**HGCAL DB Definitions for Production (updated: Feb 15, 2022)**

**Module & Component Geometries**

**HD (high density) HGCAL Module Geometries -**

A picture containing drawing, door, kite

Description automatically generated Chart, treemap chart

Description automatically generated A picture containing chart

Description automatically generated

HD Full (**HD Type 0**) HD Top (**HD Type 1**) HD Bottom (**HD Type 2**)

Shape, polygon

Description automatically generated Shape, polygon

Description automatically generated Shape

Description automatically generated

HD Left (**HD Type 3**) HD Right (**HD Type 4**) HD Five (**HD Type 5**)

Left(-) Right(-)

* **HD module geometries**

HD Full HD Type 0 hexagonal

HD Top HD Type 1 half-hexagon (upper)

HD Bottom HD Type 2 ChopTwo

HD Left HD Type 3 Left (-)

HD Right HD Type 4 Right (-)

HD Five HD Type 5 Five

* Define in the DB
  + 6 types of HD EM Si Modules (120mm Sensor)
  + 6 types of HD HAD Si modules (120mm Sensor)

**LD (low density) HGCAL Module Geometries**

A picture containing drawing, door, kite

Description automatically generated Chart, treemap chart

Description automatically generated Chart, treemap chart

Description automatically generated

**LD Full (LD Type 0) LD Top (LD Type 1) LD Bottom (LD Type 2)**

Shape, polygon

Description automatically generated Shape, polygon

Description automatically generated Shape

Description automatically generated

**LD Left (LD Type 3) LD Right (LD Type 4) LD Five (LD Type 5)**

Left Right

A close up of a logo

Description automatically generated

**LD Three (LD Type 6) LD Full+Three (LD Type 7) - multiple versions to be defined**

* **LD module geometries**

LD Full LD Type 0 hexagonal

LD Top LD Type 1 half-hexagon (upper)

LD Bottom LD Type 2 half-hexagon (lower)

LD Left LD Type 3 Left (half)

LD Right LD Type 4 Right (half)

