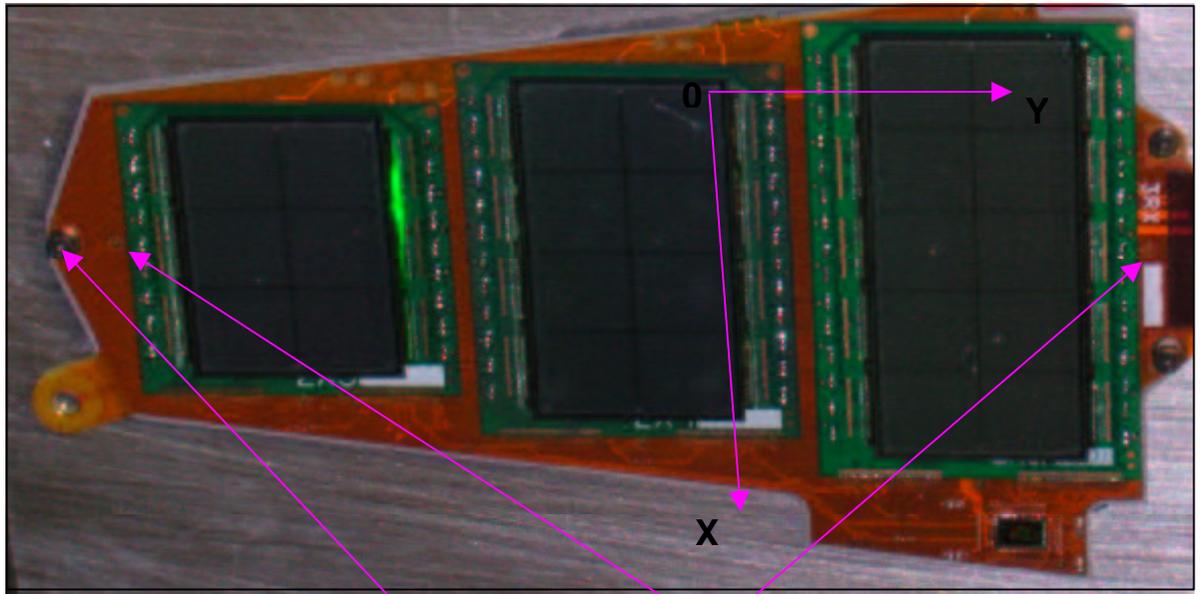


Measurements of panel dimensions for alignment and quality control

To provide data for initial alignment and quality control the following features of the assembled panel (Fig. 1) of any type will be surveyed as follows.

