

BGS survey simulation updates

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new reference BGS sky brightness for survey simulations that better reflects typical BGS exposures

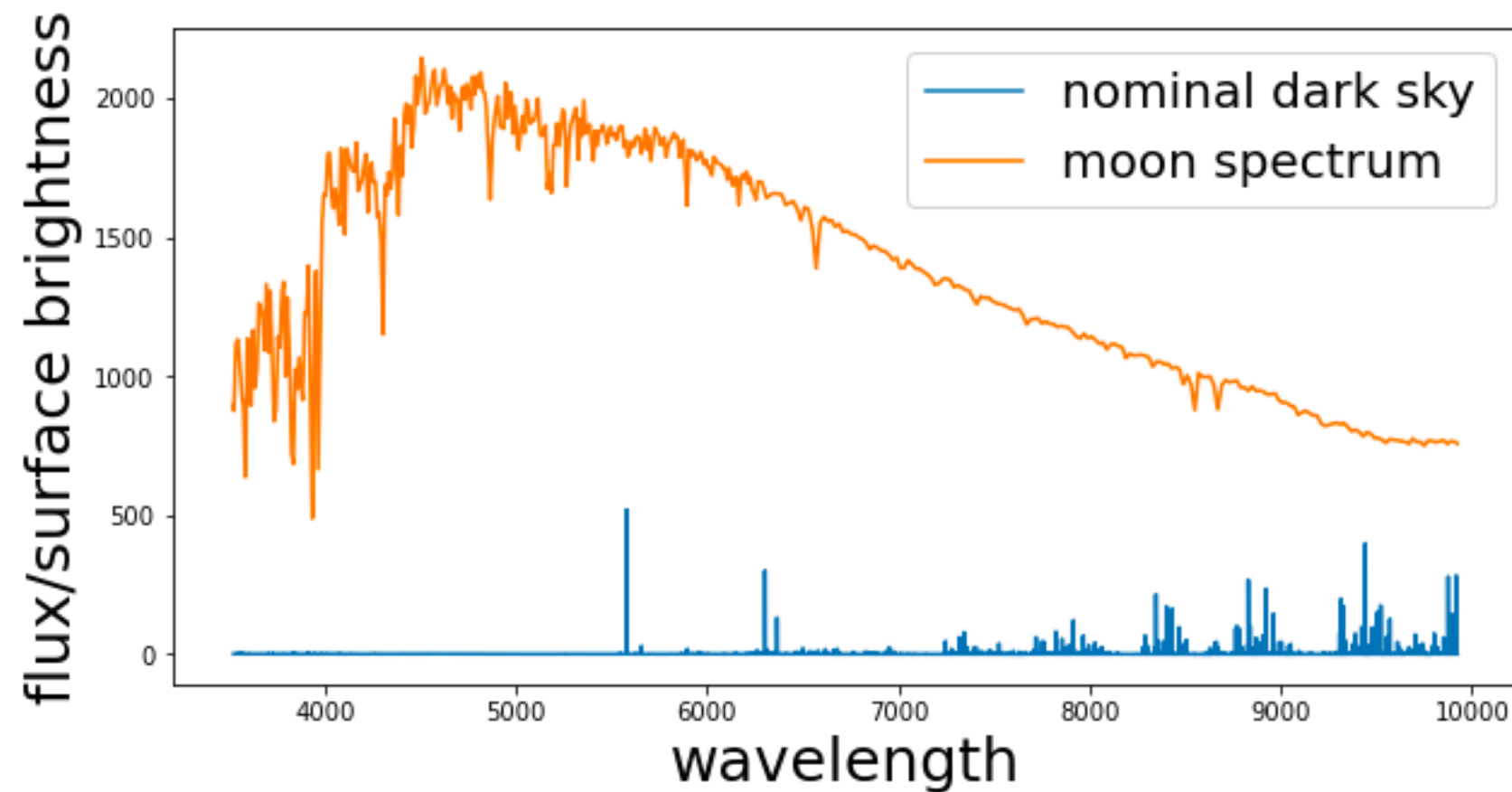
previously based on *nominal dark sky*, which complicates exposure time calculations due to read noise

new reference BGS sky brightness for survey simulations that better reflects typical BGS exposures

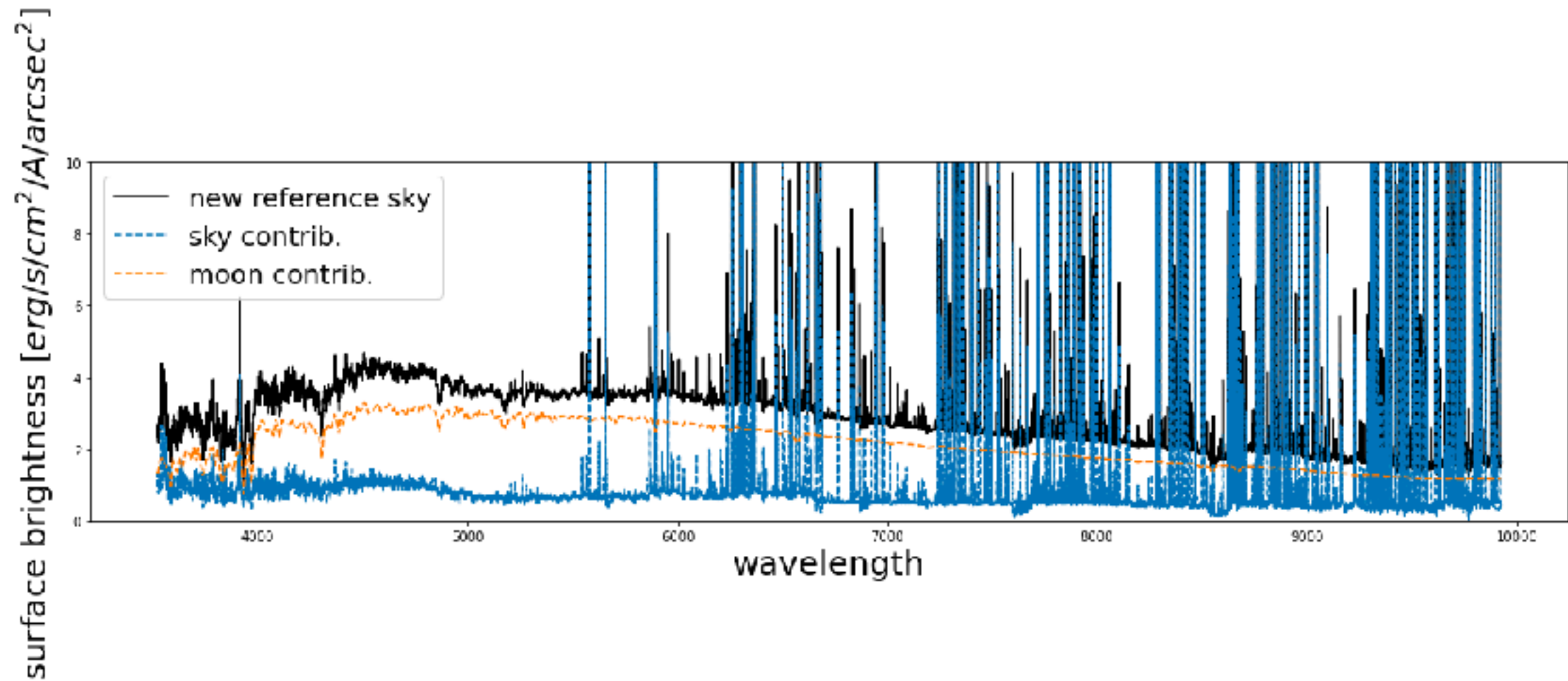
(nominal dark sky scaled to $r = 21.07$)
+ (moon spectrum scaled to $r = 20.07$)

sky brightness $\sim 3.5\times$ brighter than dark time

new reference BGS sky brightness for survey simulations that better reflects typical BGS exposures

