Fermilab

U.S. DEPARTMENT OF ENERGY | Office of Science

ASTA Commissioning & Status

Elvin Harms

ASTA Users Meeting

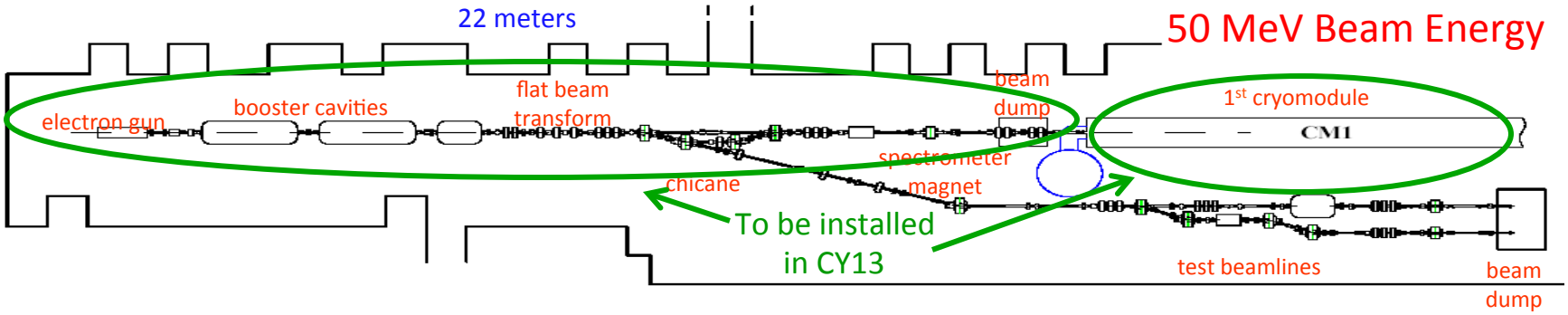
9 June 2014

Introduction

- Recap where we were last year and goals
- Accomplishment in past 12 months
- What's on the horizon
- Summary

CY13 - 50 MeV Injector + 1 Cryomodule

- Goal: installation complete and beam commissioning started by end of CY13
  - RF gun + RF system and photocathode laser system
  - 2 SRF booster cavities (CC1 and CC2) + RF systems
  - 50 MeV beam line elements and instrumentation to the low energy dump
  - Low energy beam dump
  - SRF cryomodule (RFCA002/CM2)
- Installation of 1st AARD experiment (high brightness X-ray channeling source)



Accomplishments in 2013 - Recap

- Laser installed/UV to ASTA cave
- CM-2 Installed and nearly ready for cooldown
- Warm Coupler Conditioning completed
- Gun installed and first phase of conditioning complete
- 9-way diagnostic cross installed and operational
- Electrons!
  - Beam sensed on Faraday cup, Loss Monitor, Wall Current Monitor, and now BPM's
  - Calibration in progress

Short-term Future Activities - Recap

- Continue conditioning the RF gun (goal is 45 MV/m, currently at 32 MV/m)
- Complete installation of RFCA002/CM2
- Complete upgrade and install CC1
- Cool down and commission CM2, CC1; recommission CC2
- Continue gun photoelectron studies @ 3 - 5 MeV
- Continue installation of 50 MeV beam line components
- Start commissioning 50 MeV injector into beam dump in the Fall

