Characterization of sensors at SLRI

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On behalf of the Synchrotron Light Research Institute (SLRI) and Suranaree University of Technology (SUT) Team

Outline

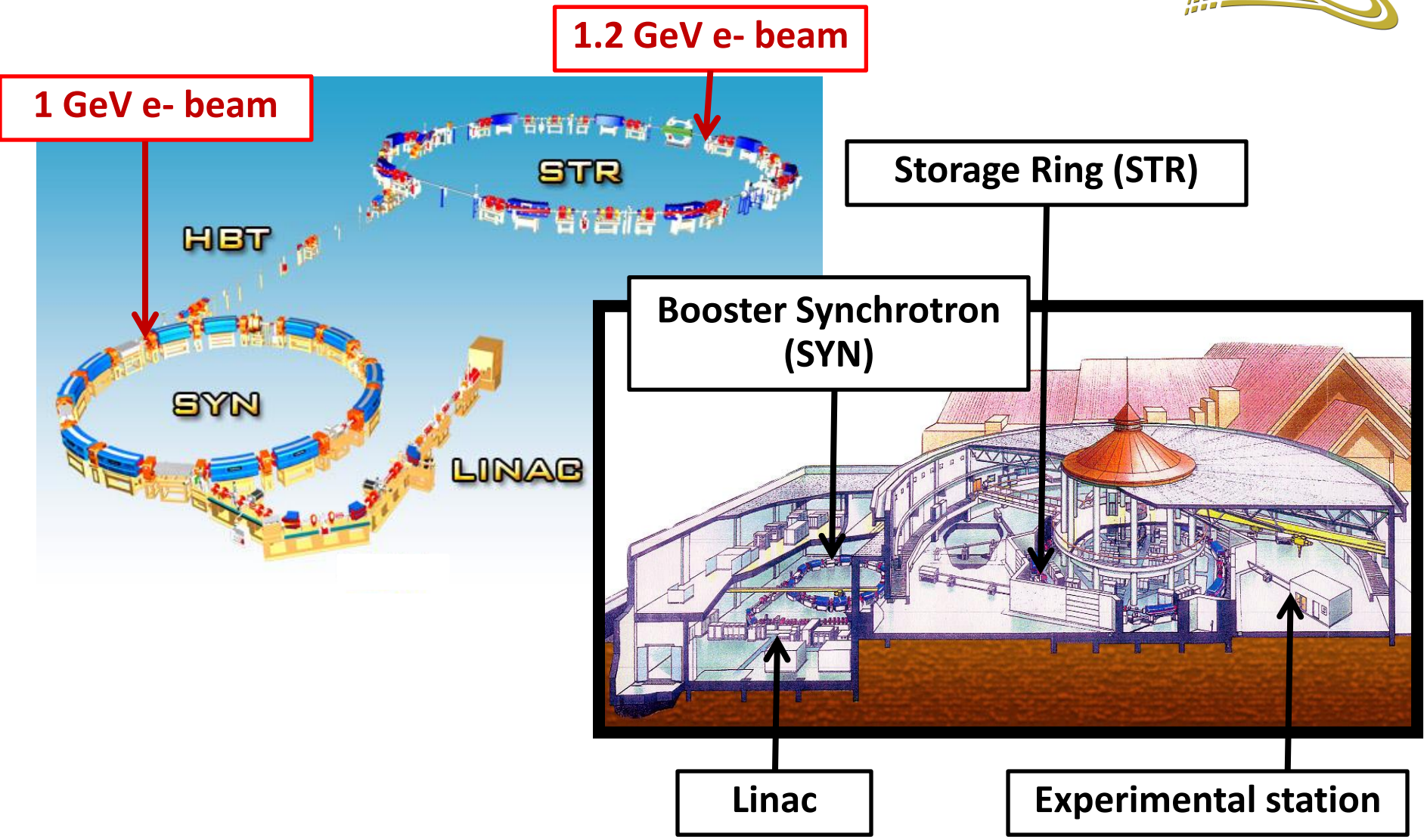
- Introduction
- Our participation
- Activities and plan
- Summary

Synchrotron Light Research Institute (SLRI)

- Synchrotron facility located in Nakhon Ratchasima.

