

AMBER APX Run Preparation

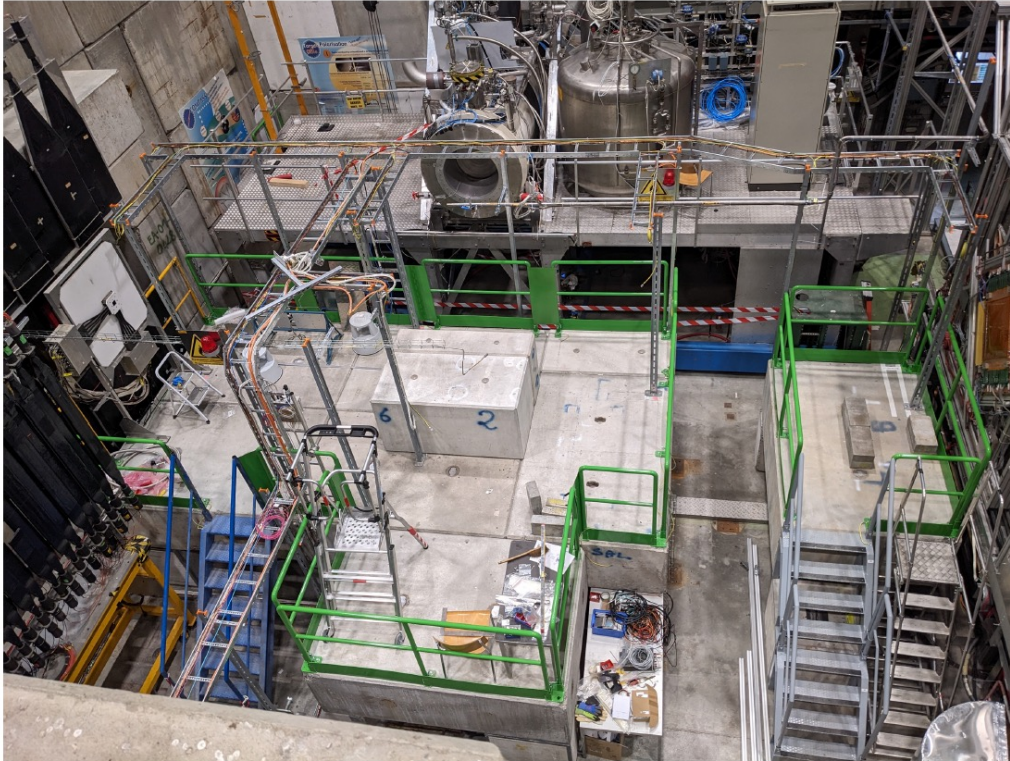
P. Zuccon –UniTN & INFN TIFPA

2nd February 2024

Outline

- AMBER APX run is planned to start on May 2nd and last for about 8 weeks
- Preparation for the run includes:
 - Liquid hydrogen and deuterium target setup
 - CEDARs refurbishment
 - RICH operations
 - Commissioning of the full spectrometer

