HPS 2014 Commissioning Run

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On Behalf of The Heavy Photon Search Collaboration

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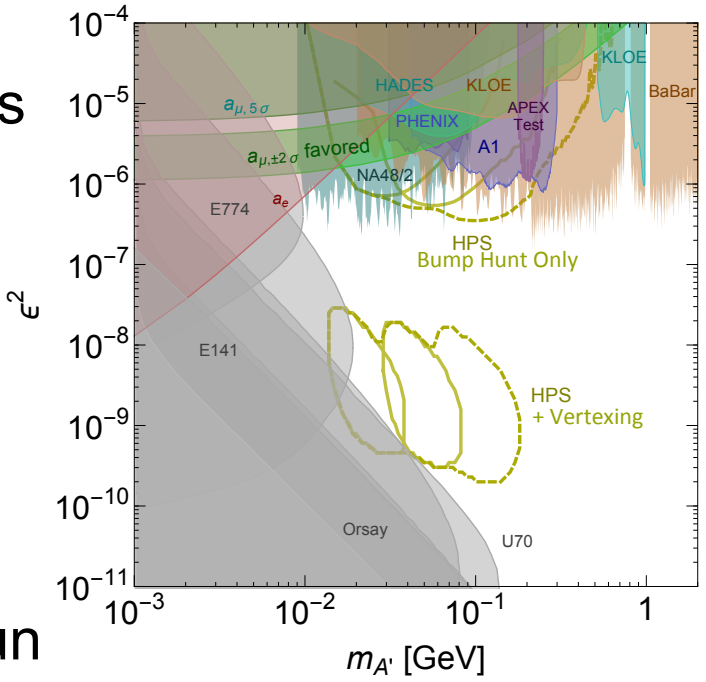
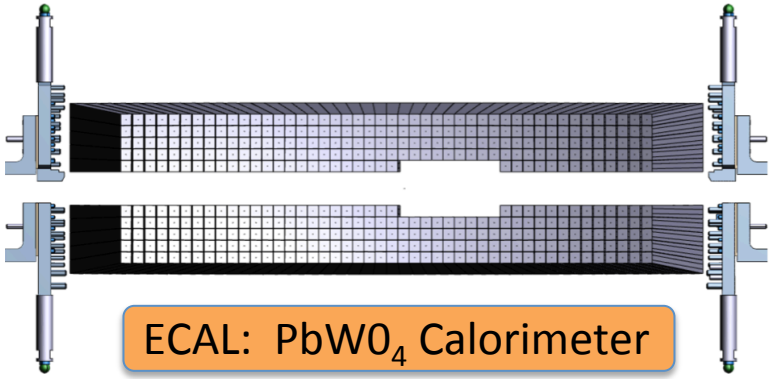
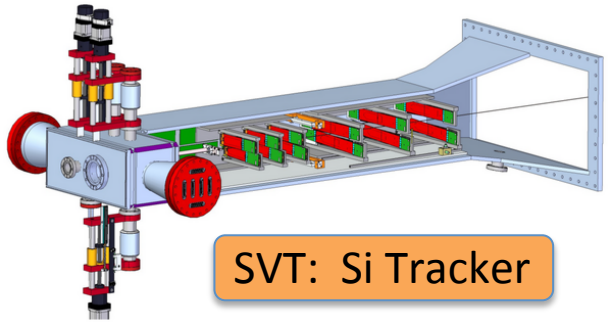
Introduction

- Previous HPS talks today explained all the motivation and detector details
  - Overview & Motivation
    - Omar Moreno
  - Silicon Tracker
    - Sho Umeura
  - Lead-Tungstate Calorimeter
    - Holly Szumila-Vance
- Here we'll discuss recent progress from our late-2014 commissioning run

