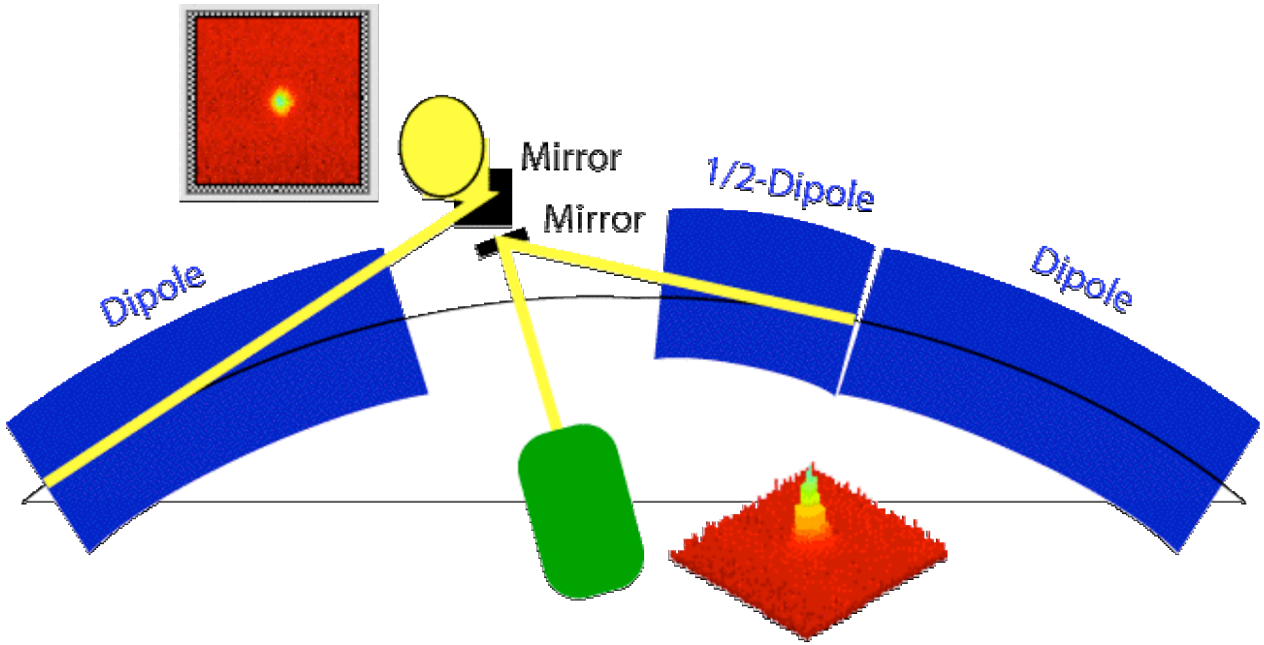
SYNCLITE

A Transverse Beam Profile Monitor



The good, the bad and the ugly:

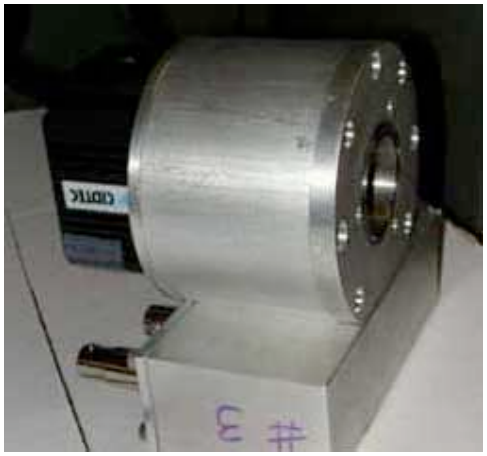
☺ Works continuously without disturbing the beam and gives 2D profile

