Assessment of main potential application areas of proposals submitted to the TWD Workshop

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Number	Proposal	Main potential Industrial application areas
1	Fast, scalable, low-dose phase-based x-ray imaging with conventional sources	• Medicine (X-ray imaging) • Manufacturing (X-ray industrial tomography) • Industrial quality control (inspection, metrology)
2	STAX. Axion-like particle searches with sub-THz photons	• Medicine & Biology (single photon detectors)
3	"4H" X-ray Camera	In general any industrial sector on the need of a detailed characterization of high performance materials (i.e. Aeronautics, Oil & Gas, Civil Engineering, Automotive, Naval Engineering, Space, etc)
4	Core-shell diode array for high performance particle detectors & imaging sensors	• Medicine (dosimetry, particle therapy) • Nuclear Industry (radiation detectors) • Space (radiation detectors) • Biology & Drug development (protein crystallography) • Homeland security (radiation detection)
5	Pixel-individually auto-sampling image sensors	• Robotics (machine vision) • Industrial manufacturing (dynamic inspection systems) • Homeland security (surveillance) In general any industrial application looking for ultra-high-speed operation at wide dynamic range with low data rates, outperforming conventional image sensors.
6	Runtime Monitoring for the Diagnosis and Recovery of Complex Physical Systems	Any industrial application on the need of machine intelligence to perform operations and/or process controls. Examples could be Industrial Manufacturing (fab 4.0), Homeland security (i.e. dynamic surveillance systems), Space (i.e. remote missions), Aeronautics (intelligent drones), etc.
7	Positron emission tomography without image reconstruction	Medicine (PET-applications in oncology, neurology, etc)
8	The ToF CMOS Visual Cortex Project	• Nuclear Industry (neutron detectors) • Homeland security (neutron detectors) The project can trigger different spin-offs other than the two main applications since it will target a camera which has a continuous frame rate of 100 000 fps or more, with on-board image treatment and extraction of useful information.
9	CUBIX - Highly sensitive radiation imaging detector with fully 3D segmentation	• Medicine (scintigraphy, SPECT, PET, radiation monitoring) • Industrial quality control (Non-destructive-testing with isotopes or low power X-ray sources) • Nuclear Industry (radiation monitoring) • Homeland security (radiation detection) • Mining/ Oil & Gas (environmental and geological research, exploration and mining)

10	Towards a high-precision "weightless" charged particle tracker: ultra-thin and fast position-sensitive-detectors with wireless data transmission.	The project can generate industrial applications in two directions separated or combined: 1) Charged particle detection applications 2) Wireless data transmission and wireless power distribution.
11	easyPET – a new approach for axial preclinical PET	• Medicine (PET-applications in oncology, neurology, etc)
12	Development of 3D Associative Memory Chip	• Medicine (real time analysis of medical imaging data) • Robotics and computer vision • Automotive (i.e. real-time context aware vehicles) • Manufacturing (control of industrial processes) In general any application looking for high performance pattern recognition.
13	Imaging in TPC detectors equipped with high granularity charge readout: transferring technology from rare event searches	• Medicine (medical imaging for diagnosis)
14	Pixelated ceramic scintillators for large-area high-resolution X-ray and gamma-ray detectors	The project can generate industrial applications in different directions: 1) Applications linked to X-ray and gamma-ray detectors 2) Novel manufacturing processes for those detectors (3D printing, of structured ceramic materials)
15	Two Photon Absorption Transient Current Technique for 3D field, time response and efficiency mapping of semiconductor detectors	Semiconductor manufacturing industry and all their applications (i.e. 3D tracing of the electric field in semiconductor detector pn junctions. The precise knowledge of the electric field distribution is key to semiconductor design and operating life monitoring).
16	Neuromorphic image sensors for future particle detectors	• Robotics (i.e. machine vision, motion sensors) • Medicine (electronic retinal implants, biomimetic circuits) In general any industrial application seeking for autonomous mobile systems, human-machine interaction, etc.
17	The use of energetic heavy ions to produce nanometre resolution molecular images in ambient conditions	In general any application seeking imaging at the molecular level. Examples: biology, medicine, forensics, cultural heritage, materials science, chemistry.
20	FLEXPIX - Flexible Pixel Detector	The project can generate industrial applications especially in the Semiconductor Industry mainly triggered by the fabrication technologies envisioned: Incorporate sensors in flexible wired 3D foil to provide interconnections (i.e. a combination of MEMS and micro-electronics fabrication processes).
21	A tomography-inspired method for event reconstruction in Liquid Argon Time Projection Chamber	The industrial value maybe coming from the development of the precise reconstruction of neutrino interaction algorithms inspired by principles used in tomography. (Not clear from the brief abstract).
22	3D diamond detectors for particle tracking and dosimetry	The industrial value can be generated in two ways: 1) The fabrication technologies envisioned for the 3D diamond detectors (spatial light modulator to produce conductive wires with ~1um diameter) 2) Applications in Medicine and Nuclear Industry (dosimetry)
23	The sixth sense: a new detector to observe the universe	Abstract too brief to judge but industrial value could come from novel opto-electronics, (MEMS) accelerometers, and sensitive readout electronics to reduce limiting noise sources in laser interferometry.

