

# EQU Projects and Upgrades

FACET-II PAC Meeting 2022

Carsten Hast / Head Test Facilities Department

October 25-27, 2022



Facility for Advanced Accelerator Experimental Tests



Stanford University

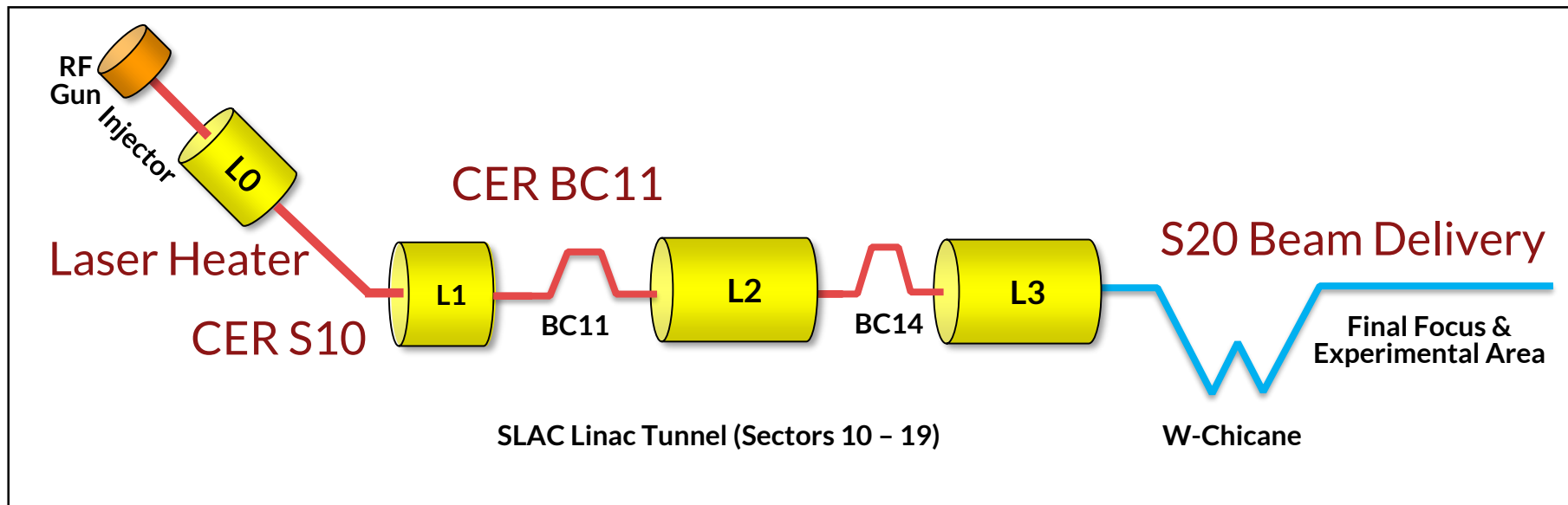
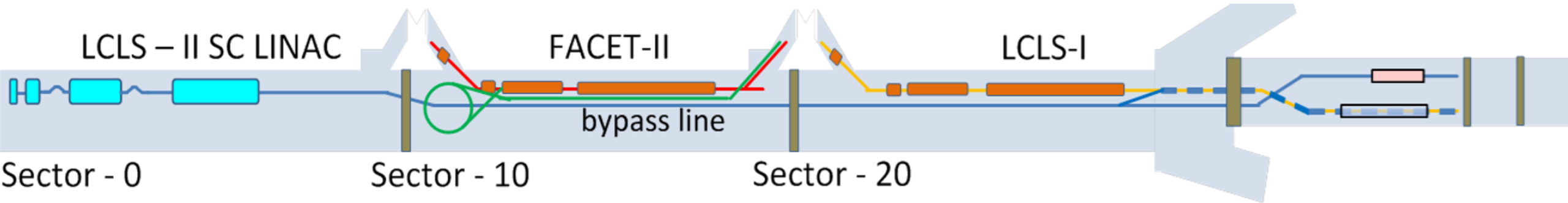


