

Equipment Projects and Upgrades (in progress and planned)

2023 FACET-II User Meeting

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October 17-19, 2023



Facility for Advanced
Accelerator Experimental Tests

Outline

- Laser Heater
- Coherent Edge Radiation Detection
- T-Cavity in S20
 - SLED Cavity
- Positron Source Revitalization
- New Layout of BC20 Chicane
- Differential Pumping
- LLRF Upgrades
- VAX/Legacy Controls – Long Term Plan
- FACET-II IP-Area / Post-Plasma / PAX Chicane
- Gamma Detection Chamber and Detectors

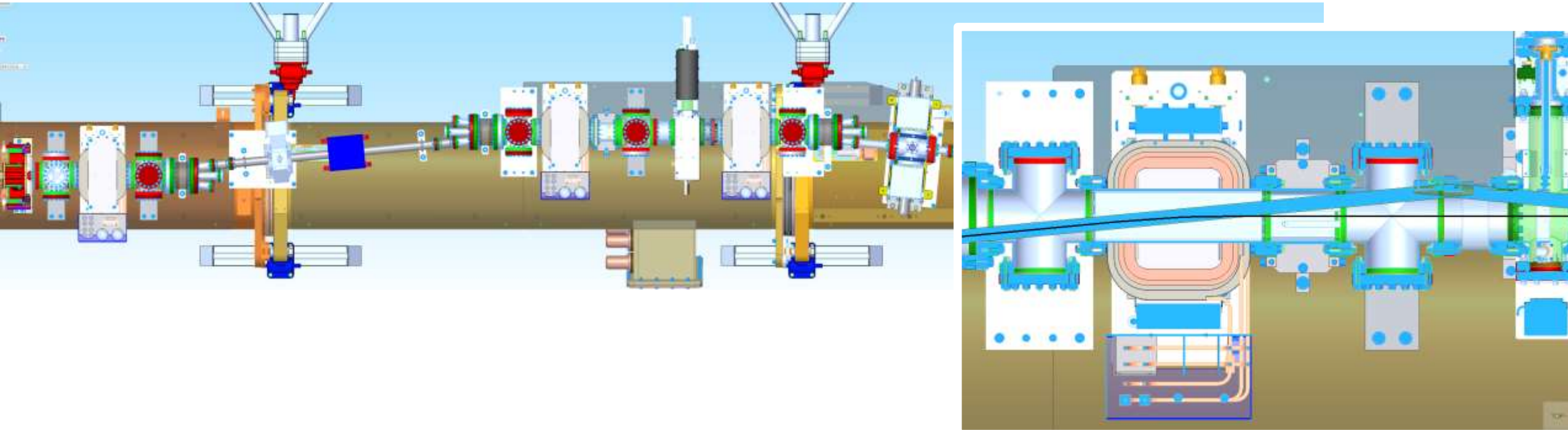
Laser Heater

- Claudio covered LH operation this morning
- We are upgrading the HVAC system for S10 Laser Room to make some miserably hot California summer days less bad for operations

Increased S10 laser stability during the hottest summer days

Coherent Edge Radiation Detection (part of E326)

