

Рассчитать и построить семейства лучевых траекторий радиоволн с частотами 3 и 8 МГц для ночных и дневных условий среднеширотной ионосферы при различных углах выхода радиоволн с земной поверхности. Использовать модель плоскослоистой холодной бесстолкновительной изотропной ионосферной плазмы.

Задача 5

$$\frac{dx}{d\tau} = p_x$$

$$\frac{dy}{d\tau} = p_y$$

$$\frac{dz}{d\tau} = p_z$$

$$p_x = \sin \theta_0 \cos \varphi_0$$

$$p_y = \sin \theta_0 \sin \varphi_0$$

$$\frac{dp_z}{d\tau} = \frac{1}{2} \frac{\partial n^2}{\partial z}$$

Численное
решение
системы ДУ

$$z(x)$$

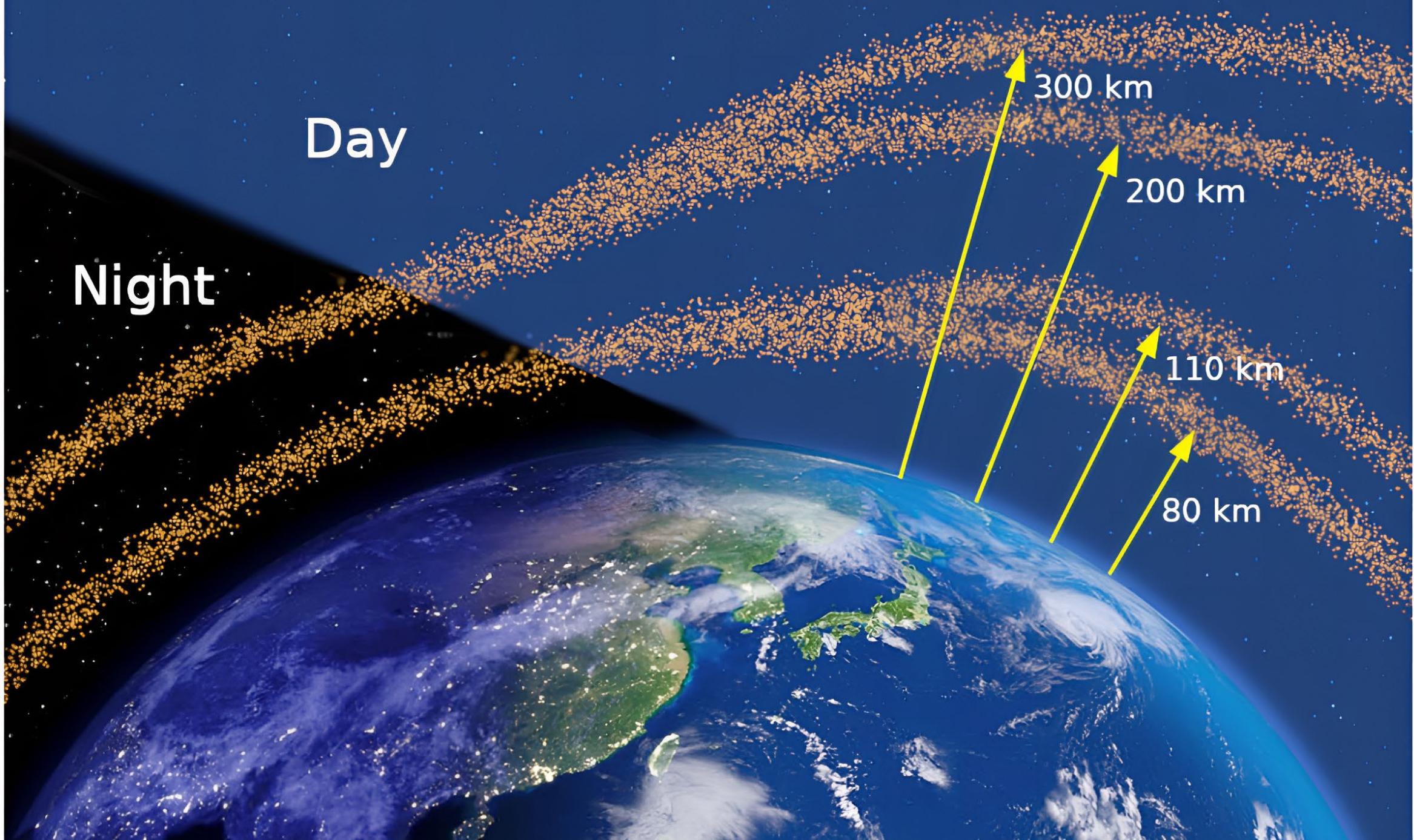
Н.у.

