Continuous Flow Cryostat control system and prototype tests

Encuentro RIA-TEC2SPACE:
Desarrollo y explotación de nuevas tecnologías para insrumentación astronómica
Madrid, 19 a 22 de abril de 2022

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http://www.fractalslne.es

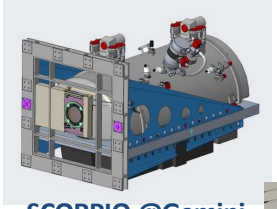
FRACTAL S.L.N.E.

Providing services and products for professional Astrophysics since 2005

https://www.fractalslne.es/ https://www.fractalslne.es/files/FRACTAL-Services-Instrumentation-and-software-general.pdf

Instrumentation

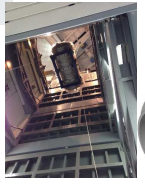
- Management and System Engineering services
- Optics, Mechanics and Opto-mechanics, Cryogenics
- Design, Development, Integration and Tests



SCORPIO @Gemini

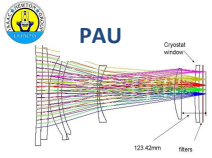
MEGARA@GTC

TSPM 6.5m



CARMENES

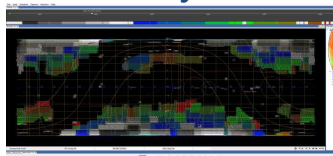
3.5m TARSIS



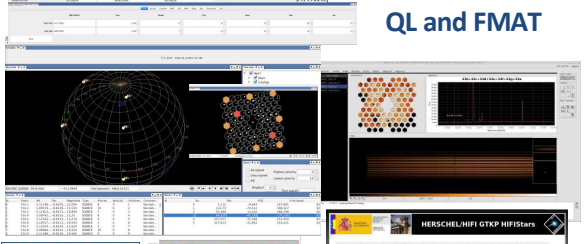
PAU

Integration at UCM laboratory

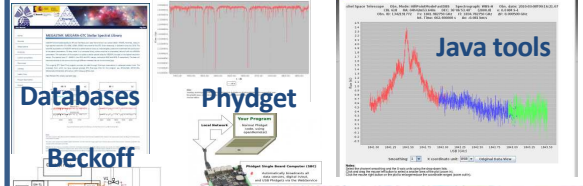
Control System & Software Tools



Euclid Mission planning



MEGARA User's tools QL and FMAT



Databases Phydget Java tools Beckoff

AstroJobs

Training General, in-house courses, in masters.

VPH gratings

Partnership with Wasatch Photonics

ESO TT-based products

Continuous-Flow Cryostats AV mounts

Management and System Engineering SW Tools

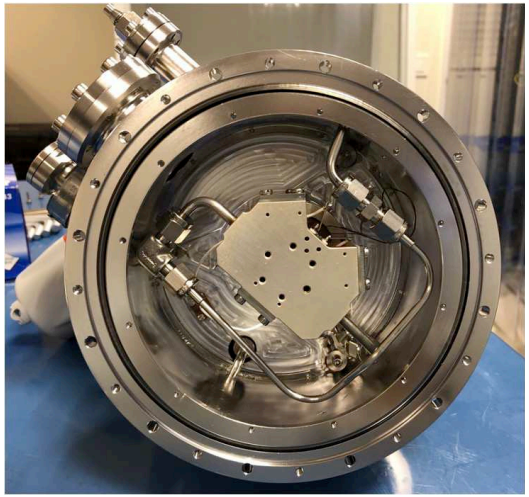
GECO	Configuration Control
DOCMA	Documentation Management
MANATEE	Project Management
LLAMA	Laboratory Management
SUMO	Operations and Maintenance

Also, at RIA-TEC2SPACE 2022:

- *Mechanical and thermal simulations to optimize performance and image quality in SCORPIO 8-channel imager and spectrograph (Manuel Maldonado)*
- *FRACTAL. Engineering services for professional Astrophysics (María Luisa García-Vargas)*
- *MEGASTAR and HR-pyPopStar: databases and web-based software tools (Emma Mujica Alvarez)*

Continuous Flow Cryostats (CFC)

Technology Transfer Licence Agreement for Cooling System developed by ESO



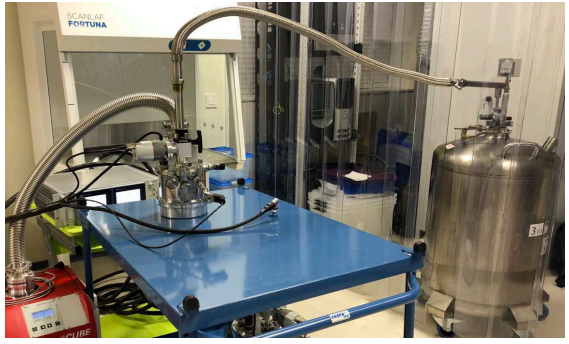
Agreement to license its cooling system technology to **FRACTAL S.L.N.E.** This technology were first developed at ESO for the cooling of instruments and detectors for the Very Large Telescope (VLT). **FRACTAL S.L.N.E.** produces these element as per client request.

