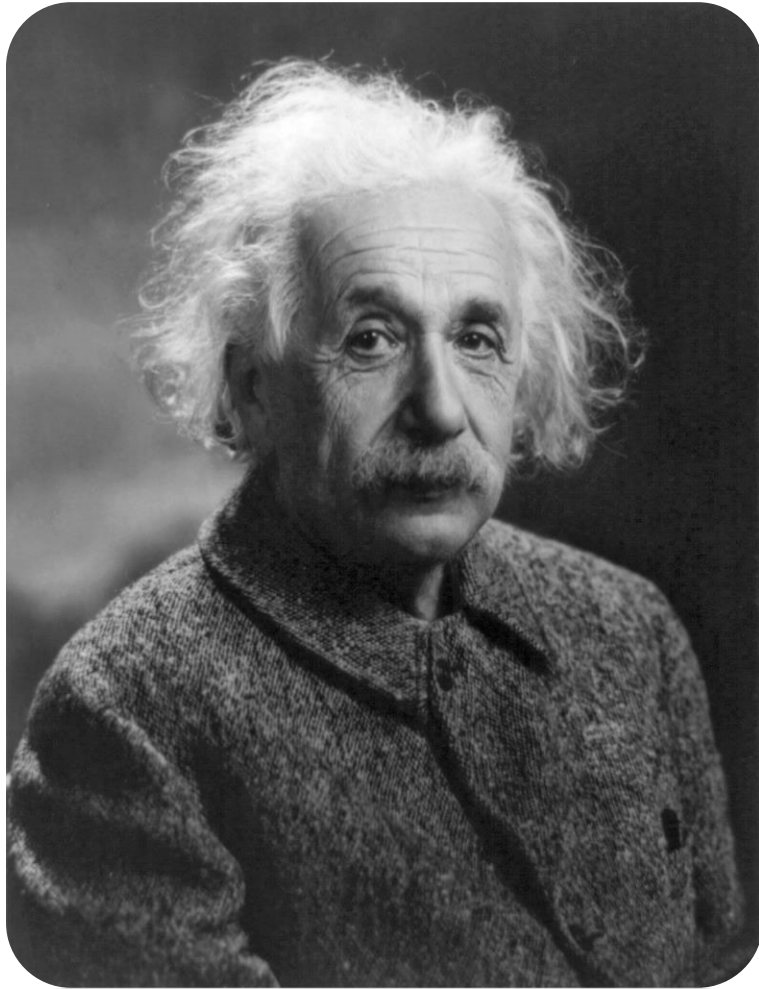


For more information please contact
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MD Demcon kryoz
pieter.lerou@demcon.com
+31 (0)88 – 115 20 00

From Science to Business
Sorption-based
Vibration-free cryocooling

From Science...



Who's this?



From Science...



Who's this?



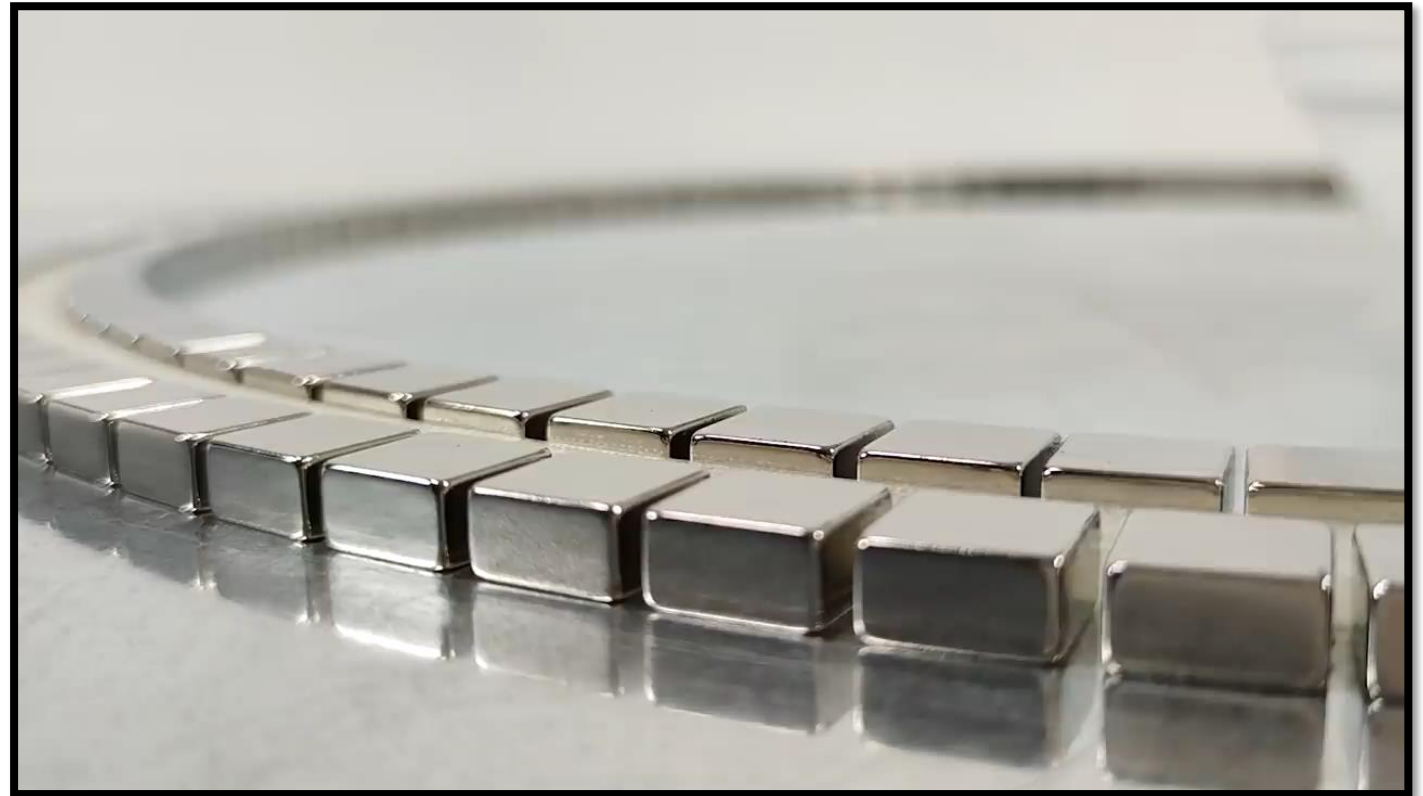
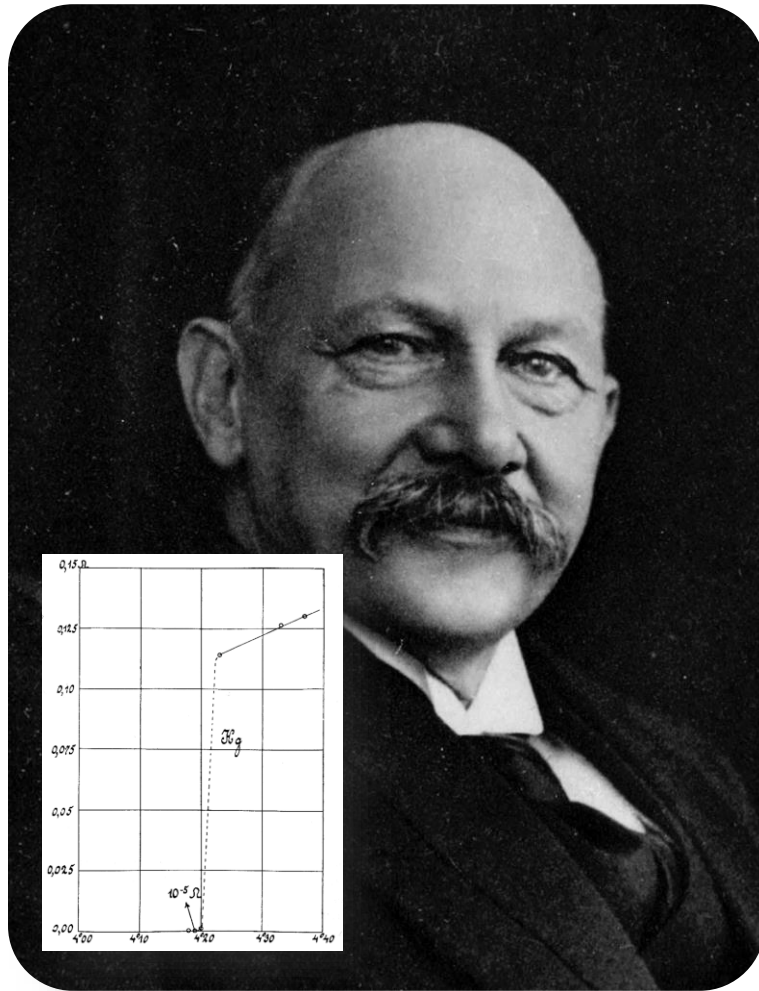
From Science...



