Testing the Test

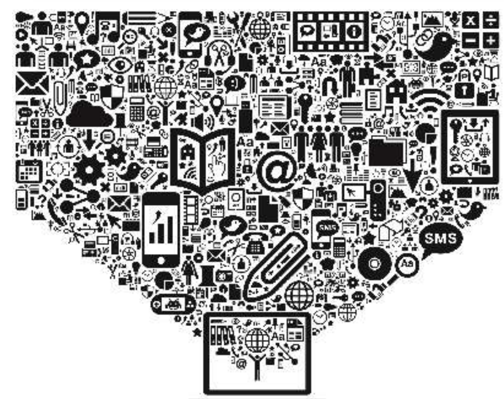
Outline

1. Experiment 3


Solar Energy Materials & Solar Cells

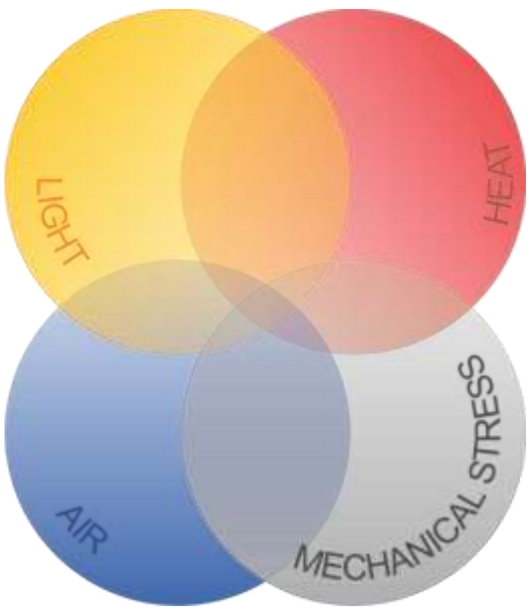
Consensus stability testing protocols for organic photovoltaic materials and devices

2. Database



Experiment 3: Testing the Test

Description:
Comparison of degradation conditions using (close to) identical samples




Solar Energy Materials & Solar Cells

Consensus stability testing protocols for organic photovoltaic materials and devices

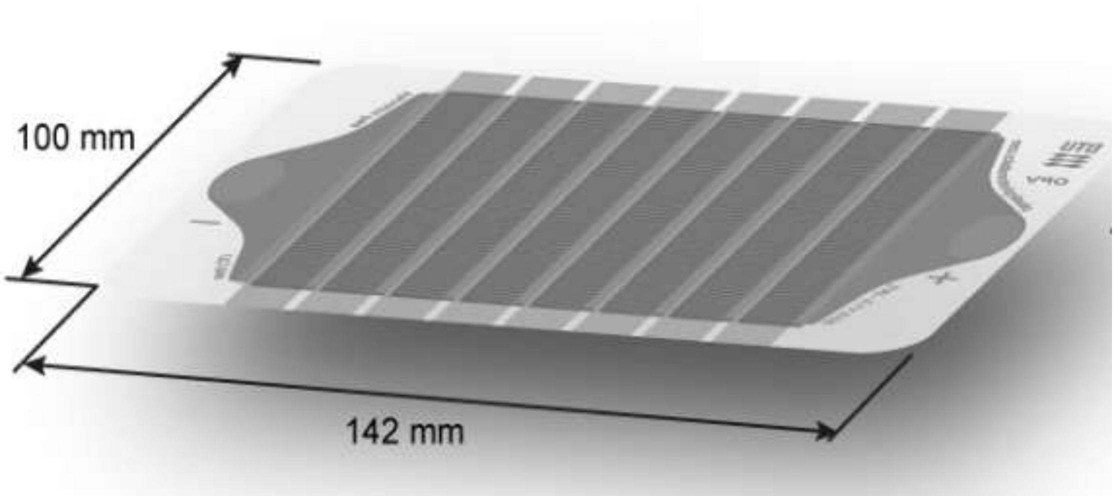
Experiment 3: aim & approach

- Compare setups to execute stability studies according to ISOS protocols/guidelines by COST Action members (WG3)