CFC is mass invariant and more compact than traditional systems that use LN_2 bath, but share the advantage of being vibration free. CFC allows the temperature within an instrument to be changed from room temperature to –193° C and is less affected by the loss of electrical power. Then, the instrument can be kept very close to its operating temperature and the vacuum within the instrument can be retained. Besides, LN_2 refilling periodicity is largely spaced and, therefore, maintenance resources can be optimized.

Continuous Flow Cryostats (CFC)

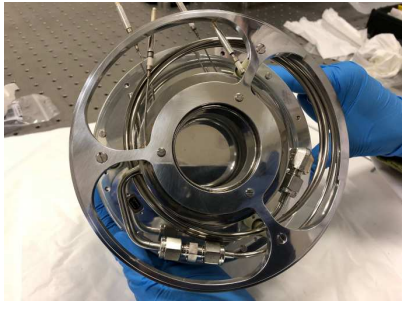
- **2021:** 4 Continuous Flow Cryostats (CFCs) for ESO have been manufactured, integrated and verified (3 lateral and 1 axial were delivered).

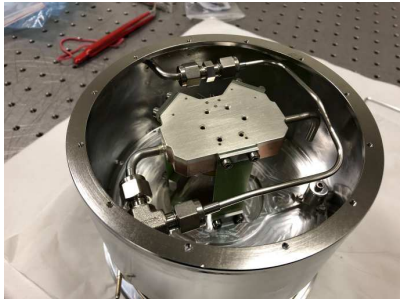





Customer: ESO
Matteo Accardo
Head of Instruments & Cryogenic Systems Group ESO

- **2022:** FRACTAL's CFC prototype is currently being integrated to be tested with the controller and control system developed by FRACTAL.

