Scintilatorji

lastnosti nekaterih organskih scintilatorjev

ABLE 8-1 Properties of Some Commercially Available Organic Scintillators

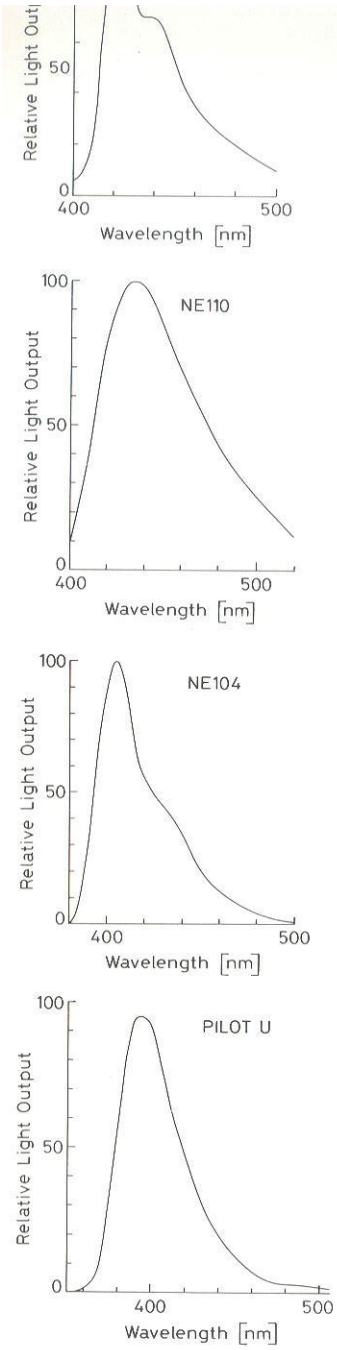
	Scintillator	Type	Density (g/cm³)	Refractive Index	Melting, Softening or Boiling Point (°)	Light Output, % Anthracene[a]	Decay Constant Main Component (ns)	Wavelength of Maximum Emission (nm)	Content of Loading Element (% by wt.)	Number of H Atoms/ Number of C Atoms	Principal Applications[b]
stal	Anthracene	Crystal	1.25	1.62	217	100	30	447		0.715	γ, α, β fast neutrons
	Stilbene	Crystal	1.16	1.626	125	50	4.5	410		0.858	Fast neutrons (PSD), γ, etc.
stic	NE 102	Plastic	1.032	1.581	75	65	2.4	423		1.104	γ, α, β, fast n
	NE 105	Plastic	1.037	1.58	75	46	~ 2.4	423			dosimetry
	NE 110	Plastic	1.032	1.58	75	60	3.3	434		1.104	γ, α, β, fast neutrons, etc.
	NE 111	Plastic	1.032	1.58	75	55	1.7	375		1.096	Ultrafast timing
	NE 113	Plastic	1.032	1.58	75	60	3.3	434		1.108	Solvent bondable
	NE 115	Plastic		1.58		35	225	385			Long decay time
	NE 140	Plastic	1.045	1.58	75	58	~ 2	425	Sn 5%		
	Pilot B	Plastic	1.032	1.58	75	68	1.8	408		1.100	Fast counting
	Pilot F	Plastic	1.032	1.58	75	64	2.1	425		1.104	Fast neutrons, protons, electrons
	Pilot U	Plastic	1.032	1.58	75	67	1.36	391		1.100	Ultrafast timing
	Pilot Y	Plastic	1.032	1.58	75	60	3.1	432		1.102	Fast neutrons, protons, electrons, Large-area applications
uid	NE 213	Liquid	0.874	1.508	141	78	3.7	425		1.213	Fast neutrons (PSD)
	NE 216	Liquid	0.885	1.523	141	78	3.5	425		1.171	α, β (internal counting)
	NE 220	Liquid	1.036	1.442	104	65	3.8	425		1.669	α, β (internal, aqueous sample)
	NE 221	Gel	1.08	1.442	104	55	4	425		1.669	α, β (internal counting)
	NE 224	Liquid	0.877	1.505	169	80	2.6	425		1.330	γ, fast neutrons
	NE 226	Liquid	1.61	1.38	80	20	3.3	430		0	γ, insensitive to neutrons
	NE 228	Liquid	0.735	1.403	99	45		385		2.00	Neutrons
	NE 230	Deuterated liquid	0.945	1.50	81	60	3.0	425	D 14.2%	0.984	(D/C) special applications
	NE 231	Liquid	0.88	1.50	80	58	2.8	425		0.984	Special applications
	NE 232	Deuterated liquid	0.89	1.43	81	60	4	430	D 24.5%	1.96	(D/C) special applications
	NE 233	Liquid	0.874	1.506	117	74	3.7	425		1.118	α, β (internal counting)
	NE 235A (235H)	Liquid	0.858	1.47	350	40 (50)	4	420		2.0	α, fast neutrons, large tanks
	NE 250	Liquid	1.035	1.452	104	50	4	425		1.760	α, β (internal, aqueous sample)
	NE 260	Liquid				40		425			α, β (internal counting)
ded uid	NE 311 (311A)	B(^{10}B) loaded	0.91	1.411	85	65	3.8	425	B 5%	1.701	Neutrons, β
	NE 313	Gd loaded	0.88	1.506	136	62	4.0	425	Gd 0.5%	1.220	Neutrons
	NE 316	Sn loaded	0.93	1.496	148.5	35	4.0	425	Sn 10%	1.411	γ, X-rays
	NE 323	Gd loaded	0.879	1.50	161	60	3.8	425	Gd 0.5%	1.377	Neutrons