# Outline

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- New and ongoing projects
  - Injector Laser Heater
  - Non-destructive edge radiation measurements at S10 dogleg and BC11
  - BC20 Reconfiguration
  - Positron Source Revitalization
- Positron Planning

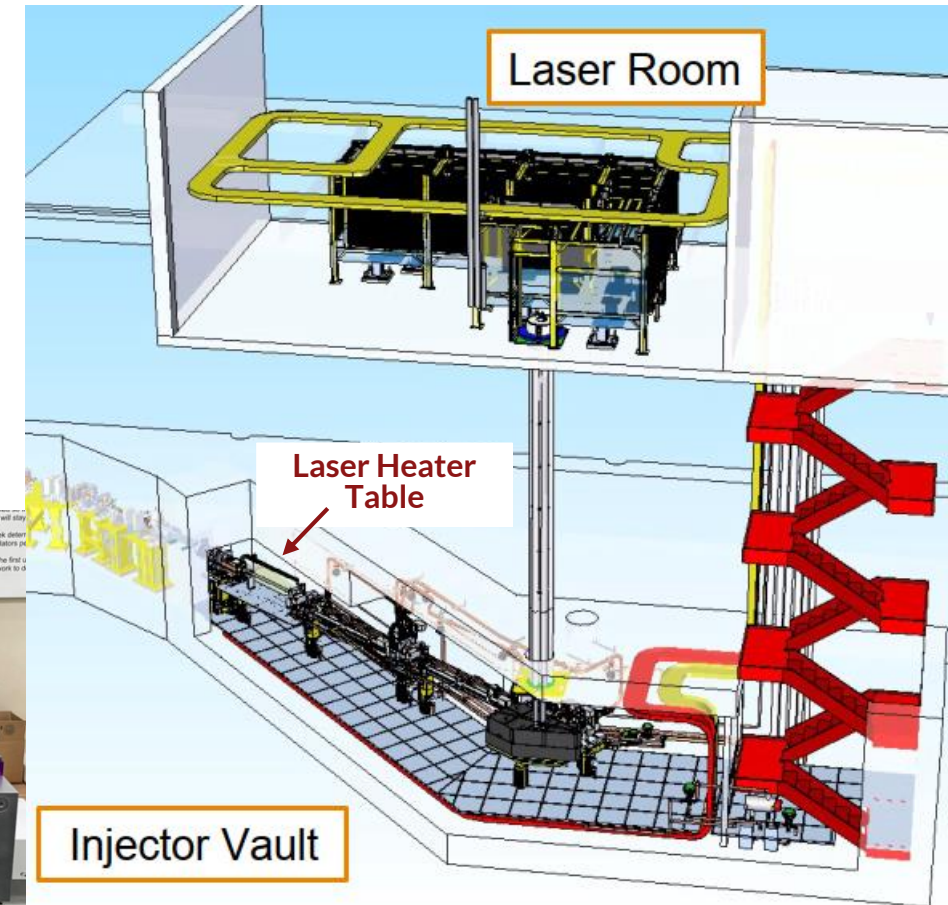
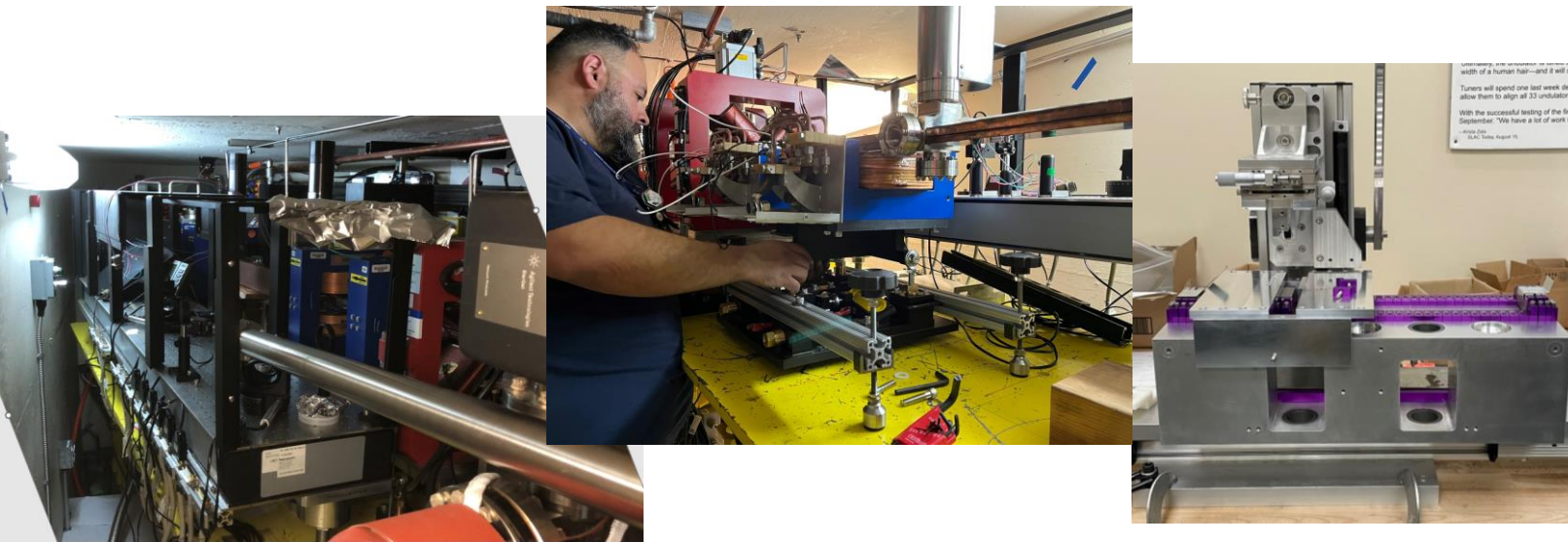
# FACET-II Upgrades since Start of Commissioning in 2021





