

Hi-Lumi RFD CM Project P455

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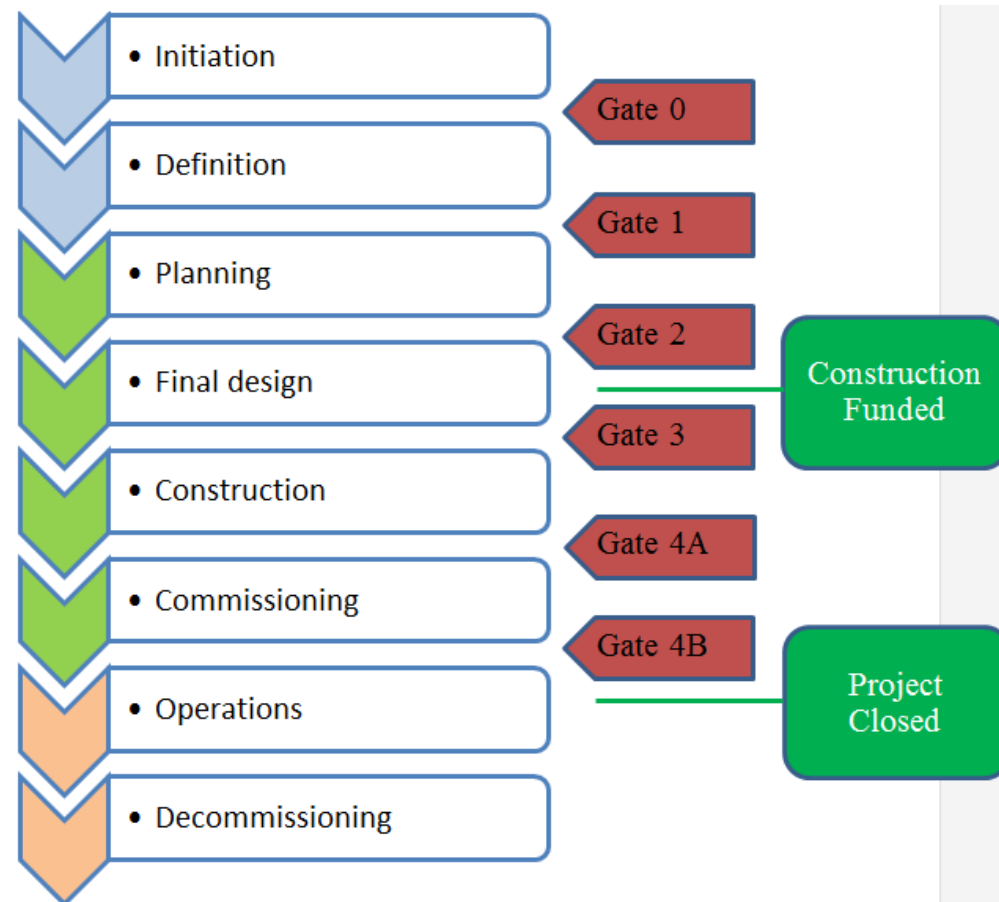
April 30, 2021











TRIUMF Project milestones



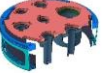
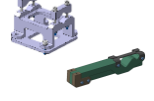
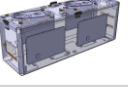



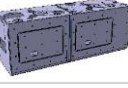


TRIUMF gate schedule will be linked with CERN technical milestones. In principle we would like to get to Gate 3 before standard procurements. **The prototype TCM0 will be considered in a Gate 3A.**

| Project Milestone | Proposed date | Hi-Lumi input |
|-------------------|---------------|---|
| Gate 1 | Dec 2019 | Conceptual design review, preliminary scope def'n |
| Gate 2 | Aug. 2020 | Final scope def'n, detailed budget |
| Gate 3A TCM0 | May 2021 | TCM0 design review, released drawings and specifications |
| Tech review | March 2022 | Launch long lead procurements |
| Gate 3B TCM1-4 | April 2022 | Final design review, released drawings and specifications |

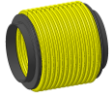
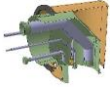




