Weekly Report

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Higgs-V CP OO calculation using MG5

An optimal observable (OO) is a Matrix Element (ME) based observable

SM: CP-even contribution, BSM: CP-odd contribution

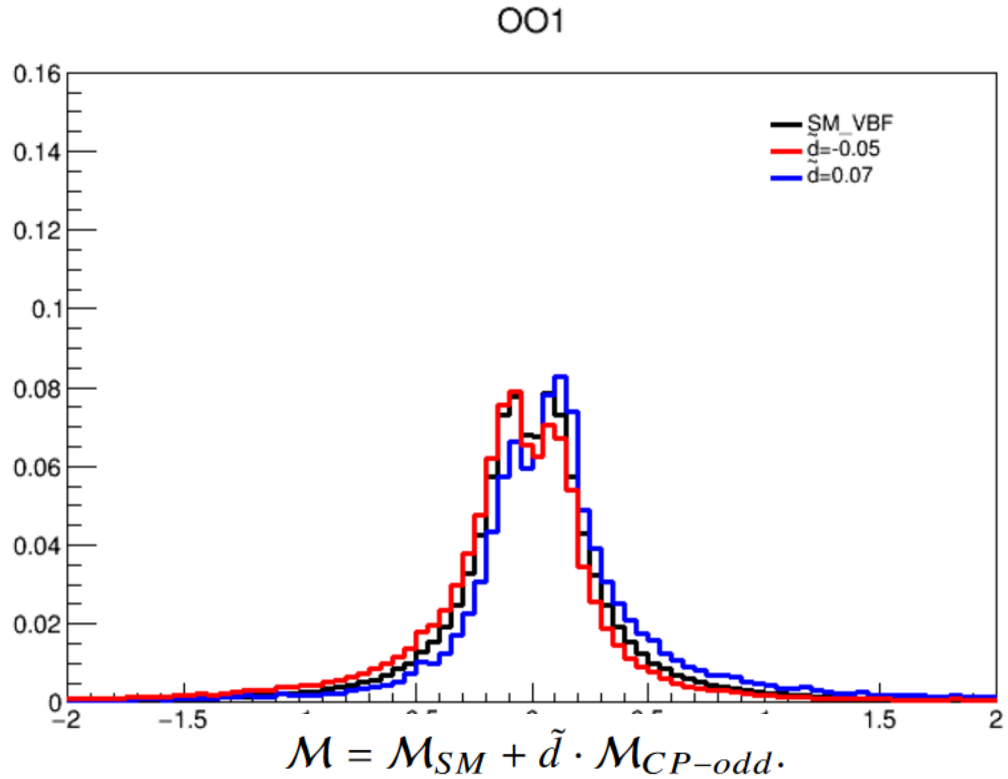
$$\mathcal{M}_{\mathrm{Mix}}(\boldsymbol{c}) = \mathcal{M}_{\mathrm{SM}} + \mathcal{M}_{\mathrm{BSM}}(\boldsymbol{c}) \implies |\mathcal{M}_{\mathrm{Mix}}(\boldsymbol{c})|^2 = |\mathcal{M}_{\mathrm{SM}}|^2 + 2\Re(\mathcal{M}_{\mathrm{SM}}\mathcal{M}^*_{\mathrm{BSM}}(\boldsymbol{c})) + |\mathcal{M}_{\mathrm{BSM}}(\boldsymbol{c})|^2$$

$\boldsymbol{c}$ is the CP-odd coupling which parametrises a BSM hypothesis under which the matrix elements are computed.

$$OO_1(\boldsymbol{c}) = \frac{2\Re(\mathcal{M}_{\mathrm{SM}}\mathcal{M}^*_{\mathrm{BSM}}(\boldsymbol{c}))}{|\mathcal{M}_{\mathrm{SM}}|^2} = \frac{|\mathcal{M}_{\mathrm{Mix}}(\boldsymbol{c})|^2 - |\mathcal{M}_{\mathrm{SM}}|^2 - |\mathcal{M}_{\mathrm{BSM}}(\boldsymbol{c})|^2}{|\mathcal{M}_{\mathrm{SM}}|^2}$$

