

På vej mod harmoniserede/standardiserede maskinlæsbare kalibrerings certifikater

metrologidagen

22. Maj 2024

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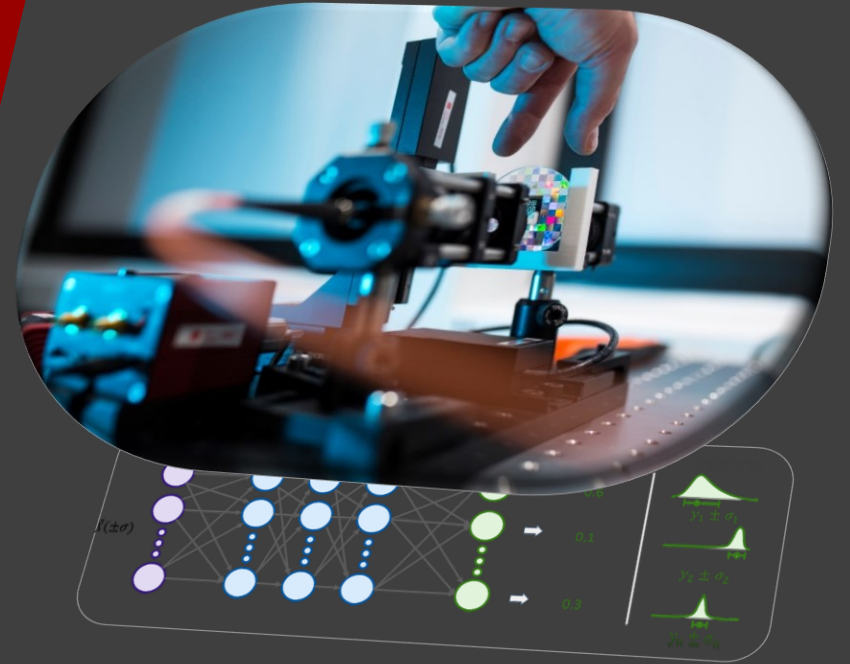


DFM

Danish National Metrology Institute



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Danish Agency for Institutions and Educational Grants*



Maskinlæsbare kalibreringscertifikater

- DFM vision: **At implementere DCC'er, der er globalt anerkendte, for at understøtte effektivitet og kvalitet i virksomheder gennem automatisering.**
- Værdiskabelse for kunderne
 - Nemmere overførsel/integration til databaser
 - Nemmere styring og justering af måleudstyr
 - Forbedret dataintegritet/sikkerhed (reduktion af manuelle fejl)
 - Effektivitet
- Primært relevant for
 - Områder med et stort antal kalibreringer: Temperatur, tryk, pipetter, IoT-sensorer
 - Certifikater med store mængder data: CMM, BRDF, akustik, ...

Danske pharma-krav til DCC

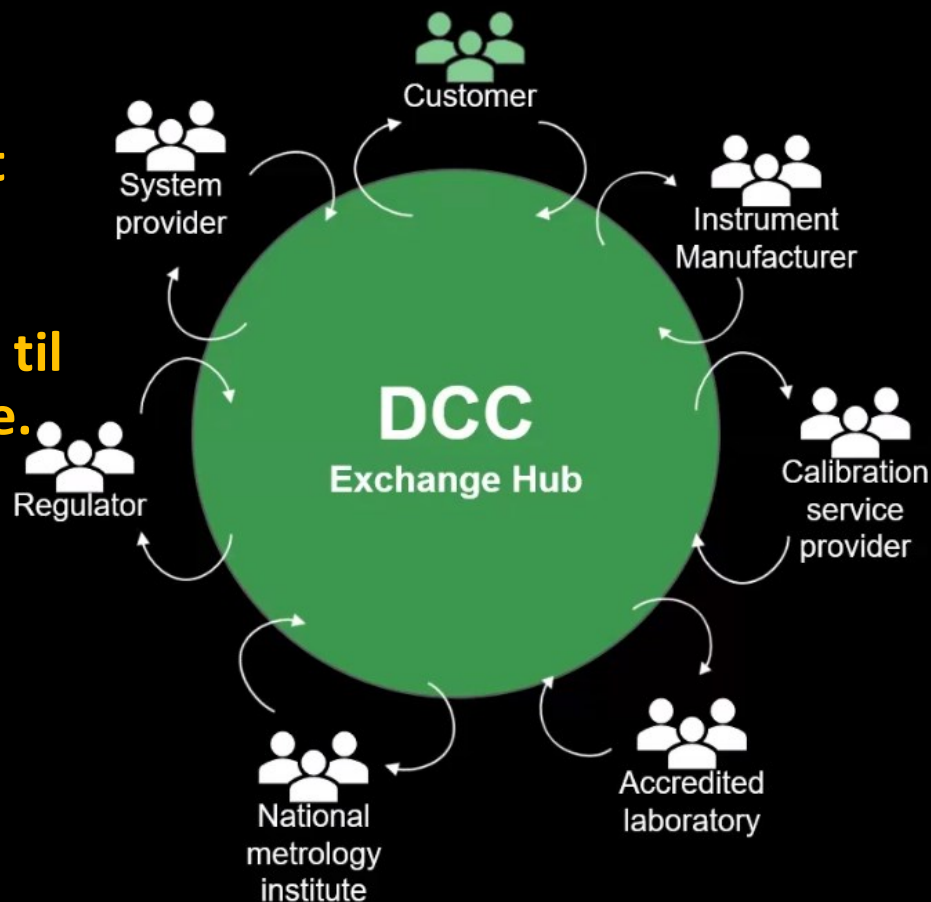
1. **Eliminer manuel overførsel af data fra store mængder certifikater.**
2. **En global standard/harmonisering:** standard = compliance & effektivitet, international standarder, Integritet i datafortolkning, og *kvalitet*.
3. **Maskine læsbare, fortolkelige, interoperabel.**
4. **Skalerbar:** Skal være brugervenlig for Accr. Cal. Labs til let at indkøre.
5. **Auditerbare:** at kunne identificere fejl, IT-standarder e.g. ISO/IEC 27001, ISO 8000, 16175 og fælles krav til rapportering (ISO-17025).
6. **Akkreditering** bør kunne identificeres pålideligt i DCC.

