WP7

Timing Detectors - MPGD

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WP7 - Timing Detectors

- Precise timing detector requirements will be addressed by different technologies
  - M(RPC)
  - MPGD
- For MPGDs, tens of ps level timing is pursued by PICOSEC Micromegas collaboration
- Time resolution on the level <ns is of interest for large / high-rate detection systems

#	Task	Performance Goal	DRD1 WGs	ECFA DRDT	Comments	Deliv. next 3y	Interested Institutes
T1	Optimize the amplification technology	- Uniformity over m^2 (time resolution, rate capability, efficiency)	WG1, WG6, WG7 (7.1-2,4)	1.1-1.3	- PICOSEC - Position-sensitive timing RPC - Ultra high-rate timing RPC development - DLC-based timing RPC - GaAs timing RPC – Resistive Cylindrical Chamber RCC	- Provide a large-area, multi-channel prototype of an MPGD-based timing detector	CERN, IRFU/CEA, U Sofia, USTC, HIP, GANIL, IP2I, MPP, U Heidelberg, NCSR Demokritos, INFN-BA, INFN-PD, INFN-PV, LIP-Coimbra, U Bursa, MSU, SBU, JLab, U Hamburg, RBI, U Tsinghua, INFN-RM2, BNL.
T2	Enhance timing	- Time resolution < 20 ps up to 30 kHz/cm^2	WG3 (3.2A, 3.2D), WG4, WG7 (7.2)	1.1	MPGD:PICOSEC	- Present large area MPGD timing detector capabilities in beam	CERN, IRFU/CEA, USTC, HIP, GANIL, IP2I, MPP, NCSR Demokritos, INFN-PD, INFN-PV, U Bursa, SBU, JLab, MSU, UW–Madison, U Hamburg, RBI, BNL.
T3	Enhance rate capability	- Time resolution < 50 ps up to 100-150 kHz/cm^2	WG3, WG4, WG7 (7.2)	1.3	RPC: - Gap thickness - Number of gaps - Thin, low-R glass - Single cell layout - GaAs timing RPC - Resistive Cylindrical Chamber RCC PICOSEC: use at high rate	- Provide a prototype for >100 kHz/cm^2 rate capability	CERN, IRFU/CEA, U Sofia, USTC, HIP, GANIL, IP2I, MPP, U Heidelberg, NCSR Demokritos, INFN-BA, INFN-PD, INFN-PV, LIP-Coimbra, U Bursa, U Manchester, MSU, SBU, JLab, CIEMAT, VUB and UGent, Istinye U, INFN-RM2, BNL.
T4	Material studies	- Rad-hardness - Longevity	WG3, WG7 (7.3,4)	1.1-1.3	- Low-resistivity glass - Spacers - Photocathodes - Photoconverters - GaAs - HPL or phenolic glass		INFN-PV, CERN, USTC, RBI, MPP, U Heidelberg, U Manchester, RBI, INFN-RM2
T5	Low-noise FEE	- High input capacitance - Large dynamic range - Fast rise time - Sensitivity to small charges - Low noise	WG5	1.2		- ASIC design - Full readout-chain for multichannel readout solutions for timing ≈10 ps (discrete and ASICs)	USTC, IP2I, IRFU/CEA, GSI, MPP, INFN-PD, INFN-PV, LIP-Coimbra, CERN, U Manchester, MSU, SBU, JLab, INFN-TO, RBI, U Tsinghua, INFN-RM2
T6	Space charge effects, IBF and stability		WG4, WG7 (7.1-2,5)		- Simulations - High gain operation - Synergy with trackers and TPCs		CERN, GSI, U Aveiro, U Tsinghua
T7	Gas studies	- Eco-friendly mixtures - Recuperation - Ageing - CO_2 based mixture with geometrical quenching	WG3 (3.2A, 3.2B, 3.2C), WG7 (7.2-4)	1.3	- Low-GWP solutions for saturated-avalanche operation	- Gas mixtures for MPGD(PICOSEC) based timing detectors (replacement of Ne, CF_4, C_2H_6)	U Sofia, USTC, HIP, GANIL, IP2I, MPP, U Heidelberg, INFN-BA, INFN-PV, LIP-Coimbra, CERN, MSU, SBU, JLab, LMU, U Aveiro, INFN-RM2

WP7 - Timing Detectors - MPGDs

PICOSEC Micromegas

- Existing collaboration with common efforts, regular meetings, participation in RD51 test beams
- Several groups confirmed interest to also join WP7 - Timing Detectors
- Tasks in WP7 draft table represent many ongoing developments in PICOSEC Micromegas collaboration

Links to WGs and other WPs

- Photocathodes / solid converters - robustness / enhanced sensitivity (WG3 + WP6 Photon detectors)
- Structures for low IBF (WP6 Photon detectors)
- Material studies, alternative gases - WG3

WP7 - Timing Detectors - MPGDs

Other MPGD timing developments

- Large detection systems with moderate timing precision
- Scalable systems and electronics
- Timing detectors with high-rate capability

- Precise mechanics for timing detectors

- Common test methods / tools / facilities (WG6)

- Electronics for precise timing (WG5)

WP7 - Timing Detectors - MPGDs

- List of tasks in draft WP table reflecting developments ongoing/planned for precise timing MPGDs - add additional tasks?

- Contacted interested institutes in draft WP table to confirm their interest

- Meeting with relevant community next week(s) to discuss which developments and institutes are interested to include ongoing/planned activities in a work package
    - Institute contacts + everyone working on / planning to work on developments

- Collecting information on deliverables per institute + resources (existing/planned) for extended WP table