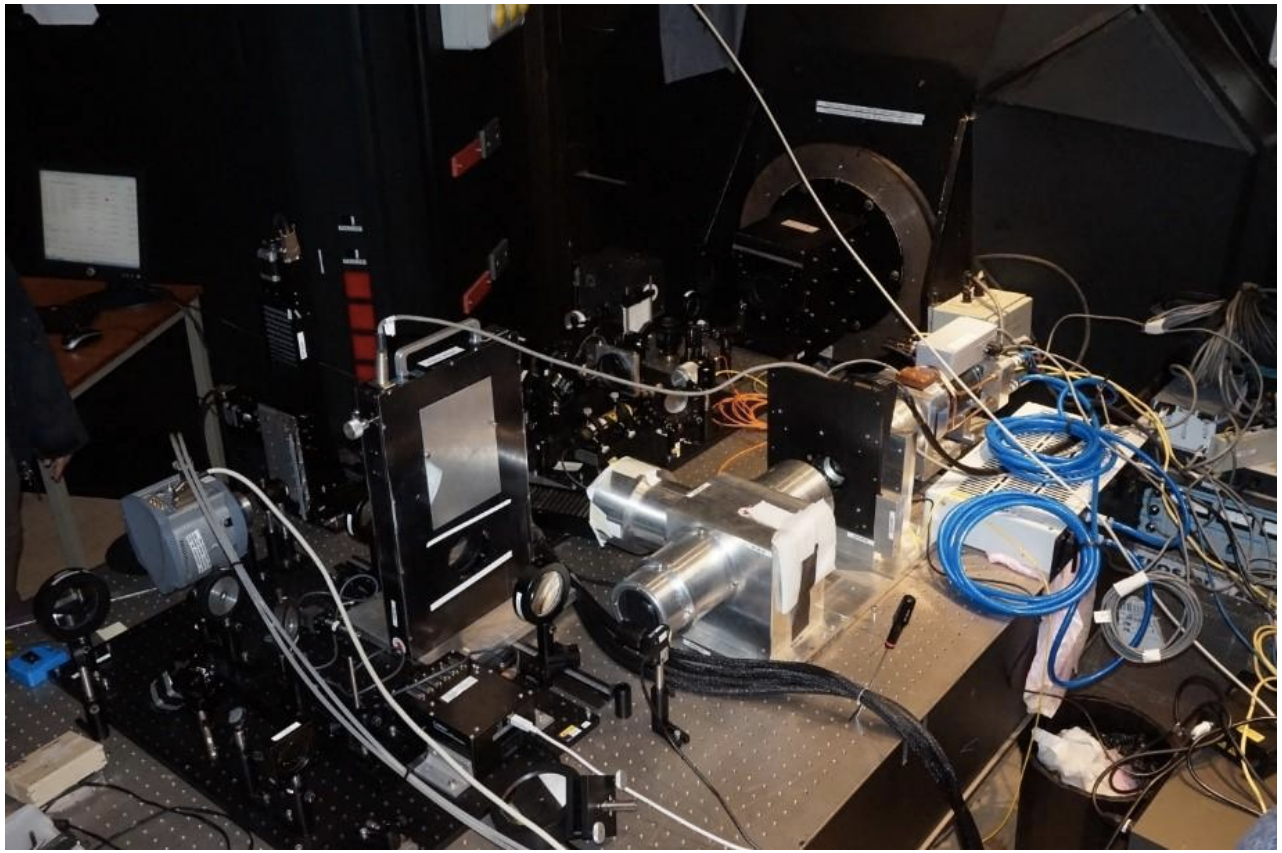
ALIOLI, state of the project.