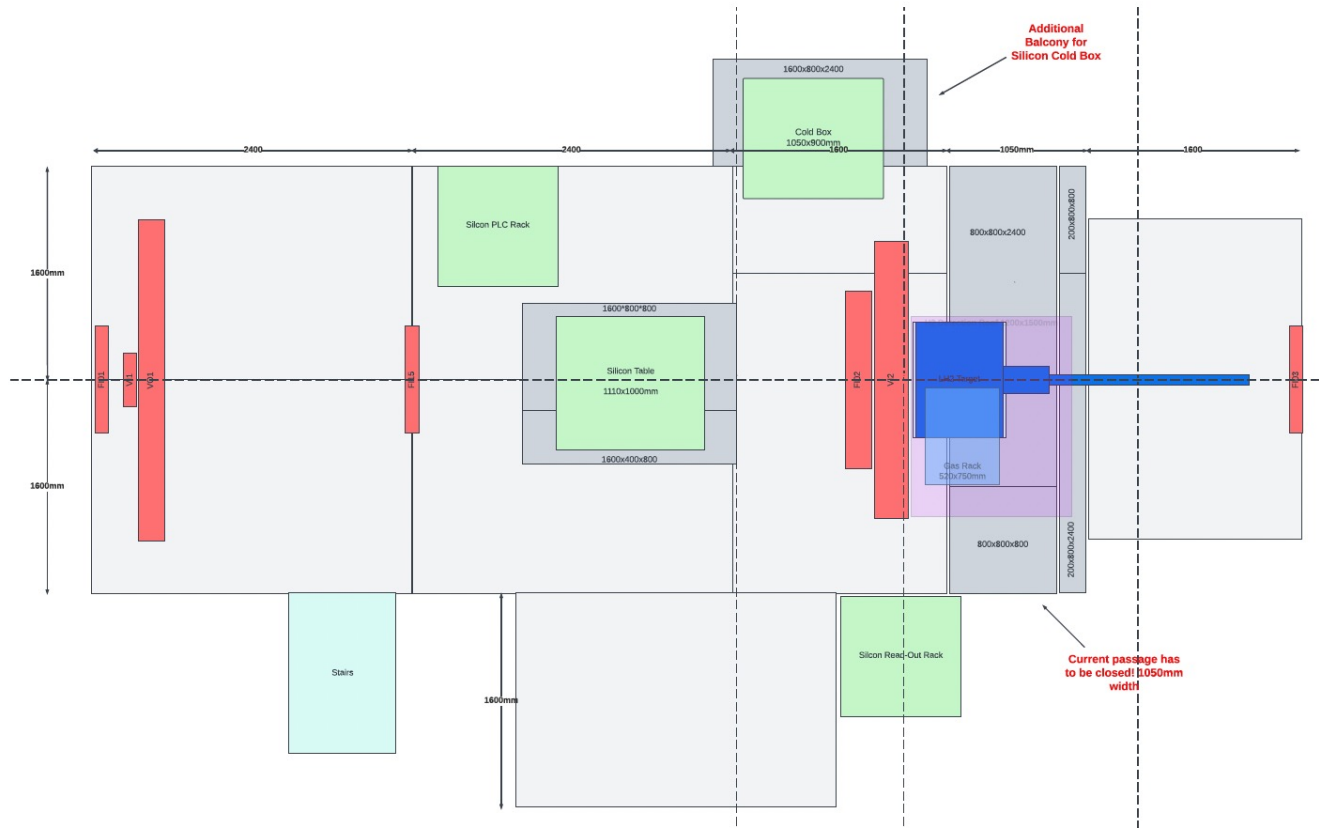
Spectrometer Status and Important Dates



- All detectors are in winter mode.
- UTS Stations removed, IKAR TPC removed.
- First concrete blocks installed for APX setup.

