Mechanics

Assuming composite materials from aeronautics technology

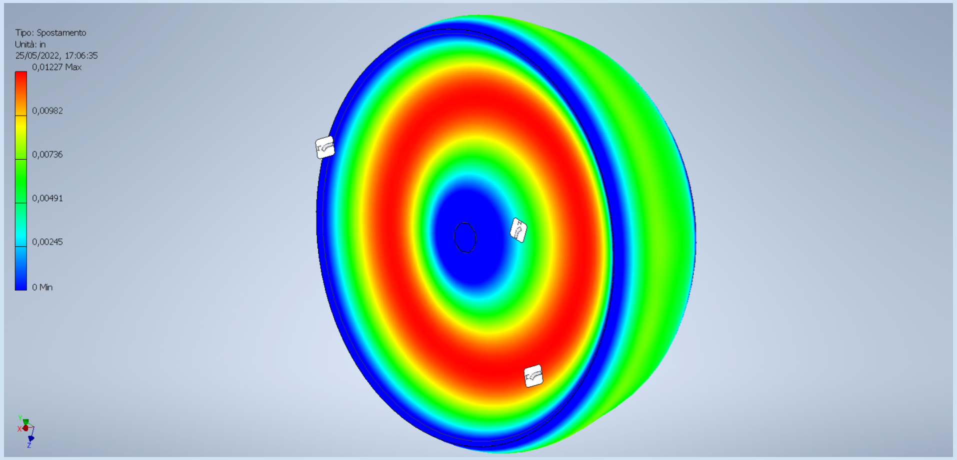
Stiff and light, with a skeleton supporting alignment elements

Need guidance to select alternatives and define specifications

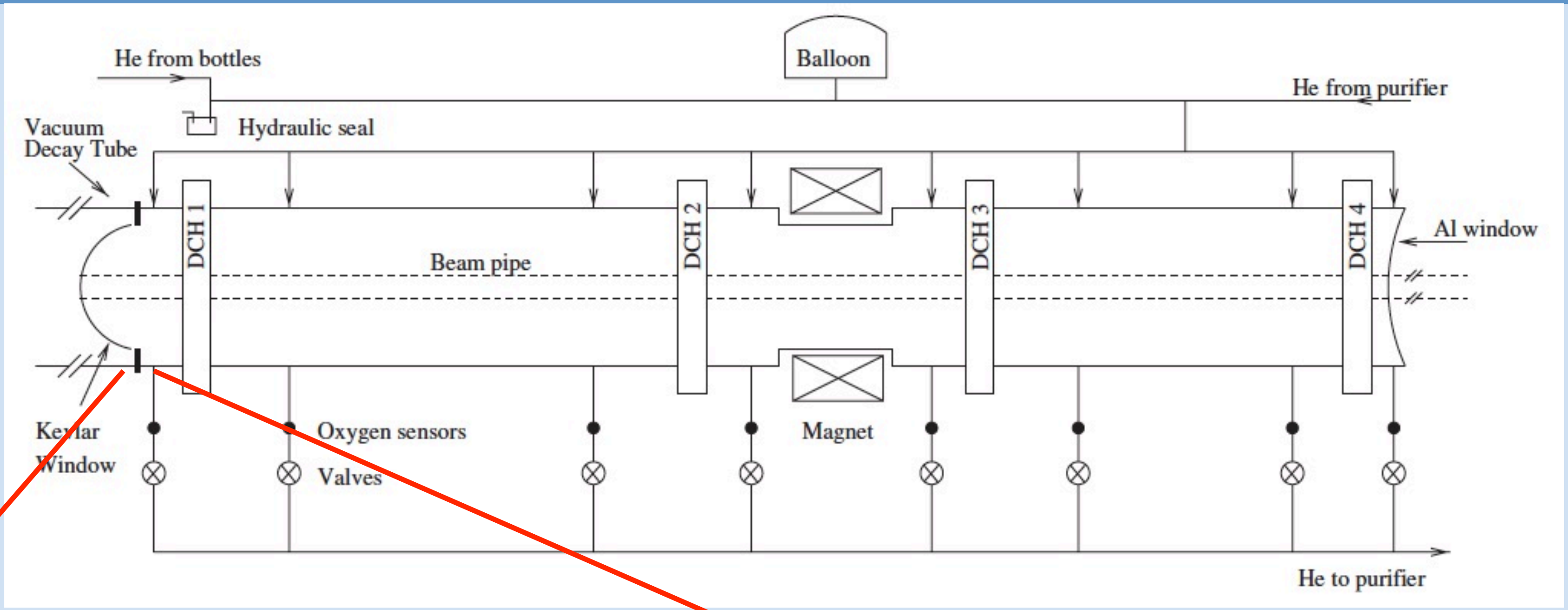
High-P Ar: Alternative to greenhouse gas
Requires to run at 2/2.5 bar absolute

