CESAR Science Case – Calculation guide

Real solar diameter:	1.391.684 km
Real solar diameter for the day of the transit:	31'30"
Real Venus diameter for de day of the transit:	0'58"
Sun-Venus distance for the day of the transit (V):	106.411.500 km
Grades, minutes and seconds conversion:	1^o = 60' = 3600"
Grades to radians conversion:	$180^o = \pi$ (rad)

Method 1

To measure the linear distance between the observatories:

a) $\overline{AB} = 2Rsin\left(\frac{\theta 1 + \theta 2}{2}\right)$

b) $\overline{AB} = 2Rsin\left(\frac{\beta'}{2}\right) \quad where \quad \cos\beta' = \sin\alpha 1 \sin\alpha 2 + \cos\alpha 1 \cos\alpha 2 \cos(\delta 2 - \delta 1)$

To calculate the Earth-Sun distance:

$$E = \frac{\overline{AB}}{S} + V$$

Method 2

To calculate the parallax:

$$\sin(\pi_v) \cong \frac{d}{R_{EV}} \text{ and } \sin(\pi_s) \cong \frac{d}{R_{ES}} \quad where \quad R_{ES} = R_{VS} + R_{EV}$$

$$\Delta\pi = \pi_s \left[\frac{R_{VS}}{R_{ES} - R_{VS}}\right]$$

To calculate the Earth-Sun distance:

$$A'B' = \frac{1}{2}\left[\sqrt{D^2 - (A_1A_2)^2} - \sqrt{D^2 - (B_1B_2)^2}\right]$$

$$R_{ES} = \left[\frac{d}{A'B' \cdot (R_{ES}/R_{VS} - 1)}\right]$$

Method 3

To calculate the earth Sun distance:

$$S = \sqrt{\left(\frac{D}{2}\right)^2 - \left(\frac{t_1 d}{2}\right)^2} - \sqrt{\left(\frac{D}{2}\right)^2 - \left(\frac{t_2 d}{2}\right)^2}$$

$$R_{ES} = \left[\frac{d}{S \cdot R_{ES}/R_{VS} - 1)}\right]$$