- Compare different levels of protocols/guidelines

- Use highly reproducible samples with narrow standard deviation in performance as well as variation in processing conditions

Experiment 3: Sample - DTU **module**



Experiment 3: Aging conditions

ISOS protocols, levels & conditions

ISOS protocol	level 1	 2	 3
Dark ISOS-D	‘shelf’	T:65/85 ^{o}C	 RH: 85%
Outdoor ISOS-O	Sunlight, ambient Solar sim MPP/V_{oc}	 Sunlight (in-situ)	 Sunlight & solar sim. MPP
Lab. Weathering ISOS-L	Light soak, ambient	 T:65/85 ^{o}C	 RH: ~50%
Thermal cycling ISOS-T (dark)	T range: RT-65^{o}C Hot plate / Oven	 Oven / Env. Chamber	T range: -40 - 85 ^{o}C RH: ~55% Env. chamber
Solar-therm.-hum. ISOS-LT	Solar/thermal cycling Light soak T range: RT-65^{o}C Weathering chamber	S/T/Humidity T range: 5-65 ^{o}C RH: ~50% Env. cham+solar sim.	S/T/H/Freeze T range: -25 - 85 ^{o}C

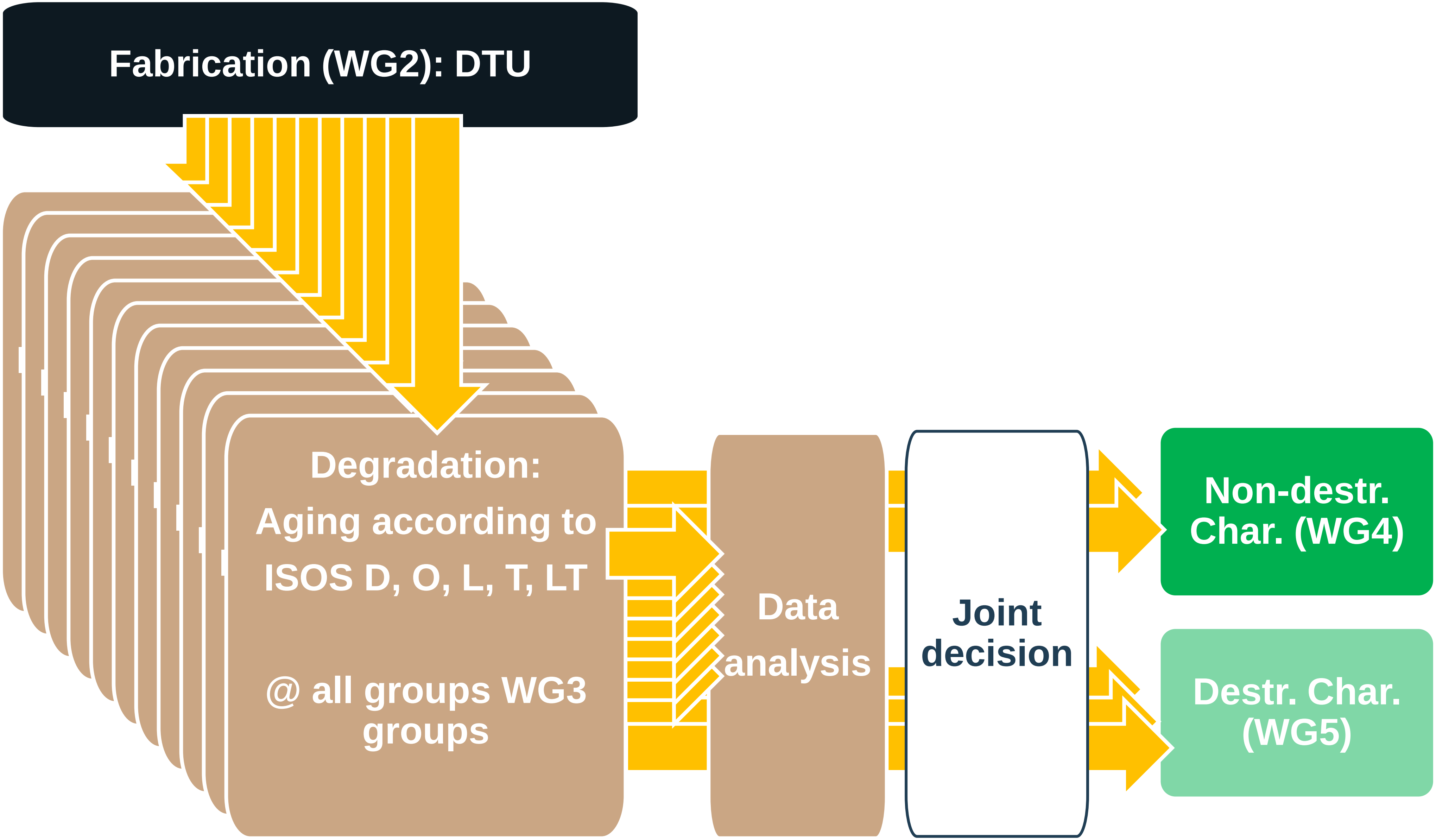
Experiment 3: Aging conditions

ISOS protocols, levels & WG3 members

ISOS protocol	level 1	2	3
Dark ISOS-D	Rudjer B Institute ICCF	TU Ilmenau Tech. Uni. Cartagena	TÜBITAK NPL
Outdoor ISOS-O	UNAM Wroclaw Research Centre EIT+	ICN2 U. Ilmenau	IAPP [illegible]ev
Lab. Weathering ISOS-L	Mcast Vilnius University	[illegible]	[illegible]
Thermal cycling ISOS-T (dark)	Uni Rovira I Virgili Uni. Oxford	[illegible]	[illegible]s [illegible]ener
Solar-therm.-hum. ISOS-LT	ICL, KAU	[illegible]st	DTU Bangor Uni.

To be completed with you!

Experiment 3: Structure

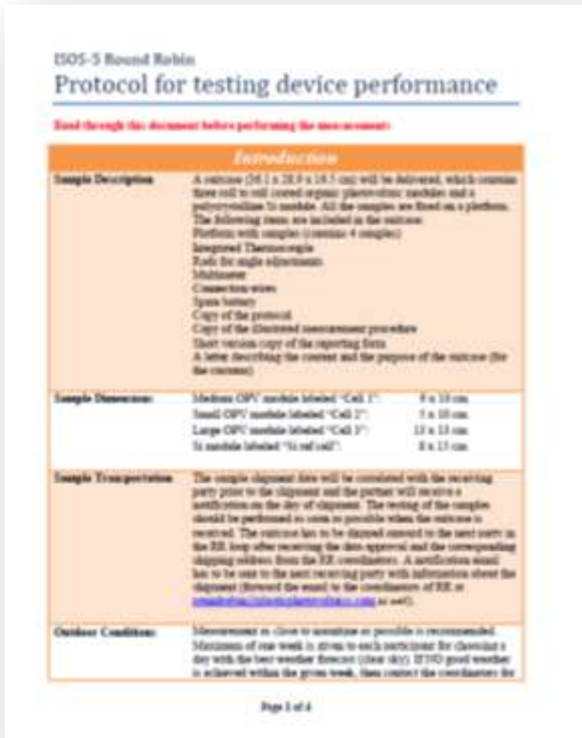


Experiment 3: Timeline

- **Processing & WG3 groups** – May
- **Distribution** – May
- **ALT** – June
- **Data Analysis** – August
- **(non) Destructive Characterization** – September