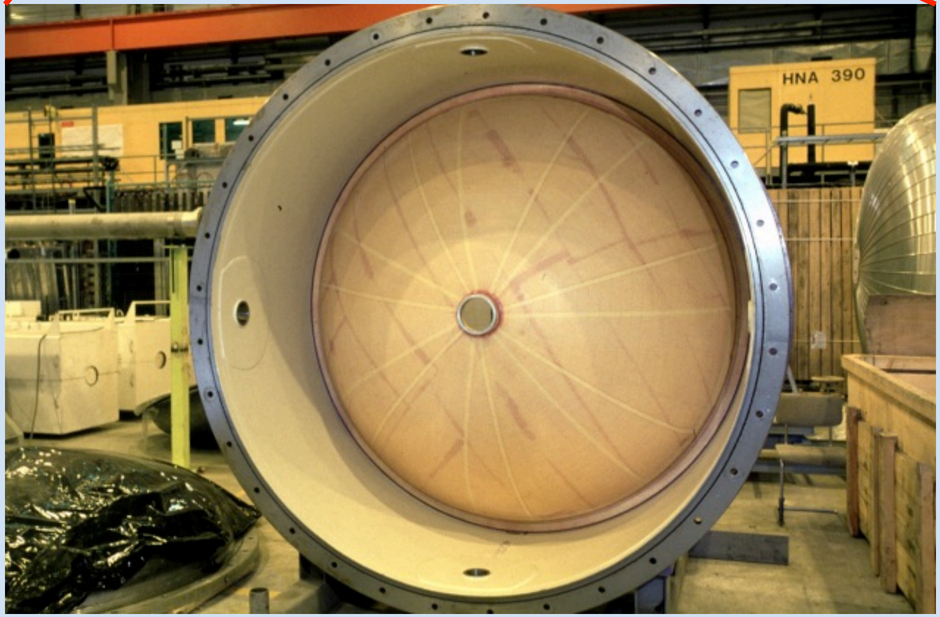
Dedicated R&D planned to start in fall 2022

stage 1: simple cylinder of candidate material(s)
stage 2: prototype on scale



NA48 Example





Example NA48 vacuum decay volume

Epoxy impregnated kevlar tissue

2.30 meter diameter

Glued to Al center ring + steel flange

1.3 m radius curvature

0.3% radiation length

Select a candidate material

Realize a simple (cylinder) prototype to test material and FEM calculations (2022)

Realize a realistic prototype (2023)

(Part of) funds budgeted by INFN committee 1 week ago

Table III. Typical Mechanical Properties of DuPont™ Nomex® 410

Property	Nominal Thickness, mm (mil)											Test Method
	0.05 (2)	0.08 (3)	0.10 (4)	0.13 (5)	0.18 (7)	0.25 (10)	0.30 (12)	0.38 (15)	0.51 (20)	0.61 (24)	0.076 (30)	
Typical Thickness, mm	0.06	0.08	0.11	0.13	0.18	0.26	0.31	0.39	0.52	0.61	0.78	ASTM D374[1]
Typical Thickness, mil	2.2	3.1	4.2	5.2	7.2	10.2	12.2	15.3	20.4	24.2	30.6	
Basis Weight, g/m²	41	64	88	115	174	249	310	395	549	692	839	ASTM D646
Density, g/cc	0.72	0.81	0.83	0.88	0.95	0.96	1.00	1.02	1.06	1.13	1.08	
Tensile Strength, N/cm MD	43	68	93	141	227	296	380	462	610	728	816	ASTM D828
Tensile Strength, N/cm XD	19	34	49	71	116	161	185	252	374	500	592	
Elongation, % MD	10	12	12	16	20	22	23	22	23	21	21	ASTM D828
Elongation, % XD	7	9	9	13	15	18	18	16	18	16	17	
Elmendorf Tear, N MD	0.8	1.2	1.9	2.3	3.7	5.6	7.1	9.0	14.3	N/A	N/A	TAPPI 414
Elmendorf Tear, N XD	1.5	2.4	4.4	4.8	7.2	10.6	13.7	16.7	24.8	N/A	N/A	
Initial Tear Strength, N MD	11	16	24	31	48	69	88	110	158	191	233	ASTM D1004[2]
Initial Tear Strength, N XD	6	9	14	17	27	42	55	71	114	153	193	
Shrinkage at 300°C, % MD	1.8	0.8	0.4	0.4	0.5	0.2	0.2	0.2	0.0	0.0	0.0	
Shrinkage at 300°C, % XD	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.0	0.0	0.0	

MD = Machine Direction; XD = Cross Direction
1. Method D; using 17 N/cm².
2. Data presented for initial tear strength is listed in the direction of the sample per ASTM D1004. The tear is 90 degrees to sample direction; hence, for papers with a higher reported machine direction initial tear strength, the paper will be tougher to tear in the cross direction.

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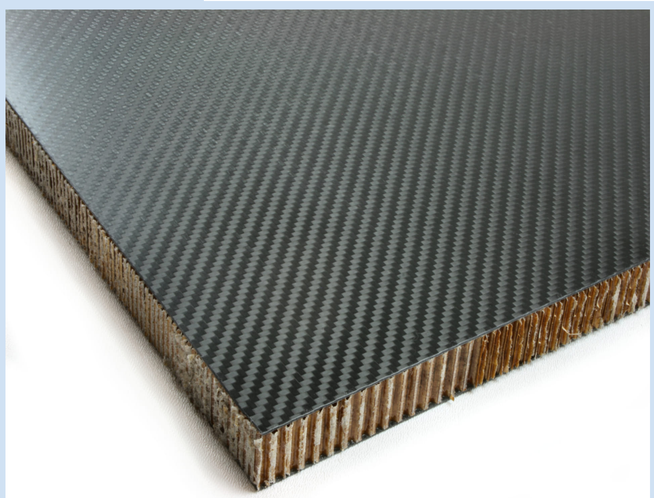

Questions

*   **What is acceptable as candidate material ?**
We assume to use CFRP or Al composites (no bulk material)

*   **Are there companies you can suggest ?**
Specialized ones could have their own suggestions based on past realizations.

*   **Is there a required certification different from EU ?**
In this case, a company in the States might be preferable

*   **Is there specific certifications BNL required in addition ?**

*   **What are the approval steps and can we have contacts with BNL experts to define them:**
certification (see above)
is an over-pressure test necessary/enough ?
is there an authority approval procedure ?

*   **What is required at TDR level ?**
FEM calculations
Prototype
………