Esther Soria Hernández

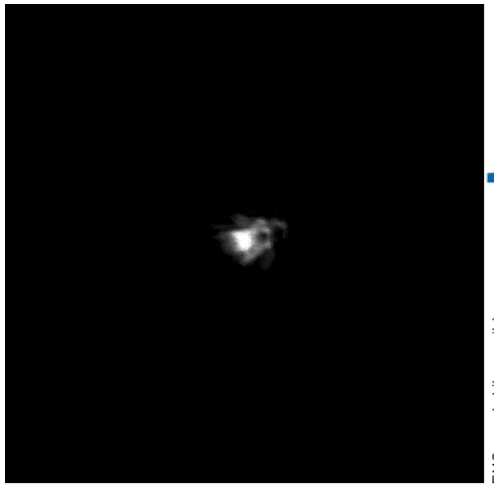
GRD Seminar 02-12-2021

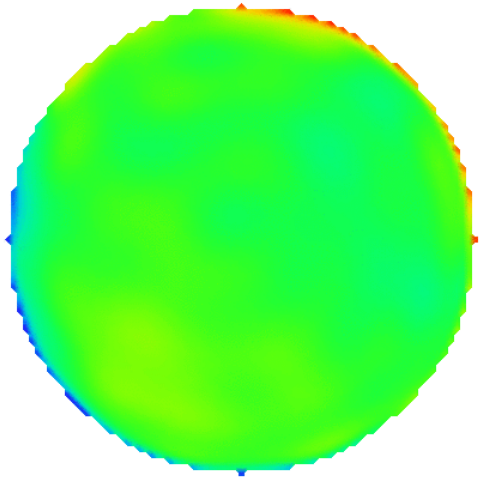
BACKGROUND

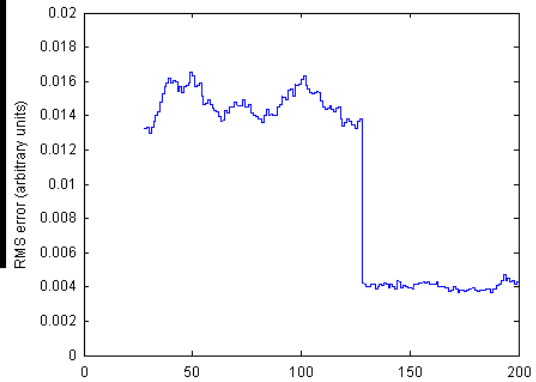


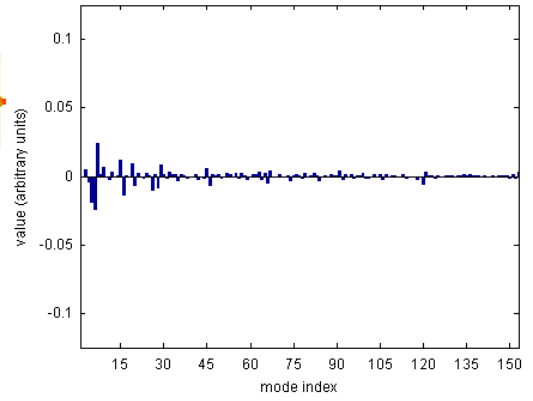
AOLI + GHaFaS WHT

BACKGROUND









Adaptive Optics Systems VI
2018-07 | Conference paper
BIBCODE: 2018SPIE10703E..61V
DOI: 10.1117/12.2311982
ARXIV: 1807.09759