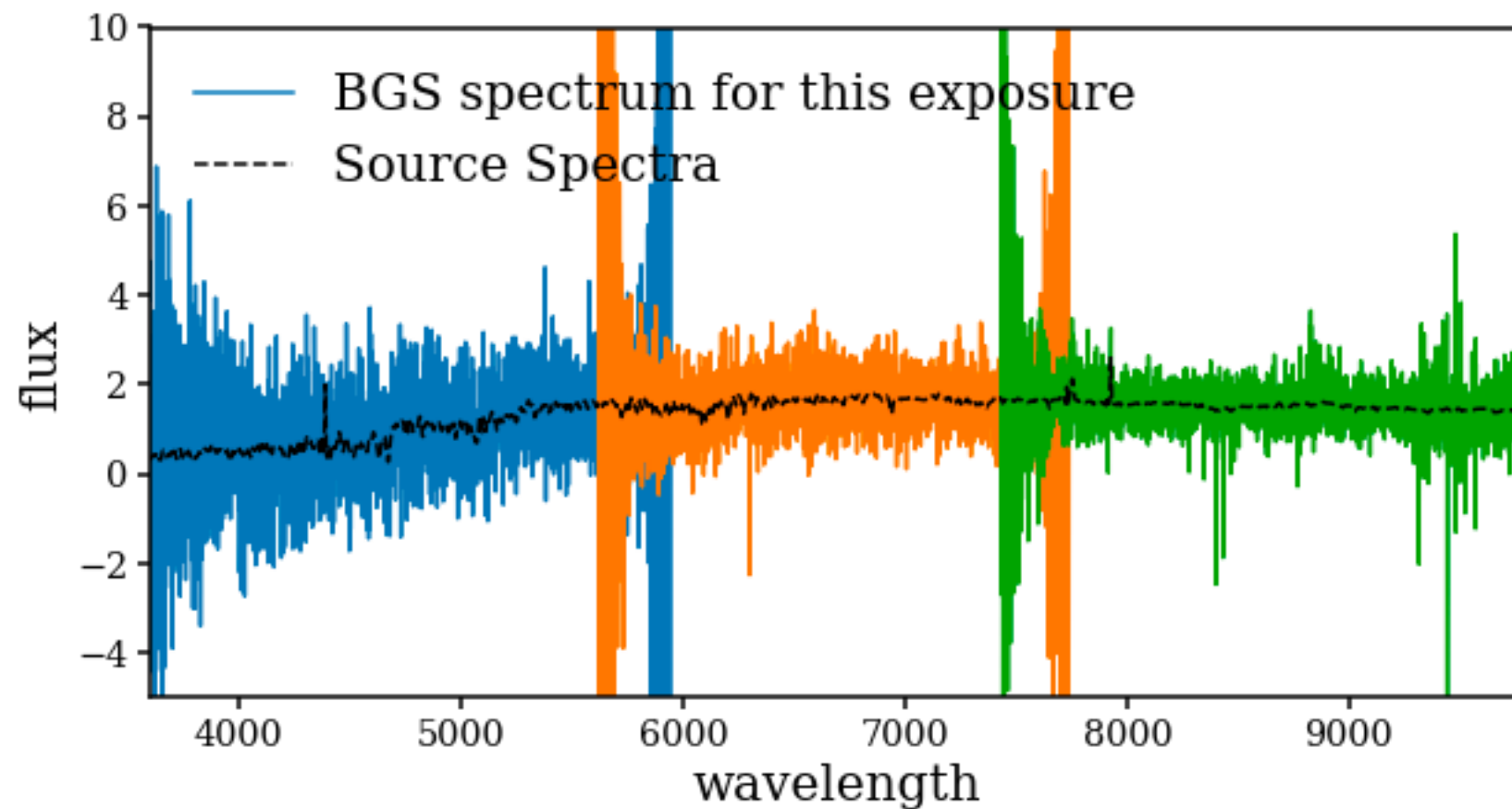


new reference BGS sky brightness for survey simulations that better reflects typical BGS exposures



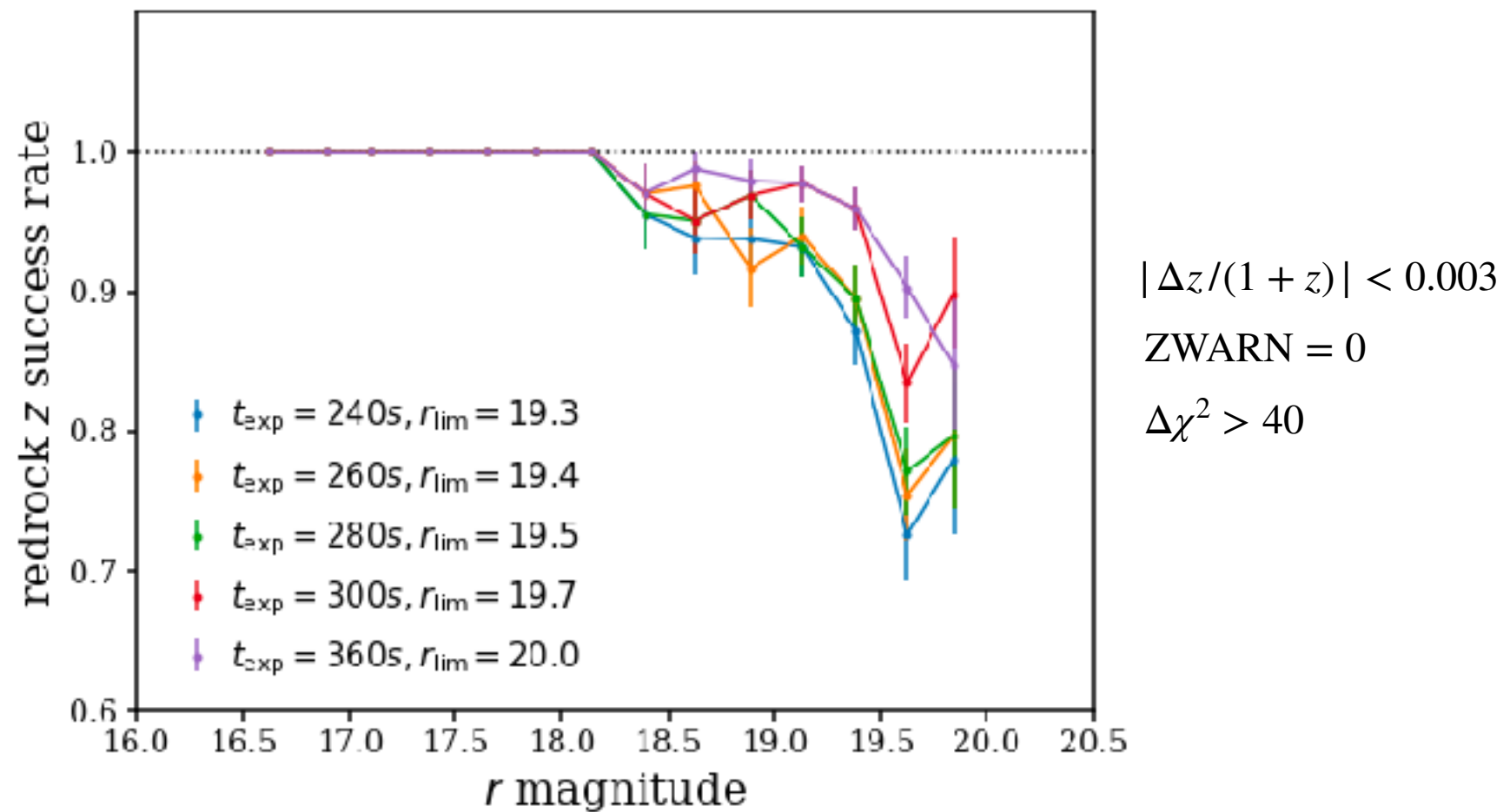
new reference exposures times for the new reference BGS sky brightness that can achieve *L2 redshift success requirements*

new reference exposures times for the new reference BGS sky brightness that can achieve *L2 redshift success requirements*



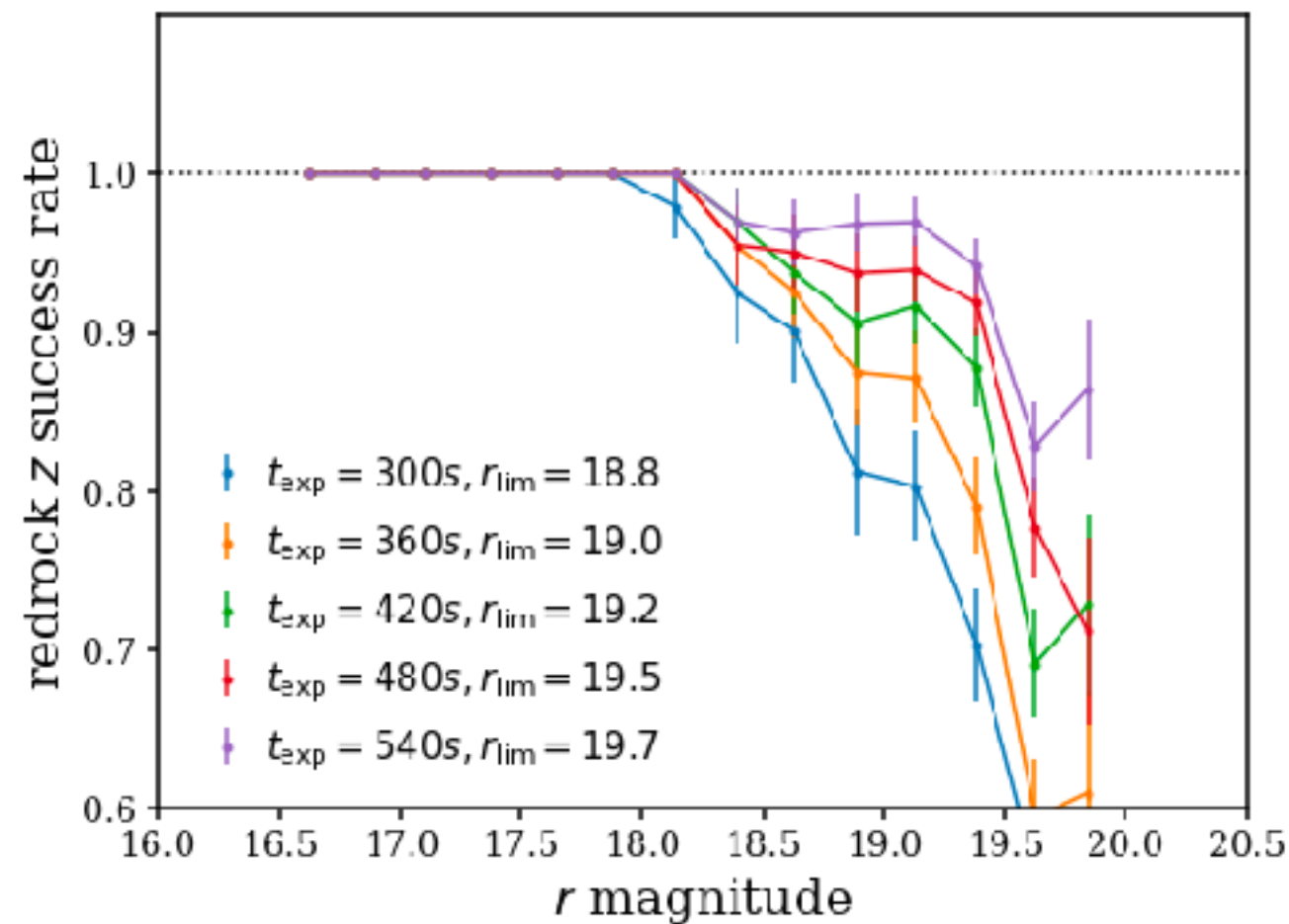
spectral simulations with new reference sky for different
 $t_{\text{exp}} = 240, 260, 280, 300, 360, 420, 480, 540 \text{ sec}$ run through redrock