Experiment 3 - (detailed) protocol

Experiment document


ISOS-5 Round Robin

Protocol for testing device performance

Introduction

Aim,

Approach,

Sample,

Contacting,

Measurement details,

Reporting format,

Equipment, settings,

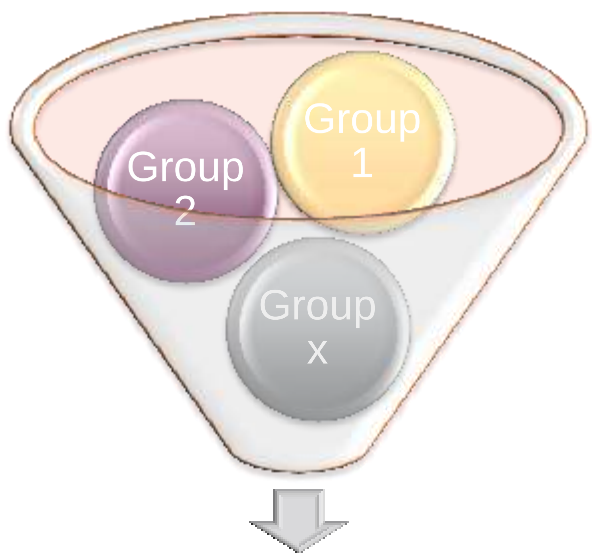
Timeline,

Data analysis

Gevorgyan, *DTU,*
ISOS 6, Chambery, 2013

Experiment 3 - Reporting

Reporting data	
***Measurement place**	ECN, Netherlands
***Measurement conducted by**	Wiljan Verhees (verhees@ecn.nl)
***Measurement date**	08.03.2012
Specimen producer and number	**ISE Si PD007 2010**
Specimen description	Si photodiode encapsulated in a special holder with an integrated RTD sensor. Both PV and RTD require LEMO connectors for measurement. LEMO connector is supplied with specimen for PV (4-point) measurement, but not for RTD.
Mismatch factor	0.995
PV parameters	Isc (mA): 13.28; Voc (V): 0.621; FF (%): 80.2; Pmax (mW): 6.62
Active Area	1 cm^2 (provided by producer)
Masking	No masking applied
Additional PV parameters	Jsc (mA/cm^2): 13.28; PCE (%): 6.62
Device Temperature during meas.	26.8 ±0.2 °C
Connection type	4-point measurement
Reporting additional data	
Light source spectrum	Class AAA (Wacom)
Reference device type	RSID2 solar cell with KG3 filter
IV scan range	-1 V to +1 V (101 points)
Spectral response measurement	No bias light, Chopper frequency 73 Hz
Temperature measurement	RTD sensor integrated inside specimen
Deviations from protocol	XXX
Comments	XXX



Database


Computer Physics Communications
On the communication of scientific data: The Full-Metadata Format

From: *Rera systems*
Maritz Riede
Verhees, ECN

Outline

1. Experiment 3

2. Database

RERA SOLUTIONS
PV MEASUREMENT SYSTEMS

ReRa Solutions

PV-DB Experiment storage system

Company

- ReRa Solutions BV
- Established in April 2008 in The Netherlands
- Spin off company Radboud University Nijmegen
- Many years of experience in the development of PV measurement systems, software and monitoring
- Broad reference list of various customers inside and outside Europe

Situation

Each member generates measurements on samples/modules

This can be all sort of measurements: EQE, IV, EL, HALL, and many more

It is very complicated to define one format to be used by everybody for all measurement setups using fixed fields and records