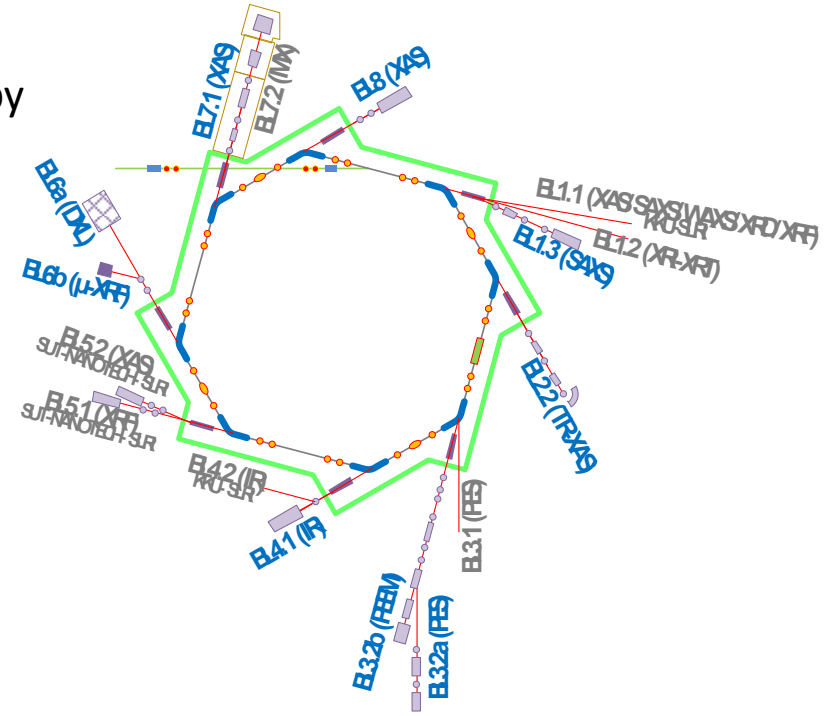
Synchrotron Light Research Institute (SLRI)
(Public Organization)

Siam Photon Source (1.2 GeV)

