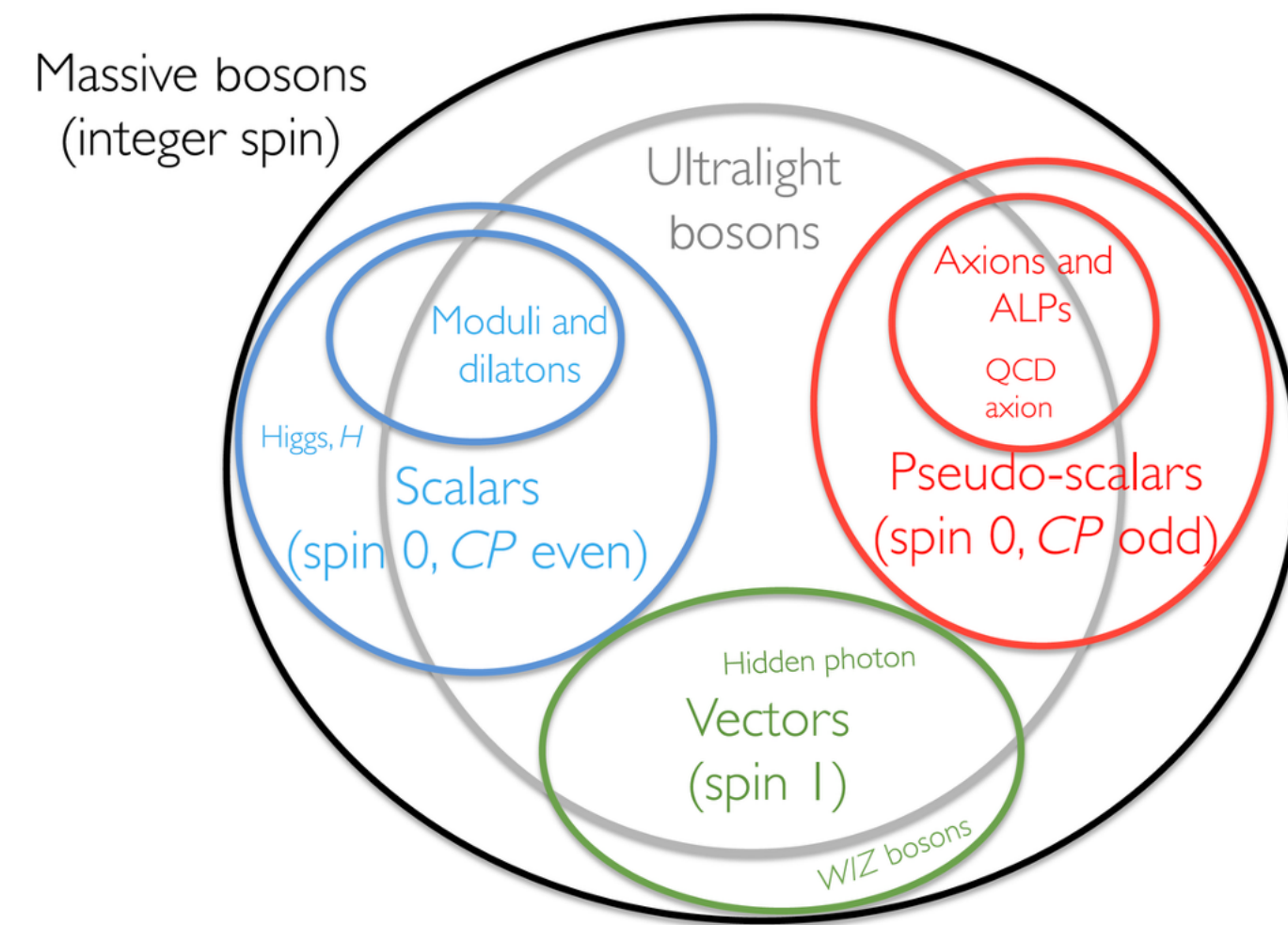


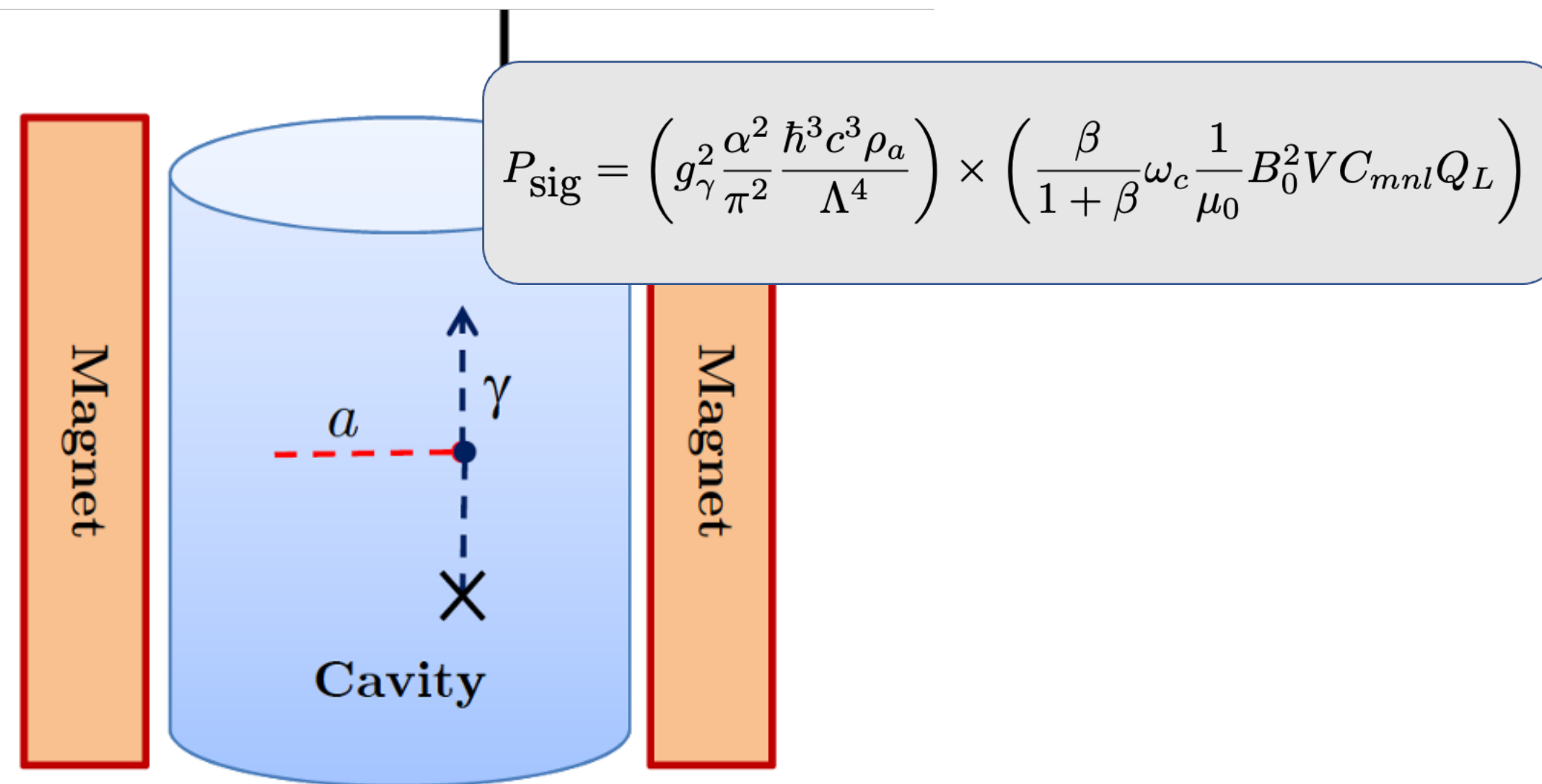
R&D proposal for Quantum and FLASH

R&D meeting 15.12.2025

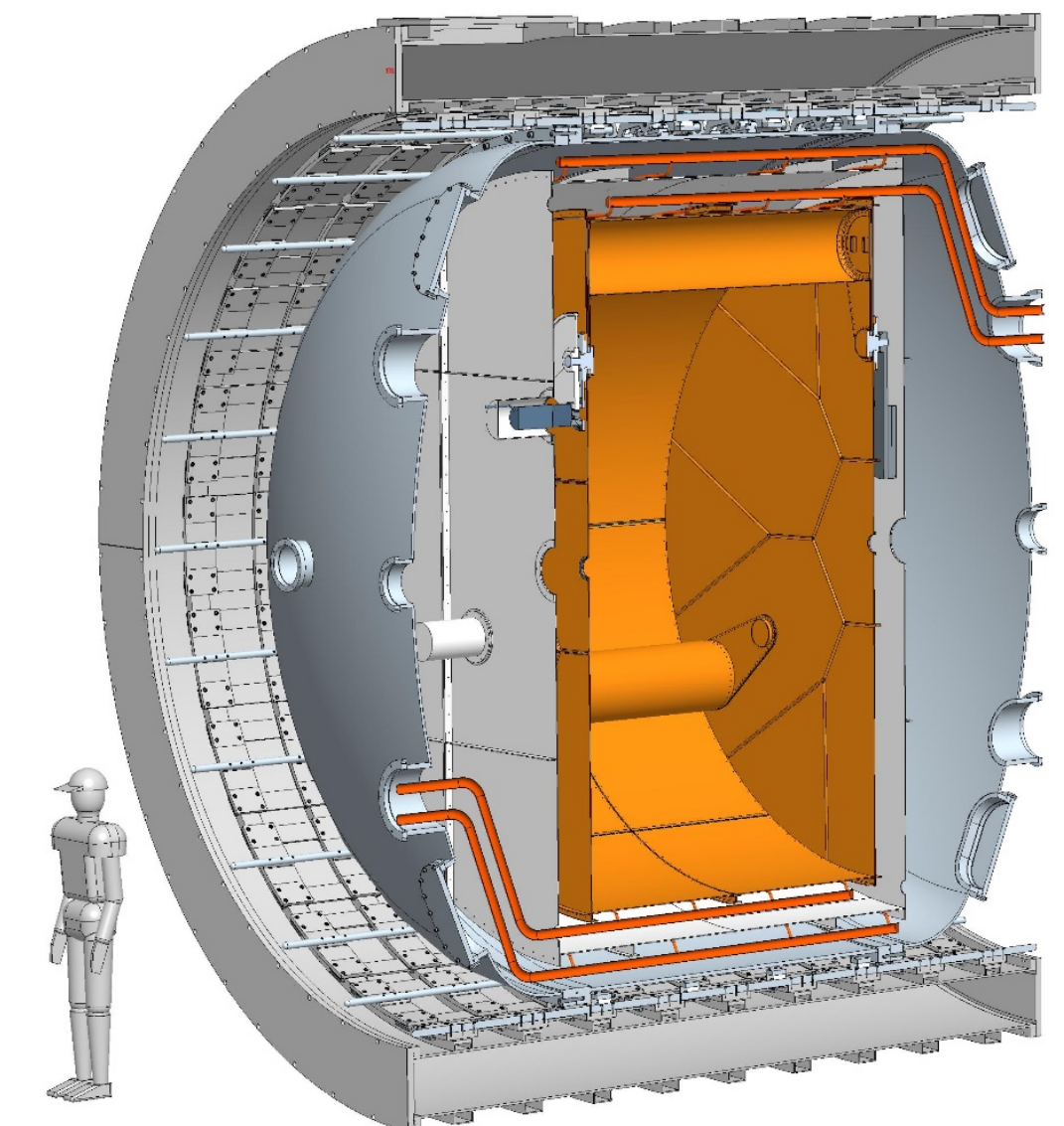
