



Electric Vehicle Batteries Made in Europe

Lighthouse Projects for EV Batteries Made in Europe

Series Production of Li Ion Batteries

Continental Powertrain HEV – Ralf Schmid – 30.11.2010

Series Production of Li Ion Batteries

The Content

Organization and Footprint

Actual Series HEV Battery Manufacturing

Future EV/HEV Battery Manufacturing (FUEL)

Quality Aspects

Div. Powertrain
BU Hybrid Electric Vehicle
30.11.2010 / Ralf Schmid



2

Series Production of Li Ion Batteries

Continental Divisions and Business Units

Continental Corporation

Automotive Group

Chassis & Safety

Powertrain

Interior

Rubber Group

Passenger and Light Truck Tires

Commercial Vehicle Tires

ContiTech

Div. Powertrain
BU Hybrid Electric Vehicle
30.11.2010 / Ralf Schmid

Continental

3

Series Production of Li Ion Batteries

BU HEV Footprint

Head Office

Production Location

Engineering Location

Div. Powertrain
BU Hybrid Electric Vehicle
30.11.2010 / Ralf Schmid

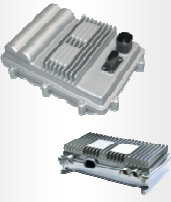
Continental

4

Series Production of Li Ion Batteries

BU HEV Product Portfolio

Power Net System



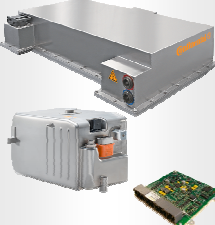
Power Net System

→ DC/DC + DLC or Lilon battery

Functions:

- Reasonable regen. Braking
- peak power supply
- Stable 14V board net
- Energy on demand

Energy Storage



Battery

→ Battery system

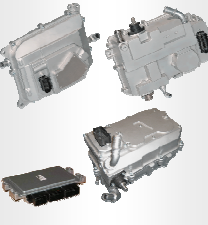
→ Battery Management Control

→ Cell Supervision Circuit

Functions:

- Lilon Energy Management for HEV/EV
- Battery Management
- Cell supervising
- Thermal Management

Power Electronics



Electronic Control Unit for electric propulsion system

→ Single Inverter for synchronous & asynchronous machines

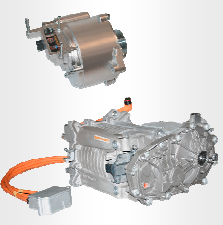
→ High power DC/DC Converter

→ Hybrid- / EV controller

Functions:

- E-Machine control
- Voltage conversion from hybrid energy storage to standard board net

Electric Machine



Electric machines for HEVs and EVs

→ Induction machine (ASM/IM)


→ Permanent magnet synchronous machine (PSM)

→ Externally excited synchronous machine (SM)

Functions:

- pos. or neg. torque

Div. Powertrain
BU Hybrid Electric Vehicle
30.11.2010 / Ralf Schmid



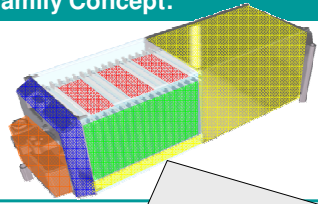
5

Series Production of Li Ion Batteries

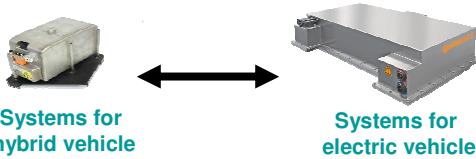
Li-Ion Battery Systems

Family concept was developed in order to target small hybrid vehicles up to power full electric vehicles

Family Concept:



Different Applications:



Systems for hybrid vehicle ↔ Systems for electric vehicle

Safety component, Sensors

Battery Management Controller

CSC

CSC

CSC


Battery module (Cell module)

