CHINA ARGENTINA RADIO TELESCOPE

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IVTW– October 2024

Agenda

1. Brief historical review of cooperation with China
2. Participant Institutions and project characteristics
3. CART milestones
4. Current status
5. Future development and Collaboration

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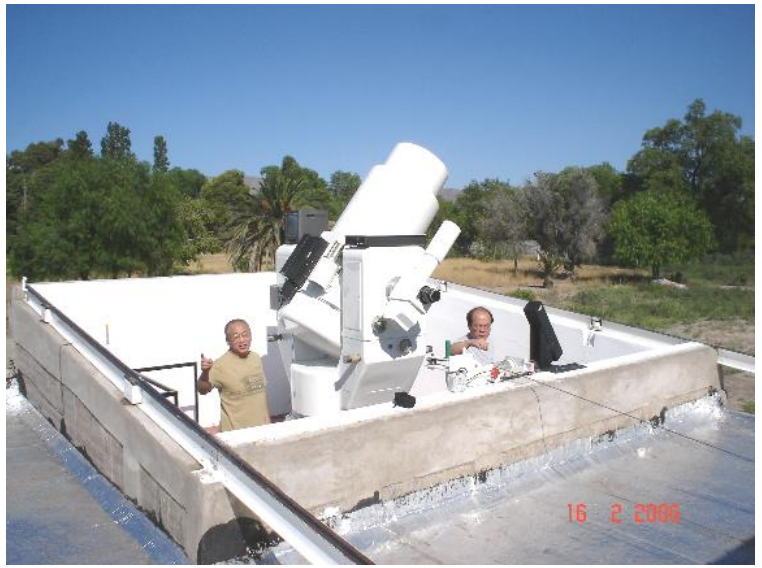
Historic collaboration with China

- 1991: Automated Photoelectric Astrolabe (PAII).
- 2005: Satellite Laser Ranging.
- 2012: Permanent GPS co-localization SLR.
- 2015: CART Radio telescope



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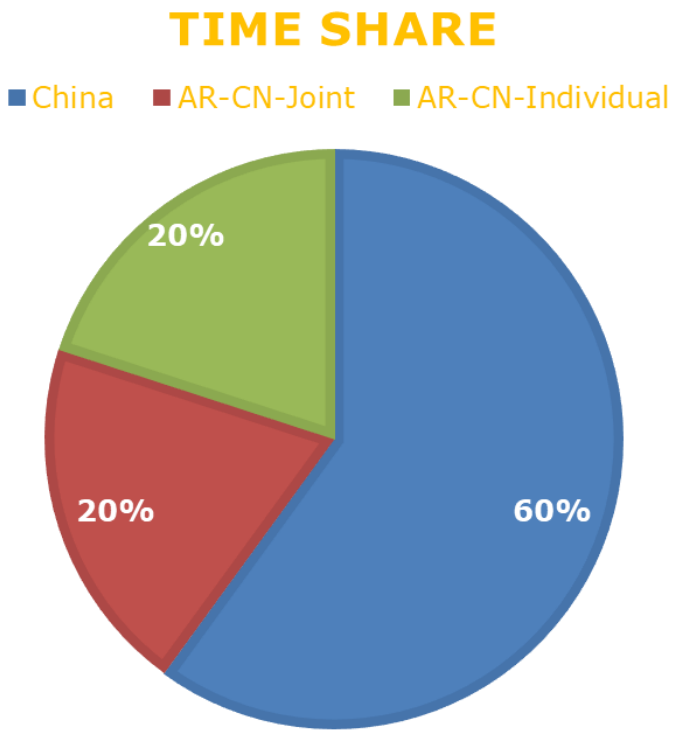
Participant Institutions