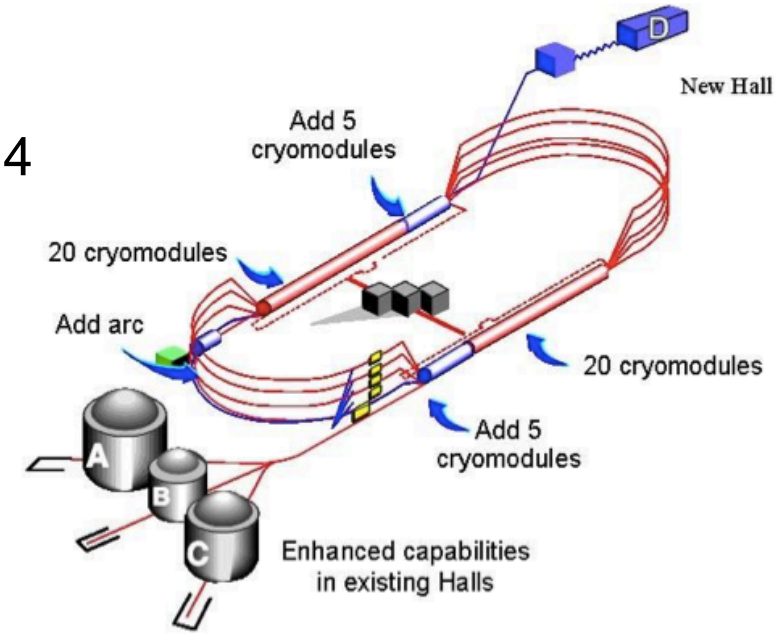






HPS 2014 Commissioning Run

- HPS in Hall-B at Jefferson Lab
  - Taking advantage of first available beam time while Hall-B's 12 GeV multi-purpose CLAS detector is being upgraded.
- So far we've had ~1 total week of opportunistic running with beam in 2014
  - And received the first beam through Hall-B in over 3 years!
- We commissioned a lot:
  - Full HPS beamline
  - Trigger and DAQ
  - Calorimeter
    - Slow Controls, Reconstruction, Calibration, Rates

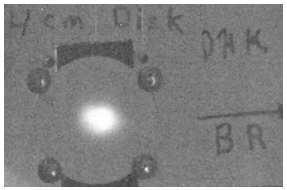


HPS Beamline

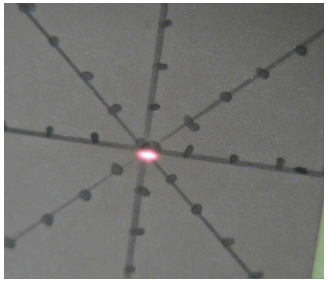
- Previous 2012 HPS Test Run had photon beam
- 2014: First full commissioning of electron beam through magnet chicane and calorimeter
  - 1.92 GeV beam (2 accelerator passes)
  - 3-Dipole chicane (One is the anlyzing magnet)
  - Sweep lowest-energy background
  - Return beam to Hall-B beam dump