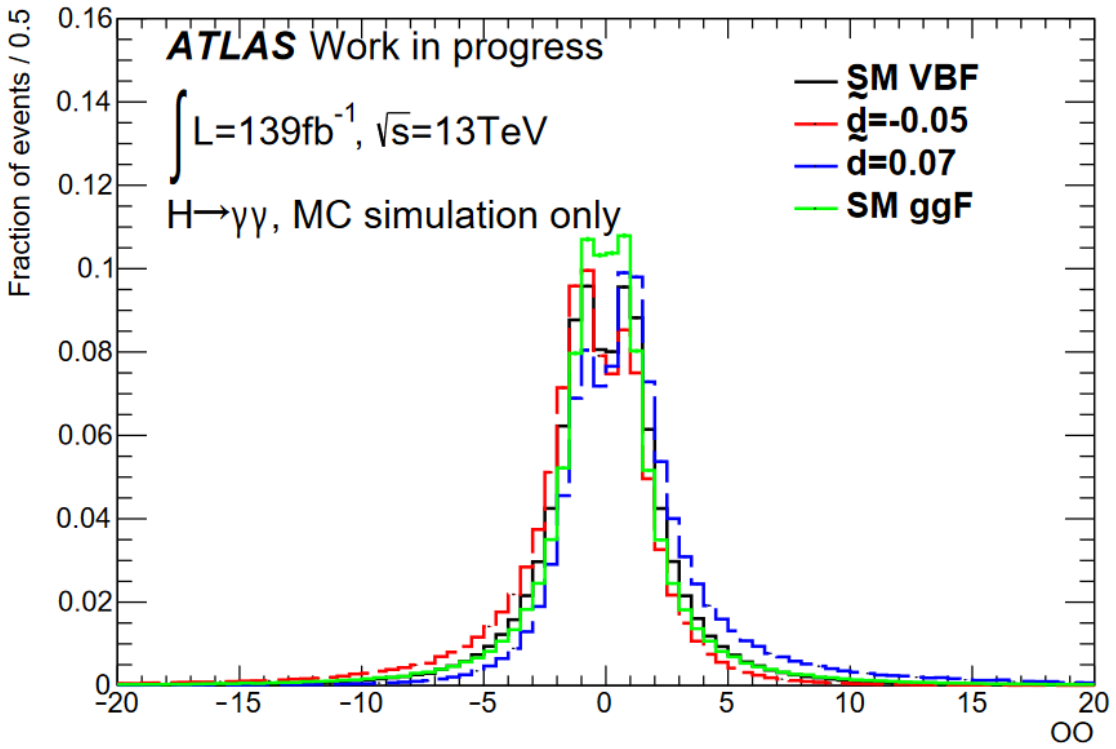
$$OO_2(\boldsymbol{c}) = \frac{|\mathcal{M}_{\mathrm{BSM}}(\boldsymbol{c})|^2}{|\mathcal{M}_{\mathrm{SM}}|^2}$$

Higgs-V CP OO calculation using MG5



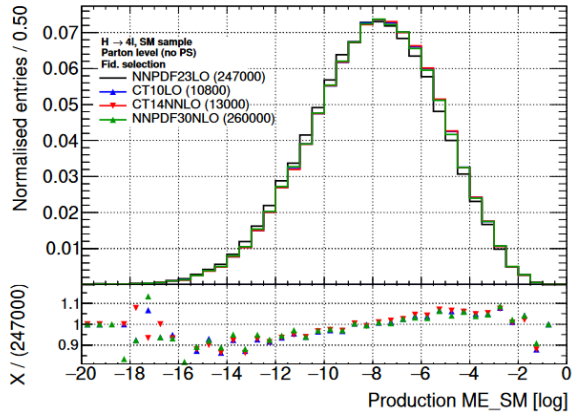
$$\mathcal{M} = \mathcal{M}_{SM} + \tilde{d} \cdot \mathcal{M}_{CP-odd}.$$

$$|\mathcal{M}|^2 = |\mathcal{M}_{SM}|^2 + \tilde{d} \cdot 2Re(\mathcal{M}^*_{SM}\mathcal{M}_{CP-odd}) + \tilde{d}^2 \cdot |\mathcal{M}_{CP-odd}|^2.$$