Halo-scopes at LNF: FLASH



- Dark matter search for particle interacting with the EM field
- LNF halo-scopes
 1. **QUAX@LNF**
(QUaerere AXions, Latin for “to search for axions”)
 2. **FLASH**
(Finuda magnet for Light Axion Search Haloscope)

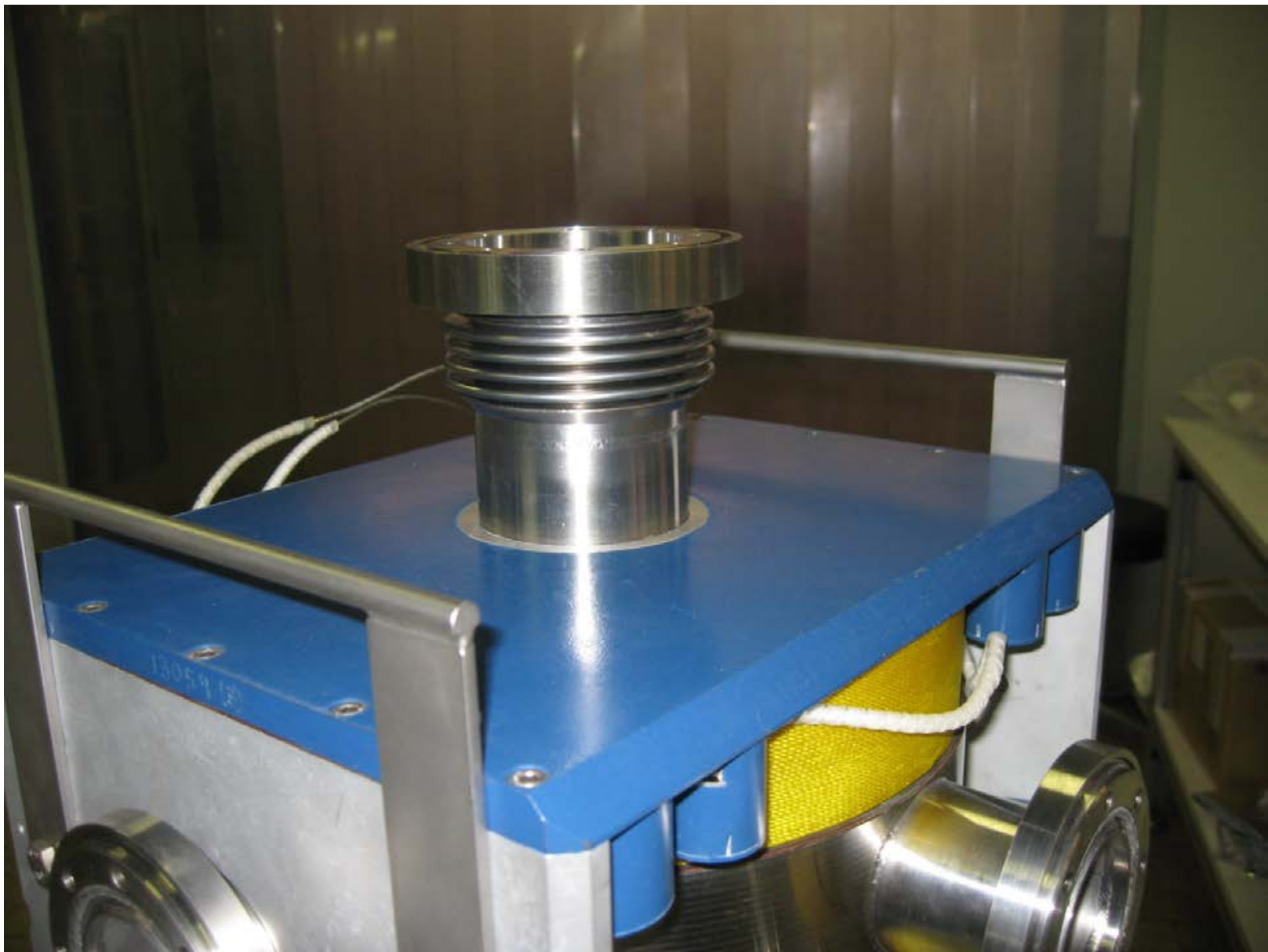


Sikivie Phys. Rev. D 32,11 (1985)



