

Contribution of SLRI toward ALICE ITS3 development

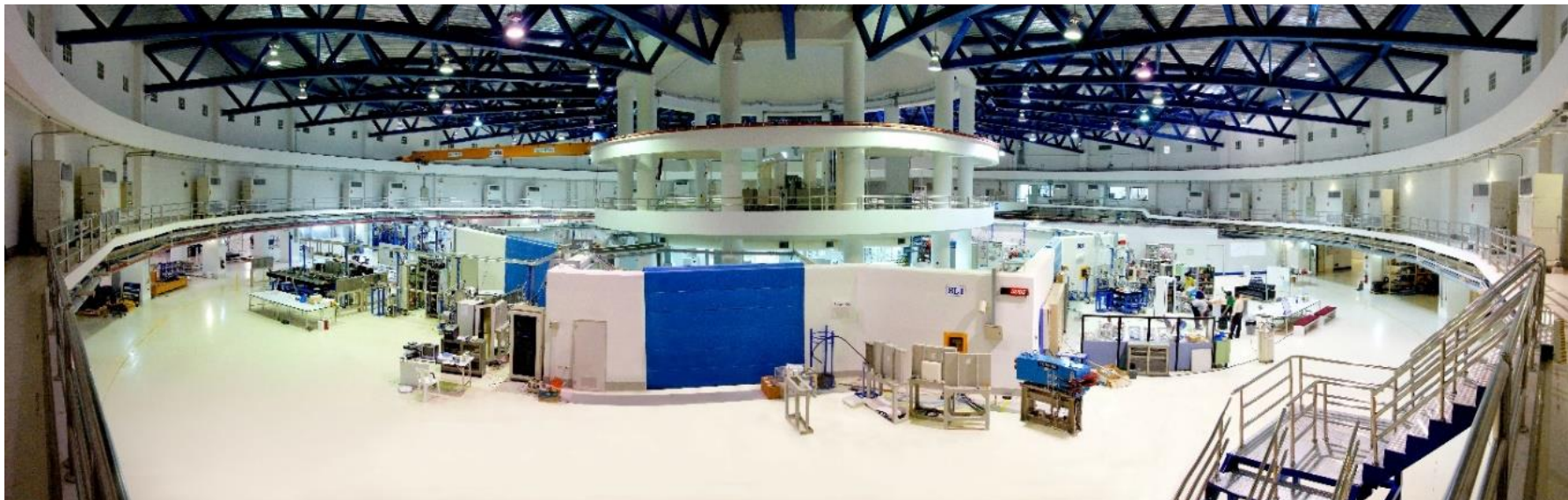
Kritsada Kittimanapun (SLRI)

ALICE-Thailand meeting

April 1st, 2021



Synchrotron Light Research Institute (SLRI)



- 23 hours of synchrotron light service provided by Siam Photon Source (SPS)
- 12 experimental stations: SAXS, XTM, XAS, PES/PEEM, IR MX etc.
- Injector (linac, booster, transport line) used twice daily
 - In operation for 1 hours
 - Available up to 23 hours

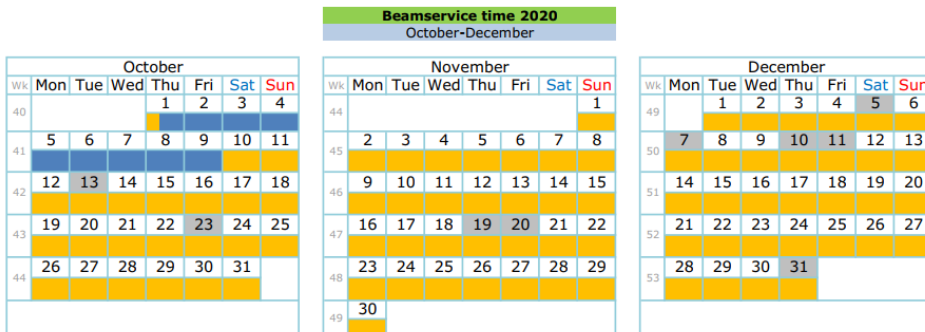
Extension of accelerator facility and increase versatility of SPS injector
-> **SLRI Beam Test Facility**
-> **Dedicated to SLRI-ALICE collaboration**

SPS Operation calendar (2021 fiscal year)