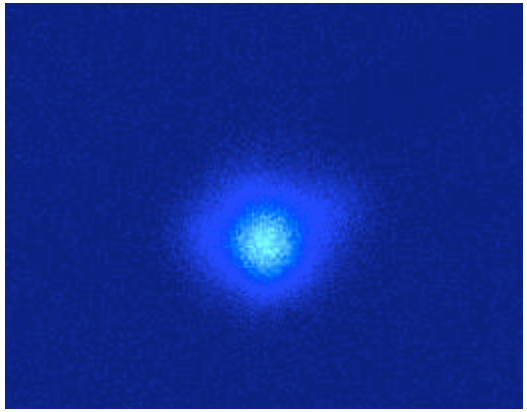
Accomplishments in 2014 so far

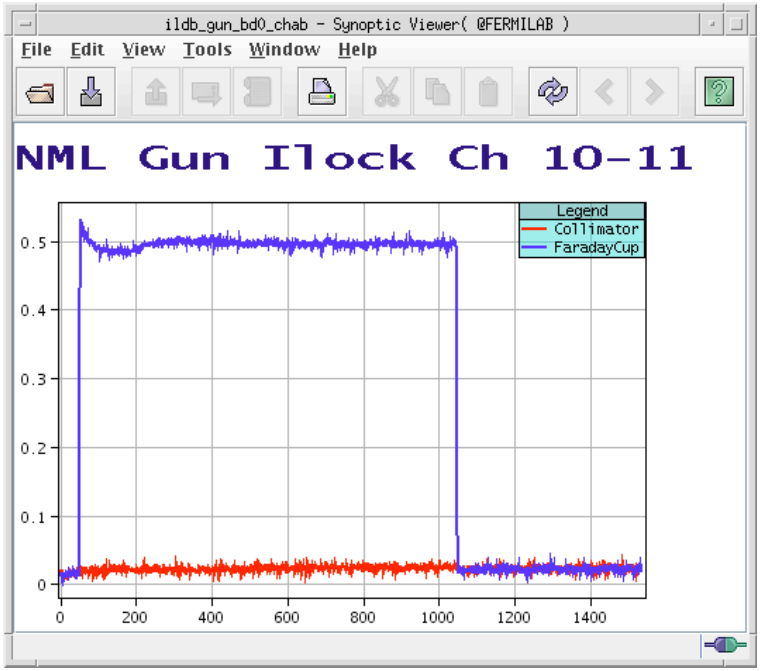
- ✓ Continue conditioning the RF gun (goal is 45 MV/m, currently at 32 MV/m)
- ✓ Complete installation of RFCA002/CM2
- • Complete upgrade and install CC1
- • Cool down and commission CM2, CC1; recommission CC2
- ✓ Continue gun photoelectron studies @ 3 - 5 MeV
- ✓ Continue installation of 50 MeV beam line components
- • Start commissioning 50 MeV injector into beam dump in the Fall

2014 Achievements: Laser & Gun

- See Jinhao's talk at 1040 - Laser
- See Giulio's talk at 13:50 - electron measurements
- 7 March 2014: Gun cavity was operated at 3.48 MW (GCVTPM), 1 ms pulse width, 1 Hz for 1.5 hours and 2.25 hours separately. 45 MV/m achieved!
- 18 March 2014: New (Cs_2Te) cathode installed and electrons produced
- 4 June 2014: 3000 Electron Bunches from the ASTA Photoelectron Gun