Hvorfor harmonisering

beamex

DCC's behov for at løse et mange-til-mange dataoverførselsproblem.

Kravene til DCC-udvekslingssystemet er sammenlignelige med grænsefladekravene til en relationsdatabase.



Databaser (e.g. SQL) er oftest designet som relationelle strukturer snarere end hierachiske strukturer

PTB's DCC's hjemmeside og dokumentation: www.ptb.de/dcc

Datatyper og -struktur defineres i XML-skemafiler: **dcc.xsd** og **SI_Format.xsd**. Disse bruges til validering af oprettede DCC-xml-filer.



Screenshot of the DCC Digital Calibration Certificate - Wiki page, showing the structure of the DCC XML schema.

The page displays the XML schema structure for the `digitalCalibrationCertificate` type, which is defined as `dcc: digitalCalibrationCertificateType`.

The structure is visualized as a tree diagram with the following elements:

- `digitalCalibrationCertificate` (Type: `dcc: digitalCalibrationCertificateType`)
 - `Attributes` (Type: `Attributes`)
 - `administrativeData` (Type: `dcc: administrativeDataType`)
 - `measurementResults` (Type: `dcc: measurementResultListType`)
 - `comment` (Type: `comment`)
 - `document` (Type: `dcc: byteDataType`)

The root element that contains the four rings of the DCC.

The page also includes a sidebar with navigation links (DCC Basics, Basics, Videos, Tutorial) and a list of XML DCC elements (root, dcc:administrativeData, dcc:measurementResult, dcc:comment, dcc:document).

For software developers, the page lists various tools and resources (Good Practice, Downloads, FAQ, Links, DCC XSD Schema, Development Platform, Wiki DCC 2.4).

The page is last edited by Lutz Doering on 01/06/2022.

1.: Administrative Data
• regulated

2.: Results of the Calibration
regulated:
 $Y = y \pm U(k) [S]$
not regulated:
• individual data

3.: Comments
• not regulated

4.: Document
• human readable

dcc:administrativeData (Ring 1; mandatory)

The element `administrativeData` contains all essential administrative information about the calibration. The entries in this area are basically the same in all DCCs and are regulated.

dcc:measurementResult (Ring 2; mandatory)

In the element `measurementResults`, all information on the results of the measurements on the calibration material are stored. The measurement and result data must have a value and a unit of measurement. Ideally, a (base) SI unit is used as the unit of measurement. The element has at least one child element. The number of further child elements is unrestricted.

Due to the different calibration requirements in the individual areas, the DCCs differ accordingly. It is logical, for example, that DCCs from the field of acoustics differ from those from the field of cyclotron radiation.

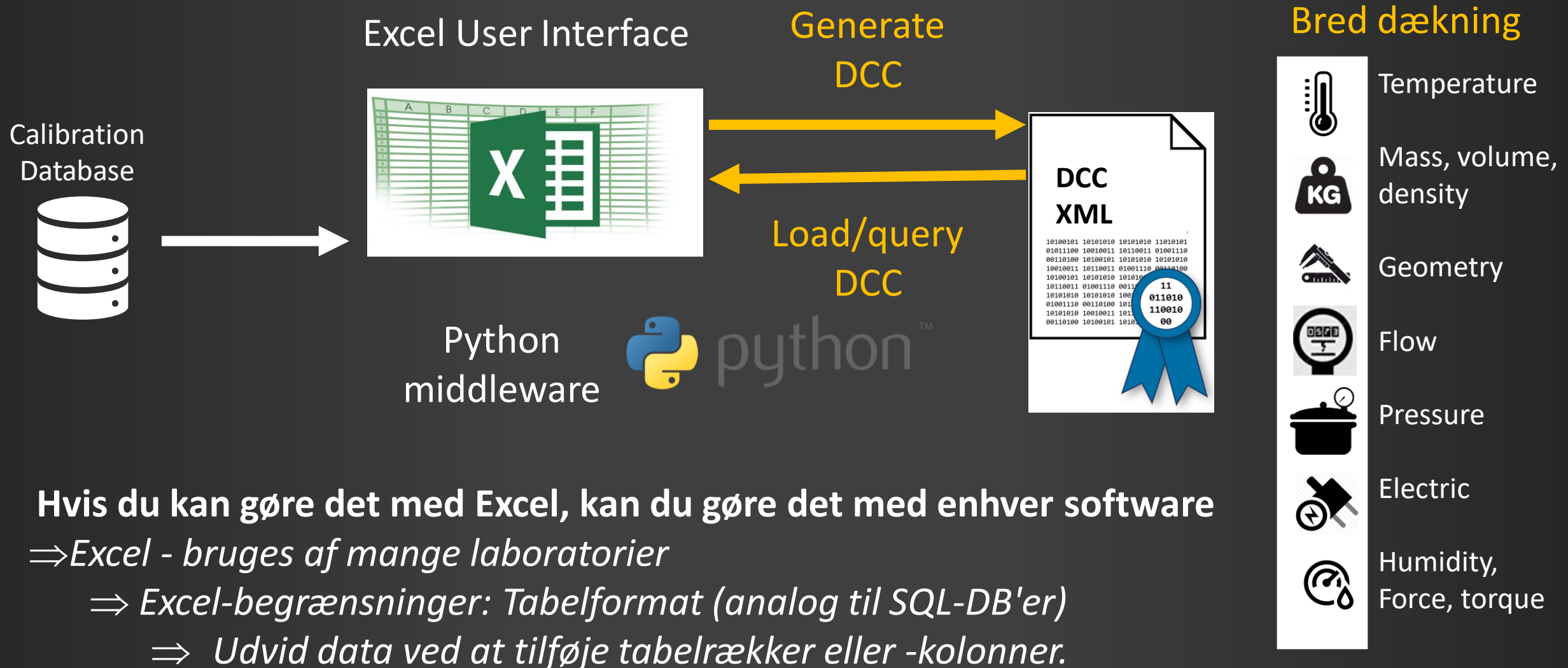
dcc:comment (Ring 3; optional)

All further information and files agreed between the client and the performing calibration laboratory can be inserted into this element. Files of different file formats (e.g. results from spreadsheet programs) are converted using the Base64 method [1] so that they can be saved in the XML structure. They can then be extracted again from the XML structure and converted back identically into the original data format using the Base64 procedure.

