

Read Noise impact on # exposures needed for SNR Goal

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Goals, Method

- Determine # exposures needed to stack to attain an arbitrary SNR for a given read noise and signal level
- Use noise equation to solve analytically
- Plot results for specific values

Equations

$$\textit{Noise} = \sqrt{\textit{Signal} + \textit{ReadNoise}^2} \quad (1)$$

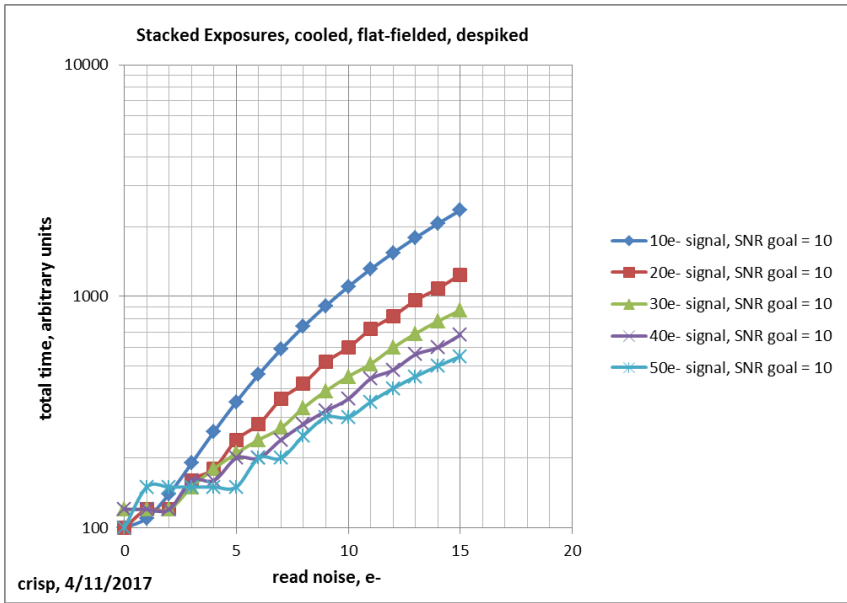
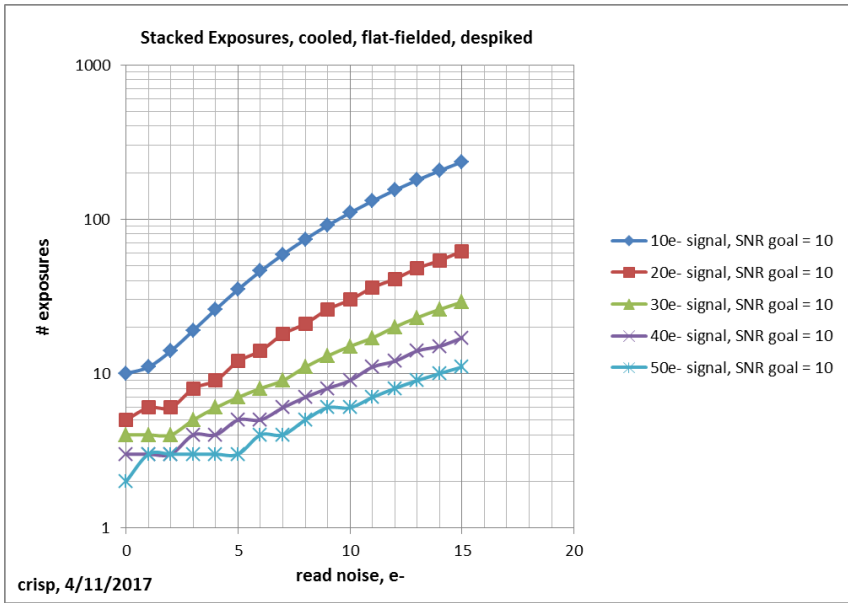
$$\textit{SNR} = \frac{\textit{Signal}}{\sqrt{\textit{Signal} + \textit{ReadNoise}^2}} \quad (2)$$

Results for Specific Cases

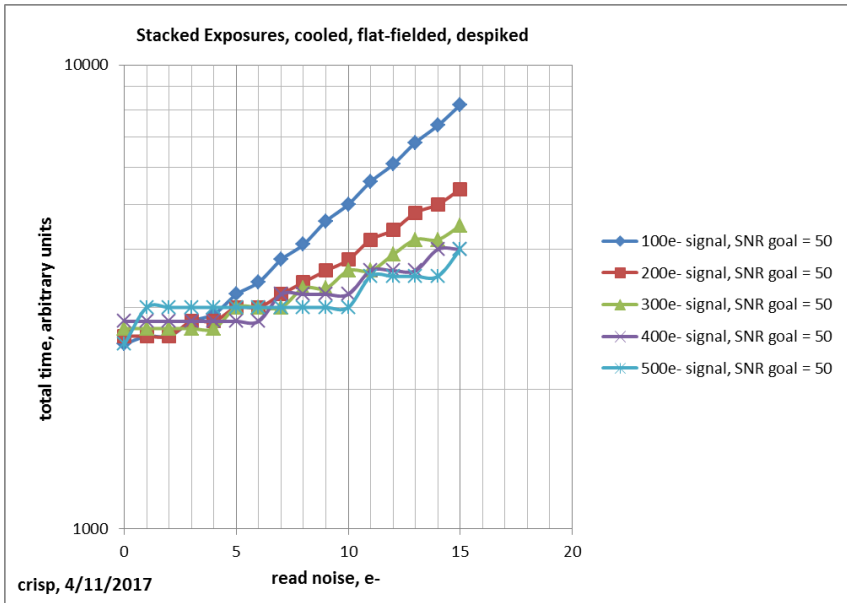
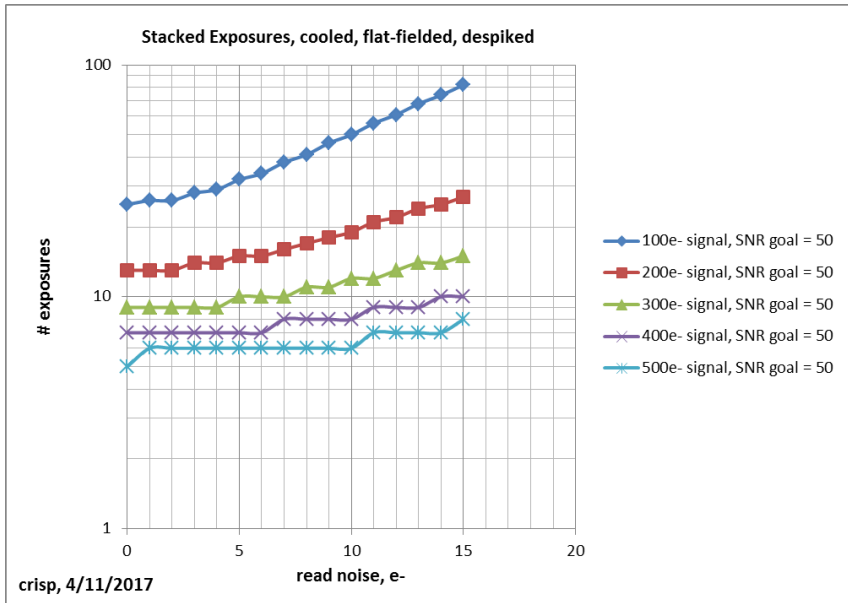
- Case 1 Narrowband
 - Signal levels range from 10 e- to 50 e-
 - Read noise: 0 to 15 electrons
 - SNR goal for stacked result: 10
- Case 2 broadband
 - Signal levels range from 100 e- to 500 e-
 - Read noise: 0 to 15 electrons
 - SNR goal for stacked result: 50