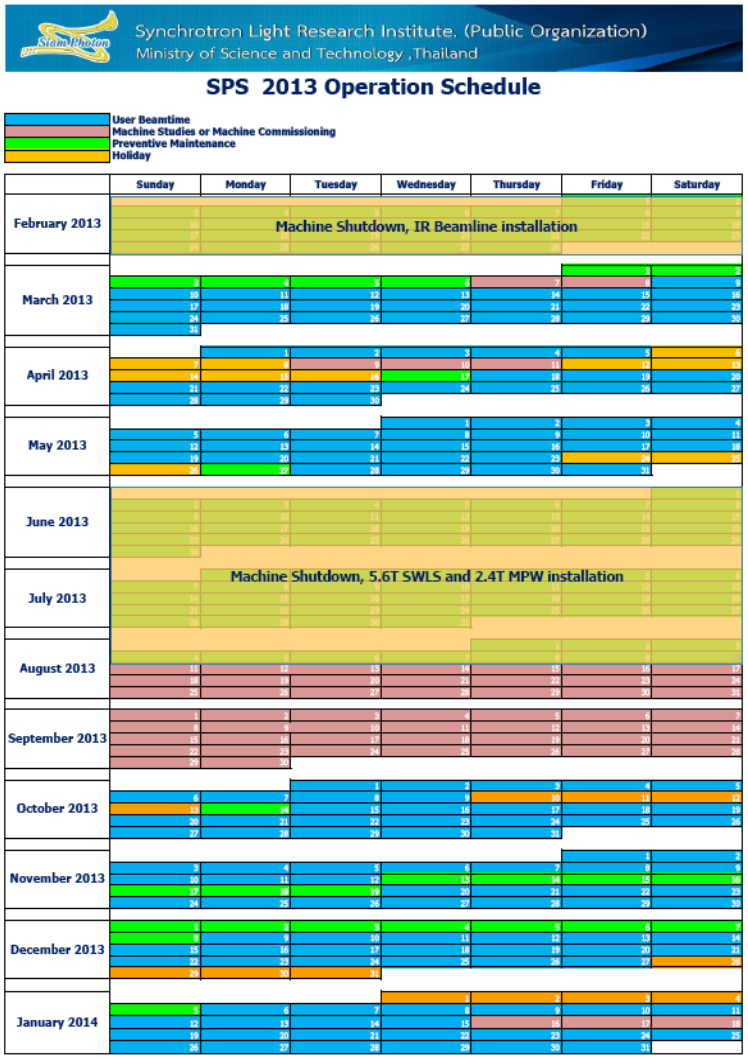


Siam Photon Laboratory

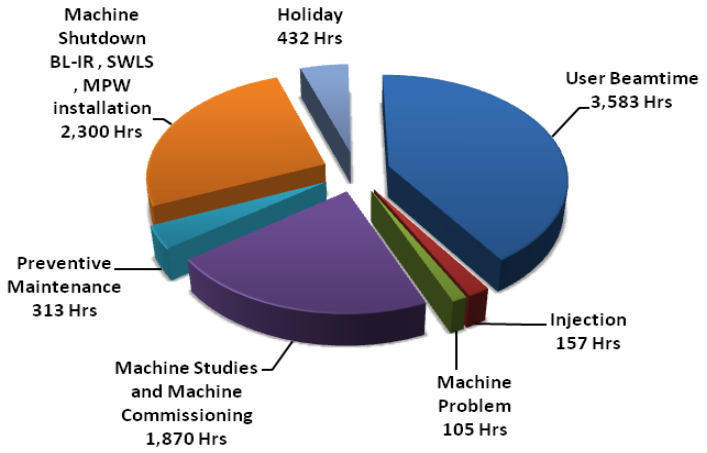
- **Beamlines and experimental stations**
  - **BL1.3W: SAXS**
    Small Angle X-ray Scattering
  - **BL2.2:TRXAS**
    Time-resolved X-ray Absorption Spectroscopy
  - **BL3.2Ua: PES**
    Photoelectron Emission Spectroscopy
  - **BL3.2Ub: PEEM**
    Photoemission Electron Microscopy
  - **BL4.1: IR**
    Infrared Spectroscopy
  - **BL5.2:XAS (SUT-NANOTEC-SLRI)**
    X-ray Absorption Spectroscopy
  - **BL6a: DXL**
    Deep X-ray Lithography
  - **BL6b: micro-XRF**
    Micro X-ray Fluorescence Spectroscopy/Imaging (μ-XRF)
  - **BL7.2:MX**
    Multi X-ray Techniques
  - **BL8:XAS**
    X-ray Absorption Spectroscopy



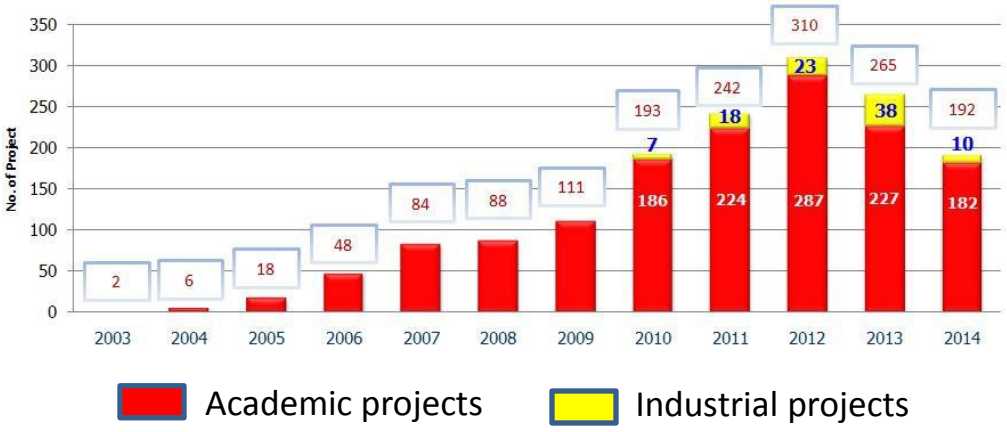
Operation



Service hours (2013)



Number of projects



Facility Overview

- **Siam Photon Laboratory**

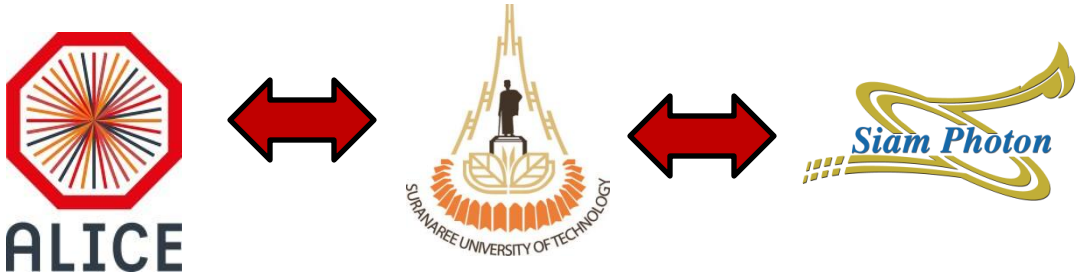
Accelerator

engineering support

Beamlines and experimental stations

Our Participation and Activities

- **SLRI has joined the ITS upgrade under the collaboration with SUT since 2013.**



