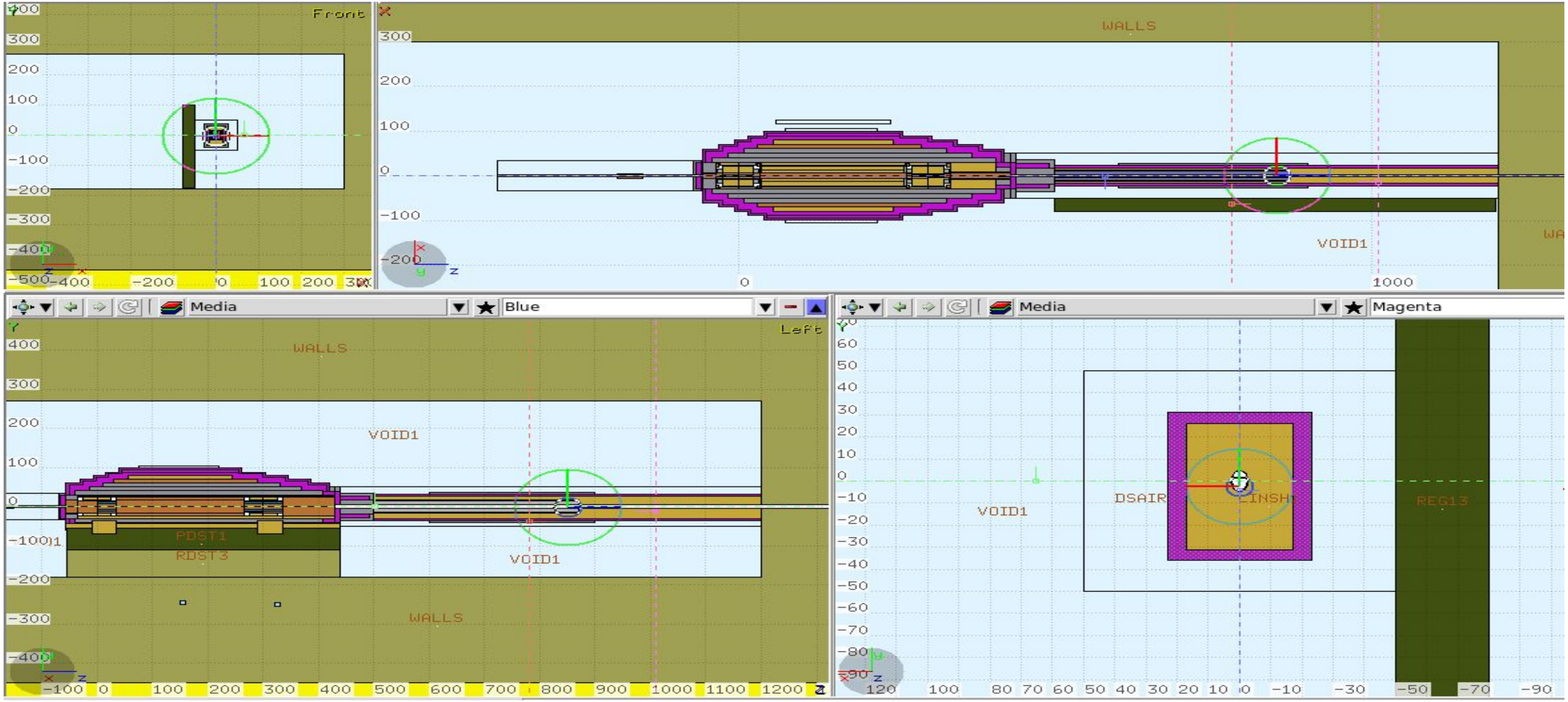
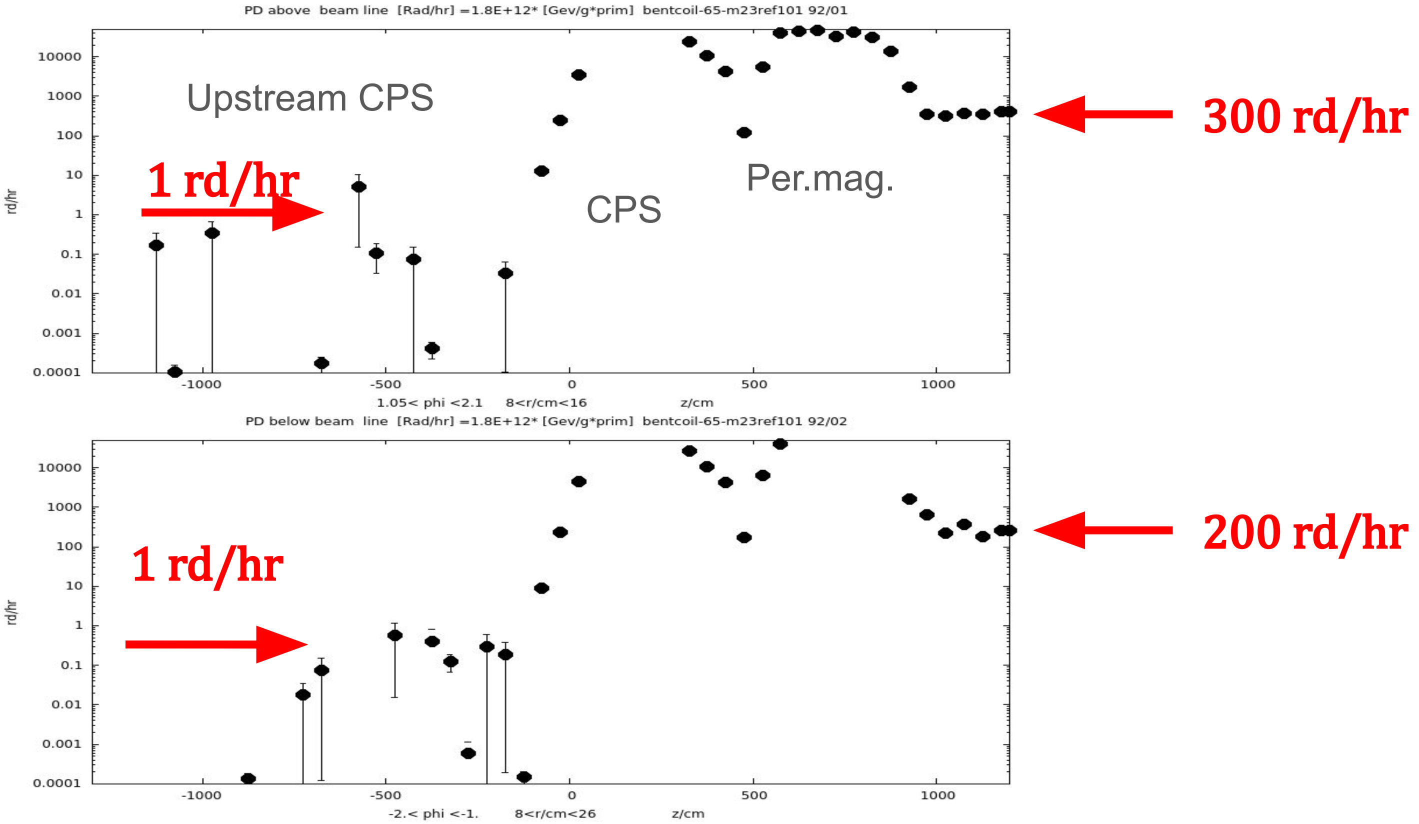
CPS and Beam Vacuum Line equipment lifetime.