Comment on Time Units

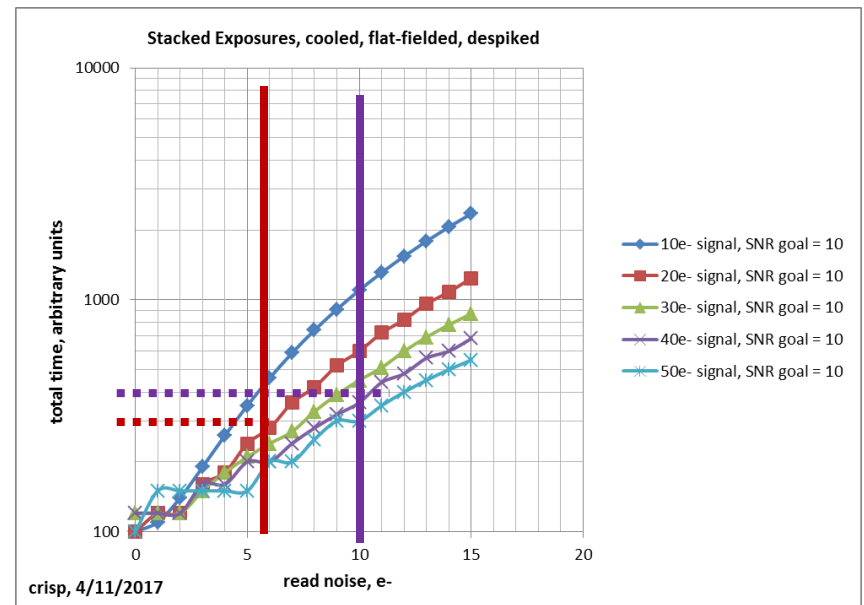
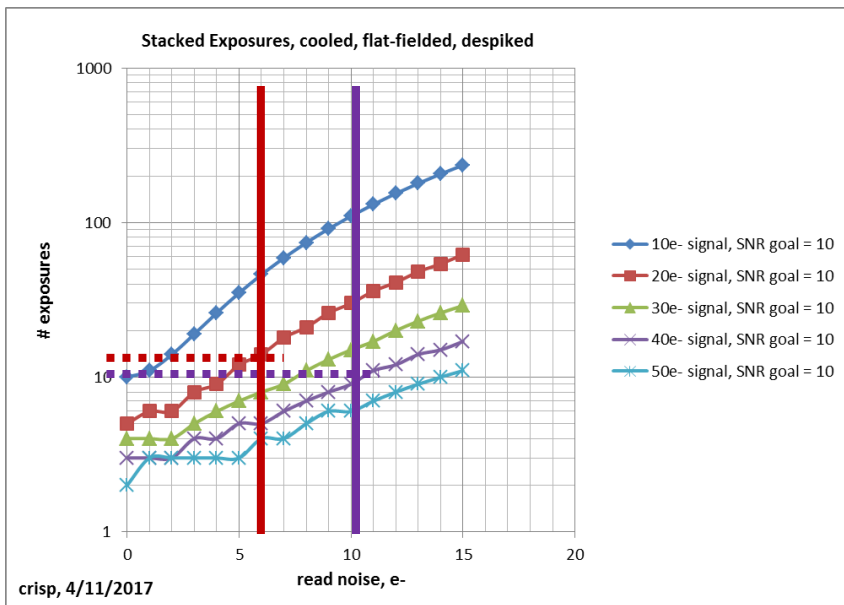
- Arbitrary units are chosen for time
- One arbitrary time unit is that amount of exposure time that results in 1 electron of signal
- Example: 10 e- take 10 arbitrary time units



