The Production and Detection of X-rays and Charged Particles

With a Focus on those Produced During and After a Nuclear Explosion

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X-Ray Production

- Accelerating Particles Cause EM Radiation
  - Inner shell electrons
  - De-excitation
  - Deceleration of incident particles
  - X-ray tubes (bremsstrahlung + characteristic)
- Strength increases with atomic number

X-Ray Production

Specifically During a Nuclear Explosion

- Initial Fire-ball
- EMP
  - Gamma rays ionize upper atmosphere
  - Free electrons accelerate towards the ground
  - Electrons spiral under earth's magnetic field
  - Synchrotron radiation

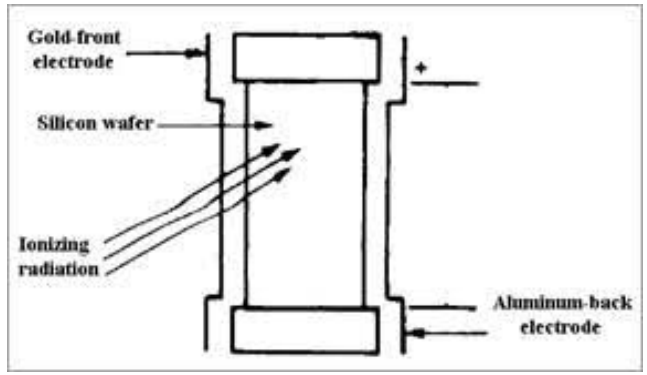
Charged Particle Production

Specifically During a Nuclear Explosion

- Alpha
- Beta
- Electrons
- Protons

Detection

- Scintillators
  - Absorbed and re-emitted as visible light
- Phosphors
  - Contain phosphorus
  - Thin layer
- Ionizing gas chamber
- Semiconductor



  - More sensitive than gas chamber
  - Shorter "dead-time"
  - Higher resolution than Scintillators

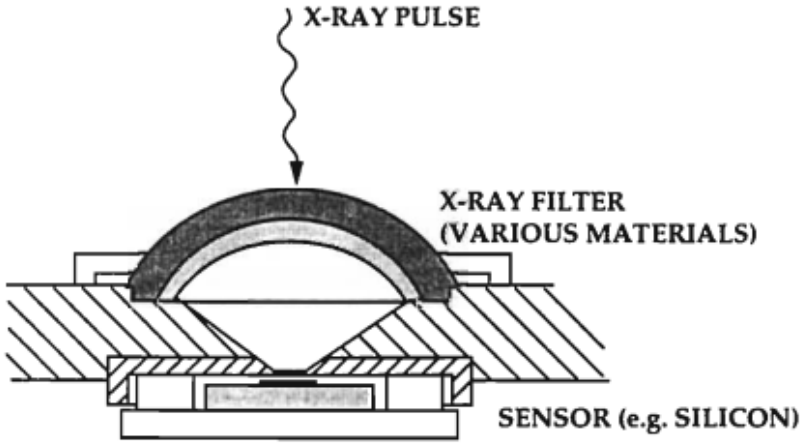


Figure 3. Schematic of a CXD medium-energy x-ray sensor.

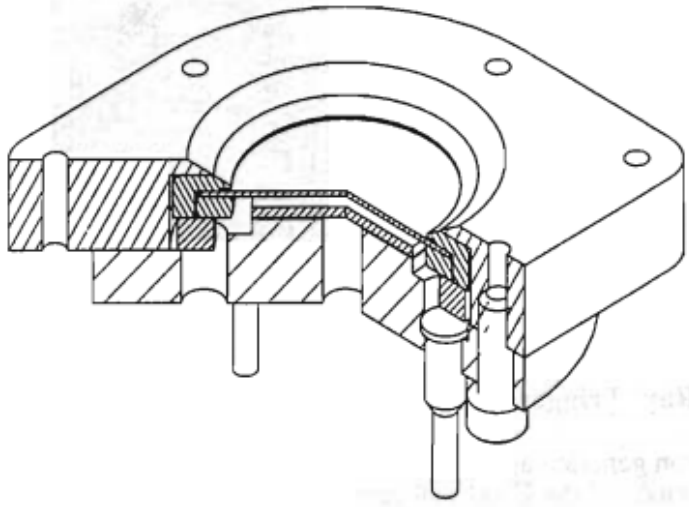


Figure 4. XRD Detector Element Cutaway.

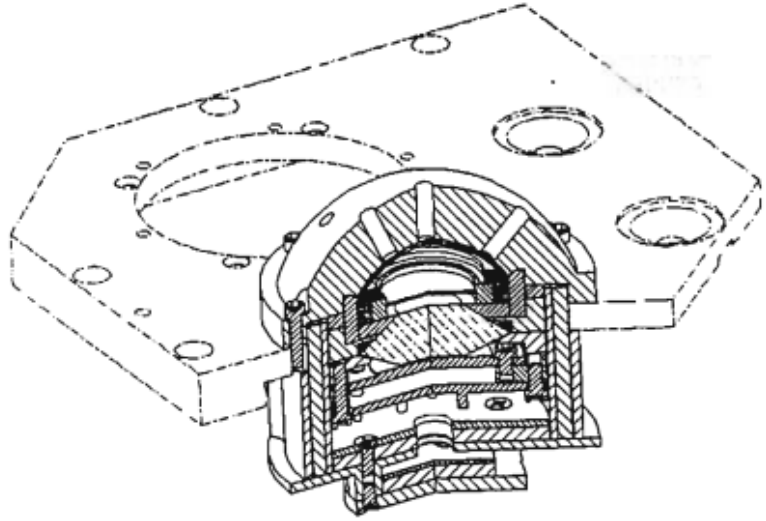


Figure 5. Cutaway View of the High-Energy X-Ray and Particle Sensor HXP1.

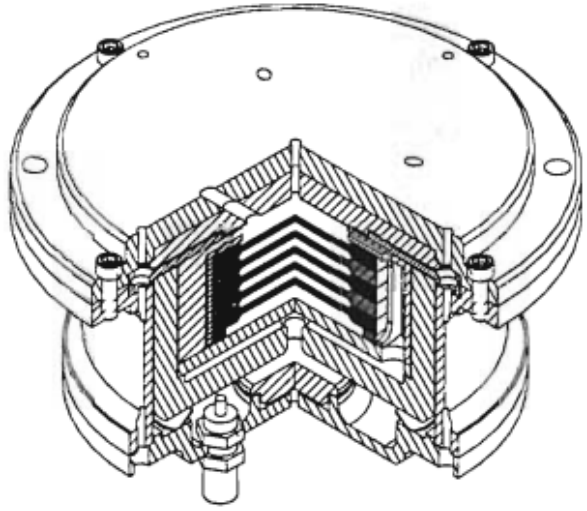


Figure 6. The Low-Energy Particle (LEP) Sensor.