Topical Workshop on Novel Radiation Detectors

Stony Brook

6th of February 2017

Welcome

Cinzia Da Via and Andrei Nomerotski

Workshop Objectives

The objective of the workshop is to promote collaborative discussions and funding strategies amongst Detector Developers and End-Users in the BNL-Stony Brook area.

Local interest in the following technologies

Sensors:

- Low Gain Avalanche Detectors (**LGAD**)
- micro-fabricated **3D sensors** with electrodes processed throughout the silicon bulk with edge electrodes, enclosed pixels and active edges
- Single Photon Sensitive technologies (**Avalanche Photodiode and Single Photon Avalanche Detector**).
- **Systems to reduce the operational temperature** by using state of the art two-phase micro-channel cooling as the mobility increases and noise decreases at low temperature

Electronics:

- **TDCpix** chip for the NA62 experiment GigaTracker ,
- **TIMEPIX** (existing and possibly new developments)

CMOS monolithic structures

Simulation and data analysis:

TCAD sensor design optimization, andsignalgeneration, detection and acquisition

GEANT4, which has now been transferred to several other fields like medicine and space applications

Application Specific packages

Applications

Tracking at particle colliders: Identifying with high precision the temporal signature of different events allows for their association and reduces random coincidences. Similar detectors are also required for the future ATLAS High Granularity Timing Detector, HGTD, and also for the upgrades of other LHC experiments, to cope with increased particle fluxes due to the higher luminosity.

Medicine and Fundamental Physics: Time of Flight (ToF): ToF is already used in many commercial applications such as ToF-enhanced PET, however with precision more than one order of magnitude worse than our goals (500 ps vs 10 ps). ToF is also widely used in HEP, neutron and ion imaging, and imaging mass spectroscopy as a versatile tool for precise particle identification and for material analysis.

Coincidence imaging mass spectrometry, molecular dynamics at laser facilities and x-ray light sources: Coincidence velocity map imaging in conjunction with timing resolution of 10-100 ps will revolutionize studies of ultra-fast molecular processes. The technique uses simultaneous registration of multiple ions and electrons in an imaging mass spectrometer to study their spatial and momentum correlations

Applications

Photon correlation spectroscopy (XPCS): X-ray registration with excellent timing resolution is important in XPCS used for studies of nanoscale dynamics of materials. The unprecedented brightness of the NSLS-II light source at BNL will allow measurements on time scales shorter than was ever possible before.

Fluorescent imaging microscopy (FLIM): Time-correlated single photon counting (TCSPC) is a precise and mature technique to time the photon arrival, which requires single photon sensitivity and ps time resolution and is one of the most promising techniques to characterize novel materials for solar cells like perovskites. First proof of principle measurements showed encouraging results using existing sensors and electronics but the picosecond scale resolution would allow using it for a much wider range of applications in life sciences and medicine.

Single photon imaging for quantum informatics: Entangled photons are most prominent manifestation of quantum information science. Real-time imaging of the entangled photons and also their spatial-mode entanglement are very promising and largely unexplored areas, which can be studied with the newly developed imagers with 10 psec resolution.

More??

Today's Timetable

09:00	**1 - Welcome and Meeting Objectives**	*Cinzia Da Via et al.*
	16 - Sensors and Cameras for Fast Imaging	*Andrei Nomerotski*
	4 - Imaging for entangled photons	*Eden Figueroa*
10:00	**8 - Opportunities and challenges for time-resolved nanoscale imaging at the US DOE Center for Functional Nanomaterials at Brookhaven National Laboratory**	*Mircea Cotlet*
	20 - TX-ray correlation spectroscopy: the VIPIC 3DIC project	*Dr. Peter Siddons*
	coffee *S240, Stony Brook*	10:35 - 11:05
11:00	**7 - Silicon R&D program and facilities in Instrumentation Div at BNL**	*Dr. Gabriele Giacomini*
	5 - Silicon R&D program at BNL for High Energy Physics	*Alessandro Tricoli*
	21 - BNL Irradiation facility	*James Kierstead*
12:00	**15 - Measurements of Impact of Total Ionising Dose on readout chips for the ATLAS tracker upgrade for HL-LHC**	*Stefania Antonia Stucci*
	Lunch	
13:00		

14:00

19 - Module and Stave Assembly at BNL for the HL-LHC ATLAS tracker — *Gerrit Jan Van Nieuwenhuizen*

3 - Using TimePix for Coincidence Velocity Map Imaging of Molecular Dynamics — *Thomas Weinacht*

2 - Mass-Resolved Imaging of Products from Surface Photoreactions — *Matt Kershis*

15:00

14 - Monolithic CMOS Silicon Pixel Detector R&D at Yale — *Christian Weber et al.*

coffee

S240, Stony Brook 15:15 - 15:45

17 - Recent Developments in 3D Silicon Radiation Detectors — *Cinzia Da Via*

16:00

11 - Experimental Tests and Simulations of 3D Trench Detectors — *Allen Mincer et al.*

9 - Fast Timing in the ATLAS Forward Proton (AFP) and High-Granularity Timing Detector (HGTD) Projects — *Michael Rijssenbeek*

18 - Discussion Next Steps

17:00

18:00

S240, Stony Brook 16:45 - 18:25

Dinner - TBD

Some practical information and acknowledgements:

Dinner: please let us know by lunchtime so we can book a restaurant

Parking: recover a parking sticker if you didn't do that already

Coffee has been offered by: Andrei Nomerotski

Thanks to the Physics and Math Departments at Stony Brook
for hosting the event