Module Assembly at Wuhan

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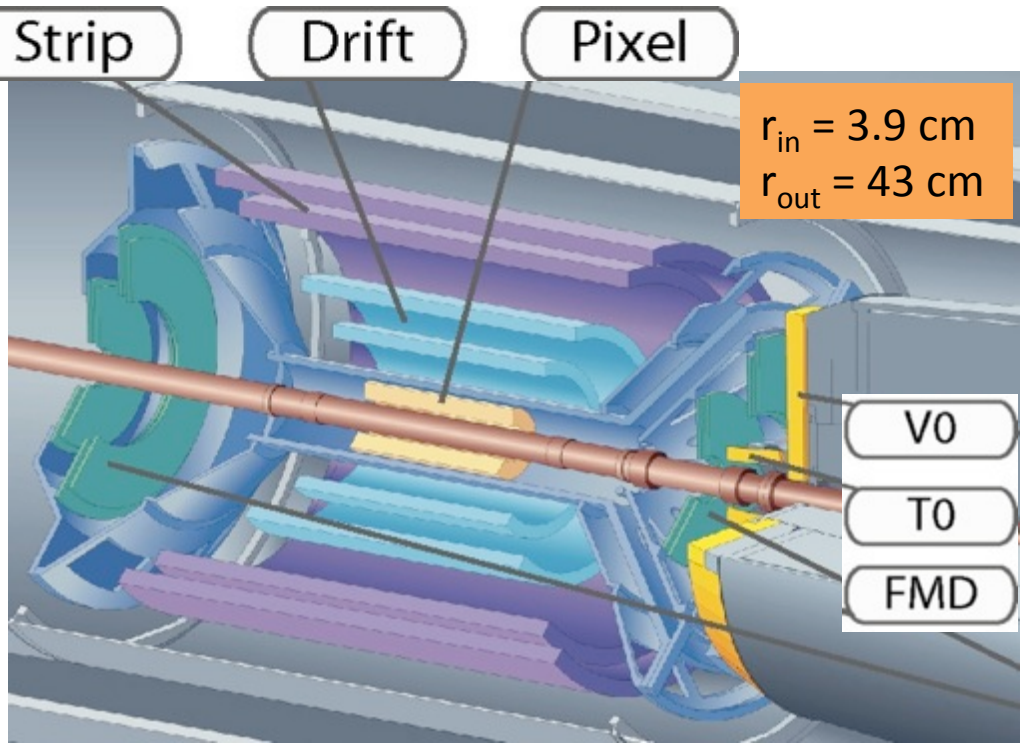
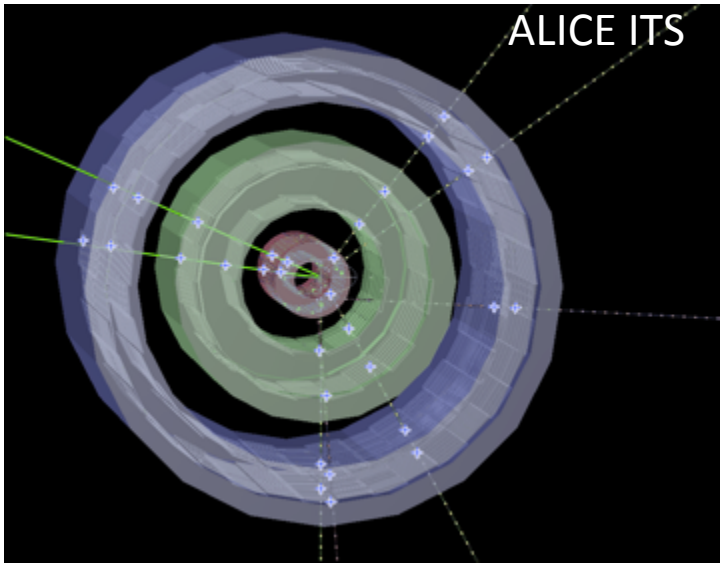
Central China Normal University, June 7-9, 2015