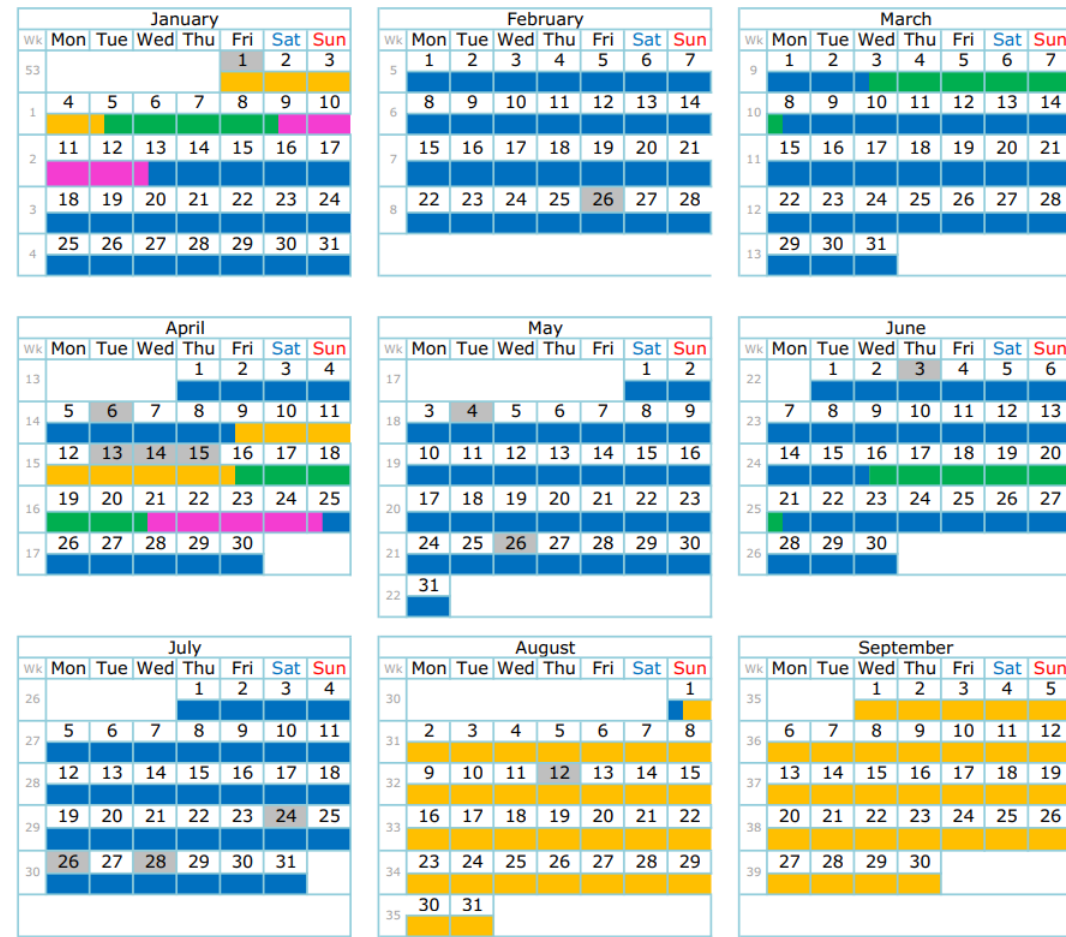
FY2021 SPS Operation Schedule

User Time
Beam Alignment
Machine Study
Machine Maintenance

User Time starts at 09:00 a.m. on the first day and ends at 08:00 a.m. on the last day of each operating period.



Beamservice time 2021 January-September



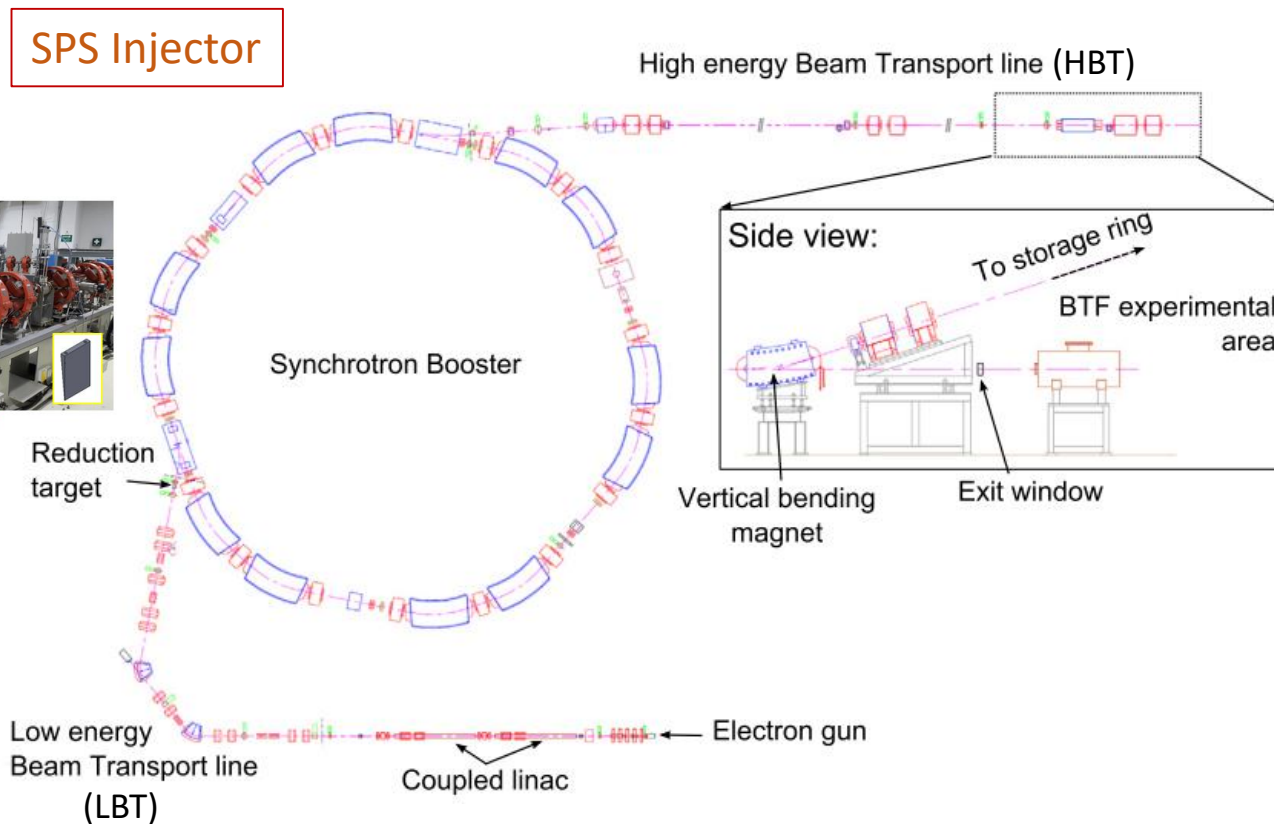
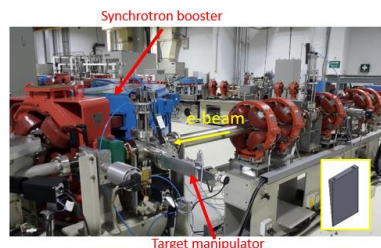
- Regular beam service Jan – Jul 2021 (7 months)
- Preventive maintenance during Oct-Dec, 2020 and Aug-Sep, 2021 (5 months in total)
- Annual holidays: New Year, Thai New Year 13-15 Apr 2021 (no beam service for a week)
- During maintenance, BTF operation could still be possible if activities are not involved SPS injector, e.g. upgrades of experimental stations

