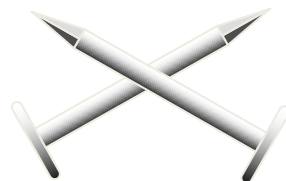


# WHITE NAIL

## *A Software-Defined Radio/Cognitive Radio Air-Interface Innovation (Equations)*

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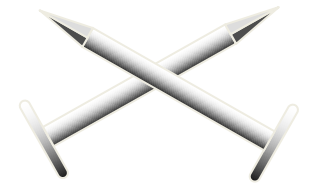
**November 30, 2011**



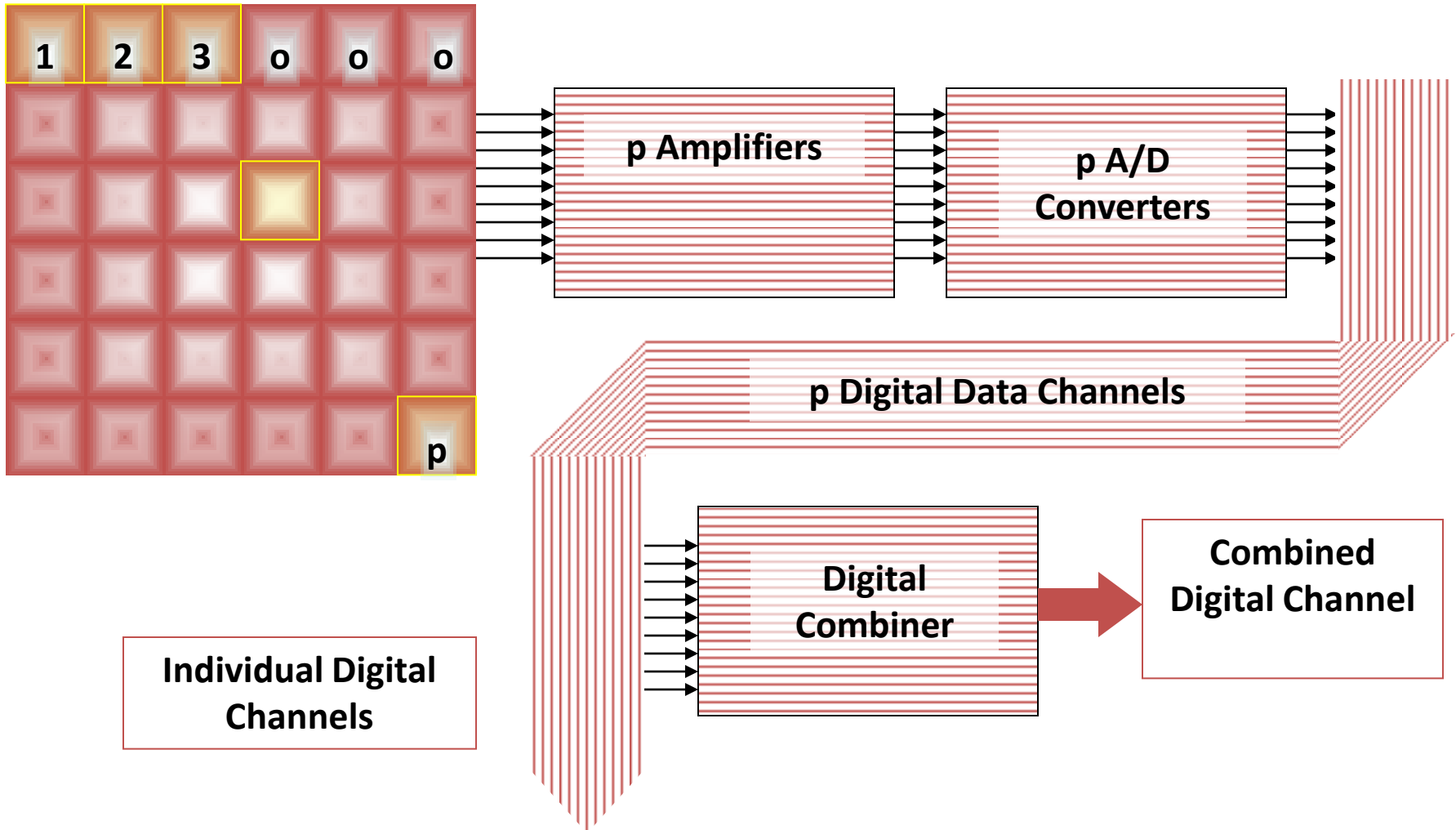
Dr. Donald H. Steinbrecher  
Donald.steinbrecher@navy.mil<#>