# S10 Injector Laser Heater

- See G. White's and D. Storey's talks for physics motivation
- Just finished installation of vacuum chamber, 4 dipole chicane and laser components
- Undulator is being built by Metrology
  - Installation next 3-day PAMM (Mid-November)
- Laser is being commissioned
- Controls of magnets and cameras, etc. are working

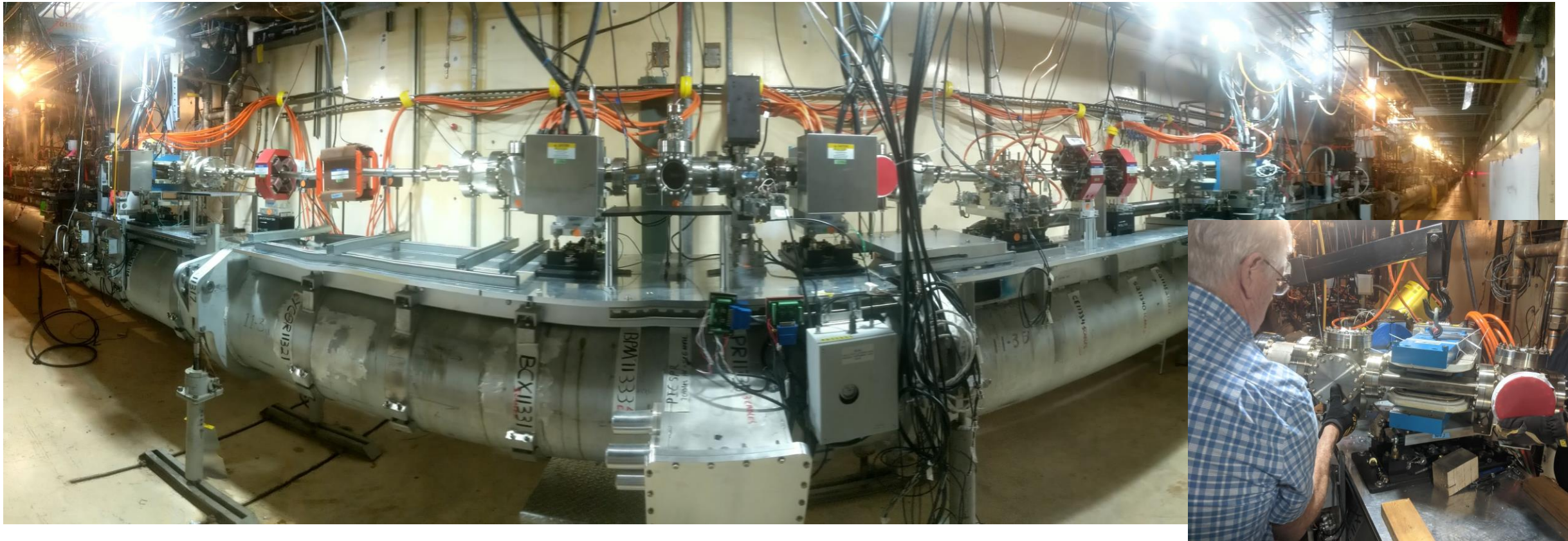


Laser Heater nearly ready for commissioning



# Coherent Edge Radiation Non-destructive Beam Measurements

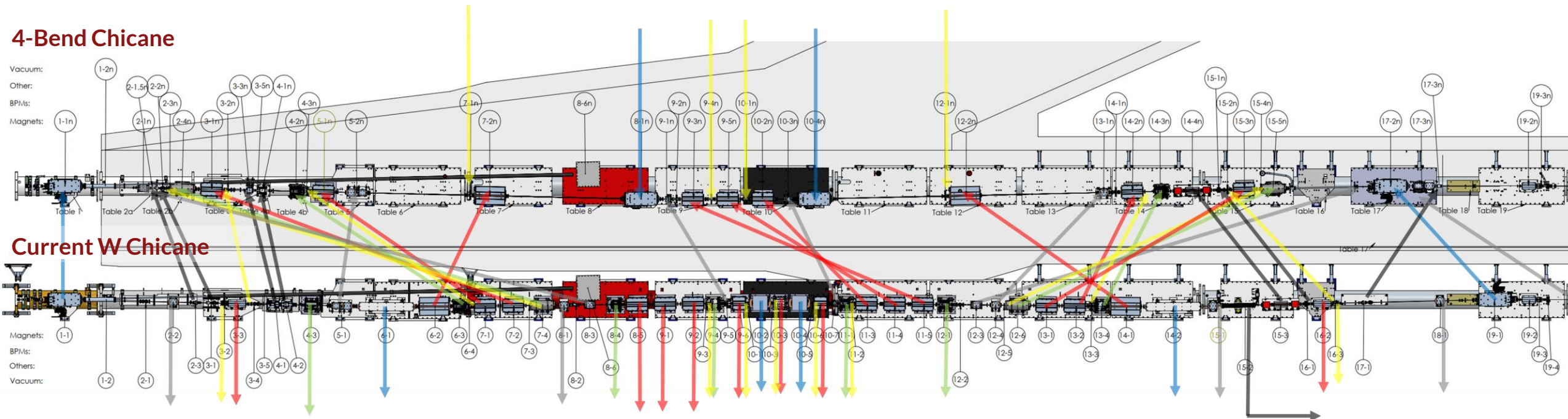
- S10 dogleg installation completed and commissioned – details by B. O'Shea in E-326 update
- BC11 beamline reconfigured for CER in September, ready for first beam



CER @ BC11 installation is ready for first beam

# S20 Chicane Rebuild

- FACET-II Project planned to reconfigure W chicane to 4-bend chicane
- Reusing existing quadrupoles and sextupoles, 2 new dipoles purchased
- Detailed reconfiguration plan developed:
  - Moves are color coded: Quadrupoles (red), Dipoles (blue), Sextupoles (green), Instrumentation (yellow)