LD Five LD Type 5 Five

LD Three LD Type 6 valid only for Si sensors

LD (Full+Three) LD Type 7 valid for Module, Protomodule, PCB,

& Baseplate

**DB Definitions for Si Sensors – HD & LD**

**DB: Kind of Part Names – Si Sensor Wafers**

**Kind of part name** **- HD & LD Si Wafers**

HD 120um Si Sensor Wafer

LD 200um Si Sensor Wafer

LD 300um Si Sensor Wafer

**DB Relationship:**

Parent: HD 120um Si Sensor Wafer

Children: HD 120um Si Sensors defined below

**DB: Kind of Part Names – HD 120um Si Sensors**

**Kind of part name** **Geometry Description LPNAME**

HD 120um Full Si Sensor Full **120um Sensor HD Type 0**

HD 120um Top Si Sensor Top(half) **120um Sensor HD Type 1**

HD 120um Bottom Si Sensor Bottom(ChopTwo) **120um Sensor HD Type 2**

HD 120um Left Si Sensor Left(-) **120um Sensor HD Type 3**

HD 120um Right Si Sensor Right(-) **120um Sensor HD Type 4**

HD 120um Five Si Sensor Five **120um Sensor HD Type 5**

HD 120um Halfmoon Si Sensor halfmoon

**Other HD 120um Si devices** (???)

**DB Relationship:**

Parent: LD 200um Si Sensor Wafer

Children: LD 200um Si Sensors defined below

**Kind of Part Names – LD 200um Sensors**

**Kind of part name** **Geometry Description LPNAME**

LD 200um Full Si Sensor Full **200um Sensor LD Type 0**

LD 200um Top Si Sensor Top(half) **200um Sensor LD Type 1**

LD 200um Bottom Si Sensor Bottom(half) **200um Sensor LD Type 2**

LD 200um Left Si Sensor Left(half) **200um Sensor LD Type 3**

LD 200um Right Si Sensor Right(half) **200um Sensor LD Type 4**

LD 200um Five Si Sensor Five **200um Sensor LD Type 5**

LD 200um Three Si Sensor Three **200um Sensor LD Type 6**

LD 200um Halfmoon Si Sensor halfmoon

**Other LD 200um Si devices** (???)

**DB Relationship:**

Parent: LD 300um Si Sensor Wafer

Children: LD 300um Si Sensors defined below

**Kind of Part Names – LD 300um Sensors**

**Kind of part name** **Geometry Description LPNAME**

LD 300um Full Si Sensor Full **300um Sensor LD Type 0**

LD 300um Top Si Sensor Top(half) **300um Sensor LD Type 1**

LD 300um Bottom Si Sensor Bottom(half) **300um Sensor LD Type 2**

LD 300um Left Si Sensor Left(half) **300um Sensor LD Type 3**

LD 300um Right Si Sensor Right(half) **300um Sensor LD Type 4**

LD 300um Five Si Sensor Five **300um Sensor LD Type 5**

LD 300um Three Si Sensor Three **300um Sensor LD Type 6**

LD 300um Halfmoon Si Sensor halfmoon

**Other LD 300um Si devices** (???)

**Tables for Si Sensor Data in DB**

Description of information listed below

* Kind of condition name 🡪 descriptive name of data type
* Table 🡪 name of table for the data

