Possibility of presence of Cryo. penetration through pacman

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Parameters for calculation

Beam Energy and Power : 500 GeV, 18 MW

Beam loss : 1 W at any point

Design goal : 0.05 mrem/h for normal,

400 mrem/h for mis-steering,

25 rem/h (3rem/event) for system failure

Target material: 20 X0 Copper cylinder

$\rightarrow$ Shielding capability : 25 rem/h /18MW = 1.39 mrem/h/kW
288 kW for 400 mrem/h, 36 W for 0.05 mrem/h

Pacman : 80cm inner radius – 70 cm iron – 200 cm concrete
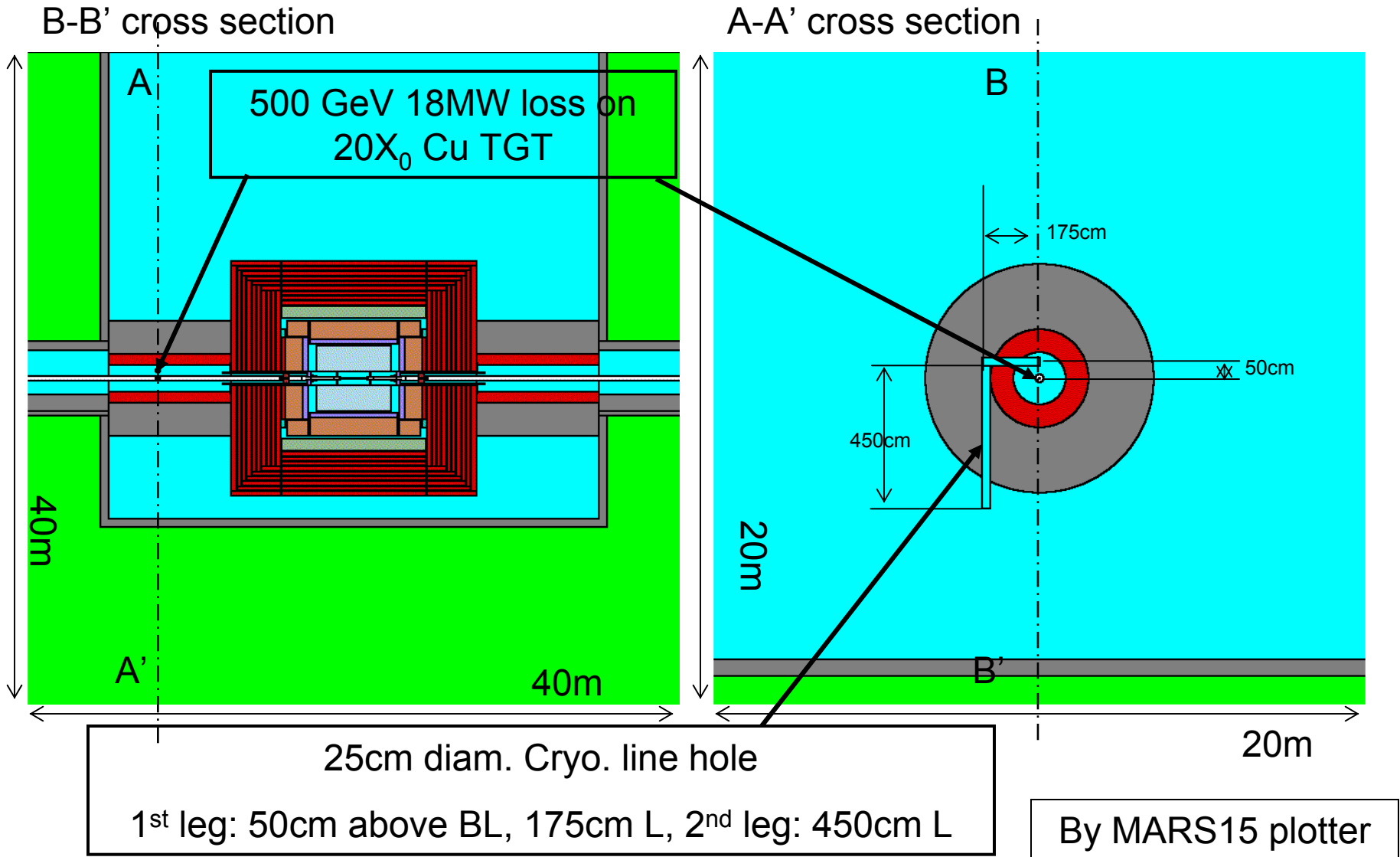
$\rightarrow$ 16.2 rem/h for 18 MW full loss