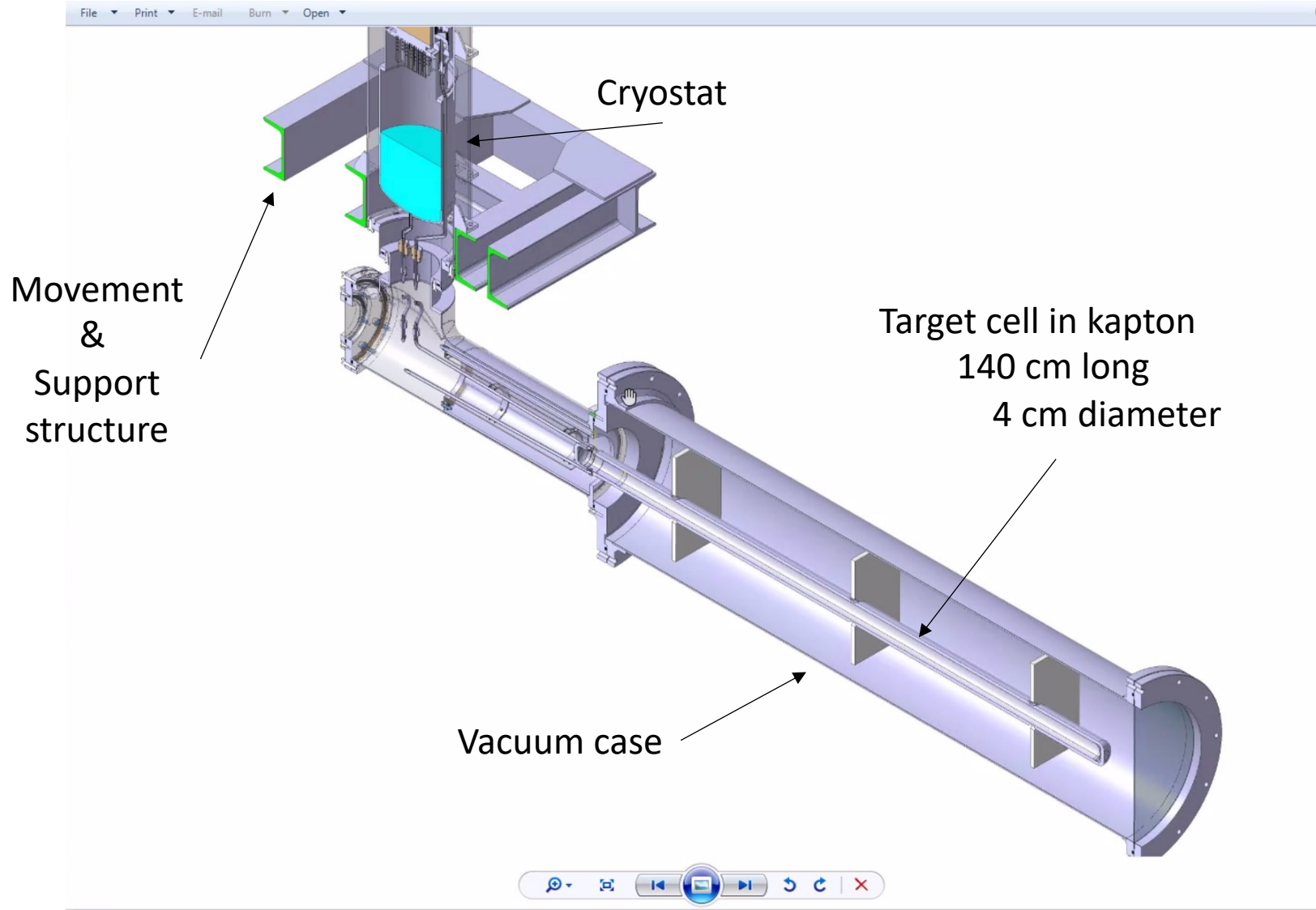
- **AUG Tests**
29/30.01.2024 (no access)
- **Start of cooling water**
16.02.2024
- **Supply of exp. Gases**
01.03.2024
- **DSO Tests:**
12.03.2024 (no access)
- **DAQ running:**
15.03.2024
- **Beam line commissioning:**
25.03.2023 - 09.04.2024
- **NA physics start:**
10.04.2024
- **Commissioning with beam:**
10.04.2024 - ≈01.05.2024
- **APX Physics run:**
≈01.05.2024 - ≈01.07.2024
- **DY High intensity test:**
+4-5 days after APX end
- **PRM Test:**
+4-5 weeks end august → end of
NA Physics 26.09.2024

AMBER APX Setup 2024



- LH2 target should be centred around zero.
- Placement of detectors (z-positions) as in 2023.
- Modifications of concrete platform needed
→ Meeting with BE (Dipanwita/Sylvain): BE will take care about the modifications (beginning of February).
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APX target layout



Hydrogen/Deuterium Target

- **Safety:**

- Several iterations with HSE, FGSO and EP-Safety
- Still some open questions:
 - Type and placement of vacuum pumps
 - Actions in case of hydrogen detection
 - flammable gas sensor around H2 buffer
- **EP-DT-DI has safety concerns for implementation of the control system.**

- **LH2 target holding structure:**

- BE offered help for the design and engineering note
- Meeting with HSE → load test in-situ.
- Costs approx 4-5kCHF.

- **Timelines:**

- LH2 target production → mid February
- LH2 target integration → mid March
- LH2 holding structure → Design ready mid February
- **LH2 PLC control rack → EP-DT availability earliest beginning of March!**