☹ Works only at 980 GeV

😐 Needs more internal checks and calibration

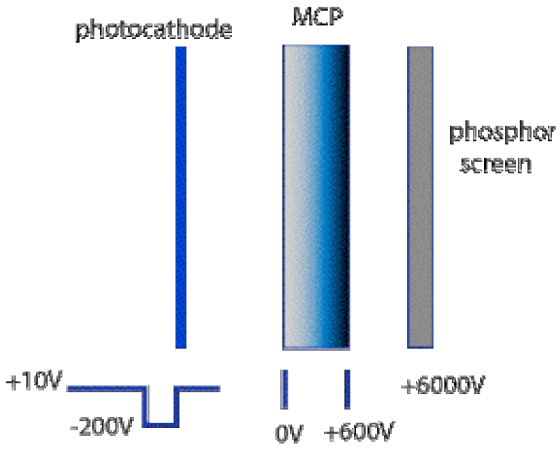
A Short Introduction 1

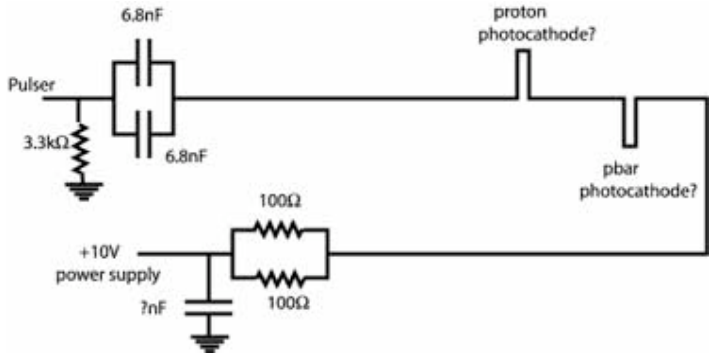
- Detects synchrotron light emitted at the edge of a magnetic field (gives blue light at the edge, c.f. infrared in uniform field)
- Via an optical system of mirrors, lenses and filters the light is detected by an image intensifier plus camera and captured by a video frame grabber and analyzed in LabVIEW



A Short Introduction 2

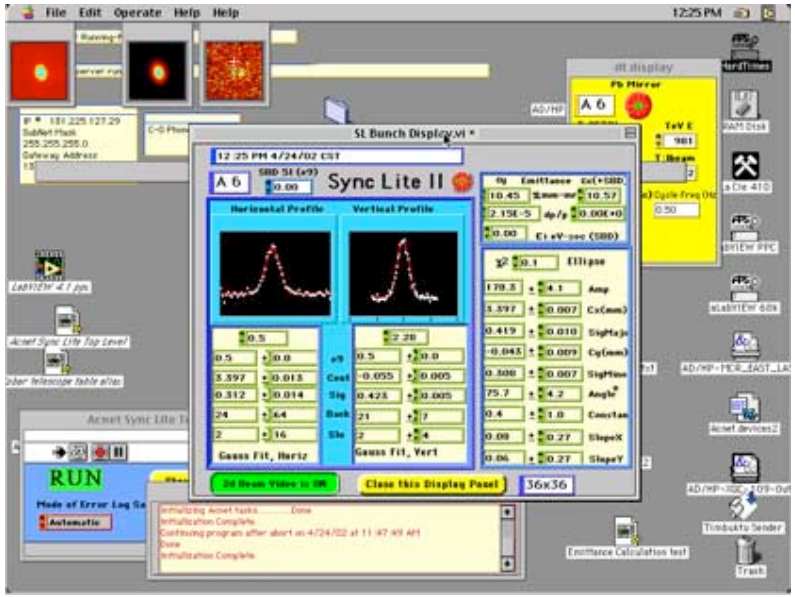
- Camera integrates over 30 ms but image intensifier can be gated to collect data for each bunch at a time. (One image system each for protons and pbars but just one video frame grabber and one gate generator.)





A Short Introduction 3

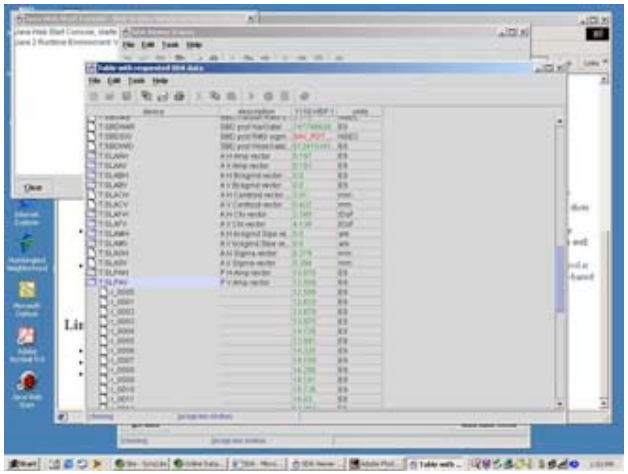
- Camera video picture gives 2D 8-bit data analyzed in LabVIEW
- Can take data for 36 proton and pbar bunches in 30sec. (min.)
- Horizontal and vertical profile projections are fitted
- Bunch positions, sigmas and intensities delivered to Acnet
- A full 2D ellipse fit slows program down by a factor >5 but gives rotation information



SyncLite Data Access

- SL Mac controllable via Timbuktu program
- Data in Acnet (temp. storage) and access via beam console page D96
- Data in Data Logger (temp.) access via page D44 plotter
- Data in SDA (permanent) access via SDA Viewer or plotter or Java interface
- Summary data (last 10 min.) on SyncLite WEB page

Beam console Page D96



Java SDA Viewer

SyncLite Status 1

- Was working in ungated mode until February 2002
- Commissioned Feb.-July to operate in gated mode and to get image intensifier calibration working (some dead regions in image intensifiers but using good regions.) All hardware working.
- Data collection, storage and delivery working
- Hardware monitored by MCR and they receive alarms
- SyncLite data monitored in Web page and email alarms sent to SL group (6 people) - can be H/W, Acnet or SDA Java problems. 1 problem per week - sometimes 1/day. (Software/server problems has improved.)

