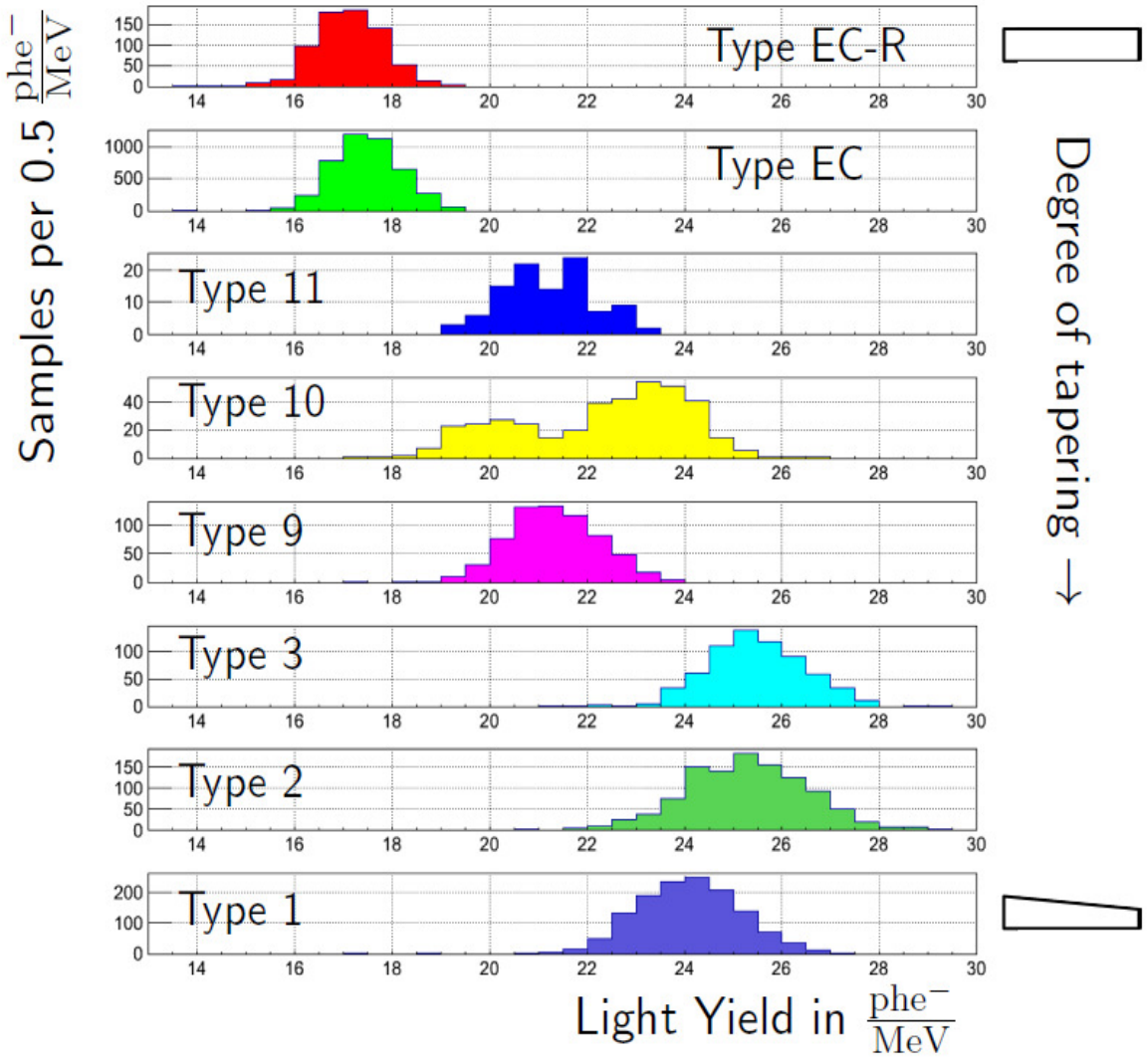
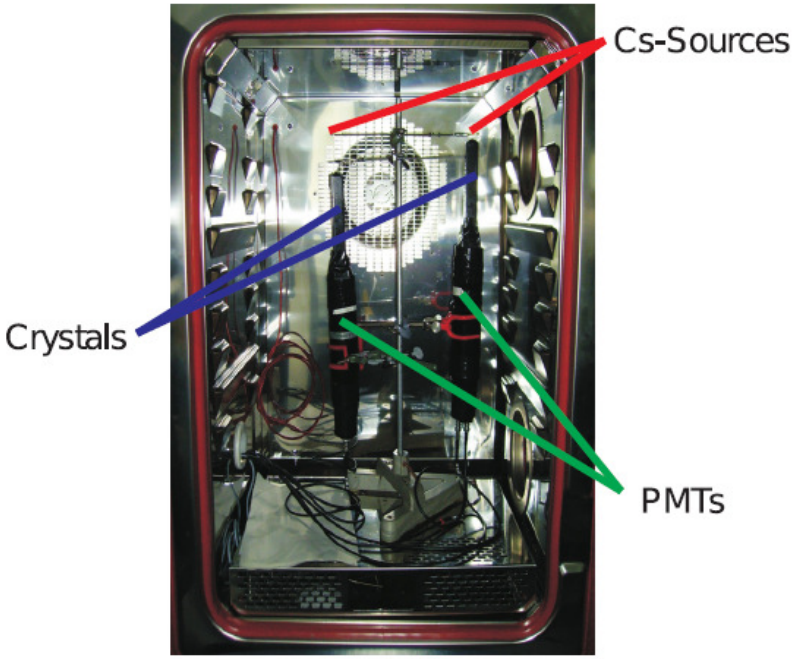
light yield measurement