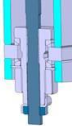




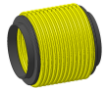
Design Status (1)

| EDMS 2427601 | Version 6 : 02-02-2021 (t.capelli) | | |
|--|---------------------------------------|---|--|
| Group | Name | Ref drawing | Status |
| OVC | | | |
|  | OVC | | Released |
| | OVC extension for cryogenic extension | https://edms.cern | Released |
| Cryogenic | | | |
|  | Biphase line | LHCACFQC0212 | 3D/2D Drawing done ✓ calculation on-going |
|  | Lower line | ST1324548_01 | 3D detailed model done ✓ 2D Drawing global assembly missing 2D drawing sub components - engineering check on-going Calculation on-going |
|  | 4-20K cooling line | ST1339789_01/ST1337097_01 ST1194104_01/ST1194093_01 | 3D detailed model done ✓ 2D drawing not started |
|  | H-HOM cooling | LHCACFQC0256 | 3D/2D Drawing done ✓ - waiting for calculation results |
|  | Cryogenic safety (outside cryomodule) | ST1219626_01 | 3D detailed model to be updated 2D drawing not started |
|  | Helium guard for level gauge | ST1152433_01 | 3D detailed model done ✓ 2D drawing not started |
| | Helium level gauges | Supplier : American Magnetics Inc. Reference : HS-1/4-RGD-30/31in-4LdCp-LL6-S | 3D detailed model done ✓ 2D drawing not started (drawing with interfaces) |
|  | Instrumentation rails | | 3D concept updated |

| | | | |
|---|--------------------------------|--|---|
|  | Sensor integration and support | | 3D detailed model-done ✓ 2D drawing not started Specification list and schematic shared with STFC |
| CRYOGENIC SUPPORTS | | | |
|  | Biphase support | LHCACFQC0266 | 3D/2D Drawing done - waiting for calculation results ✓ |
|  | Jumper support | | 3D detailed model done - may need to be more rigid ✓ 2D drawing not started |
|  | 4-20K cooling line support | ST1395489_01 ST1396415_01 LHCACFQC0225, 226, 227 | 3D detailed design done ✓ 2D drawing partially done / on-going |
| THERMAL SCREEN | | | |
|  | Thermal screen | | 3D detailed model missing few holes 2D drawing not started |
|  | Braids for thermal intercept | LHCACFTS0160 | 3D concept done 2D spec drawing done for tender ✓ |
| MLI | | | |
|  | 50K MLI | LHCACFTS0158 | 3D concept done 2D spec drawing done for tender ✓ |
|  | 2K MLI | LHCACFTS0159 | 3D concept done 2D spec drawing done for tender ✓ |
| WARM MAGNETIC SHIELD | | | |
|  | Warm magnetic shield | | 2D drawing done ✓ - Engineering check on-going |
| CAVITY SUPPORT | | | |
|  | Cavity support | LHCACFAH0051 (a) | 3D/2D Drawing done ✓ engineering check done - minor correction to be done |
| CRYOMODULE JACKS (SPS) | | | |
|  | Adaptor for existing jacks | ST1006722_01 | 3D detailed model done ✓ 2D drawing not started |

