Research – with the Spirit of Safety

PILZ
THE SPIRIT OF SAFETY

Product and Technology Management

Harald Wessels
September 2017

Vita Harald Wessels

- Education:
  Dipl. Ing (FH) Electrical Engineering
- Since Dec 2013 in Pilz GmbH
  - Senior Manager Product & Technology Management
- Standardization and standards committees
  - IEC SC65 TC65 JWG10
  - ZVEI „Automation Security“
  - OPC Foundation
  - Labs Network Industrie 4.0
  - Industrial Internet Consortium

Content

PILZ
THE SPIRIT OF SAFETY

- Pilz
- Safety
- Functional Safety Principles
- Synchrotron applications
- PSS 4000
- Industrie 4.0

Pilz - The Company

- Independent automation company, founded in 1948
- Headquarters in Ostfildern near Stuttgart, Germany
- Employees:
  - More than 2.400 worldwide
- Turnover 2016:
  - 306 Millionen Euro
  - 70 % Export

- Local representation via:
  - 31 Subsidiaries
  - 15 sales partners

Product Portfolio

PILZ
THE SPIRIT OF SAFETY

Sensors

Controller

Network Components

Drives

Operating & Monitoring

Services

Exemplary Industries

PILZ
THE SPIRIT OF SAFETY

Machine Building

Automotive

Transport/Logistics

Railway

Amusement Parks

Wind Energy

- Our customers benefit from the diverse experience we have in safe automation.

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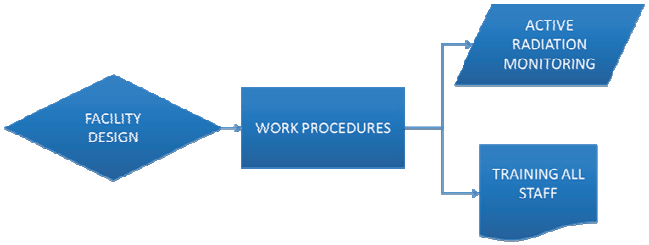
Health & Safety at Alba

Source: https://www.cells.es/en/safety/occupational-h-s/occupational-h-s



Source: https://www.cells.es/en/safety/radiation-protection-service/radiation-protection-service

- Occupational Health & Safety Activities
  - Own stuff
  - External companies
  - Emergency plan
- Radiation Hazard Safety
  - Developing policies and working procedures to prevent radiological risk
  - Managing personal and area dosimetry
  - Defining and managing the access to Radiological Zones
  - etc.

Technical Safety

http://www.pre-vent.com/de_corporation_news_reader/pre-vent-erhaelt-sil-zertifikate-nach-iec-61508-fuer-ventile-und-antriebe.html

- In the technical field, "safety" is often dependent on how it is defined or what degree of uncertainty is accepted for the use of the technical function.
- The IEC 61508 standard uses the concept of functional safety as a partial aspect of the overall safety of a technical system.

Safe Automation Worldwide

One global safety objective, but diverse implementation at local level, because safety awareness, and culture are different.

- International standards
- National and intern. approvals
- Certification from external bodies e.g. TÜV, BG
- Stable and efficient processes (ISO certification)

- Europe has a long history in safety
- In the US…taking a risc = is a positive attitude

Statistics Regarding Work Accidents

- Every day (on global scale) happen approx. 860 000 work accidents
- 6300 people are dying worldwide on the consequences of work accident
- This creates costs of about 2,8 Billions of US$

- In Germany every year 500 people are dying in relation with work accidents
- In comparison this have been 10 000 people in 1900.

Source: German BG

Functional Safety

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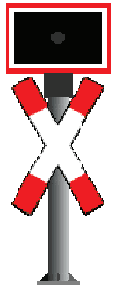
THE SPIRIT OF SAFETY

- **Protection of human beings**
  Reduced work incidents due to safety and protection at work

- **Protection of machine(s)**
  Higher machine park reliability

In order to achieve functional safety of a machine or plant, it is necessary that the safety-relevant parts of the protective and control devices function correctly and in the event of a fault, behave in such a way that the system remains in a safe state or is brought to a safe state.