dcc:document (Ring 4; optional)

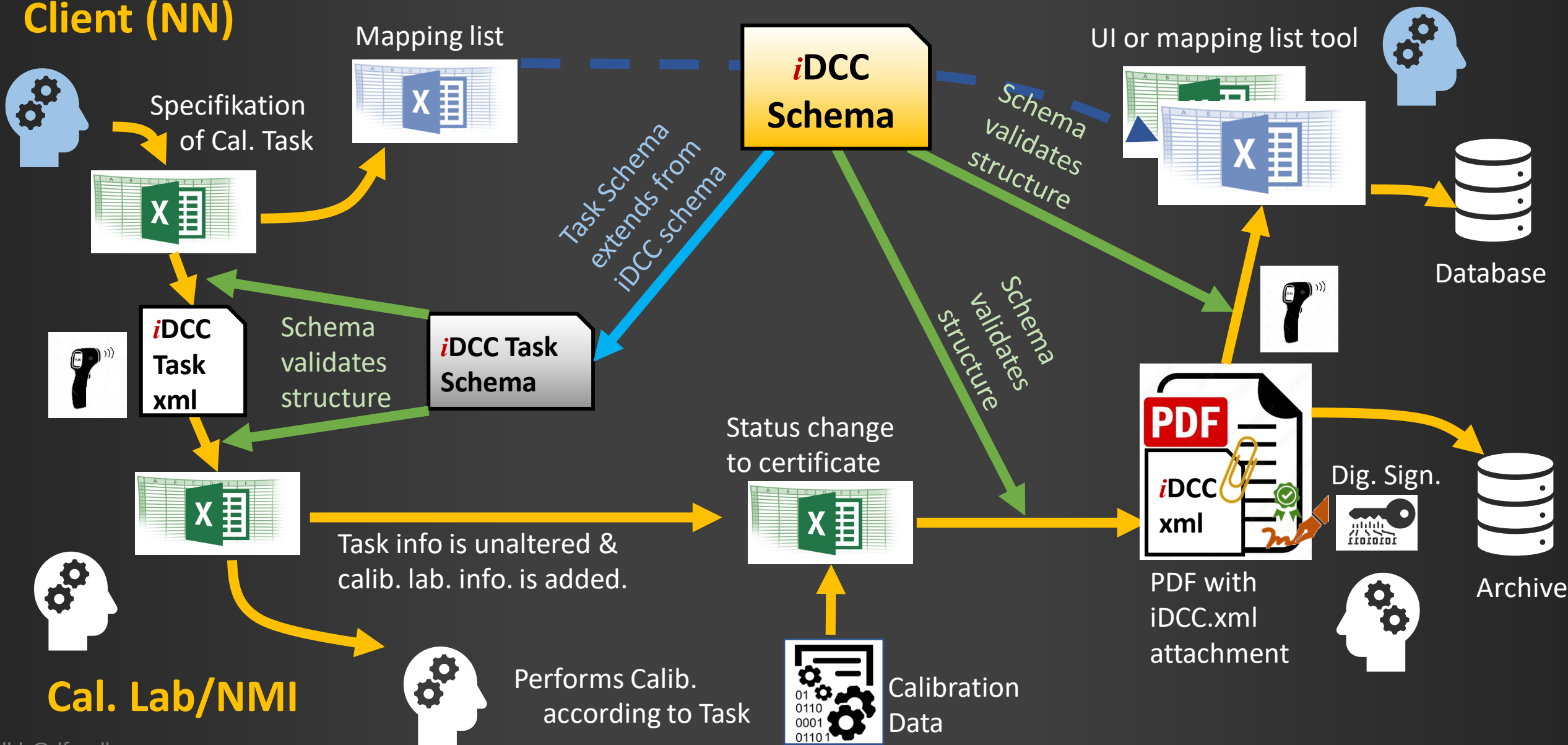
The element `document` contains the human-readable variant of the DCC.

TC-IM 1448 WG2 anmodning om Excel DCC-værktøj:



Envisioned demo workflow for *i*DCC

Client (NN)



DCC packaged in a digitally signed PDF/A-3

Attached DCC file, could be any type of file

Hashsum of the attached file ensures integrity.

The screenshot shows the Foxit Reader interface with a document titled 'eExample-1.pdf'. The 'Attachments' panel on the left lists two files: 'DCC_hash.txt' (0 KB) and 'DCC_hash.xml' (17 KB). An orange circle highlights these two entries, and an orange arrow points from the text 'Attached DCC file, could be any type of file' to the circle. The main document content is a 'Certificate of Calibration No XXX-01234' from DFM - Danish National Metrology Institute. The certificate includes fields for Object, Order, Applicant, Traceability, Date of Calibration, Marking, and Mutual recognition. The footer contains contact information for DFM and a note about the document's validity.

Name	Description	Size
DCC_hash.txt	DCC_hash.txt	0 KB
DCC_hash.xml	DCC_hash.xml	17 KB

DFM - Danish National Metrology Institute

DFM A/S
Køge Allé 5, 2970 Hørsholm, Denmark
Tel: +45 7730 5800 | www.dfm.dk

Certificate of Calibration No XXX-01234

Object	Description of the test item, clear identification
Order	Brief description of the order (If the calibration scope is clear from the calibration item (e.g. resistance, gauge block), this section can be omitted in exceptional cases.)
Applicant	Name und Adresse des Auftraggebers Firma, [Abteilung], Adresse PLZ Ort
Traceability	The reported measurement values are traceable to national standards and thus to internationally supported realisations of the SI units.
Date of Calibration	dd.mm.yyyy
Marking	Calibration label DFM mm.yyyy

2970 Hørsholm, 25 October 2021

For the Measurements	First Name Last Name
Approved by	Dr First Name Last Name, Head of sector Sector xxx

Mutual recognition
This certificate is consistent with Calibration and Measurement Capabilities (CMCs) that are included in Appendix C of the Mutual Recognition Arrangement (MRA) drawn up by the International Committee for Weights and Measures. Under the MRA, all participating institutes recognize the validity of each other's calibration certificates and measurement reports for the quantities, ranges and measurement uncertainties specified in Appendix C (for details see www.bipm.org).