Narrowband Typical



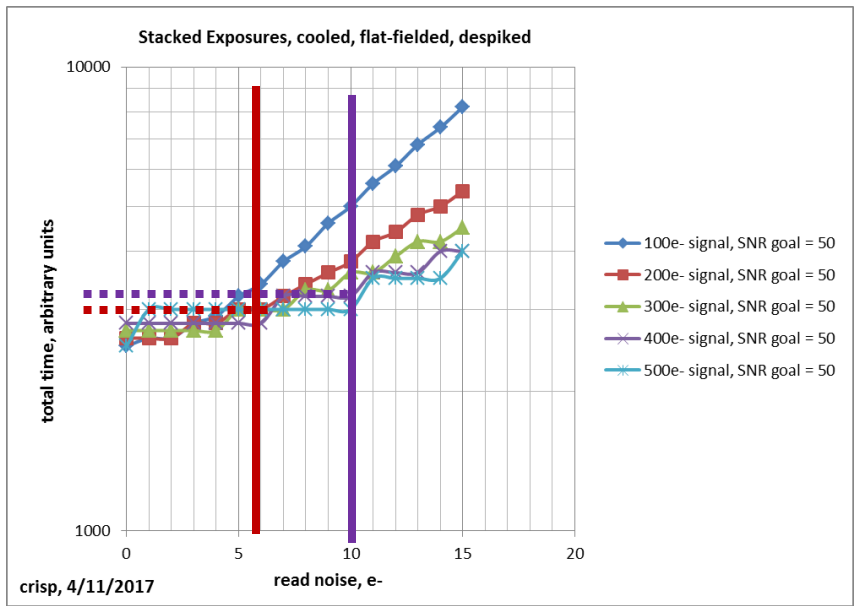
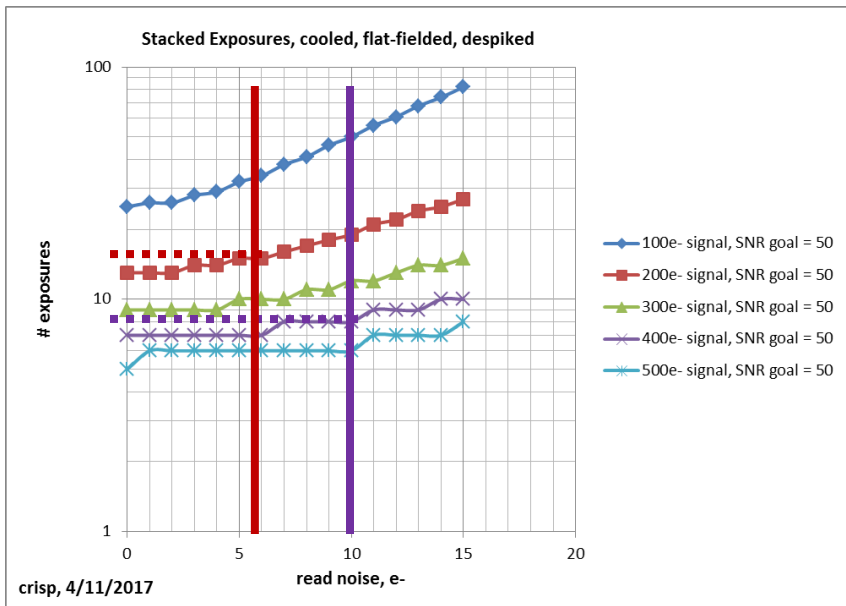
Broadband Typical



Narrowband Typical

Assume 10 e- read noise Camera 1 and 40 e- signal levels
 Assume 6 e- read noise Camera 2 and 20 e- signal levels
 Compare total exposure time for SNR 10

camera	Signal level (e-)	# exp	Total Time (arb units)
Camera 1	40	9	360
Camera 2	20	14	280



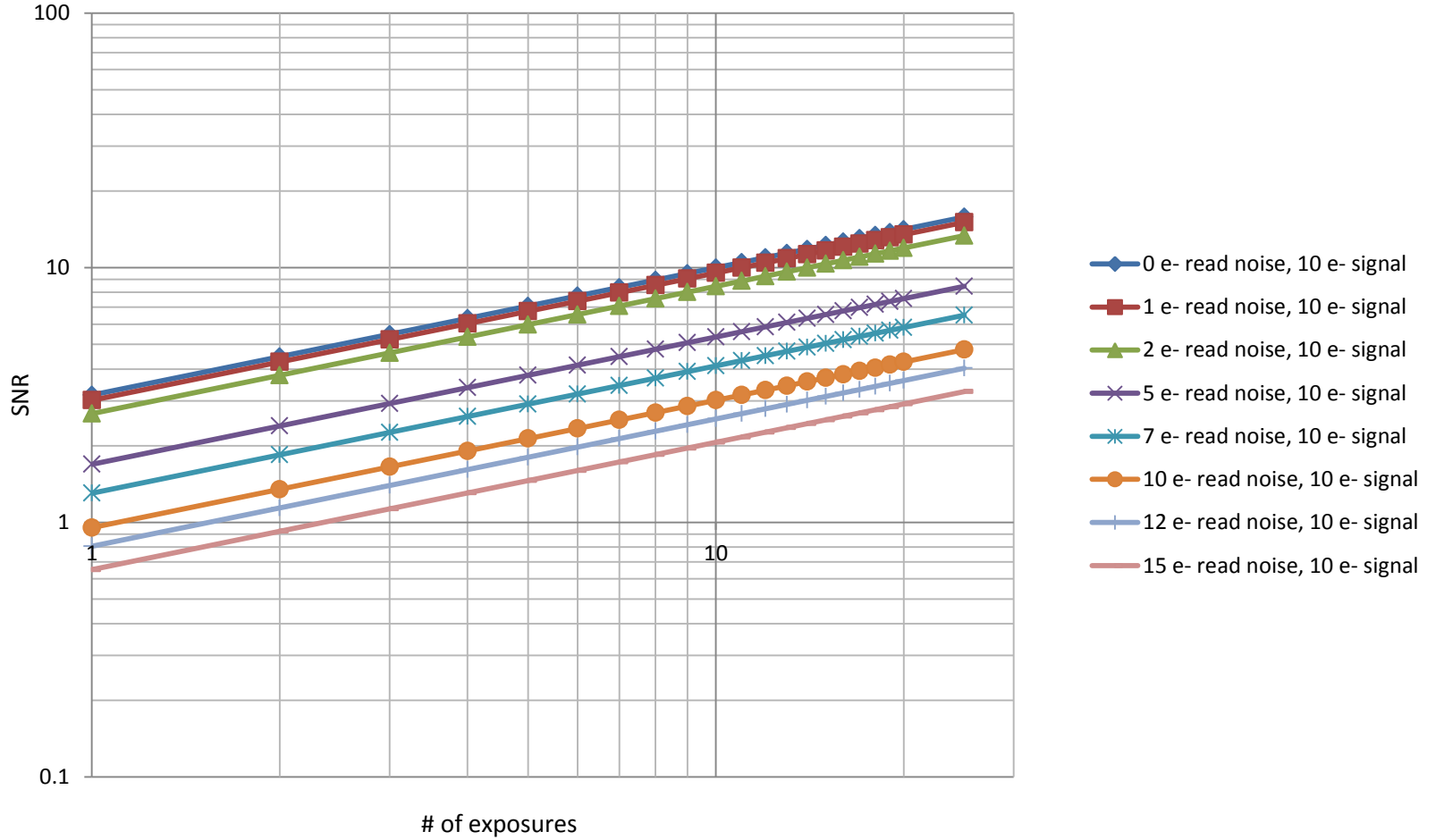
Broadband Typical

Assume 10 e- read noise Camera 1 and 400 e- signal levels
 Assume 6 e- read noise Camera 2 and 200 e- signal levels
 Compare total exposure time for SNR 50