Plenty of beam time available for BTF

SLRI-Beam Test Facility

- Provide electron test beam with energy between 40 MeV – 1.2 GeV (now fixed at 1.0 GeV)
- Adjustable test beam intensity from 1 – 10^9 electron/repetition rate
- Benefit to testing and calibration of high-energy instrumentations and detector

SPS Injector

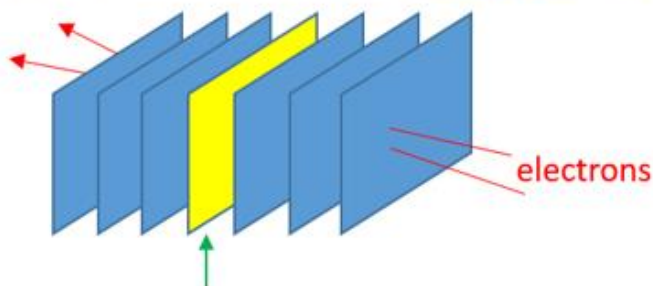
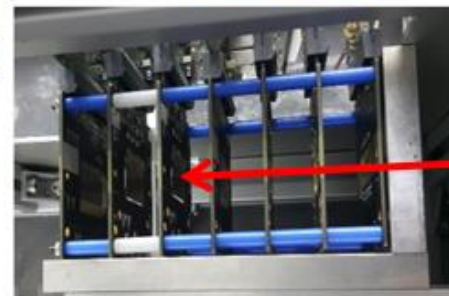
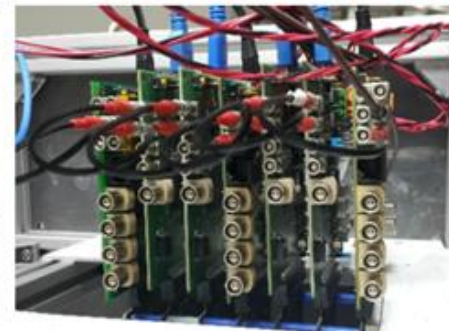
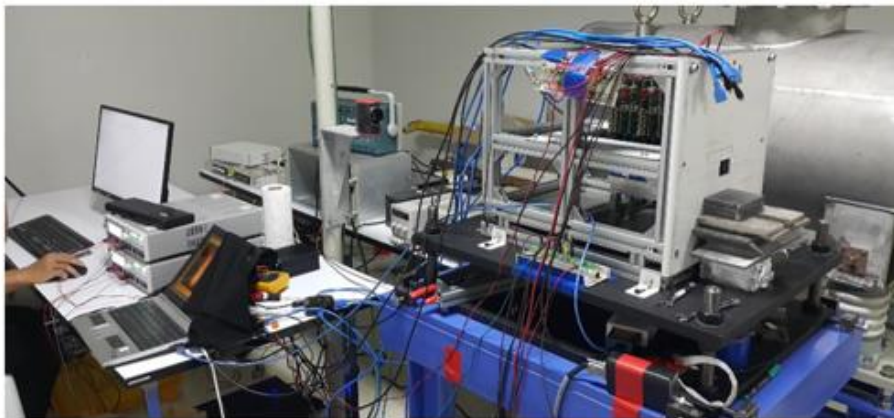


3 x 3.5 m² available area, reserved for Faraday cup

Particle	electron
Energy	1 / 1.2 GeV
Energy spread	0.05% at 1 GeV
Pulse duration	8.5 ns
Bunch length	0.5 ns
Repetition rate	0.5/0.33 Hz for 1/1.2 GeV

