DATA :=

	0	1	2
0	$7.6282890000000\cdot10^{6}$	$1.2625163000000\cdot10^{7}$	$7.2200740000000\cdot10^{6}$
1	$7.6281810000000\cdot10^{6}$	$1.2625263000000\cdot10^{7}$	$7.2200340000000\cdot10^{6}$
2	$7.6284040000000\cdot10^{6}$	$1.2624888000000\cdot10^{7}$	$7.2200600000000\cdot10^{6}$
3	$7.6284000000000\cdot10^{6}$	$1.2625502000000\cdot10^{7}$	$7.2196320000000\cdot10^{6}$
4	$7.6287310000000\cdot10^{6}$	$1.2625519000000\cdot10^{7}$	$7.2194210000000\cdot10^{6}$
5	$7.6287170000000\cdot10^{6}$	$1.2625553000000\cdot10^{7}$	$7.2191620000000\cdot10^{6}$
6	$7.6340700000000\cdot10^{6}$	$1.2623398000000\cdot10^{7}$	$7.2234510000000\cdot10^{6}$
7	$7.6337080000000\cdot10^{6}$	$1.2631184000000\cdot10^{7}$	$7.2231280000000\cdot10^{6}$
8	$7.6301850000000\cdot10^{6}$	$1.2624823000000\cdot10^{7}$	$7.2249290000000\cdot10^{6}$
9	$1.2060822000000\cdot10^{7}$	$1.0847085000000\cdot10^{7}$	$7.5965390000000\cdot10^{6}$

Coefficients

BX := 8523842.859   BY := 8523842.8   BZ := 8521931.578   HEXB := 8388608   B

SX := 9103   SY := 9103   SZ := 9106   u1 := 0   u2 := 0   u3 := 0

Data Arrays

i := 1, 2 .. rows(DATA)

$positionXData_i := submatrix(DATA, i-1, i-1, 0, 0)$ $positionYData_i := submatrix(DATA, i -$

$$positionXmG_i := \frac{\left[\left(positionXData_i\right)^{\langle 0\rangle}\right]_0 - BX}{SX} \qquad positionYmG_i := \frac{\left[\left(positionYData_i\right)^{\langle 0\rangle}\right]_0 - BY}{SY}$$

Model Vectors

$$E_i := \begin{bmatrix} \left[\left(positionXData_i\right)^{\langle 0\rangle}\right]_0 \\ \left[\left(positionYData_i\right)^{\langle 0\rangle}\right]_0 \\ \left[\left(positionZData_i\right)^{\langle 0\rangle}\right]_0 \end{bmatrix} \qquad b := \begin{pmatrix} BX \\ BY \\ BZ \end{pmatrix} \qquad S := \begin{pmatrix} SX & 0 & 0 \\ 0 & SY & 0 \\ 0 & 0 & SZ \end{pmatrix} \qquad P := \begin{bmatrix} 1 & \\ -\sin(u1) & co \\ \sin(u2) & si \end{bmatrix}$$

$$\sqrt{\left(E_{20}-b\right)^{T}\cdot S^{-1}\cdot\left(P^{-1}\right)^{T}\cdot P^{-1}\cdot S^{-1}\cdot\left(E_{20}-b\right)} = 477.947$$

$$E_i := \begin{pmatrix} positionXmG_i \\ positionYmG_i \\ positionZmG_i \end{pmatrix}$$

$BX := 0$ $BY := 0$ $BZ := 0$

$SX := 1$ $SY := 1$ $SZ := 1$

$$b := \begin{pmatrix} BX \\ BY \\ BZ \end{pmatrix} \quad S := \begin{pmatrix} SX & 0 & 0 \\ 0 & SY & 0 \\ 0 & 0 & SZ \end{pmatrix} \quad P := \begin{bmatrix} 1 & 0 & 0 \\ -\sin(u1) & \cos(u1) & 0 \\ \sin(u2) & \sin(u3) & \sqrt{\left(1-\sin(u2)^2-\sin(u3)^2\right)} \end{bmatrix}$$

$$\sqrt{\left(E_{20}-b\right)^{T}\cdot S^{-1}\cdot\left(P^{-1}\right)^{T}\cdot P^{-1}\cdot S^{-1}\cdot\left(E_{20}-b\right)} = 1.622\times 10^{3}$$