- National University of San Juan, Secyt: Dr. Eric Laciar.
  Astronomic Observatory Felix Aguilar **(OAFA)**, Dr. Carlos Francile
- Secretary of Science and Technology of San Juan Province. Mr. German Von Euw
- CONICET, National Council for Scientific and Technical Research. PM Dr. Marcelo Segura
- National Astronomic Observatory of China (**NAOC**), PI: Dr. Li Jinzeng

Location: CESCO Observatory, San Juan, ARG

Operation Characteristics

- Directive Committee: CAS (3), CONICET (1), Gob SJ (1), UNSJ (1)
- Scientific Committee: CAS (3), CONICET (1), UNSJ (2)
- Directory: China (1), Argentina (1)
- Observation time:



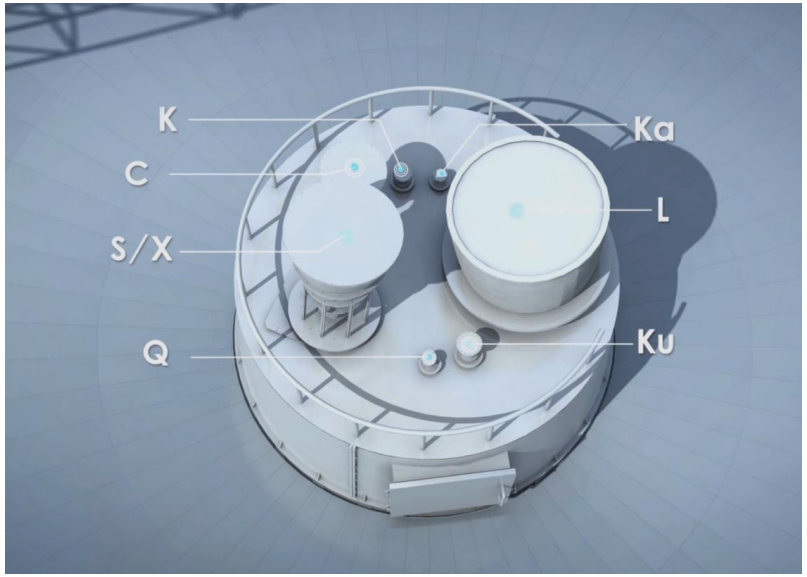
CART scientific objectives

- Establishment and Maintenance of the International Celestial Reference System (ICRF)
- Improvement of the International Terrestrial Reference System (ITRF) in the southern hemisphere.
- Improvement of the Argentine national geodetic network.
- Geo-dynamic studies of the Earth's crust. Movement of the Earth's tectonic plates.
- Determination of Earth Orientation Parameters (EOP).
- Study of Radio Sources and their structure variations.
- Observations of X-ray binaries, supernovae, and nova envelopes.

CART main characteristics

- Specification:
  - Main Reflector 40 m
  - Secondary Reflector 4.2 m
  - Phase I operating frequency: S (2-4) y X (8-12)
  - Phase II operating frequency : L, C, Ku, K, Ka, K y Q (1- 45Ghz)
  - Azimuth Range -275°/275°
  - Altitude Range 4°/90.5°
  - Pointing accuracy <0.35 arcs

https://youtu.be/ZayqPdpZcAg?si=xDuSdIIrxov8Zb_n



CART Specifications

Electronic Parameters								
Band	L	S	C	X	Ku	K	Ka	Q
Wavelength (cm)	21/18	13	6/5	3.6	2.5/2	1.35	0.9	0.7
Feeds Freq. Range (GHz)	1.35-1.75	2.15-2.45	4.5-6.9	8.2-9	12-15.5	18-26.5	26.5-40	40-46
Antenna Efficiency % Alt. 45°	65	65	65	65	65	55	50	40
Antenna Efficiency % Alt. 10° or 80°	60	60	60	50	50	45	35	30
Polarization	LCP&RCP	LCP&RCP	LCP&RCP	LCP&RCP	LCP&RCP	LCP&RCP	LCP&RCP	LCP&RCP
Noise Temp of Receiver	<15K	<20K	<20K (5G-6G)	<20K	<30K	<20K (22G)	TBD	TBD
Back-End	TBD	VLBI	TBD	VLBI	TBD	TBD	TBD	TBD
Cryo-part	LNA to Feed	LNA	LNA to Feed	LNA & Polarizer	TBD	LNA to Feed	TBD	TBD