(Tl) is 230% on this scale.
represents neutron–gamma pulse shape discrimination.

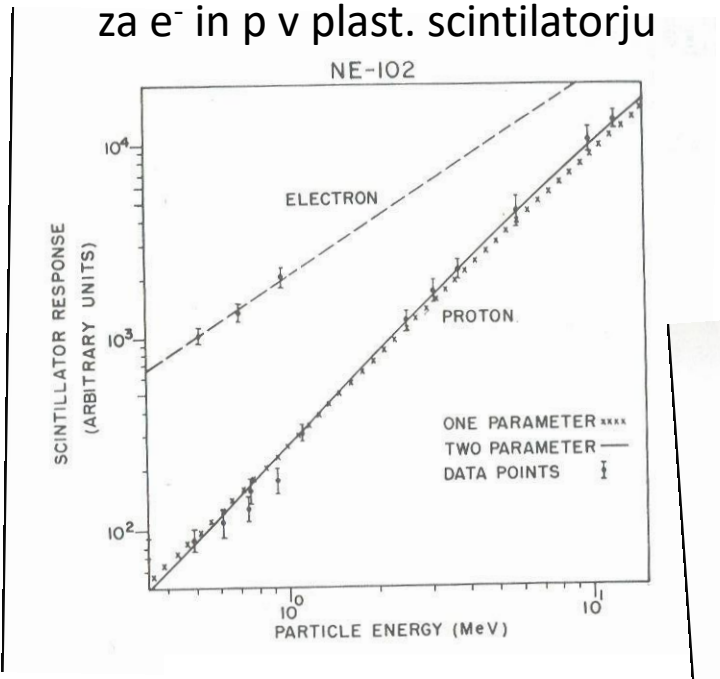
e: Table of Physical Constants of Scintillators, Nuclear Enterprises, Inc.

Scintilatorji

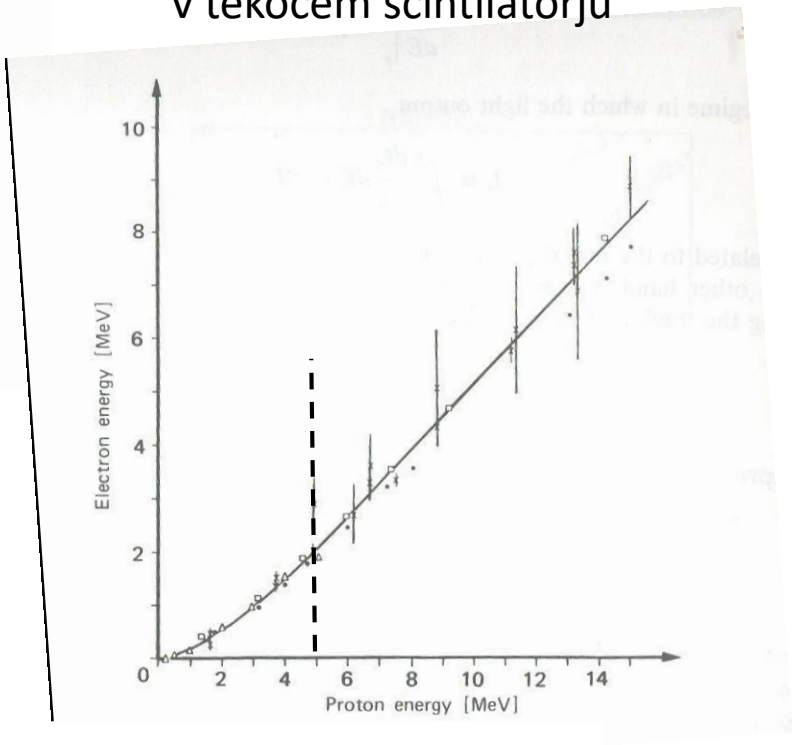
spekter nekaterih plastičnih org. scintilatorjev



