Reconstruct sky map

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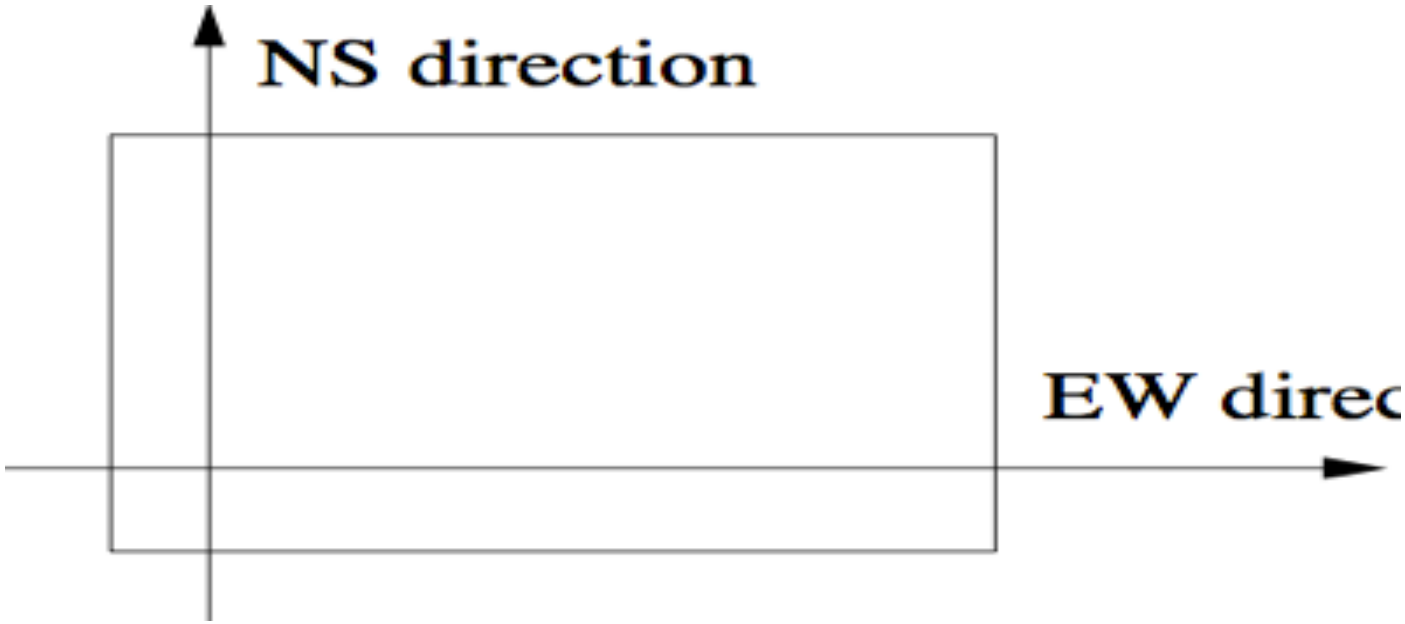
aim

- Reconstruct sky map from visibility and A matrix.
- A matrix present the interferometer configuration and survey strategy.

- we consider rectangular sky map at present.
- The map is mainly the low dimensional in NS direction.



Method 1

- Full 2 dimension scan
- If we could scan all of the x, y points, our measurement is give by

$$\begin{aligned} mes(x_0, y_0) &= \iint dxdysky(x, y)beam(x - x_0, y - y_0) \\ &= \mathscr{F}(F_{sky}(u, v) \times F_{beam}(u, v)) \\ &= Convolve(beam, sky) \end{aligned}$$

- Only using one dish.

Method 2

- If we only scan all of the x value (sky rotation), we could have the mes as follow

$$
\begin{aligned}
mes(x_0, y_0) &= \iint dxdysky(x,y)beam(x-x_0, y-y_0) \\
&= \iint dudv F_{sky}(u,v)F_{beam}(u,v)\exp(i2\pi u x_0)\exp(i2\pi v y_0) \\
&= \sum_u \sum_v F_{sky}(u,v)F_{beam}(u,v)\exp(i2\pi u x_0)\exp(i2\pi v y_0)
\end{aligned}
$$

