

Method 1 – Elog post 191

$$\left. \begin{aligned} \theta_i &= \tan^{-1}(\sqrt{(\theta_{beam}^2 + \phi_{beam}^2)}) \\ \phi_i &= \tan^{-1}\left(\frac{\tan(\theta_{beam})}{\tan(\phi_{beam})}\right) \end{aligned} \right\} \text{Incident beam theta/phi with coordinate transformation to HCS (?) from bpm}$$

$$\left. \begin{aligned} \theta_o &= \theta_{rec} \\ \phi_o &= \phi_{rec} \end{aligned} \right\} \text{scattered beam theta/phi from optics reconstruction in HCS}$$

$$\vec{A} = [\sin(\theta_i)\cos(\phi_i), \sin(\theta_i)\sin(\phi_i), \cos(\theta_i)]$$

$$\vec{B} = [\sin(\theta_o)\cos(\phi_o), \sin(\theta_o)\sin(\phi_o), \cos(\theta_o)]$$

$$\theta_{scat} = \cos^{-1}(\vec{A} \cdot \vec{B})$$

Method 2 – Chao's optics technote

$$\left. \begin{aligned} \theta_i &= \cos^{-1} \left(\frac{1}{\sqrt{(\tan^2(\theta_{beam}) + \tan^2(\phi_{beam}) + 1)}} \right) \\ \phi_i &= \tan^{-1} \left(\frac{\tan(\theta_{beam})}{\tan(\phi_{beam})} \right) \end{aligned} \right\} \text{ Incident beam theta/phi with coordinate transformation to TCS (?) from bpm}$$

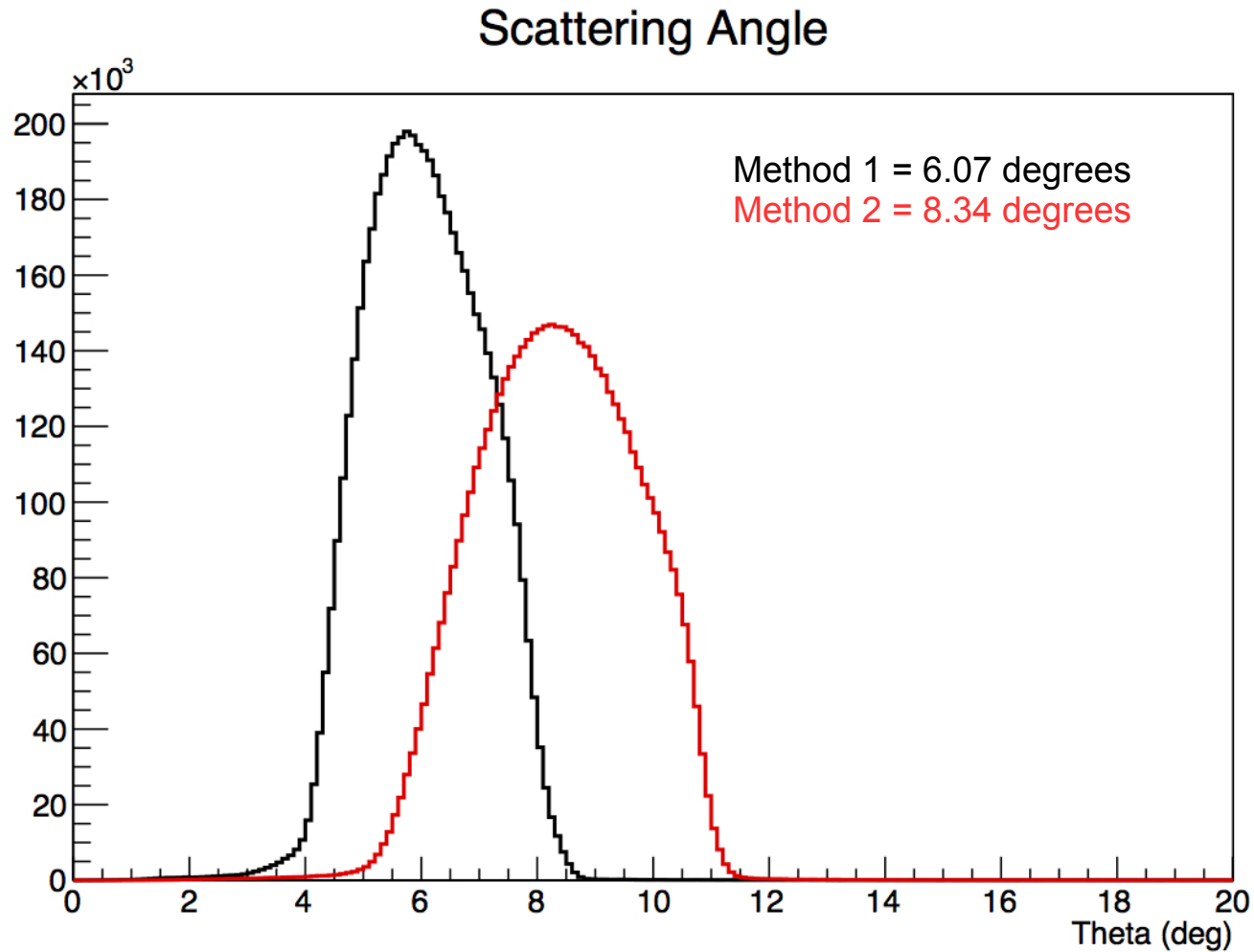
$$\left. \begin{aligned} \theta_o &= \theta_{tg} \\ \phi_o &= \phi_{tg} \end{aligned} \right\} \text{ scattered beam theta/phi from optics reconstruction in TCS}$$

$$\vec{A} = [\sin(\theta_i) \cos(\phi_i), \sin(\theta_i) \sin(\phi_i), \cos(\theta_i)]$$

$$\vec{B} = [\phi_o \cos(\theta_{central}) + \sin(\theta_{central}), -\theta_o, \cos(\theta_{central}) - \phi_o \sin(\theta_{central})]$$

$$\theta_{scat} = \cos^{-1} \left(\frac{\vec{A} \cdot \vec{B}}{|\vec{A}| |\vec{B}|} \right)$$

Methods do not agree!!!!



Example calculated from run 3545