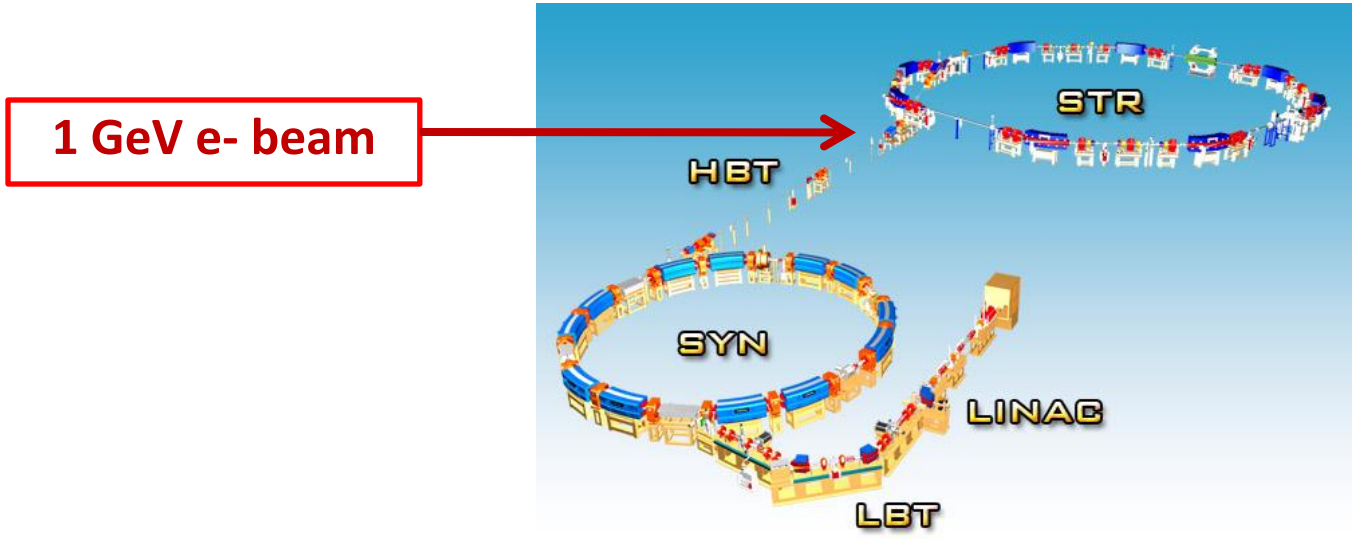
SLRI visit CERN, 10 Feb 2014

Our Participation and Activities

- **SLRI has joined the WG5: Sensor Characterization and Qualification.**
- **Our plan:**

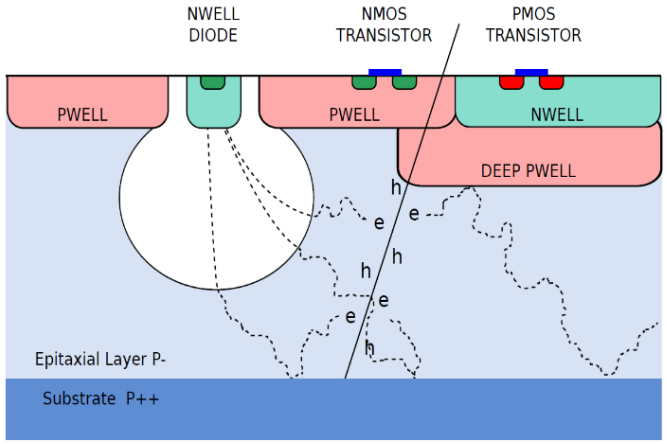
  Constructing the characterization test system for ITS pixel sensor at SLRI.

  - **1GeV e- beam at the Siam Photon Source.**



ALICE ITS Pixel Sensor R&D

- **Monolithic Active Pixel Sensors (MAPS) using Tower Jazz 0.18 µm**
  - Chip size: 15 mm x 30 mm
  - Pixel pitch ~ 30 µm
  - Spatial resolution ~ 5 µm
  - Power density < 100 mW/cm^2