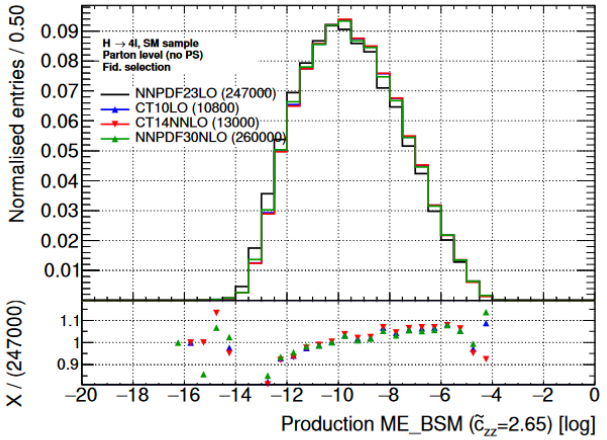


Higgs-V CP OO calculation using MG5

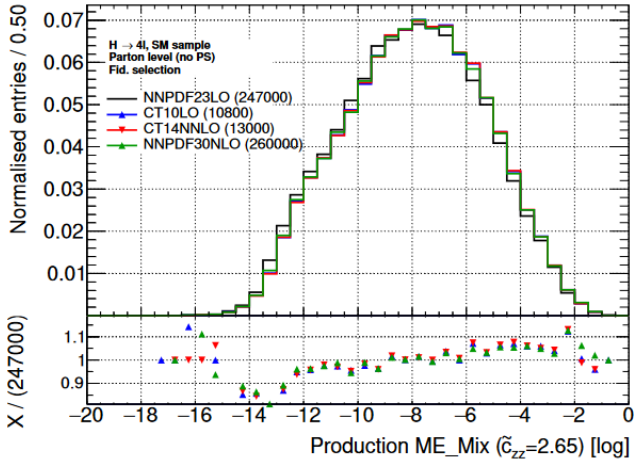
ME discrepancy：



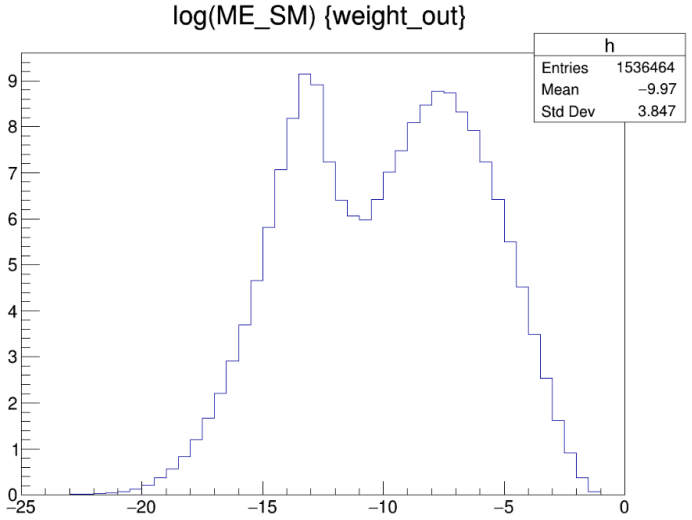
(a) $|\mathcal{M}_{\mathrm{SM}}|^2$ for SM sample.

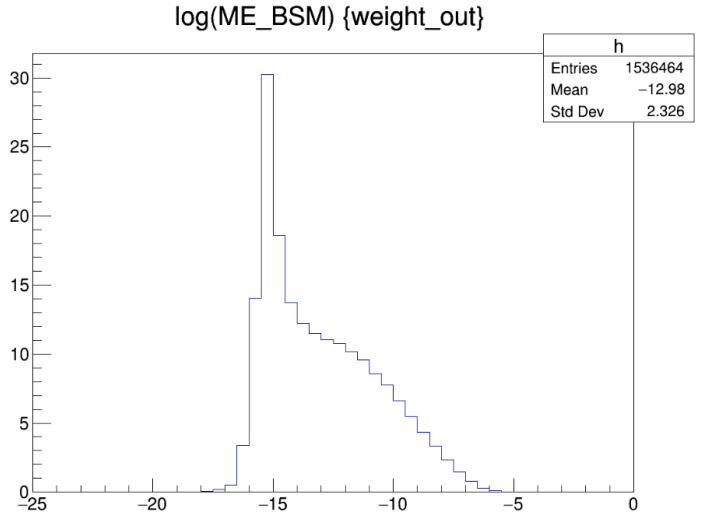


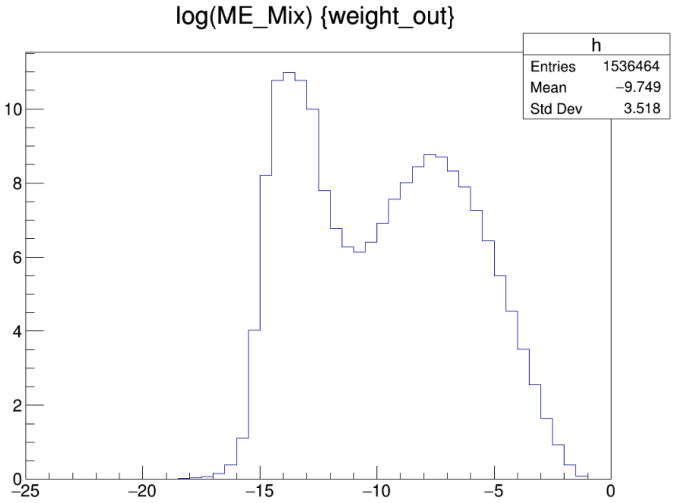
(c) $|\mathcal{M}_{\mathrm{BSM}}|^2$ for SM sample.



(e) $|\mathcal{M}_{\mathrm{Mix}}|^2$ for SM sample.