**Kind of condition: HGC PQC Summary**

**Table: HGC\_PQC\_SUMRY**

**CREATE TABLE CMS\_HGC\_HGCAL\_COND.HGC\_PQC\_SUMRY**

**(**

**RECORD\_ID NUMBER(38) NOT NULL,**

**CONDITION\_DATA\_SET\_ID NUMBER(38) NOT NULL,**

**VFLATBAND\_VOLT FLOAT(126),**

**VTHRESHOLD\_VOLT FLOAT(126),**

**ISURF\_AMP FLOAT(126),**

**RSHEET\_N\_OHMSQ FLOAT(126),**

**RSHEET\_P\_OHMSQ FLOAT(126),**

**RSHEET\_PSTOP\_OHMSQ FLOAT(126),**

**VBD\_DIODE\_VOLT FLOAT(126),**

**VBD\_OXIDE\_VOLT FLOAT(126)**

**)**

**Kind of condition: HGC PQC Diode IV**

**Table: HGC\_PQC\_DIODE\_IV**

**CREATE TABLE CMS\_HGC\_HGCAL\_COND.HGC\_PQC\_DIODE\_IV**

**(**

**RECORD\_ID NUMBER(38) NOT NULL,**

**CONDITION\_DATA\_SET\_ID NUMBER(38) NOT NULL,**

**VOLTS FLOAT(126) NOT NULL,**

**CURNT\_NANOAMP FLOAT(126) NOT NULL,**

**TEMP\_DEGC FLOAT(126),**

**HUMIDITY\_PRCNT FLOAT(126),**

**TIME\_SECS FLOAT(126)**

**)**

**Kind of condition: HGC PQC Diode CV**

**Table: HGC\_PQC\_DIODE\_CV**

**CREATE TABLE CMS\_HGC\_HGCAL\_COND.HGC\_PQC\_DIODE\_CV**

**(**

**RECORD\_ID NUMBER(38) NOT NULL,**

**CONDITION\_DATA\_SET\_ID NUMBER(38) NOT NULL,**

**VOLTS FLOAT(126) NOT NULL,**

**CPCTNCE\_FRD FLOAT(126) NOT NULL,**

**RESISTANCE\_OHM FLOAT(126),**

**TEMP\_DEGC FLOAT(126),**

**HUMIDITY\_PRCNT FLOAT(126),**

**TIME\_SECS FLOAT(126)**

**)**

**Kind of condition: HGC PQC Metal Oxide Semiconductor**

**Table: HGC\_PQC\_MOS**

**CREATE TABLE CMS\_HGC\_HGCAL\_COND.HGC\_PQC\_MOS**

**(**

**RECORD\_ID NUMBER(38) NOT NULL,**

**CONDITION\_DATA\_SET\_ID NUMBER(38) NOT NULL,**

**VOLTS FLOAT(126) NOT NULL,**

**CPCTNCE\_FRD FLOAT(126) NOT NULL,**

**TEMP\_DEGC FLOAT(126),**

**HUMIDITY\_PRCNT FLOAT(126),**

**TIME\_SECS FLOAT(126)**

**)**

**Kind of condition: HGC PQC Field Effect Transistor**

**Table: HGC\_PQC\_FET**

**CREATE TABLE CMS\_HGC\_HGCAL\_COND.HGC\_PQC\_FET**

**(**

**RECORD\_ID NUMBER(38) NOT NULL,**

**CONDITION\_DATA\_SET\_ID NUMBER(38) NOT NULL,**

**VOLTS FLOAT(126) NOT NULL,**

**CURNT\_AMP FLOAT(126) NOT NULL,**

**TEMP\_DEGC FLOAT(126),**

**HUMIDITY\_PRCNT FLOAT(126),**

**TIME\_SECS FLOAT(126)**

**)**

**Kind of condition: HGC PQC Gate Controlled Diode**

**Table: HGC\_PQC\_GCD**

**CREATE TABLE CMS\_HGC\_HGCAL\_COND.HGC\_PQC\_GCD**

**(**

**RECORD\_ID NUMBER(38) NOT NULL,**

**CONDITION\_DATA\_SET\_ID NUMBER(38) NOT NULL,**

**VOLTS FLOAT(126) NOT NULL,**

**CURNT\_AMP FLOAT(126) NOT NULL,**

**BIAS\_VOLT FLOAT(126) NOT NULL,**

**TEMP\_DEGC FLOAT(126),**

**HUMIDITY\_PRCNT FLOAT(126),**

**TIME\_SECS FLOAT(126)**

**)**

**Kind of condition: HGC PQC Van Der Pauw N**

**HGC PQC Van Der Pauw PEdge**

**HGC PQC Van Der Pauw PStop**

**Table: HGC\_PQC\_VAN\_DER\_PAUW**

**Note: This table hosts 3 different types of data**

**CREATE TABLE CMS\_HGC\_HGCAL\_COND.HGC\_PQC\_VAN\_DER\_PAUW**

**(**

**RECORD\_ID NUMBER(38) NOT NULL,**

**CONDITION\_DATA\_SET\_ID NUMBER(38) NOT NULL,**

**VOLTS FLOAT(126) NOT NULL,**

**CURNT\_AMP FLOAT(126) NOT NULL,**

**TEMP\_DEGC FLOAT(126),**

**HUMIDITY\_PRCNT FLOAT(126),**

**TIME\_SECS FLOAT(126)**

**)**

**Kind of condition: HGC PQC Linewidth N**

**HGC PQC Linewidth PEdge**

**HGC PQC Linewidth PStop**

**Table: HGC\_PQC\_LINEWIDTH**

**Note: This table hosts 3 different types of data**

**CREATE TABLE CMS\_HGC\_HGCAL\_COND.HGC\_PQC\_LINEWIDTH**

**(**

**RECORD\_ID NUMBER(38) NOT NULL,**

**CONDITION\_DATA\_SET\_ID NUMBER(38) NOT NULL,**

**VOLTS FLOAT(126) NOT NULL,**

**CURNT\_AMP FLOAT(126) NOT NULL,**

**TEMP\_DEGC FLOAT(126),**

**HUMIDITY\_PRCNT