Integration + Mechanic + Cooling

Basic

Application

Div. Powertrain
BU Hybrid Electric Vehicle
30.11.2010 / Ralf Schmid




6

Joint EC / EPoSS / ERTRAC Expert Workshop 2010

3

Series Production of Li Ion Batteries

Realized Battery Systems



Li-Ion Energy Pack	ELF1-1	ELF2-20	ELA2-40	ELF2-60*	ELF3-105	ELF4-55	ELF4-60
Project Status	Series	B-Sample	B-Sample	B-Sample	A-Sample	A-Sample	A-Sample
Max. power discharge @ 10s / 20 °C	19 kW	20 kW	40 kW	60 kW	105 kW	55 kW	60 kW
Nominal Voltage	122 V	126 V	302 V	333 V	360 V	366 V	390 V
Capacity	6 Ah	5,5 Ah	5,5 Ah	5,5 Ah	40 Ah	45 Ah	50 Ah
Volume approx.	13 l	12 l	45 l	50 l	120 l	90 l	110 l
Weight approx.	26 kg	25 kg	45 kg	60 kg	180 kg	140 kg	175 kg
Nominal energy (typically useable)	800 Wh (ca. 250Wh)	730 Wh (290 Wh)	1.700 Wh (680 Wh)	1.830 Wh (730 Wh)	14.400 Wh (10.800 Wh)	17.200 Wh	18.300 Wh