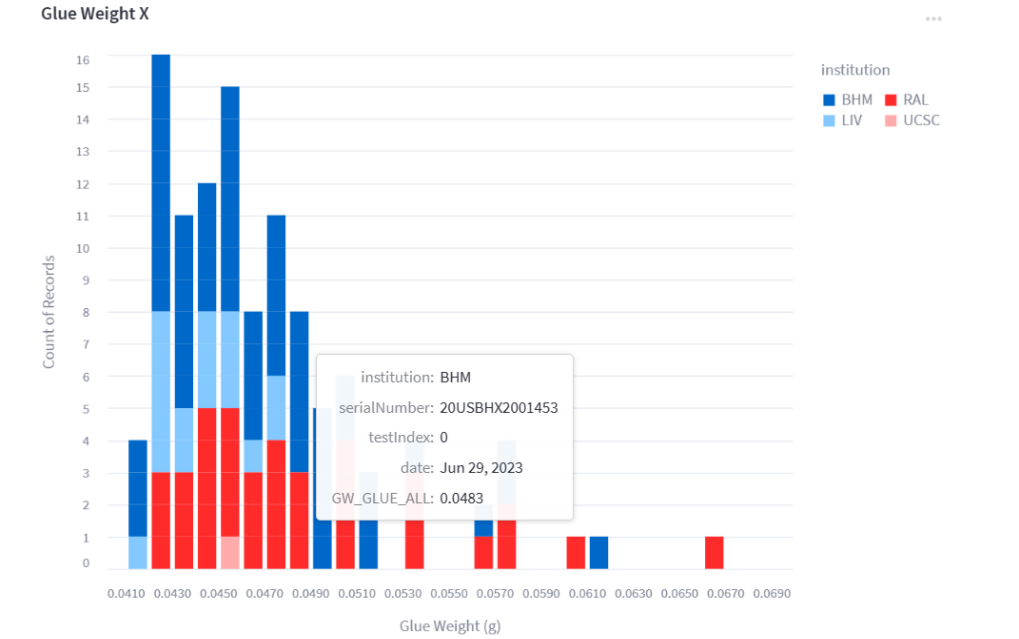


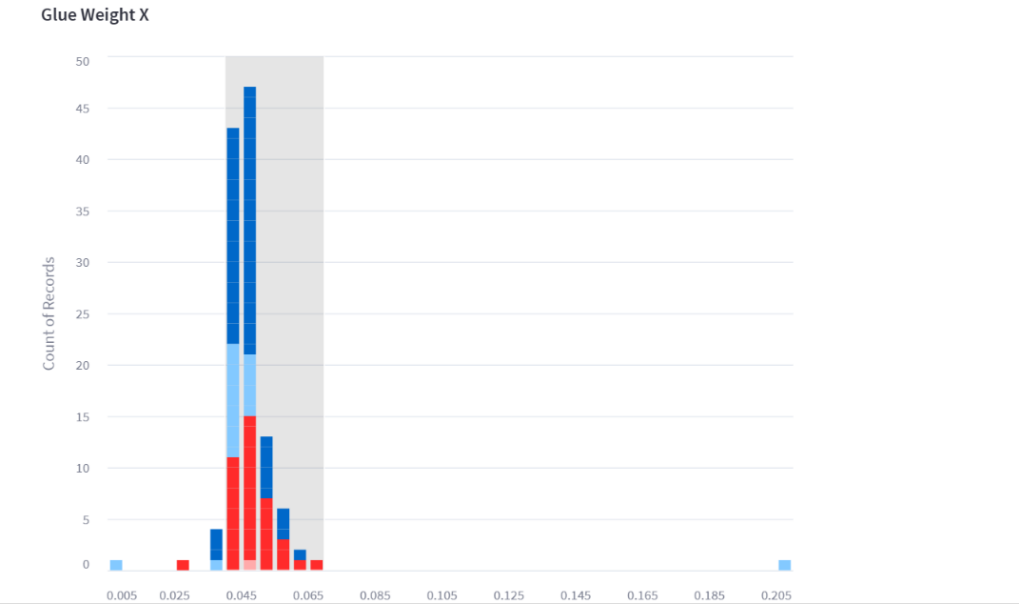


Glue weight

- Glue weight: (per type)
  1. Histogram of total glue weight (test parameter) on all hybrids or modules with allowed boundaries marked
     a. Past month, past 3 months, all times

- **Based on `itk_pdb_testapp & itk-reports & itkdb`**
- **Take barrel hybrids as example:**



