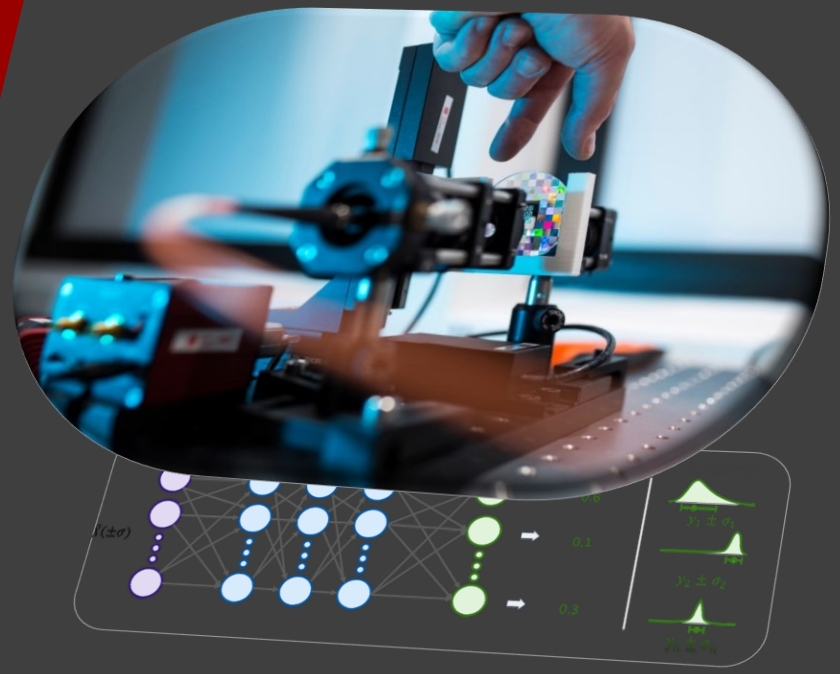
På vej mod harmoniserede/standardiserede maskinlæsbare kalibrerings certifikater



metrologidagen

22. Maj 2024

David Balslev-Harder & Søren R. Kynde

DFM
Danish National Metrology Institute

DFM receives funding by:
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.

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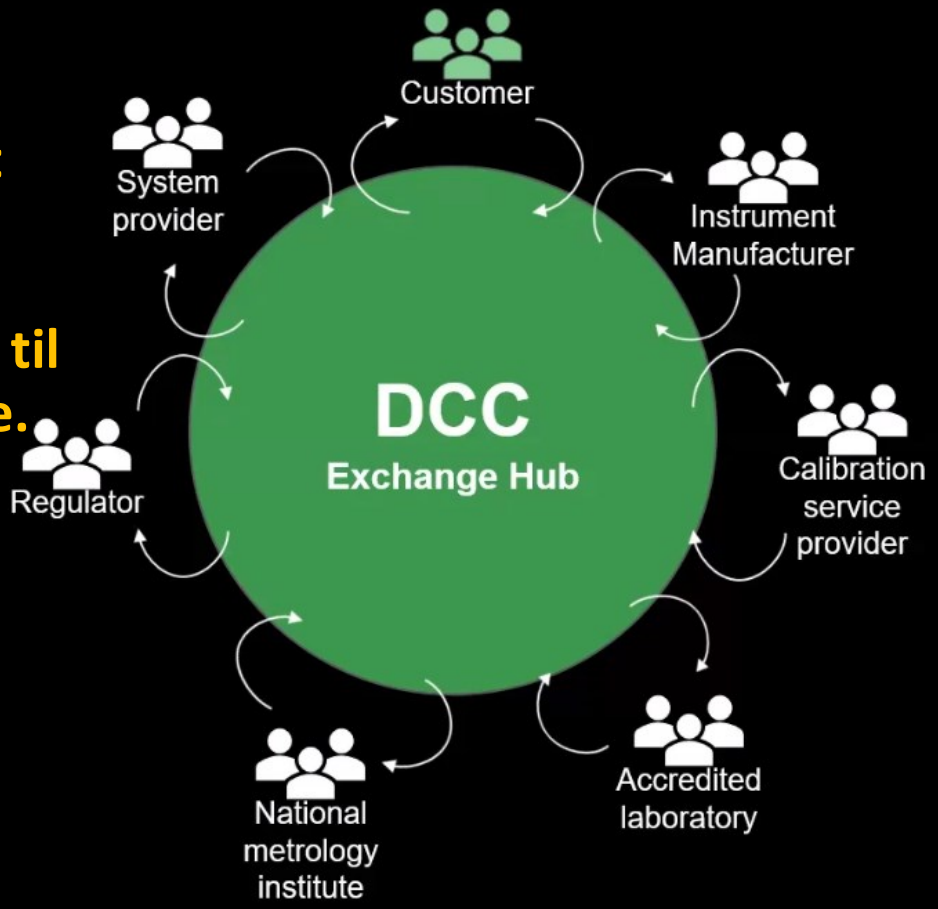
Hvorfor harmonisering

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

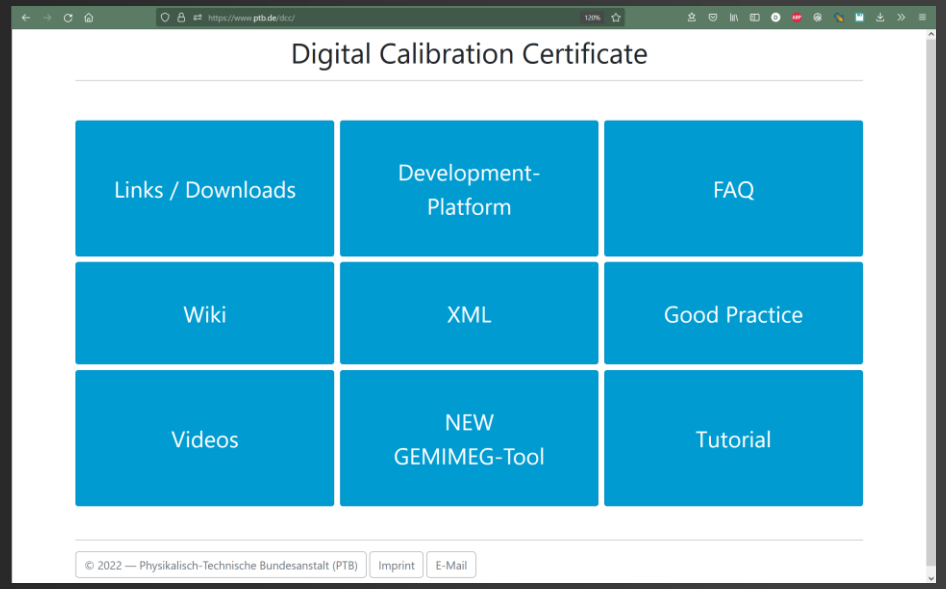
Kravene til DCC-udvekslingssystemet er sammenlignelige med grænsefladekravene til en relationsdatabase.