1st platform HEV

2nd platform family concept HEV

3rd platform PHEV

4th platform EV

Div. Powertrain
BU Hybrid Electric Vehicle
30.11.2010 / Ralf Schmid

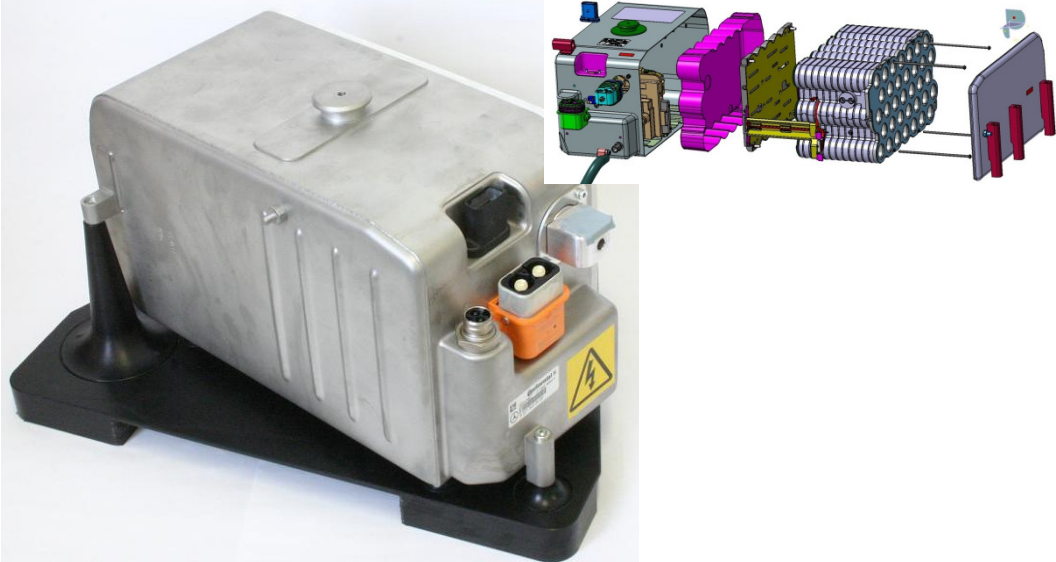
Continental

7