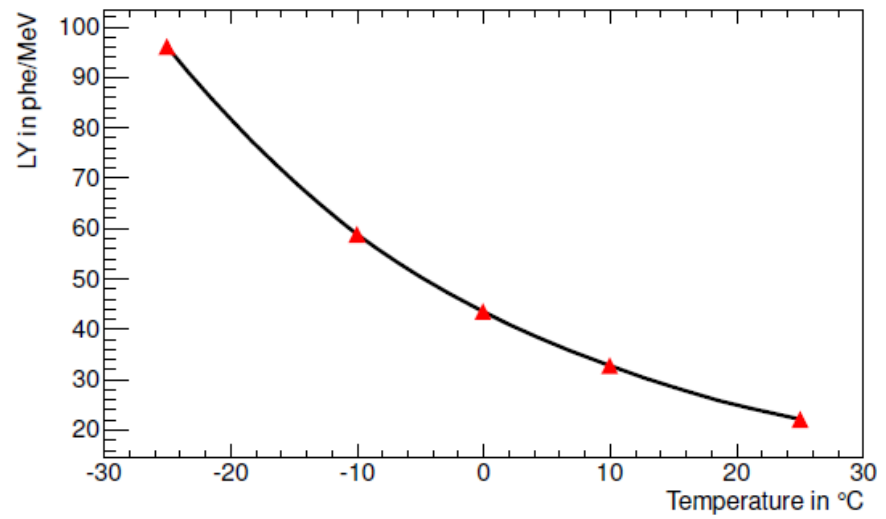


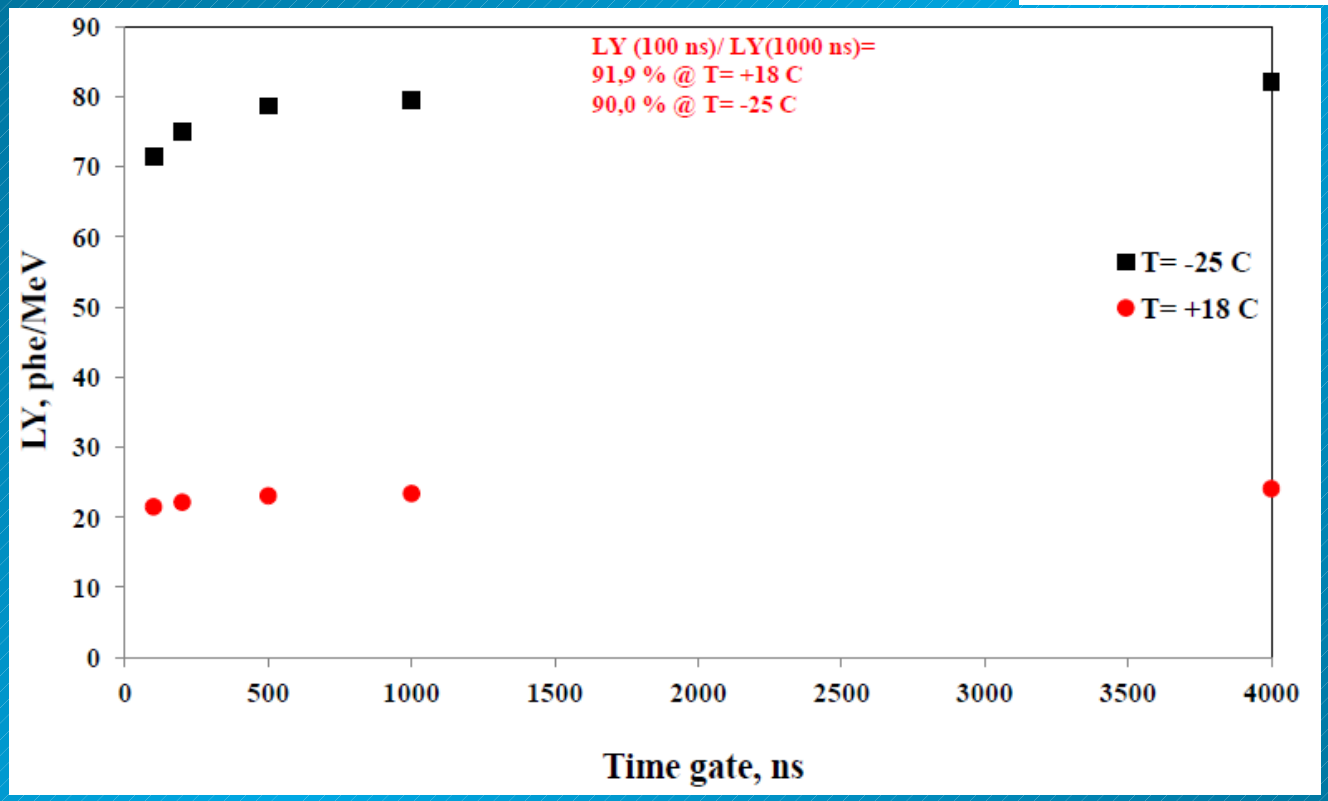


@ 18oC

light yield measurement

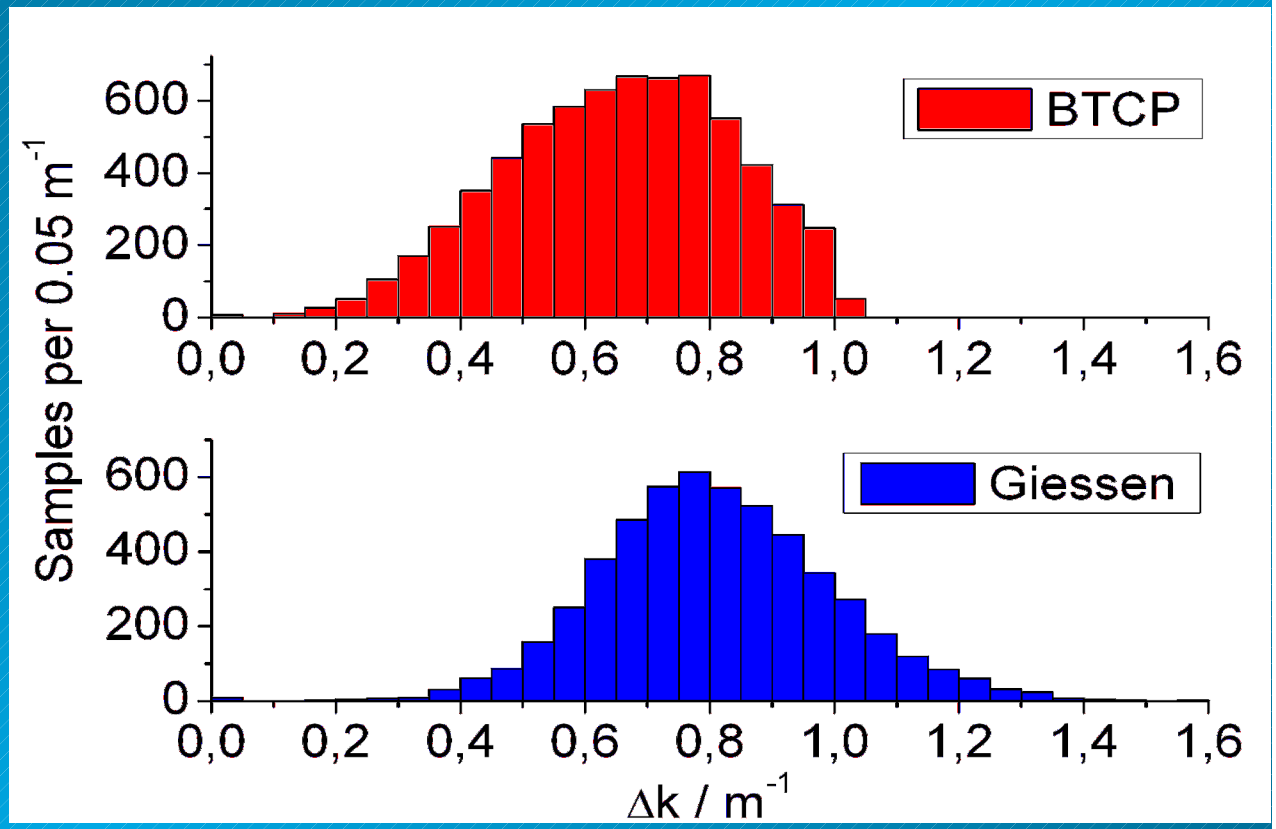