SyncLite Status 2

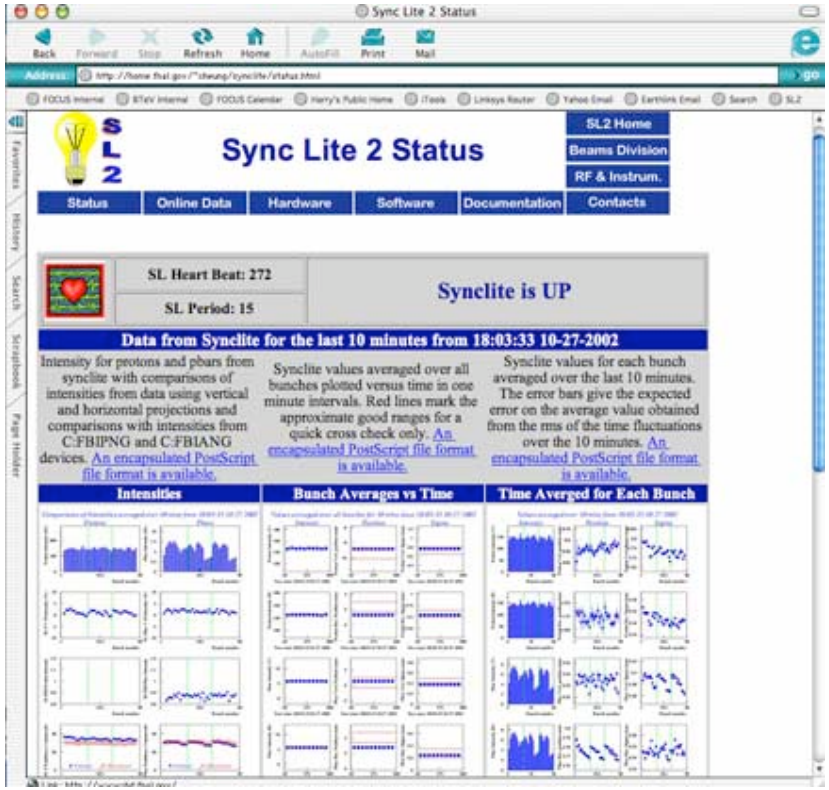
- Need to understand pbar mm scale (beam study disagrees with optical calculation by a factor of 1.8.) Quite sure beam study gives correct scale - but should resolve and check scale independent of knowledge of beam/lattice. (Comparing to Flying Wires …in progress.)
- Need to determine the optical (diffraction) resolutions. (Current numbers from Run 1 calculation of optics, about 0.1-0.2 mm.) Important effect for pbars (10-30% in c.f. 5-10% in protons.) Previous method of scraping the beam did not work in a beam study.
- Need to compare to Flying Wires. (Both SL and FW aim to get 's to 10-15%)

SyncLite Status 3

- Web page written for documentation and monitoring

http://home.fnal.gov/~cheung/synclite

  - Contains descriptions of hardware and how to run software
  - Need to update, improve and provide tools to access archived summary data



SyncLite Future Plans 1

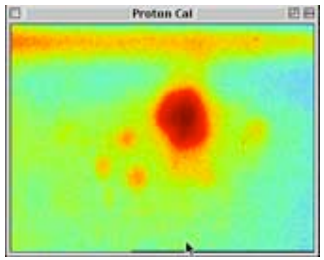
- Resolve pbar scale (Look closer at optical calculation and assumptions; get scale at image intensifier by placing a mask with a known size hole and illuminate to simulate a known size beam spot.)
- Determine uncertainty due to poorly known diffraction resolution. Think about how to measure this in the future if/when system is moved or upgraded.
- Analyze data to understand real uncertainty in measurements including comparing to the Flying Wire data. Improve the data uncertainty if possible, (e.g. maybe via changes in parts of the data analysis like the background subtraction - there is an indication of a 5-10% problem in measured intensity.)

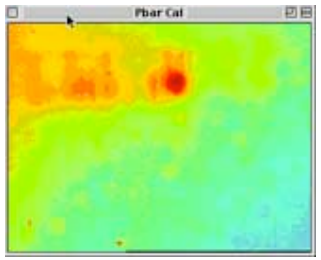
SyncLite Future Plans 2

- Upgrade the hardware - faster computer and associated interface hardware and software. (Replace slow Mac with faster Windows PC (for LabVIEW support); change NuBus motor drive hardware to PCI hardware; change video frame grabber hardware; change the associated software.
  - All replacement/duplicate hardware received by mid- or end of November
  - Software work and setting up replacement system done by beginning February. (Intend to have it all working before switching production system to upgraded system. And would do it only during a long enough shutdown.)

SyncLite Future Plans 3

- The system might be moved in the next major shutdown from C11 to B48 for C0 aperture work. (Need to look at changes to optics, need technician to pull new cables and move system to B48.) May want to improve system if possible at this time, e.g. changes that would improve system if run with 132 ns bunch spacing and improvements to internal checks/calibration.
- Fabricate new image intensifiers in case we need replacements (black/red marks dead regions in proton and pbar image sens.)





For more information on SyncLite see:
http://home.fnal.gov/~cheung/synclite