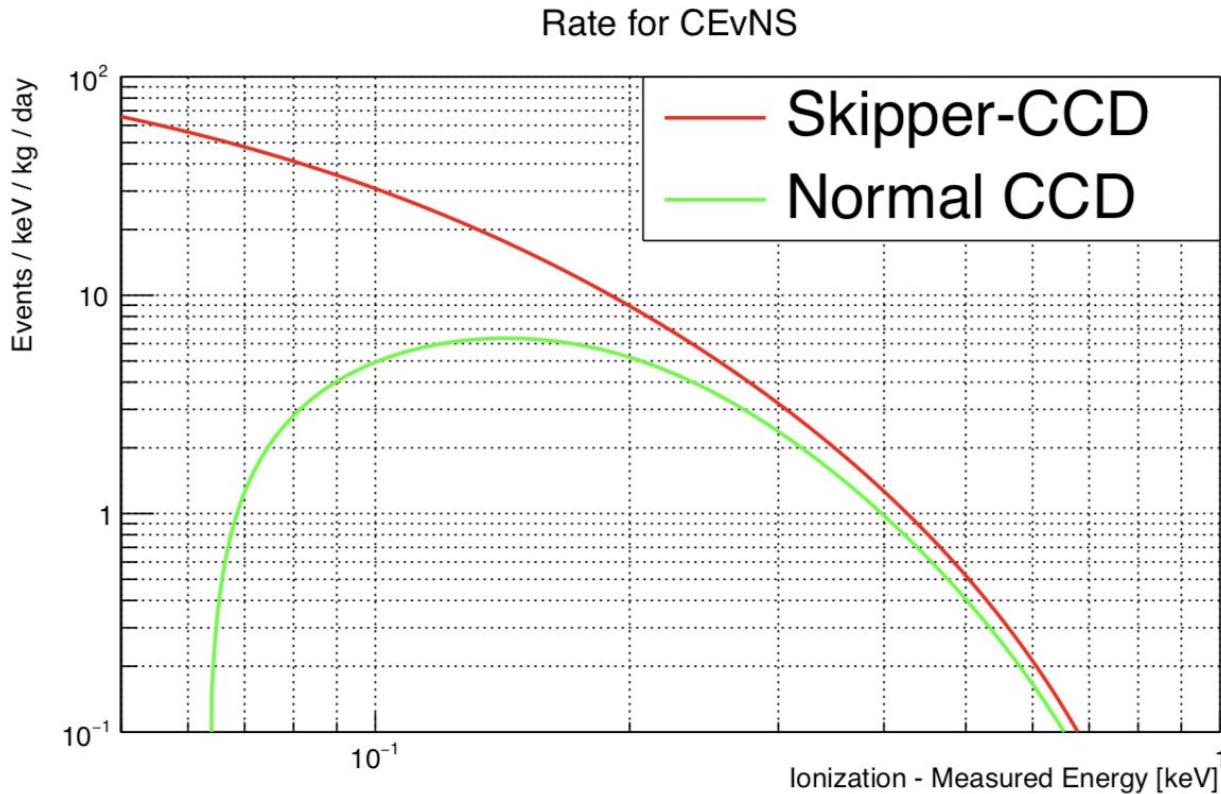
Argentina: first readout electronics for Skipper CCDs

First readout electronics for Skipper CCD developed in Argentina. Designed in Argentina, now being the electronic for the SENSEI 100-grams Dark Matter Experiment.

