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# **The Automated Control of the ATLAS Pixel Sensor LASER Setup**

**15.08.2012**

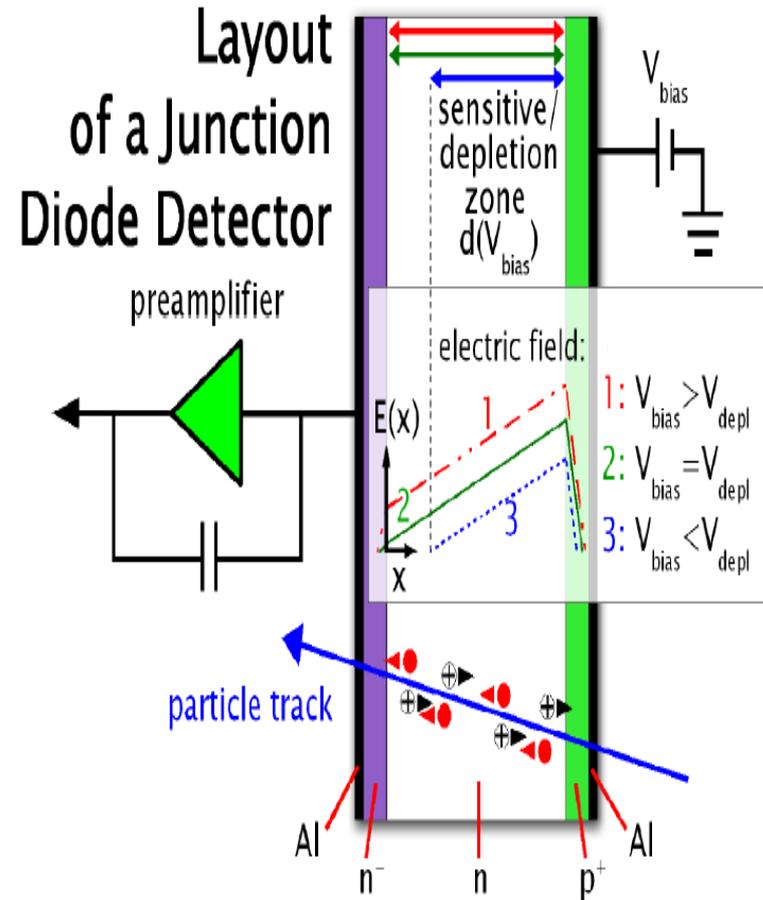
**Yasin BUYUKALP**

**Supervised by Christian GALLRAPP**

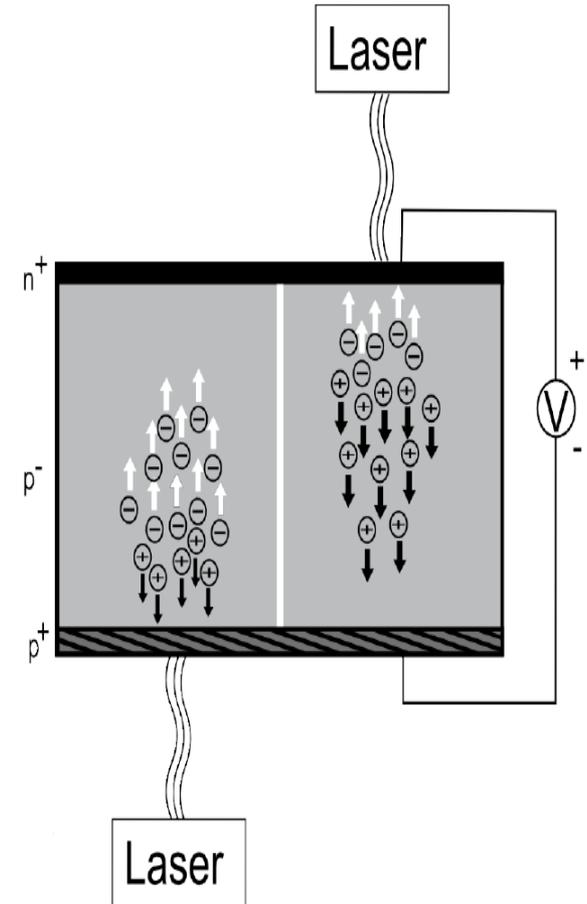