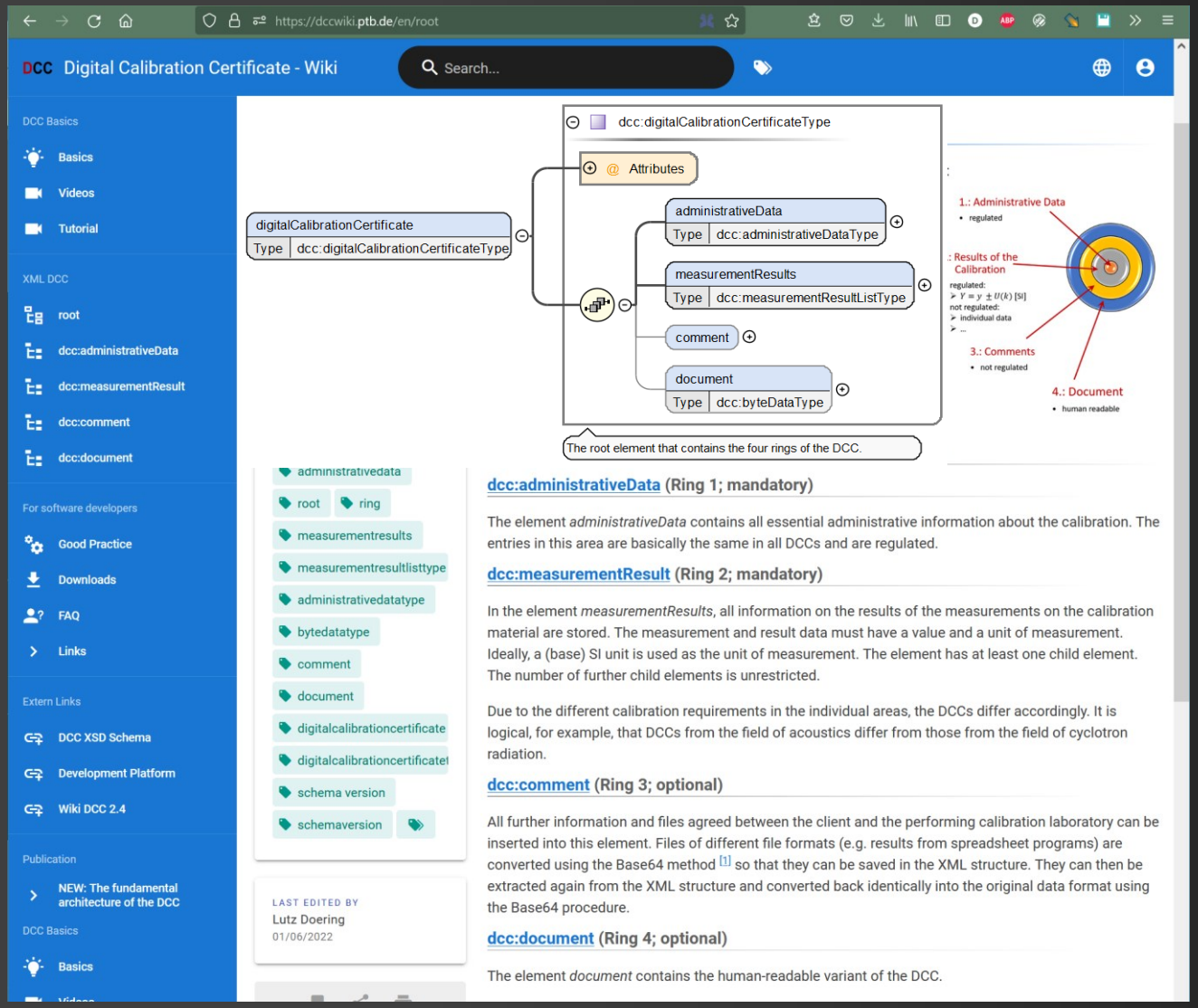


Databaser (e.g. SQL) er oftest designet som relationelle strukturer snarere end hierachiske strukturer

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.



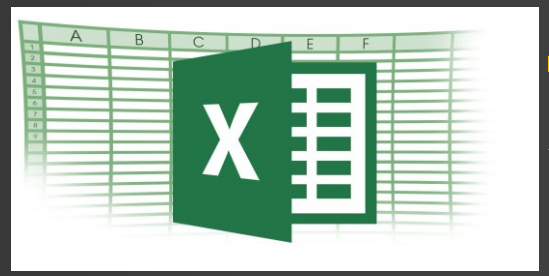


TC-IM 1448 WG2 anmodning om Excel DCC-værktøj:

Excel User Interface

Generate DCC

Calibration Database



Load/query DCC

DCC XML

Python middleware

Hvis du kan gøre det med Excel, kan du gøre det med enhver software

⇒*Excel - bruges af mange laboratorier*

⇒ *Excel-begrænsninger: Tabelformat (analog til SQL-DB'er)*

⇒ *Udvid data ved at tilføje tabelrækker eller -kolonner.*

Bred dækning

- Temperature
- Mass, volume, density
- Geometry
- Flow
- Pressure
- Electric
- Humidity, Force, torque

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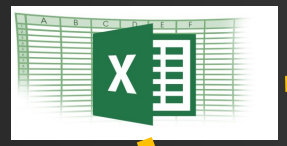
Envisioned demo workflow for *i*DCC

Client (NN)

Specifikation of Cal. Task



Mapping list

iDCC Schema

Task Schema extends from iDCC schema

Schema validates structure

UI or mapping list tool

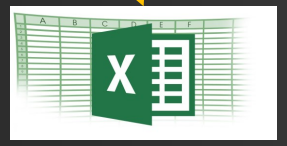
Database

iDCC Task xml

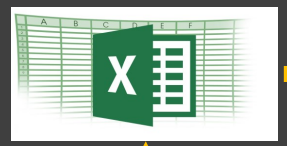
Schema validates structure

iDCC Task Schema

Schema validates structure



Status change to certificate



Dig. Sign.

Archive

Task info is unaltered & calib. lab. info. is added.

