

# **SLAC ESTB End Station A Test Beam**

## **Other Test Beams**

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# Other Test Beams

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## 2nd Linear Collider Test Beam Workshop (LCTW 09)

- **IHEP Protvino** electron/hadron beams 1 and 45 GeV. Two months in winter
- **Other sites** beam test facilities in Europe: PSI Villingen (CH), GSI Darmstadt (D), the ELSA beam at Bonn (D), FZD at Dresden-Rossendorf (D).
- **FTBL KEK** (Fuji Test Beam Line) synchrotron photons from KEKB
  - electron beams with momentum 0.4 - 3.4 GeV
  - FTBL shutdown (2010-2012) for the upgrade of KEKB
- **JPARK** hadrons with momentum 0.5-1.5 GeV
- **IHEP Beijing** BTF (Beijing Testbeam Facility) primary (secondary) electron beam with momentum 1.1-1.5 (0.4-1.2) GeV. BTF is under a long shut down(2008-2010) for its upgrade. I have not managed to get a reliable update for of its state
- **Tohoku University**, Japan has a beam test facility providing electrons with momentum 0.3 - 1.2 GeV

**Has anybody here engaged with any of these?**



# SLAC End Station A Test Beam (ESTB)

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- Test beam activities have been interrupted by ending PEP II operation and start of LCLS
- ESTB will be a unique HEP resource
  - World's only high-energy primary electron beam for large scale Linear Collider MDI and beam instrumentation studies
  - Exceptionally clean and well-defined secondary electron beams for detector development
  - Huge experimental area, good existing conventional facilities, and historically broad user base
  - Secondary hadron beam available as an upgrade



# ESTB Proposal

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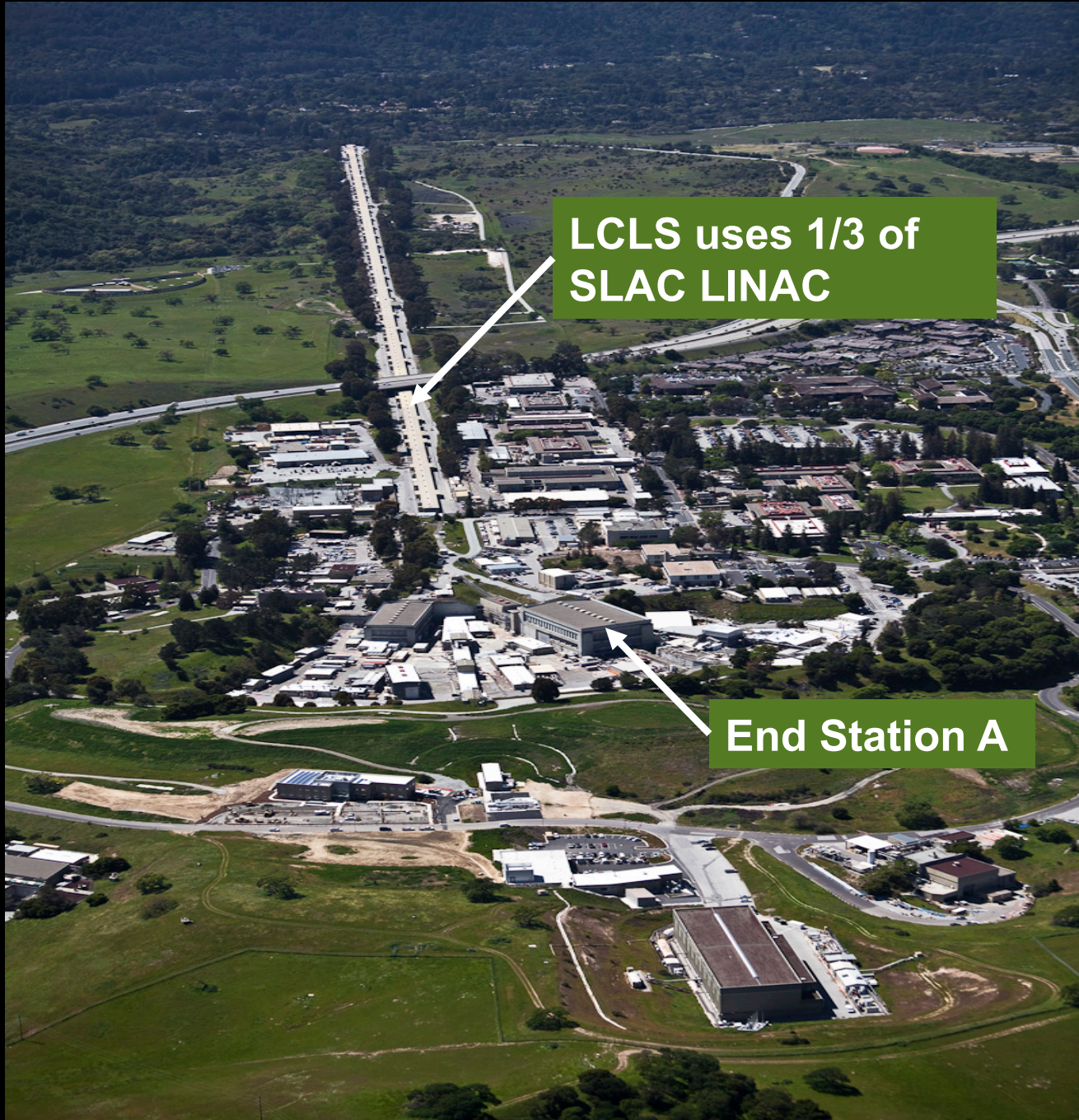
R.Erickson, T.Fieguth, C.Hast, J.Jaros, D.MacFarlane, T.Maruyama, Y.Nosochkov, T.Raubenheimer, J.Sheppard, D.Walz, and M.Woods,  
**“ESTB proposal” July 2009**

L.Keller, M.Pivi joined 2010

## 1<sup>st</sup> ESTB User Workshop on Thursday March 17<sup>th</sup> 2011

- 50 participants from 16 institutions and 5 countries
- 13 short presentations for proposed test beam uses
- 6 formal requests (already before the workshop)