- **Deuterium:**

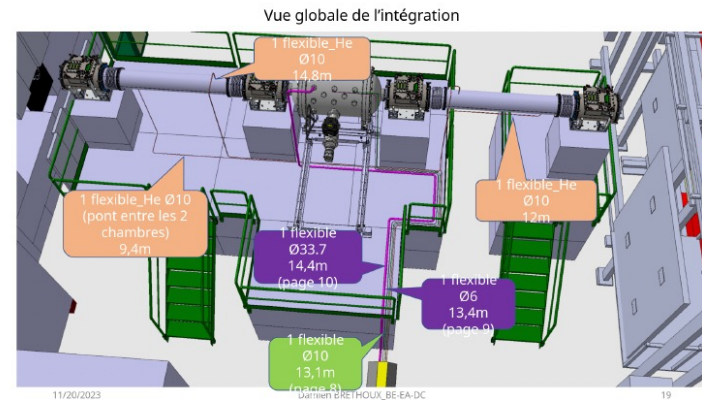
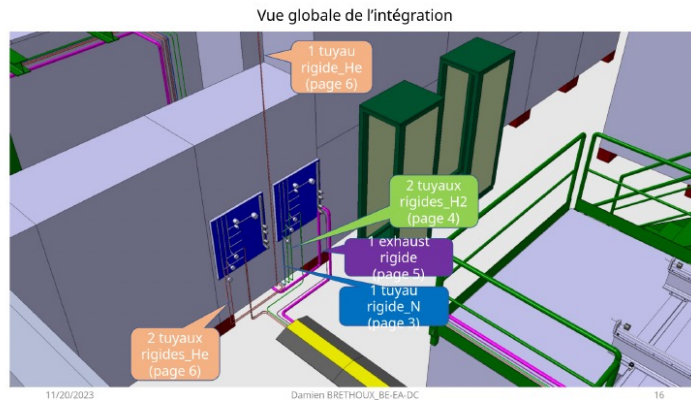
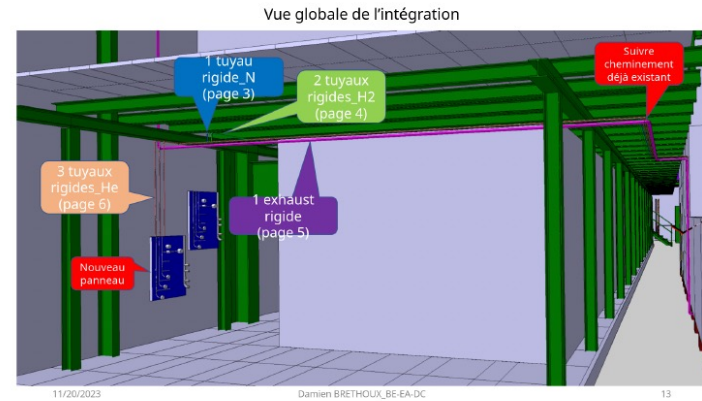
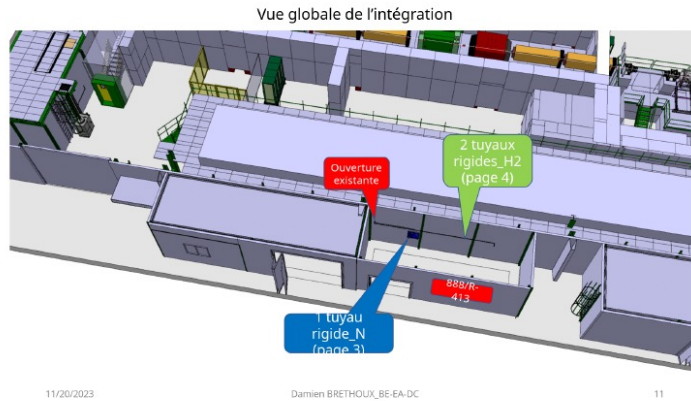
The offer for the Deuterium below – let me know if acceptable.

Gas: Deuterium 2.8 - BOTTLE OF 50L - CAPACITY 9.2NM3 - PRESSURE 200BAR - FITTING DIN14 LEFT

Lead time : 30 working days

H2 Line Installation

Installation of 2x exhaust line, 1xH2 line, 1xN2 line is done



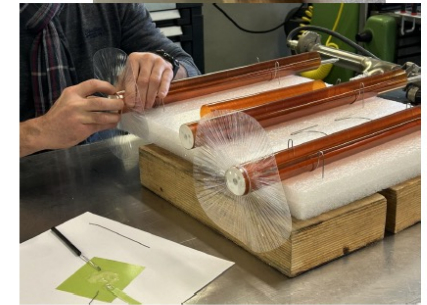
Final acceptance showed that wrong flexible pipes were installed (stamped with 1 barg)

→ will be exchanged.

LH2 Target Cell construction (Nori D.)

