LGAD Discussion session

LGADs – points for discussion

- SEB limits the operation of LGADs
  - It driven by the average electric field in the device – safe <11 V/μm, danger >12 V/μm
  - Limits the operation voltage range and ability for compensation of radiation damage
  - Can we increase it by the device design? HPK-P4 run failed to achieve it – sensors died in the same way as the others.
- Improvement of radiation hardness
  - C enrichment mastered to the level that sensors can survive 2.5e15 cm^{-2} (HL-LHC) timing was mastered by FBK/IME (IHEP,USTC). The latest CNM run 15973 shows a huger improvement and may stand the requirements from ATLAS and CMS.
  - Half-activated-Boron approach of HPK is currently investigated (first tests at INFN-TO and JSI) – an improvement has been seen, but not to the same level as with carbon. First measurements by Japanese groups looked more promising. Sensors are now in the AIDAINNOVA TB and we will have a much better picture on their potential in a month.
  - Compensated LGADs (INFN-TO) may be a solution, but this requires good knowledge and control of B and P removal and super fine tune. HPK tested their devices utilizing compensation and the outcome was not promising – actually very little difference to reference LGADs. This approach is also AIDAINNOVA blue sky project.
- Understanding the origin of the damage
  - Can we invent some other impurity that would reduce the removal constant even further? Replace the B with something else?
  - Understanding the acceptor removal on microscopic level:
    - BiOi
    - g_{Bi}-g_{BiOi}= ?

LGADs – points for discussion

- Understanding the operation
  - screening effects (angled tracks, irradiated sensors, current gain)
  - Impact ionization at very high fluences (preparation of the RD50 project on super-doped LGADs that would only work at very high fluences – and probing of the impact ionization will be possible – collecting the interest – is use of multiplication possible at extreme fluences?)
  - cp/cn ratio for different charged hadrons
- Improvement of inter-pad distance (progressing fast on many fronts)
  - TI-LGADs
  - iLGADs
  - DJ-LGADs
  - AC-LGAD
  - DC-RSD
- Detection of non-mip particles for use in medicine nuclear physics.