Cryo. penetration: 25 cm ID, 50 cm vertical offset, 1 knee

$\rightarrow$ To check possibility of presence of Cryo. penetration through pacman

| Beam loss estimation |

| Site dependant |

| Engineering design |

| Design goal |

| Engineering design |

25cm 1 knee geometry

B-B' cross section

A

A'

500 GeV 18MW loss on 20X$_0$ Cu TGT

40m

40m

A-A' cross section

B

175cm

450cm

50cm

20m

B'

20m

25cm diam. Cryo. line hole

1st leg: 50cm above BL, 175cm L, 2nd leg: 450cm L
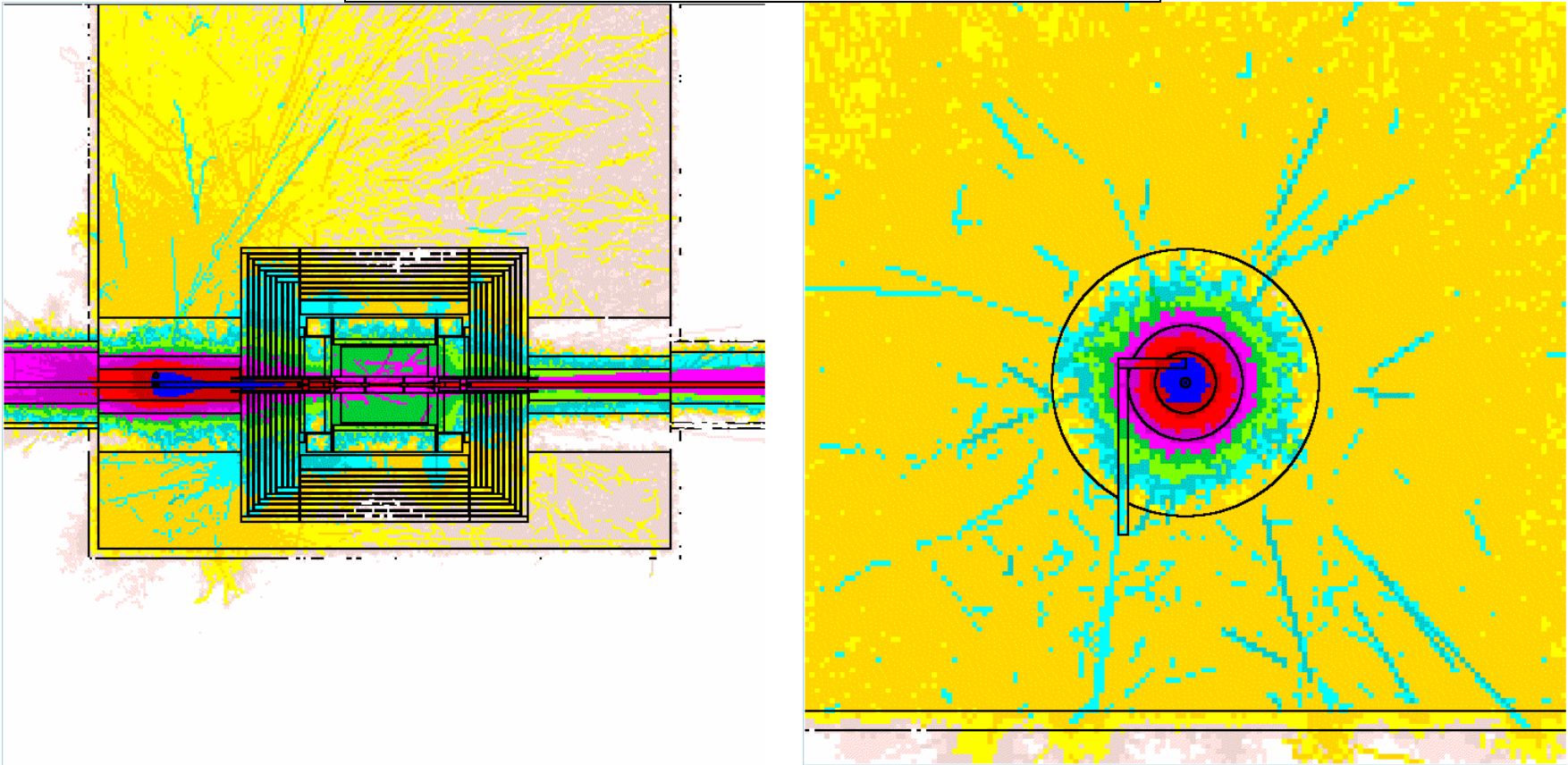
By MARS15 plotter
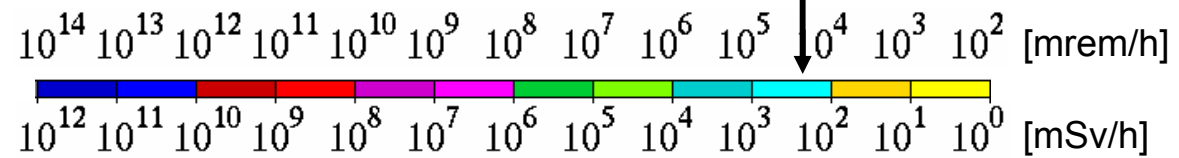
Detector: GLD, IR hall: 20m(L)x110m(W)x35m(H)