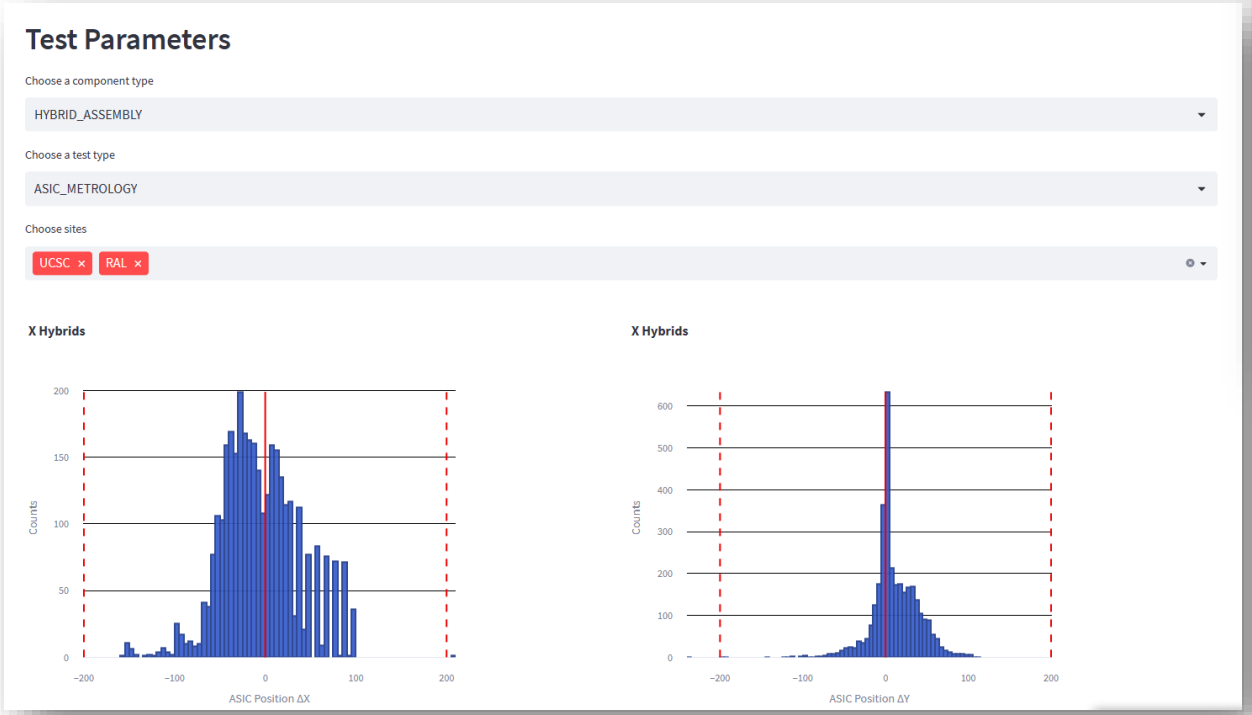


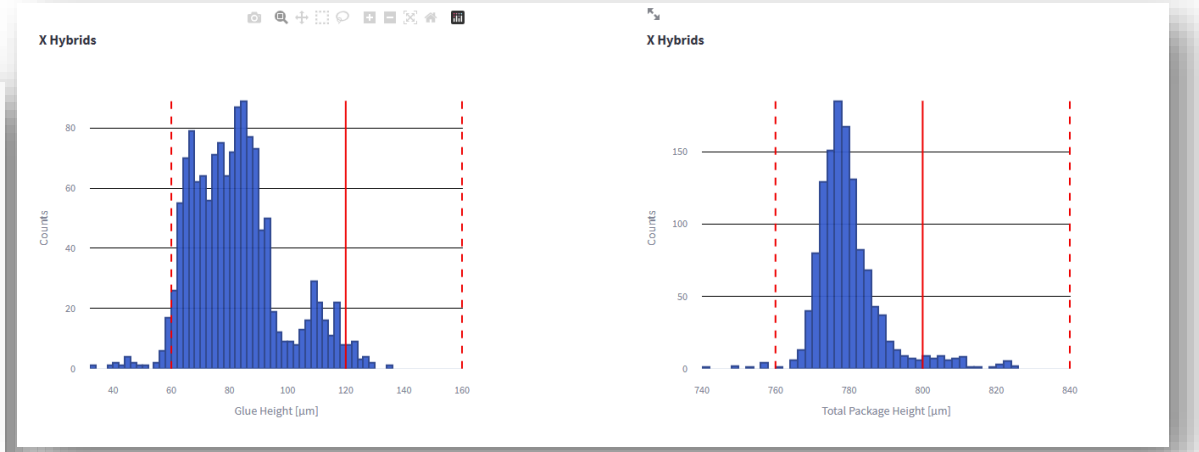
- **Improvements**
  - **migrated to *altair* plotting package, more choice for interactive figures, cope with outliers using features of *altair* (select&zoom-in).**
  - **add period selection**

Hybrid metrology

- Glue heights
  Histogram: calculate glue heights of all ASICs and plot with allowed boundaries
  1. Per institute, per cluster, for all

- **Take barrel X hybrids as example:**





- **migrating to *altair* plotting package to try to cope with outliers using features of *altair.***

IV Test

IV test result

List showing the IV results pre- and post HV-tabbing (per institute, per cluster), from latest (top) to oldest (bottom)

1. Column: sensor ID
2. Column: Breakdown voltage before tabbing
3. Column: Breakdown voltage after tabbing
4. Column: Normalized current at 500V before tabbing
5. Column: Normalized current at 500V after tabbing