This document is only valid and reviewable in its electronic form.
Please observe the information given on www.daniamet.dk/dcc.

DFM
Køge Allé 5, 2970 Hørsholm, Denmark, phone +45 7730 5800, www.dfm.dk

1/2

1 til 1 repræsentation af calibrationResults i iDCC - XML

```
190 <dcc:measurementResults>
191   <dcc:calibrationResult tableId="cal_1_T1"
192     serviceCategory="T/T-2.2.3 Thermistors and other resistive thermometers"
193     measuringSystemRef="ms1"
194     numRows="5"
195     numCols="7">
196     <dcc:heading lang="da">-</dcc:heading>
197     <dcc:heading lang="en">calibrationResult 1_T1</dcc:heading>
198     <dcc:column scope="-"
199       dataCategoryRef="-"
200       measurand="-">
201       <dcc:heading lang="da">Kundens kode</dcc:heading>
202       <dcc:heading lang="en">Customer Tags</dcc:heading>
203       <dcc:unit>-</dcc:unit>
204       <dcc:dataList>
205         <dcc:rowTag>
206           <dcc:row idx="1">T1</dcc:row>
207           <dcc:row idx="2">T2</dcc:row>
208           <dcc:row idx="3">T3</dcc:row>
209           <dcc:row idx="4">T4</dcc:row>
210           <dcc:row idx="5">T5</dcc:row>
211         </dcc:rowTag>
212       </dcc:dataList>
213     </dcc:column>
214     <dcc:column scope="reference"
215       dataCategoryRef="-"
216       measurand="Temperature">
217       <dcc:heading lang="en">True mean value (°C)</dcc:heading>
218       <dcc:unit>\degreeCelcius</dcc:unit>
219       <dcc:dataList>
220         <dcc:value>
221           <dcc:row idx="1">-40.006</dcc:row>
222           <dcc:row idx="2">-20.014</dcc:row>
223           <dcc:row idx="3">-0.007</dcc:row>
224           <dcc:row idx="4">19.998</dcc:row>
225           <dcc:row idx="5">40.0</dcc:row>
226         </dcc:value>
227       </dcc:dataList>
228     </dcc:column>
229     <dcc:column scope="indication"
230       dataCategoryRef="-"
231       measurand="Temperature">
232       <dcc:heading lang="en">Object mean value (°C)</dcc:heading>
233       <dcc:unit>\degreeCelcius</dcc:unit>
```

	A	B	C	D	E
1	heading[en]	heading[da]	Description	Value	XPath
2	Calibration certificate	Kalibreringscertifikat	Certificate-Title		/dcc:digitalCalibrationCertificate
3	This document was created with:	Dette dokument blev genereret ved hjælp af:	software		/dcc:digitalCalibrationCertificate/dcc:administrativeData/dcc:dccSoftware/dcc:software
4			name	ioDccGuiTool.py	/dcc:digitalCalibrationCertificate/dcc:administrativeData/dcc:dccSoftware/dcc:software/dcc:
5			release	v0.0.2	/dcc:digitalCalibrationCertificate/dcc:administrativeData/dcc:dccSoftware/dcc:software/dcc:
6			countryCodeISO3166_1	DK	/dcc:digitalCalibrationCertificate/dcc:administrativeData/dcc:coreData/dcc:countryCodeISO
7			usedLangCodeISO639_1	da	/dcc:digitalCalibrationCertificate/dcc:administrativeData/dcc:coreData/dcc:usedLangCodeISO
8			mandatoryLangCodeISO639_1	en	/dcc:digitalCalibrationCertificate/dcc:administrativeData/dcc:coreData/dcc:mandatoryLang
9	Certificate number	Certifikatnummer	uniqueIdentifier		/dcc:digitalCalibrationCertificate/dcc:administrativeData/dcc:coreData/dcc:uniqueIdentifier
10			value	K063497	/dcc:digitalCalibrationCertificate/dcc:administrativeData/dcc:coreData/dcc:uniqueIdentifier
11	Order number	Ordrenummer	customerIdentification		/dcc:digitalCalibrationCertificate/dcc:administrativeData/dcc:coreData/dcc:customerIdentif
12			value	Q0795429	/dcc:digitalCalibrationCertificate/dcc:administrativeData/dcc:coreData/dcc:customerIdentif
13			receiptDate	2023-04-25	/dcc:digitalCalibrationCertificate/dcc:administrativeData/dcc:coreData/dcc:receiptDate
14			beginPerformanceDate	2023-04-25	/dcc:digitalCalibrationCertificate/dcc:administrativeData/dcc:coreData/dcc:beginPerforman
15			endPerformanceDate	2023-04-25	/dcc:digitalCalibrationCertificate/dcc:administrativeData/dcc:coreData/dcc:endPerformanc
16			performanceLocation	laboratory	/dcc:digitalCalibrationCertificate/dcc:administrativeData/dcc:coreData/dcc:performanceLoc
17			issueDate	2024-04-26	/dcc:digitalCalibrationCertificate/dcc:administrativeData/dcc:coreData/dcc:issueDate
18	Calibration laboratory	Kalibreringslaboratorium	calibrationLaboratory		/dcc:digitalCalibrationCertificate/dcc:administrativeData/dcc:calibrationLaboratory
19			companyName	Buhl & Bønsøe A/S	/dcc:digitalCalibrationCertificate/dcc:administrativeData/dcc:calibrationLaboratory/dcc:con
20	Address	Adresse	location		/dcc:digitalCalibrationCertificate/dcc:administrativeData/dcc:calibrationLaboratory/dcc:loca
21			city	Smørum	/dcc:digitalCalibrationCertificate/dcc:administrativeData/dcc:calibrationLaboratory/dcc:loca
22			countryCode	DK	/dcc:digitalCalibrationCertificate/dcc:administrativeData/dcc:calibrationLaboratory/dcc:loca
23			postCode	2765	/dcc:digitalCalibrationCertificate/dcc:administrativeData/dcc:calibrationLaboratory/dcc:loca
24			street	Hassellunden	/dcc:digitalCalibrationCertificate/dcc:administrativeData/dcc:calibrationLaboratory/dcc:loca
25			streetNo	11A	/dcc:digitalCalibrationCertificate/dcc:administrativeData/dcc:calibrationLaboratory/dcc:loca
26	Contact info	Kontaktinformation	contactInfo		/dcc:digitalCalibrationCertificate/dcc:administrativeData/dcc:calibrationLaboratory/dcc:con
27			eMail	info@buhl-bonsoe.dk	/dcc:digitalCalibrationCertificate/dcc:administrativeData/dcc:calibrationLaboratory/dcc:con
28			phone	+45 4995 0410	/dcc:digitalCalibrationCertificate/dcc:administrativeData/dcc:calibrationLaboratory/dcc:con
29	Main signer	Underskriftsberettiget	respPerson		/dcc:digitalCalibrationCertificate/dcc:administrativeData/dcc:respPersons/dcc:respPerson
30			name	Bo Bøgwald	/dcc:digitalCalibrationCertificate/dcc:administrativeData/dcc:respPersons/dcc:respPerson/
31			mainSigner	TRUE	/dcc:digitalCalibrationCertificate/dcc:administrativeData/dcc:respPersons/dcc:respPerson/
32	Accreditation	Akkreditering	accreditation		/dcc:digitalCalibrationCertificate/dcc:administrativeData/dcc:accreditation
33			accreditationCountry	DK	/dcc:digitalCalibrationCertificate/dcc:administrativeData/dcc:accreditation/dcc:accreditation
34			accreditationBody	DANAK	/dcc:digitalCalibrationCertificate/dcc:administrativeData/dcc:accreditation/dcc:accreditation
35			accreditationLabId	142	/dcc:digitalCalibrationCertificate/dcc:administrativeData/dcc:accreditation/dcc:accreditation

