SuperB Integration Questionnaire

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Sub detector name: DCH

Author: G.Felici, G. Finocchiaro, M. Roney

Electronics: DCH (on-detector+off-detector)

Number of electronic channel: 9216 (unoptimized 44 layers, 12mm (r)x18mm,(rphi); for first 8 layers 12mmx9mm)

Power dissipated per channels:

* ON-DETECTOR :
  + Standard dE/dx by means of charge measurement: 30 mW/ch “normal BW ~100MHz BaBar”
  + cluster counting: 100 mW/ch “250MHz BW”
* OFF-DETECTOR (Data Conversion) – contribution to Feature Extraction to be checked
  + Standard dE/dx: 0.9 W/ch (48 chs/board – 43W/board) 8.3kW total
    - could be 0.7 W/ch (64 chs/board – 45 W/board) because of improvement in component power requirements. 7.4kW total
  + cluster counting: 5 W/ch (8 chs boards – 40W/board) 46kW
    - could be 2.5W/ch (16 chs/board – 40W/board) because of improvement in component power requirements. 23kW
* OFF-DETECTOR (Concentrators)
  + Assuming the same number of concentrators for both options (Feature Extraction on Data Conversion boards): 70 mW/ch (Concentrators boards must be located in non hostile environment): 650W
* OFF-DETECTOR (Trigger – Primitives generation)
  + We are considering 2 options:

1. Off-Detector electronics generates only primitives  power requirement already considered in Data Conversion board
2. Off-Detector electronics includes electronics for partial super-layer track reconstruction  Off-Detector power and housing requirement would change. The option is under study.

Volume occupied by the electronics (drawings of electronic modules – non available yet):

* ON-DETECTOR:
  + HV distribution boards on forward endplate **-** Preamplifier boards on backward endplate. Position (both boards): 2-3 cm from endplate. Height (board + support) 3-4 cm (HV distribution/Preamplifier boards – boards thickness: 5 mm including components)

Nitrogen gas enclosure volumes are being determined

* OFF-DETECTOR:
  + HV: 2 Crates 19"- wide, 8U-high Euro-mechanics rack (Ref: CAEN SY1527LC)
  + Standard dE/dx - 16 boards/crate: 192 boards  12 VME crates 19" x 8U (6+2) enclosure (Ref : CAEN VME8100 )
    - could be 9 VME crates 19" x 8U (6+2) enclosure (Ref : CAEN VME8100 )
  + cluster counting - 16 board/crate: 72 VME crates 19" x 8U (6+2) enclosure (Ref : CAEN VME8100 )
    - could be 36 crates VME crates 19" x 8U (6+2) enclosure (Ref : CAEN VME8100 )

Max tolerable distances between the detectors to the electronic modules: (ON-DETECTOR – OFF-DETECTOR) ≈ 5 m

Access frequency on the external electronic per year: 12 access/year (after debug)

Frequency access on the detector per year: 1-2 access/year (after debug) (including HV end)

Modularity of the electronic unit (housing racks): ??? 200 cm (45 rack units)

Cables:

Number and size of power cable:

* ON-DETECTOR:
  + - Preamp LV power cables: 12 chans/board modularity  768 cables – 1.5 mm^2 size
    - HV cables: less than 100

Number and size of Read-out cables or fibers:

* OFF-DETECTOR
  + Data Conversion  Concentrators: 192 fibers
  + Concentrators  DAQ: 16 fibers
  + Data conversion  Trigger: 144 fibers (150 kHz trigger rate - 10% occupancy – 20% safety – 1.2 Gbits/s link)

Number and size of slow control cables: 16 fibers

Minimum bending radius

* Fibers: depends on assembly. Single fiber: 2 in; bundle: 15 times external bundle diameter. Waiting for experiment fiber/assembly selection
* ON-DETECTOR LVPS cables: depends on the assembling. Assuming a round shielded (aluminum foil) bundle of 12 cables  12 x cable diameter (12 conductors – 1.5 mm^2 size  outer diameter ≈ .520 in ≈ 13.2 mm)
* ON-DETECTOR HV cables: depends on the assembling. Assuming a shielded (aluminum foil) bundle of 12 cables  12 x cable diameter (12 conductors overall cable diameter ≈ 9 mm)
* ON-DETECTOR signal cables:
  + Standard dE/dx: assuming a flat assembly of 12 cables  24 x cable diameter (micro-coax cable diameter ≈ 0.5 mm – aluminum foil shielding)
  + Cluster counting: assuming a flat assembly of 12 cables  12 x cable diameter (RG178 cable diameter ≈ 1.8 mm)

Shielding requirements (thermal and electrical)

* Thermal: NO
* Electric fields: if cluster counting will be implemented some shielding could be useful. For standard approach (dE/dx by means of charge measurement) the magnetic field return iron should be enough.

Information drawings on the cable distribution on the detector geometry: non available yet

* Only preamplifiers should be installed on backward-end plate. Connection to off-detector electronics will be implemented by coax cables (cluster counting) or coax/twisted cables (standard dE/dx). Cables should leave the detector along the outer diameter.

Cooling system.

Requirement of cooling system: backward endplate

Power, flow, temperature and type of fluid:

* Standard dE/dx: 300W  air flow cooling should be enough to provide good air exchange ≈ 1000 m^3/h - coarse calculation  (3.16 x Watt) /(t\*0.589)  t = 4 **(!)**, degrees, PD = 300W  500 m^3/h)
* Cluster counting: 1 kW  liquid cooling required

Allowed detector temperature variations: backward end-plate  4 degrees **(!)**

Size of the chiller:

Cooling pipes distribution at sub detector ends (drawings):

Describe other requirements that have an impact of the space available like auxiliary equipment, minimum space for accessibility, etc

Describe other requirements that have an impact of the space available like space for the commissioning operations and assembly.