temperature dependence
of luminescence





radiation hardness

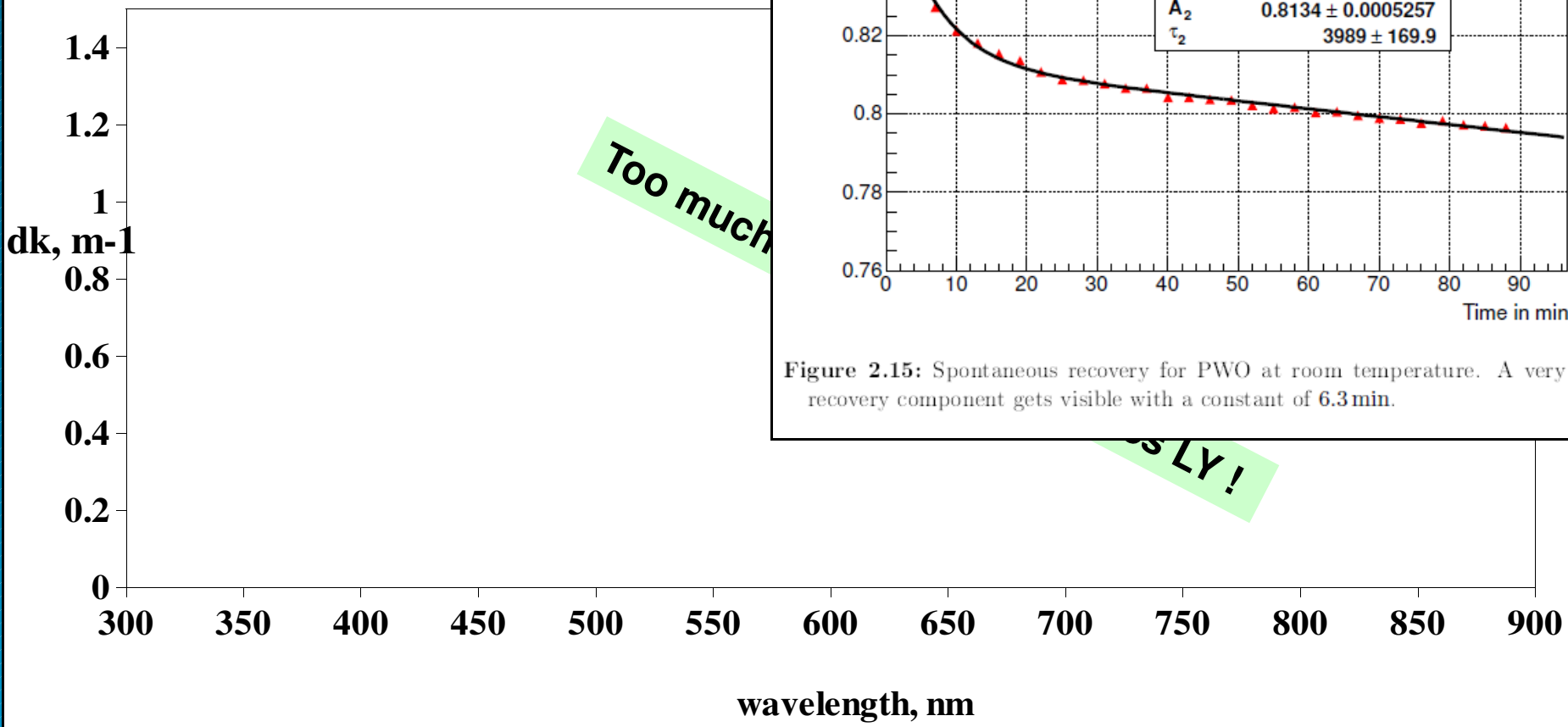
$$\Delta k = \ln\left(\frac{T_{bef}}{T_{after}}\right)\cdot\frac{1}{d}$$