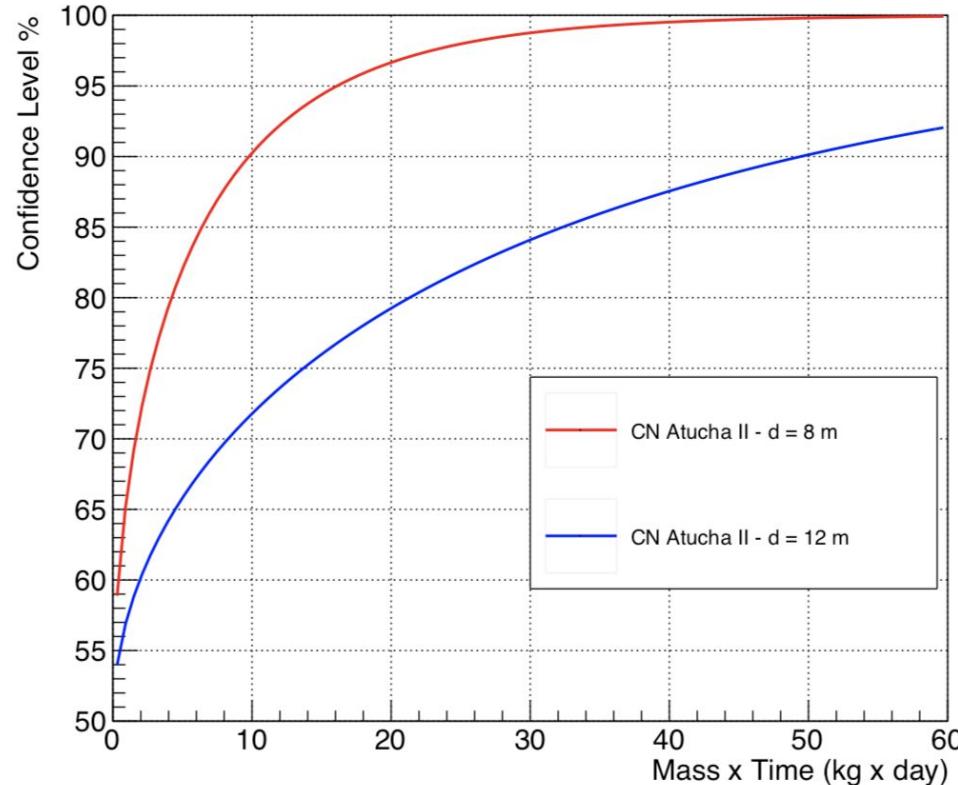


@ SNOLAB for SENSEI experiment

Skipper sensibility in the context of neutrino detection



Skipper sensitivity to CEvNS with nuclear reactor neutrinos



Neutrino Facilities in Argentina

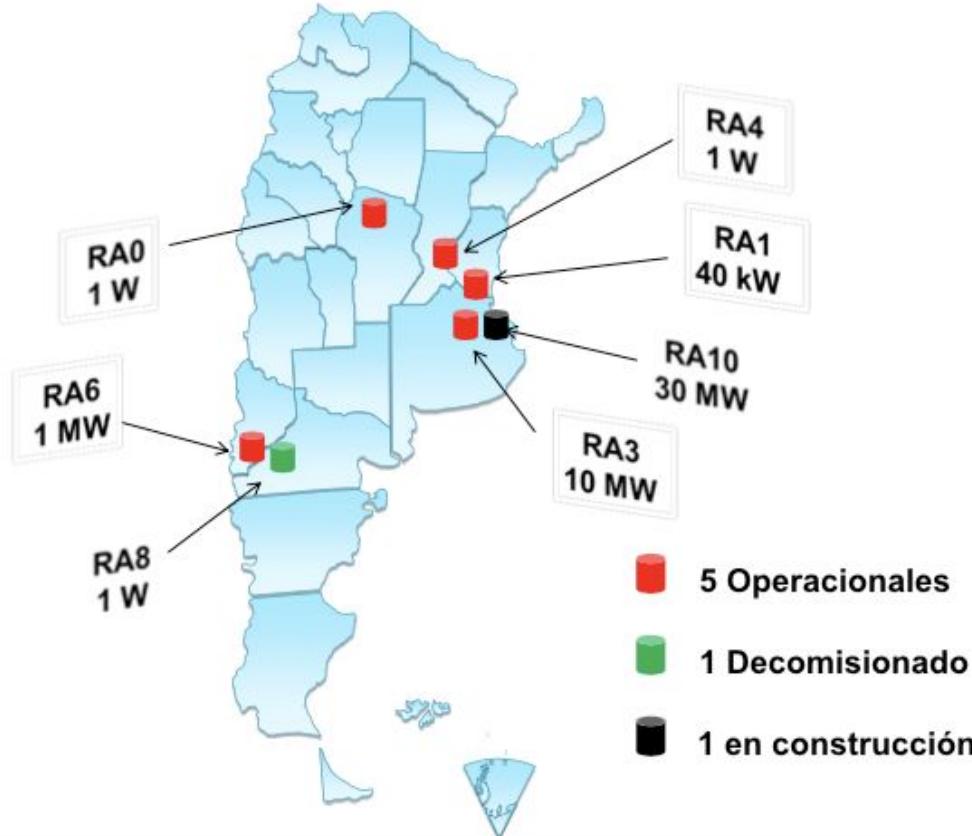
Very lazy: I will cover only two cases: One research reactor and power reactor

