

SLAC Test Beams Status Report



SiD Workshop, October 26-28, 2006

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(quick) Review of Test Beam Capabilities at SLAC

Current Capabilities for FY07-08

Future of (secondary) Test Beams at SLAC

- **SABER Facility (limited capabilities; e⁻ only)**
- **? ESA? offers wide range of possibilities for primary and secondary beams**

SLAC Test Beam Capabilities in End Station B in 1970s

(just for reference and historical note ...)

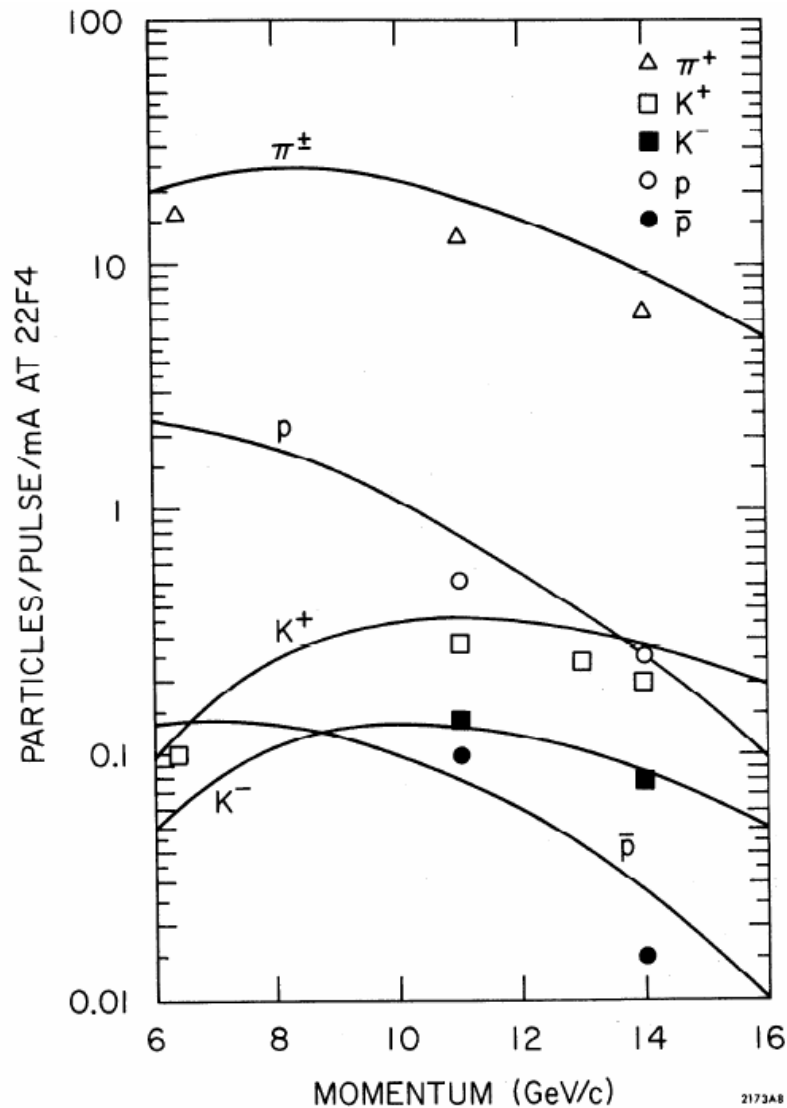


Fig. 8.1 -- Measured fluxes at 22F4 vs. beam momentum for $E = 19.5$ GeV, production angle $= 1.5^\circ$, $\Delta p/p = \pm 2\%$, F1 vertical aperture $= 0.25''$, and F2 aperture $= 0.25''$. The curves are predicted fluxes.

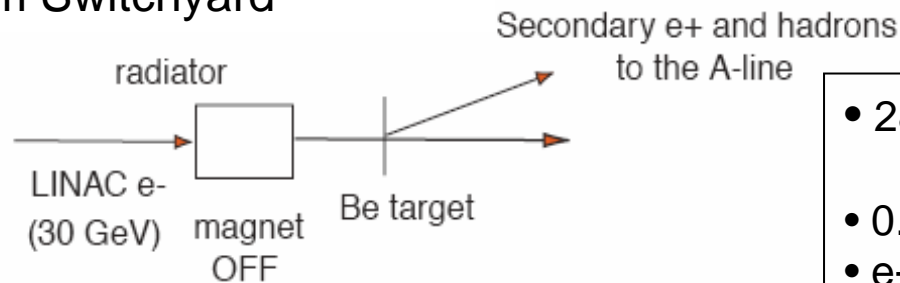
From F. Winkelmann,
SLAC-Report-160 (1973)