**Summer Student Session 2012**

# Pixel Detectors

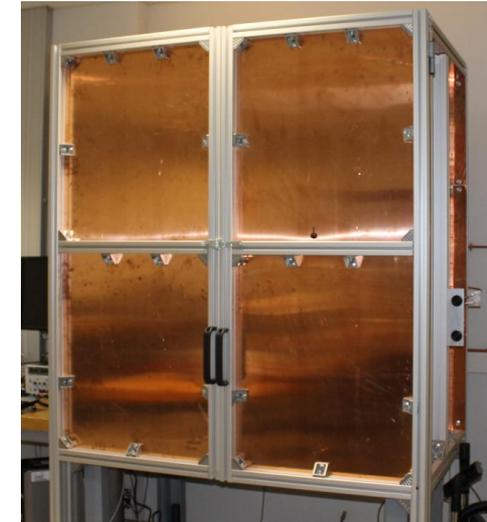
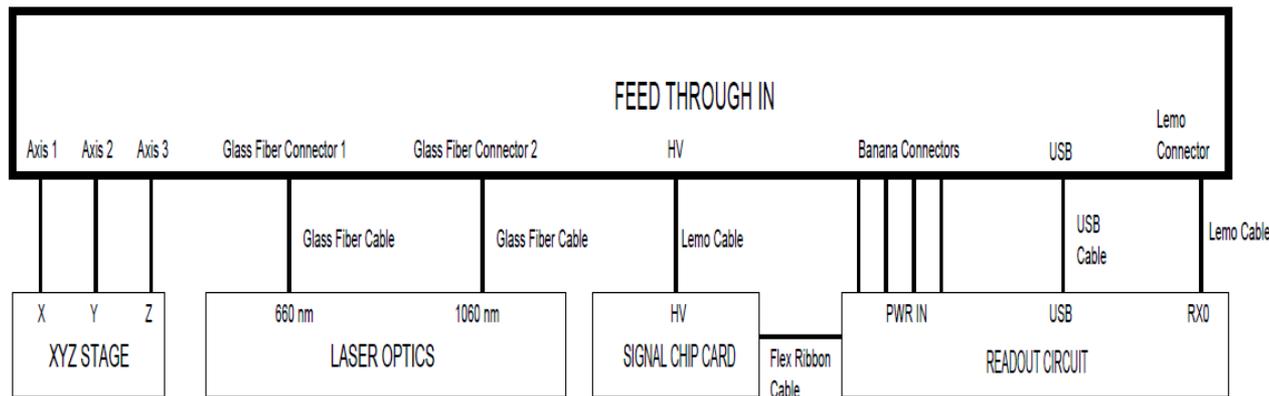
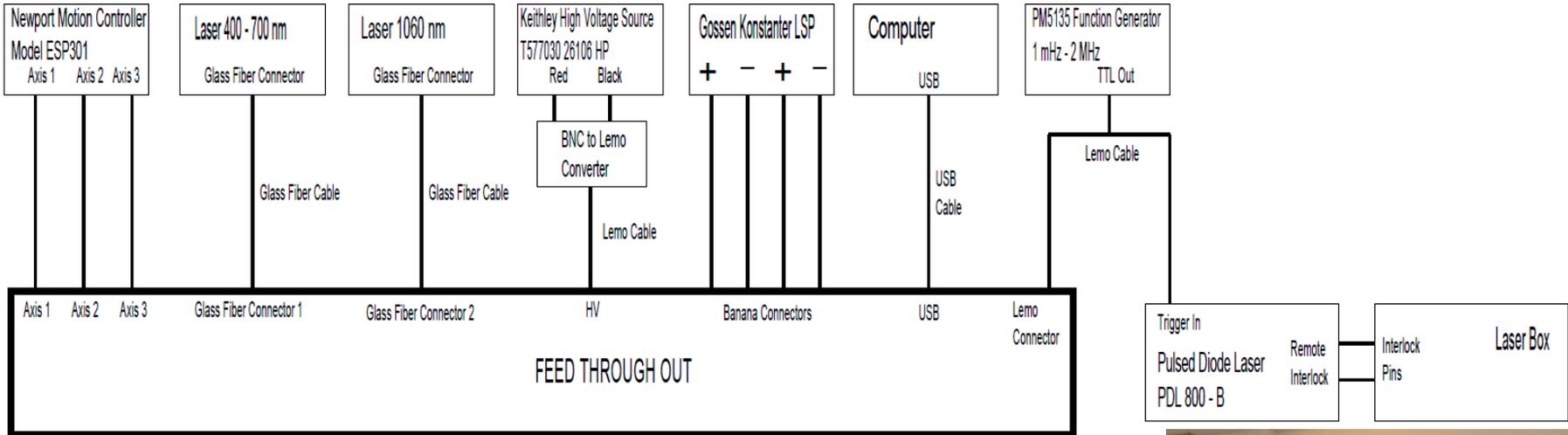
- Wide depletion region
  - p-n junctions
  - Reverse bias voltage
  