Heike Kamerlingh Onnes, the Dutchman who, in 1908
liquified helium for the very first time in Leiden.



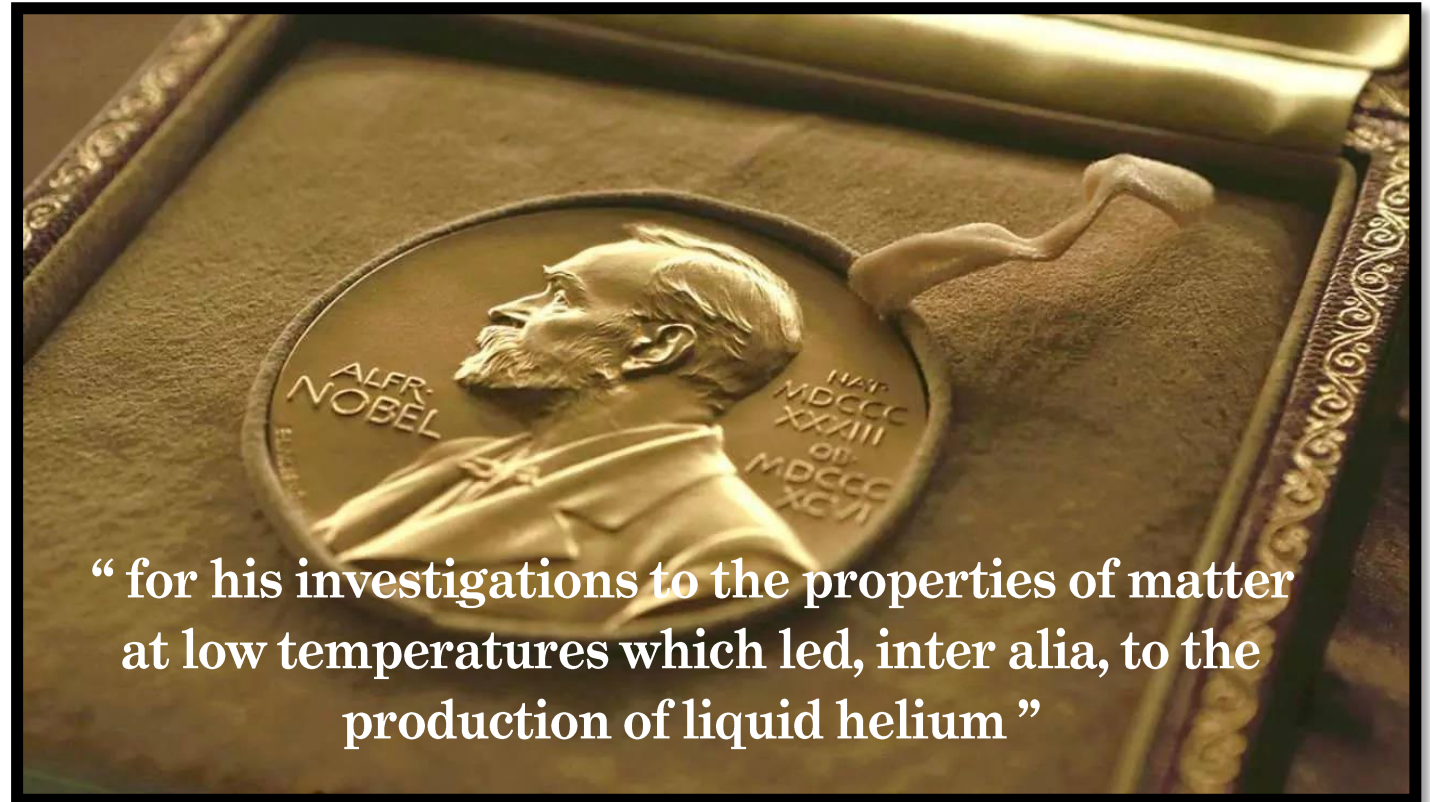
From Science...



And in 1911 discovered superconductivity.



From Science...



And got the Nobel price for it in 1913.



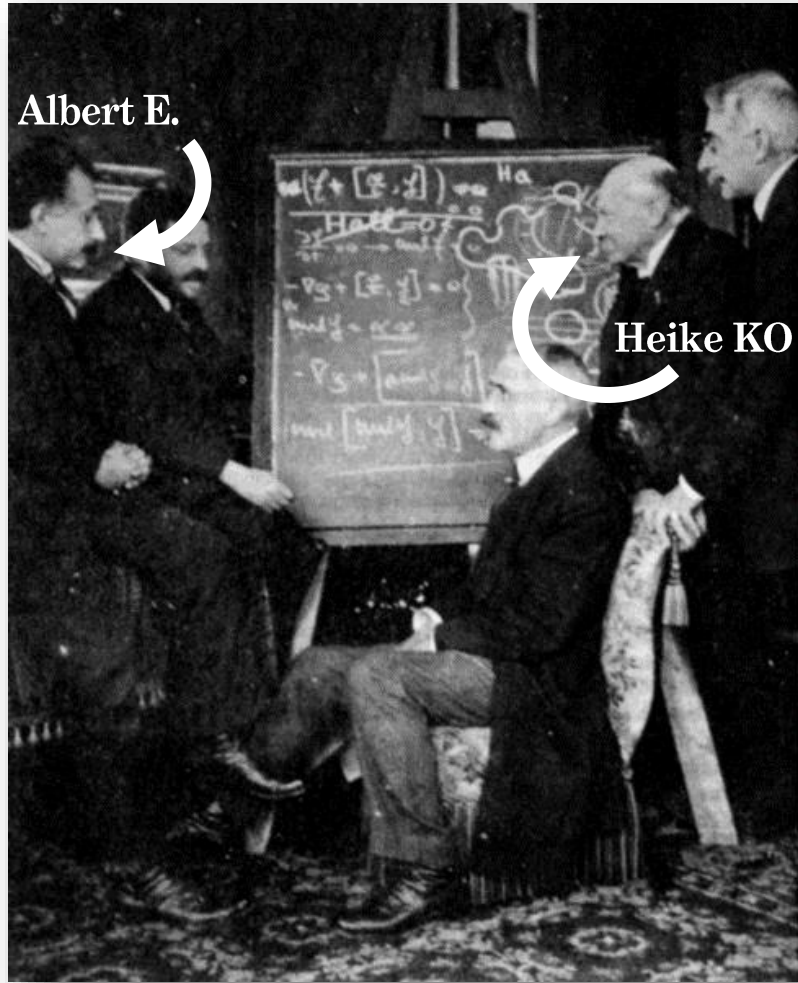
From Science...



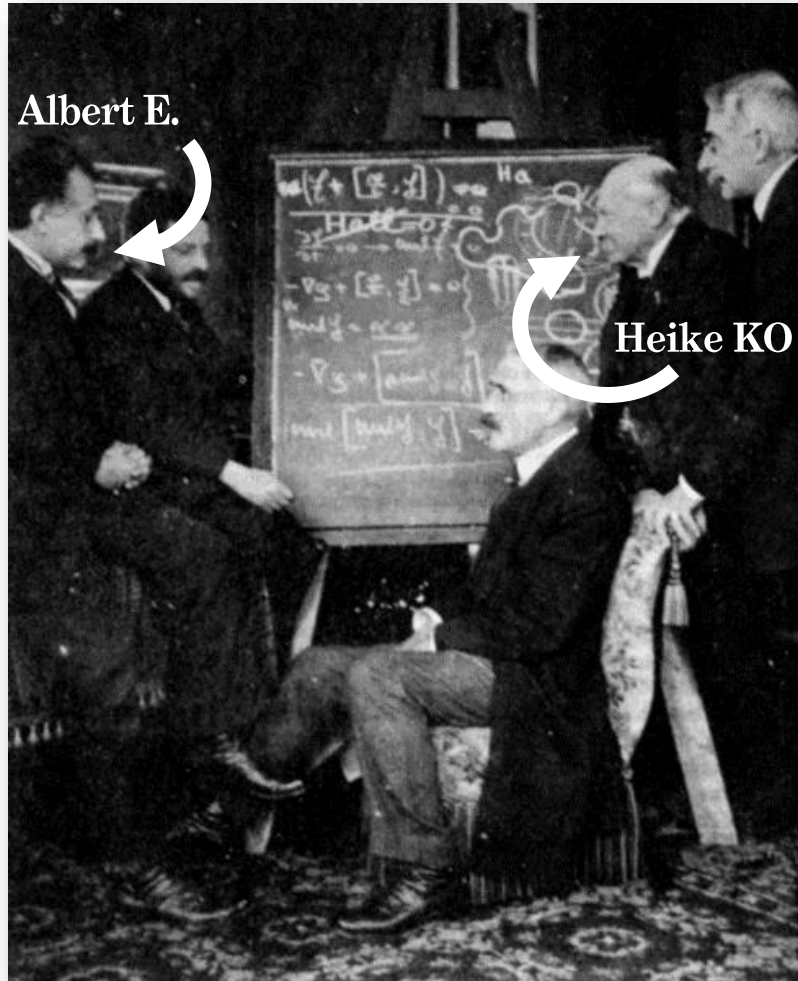
And turned down Albert Einstein as an assistant in his lab.



