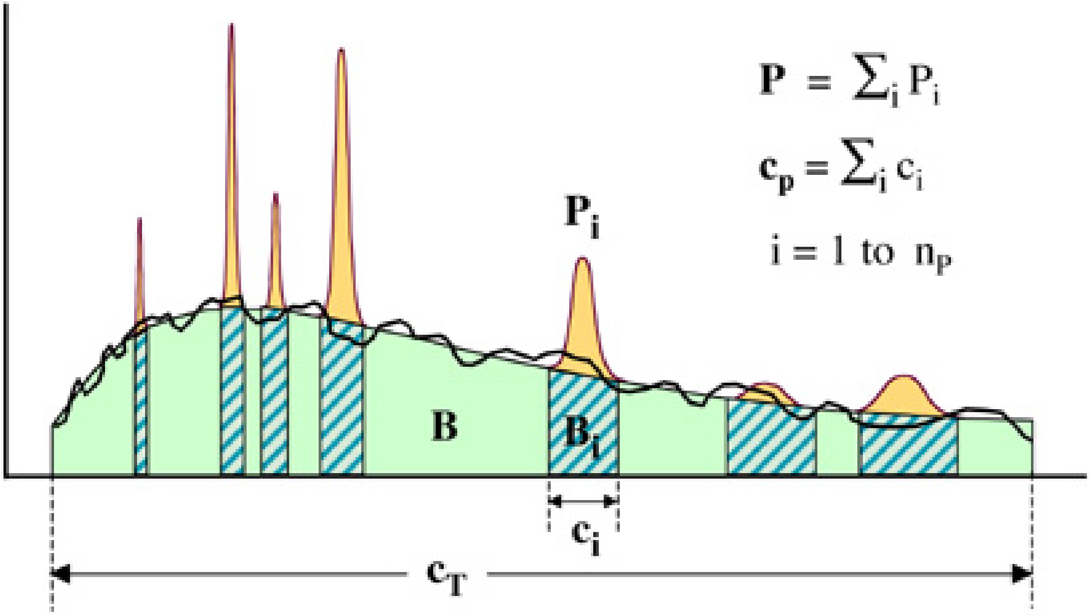
SPECTRUM QUALITY

P. Spolaore



$\mathbf{P} = \sum_i P_i$

$\mathbf{c_p} = \sum_i c_i$

$i = 1$ to n_P

The peak area must be large compared to the background fluctuations:

$$P_i > \sqrt{B_i}$$

For the "average peak": $P_{av} = P / n_P$, $B_{av} = (B / c_T) \times (c_P / n_P)$

The spectrum quality is measured by:

$$Q = \frac{P_{av}}{\sqrt{B_{av}}} = \left(\frac{P}{B} \times \frac{P}{n_P} \times \frac{c_T}{c_P} \right)^{1/2}$$

With ε = efficiency, N = total peak area for $\varepsilon = 1$, $\Rightarrow$ $\mathbf{P = N \cdot \varepsilon}$:

$$Q = \left(\underbrace{\frac{P}{B}}_{P/B = 1/\{[1/(P/T)]-1\}} \times \overbrace{\varepsilon}^{\text{Efficiency}} \times \frac{\overset{\text{Statistics}}{N}}{\underset{\text{=Multiplicity}}{n_P}} \times \underbrace{\frac{c_T}{c_P}}_{\text{=Resolution}} \right)^{1/2}$$

Q is a measure of the "sensitivity"