Argentina has a long tradition in the development of reactor technology



Research reactors in Argentina

Reactores de investigación, enseñanza y producción



RA-10



Ubicación: Centro Atómico Ezeiza

Área del emplazamiento: 3.85 hectáreas

Superficie construida: 17724 m²

Niveles de construcción: -8 hasta +26 mts

RA-10: El Reactor

Núcleo: Grilla de 5 x 5

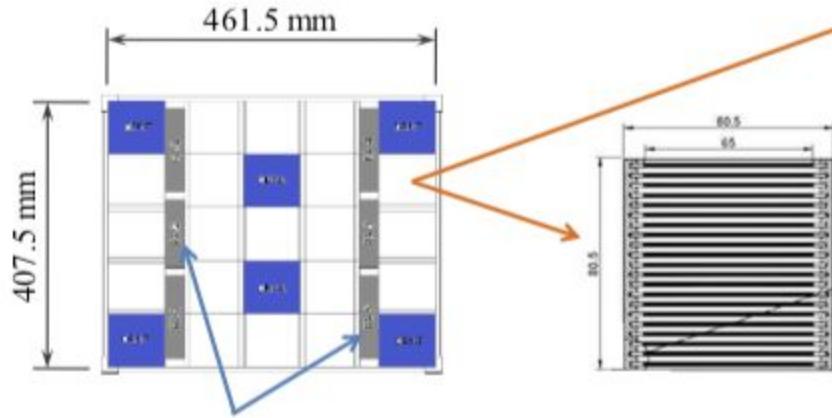
19 EECC "MTR", sección cuadrada, 21 placas planas