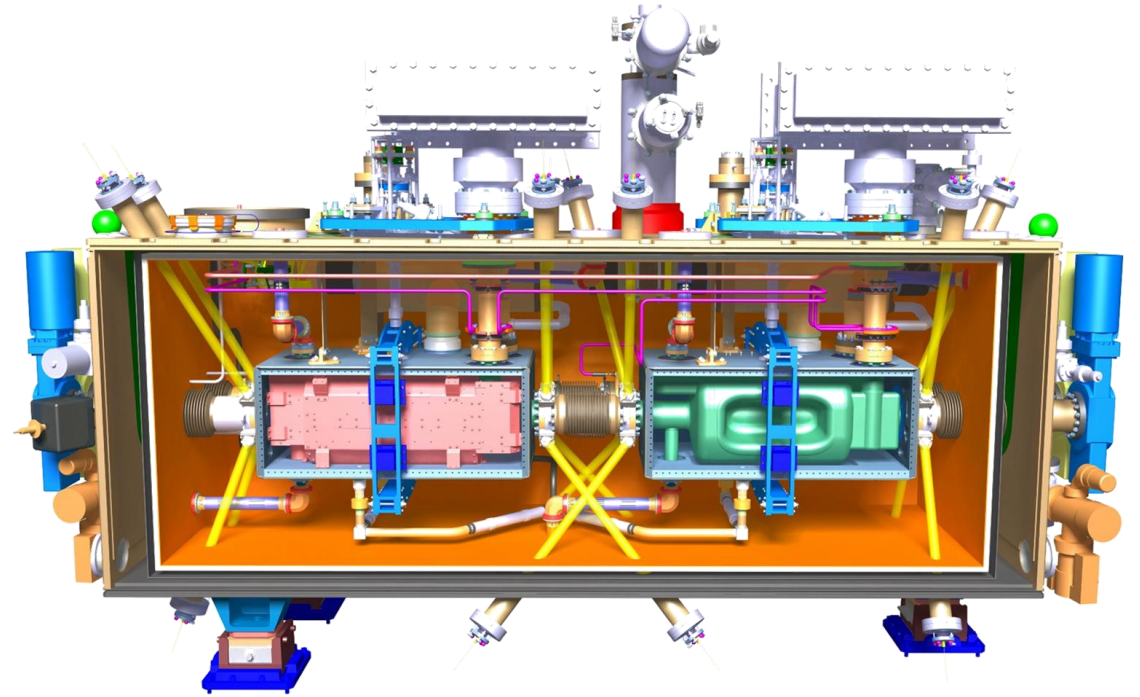
Design Status (2)

| Cryogenic bellows | | | |
|--|--------------------------------|-----------------|---|
|  | Biphase bellows D132mm | LHCACFQC0237 | 3D/2D Drawing done - engineering check done |
| | Biphase bellows D132mm - blind | LHCACFQC0239 | 3D/2D Drawing done - engineering check done |
| | Level gauge bellows | LHCACFQC0242 | 3D/2D Drawing done - engineering check done |
| | Lower line bellows | LHCACFQC0258 | 3D/2D Drawing done - engineering check done |
| | H-HOMs bellows | LHCACFQC0253 | 3D/2D Drawing done - engineering check done |
| Jumper | | | |
|  | LHC Jumper | | 3D concept for LHC integration done |
| | SPS Jumper | | Not started |
| Tuner | | | |
|  | Tuner frame | LHCACFTU0162 | Ready  |
|  | Tuner actuation | | Released, if time still improvements towards series, will be delivered assembled and calibrated |
|  | Tuner double pipe | | 3D detailed model 95 % done, review calculations ongoing, improvement coupling, assembly sequence available Next step drawings |
|  | Bottom coupling | LHCACFTU0170-01 | 3D/2D Drawing done - engineering check pending |
|  | Flexural guidance | | 3D detailed model 100 % done, Calculation report done Next step drawings |

| RF LINES | | | |
|---|---|---------------|--|
|  | H-HOMS/V-HOMS coaxial lines | | 3D/2D Drawing done - engineering check pending |
| | Pick up antenna coaxial lines | | 3D/2D Drawing done - engineering check pending |
| FPC | | | |
|  | outer pipe | LHCACFMC0163 | Released |
| UHV chamber | | | |
|  | Extremity chamber | LHCVMACAA_T00 | Released |
|  | Cold warm transition cavity line SHORT | LHCVBMCC0010 | Released |
| | Cold warm transition cavity line LONG | LHCVBMCC0034 | Released |
| | Cold warm transition secondary line SHORT | LHCVBMCC0033 | Released |
| | Cold warm transition secondary line LONG | LHCVBMCC0035 | Released |
|  | Inter cavity chamber | LHCVBMCI0014 | Released |
| | Inter beam screen chamber | LHCVBMCI0015 | Released |
| | Beam screen | LHCVSSCA0024 | Released |
| UHV bellows | | | |
|  | Cold/warm transition bellows | LHCVBUCA0001 | Released |
| | Inter cavity bellows | LHCVBUCIB0001 | Released |
| | Inter beam screen bellows | LHCVBUCIA0001 | Released |
| | Beam screen bellows | LHCVBUCBA0006 | Released |
| Insulation vacuum bellows | | | |
|  | Blade bellows | LHCACFVT0090 | 3D/2D Drawing done - engineering check done |
| | FPC bellows | LHCACFVT0093 | Released |
| | Tuner bellows | LHCACFTU0187 | 3D detailed model done, drawings in preparation Requires a review of the calculations before fabrication. Available heater length has increased, requires review |