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Pacman: ID:160cm, Iron 70cm, Conc 200cm → 16.2rem/h for 18MW (Shield11)

Dose rate for 25cm 1 knee

500 GeV, 18MW on $20X_0$ Cu cylinder

25rem/h

10^{14} 10^{13} 10^{12} 10^{11} 10^{10} 10^9 10^8 10^7 10^6 10^5 10^4 10^3 10^2 [mrem/h]

10^{12} 10^{11} 10^{10} 10^9 10^8 10^7 10^6 10^5 10^4 10^3 10^2 10^1 10^0 [mSv/h]

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50cm straight geometry

B-B' cross section

A-A' cross section

A

500 GeV 18MW loss on $20X_0$ Cu TGT

B

40m

40m

A'

B'

50cm diam. Cryo. line hole

40m

Detector: GLD, IR hall: 20m(L)x110m(W)x35m(H)

Pacman: ID:160cm, Iron 70cm, Conc 200cm → 16.2rem/h for 18MW (Shield11)

Dose rate for 50cm straight
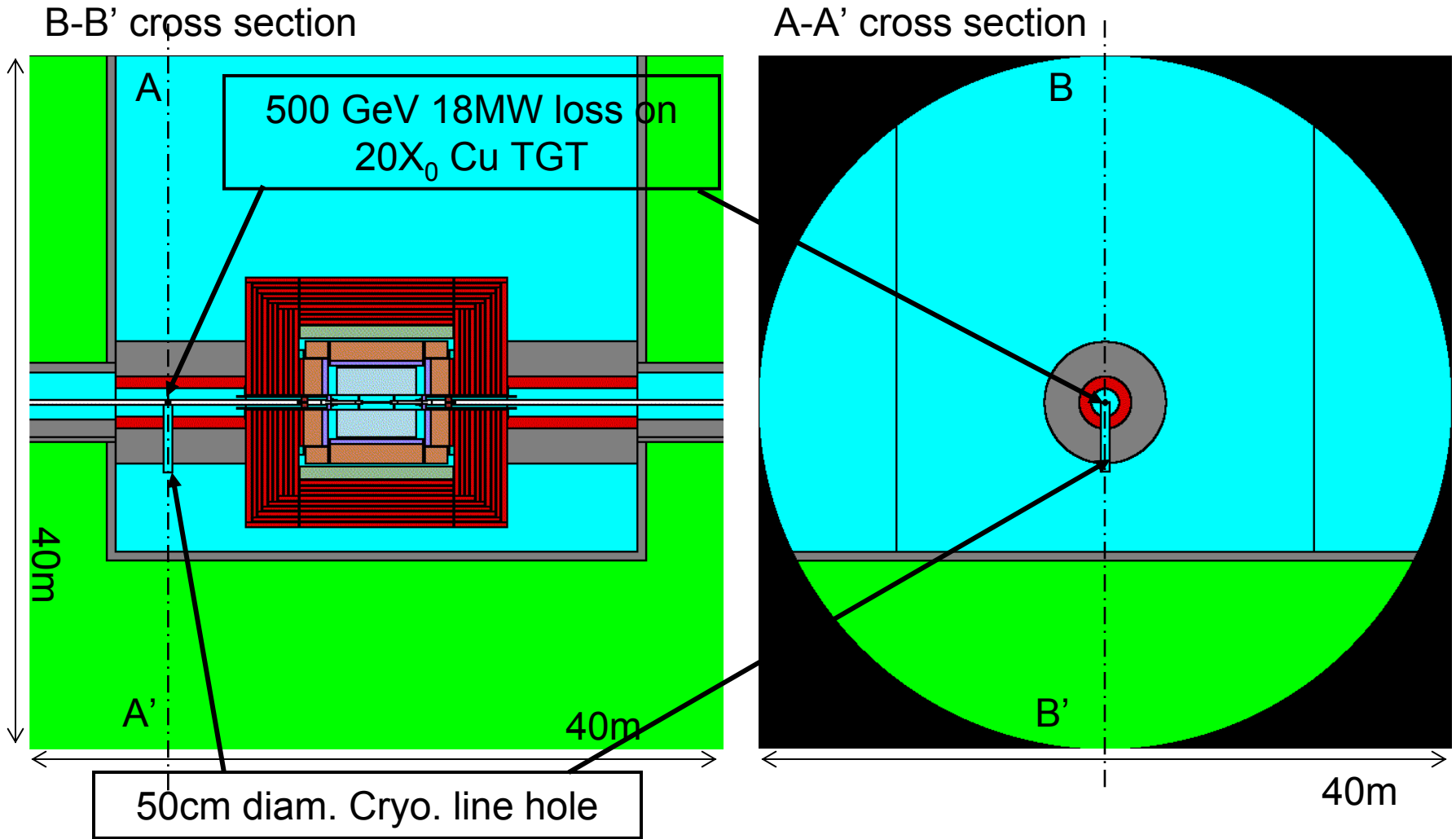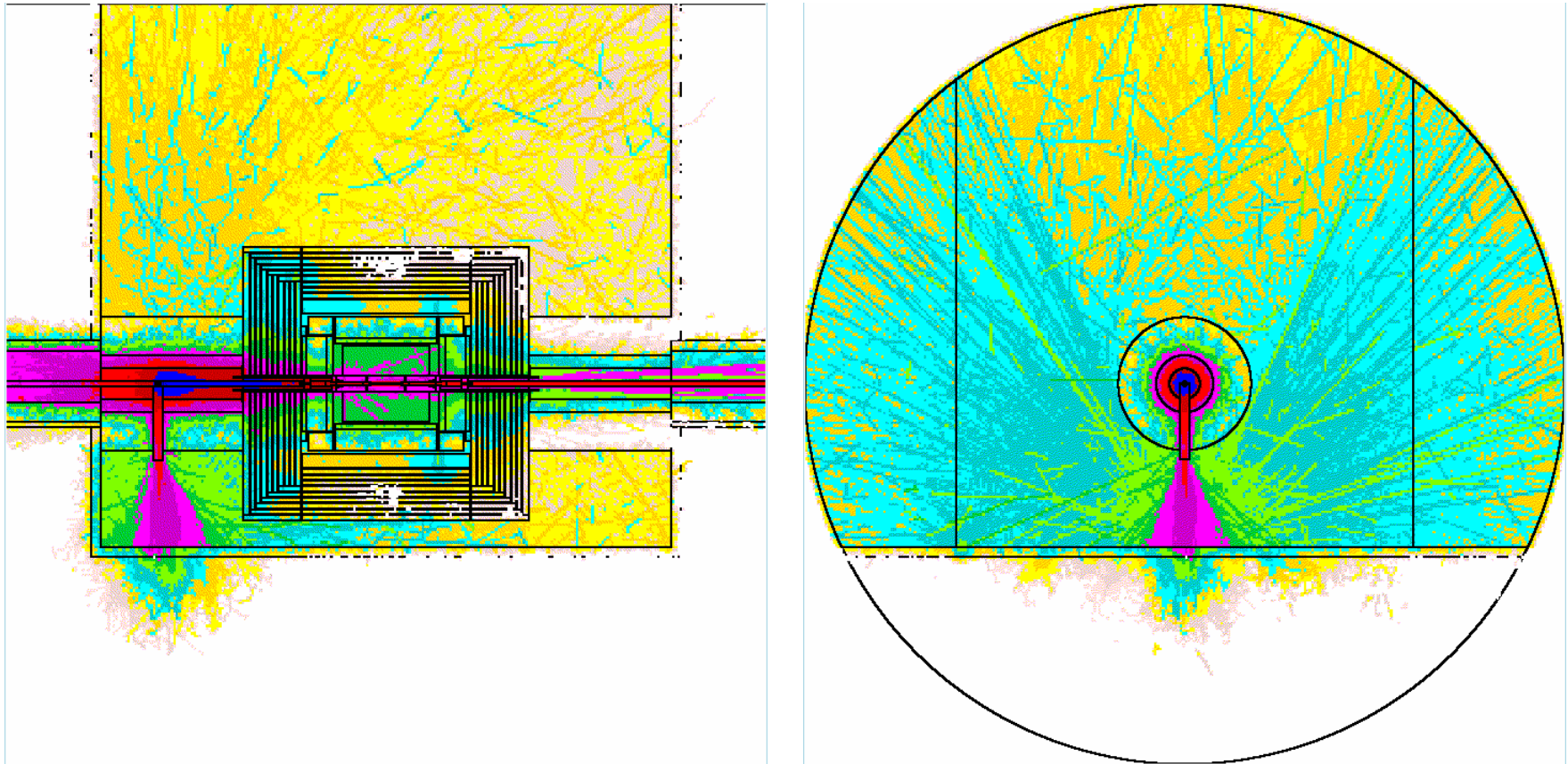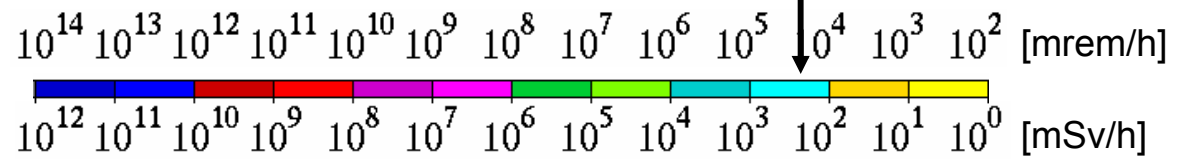