Beam Viewers

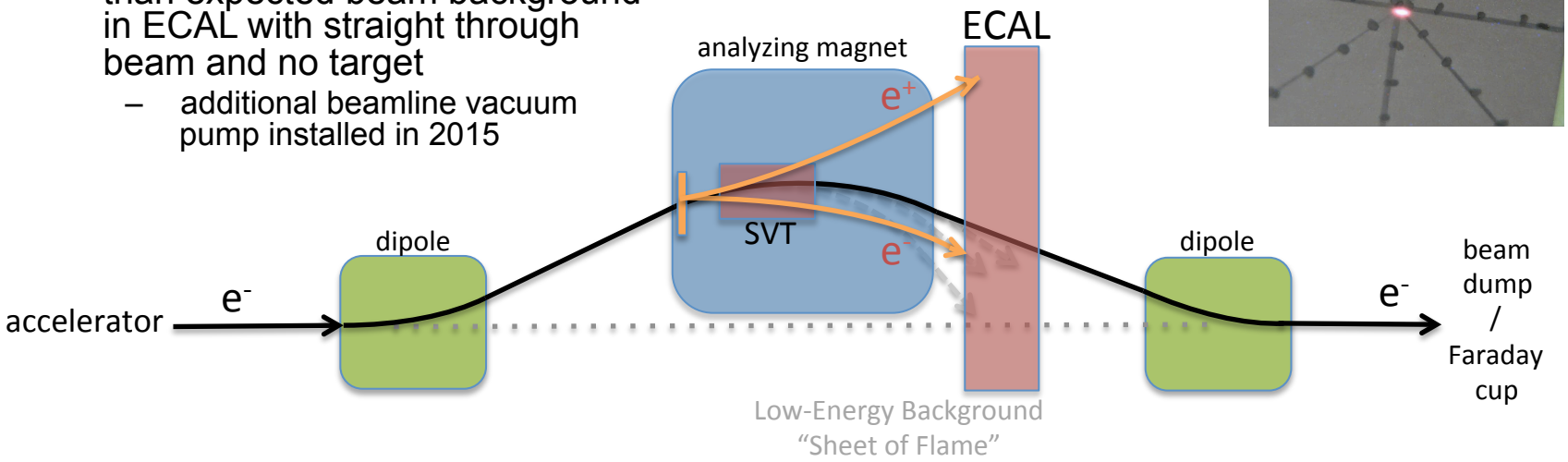
Far Upstream



At HPS

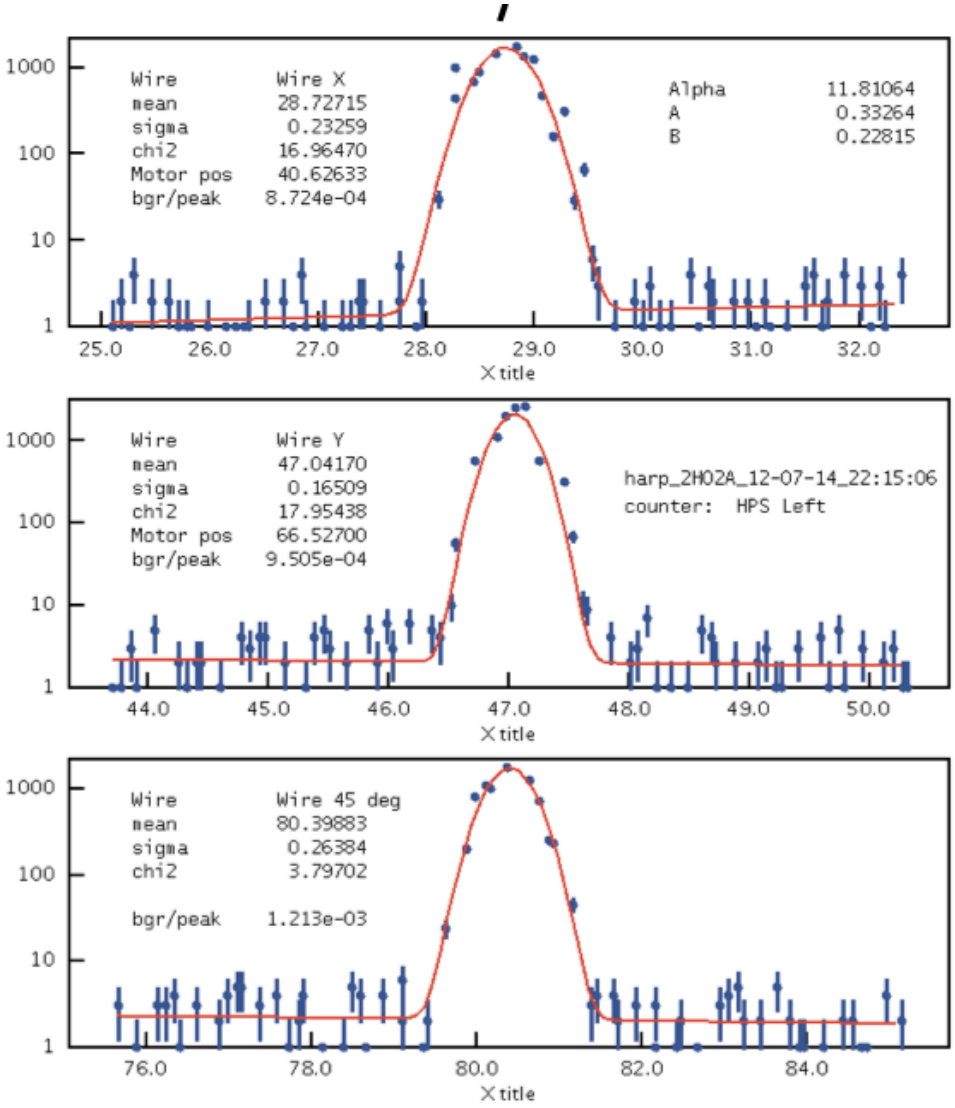


- Identified and resolved higher than expected beam background in ECAL with straight through beam and no target
  - additional beamline vacuum pump installed in 2015