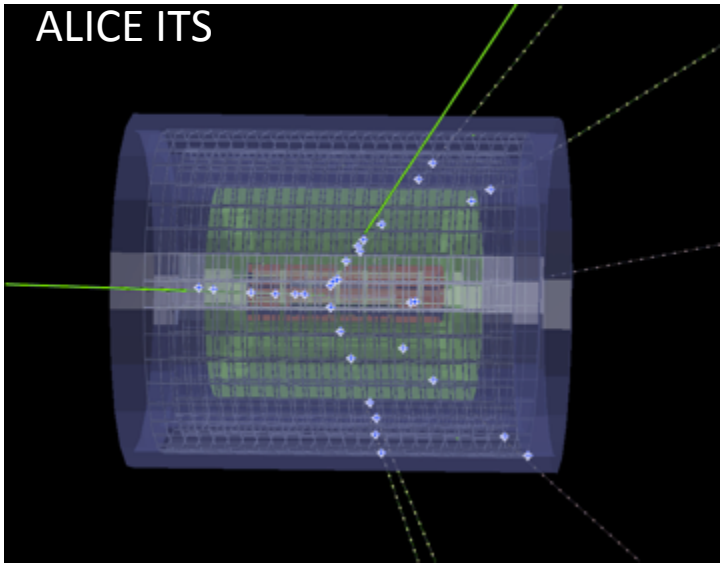
Outline

- ALICE ITS Upgrade
- Wuhan Plan on the ALICE ITS Upgrade
- Activities at Wuhan
- Lab Preparation at Wuhan

ALICE ITS Upgrade -- Current ITS







The Current ITS:

6 concentric barrels, 3 different technologies

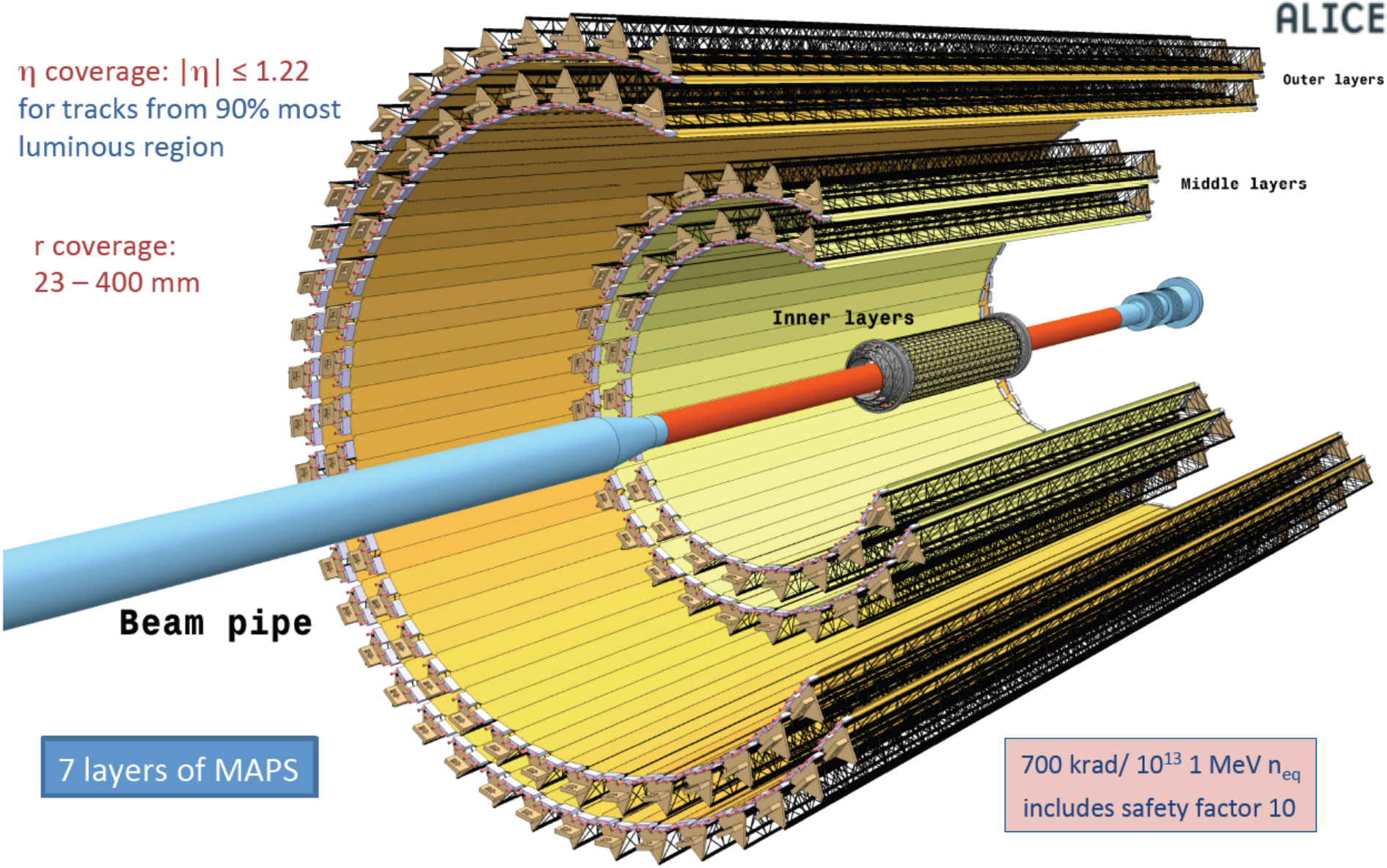
- 2 layers of silicon pixel (SPD)
- 2 layers of silicon drift (SDD)
- 2 layers of silicon strips (SSD)