* Truck application

Series Production of Li Ion Batteries

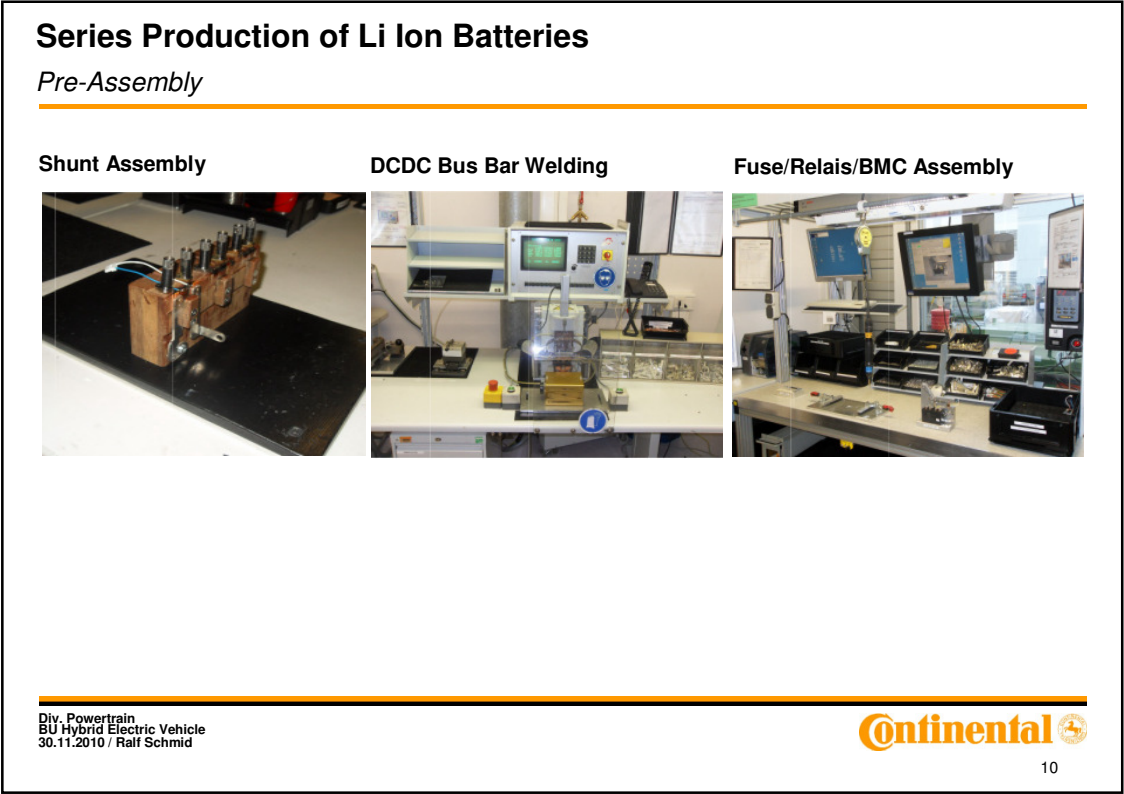
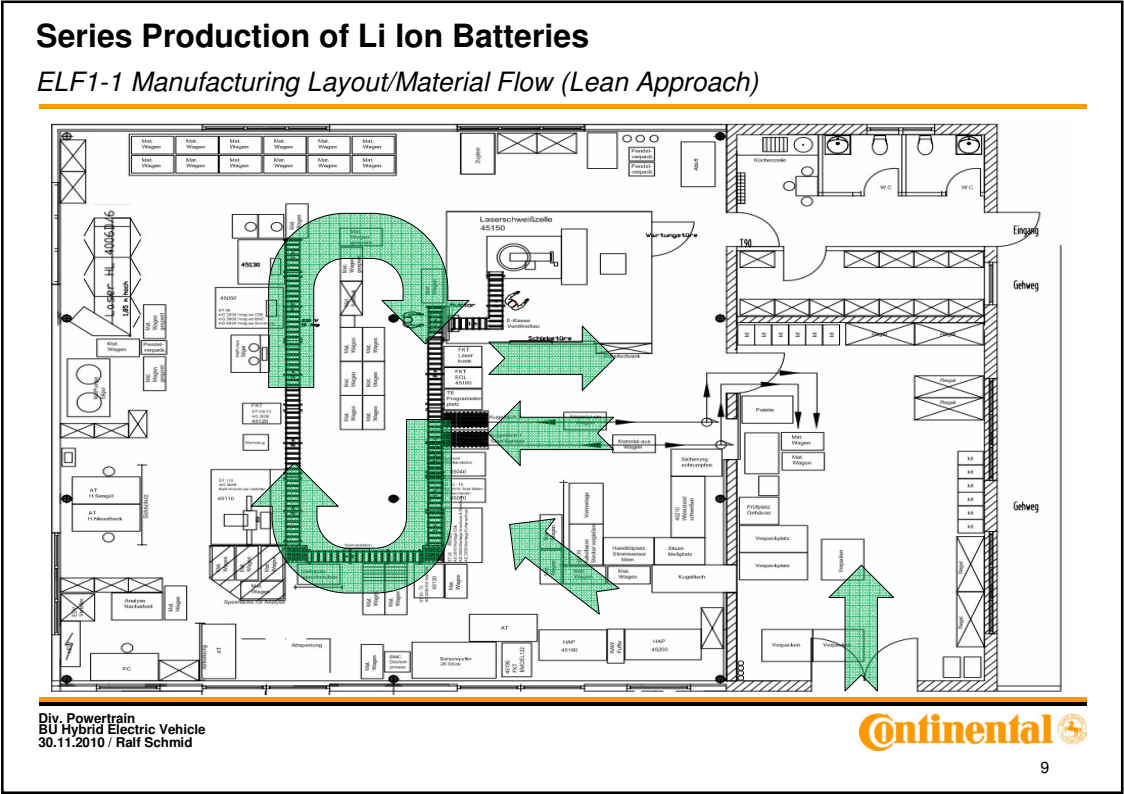
Actual Product ELF1-1 – Launched 2008 at Continental in Nuernberg/Germany