arXiv e-prints
2018-11 |
BIBCODE: 2018arXiv181105607C
ARXIV: 1811.05607

ALIOLI

Adaptive Optics and Lucky Imaging Lightweight Instrument

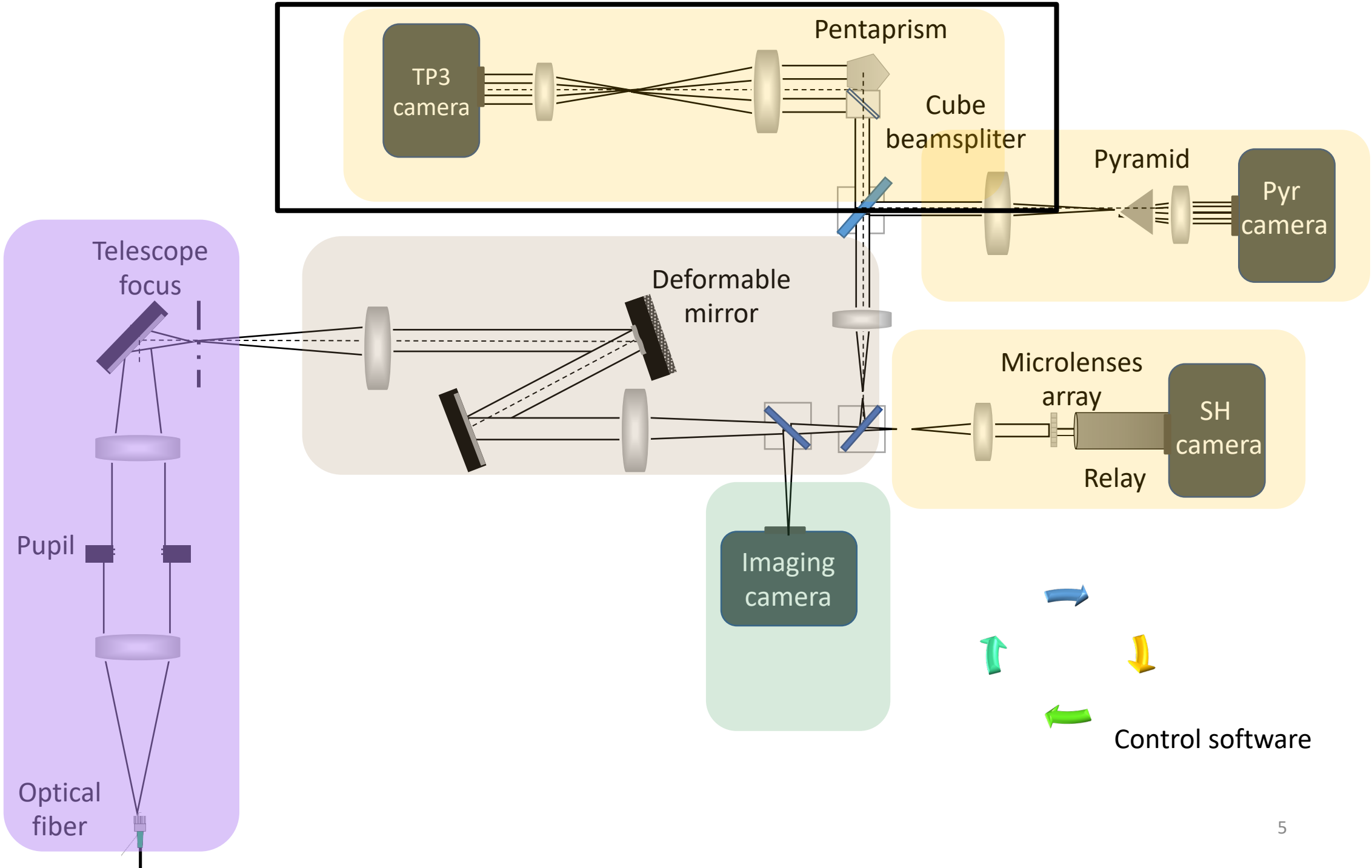
Modular concept

Portable

Low budget

Used as a demonstrator

Adaptive Optics Systems VI
2018-07 | Conference paper
BIBCODE: 2018SPIE10703E..6AV
DOI: 10.1117/12.2313692
ARXIV: 1807.09297


Pentaprism
TP3 camera
Cube beamspliter
Pyramid
Pyr camera
Telescope focus
Deformable mirror
Microlenses array
SH camera
Relay
Pupil
Imaging camera
Optical fiber
Control software

Two Pupil Plane WFS

Vam Dam and Lane in 2002.

Close Loop in AOLI 2016.

Processing two fluctuations intensity maps.

Based on the principle of conservation of energy.

