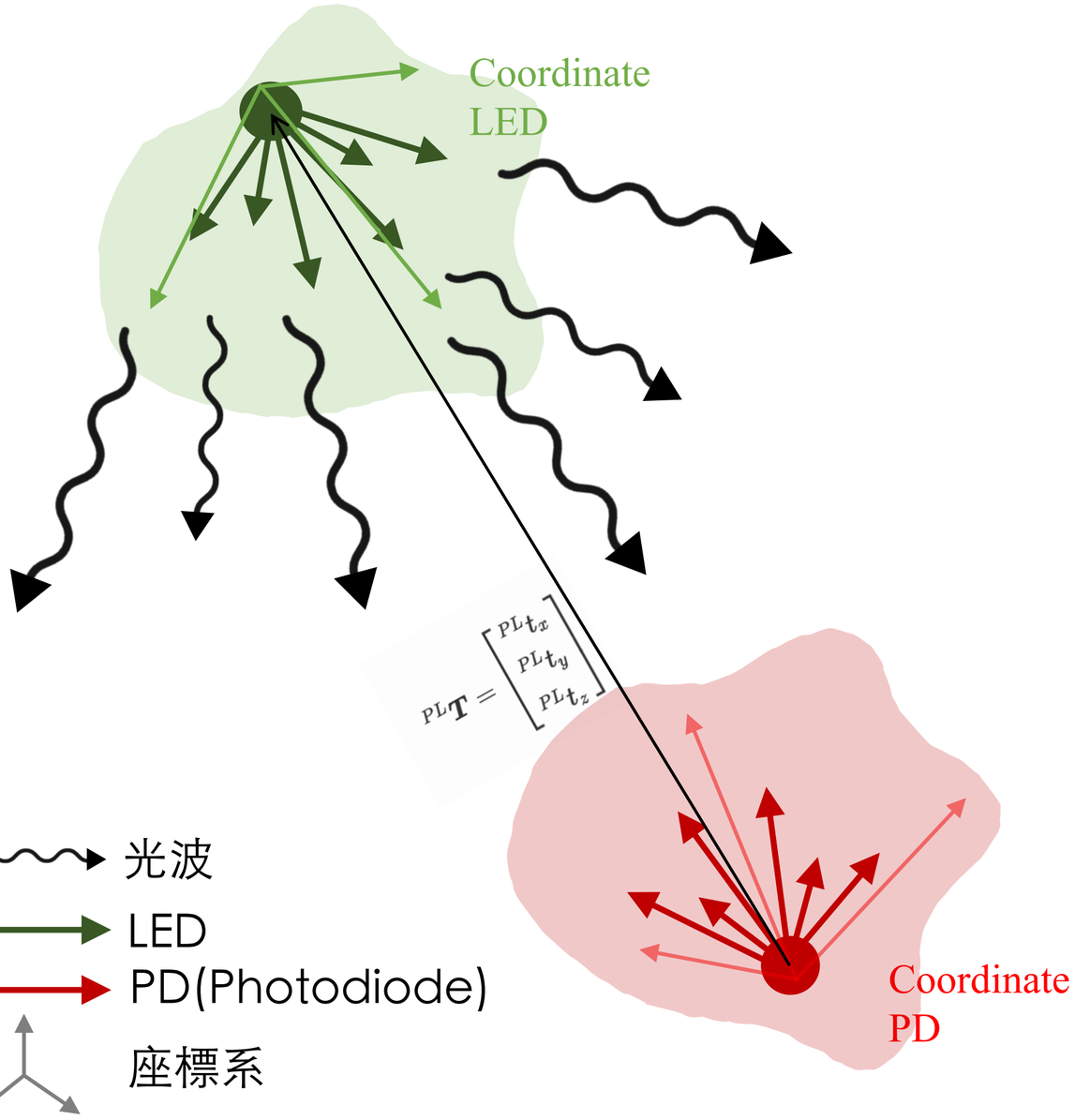
多LED對多PD定位系統：介紹

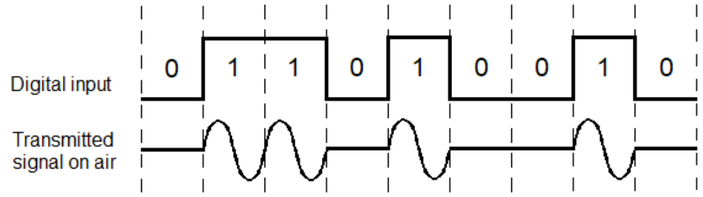


各LED進行編碼
(Modulation)