PDF with iDCC.xml attachment

Cal. Lab/NMI

Performs Calib. according to Task

Calibration Data

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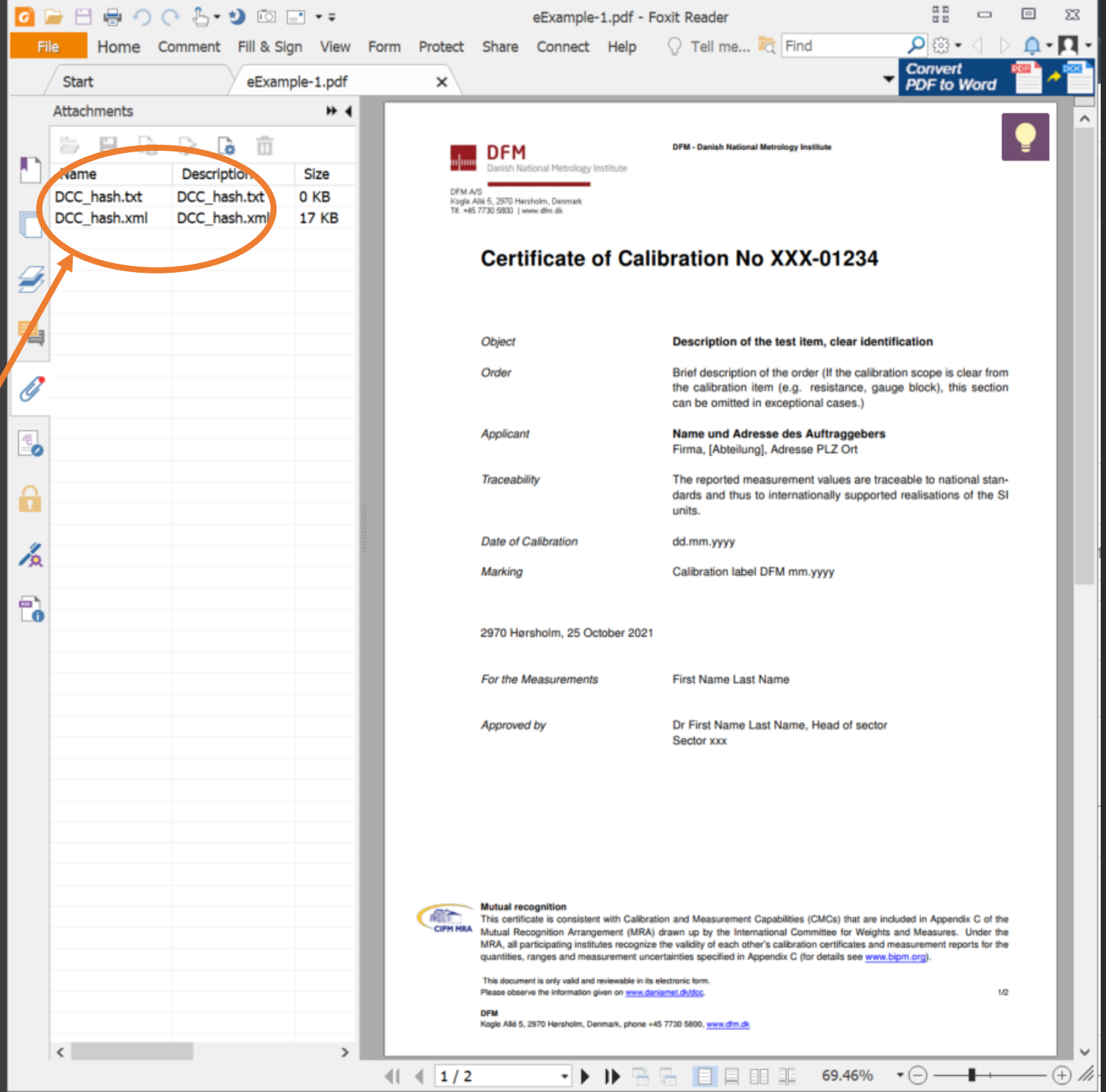
DCC packaged in a digitally signed PDF/A-3

Attached DCC file, could be any type of file

Hashsum of the attached file ensures integrity.



1 til 1 repræsentation af calibrationResults i *i*DCC - XML

```
<dcc:measurementResults>
    <dcc:calibrationResult tableId="cal_1_T1"
                           serviceCategory="T/T-2.2.3 Thermistors and other resistive thermometers"
                           measuringSystemRef="ms1"
                           numRows="5"
                           numCols="7">
        <dcc:heading lang="da">-</dcc:heading>
        <dcc:heading lang="en">calibrationResult 1_T1</dcc:heading>
        <dcc:column scope="-"
                    dataCategoryRef="-"
                    measurand="-">
            <dcc:heading lang="da">Kundens kode</dcc:heading>
            <dcc:heading lang="en">Customer Tags</dcc:heading>
            <dcc:unit>-</dcc:unit>
            <dcc:dataList>
                <dcc:rowTag>
                    <dcc:row idx="1">T1</dcc:row>
                    <dcc:row idx="2">T2</dcc:row>
                    <dcc:row idx="3">T3</dcc:row>
                    <dcc:row idx="4">T4</dcc:row>
                    <dcc:row idx="5">T5</dcc:row>
                </dcc:rowTag>
            </dcc:dataList>
        </dcc:column>
        <dcc:column scope="reference"
                    dataCategoryRef="-"
                    measurand="Temperature">
            <dcc:heading lang="en">True mean value (°C)</dcc:heading>
            <dcc:unit>\degreeCelcius</dcc:unit>
            <dcc:dataList>
                <dcc:value>
                    <dcc:row idx="1">-40.006</dcc:row>
                    <dcc:row idx="2">-20.014</dcc:row>
                    <dcc:row idx="3">-0.007</dcc:row>
                    <dcc:row idx="4">19.998</dcc:row>
                    <dcc:row idx="5">40.0</dcc:row>
                </dcc:value>
            </dcc:dataList>
        </dcc:column>
        <dcc:column scope="indication"
                    dataCategoryRef="-"
                    measurand="Temperature">
            <dcc:heading lang="en">Object mean value (°C)</dcc:heading>
            <dcc:unit>\degreeCelcius</dcc:unit>
```

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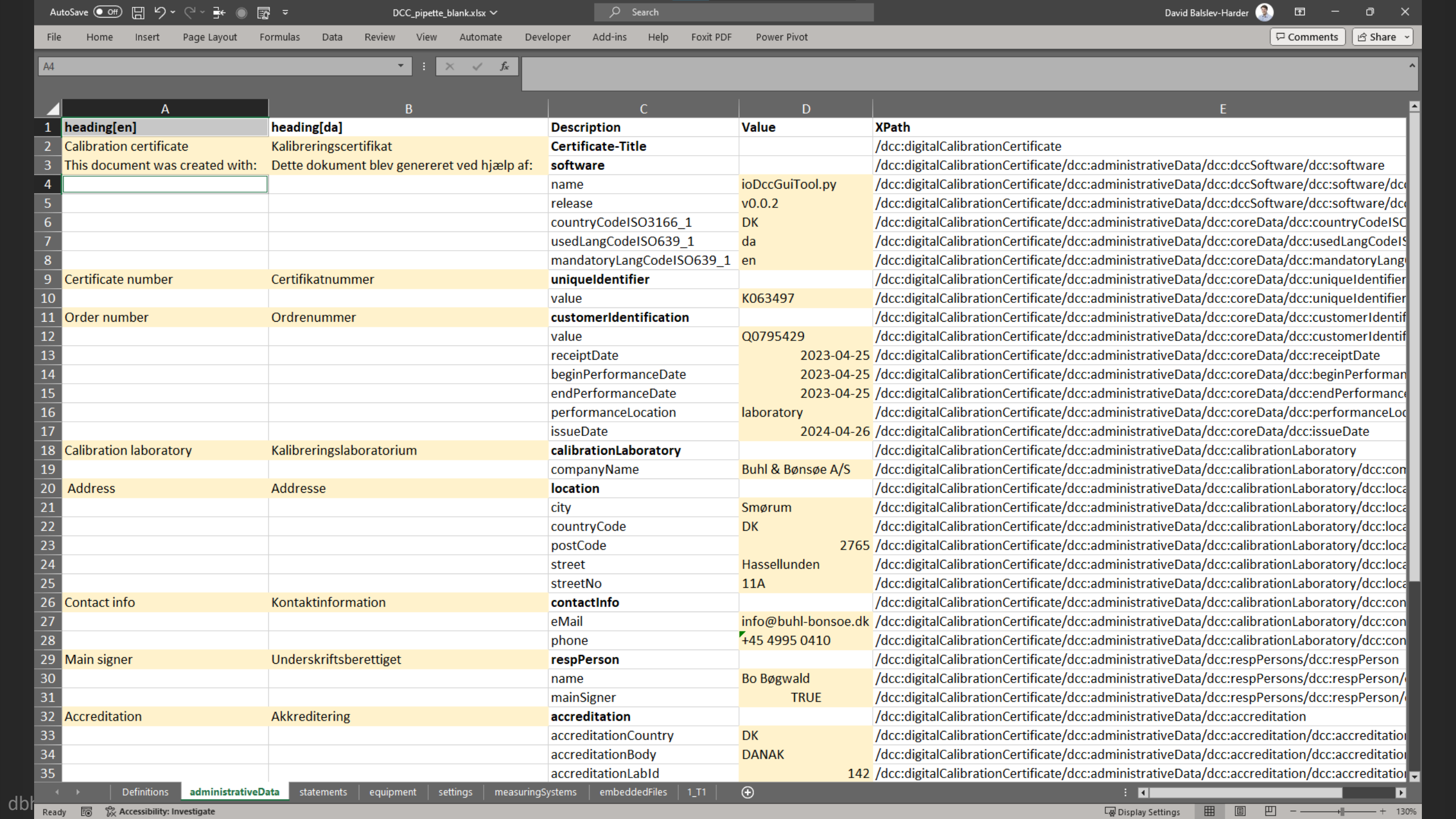