Div. Powertrain
BU Hybrid Electric Vehicle
30.11.2010 / Ralf Schmid

Continental

8



Series Production of Li Ion Batteries

Pre-Assembly

Pre-Assembly Housing with BMC (Pick to Light)



Electrical Pre Test



Div. Powertrain
BU Hybrid Electric Vehicle
30.11.2010 / Ralf Schmid



11

Series Production of Li Ion Batteries

Assembly

Incomming Electrical Cell Test / Start Traceability



Div. Powertrain
BU Hybrid Electric Vehicle
30.11.2010 / Ralf Schmid

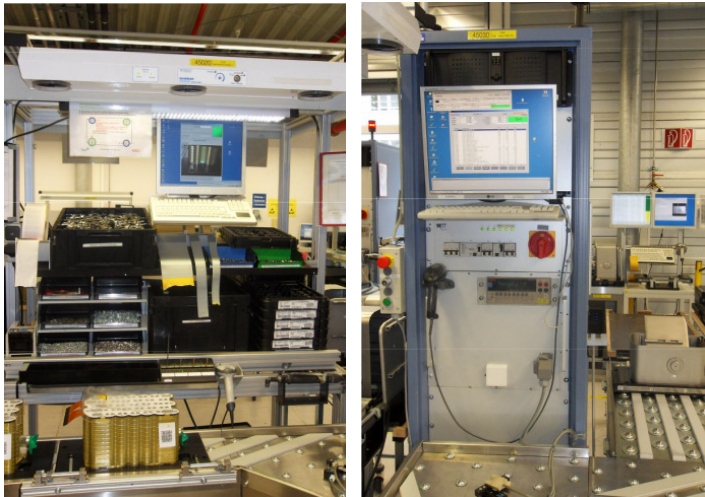


12

Series Production of Li Ion Batteries

Assembly

Assembly of the CSE (cell supervision electronics, Fuse, Electrical Test



Div. Powertrain
BU Hybrid Electric Vehicle
30.11.2010 / Ralf Schmid



13

Series Production of Li Ion Batteries

Assembly

Assembly of the Housing with the Cell Block – Welding the Battery Connection



Div. Powertrain
BU Hybrid Electric Vehicle
30.11.2010 / Ralf Schmid

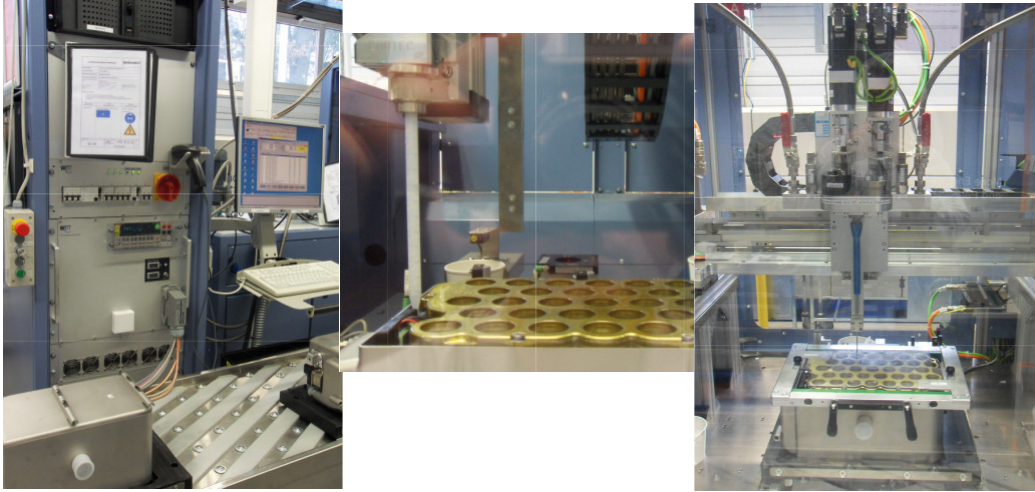


14

Series Production of Li Ion Batteries

Assembly

Testing with parallel Charging, Potting, Curing



Div. Powertrain
BU Hybrid Electric Vehicle
30.11.2010 / Ralf Schmid

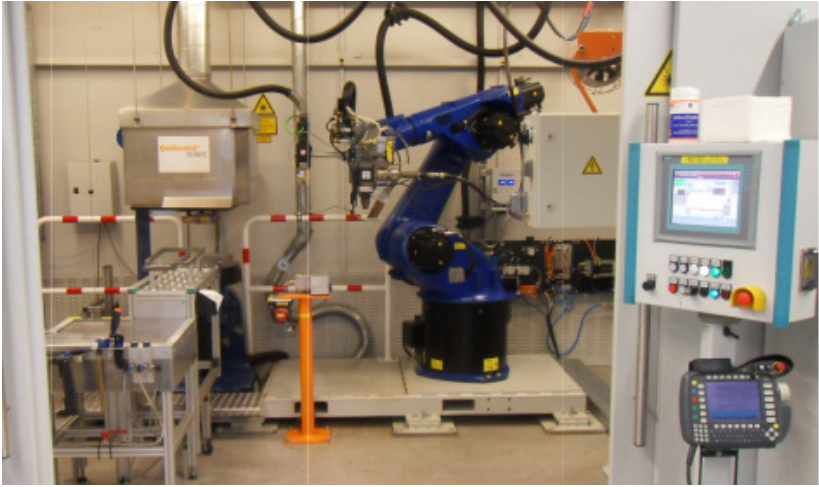


15

Series Production of Li Ion Batteries

Assembly

Laser Welding of the Housing (Stainless Steel)



Div. Powertrain
BU Hybrid Electric Vehicle
30.11.2010 / Ralf Schmid



16

Series Production of Li Ion Batteries

Assembly

EOL Test, Flashing of the Application Software



Div. Powertrain
BU Hybrid Electric Vehicle
30.11.2010 / Ralf Schmid



17

Series Production of Li Ion Batteries