*This slide is from Luciano Musa's talk

ALICE ITS Upgrade -- New ITS

η coverage: $|\eta| \leq 1.22$
for tracks from 90% most luminous region

r coverage:
23 – 400 mm



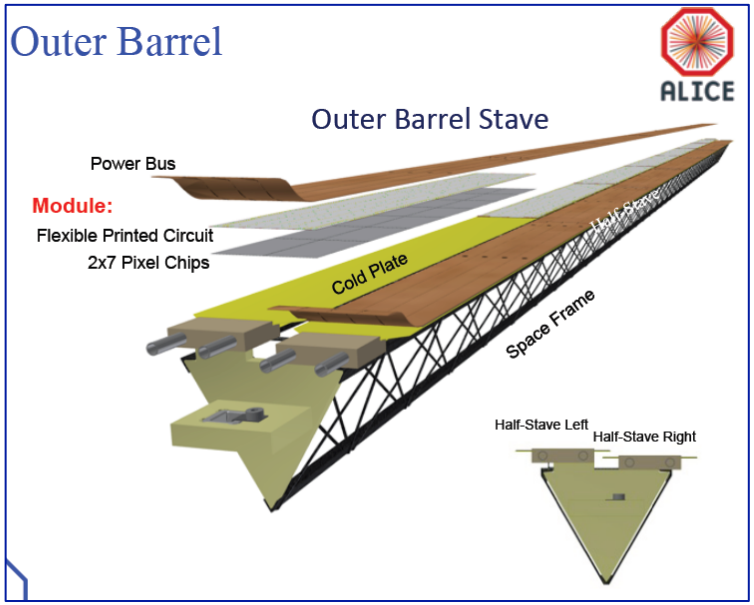
7 layers of MAPS

700 krad/ 10^{13} 1 MeV n_{eq}
includes safety factor 10

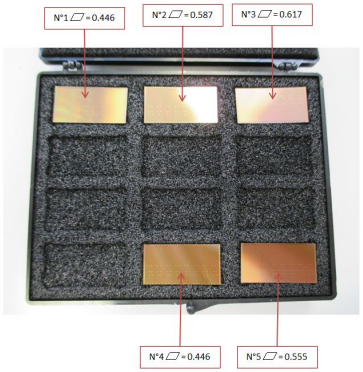
Wuhan Plan on the ALICE ITS Upgrade

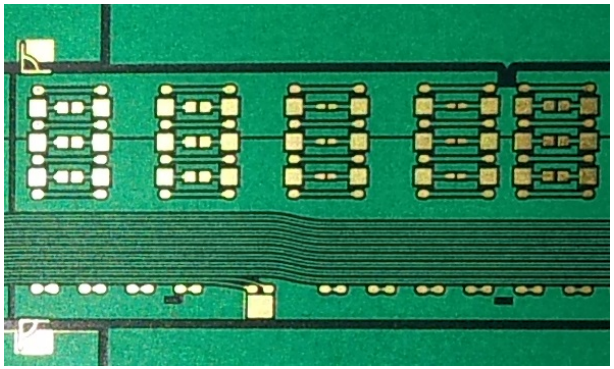
① Pledge to CERN that CCNU imports a baseline module assembly machine, and covers one outer layer module assembly.

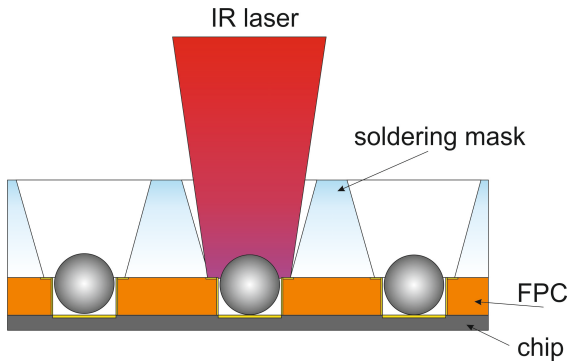
② Efforts on vision control software development for automatic placement of soldering balls and quality control of soldering joints.