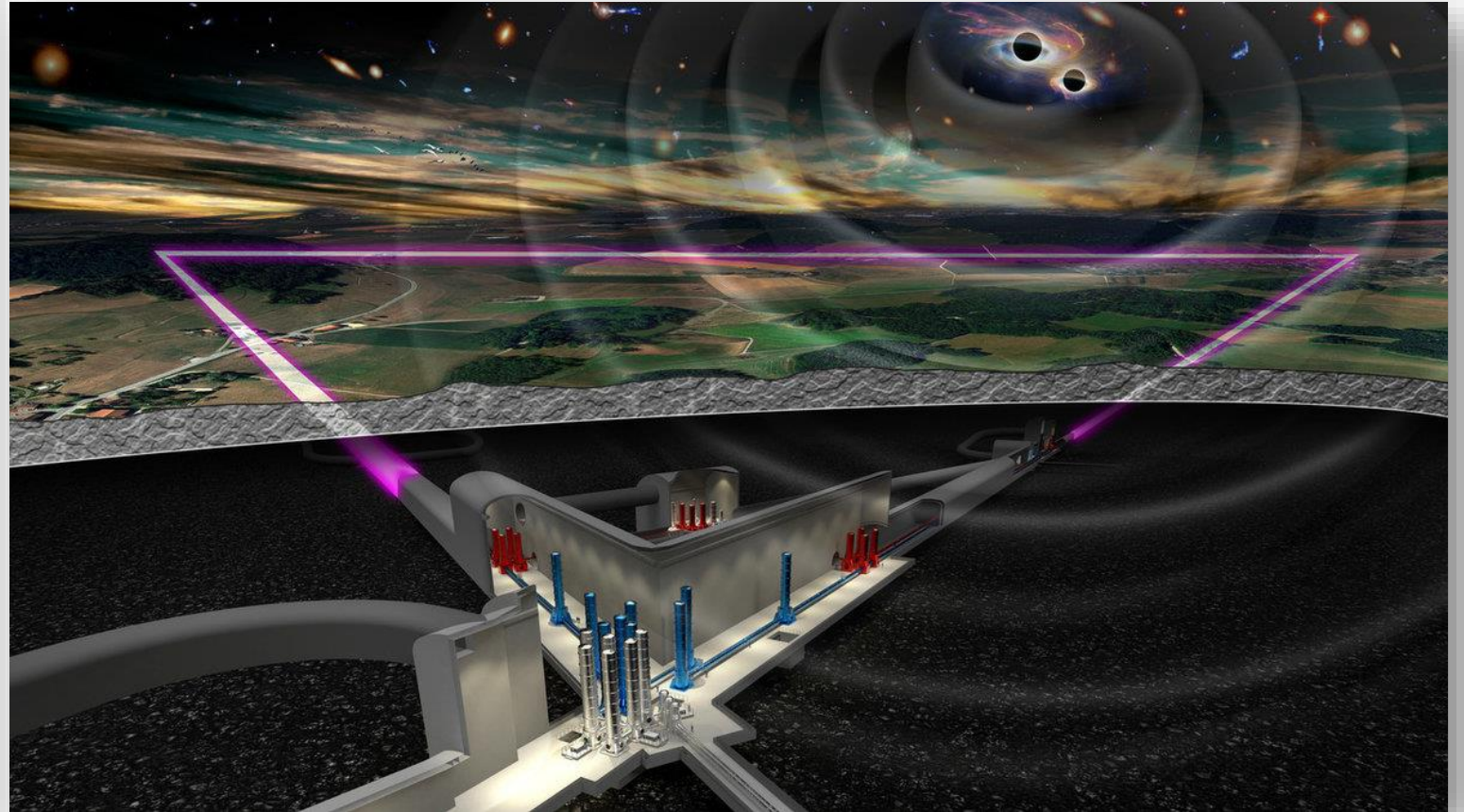
From Science...



From Science...



The Einstein (and a little bit Kamerlingh-Onnes) Telescope



The unique Cryogenic Network of the Netherlands

 **DEMCO**

 **DEMCON**

KRYOZ

 **JPE**


advanced cryogenics


COOLL


STIRLING
CRYOGENICS

UNIVERSITEIT TWENTE.

 Universiteit
Leiden

THALES
Cryogenics

Onnes
Technologies

 NOVA

 **LEIDEN CRYOGENICS BV**
Leader in Low Temperature Techniques

ASTRON

 **DEMCON** | kryoz



The ETPF Cryo Consortium



KRYOZ

Established system- and knowledge provider including vibration free cryocooling products.



Industrial producer of high-end activated carbon, currently used inside their domestic heat pump system.

UNIVERSITY OF TWENTE.

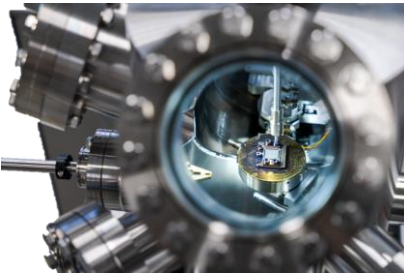
Proven track record on vibration free sorption cryocooling research.