光波傳遞

各PD進行解碼
(Demodulation)

定位演算法



	LED_1	LED_2	⋯	LED_L
PD_1	5	0.01	⋯	-
PD_2	0.02	-	⋯	-
⋮	⋮	⋮		⋮
PD_p	-	3.21	⋯	10.35

單位：μA

光傳遞模型

LED發光輻射強度I_{LED}

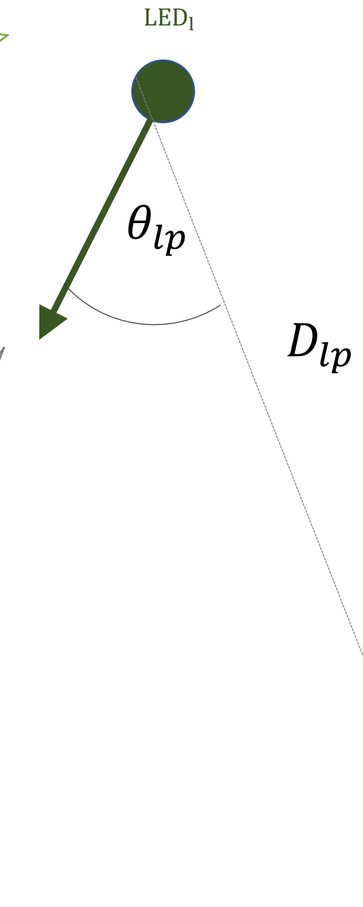
$$I_{LED} = Pt\frac{(Ml+1)}{2\pi}\cos\theta_{lp}{}^{Ml}$$

Pt	LED總輻射能量
Ml	LED朗博次方

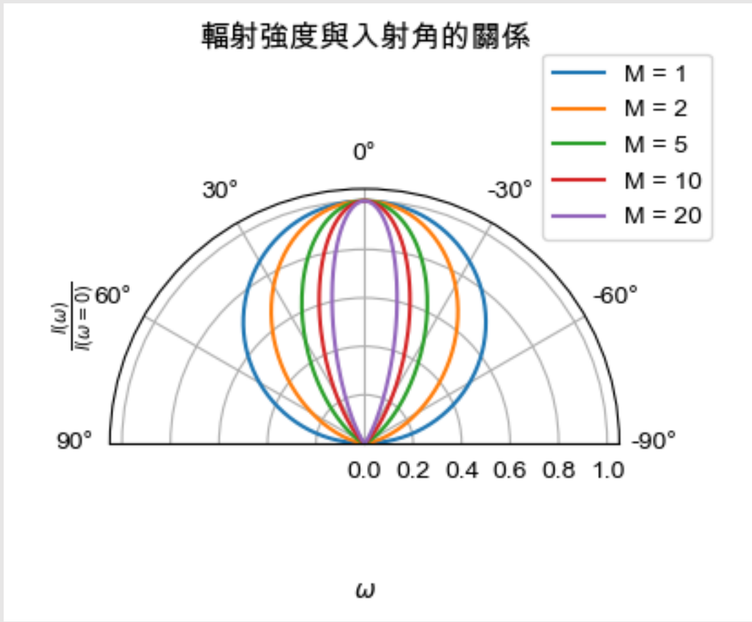
PD接收光輻射強度I_{PD}

$$I_{PD} = I_{LED} \times \frac{\cos\phi_{lp}{}^{Mp}}{D_{lp}{}^{2}}$$

θ	LED出射角
D	距離
ϕ	PD入射角



朗博次方與輻射模式(Pattern)