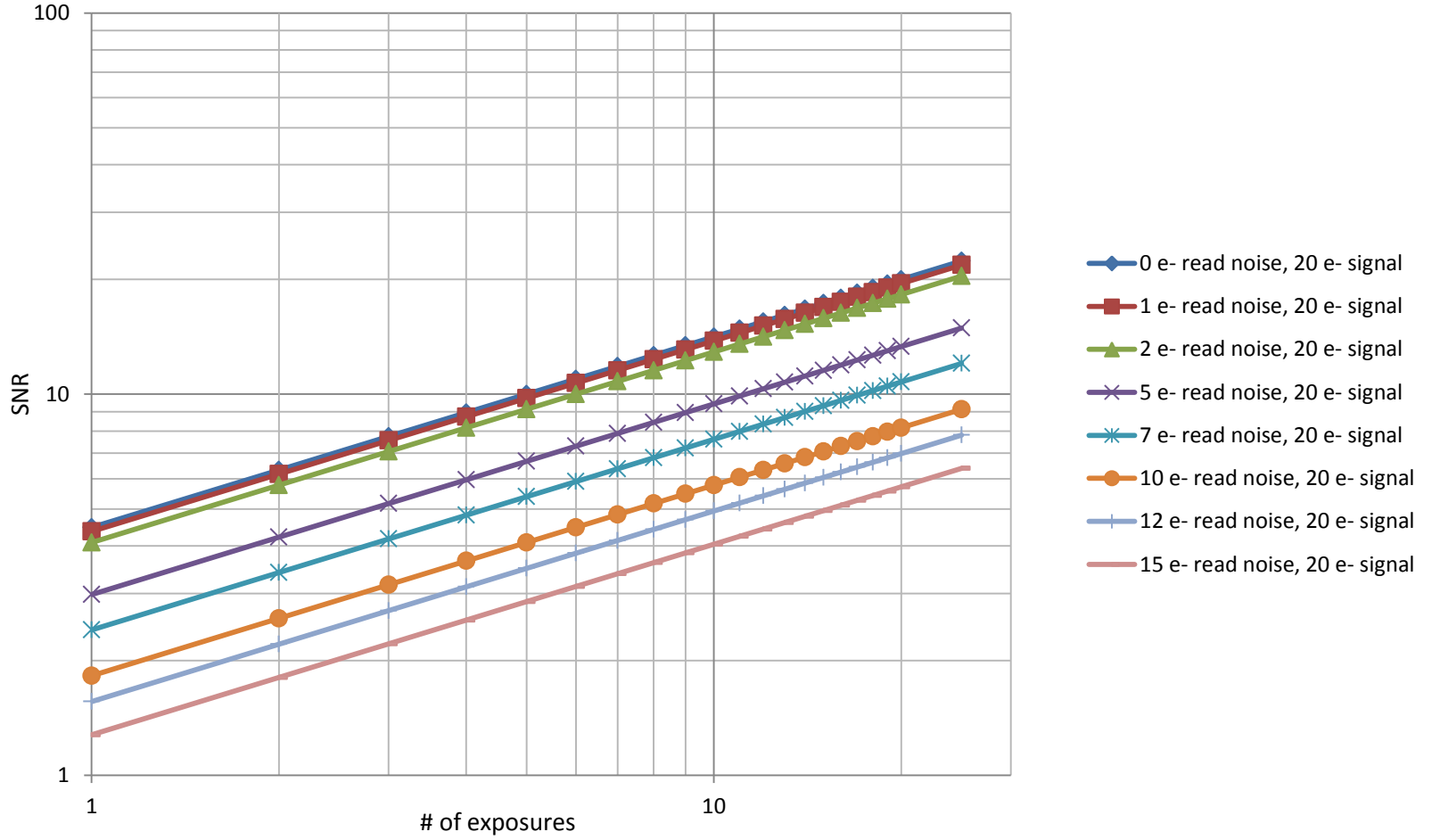
camera	Signal level (e-)	# exp	Total Time (arb units)
Camera 1	40	8	3200
Camera 2	20	15	3000

Low Signal Levels
Like in Narrowband Imaging

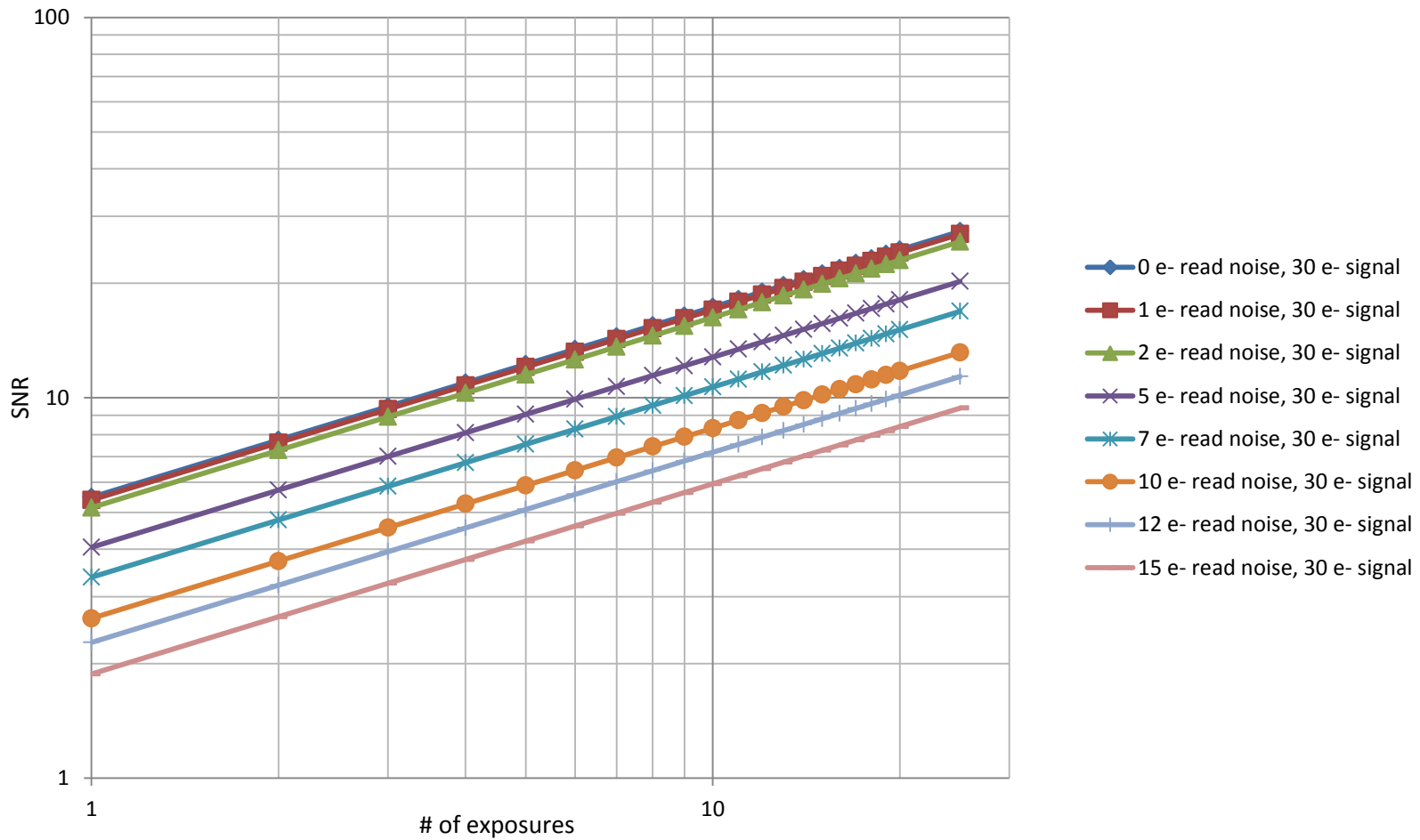
Stacked Exposures, cooled, flat-fielded, despiked