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A4

	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/dc
5			release	v0.0.2	/dcc:digitalCalibrationCertificate/dcc:administrativeData/dcc:dccSoftware/dcc:software/dc
6			countryCodeISO3166_1	DK	/dcc:digitalCalibrationCertificate/dcc:administrativeData/dcc:coreData/dcc:countryCodeISC
7			usedLangCodeISO639_1	da	/dcc:digitalCalibrationCertificate/dcc:administrativeData/dcc:coreData/dcc:usedLangCodeIS
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:com
20	Address	Addresse	**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:accreditatio
34			accreditationBody	DANAK	/dcc:digitalCalibrationCertificate/dcc:administrativeData/dcc:accreditation/dcc:accreditatio
35			accreditationLabId	142	/dcc:digitalCalibrationCertificate/dcc:administrativeData/dcc:accreditation/dcc:accreditatio

Definitions | administrativeData | statements | equipment | settings | measuringSystems | embeddedFiles | 1_T1

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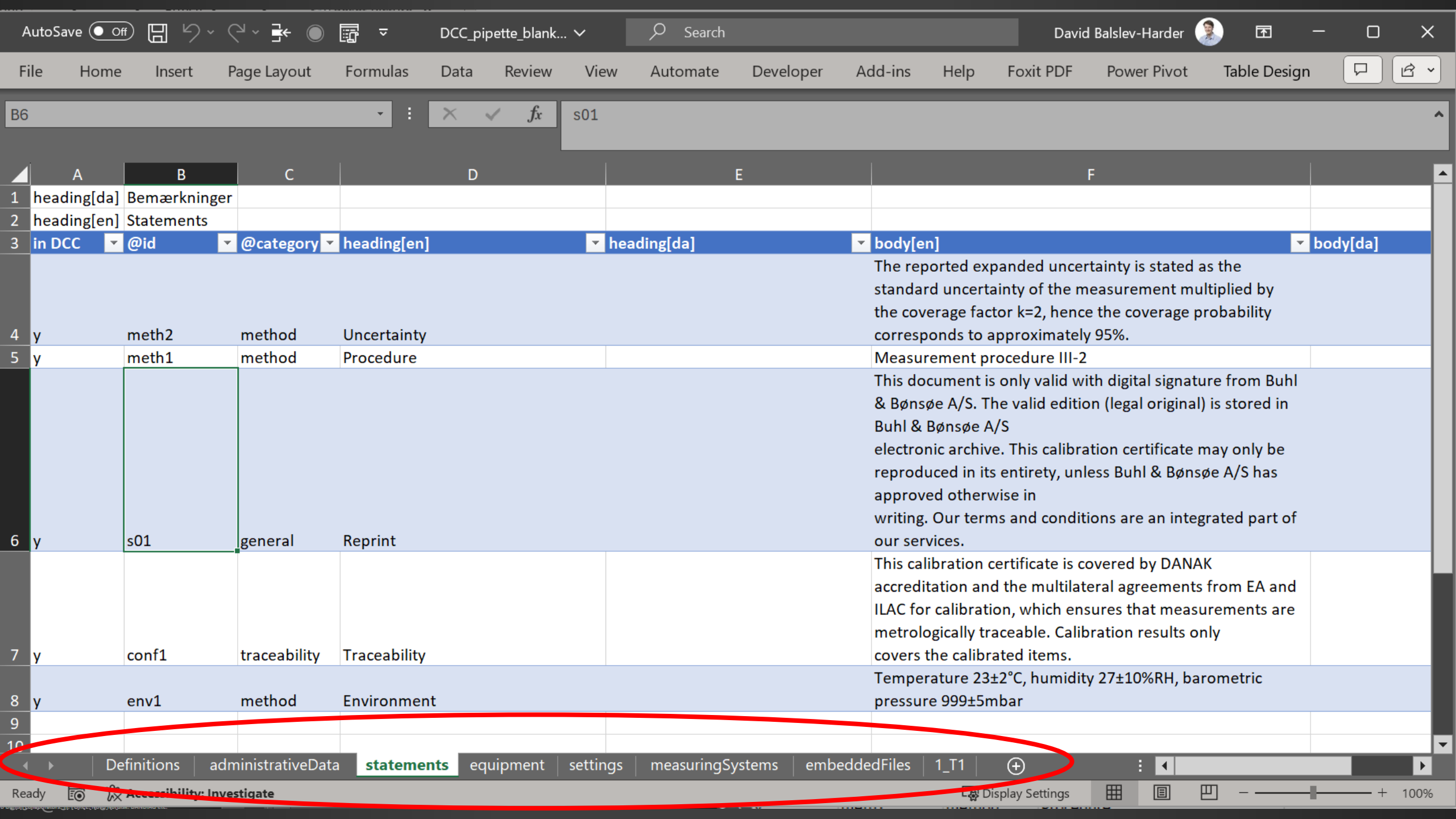