$$N_e(z)$$

$$\omega_p^2 = \frac{4\pi e^2 N_e}{m_e}$$

$$n^2 = 1 - \frac{\omega_p^2}{\omega^2}$$

$$\omega = 2\pi \cdot 3/8 \text{ MHz}$$



Night

Day

300 km

200 km

110 km

80 km

F2

F1

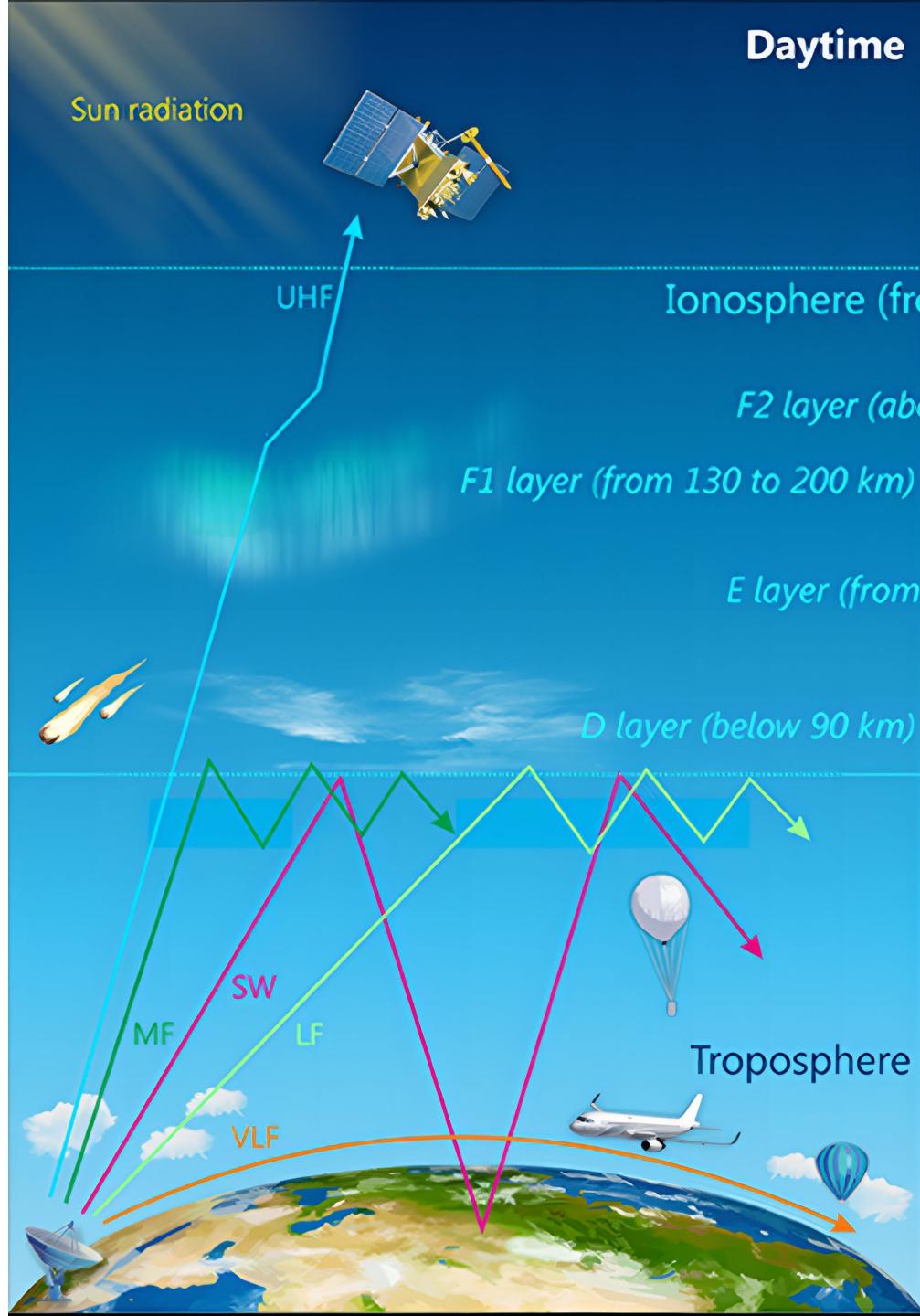
E

D

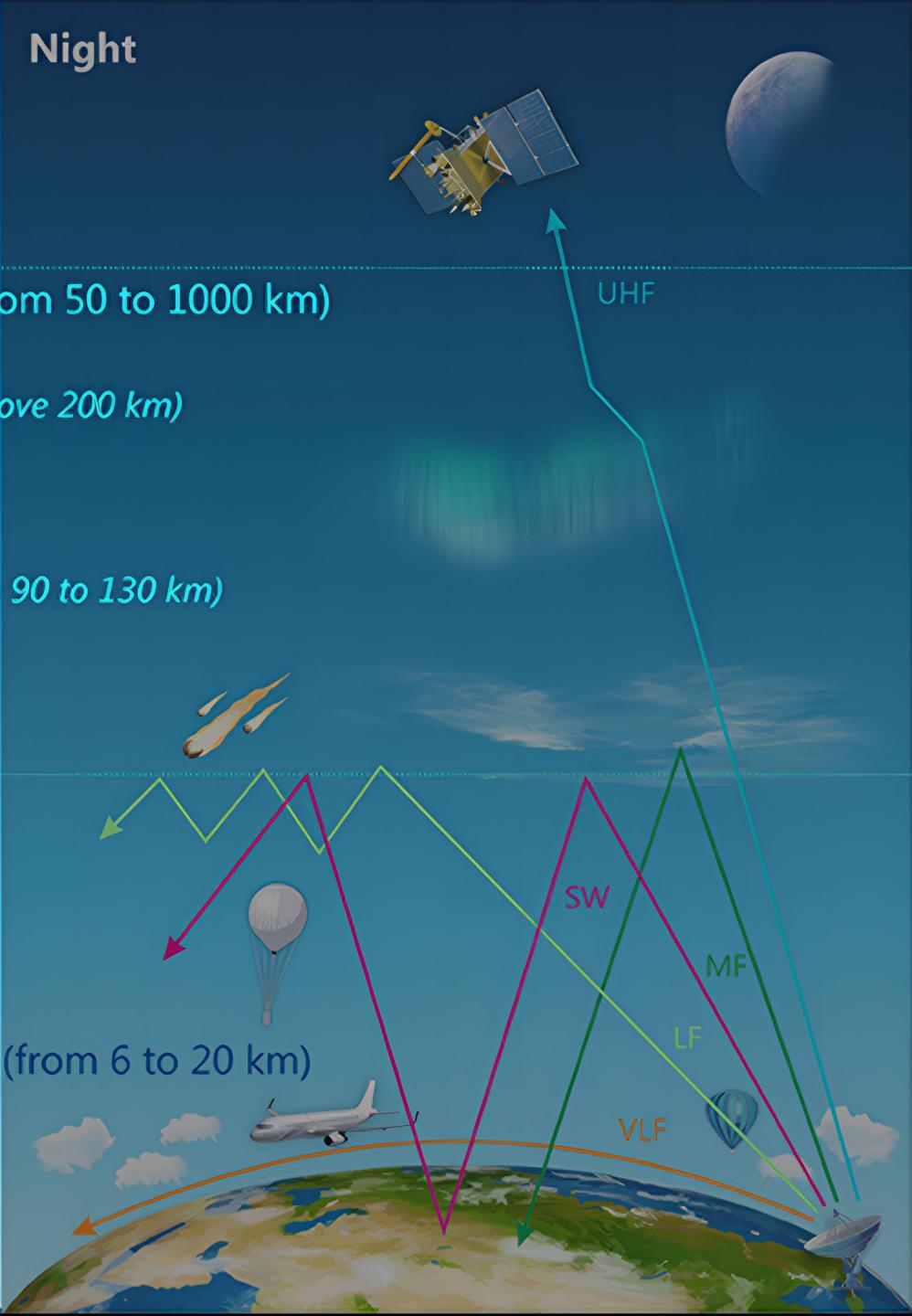
F

E

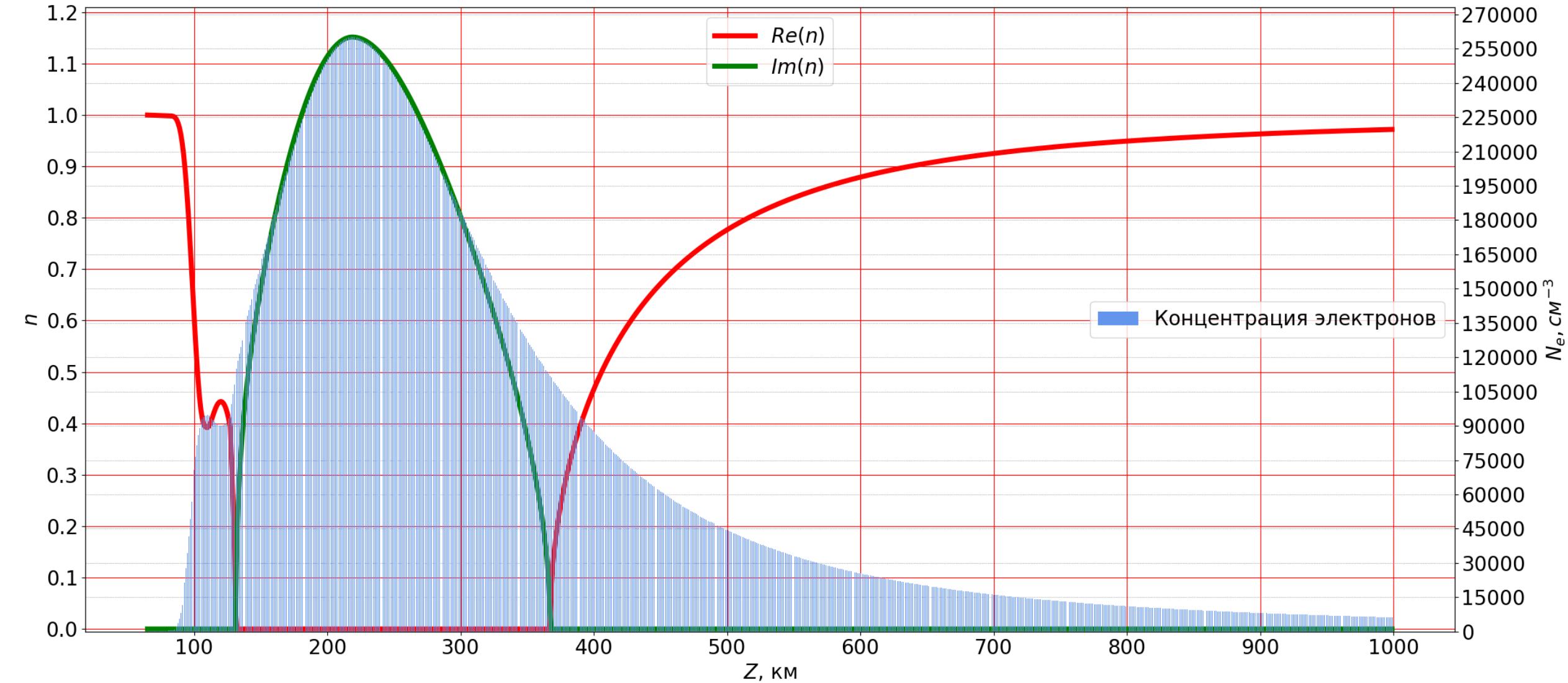
Daytime