tested using γ-rays: ~ 1.2 MeV
60Co
integral dose: 30Gy

acceptance limit: Δk < 1.1 m-1

radiation hardness



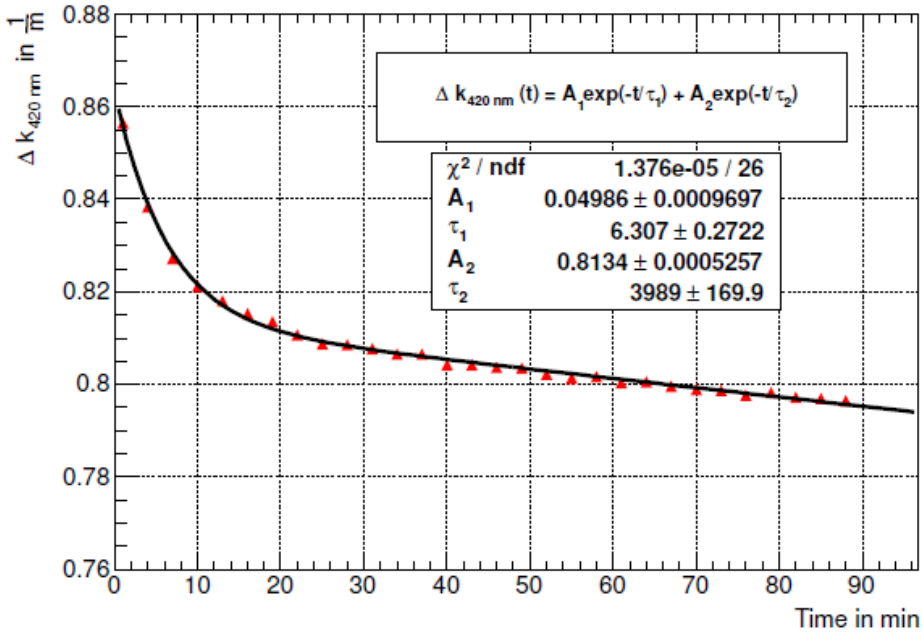
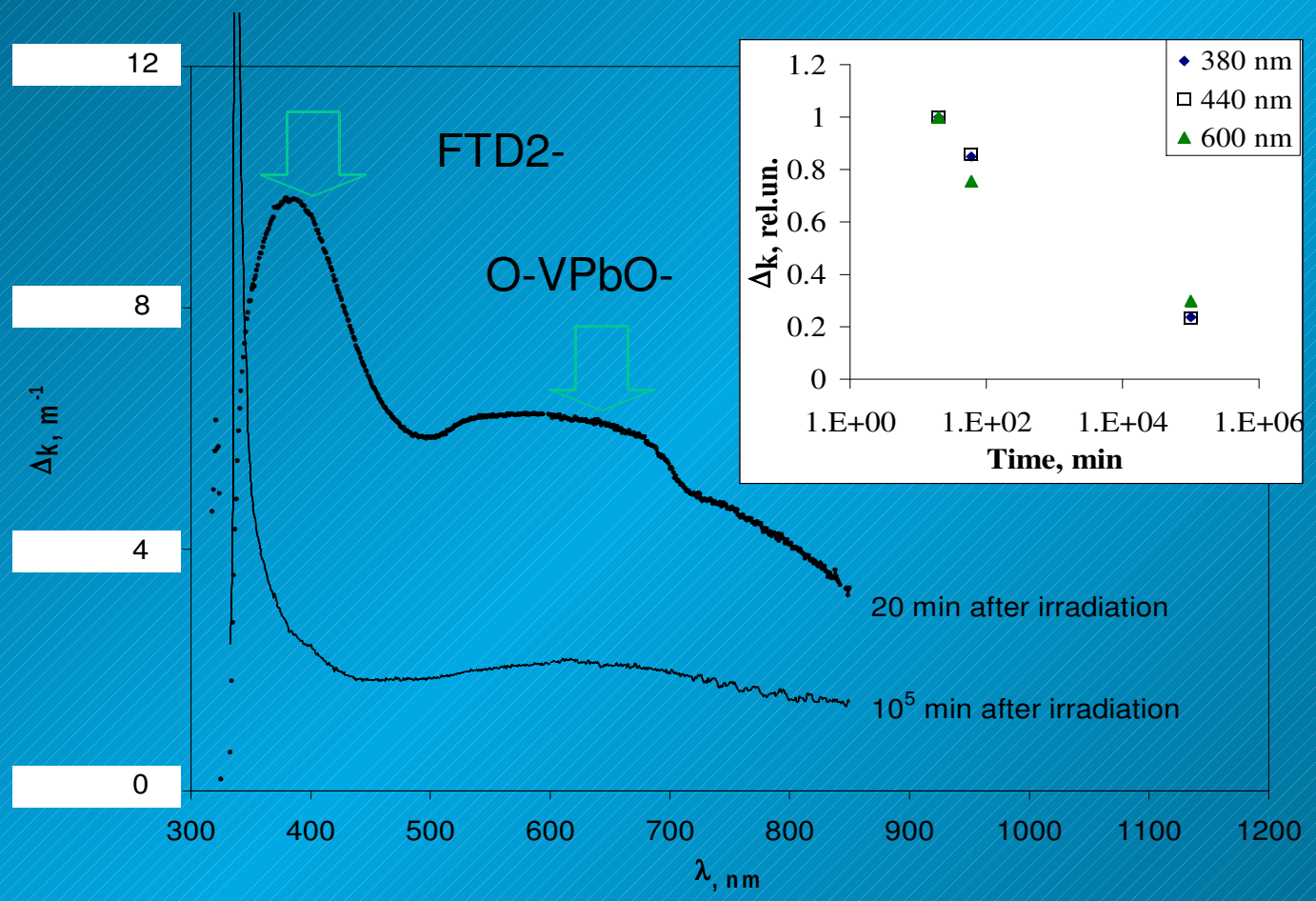


Figure 2.15: Spontaneous recovery for PWO at room temperature. A very fast recovery component gets visible with a constant of 6.3 min.