Target cell construction

- 0.125 mm thickness Kapton tube
- 3 companies
- USA : produced in 2012
- UK : produced in 2017
- Italy : produced in 2017
- Pressure test planed : 50 cm long cell



Pressure test on January 25

Number	Burst pressure	Supplier
1009	+4.0 bar relative	UK, LN2 test
1010	+5.5 bar relative	UK
1011	+6.0 bar relative	UK
1012	+6.5 bar relative	USA same as in 2012



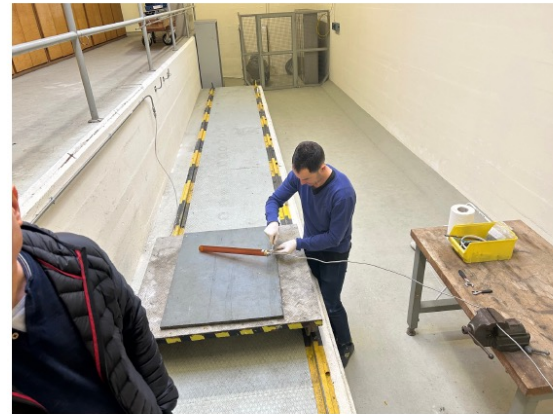
Planning

- Producing 3 sets of test chambers with Italian company
- Another tests on Feb. 1
- Target cell construction : until 15/2
- Helium cold test : until 29/2
- Integration : until 15/3
- Installation : March

LH2 Target Cell construction - latest news from today!

Pressure test on Feb. 1

Number	Burst pressure	Supplier
1013	+5.7 bar relative	Italy
1014	+5.9 bar relative	Italy
1015	+5.5 bar relative	Italy
1016 25 cm long	+5.9 bar relative	Italy, LH2 test without pressuring outside



The Italian material is supposed to be the first choice.
TE-CRG are going to produce three sets of 140 cm long cell from the next week if we agree on it.

One is for the experiment, another is for helium cooling test and the last is for spare.

RICH status and plans (Fulvio T.)

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RICH status



First look to 2023 RICH data: quality seems good.

The monochromator system PC died after the end of last year run.

Resurrection: difficult task, successfully completed now.

Monochromator ordinary maintenance performed: system ready

C₄F₁₀ reserve marginal: enough for start, not for long run

→ Decision to buy 250 kg C₄F₁₀ to guarantee a full run

INFN sponsoring 50%, AMBER the remaining 50%

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RICH run 2024 preparation



Cleaning of 250 kg C₄F₁₀ expected to require one month of work

Triloki is no more working for INFN Trieste

Fulvio, Stefano, Chandra, Andrea and a new young colleague: Richa Rai

Operation being scheduled in March – April

Expired validity of the pressure test of the filter cartridges belonging to the precleaning system --> ask for a derogation, pressure test with water not possible

Also, normal maintenance operations to be performed before the run

Time and manpower shortage

Please, carefully define exact date when the RICH needs to be operational

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New C₄F₁₀



Only one C₄F₁₀ provider has large quantity on stock: F2 Chemicals

CERN BE provided help for the purchasing procedure

5 Companies invited to participate

Call for tendering in November – December

Deadline extended to January. Only one offer received

Price and quality are the same as the previous purchase (same production lot)

Order placed yesterday to F2 Chemicals for 250 kg C₄F₁₀

Delivery expected in about one month

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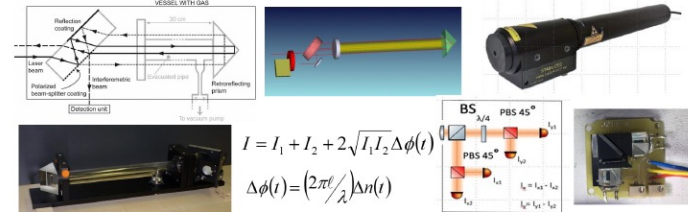
Interferometer



Modified Jamin interferometer (Trieste-Librez project) built.

Readout and gas control systems are being prepared

F.T, Stefano Levorato, Marketa Peskova, Richa Rai, Luis Garzia Ordenez are commissioning it



$$I = I_1 + I_2 + 2\sqrt{I_1 I_2} \Delta\phi(t)$$

$$\Delta\phi(t) = \left(2\pi n / \lambda\right) \Delta n(t)$$

AMBER Interferometer for refractive index monitoring: permission to install it if ready

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Also problems with the supply of Methan 4.5 this year (costs and availability) → Under Investigation!