primerjava izkoristka za e^- in p v plast. scintilatorju

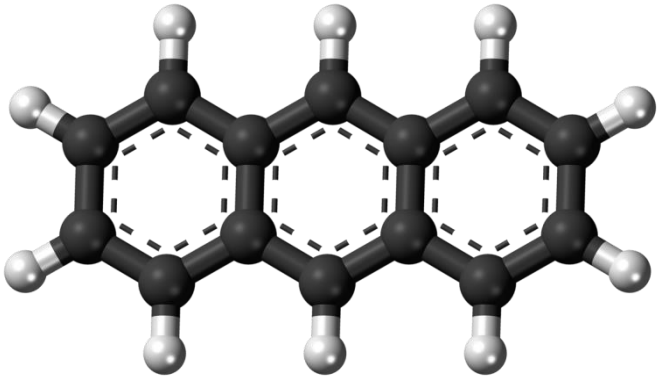


nelinearnost odziva za p v tekočem scintilatorju

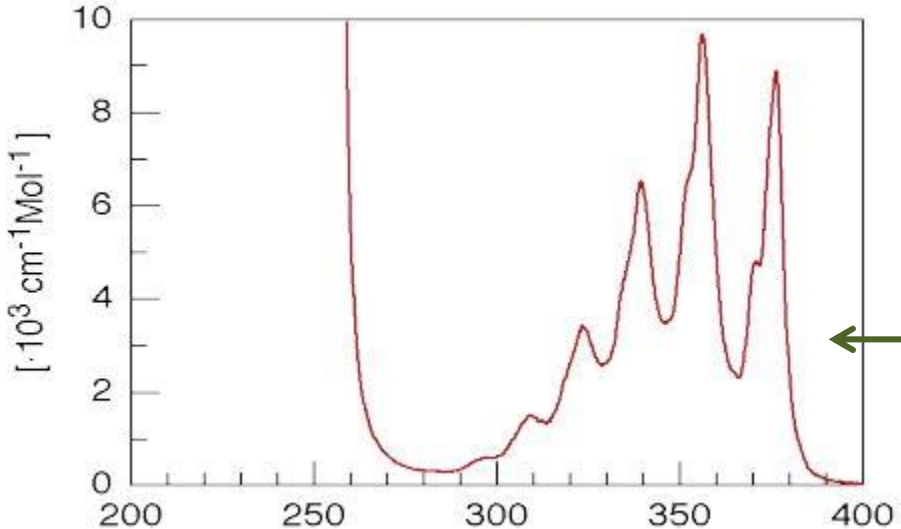


Scintilatorji

antracen ($C_{14}H_{10}$)