[baturin@hallal1 ABSTSTref9]$ flair bentcoil-65-m23ref101.flair

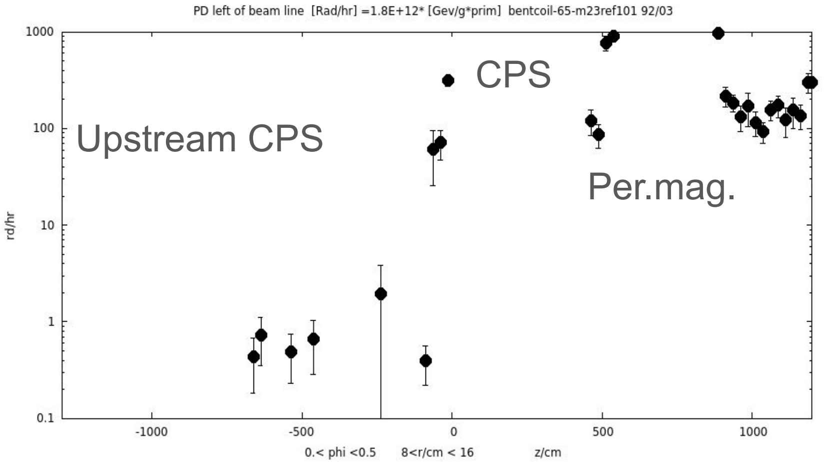


- Assume that critical part of vacuum remote control is located at 8<r/cm<16
- What is PD in this area along the beam line?

