SPECIM
SPECTRAL IMAGING

TECHNICAL NOTE TN-15

Problem	What is FOV? What is IFOV?	Date	26th of August 2015
Author(s)	EHE, HKA	Ver	2.0

1. Introduction

- ### FOV = Field of view

The field of view is determined by the angle of view from the lens out to the scene and can be measured horizontally or vertically. Usually expressed in degrees (angle).

- ### IFOV = Instantaneous field of view

Instantaneous field of view is the angle subtended by the geometrical projection of single detector element to the target surface.

What affects FOV and IFOV

There are two main factors which determine the FOV in both vertical and horizontal axis direction.

1. The *focal length f* of the objective.
2. The active size of the *input/entrance slit*. Normally the horizontal dimension is called the *slit length* and vertical dimension is called the *slit width*. Active length of the slit is the same as detector width.

In some cases when determining the $IFOV_v$ the pixel size must be taken into account.

How to calculate FOV and IFOV

In order to calculate *FOV* one needs to know the following values:

f = Focal length of the fore objective

x_h = Slit dimension in horizontal direction (slit length) = detector width

x_v = Slit dimension in vertical direction (slit width)

The basic equation for horizontal (FOV_h) and vertical (FOV_v) Field Of Views are

$$FOV_h = 2 \cdot \arctan \frac{x_h}{2f} \qquad and \qquad FOV_v = 2 \cdot \arctan \frac{x_v}{2f} \qquad (1)$$

$IFOV_h$ is determined by FOV_h and number of pixels in the horizontal (length) direction. Because the magnification of the spectrograph is one the $IFOV_h$ can be calculated by dividing the FOV_h by the number of pixels in horizontal direction.

When calculation $IFOV_v$ comparison of slit width and pixel size has to done first. If pixel pitch is smaller that slit width one needs to use pixel size as x_v and use the equation (1). In this case using pixel size as x_v the equation (1) gives $IFOV_v$ instead of FOV_v.

Example
Here are few examples of FOVs calculated for our Spectral Camera model QE, HS and PFH using default input slits and range of different objectives from SPECIM catalogue. The equations (1) are used.

Spectral camera PFD with V8E or V10E spectrograph
    Slit width: x_h=30um,
    Slit length: x_v= 10.5 mm
    Focal lengths: f=8, 12, 17, 23, 35 and 50 mm (Schneider-Kreuzhnach)
                              9, 18.5, 23, 140 (Specim)

f	FOVh	FOVv
8,00	66,55	0,21
9,00	60,51	0,19
12,00	47,26	0,14
17,00	34,32	0,10
18,50	31,69	0,09
23,00	25,72	0,07
35,00	17,06	0,05
50,00	11,99	0,03
140,00	4,30	0,01

Spectral camera HS with V8E or V10E spectrograph
    Slit width: x_h=30um,
    Slit length: x_v= 11.840mm
    Focal lengths: f=8, 12, 17, 23, 35 and 50 mm (Schneider-Kreuzhnach)
                              9, 18.5, 23, 140 (Specim)

f	FOVh	FOVv
8,00	73,00	0,21
9,00	66,67	0,19
12,00	52,52	0,14
17,00	38,40	0,10
18,50	35,49	0,09
23,00	28,87	0,07
35,00	19,20	0,05
50,00	13,50	0,03
140,00	4,84	0,01