Operation of SLRI-BTF requires all components up to 2nd pair of focusing-defocusing quadrupole of HBT

SLRI-Beam Test Facility



Device Under Test (DUT) – final version of ALPIDE sensor

Combination of pALPIDE I & II

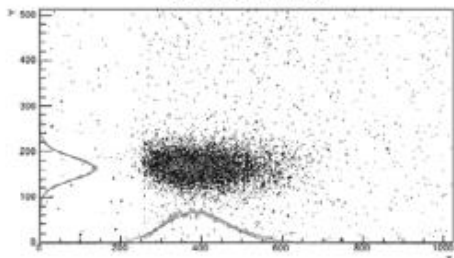
**Electron
test beam**

Telescope was successfully installed and efficiency of tested sensor was obtained

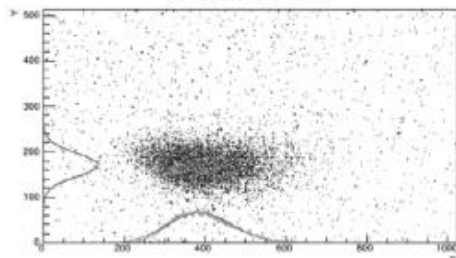
Telescope setup: Telescope will be upgraded from combination of pALPIDE1 and 2 to ALPIDE
Telescope is modified to have DUT to be movable in 2D (transverse plane)

Electron test beam profile

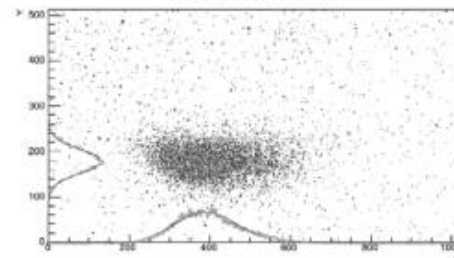
Plane 0



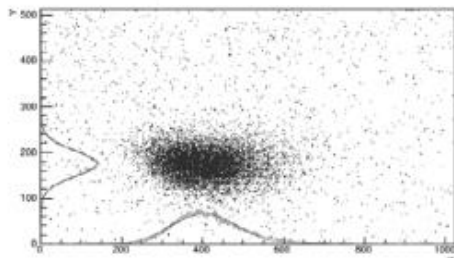
Plane 1



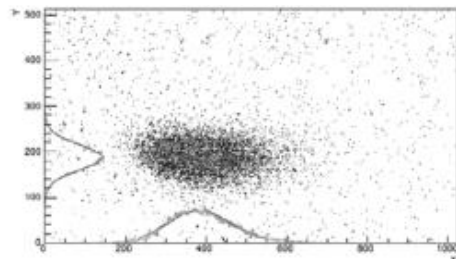
Plane 2



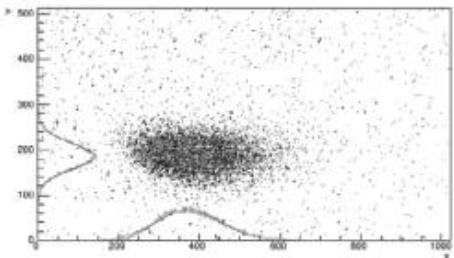
Plane 3



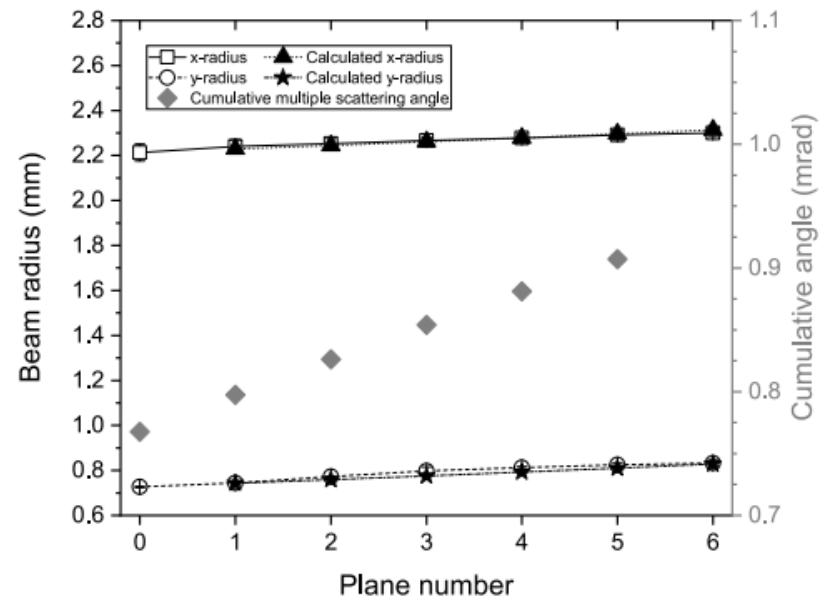
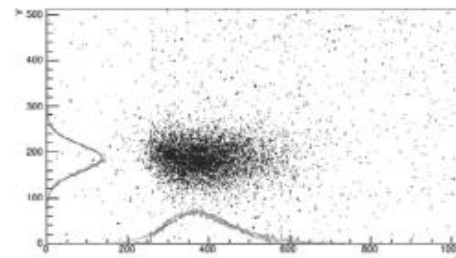
Plane 4