DEMCON

- Developer and producer of high-end high-tech systems and products

- Thin-film PLD systems



- Miniature CryoEM cryocooler



- Cooler for space satellites



- Eye surgery fluidic pump



- Soldier mobile power system



- Laser communication system



- Unmanned, autonomous offshore platform

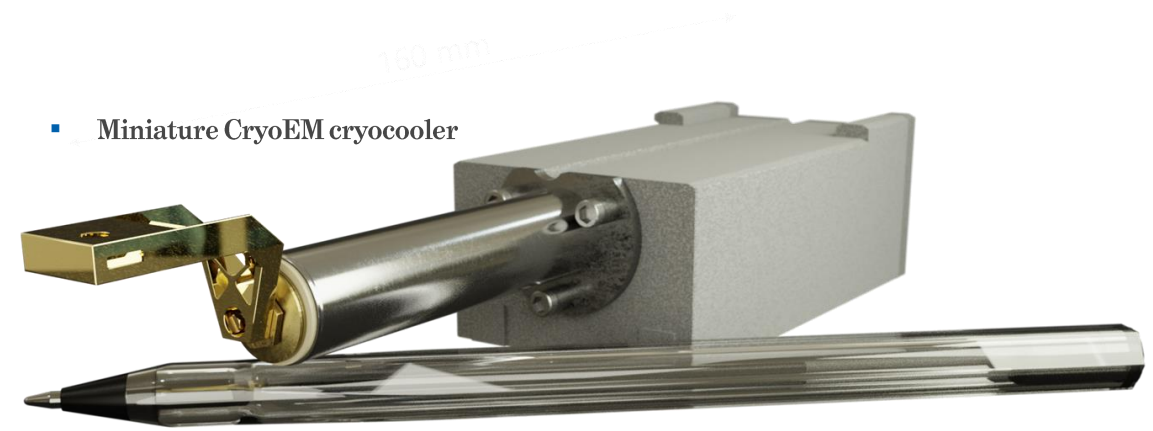


- Surgical stitch instrument



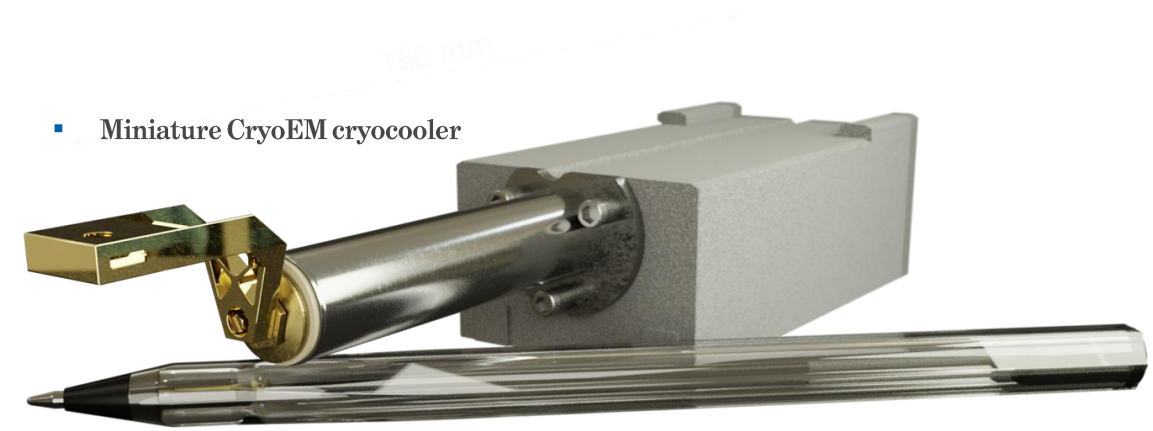
DEMCON kryoz - Zero vibration cryocooling

- Developed as a next generation cryocooler for high-resolution microscopy



DEMCON kryoz - Zero vibration cryocooling

- Developed as a next generation cryocooler for high-resolution microscopy

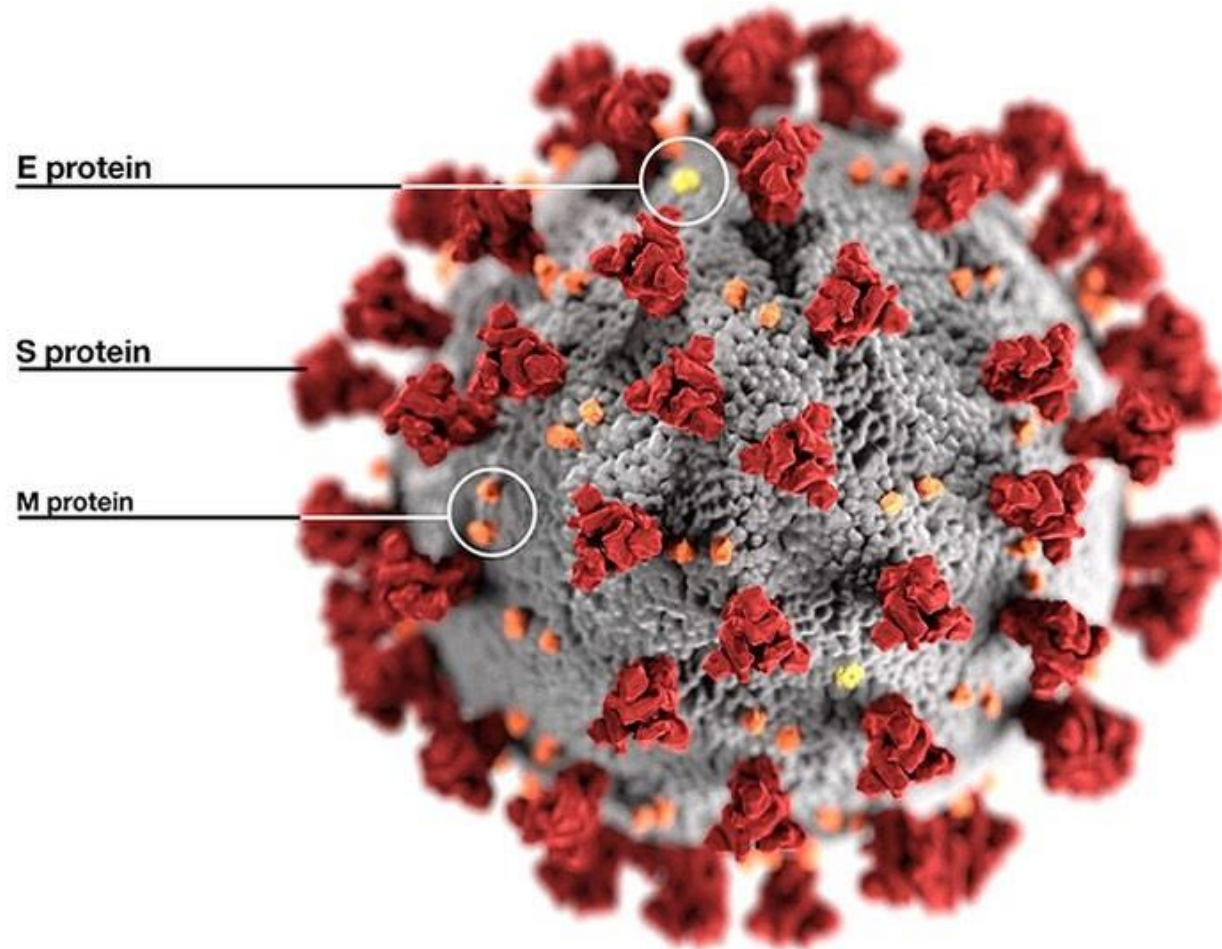


■ Miniature CryoEM cryocooler

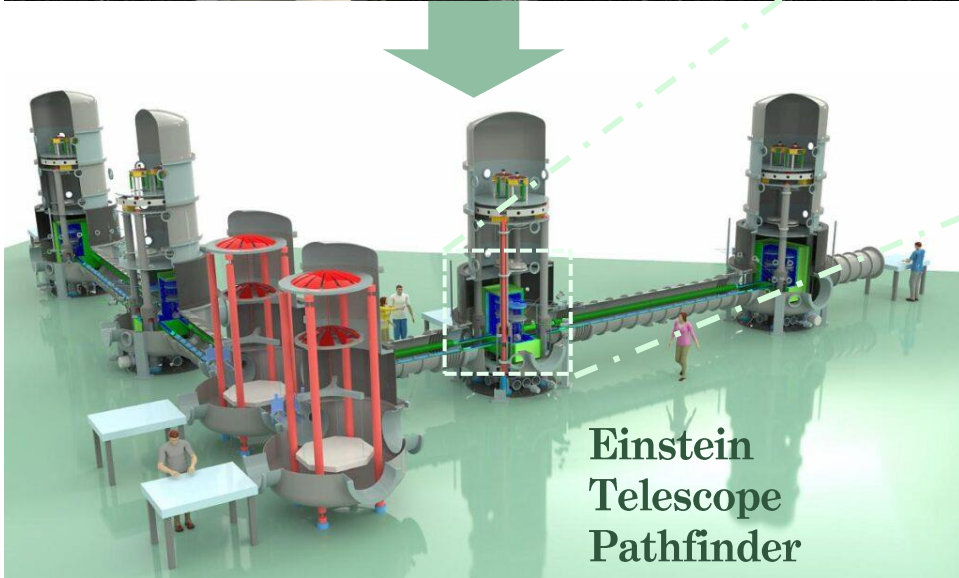
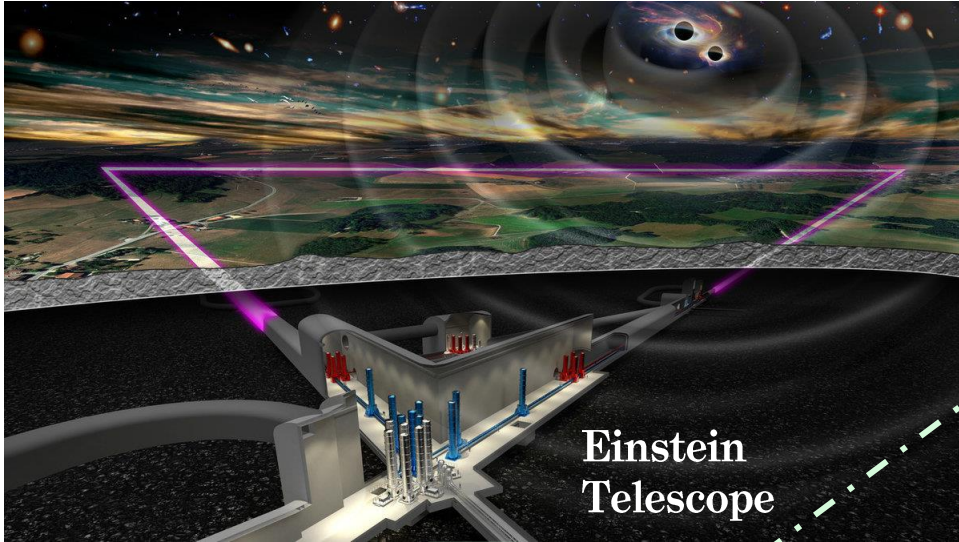