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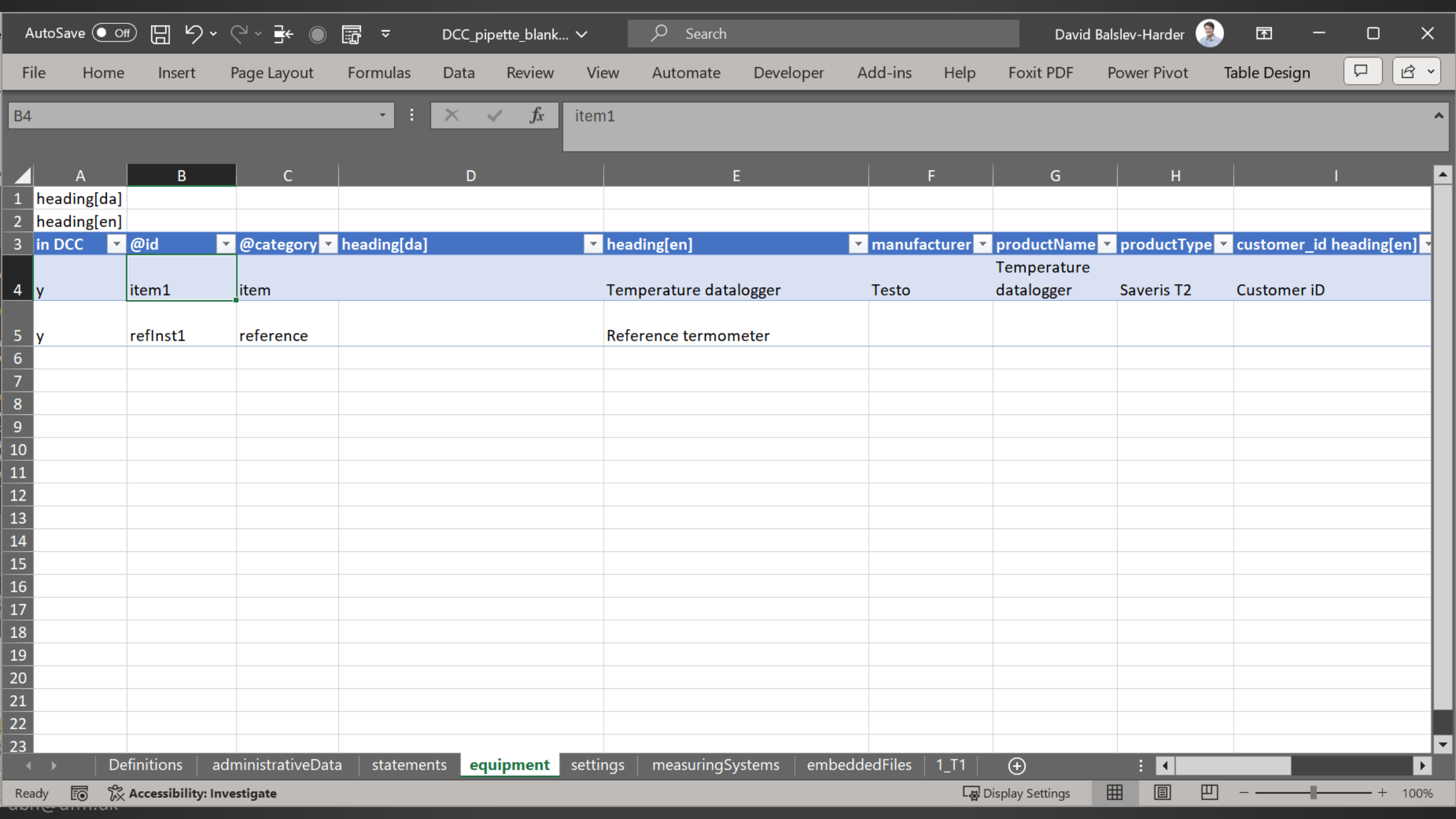
2	heading[en]	Statements					
3	in DCC	@id	@category	heading[en]	heading[da]	body[en]	body[da]
4	y	meth2	method	Uncertainty		The reported expanded uncertainty is stated as the standard uncertainty of the measurement multiplied by the coverage factor k=2, hence the coverage probability corresponds to 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							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DCC_pipette_blank...
Search
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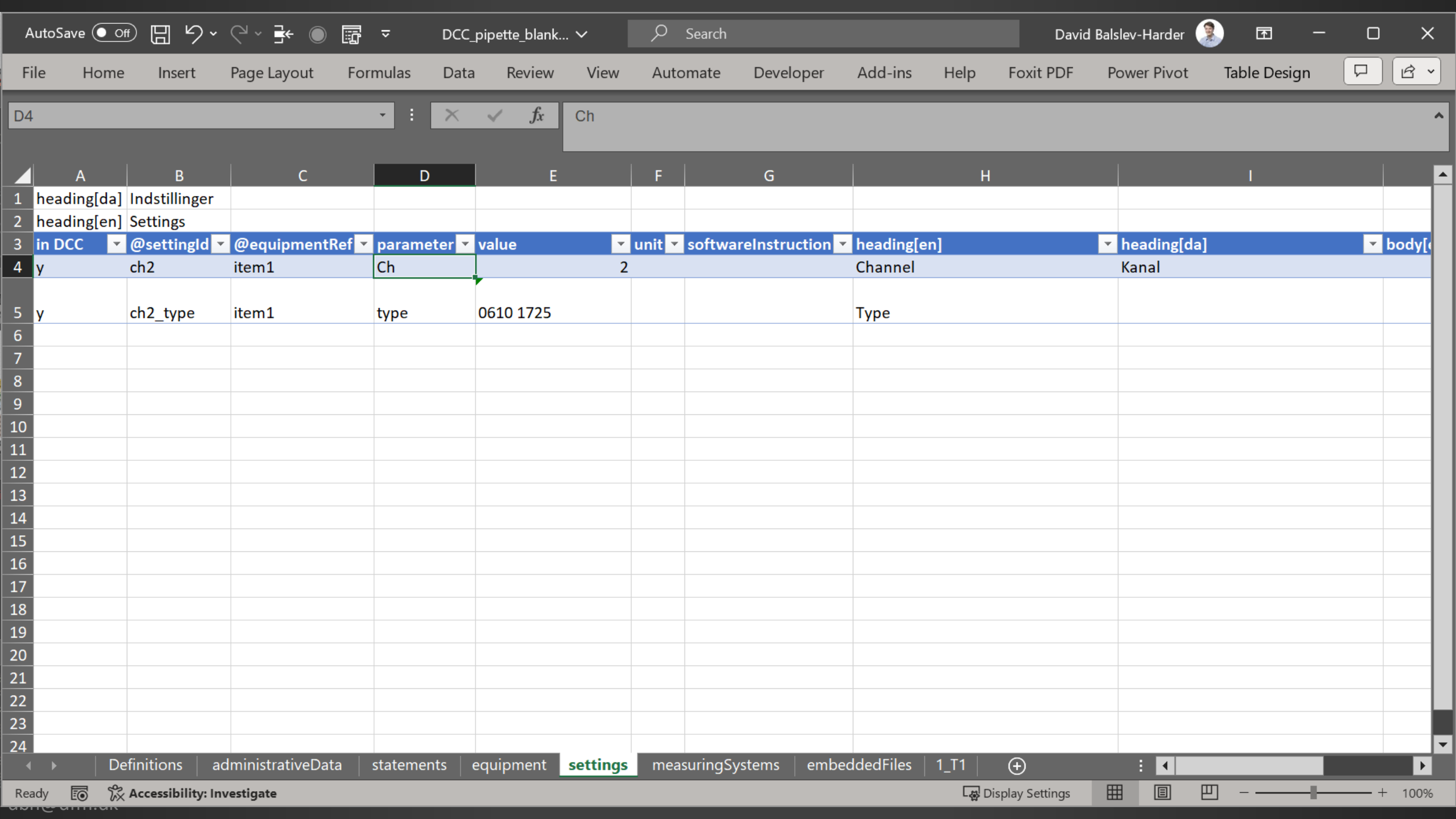
File Home Insert Page Layout Formulas Data Review View Automate Developer Add-ins Help Foxit PDF Power Pivot Table Design
B4
item1
heading[da]
heading[en]
in DCC | @id | @category | heading[da] | heading[en] | manufacturer | productName | productType | customer_id heading[en]
y | item1 | item | | Temperature datalogger | Testo | Temperature datalogger | Saveris T2 | Customer iD
y | refInst1 | reference | | Reference termometer
Definitions administrativeData statements equipment settings measuringSystems embeddedFiles 1_T1
Ready
Accessibility: Investigate
Display Settings
100%



