"new" materials

Diamond: Challenges for the future (ECFA report)

- **Polycrystalline CVD diamond.**
  - Collection distance 25% increase.
  - Decrease price by 50% (happens with larger use as in Si).
- **Radiation tolerance.**
  - Go to smaller cell size.
  - True 3D field electrodes (internal cages) offer huge potential to optimize electric field distribution to minimize drift time.
  - Also offer possibility of gain in diamond.
- **Processing of 3D graphitic wires in diamond.**
  - Reduce resistivity.
  - Scale production capability.

Potential UK project?

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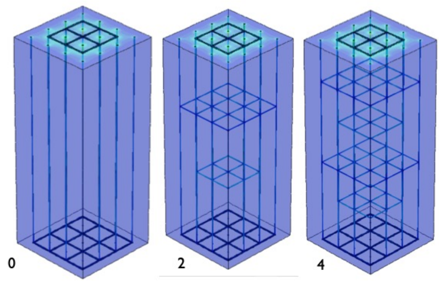
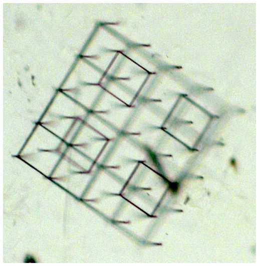
Estimated cost and FTE <2027			
	Description	Cost [kCHF/y]	FTE/y
MS 6.1	3D diamond detectors, cages / interconnects, base length 25 μm ,impact ionisation	250	10
MS 6.2	Fabrication of large area SiC and GaN detectors, improve material quality and reduce defect levels.	350	16
MS 6.3	Improve tracking capabilities of WBG materials	100	1
MS 6.4	Apply graphene and/or other 2D materials in radiation detectors, understand signal formation.	100	1

Table 9: WG6 Milestones for < 2027





DRD3.6 "*WB bandgap materials*", milestone 6.1

- Demonstrate fabrication of 25μm base length cubic cell 3D diamond devices.
- Verify rad hardness of 25μm base length 3D diamond detectors (>1e16 1MeV neq cm^{-2})
- Investigate charge multiplication with optimised 3D electrode geometries and map timing capabilities (great potential, not Landau limited).

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“new” materials

UK institutes with Diamond interests

- Manchester (3D), Bristol (general), QMUL (neutron detection)

Project Deliverables

- small scale demonstrator device for 25μm cell size
- (low) gain structure for diamond
- technology to provide radiation hardness at 1e17- 1e18 neq cm^{-2}

Resource estimate

- 4 project years with 1 RA and 2 PhD