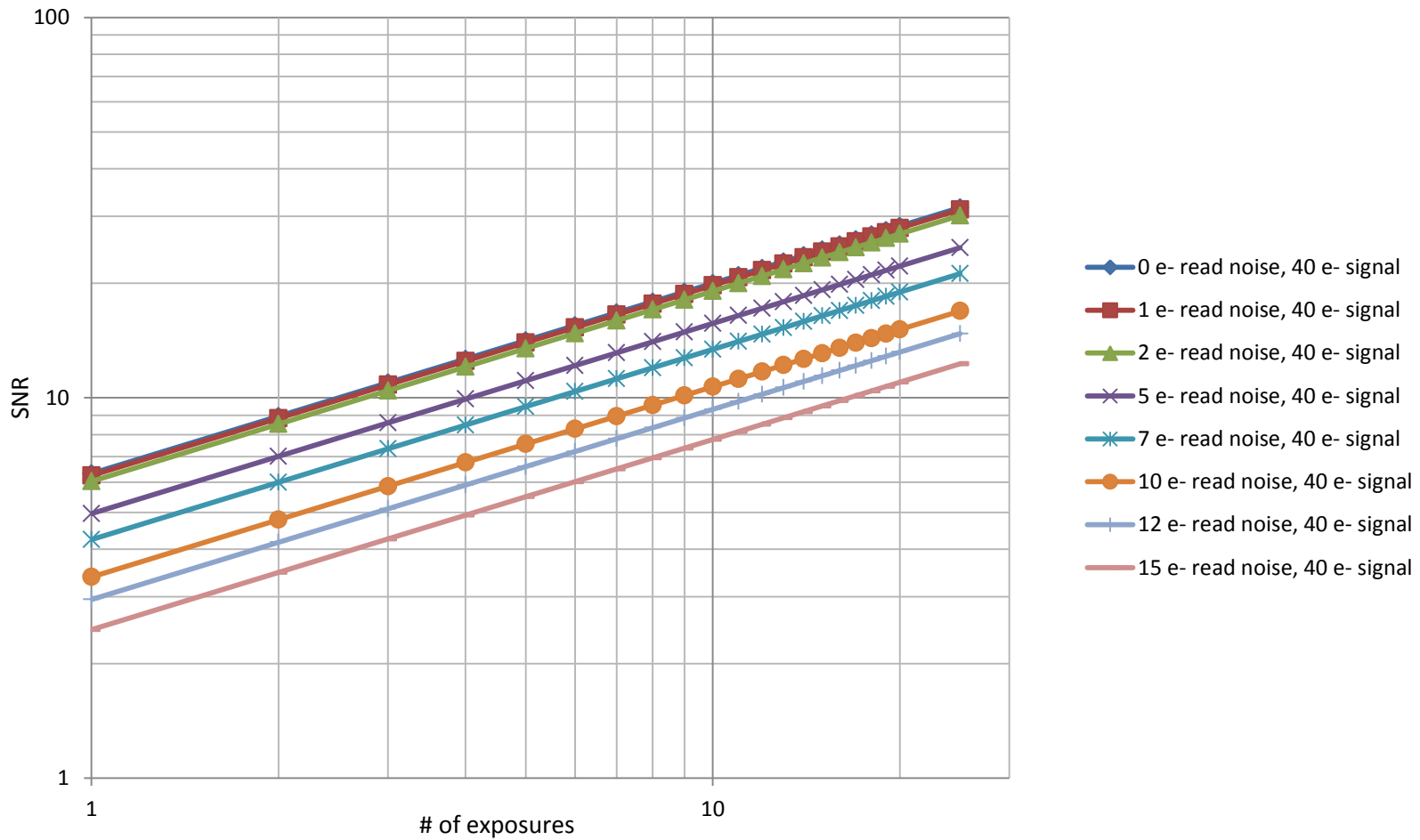
Stacked Exposures, cooled, flat-fielded, despiked