**Underlines the broad  
community needs**

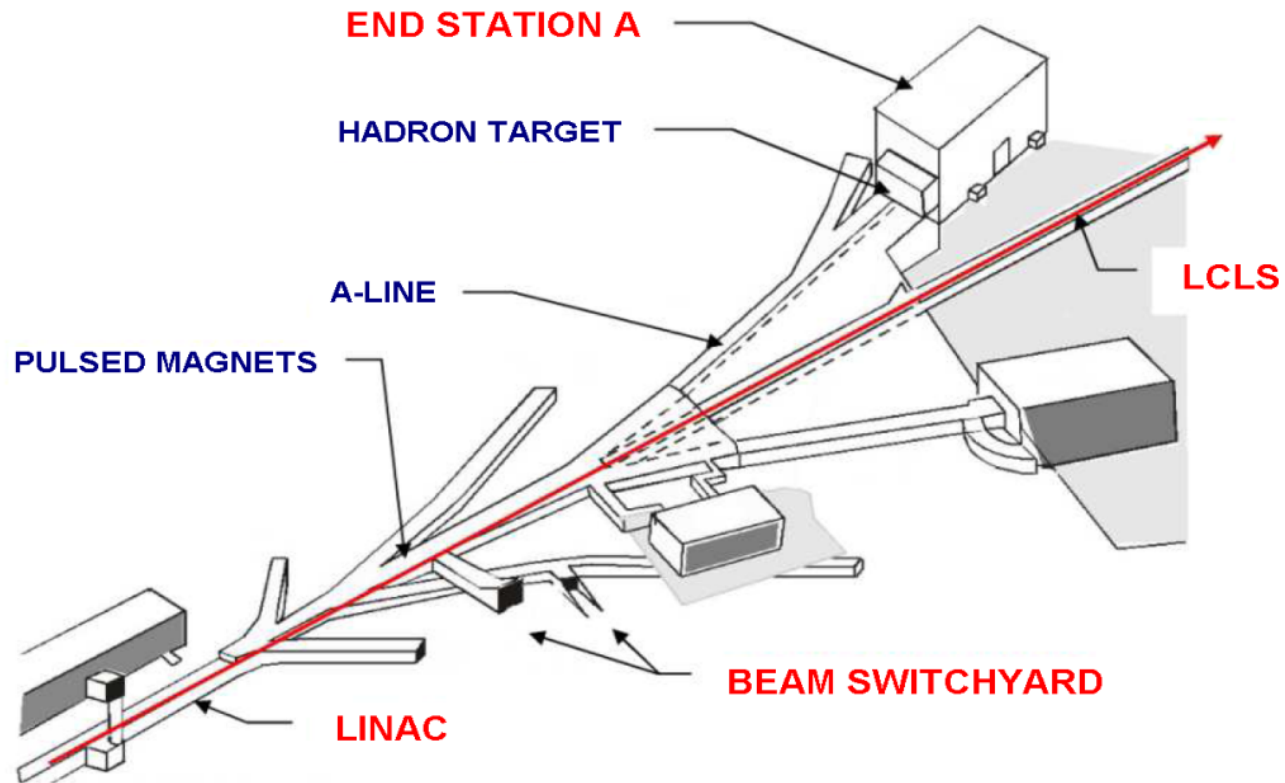


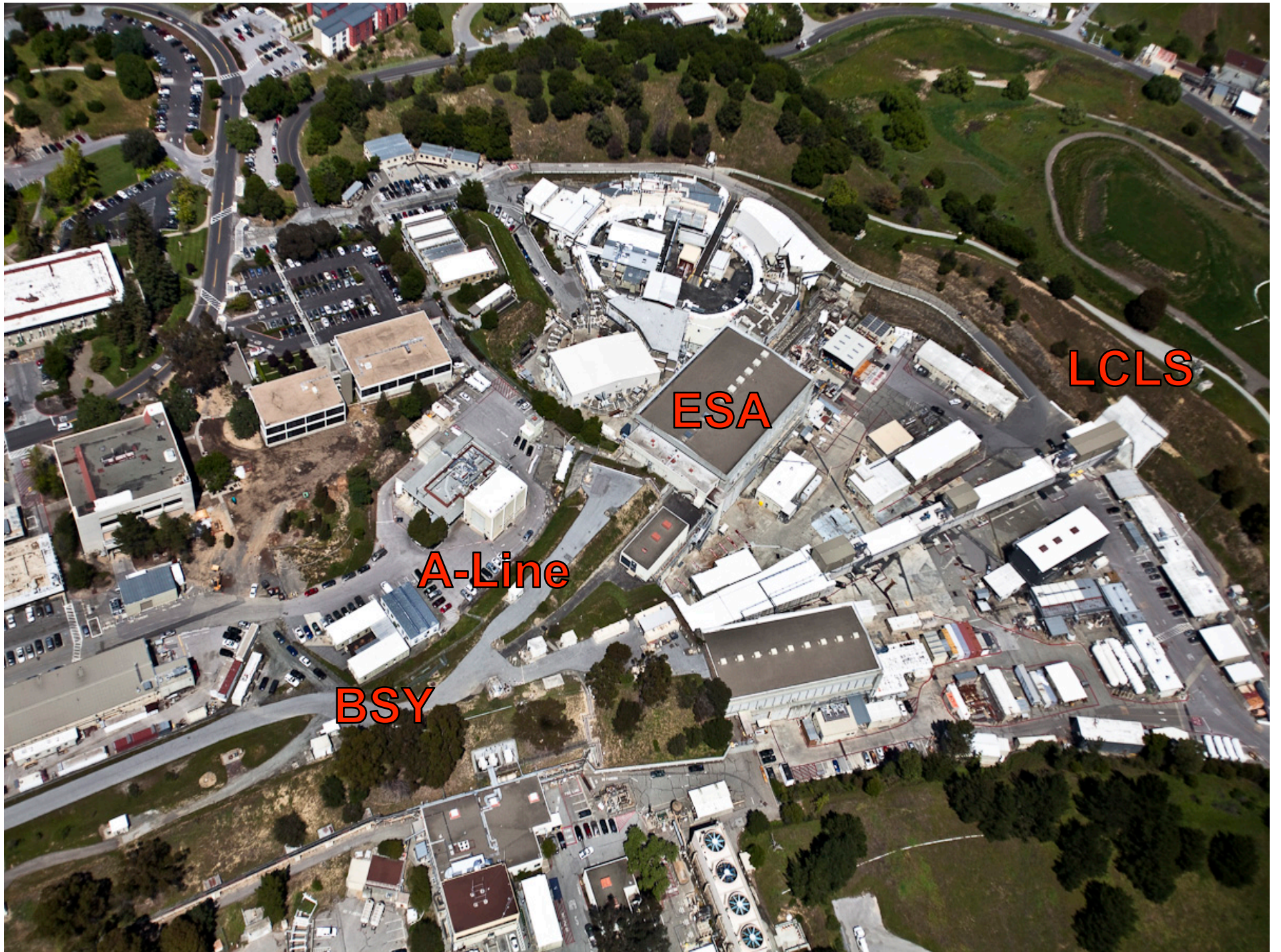
LCLS uses 1/3 of  
SLAC LINAC

End Station A

# LCLS and ESA

Use pulsed magnets in the beam switchyard to send beam in ESA.