- Some redundancy in the quantity of modules to be produced is required, specifically 120% for the IB, 20% for the OB, resulting in a total 2136 Hybrid Integrated Circuits (HICs); more specifically:
  - IB: n. 106 "*9-chips*" HICs (954 chips to be soldered)
  - OB: n. 2030 "*14-chips*" HICs (28420 chips to be soldered)
- Considering ~ 80 pads/chip → ~ 2.4 M interconnections







Activities at Wuhan -- Funding support

Funding status:

- ✓ Prof. Nu Xu's "1000plan" funding from CCNU
- ✓ Possible funding support from NSFC* (organized by Prof. Daicui Zhou)
- ✓ ……

*NSFC: China Natural Science Founding Committee

Activities at Wuhan -- Manpower

Hardware team (based on CCNU-PLAC manpower):

- Bingwei Deng (Faculty of HBPU, Expert on electric design)
- Daming Sun (Temporary employee of CCNU, Machining engineer)
- Xiangming Sun (Expert on silicon sensor design, rich experiences in STAR-HFT/PXL detector)
- Yaping Wang (Rich experiences in STAR-HFT/IST detector on both hardware and software)
- Hongbo Xu (Faculty of CCNU, expert on image processing)
- Chengke Yin (Faculty of SUDA, Expert on automatic system control and rich experiences in software design)
- Xuan Chen (Master student of CCNU-PLAC)
- Jiankai Huang (Master student of CCNU-PLAC)
- Lu Liu (Master student of CCNU-CS)
- Xiaoju Pan (Master student of CCNU-CS)
- Yan Zhu (Master student of CCNU-PLAC)

PLAC: Pixel Lab At CCNU
HBPU: Hubei Polytechnic University
STAR-HFT: Heavy Flavor Track at STAR
IST: Intermediate Silicon Tracker at STAR-HFT
SUDA: Soochow University
CCNU-CS: Computer School of CCNU

Activities at Wuhan -- Manpower

Project team (based on CCNU-ALICE manpower):

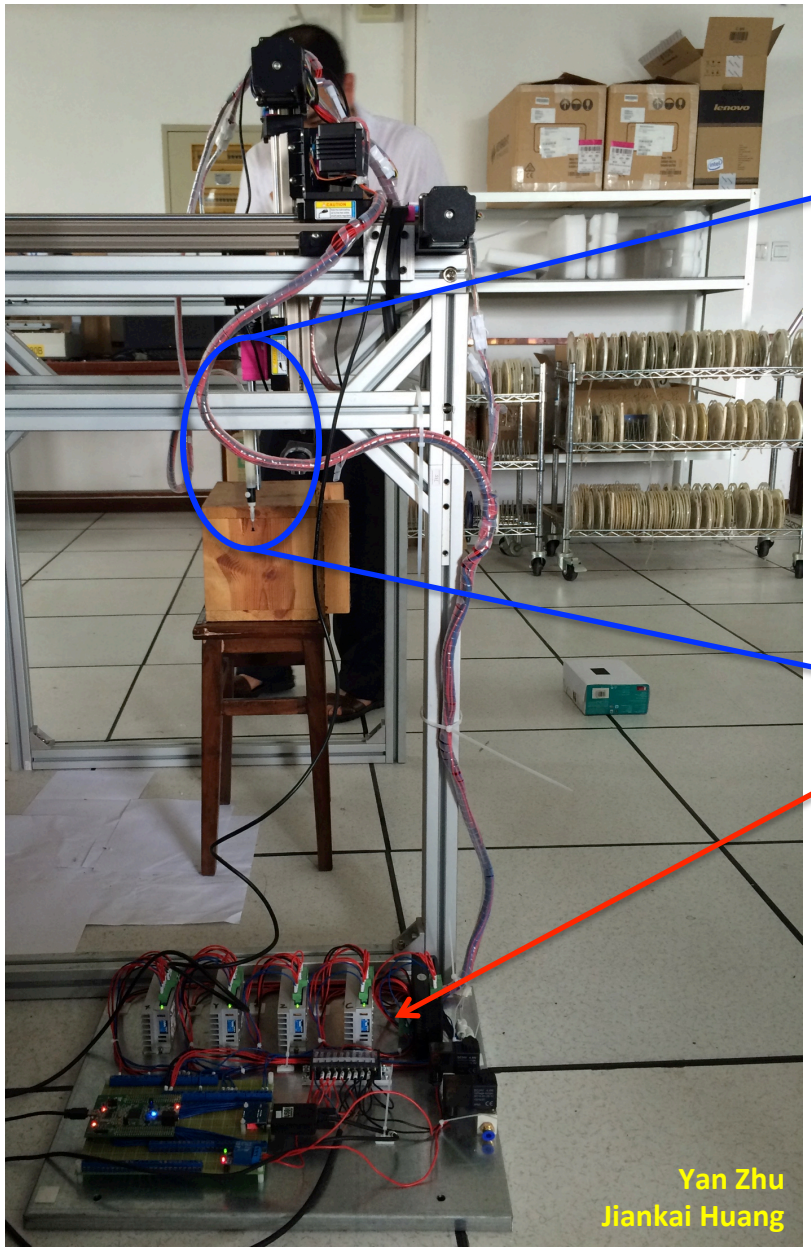
- ✓ Prof. Zhou is leading key members of the ALICE-China team to seek for funding support from government.
- ✓ Proposal has been submitted to the NSFC in March 2015, which covers the ITS module assembly production and related physics.