- **Cryogenic Laboratory for Detectors:**
 - Axion Dark Matter Experiments
 - Quantum Sensing with Superconducting Devices
 - Type II and HTC Superconducting Cavities
- Cryostat with a 8T magnet to be sent to the Liverpool University
 - ▶ AMI Magnet + PRESSMAGO Cryostat

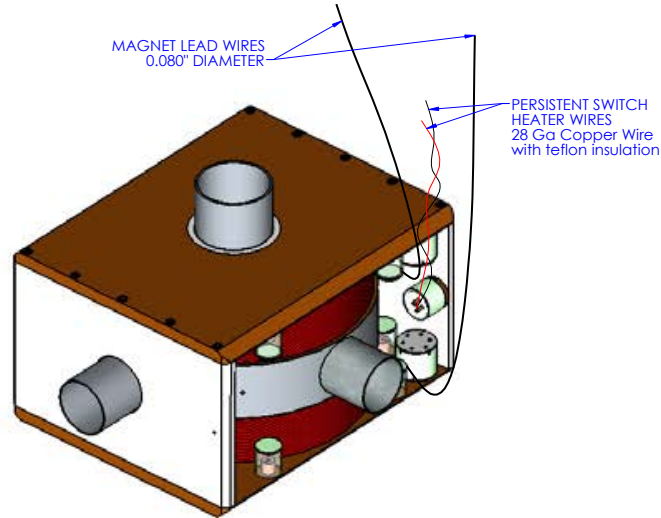
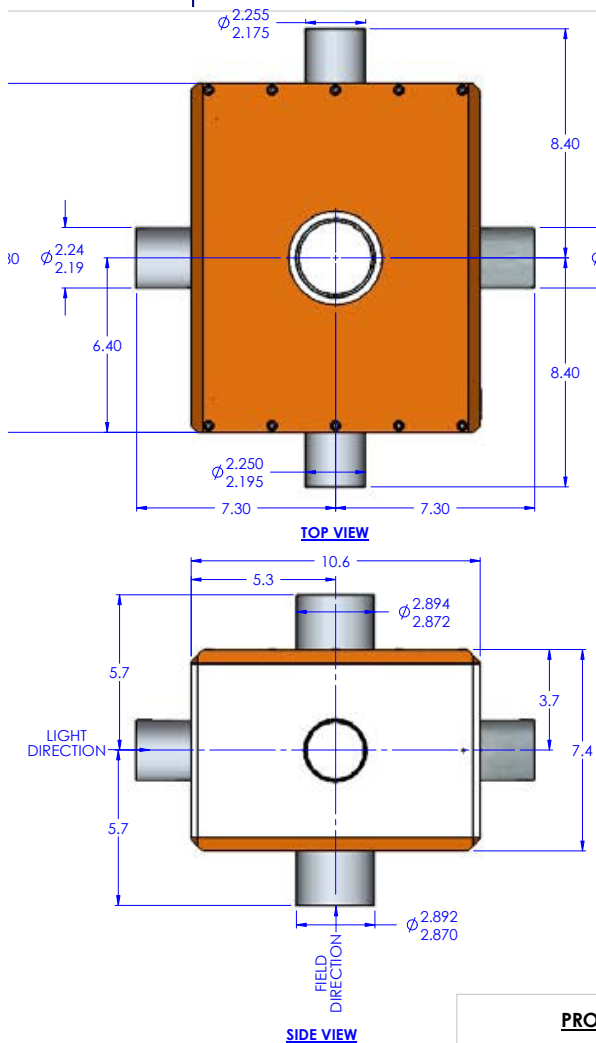
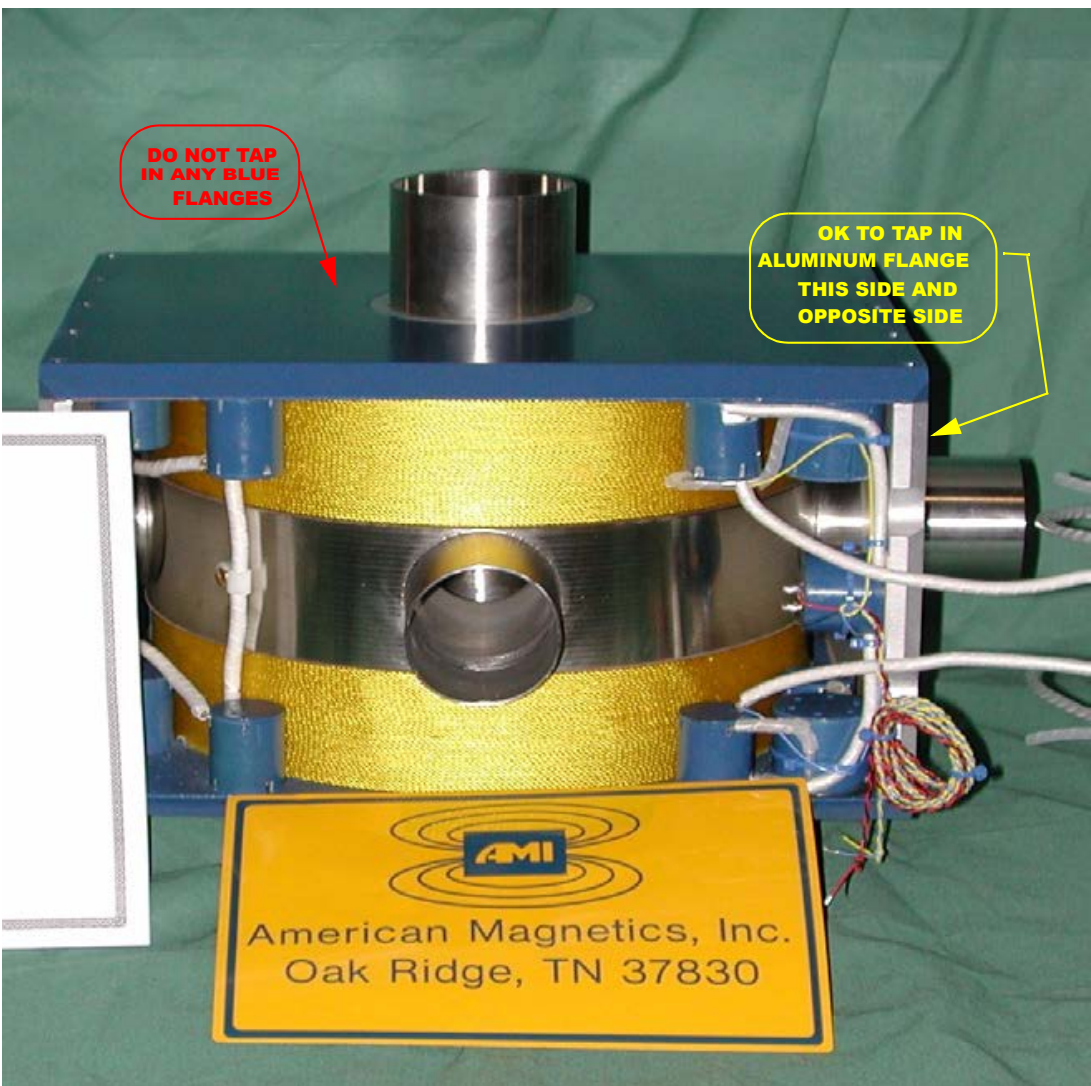
- American Magnetics Inc
 - Magnetic field (Tesla) 8.0 @ 4.2 K
 - Homogeneity (1 cm dsv) +/-0.5%
 - Approximate max current(amps) 85
 - Axial Clear bore "A". 6.86 cm
 - Radial Access "B" 5.33 cm