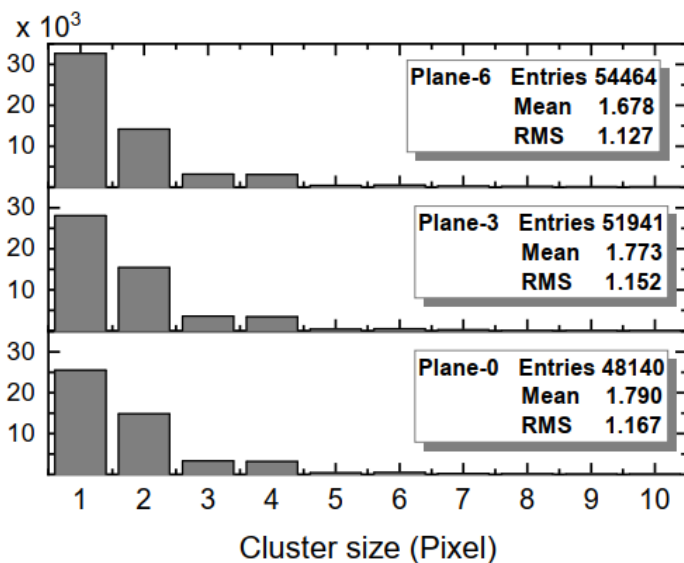
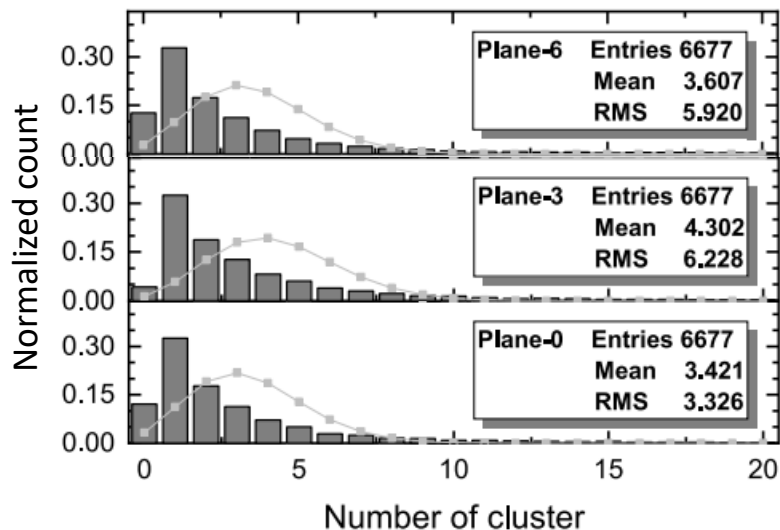
Plane 3