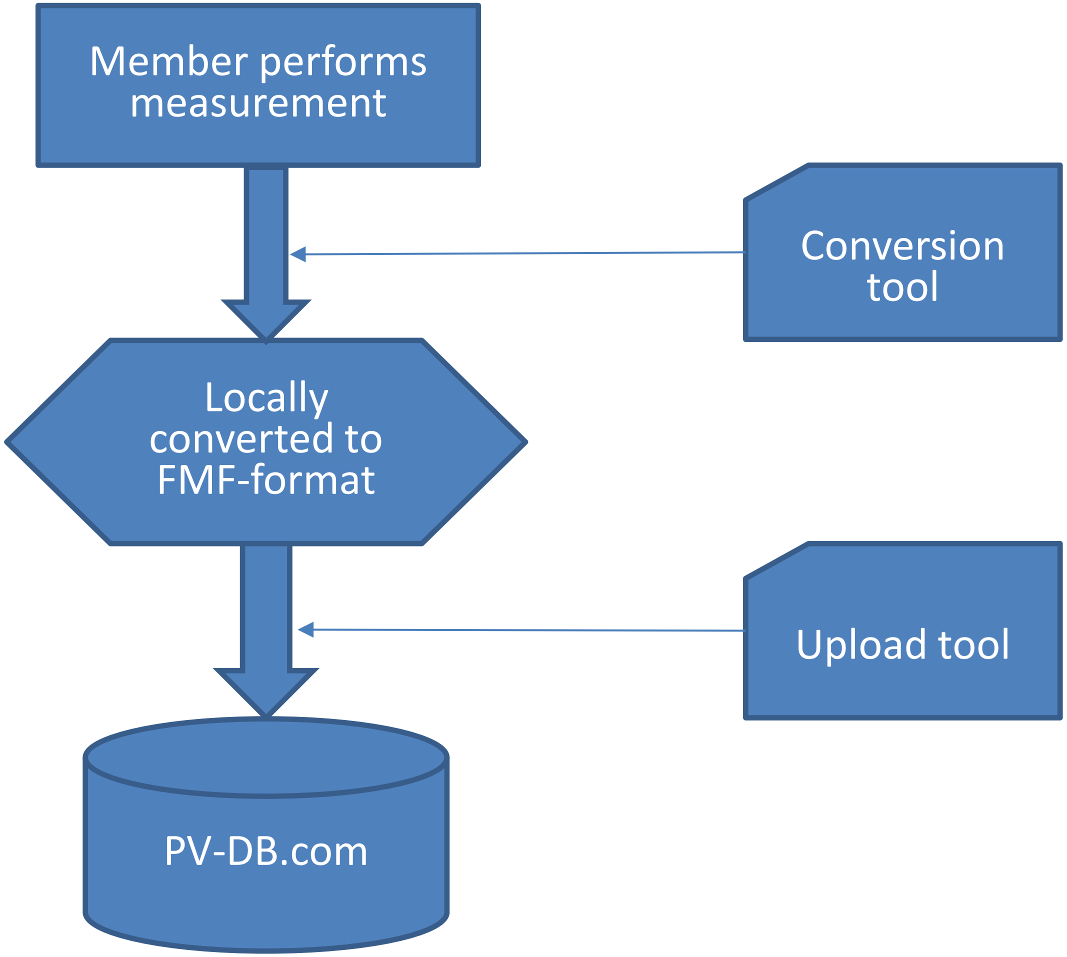
Solution: Full-Metadata Format (FMF) by Moritz Riede et all. This is a self documenting, flexible format to store tabular data