new reference exposures times for the new reference BGS sky brightness that can achieve *L2 redshift success requirements*



$t_{\text{exp}} = 280s$ achieves 95% redshift success to $r = 19.5$

new reference exposures times for the new reference BGS sky brightness that can achieve *L2 redshift success requirements*



$$|\Delta z / (1 + z)| < 0.003$$

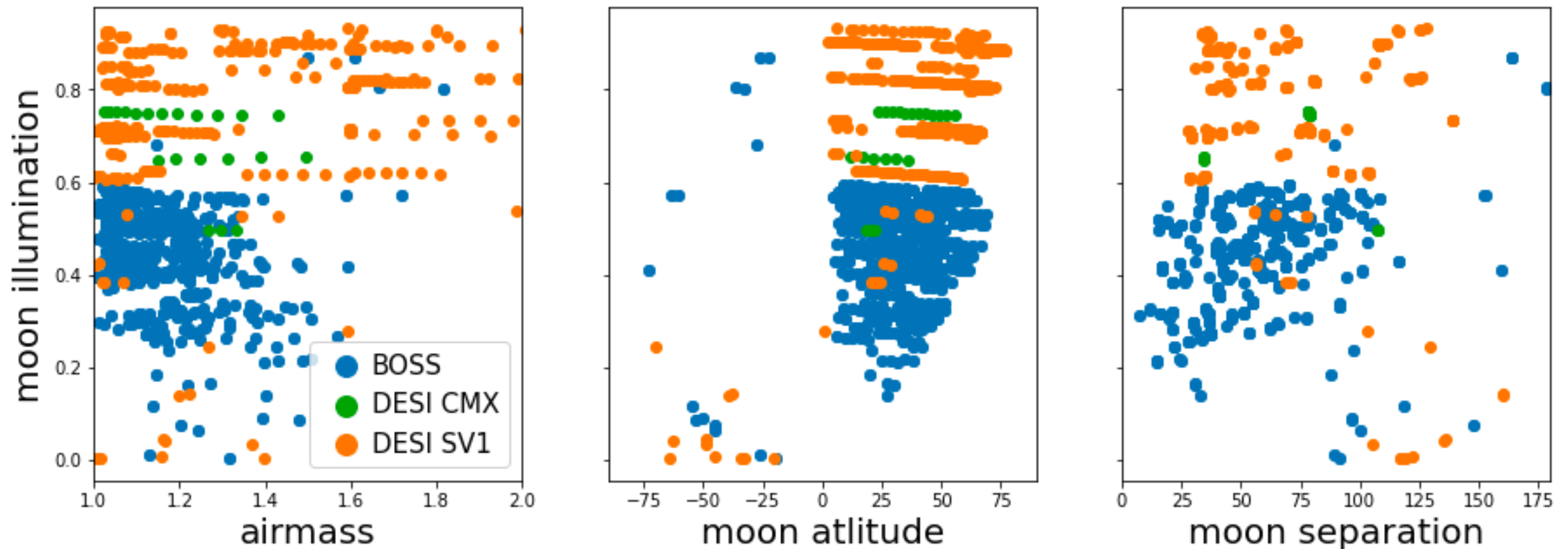
$$\text{ZWARN} = 0$$

$$\Delta\chi^2 > 100$$

for $\Delta\chi^2 > 100$, we need $t_{\text{exp}} = 480s$

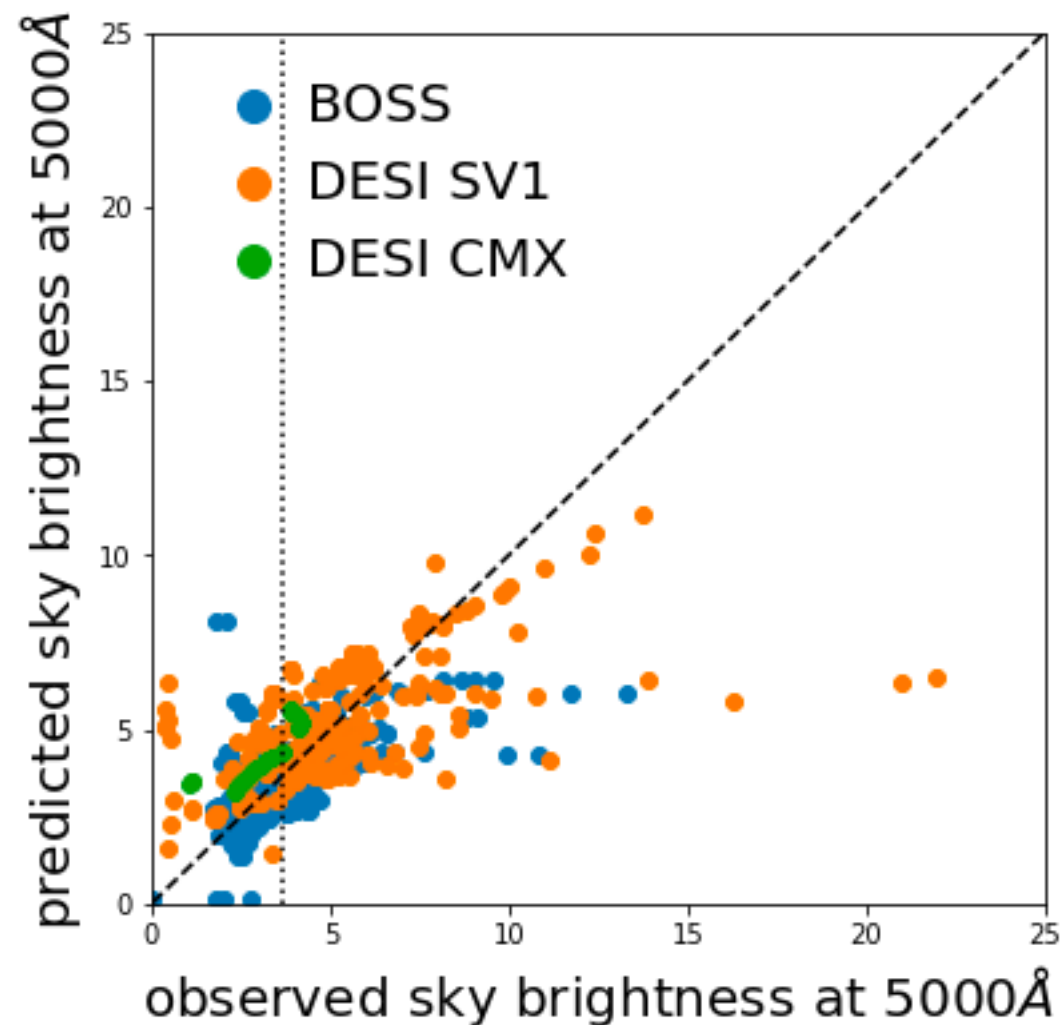
we can simplify the exposure time calculations with the new reference BGS sky — need to **update the sky model**

new sky model that predicts sky brightness at 5000\AA given observing conditions fit using *SV1*, *CMX*, and *BOSS* observations