	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]
4	y	ch2	item1	Ch	2			Channel	Kanal
5	y	ch2_type	item1	type	0610 1725			Type	
6									
7									
8									
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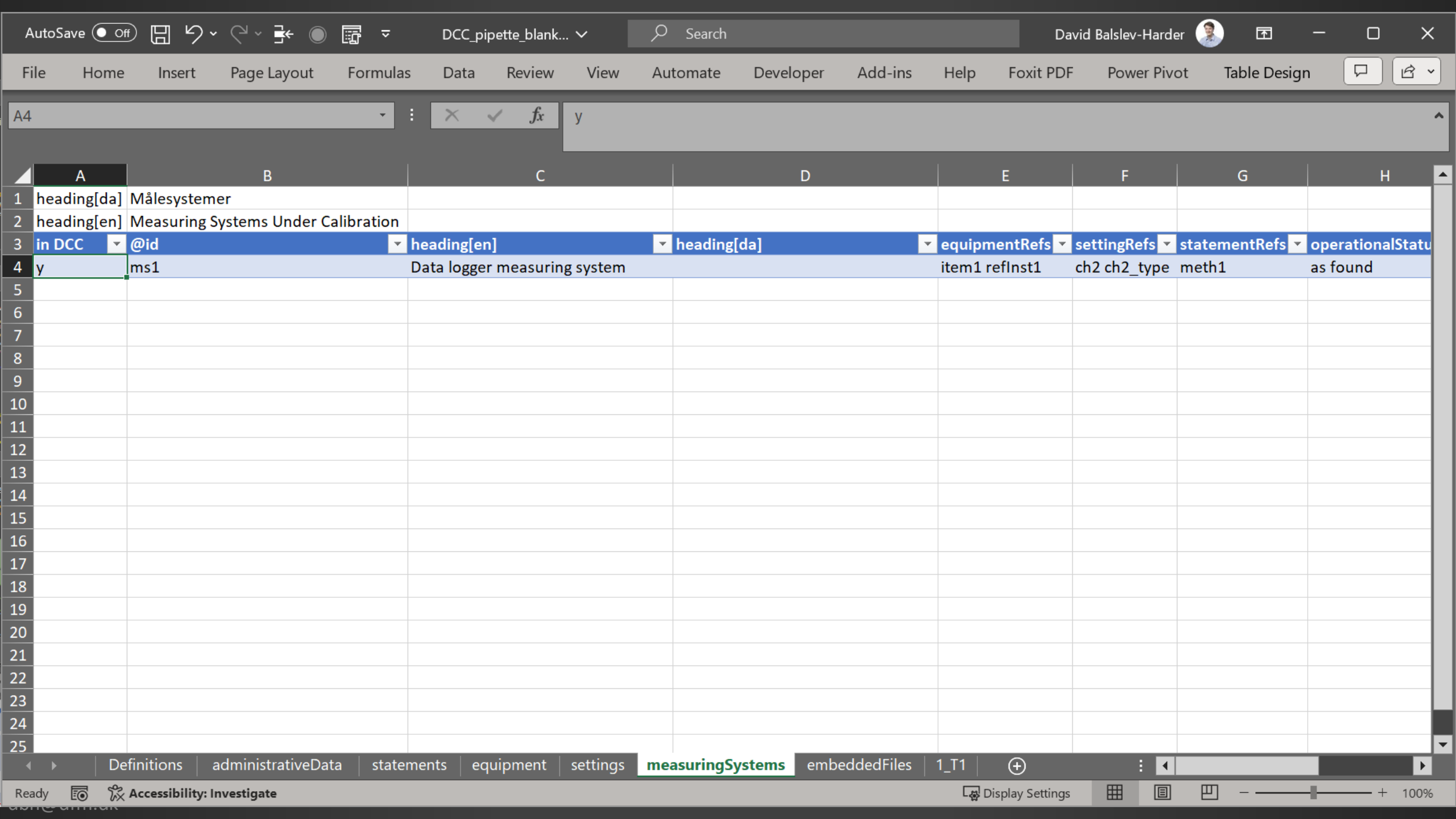
24									