**BSY**

**A-Line**

**ESA**

**LCLS**

# LCLS/ESTB Beams

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## LCLS beam

- Energy: 3.5 –13.6 GeV
- Repetition rate: 120Hz
- Beam current: 20 to 250 pC
  - 150 pC preferred by LCLS Users these days
- 350 pC @ 120Hz has been provided
  - This is the current upper limit for the present cathode
  - Radiation Safety approved yesterday 600 pC running!
- Beam availability >95%!

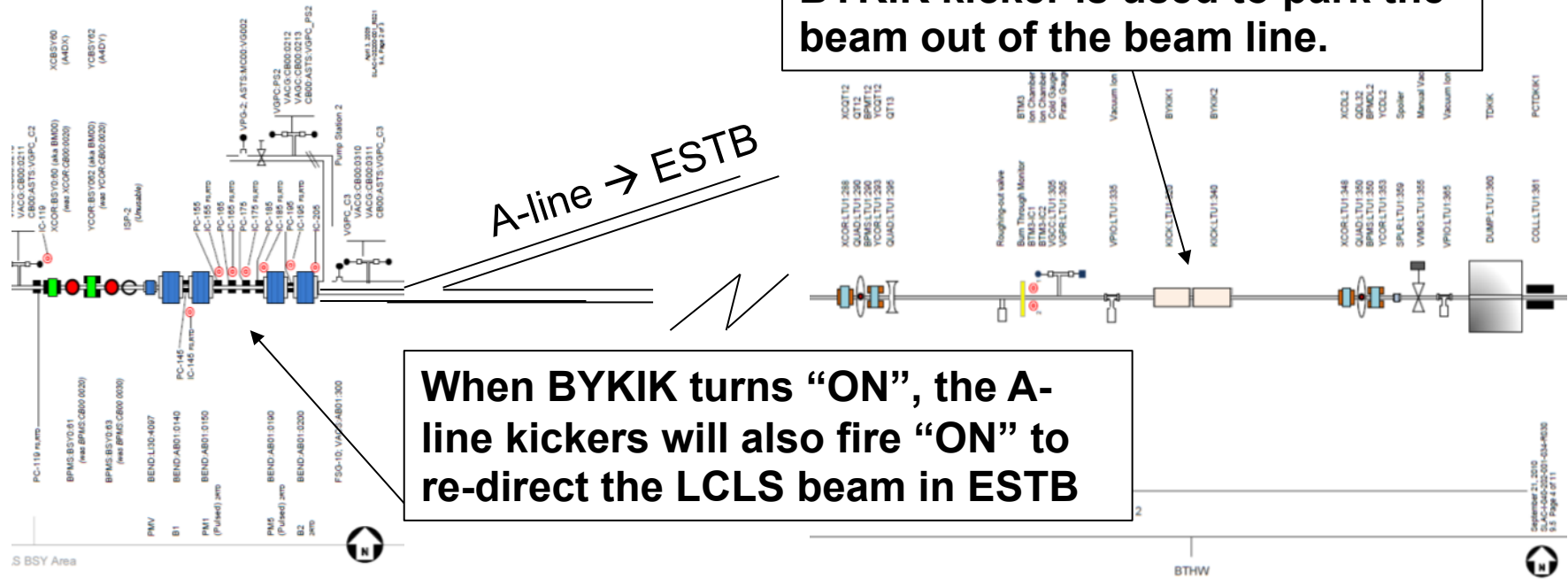
## ESTB beam

- Kick the LCLS beam into ESA @ 5 Hz
- Primary beam 3.5 -13.6 GeV
  - Determined by LCLS
  - $<1.5 \times 10^9$  e-/pulse (250 pC)
- Clean secondary electrons
  - 1 GeV to 13.6 GeV, 0.1/pulse to  $10^9$  e-/pulse



# Additional Rate: BYKIK “On”

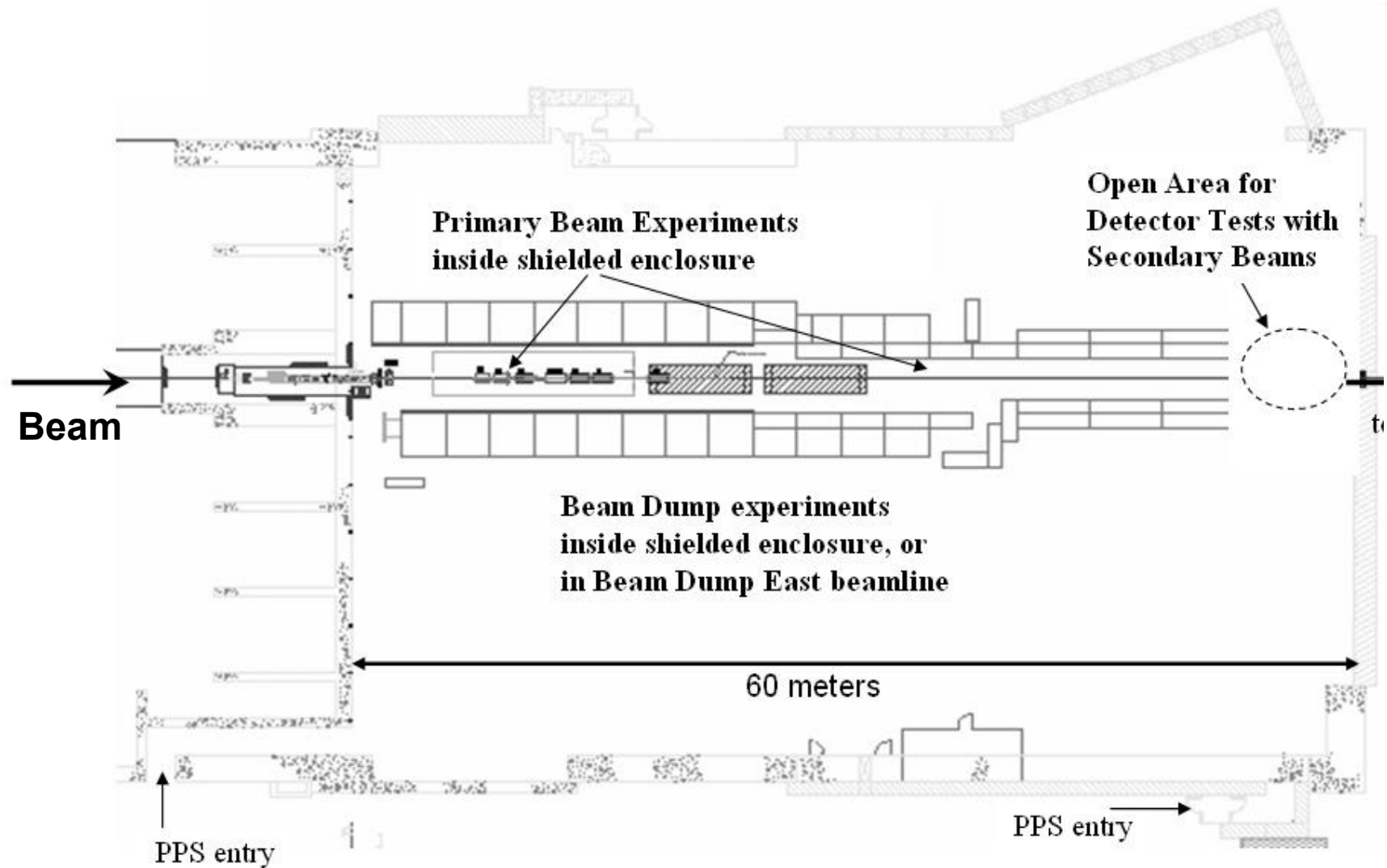
If LCLS experiments don't need full 120 Hz rate, the remaining beam is parked out by BYKIK