Safety Measures

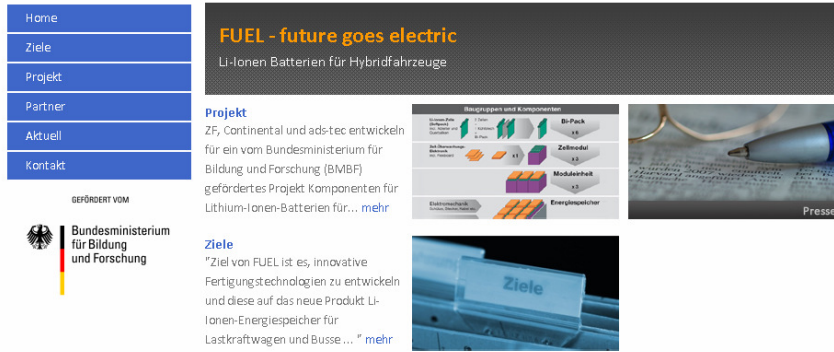
- ✓ **Special Training for High Voltage / working with Li Ion Batteries (ext/int)**
- ✓ **Avoiding any Short Circuits through the whole manufacturing process**
- ✓ **Fire safety measures**
- ✓ **Evacuation Plan**
- ✓ **Extensive Training + Re-Training**

Div. Powertrain
BU Hybrid Electric Vehicle
30.11.2010 / Ralf Schmid



18

Future Battery Manufacturing – Partially BMBF supported






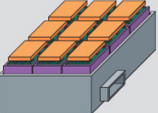
Div. Powertrain
BU Hybrid Electric Vehicle
30.11.2010 / Ralf Schmid



19

Series Production of Li Ion Batteries

Future Battery Manufacturing

Baugruppen und Komponenten		Produktionstechnik	Test und Validierung
Li-Ionen-Zelle (Sottpack) incl. Ableiter und Querbalken  2 Zellen + 1 Kühlblech = Bi-Pack	Bi-Pack x 6	Automatisiertes Nieten und Kleben	900 V Test
Zell-Überwachungs- Elektronik incl. Flexboard  x 1	Zellmodul x 3	Automatisiertes Zuführen, Positionieren, Arbeiter kontaktieren, Flexboardanschluss	900 V Test
	Moduleinheit x 3	Elektronk und Flexboardmontage	900 V Test
Energiespeicher 		Komponenten- Endmontage, Leiter- und Kühlungsverbindungen	900 V Test Funktionsprüfung 100% Qualifizierung: Nachweis der – Schutzklasse – Dauerfestigkeit – Prozessfähigkeit
Fahrzeug-Hybridsystem			
AP 1 NKW Speichersystem: Komponenten ZF, Continental	AP 2 NKW Speichersystem: Produktionstechnik ads-tec, Continental	AP 3 Testverfahren, Validierung u. Systemdemonstration ZF, ads-tec, Continental	
FUEL Koordination: Continental			