YaG screen image of first electrons from Cs_2Te cathode



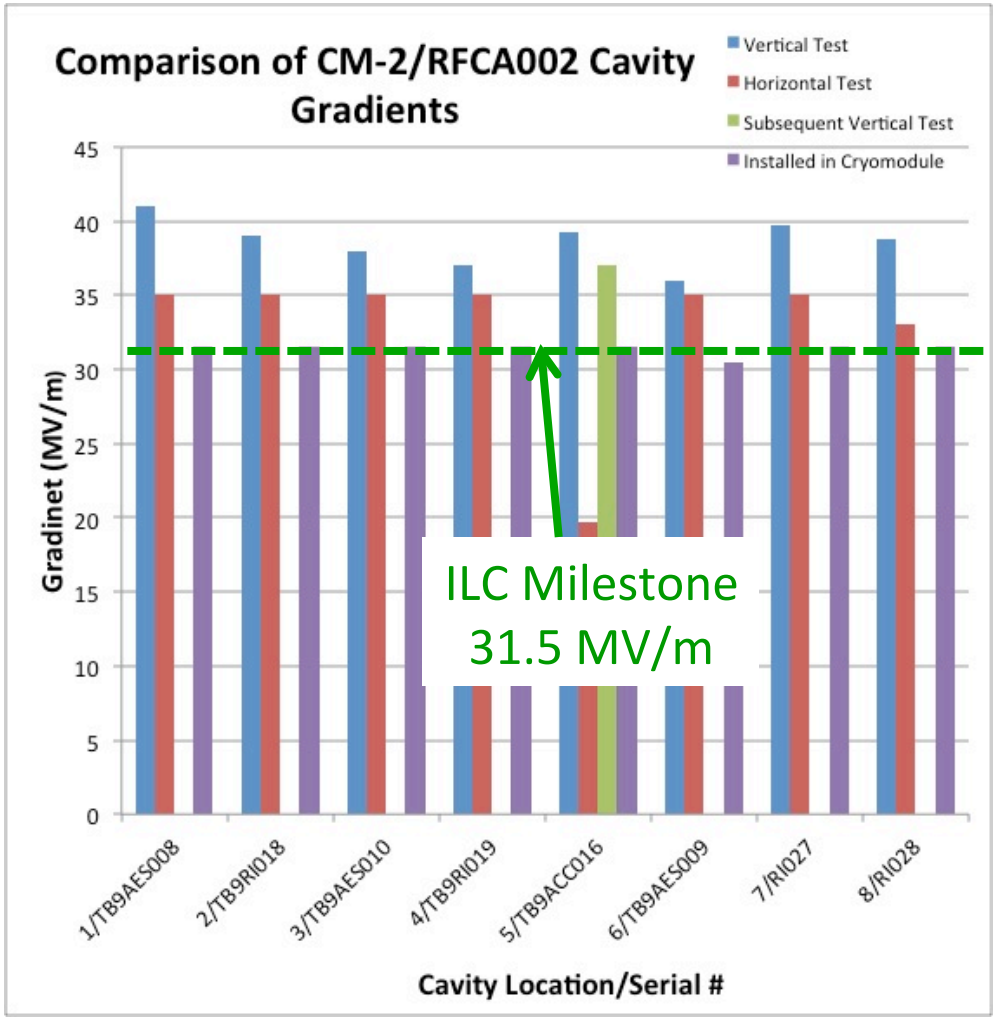


3000 bunches on Faraday cup

2014 Achievements: Cryomodules

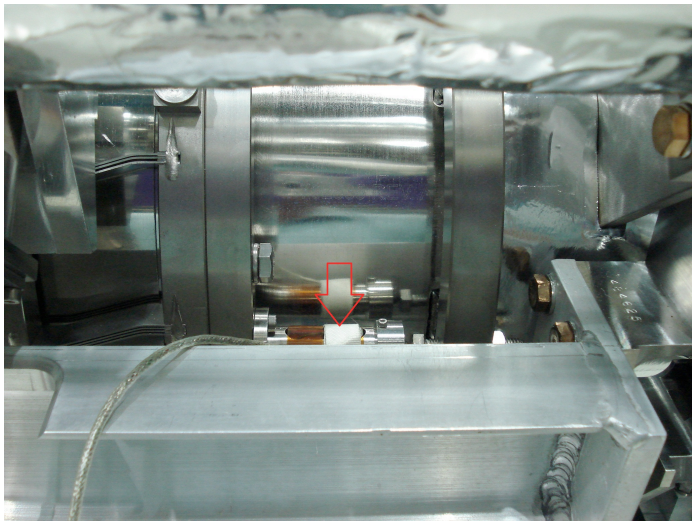
- See Elvin's talk at 13:30
- CM-2 cooled to 2 K and has stayed there with excellent reliability
  - Individual cavity testing essentially complete – good results
  - Fewer problems as compared to CM-1
  - Begin full cryomodule powering this summer
- CC2 re-commissioned in late 2013
  - on-resonance conditioning
  - peak gradient reduced (<21 MV/m)
  - should attempt higher power conditioning as conditions allow
  - updated ESECON LLRF and calibration factors
- CC1 upgrade continues
  - replacing a piezo tuner which failed during final checkout
  - HLRF (klystron) commissioning begun
  - support systems in place and checkout in progress

