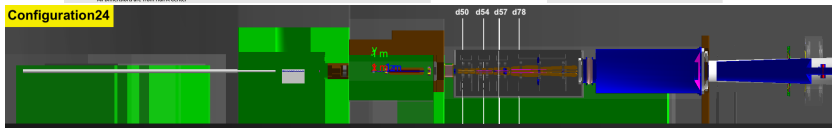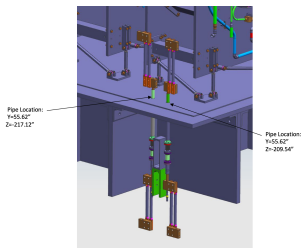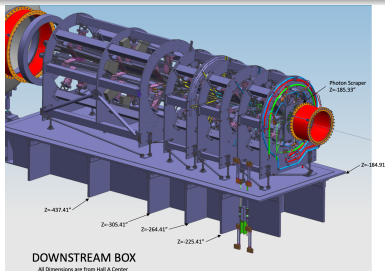# TID calculation for DS Coil water-cooled leads

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TID calculations for DS coils water-cooled leads

- Simulation ran with shielding config24 (100M beam generator events).
- The particles are passed through 1cm thick of $G4\_RUBBER\_BUTYL$ and deposited energy are evaluated.
- TID is computed for each $5 \times 5 mm^2$ block by dividing the energy deposition in the block by the mass and the results are integrated over the whole MOLLER run.
- z_{d50}=5200.5mm; z_{d54}=6400.5mm; z_{d57}=7300.5mm; z_{d78}=8432.04mm
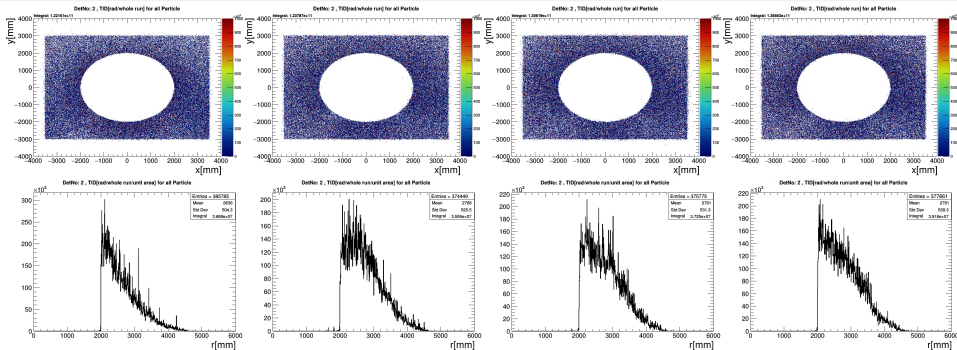
Top: The 2D position distributions of all the hits which are weighted by radiation dose for the d50 (1st column), d54 (2nd column), d57 (3rd column), d78 (4th column). Bottom: The average radiation dose as a function of radius for the d50 (1st column), d54 (2nd column), d57 (3rd column), d78 (4th column).

- The maximum radiation doses in d50/d54/d57/d78 are around 400MRad/140MRad/200MRad/140MRad, respectively.
- The average numbers are much important here and it corresponds to a dose of ≈ 200kRad.

- In order to estimate the potential radiation dose in the vacuum pumps, we used the POLYETHYLENE as the material and computed the TID per 1 hour.
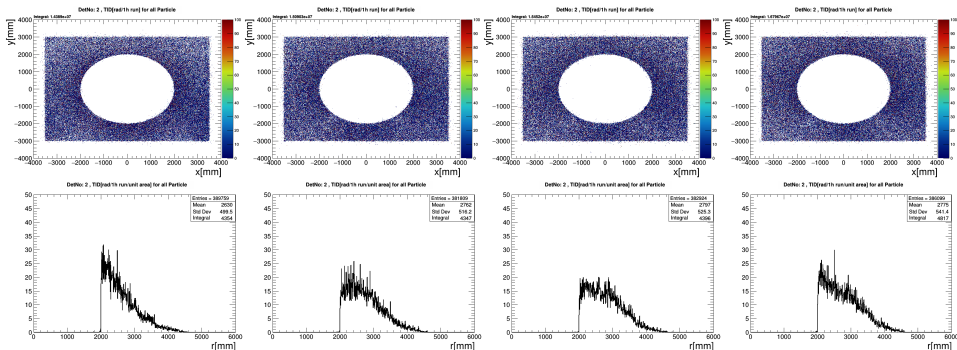

