J.Nolen, 5 May 2011

Update of cryogenic requirements for S3 - 7 SC triplets

Requirements for the cold box in the S3 vault

Entrance elevator and doorway dimensions and distribution line layout from Franck
Helium cooling requirements based on analysis below with some margin:

Refrigeration at 4.5 K:

75 W (50 W estimated with 50% margin including allowance for junction box and storage dewar at cold box)

Cold gas at 50K:

10 g/s at 50 K returned at 65 K (~50% margin)
5 g/s at 50 K returned at 300 K (~50% margin)

Helium Compressors:

To provide high pressure helium and suction pressure return from a distance of 100 m from the cold box which is in the underground cave.

Heat loads

4.5 K

Each cryostat:

2 4.5 K valves per triplet (2W)
1 vacuum break per triplet (1W)
static load per triplet including support links (2W)
thermal load of 9 pairs of 400 amp HTS leads (0.05W)

Total for 7 triplets 35W

Distribution line:

Assume 50 m at 0.3 W/m: 15W

Total 4.5 K load: 50 W

50 K

Each cryostat:

1 g/s at 50 K returned at 60 K (equivalent to 52 W, or one liter/hr LN2)
0.5 g/s at 50K returned at 300 K to compressor suction (to cool 9 pair of 400 amp leads per cryostat)

Distribution line:

Additional 1.5 W/m times 50 m (to be confirmed by Franck), 75 W total adding small amount to the 60 K cold gas return. Assume net effect is to return cold gas at ~65 K.

Total load at 50K:

7 g/s returned at 65 K
3.5 g/s returned at 300K to pump suction