Given

$$b = \begin{pmatrix} BX \\ BY \\ BZ \end{pmatrix} \quad S = \begin{pmatrix} SX & 0 & 0 \\ 0 & SY & 0 \\ 0 & 0 & SZ \end{pmatrix} \quad P = \begin{bmatrix} 1 & 0 & 0 \\ -\sin(u1) & \cos(u1) & 0 \\ \sin(u2) & \sin(u3) & \sqrt{\left(1-\sin(u2)^2-\sin(u3)^2\right)} \end{bmatrix}$$

$$\sqrt{\left(E_{1}-b\right)^{T}\cdot S^{-1}\cdot\left(P^{-1}\right)^{T}\cdot P^{-1}\cdot S^{-1}\cdot\left(E_{1}-b\right)} = Bcsc$$

$$\sqrt{\left(E_{2}-b\right)^{T}\cdot S^{-1}\cdot\left(P^{-1}\right)^{T}\cdot P^{-1}\cdot S^{-1}\cdot\left(E_{2}-b\right)} = Bcsc$$

$$\sqrt{\left(E_{3}-b\right)^{T}\cdot S^{-1}\cdot\left(P^{-1}\right)^{T}\cdot P^{-1}\cdot S^{-1}\cdot\left(E_{3}-b\right)} = Bcsc$$

$$\sqrt{\left(E_{4}-b\right)^{T}\cdot S^{-1}\cdot\left(P^{-1}\right)^{T}\cdot P^{-1}\cdot S^{-1}\cdot\left(E_{4}-b\right)} = Bcsc$$

$$\sqrt{\left(E_{5}-b\right)^{T}\cdot S^{-1}\cdot\left(P^{-1}\right)^{T}\cdot P^{-1}\cdot S^{-1}\cdot\left(E_{5}-b\right)} = Bcsc$$

$$\sqrt{\left(E_{6}-b\right)^{T}\cdot S^{-1}\cdot\left(P^{-1}\right)^{T}\cdot P^{-1}\cdot S^{-1}\cdot\left(E_{6}-b\right)} = Bcsc$$

$$\sqrt{(E_7 - b)^T \cdot S^{-1} \cdot (P^{-1})^T \cdot P^{-1} \cdot S^{-1} \cdot (E_7 - b)} = Bcsc$$

$$\sqrt{(E_8 - b)^T \cdot S^{-1} \cdot (P^{-1})^T \cdot P^{-1} \cdot S^{-1} \cdot (E_8 - b)} = Bcsc$$

$$\sqrt{(E_9 - b)^T \cdot S^{-1} \cdot (P^{-1})^T \cdot P^{-1} \cdot S^{-1} \cdot (E_9 - b)} = Bcsc$$

$$\sqrt{(E_{10} - b)^T \cdot S^{-1} \cdot (P^{-1})^T \cdot P^{-1} \cdot S^{-1} \cdot (E_{10} - b)} = Bcsc$$

$$\sqrt{(E_{11} - b)^T \cdot S^{-1} \cdot (P^{-1})^T \cdot P^{-1} \cdot S^{-1} \cdot (E_{11} - b)} = Bcsc$$

$$\sqrt{(E_{12} - b)^T \cdot S^{-1} \cdot (P^{-1})^T \cdot P^{-1} \cdot S^{-1} \cdot (E_{12} - b)} = Bcsc$$

$$\sqrt{(E_{13} - b)^T \cdot S^{-1} \cdot (P^{-1})^T \cdot P^{-1} \cdot S^{-1} \cdot (E_{13} - b)} = Bcsc$$

$$\sqrt{(E_{14} - b)^T \cdot S^{-1} \cdot (P^{-1})^T \cdot P^{-1} \cdot S^{-1} \cdot (E_{14} - b)} = Bcsc$$

$$\sqrt{(E_{15} - b)^T \cdot S^{-1} \cdot (P^{-1})^T \cdot P^{-1} \cdot S^{-1} \cdot (E_{15} - b)} = Bcsc$$

$$\sqrt{(E_{16} - b)^T \cdot S^{-1} \cdot (P^{-1})^T \cdot P^{-1} \cdot S^{-1} \cdot (E_{16} - b)} = Bcsc$$

$$\sqrt{(E_{17} - b)^T \cdot S^{-1} \cdot (P^{-1})^T \cdot P^{-1} \cdot S^{-1} \cdot (E_{17} - b)} = Bcsc$$

$$\sqrt{(E_{18} - b)^T \cdot S^{-1} \cdot (P^{-1})^T \cdot P^{-1} \cdot S^{-1} \cdot (E_{18} - b)} = Bcsc$$

