Radiation Hardness Assurance. Military/Space grade. Contacts with manufacturers.

- Example of Rad. Hardness specifications. Military Grade Chip RH3080. (https://www.analog.com/en/products/rh3080mk.html#product-overview)

  TID =200 krad at 50 rad/c;
  TID =100 krad at 10 mrad/c ;
  SED SEU SEL = 120 MeV/cm^2/mg;
  DDD =1.E+12 n/cm^2.
- More Examples of Rad. Hardness specifications.

Data Device Corporation **TID >=100 krad** (memory and processors),
CMOS chips up to **DDD=1.E+15 n/cm^2** and **50 krad**.
TTL 5400 The low-power Schottky (LS) **TID=1000 krad**.
Emitter-coupled logic (ECL) **TID= 1.E+4 krad**.

- For now E-mails are sent to:

1) ARI Corp (www.aricorp.com), Jozef Lebiedzik. Preamplifier PMT-5R for active collimator. Responded:"...All parts in the PMT-5R are standard commercial grade rating… most sensitive is **CMOS LMC662** …".
2) Rockwell Automation. (https://www.rockwellautomation.com). Allen Bradley 1769-L35E controller. Responded : no grade specifications (we should assume commercial/industrial)-> Next step:
3) Mail to Allen Bradley https://industrialautomationco.com/collections/allen-bradley-electronic-parts. sales@iac.us.com
4) HiCube Pro in relation to Turbo Pumping Station. info@pfeiffer-vacuum.de www.pfeiffer-vacuum.net

- Most likely all chips in Tagger Hall are of **commercial grade**. Therefore, for the electronic chip Lifetime estimates we may use:

  Chip TID = 5-10 krad **Teflon TID =>1Mrad**
  Chip DDD = E+(11:15) n/cm^2 **Teflon DDD =>E+13 n/cm^2 (14 MeV)**

  References in Technical Note.

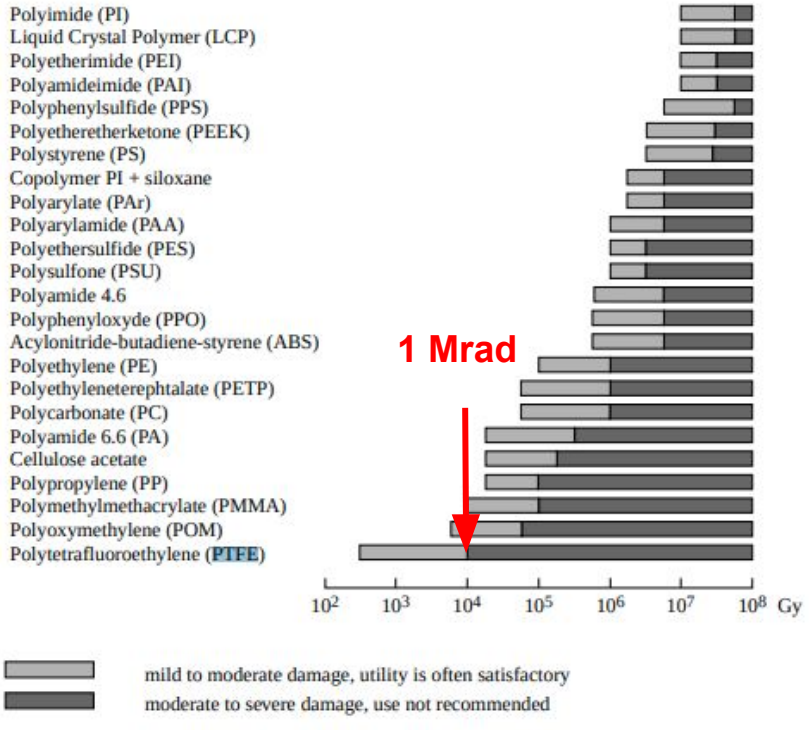
Radiation Hardness of plastics. See Technical Note for references.