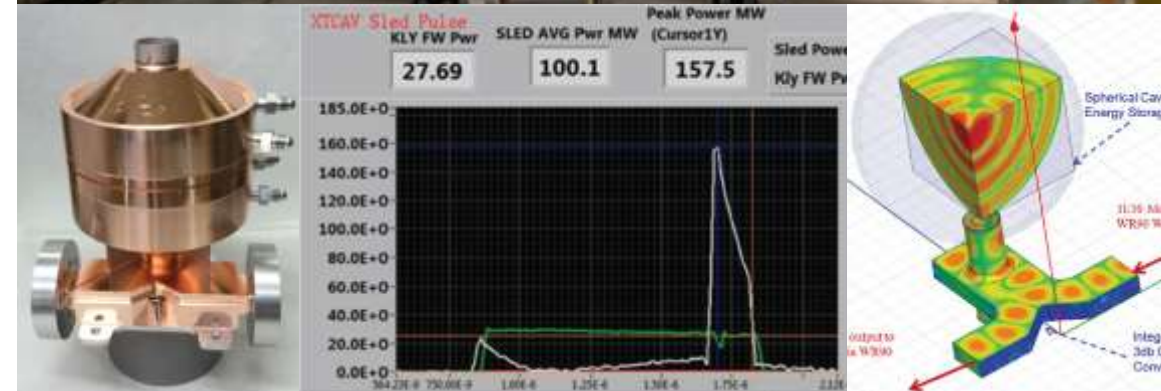
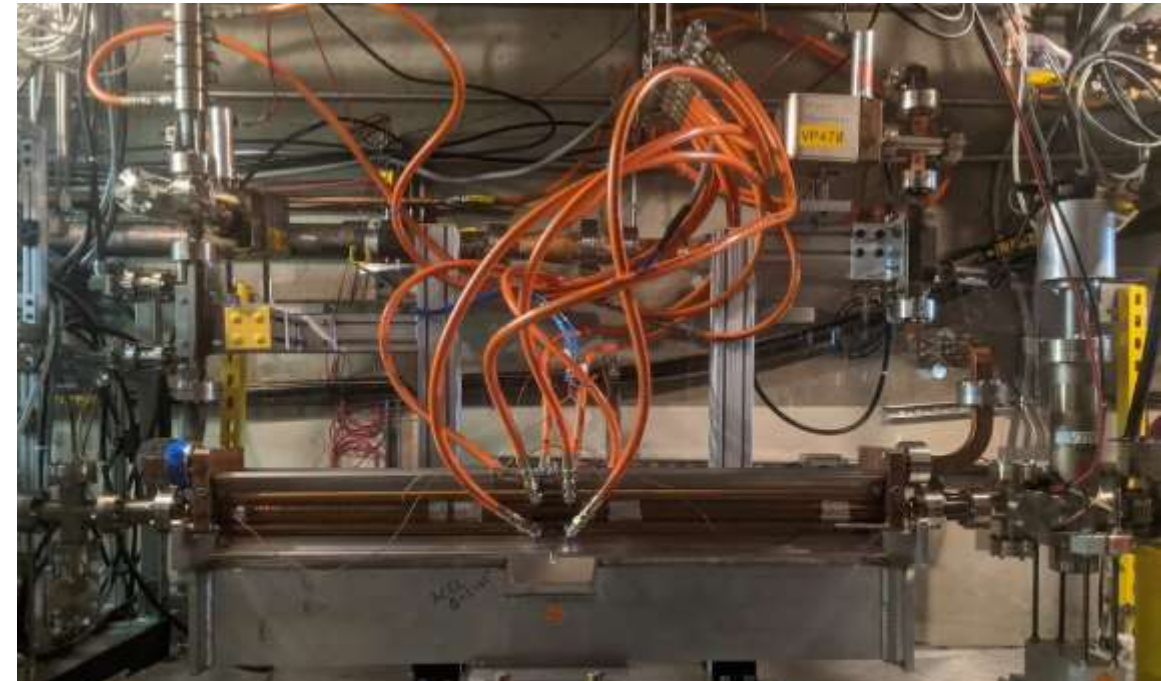
- Brendan will discuss in detail tomorrow
- We rebuild S10 dogleg and BC11 chicane to measure CER



I assume there will be modifications / upgrades / great ideas coming with every additional bit of data we have analyzed

S20 T-Cavity and SLED Cavity

- Moved T-cavity to new location in BC20 and it's working. Can be rotated by 90°.
- We are installing a SLED cavity (SLAC Linac Energy Doubler)
 - Will compress RF pulses and thus give a shorter but larger kick to the T-cavity
 - Many parts of hardware are in hand
 - Especially the cavity
 - Need some machining and procurement
 - Install this summer (latest)



More kick for better diagnostics coming to you in '24

Positron Source Revitalization

- Operational requirement
 - Need the positron target as “beam dump”
 - Park unused beam which should not go through to the User Area
 - Keep Linac at optimal rate for feedbacks while delivering variable rate to User Area
 - Unfortunately, we finished FACET operations with vacuum issues in the vault
 - Need to fix that before we can bring beam to the target, otherwise too much radiation to work there later
- Expect the vacuum issues will be fixed this fiscal year

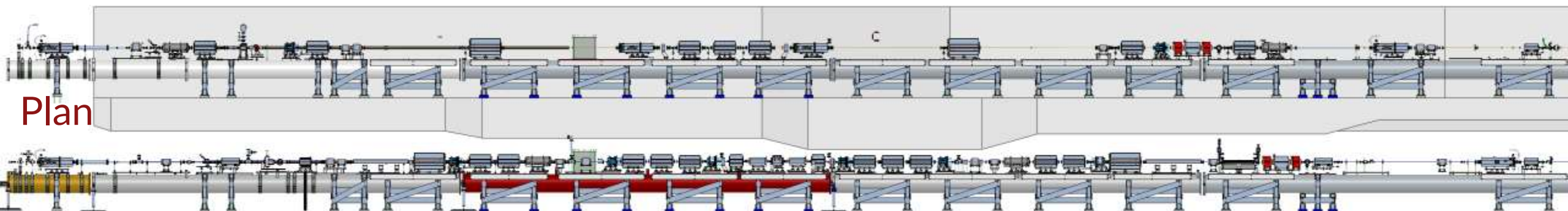
Positron target as beam dump available later in 2024