- **Another approach using itk-reports functions, LS-Module**
- **Could combine into webpage easily**

656 rows | Run SQL Query | Export

	parent_child	institution	ATLAS18_IV_TEST_V1->VBD	MODULE_IV_PS_V1->VBD
197	20USBML1235119_20U...	UCSC	690.219970703125	690.260009765625
198	20USBML1235121_20U...	UCSC	690.02001953125	690
199	20USBML1235122_20U...	UCSC	690.219970703125	695.1900024414062
200	20USBML1235124_20U...	UCSC	689.97998046875	690
201	20USBML1235125_20U...	UCSC	690.02001953125	690.0399780273438
202	20USBML1235130_20U...	UCSC	690.239990234375	690.219970703125
203	20USBML1235133_20U...	UCSC	690.02001953125	690
204	20USBML1235135_20U...	UCSC	690.260009765625	690.280029296875
205	20USBML1235137_20U...	UCSC	574.9000244140625	690
206	20USBML1235143_20U...	UCSC	635.1699829101562	690.260009765625

- **Take ATLAS18LS sensor as example:**

Choose a sensor type: ATLAS18LS

Choose a sensor home site: CERN

	Sensor SN	Sensor VBD	Sensor I_500V	Sensor IV Test Institution	Module SN	Module VBD	Module I_500V	Module IV Test Institution
0	20USBSL0000003	500	1.2950	CAM	20USBML1234657	500.0000	1.0102	CAM
1	20USBSL0000004	500	1.2320	CAM	20USBML1234658	-500.0000	1.0456	CAM
2	20USBSL0000009	500	1.2863	CAM	20USBML1234660	-110.0000	0.3017	CAM
3	20USBSL0000013	500	1.4253	CAM	20USBML1234662	500.0000	2.2893	CAM
4	20USBSL0000018	500	1.3511	CAM	20USBML1234664	500.0000	1.1566	CAM
5	20USBSL0000025	700	0.9625	CAM	20USBML1234666	660.0000	1.3752	CAM
6	20USBSL0000026	700	0.9842	CAM	20USBML1234667	550.0000		
7	20USBSL0000027	700	0.9949	CAM	20USBML1234668	-500.0000		
8	20USBSL0000029	700	0.9814	CAM	20USBML1234669	500.0000		
9	20USBSL0000030	700	0.9701	CAM	20USBML1234670	500.0000		

- Sensors that are not assembled to a module are excluded
- Take parameters of the latest IV test of a sensor
- Take parameters of the latest IV test that is performed at the HV-Tabbing site of the corresponding module

Electrical Test (noise)

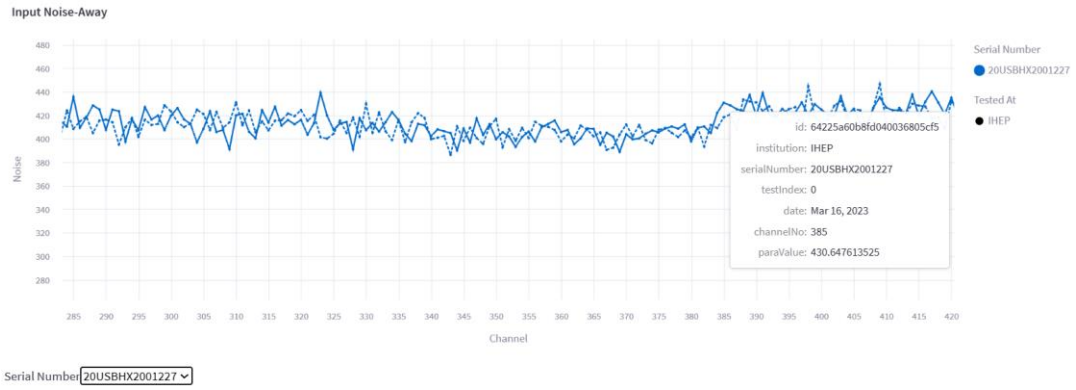
- Electrical test data

Histogram: plot noise (and allowed limits) for

1) All channels on a hybrid, per hybrid/all channels on a module, per module (of the same type)
2) Per institute/per cluster/all sites
3) For the past month/3 months/all times

- **Take barrel X hybrid as example:**

- **Deal with strange entries by having two plots, the lower one has a default upper limit, exclude entries with strange mean noise level.**
- **Interactive, zoom-in & move to check details**



Failed wire bonds

- Electrical test data

Histogram: plot noise (and allowed limits) for

1) All channels on a hybrid, per hybrid/all channels on a module, per module (of the same type)
2) Per institute/per cluster/all sites
3) For the past month/3 months/all times