Material físico: U_3Si_2 , con enriquecimiento <20%

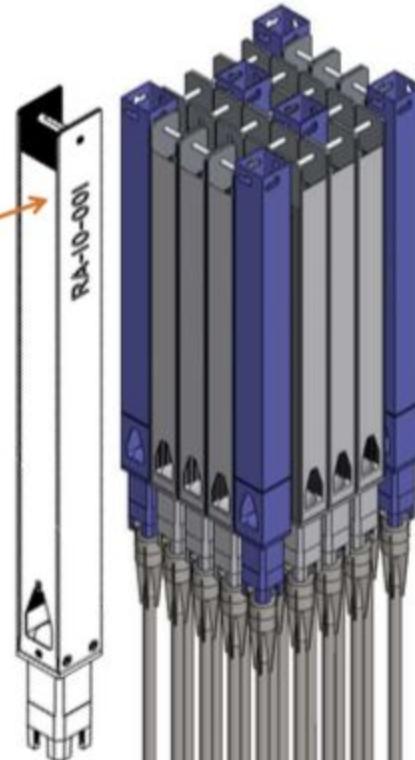
Longitud activa: **615mm**

Revestimiento/estructura: Aluminio 6061

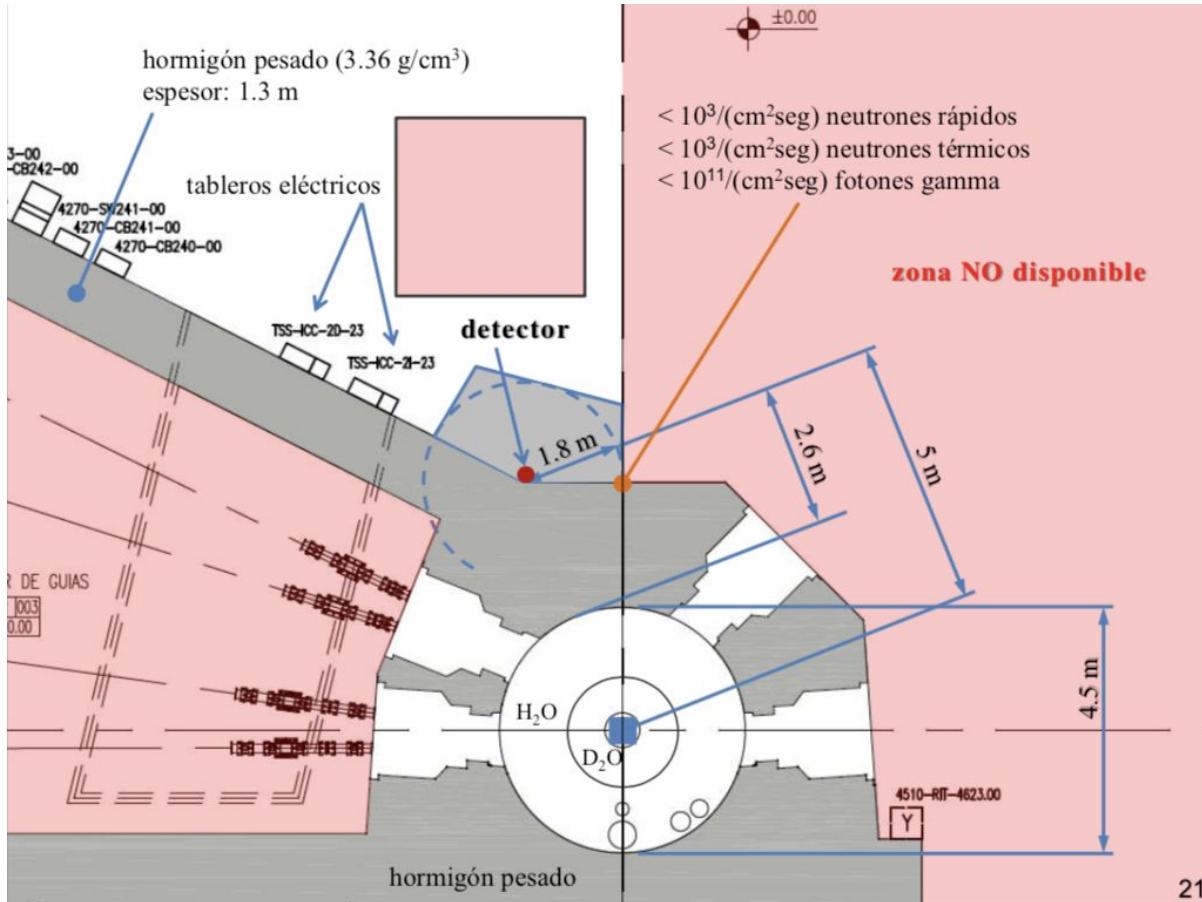
+6 posiciones de irradiación



"Barras" de control: placas de **Hafnio**,
cajas guía de Zircaloy



Available location in RA10

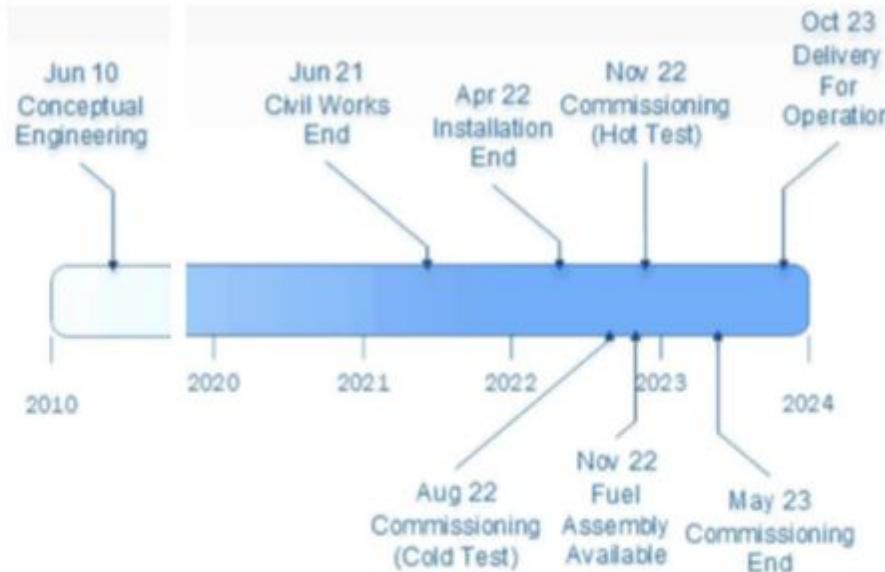