New Layout of BC20 Chicane

- We planned to modify the existing W-chicane into a “normal” double dog-leg
 - Difficulties to find the needed engineering and design support while SLAC was focused on LCLS-II
 - reevaluated the effort needed vs. scientific benefits to modify the chicane
 - ➔ concentrated on all the other good things presented in this talk
- Nevertheless
 - Close to finalizing the drawings
 - Will have a review of our designs and installation plans after that
 - Reevaluate the benefits of the rebuild when there is more clarity about FACET-II’s positron program

Soon we will be ready to implement when the opportunity arises

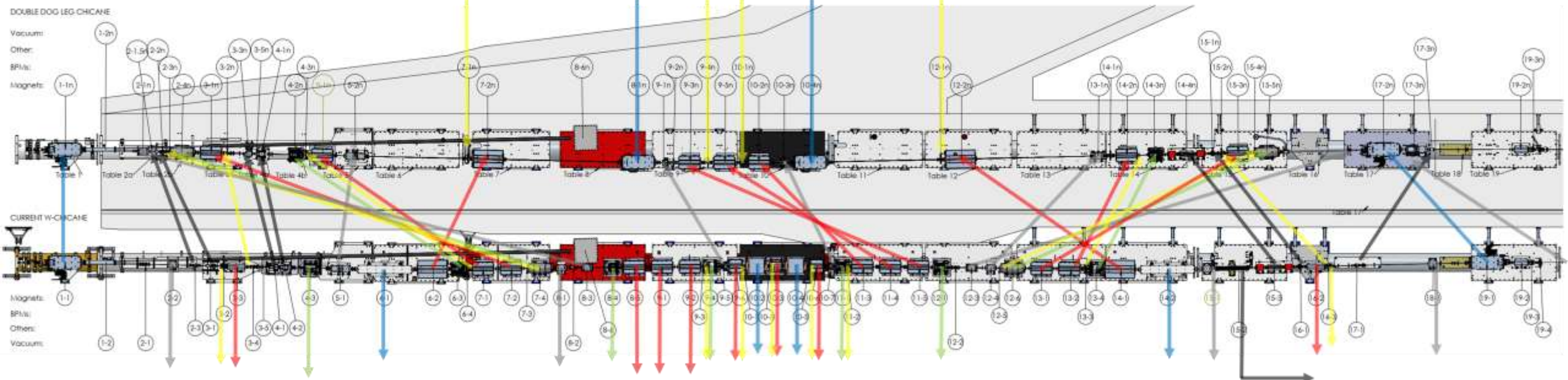
New Layout of BC20 Chicane



Plan

Present Layout

Moves are color coded: Quadrupoles (red), Dipoles (blue), Sextupoles (green), Instrumentation (yellow)



Differential Pumping

- Works not quite as designed, but works better than we thought
 - Differential apertures were replaced with “holes” in Be-windows
 - Li-oven can operate as specified at 5 Torr
 - Tested diff pumping to work even at 10 Torr
 - Gas jets can run at high rate, only limited by how fast we can evacuate PB
- Needs some form of hand holding
 - Radiation protection of pump controllers
 - Seems to work for now
 - Operational not quite on auto-pilot yet, but we'll be getting there with more run time and operational experiences

DPS works reliably

LLRF Upgrades

- Will improve control and stability of FACET-II compressed beams
 - Designs are available
 - Most/all hardware for L1 has been ordered
 - Resources are now available to start the installation
 - Will upgrade stations 11-1 and 11-2 during FY2024
 - Then move on to L2, stations 14-4, 14-5, and 14-6