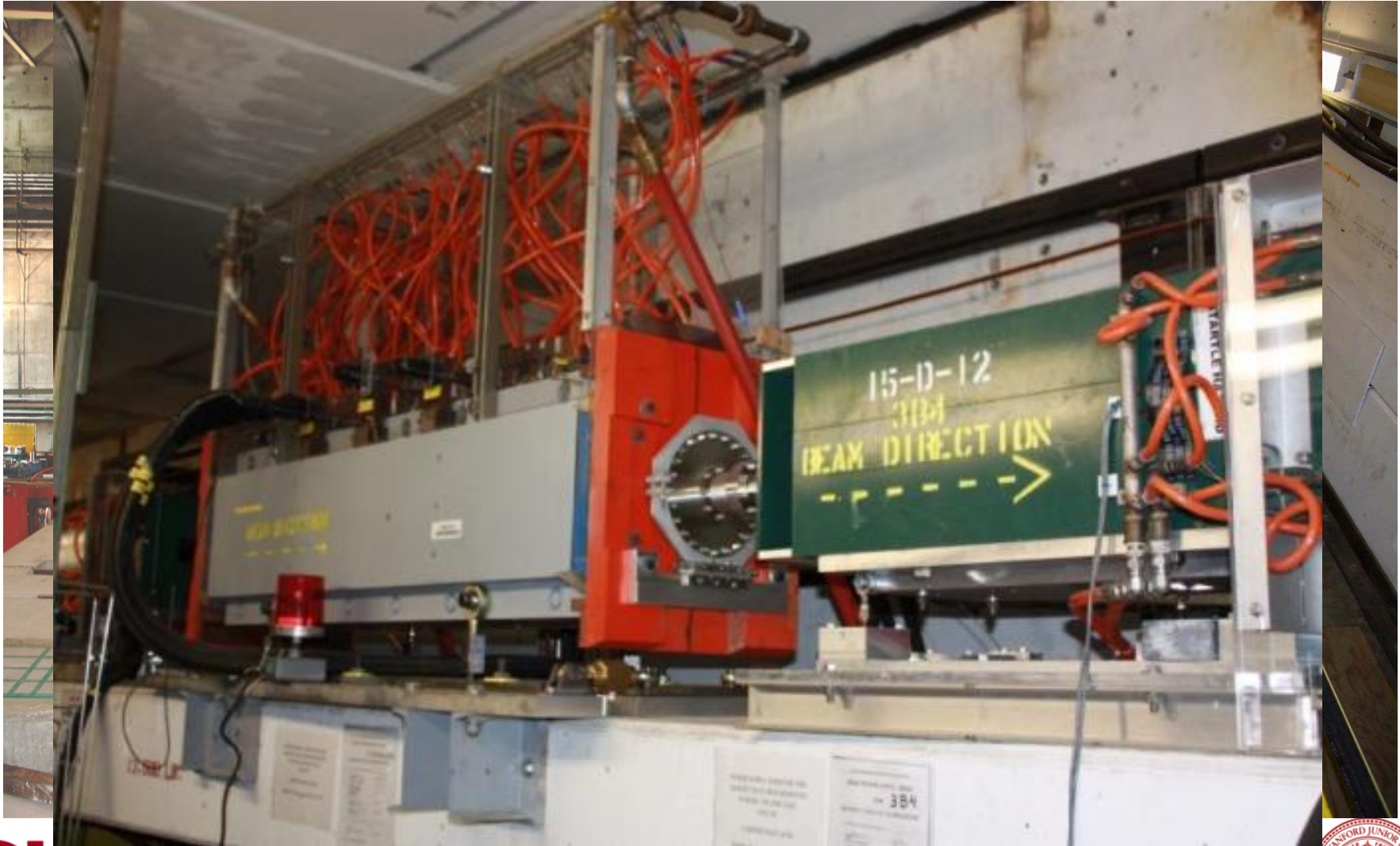
**Extra 5% of beam time at 120Hz possible**