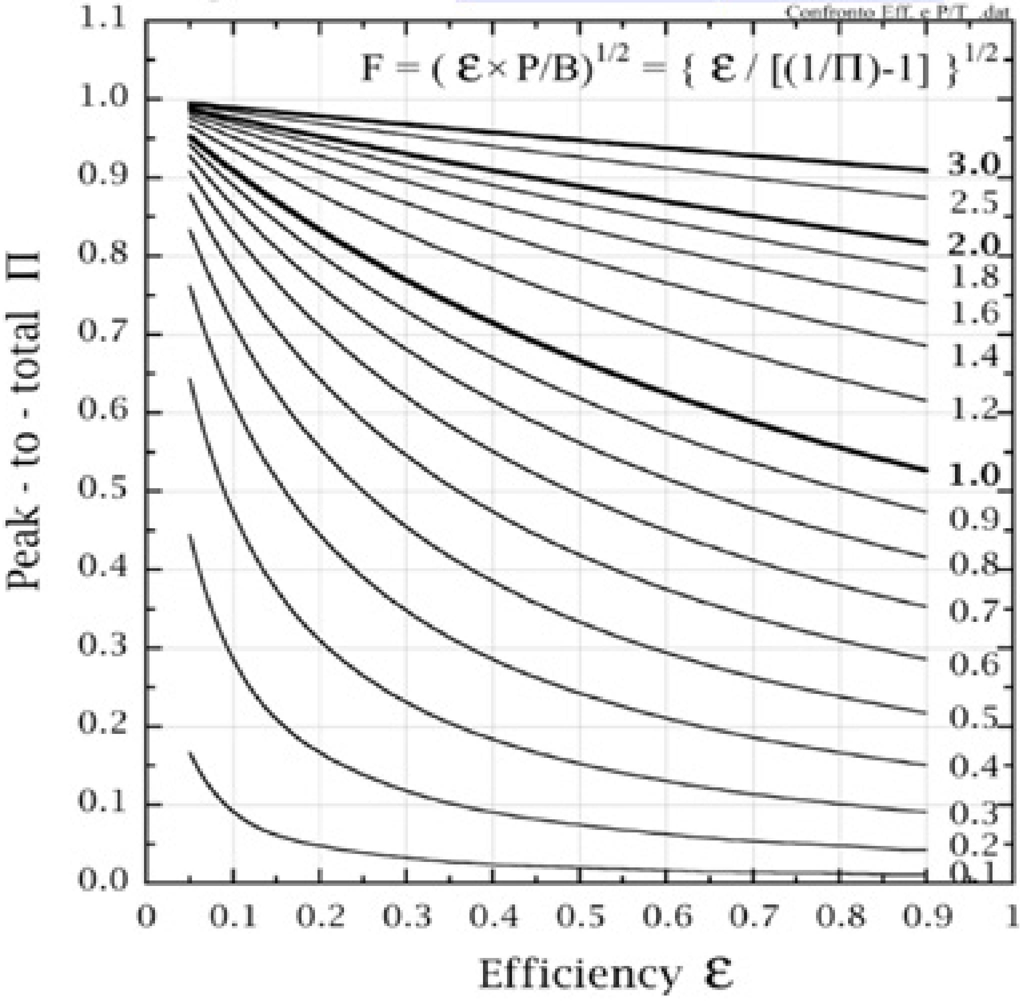
of the method/apparatus that produced the spectrum.