AutoSave Off

DCC_pipette_blank...

Search

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FileHomeInsertPage LayoutFormulasDataReviewViewAutomateDeveloperAdd-insHelpFoxit PDFPower PivotTable Design

B6

s01

	A	B	C	D	E	F
1	heading[da]	Bemærkninger				
2	heading[en]	Statements				
3	in DCC	@id	@category	heading[en]	heading[da]	body[en]
4	y	meth2	method	Uncertainty		The reported expanded uncertainty is stated as the standard uncertainty of the measurement multiplied by the coverage factor k=2, hence the coverage probability corresponds to approximately 95%.
5	y	meth1	method	Procedure		Measurement procedure III-2
6	y	s01	general	Reprint		This document is only valid with digital signature from Buhl & Bønsøe A/S. The valid edition (legal original) is stored in Buhl & Bønsøe A/S electronic archive. This calibration certificate may only be reproduced in its entirety, unless Buhl & Bønsøe A/S has approved otherwise in writing. Our terms and conditions are an integrated part of our services.
7	y	conf1	traceability	Traceability		This calibration certificate is covered by DANAK accreditation and the multilateral agreements from EA and ILAC for calibration, which ensures that measurements are metrologically traceable. Calibration results only covers the calibrated items.
8	y	env1	method	Environment		Temperature 23±2°C, humidity 27±10%RH, barometric pressure 999±5mbar
9						
10						

DefinitionsadministrativeDatastatementsequipmentsettingsmeasuringSystemseembeddedFiles1_T1

ReadyAccessibility: Investigate

Display Settings

AutoSave

Off

DCC_pipette_blank...

Search

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File

Home

Insert

Page Layout

Formulas

Data

Review

View

Automate

Developer

Add-ins

Help

Foxit PDF

Power Pivot

Table Design

D4

Ch

	A	B	C	D	E	F	G	H	I	
1	heading[da]	Indstillinger								
2	heading[en]	Settings								
3	in DCC	@settingId	@equipmentRef	parameter	value	unit	softwareInstruction	heading[en]	heading[da]	body
4	y	ch2	item1	Ch	2			Channel	Kanal	
5	y	ch2_type	item1	type	0610 1725			Type		
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										

Definitions

administrativeData

statements

equipment

settings

measuringSystems

embeddedFiles

1_T1

Ready

Accessibility: Investigate

Display Settings

100%

Ready **Accessibility: Investigate** Display Settings - + 100%

AutoSaveOff

File

Home

Insert

Page Layout

Formulas

Data

Review

View

Automate

Developer

Add-ins

Help

Foxit PDF

Power Pivot

Comments

DCC_pipette_blank...

Search

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B3

T/T-2.2.3 Thermistors and other resistive thermometers

	A	B	C	D	E	F	G
1	tableCategory	calibrationResult					
2	@tableId	cal_1_T1					
3	@serviceCategory	T/T-2.2.3 Thermistors and other	sistive thermometers				
4	@measuringSystemRef	ms1					
5	@customServiceCategory						
6	statementRef						
7	heading[da]	-					
8	heading[en]	calibrationResult 1_T1					
9	@numRows	5					
10	@numCols	7					
11							
12	scope	-	reference	indication	indication	bias	indication
13	dataCategory	rowTag	value	value	repeatability	value	expanded
14	dataCategoryRef	-	-	-	-	-	value
15	measurand	-	Temperatur	Temperature	Temperatur	Temperature	Tempera
16	unit	-	\degreeCelc	\degreeCelcius	\degreeCelc	\degreeCelcius	\degreeC
17	heading[da]	Kundens kode					
18	heading[en]	Customer Tags	True mean v	Object mean value	Repeatabilit	Error (°C)	Uncertain
19	idx						
20	1	T1	-40.006	-39.900	0.000	0.106	0.1
21	2	T2	-20.014	-19.900	0.000	0.114	0.1
22	3	T3	-0.007	0.100	0.000	0.107	0.1
23	4	T4	19.998	20.000	0.000	0.002	0.1
24	5	T5	40.000	40.000	0.000	0.000	0.1
25							

DCC EXCEL UI Tool

load excel-file

DCC_pipette_blank.xlsx

load DCC.xml

Select a DCC file

Export DCC from GUI

... ns

administrativeData

statements

equipment

settings

measuringSystems

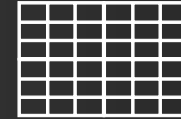
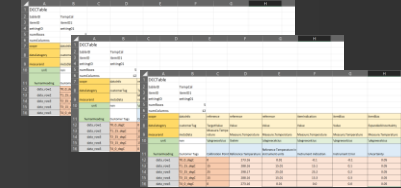
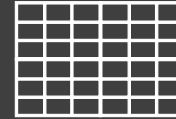
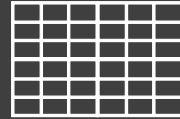
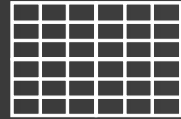
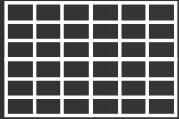
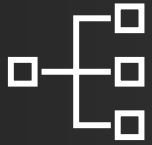
embeddedFiles

1_T1

ReadyAccessibility: InvestigateDisplay Settings100%

iDCC Architecture

All row entries in the tables have unique identifiers – which can be reference /linkedto as required or needed.