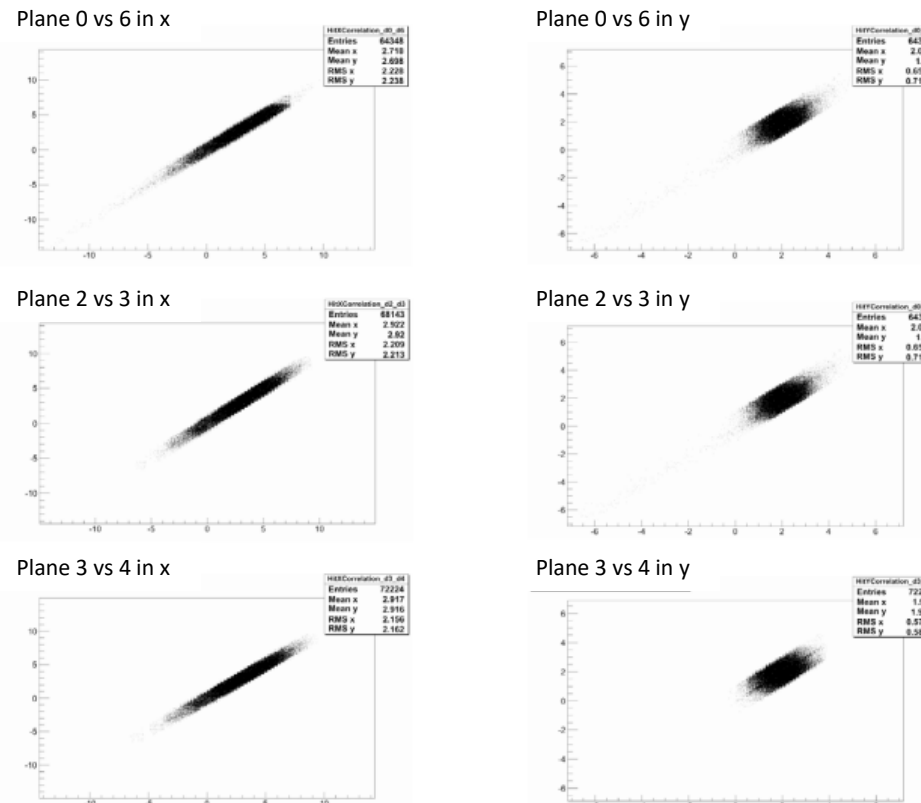
Plane 4



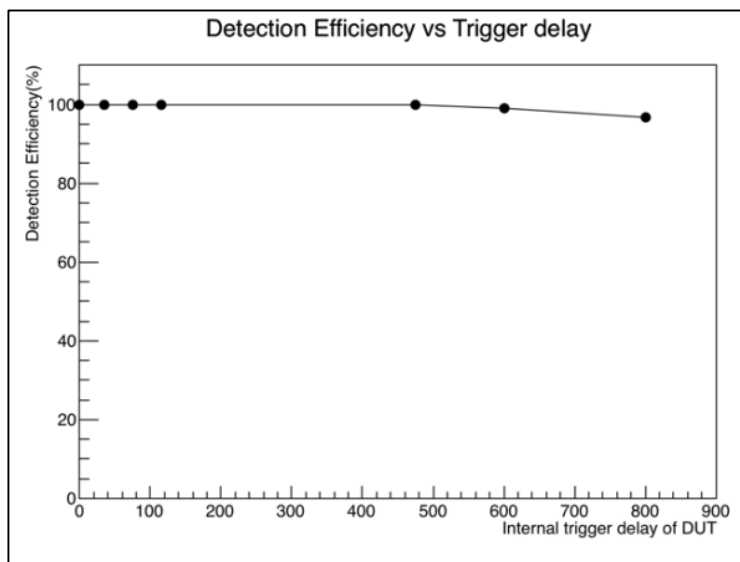
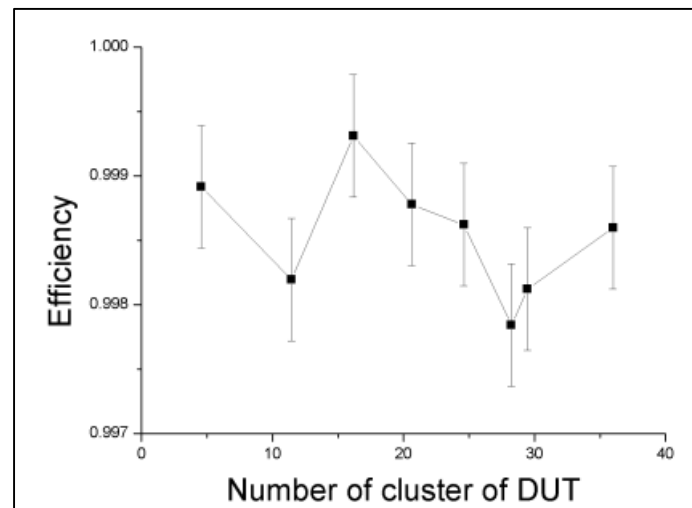
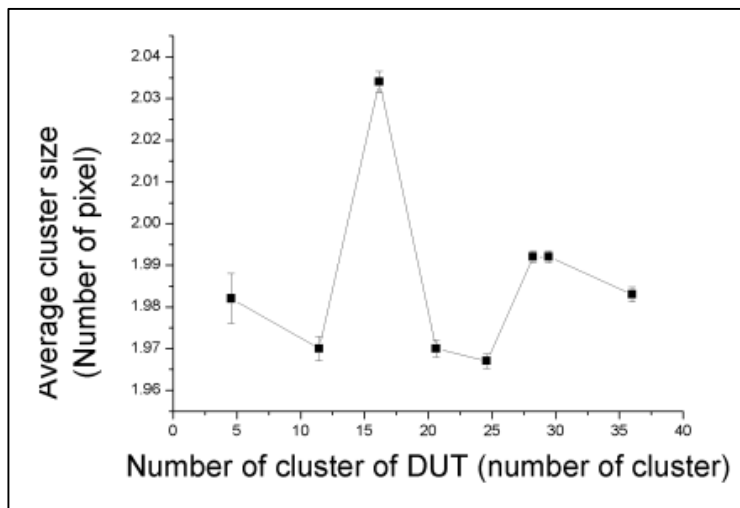
Results of test beam measurement



Correlation plot



Efficiency of ALPIDE and pALPIDE-2 sensors



- One experiment lasted about 10 hours
- Efficiency ALPIDE and pALPIDE-2 agrees with design parameters (> 99%)