CART Specifications

Mechanical Parameters:				
Pannel Accuracy	<0.1mm			
Main Reflactor Accuracy	<0.35mm	best, r.m.s.		
	<0.45mm	worst, r.m.s.		
Pointing Accuracy	<0.35 asec	wind <5m/s		
Sub-reflector	Stewart platform + Z axis rotation			
Band changing	Rotating Asymmetric Sub-reflector			
Track inflatness	<0.5mm	25m diameter		
Track form	On-site soldering			
Az. Range	from -275 deg. to +275 deg.			
Alt. Range	from 4 deg. to 90.5 deg.			
Pointing Speed	1deg./s ; 0.5deg./s^2 (Az.) 0.6deg./s; 0.3deg./s^2 (Alt.)			

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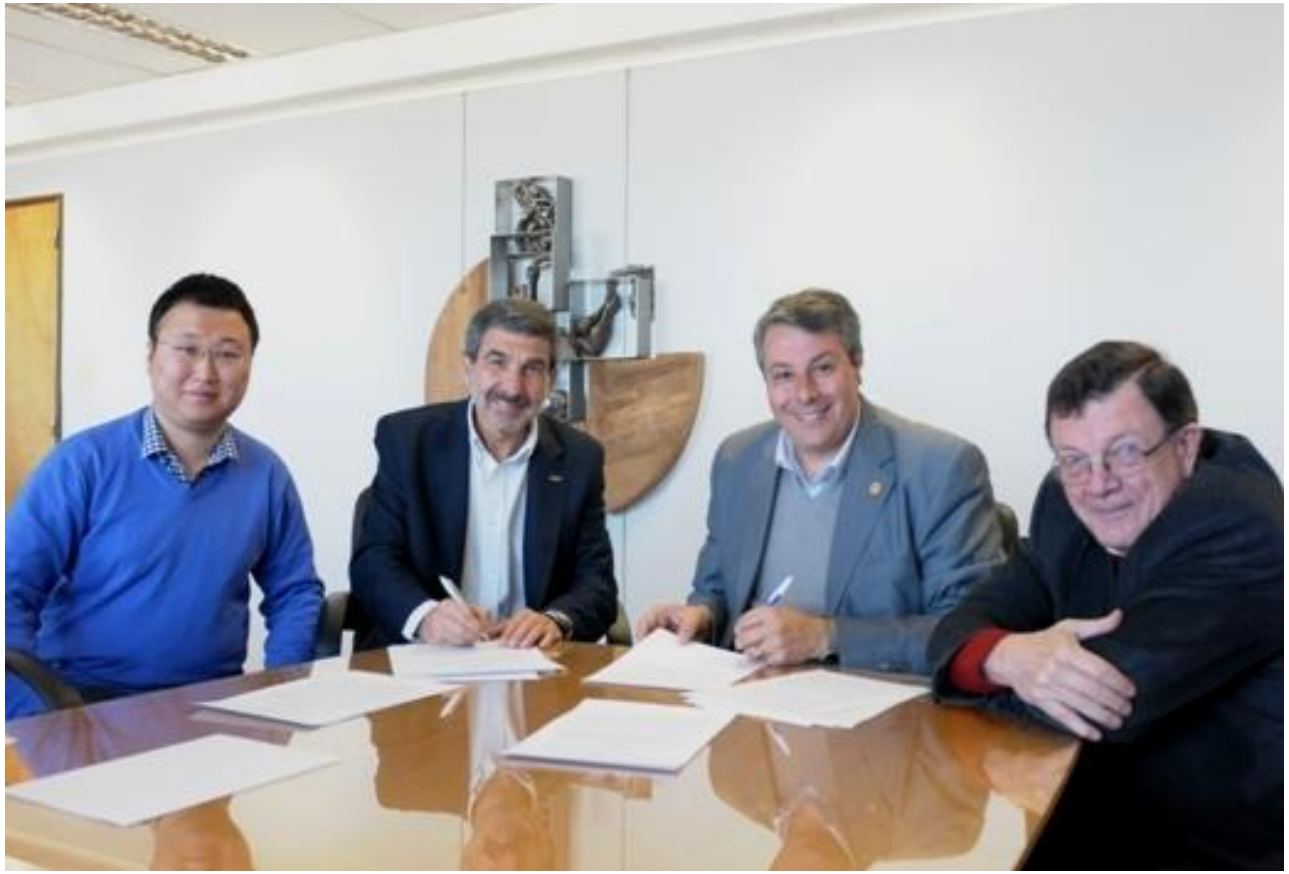
CART Milestones