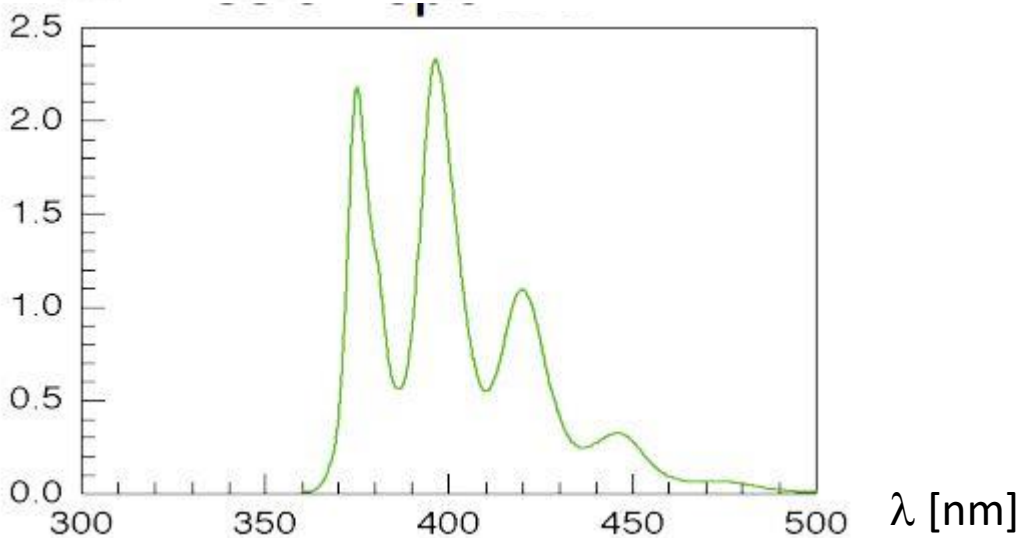


absorpcijski spekter:



vidna svetloba

emisijski spekter:



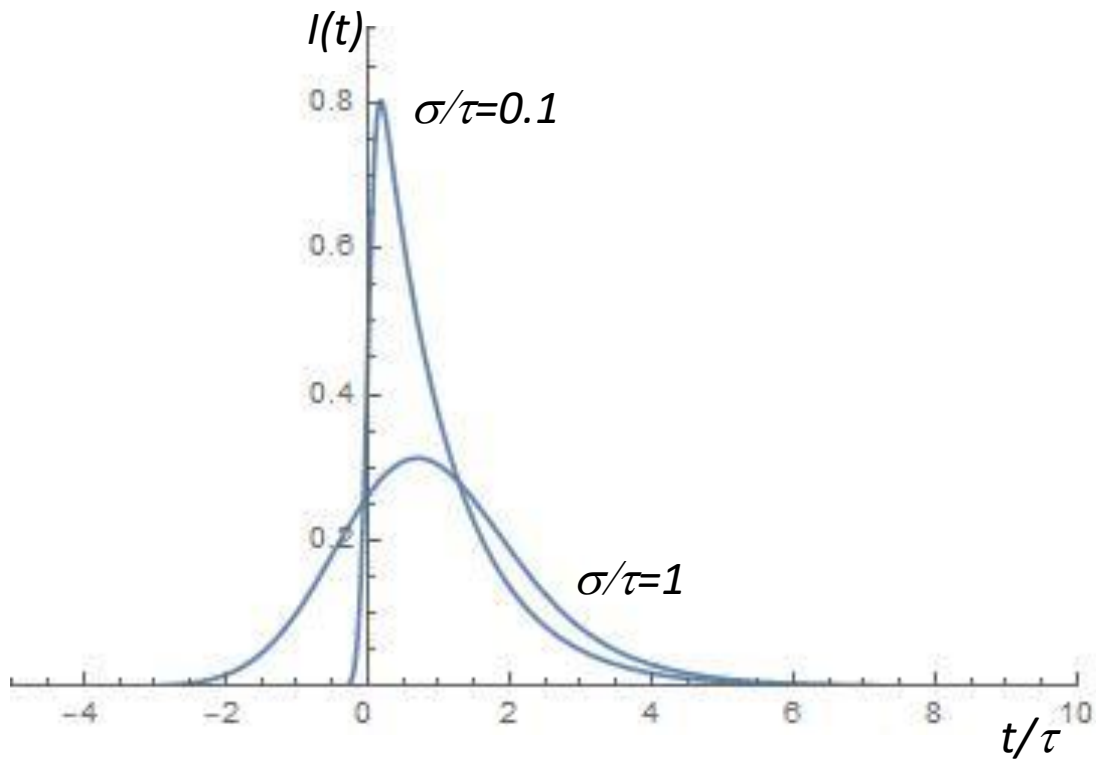
λ [nm]

Scintilatorji

konvolucija eksponentne in Gaussove funkcije

$$I(t) = \left(\frac{1}{\sqrt{2\pi}\sigma} \right) \int_0^\infty e^{-t'/\tau} e^{-(t-t')^2/2\sigma^2} dt'$$