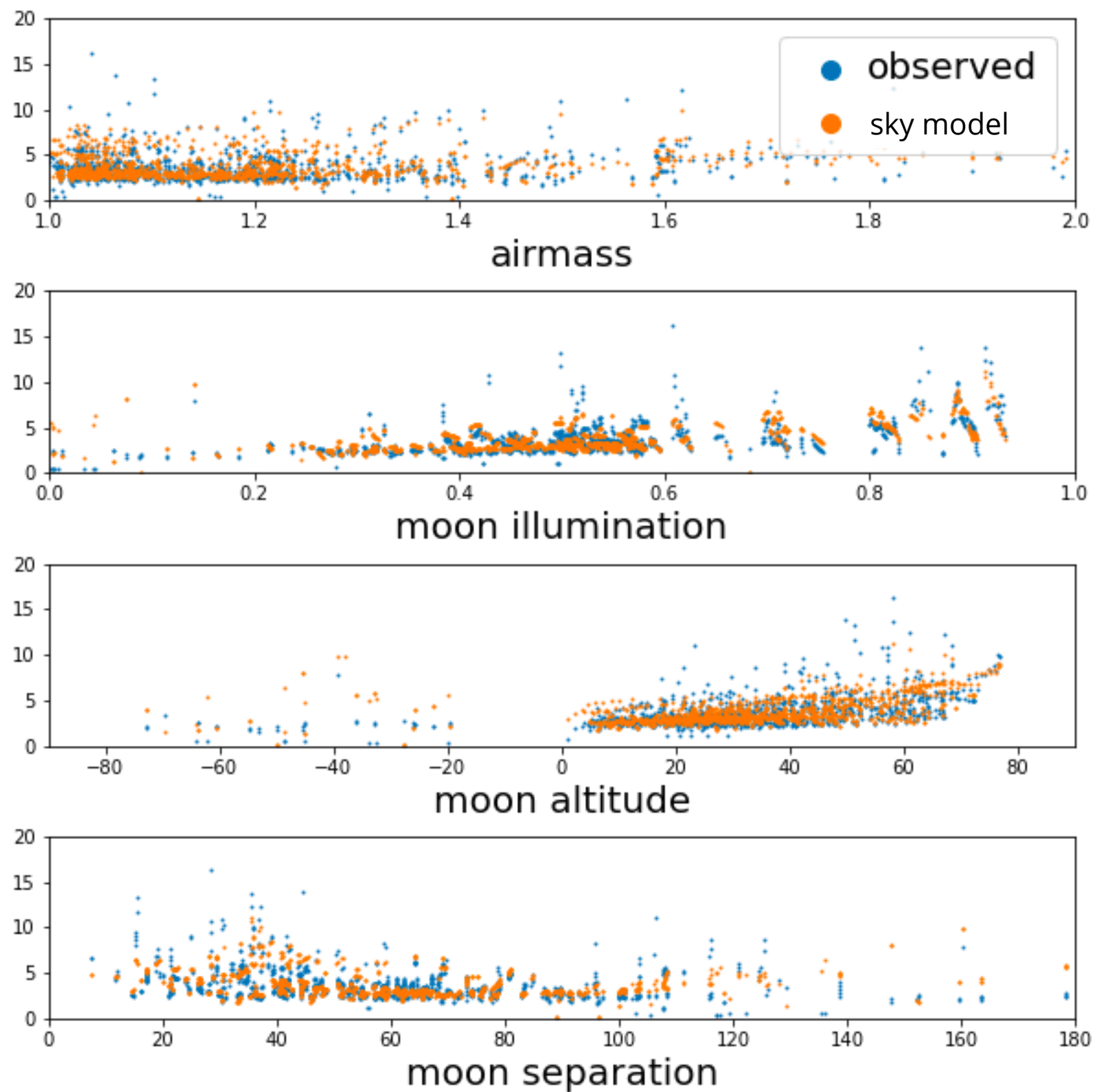


258 SV1 bright time exposures as of Feb 15

new sky model that predicts sky brightness at 5000\AA given observing conditions fit using *SV1*, *CMX*, and *BOSS* observations

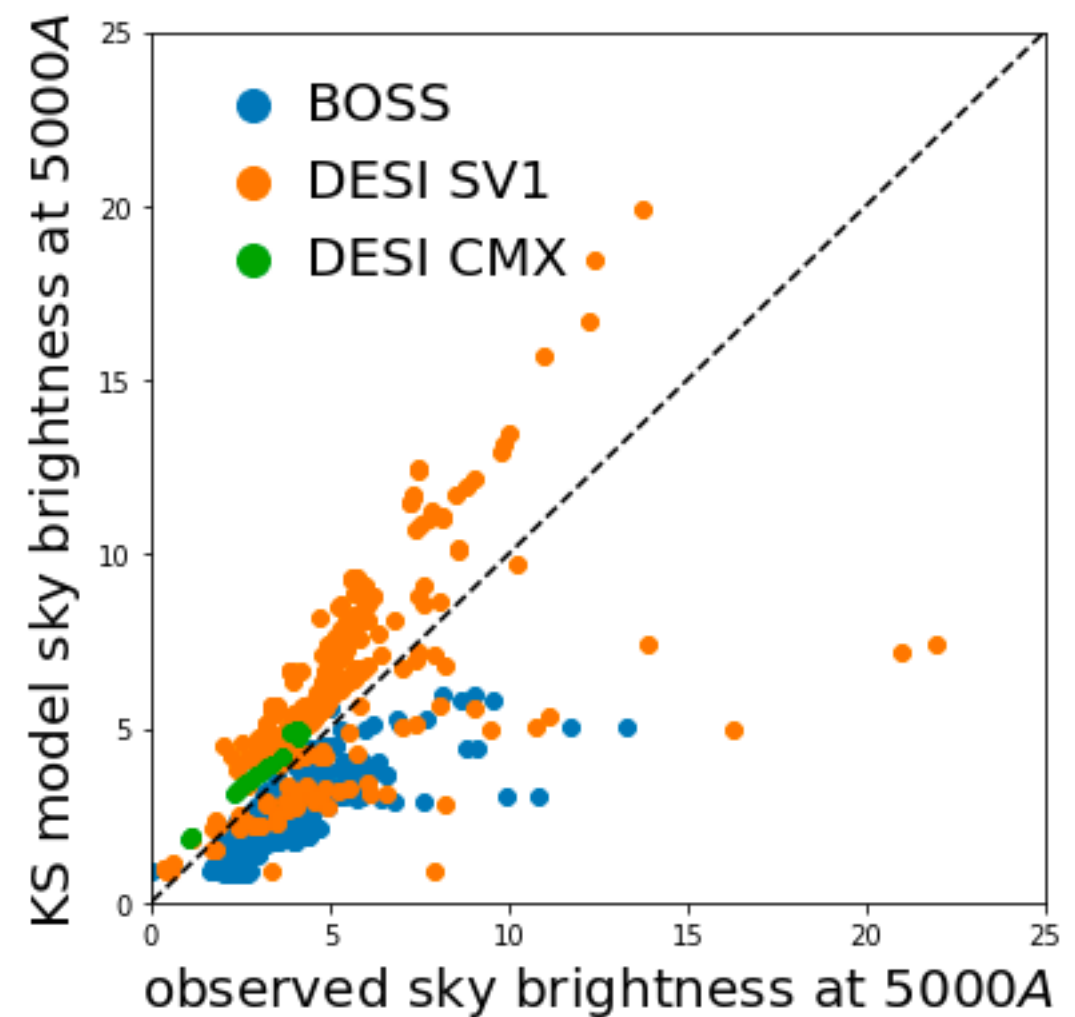
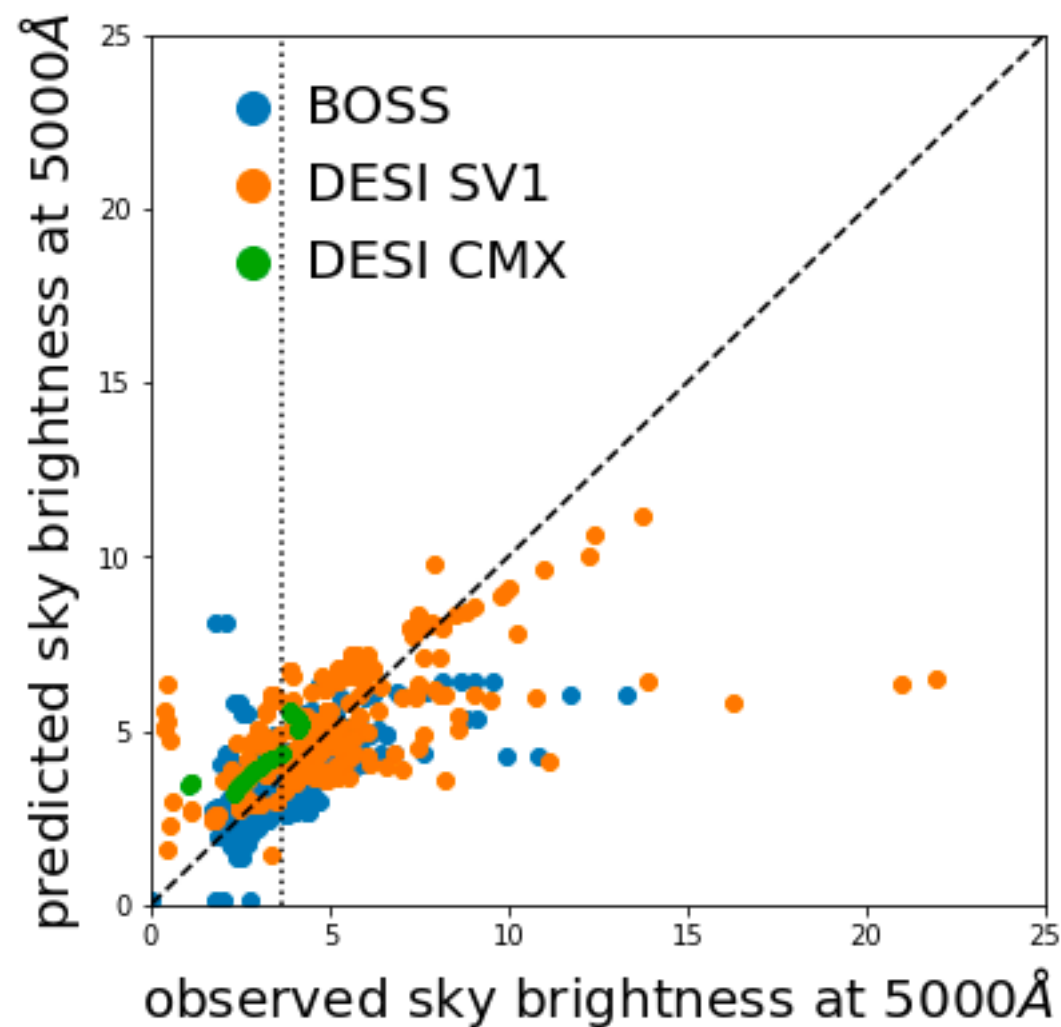