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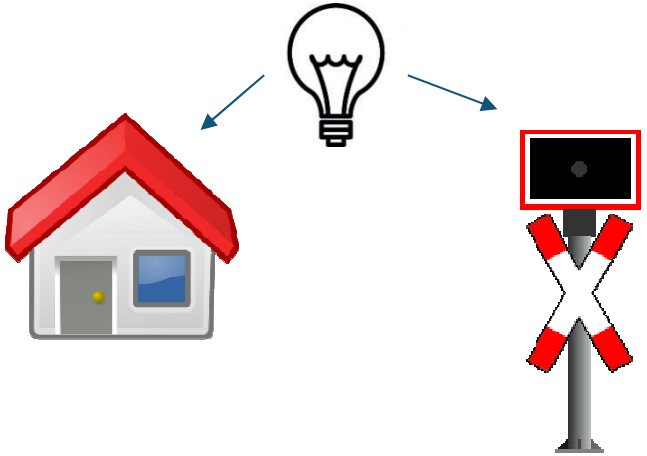
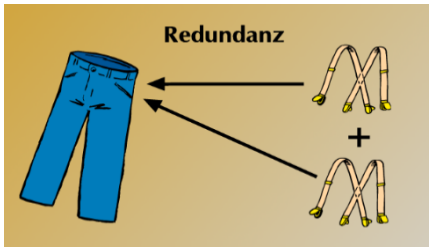
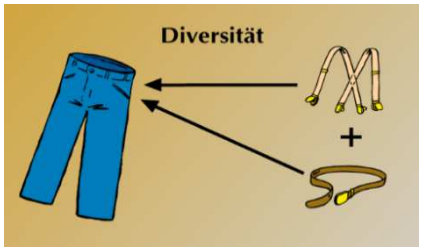
Functional Safety Principles
Redundancy and Diversity



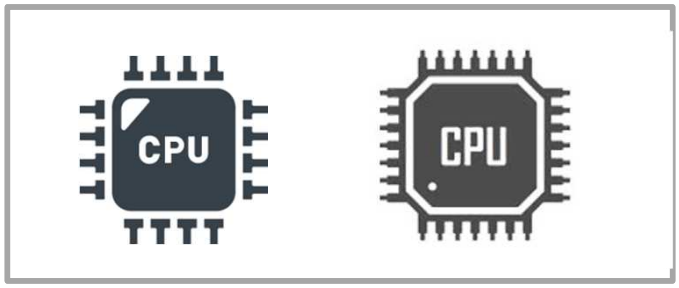
Functional safety of a machine or plant, requires the use of specially qualified technology.