- Paolo Bartalini (CCNU)
- Xiaomei Li (China Institute of Atomic Energy, Beijing)
- Yaxian Mao (CCNU)
- Hua Pei (CCNU)
- Qiye Shou (Postdoc, CCNU)
- Prabi Palni (Postdoc, CCNU)
- Dong Wang (CCNU)
- Zhongbao Yin (CCNU)
- Daicui Zhou (CCNU)

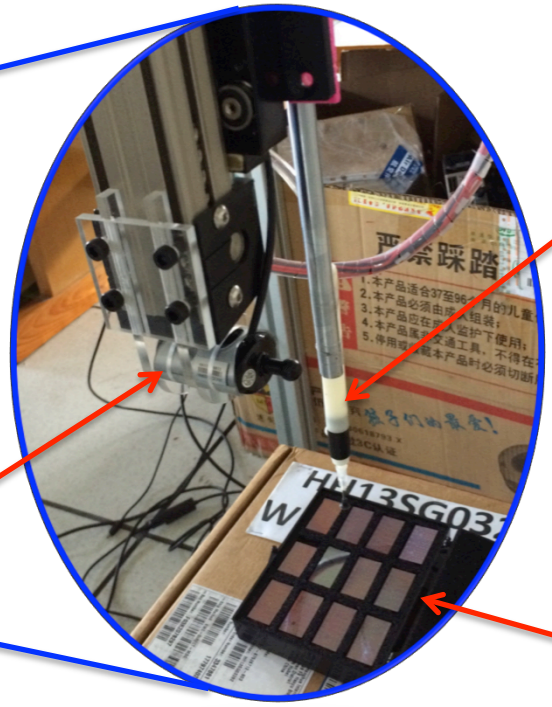
Activities at Wuhan – Efforts and Plan

- Visited CERN to follow ITS assembly technique in 2014
- CCNU assembly weekly meeting (Saturday, 20:00-22:00) among hardware team
- Paperwork for HIC assembly machine order has been started since Feb. 2015.
- Contract to import the HIC assembly machine is hoped to be released at the end of June, 2015.
- Procurements for lab construction are scheduled to be started after this workshop.
- R&D activities on the vision control system for the assembly system.

Activities at Wuhan – R & D on Vision Control System



Custom designed test stand:

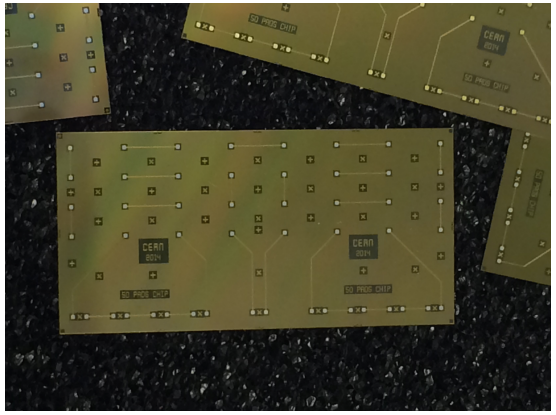


- Automated video system: edge tracking
- Automated software-based shape analysis
- Fully programmable interface (PC)
- Wide travel range in XYZ, and rotatable in XY plane
- ~100 macrons XYZ scale resolution
- Binocular to be installed close to vacuum pen to determine distance to object in Z direction