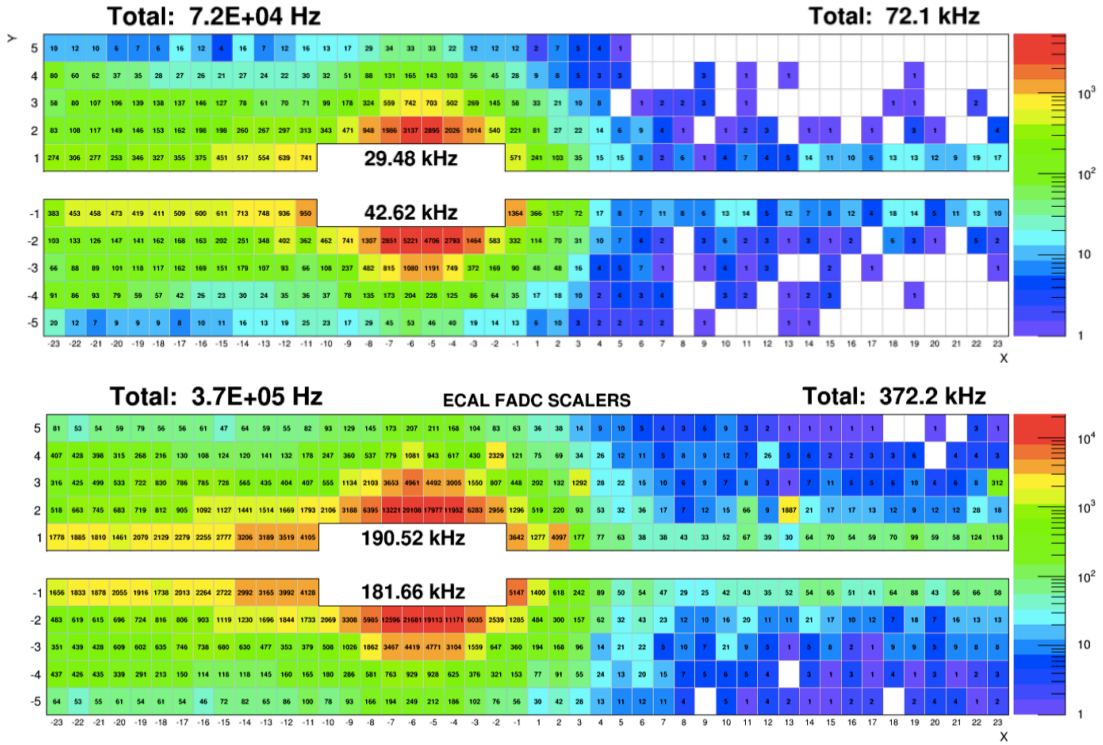
HPS Beam Quality

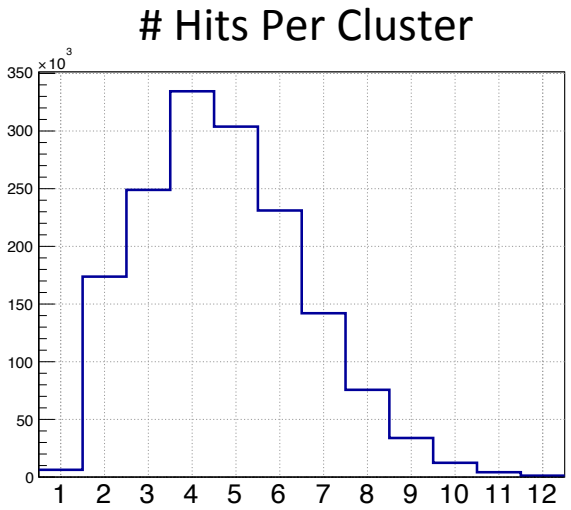
- HPS requires high quality beam
  - Halo < 1e-3
  - Heavily squeezed / focused in the vertical direction at HPS target
    - σ_y ~ 30 μm
    - σ_x ~ 200 μm
- Wire scans to measure beam profile along the Hall-B beamline
- Got everything in 2014 but σ_y
  - Good enough for much of our commissioning work
  - In the past month the accelerator got σ_y down to 30 μm
- We also developed methods to study beam stability and motion during trips
  - Important for SVT's Silicon very close to the beamline