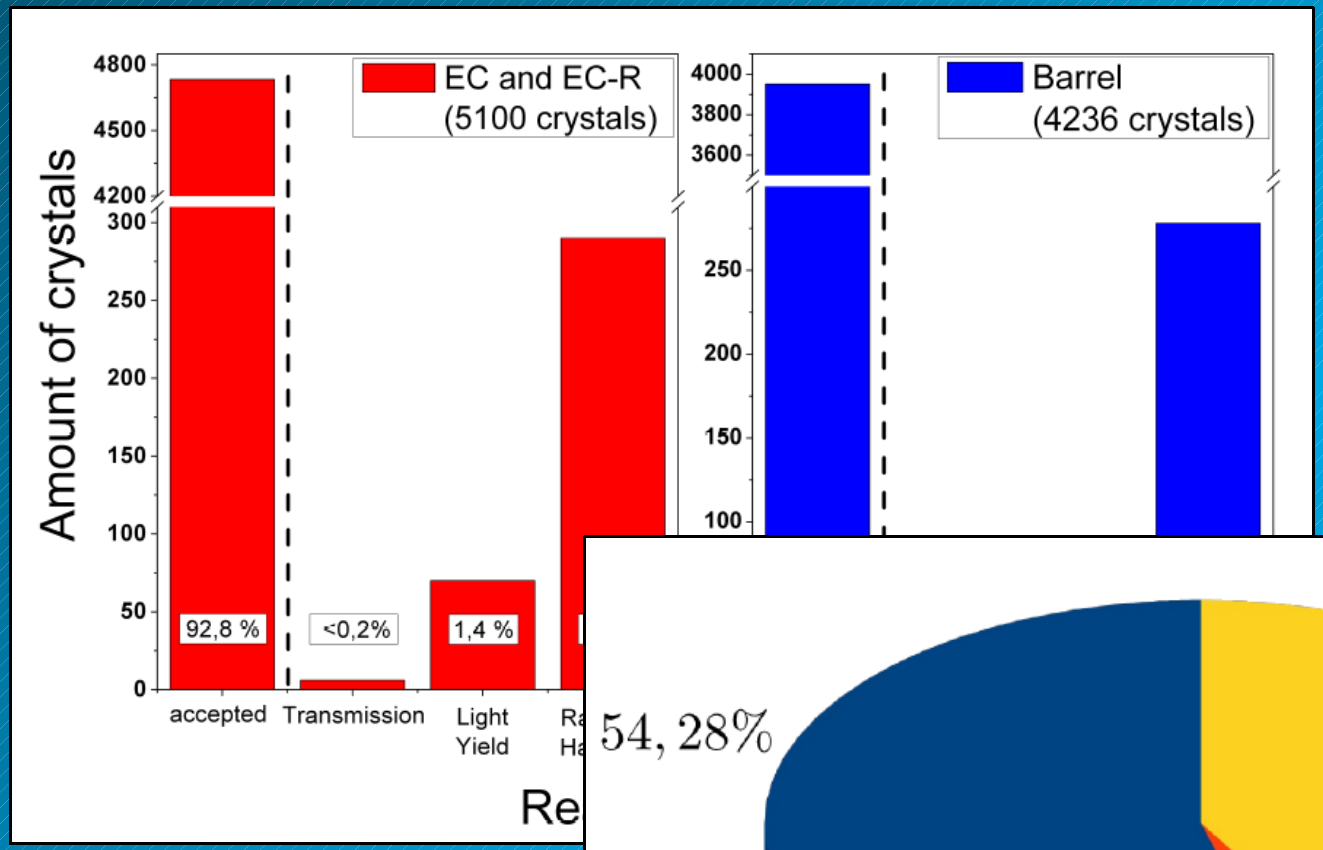
Induced absorption spectra of PWO crystal in early days of PWO-II