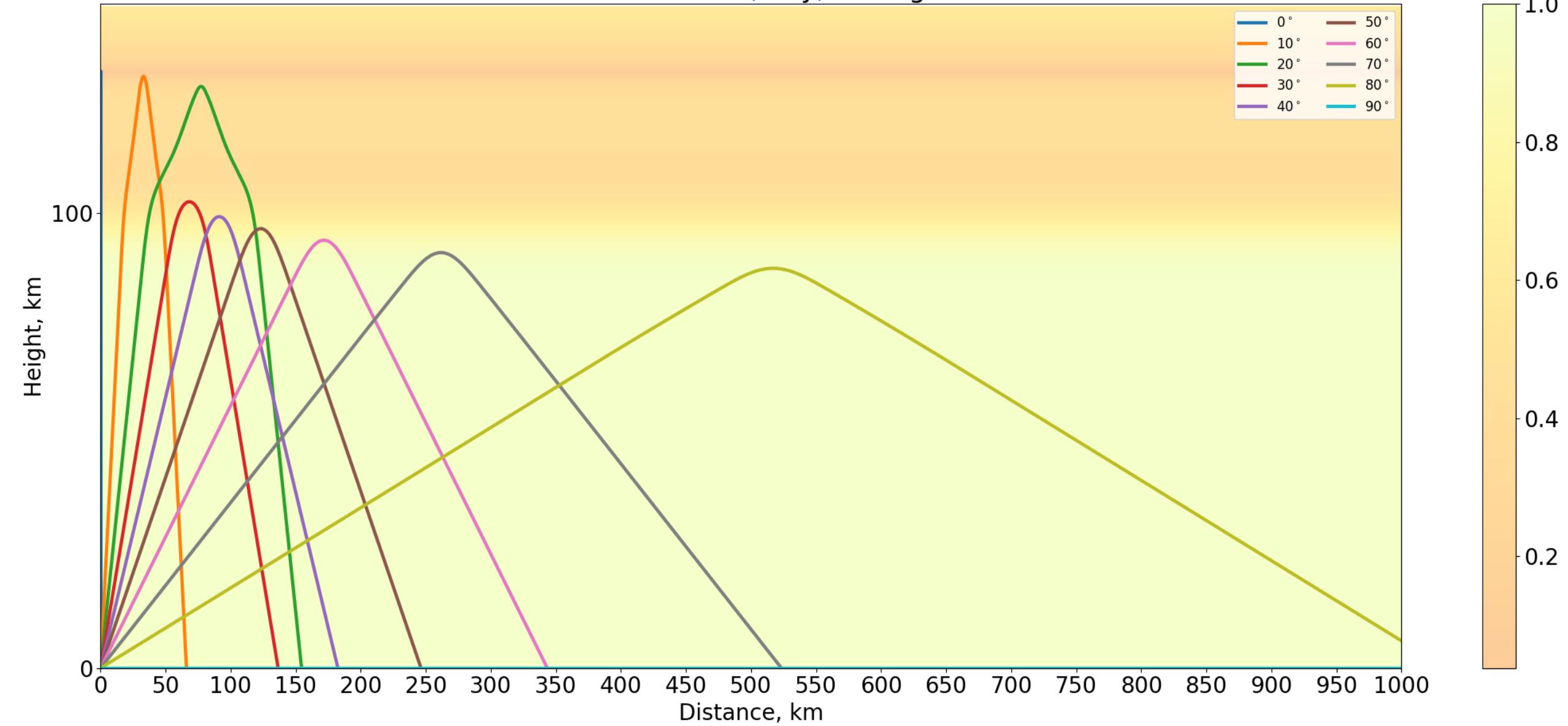
Night



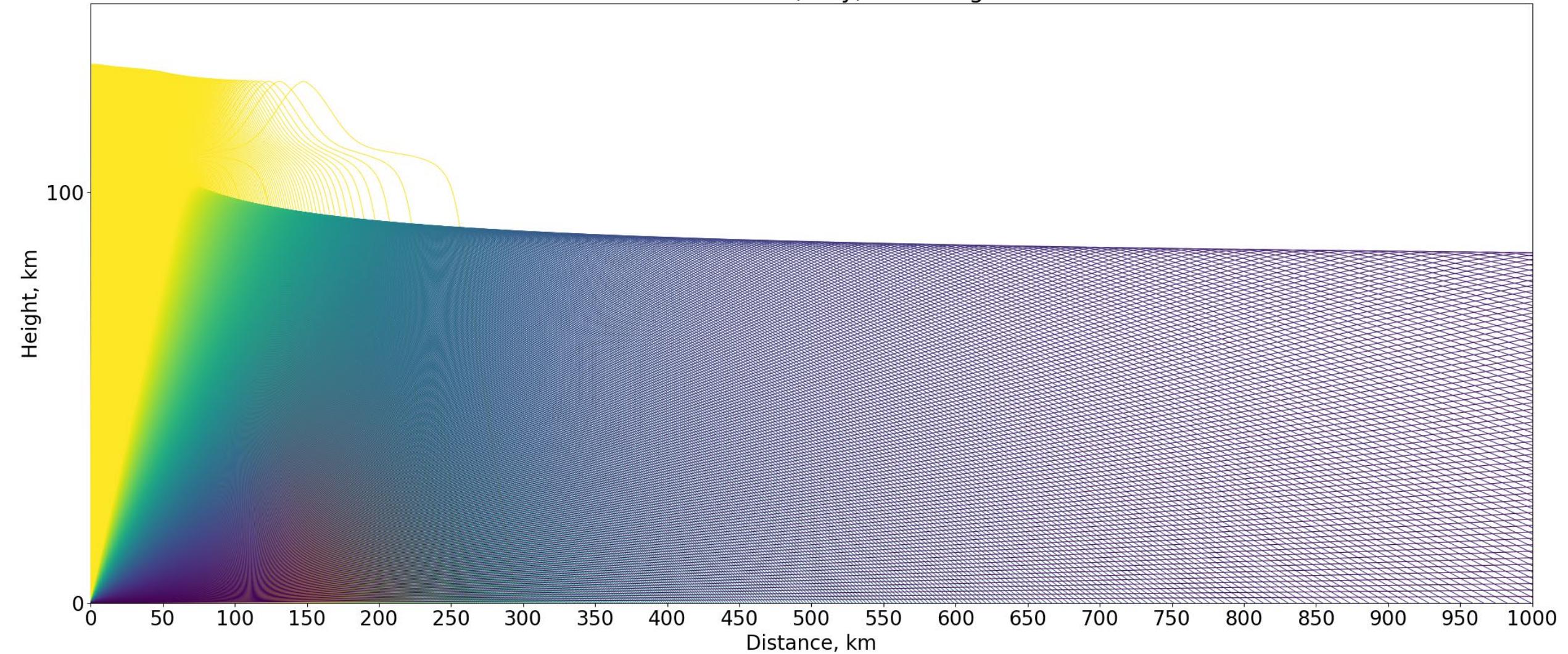
3 ГГц

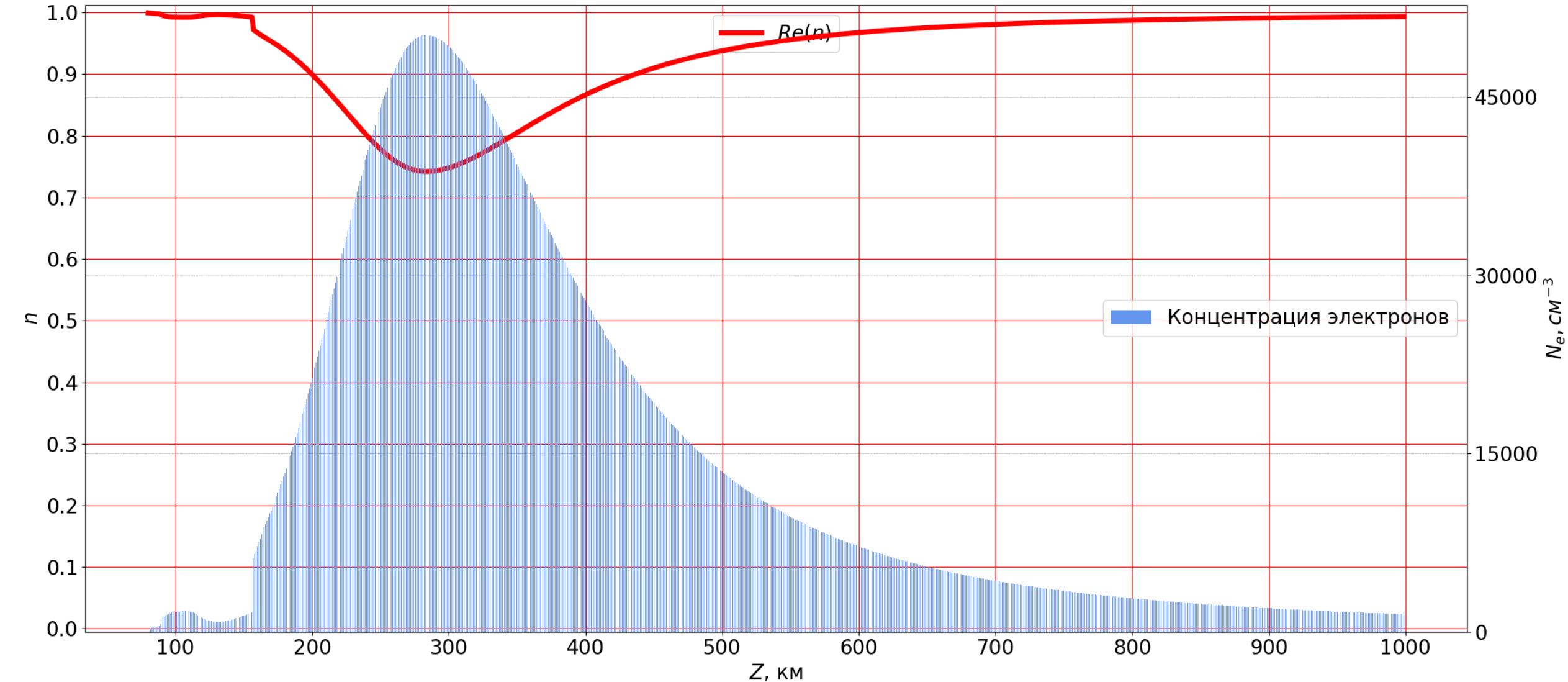


Beam for 3 MHz, day, 10 angles