Design Status – Summary for Gate 3A

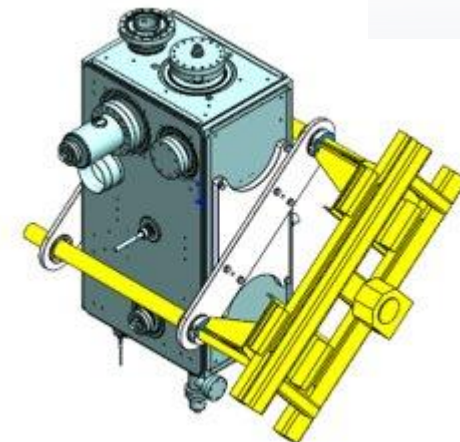
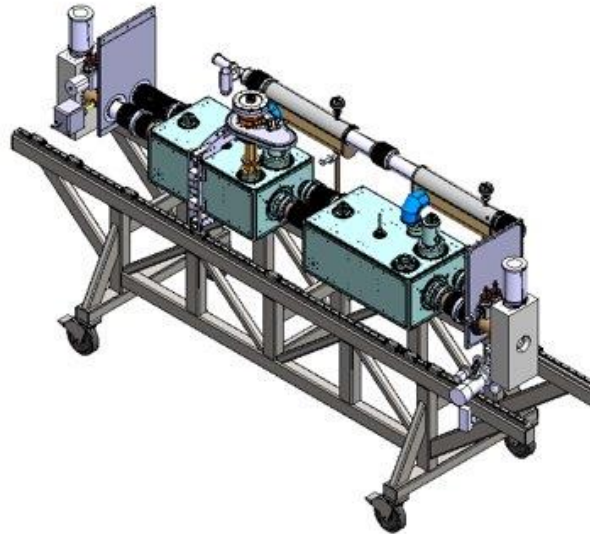
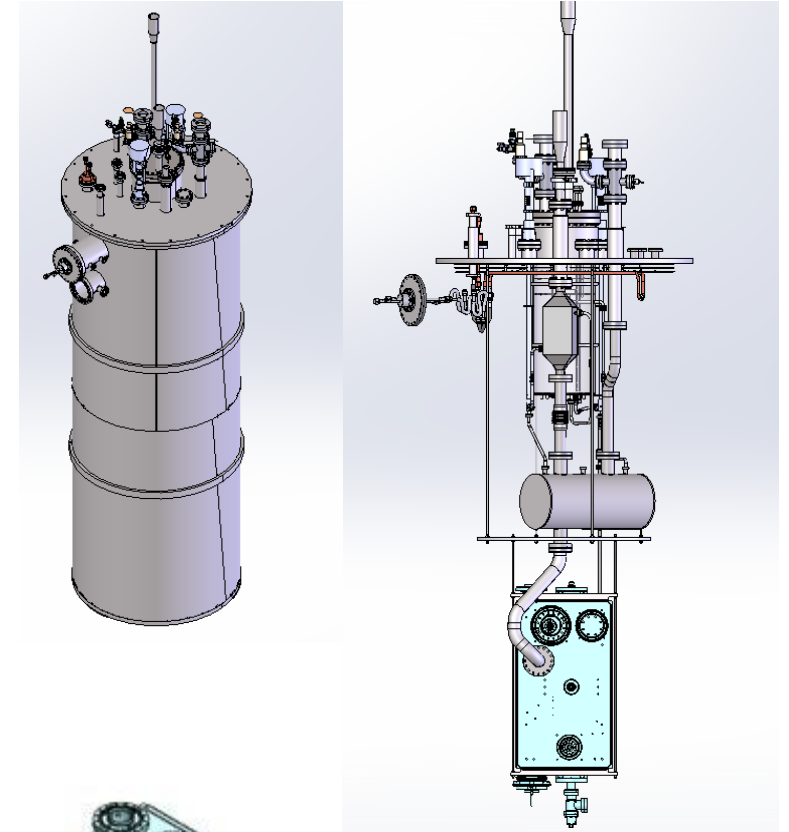
- Cryomodule design well-advanced
- UK procurements have begun for SPS RFD CM
 - This CM represents a prototype for Hi-Lumi – ie fully compatible with LHC tunnel installation
- Major components released – minor components design complete but not yet released
- We deem this safe to enter the procurement phase for TCM0 – launching now will give us more time to evaluate the engineering before launching the series production