Calorimeter & Trigger/DAQ

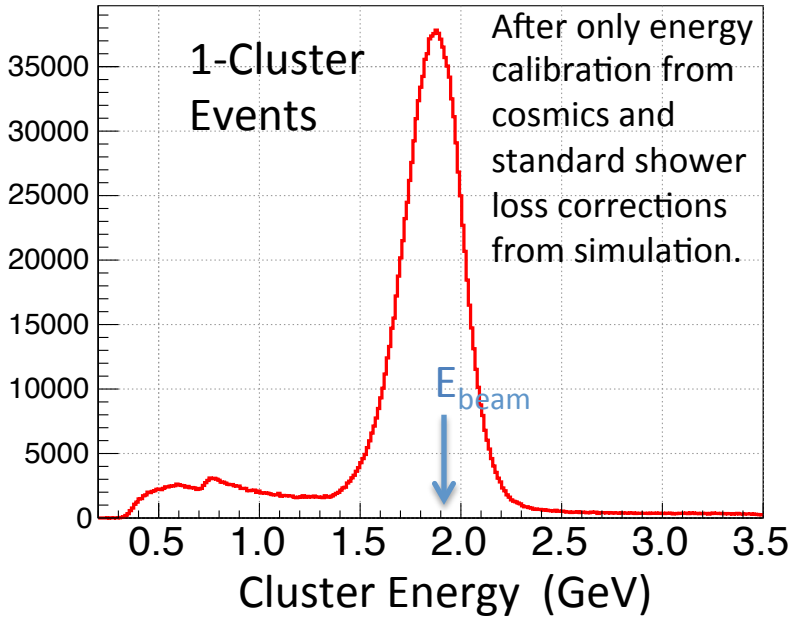
- After quality beam through chicane and on target, calorimeter rates very much as expected and scaling with beam current
  - Highest rate channels up to ~MHz at full lumiosity (~2 MeV threshold)
- DAQ operated well over 50 kHz event-rate with little dead time
- Trigger throroughly debugged; all big issue worked out
  - A complicated A'-optimized trigger logic