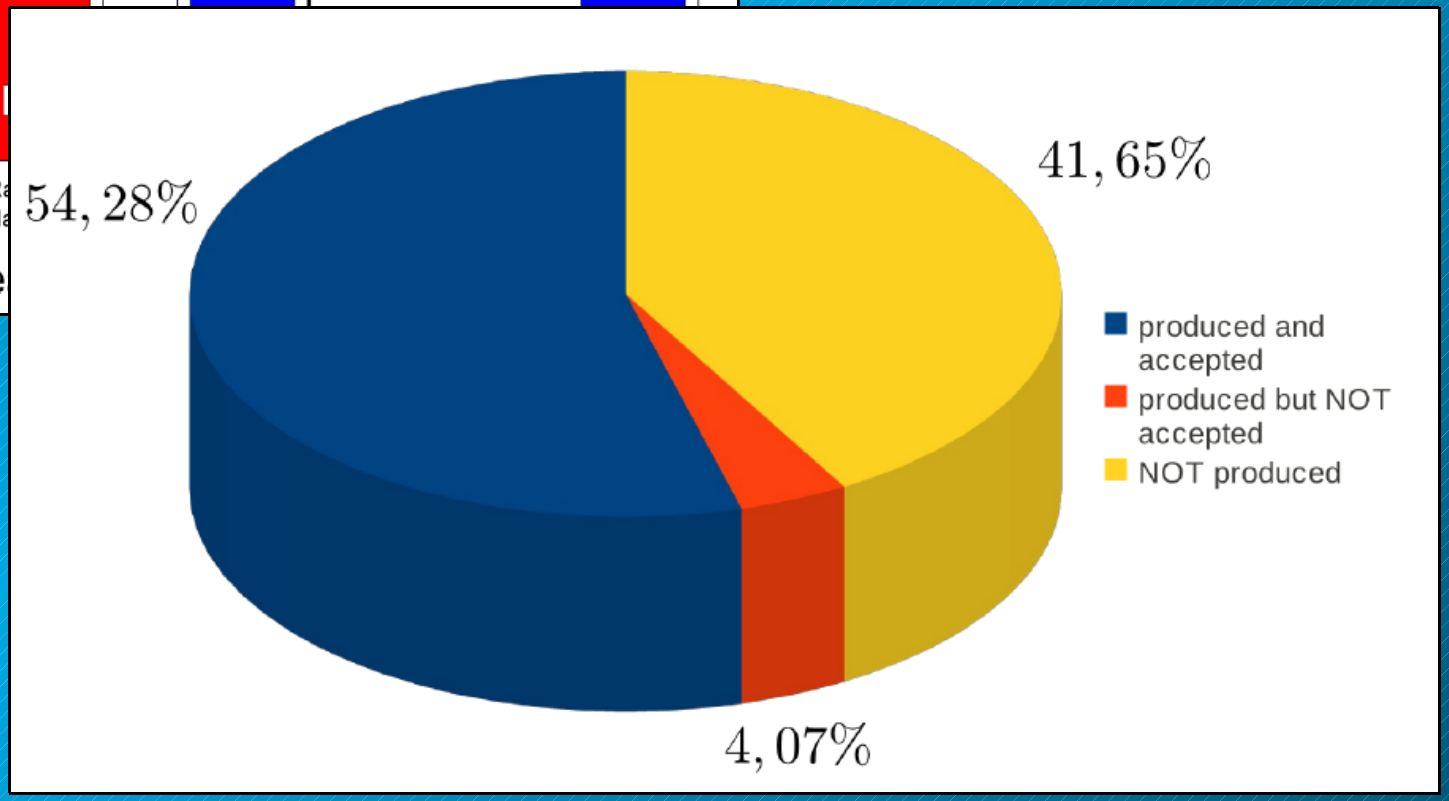
radiation hardness



Typical induced absorption spectra of PWO undoped and uncompensated crystal grown in early days