Administrative:

DCC schema ver.
certificate #
Order #
arrival Date
start Date
end Date
performance Loc.
issue Date
callLab address
customer address
Software ref.
....

Accreditation:

Lab ID code
Accred. Norm
Accred. Body
Accred. Country
Accred. Applicability

Statements:

@id
@category
heading [lang]
body [lang]
ext. Reference

Equipment:

@id
@category
manufacturer
productName
productModel
productType
equipmentClass
identifications
Customer
Manufacturer
Laboratory
heading [lang]

Settings:

@id
@equipmentRef
parameter
value
unit
software instruction
heading [lang]
body [lang]

MeasuringSystems:

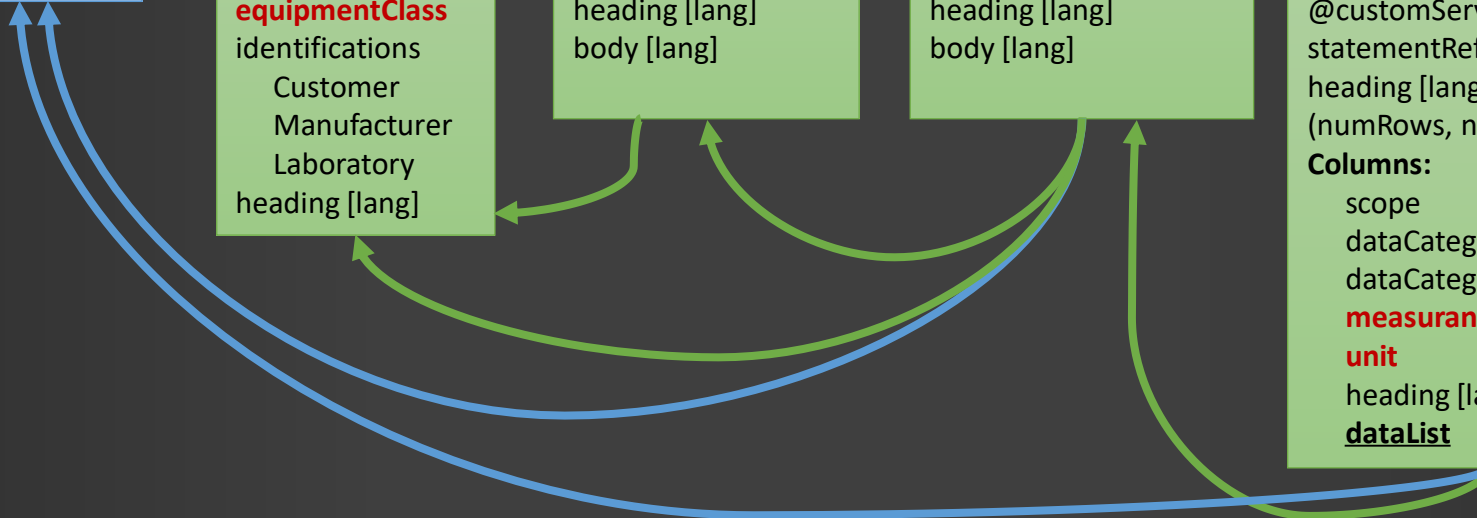
@id
equipmentRefs
settingRefs
statementRefs
operationalStatus
[as found/as left]
heading [lang]
body [lang]

Result 1...N:

tableCategory
[calibrationResult/
measurementSeries]
@tableId
@serviceCategory BIPM
@measuringSystemRef
@customServiceCategory
statementRefs
heading [lang]
(numRows, numColumns)
Columns:
scope
dataCategory
dataCategoryRef
measurand
unit
heading [lang]
dataList

EmbeddedFiles:

@id
@category
Heading [lang]
Body [lang]
fileExtension



Allowed names are provided in the schema as `xs:restriction`

```
974 <xs:simpleType name="scopeType">
975   <xs:annotation>
976     <xs:documentation>
      The scopeType is restricting the scope attribute of the columnType.
      For data columns the attribute is used to describe the data..
      For meta data columns the attribute is used to match the data
      column(s) that is enriched with the meta data.

      * reference : Data relating to the reference equipment. E.g.
      measured value or uncertainty of the reference.
      * indication : Data relating to the device under test. E.g. nominal
      value of an artefact or display value of an active instrument
      * bias : Data relating to the difference item_value -
      reference_value.
      E.g. the calibration result (bias of the item and
      its uncertainty.)
      * environment: Influece conditions measured in the environment .
      E.g. laboratory temperature, pressure etc...
      * Other : the content may be specified in the column name in
      human readable form.
      * '-' : Used for meta data columns to refer to all scopes
    </xs:documentation>
  </xs:annotation>
  <xs:restriction base="xs:string">
    <xs:enumeration value="reference" />
    <xs:enumeration value="indication" />
    <xs:enumeration value="bias" />
    <xs:enumeration value="environment" />
    <xs:enumeration value="Other" />
    <xs:enumeration value="-" />
  </xs:restriction>
</xs:simpleType>
```

Python search function

- `search( cal_1_T1, indication, value, -, Temperature, \degreecelcius, rowTag=T2) -> - 20.014`
- `search( cal_1_T1, bias, value, -, Temperature, \degreecelcius, rowTag=T2) -> 0.114`
- `search( cal_1_T1, bias, ExpandedUncertainty, value, Temperature, \degreecelcius, T4) -> 0.1`