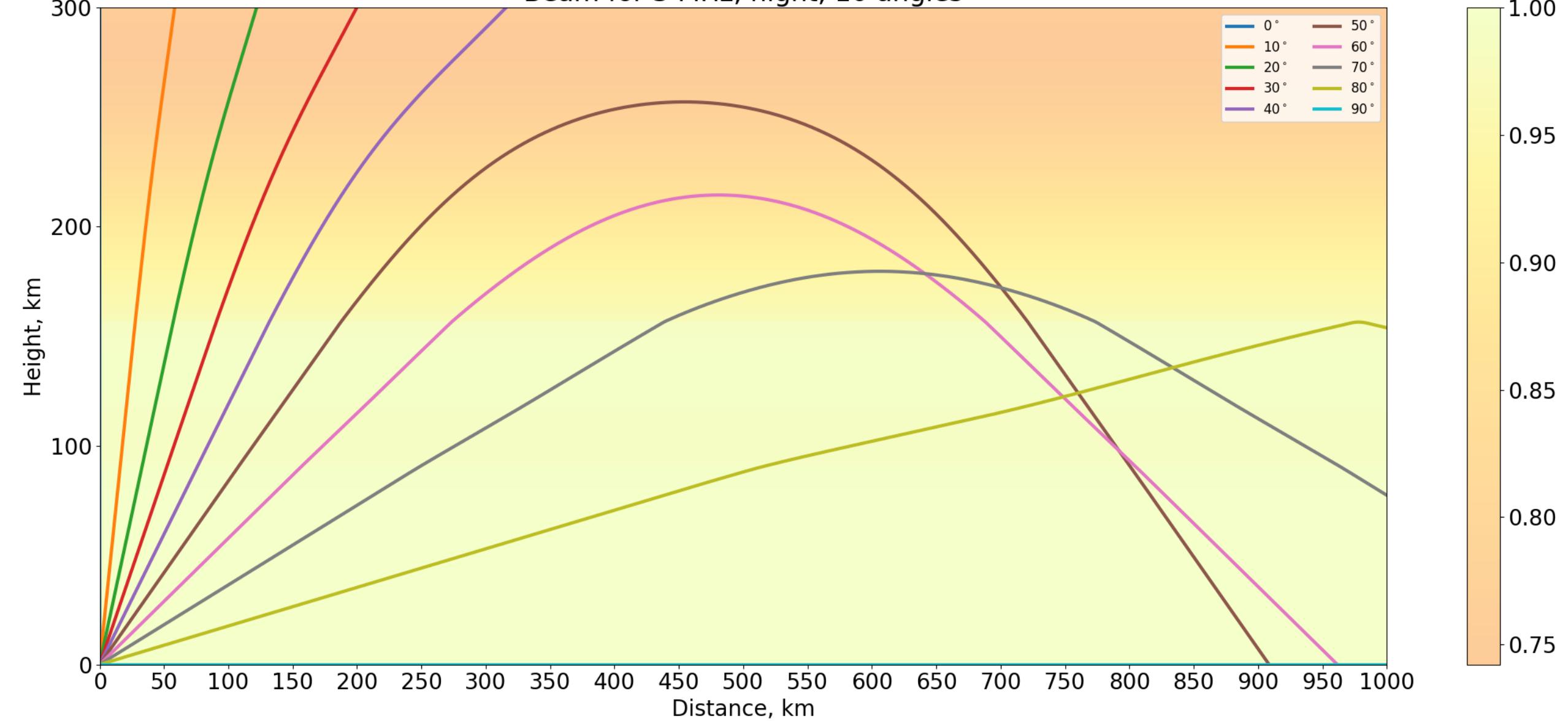


Beam for 3 MHz, day, 1000 angles

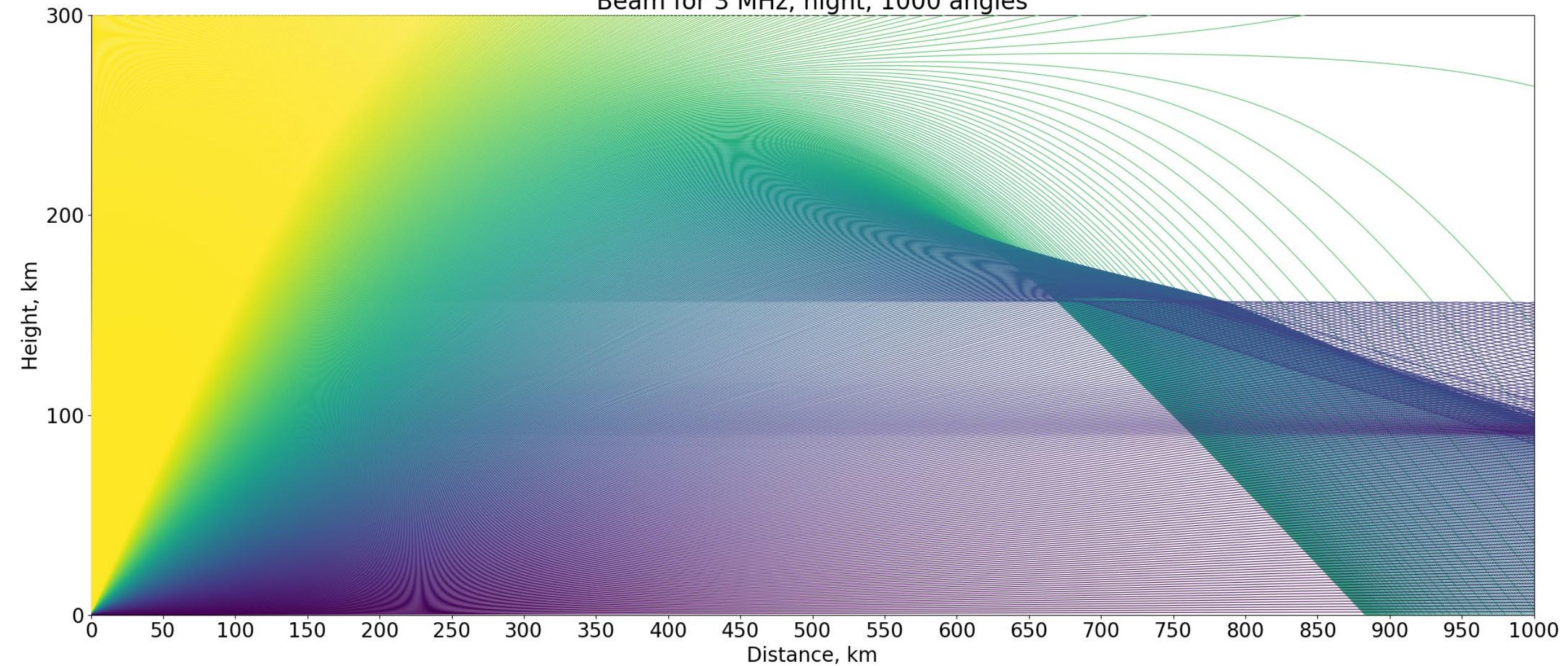




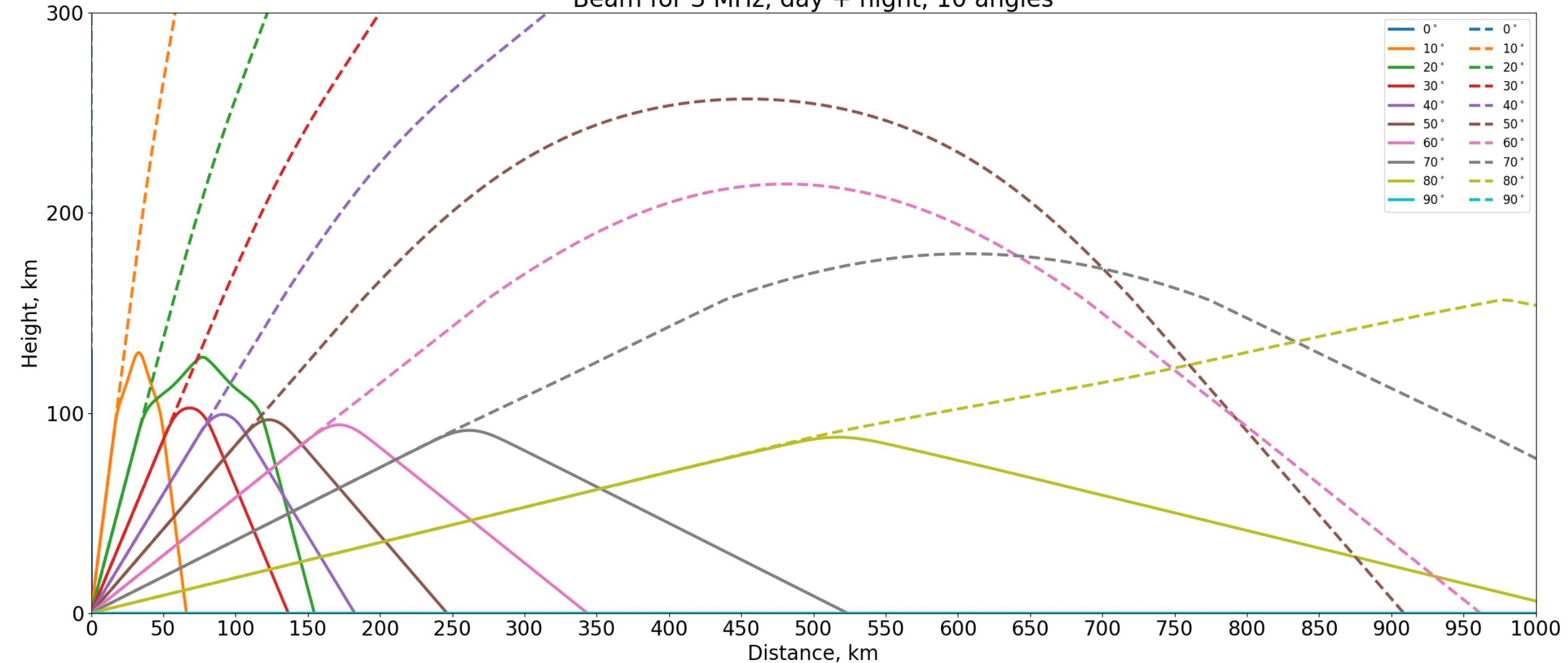
Beam for 3 MHz, night, 10 angles