1.6 μ s pulse, 1 mA = 10^{10} e⁻/pulse
20 GeV primary beam, 55 mA, 180 Hz

Current Capability for Secondary Beams to ESA

e.g. GLAST test beam in 2000

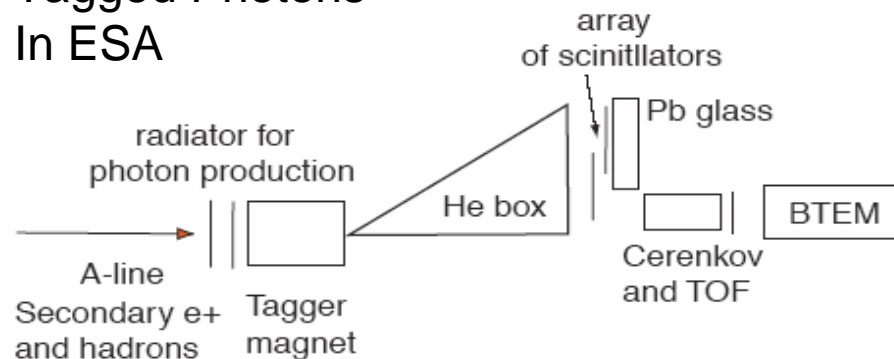
Secondary Beam Production in Beam Switchyard



SLAC PUB 8682

- 28.5 GeV primary electron beam, 3.5×10^{10} e⁻/pulse
- 0.5 r.l. Be target is insertable in BSY
- e⁺ or e⁻ and hadrons accepted into A-line at 0.5deg production angle; 1.0-20 GeV, momentum analyzed to <1%, flux .01 to 0.5 per pulse with magnet off
- e⁻ flux 1 to 10^6 per pulse with magnet on
- use time-of-flight and Cherenkov counters for particle id
- at 13 GeV: 50% π^+ , 50% e⁺, 0.4% protons, <1% K⁺; beam intensity set to <1/pulse