FLOAT(126),**

**TIME\_SECS FLOAT(126)**

**)**

**Kind of condition: HGC PQC Oxide Breakdown**

**Table: HGC\_PQC\_OXIDE\_BREAKDOWN**

**CREATE TABLE CMS\_HGC\_HGCAL\_COND.HGC\_PQC\_OXIDE\_BREAKDOWN**

**(**

**RECORD\_ID NUMBER(38) NOT NULL,**

**CONDITION\_DATA\_SET\_ID NUMBER(38) NOT NULL,**

**VOLTS FLOAT(126) NOT NULL,**

**CURNT\_AMP FLOAT(126) NOT NULL,**

**TEMP\_DEGC FLOAT(126),**

**HUMIDITY\_PRCNT FLOAT(126),**

**TIME\_SECS FLOAT(126)**

**)**

**Kind of condition: HGC CERN Sensor IV**

**Table: HGC\_CERN\_SENSOR\_IV**

**CREATE TABLE CMS\_HGC\_HGCAL\_COND.HGC\_CERN\_SENSOR\_IV**

**(**

**RECORD\_ID NUMBER(38) NOT NULL,**

**CONDITION\_DATA\_SET\_ID NUMBER(38) NOT NULL,**

**VOLTS FLOAT(126) NOT NULL,**

**CURNT\_NANOAMP FLOAT(126) NOT NULL,**

**ERR\_CURNT\_NANOAMP FLOAT(126),**

**TOT\_CURNT\_NANOAMP FLOAT(126),**

**ACTUAL\_VOLTS FLOAT(126),**

**TIME\_SECS FLOAT(126),**

**TEMP\_DEGC FLOAT(126),**

**HUMIDITY\_PRCNT FLOAT(126),**

**CELL\_NR NUMBER(10)**

**)**

**Kind of condition: HGC CERN Sensor IV Summary**

**Table: HGC\_CERN\_SENSOR\_IV\_SUMRY**

**CREATE TABLE CMS\_HGC\_HGCAL\_COND.HGC\_CERN\_SENSOR\_IV\_SUMRY**

**(**

**RECORD\_ID NUMBER(38) NOT NULL,**

**CONDITION\_DATA\_SET\_ID NUMBER(38) NOT NULL,**

**TOT\_CURNT\_NANOAMP\_600V FLOAT(126),**

**TOT\_CURNT\_NANOAMP\_800V FLOAT(126),**

**NUM\_BAD\_CELLS NUMBER(10),**

**PASS CHAR(1 BYTE),**

**GRADE CHAR(10 BYTE),**

**NUM\_BAD\_ADJ\_CELLS NUMBER(10)**

**)**

**Kind of condition: HGC CERN Sensor CV**

**Table: HGC\_CERN\_SENSOR\_CV**

**CREATE TABLE CMS\_HGC\_HGCAL\_COND.HGC\_CERN\_SENSOR\_CV**

**(**

**RECORD\_ID NUMBER(38) NOT NULL,**

**CONDITION\_DATA\_SET\_ID NUMBER(38) NOT NULL,**

**VOLTS FLOAT(126) NOT NULL,**

**CPCTNCE\_PFRD FLOAT(126) NOT NULL,**

**ERR\_CPCTNC\_PFRD FLOAT(126),**

**TOT\_CURNT\_NANOAMP FLOAT(126),**

**ACTUAL\_VOLTS FLOAT(126),**

**ORG\_CPCTNC\_PFRD FLOAT(126),**

**TEMP\_DEGC FLOAT(126),**

**HUMIDITY\_PRCNT FLOAT(126),**

**IMP\_OHM FLOAT(126),**

**PHS\_RAD FLOAT(126),**

**TIME\_SECS FLOAT(126),**

**CELL\_NR NUMBER(10)**

**)**

**Kind of condition: HGC CERN Sensor CV Summary**

**Table: HGC\_CERN\_SENSOR\_CV\_SUMRY**

**CREATE TABLE CMS\_HGC\_HGCAL\_COND.HGC\_CERN\_SENSOR\_CV\_SUMRY**

**(**

**RECORD\_ID NUMBER(38) NOT NULL,**

**CONDITION\_DATA\_SET\_ID NUMBER(38) NOT NULL,**

**SNSR\_THCKNESS FLOAT(126),**

**DEPL\_VOLTS FLOAT(126),**

**MAX\_DEPL\_VOLTS FLOAT(126),**

**DEPL\_UNIF\_VOLTS FLOAT(126),**

**SNSR\_THKNES\_UNIF FLOAT(126),**

**PASS CHAR(1 BYTE),**

**GRADE CHAR(10 BYTE)**

**)**

**Additional Sensor Information**

Kind of Part: HGC 8in Sensors HD:

total cells 🡺 444 (432 cells in full sensor)

Cell size: 0.52 cm2

Thickness: 120mm

120mm HD full sensors have 444 cells (432 channels in full sensor) each

Kind of Part: HGC 8in Sensors LD:

total cells 🡺 207 (196 cells in full sensor), cell 199: guard

Ring, 200 🡪 207: test channels

Cell Size: 1.18 cm2

Thickness: 200mm & 300mm

200mm & 300mm LD full sensors have 207 cells (196 channels in full sensor) each

**Note: We need channel maps (for sensors only) for each sensor type to store channel level test data?**

Sensor Cells Cell number in channel map

Sensor Calib Cells Cell number in channel map (?)

Sensor Guard Ring Cell number in channel map (?)

Sensor Monitor Diodes Cell number in channel map (?)

120mm sensors with 432 channels (full sensor) **– 6 HGCROCs** for a full module (**HD PCB**)

200mm & 300mm with 196 channels (full sensor) – **3 HGCROCs** for a full module (**LD PCB**).

