



India



PTB project “Metrology for Digital Transformation – International Cooperation” CABUREK Global Program

Working Group:

National project title:

National Metrology Institute: NPLI India

WG-2: Digital Calibration Certificate

Development of DCC for AC high voltage and current metrological parameters

Coach: CENAM Mexico, INTI Argentina, PTB

Motivations

NPLI, the NMI of India, provides calibration services to industries & SAARC countries on various parameters

Reports mostly manually PDF generated documents: laborious, time-consuming, cumbersome, prone to human errors

NPLI aims to develop certified framework for machine readable calibration information to assure traceability to national measurement standards and further to SI units.

It can solve issues of accessibility, reliability, security, traceability, data mismanagement, allow the machines to communicate with each other to reduce human interventions.

Highly beneficial for various industries, particularly those who are from far lung or outside India.

Proposed digital approach aligns with industry trends toward digitalization and automation, reduced operational costs, easier compliance with standards, and improved system integration.

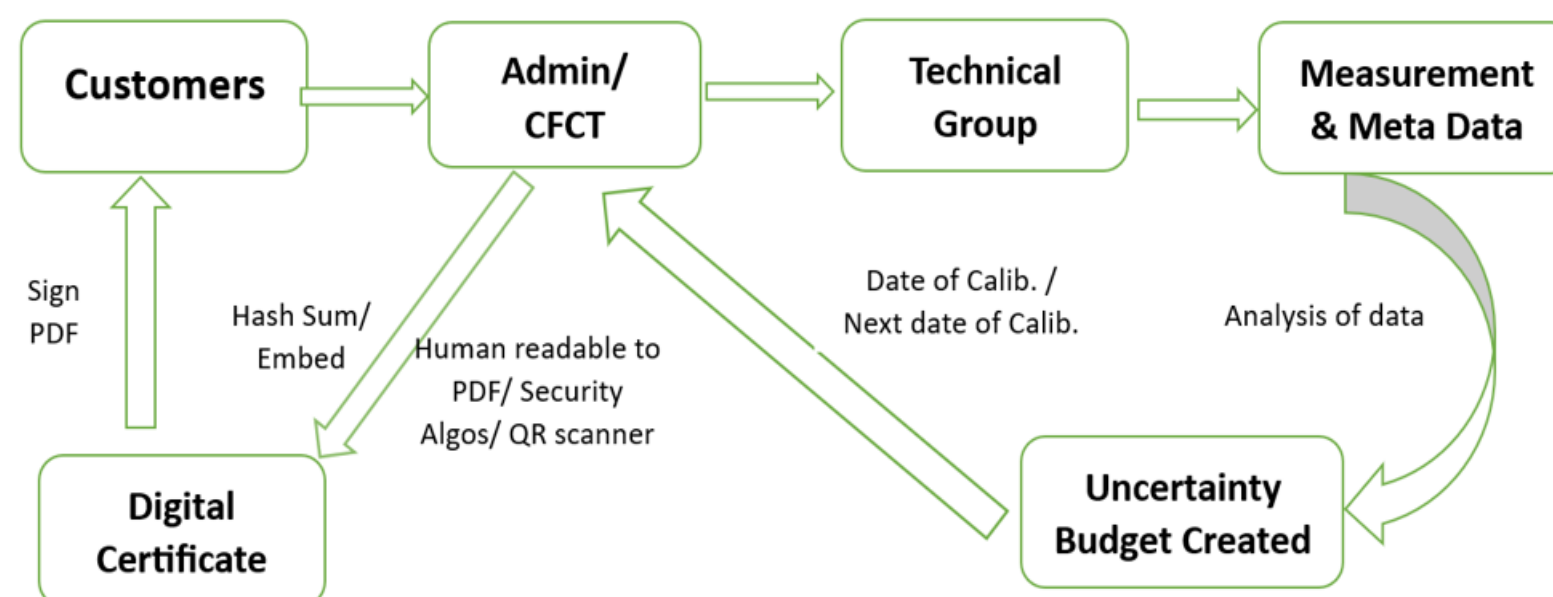
Key Objectives:

