**Operational Issues:**

- **Operation:**
  - Detector is not accessible
  - Power supplies, part of the DAQ boards in collision hall
  - Has to last longer than designed for
    - Maintenance is a significant challenge

- **Commissioning:**
  - Several initial problems: Blocked ISL cooling lines, bond resonances, L00 power supply burnout, L00 noise
  - All of them have been addressed: e.g. use dedicated board to protect for resonances

**Operational Issues:**

- Single event upsets (SEU): DAQ, power supplies
- Failures of DAQ hardware: Boards, Dense Optical Interface Modules
- Failures caused by incidents: beam, cooling trip, clock...

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### Silicon Detectors:

- Largest HEP silicon detector
- Dimension: ISL is 2m long with a radius of 38cm
- 7-8 silicon layers (total 6m²)
- 722k readout channels on 5.4k readout chips
- Designed to last for 2-3 fb⁻¹ (SVX), must last for 4-8 fb⁻¹
- Used in hardware displaced vertex trigger
  - Fast, dead time less data acquisition

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- LHC-like single-sided sensors
- 72 ladders, 108 chips
- Mounted on beam pipe: Precision tracking point before scattering in detector

- 2 layers of double-sided sensors
- 296 ladders, 2368 chips
- Links SVX and drift chamber
- Forward tracking to η = 2

---

**Component inoming:**

- **Failure Modes:**
  - DAQ, power supplies
  - Single event upsets (SEU): DAQ, power supplies
  - Failures of DAQ hardware: Boards, Dense Optical Interface Modules
  - Failures caused by incidents: beam, cooling trip, clock...

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### Beam induced effects

- Most dangerous beam incidents are unplanned beam aborts: Chips are affected the most
- Lifetime of silicon restricted by longterm radiation damages: Increase of silicon sensor leakage current and increase of depletion voltage → Decrease of signal-to-noise ratio
- Single events upsets in CAEN power supplies and DAQ boards located in the collision hall → Major contributor to downtime during data taking

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### CAEN power supplies: Single events upsets

- Failure Modes: Loss of communication, spontaneous turn off, Current/ Voltage readback are corrupted
- **Fix:** Reset crate

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### Longevity of Silicon Detector

- Non ionizing energy loss causes change of effective doping concentration $N_{eff} = V_{int} \sim N_{eff}$
- Result follows optimistic prediction

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