Material	Neutron /cm^2	TID /rad	TensStr /%	TensStr /psi	Elong /%	Tickness /in	Ref.
Teflon(PTFE), air	-	1.E+5	50-10	4800	80-50	0.06	24
Teflon, vacuum	-	1.E+6	80-50	4800	100-80	0.06	24
RT/duroid (PFTE)	-	1.E+6					22
porous PTFE	1.E+13	1.E+4					23
Teflon	3.E+14		50-10				15
Teflon		2.E+6	60-40	-	2-6	0.25×2	27
Nylon		1.E+7					23
Epoxy		1.E+8					23
Polyethylene		**>2.E+7**					23

ebook: 10.5170/CERN-1998-001

Table 2a

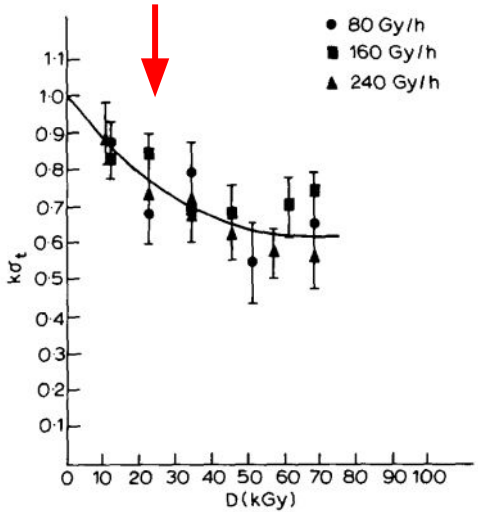
General classification of rigid thermoplastics with respect to their radiation resistance



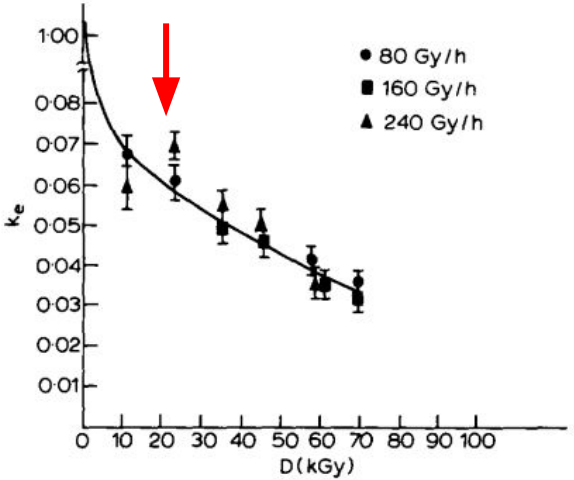
Tensile strength of Teflon (cPTFE 6.4×50.1 mm) vs TID **in Air.**

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

M. I. Chipară



Ratio of "tensile strength" of irradiated and unirradiated samples of cPTFE vs TID/kGy .



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

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

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

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

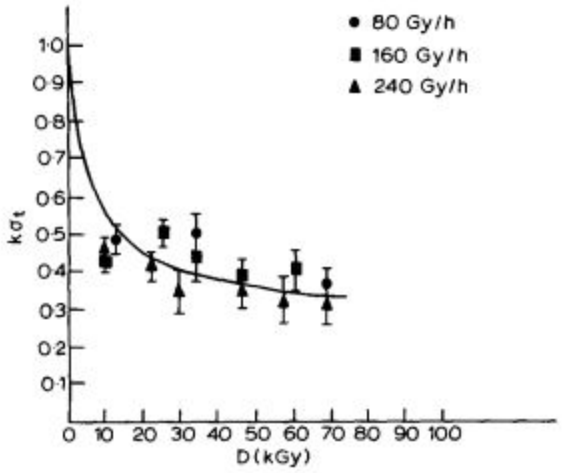


Fig. 3. The dependence of K_{σ_t} on the doses, D, for pPTFE irradiated at various dose rates (80 Gy/h, 160 Gy/h, 240 Gy/h).

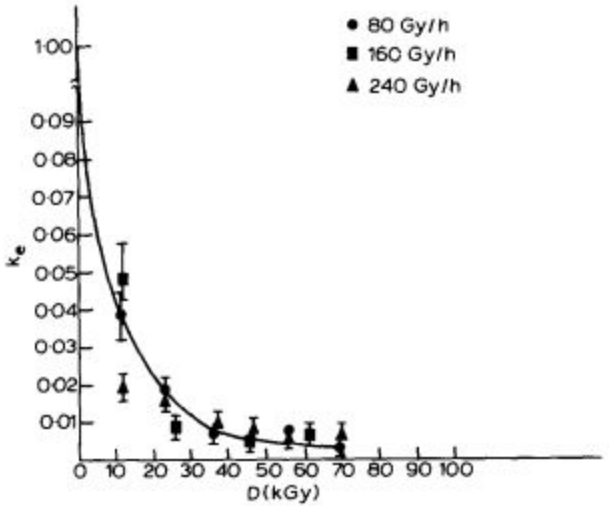


Fig. 6. The dependence of K_ε on the dose, D, for pPTFE irradiated at various dose rates (80 Gy/h, 160 Gy/h, 240 Gy/h).

- 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 $\boldsymbol{\gamma}$) Teflon LT = 2.E+4 hrs = 2.3 years.