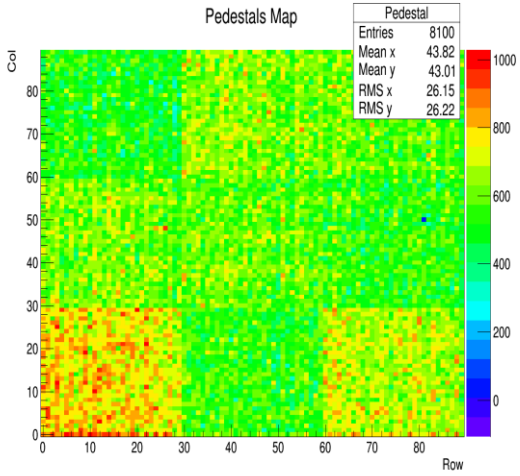
Schematic cross section of a MAPS pixel

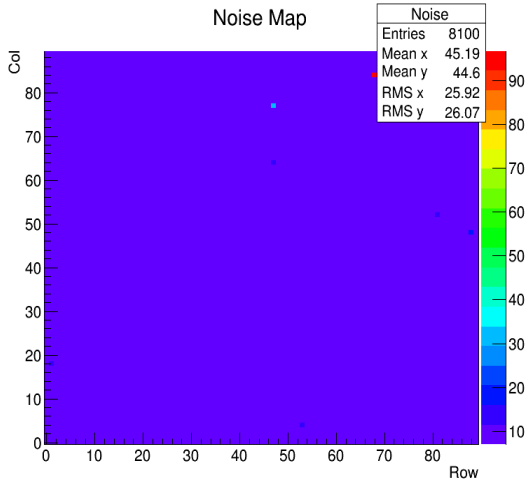
- **R&D is still underway:**
  - Improve Signal/Noise Ratio (SNR):
    - optimization of charge collection diode, apply reverse-bias voltage.
    - optimize thickness and resistivity of epitaxial layer.
  - Study different front-end and readout architectures.
    - Reduce power consumption and integration/readout time.
  - Study radiation effects.
- **Experimental characterization is crucial.**