ReRa operates an online storage system for these files: www.pv-db.com

First focus: **Get the data in there!**

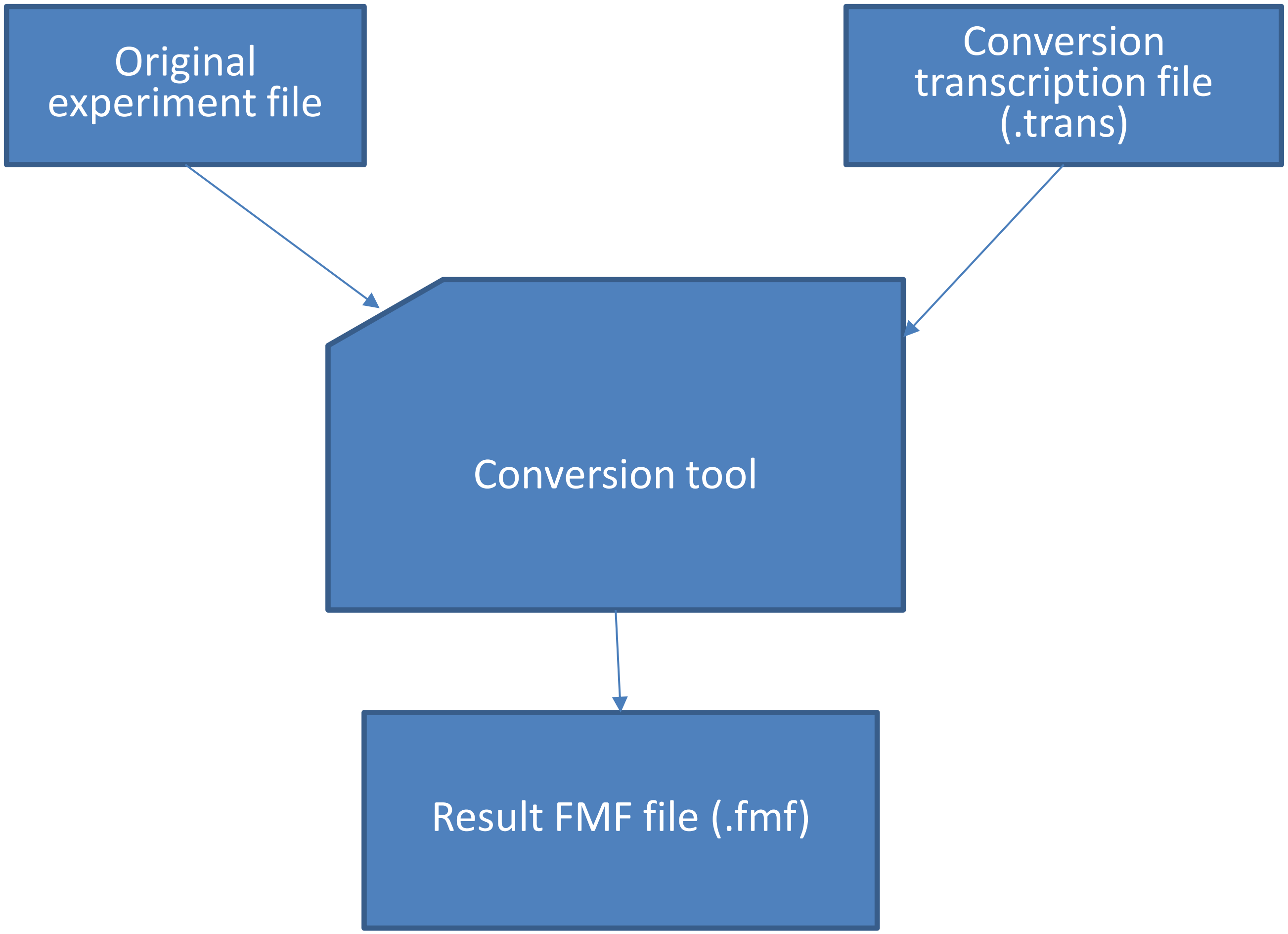
Second: Analyze and visualize the data

Dataflow



Member performs measurement
Conversion tool
Locally converted to FMF-format
Upload tool
PV-DB.com

Conversion tool



Experiment types

- We need to define some common experiments and their fmf representation (EQE, IV, EL, HALL??)
- In principle any fmf file can be stored, but if the structure is unknown it is difficult to represent the contents