Wave-front sensing from defocused images by use of wave-front slopes

Marcos A. van Dam and Richard G. Lane

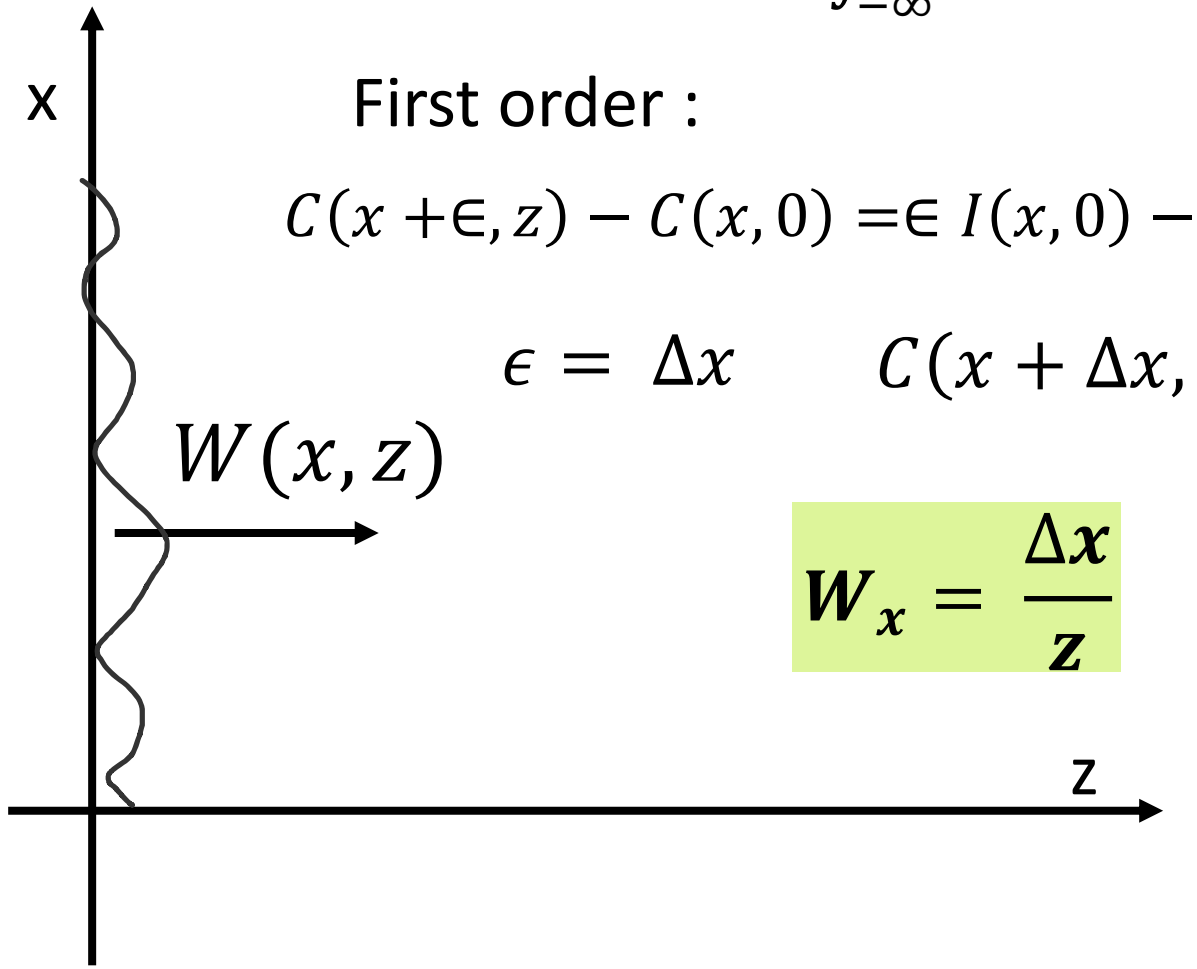
We describe a novel technique for deriving wave-front aberrations from two defocused intensity measurements. The intensity defines a probability density function, and the method is based on the evolution of the cumulative density function of the intensity with light propagation. In one dimension, the problem is easily solved with a histogram specification procedure, with a linear relationship between the wave-front slope and the difference in the abscissas of the histograms. In two dimensions, the method requires use of a Radon transform. Simulation results demonstrate that good reconstructions can be attained down to 100 photons in each detector. In addition, the method is insensitive to scintillation at the aperture. © 2002 Optical Society of America

OCIS codes: 010.1080, 010.7350.

1D

CDF (Cumulative Distribution Function)

$$C(x,0) = \int_{-\infty}^{x} I(x',0)dx'$$



First order :