Top: The 2D position distributions of all the hits which are weighted by radiation dose for the d50 (1st column), d54 (2nd column), d57 (3rd column), d78 (4th column). Bottom: The average radiation dose as a function of radius for the d50 (1st column), d54 (2nd column), d57 (3rd column), d78 (4th column).

- The average dose is ≈ 25Rad.
- Whole MOLLER run-time is 8256 hours, 25Rad → ≈206kRad

- The similar study is performed for the controller of vacuum pumps. We used the SiO_2 as the material and computed the TID per 1 hour.
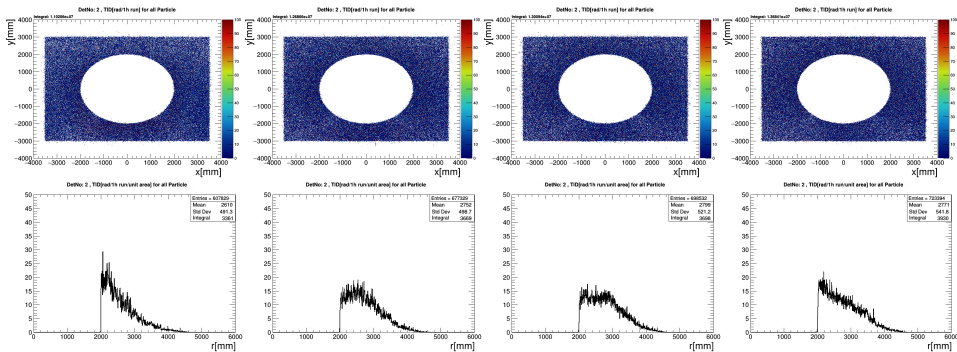

Top: The 2D position distributions of all the hits which are weighted by radiation dose for the d50 (1st column), d54 (2nd column), d57 (3rd column), d78 (4th column). Bottom: The average radiation dose as a function of radius for the d50 (1st column), d54 (2nd column), d57 (3rd column), d78 (4th column).

- The average dose is ≈ 20Rad.
- Whole MOLLER run-time is 8256 hours, 20Rad → ≈165kRad

Backup

TID calculations for DS coils water-cooled leads

- Skimmed the remoll output files for d50/d54/d57/d78 by using skimTree.C. While doing the analysis, the skimmed root output is produced separately for the p_z states($p_z > 0/p_z < 0$) with $hit.r$ >2000mm.
    - det50: 100M beam generator events.
        - $p_z > 0$: 441122 Events; $p_z < 0$: 263887 Events
    - det54: 100M beam generator events.
        - $p_z > 0$: 409975 Events; $p_z < 0$: 279430 Events
    - det57: 100M beam generator events.
        - $p_z > 0$: 391800 Events; $p_z < 0$: 281666 Events
    - det78: 100M beam generator events.
        - $p_z > 0$: 376566 Events; $p_z < 0$: 267622 Events
    - Then, ran the tid.mac by using the external generator
        - file: Skimmed root file
        - copyRate 1
        - startEvent 0
        - detid: 50/54/57/78
        - zOffset:$-(\pm10$ the value of z-position as in mollerParallel.gdml)
        - run # skimmed events
    - tidAna.C macro is used to analyse this ext. generator root file.
- 1mm/10mm/1mm thick $G4\_RUBBER\_BUTYL$ (density=0.92 g/cm^3) planes are used in the tid.gdml
- 1mm/10mm/1mm thick $G4\_POLYETHYLENE$ (density=0.94 g/cm^3) planes are used in the tid.gdml
- 1mm/10mm/1mm thick $G4\_SILICON\_DIOXIDE$ (density=2.32 g/cm^3) planes are used in the tid.gdml