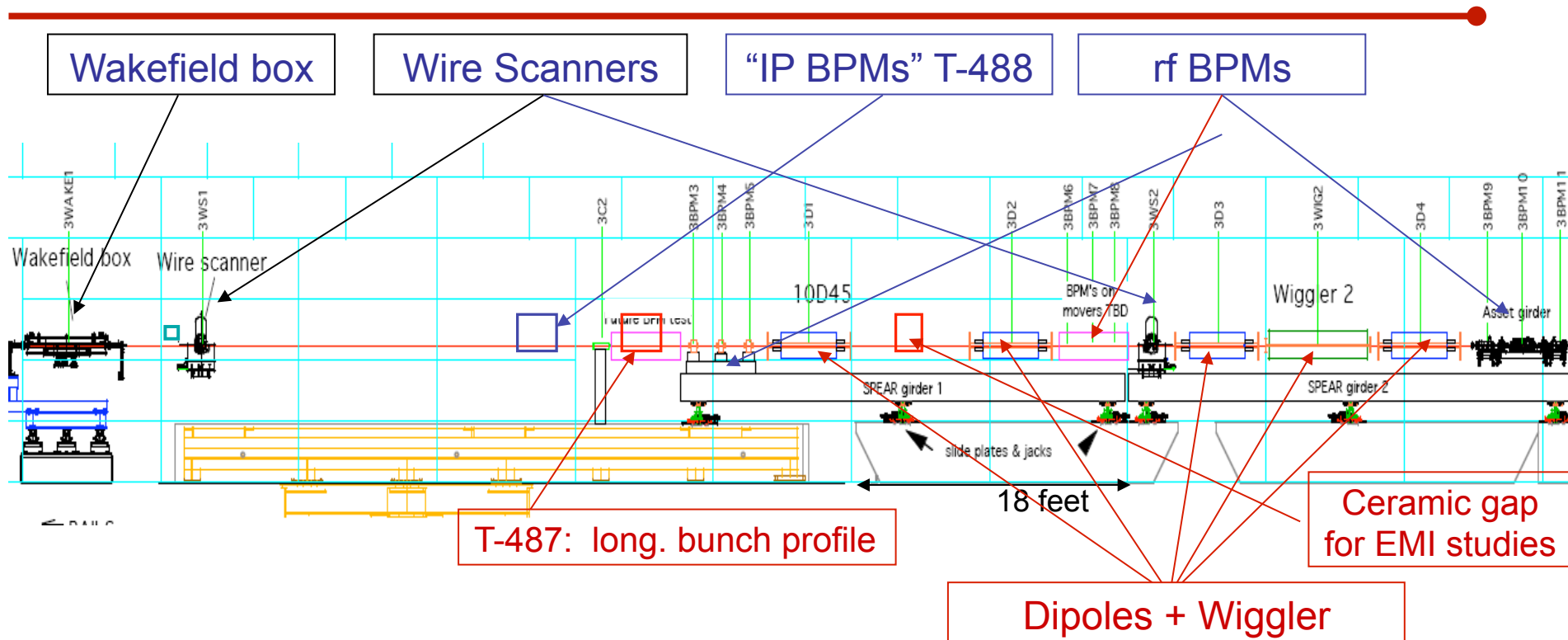
# End Station A Experimental Area



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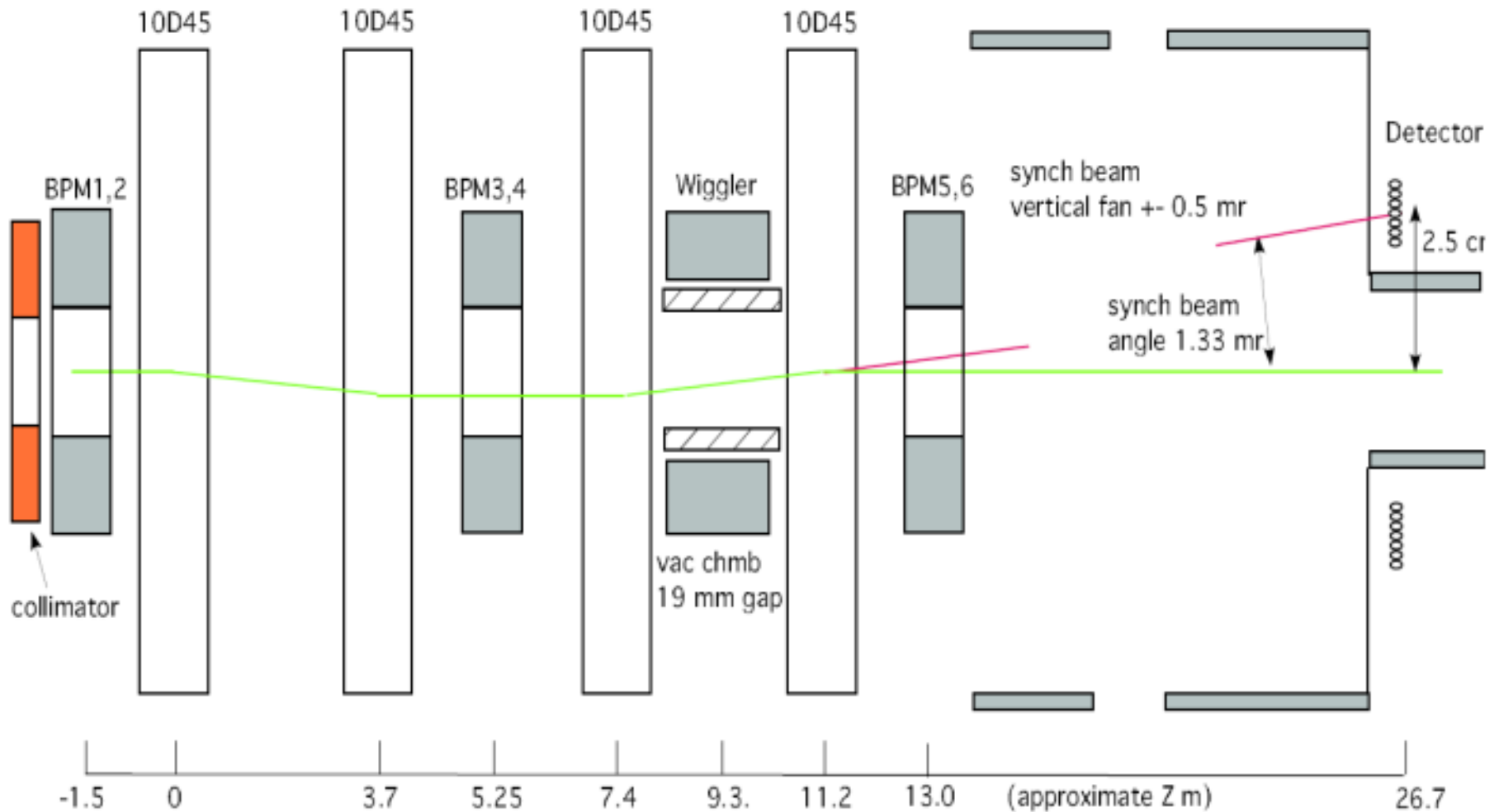
# ESA Past Experiments



BPM energy spectrometer (T-474/491)  
 Synch Stripe energy spectrometer (T-475)  
 Collimator design, wakefields (T-480)  
 Bunch length diagnostics (T-487)  
 Smith-Purcell Radiation

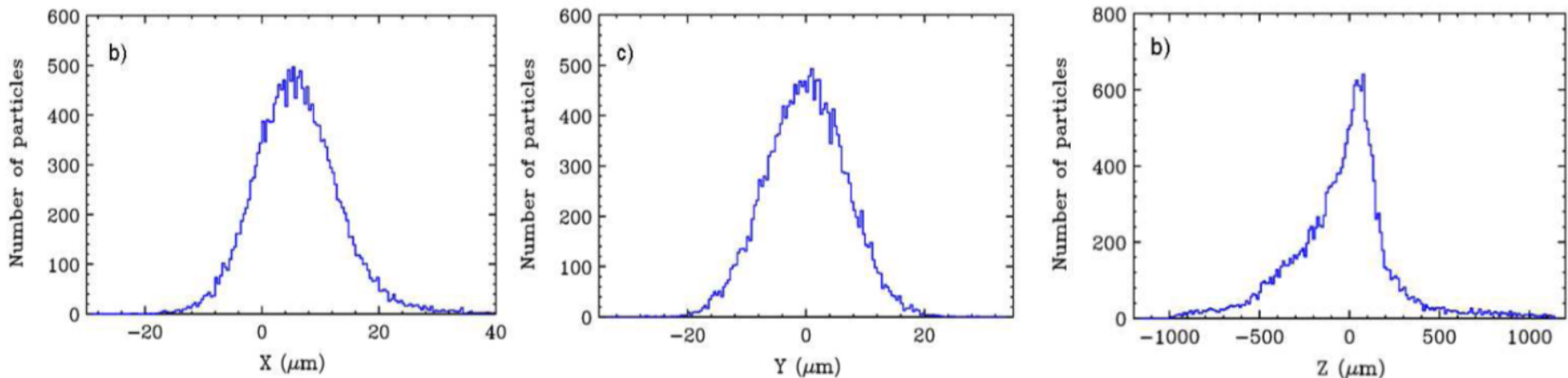
IP BPMs—background studies (T-488)  
 LCLS beam to ESA (T490)  
 Linac BPM prototypes  
 EMI (electro-magnetic interference)  
 Irradiation Experiments