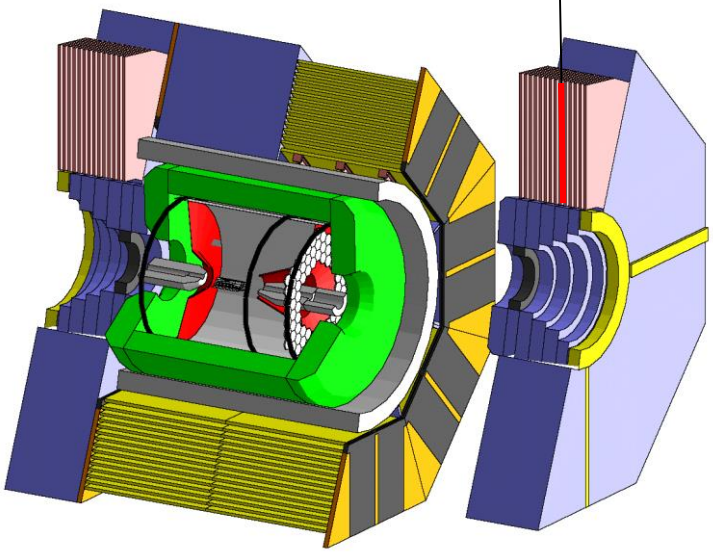
$$I(t) = \frac{1}{2} e^{-(t/\tau - 1/2\,\sigma^2/\tau^2)} \left[1 + erf\left(\frac{t - \sigma^2/\tau}{\sqrt{2}\sigma} \right) \right]$$