DEMCON kryoz - Zero vibration cryocooling

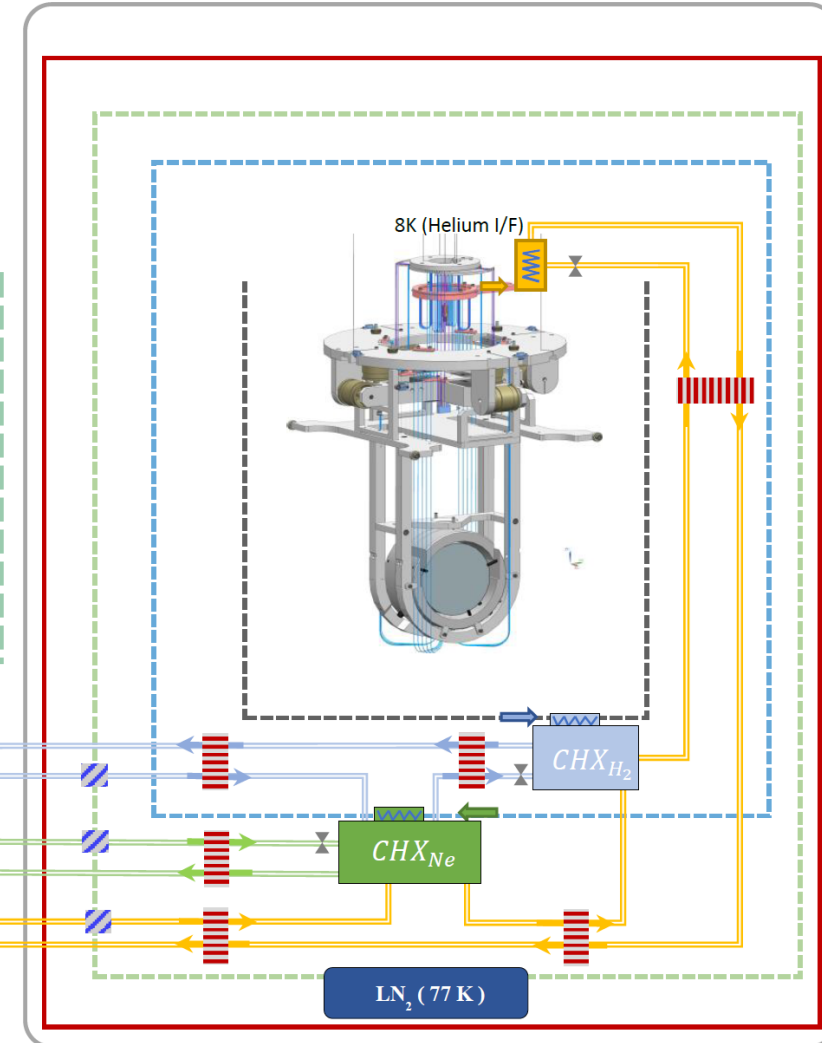
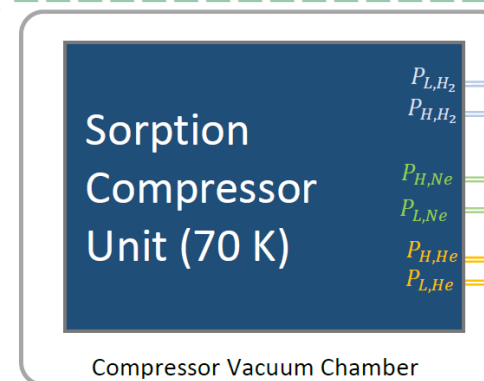
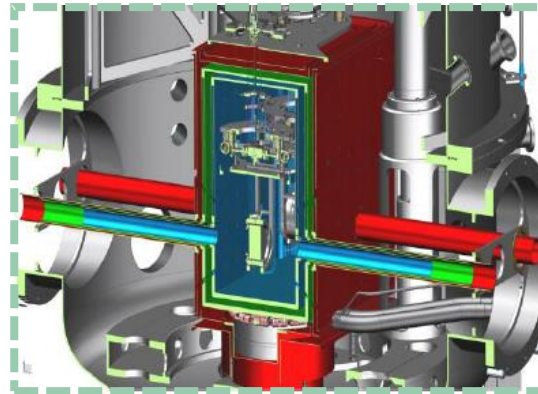
- Using this technology we are able to create pictures like....



