and from the condition of $\partial H/\partial C_k = 0$, we have

$$\Delta C_k = \frac{\sum_{ij}(-C_k - F_{ij} - O_{i-l_k,j-m_k} + A^k_{ij})p(i-l_k)q(j-m_k)}{\sum_{ij} p(i-l_k)q(j-m_k)} \qquad (7)$$

For the determination of O_{ij}, we optimize the functional

$$H = \sum_k \sum_{ij} (C_k + O_{ij} + F_{i+l_k,j+m_k} - A^k_{i+l_k,j+m_k})^2 p(i+l_k)q(j+m_k) \qquad (8)$$

with respect ot O_{ij} and find the formal solution

$$\Delta O_{ij} = \frac{\sum_k(-C_k - O_{ij} - F_{i+l_k,j+m_k} + A^k_{i+l_k,j+m_k})p(i+l_k)q(j+m_k)}{\sum_k p(i+l_k)q(j+m_k)}. \qquad (9)$$

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When the same object o_{ij} (i=0,..,n_x-1, j=0,.., n_y-1) is imaged several times with different relative offsets, it is possible to determine the gaintable of the observing system, f_{ij}, as a function of detector pixel coordinates, i and j. The k-th observed image a^k_{ij} may be expressed as follows:

$$a^k_{ij} = c_k o_{i-l_k, j-m_k} f_{ij}. \tag{1}$$

Here l_k and m_k are the offsets of the a^k_{ij} determined with respect to o_{ij}. The parameter f_{ij} is the detector gain pattern, which is assumed to be constant over time, and the parameter c_k represents the detector-postion independent overall gain change. The logarithmic form of the above equation is

$$A^k_{ij} = C_k + O_{i-l_k, j-m_k} + F_{ij}. \tag{2}$$

where the capital letters represent the logarithmics of the corresponding variables. The problem is then defined as follows: "Determine C_k, F_{ij}, and O_{ij} when A^k_{ij} are given. "

The formal solutions for C_k and F_{ij} can be found by optimizing the functional

$$H = \sum_k \sum_{ij} (C_k + O_{i-l_k, j-m_k} + F_{ij} - A^k_{ij})^2 p(i-l_k) q(j-m_k). \tag{3}$$

Note that the two functions p and q are introduced to deal with the boundary effects, and are defined as

$$p(i) = \begin{cases} 1 & : \quad 0 \le i \le n_x - 1 \\ 0 & : \quad \text{otherwise} \end{cases} \tag{4}$$

and

$$q(j) = \begin{cases} 1 & : \quad 0 \le j \le n_y - 1 \\ 0 & : \quad \text{otherwise} \end{cases} \tag{5}$$

From the condition of $\partial H / \partial F_{ij} = 0$, we have the formulae for iterative solution

$$\Delta F_{ij} = \frac{\sum_k (-C_k - O_{i-l_k, j-m_k} - F_{ij} + A^k_{ij}) p(i-l_k) q(j-m_k)}{\sum_k p(i-l_k) q(j-m_k)} \tag{6}$$