- Traversing particle excites valence electrons and creates electron-hole pairs.
  
- E-field transports the induced charges to electrodes.



- LASER
  - Single frequency
  - Spatial coherence
  - Focused energy on tiny spots
  
- Creation of electron-hole pairs by photoelectric effect
  
- Finding efficiency map of one pixel

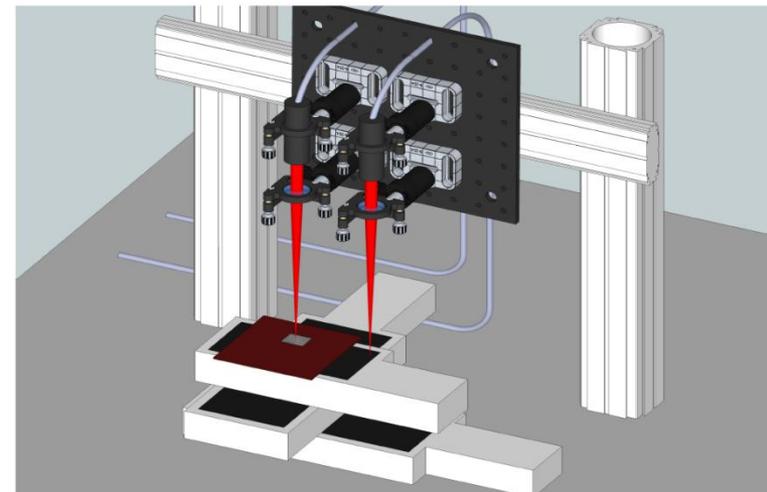
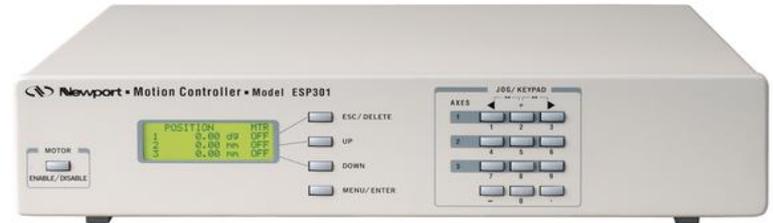


# Schematics of LASER Setup



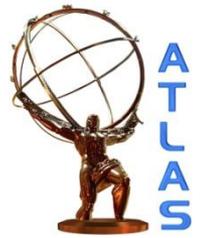
# XYZ Stage

- Motion Controller
  - Newport Model ESP301
  - Accuracy  $< 1 \mu\text{m}$
- Special communication cable design
- By moving the sensor chip, high resolution scanning to find the spatial dependency of charge collection efficiency over single pixel or whole sensor