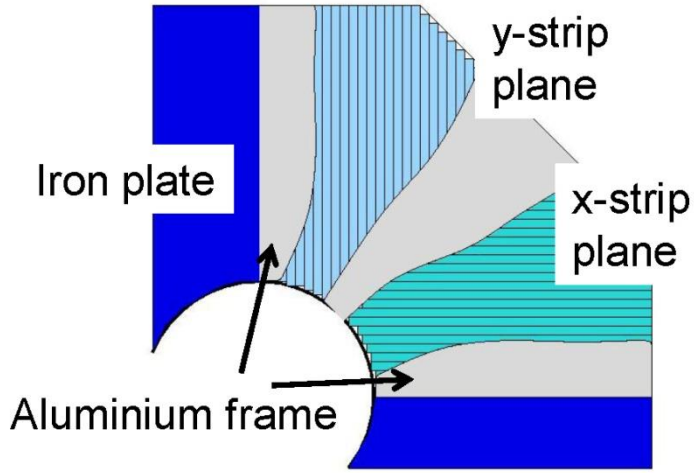


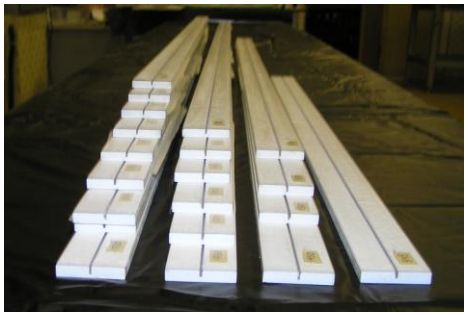
Scintilatorji

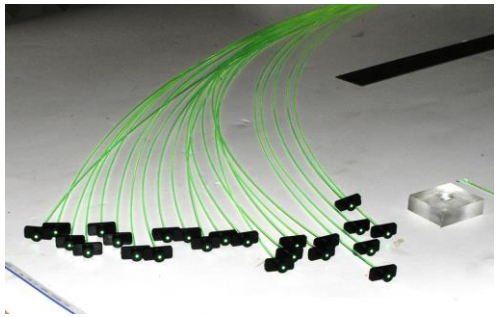
pozicijsko občutljivi

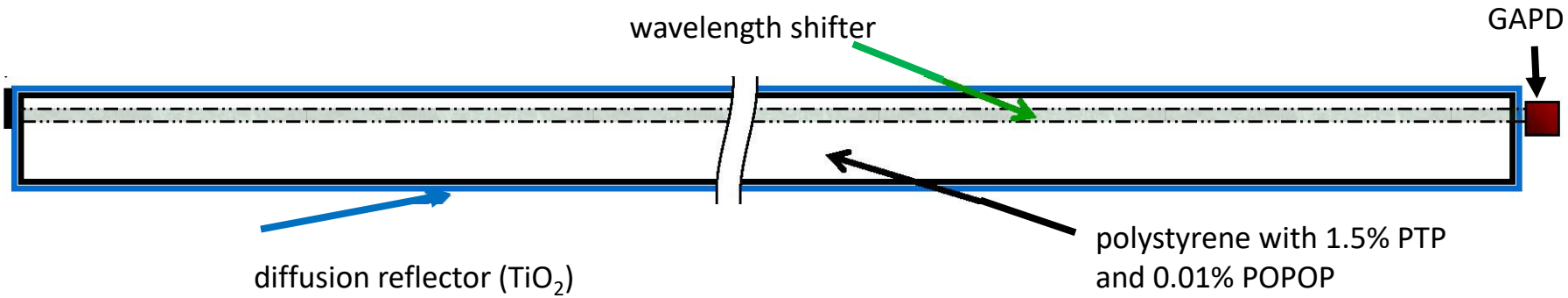
primer: Belle II







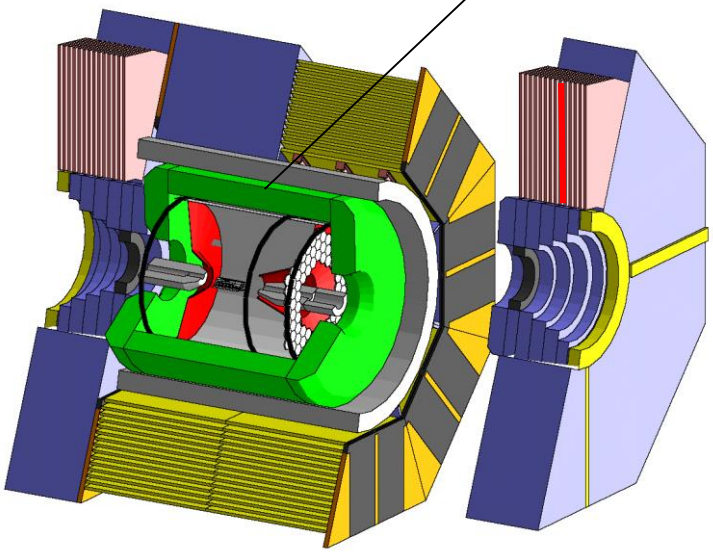


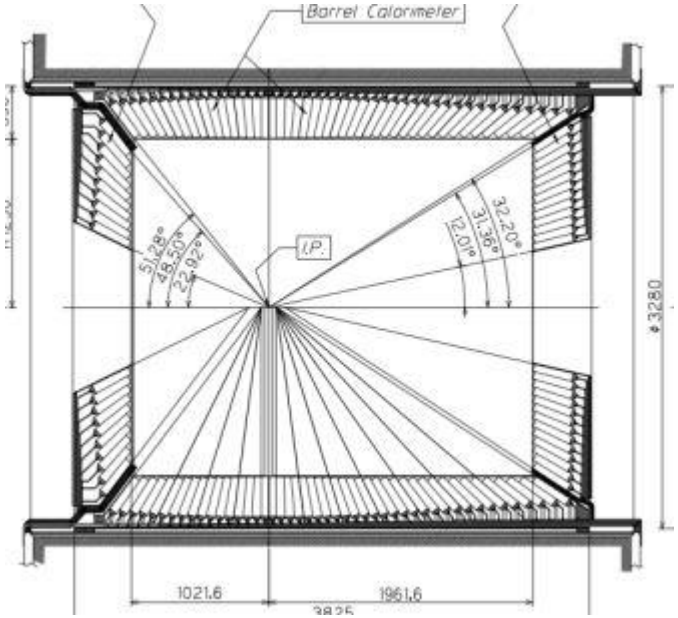


Scintilatorji