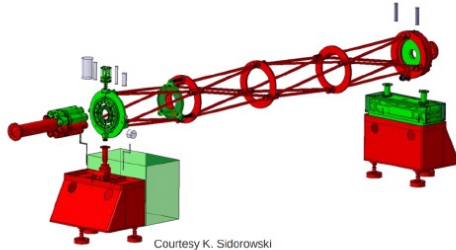
CEDAR refurbishment

YETS 2023/2024 PRIORITIES

The open issues were compiled and reported at the end of the 2023 run. In a consensus between E/BI and users, criticality for operation, availability, and resources/planning two CEDARs are being refurbished:

M2 - SPXCEDN001 - CR000002
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- Diaphragm – Mechanics Refurbishment
- Motor + Switches – Replacement
- Gas – Gas pipes refurbishment (correct sized shape etc.)
- Joints – Replacement
- Optics – Alignment
- XY Table – Table precision check / replacement
- Alignment – Realignment of CEDAR

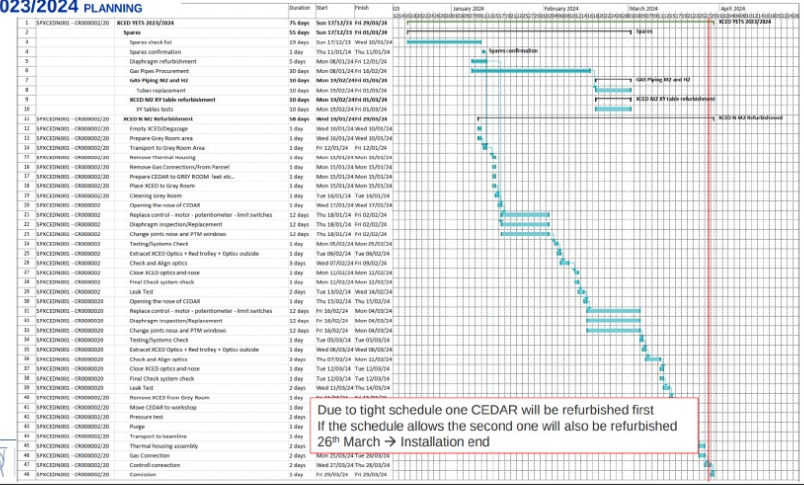


Courtesy K. Sidorowski

For all CEDARS

- Installing new pressure sensors
- Validating new diaphragm movement algorithm
- Measuring quantum efficiency of spare PMTs – To qualify or discard the spare park of PMTs

YETS 2023/2024 PLANNING



14.12.2023

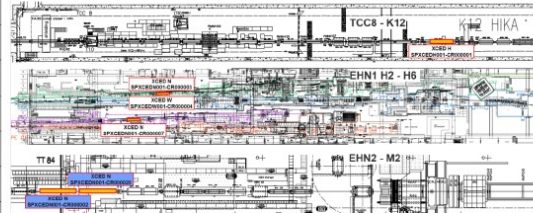
XCED - YETS 23-24

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CONCLUSION

M2 - SPXCEDN001 - CR000002 (2)	
System	Solution
Gas	New pressure sensors – TERPS pressure sensor
	New electro valve
Mechanical / Software	All piping in the CEDAR shall be replaced by new red hard piping compliant with operation pressures
	Software optimization, Mechanical Refurbishment
Mechanical	Convergence algorithms implemented as mitigation, Mechanical refurbishment
	Replace with new mechanical parts.
Alignment	New alignment procedure
Control & acquisition	New electronics being developed to be deployed during LS3
PMTs	Quantum efficiency measurements of NDS PMTs. New 9829 PMTs and voltage dividers to be acquired. Requires mechanical works to modify the CEDARs for compliance.



14.12.2023

XCED - YETS 23-24

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APX tentative schedule

Tentative Schedule

COMMISSIONING (with beam) 2 WEEKS ?

- Spectrometer commissioning
 - ECAL calibration
 - RICH filling and calibration
- Beam setup commissioning
- CEDAR commissioning & Alignment

- Liquid hydrogen target
 - W • 80 GeV 5 days
 - 3 E • trigger & CEDAR setup 1 day
 - / E • 160 GeV 5 days
 - 4 K • trigger & CEDAR setup 1 day
 - S • 250 GeV 5 days
 - trigger & CEDAR setup 1 day
 - 190 GeV

- Liquid deuterium target (3 days switch)
 - W • 80 GeV 5 days
 - 3 E • trigger & CEDAR setup 1 day
 - / E • 160 GeV 5 days
 - 4 K • trigger & CEDAR setup 1 day
 - S • 250 GeV 5 days
 - trigger & CEDAR setup 1 day
 - 190 GeV 5 days

if time allows

Empty target & CEDAR efficiency runs 3 days