# Energy Spectrometer Chicane and Wiggler



# Primary e<sup>-</sup> Beam Operations

- A full intensity, high energy e- beam
- The beam is focused in the middle of ESA



- $\sigma_x \sim \sigma_y \sim 7 \mu\text{m}$
- $\sigma_z = 280 \mu\text{m}$ 
  - 28 larger than LCLS, large R56 in A-line
- 3.5-13.6 GeV, up to 250 (maybe 350) pC

# Secondary e<sup>-</sup> Beam Operations

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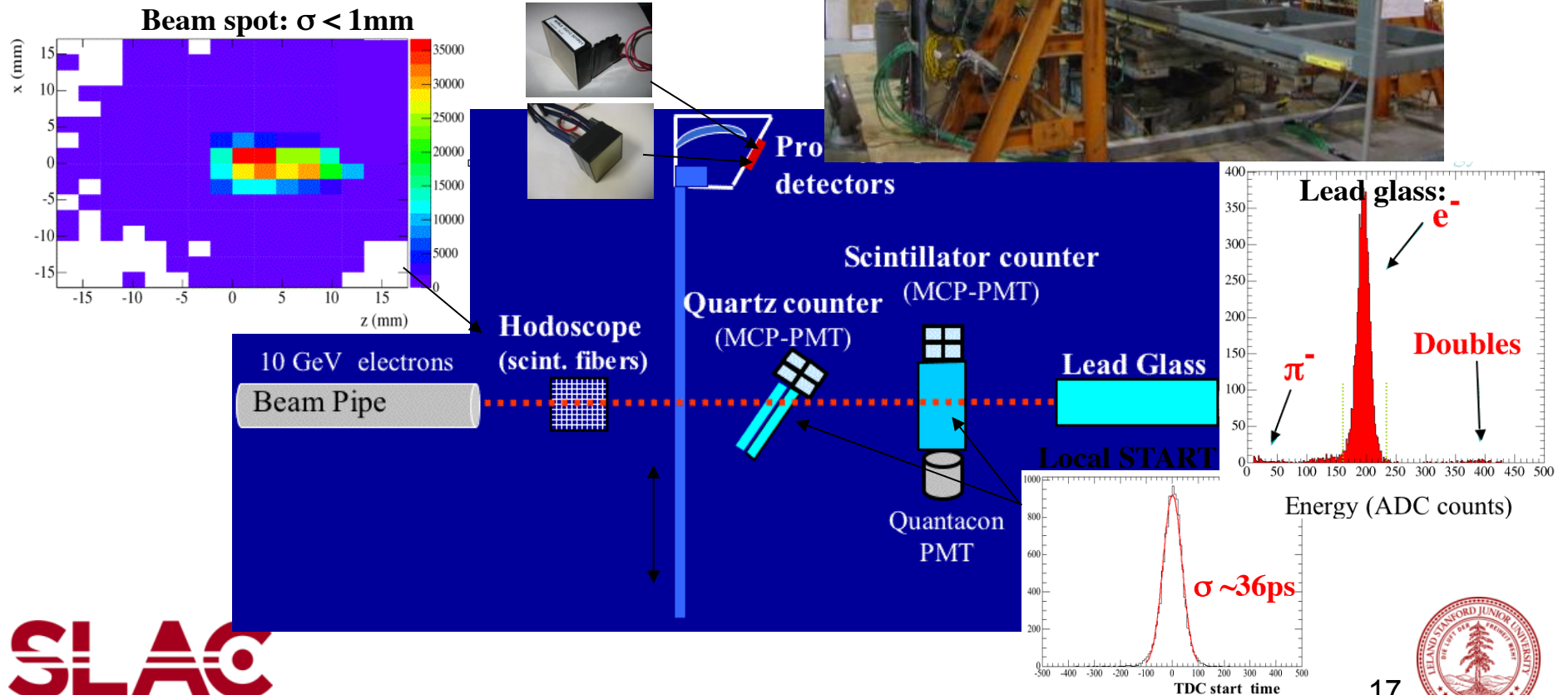
Primary beam can be directed onto a target

- Secondary e<sup>-</sup> are momentum-selected in A-line
  - 1 GeV (maybe, has been done in the past)
  - 2 GeV for most likely
  - 4 - 13 GeV easy, 10<sup>-4</sup> momentum resolution
- Adjusting 2 existing collimators
  - 0.1 - 10<sup>9</sup> particles/pulse