	A	B	C	D	E	F	G	H	I
1	tableCategory	calibrationResult							
2	@tableId	cal_1_T1							
3	@serviceCategory	T/T-2.2.3 Thermistors and other resistive thermometers							
4	@measuringSystemRef	ms1							
5	@customServiceCategory								
6	statementRef								
7	heading[da]	-							
8	heading[en]	calibrationResult 1_T1							
9	@numRows	5							
10	@numCols	7							
11									
12	scope	-	reference	indication	indication	bias	indication	bias	
13	dataCategory	rowTag	value	value	repeatability	value	expanded	expandedUncertainty	
14	dataCategoryRef	-	-	-	-	-	value	-	
15	measurand	-	Temperature	Temperature	Temperature	Temperature	Temperature	Temperature	
16	unit	-	\degreeCelc	\degreeCelcius	\degreeCelc	\degreeCelcius	\degreeC	\degreeCelcius	
17	heading[da]	Kundens kode							
18	heading[en]	Customer Tags	True mean v	Object mean value	Repeatability	Error (°C)	Uncertain	Measurement uncertainty (°C)	
19	idx								
20	1	T1	-40.006	-39.900	0.000	0.106	0.1	0.089	
21	2	T2	-20.014	-19.900	0.000	0.114	0.1	0.089	
22	3	T3	-0.007	0.100	0.000	0.107	0.1	0.089	
23	4	T4	19.998	20.000	0.000	0.002	0.1	0.089	
24	5	T5	40.000	40.000	0.000	0.000	0.1	0.089	

Excel query tool for iDCC xml's

Novo Nordisk DB ref	Novo Description	QueryType	xpath	tableId	itemRef	settingRef	scope	DataCategory	measurand	metaDataCategory	unit	customerTag	QueryResult
MIC in SAP	Customer order IC	xpath	/dcc:digitalCalibrationCertificate/dcc:administrativeData/dcc:coreData/dcc:customerIdentification/dcc:value										8000650430
01ECERTa	Calibration Labora	xpath	/dcc:digitalCalibrationCertificate/dcc:administrativeData/dcc:accreditation/dcc:accreditationBody										DANAK
01ECERTb	Calibration Labora	xpath	/dcc:digitalCalibrationCertificate/dcc:administrativeData/dcc:accreditation/dcc:accreditationLabId										491
01ECERTc	Certificate ID	xpath	/dcc:digitalCalibrationCertificate/dcc:administrativeData/dcc:coreData/dcc:uniqueIdentifier										Stip-230063-V
01ECERTd	Laboratory Name	xpath	/dcc:digitalCalibrationCertificate/dcc:administrativeData/dcc:calibrationLaboratory/dcc:contact/dcc:name/dcc:content										Medico Supp
01U	Uncertinaty for 1 c	data		TempCal	item1	setting1 setting2	itemBias	ExpandedUnc	Measure.Temperature	Data	\degreecelsiusT1		0.108
01PRT01	Reading of the sta	data		TempCal	item1	setting1 setting2	reference	Value	Measure.Temperature	Data	\degreecelsiusT1		-6.076
01UUT	Reading of the DU	data		TempCal	item1	setting1 setting2	itemIndicator	Value	Measure.Temperature	Data	\degreecelsiusT1		-6.06
02U	Uncertinaty for 1 c	data		TempCal	item1	setting1 setting2	itemBias	ExpandedUnc	Measure.Temperature	Data	\degreecelsiusT2		0.108
02PRT01	Reading of the sta	data		TempCal	item1	setting1 setting2	reference	Value	Measure.Temperature	Data	\degreecelsiusT2		5.017
02UUT	Reading of the DU	data		TempCal	item1	setting1 setting2	itemIndicator	Value	Measure.Temperature	Data	\degreecelsiusT2		5.05
03U	Uncertinaty for 1 c	data		TempCal	item1	setting1 setting2	itemBias	ExpandedUnc	Measure.Temperature	Data	\degreecelsiusT3		0.108
03PRT01	Reading of the sta	data		TempCal	item1	setting1 setting2	reference	Value	Measure.Temperature	Data	\degreecelsiusT3		27.054
03UUT	Reading of the DU	data		TempCal	item1	setting1 setting2	itemIndicator	Value	Measure.Temperature	Data	\degreecelsiusT3		27.16
ACCSTATEMENT	statement on accr	xpath	//*[@statementId="acc1"]/dcc:body[@lang="da"]										Kalibreringen
--END--													

Implementering er tilgængelig:

<https://github.com/TC-IM-1448/DCC-Tables/tree/master>

dcc.xsd - Schema file for iDCC.

ioDCCGuiTool.py - for interfacing with Excel.

dccQueryGui.py – for data querying into Excel.

DCChelpfunctions.py – used for validation

SKH_10112_2.xml – an iDCC validating example

TC-IM-1448 / DCC-Tables

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This branch is 63 commits ahead of main.

File	Commit Message	Time Ago
Examples	minor corrections.	2 hours ago
DCC_UI_blank.xlsx	DCC_UI_blank.xlsx was made bl...	3 weeks ago
DCC_template.xlsx	Change item to measuringInstr...	last month
DCChelpfunctions.py	minor corrections.	2 hours ago
README.md	Update README.md	5 months ago
SKH_10112_2.xml	minor corrections.	2 hours ago
dcc-env.yml	Update af DCChelpfunctions til ...	last month
dcc.xsd	minor corrections.	2 hours ago
dcc2excel.py	minor change to dcc2excel.py	last month
dccQueryGui.py	dccQueryGui.py : Updated to in...	last month
dccquery.py	dccquery.py : output is written ...	4 months ago
excel2dcc.py	DCC_UI_blank.xlsx was made bl...	3 weeks ago
ioDccGuiTool.py	minor corrections.	2 hours ago

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Joint Statement of intent (signed March 2022)



ISO



CIPM



ISC



CODATA



IEC



ILAC



IMEKO



OIML

We the undersigned undertake to support in a way appropriate to each organisation the development, implementation, and promotion of the SI Digital Framework as part of a wider digital transformation of the international scientific and quality infrastructure.