overall quality

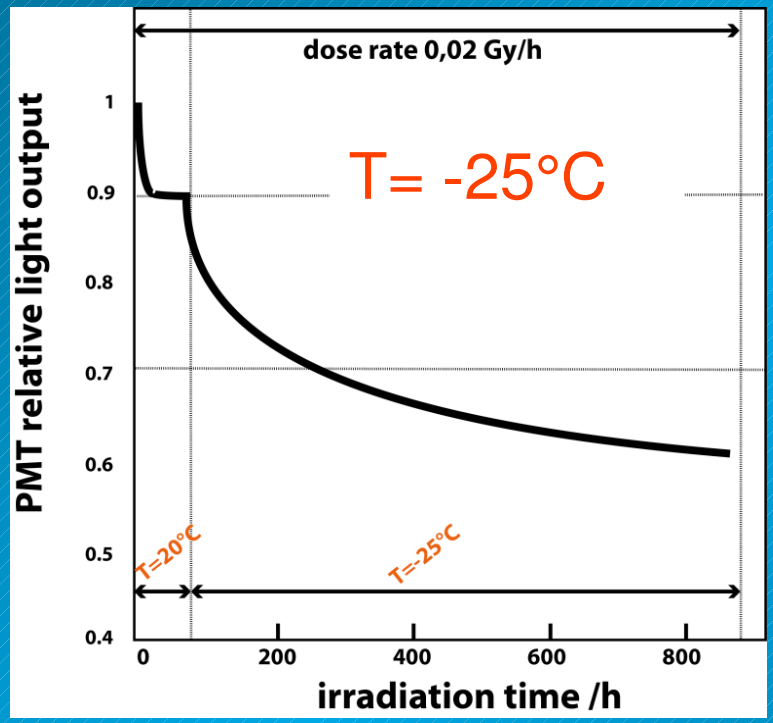


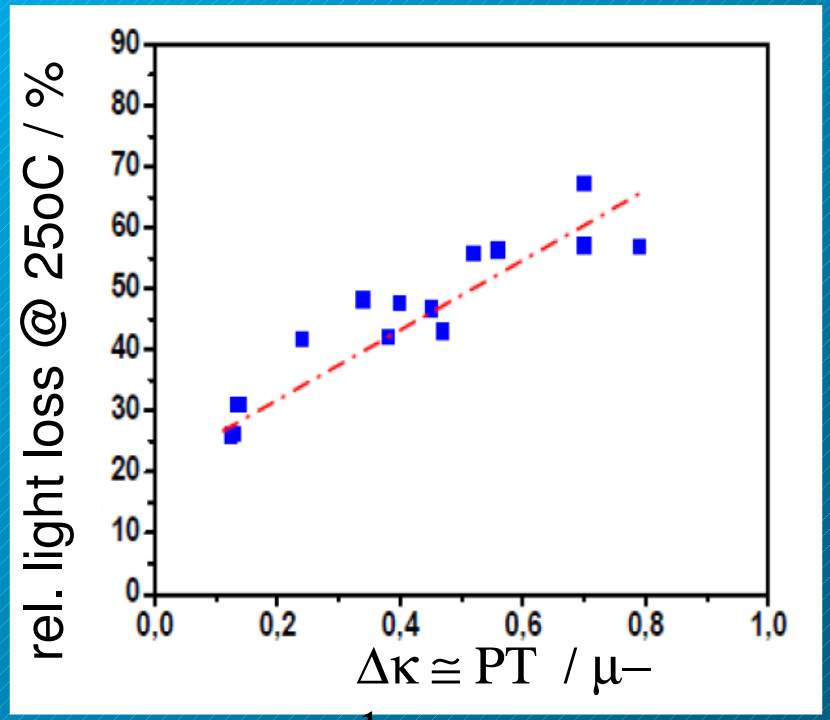


consequences of cooling

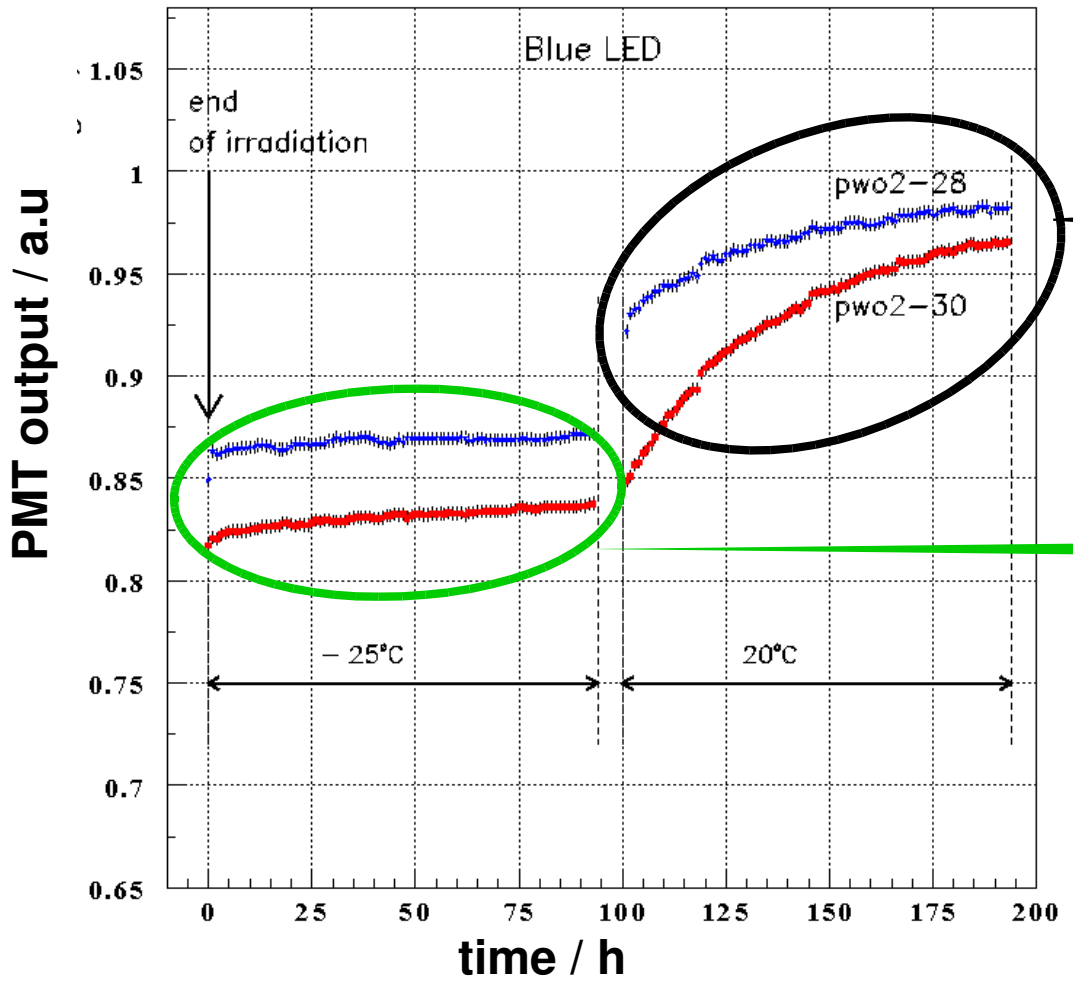
- fast decay kinetics even at T=-25oC: LY(100ns)/LY(1µs) > 0.9
- constant temperature gradient: LY(-25oC)/LY(+18oC) ~ 3.9

- „no“ statistical recovery of radiation damage at T=-25oC
  asymptotic light loss correlated with Δk (@RT)





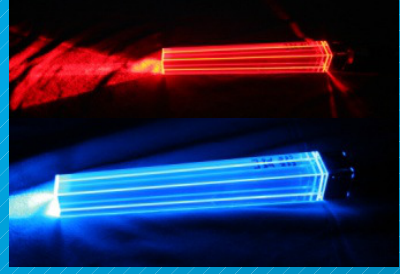
radiation hardness: limitations at T=-25oC