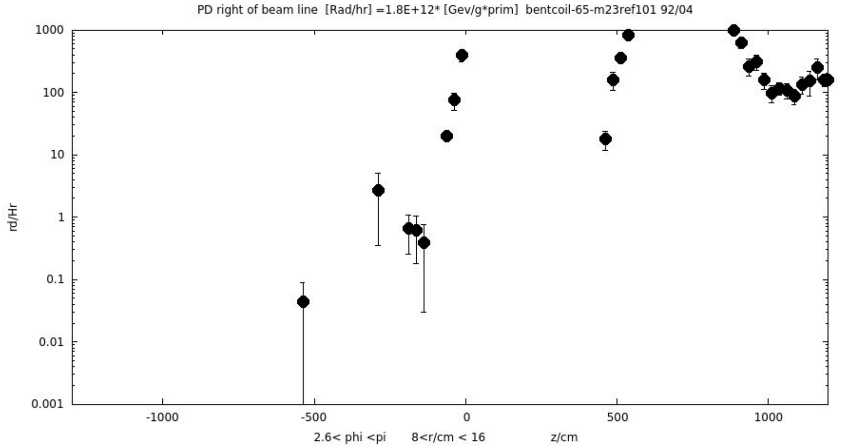
PD z-profile above and below the beam line at 8<r/cm<16