AMI MAGNET

American Magnetics, Inc.

P.O. Box 2509, 112 Flint Road, Oak Ridge, TN 37831-2509
Phone: (865) 482-1056 Fax: (865) 482-5472
Internet: <http://www.americanmagnetics.com> E-mail: sales@americanmagnetics.com



- MAGNET SPECIFICATIONS:
- Magnetic field (Tesla).....8.0 @ 4.2K
 - Homogeneity (1 cm dsv).....+/-0.5%
 - Approximate max current(amps).....85
 - Axial Clear bore "A"(inches).....2.7
 - Radial Access "B" (inches).....2.1
 - Vacuum Bobbin leak tested by AMI
 - Persistent Switch: Yes

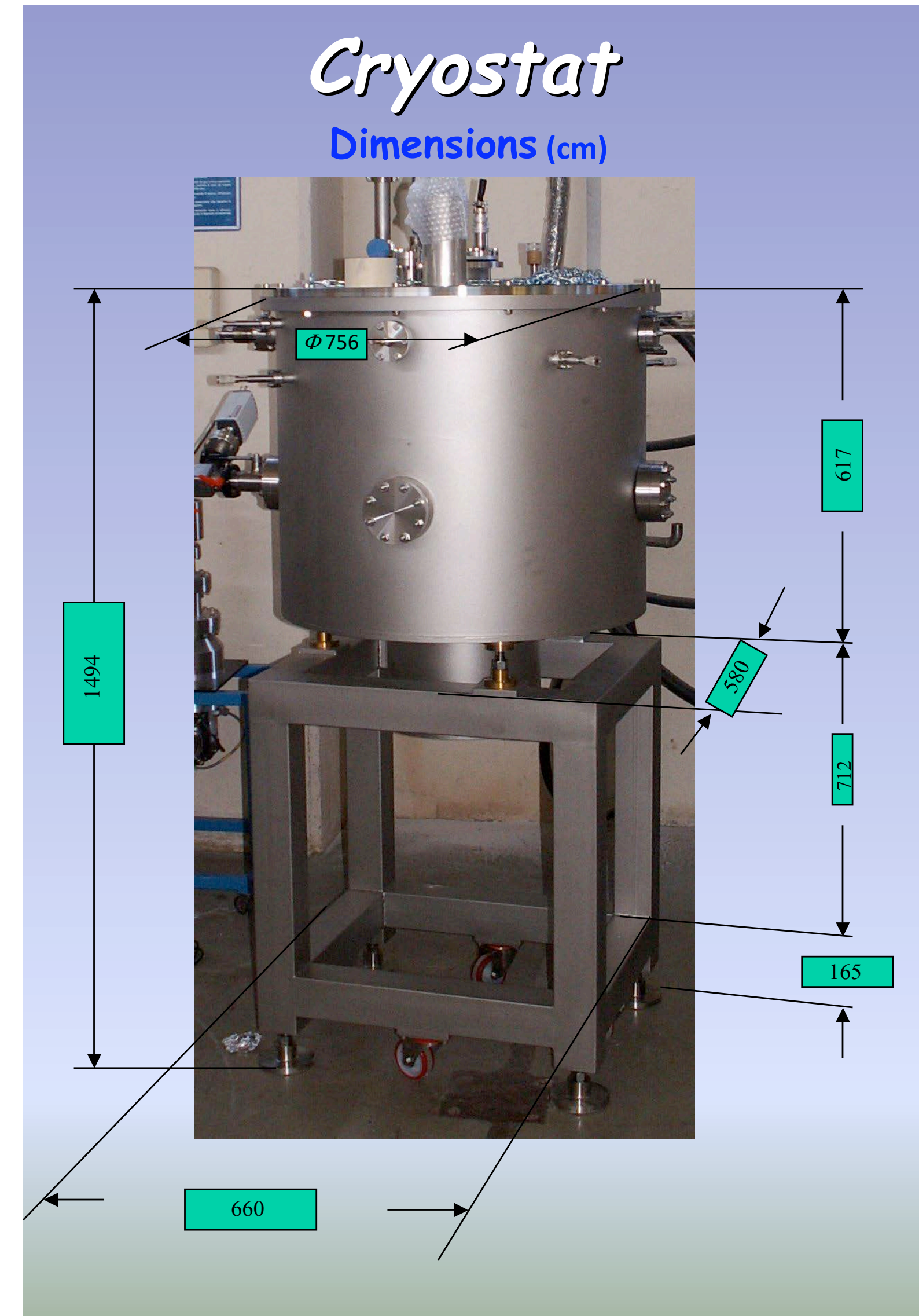
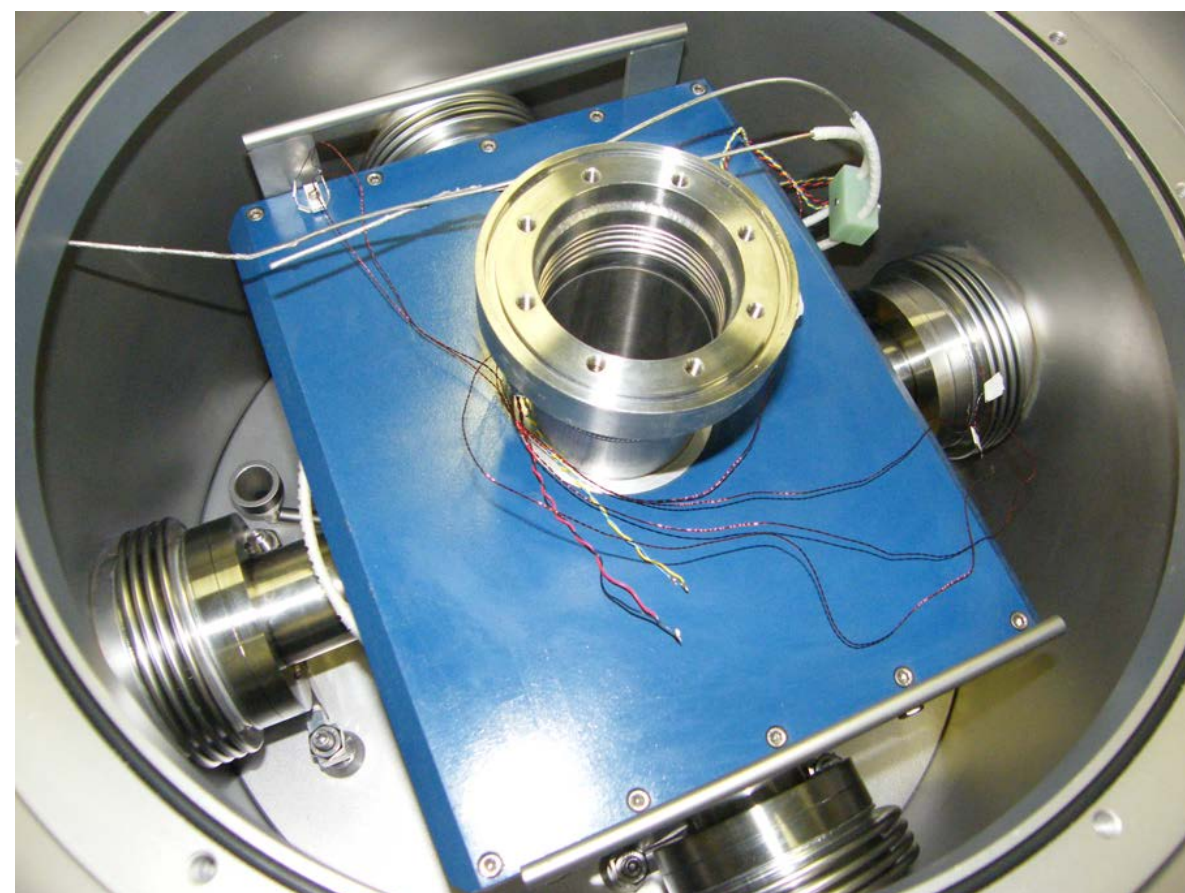
AMERICAN MAGNETICS, INC.			
TOLERANCES UNLESS OTHERWISE SPECIFIED		DESCRIPTION INFN PRESS-MAG-O EXPERIMENT AS-BUILT DRAWING	
FRACTIONS: +1/64 XX DECIMALS: +0.01 XXX DECIMALS: +0.005 ANGLES: +0°30' BREAK SHARP EDGES 1/64 MAX SURFACE FINISH = 125 RMS		DATE: 1/3/06 DRAWN BY: PEA REVIEWED BY: APPROVED:	
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN		SCALE: SIZE DRAWING NO.: SHEET 1 OF 1 REV.	