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A4 | y

	A	B	C	D	E	F	G	H
1	heading[da]	Målesystemer						
2	heading[en]	Measuring Systems Under Calibration						
3	in DCC	@id	heading[en]	heading[da]	equipmentRefs	settingRefs	statementRefs	operationalStatu
4	y	ms1	Data logger measuring system		item1 refInst1	ch2 ch2_type	meth1	as found
5								
6								
7								
8								
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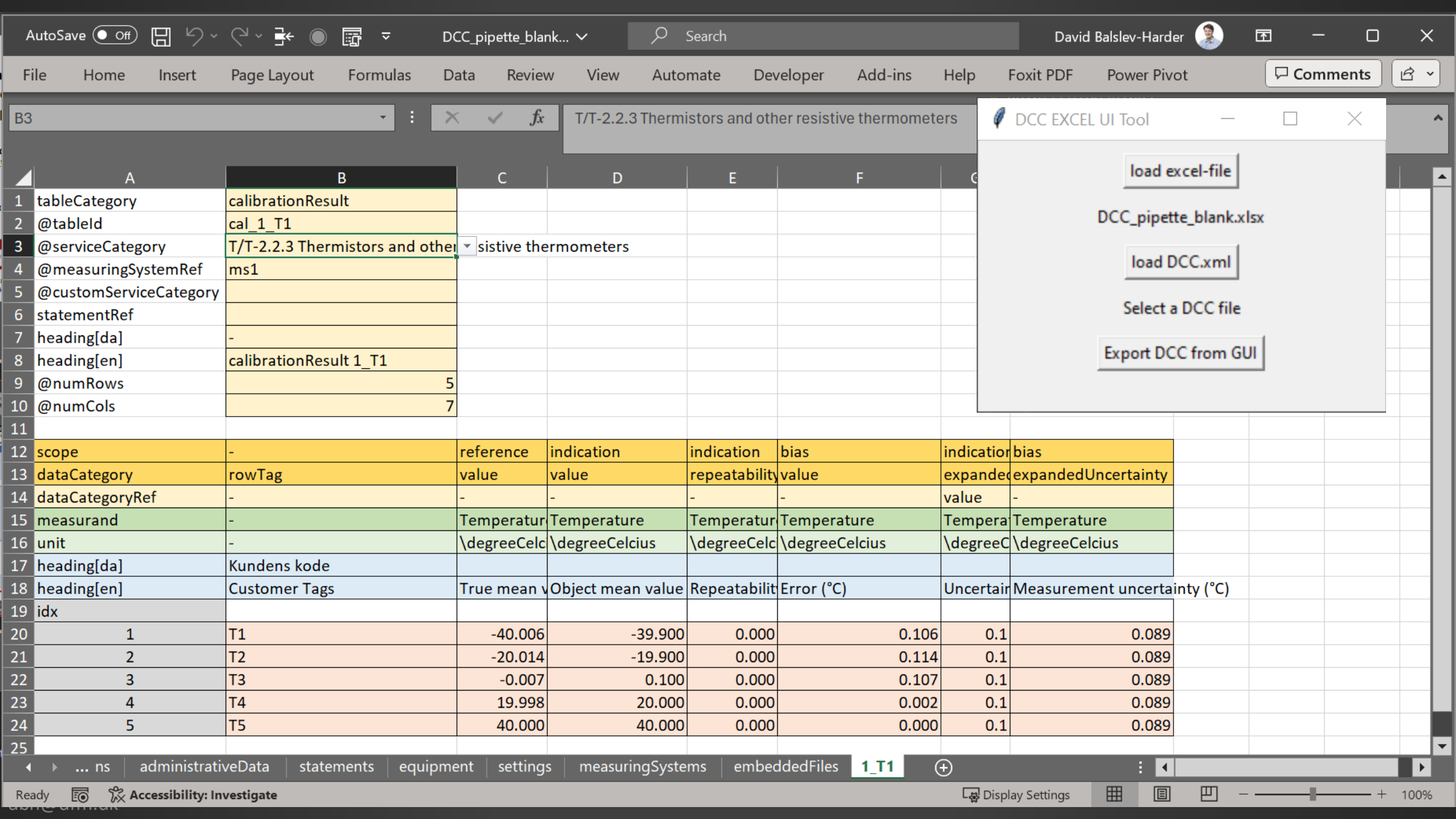
25								

Definitions | administrativeData | statements | equipment | settings | measuringSystems | embeddedFiles | 1_T1

Ready | Accessibility: Investigate | Display Settings | 100%



	A	B	C	D	E	F	G	H
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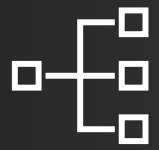
2	@tableId	cal_1_T1						
3	@serviceCategory	T/T-2.2.3 Thermistors and other	sistive thermometers					
4	@measuringSystemRef	ms1						
5	@customServiceCategory							
6	statementRef							
7	heading[da]	-						
8	heading[en]	calibrationResult 1_T1						
9	@numRows	5						
10	@numCols	7						
11								
12	scope	-	reference	indication	indication	bias	indicatior	bias
13	dataCategory	rowTag	value	value	repeatability	value	expandec	expandedUncertainty
14	dataCategoryRef	-	-	-	-	-	value	-
15	measurand	-	Temperatur	Temperature	Temperatur	Temperature	Tempera	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	Repeatabilit	Error (°C)	Uncertair	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
25								

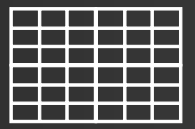
*i*DCC Architecture

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

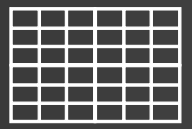


Administrative:
DCC schema ver.
certificate #
Order #
arrival Date
start Date
end Date
performance Loc.
issue Date
calLab address
customer address
Software ref.
….

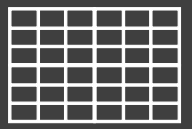
Accreditation:
Lab ID code
Accred. Norm
Accred. Body
Accred. Country
Accred. Applicability



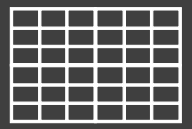
Statements:
@id
@category
heading [lang]
body [lang]
ext. Reference



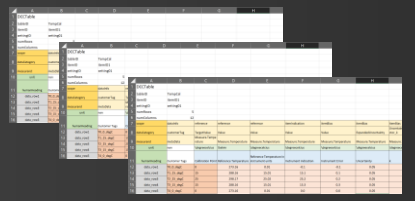
Equipment:
@id
@category
manufacturer
productName
productModel
productType
equipmentClass
identifications
Customer
Manufacturer
Laboratory
heading [lang]



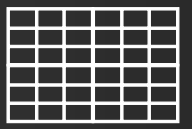
Settings:
@id
@equipmentRef
parameter
value
unit
software instruction
heading [lang]
body [lang]