PD z-profile Left and Right to the beam line ar 8<r/cm<16

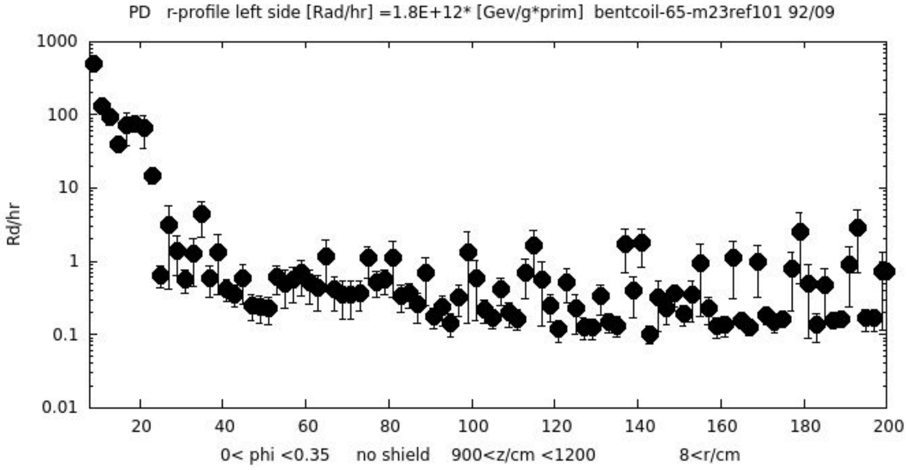


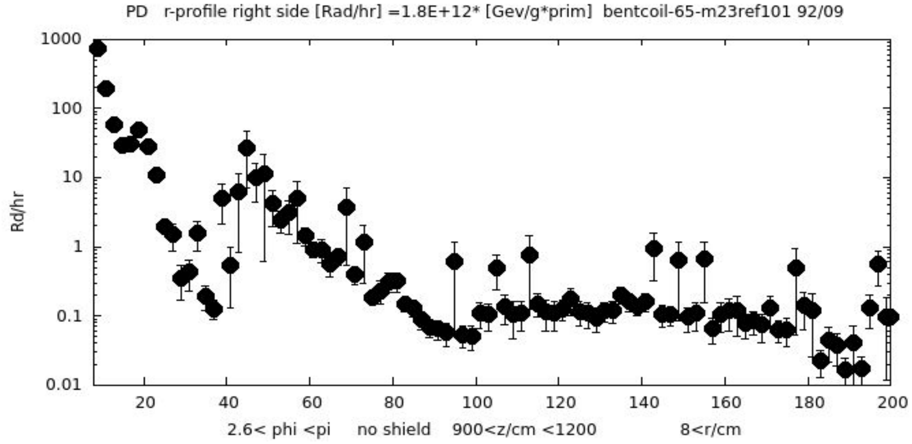
150 rd/hr Left side



150 rd/hr

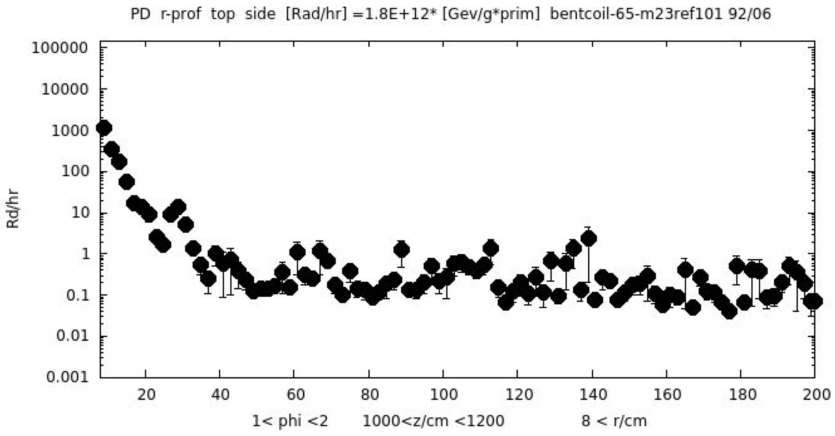
PD r-profile Left and Right to the beam line

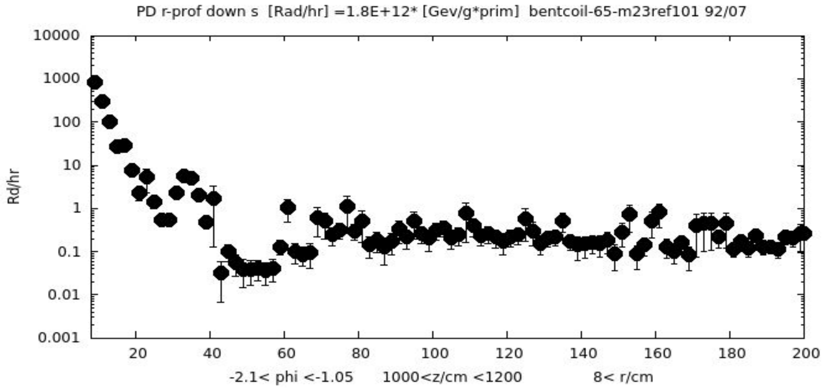




- At r/cm = 8 PD=~1000 rd/hr !
- At r/cm =10 PD=~100 rd/hr
- At r/cm = 30 PD =~1 rd/hr !
- Left=right difference is due to the additional concrete shield at the right side

PD r-profile on Top and Bottom of the beam line





- At r/cm = 8 PD=1000 rd/hr !
- At r/cm= 11 PD=~**100 rd/hr**
- At r/cm > 30 PD <1rd/hr !

Tensile strength of Teflon (pPTFE 6.4×50.1 mm) vs TID **in Air.**

https://www.sciencedirect.com/science/article/pii/014139109290093K?via%3Dihub

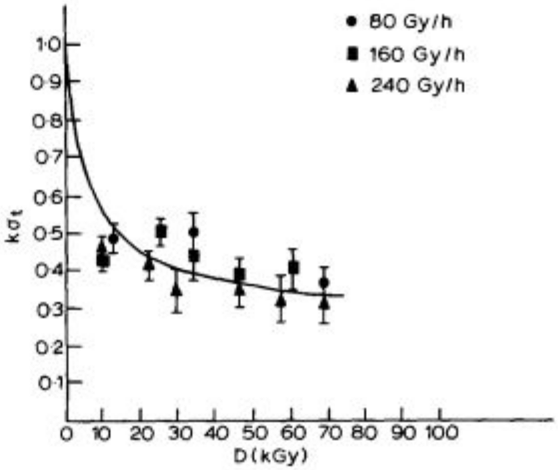


Fig. 3. The dependence of K_{σ_t} on the doses, D, for pPTFE irradiated at various dose rates (80 Gy/h, 160 Gy/h, 240 Gy/h).