Estado de la obra civil



RA-10: El Proyecto

Cronograma



Inicio de operación: finales de 2023

Desarrollado por **CNEA** con **INVAP/Caputo** como principales contratistas

Plantel de Operación: Un total de 95 puestos, ~55 licenciables (20 profesionales y 35 técnicos)

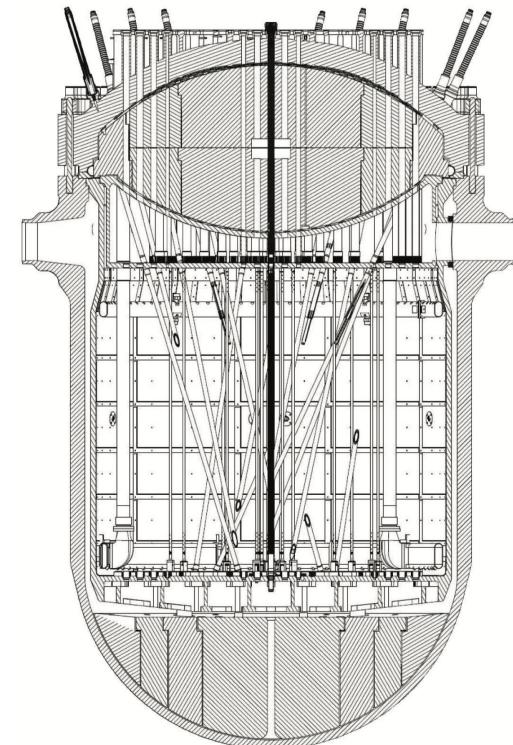
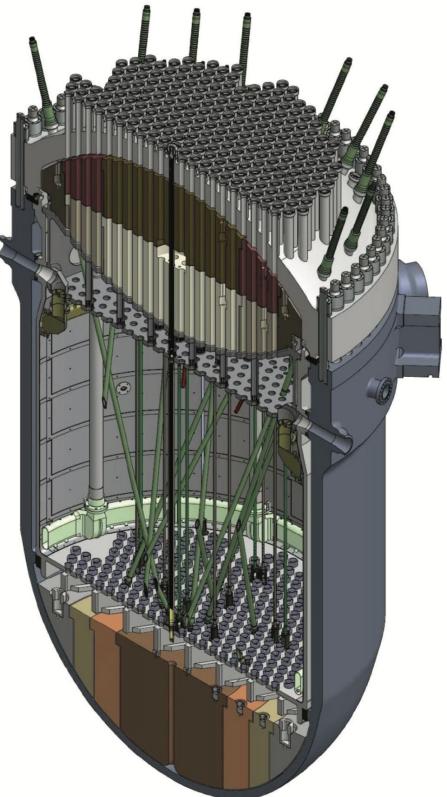
ATUCHA 2 power reactor