PD輸出電流Ie

$$Ie = I_{PD} \times A \times Re$$

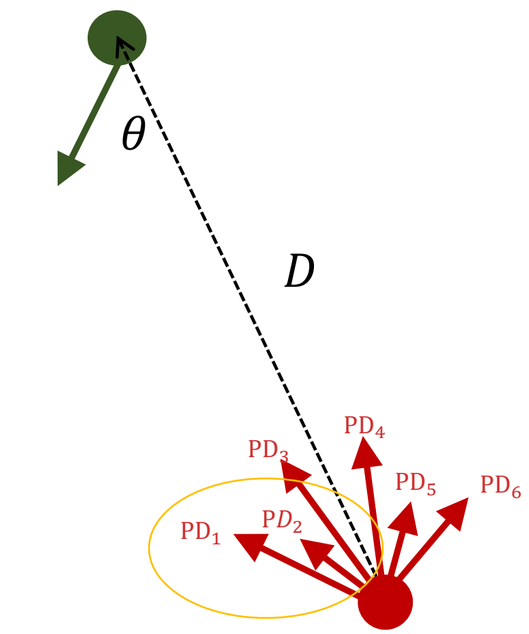
Mp	PD朗博次方
A	PD有效面積
Re	PD響應率

定位演算法：獲得入射方位

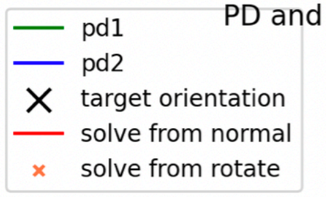
限制組態

兩PD強度比值開朗博次方根，為入射角餘弦比值，即為一平面

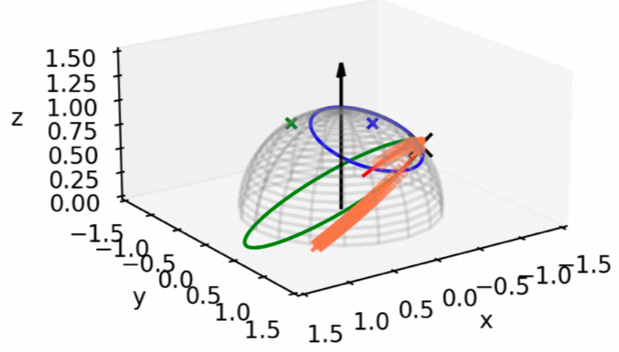
多個平面交得一點



$$Ie_p = f(\phi)$$



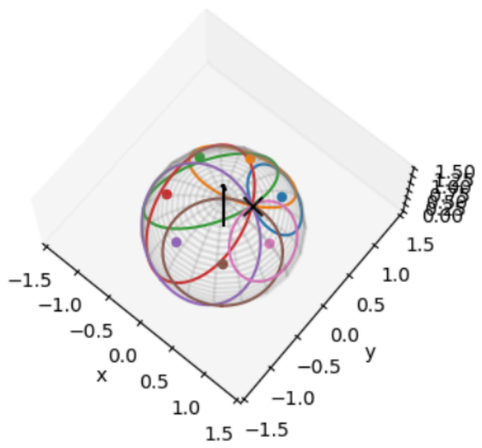
PD and Stereographic Projection

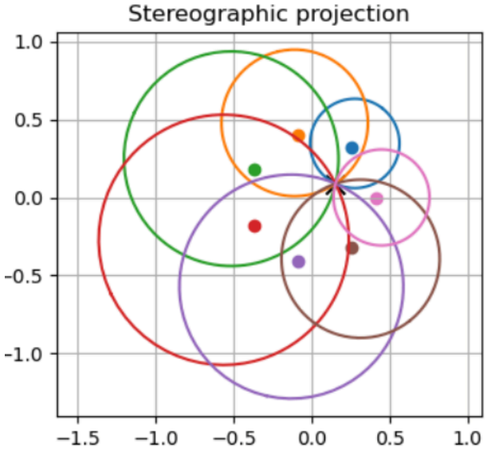


$$Mp\sqrt{\frac{Ie_1}{Ie_2}} = \frac{cos\phi_{l1}}{cos\phi_{l2}} = \frac{\overrightarrow{{}^{P}V_1}\cdot\vec{D}}{\overrightarrow{{}^{P}V_2}\cdot\vec{D}}$$

$$Mp\sqrt{\frac{Ie_1}{Ie_2}} \times \overrightarrow{{}^{P}V_2}\cdot\vec{D} - \overrightarrow{{}^{P}V_1}\cdot\vec{D} = 0$$