PRESSMAGO Cryostat

- Vessels
 1. External, sitting on the trolley
 2. Containing the LN2



3. Container of **LHe** and Magnet



Helium Purifier and Liquifier

The system requires LN2 and LHe

- 11 litres of LHe within the 3rd container
- At LNF using ~ 100 l in a week

A. Refurbishing the “old” system in the Physics Dept. basement

B. Purchasing a new device

1. **Minisystem** (desk size)
High electricity costs, low efficiency
For physics... but not for others?
 \Rightarrow Quantum Technology (also in UK)
2. Intermediate
Balloon and high pressure storage, recovery from evaporation
3. Full system (£ 1.2M)

A. The He system in Physics

- System ~25 yrs. old (almost OK)
 - service every 5 yrs.: £ 40k-50k
 - Noise and vibration... working over the weekend
- Chemistry 120 litres/month
 - 2024: £ 60k
- Contact with:
Konstantin Luzyanin (Department of Chemistry)
Matty Henderson (Department of Chemistry)



B. New device



- NexGen liquefiers and purifiers
 - recycle the helium gas lost from the normal boil off and helium transfers of the cryogenic instruments
- **NexGen 160 (250)**
 - Liquefaction Rate: 20+ liters/day (typical)
 - Dewar Capacity: 160 liters (250 liters)
 - Dimensions (L x W x H): 104 x 71 x 152 cm (liquefier without compressor)
 - Gaseous Helium Requirement: Ultra-High Purity (UHP) He (99.999%)
- **ATP30 (Purifiers)**
 - Purifies 30 liters of helium gas per minute (typical)
Purifies helium gas to 99.9995% (better than UHP)



- Suitable for our needs
(just for the Cryostat from LNF, it's however movable)
- Total Cost: £ 241,370 (complete system)
 - NexGen160 alone £ 152,870
 - Prices exclude VAT and installation unless stated otherwise
 - Delivery Time: 6 months from receiving PO

Quote from Quantum Design

Item No.	Part Number Description	Qty	Unit Price	Total
1	NexGen 160 Quantum Design Next Generation Liquefier. 160L Dewar capacity, +25L/day liquefaction at 1PSIg only. [Installation Not Included]. Note: Compressor not included in price, compressor type is required and must be added. Compressor voltage is 3-phase (choices: Low Voltage (200 - 240V) or High Voltage (380 - 480V)) must be selected; flex lines length (10 or 20 m) must be specified.	1	£152,870	£152,870
2	Water-Cooled Compressor - Standard Water-cooled Compressor with hoses, PDU cabling, and water filter system. Configuration must specify Flex hose length (10m or 20m) and compressor voltage (Low Voltage (200 - 240V) or High Voltage (380 - 480V)).	1	£22,335	£22,335
3	Direct Recovery Kit Standard Recovery Kits for Direct Recovery Configuration; includes KF25 connections, 0.15 psi inline check valve to prevent back streaming and 2-psi over pressure relief valve. (The kit contains quick-connects for BPC and ATL connections)	1	£3,970	£3,970
4	Back Pressure Controller (BPC)	1	£18,495	£18,495
5	BPC Bypass	1	£2,170	£2,170
6	50 lb Drier High Pressure and Medium Pressure Drier; 50 lb capacity, indicating material to signify the need for regeneration, freestanding unit.	1	£4,830	£4,830
7	QDS-INST-NexGen Installation of Quantum Design NexGen Helium Liquefier	1	£14,000	£14,000
8	Silver+ Service Contract – NexGen (1 year) Includes: <ul style="list-style-type: none">- Annual coldhead swap- Unlimited priority support- On site response (typical <2 weeks)- 1 service day per year- Annual System health check (2 days)- 10% discount on further service work- 5% discount on parts NOTE: Contract runs from end of warranty and renewable each year	1	£18,000	£18,000
			Nett value	£236,670
			Delivery	£5,000
			Total (ex-VAT)	£241,370

Notes:

- Prices exclude VAT and installation unless stated otherwise
- No pipework included. Helium Liquefaction system for direct recovery or from clean bottled supply only

Terms and Conditions

Delivery Time: 6 months from receiving PO

Delivery Terms: DDP to Liverpool (Incoterms 2020)

Payment Terms: Nett 30 days

Warranty: 1 Year

Please send your PO to: orders@gd-uki.co.uk

Our Bank details: Barclays Bank UK PLC, 82/84 High Street, Epsom, Surrey, KT19 8BH, UK
Sort Code: 20-30-06, GBP A/C No: 63834018
Swift Code: BARCGB22, IBAN: GB32 BARC 2030 0663 8340 18

This quotation is subject to NWUPC HVLE (LAB3162) framework agreement terms and conditions.