Tagged Photons In ESA

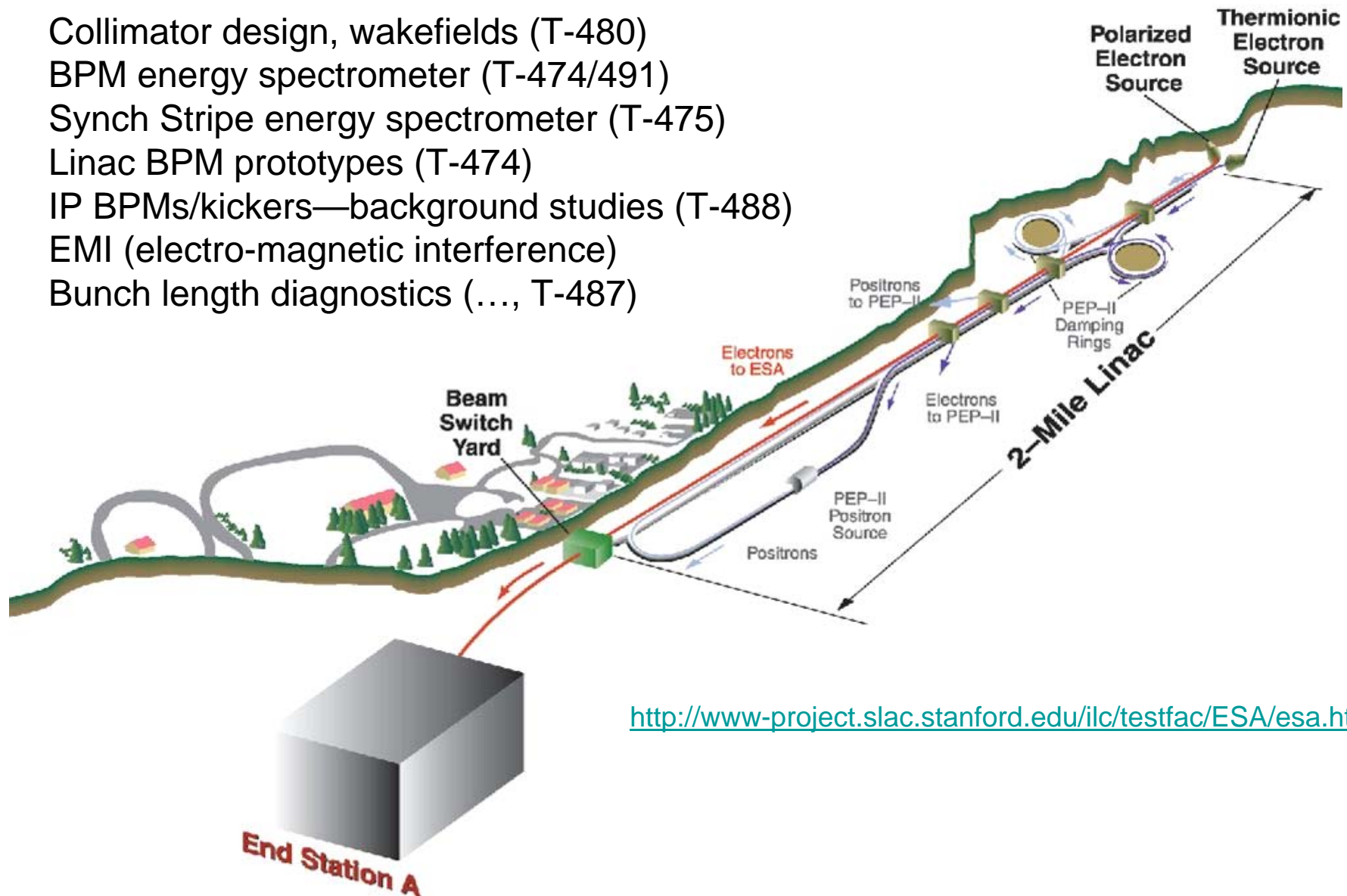


- secondary beams at 10Hz, using PEP-II beam between fills, available in FY07-08, non concurrent with LCLS commissioning

ILC Beam Tests in End Station A

Experiments in Progress Using Primary Beam

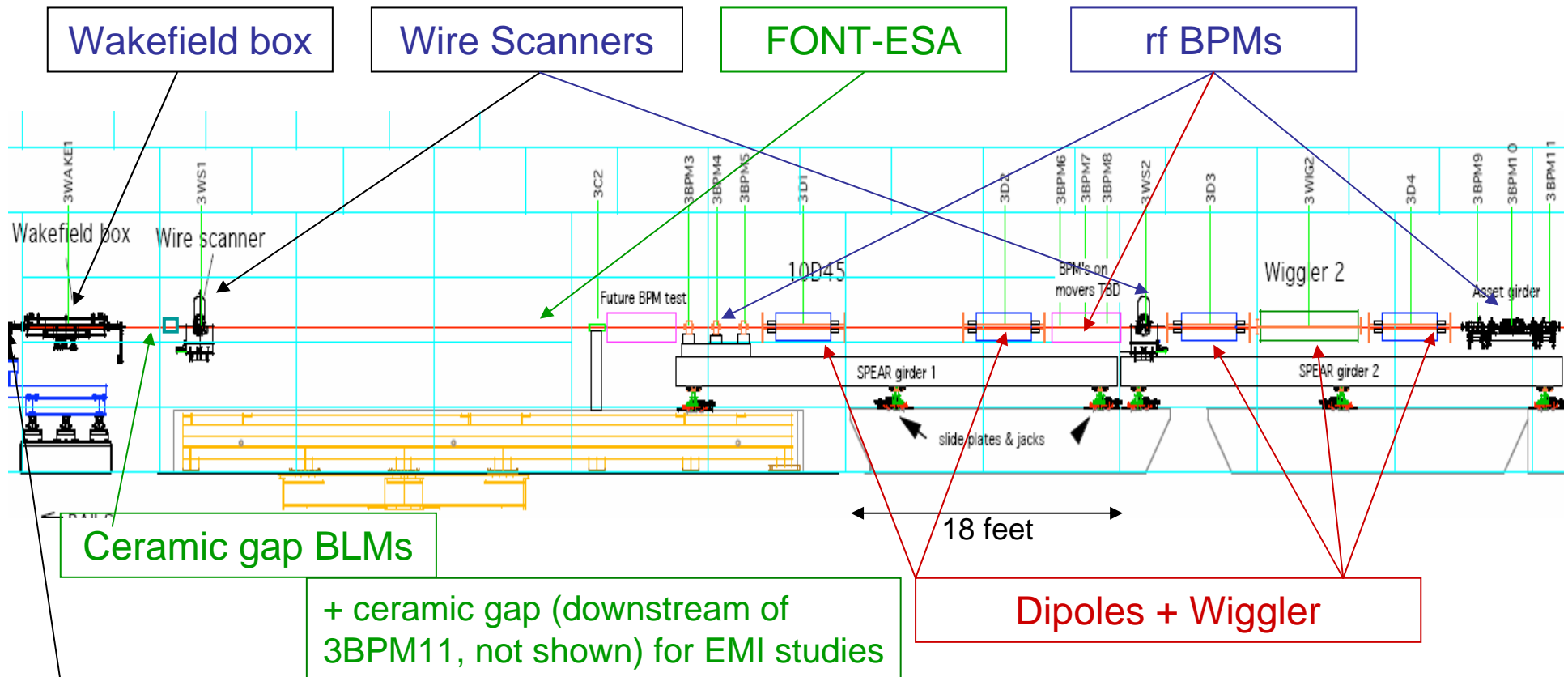
- Collimator design, wakefields (T-480)
- BPM energy spectrometer (T-474/491)
- Synch Stripe energy spectrometer (T-475)
- Linac BPM prototypes (T-474)
- IP BPMs/kickers—background studies (T-488)
- EMI (electro-magnetic interference)
- Bunch length diagnostics (..., T-487)