Q = 1 corresponds to the **visibility limit**: $P_{av} = \sqrt{B_{av}}$

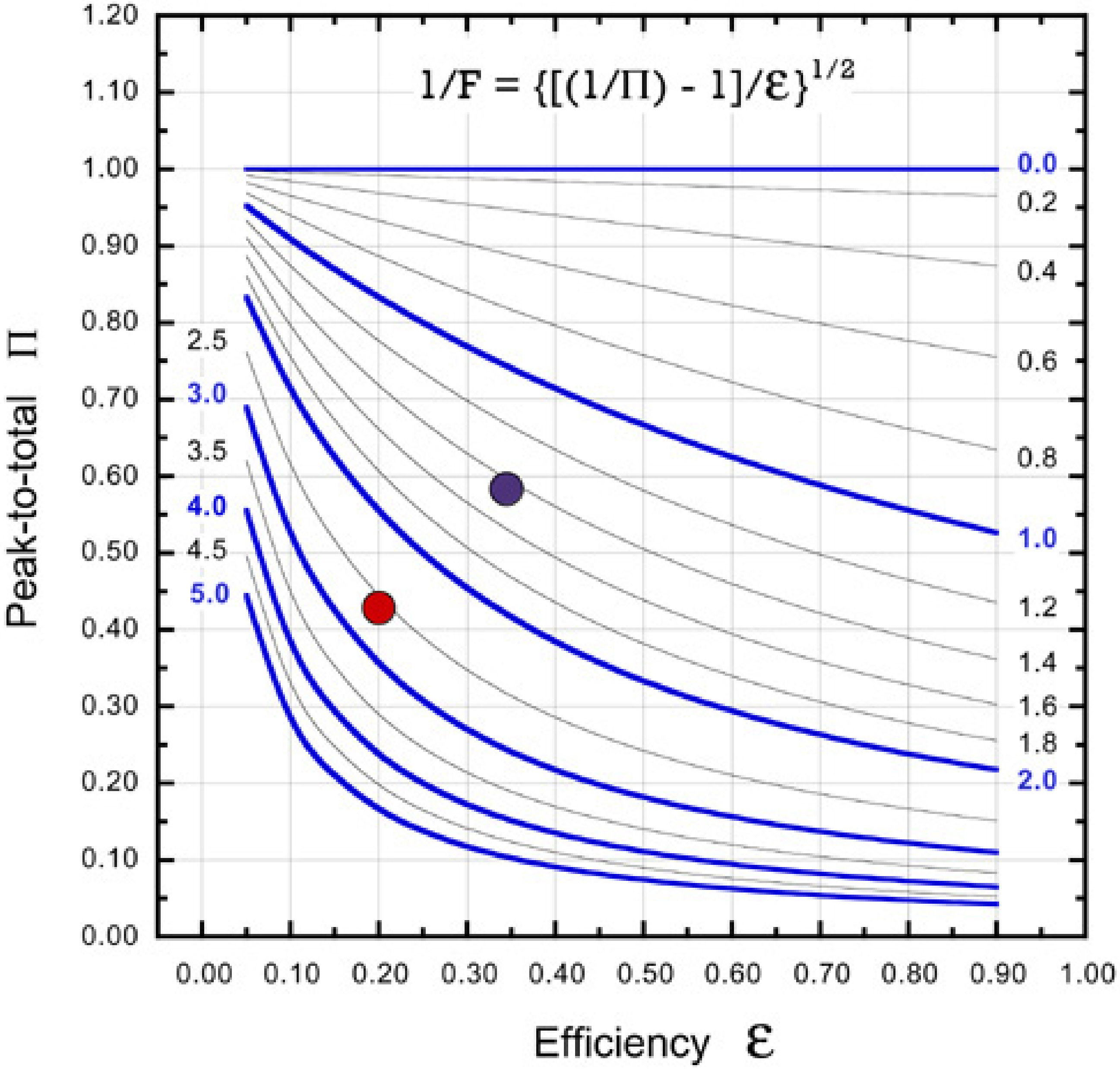
The quality of various gamma spectra with **similar statistics, multiplicity and resolution** can be compared by the quantity:

$$F = (\varepsilon \times P/B)^{1/2} = \left(\varepsilon \times \frac{1}{\frac{1}{P/T} - 1} \right)^{1/2}$$

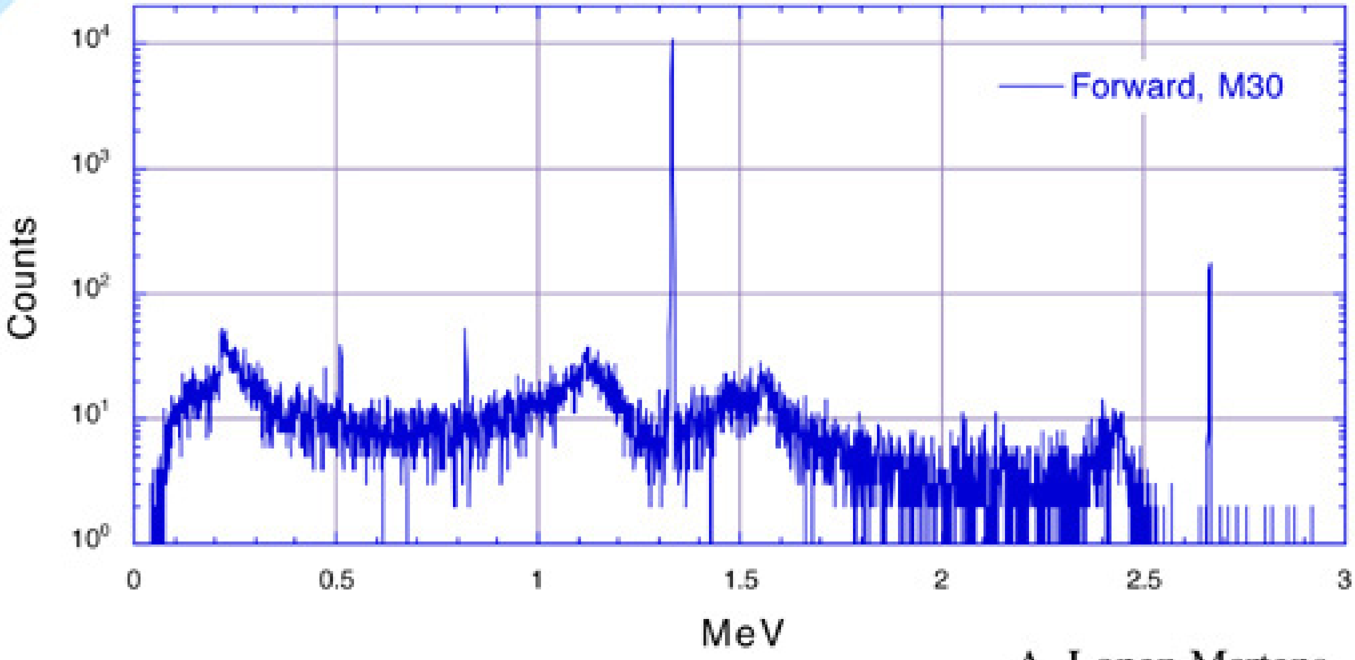
Figure. Curves of constant F in the plane: P/T vs ε