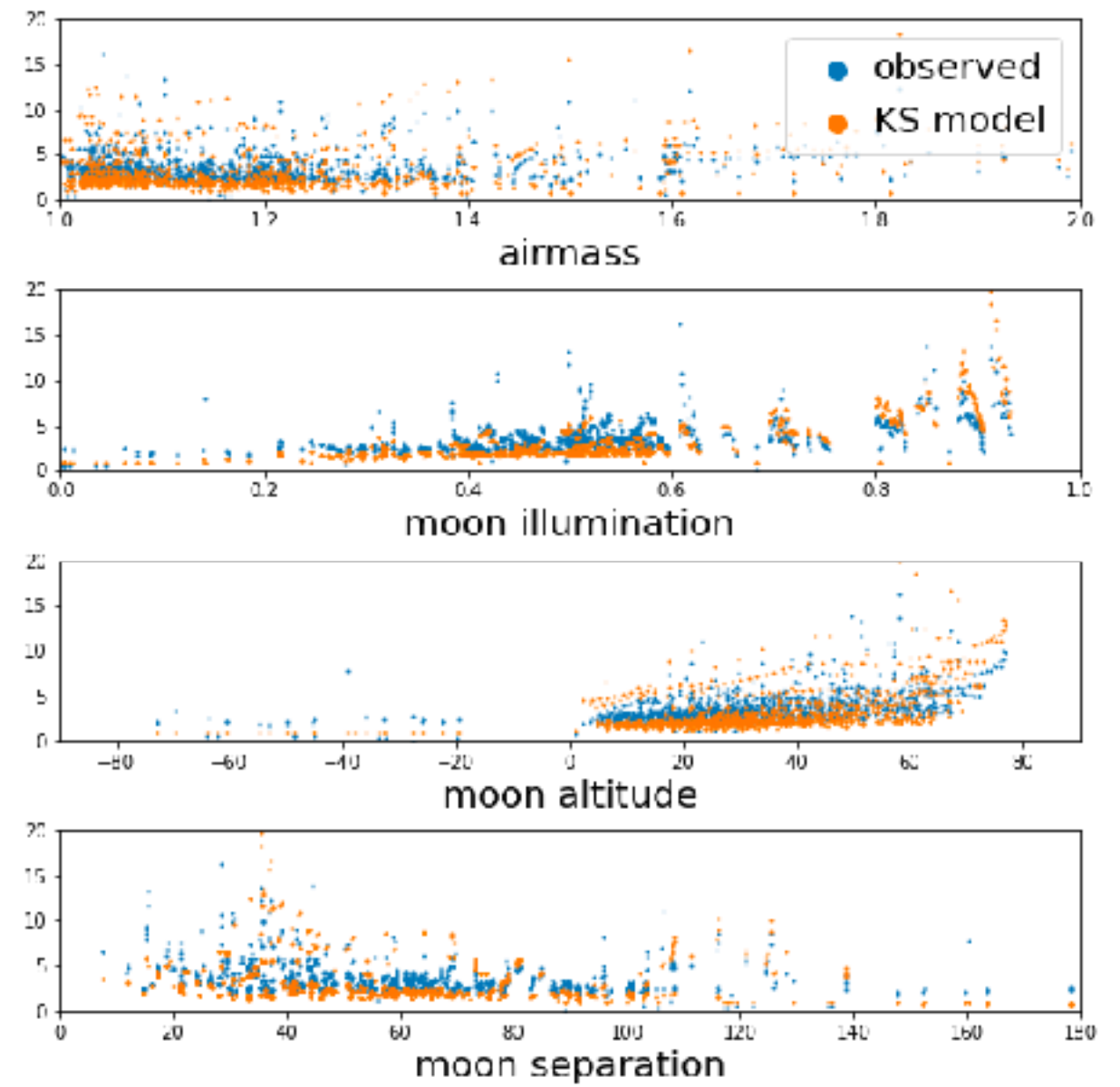
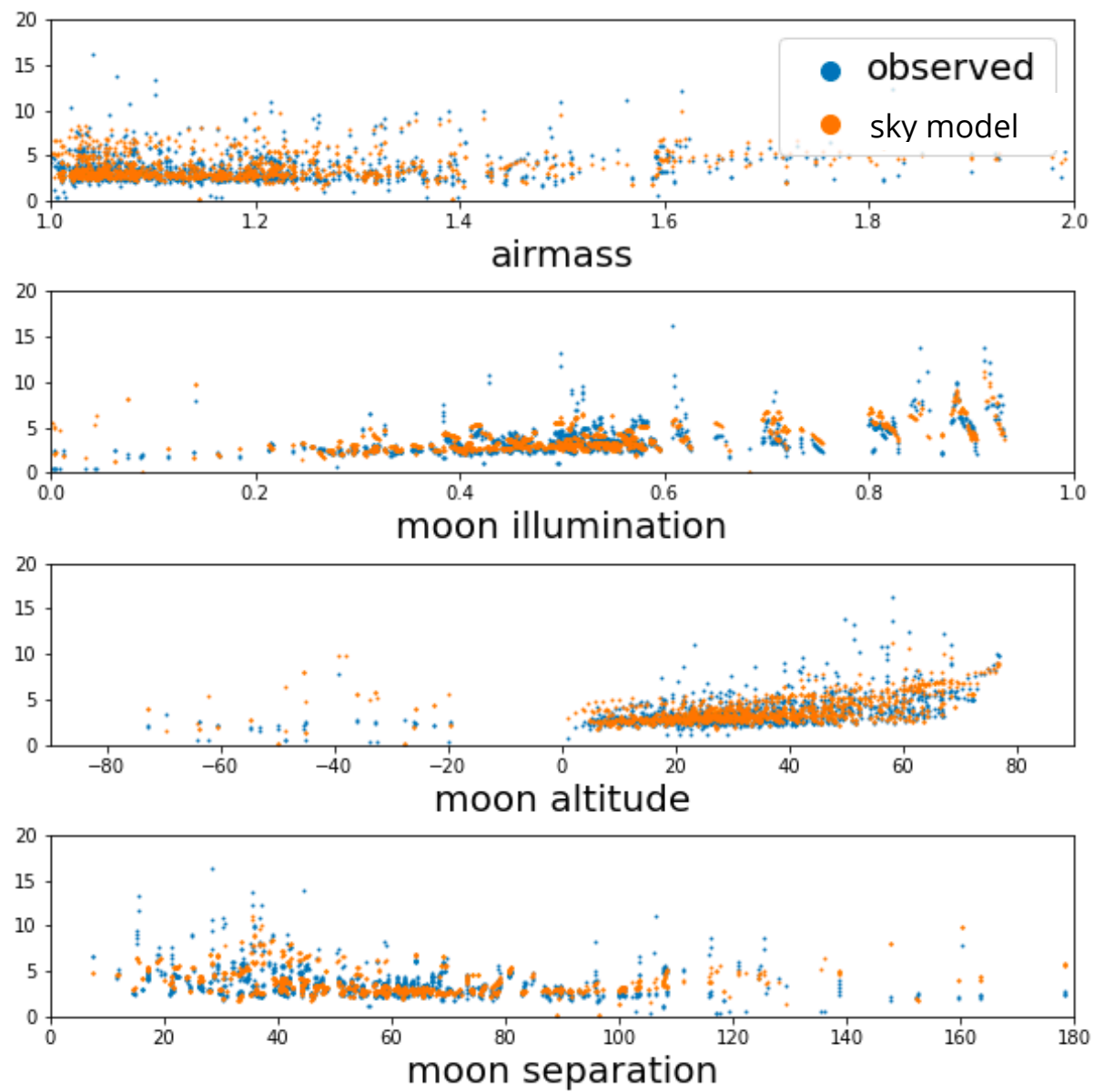
simple polynomial regression model



new sky model captures the *dependence on observing conditions*

how does the **new sky model** compare to Krisciunas & Schaefer model?