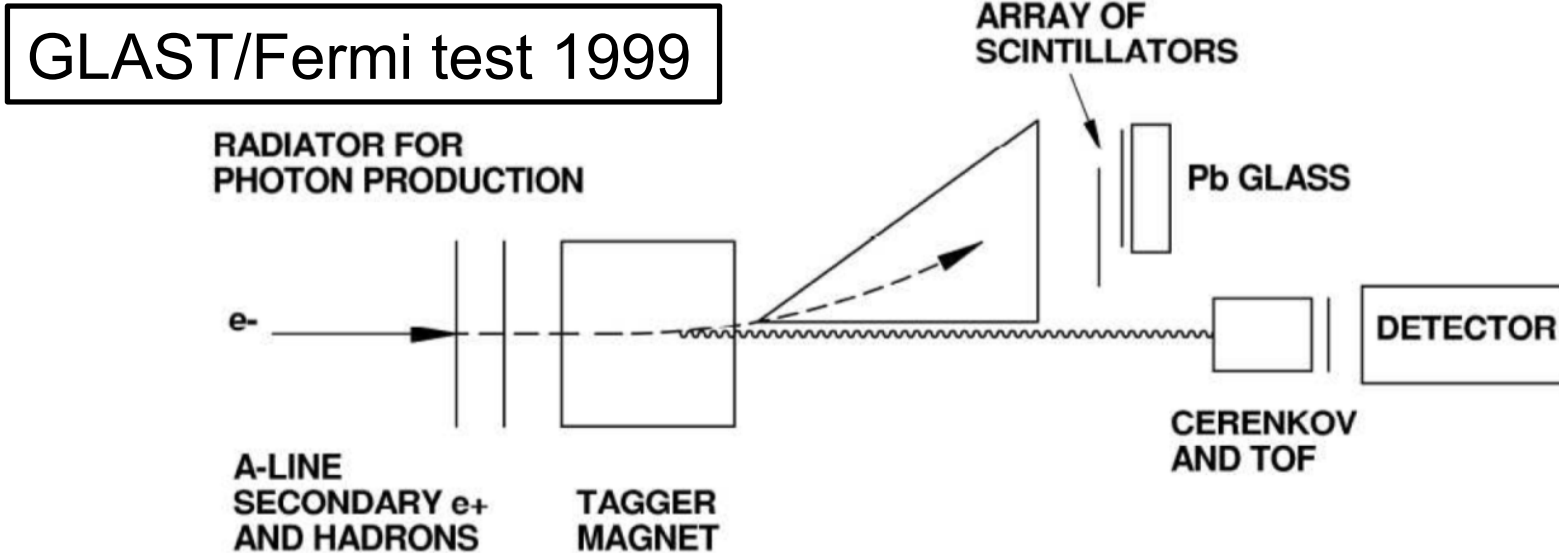


# Jerry Va'vra's Focusing DIRC Tests

- SLAC 10 GeV/c 2<sup>nd</sup> electrons
- Time start from the LINAC RF signal, but correctable with a local START counter



# Tagged Photon Beam in ESA

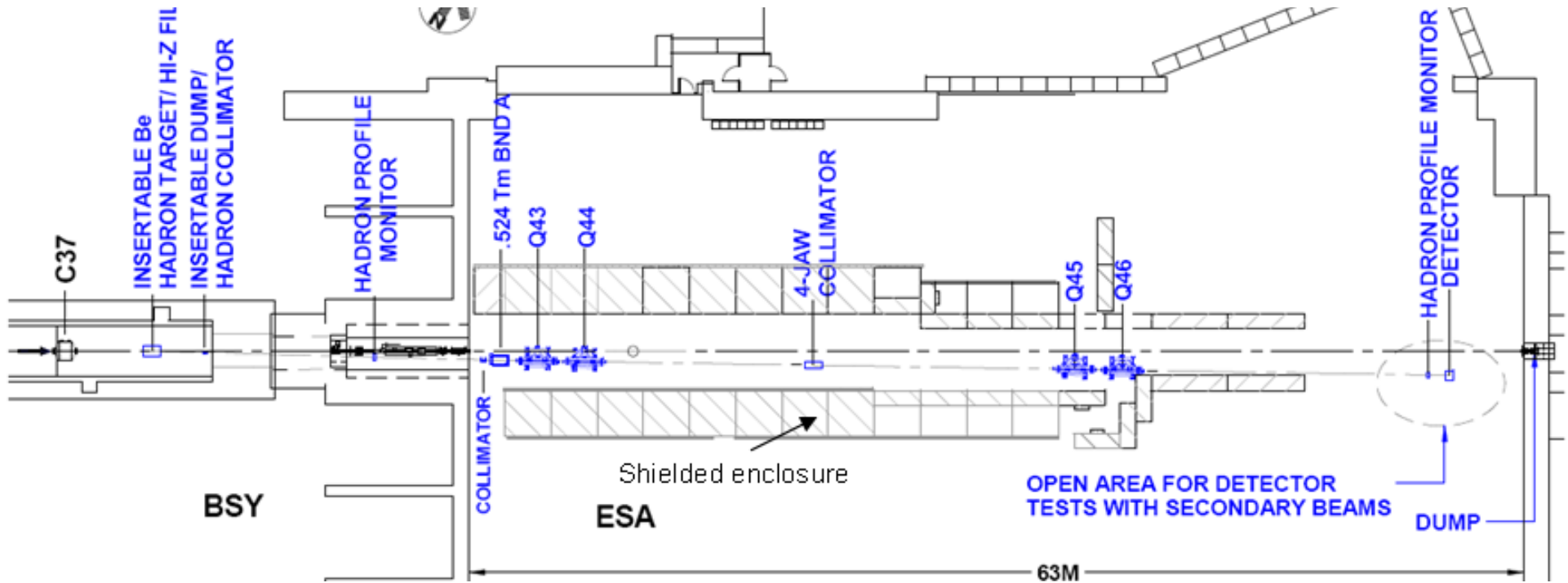


- 2<sup>nd</sup>  $e^-$  beam hits thin radiator in ESA
- Bend  $e^-$  off axis and measure displacement = energy of  $e^-$
- tagging the photon energy

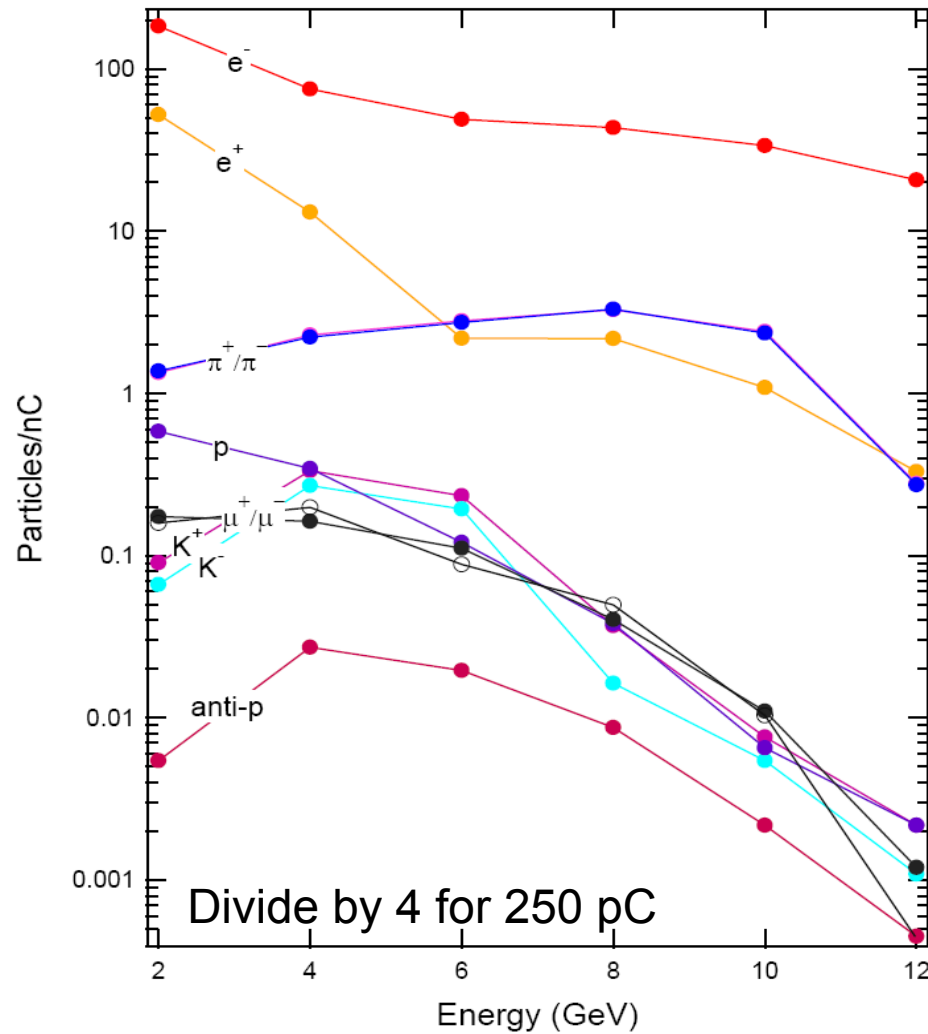
We need 10cm by 2cm, 100  $\mu\text{m}$  pitch Si strip detector  
**Donations welcome!**