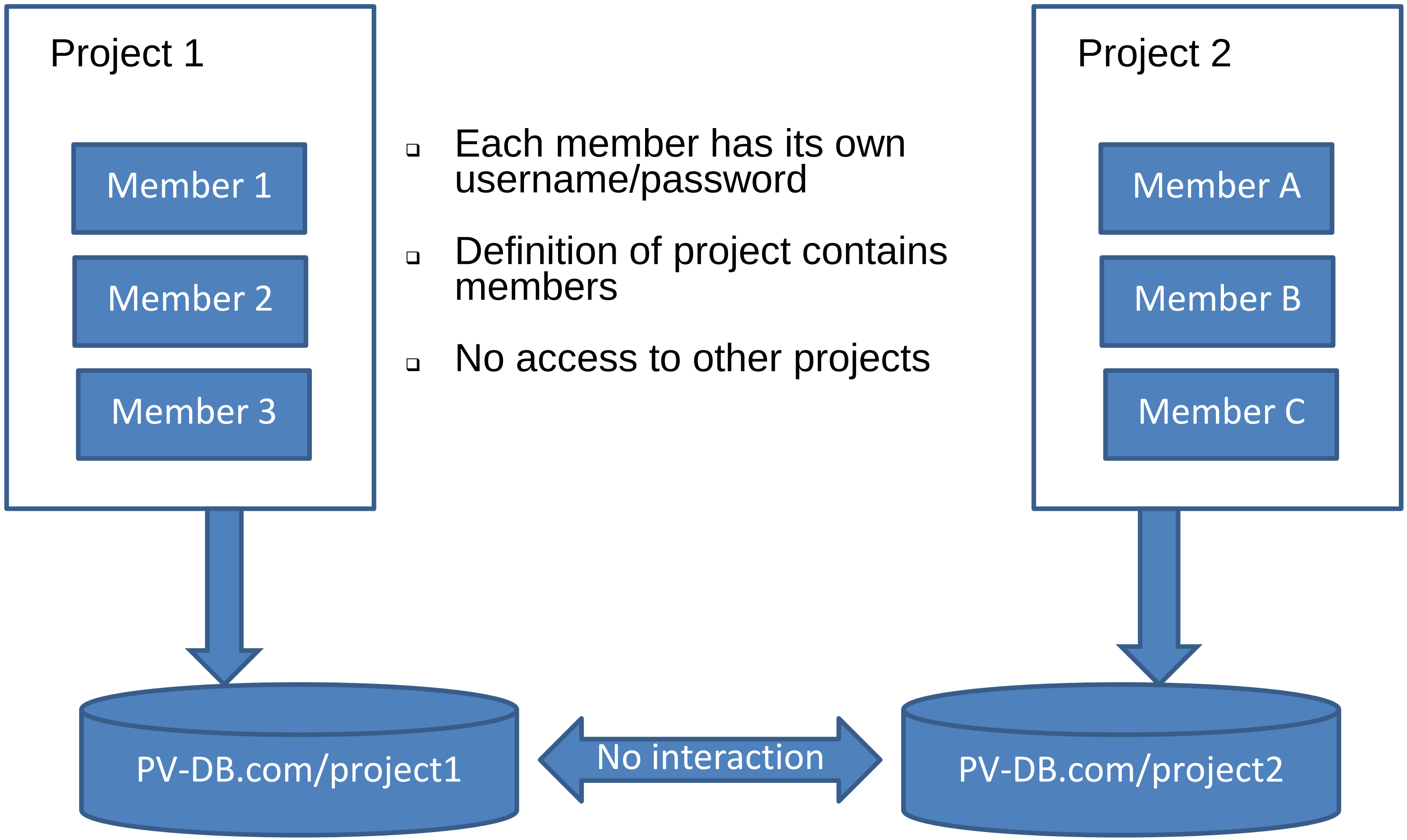
Agreements

Flexible format is nice, but some agreements should be made in order to search and analyze the data

- Sample name
- Measurement types
- Header format
- Fixed fields
- This needs to be defined in a document

Authentification

- Each member has its own username/password
- Definition of project contains members
- No access to other projects



Access rights

- Each project has 1 Experiment Coordinator (EC), which is one of the members.
- The EC has read/write access to all files in the project
- The EC can add/remove other members and apply read/write access rights.
- A member always has read/write access rights on its own files
- A member only has read access on the other members' files when this is allowed for by the EC

Current Status

Operational:

- Online FMF storage (www.pv-db.com)
- User management and project control

Current priority:

- Upload tool (Linux, Windows and Apple)
- Definitions of fixed fields
- Simple viewer

Future:

- Local conversion tool (Linux, Windows and Apple)
- Extended viewer