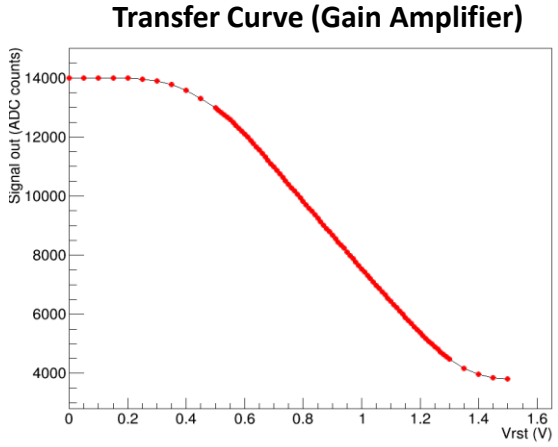
Our Participation and Activities

- **Trained and work with the WG5 at CERN.**

Lepix test system at CERN

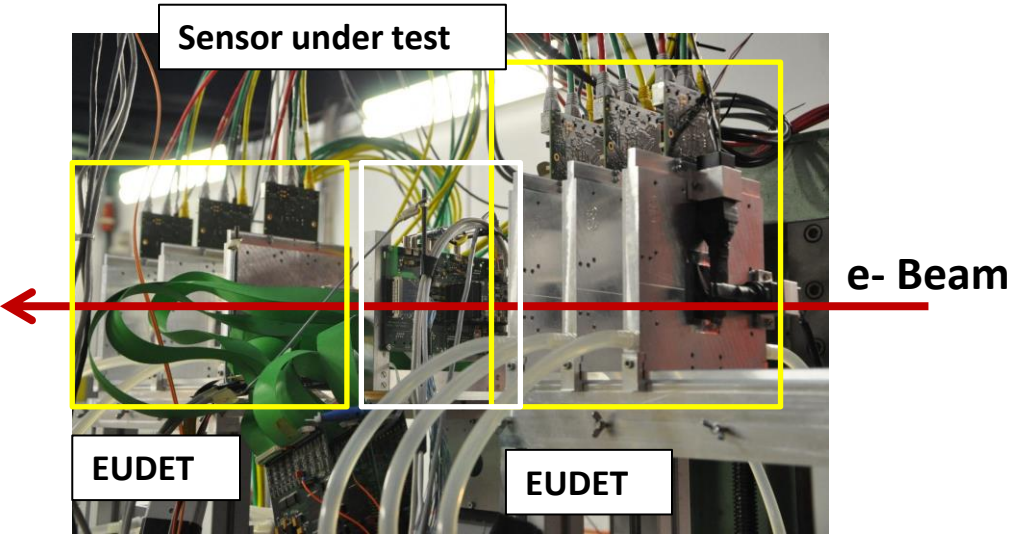




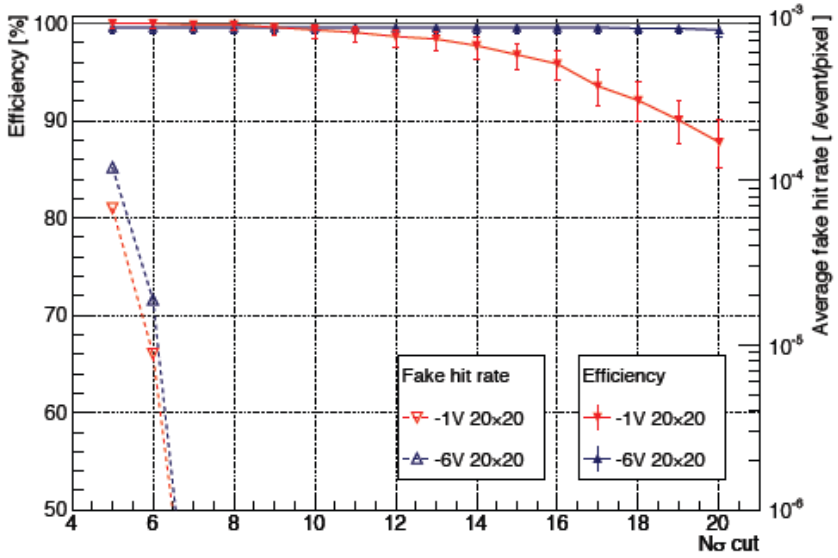


Beam Test in DESY

- **Participated the ITS beam test in DESY in Sept and Dec 2013.**



Explorer chip*, performance of pixel chip, pixel size: 20x20 μm^2

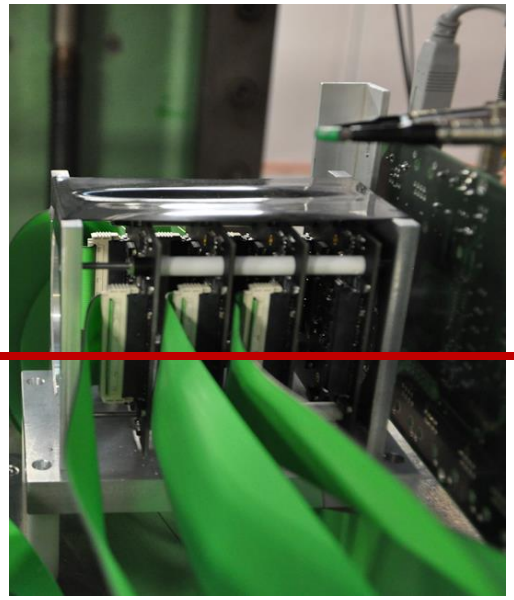


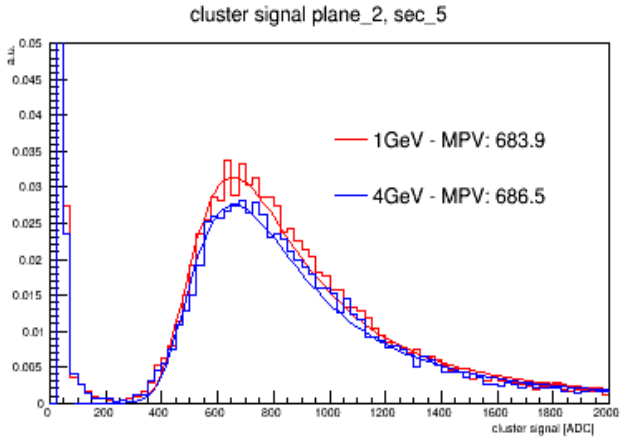
Measurements at DESY Test beam (4.4 GeV electron beam)

*Presentation by L. Musa, ALICE Week, CERN, 24 March 2014

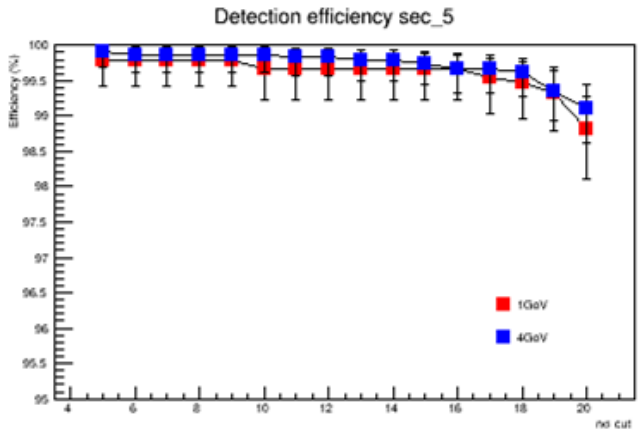
Feasibility of 1 GeV Beam Test

- **Studied the feasibility of 1 GeV beam test from the result measured in DESY.**