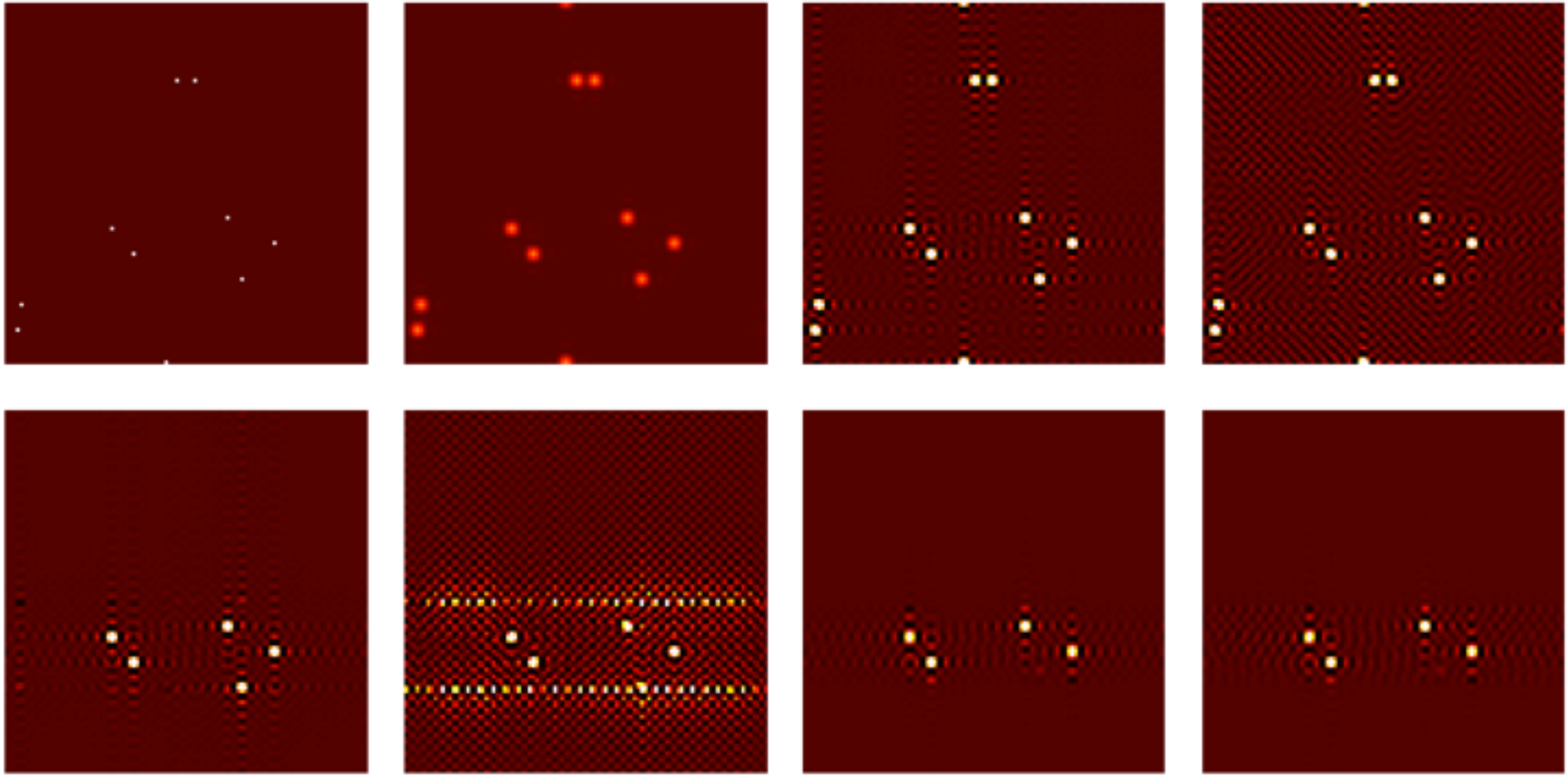
$$
mes(u, y_0) = \sum_v F_{sky}(u,v)F_{beam}(u,v)\exp(i2\pi v y_0)
$$

- We keep only Vij corresponding to different baseline.

$$mes(u, y_0) = \sum_v F_{sky}(u, v) F_{beam}(u, v) \exp(i2\pi v y_0)$$

$$\begin{pmatrix} V_{11}(y_0) \\ V_{11}(y_1) \\ \cdots \\ V_{11}(y_n) \\ V_{ij}(y_0) \\ V_{ij}(y_1) \\ \cdots \\ V_{ij}(y_n) \end{pmatrix} = \begin{pmatrix} F_b(v_1)\exp 2i\pi y_0 & F_b(v_2)\exp 2i\pi y_0 & \cdots & F_b(v_m)\exp 2i\pi y_0 \\ & \cdots & & \\ F_b(v_1)\exp 2i\pi y_n & F_b(v_2)\exp 2i\pi y_n & \cdots & F_b(v_m)\exp 2i\pi y_n \\ F_{bij}(v_1)\exp 2i\pi y_0 & F_{bij}(v_2)\exp 2i\pi y_0 & \cdots & F_{bij}(v_1)\exp 2i\pi y_0 \\ & \cdots & & \\ F_{bij}(v_1)\exp 2i\pi y_n & F_{bij}(v_2)\exp 2i\pi y_n & \cdots & F_{bij}(v_1)\exp 2i\pi y_n \end{pmatrix} \times \begin{pmatrix} F_s(v_1) \\ \cdots \\ F_s(v_n) \end{pmatrix} + n$$

1 dish



2 dish