DataPoints

In[1]:= **SettingsSVL = {{-0.13, -13.5294, -0.065},**
{0.028, 13.0198, -0.218}, {-5.692, 0.168184, -4.482}, {5.689, 0.168184, 4.078},
{-4.236, 0.168184, 5.515}, {-5.806, 0.168184, -4.622}, {5.593, 0.168184, 4.061},
{-4.238, 0.168184, 5.527}, {4.286, 0.168184, -6.001}, {0.022, 13.0198, -0.218}};

In[3]:= **SettingsSVL // TableForm**

Out[3]//TableForm=

-0.13	-13.5294	-0.065
0.028	13.0198	-0.218
-5.692	0.168184	-4.482
5.689	0.168184	4.078
-4.236	0.168184	5.515
-5.806	0.168184	-4.622
5.593	0.168184	4.061
-4.238	0.168184	5.527
4.286	0.168184	-6.001
0.022	13.0198	-0.218

Parameters

In[105]:= **Aa = 0.0248;**
ErrAa = 0.0123;
Bb = 0.1565;
ErrBb = 0.0377;
Rr = 0.99745;
ErrRr = 0.00130;
Kk = 0.550365;
ErrKk = 0.008133;
Ee = 0.168082;
ErrEe = 0.06048;

Calculations

In[120]:= **PhiBar[{IS_, IV_, IL_}] := ArcTan$\left[Kk (IV + Ee), \sqrt{(IS + Aa)^2 + Rr^2 (IL + Bb)^2} \right]$**

In[77]:= **ThetaBar[{IS_, IV_, IL_}] := ArcTan[(IS + Aa), Rr (IL + Bb)]**

Vertical Compass

In[121]:=

Map$\left[\dfrac{180}{\pi} * $PhiBar[#] &, SettingsSVL$\right]$

Out[121]= {178.915, 0.638891, 88.5116, 88.508, 88.4968, 88.5474, 88.4895, 88.4991, 88.5378, 0.609055}

In[129]:= $\mathtt{D\Big[ArcTan\big[pKk\ (IV + pEe),\ \sqrt{(IS + pAa)^2 + pRr^2\ (IL + pBb)^2}\ \big],\ pBb\Big]}$

Out[129]= $\dfrac{(IL + pBb)\ (IV + pEe)\ pKk\ pRr^2}{\sqrt{(IS + pAa)^2 + (IL + pBb)^2\ pRr^2}\ \Big((IS + pAa)^2 + (IV + pEe)^2\ pKk^2 + (IL + pBb)^2\ pRr^2\Big)}$

In[130]:= $\mathtt{PhiBarWithError[\{IS\_,\ IV\_,\ IL\_\}]} := \Big\{ \mathtt{ArcTan}\big[\mathtt{Kk}\ (IV + Ee),\ \sqrt{(IS + Aa)^2 + Rr^2\ (IL + Bb)^2}\ \big],$

$\mathtt{Abs}\Big[-\dfrac{(IV + Ee)\ \sqrt{(IS + Aa)^2 + (IL + Bb)^2\ Rr^2}}{(IS + Aa)^2 + (IV + Ee)^2\ Kk^2 + (IL + Bb)^2\ Rr^2}\Big] * \mathtt{ErrKk} +$

$\mathtt{Abs}\Big[-\dfrac{Kk\ \sqrt{(IS + Aa)^2 + (IL + Bb)^2\ Rr^2}}{(IS + Aa)^2 + (IV + Ee)^2\ Kk^2 + (IL + Bb)^2\ Rr^2}\Big] * \mathtt{ErrEe} +$

$\mathtt{Abs}\Big[\dfrac{(IS + Aa)\ (IV + Ee)\ Kk}{\sqrt{(IS + Aa)^2 + (IL + Bb)^2\ Rr^2}\ \Big((IS + Aa)^2 + (IV + Ee)^2\ Kk^2 + (IL + Bb)^2\ Rr^2\Big)}\Big] * \mathtt{ErrAa} +$

$\mathtt{Abs}\Big[\dfrac{(IL + Bb)^2\ (IV + Ee)\ Kk\ Rr}{\sqrt{(IS + Aa)^2 + (IL + Bb)^2\ Rr^2}\ \Big((IS + Aa)^2 + (IV + Ee)^2\ Kk^2 + (IL + Bb)^2\ Rr^2\Big)}\Big] * \mathtt{ErrRr} +$

$\mathtt{Abs}\Big[\dfrac{(IL + Bb)\ (IV + Ee)\ Kk\ Rr^2}{\sqrt{(IS + Aa)^2 + (IL + Bb)^2\ Rr^2}\ \Big((IS + Aa)^2 + (IV + Ee)^2\ Kk^2 + (IL + Bb)^2\ Rr^2\Big)}\Big] * \mathtt{ErrBb}\Big\}$