Technology Domain 1 – Vibration free cooling

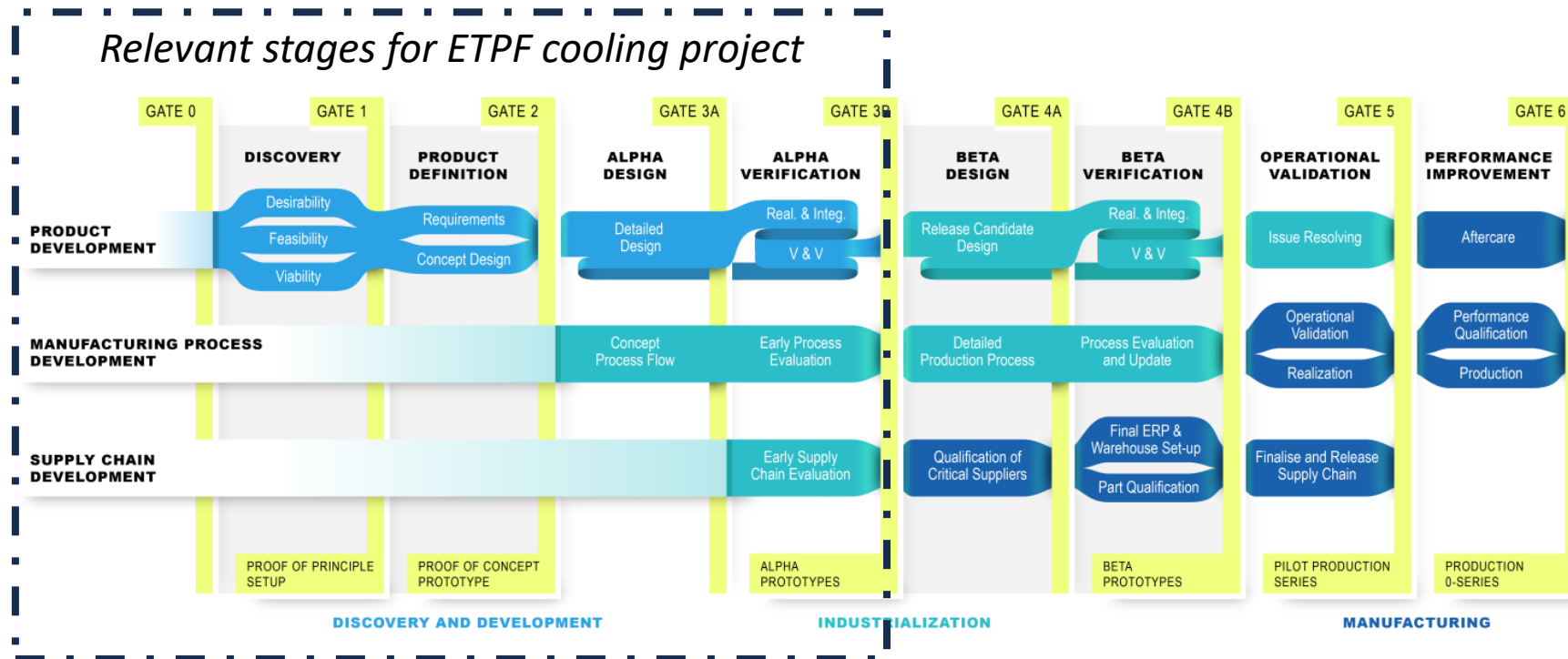


Sorption-based
Vibration-free cryocooler

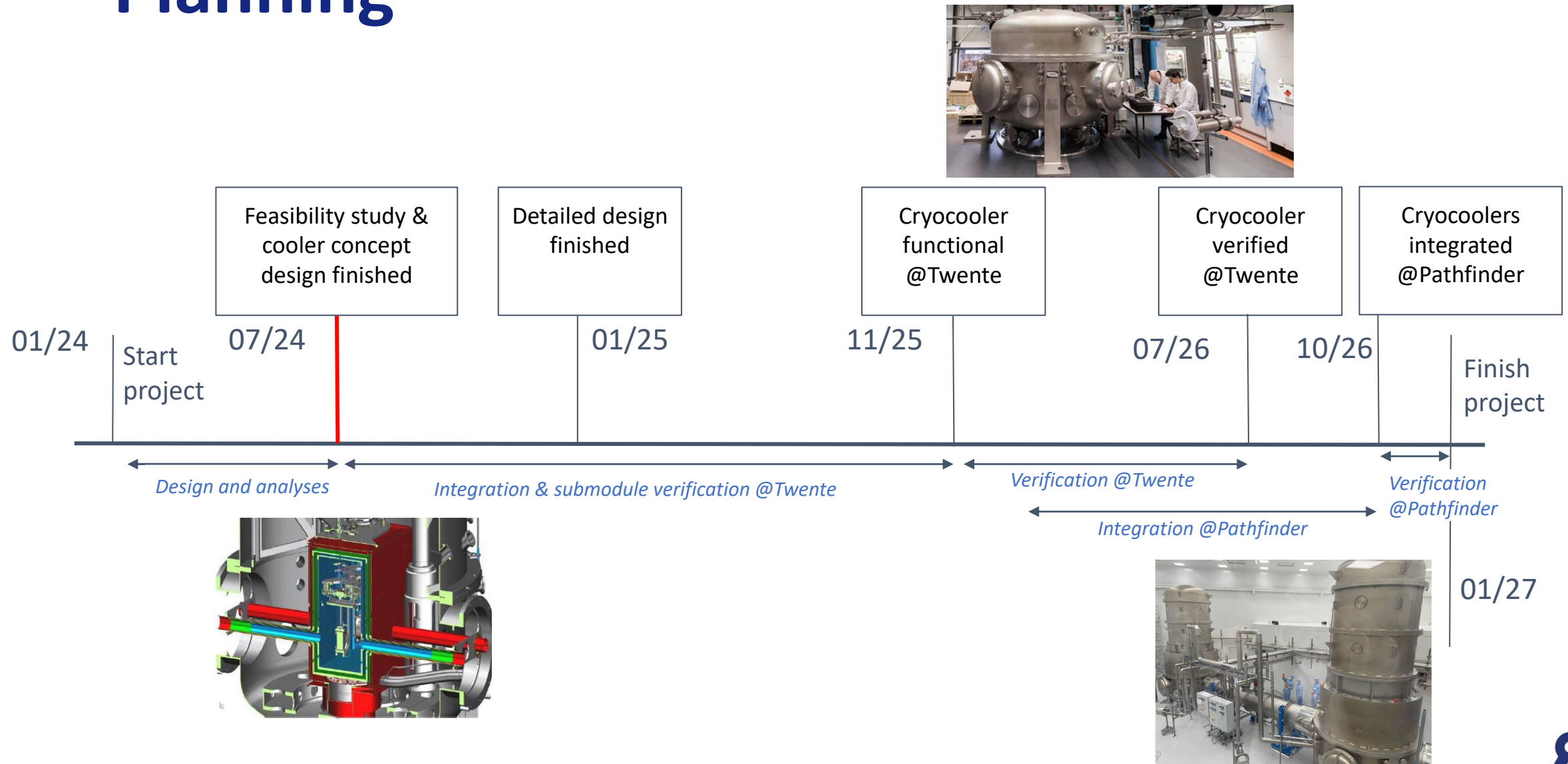


Project approach

We try to follow (as much as possible) our industrial product development and industrialization stage-gate model.



Planning



Status

Requirements / Specifications / Traceability

Einstein Telescope

Customer Requirements

1798 - Zero-vibration Suspension Cryocooler for Einstein

Author(s):

Partner: DEMCON Kryoz
Function & name: Name: Signature: Date: 1798-01-01
Signature: Date: 1798-01-01

Document Approval

Function: Customer representative
Name: Name: Signature: Date: 1798-01-01
Signature: Date: 1798-01-01

Partner: DEMCON Kryoz
Function & name: Name: Signature: Date: 1798-01-01
Signature: Date: 1798-01-01

Partner: Cool Sustainable Energy Solutions
Function & name: Name: Signature: Date: 1798-01-01
Signature: Date: 1798-01-01

Document Release

Partner: DEMCON Kryoz
Function & name: Name: Signature: Date: 1798-01-01
Signature: Date: 1798-01-01

Document Identification and Filing

Product: 1798
Version: 0.17
Status: Draft
Project: Project
Doc. ID: 1798-01-01
2578 PD 1563075348-18

Einstein Telescope

System Requirements

1798 - Zero-vibration Suspension Cryocooler for Einstein

Author(s):

Partner: DEMCON Kryoz
Function & name: Name: Signature: Date: 1798-01-01
Signature: Date: 1798-01-01

Document Approval

Function: Customer representative
Name: Name: Signature: Date: 1798-01-01
Signature: Date: 1798-01-01

Partner: DEMCON Kryoz
Function & name: Name: Signature: Date: 1798-01-01
Signature: Date: 1798-01-01

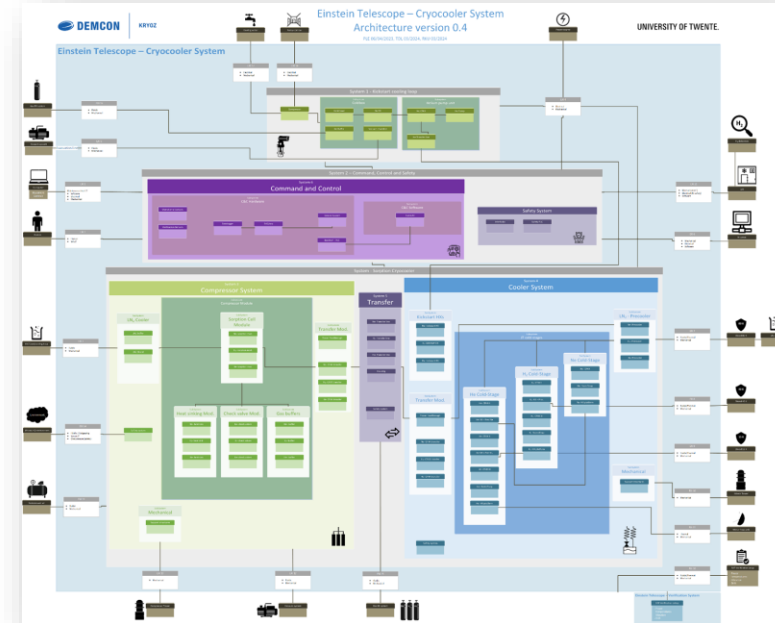
Partner: Cool Sustainable Energy Solutions
Function & name: Name: Signature: Date: 1798-01-01
Signature: Date: 1798-01-01

Document Release

Partner: DEMCON Kryoz
Function & name: Name: Signature: Date: 1798-01-01
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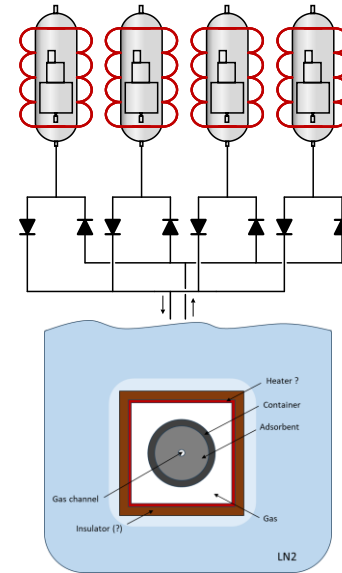
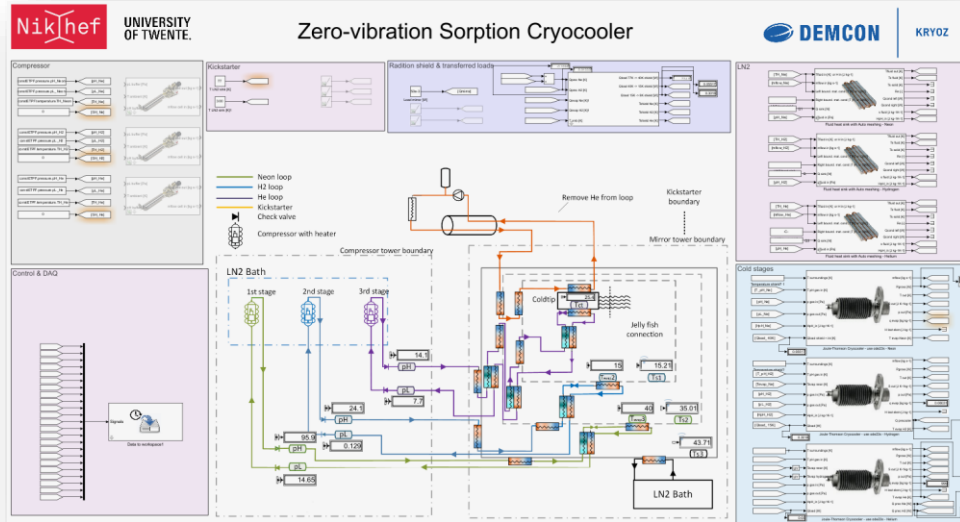
Risk Analyses and Management

