

Comments from CRP PDR review 22/04/2022:

1) In slide 2: the line “Suspended CRP structure” for CRPs 1-2-3, refers just to the fact the CRP are suspended (in the coldbox and in Module-0), or has additional implications (like tests on planarity/warpness, possibly done in the cold) ?

Yes the line is only to mention that CRP1 to 4 will be suspended in the coldbox for the cold test. In Module-0 CRP4 and CRP5 will be supported by feet

2) In slide 3, could you add an indication of when each item is expected to be validated?

1) What are the features, i.e. the minimal set of requirements, that you consider necessary for the FDR?

- Assembly of PCB panels, gluing and silver printing with 30,-30,90 strip orientation **June 2022**
- Use of composite structure made of 2 parts bolted together with 2 skins and G10 profiles for the skeleton **July 2022**
- New layout of adapter boards **June 2022**
- Edge connectors for the strip connection to RO **June 2022**
- Latest bias filter board layout **June 2022**
- Latest shield plane filtering configuration **June 2022**
- Full bottom readout with connectivity through patch panels (tested at cold in US) **Sept 2022**
- Support system for bottom **CRP October 2022**
- Complete CRP specifications (bias HV, anode geometry) tested and validated in cold (CRP2 and CRP3) **July-Oct. 2022**

3) Still for slide 3:

- will mechanical tests on the support structure be done before the FDR?

Yes and dates to be discussed and defined with Wisconsin

- we think that a design study, including FEA completed to good extent, should be available for the FDR.

At the time of FDR we plan to have the corresponding design study with FEA since they will be needed for Module0 installation

- the study should include mechanical issues related to the shipment of bottom CRUs, and to the rotation of bottom CRPs for installation.

The design study of transport system and manipulation of bottom CRPs will be developed in the coming months

- design codes for each part should be defined

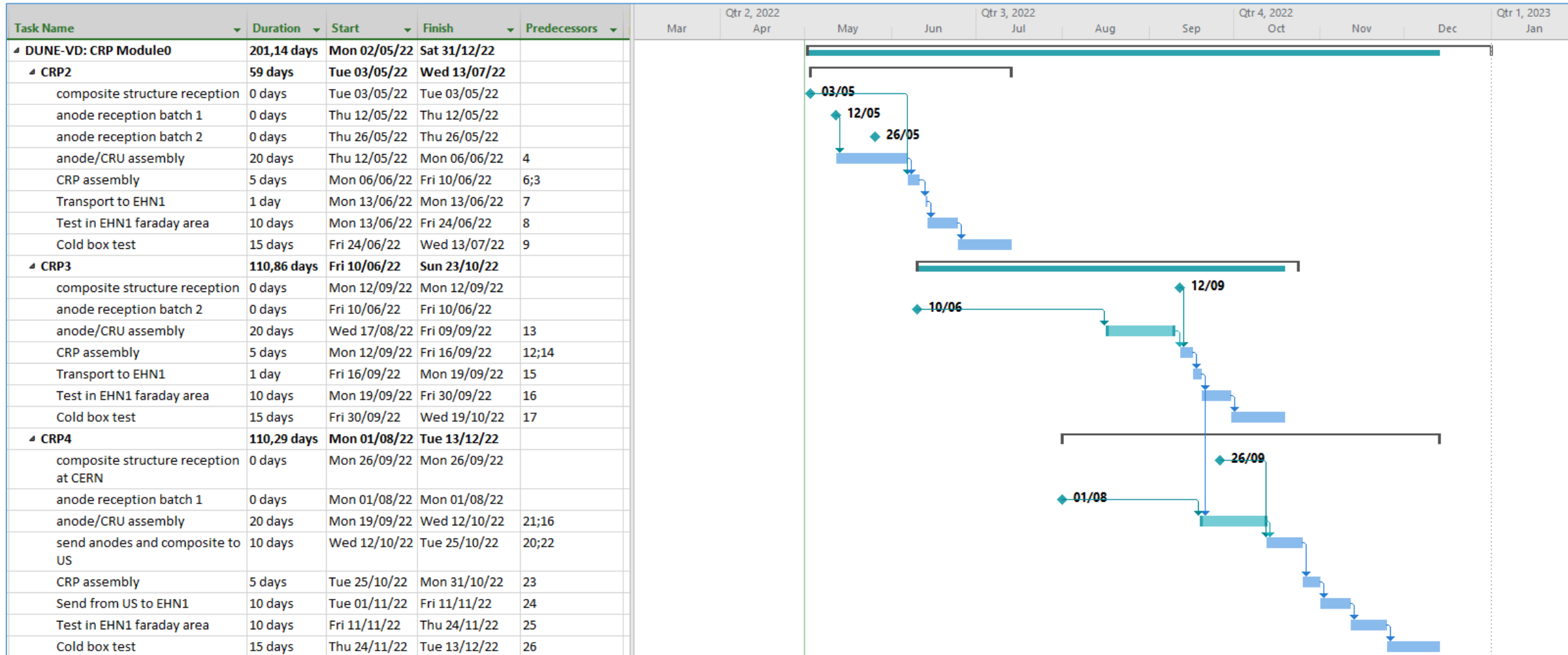
- contacts with the compliance office should be strengthened

we will work more closely with the compliance office for all the mechanical studies linked to the top CRP superstructures and the bottom CRP supports

4) Slide 4: you mention two months margin for the components of CRP2; what safety margin is there for CRP 3-4-5 ?