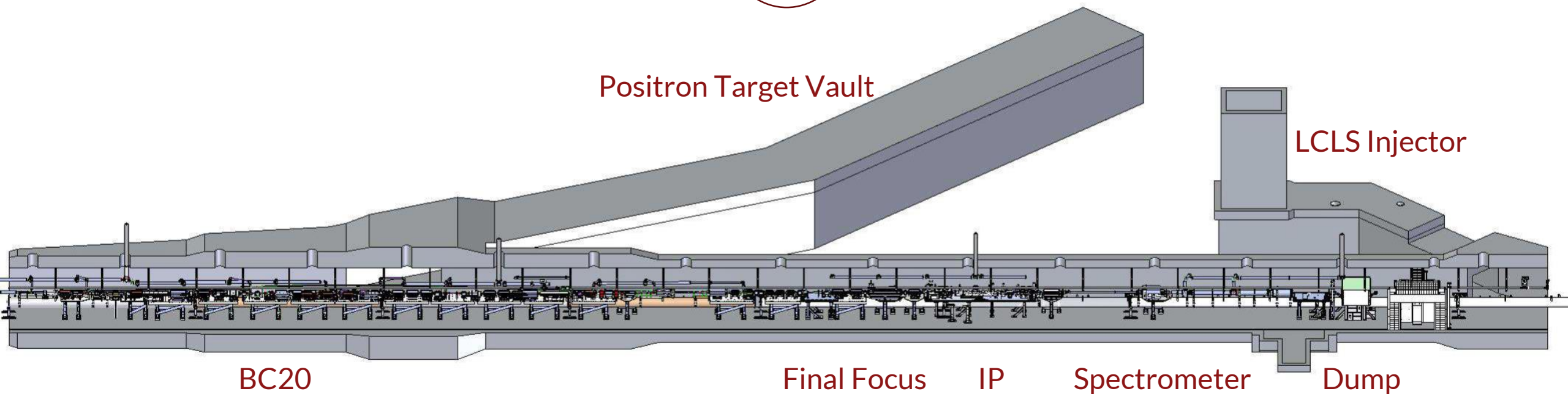
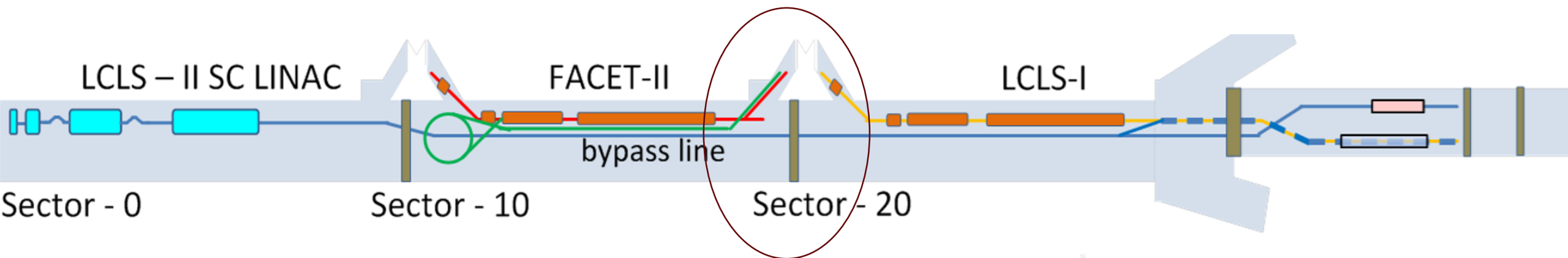
# S20 Chicane Rebuild Status

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- Operating with W-chicane until an installation opportunity exits
- Detailed engineering nearly complete
- Most parts in hand and ready for installation
- No new power supplies required:
  - Redesigned the PS layout reusing existing supplies
  - Rerouting of cables is fully designed
- Prepared a strawman MS Project schedule
  - Requires an extended period to complete the installation
- Will have an installation readiness review in 2023

