LIGHTSPEED TECHNOLOGIES

Standard Wavefront Sensor Specifications

Hartmann-Shack wavefront sensor for real-time monitoring and characterization of laser beams, consisting of:

Digital camera equipped with two-dimensional quartz microlens array, C-mount adapter, kinematic camera mount for angular alignment, USB 2.0 interface for adaptation to PC or Notebook:

spectral sensitivity:	*350nm – 1100nm*
dynamic range:	*12 bit (digital)*
active camera area:	*8.8mm x 6.6mm (2/3“)*
resolution:	*1280x1024 pixels (square, 6.45µm)*
frame rate:	*up to 7.5Hz, external trigger*
exposure time:	*50µs …. several s (automatic exposure control)*
microlens array:	*12mm x 12mm, refractive*
focal length	*3.5mm*
lens dimension:	*150µm x150µm*
fill factor	*>95%*
subapertures:	*max. 50 x 40*
wavefront sensitivity:	*≈ λ/10 per subaperture (633nm)*
wavefront dynamic range:	*≈ 5λ per subaperture, ≈150λ total*
camera size (incl. microlens array):	*≈80mm x 60mm x 40mm*
power supply:	*via USB 2.0*
camera cable:	*5m*

Software package for wavefront analysis

Beam Diagnostics Software ´MrBeam´ 3.3 (Windows XP) for real-time laser beam and wavefront diagnostics according to ISO standards (ISO 11146, ISO 13694, ISO 15367, ISO 11670); near-field profile, wavefront and far-field distribution from single measurement

General features:

- Various profile acquisition modes: *´snap´, ´grab´, ´averaging´, ´floating average´, ´summation´*
- 2D profile arithmetics (ADD, SUB, MULT, DIV, EXP, LOG etc.)
- flexible selection of *area-of-interest* for analytic beam evaluations
- real-time display and evaluation of cross-sections (horizontal / vertical), including profile-fit (*Gaussian, super-Gaussian, top-hat etc.*), ‘*history*’ function
- 3D graphics with variable resolution and viewing angle
- various colour palettes, incl. different analytic palette functions (e.g. *´intensity threshold´*, *´intensity window´*)
- easy-to-use ‘zoom’-functions
- ‘preview’ of profiles stored on disk
- fast access to profiles stored in RAM
- comprehensive user-programmable macro language
- export of all data, plots and profiles to Windows clipboard or printer

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Specifications for Quotation 04232007RW-288 UV Wavefront Sensor (continued)

Beam and wavefront analysis:

- on-line evaluation of beam parameters from *near-field profile I(x,y)* at camera position, obtained by integration over Hartmann-Shack subapertures (spatial resolution given by pitch of microlens array):

  beam width (2nd moment (x,y))
  centroid
  ellipticity
  uniformity
  relative pulse energy
  pointing stability etc.

- fast wavefront reconstruction (> 1Hz), accuracy ~ $\lambda/10$ per subaperture
- graphical representation of *wavefront w(x,y)* (= OPD at camera position) as 3D plot, tabulated numerical data
- optional correction of w(x,y) for tilt (x,y) and defocus
- real-time modal analysis (*Zernike* and *Legendre* polynomials), *Seidel* aberrations, optional subtraction from displayed wavefront
- wavefront parameters according to ISO/DIS 15367 (*rms wavefront deformation, wavefront irregularity (P-V))*
- comprehensive beam propagation analysis by Fourier algorithm: computation of profiles at *arbitrary z positions*, especially *near-field*, *far-field, waist profiles*
- real-time computation and display of propagation data (absolute accuracy < 10%):

  beam propagation ratio M^2 (x,y)
  divergence θ_x, θ_y
  waist diameter (x,y)
  waist position (x,y)
  Rayleigh length (x,y)
  astigmatic waist separation

Remarks:

- PC (or Notebook) requirement: e.g. Pentium IV, Windows XP, USB 2.0 interface. Computer can be quoted also at your request.

- For proper use of the Hartmann-Shack camera the beam under investigation has to be attenuated to a fluence level of ~ µJ/cm² (µW/cm² for cw sources). The camera is equipped with a N.D. filter (OD 3) for attenuation and blocking of residual light (only for VIS spectral range), allowing for measurement of laser beams in the mW region. For high power lasers further attenuation is required, e.g. by quartz wedges.