<http://www-project.slac.stanford.edu/ilc/testfac/ESA/esa.html>

ILC ESA Equipment Layout

Using Primary Beam



4 rf BPMs for incoming trajectory
1st Ceramic gap w/ 4 diodes (16GHz, 23GHz, 2 @ 100GHz), 2 EMI antennas

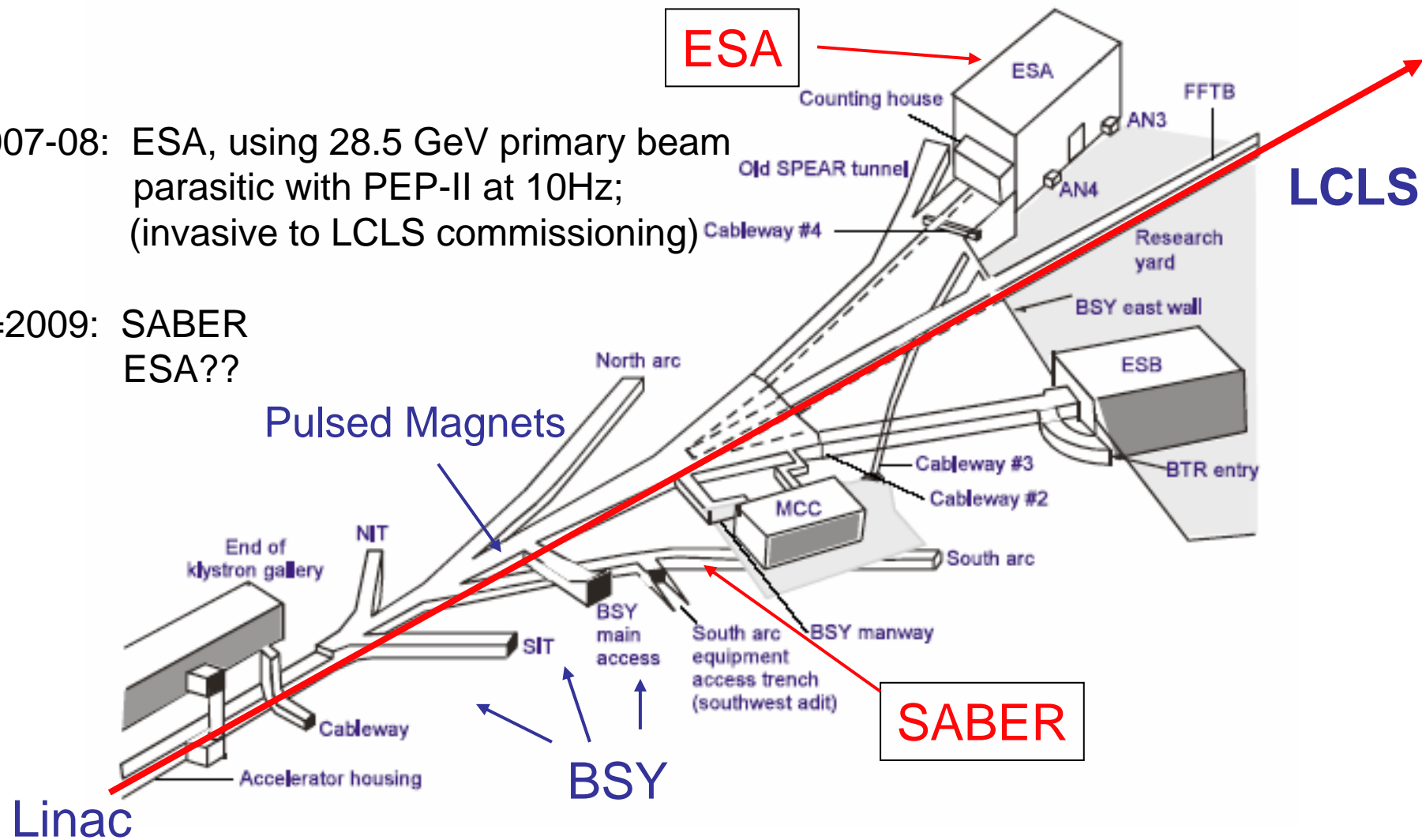
+ T-487 for longitudinal bunch profile (location tbd)
using pyroelectric detectors for Smith-Purcell radiation