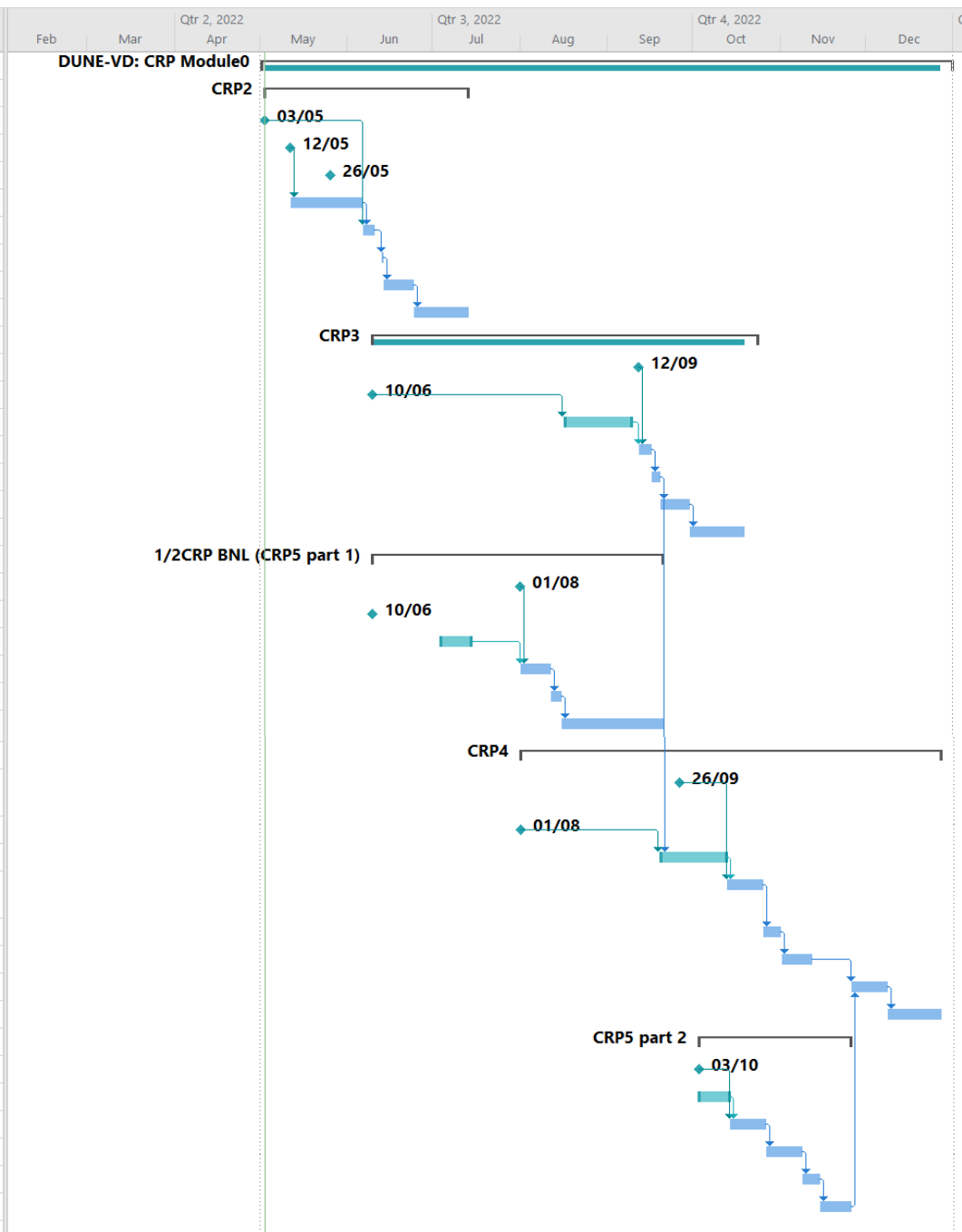
For CRP3 there is one month of margin to complete a cold box test before CRP4 arrives; for CRP4 the margin in 2022 is negligible but cold box test can be performed eventually early 2023 since it is a bottom CRP to be installed in Module 0 at the end

Ideally, a GANTT chart would be useful to describe the planning of Module 0.



