

# Recommissioning SLAC's LINAC West for FACET

## Workshop on Accelerator Operations 2012

Peter Schuh, August 9, 2012

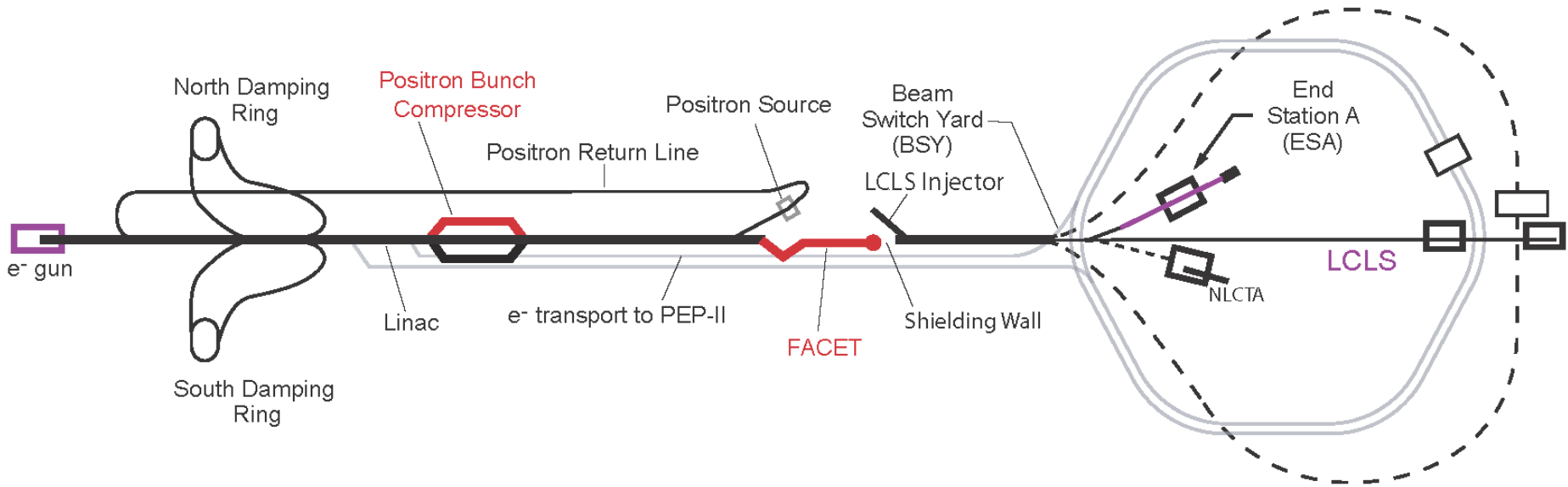


# Outline

- Background
- FACET
- Pre-commissioning preparation
- Challenges during commissioning
- Conclusions

- SLAC's National User Facilities
  - Linac Coherent Light Source (LCLS)
  - Facility for Advanced aCcelerator Experimental Tests (FACET)
  - SPEAR3

# Schematic Map FACET and LCLS



Drawing not to scale

# Background

- Main Control (MCC) – LCLS and FACET
  - 13 Accelerator Systems Operators in 5 teams of 2-3 people
  - 7 Operations Engineers (EOICs)

- Uses portion of SLAC Linac that was last used as an injector for PEP-II in 2008
- Operates 4-6 months per year
- Commissioning started in 2011
- Second run with brief commissioning and users in 2012
- Ends in 2016 when LCLS-II begins commissioning

# Pre-commissioning preparation

- Experienced operators were divided into six teams of two. Each team was assigned a different topic or geographic region
- Each team gave a 1.5 to 3 hour training presentation on their area/topic that included:
  - An overview of the area
  - The initial beam setup procedure
  - Tuning practices/tips, common problems
- The talks were video taped and made available online

# Challenges during commissioning

- Control room division of labor and the experience gap
- Control system ease of use
- Standard operating point and procedures not established



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# Challenges during commissioning