- **Take R5 module as example:**

SerialNumber	FailedFE	RepairedFE	FailedH2PB	RepairedH2PB	Date	Institution	ComponenType	Type	PassedOrNot
20USEM50000004	0	0	0	0	2022-03-12 07:13:00+00:00	IFIC	MODULE	R5	Passed
20USEM50000005	0	0	0	0	2022-07-07 12:14:00+00:00	IFIC	MODULE	R5	Passed
20USEM50000006	0	54	0	0	2022-02-28 17:58:00+00:00	TRIUMF	MODULE	R5	Passed with problems
20USEM50000007	0	0	0	0	2022-03-24 16:54:00+00:00	TRIUMF	MODULE	R5	Passed
20USEM50000008	7	25	0	0	2022-07-07 10:57:00+00:00	IFIC	MODULE	R5	Passed
20USEM50000009	0	22	0	0	2022-07-18 10:03:00+00:00	IFIC	MODULE	R5	Passed
20USEM50000010	0	0	0	0	2022-06-03 20:03:00+00:00	TRIUMF	MODULE	R5	Passed
20USEM50000011	0	0	0	0	2022-06-03 19:59:00+00:00	TRIUMF	MODULE	R5	Passed
20USEM50000012	0	84	0	0	2023-06-05 08:43:00+00:00	IFIC	MODULE	R5	Passed
20USEM50000013	0	18	0	0	2023-06-29 12:53:00+00:00	IFIC	MODULE	R5	Passed
20USEM50000014	0	0	0	0	2022-07-22 20:54:00+00:00	TRIUMF	MODULE	R5	Passed
20USEM50000015	0	22	0	0	2023-01-27 17:36:00+00:00	TRIUMF	MODULE	R5	Passed with problems
20USEM50000016	0	0	0	0	2023-01-27 20:33:00+00:00	TRIUMF	MODULE	R5	Passed
20USEM50000017	0	0	0	0	2023-01-27 22:11:00+00:00	TRIUMF	MODULE	R5	Passed
20USEM50000019	0	2	0	0	2023-07-14 10:05:00+00:00	IFIC	MODULE	R5	Passed
20USEM50000022	0	0	0	0	2023-06-30 18:40:00+00:00	TRIUMF	MODULE	R5	Passed
20USEM50000023	0	1	0	0	2023-07-07 18:39:00+00:00	TRIUMF	MODULE	R5	Passed
20USEM50000024	0	0	0	0	2023-07-21 20:36:00+00:00	TRIUMF	MODULE	R5	Passed
20USEM50000025	1	479	0	0	2023-08-02 09:26:00+00:00	IFIC	MODULE	R5	Passed
20USEM50000029	1	5	0	0	2023-09-22 20:23:00+00:00	TRIUMF	MODULE	R5	Passed with problems

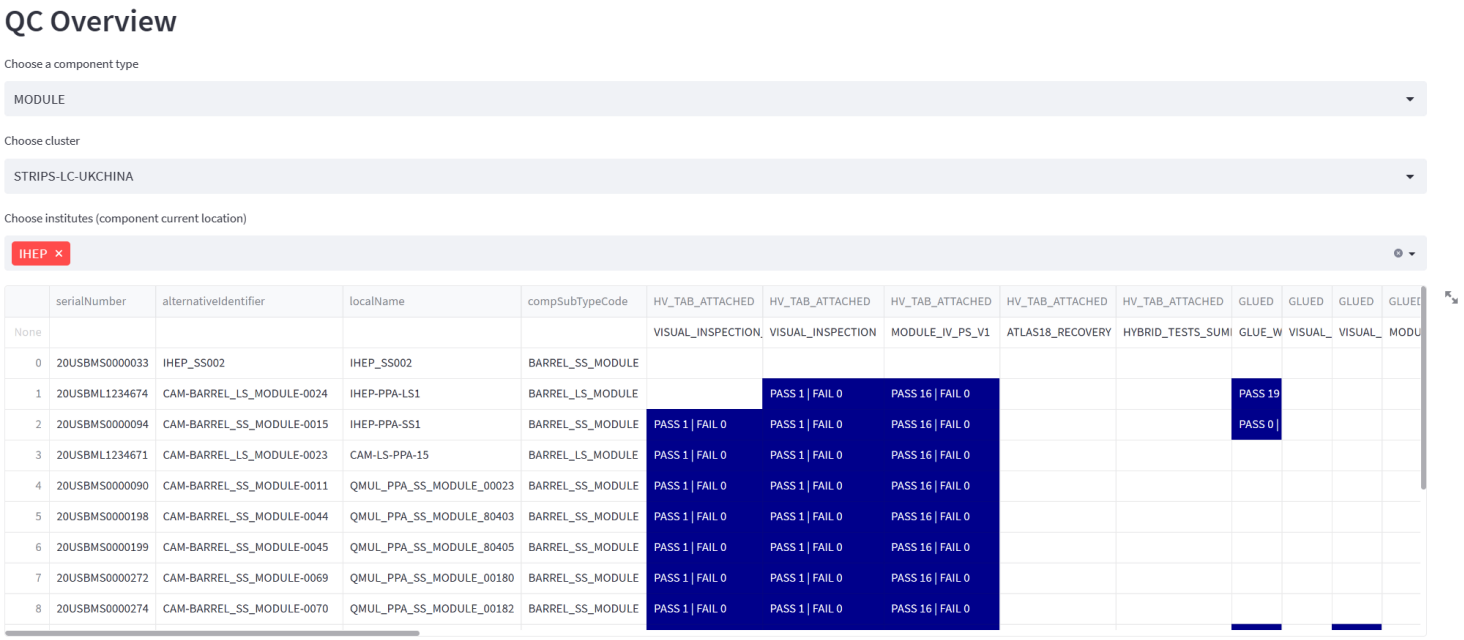
- **Core function finished, dedicated section to cope with low data quality**
- **Migrating to webpage**