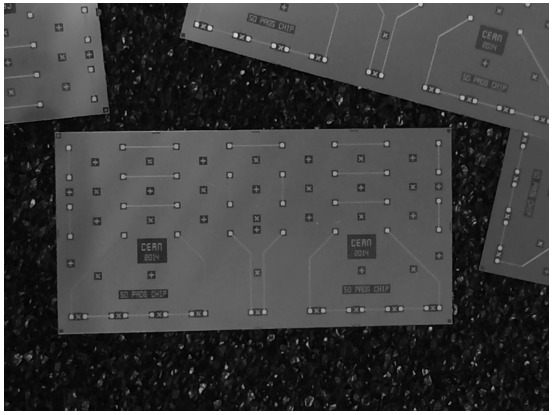
Activities at Wuhan – R & D on Vision Control System

Image processing:

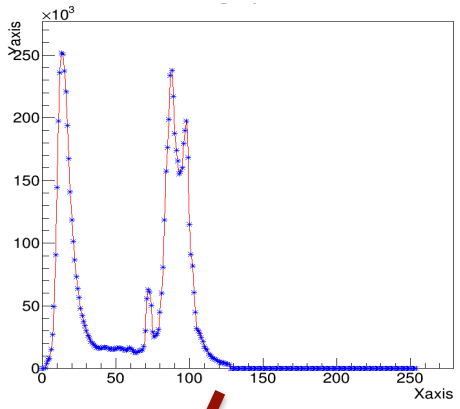
color image by camera



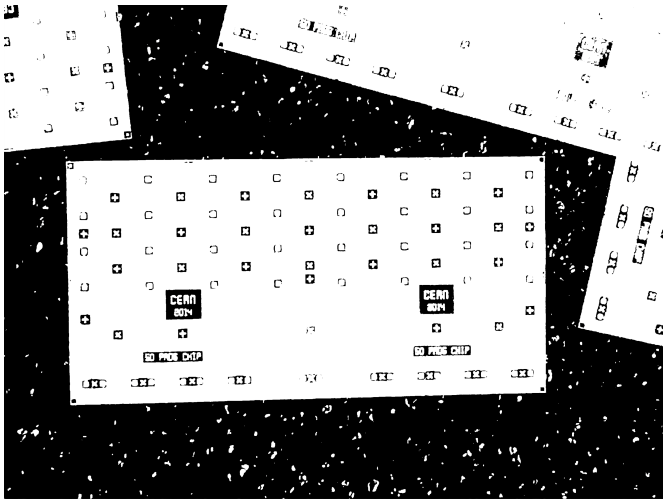
grayscale image

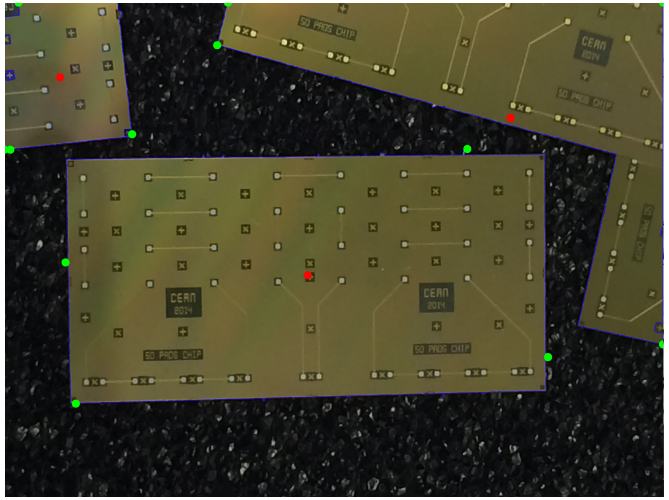


gray histogram



binary image





- Object edges are tracked and determined
- Geometry center of object shape was defined
- Rotation angle was determined

Yan Zhu, Xiaoju Pan, Lu Liu guided by Dr. Hongbo Xu

Lab Preparation at Wuhan

Two candidates:

- Clean room (10K)
- 7th floor, ~ 120 m^2
- Controllable temperature and humidity
- Need to check the load bearing of the floor

- An unoccupied room
- Ground floor, ~ 80 m^2
- Need to decorate (at 100K clean room level)

The lab construction and equipment procurements are scheduled to start after this workshop.

Thanks for your attention!