S20 Electron chicane rebuild target date summer down 2023

# Positron Source Revitalization





# Positron Source Revitalization

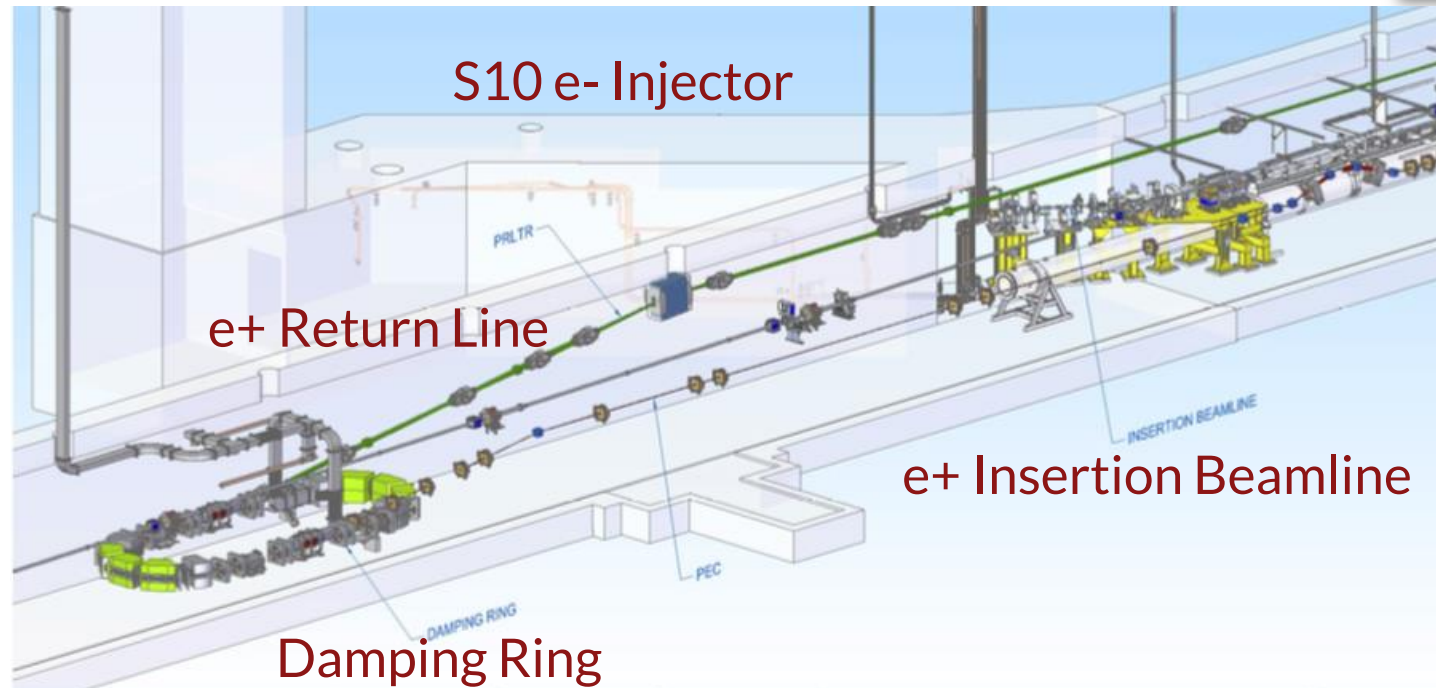
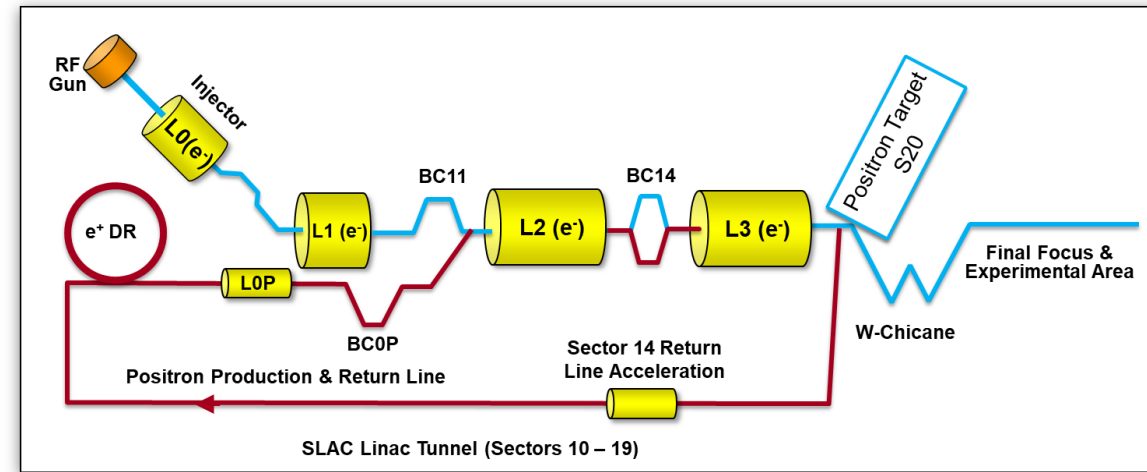
- Operational requirement
  - Need the positron target as a “beam dump”
  - Park unused beam which should not go through to the User Area
    - Keep Linac at optimal rate for feedbacks while delivering variable rate to User Area
  - Unfortunately, we finished FACET operations with vacuum issues in the vault area
  - Need to fix that before we can bring beam to the target, otherwise too much radiation to work there later
- Have asked MFD to start working on job planning
- Expect the vacuum issues will be fixed in a few months
  - Alternatively, we need to design and build another beam dump