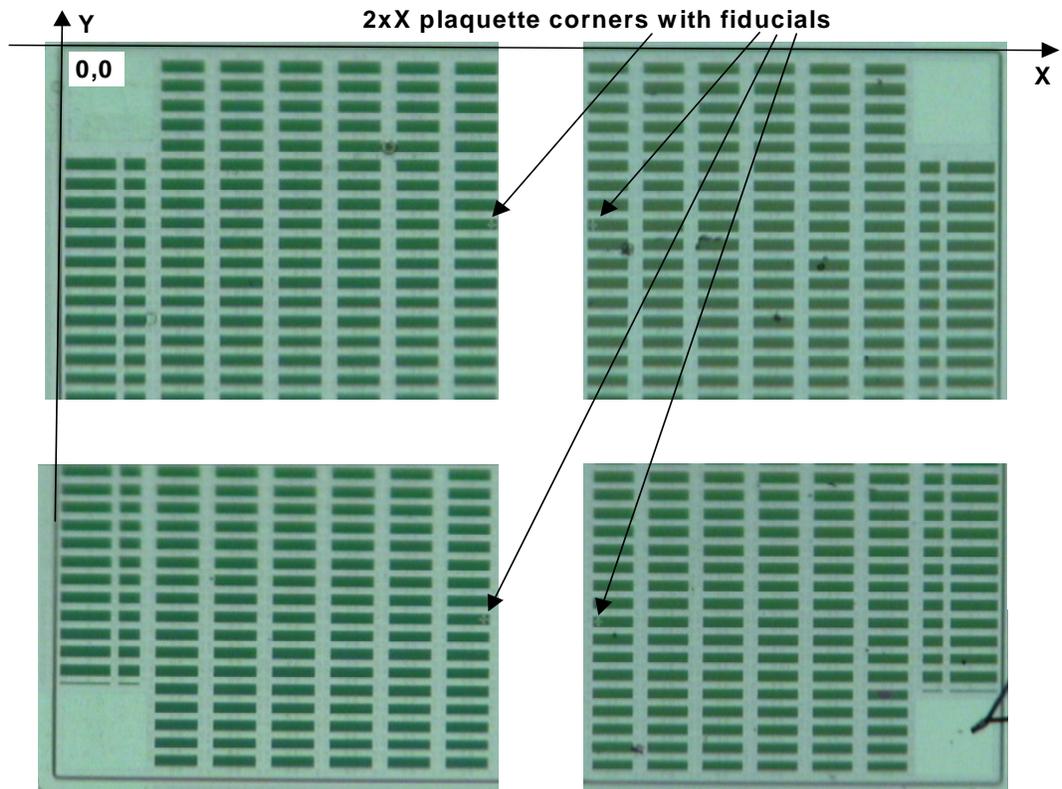
1. First, the screw holding the lower end of panel on the base plate is removed.
2. An initial (major) coordinate system is established on the 2x4 plaquette. The origin is established at the crossing point of the borderlines the sensor pixel area in the upper left corner. The X-axis along long side of the sensor is established using the crossing point of the borderlines in the upper right corner (Fig.2).
3. 4 fiducials are measured on the sensor in vicinity of the bias wire pads in the corners of the sensor as shown on Fig 2 using automatic finding (see Appendix Table for coordinates of these fiducials (highlighted) in the Readout Chip coordinate system)
4. the same measurements are made on other plaquette sensors (2x5 and 2x3 on the 3-plaquette panel and 1x5, 2x3 and 1x2 plaquettes on the 4-plaquette panel). On each plaquette measurements are made in a local coordinate system, then they are reported in the initial (major) coordinate system
5. 4 corners of the each sensor measured as a crossing point of two edge lines of the sensor
6. The following panel features are measured and reported in the major coordinate system:
 - a screw hole in the lower end of the panel (the screw is removed)
 - upper and lower round fiducials on the HDI flex (Fig.1)
 - four corners of each plaquette VHDI measured as a crossing point of two edge lines of the plaquette

Note. An edge line of the sensor or plaquette VHDI is to be measured as the outermost (leading) edge of the piece.



Round fiducial marks on the HDI Hole in the Be panel (the screw removed)