24	A pixelated detector for thermal neutrons	• Nuclear Industry (neutron detectors) • Homeland security (neutron detectors)
25	Smart pixels for single photons	• Semiconductor Industry and any of the applications of it. • Biology, Medicine and Drug Development (single photon detectors) The industrial value will come from the figures of merit envisioned and fabrication technologies: CMOS pixel chips with MEMS-built structures. Push for imaging with time resolution down to the picosecond regime while reaching MHz readout speed.
26	PYXGEN: A novel charge domain global shutter pixel platform for scientific imaging with automated generator	• Biology (high speed low noise imaging) • Space (earth observation satellites) • Medicine (medical imaging) In general any industrial application seeking high performance affordable imaging technologies.
27	Simultaneous x-ray transmission and fluorescence imaging	• Medicine (imaging for diagnostics) The industrial value will come from the simultaneous combination of computed tomography and x-ray fluorescence tomography.
28	Magnetic field sensors for medical imaging: Wishes and potential	This submission seems to be a “state of the art” and “future needs” talk. The abstract is not specifying any project to be undertaken by the author.
29	PYX-XL: World largest resolution sensor for scientific applications	• The industrial added value will come from the challenges to be overcome in the fabrication. Interesting for the Semiconductor Industry and its applications. Also for Space (earth observation).The project envisions the design and manufacture of the world largest resolution sensor. It will be also the largest monolithic sensor with a 29mm diagonal (8x10 optical format).
30	Efficient and time-encoded imaging detectors based on MPGDs	• Medicine (x-ray fluoroscopy and 3D imaging)
31	Direct optical readout of ionisation tracks in gas-based TPCs	• Medicine (medical imaging and radiation detection)
32	Modules for an organ-specific personalized PET scanner	• Medicine (PET-applications in oncology, neurology, etc)
33	Progress on simulation and first prototype results on a beam monitor based on MPGD detectors for hadron therapy	• Medicine (hadron therapy)
34	Graphene-based Golay THz arrayed detectors	All industrial applications using THz imaging. Examples: • Homeland Security (stand-off detection of hidden objects and weapons) • Drug discovery (discovery and formulation analysis of coatings and cores) • Automotive/Aerospace (non-contact material integrity imaging of coatings and composites) • Energy (detection of cracks and defects in solar panels) • Cultural heritage (non-contact imaging for conservation of paintings, manuscripts and artefacts)

		• Electronics/Semiconductors (non-destructive rapid fault isolation in IC packages, Characterisation of electron carriers and metamaterials) Additionally the project envisions the use and integration of graphene which may trigger additional added value.
35	Nanomechanical biosensors	• Biology/Drug discovery (genomics, proteomics) • Medicine (real time diagnostics) In general any industrial application benefitting from NEMS. Additionally the project will generate industrial value through the integration and data acquisition methods proposed (i.e. highly parallelized optical read-out method based on CCD imaging and software image analysis)
36	Electron and Photon beam monitors	The potential industrial added value may come out of the beam alignment technologies and fabrication processes envisioned. If so it could be interesting for Industrial manufacturing processes using LASER technology.
37	Implemented Pixelated Phosphor Detector (PPD) for laser coupled FEL beam diagnosis	The industrial value will come from the methods proposed for the characterization of the beam quality for a reliable application of pulsed high-power vacuum ultraviolet (VUV) and soft X-ray (SXR) beams. For example Medicine (X-ray beams).
38	Sensing the Universe in colour; Kinetic Inductance Detectors for optical and near-IR astronomy	Superconducting Microwave Kinetic Inductance Detectors (MKIDs) for optical and infra-red astronomy (arrays of 20,000 MKIDs, where each pixel is capable of determining the arrival time of a photon to 1 microsecond and the energy of the photon to around 5%) The industrial value may come from superconducting applications (fabrication, integration and uses) but as well from data acquisitions systems and algorithms.
38	Avalanche pixelated sensors and dedicated front-end electronics as imaging detectors for time resolved experiments	Pipeline technology: Large area imaging detector based on the Timepix3 ASIC for time resolved experiments. Time resolution from tens of nanoseconds to milliseconds and will reduce by order of magnitudes the time that it takes to collect a data set in pump and probe time resolved experiments. Further improvement: pixelated avalanche sensors working in proportional regime and dedicated front-end electronics can overcome dead time between two events by shortening considerably the duration of the analogue pulse. The industrial value may come from fabrication, integration and uses of Timepix but as well from data acquisitions systems and algorithms (X-ray imaging in general for industrial manufacturing, medicine, characterization and testing of high performance materials in Aerospace, etc)
39	Large area photon-counting X-ray or particle image sensor using pixelated scintillator	• CMOS ROIC plus a pixel-matched pixelated scintillator. • All applications related to X-ray imaging.
40	Internet of radiation Sensors (IoS)	Affordable solid-state radiation sensors, of reliable and cheap micro-controllers and memories, together with new developments in the fields of wireless communication, low power microelectronics and efficient

		batteries, make possible building a practical, fully automated and remotely controlled network of radiation sensors. • Nuclear Industry (monitoring of nuclear installations) • Environmental monitoring. • Homeland security/Transport (monitoring of airports, harbours, etc)
41	Large format (2kx2k and larger) of hybridized HgCdTe/silicon	• Deep space astronomy • Pollution monitoring • Space applications (with the associated cold and warm electronics and packaging/cables) • Homeland security and civilian IR applications
42	Innovative devices for amplification of ionisation charge in liquid Argon Time Projection Chamber detectors	• Medicine (medical Imaging) • Homeland security (cargo inspection, airports, etc) Novelty: development of innovative devices to multiply and collect electron charge generated by ionising particles passing through liquid Argon (LAr) medium.
43	3D^3: Simple, Reliable, Low Cost Particle Dosimetry for Cancer Therapy using 3D printing and Geant4 simulation	• Medicine: cancer detection, human body digitalization. • Big data: algorithms for data processing