Calibration of the PSPMT (LJU diary 8)

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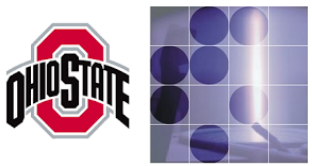

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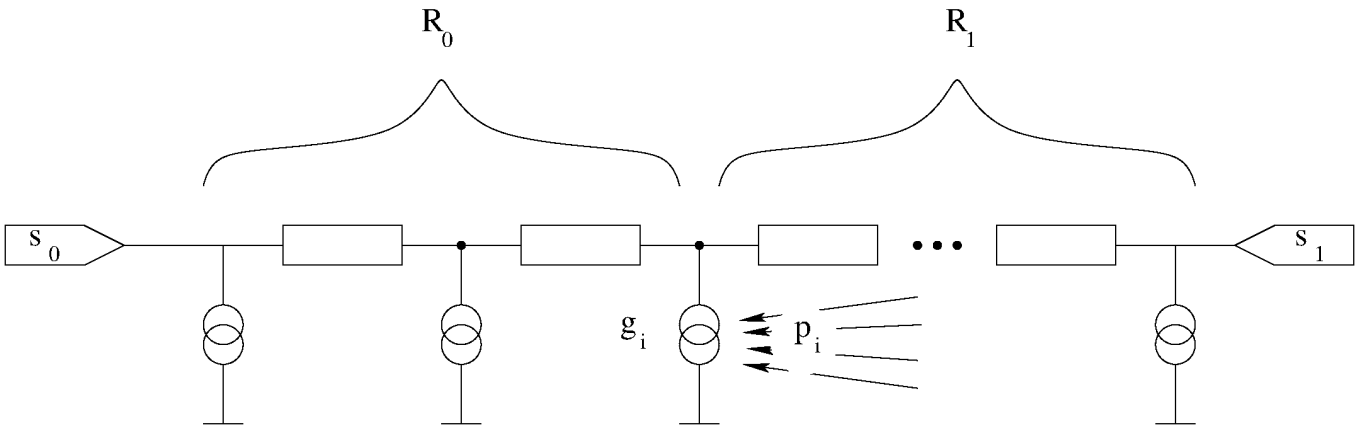
LYSO module study

/mnt/hrpet1/data1/pet/test/20171214/ants2Flood/run0/root

LYSO position decoding



- Light p_i incident on tube i out of N tubes with gain g_i connected through resistor chain to outputs s_0 and s_1, i numbering from 0 at s_0 to $N-1$ at s_1
- For a single hit in i-th PSPMT, we get

$$s_0 = (1-\alpha_i)g_i p_i \qquad s_1 = \alpha_i g_i p_i$$

where α_i is the ratio of resistivity

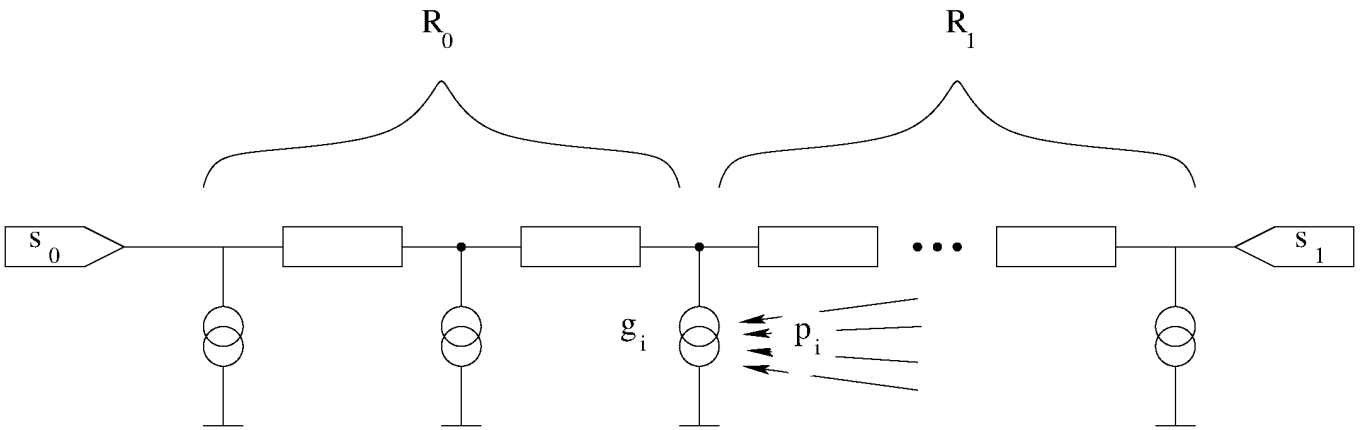
$$\alpha_i = \frac{R_0}{R_1 + R_0} = i/(N-1)$$

- In actual events, more than 1 PMT is hit, hence

$$s_0 = \sum_i (1-\alpha_i) g_i p_i \qquad s_1 = \sum_i \alpha_i g_i p_i$$

- Asymmetry in expresions prevents from absorbing g_i in resistor values. Equivalently - cannot separate low energy event in high gain tube from high energy event in low gain tube.

LYSO position decoding



- Convert to linear algebra by writing:

$$G = \text{diag}\{g_i\}$$

$$\mathbf{e} = \text{ones}(\text{size}(\mathbf{p}))$$

$$\mathbf{p} = \{p_i\} \quad , \quad \boldsymbol{\alpha} = \{\alpha_i\}$$

- Coordinate in Anger's algebra:

$$x = \frac{s_1 - s_0}{s_1 + s_0} = \frac{(\mathbf{e} - 2\boldsymbol{\alpha})^T G\mathbf{p}}{\mathbf{e}^T G\mathbf{p}}$$