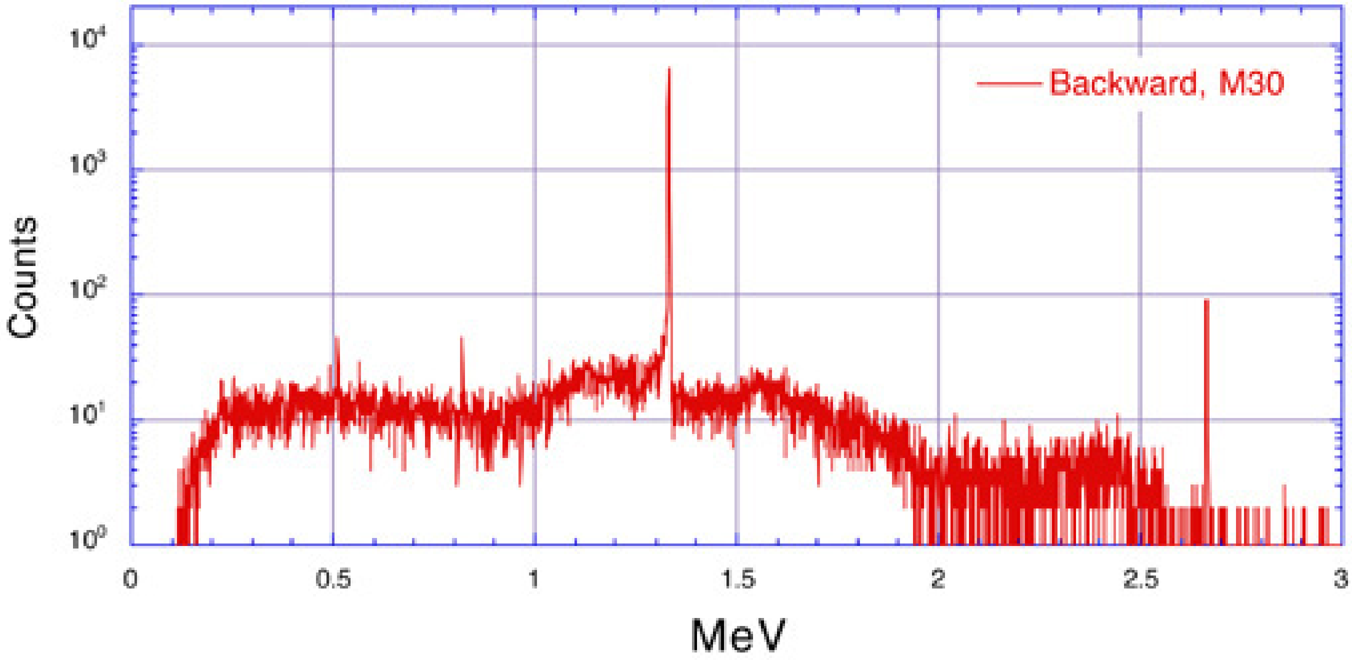
$$1/F = \left(\frac{\frac{1}{P/T} - 1}{\varepsilon} \right)^{1/2}$$



