Sipm selection - Comparing Integral Non Linearities

Linearity Computation

$$N_{fired}(M, V, \lambda) = M\left(1 - \exp\left(-\frac{PDE(V, \lambda) \cdot N_{ph}}{M}\right)\right)$$

Nfired : Number of activated cells
Npn : Number of incidents photons
M : Total number of cells
PDE : Photons detection efficiency

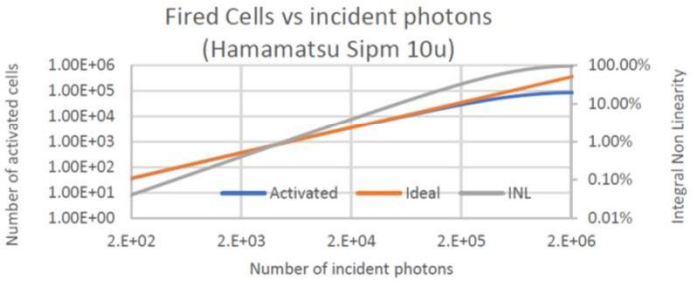
Using the formula shown above,

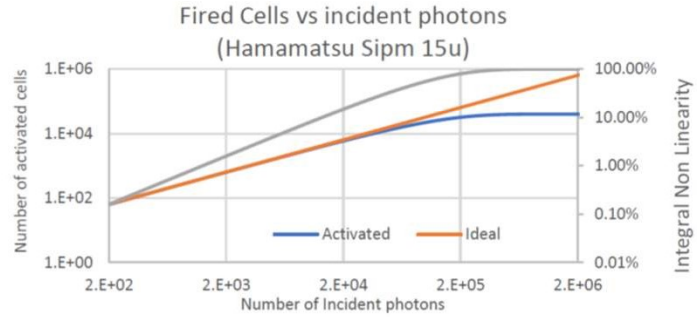
Compute d(Nfired)/d(Nphoton) = PDEactual

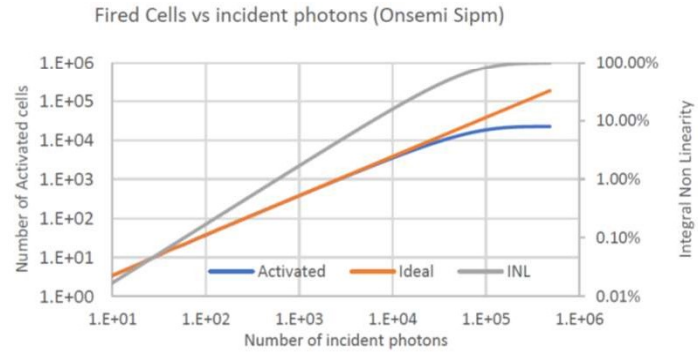
Derive the value of Nph giving PDEactual = 0.99 (INL = 1%)

Find the number of Sipm needed to have NFired expressed as a n bit number matching the ADC resolution

Brand / Make	Resolution required (bits)	PDE	Ntot (M)	Nph (INL= 1%)	Nfired (INL=1%)	Nb of Sipm to Match resolution	Nb of Sipm to Fill crystal face area	fill	active fill
Hamamatsu S14160-3010PS	12	0.18	89984	5024	899	4	16	67%	36.00%
Hamamatsu S14160-3015PS	12	0.32	39984	1255	399	8	16	67%	36.00%
Onsemi 60035	12	0.38	22292	589	222	16	8	75%	73.69%







Sipm selection – Reality check

Reality check for sipm and PWO crystal					
	Hamamatsu S14160-3010 10u	**Onsemi 60035**	**Hamamatsu S14160-3015 15u**		
Incoming Particle energy)	1.50E+10	1.50E+10	1.50E+10	EV	15GeV
Scintillator light yield	15	15	15	ph/Mev	
Scintillator light yield	1.50E-05	1.50E-05	0.000015	ph/ev	
Nph	2.25E+05	2.25E+05	2.25E+05		
Crystal surface area	400	400	400	mm2	Assume everything is reflected on one face
Nflux	563	563	5.63E+02	photons/mm2	
Nb of sipm	16	8	16		Nb of Sipm to Fill crystal face area
SIpm area	9	37	9	mm2	
Nph for one sipm	5063	20725	5063		Nflux * sipm area
Nb of activated sites/sipm	907	6635	1588		Use formula above
INL	0.18%	10.69%	1.26%		**May need to investigate larger pitch S14160-3015**
Grand total	14506	53078	25402		
Resolution	14	16	15		Bits