- **2012**: RFI measurements for site selection

http://center.shao.ac.cn/twxjz/abstract/2014/20140308.pdf

CART Milestones

- **2015**: The four parties frameworks agreement was signed by UNSJ, San Juan Government, CONICET and NAOC.



ARTÍCULO 15 - DURACIÓN, MODIFICACIÓN Y RESCISIÓN

1. El presente Convenio entrará en vigor una vez firmado por las Partes. La validez de este convenio es de 10 años y se renovará antes de la fecha de vencimiento, si todas las partes están de acuerdo. El presente Convenio podrá ser modificado solamente por acuerdo escrito de las Partes.

Firmado el veintidos de junio de 2015.

Prof. Yun Jan.
Director General
National Astronomical Observatories of Chinese Academy of Science.

Dr. Roberto Salvarezza.
Presidente.
Consejo Nacional de Investigaciones Científicas y Técnicas

Dr. Oscar Nasisi
Rector
Universidad Nacional de San Juan

Ing. José Luis Gioja.
Gobernador.

CART Milestones

- **2016:** CART Platform was completed

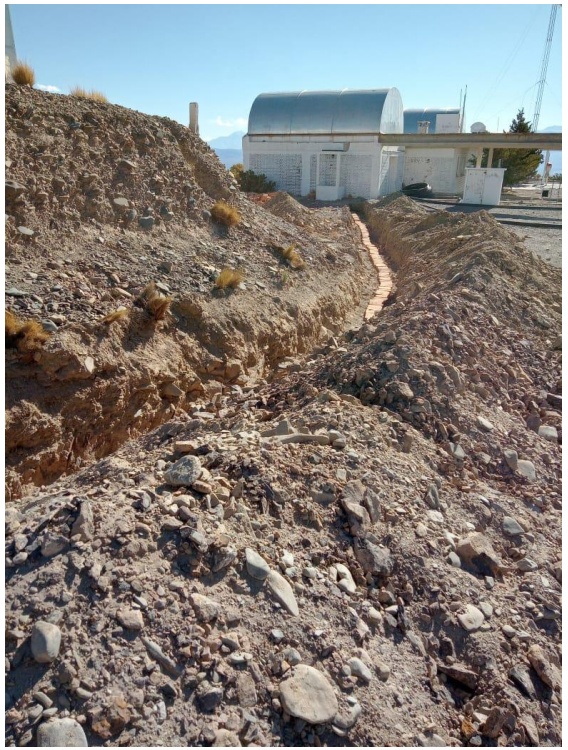
CART Milestones

- **2020:** CART basement was completed, Iron 300Tn, Concrete 3000m3



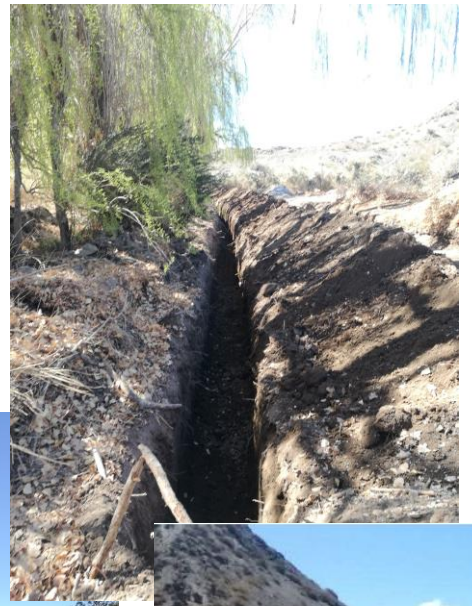
CART Milestones

- **2021:** November, CART main backbone 200Mb (wireless link)



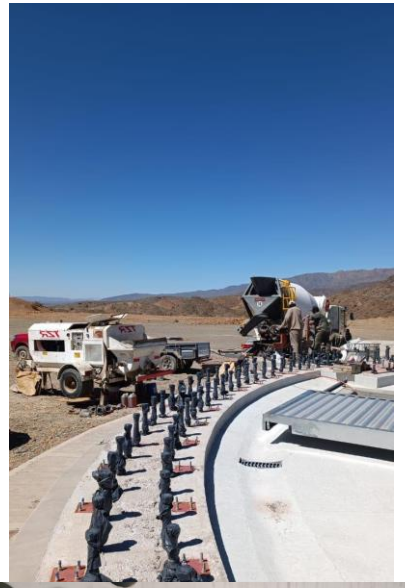
CART Milestones

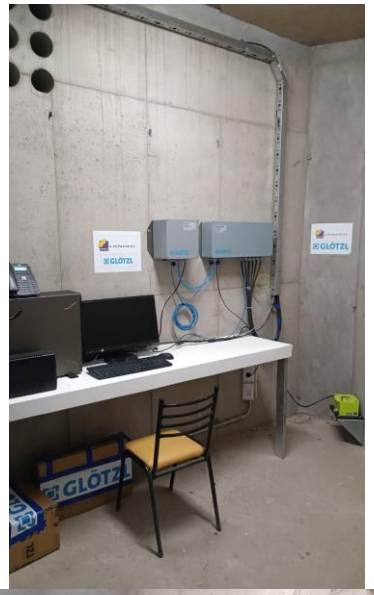
- **2022:** March, CART main water pipe



CART Milestones

- **2022:** November, CART basement instrumentation





CART Milestones

- **2023:** April, CART fiber optic connection to San Juan University (300km)

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CART Current Status

- 2023 May, CART parts were delivered from China.

- 2023 August, CART parts arrived to CESCO Observatory

CART Assembly

https://youtu.be/_1FMgouNw10?si=hqri1GILS4qeche1

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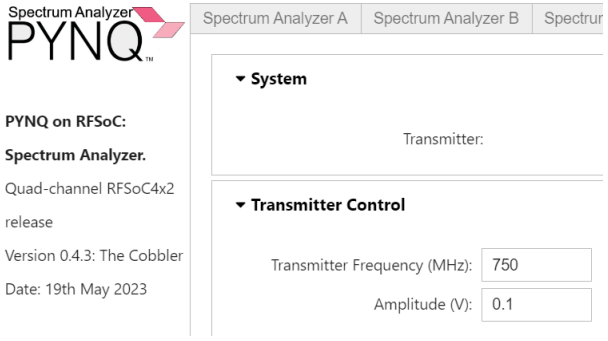
International Collaborations