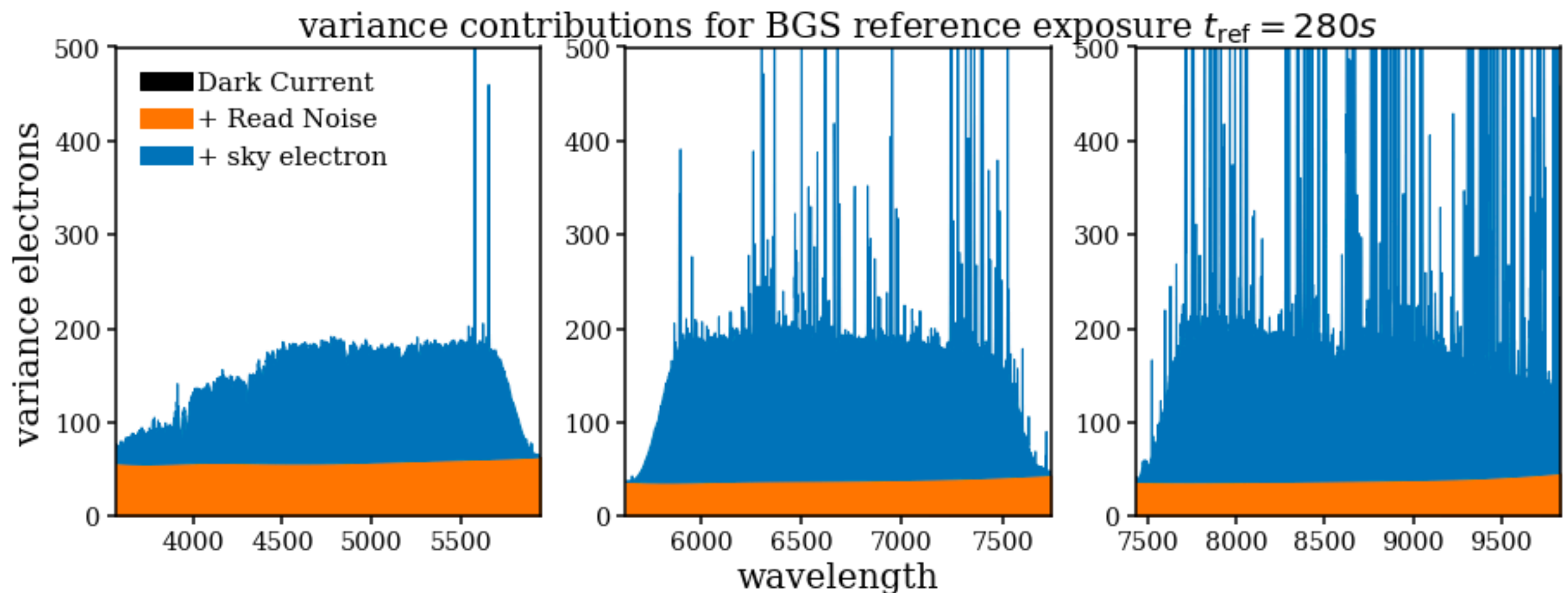




new sky model better reproduces observations

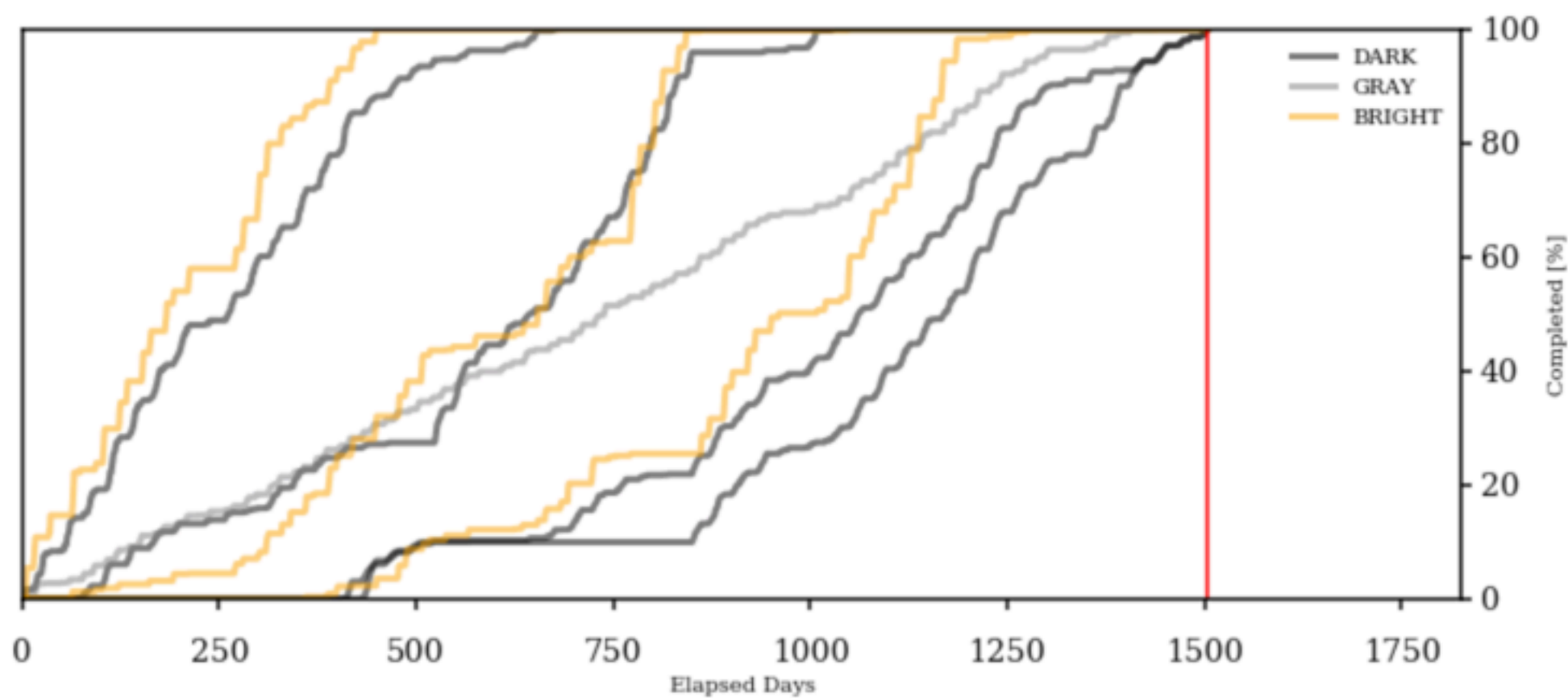
rerun survey simulations with: *new reference BGS sky, new reference exposure time, new sky model*

does the new reference BGS sky fix simplify the exposure time calculation? ***not really***