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

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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 descibe 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
985             </xs:documentation>
989         </xs:annotation>
990         <xs:restriction base="xs:string">
991             <xs:enumeration value="reference" />
992             <xs:enumeration value="indication" />
993             <xs:enumeration value="bias" />
994             <xs:enumeration value="environment" />
995             <xs:enumeration value="Other" />
996             <xs:enumeration value="-" />
997         </xs:restriction>
998     </xs:simpleType>
```

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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	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	indicatior	bias	
13	dataCategory	rowTag	value	value	repeatability	value	expande	expandedUncertainty	
14	dataCategoryRef	-	-	-	-	-	value	-	
15	measurand	-	Temperatur	Temperature	Temperatur	Temperature	Tempera	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	Repeatabilit	Error (°C)	Uncertair	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	

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Excel query tool for *i*DCC 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 ID	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	\degreecelsius	T1	0.108
01PRT01	Reading of the sta	data		TempCal	item1	setting1 setting2	reference	Value	Measure.Temperature	Data	\degreecelsius	T1	-6.076
01UUT	Reading of the DU	data		TempCal	item1	setting1 setting2	itemIndicatior	Value	Measure.Temperature	Data	\degreecelsius	T1	-6.06
02U	Uncertinaty for 1 c	data		TempCal	item1	setting1 setting2	itemBias	ExpandedUnc	Measure.Temperature	Data	\degreecelsius	T2	0.108
02PRT01	Reading of the sta	data		TempCal	item1	setting1 setting2	reference	Value	Measure.Temperature	Data	\degreecelsius	T2	5.017
02UUT	Reading of the DU	data		TempCal	item1	setting1 setting2	itemIndicatior	Value	Measure.Temperature	Data	\degreecelsius	T2	5.05
03U	Uncertinaty for 1 c	data		TempCal	item1	setting1 setting2	itemBias	ExpandedUnc	Measure.Temperature	Data	\degreecelsius	T3	0.108
03PRT01	Reading of the sta	data		TempCal	item1	setting1 setting2	reference	Value	Measure.Temperature	Data	\degreecelsius	T3	27.054
03UUT	Reading of the DU	data		TempCal	item1	setting1 setting2	itemIndicatior	Value	Measure.Temperature	Data	\degreecelsius	T3	27.16
ACCSTATEMENT	statement on accr	xpath	//*[@statementId="acc1"]/dcc:body[@lang="da"]										Kalibreringen
--END--													

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Implementering er tilgængelig:

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

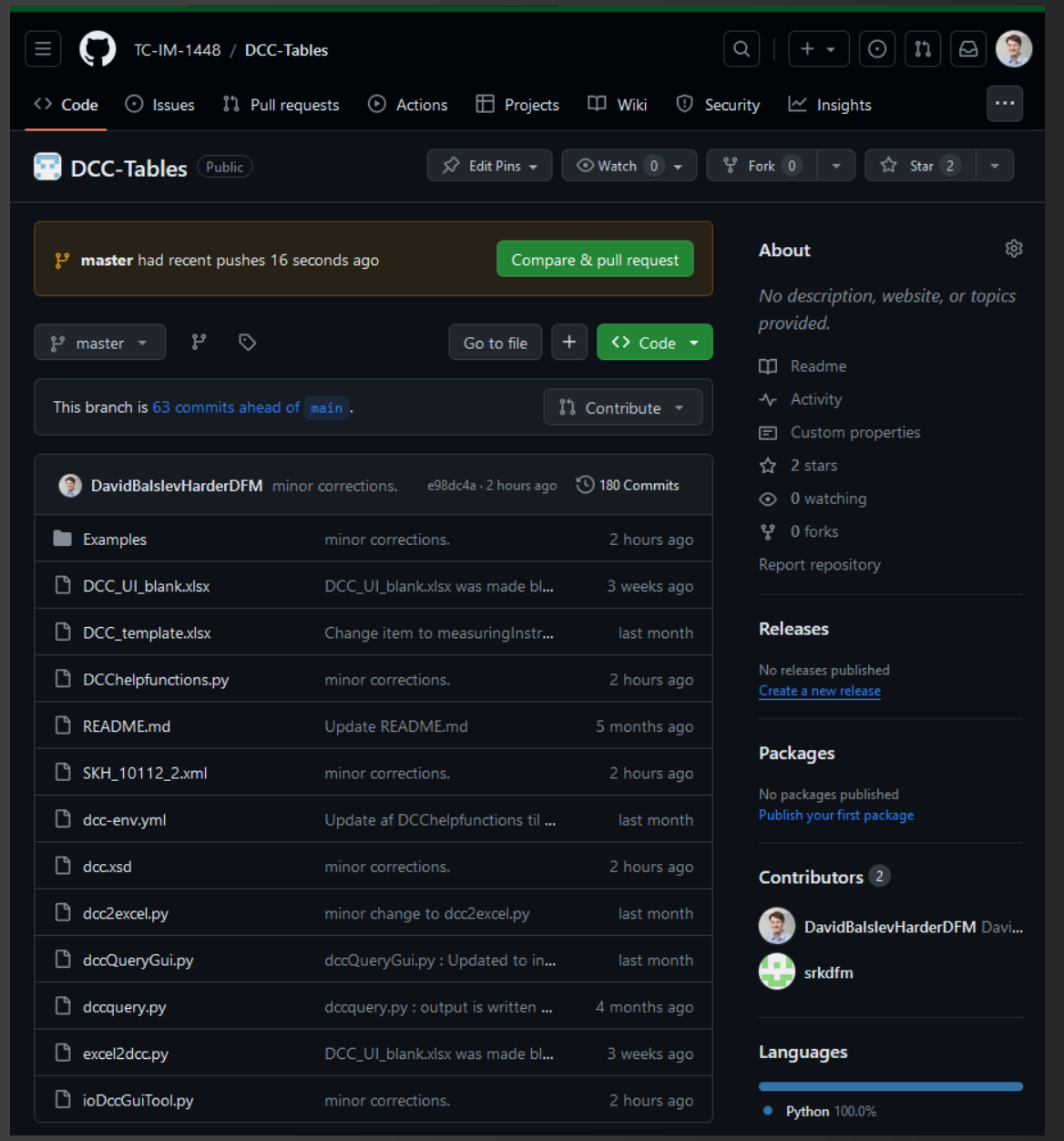
dcc.xsd - Schema file for *i*DCC.

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



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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.

https://www.bipm.org/en/-/2022-03-30-digital-statement

Harmonisation activiteter 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:
  - 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,....)

NOTE 3 Symbols for quantities are given in the ISO 80000 and IEC 80000 series *Quantities and units*.

- 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

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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

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ISO 80000 – Content of the standards

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

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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.

@id	Measurand	Unit category	Symbol	S	m	kg	A	K	mol	cd	SI unit	heading[en]	heading[da]	body[en]	body[da]	OP1	Var1	OP12	Var13	OP13	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^		*	

Næste trin

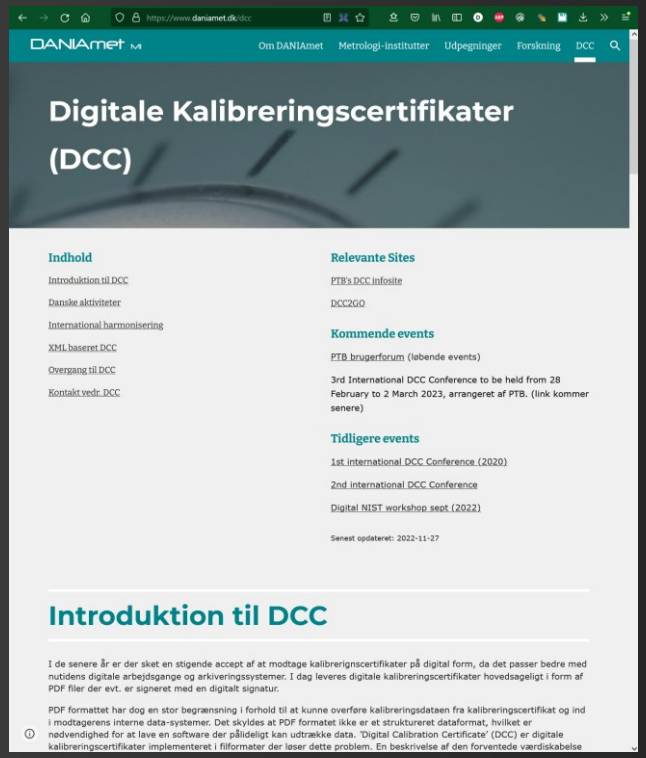
- Test af iDCC og sammenligning med PTB DCC 3.x er i gang, i samarbejde mellem Novo Nordisk, PTB, DFM, Teknologisk Institut, FORCE Technology og Dandiag (pipetter).

- 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

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Thank You

Scan og giv en
støttende kommentar på
BedreInnovation.dk

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 Soeylev-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)