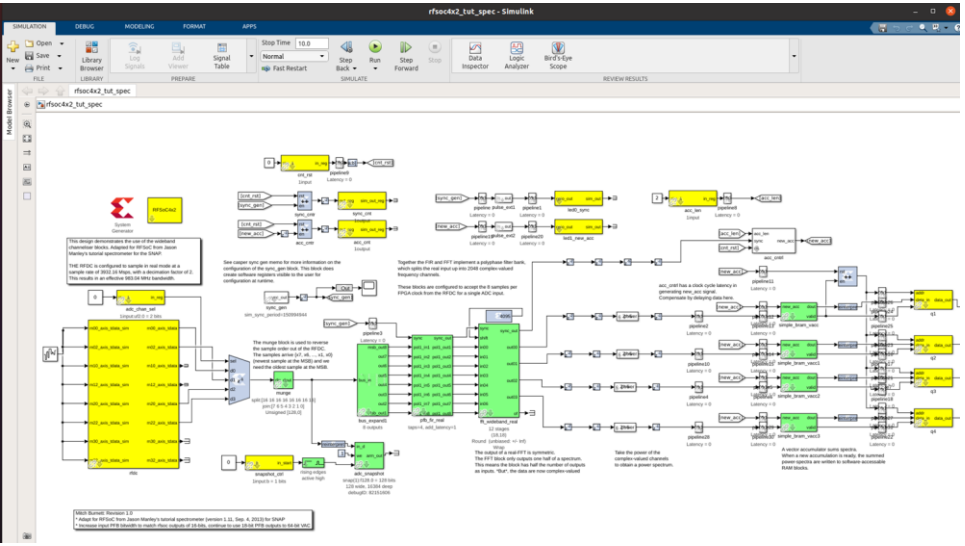
- **Historic Agreement with Yale and Columbia University, (1965-2015)**
- China: National Astronomic Observatory of China, (NAOC), Chinese Academy of Science (CAS) (1991- today).
- Rusia: Lomonosov Moscow State University, Sternberg Astronomical Institute. (MASTER) (2011-today)
- Germany: Institute of Astronomy and Space Physics (IAFE-CONICET), MaxPlank (MPE and MPS).
- Brazil: Mackenzie Presbyterian University (UPM), Brazil. High Altitude THz Solar photometer" (HATS). 2024
- USA: University Corporation for Atmospheric Research (UCAR), National Center for Atmospheric Research (NCAR), EEUU. Project COSADA.
- USA: University of Texas Rio Grande Valley: Observation of Astronomical Transient Events. Optical counterparts of GRBs and Gravitational Waves. 2024
- Spain: IGN/Yebes : Radio Astronomy and Space Geodesy. (2022-today)
- France: Centre National d'Études Spatiales" (CNES) y el "Institut Géographique National" (IGN)
- Italy: Italian Space Agency: Determination and monitoring of space debris. 2024
- Waiting for your collaboration!!