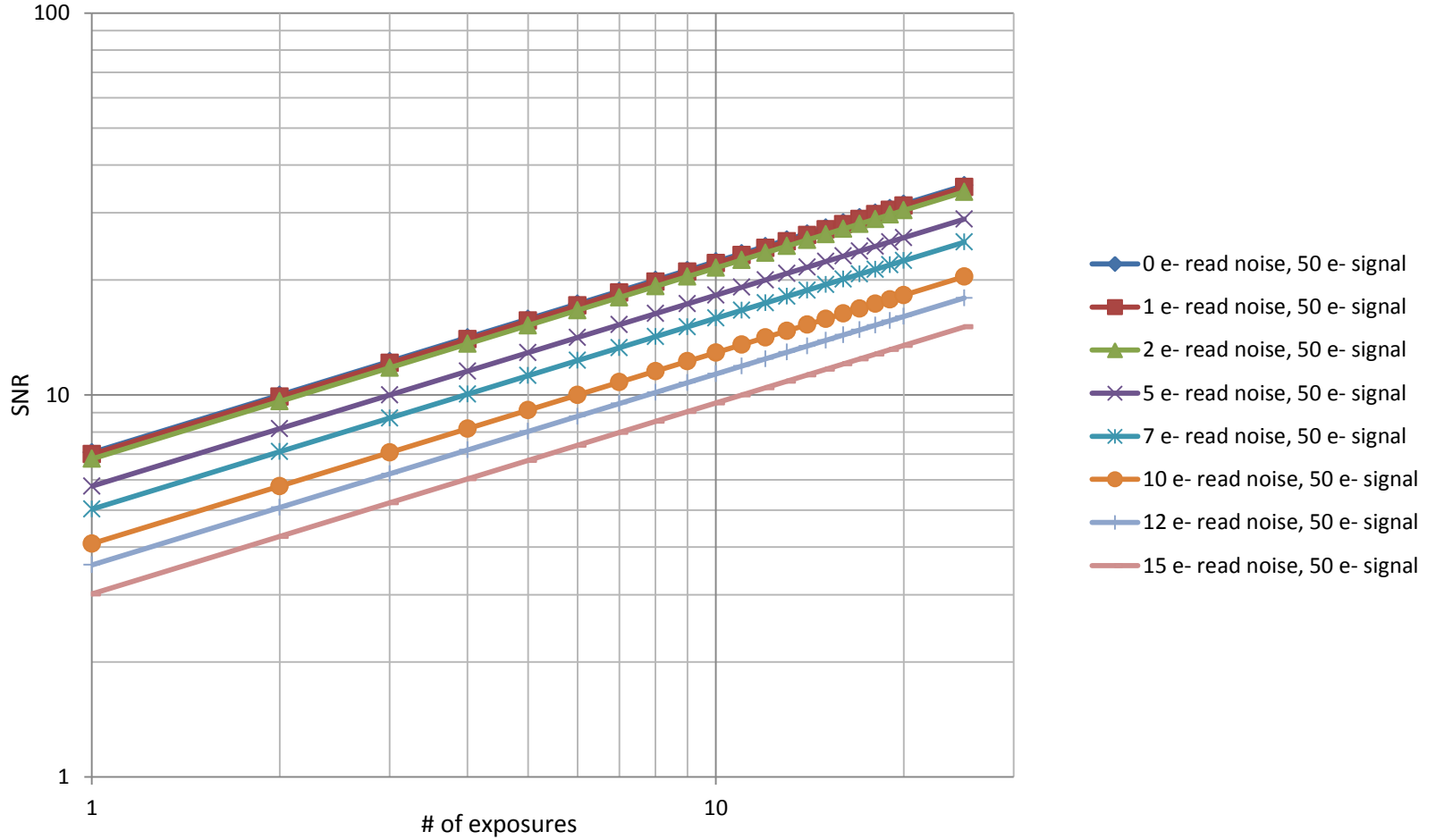
Stacked Exposures, cooled, flat-fielded, despiked