# ESTB Stage II: Hadron Production

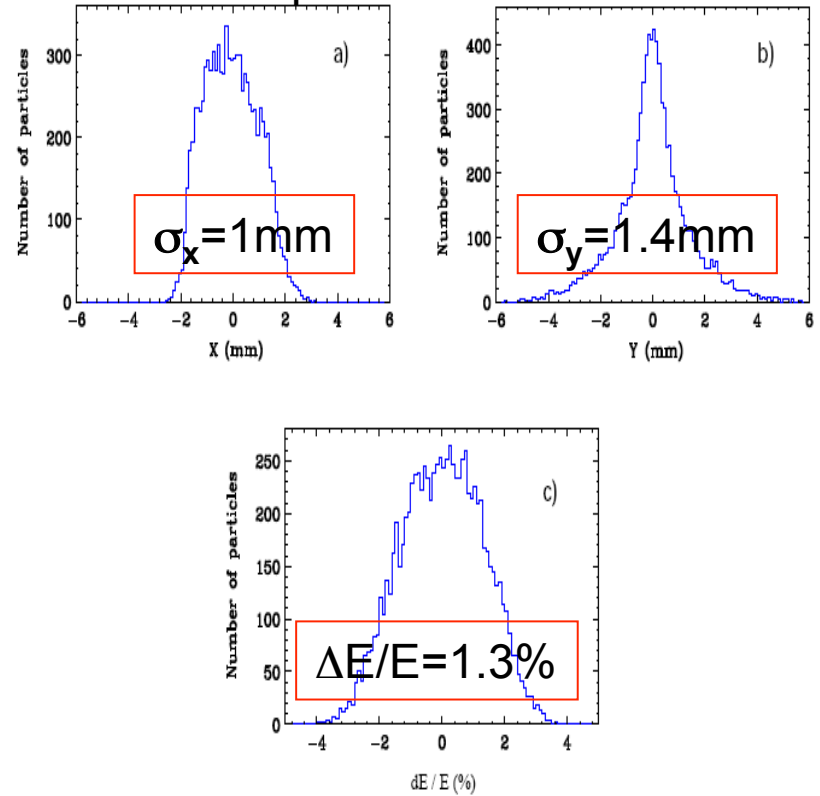
- Add Be target, beam dump, analyzing magnet, momentum slit, and quadrupole doublets to produce a secondary hadron beam
- Production angle =  $1.35^\circ$  and Acceptance =  $10 \mu\text{sr}$



# Secondary Hadron Beam Properties



## Beam Properties at Detector Plane



$\pi$  produced 1/0.25nC beam

Protons and Kaons at  $\sim 0.02/0.25\text{nC}$

# Secondary Hadron Beam Properties

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**Production of Hadrons  
would add  
desirable capabilities to  
ESTB**

**But:  
Not Funded**

**We need User Requests!!!**

# Proposals

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- [Test of the SSD Electronics for STAR HFT Upgrade](#) Howard Matis, LBNL
- [Pixel Sensors for ATLAS Upgrades](#) Philippe Grenier, SLAC
- [STAR Pixel Detector](#) Leo Grenier, LBNL
- [Fermi Large Area Telescope](#) Elliott Bloom, SLAC
- [LC detector: Silicon-Tungsten Calorimeter](#) Ray Frey, University of Oregon
- [Super B R&D](#) Jerry Va'Vra, SLAC
- [Energy Spectrometry](#) Mike Hildreth, Notre Dame University
- [CLIC Wakefield Collimator Studies](#) Roger Jones, Cockcroft/Manchester U
- [Radiation Physics Beam Tests](#) Mario Santana, SLAC
- [Beamcal Radiation Damage Study](#) Bruce Schumm, UC Santa Cruz
- [Geosynchrotron Radio Emission from Extensive Air Showers](#) Konstantin Belov, UCLA
- [Modeled pulse function for waveform analysis using DRS4](#) Andriy Zatserklyaniy, Puerto Rico Univ.

# Schedule

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- This Down Time (now to mid May)
  - We install one BSY kicker with a stainless steel vacuum chamber
- End of May LCLS starts up and runs until Christmas (one week off in October)
- Mid of June FACET runs until August
- Mid of July ESTB can do first test of kicking a 4GeV beam into A-line
- ESA PPS becomes available this summer
  - 4GeV primary beam to ESA
  - 4-14GeV secondary electron beam to ESA
- Commissioning of ESA infrastructure September/October
- Oct 25<sup>th</sup> – Nov 1<sup>st</sup> install 4 BSY kicker magnets with ceramic chambers
- First ESTB run in November and December (need commissioning time)
- Linac off from Christmas to end of January
- ESTB running resumes February 2012
- SLAC downtimes are in Aug/Sept and over Christmas for the next years

# Summary

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- We are excited to re-start ESA test beams!
  - Unique High energy test beam line in the US, with plenty of infrastructures and SLAC support for Users
- We install a short-term system for  $e^-$  beams in ESTB with commissioning by summer
  - 4 GeV full intensity or up to 13.6 GeV 2<sup>nd</sup>  $e^-$  beams
- Installation of the full 4 kicker system by end October
  - First ESTB run in November / December 2011
- Beam parameters determined by LCLS. Availability 5Hz. Some opportunities to increase rate when not needed for LCLS.
- Hadron beam line upgrade needs user requests and funding

**See you all at SLAC soon!**