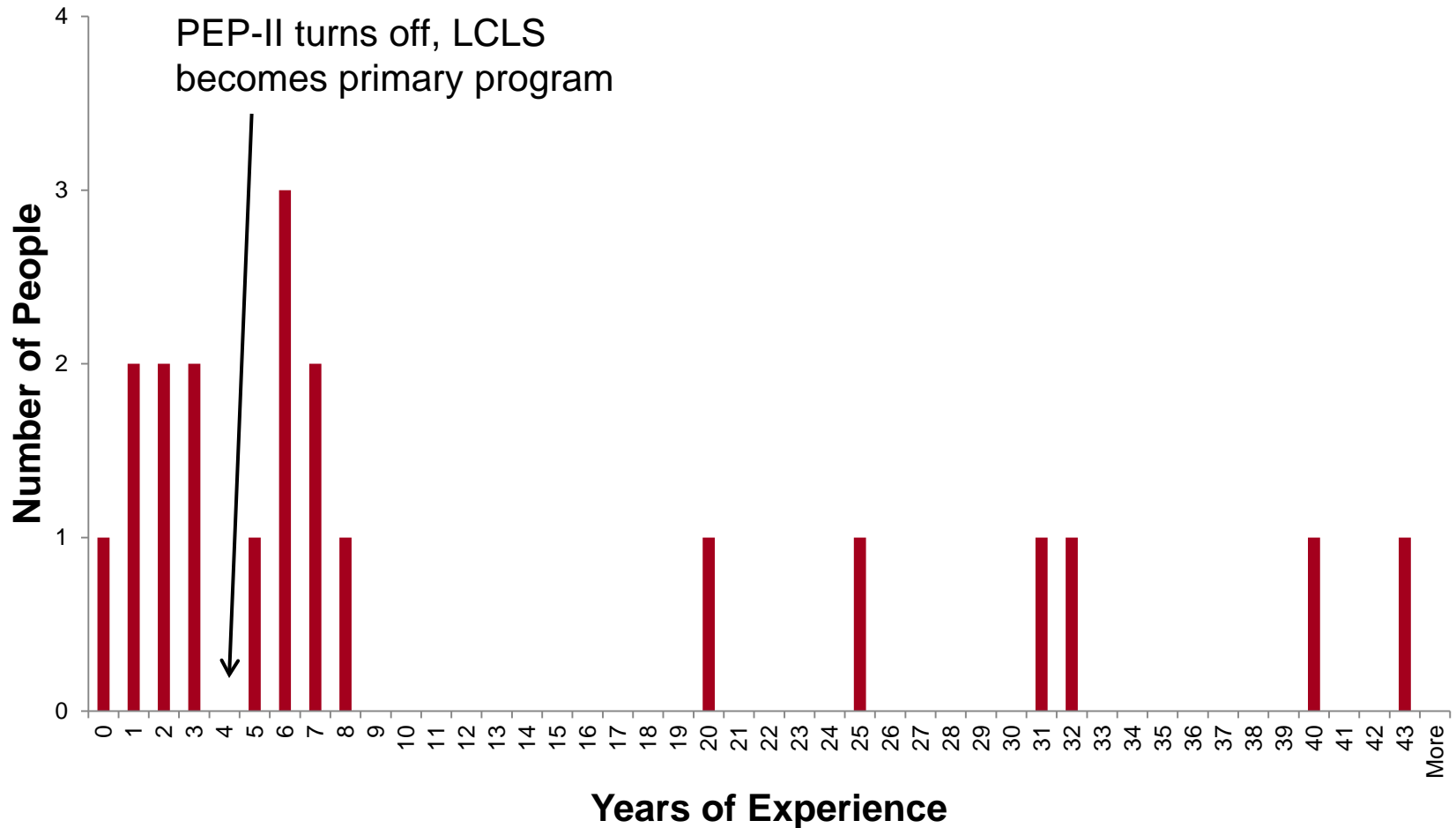
- Control room division of labor and the experience gap
  - Prior to April 2008 – PEP-II and LCLS commissioning
  - April 2008 – PEP-II turns off, LCLS becomes sole program in Main Control
  - To optimize efficiency operators began sharing workload of LCLS tasks
  - Operators divided tasks for configuration changes and complex tuning procedures into pieces that could be done simultaneously by different operators
    - One operator prepares the injector, another prepares the Linac, and a third prepares the photon diagnostics
  - Very efficient

# Challenges during commissioning

- Introduction of FACET reduced number of operators available to focus on LCLS
- Operator self-sufficiency now much more important
- Single program operation had encouraged specialization
- Gaps in skill sets made apparent by independence

# Challenges during commissioning

## Operator and EOIC Experience Distribution



# Challenges during commissioning

- The experience gap
  - FACET initially relied on most experienced operators
    - Efficient for short periods
    - Success relied too heavily on who was on shift

# Challenges during commissioning

- What we did
  - During break between FACET runs, practiced having one operator responsible for LCLS
    - All operators rotated through this role
    - Less efficient, but some short term inefficiency necessary to improve skills
    - Conflicts with strong desire to optimize
    - Struggle and even failure, when managed carefully, can improve skills and boost confidence
  - EOICs shifted role to focusing on coordination and helping whichever program needed more help
  - Continued with this scheme during FACET and LCLS operation

# Challenges during commissioning

- Control room division of labor and the experience gap
- **Control system ease of use**
- Standard operating point and procedures not established

# Challenges during commissioning

- Control system ease of use
  - Most of FACET uses older non-EPICS control system
    - Mature, but not as intuitive as current standard (LCLS)
    - Steep learning curve for new users
      - Basic operating point information has to be actively extracted from the system



# Challenges during commissioning

- Control system ease of use
  - In the past we tolerated this
    - Only painful for small fraction of people at once (new operators)
    - People “train past” the problem
    - Afterwards, sense of accomplishment (rite of passage)
    - Seeing such a large fraction of the group suffer, realized it is worth fixing

# Challenges during commissioning

- Control system ease of use, continued
  - Have begun to make more EPICS and Matlab interfaces to the old control system
    - Fortunately most of infrastructure to support this is already in place
    - Data displayed in a more intuitive way
      - This really helps!
      - See Chris Melton's talk for examples
    - Operating point data collected and displayed in real time without requiring operator intervention
      - Fewer actions required to understand state of accelerator

# Challenges during commissioning

- Control room division of labor and the experience gap
- Control system ease of use
- **Standard operating point and procedures not established**

# Challenges during commissioning

## Standard operating point difficult to establish

- Evolving lattice and impaired hardware made it hard to get a good sense for “normal” beam parameters and conditions
- Established “standard setup” parameters and practices (ongoing)
  - Shift routines (saving configurations, measuring and recording important parameters)
  - Standard procedures
  - Standard configurations, standard orbits
  - Logging observation of non-standard behavior

- What we learned

- Processes that work well for one mode of operation may not work well for another
- It's hard to abandon practices that have worked well in the past
- We underestimated the value of an intuitive control system
- Establishing a common frame of reference is a critical part of commissioning