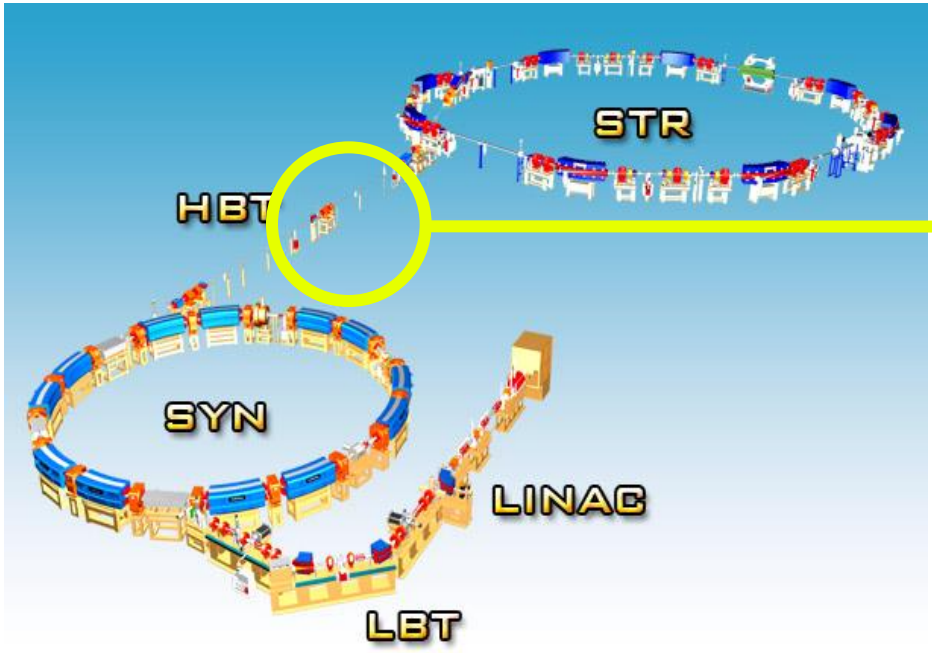


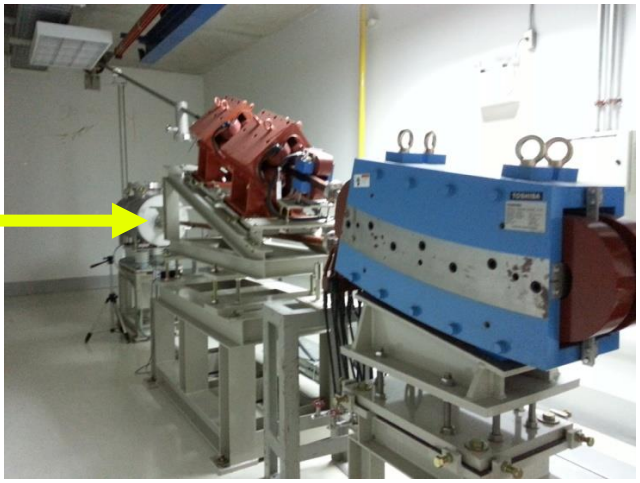
Comparison of the cluster signal between 1 and 4 GeV beam test



Comparison of the detection efficiency between 1 and 4 GeV beam test

1GeV Beam Test at the SLRI



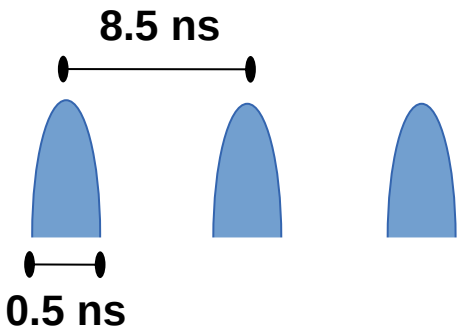


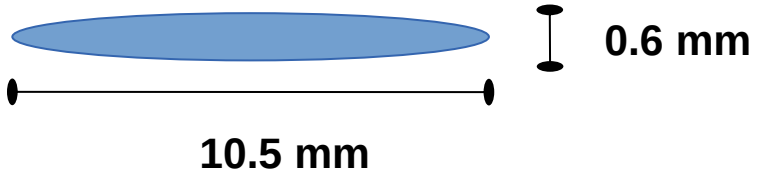
Experimental area = 3.5 m x4.5 m x 3.5 m

Beam Parameters

- Beam parameters at the extracting point.

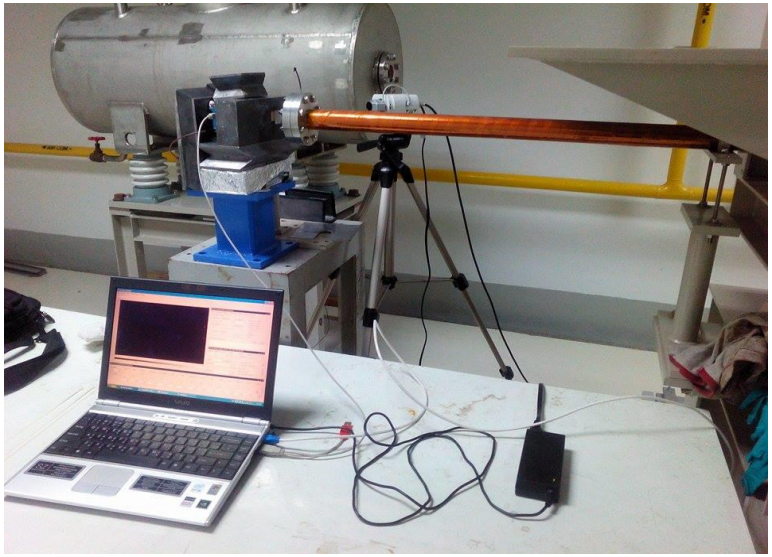
Particle	electron
Energy	1 GeV
Energy Spread	~0.05% at 1GeV
Max. Current	~10 mA
Pulse duration (bunch duration)	~8.5 ns
Bunch length	~0.5 ns
Repetition rate	0.5 Hz
No. of particle/bunch	~$5*10^8$
Beam size at the exit port	10.5 mm (H)*0.6mm(V)