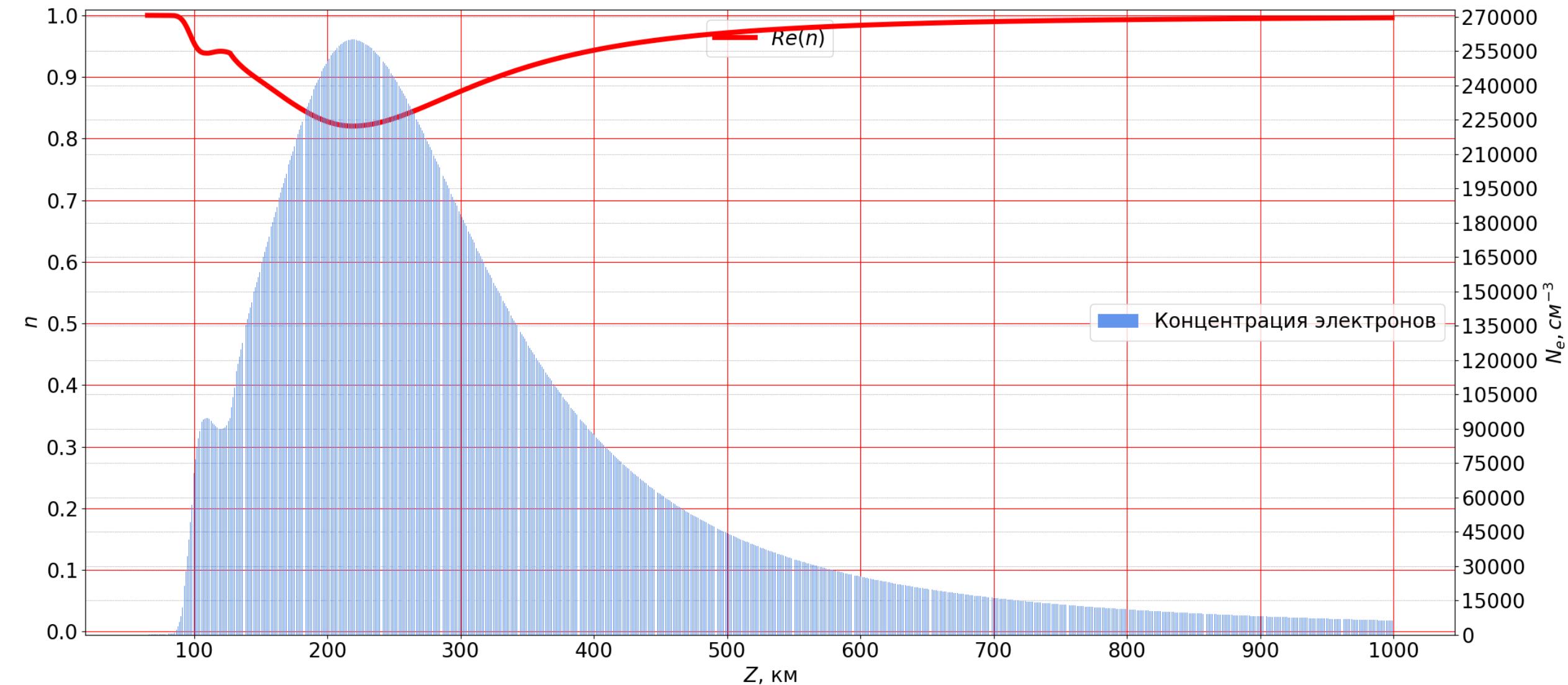
Beam for 3 MHz, night, 1000 angles



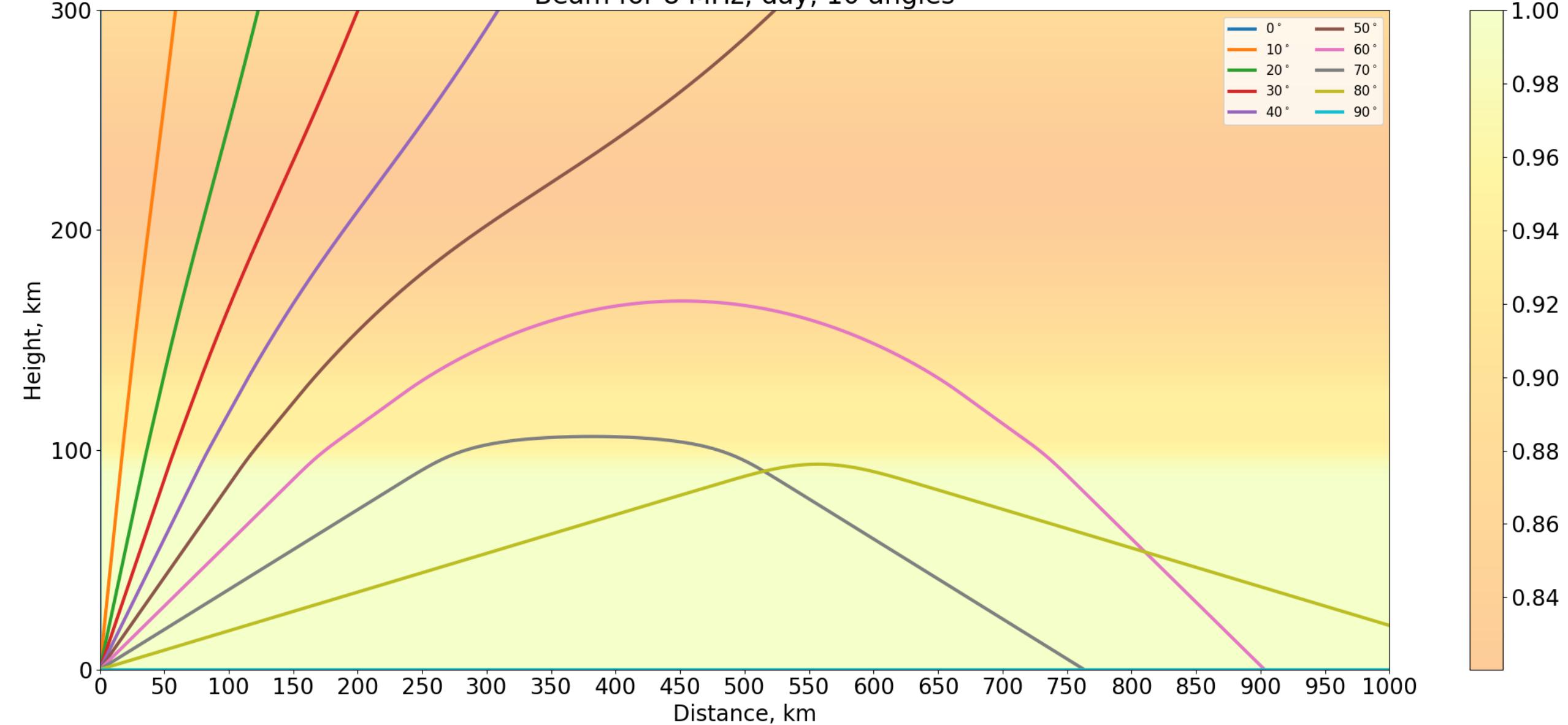
Beam for 3 MHz, day + night, 10 angles



