EQU Projects and Upgrades

FACET-II PAC Meeting 2022

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October 25-27, 2022
Outline

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

• Positron Planning
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
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

• 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

LCLS – II SC LINAC

FACET-II

bypass line

LCLS-I

Sector - 0

Sector - 10

Sector - 20

Positron Target Vault

BC20

Final Focus

IP

Spectrometer

Dump

LCLS Injector
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
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

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

• 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?