Infrastructure upgrade

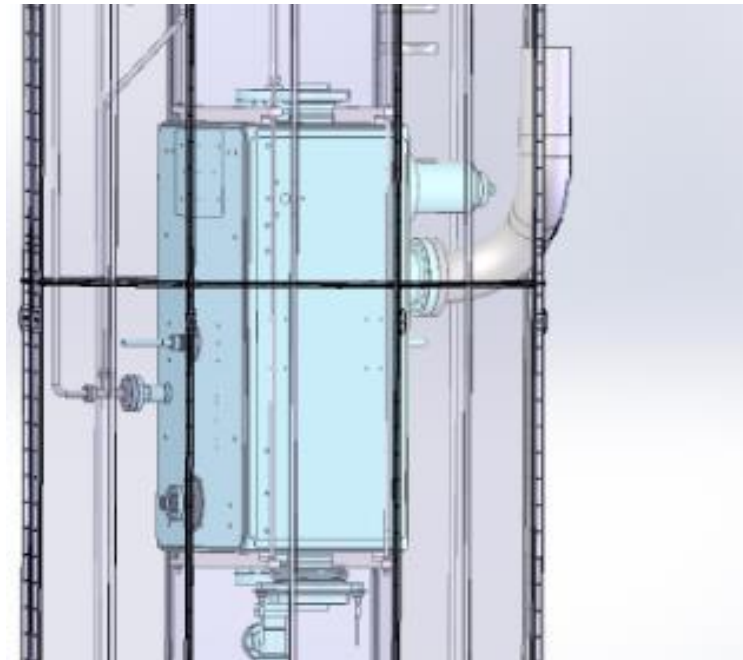
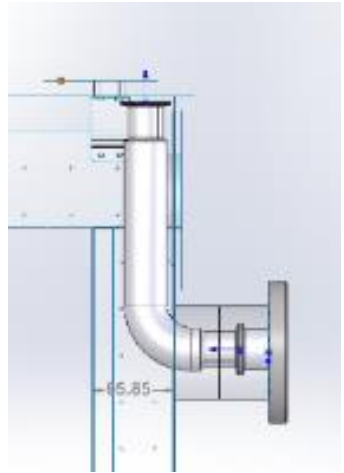
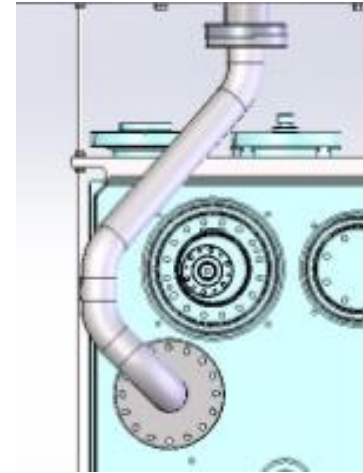