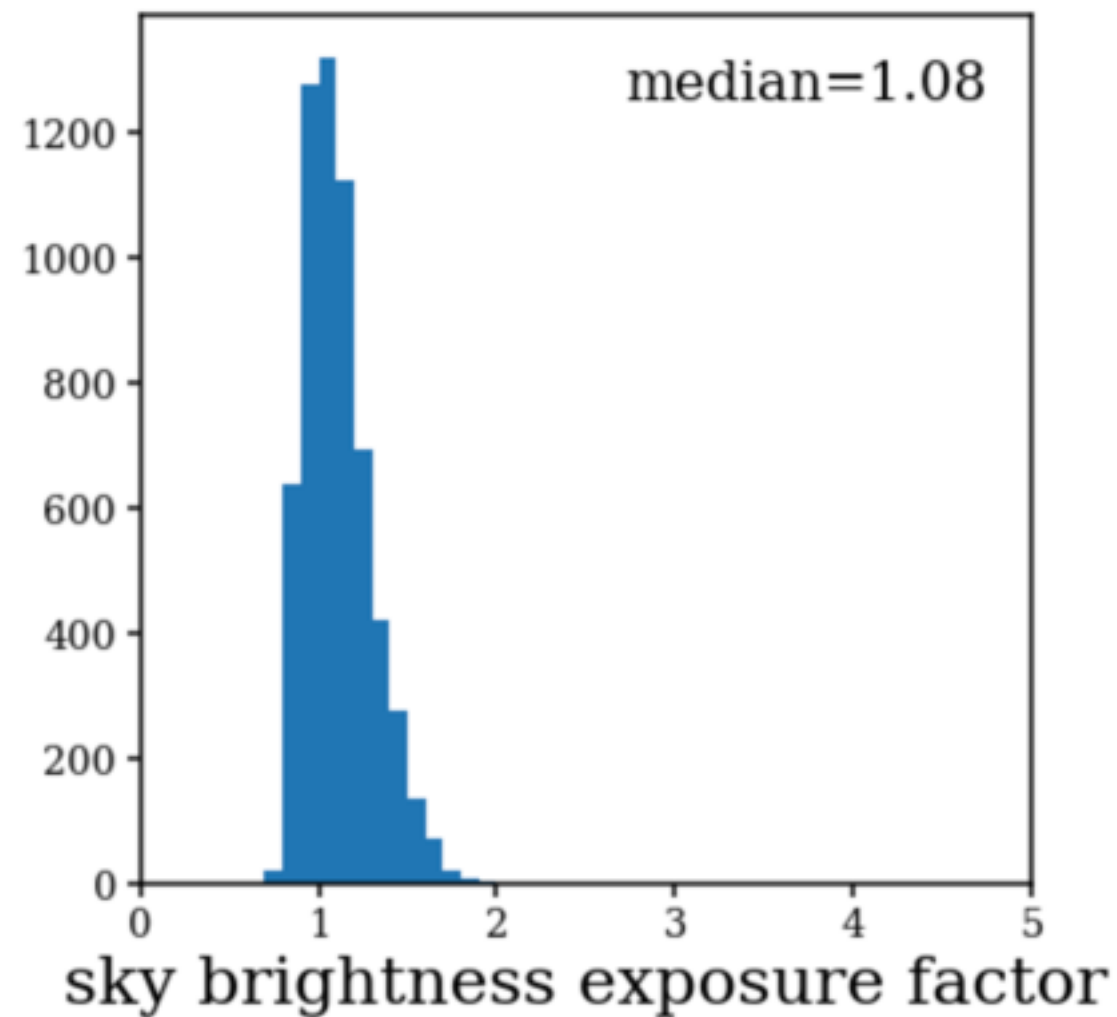


there's still significant read noise contribution

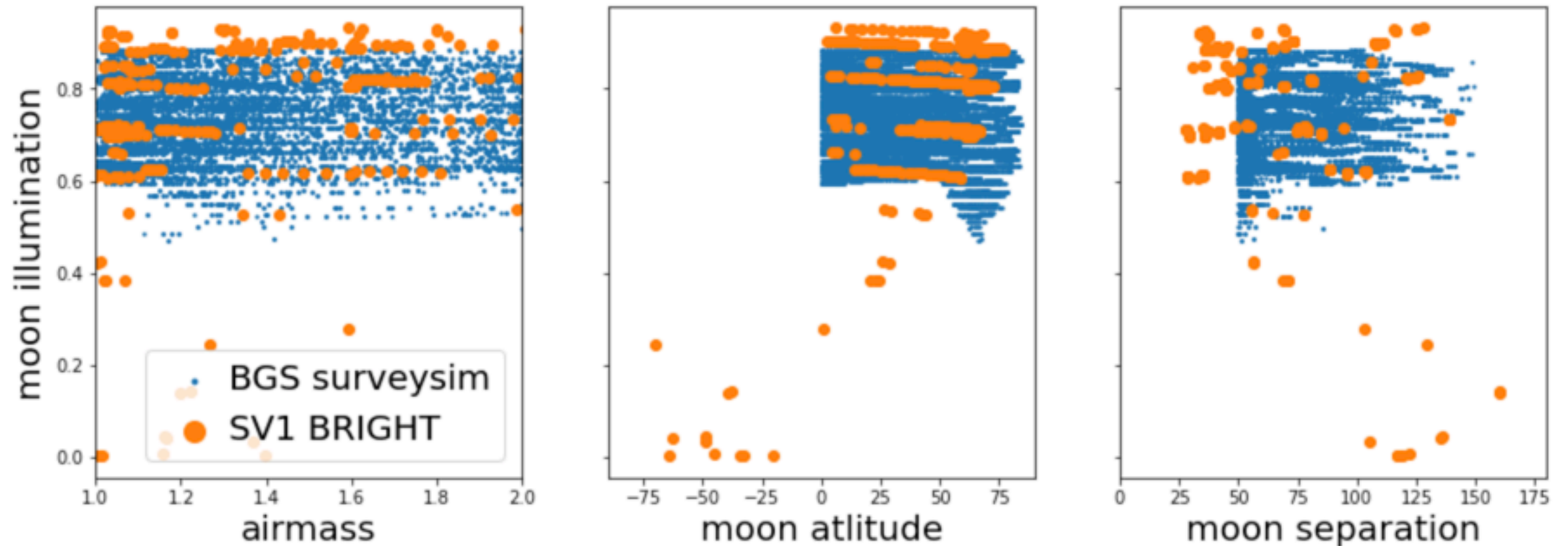
for $t_{\text{ref}} = 280s$ we can complete 14,000deg² BGS with 25% margins



BRIGHT exposures in survey simulations have sky brightness similar to new reference BGS sky



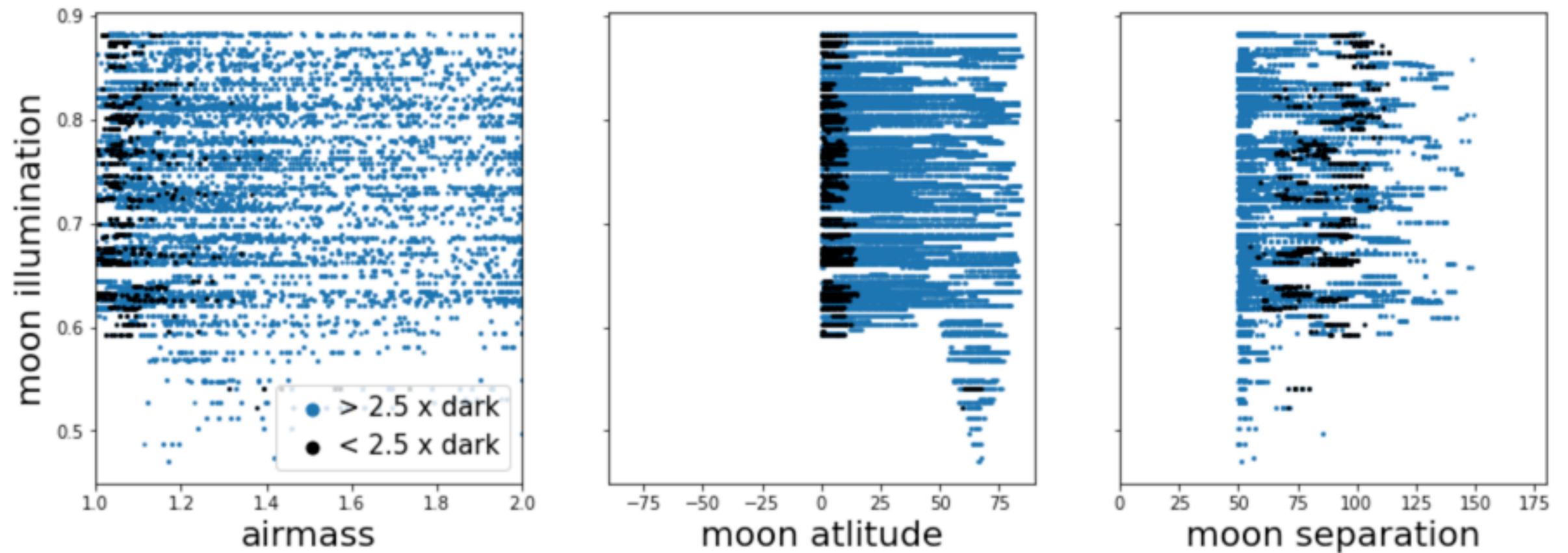
caveats: not all the exposures in the survey sim are BRIGHT time



BRIGHT in survey sim: (moon frac > 0.6) & (moon frac x moon alt > 30)