blue=April '06
green=July '06
red=FY07

Possibilities for Test Beams in 2007-2008 and in LCLS Era

2007-08: ESA, using 28.5 GeV primary beam
parasitic with PEP-II at 10Hz;
(invasive to LCLS commissioning)

>=2009: SABER
ESA??



Secondary Test Beams in SABER?

Notes:

- 28.5 GeV primary beam post-PEP-II, starting in 2009
- probably electrons only, no hadrons for secondary beams (needs study)
- space limitations (beam 42" above floor, 36" from nearby tunnel wall, no crane.)
- need to demonstrate capabilities for secondary electron production at $<1e/pulse$ and what momentum range achievable is; do in FY07?
- probably good for electron tests for small setups



ESA Test Beams in LCLS Era?

PEP II Finished

Primary Beams

Upgrade of ESA PPS system needed

Possible modes:

- i. High energy beam 28.5 GeV available when LCLS not running; competes with SABER for pulses.
 - ii. Use LCLS beam with pulsed magnets to have 10Hz e⁻ beam to ESA interleaved with 110Hz beam to LCLS; 5 to 14 GeV, 6×10^9 per pulse.
- Would allow continuation of current ILC beam instrumentation tests, in particular for collimator wakefield and energy spectrometer studies, that are not easily done in SABER or at other facilities.

ESA Test Beams in LCLS era?