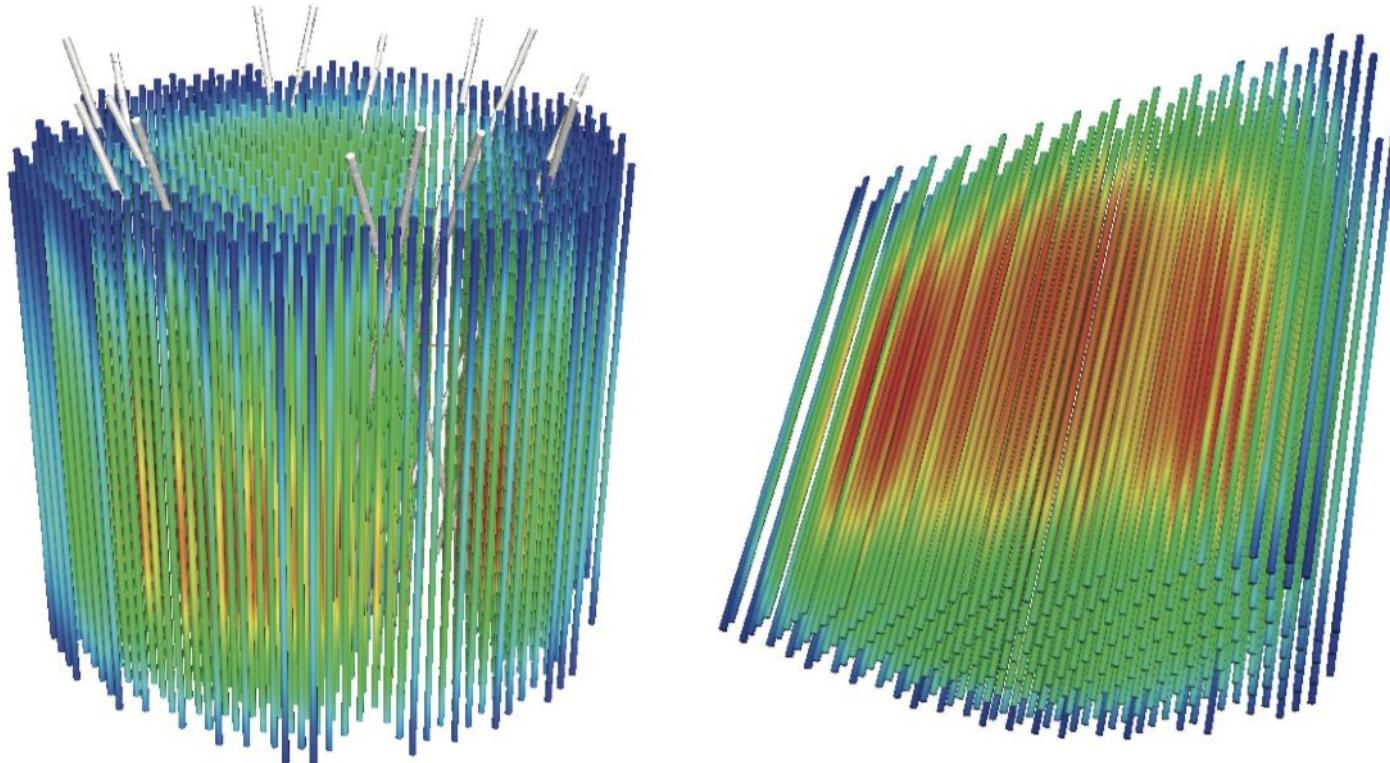
During last visit December 21, 2019



Core of the reactor (2GW thermal power)



Núcleo del reactor



Simulación de la potencia térmica instantánea a 100% de capacidad.

Conclusions

- Low threshold technology development in America.
- Ongoing R&D effort to build a big experiment based on Skipper CCD.
- We can provide neutrino facilities for other technologies.

Near term future:

- Build and install a 2.5-10g Skipper prototype in Atucha 2.