Ongoing project which improves beam quality along the way

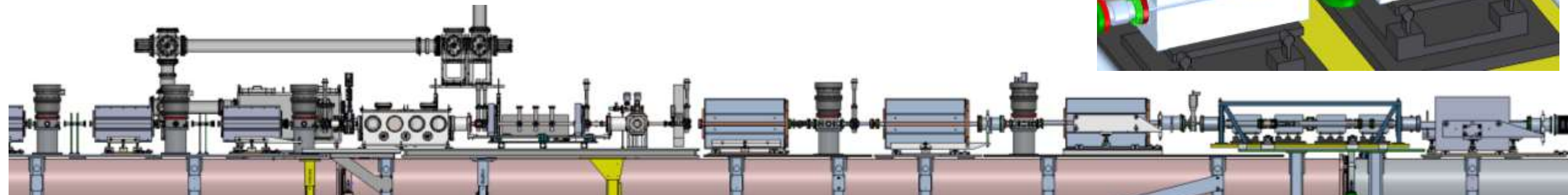
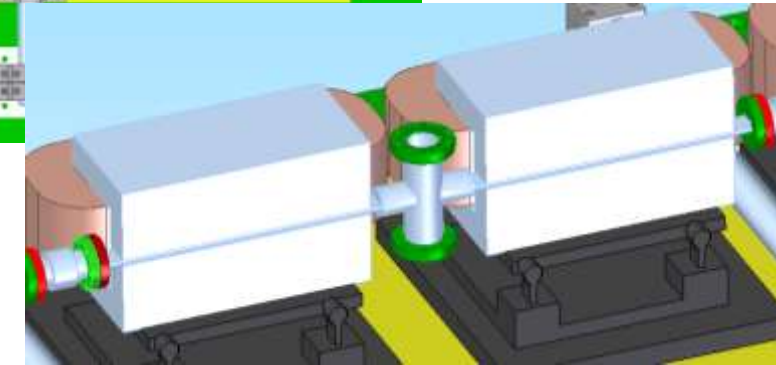
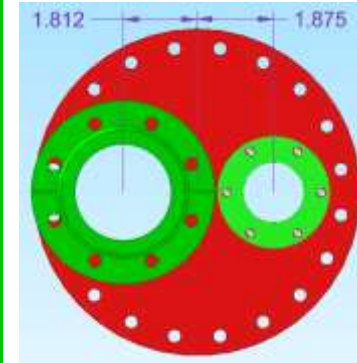
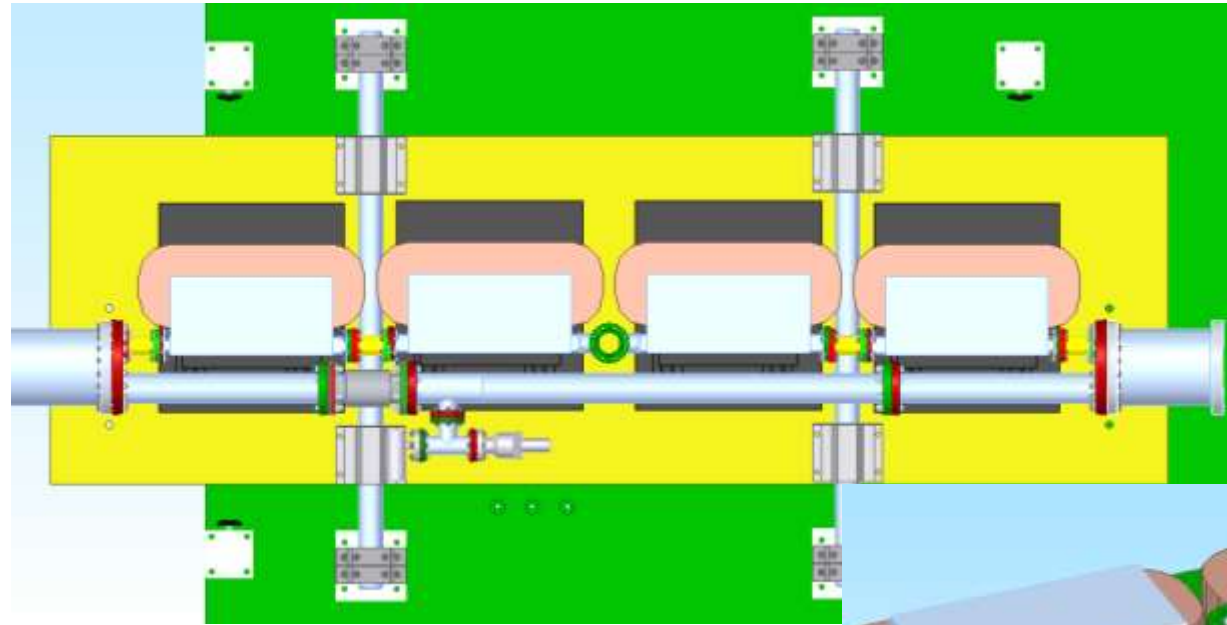
VAX/Legacy Controls – Long Term Plan

- Yes, we have a VAX at SLAC, and we still use it
 - Significant parts of the FACET-II Linac relies on SLAC's legacy control system
 - Magnets, klystrons, vacuum, temperature, BPMs, toroids, timing distribution, MPS and PPS
 - NLCTA, A-Line, and End Station A depend on this legacy controls as well
- There is a path for FACET-II to remove VAX dependencies
 - Follows what was done for LCLS
 - Is a large effort in both labor and materials