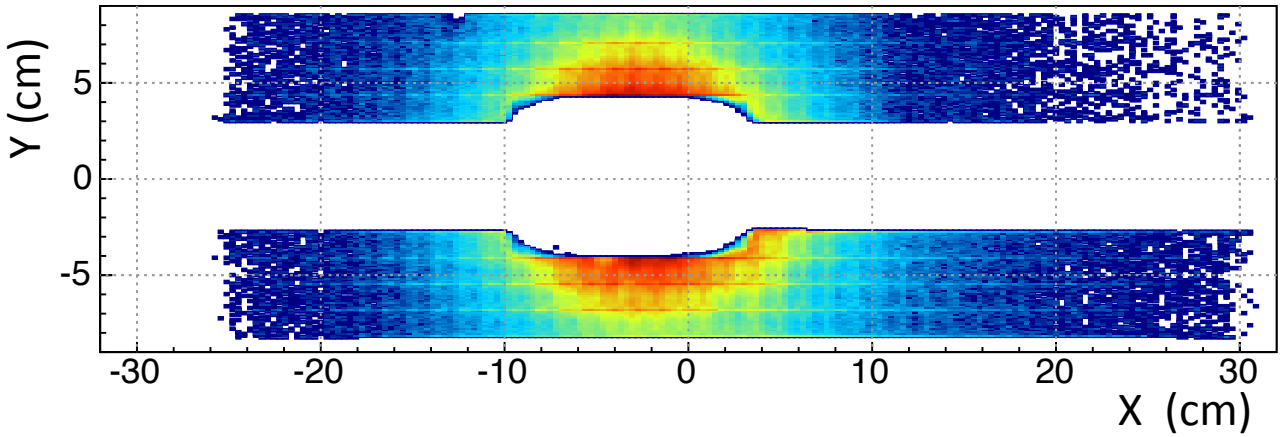




Coulomb Scattering

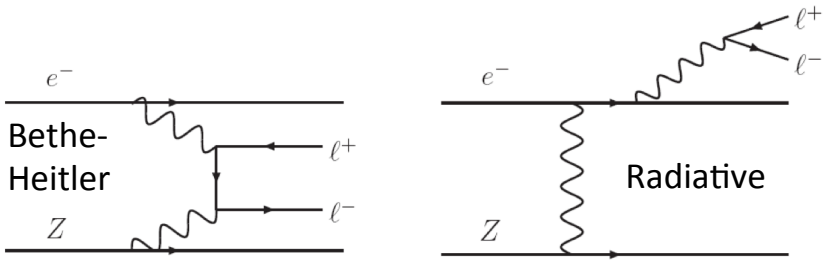
- Our Dominant Singles Background
  - But useful for calibration and normalization studies
- For HPS acceptance, Coulomb scattered beam electron carries basically full beam energy (1.92 GeV)
- Energy / Position Distributions similar to Expected
- Coulomb Rate Study in Progress



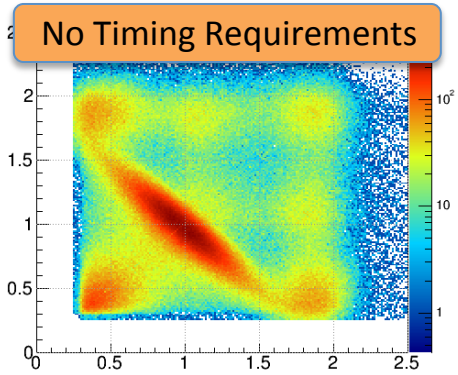


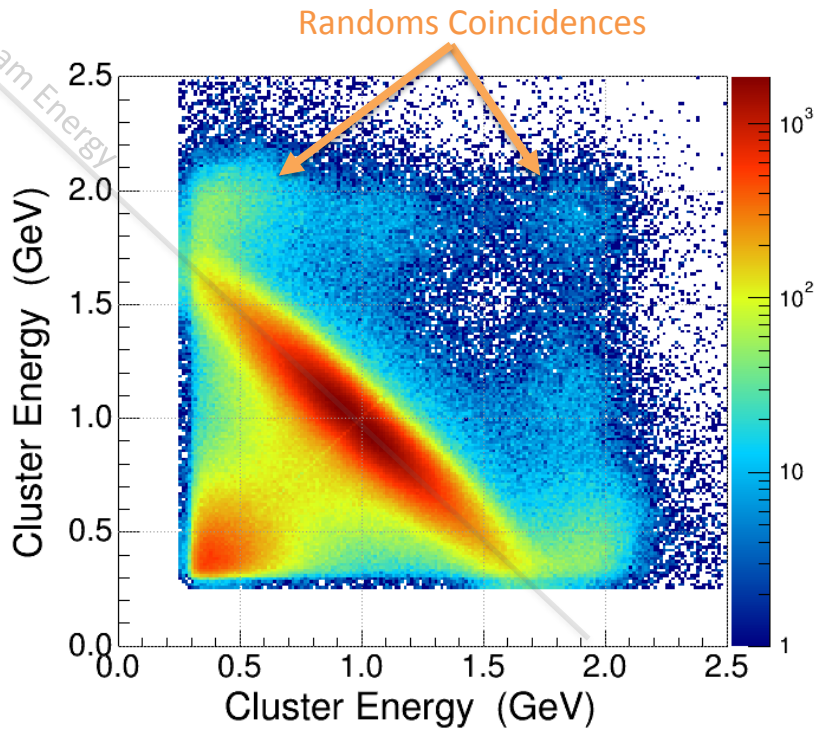
2-Cluster Events

- Expected dominant e^+e^- backgrounds:
  - Bethe-Heitler Tridents
    - Dominates at low e^+e^- energy
  - Radiative Tridents
    - Contribute at large e^+e^- energy, close to E_{beam}



- Additional contributions from Non-e^+e^- will be easy to separate with the SVT and its tracking in B-field:
  - Large-Angle Bremsstrahlung (γe^-)
  - Moller (e^-e^-)





Outlook

- Much HPS commissioning accomplished in Late-2014 Commissioning Run
  - Trigger, DAQ, Calorimeter, Beamline
- Ready for last step of including SVT
  - Installed and ready for beam
- Possibility of 2 more weeks of beam this Spring starting this week!
  - 1.06 GeV