**Treat Cell Position as a Channel Number of a HGC Sensor – Channel Map**

**(for each geometry type - HD & LD) to store readout data at channel level**

**Example: Full Eight Inch Sensor type (LD, HD)**

(**Repeat for each geometry & type**)

Knowing the ROC position on the PCB and ROC channel number, a map for a LD/HD module of a given geometry is needed to record data at channel level, e.g. for a generic Full LD module

TABLE CMS\_HGC\_HGCAL\_COND.HGC\_FULL\_LD\_MOD\_CHAN\_MAP

(

CHANNEL\_MAP\_ID NUMBER(38) NOT NULL,

ROC\_POSN NUMBER(4) NOT NULL,

ROC\_CHAN NUMBER(4) NOT NULL,

SNSR\_CHAN NUMBER(4) NOT NULL

)

**Si Sensor Wafer Attributes (will/may change)**

**Attribute Names** **Values**

Wafer Substrate STD, DD, FZ thin, Epi

Wafer polarity n, p

Wafer Class prototype, pre-series, pre-production, production

**Si Sensor attributes:** inherited + additional attributes **(may change)**

**Attribute Names** **Values**

Wafer Substrate STD, DD, FZ thin, Epi

Wafer polarity n, p

Wafer Class prototype, pre-series, pre-production, production

Sensor P-Stop individual, common, none

Sensor Substrate STD, DD, FZ thin, Epi

Sensor polarity n, p

Sensor Class prototype, pre-series, pre-production, production

Question: **What all do we track in the DB?**

**Tables Deployed for Storing Si Sensor Data in HGCAL (Development) DB**

(will/may change)

**Attention:** All PQC tables were defined by Florian M. Pitters

|  |  |
| --- | --- |
| **Database: KIND\_OF\_CONDITION Name** | **Database: TABLE Name** |
|  |  |
| HGC Sensor Manufacturer IV Test | HGC\_SENSOR\_IV |
| HGC Sensor Manufacturer CV Test | HGC\_SENSOR\_CV |
| HGC Sensor Irradiation Summary Data | HGC\_SENSOR\_IRRADIATION\_SUMRY |
|  |  |
| HGC CERN Sensor IV | HGC\_CERN\_SENSOR\_IV |
| HGC CERN Sensor CV | HGC\_CERN\_SENSOR\_CV |
|  |  |
| HGCAL Sensor Defect Checks | HGC\_SENSOR\_DEFECT\_CHKS |
|  |  |
| HGC CERN Sensor IV Summary | HGC\_CERN\_SENSOR\_IV\_SUMRY |
| HGC CERN Sensor CV Summary | HGC\_CERN\_SENSOR\_CV\_SUMRY |
|  |  |
|  |  |
| HGC PQC Summary | HGC\_PQC\_SUMRY |
| HGC PQC Diode IV | HGC\_PQC\_DIODE\_IV |
| HGC PQC Diode CV | HGC\_PQC\_DIODE\_CV |
| HGC PQC Metal Oxide Semiconductor | HGC\_PQC\_MOS |
| HGC PQC Field Effect Transistor | HGC\_PQC\_FET |
| HGC PQC Gate Controlled Diode | HGC\_PQC\_GCD |
| HGC PQC Van Der Pauw N | HGC\_PQC\_VAN\_DER\_PAUW |
| HGC PQC Van Der Pauw PEdge | HGC\_PQC\_VAN\_DER\_PAUW |
| HGC PQC Van Der Pauw PStop | HGC\_PQC\_VAN\_DER\_PAUW |
| HGC PQC Linewidth N | HGC\_PQC\_LINEWIDTH |
| HGC PQC Linewidth PEdge | HGC\_PQC\_LINEWIDTH |
| HGC PQC Linewidth PStop | HGC\_PQC\_LINEWIDTH |
| HGC PQC Oxide Breakdown | HGC\_PQC\_OXIDE\_BREAKDOWN |

**Sensors**

1. Flow of parts: Sensors

Hamamatsu 🡪 CERN 🡪 MOD fabrication centers

Any QC data from Hamamatsu?

QC of Sensors – **Who performs QC & enters QC data in DB - Vienna?**

**Status: Florian Pitters** from Vienna had been working on this and provided most of the data descriptions. Moritz Wiehe has undertaken the responsibility, and we have started communicating.

**Listed below: status and information needed**

* Specify a complete suite of QC tests (who is responsible, Vienna?)
* Does every sensor undergo QC testing?
* What QC data does Hamamatsu provide?
* Who is responsible for verifying Hamamatsu QC data?
* Will there be additional QC testing by HGCAL collaboration?
* If yes, who is responsible - Vienna?
* Does every sensor undergo QC testing?
* Need to specify procedure and requirements to select sensors for module fabrication?
* Information in DB will be used to select sensors for module fabrication(?).

**Note:** **A substantial amount of DB work remains**