Risk Analysis									
No.	Sequence of events (SOE)	Hazardous situation (HS)	Item (R)	Severity 1-2-3	Exposure 1-2-3	Probability 1-2-3	Consequence 1-2-3	DPK	Risk mitigation actions
Examples	U	Ends with slippery handle and sharp edge drops	Operator picks up the handle	Severe Cut	2	2	1	4	SOE: Prevent dropping by better grip on handle. HS: Instruction not picking up at handle. WS: ISO 7096 warning symbol on the blade of the handle. RS: Instruction to use safety device and helmet.
A	Load drops during lifting operation	Operator is hit with dropping load	Crushed limb	2	2	2	1	5	SOE: Instruction for qualified operator with certified handling. WS: Instruction to use safety device and helmet.
General									
101	Misses generated by various components	user exposed to food waste	Purposive handling damage/loss	2	2	3	1	5	SOE: Identified component: vacuum pump and isolator for use and check. If possible select components before SOE. WS: If possible, use safety conditions (ETPF facility). RS: Instruction not touching the food.
102	Damage during operation of equipment within the lab upon	Barrel/bulk in system: user exposed to ergonomic materials	burns / frostbite	2	2	2	1	4	SOE: If possible, design protection around custody components. WS: Instruction equipment handling to laboratory responsible and PFI. RS: Instruction to use safety device and helmet.
103	Toxic material used	user exposed to toxic levels of material	distress	2	1	2	2	3	SOE: Possible identified: thermal insulation material and gas. If possible prevent contact with material by design. WS: If possible, use safety conditions (ETPF facility) and PFI. RS: Instruction not touching the food.
104	Working parts exposed: user can access moving parts	User gets stuck between moving parts	crushed limb	2	1	1	1	2	SOE: Identified component: vacuum pump and isolator for use and check. COTS parts probably protection in place. Check during design. WS: PFI.
105	Installation is done at height	User falls	broken limbs	2	2	2	2	5	SOE: Effectiveness of maintenance and compressor tower are given. At UT location lights are weak lower. WS: PFI, only handling by trained personnel (ETPF facility and UT location). RS: Instruction not touching the food.
106	Lifting of parts	Parts are heavy and fall	broken limbs	2	2	2	1	4	SOE: Check design for handling and weight. If possible/invested add handling provisions in design (e.g. lifting). WS: PFI, only handling by trained personnel (ETPF facility and UT location). RS: Instruction not touching the food.
107	During installation, parts move unexpectedly, user gets stuck between moving parts	user is crushed between parts	crushed limb	2	2	2	1	4	SOE: Identified component: vacuum pump and isolator for use and check. COTS parts probably protection in place. Check during design. WS: PFI, only handling by trained personnel (ETPF facility and UT location) using variable equipment. RS: Instruction not touching the food.
108	An installation setting possible to do only with RIE and VCA heater	Exposure to various dangerous scenarios	distress	2	1	1	1	2	SOE: Consider installation plan and check with safety leader. WS: PFI, only handling by trained personnel (ETPF facility and UT location) using variable equipment. RS: Instruction not touching the food.
109	Maintenance performed: parts not fitted correctly	Exposure to various dangerous scenarios	distress	2	1	2	1	2	SOE: Consider maintenance instructions. WS: PFI, only handling by trained personnel (ETPF facility and UT location) using variable equipment. RS: Instruction not touching the food.
110	Electric safety / short circuit	user touches live parts	electric shock	2	2	3	1	5	SOE: Design according to relevant standards, perform EL safety tests during system integration and verification (E.g. Compressor module about 400V, probably 400VAC on input). WS: PFI, only handling by trained personnel (ETPF facility and UT location) using variable equipment.

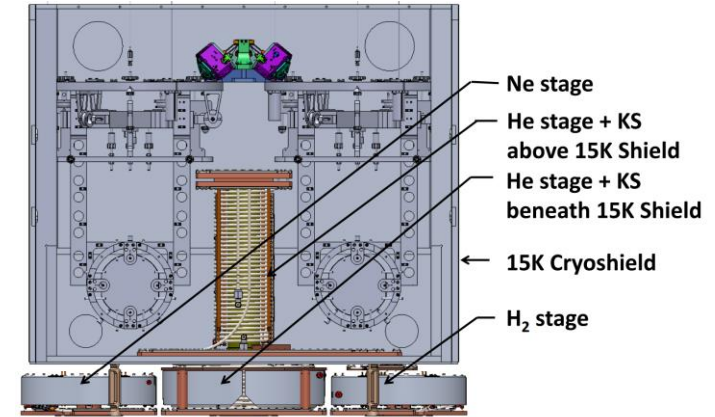


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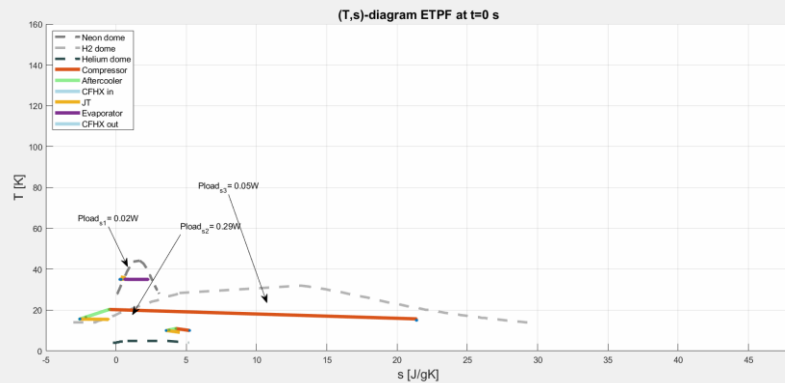
Full system – Simulations and analyses



Design – Concept & Detailed



Feasibility Analyses



Feasibility report

CD0

1788 - Zero-vibration Sorption Cryocooler for Einstein

Author(s)	DEMCOR Kryo	Partner:	University of Twente
Function & name:	Zero-vibration Sorption Cryocooler	Function & name:	Zero-vibration Sorption Cryocooler
Signature:		Signature:	
Date:	2023-01-10	Date:	2023-01-10
Partner:	Cool Sustainable Energy Solutions	Partner:	Cool Sustainable Energy Solutions
Function & name:	Zero-vibration Sorption Cryocooler	Function & name:	Zero-vibration Sorption Cryocooler
Signature:		Signature:	
Date:	2023-01-10	Date:	2023-01-10
Document Approval	DEMCOR Kryo	Partner:	University of Twente
Function & name:	Zero-vibration Sorption Cryocooler	Function & name:	Zero-vibration Sorption Cryocooler
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Date:	2023-01-10	Date:	2023-01-10
Document Release	DEMCOR Kryo	Partner:	University of Twente
Function & name:	Zero-vibration Sorption Cryocooler	Function & name:	Zero-vibration Sorption Cryocooler
Signature:		Signature:	
Date:	2023-01-10	Date:	2023-01-10
Document Identification and ETag	Project:	Version:	Status:
ETPF	0.3	Draft	
DF	1.0	Doc: 01	
DF	1.0	Doc: 01	

Page 1 of 6



Status

Critical function testing



*Verification / Validation
Test facilities*

**UNIVERSITY
OF TWENTE.**



Status

- In closed collaboration with other stakeholders (Umaastricht & NIKHEF)