Positron target as beam dump should become available next year

# Positrons

- Positrons were descoped from FACET-II Project
- Damping Ring magnet design was completed, and prototypes were procured as part of the Project
- Positrons represent a unique opportunity for SLAC with global enthusiasm



- Positron Target
  - S14 Energy Boost
  - S10/11 Return to Ring
  - S10 Damping Ring
  - S10/11 Ring to Linac
  - BC14P
  - S20 Positron Arm
  - S11-20 e/p Diagnostics Upgrade
  - S10-20 PPS/BCS Upgrade
  - S10 Reconfiguration for LCLS-II-HE
- Original FACET-II Plan



# Positron Outlook

- Design requires ~11,000 hours of engineering → **Requires 6-8 engineers for 1.5 years**
- Access to S10-S20 is driven by
  - FACET-II Operations schedule
  - LCLS-II Operations schedule
  - LCLS-II-HE Installation Schedule
- Several extended down times in the coming years:
  - Summer 2023: 3 weeks of tunnel access
  - Summer 2024: 10 weeks of tunnel access
  - Fall 2025 to summer 2026: ~12 months of tunnel access
- Installation opportunity dates are fast approaching. Need to start detailed planning and designing soon

**SLAC is the only place to do PWFA with Positrons**

**Needs a strong concerted effort to make it a reality**

**FACET-II team's first task is the success of the experimental program**

**FACET-II needs significant additional resources to make Positrons happen**

# Future Upgrades

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Future upgrades are motivated by science needs

- Improved phase and amplitude control in the RF systems will allow for more stable and reproducible beam delivery
  - L1 LLRF upgrade initiated
- Detailed designs for upgrades to spectrometer beamline driven by multiple experiments
  - Compact chicane
  - Compton and Gamma Pair spectrometers
- Further upgrades under consideration include:
  - Improvements to the differential pumping system
  - Experimental Laser system
  - ... and of course, Positrons...

Outcome of PAC meetings are important for identifying and prioritizing future upgrades



# Summary

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- We installed a lot of hardware and there is still a lot in the pipeline
  - Ample opportunities for User Experiments
- S10 and BC11 Coherent Edge Radiation and Injector Laser Heater completed
- S20 beamline reconfiguration interleaved with beam operations
- S20 Chicane rebuild envisioned summer 2023
- Positron source revitalization started
  
- Positrons present an opportunity to open unique scientific avenues for Users
- Positrons will demonstrate technologies important for HEP
- If we start now, we can be ready for the long down time in 2025

**FACET-II is improving the User hardware one PAMM at a time**



# Questions?

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