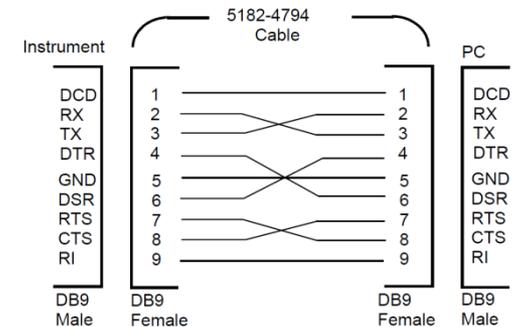
# Why Automated Communication?



- LASER beam width at working point  $\approx 10 \mu\text{m}$
- Scanning with steps of  $2 \mu\text{m}$  movement
- $50 \mu\text{m} \times 250 \mu\text{m}$  pixel
  - 2541 tests for one pixel
- Trigger rate is 5000 – 10000 Hz
- 3000000 times triggers the LASER for the test of one step
  - At least 5 minutes for each step
  - 12705 minutes  $\approx 9$  days for each pixel
- $2 \text{ cm} \times 2 \text{ cm}$  sensor
- $80 \times 336 = 27880$  pixels on one sensor
  - 250920 days  $\approx 687$  years to test whole of one sensor

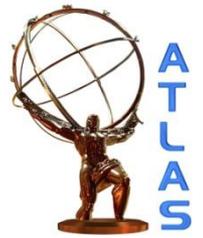
# Controlling Power Supply

- For future research needs, RS-232 instead of USB
- Broken Motion Controller
- HP(Agilent) E3631A DC Power Supply
- ATEN USB-to-Serial Converter
- Crossover DB-9 cable





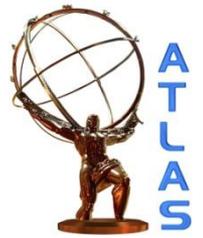
# RS-232 Communication



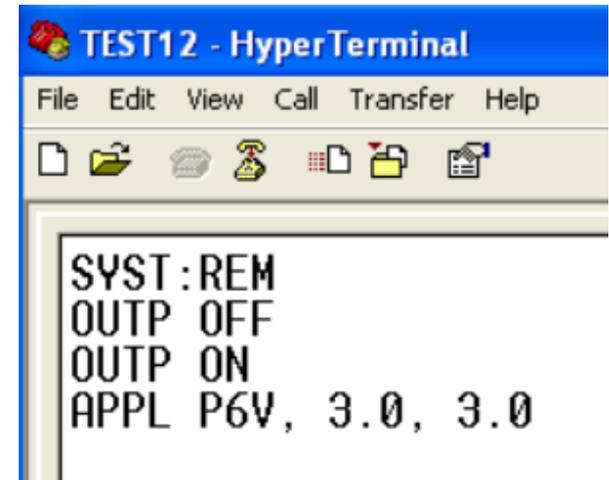
- Serial Communication
  - Sequentially sending data one bit at a time over a communication channel
- A series of standards for serial binary single-ended data and control signals connecting between a computer and a communicated device.
- Standards about the electrical characteristics and timing of signals, the meaning of signals, and the physical size and pin out of connectors
- Standard does not define frame of characters such as baud rate, number of data bits, stop bits or type of parity and flow-control.
- Data frame is determined by the communicating devices.



# Programming Stage

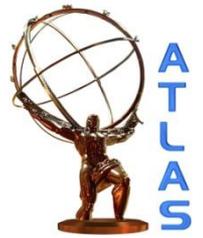


- Predefined commands to control the device
  - For power source, Standard Commands for Programmable Instruments (SCPI) Language
- HyperTerminal
  - Automatically opens the port
  - Choosing correct port number
  - Adjusting correct frame
  - Sending the correct command
- C++ code for communication
  - Boost C++ libraries
    - Opening the chosen port
    - Adjusting the data frame
  - Interface to take the inputs (port number, data frame, commands)





# References



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