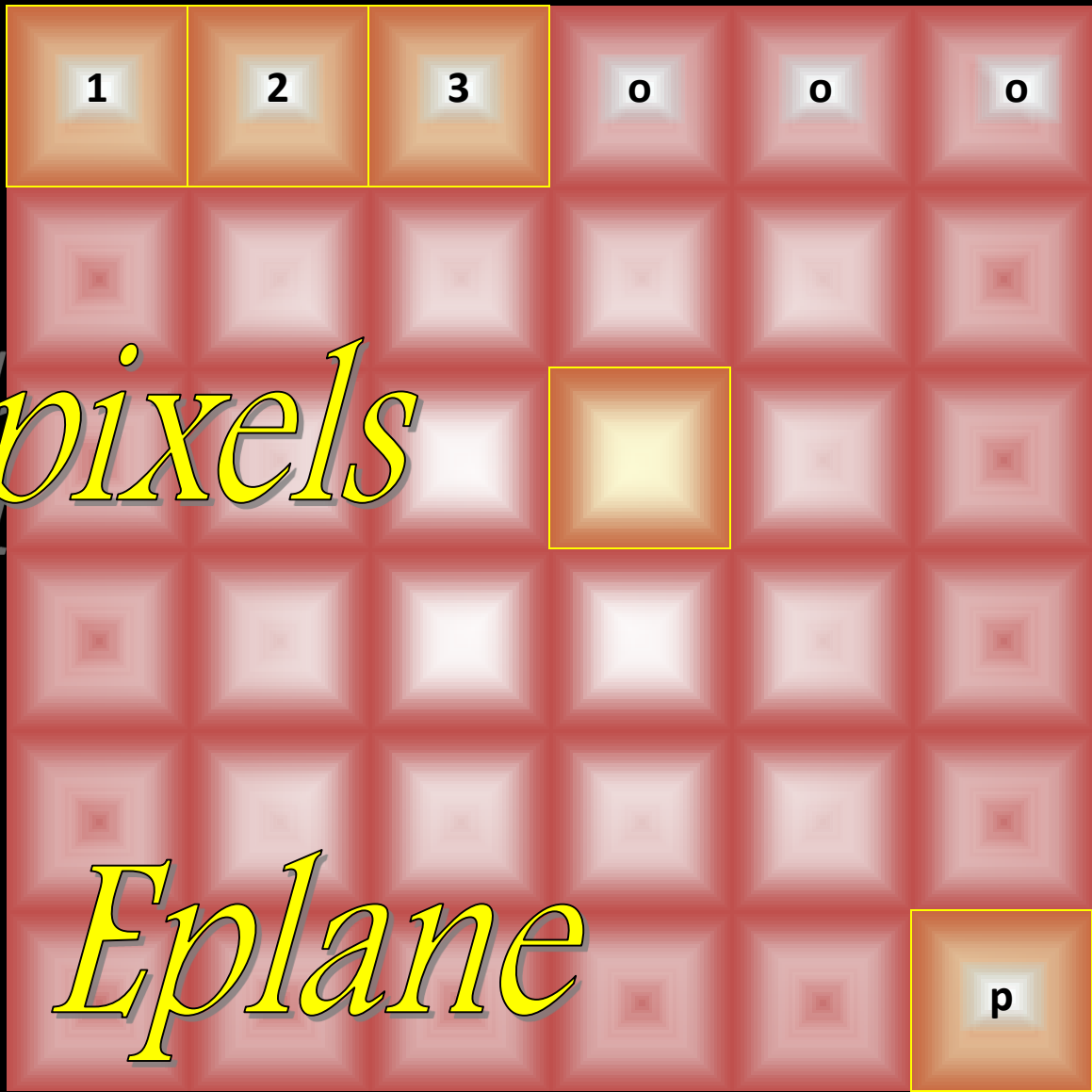
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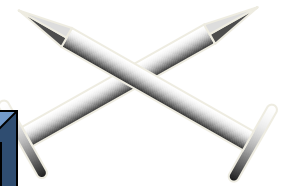




# p-Channel Software Defined Signals Acquisition System





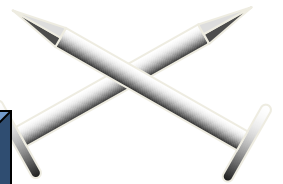


***..a fundamental limit is revealed:***

$$p \geq \frac{A_{MDS}}{A_{XIS}} = \frac{W_{XIS}}{W_{MDS}} \frac{U_{ADC} B_d}{1 - \frac{kT_0 B_d}{P_{MDS}}}$$

***..which can be expanded :***

$$p \geq \frac{W_{XIS}}{W_{MDS}} \frac{B_d}{f_N} \left[ \frac{2}{3} 2^{-2N} \right] \frac{F_{SYS}}{F_{SYS} - 1}$$

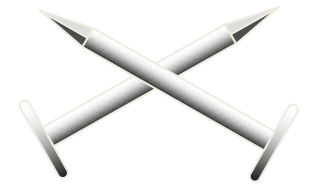


***..a small-signal effective aperture  
(Eplane) is defined:***

$$A_{Eplane} \geq \frac{kT_0 F_{GSYS} B_d}{W_{MDS}}$$

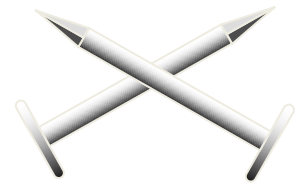
***..and a BIG signal effective aperture  
(Epixel) is defined:***

$$A_{Epixel} \leq \frac{kT_0 \left( F_{GSYS} - 1 \right)}{W_{XIS} U_{ADC}}$$



***Finally, the required  
preamplifier gain is:***

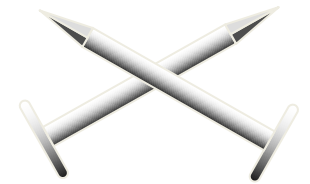
$$G_A \geq \frac{2}{3} 2^{-2N} \frac{B_d}{f_N} \frac{P_{FSAO}}{P_{MDS} - kT_0 B_d}$$



## Defining the system parameter 'p'

$$p = \frac{A_{\text{Minimum Detectable Signal}}}{A_{\text{Maximum Interfering Signal}}}$$

$$p \geq \frac{P_{\text{MDS}}(\text{system})}{P_{\text{XIS}}(\text{system})} \frac{W_{\text{XIS}}}{W_{\text{MDS}}}$$



***The system signal dynamic range Fundamental Limit is:***

$$\frac{P_{XIS}(\text{system})}{P_{MDS}(\text{system})} = \frac{f_N}{B_d} \left[ \frac{3}{2} 2^{2N} \right] \frac{F_{SYS} - 1}{F_{SYS}}$$