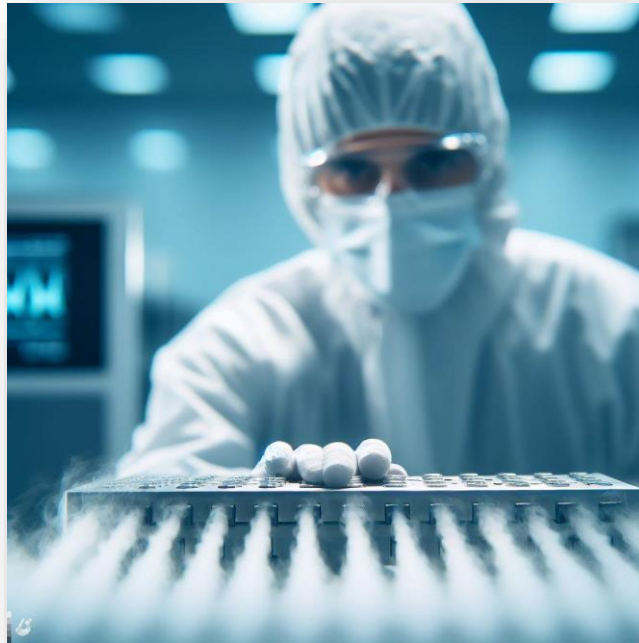
Organization and collaboration

1. Regular contact and collaboration (tech weekly, PM bi-weekly).
2. Generated PBS and defined responsibilities.
3. Consortium data sharing – (Sharefile, Teams, DMS).
4. Workshops, STAC meeting, visit ETPF site and ET-Liege.



Why DEMCON kryoz is interested in ET

- As DEMCON we are always interested in joining these “man-on-the-moon” type projects
- Broaden and strengthen national / international cryogenic network
- Interest in (ET) technologies and specific (cryo) technology development for other (commercial) applications



Valorization value

Spin-off opportunities

10 Kelvin sorption based vibration free cryocooling



***Life-sciences & material
research***



***Sample research at
(extreme) low
temperatures***



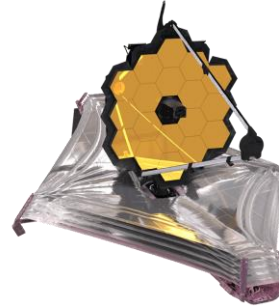
Semicon



***Cryocooling
superconducting
devices used in semicon
production machines***



Space



***Cryocooled (optical)
sensors in space
satellites or radio
astronomy antennas***

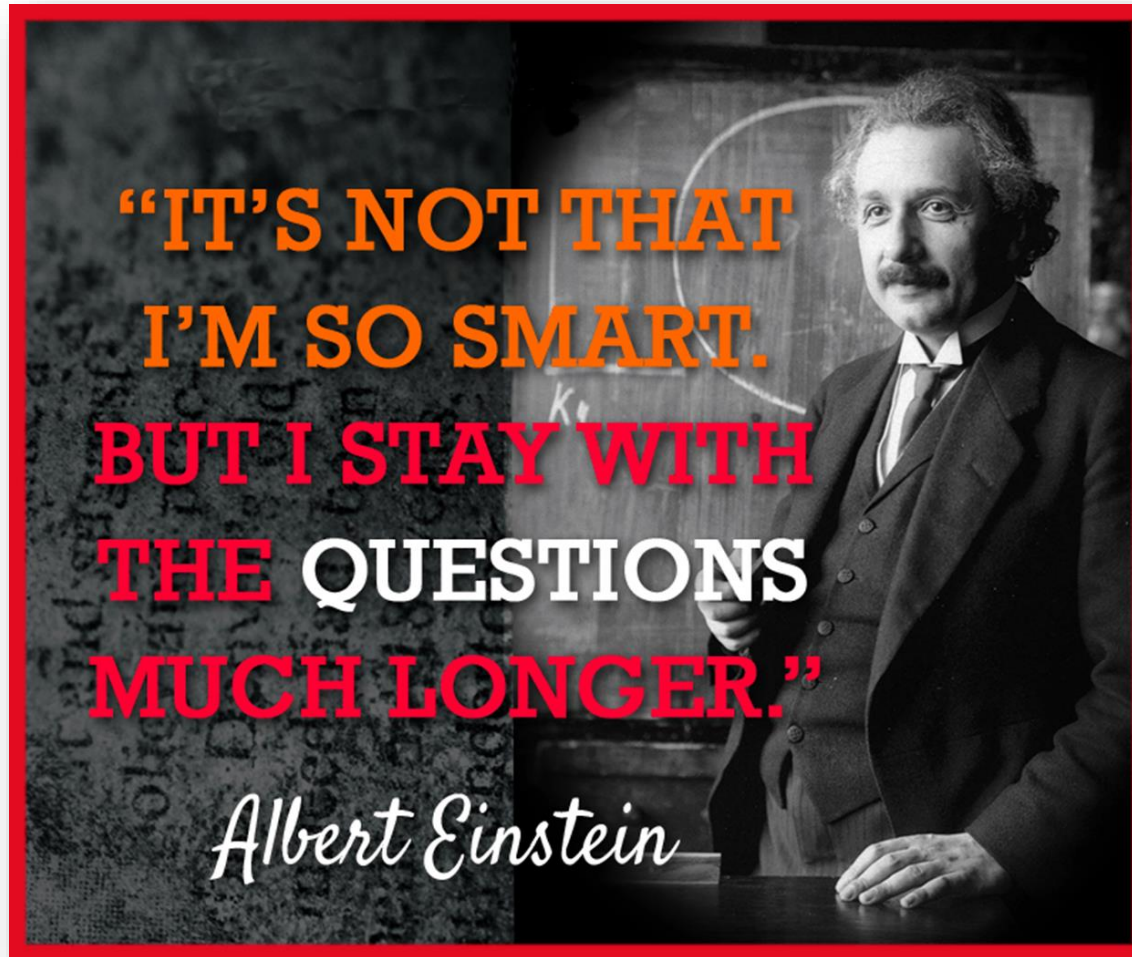


***Quantum
computing***



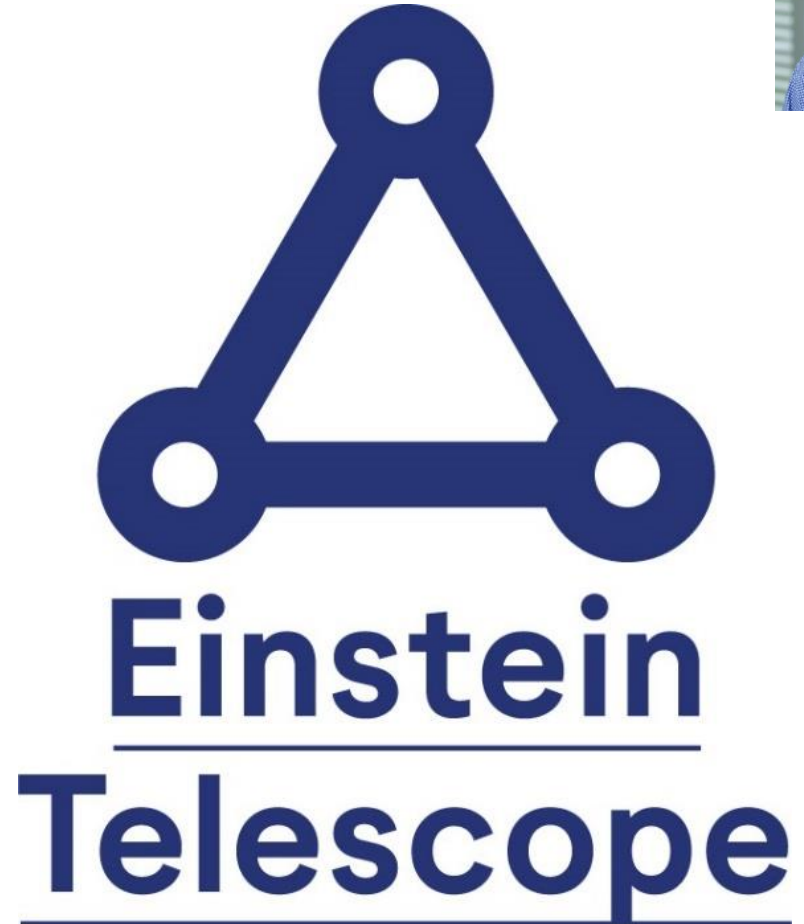
***(cost) efficient
cryocooling for
quantum computers***





Q&A





*For more information please contact
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MD Demcon kryoz
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+31 (0)88 – 115 20 00*