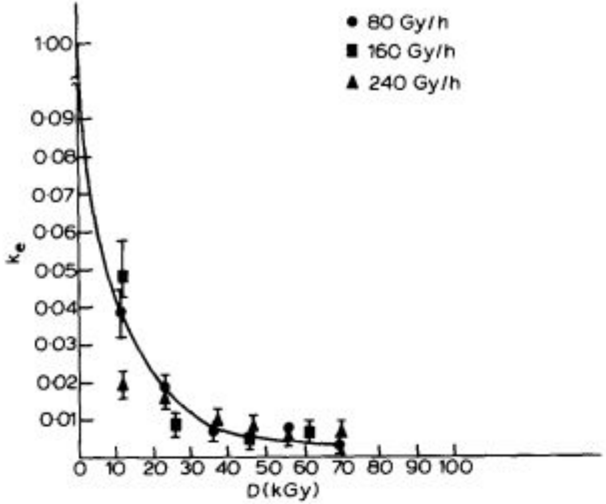
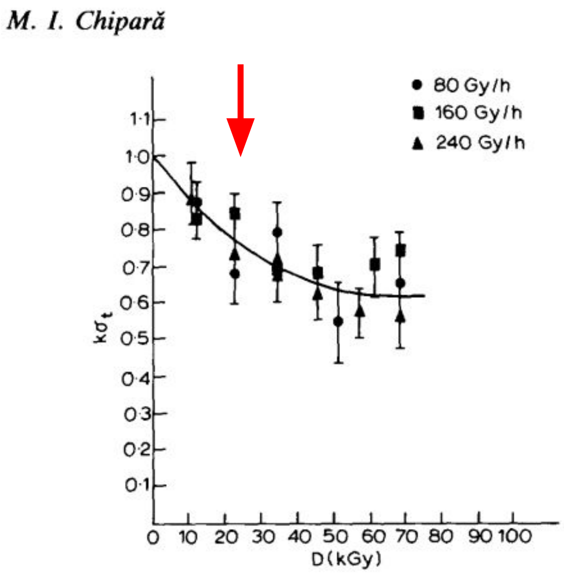


Fig. 6. The dependence of K_e on the dose, D, for pPTFE irradiated at various dose rates (80 Gy/h, 160 Gy/h, 240 Gy/h).

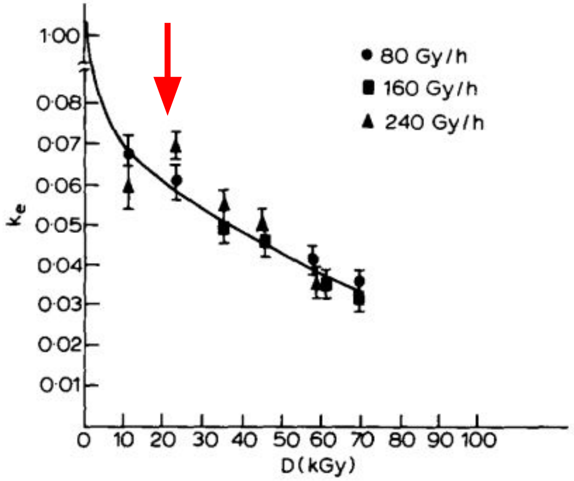
- At 20.E+3 Gy= **2.E+6 rad** pure Teflon sample brakes at ~ 45% of nominal load, while elongates by ~2%.
- At 100 rad/hr (of γ) Teflon LT = 2.E+4 hrs = 2.3 years. May be 3 times longer - 7 years!

Tensile strength of Teflon (cPTFE 6.4×50.1 mm) vs TID **in Air.**

https://www.sciencedirect.com/science/article/pii/014139109290093K?via%3Dihub



Ratio of "tensile strength" of irradiated and unirradiated samples of cPTFE (Carbon filled)) vs TID/kGy .



Ratio of the "elongation at break" for irradiated to that of unirradiated cPTFE vs TID/kGy.

- At 20.E+3 Gy= **2 .E+6 rad** Teflon+C sample Brakes at ~ 80% of nominal load, while elongates by ~6%.
- At 100 rad/hr (of γ) Teflon LT = 2.E+4 hrs = 2.3 years.

Compilation of Radiation Damage Test Data

https://cds.cern.ch/record/357576/files/CERN-98-01.pdf

Table 2a

General classification of rigid thermoplastics with respect to their radiation resistance