QC Overview

- QC overview

  For hybrid assemblies and module assemblies, list showing
  First column: serial number
  Subsequent columns: tests to be passed for this component with a pass/fail entry

- **Take module as example:**



QC Overview

Choose a component type

MODULE

Choose cluster

STRIPS-LC-UKCHINA

Choose institutes (component current location)

IHEP ×

	serialNumber	alternativeIdentifier	localName	compSubTypeCode	HV_TAB_ATTACHED	HV_TAB_ATTACHED	HV_TAB_ATTACHED	HV_TAB_ATTACHED	HV_TAB_ATTACHED	GLUED	GLUED	GLUED	GLUED
None					VISUAL_INSPECTION_	VISUAL_INSPECTION	MODULE_IV_PS_V1	ATLAS18_RECOVERY	HYBRID_TESTS_SUM	GLUE_W	VISUAL_	VISUAL_	MODU
0	20USBMS0000033	IHEP_SS002	IHEP_SS002	BARREL_SS_MODULE									
1	20USBML1234674	CAM-BARREL_LS_MODULE-0024	IHEP-PPA-LS1	BARREL_LS_MODULE		PASS 1 | FAIL 0	PASS 16 | FAIL 0			PASS 19			
2	20USBMS0000094	CAM-BARREL_SS_MODULE-0015	IHEP-PPA-SS1	BARREL_SS_MODULE	PASS 1 | FAIL 0	PASS 1 | FAIL 0	PASS 16 | FAIL 0			PASS 0 |			
3	20USBML1234671	CAM-BARREL_LS_MODULE-0023	CAM-LS-PPA-15	BARREL_LS_MODULE	PASS 1 | FAIL 0	PASS 1 | FAIL 0	PASS 16 | FAIL 0						
4	20USBMS0000090	CAM-BARREL_SS_MODULE-0011	QMUL_PPA_SS_MODULE_00023	BARREL_SS_MODULE	PASS 1 | FAIL 0	PASS 1 | FAIL 0	PASS 16 | FAIL 0						
5	20USBMS0000198	CAM-BARREL_SS_MODULE-0044	QMUL_PPA_SS_MODULE_80403	BARREL_SS_MODULE	PASS 1 | FAIL 0	PASS 1 | FAIL 0	PASS 16 | FAIL 0						
6	20USBMS0000199	CAM-BARREL_SS_MODULE-0045	QMUL_PPA_SS_MODULE_80405	BARREL_SS_MODULE	PASS 1 | FAIL 0	PASS 1 | FAIL 0	PASS 16 | FAIL 0						
7	20USBMS0000272	CAM-BARREL_SS_MODULE-0069	QMUL_PPA_SS_MODULE_00180	BARREL_SS_MODULE	PASS 1 | FAIL 0	PASS 1 | FAIL 0	PASS 16 | FAIL 0						
8	20USBMS0000274	CAM-BARREL_SS_MODULE-0070	QMUL_PPA_SS_MODULE_00182	BARREL_SS_MODULE	PASS 1 | FAIL 0	PASS 1 | FAIL 0	PASS 16 | FAIL 0						

QC Overview

Inventory

Per site:

- Number of (good, non-trashed) HCCs per site in gel packs or not assembled to anything
- Number of (good, non-trashed) ABCs per site in gel packs or not assembled to anything
- Number of (good, non-trashed) hybrid flexes per site, not assembled to anything or assembled to hybrid *array*
- Number of (good, non-trashed) star hybrid assembled per site, assembled to test panels or not assembled to anything
- Number of (good, non-trashed) powerboards per site, *not* assembled to modules
- Number of (good, non-trashed) sensors per site, *not* assembled to modules

- **Take IHEP as example:**
  - **Gray—total**
  - **Colored—ready**
  - **could also use streamlit (st.metrics) elements to show some beautiful numbers**