In[133]:= $\mathtt{Map\Big[\Big\{Flatten[\#],\ \Big(\dfrac{180}{\pi} * First[PhiBarWithError[\#]]\Big),\ \Big(\dfrac{180}{\pi} * Last[PhiBarWithError[\#]]\Big)\Big\}\ \&,}$

$\mathtt{SettingsSVL\Big]\ //\ MatrixForm}$

Out[133]//MatrixForm=

$$\begin{pmatrix}
\{-0.13, -13.5294, -0.065\} & 178.915 & 0.285844 \\
\{0.028, 13.0198, -0.218\} & 0.638891 & 0.301136 \\
\{-5.692, 0.168184, -4.482\} & 88.5116 & 0.297077 \\
\{5.689, 0.168184, 4.078\} & 88.508 & 0.297718 \\
\{-4.236, 0.168184, 5.515\} & 88.4968 & 0.301695 \\
\{-5.806, 0.168184, -4.622\} & 88.5474 & 0.289823 \\
\{5.593, 0.168184, 4.061\} & 88.4895 & 0.301537 \\
\{-4.238, 0.168184, 5.527\} & 88.4991 & 0.301225 \\
\{4.286, 0.168184, -6.001\} & 88.5378 & 0.293271 \\
\{0.022, 13.0198, -0.218\} & 0.609055 & 0.307159
\end{pmatrix}$$

Horizontal Compass

In[85]:= $\mathtt{Map\Big[-180 + \Big(143 + \Big(\dfrac{180}{\pi} * ThetaBar[\#]\Big)\Big)\ \&,\ SettingsSVL\Big]}$

Out[85]= $\{102.057, -86.2804, -179.718, -0.527792,$
$89.6647, -179.388, -0.173237, 89.6197, -90.5183, -89.6592\}$

In[84]:= $\mathtt{Map\Big[-37 + \Big(\dfrac{180}{\pi} * ThetaBar[\#]\Big)\ \&,\ SettingsSVL\Big]}$

Out[84]= $\{102.057, -86.2804, -179.718, -0.527792,$
$89.6647, -179.388, -0.173237, 89.6197, -90.5183, -89.6592\}$

In[96]:= **D[ArcTan[(IS + pAa), pRr (IL + pBb)], pRr]**

Out[96]= $\dfrac{(IS + pAa)\ (IL + pBb)}{(IS + pAa)^2 + (IL + pBb)^2\ pRr^2}$

In[125]:= **ThetaBarWithError[{IS_, IV_, IL_}] :=**

$\left\{ \text{ArcTan}[(IS + Aa),\ Rr\ (IL + Bb)],\ \text{Abs}\left[-\dfrac{(IL + Bb)\ Rr}{(IS + Aa)^2 + (IL + Bb)^2\ Rr^2}\right] * \text{ErrAa} + \right.$

$\left. \text{Abs}\left[\dfrac{(IS + Aa)\ (IL + Bb)}{(IS + Aa)^2 + (IL + Bb)^2\ Rr^2}\right] * \text{ErrRr} + \text{Abs}\left[\dfrac{(IS + Aa)\ Rr}{(IS + Aa)^2 + (IL + Bb)^2\ Rr^2}\right] * \text{ErrBb}\right\}$

In[126]:= **Map[**

$\left\{ \text{Flatten[\#]},\ \left(\dfrac{180}{\pi} * \text{First[ThetaBarWithError[\#]]} - 37\right),\ \left(\dfrac{180}{\pi} * \text{Last[ThetaBarWithError[\#]]}\right)\right\} \&,$

SettingsSVL] // MatrixForm

Out[126]//MatrixForm=

$\begin{pmatrix}
\{-0.13,\ -13.5294,\ -0.065\} & 102.057 & 15.0384 \\
\{0.028,\ 13.0198,\ -0.218\} & -86.2804 & 24.002 \\
\{-5.692,\ 0.168184,\ -4.482\} & -179.718 & 0.336607 \\
\{5.689,\ 0.168184,\ 4.078\} & -0.527792 & 0.33849 \\
\{-4.236,\ 0.168184,\ 5.515\} & 89.6647 & 0.298352 \\
\{-5.806,\ 0.168184,\ -4.622\} & -179.388 & 0.328901 \\
\{5.593,\ 0.168184,\ 4.061\} & -0.173237 & 0.341747 \\
\{-4.238,\ 0.168184,\ 5.527\} & 89.6197 & 0.297788 \\
\{4.286,\ 0.168184,\ -6.001\} & -90.5183 & 0.290537 \\
\{0.022,\ 13.0198,\ -0.218\} & -89.6592 & 24.2352
\end{pmatrix}$