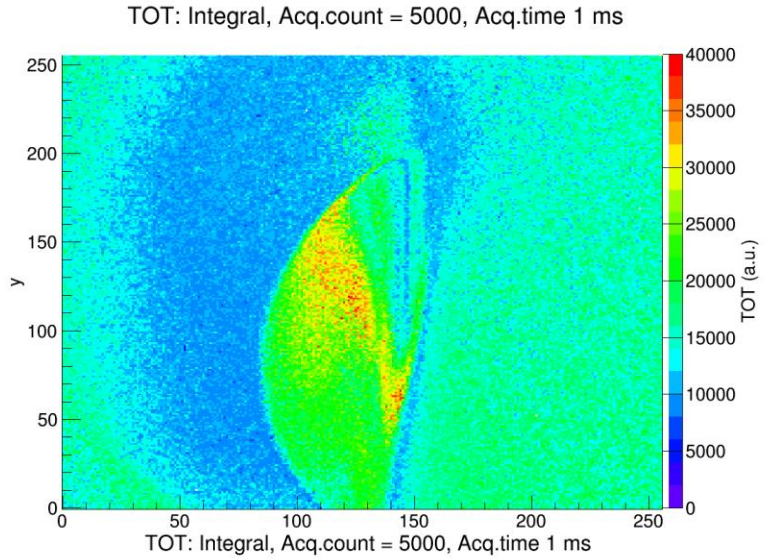


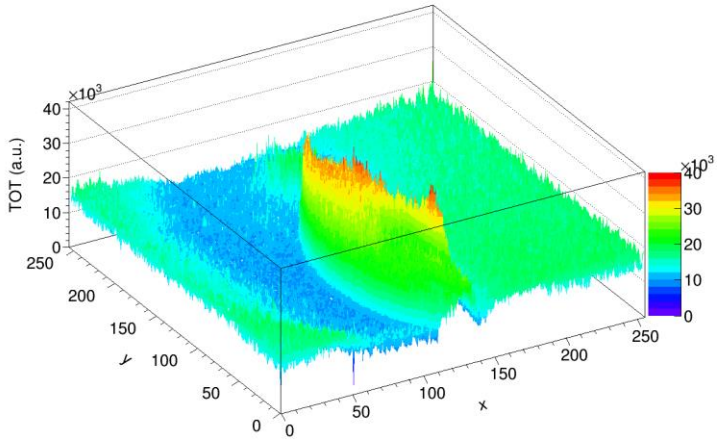
Preliminary Test

- **Preliminary test with the TimPix sensor.**



- **Time over threshold mode measurement**



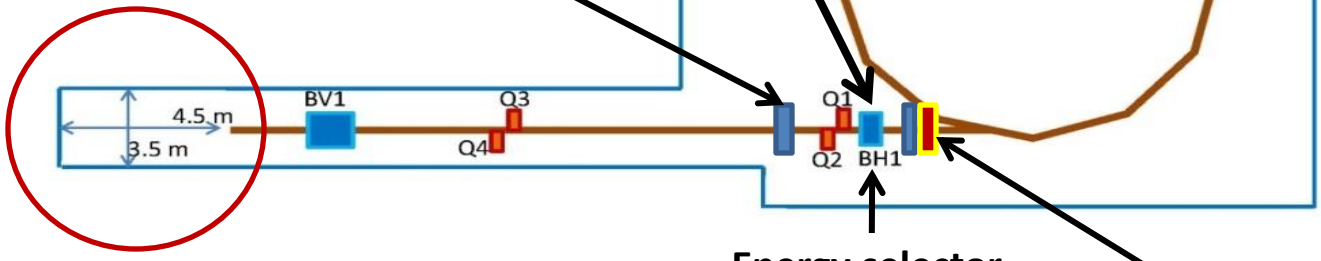


Possible Solution and Plan

- **Proposed beam test facility for the ITS upgrade.**

SLRI Beam Test Facility

Additional Slits



Energy selector

Target

Experimental area

Summary and Outlook

- We have joined the ITS upgrade: WG5 Sensor Characterization and Qualification.
- We have planed to set up test system at the SLRI and SUT.
- The 1GeV beam test facility has been proposed for the ITS pixel sensor characterization at the SLRI.

We would like to thank to the WG5 and ITS upgrade team.