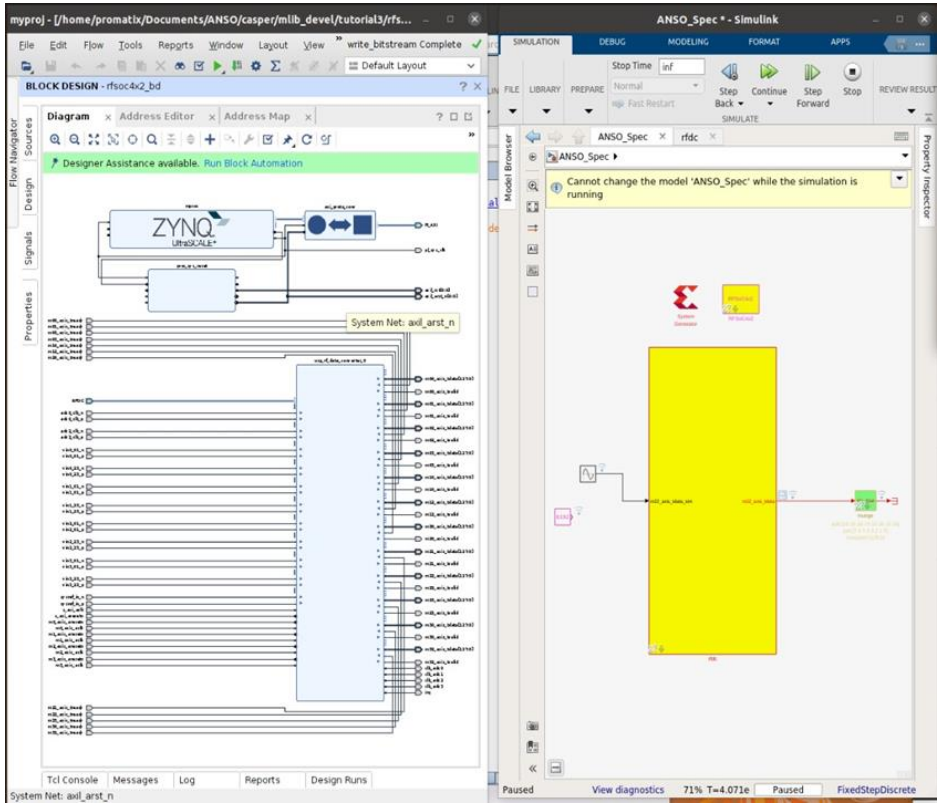
Future Works: CART Digital Back-End

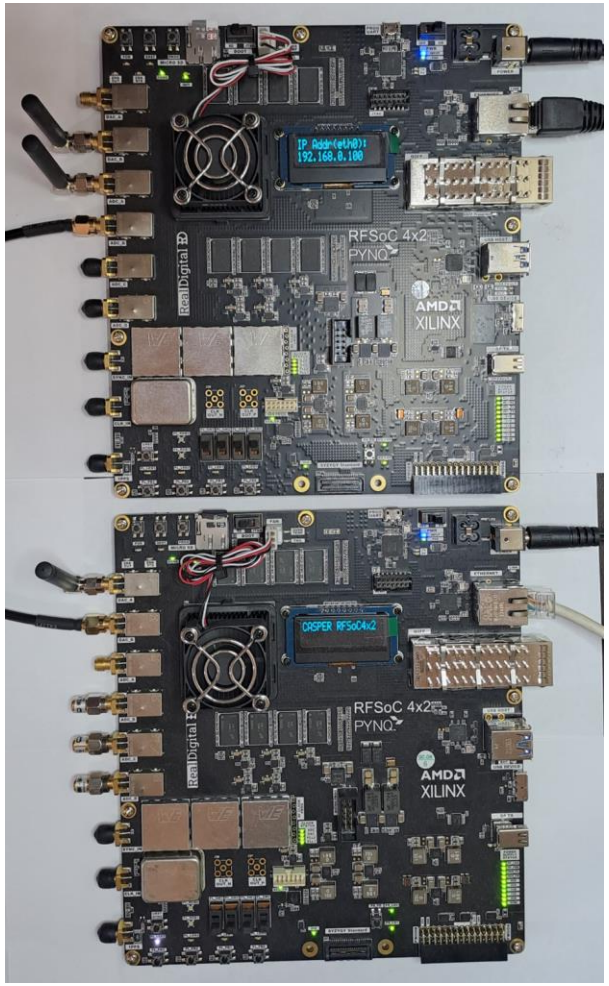
Development of Digital Back End using Software Defined Radio: RFSoC4x2

- Collaboration with Argentina Institute of Radioastronomy (IAR)
- Tone Generator - PYNQ
- Spectrometer - CASPER Community









Timeline

- Bid Opening for S/X band receiver manufacture: 3Q 2024
- Finish Mechanical Assembly: 1Q 2025
- Arriving of electrical parts and electronic control systems: 2Q 2025
- Install S/X band receiver, testing and first light: 3Q 2025
- CART operational on 1Q 2026

THANKS!!

QUESTIONS???

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