Stacked Exposures, cooled, flat-fielded, despiked

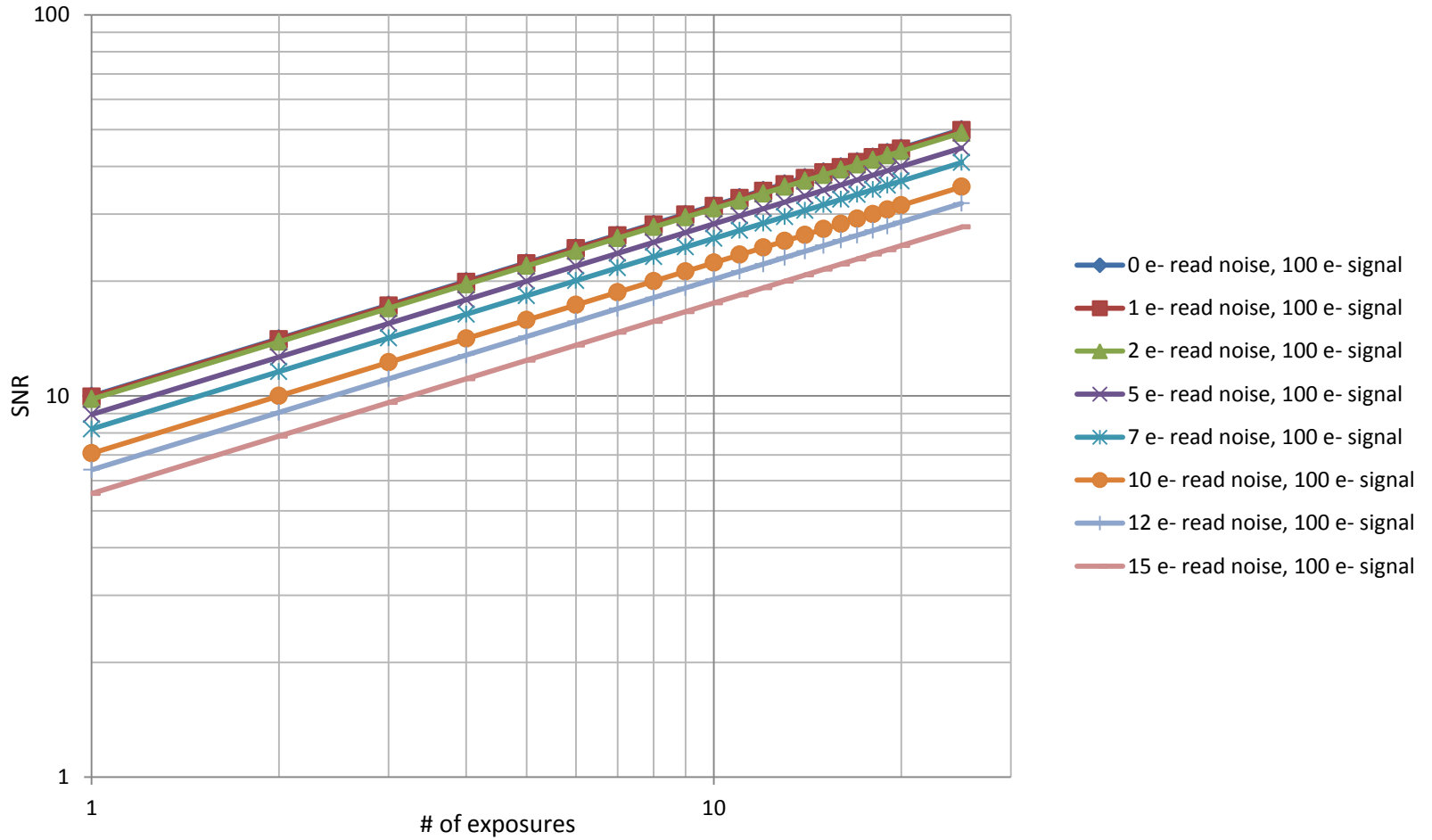


Stacked Exposures, cooled, flat-fielded, despiked

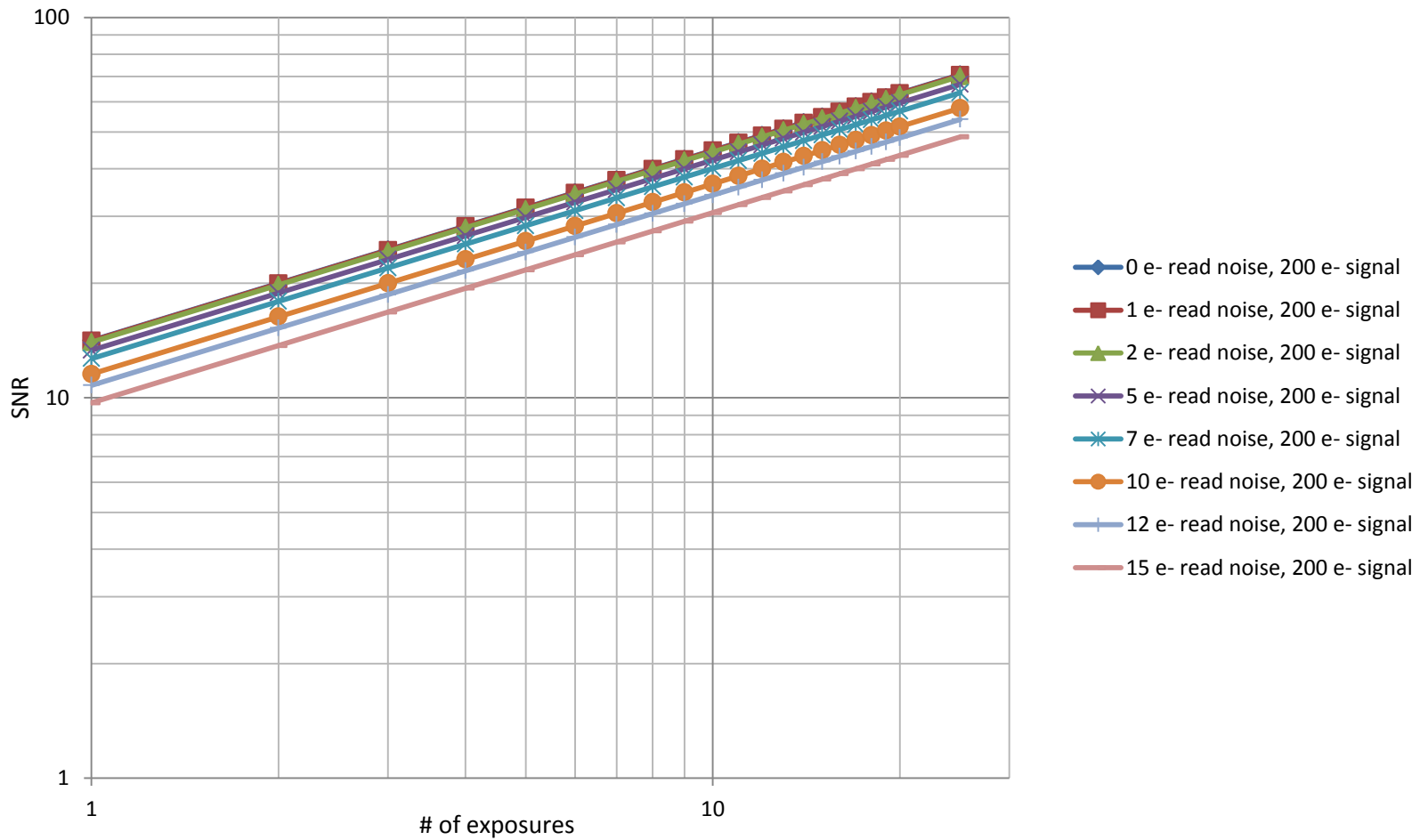


High Signal Levels
Like in Broadband / Terrestrial Imaging

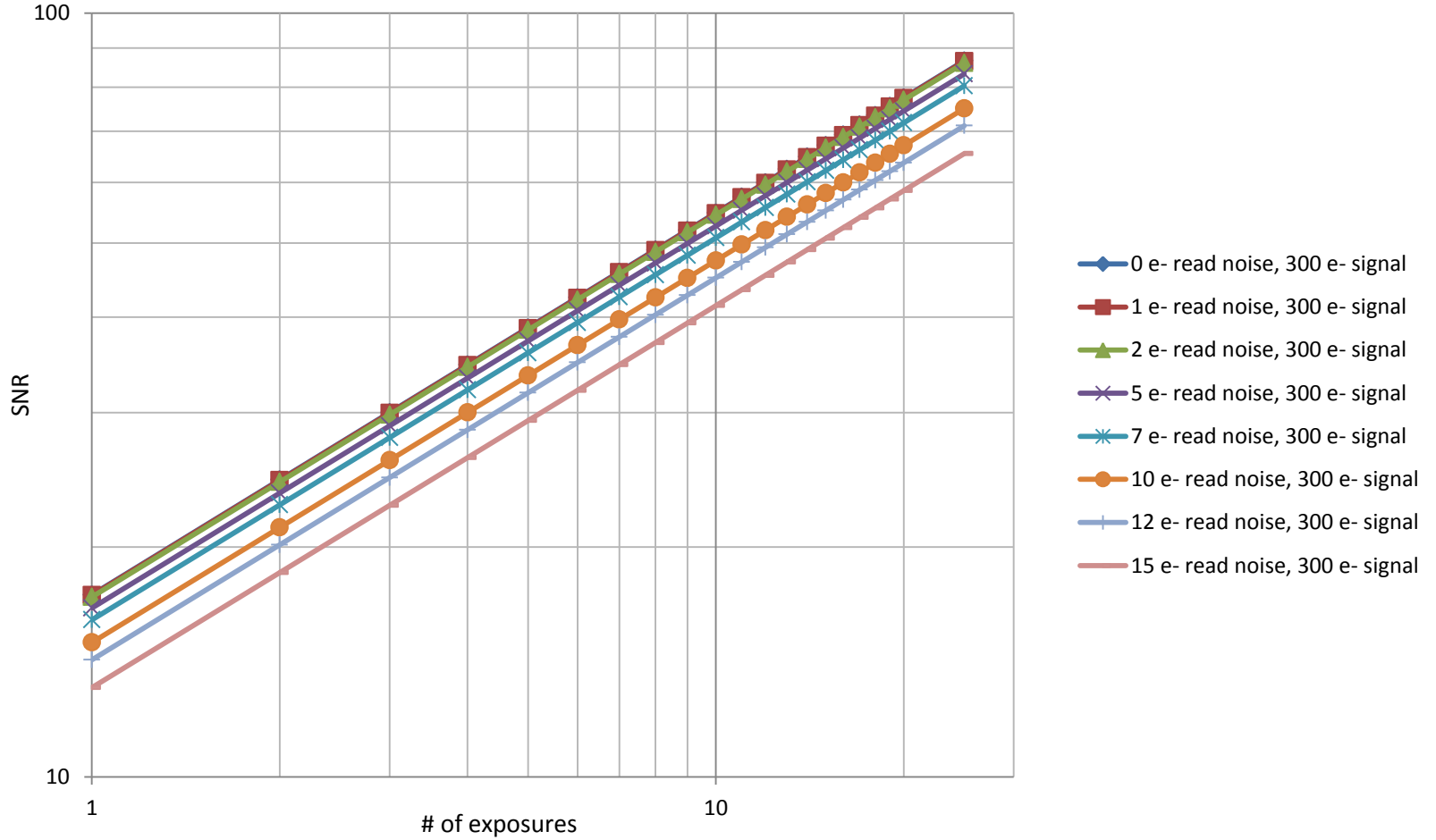