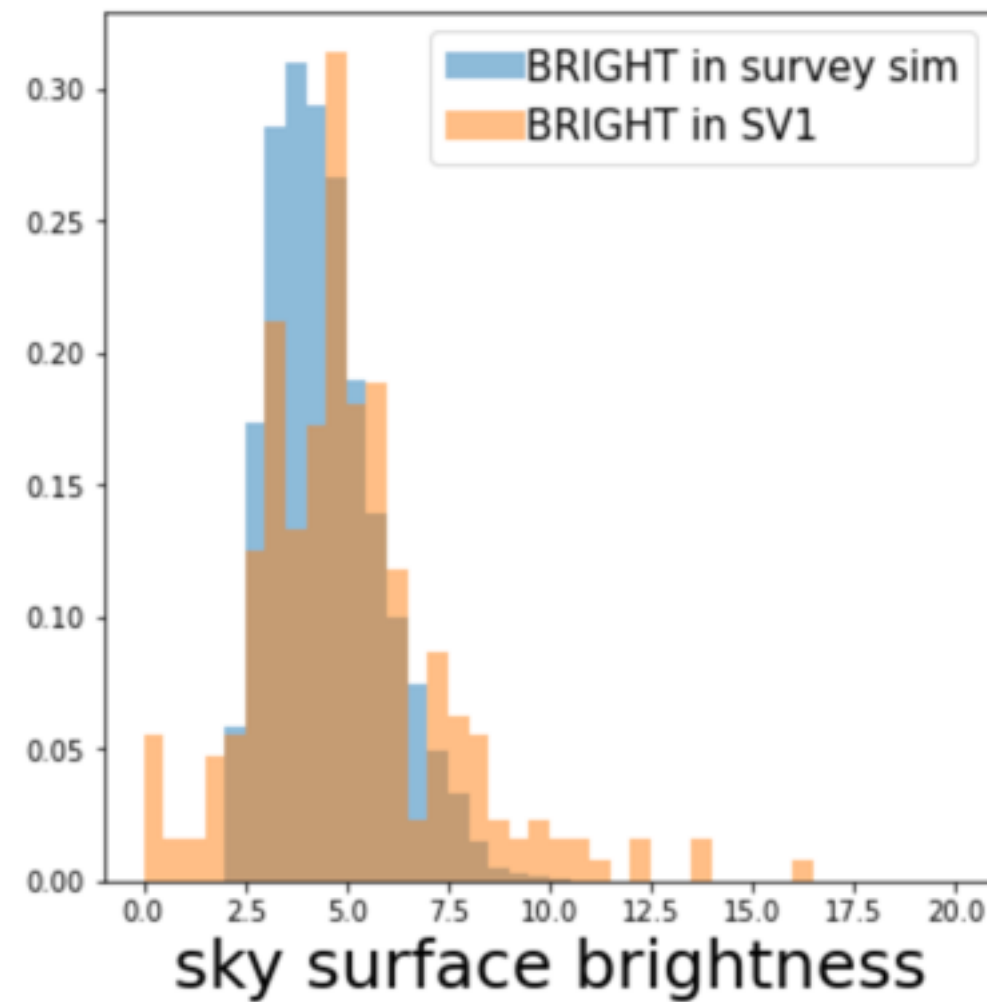
BRIGHT in practice: 2.5 x (dark time)

caveats: not all the exposures in the survey sim are BRIGHT time



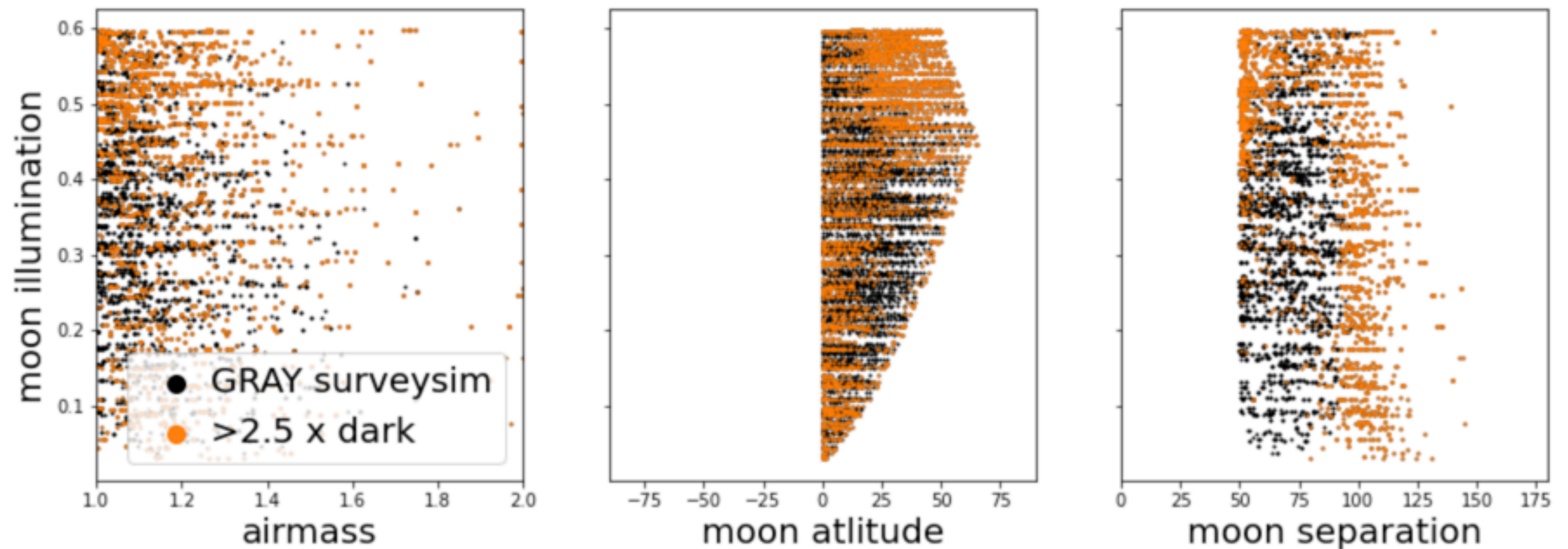
~8% of survey sim BRIGHT exposures are not BRIGHT in practice

caveats: not all the exposures in the survey sim are BRIGHT time



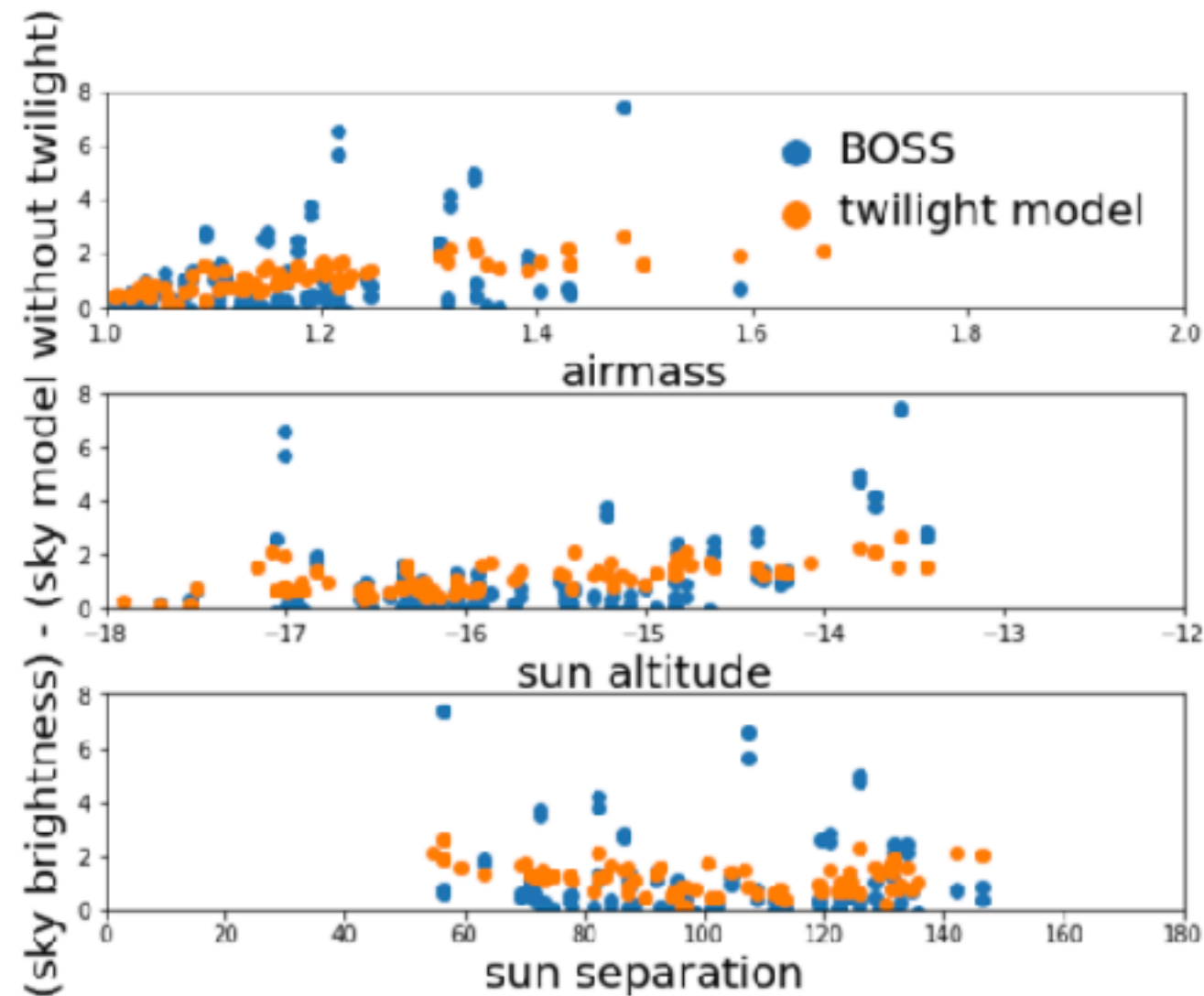
but sky brightness distribution is in agreement with SV1

but many survey sim GRAY time may be too bright



*using BRIGHT sky model

caveats: some twilight contribution is included in the survey simulations — *exposures with $-18 < \text{sun altitude} < -13$*



linear regression fit using BOSS twilight exposures