2014 Achievements: CM-2

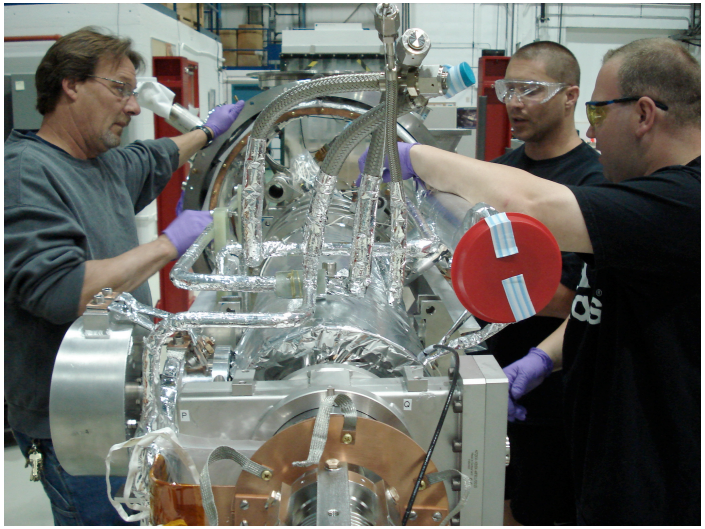


2014 Achievements: CC-1

Failed Piezo tuner



Cavity removal

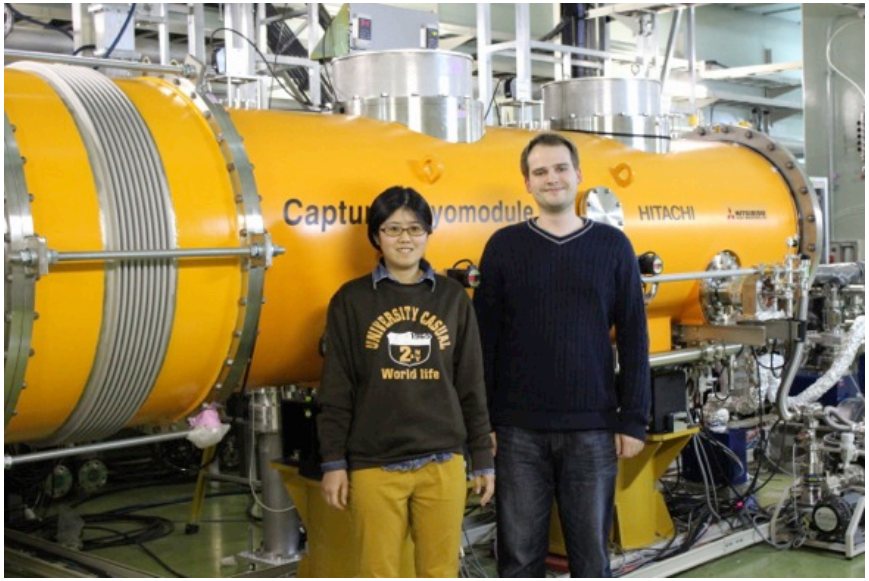


2014 Achievements: 50 MeV beam-line

- See Curtis's talk at 11:00
- Third Girder (of 3) installed this week
- Dump and shielding in place
- Components necessary for first beam to dump identified
- Priority installation and hook-up for those devices
- Careful and extensive check-out
- Machine Protection System development & installation proceeding

2014 Achievements: Guests & Users

- See Auralee's talk at 14:10
- Visitors from KEK: CM-2
- Jun Zhu: Guest from Batelle
  - RTFB development and SRF commissioning
- (at least) three Summer interns assigned to ASTA activities



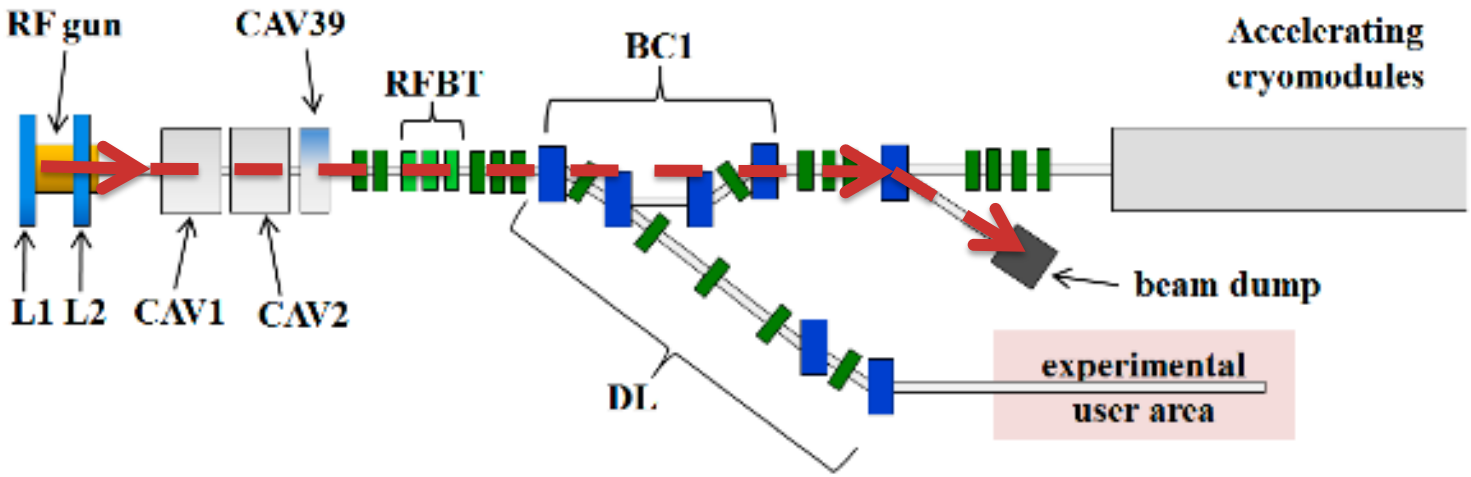
Ayaka & Mathieu

Summary of 2014 Achievements

- RF gun has reached goal of 45 MV/m, 1ms, 1 Hz
  - Increase repetition rate to 5 Hz
- RFCA002/CM-2 works in the cold
  - full cryomodule powering and other testing to follow
- CC1 upgrade nearly complete
  - (cryo) installation will take time
- CC2 cooled back down and operation verified
  - reduced gradient will require attention
- Beam-line installation well along
  - vacuum, cabling etc. still a significant effort
- Pressing for 20 MeV electrons this summer
- 50 MeV this FY
- Balancing installation, Cryomodule commissioning, electron operation requires careful coordination and flexibility

Summary

- Progress on virtually every front
  - notable achievements
- This summer will be busy and hopefully exciting
- Looking forward to hosting first experiments
- An extremely dedicated and capable ASTA staff
  - KUDO's to them!



Thank you for your attention