PD and Stereographic Projection



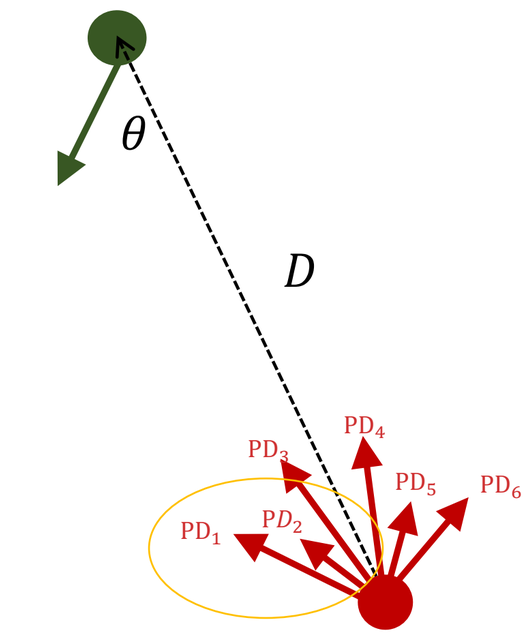


定位演算法：獲得距離

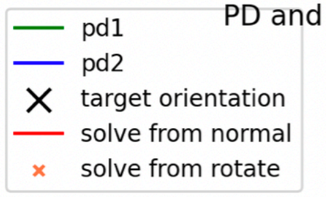
限制組態

兩PD強度比值開朗博次方根，為入射角餘弦比值，即為一平面

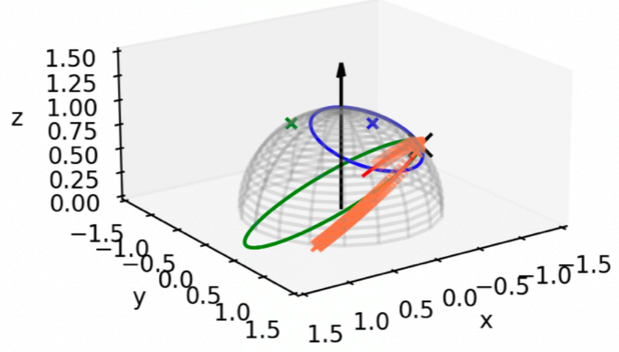
多個平面交得一點



$$Ie_p = f(\phi)$$



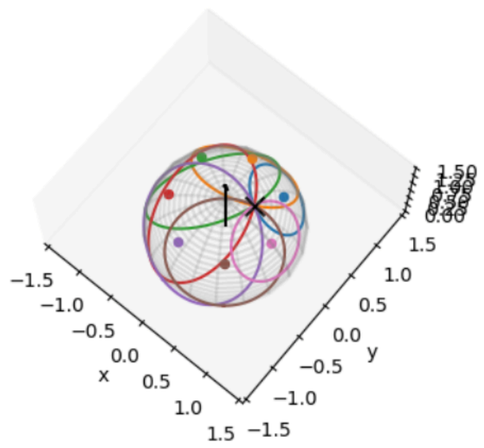
PD and Stereographic Projection



$$Mp\sqrt{\frac{Ie_1}{Ie_2}} = \frac{cos\phi_{l1}}{cos\phi_{l2}} = \frac{\overrightarrow{{}^{P}V_1} \cdot \vec{D}}{\overrightarrow{{}^{P}V_2} \cdot \vec{D}}$$

$$Mp\sqrt{\frac{Ie_1}{Ie_2}} \times \overrightarrow{{}^{P}V_2} \cdot \vec{D} - \overrightarrow{{}^{P}V_1} \cdot \vec{D} = 0$$