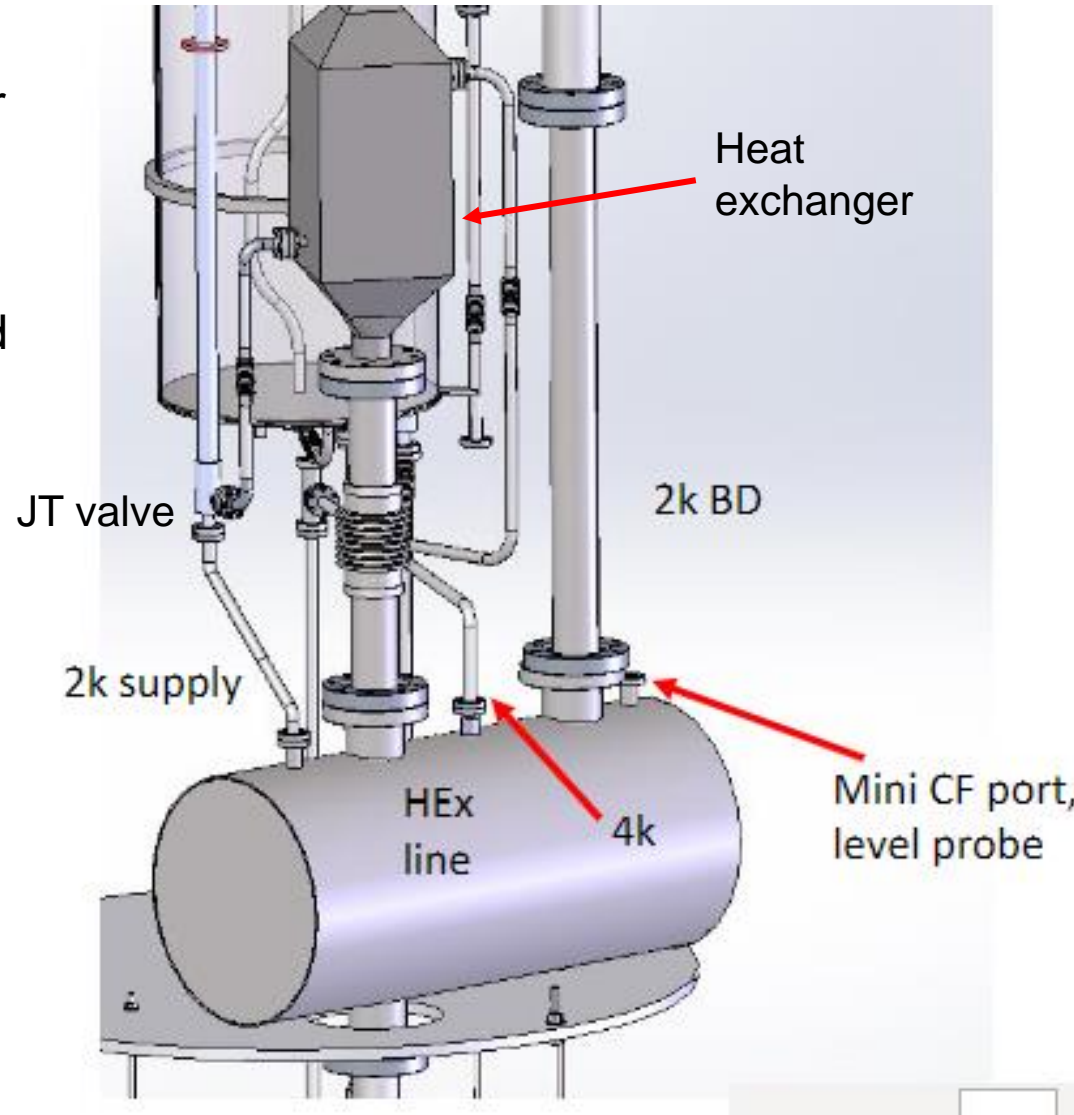
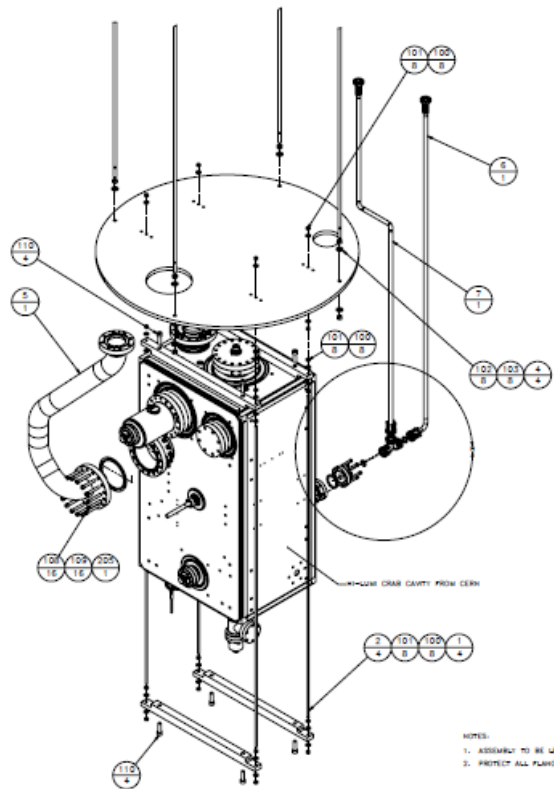
SRF infrastructure upgrade procurements in progress. The improvements can be grouped into categories