- Awareness of importance to use DCC among staff members to be increased
- Calibration certificates in digital formats for phase error and ratio error of AC high voltage and current metrology to be developed

Beneficiary:

Internal and External Stakeholders of NPLI

Schema of certificate creation using PDF DCC approach



Stakeholder engagement activities

Activity undertaken to discuss project plans with INTERNAL stakeholders

- Digital component: Development of DCC for electrical metrology
- Title of the activity: Need for digitalization of metrological parameters
- When and where: 5th March, 2025 at NPLI
- Who participated:
 - Scientists
 - Technical Officers
 - Project Staff
 - Research Interns
- Impacts / Results: NPLI staff have acknowledged the importance of implementation of DCC/digital transformation as it has fewer errors, traceability can be maintained, improved operational efficiency, better compliances etc

Activity undertaken to discuss project plans with EXTERNAL stakeholders

- Digital component: Development of DCC for electrical metrology
- Title of the activity: Need for digitalization of metrological parameters
- When and where: Virtual, 13th May to 6th June 2025
- Who participated:
 - Government customers: 5
 - Private customers: 22
 - University/academic institutes: 10
- Impacts / Results: external stakeholders say facilities to submit online requisition for calibration, online payments of calibration requests, monitor the status/progress of the accepted calibration request, Electronic Calibration Certificate, check authenticity of the certificate issued required

Log-in Pages



Interfaces used:

- HomePage login
- Template.jsx
- Admin.jsx
- TechnicalCalibrationForm.jsx
- Results.jsx
- Ctbr.jsx

Case study-1: DCC for PT Burden data

Experimental Procedure

- 110 V source connected in series with a PT burden, power analyzer.
- Measurements taken at different VAs and power factors
- Based on the experimental results, an uncertainty budget is calculated.
- Cryptographic algorithms viz. RSA and ECC developed for security purposes.



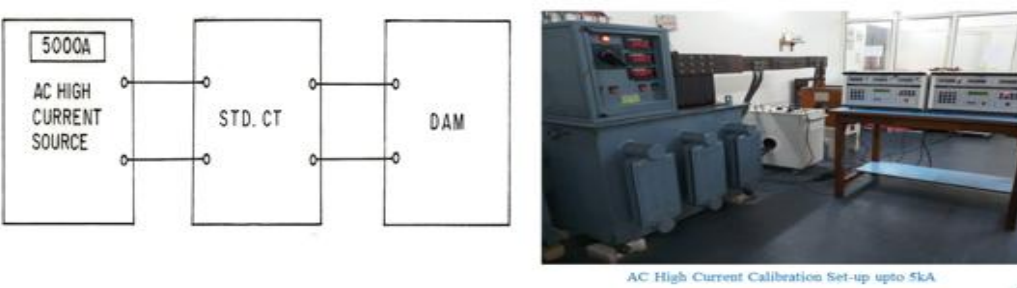
Calibration Form	
Form Title	Calibration Form
Form ID	Form ID
Form Date	Form Date
Form Version	Form Version
Form Status	Form Status
Form Type	Form Type
Form Category	Form Category
Form Subcategory	Form Subcategory
Form Description	Form Description
Form Parameters	Form Parameters
Form Results	Form Results
Form Uncertainty	Form Uncertainty
Form Signature	Form Signature
Form Date	Form Date
Form Time	Form Time
Form Location	Form Location
Form Operator	Form Operator
Form Customer	Form Customer
Form Instrument	Form Instrument
Form Parameter	Form Parameter
Form Item Type	Form Item Type
Form Item Name	Form Item Name
Form Alias Name	Form Alias Name
Form Range	Form Range
Form Remarks	Form Remarks
Form Delete Row	Form Delete Row
Form Previous	Form Previous
Form Next	Form Next