25rem/h

10^{14} 10^{13} 10^{12} 10^{11} 10^{10} 10^{9} 10^{8} 10^{7} 10^{6} 10^{5} 10^{4} 10^{3} 10^{2} [mrem/h]

10^{12} 10^{11} 10^{10} 10^{9} 10^{8} 10^{7} 10^{6} 10^{5} 10^{4} 10^{3} 10^{2} 10^{1} 10^{0} [mSv/h]

Design Goal

[SLAC rule]

- Normal operation :
  - → **0.05 mrem/h (= 0.5 μSv/h) for GERT**
  - **0.5 mrem/h (= 5 μSv/h, 1 rem/y) for RW**

- Miss steering :
  - → **400 mrem/h (= 4 mSv/h)**

- System Failure :
  - → **25 rem/h (250 mSv/h), 3 rem/event (30 mSv/event)**
  - **for maximum credible beam loss in any accessible area**
  - **assuming that the BCS devices that limit beam power have failed**

Design Goal

[LHC design] (from http://indico.cern.ch/conferenceDisplay.py?confId=1561 talk of D. Forkel-Wirth)

- Normal operation :
    - → 0.3 mrem/h (= 3μSv/h) for Simple controlled area
    - → 0.1 mrem/h (= 1μSv/h) for Supervised area
    - → 0.01 mrem/h (= 0.1μSv/h) for Non-designated area
- Total Beam loss :
    - → 5 rem (50mSv) for Simple controlled area
    - → 250 mrem (2.5mSv) for Supervised area
    - → 30 mrem (0.3mSv) for Non-designated area

[J-PARC design] (from Dr. Nakashima, JAEA)
- Normal operation : (**1W/m beam loss assumed for 1MW**)
    - → 1.25 mrem/h (= 12.5μSv/h) for Controlled area
    - → 0.025 mrem/h (= 0.25μSv/h) for In-site

Total Beam loss :

Accelerator stops within 1 sec

by monitoring beam current, beam loss and 1 hour integrated dose rate