- Clean room upgrades to reduce chance of particulate pollution
 - Garments upgrade
 - Diagnostics upgrade (new distributed particulate counters)
 - Vacuum equipment upgrade (dedicated pumps and equipment)
- Testing infrastructure
 - Prepare 4k/2k insert for multi-purpose cryostat
 - Upgrade cavity test diagnostics
 - Upgrade 2K pumping capacity
- Assembly fixtures
 - Cavity handling tooling
 - Hermetic string assembly
 - Top down assembly



Completing the detailed drawings of the cryo-insert for jacketed 2K tests – preparing to release for manufacture

Heat exchanger, JT valve and cooldown valve received

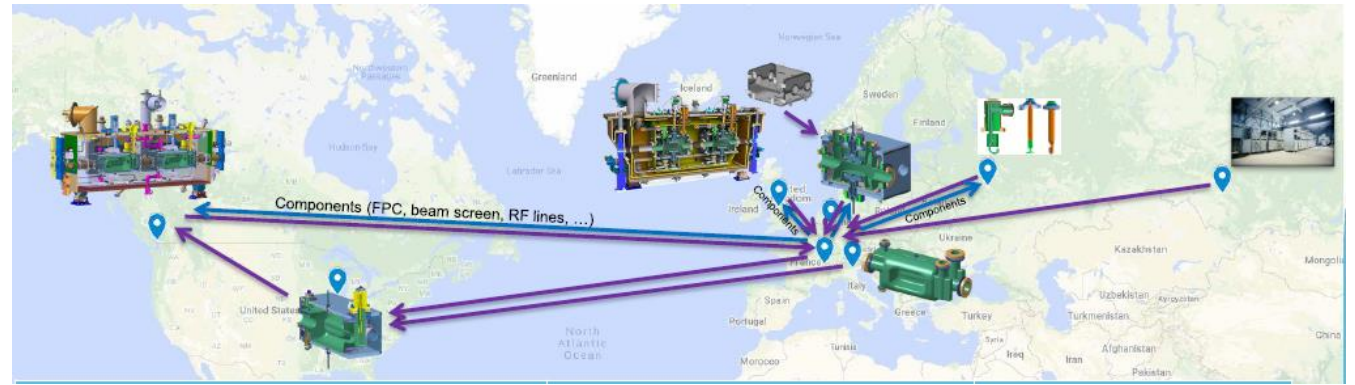


Cavity Delivery from AUP

RFD cryomodule production is obviously a relay race – any delays in delivery of dressed cavities, FPCs, rf lines from AUP or CERN will impact final delivery