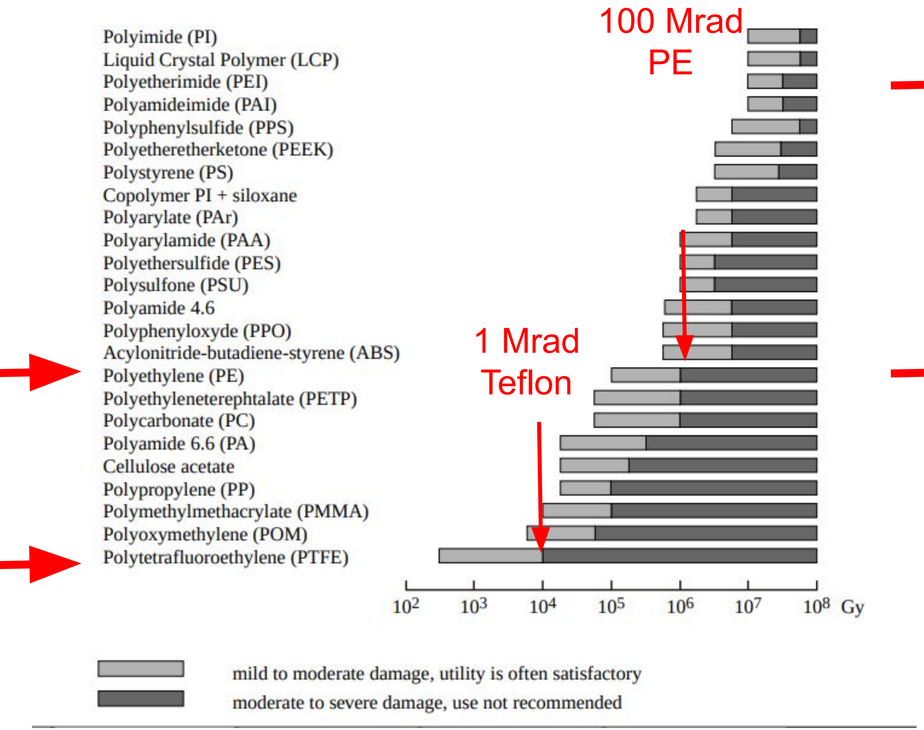
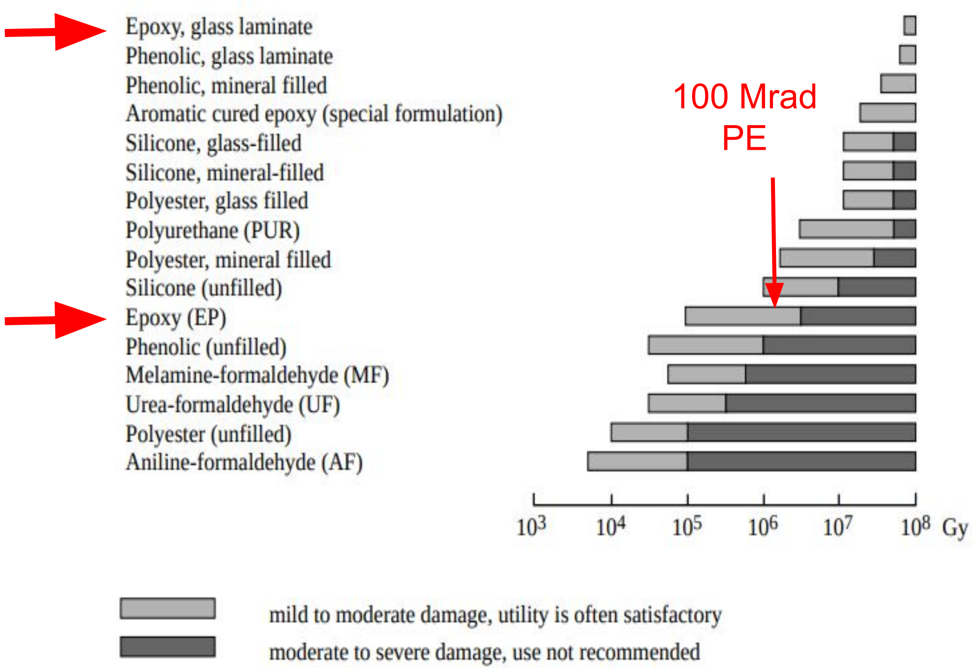


Table 2b

General classification of thermoset resins and composites with respect to their radiation resistence



CONCLUSION

- **Vacuum equipment** at near Exit from Tagger Hall (10<z/m<12) is **exposed to 100 rad/hr** (at r >10 cm).
- From **CERN** database we read the Teflon TID >**1 Mrad** (up to 5 Mrad). Therefore
- **Teflon LT = 1.E+4 hrs** of continuous operation (~420 days; SHV connectors).
- **Epoxy** and **Polyethylene LT = 1.E+6 hrs** (PCBs and cable insulation).
- At the **upstream** side of the beam line **lifetimes are practically unlimited (>100 time longer).**
- Is it possible to **avoid** placing **vacuum equipment downstream** the CPS?