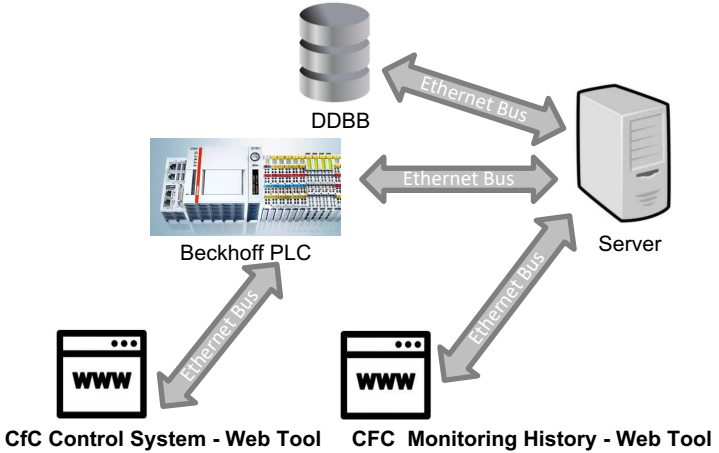



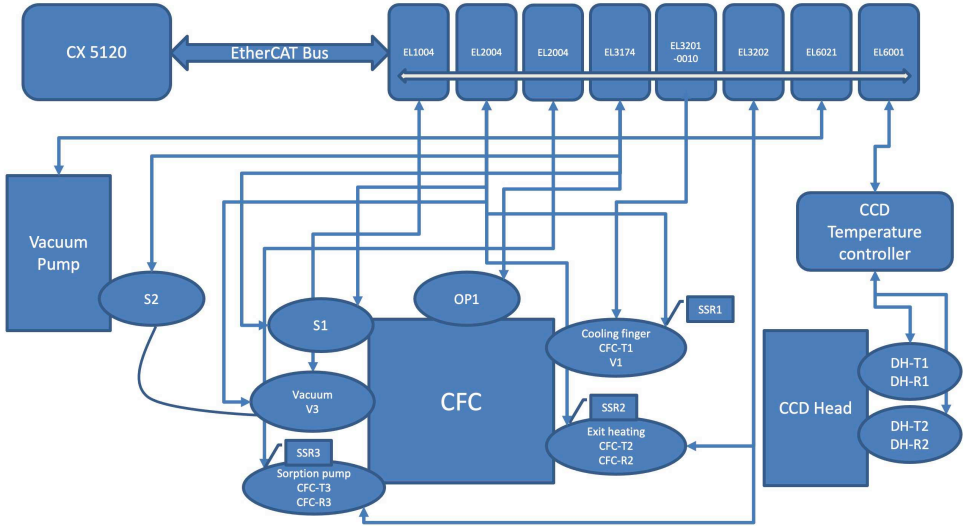


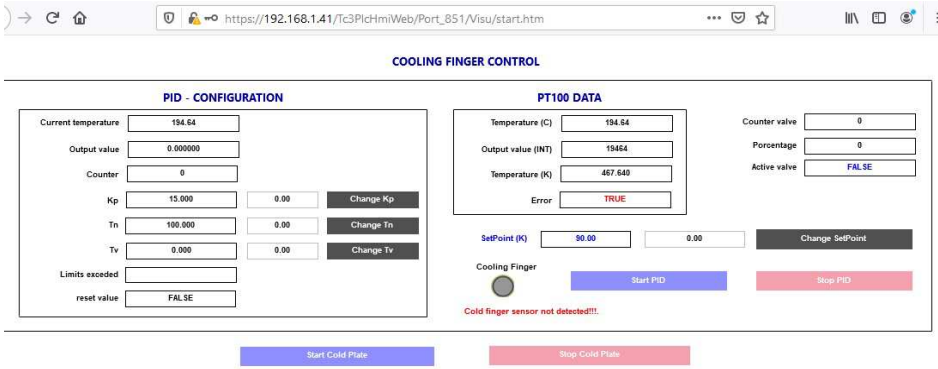
Continuous Flow Cryostats (CFC)

CFC controller based on Beckhoff technology

	Technology
PLC	Beckhoff CX Embedded PC
Bus	EtherCat
OS	TwinCat 3.1 (Beckhoff)
Programing Language	Structure text (ST), C++
Drivers	N/A (i.e, direct access to HW)





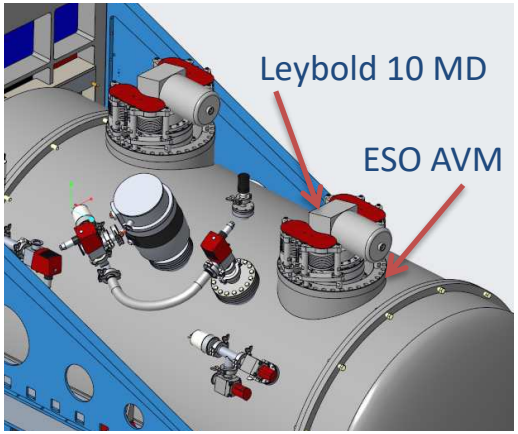


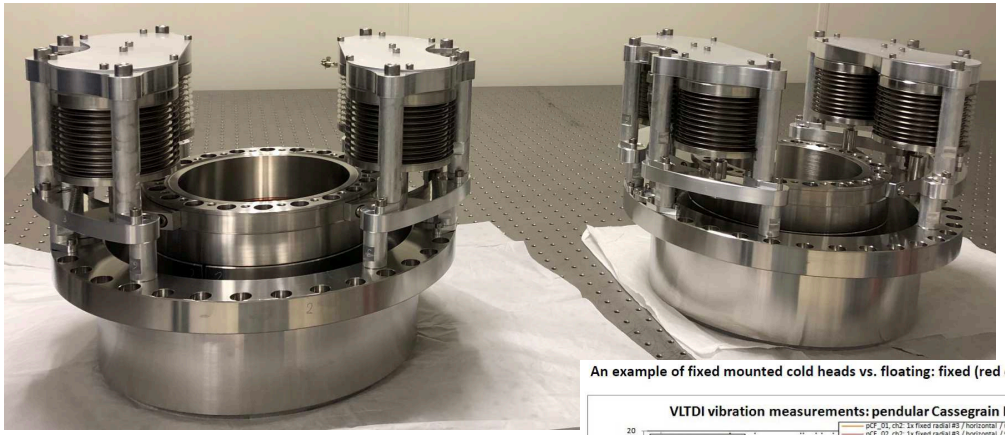
FRACTAL development

CFC control system software architecture

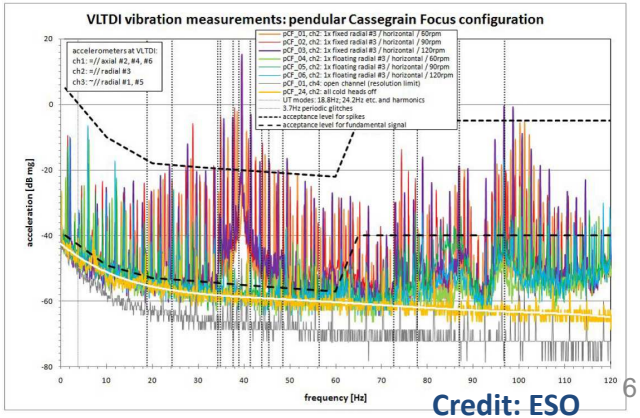
Antivibration mounts (AVM)

Technology Transfer Licence Agreement for AVM developed by ESO for closed cycle cooler cold heads





An example of fixed mounted cold heads vs. floating: fixed (red curves) and floating (green)



Credit: ESO

Agreement to license AVM for Closed Cycle Cooler Cold Head to **FRACTAL S.L.N.E.** AVM allows to reduce the cold head vibrations to the stability levels demanded for the instruments and the high stability demanded by the VLTI configuration. This system keeps the cold head fully floating between two soft bellows removing vibration coming from the motion of the heavy displacer.

FRACTAL has provided the 2 AVMs that will be integrated at SCORPIO (new instrument for Gemini).