PD and Stereographic Projection



目標函數

目標：目標物在ROI中，使相對位置誤差在容許誤差內的範圍提高

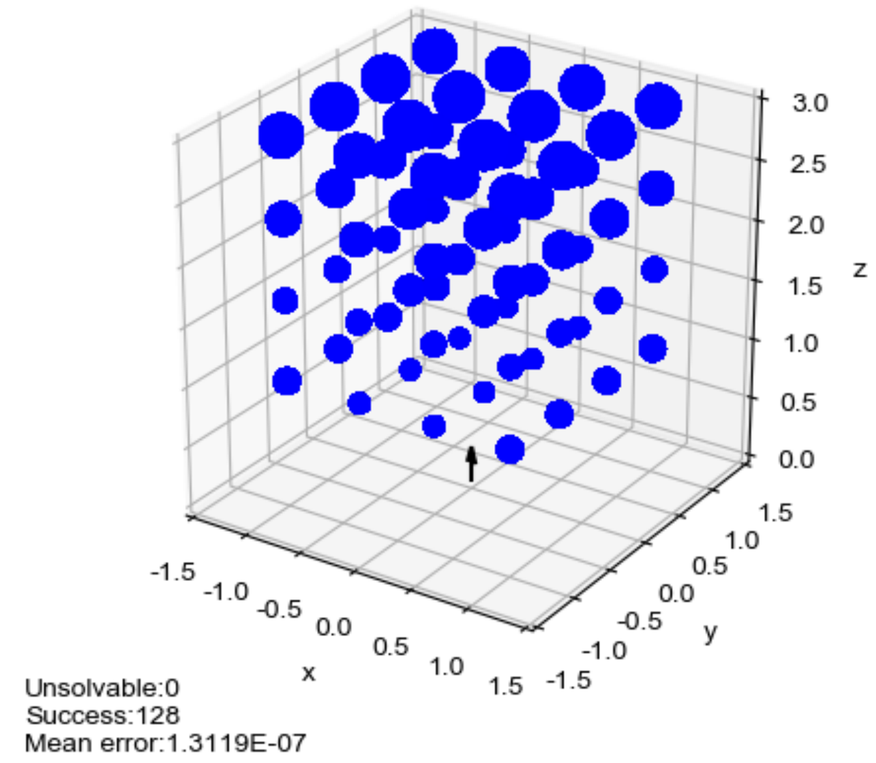
在ROI中選則K個樣本點

↓

各樣本點利用定位演算法求相對位置

↓

系算容許誤差內的樣本點數量

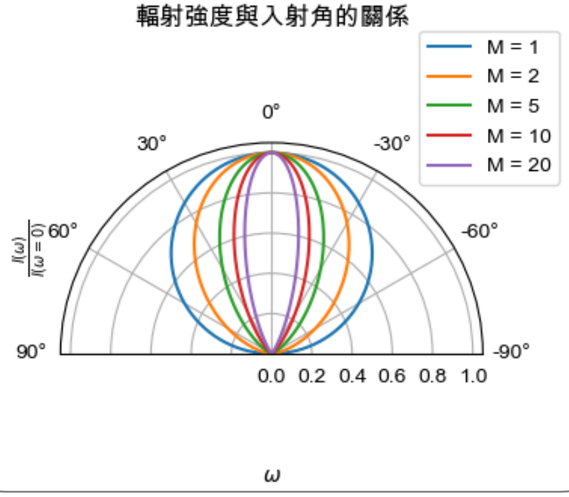


最佳化變數

變數數量 $=$ 2 $+$ $2*L$ $+$ $2*P$

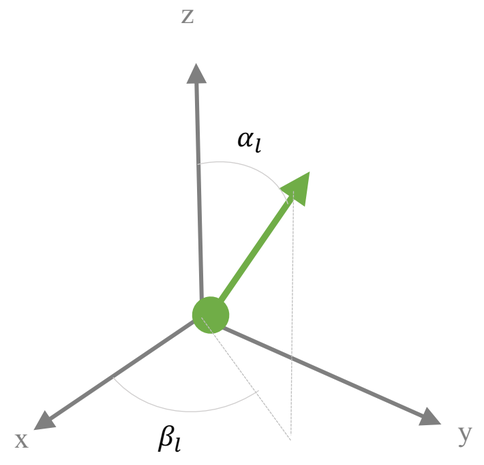
硬體參數

LED朗博次方Ml
PD朗博次方Mp



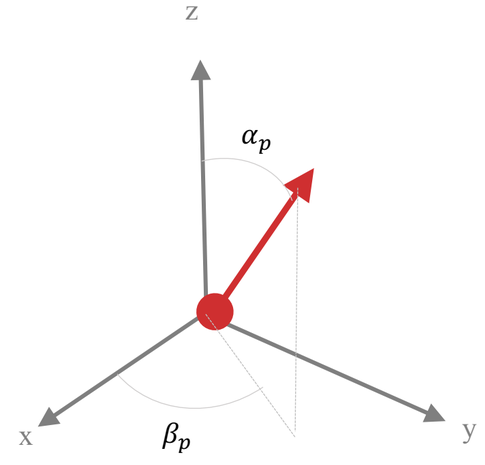
LED組態

第l個LED的參數：
天頂角α_l與方位角β_l



PD組態

第p個PD的參數：
天頂角α_p與方位角β_p



最佳化結果

樣本點

	min	max	amount
x	-1	1	4
y	-1	1	4
z	1	3	4
rotation	0	10deg	2

LED朗博次方：1.11833
PD朗博次方：1.35157

容許誤差內的樣本點數：128/128