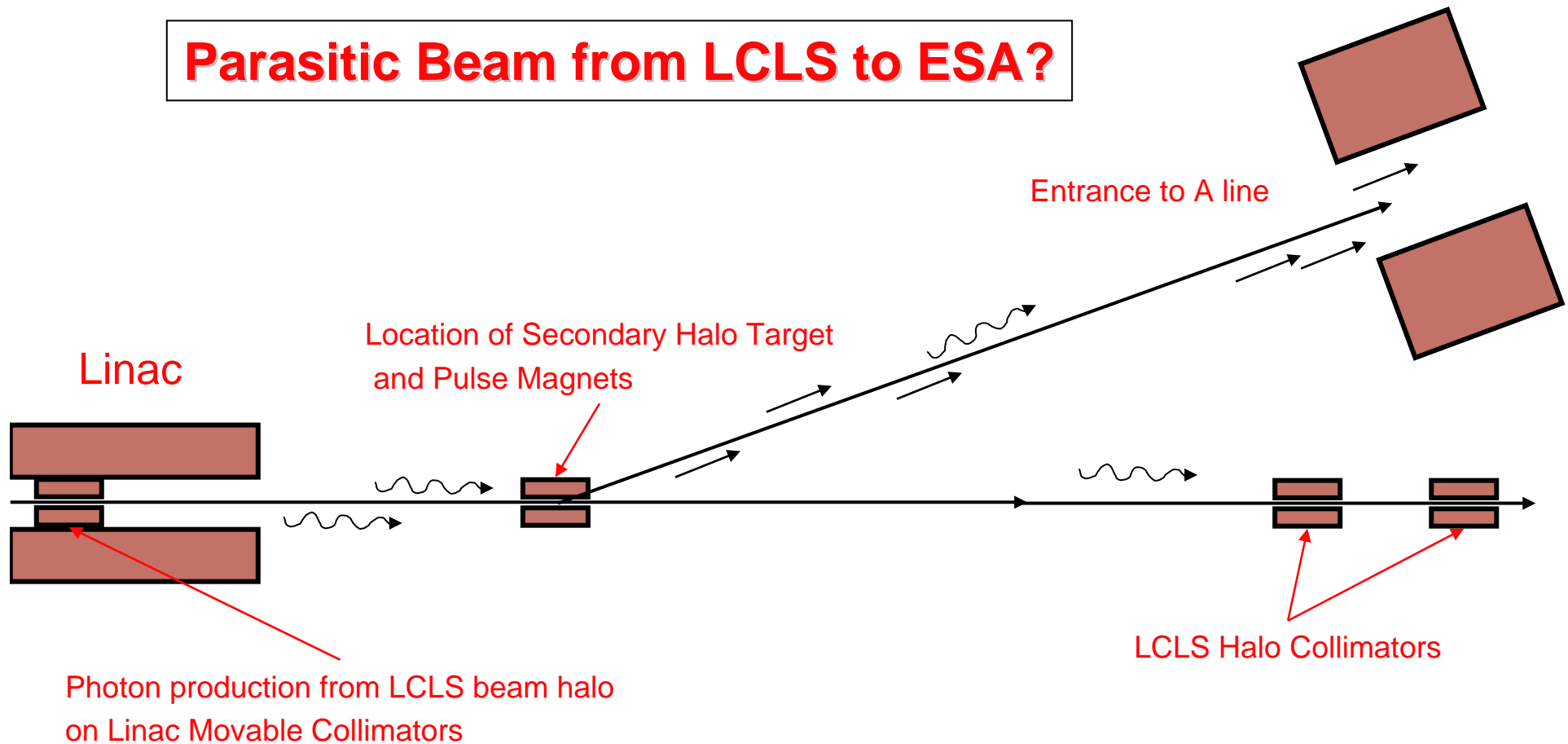
PEP II Finished

Secondary Beams

Possible modes:

- i. Use high energy 28.5 GeV primary beam on Be target when LCLS not running, have same capability e^+ , e^- and hadrons, 1-20 GeV, as currently. Competes with SABER for run time.
- ii. Use LCLS beam and secondary electron production from beam halo on halo target at PM3 location in BSY. Completely parasitic to LCLS with secondary electrons at 120 Hz. Probably limited to <7 GeV electrons? Need to demonstrate this mode; do test in 2007 to quantify beam halo and secondary yield?
- iii. Use LCLS beam with pulsed BSY to kick 10Hz primary beam onto Production target/collimator at PM3 location. Secondary electron and hadron beams possible.

Parasitic Beam from LCLS to ESA?



L. Keller, using EGS, has estimated a yield of 8 electrons per pC-pulse at 2.25 GeV into A-line acceptance from the halo of 13 GeV LCLS beam hitting a 9mm Tungsten Target.

Can we obtain a pC of halo hits from Dark Current and Gas Scattering?

Primary Beam from LCLS to ESA?

10Hz interleaved beam to ESA with LCLS at 120 Hz, using pulsed magnets in BSY?

- At beginning LCLS will operate at 5 GeV, with eventual design energy of ~14 GeV
- The existing pulse magnets can handle 10 GeV.
Two more pulse magnets exist but must be refurbished and two power supplies provided, ~\$200k allow operation at 14 GeV.
- Could have 10Hz primary beam to ESA, or use PM1 to steer beam onto collimator/target at PM3 location to produce secondary electrons and hadrons to ESA

Summary

Good capability for secondary beams, electrons and hadrons, in ESA in FY07 and FY08. Lab commitment to runtime and funding for ESA in FY08 and beyond is uncertain.

SABER capability for secondary electron beams in FY09 possible(?), needs to be demonstrated. Limited space and infrastructure. Hadrons unlikely.

Good possibilities for both primary and secondary test beams in ESA in LCLS era in FY09 and beyond, if investment in infrastructure improvements: ESA PPS and pulsed BSY operation.

- Considering to submit Letter-of-Intent to SLAC for the December EPAC meeting indicating desire and need for ESA test beam facility, and requesting infrastructure improvements for this.

Input and support from user community needed!