Div. Powertrain
BU Hybrid Electric Vehicle
30.11.2010 / Ralf Schmid



20

Series Production of Li Ion Batteries

Future Battery Manufacturing

- *The present market of hybrid systems for commercial vehicles doesn't provide any battery solution based on soft-pack / coffee-pack formatted Li-Ionen cells*
- *Assembly technologies need to be developed and to be feasible for high volume production*
- *Simultaneous engineering is demanded for energy storage systems and the assembly processes*



Div. Powertrain
BU Hybrid Electric Vehicle
30.11.2010 / Ralf Schmid



21

Series Production of Li Ion Batteries

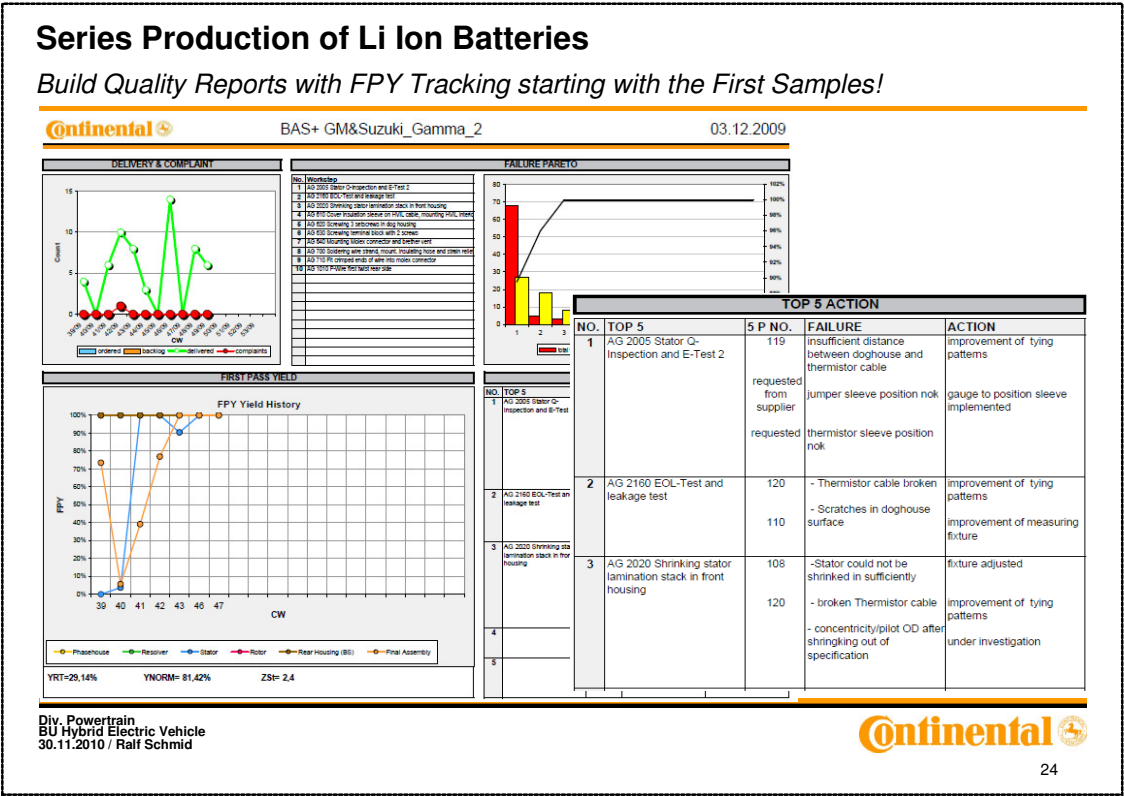
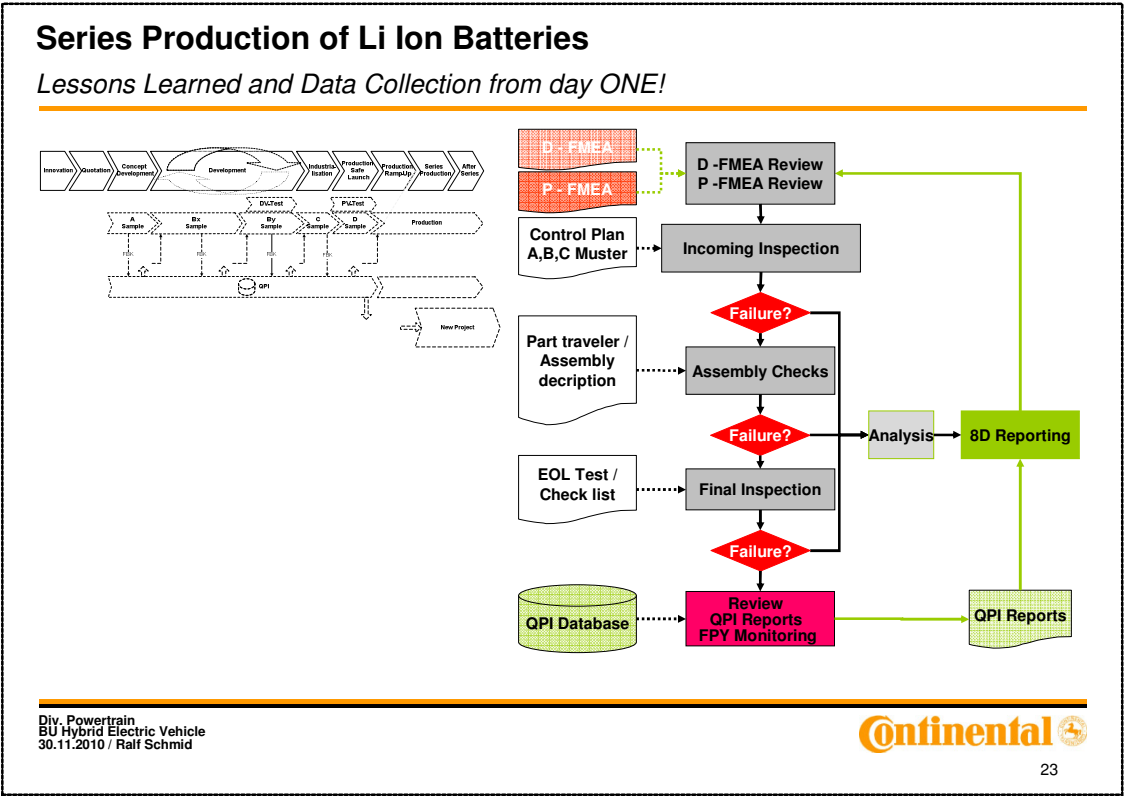
Future Battery Manufacturing