Customer and instruments details

Case study-2: DCC for High Current Source

Experimental Procedure

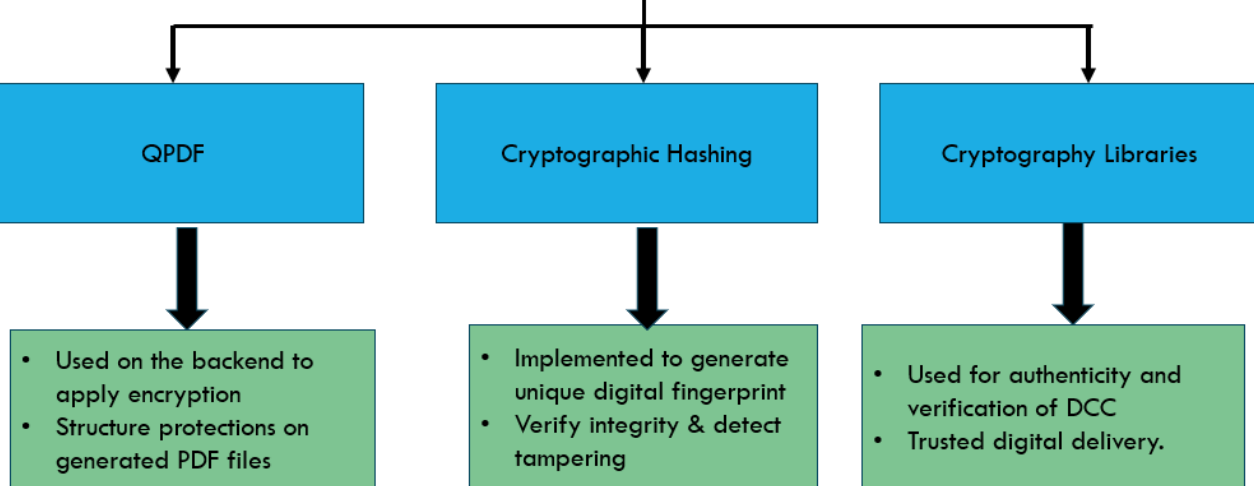
- Calibration is accomplished by direct method.
- The customer's current source is connected to the Current Comparator's primary terminals.
- In the secondary, a Calibrated Digital Ammeter (DAM) is connected.
- The accuracy of the Current Comparator and the DAM should be one order better, for negligible corrections.



Calibration Form	
Form Title	Calibration Form
Form ID	Form ID
Form Date	Form Date
Form Version	Form Version
Form Status	Form Status
Form Type	Form Type
Form Category	Form Category
Form Subcategory	Form Subcategory
Form Description	Form Description
Form Parameters	Form Parameters
Form Results	Form Results
Form Uncertainty	Form Uncertainty
Form Signature	Form Signature
Form Date	Form Date
Form Time	Form Time
Form Location	Form Location
Form Operator	Form Operator
Form Customer	Form Customer
Form Instrument	Form Instrument
Form Parameter	Form Parameter
Form Item Type	Form Item Type
Form Item Name	Form Item Name
Form Alias Name	Form Alias Name
Form Range	Form Range
Form Remarks	Form Remarks
Form Delete Row	Form Delete Row
Form Previous	Form Previous
Form Next	Form Next

- Pre-processed data (in .csv format) converted into JSON
- Used JavaScript for frontend and backend development due to its wide ecosystem and flexibility.
- React.js used to generate certificate technically similar to paper format.
- Vite.js is used to develop frontend build tool for the real-time updates during coding
- Node.js facilitates backend logic, including request handling, data processing, and certificate generation.
- Express.js and MongoDB used to store calibration data, user records, and metadata related to certificate generation

Data Security



Publications:

- “Progress towards the Development of Digital Calibration Certificate for High Voltage PT burden calibration” published in BIPM 150
- “Development of Frontend Interface for Digital Calibration Certificate for AC High Current Source Parameters” published IMEKO 2025
- “Progress of NPLI in DCC” in Samiksha, Hindi journal of NPL (accepted)

5th CABUREK-M4DT-IC Workshop
Bangkok, Thailand
November 17th to 20th, 2025



Physikalisch-Technische Bundesanstalt
Nationales Metrologieinstitut