$$\sqrt{(E_{19} - b)^T \cdot S^{-1} \cdot (P^{-1})^T \cdot P^{-1} \cdot S^{-1} \cdot (E_{19} - b)} = Bcsc$$

$$\sqrt{\left(E_{20}-b\right)^T \cdot S^{-1} \cdot \left(P^{-1}\right)^T \cdot P^{-1} \cdot S^{-1} \cdot \left(E_{20}-b\right)} = \text{Bcsc}$$

$$\begin{pmatrix} S\_ \\ b \\ U \end{pmatrix} := \text{Minerr}\left[\begin{pmatrix} SX \\ SY \\ SZ \end{pmatrix}, \begin{pmatrix} BX \\ BY \\ BZ \end{pmatrix}, \begin{pmatrix} u1 \\ u2 \\ u3 \end{pmatrix}\right]$$

$ERR = 5031.836$

$$S := \text{diag}(S\_) = \begin{pmatrix} 9.103 \times 10^3 & 0 & 0 \\ 0 & 9.103 \times 10^3 & 0 \\ 0 & 0 & 9.106 \times 10^3 \end{pmatrix}$$

$$b = \begin{pmatrix} 8.524 \times 10^6 \\ 8.524 \times 10^6 \\ 8.522 \times 10^6 \end{pmatrix}$$

$$U = \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix} \qquad P := \begin{bmatrix} 1 & 0 & 0 \\ -\sin\left(U_0\right) & \cos\left(U_0\right) & 0 \\ \sin\left(U_1\right) & \sin\left(U_2\right) & \sqrt{\left(1-\sin\left(U_1\right)^2-\sin\left(U_2\right)^2\right)} \end{bmatrix} = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$$

$k := 1..20$

$$\sqrt{\left(E_k-b\right)^T \cdot S^{-1} \cdot \left(P^{-1}\right)^T \cdot P^{-1} \cdot S^{-1} \cdot \left(E_k-b\right)} =$$

1621.541
1621.541
1621.541
1621.541
1621.541
1621.541
1621.541
1621.541
1621.541
1621.519
1621.555
1621.555
1621.601
1621.599
1621.583
1621.583
1621.583
1621.547
1621.529
1621.532

$\text{Bcsc} = 496.4$

$$\sqrt{\left(E_{20} - b\right)^{T} \cdot S^{-1} \cdot \left(P^{-1}\right)^{T} \cdot P^{-1} \cdot S^{-1} \cdot \left(E_{20} - b\right)} = 1621.532$$

$$Bcsc = 496.4$$

$$E_{20} - b = \begin{pmatrix} -8523822.194 \\ -8523385.328 \\ -8522068.222 \end{pmatrix} \qquad E_{20} = \begin{pmatrix} 20.665 \\ 457.531 \\ -136.644 \end{pmatrix} \qquad b = \begin{pmatrix} 8.524 \times 10^{6} \\ 8.524 \times 10^{6} \\ 8.522 \times 10^{6} \end{pmatrix}$$

3	4	5	6
80.5704712732066	-486.7787458443196	118.2896666666667	507.383083564
80.5823354937933	-486.7902097902098	118.2941111111111	507.397002222
80.5578380753598	-486.7472199931216	118.2912222222222	507.351194638
80.5582774909371	-486.8176086208873	118.3387777777778	507.429883295
80.5219158519169	-486.8195574916886	118.3622222222222	507.431449693
80.5234538064374	-486.8234552332913	118.3910000000000	507.442146514
79.9354059101395	-486.5764071993580	117.9144444444444	507.001070383
79.9751730198836	-487.4689900263671	117.9503333333333	507.872351748
80.3621882895749	-486.7397684282930	117.7502222222222	507.187143281
-406.3605404811601	-282.9408460392067	76.4602222222222	

csc := 496.4

- 1, i − 1, 1, 1)

$\text{positionZData}_i := \text{submatrix}(\text{DATA}, i-1, i-1, 2, 2)$

$$\text{positionZmG}_i := \frac{\left[\left(\text{positionZData}_i\right)^{\langle 0\rangle}\right]_0 - \text{BZ}}{\text{SZ}}$$

0 0

s(u1) 0

n(u3) $\sqrt{\left(1 - \sin(u2)^2 - \sin(u3)^2\right)}$]

$$P = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$$

1512
9129
6205
8150
6994
4553
1859
2824
1562
...