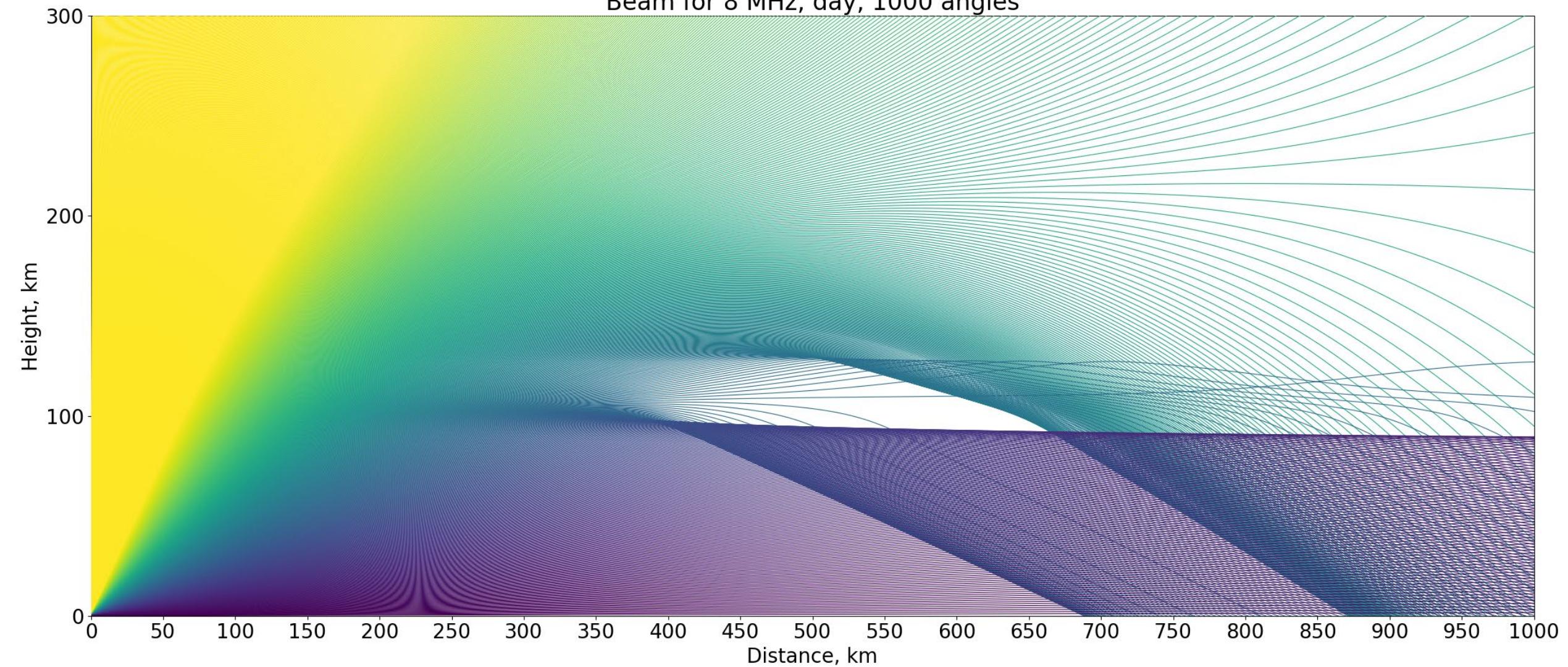
8 ГГц

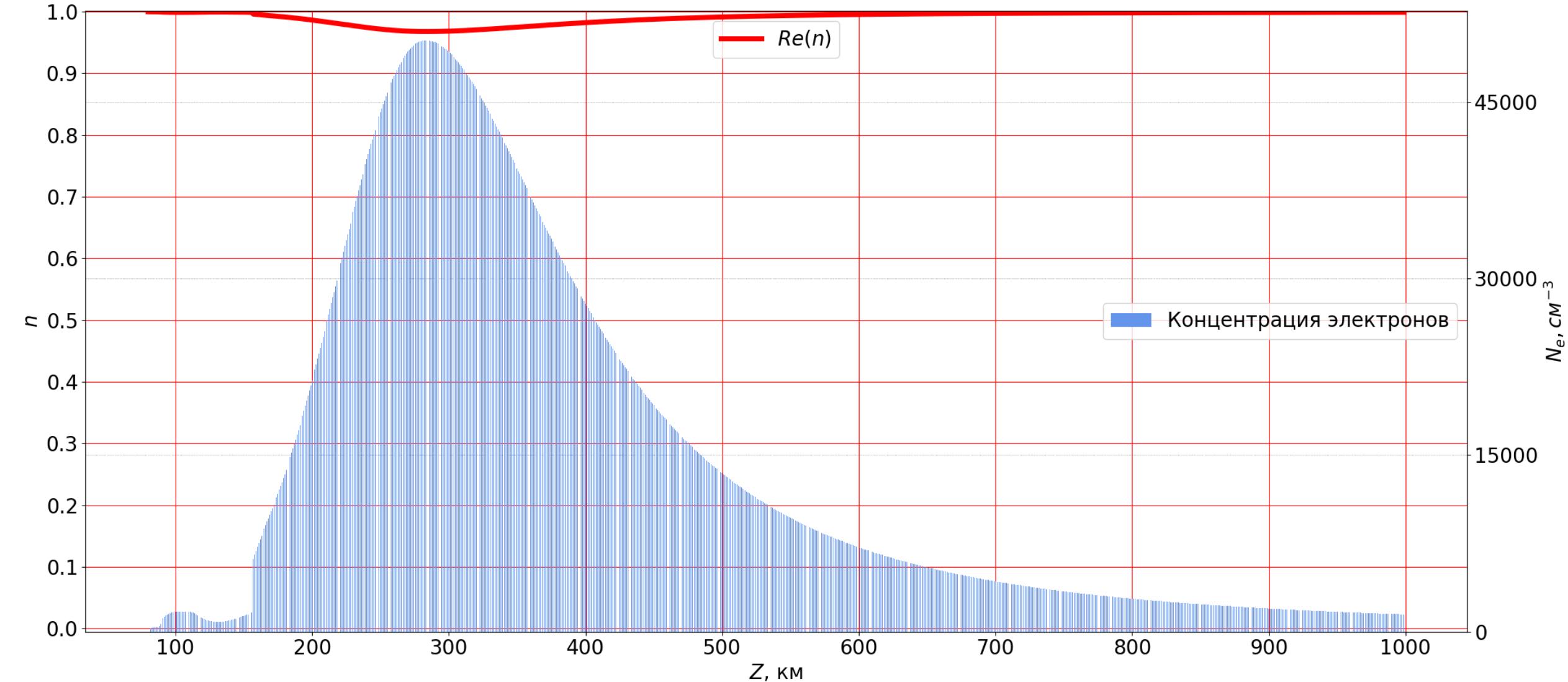


Beam for 8 MHz, day, 10 angles

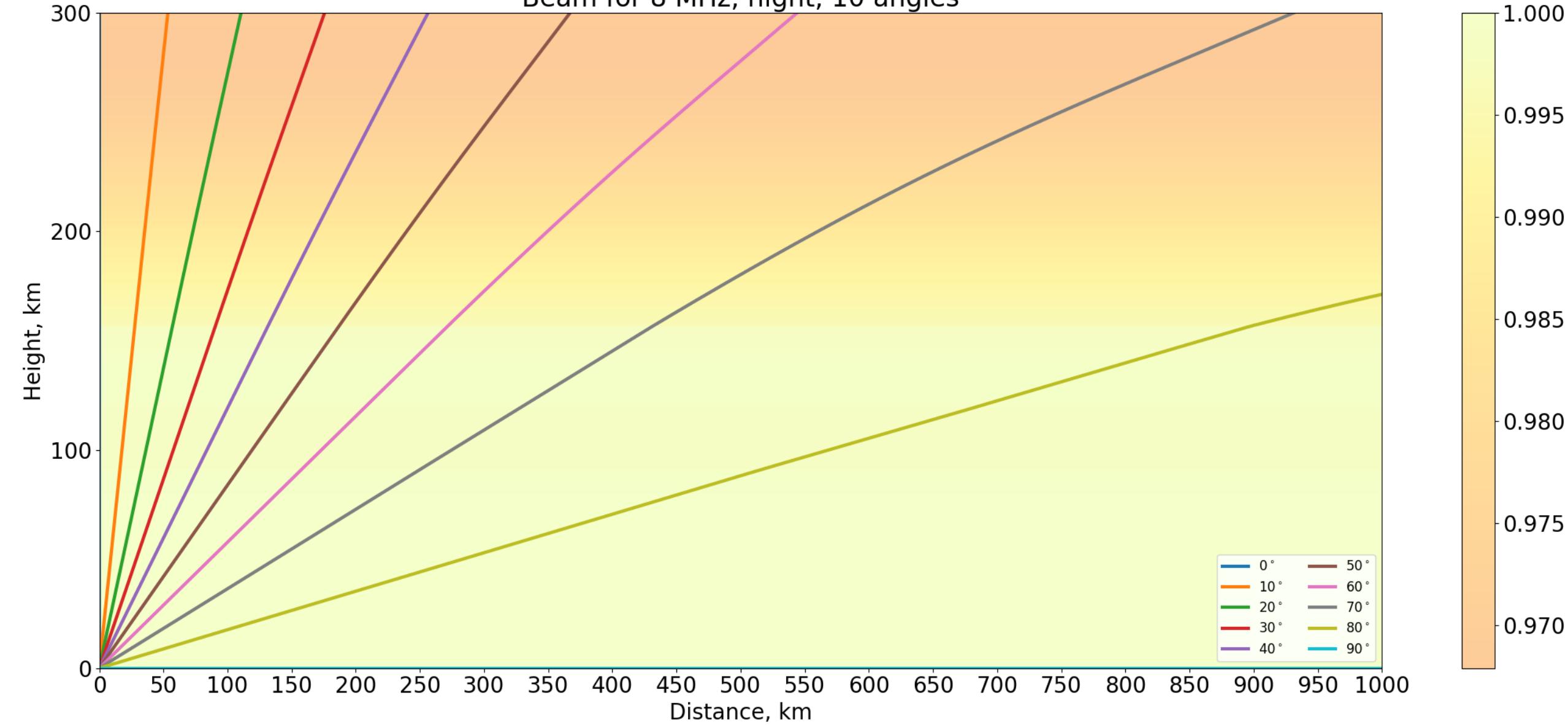


Beam for 8 MHz, day, 1000 angles