Long term project to remove a single point of failure

FACET-II IP-Area / Post-Plasma / PAX Chicane

- Agostino's talk tomorrow
 - Extreme compression of e-beams to nm duration and coherent XUV generation
 - Magnets, beam lines, and supports are conceptually designed
 - Going out for quotations next week
 - Order in 2023



Will be tight for next summer installation, but could be done during PAMMs as well

Gamma Detection Chamber (GDC)

- See Brian's talk tomorrow
 - Converter for IP photons with 2 spectrometers for different γ -energies
- A really big chamber (support table is already installed in tunnel)



- PDC, EDC and GDC are rather universal chambers with removable side panel or flanges which can be modified for your new additions

Should be installed summer down time 2024 or earlier

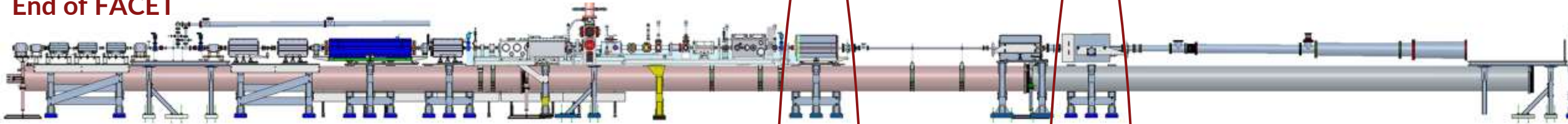
Summary

- We installed quite a few improvements over the past 3 years and install more in the coming years
 - SLED cavity, CERD will improve diagnostics
 - LLRF, HVAC upgrades, positron source revitalization make more stable beams
 - Differential pumping enables many experiments
 - PAX chicane and PDC are the next two big experimental elements
- Every available spot between IP and dump is covered with some form of chamber or access port to implement experiments
- There is one “empty” space, the old THz table upstream of the IP...

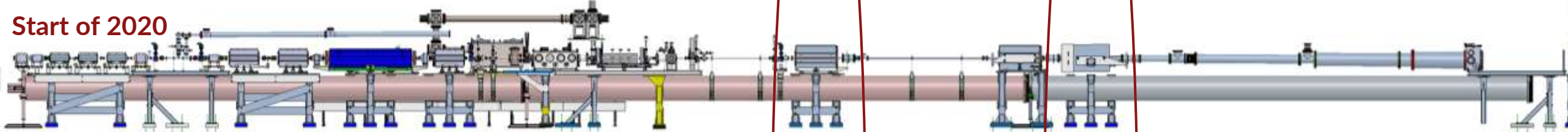
Keep great ideas coming
We are at the ready to implement

S20 Installation Progression for Present IP Layout

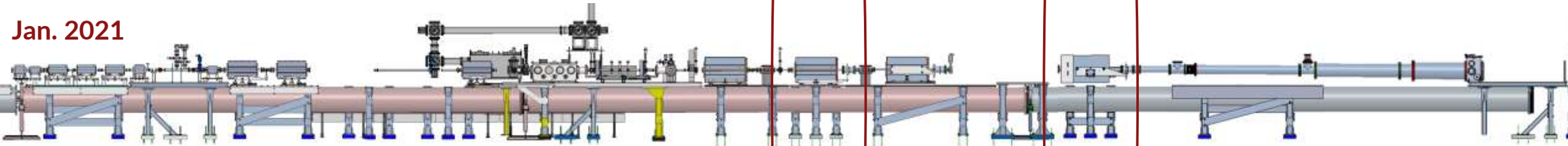
End of FACET



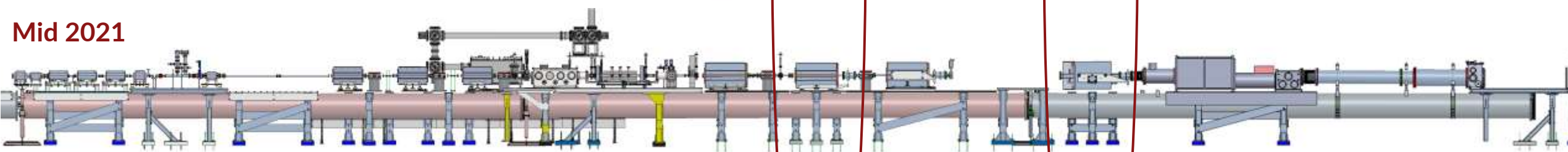
Start of 2020



Jan. 2021



Mid 2021



Summer 2022