Current status of SLRI-BTF team

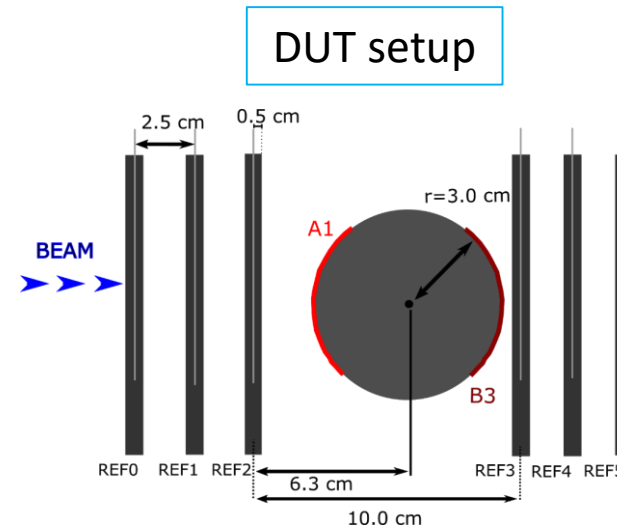
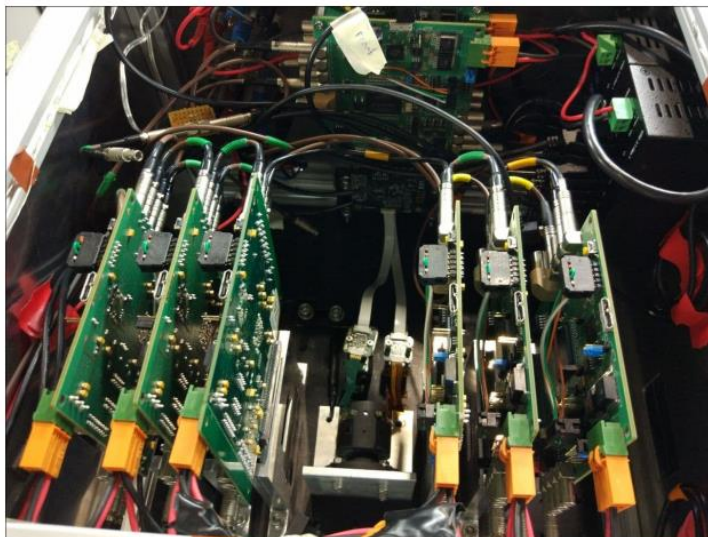
- Manpower
 - 1 Ph.D. student (Jetnipit recently started Ph.D program at SUT)
 - 2 Staff
 - 1 or more Master degree students expected to join BTF team
- Proposals submitted to two funding agencies:
 - NSTDA - Recently approved by the committee, starts June 2021 – May 2026 approximately (5 year long)
 - TSRI – Proposal submitted (3 year long)

Activity plans for ITS3 development

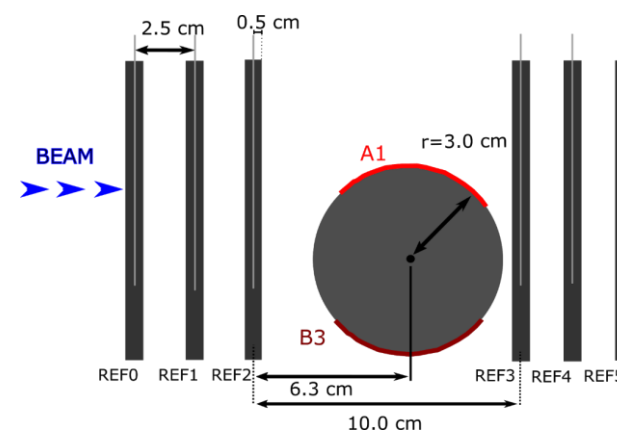
- Participate in WP3: Sensor Characterization and Qualification of ITS3 sensor
- Focus on characterization of sensor prototypes using electron test beam at SLRI-BTF
- Once produced, the new prototype will be shipped to SLRI and tested with 1/1.2 GeV electron testbeam depending the status of the injector
- Meanwhile participating in data analysis from other test beams e.g., August 2020
- Join testbeam experiments at CERN, DESY, etc. (once the Covid-19 situation is better)

Testbeam experiment setup with bent ALPIDE

Testbeam setup at DESY (December 2020)

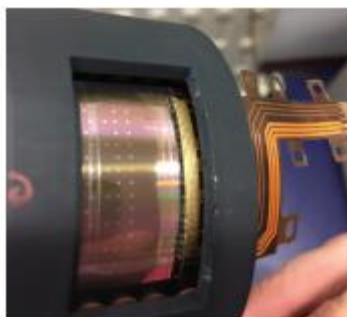


Perpendicular



Double crossing

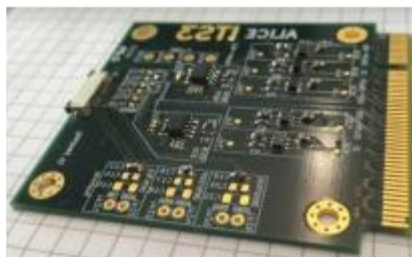
Bent chip + FPC on cylindrical jig



I-board (FPC to long flex; lessens tension)



Flex2DAQ (interface & decoupling)