Fig.1 Major features for panel survey



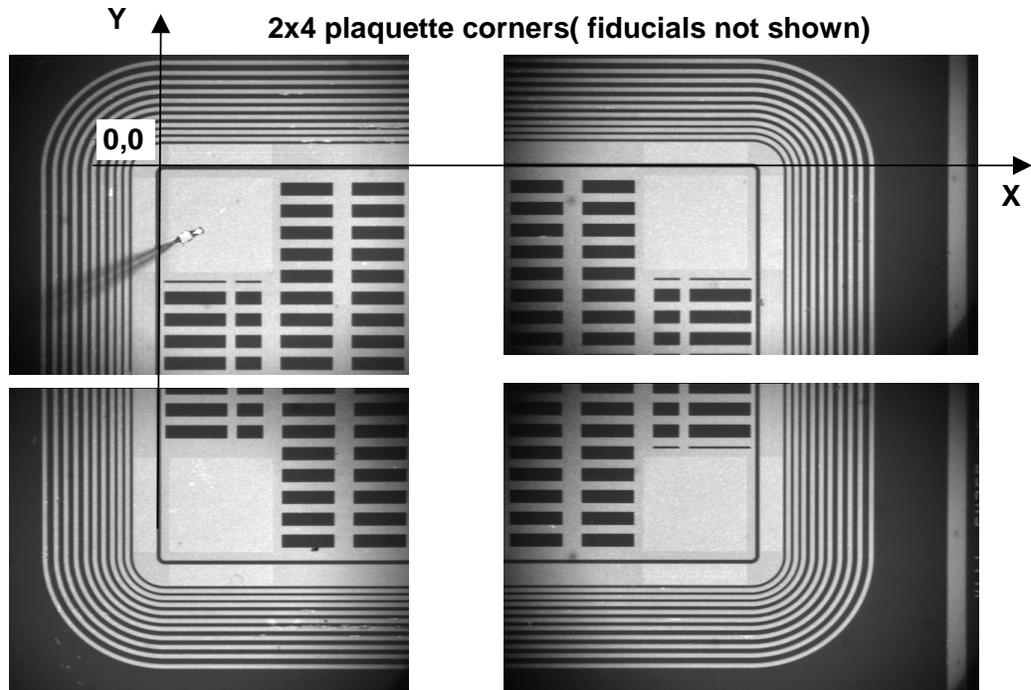


Fig.2 Corners of the sensor with a coordinate system origin and fiducials to be surveyed.

APPENDIX

Sensors fiducials for post-assembly alignment

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Overview

The CMSFPPIX project requires 672 sensors (plaquettes) to be installed in four disks. It is planned to build at least 20% spare sensors (plaquette) and so the total number of devices is closer to 800 (but not bigger than 1000).

Plaquettes are mounted on a panel. The relative position of plaquettes w.r.t. each other within a panel can be measured by using fiducials that are implemented on the p-side metal layer (this is the side that is still visible after bumpbonding).

This document describes the fiducial shape and locations on the sensors.

Fiducial shape

The fiducial is made of four diamonds to form a cross. The dimensions can be seen in Figure 1.

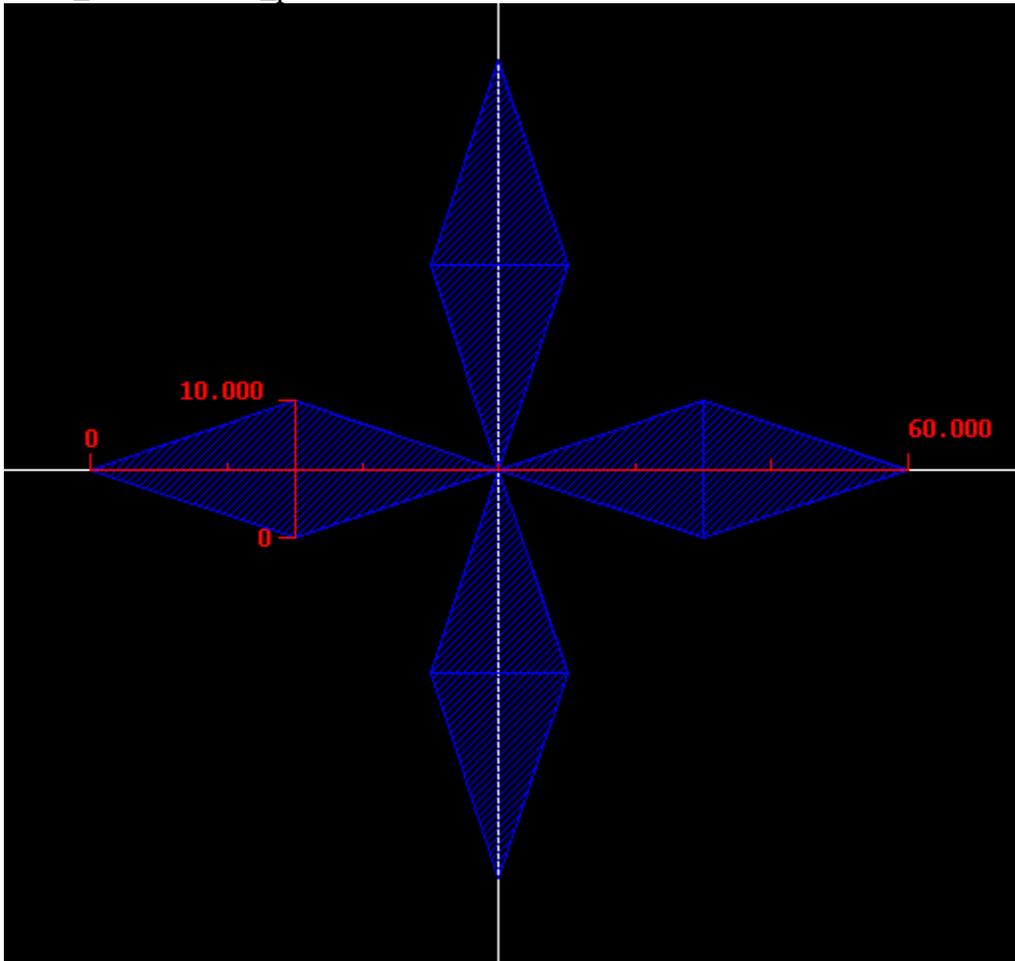


Figure 1, Fiducial shape and measurements. measurements are in micro meters

Fiducials pattern within a sensor.