Harmonisation aktiviteter for DCC

Nationalt

DANIAMet

GTS arbejdsgruppe:
DFM,
Teknologisk Institut
FORCE Technology

Temadage om DCC

Case-studies med virk.
Dandiag
Novo Nordisk

Europæisk

EURAMET TC-IM 1448

Interdisciplinary Project
Focusing on the DCC

EURAMET TCs

Digitalisation Working Groups

Globalt

Forum on Metrology and Digitalization (FORUM-MD)

DCCs on CIPM and CC level
Semantics for SI

Nationalt Tyskland

DKD

German Calibration Service
Technical Subcommittees for
Harmonisation of DCC Examples,
Wording, Expert Reports

QI Digital

Digital Accreditation Symbol
eAttestation including DCC Use Cases

VIM – målestørrelser og enheder

Definitionen | Terminologie

- 1.1 quantity: NOTE 3 Symbols for quantities are given in the ISO 80000 and IEC 80000 series *Quantities and units*.
 - property of a phenomenon, body, or substance, where the property has a magnitude that can be expressed as a number and a reference (length, radius, wavelength,...)
- 1.2 kind of quantity:
 - aspect common to mutually comparable quantities (length, energy,...)
- 2.3 measurand:
 - quantity intended to be measured
- 3.2 measuring system:
 - set of one or more measuring instruments and often other devices, including any reagent and supply, assembled and adapted to give information used to generate measured quantity values within specified intervals for quantities of specified kinds

ISO 80000 – series on quantities and units

ISO 80000 consists of the following parts, under the general title Quantities and units

- Part 1: General
- Part 2: Mathematical signs and symbols to be used in the natural sciences and technology
- Part 3: Space and time
- Part 4: Mechanics
- Part 5: Thermodynamics
- Part 6: Electromagnetism
- Part 7: Light
- Part 8: Acoustics
- Part 9: Physical chemistry and molecular physics
- Part 10: Atomic and nuclear physics
- Part 11: Characteristic numbers
- Part 12: Solid state physics
- Part 13: Information science and technology
- Part 14: Telebiometrics related to human physiology

ISO 80000 – Content of the standards

Item No.	Quantity			Unit	Remarks
	Name	Symbol	Definition	Symbol	
6-46	resistance	R		Ω $\text{kg m}^2 \text{s}^{-3} \text{A}^{-2}$	
6-47	conductance	G		S $\text{kg}^{-1} \text{m}^{-2} \text{s}^3 \text{A}^2$	
6-48	phase difference	φ		rad 1	
6-49	electric current phasor	$\underline{I}$		A	

ISO 80000 – målestørrelser og enheder

Angiver de ikke-skalerede basisenheder for hver af mængderne

Enheder, der anvendes i DCC, er angives i en tabel.

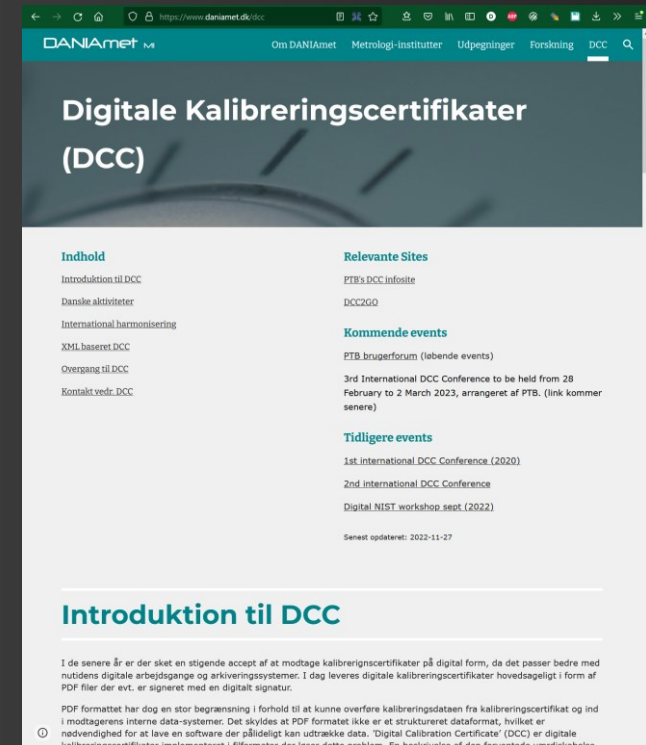
En omregningsfunktion angives for alle enheder, der afviger fra uskalerede basisenheder.

Funktionen kan inverteres dvs. bruges til at konvertere i begge retninger.

															bod				Var OP			
@id	Measurand	Unit category	Symbol	S	m	kg	A	K	mol	cd	SI unit	heading[en]	body y[da]	OP1	Var1	OP12	13	13	Var1			
degreeCelcius	T 5-1: temperature, thermodynamic	ISO80k_Unit	°C		0	0	0	0	1	0	0 K	Degree Celcius	Grader Celcius	-	-	273.2						
mAmp	Ratio.Power.Reflection Factor.RF	scaled_ISO80k_Unit	mA					1			A				*	0.001						
dBm	Power.RF.Sinewave	scaled_ISO80k_Unit	dBm		-3	2	1				W				/	10 10^		*	0			

Næste trin

- Test af iDCC og sammenligning med PTB DCC 3.x er i gang, i samarbejde mellem Novo Nordisk, PTB, DFM, Teknologisk Institut, FORCE Technology og Dandiag (pipetter).
- Implementering af ISO 80000 og enheds konvertering. og PDF generering
- Implementering af flere eksempler: masse, kemiske,...
- Implementering af DCR og tilhørende skema.
- International harmonisering drøftes i EURAMET TC-IM 1448 WP1 og når muligt i regi af CIPM MFD.
- Hold dig opdateret på den danske hjemmeside for at koordinere og formidle information om DCC til danske interessenter.
www.daniamet.dk/dcc og linkedin.com/groups/14352279/



www.daniamet.dk/dcc

Thank You



Scan og giv en
støttende kommentar på
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To participants in TC-IM 1448 WG1:

Zoltan Zelenka (BEV), Michael Chrubasik (NPL), Diego Coppa (INTI), Quentin Baire (SMD), Carlos Pires (IPQ)
PTB: Shanna Schönhalls, Daniel Hutzschenreuter, Gamze Soylev-oektem, Clifford Brown, Wiebke Heeren.

To International collaborators at PTB, DCC2GO project, and other fora.

To Danish collaborators, Teknologisk Institute, FORCE, Novo Nordisk, DANDIAG etc.

Contact: David Balslev-Harder (dbh@dfm.dk)