Next slide includes 1/2BNL CRP and CRP5

Task Name	Duration	Start	Finish
▲ DUNE-VD: CRP Module0	201,14 days	Mon 02/05/22	Sat 31/12/22
▲ CRP2	59 days	Tue 03/05/22	Wed 13/07/22
composite structure reception	0 days	Tue 03/05/22	Tue 03/05/22
anode reception batch 1	0 days	Thu 12/05/22	Thu 12/05/22
anode reception batch 2	0 days	Thu 26/05/22	Thu 26/05/22
anode/CRU assembly	20 days	Thu 12/05/22	Mon 06/06/22
CRP assembly	5 days	Mon 06/06/22	Fri 10/06/22
Transport to EHN1	1 day	Mon 13/06/22	Mon 13/06/22
Test in EHN1 faraday area	10 days	Mon 13/06/22	Fri 24/06/22
Cold box test	15 days	Fri 24/06/22	Wed 13/07/22
▲ CRP3	110,86 days	Fri 10/06/22	Sun 23/10/22
composite structure reception	0 days	Mon 12/09/22	Mon 12/09/22
anode reception Eltos batch 3	0 days	Fri 10/06/22	Fri 10/06/22
anode/CRU assembly	20 days	Wed 17/08/22	Fri 09/09/22
CRP assembly	5 days	Mon 12/09/22	Fri 16/09/22
Transport to EHN1	1 day	Fri 16/09/22	Mon 19/09/22
Test in EHN1 faraday area	10 days	Mon 19/09/22	Fri 30/09/22
Cold box test	15 days	Fri 30/09/22	Wed 19/10/22
▲ 1/2CRP BNL (CRP5 part 1)	83,14 days	Fri 10/06/22	Tue 20/09/22
composite structure reception	0 days	Mon 01/08/22	Mon 01/08/22
anode reception Eltos batch 3	0 days	Fri 10/06/22	Fri 10/06/22
anode/CRU assembly	10 days	Mon 04/07/22	Thu 14/07/22
send anodes and frame to BNL	10 days	Mon 01/08/22	Thu 11/08/22
1/2CRP assembly	2 days	Thu 11/08/22	Mon 15/08/22
BDE integration tests at BNL	30 days	Mon 15/08/22	Tue 20/09/22
▲ CRP4	121,43 days	Mon 01/08/22	Tue 27/12/22
composite structure reception at CERN	0 days	Mon 26/09/22	Mon 26/09/22
anode reception batch 1 NCAB	0 days	Mon 01/08/22	Mon 01/08/22
anode/CRU assembly	20 days	Mon 19/09/22	Wed 12/10/22
send anodes and composite to US	10 days	Wed 12/10/22	Tue 25/10/22
CRP assembly	5 days	Tue 25/10/22	Mon 31/10/22
Send from US to EHN1	10 days	Tue 01/11/22	Fri 11/11/22
Test in EHN1 faraday area	10 days	Fri 25/11/22	Thu 08/12/22
Cold box test	15 days	Thu 08/12/22	Tue 27/12/22
▲ CRP5 part 2	45 days	Mon 03/10/22	Fri 25/11/22
composite structure reception	0 days	Mon 03/10/22	Mon 03/10/22
anode/CRU assembly	10 days	Mon 03/10/22	Thu 13/10/22
send anodes and frame to Yale	10 days	Thu 13/10/22	Wed 26/10/22
1/2CRP assembly and test	10 days	Wed 26/10/22	Tue 08/11/22
CRP5 complete assembly	5 days	Tue 08/11/22	Mon 14/11/22
Send from US to EHN1	10 days	Mon 14/11/22	Fri 25/11/22



5) Still on slide 4: you mention the 1/2 CRP used for a readout test in BNL. Going back to activities and reviews in 2022, can you add some information on plans and schedule for the test in BNL, and whether it is expected to provide results useful for the FDR?

The 1/2 CRP at BNL will be used for cold electronics integration tests and noise studies beginning in July-August 2022. The BNL team has a great deal of experience from the integration tests on the DUNE 40% APA, which provided a very accurate prediction of the ENC observed in the protoDUNE SP detector. The CRP integration tests will use the final DUNE electronics (e.g. the monolithic FEMBs, patch panel), in the same low-noise environment developed for the 40% APA tests, and thus are expected to provide a good prediction of the ENC that will be observed in FD-2. Given that the monolithic FEMBs will have already been demonstrated on the 40% APA prior to the CRP integration tests, only several months of testing are anticipated, with results by September 2022.

6) Slide 5: the schedule for CRP4 is extremely tight for a report at the FDR. We understand that a “swap” is not possible in the schedule of Module 0, but we are concerned that the plan for bottom CRPs might not be sufficiently validated for the FDR, which will remain scheduled in 2022. Moving the assembly of CRP4 to Europe might help with the schedule for Module 0, but not for the validation of the program in US.

This is a concern that we share and try to mitigate by eventually be able to send the CRP4 elements to US earlier; the discussion is going on with the structure and anode companies to see their production time.

7) Slide 6: can you confirm that the option of 3-segment panels is kept alive and the plan, if agreement on a manufacturer is reached, is to test the boards before the PRR in spring 2023?

The option for the 3-segment panels is still alive and we'll continue to investigate the feasibility, both for prototyping and far detector production with vendors. If the agreement on production is reached and the cost is compatible to the current scheme, we can test the boards before the PRR.