$$C(x+\in,z) - C(x,0) = \in I(x,0) - zI(x,0)W_x(x,0)$$

$$\epsilon = \Delta x \qquad C(x+\Delta x,z) = C(x,0)$$

$$\boldsymbol{W_x = \frac{\Delta x}{z}}$$

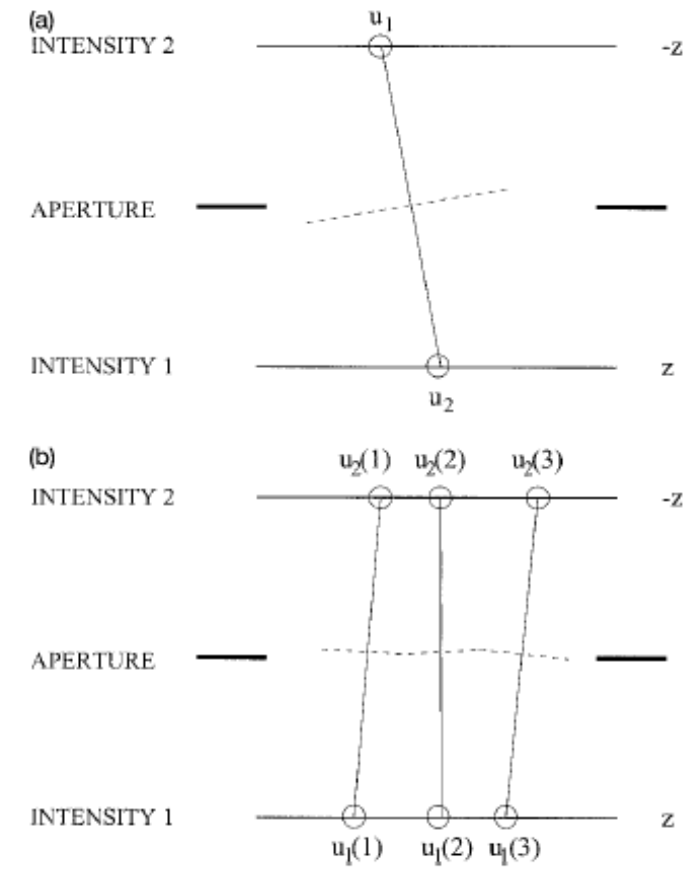
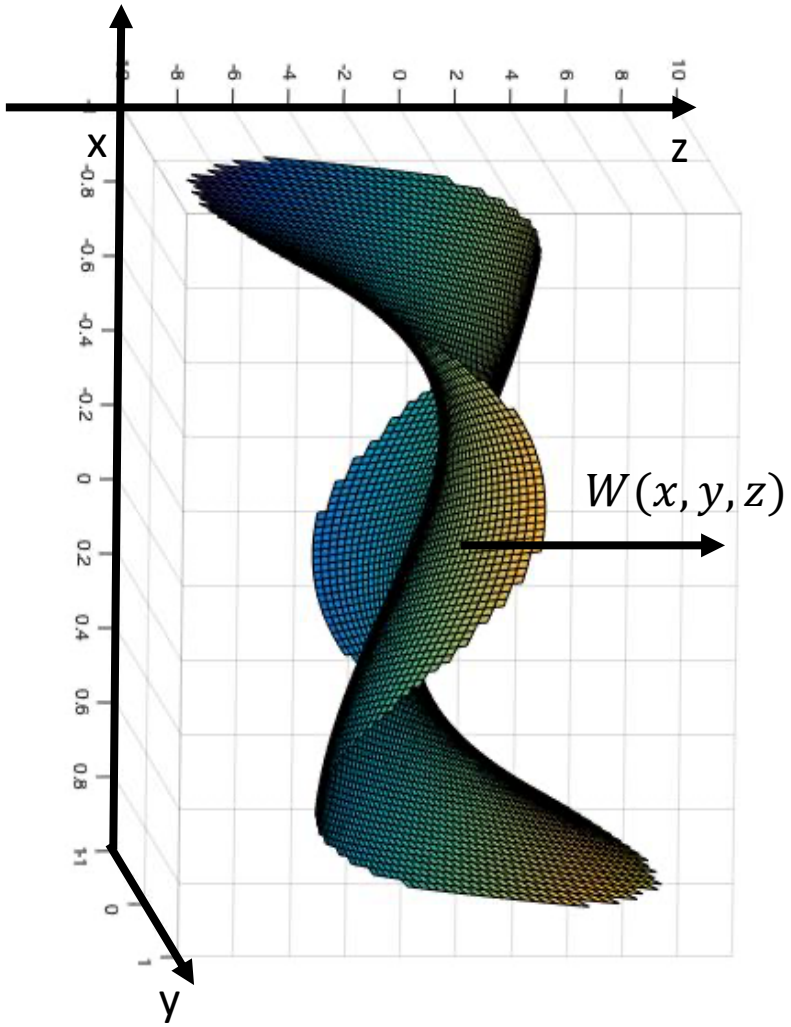


Fig. 1. Estimation of the wave front with (a) one detected photon and (b) three detected photons in each plane.

Van Dam 2002 Optical Society of America
OCIS codes: 010.1080, 010.7350.

2D



$$W(x, y, z) = \sum_{k=1}^{\infty} d_k Z_k$$

PDF (Probability Density Function) → CDF

Radon transform $\Re(u, \alpha) = \int_L f_{X,Y}(x, y)dl$

$$C(u, \alpha) = \int_{-\infty}^{x} P(u', \alpha)du' \qquad C_1[u_1(i, \alpha), \alpha] = C_2[u_2(i, \alpha), \alpha]$$

$$\frac{dW[\frac{u_1(i,\alpha) + u_2(i,\alpha)}{2}]}{r\partial[\cos(\alpha)\,\hat{x} + \sin(\alpha)\,\hat{y}]} = \frac{u_1(i, \alpha) - u_2(i, \alpha)}{2z}$$

Van Dam 2002 Optical Society of America
OCIS codes: 010.1080, 010.7350.