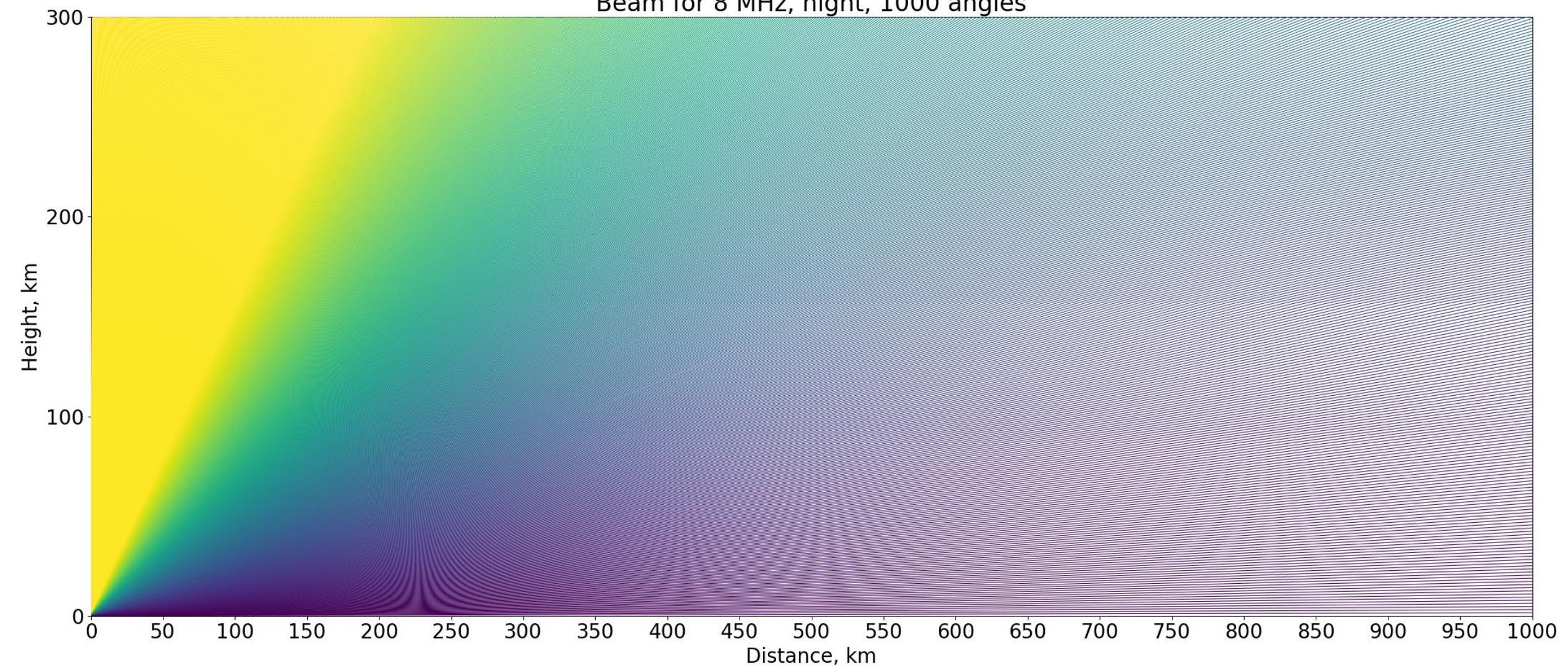




Beam for 8 MHz, night, 10 angles



Beam for 8 MHz, night, 1000 angles



Beam for 8 MHz, day + night, 10 angles