Place for the cryostat and the He system

- Two options in the Department of Chemistry:
 - to be used for 3 years

1. Basement (near neutrino physics room)

- The basement room doorway
115cm x 203cm
Full cryostat dimensions
70 cm x 150 cm



2. Ground Floor



- Cryostat and Magnet
 - for free from LNF \Rightarrow ask for the shipment as soon as possible
 - What can we do with it w/o setting the cryogenic temperature?
 - Can be good to create a good momentum/story
 - There are 8 NMRs in chemistry. Liverpool Shared Research Facilities have more
- Liquid and recovery system
 - To refurbish the old system bit less than £ 100k
can be used also by other groups (having line of He and/or dewars), however it is noisy and bit old technology wise
 - NexGen 160
usable only by one system at time (it is movable), expensive (\sim £ 200k)
- Location: on the Department of Chemistry basement

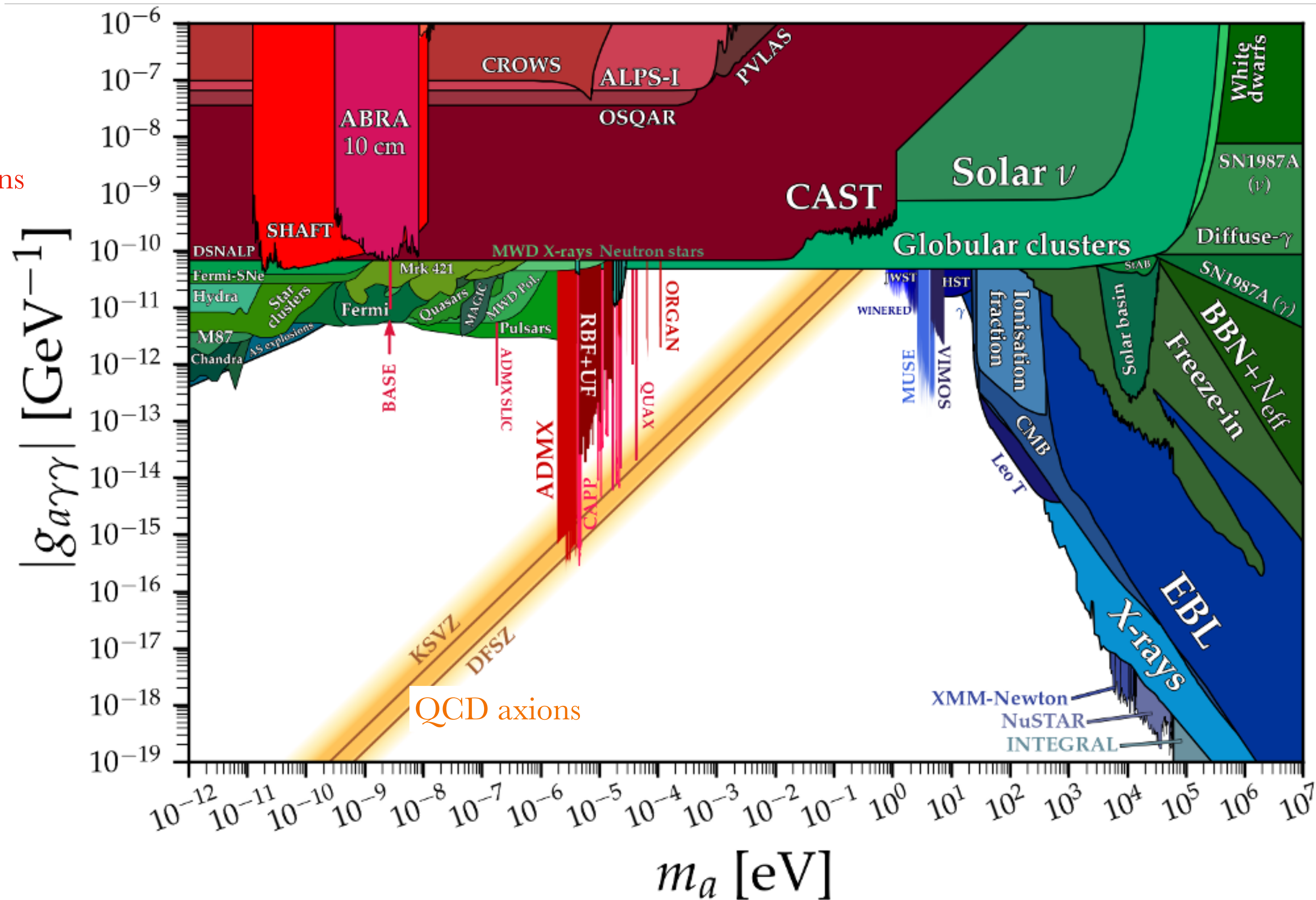
Back up

Axion Limits

Laboratory
experiments

Detection of axions
from the Sun
(Helioscopes)

DM axion detection
(Haloscopes)



Stellar physics:
Constraints on
stellar lifetime or
energy-loss rates

Astronomy:
No DM $a \rightarrow \gamma\gamma$ decays seen
in the visible region
from galaxies with telescopes.
Similar searches with X-rays
and extragalactic background
light (EBL) or H ionization.