Stacked Exposures, cooled, flat-fielded, despiked



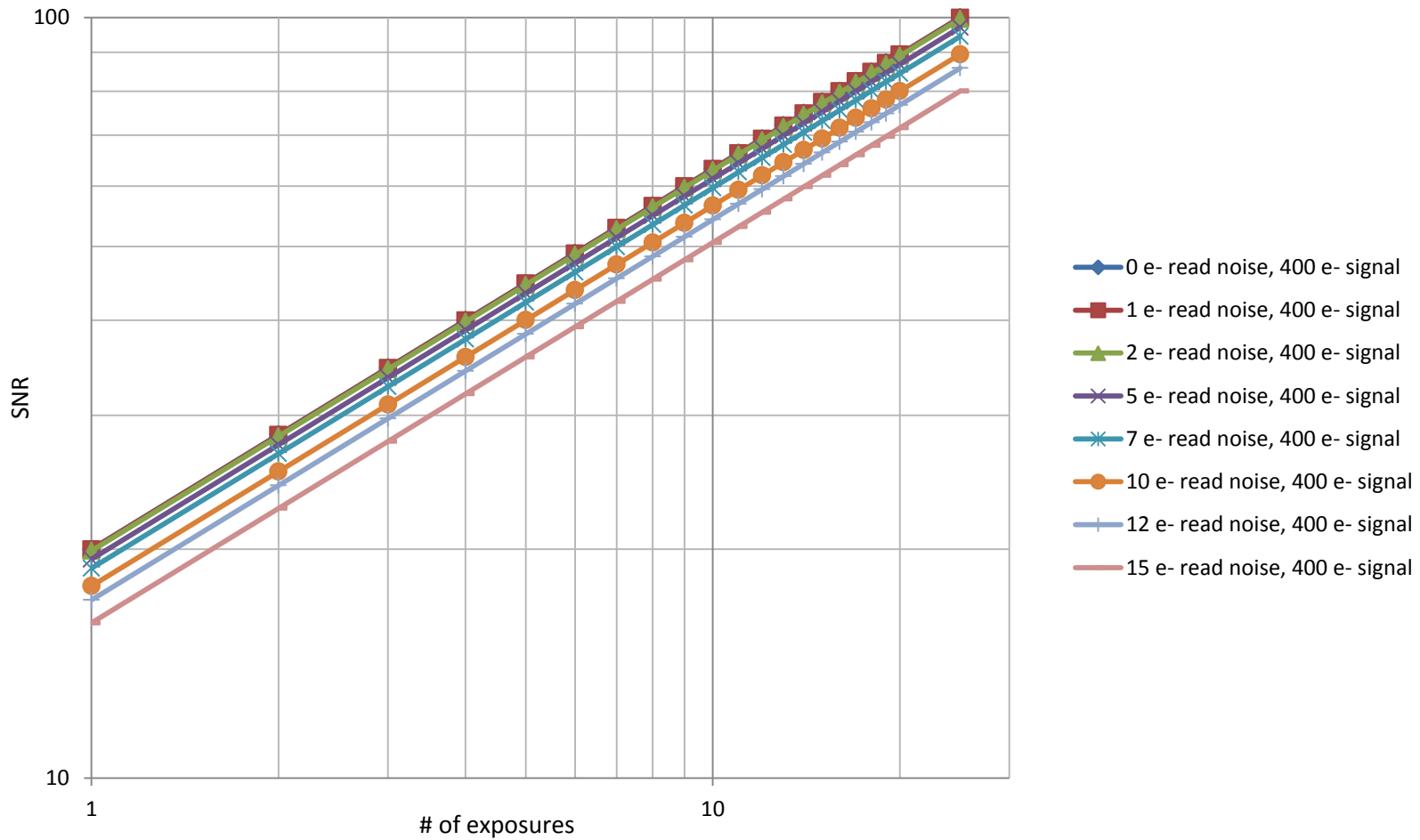
Stacked Exposures, cooled, flat-fielded, despiked



Stacked Exposures, cooled, flat-fielded, despiked



Stacked Exposures, cooled, flat-fielded, despiked



Stacked Exposures, cooled, flat-fielded, despiked