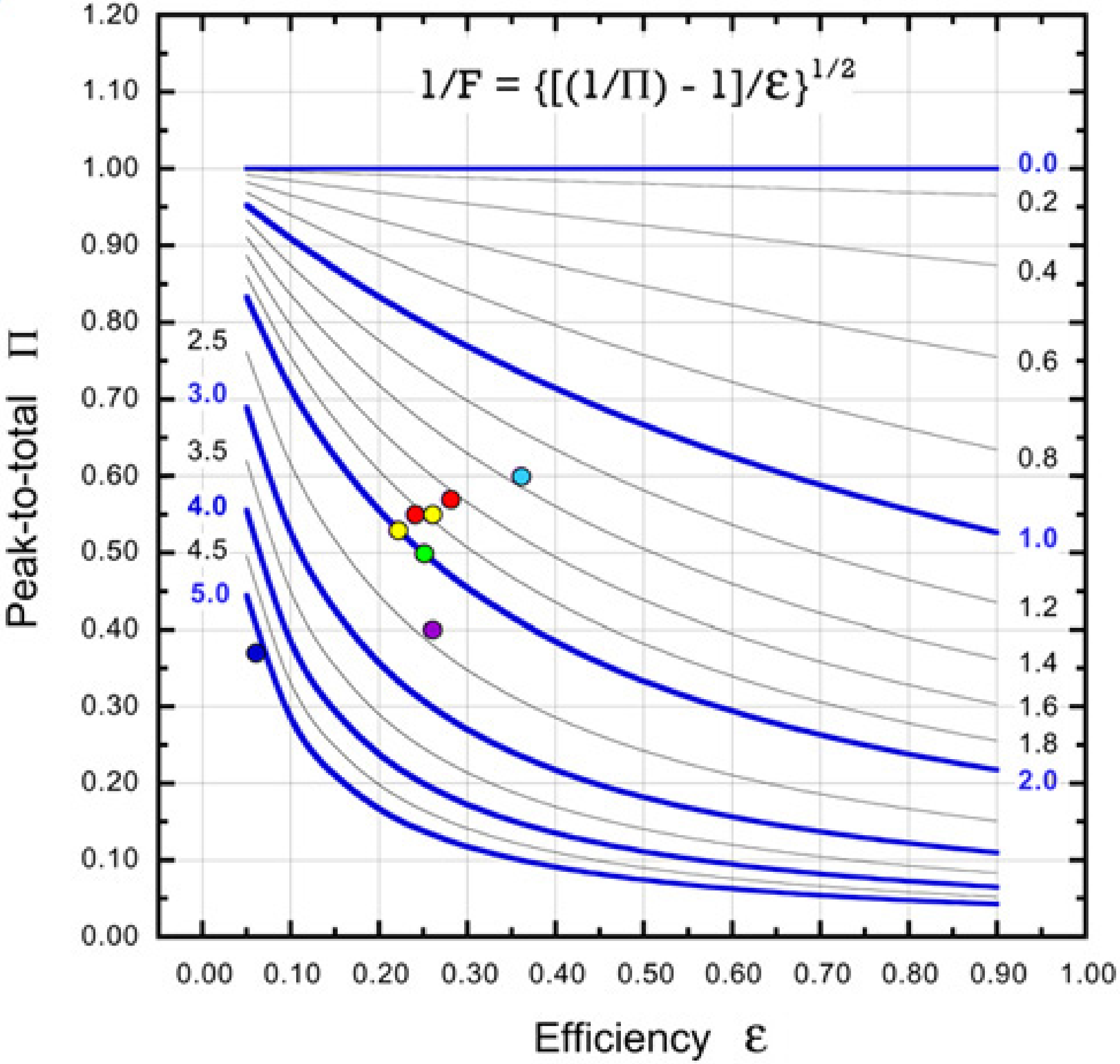
F. Camera



A. Lopez-Martens



	M	ε	P/T	F	Q	1/F	1/Q
Forward	10	0.45	0.67	0.95	4392	1.05	$2.3 \cdot 10^{-4}$
Forward	**30**	**0.34**	**0.58**	**0.69**	**3469**	**1.44**	$2.9 \cdot 10^{-4}$
Backward	10	0.25	0.55	0.55	2553	1.81	$3.9 \cdot 10^{-4}$
Backward	**30**	**0.20**	**0.43**	**0.39**	**1953**	**2.56**	$5.1 \cdot 10^{-4}$



Detector	M	Eff.	P/T	1/F
Ideal shell	30	0.36	0.60	1.36
A180	30	0.28	0.57	1.64
A120C4	30	0.26	0.55	1.77
A180S	30	0.24	0.55	1.85
AGATA specs	30	0.25	0.50	2.00
A120	30	0.22	0.53	2.01
A120G	30	0.22	0.53	2.01
Planar	30	0.26	0.40	2.40
EB	30	0.06	0.37	5.33