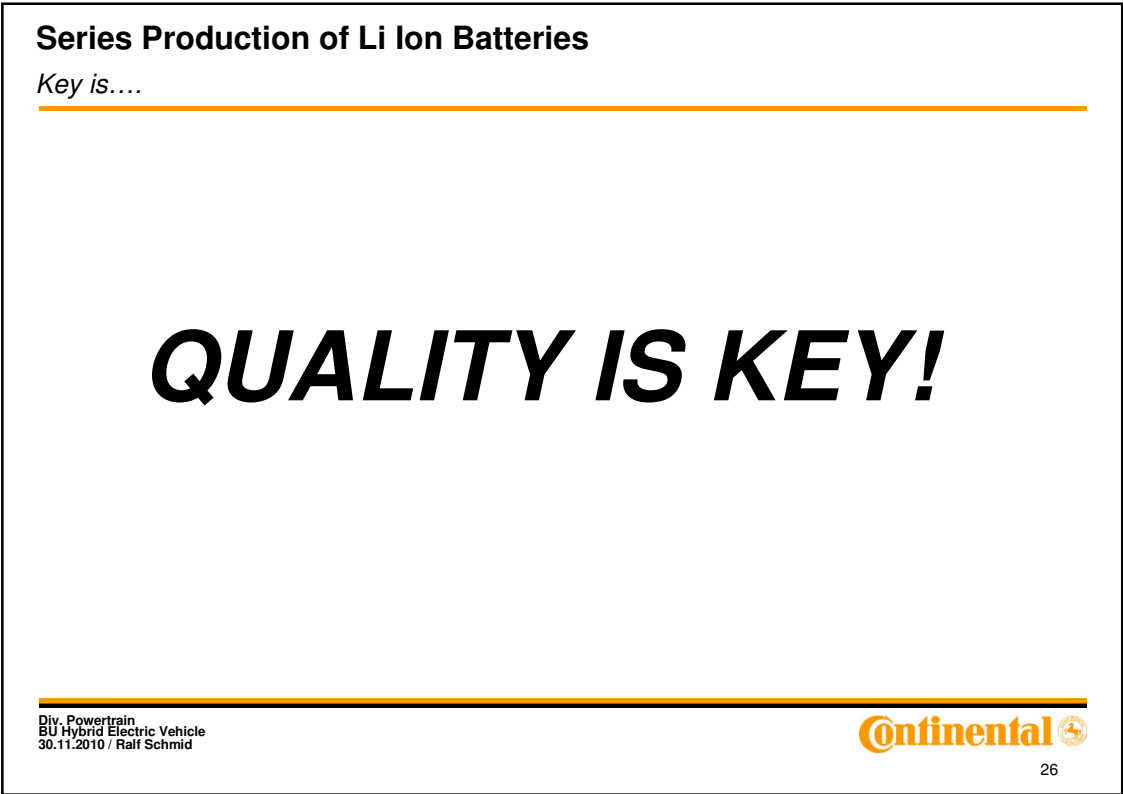
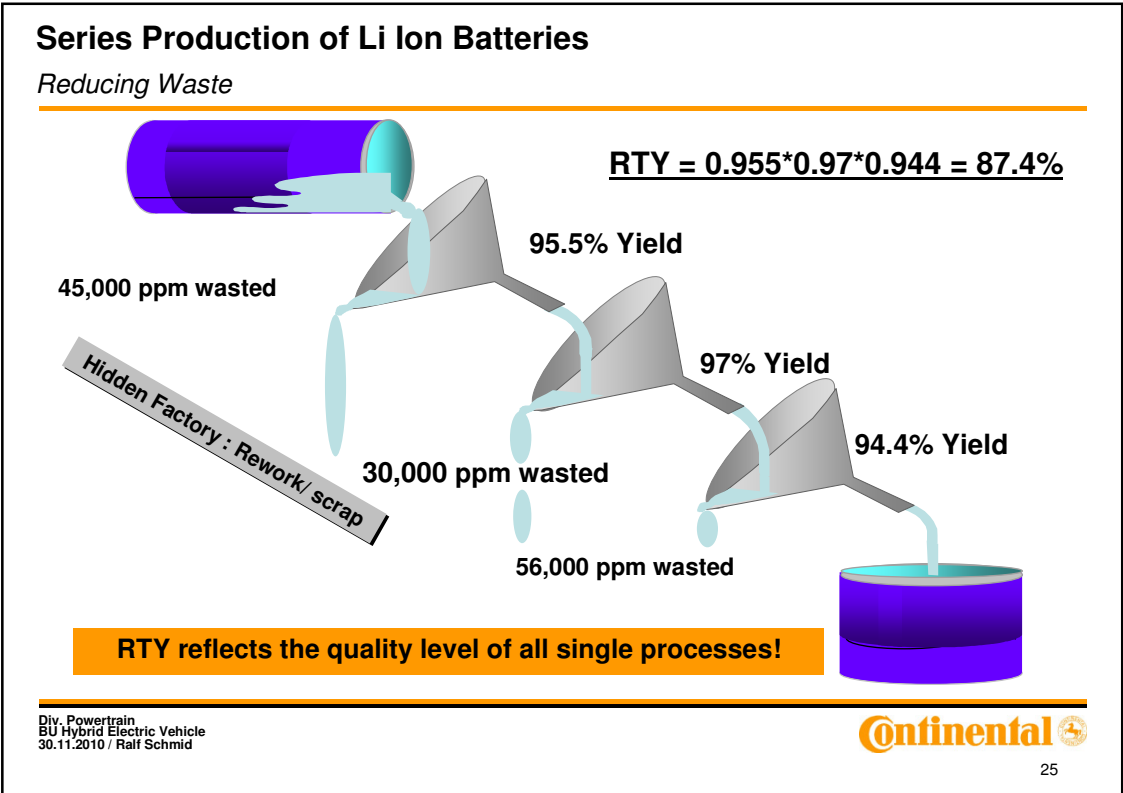
- ◻ **Work package AP I:** Development of components and functions of Li-Ionen for hybrid commercial vehicles
- ◻ **Work package AP II:** Development of manufacturing processes for assembly of Energy storage systems based on soft-pack Li-Ion cells.
 1. Automatical Bi-Pack assembly,
 2. Stacking to cell module formates
 3. Connector welding process (e.g. Resistance-, Laser- ultra sonic welding)
 4. Assembly and contacting of CSE (cell supervising electronic)
 5. Back end assembly of entire energy storage system
- ◻ **Workpackage AP III:** Test und Validation of Li-Ionen batteries and components and manufacturing processes.
- ◻ Ensure process capabilities and component reliability over lifetime.

Div. Powertrain
BU Hybrid Electric Vehicle
30.11.2010 / Ralf Schmid



22





Thank you for your Attention