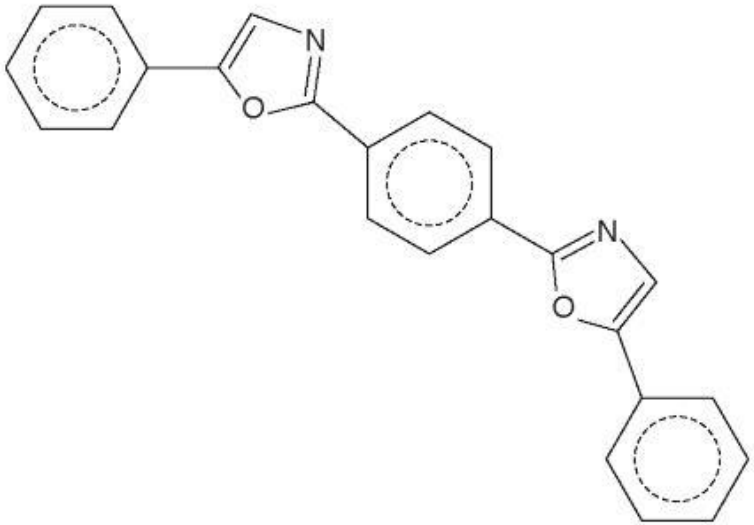
anorganski, CsI(Tl)

primer: Belle (II)



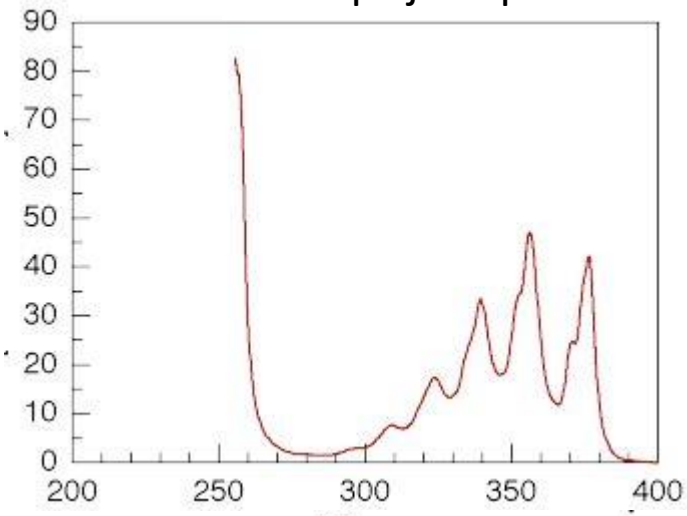


Scintilatorji

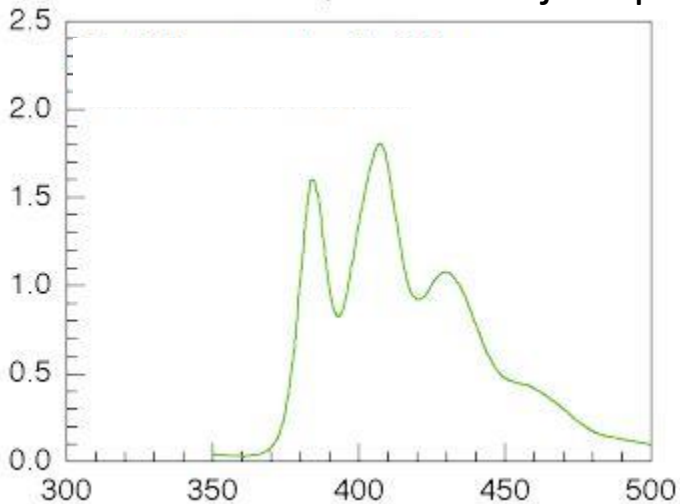


premikalci valovne dolžine (wavelength shifters)
POPOP, $C_{24}H_{16}N_2O_2$

absorpcijski spekter:



emisijski spekter:



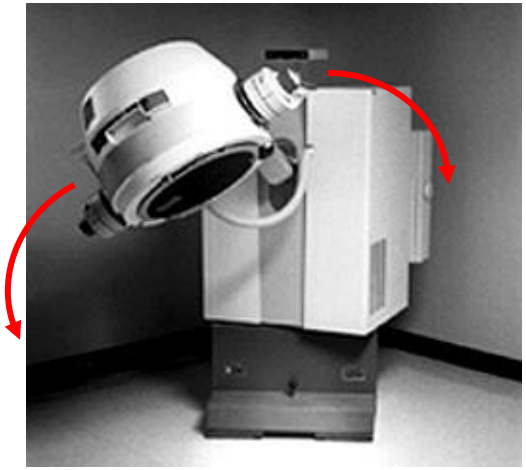
λ [nm]