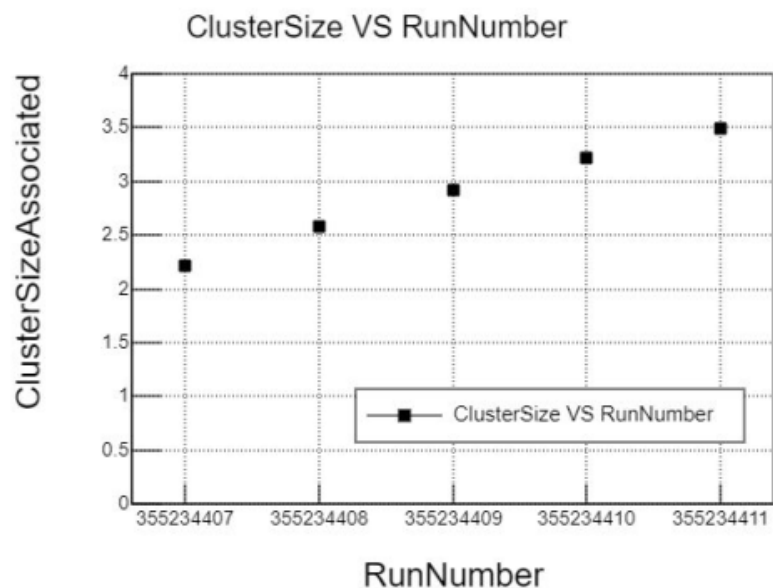
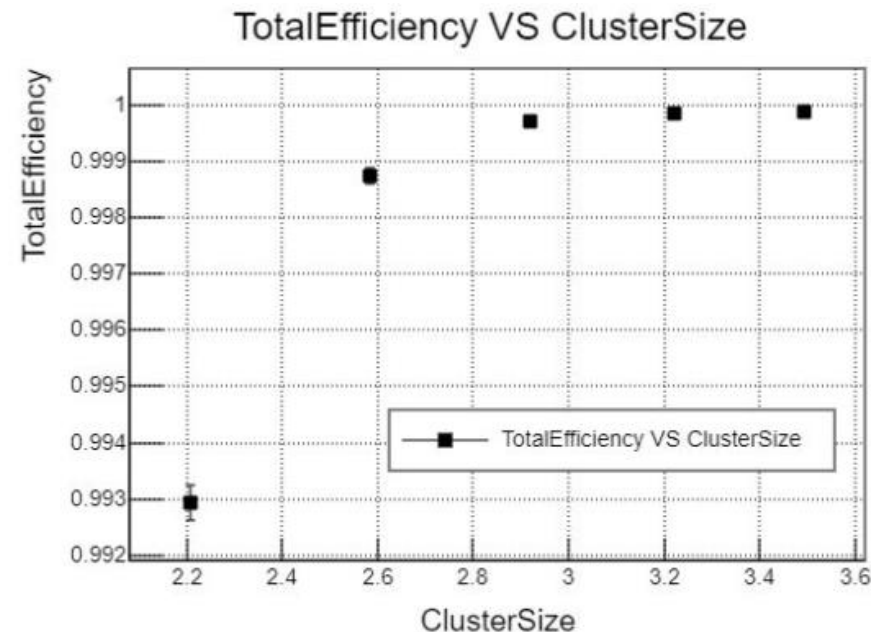
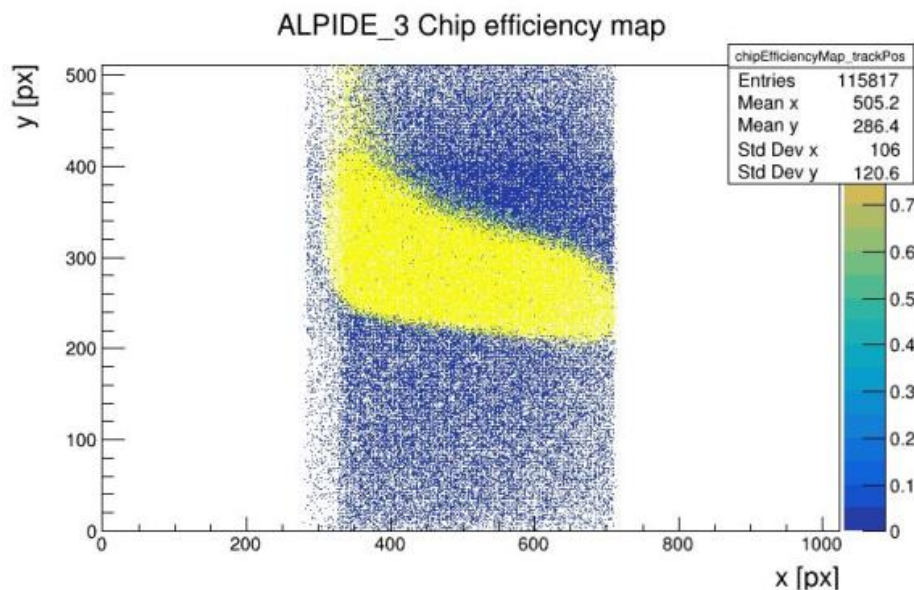
DAQ board



Procurement of parts starts after receiving the budget

Pictures from ITS3 WP3

Data analysis (August bent data)



Preliminary results:

- Small cluster size -> small efficiency
- Maximum efficiency > 99.98%

Collaboration

- **SUT:** C. Kobdaj, N. Laojamnongwong, A. Lakrathok, J. Kaewjai
- **CERN:** M. Mager (ITS3 upgrade leader), M. Suljic (WP3 convener), WP3
- **RMUTI:** W. Poonsawat
- **SLRI:** K. Kittimanapun, N. Chanlek, SUMO (Accelerator Support Team)



Thank you for attention