Dates have shifted over the dates predicted in Sep 2020 by up to 5 months

Need to fix the dates of delivery of production rf components from CERN



TCM0 dates

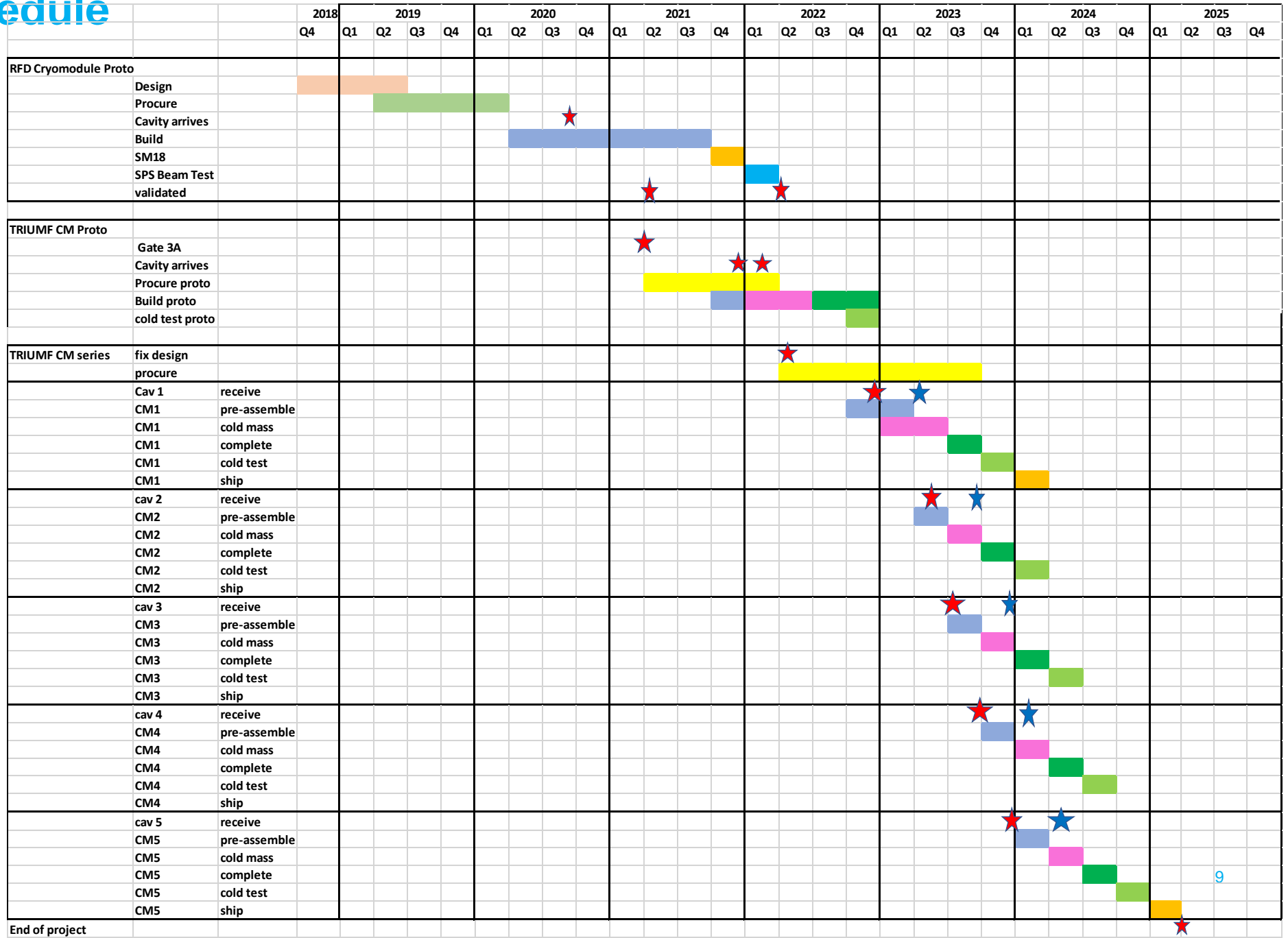
Latest schedule has TCM0 cavities delivered in Dec 2021

Need to fix the dates for delivery of rf equipment from CERN – FPC (March 2022 ?), rf internal lines (May 2022 ?), rf amplifier – will meet with Eric to discuss

| | Sep 2020 ➔ | Feb 2021 | “Late” Agreed Dates |
|------------------|---|-------------|---------------------|
| Cavities 01 & 02 | 30-Jun-22 | 27-Dec-2022 | June 2023 |
| Cavities 03 & 04 | 28-Dec-22 | 02-May-2023 | Sept 2023 |
| Cavities 05 & 06 | 27-Mar-23 | 27-Jul-2023 | Dec 2023 |
| Cavities 07 & 08 | 06-Jun-23 | 06-Oct-2023 | Feb 2024 |
| Cavities 09 & 10 | 16-Aug-23 | 19-Dec-2023 | May 2024 |



Updated schedule



Summary

- Advancing towards Gate 3A for TCM0.
- Procurements for clean room and cavity testing on-going.
- TCM0 procurements are due to start this year.
- Schedule updated with latest dates from AUP.
- TCM0 cavities – Dec 2021
- AUP Production dates Dec 22, May 23, July 23, Oct 23, Dec 23
- Need to fix delivery of rf components from CERN