Scintilatorji

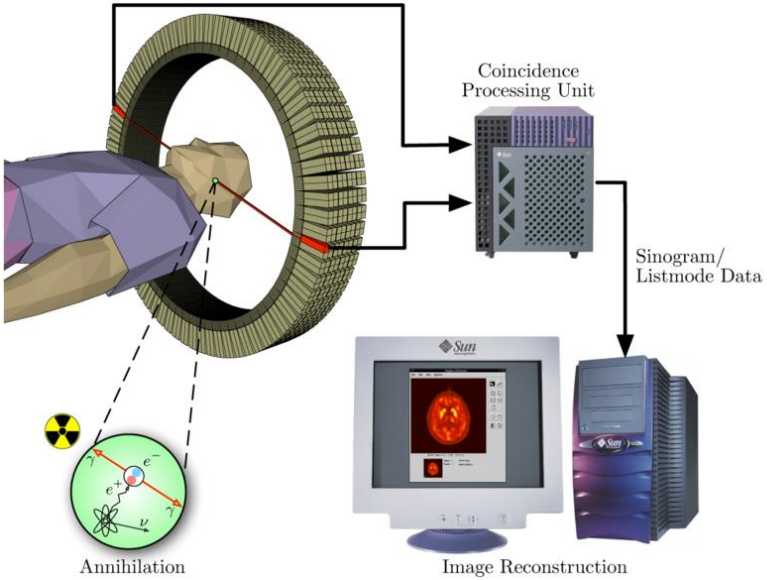
uporaba v medicini

γ kamera - scintigrafija

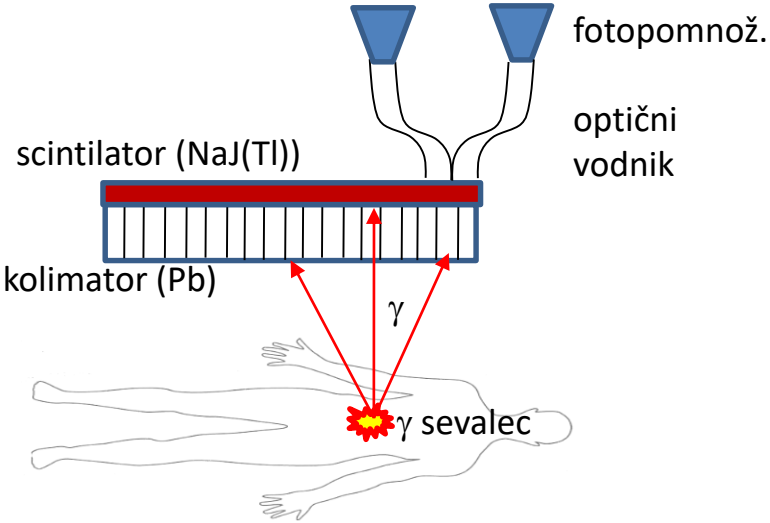
SPECT - Single Photon Emission Computed Tomography



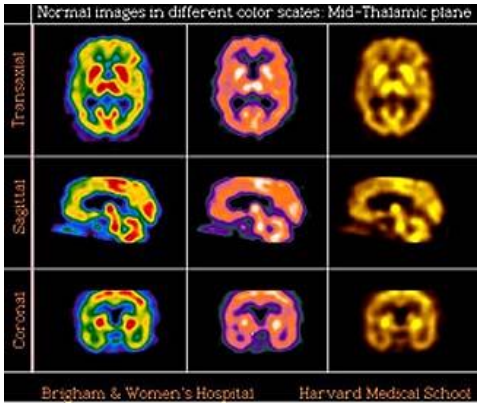
PET – Positron Emission Tomography



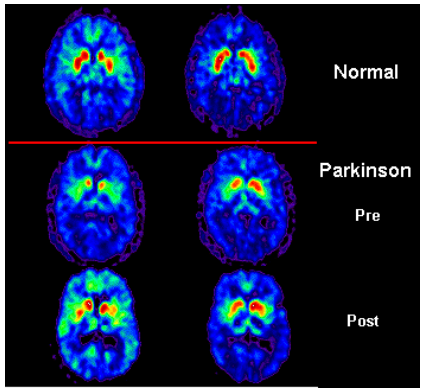
hkratna detekcija dveh fotonov – boljša resolucija



slika SPECT (σ~1,5 cm)



slika PET (σ~0,5 cm)



račun. obdelava: intenziteta →barva