Fiducials are repeated within a sensor with a specific pattern suggested by Bruno Gobbi. In order to describe their position we have to fix a reference point. The chosen reference point is the beginning of the sensor active area in the lower left corner of pixel (0,0) of the first ROC (ROC ID = 0) as shown in Figure 2.

Panel_measurement_procedure3

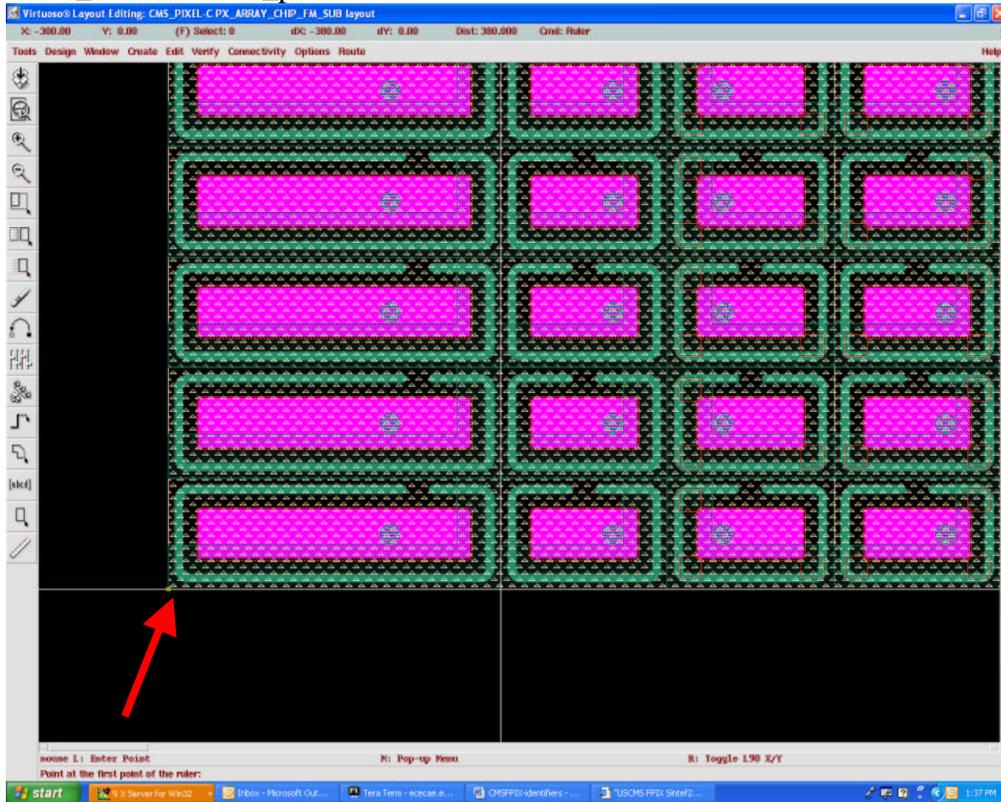


Figure 2 Reference point chosen for the fiducial positions. The RED arrows point to what is considered point 0,0 in this document.

According to the reference point just chosen the position of the fiducials within the first ROC (ROC ID = 0) is (there are 20 fiducials per ROC):

Fiducial number	X position (μm)	Y position (μm)
1	380	2470
2	380	4070
3	380	5670
4	2180	870
5	2180	4070
6	2180	5670
7	2180	7270
8	3980	870
9	3980	4070
10	3980	7270
11	4120	870
12	4120	4070
13	4120	7270
14	5920	870
15	5920	4070
16	5920	5670
17	5920	7270
18	7720	2470
19	7720	4070
20	7720	5670

Note. Highlighted are fiducials used in the survey.

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