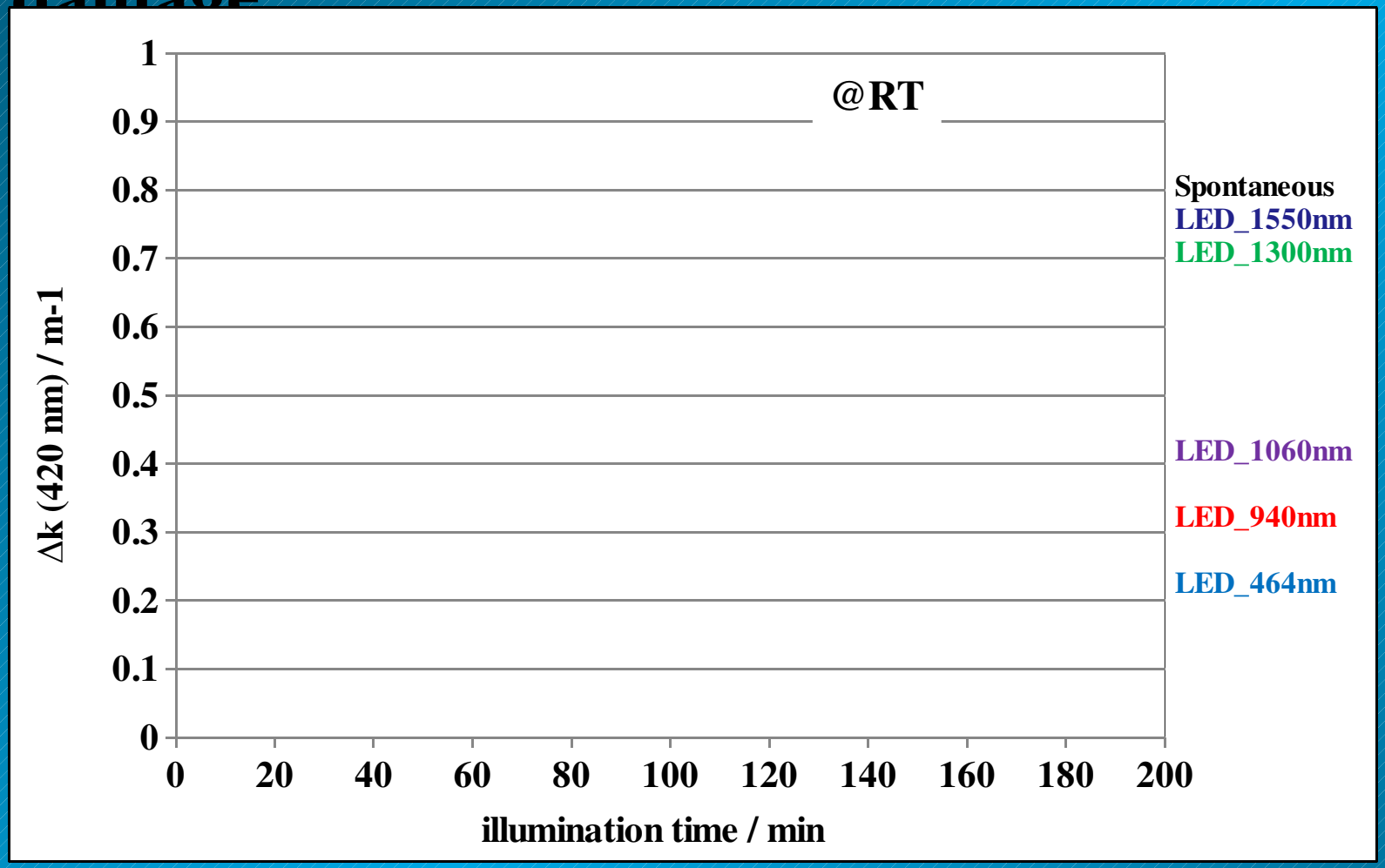


recovery at +20oC

recovery at –25oC

- *stimulated recovery* of radiation damage

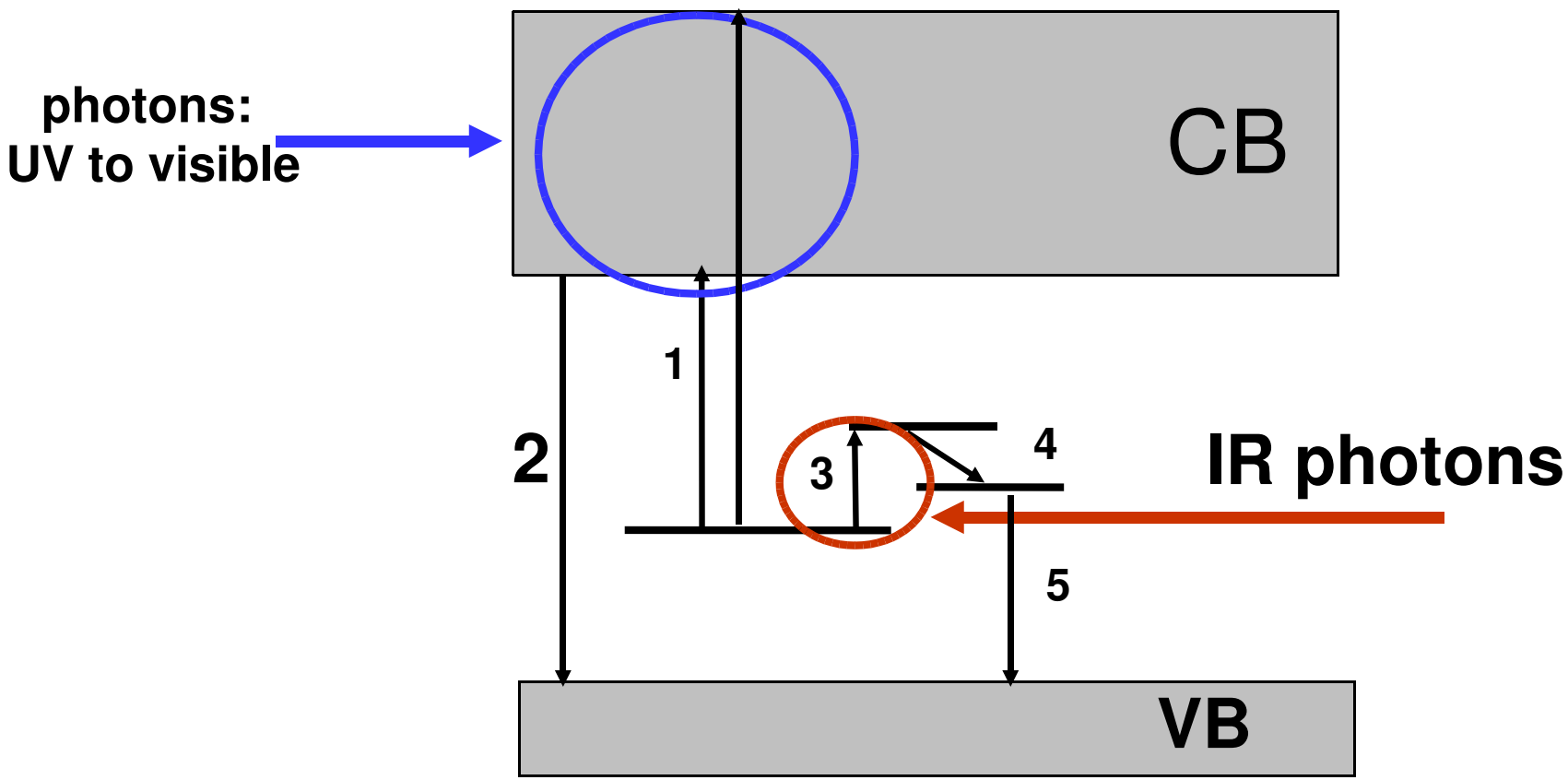




applied integral dose of 60Co: D = 30Gy

V. Dormenev et al., NIM A623 (2010) 1082 - patented

ionization and stimulation processes in PWO



1 ionization of FTDo, **2** radiative/non-radiative recombination,
3 intra-center absorption in FTDo, **4** non-radiative relaxation,
5 radiative/non-radiative recombination of FTDo.