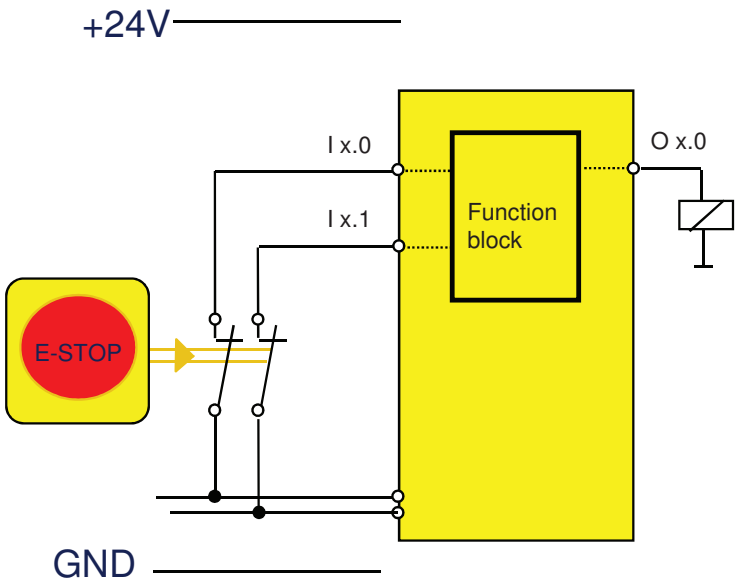


Basic functional safety principals

- Redundancy
- Diversity



Safety Principles
Two Channel Approach and Pulse Signals



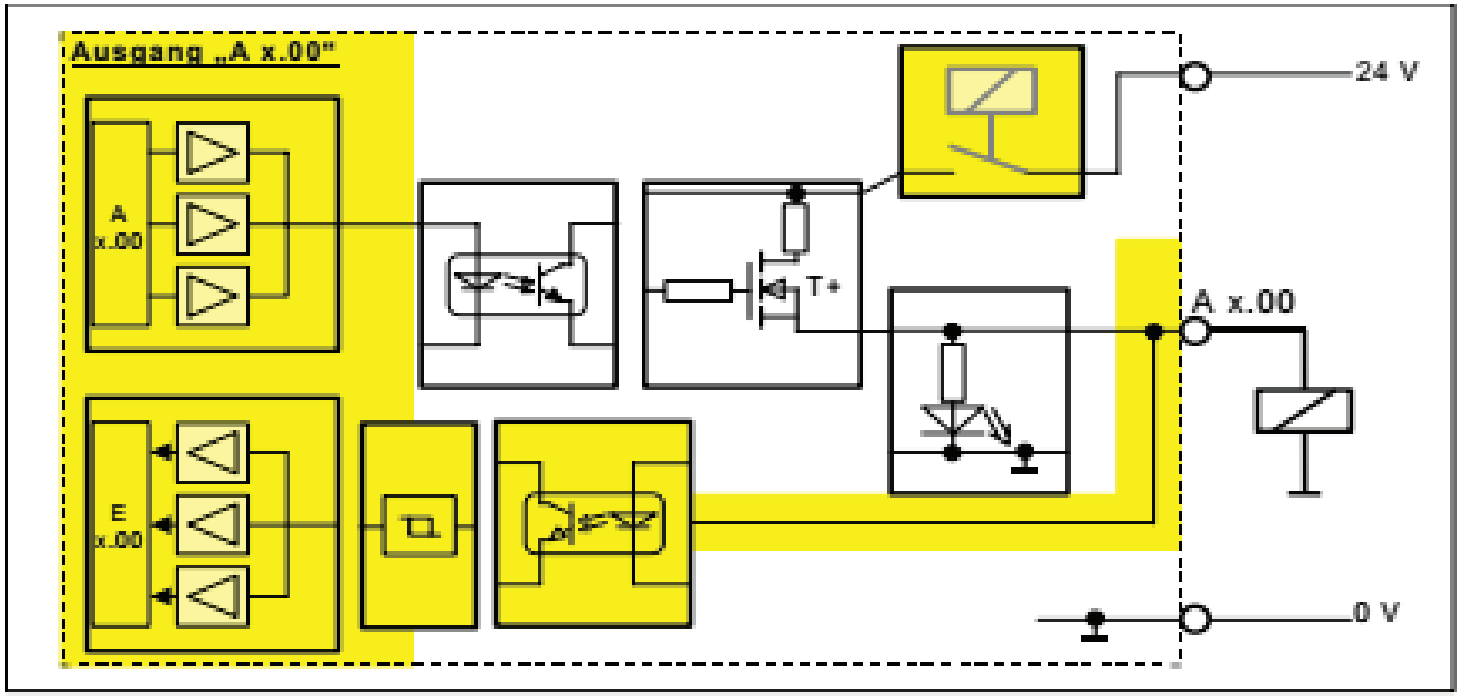
Risks

- Interruption
- Short circuit
- Short between contacts

Measures

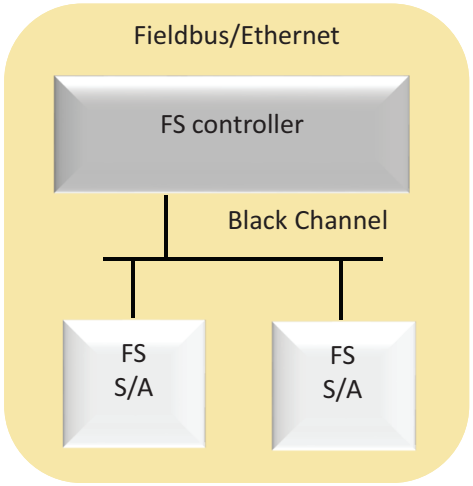
- 2-channel circuits
- Pulse signals

Safety Principles
Dynamic Control and Feedback



Technology used to made cyclical self tests in semiconductor outputs

Safety Principles
Safety Protocolls



Risks

- Loss
- Corruption
- Repetition
- Delay
- . . .

Measures

- Sequential number
- Data backup
- Time stamping
- Redundancy with cross monitoring
- Diverse data backup
- . . .

- In order to safeguard data transfers additional measures are required

IEC 61508 – Certificate for Safety Management

ZERTIFIKAT ◆ CERTIFICATE ◆ СЕРТИФИКАТ ◆ CERTIFICADO ◆ CERTIFICAT

TÜV SÜD Product Service

CERTIFICATE

No. Q4B 16 07 20132 221

Holder of Certificate: Pilz GmbH & Co. KG
Felix-Wankel-Str. 2
73760 Ostfildern
GERMANY

Factory(ies): Pilz GmbH & Co. KG
Felix-Wankel-Str. 2, 73760 Ostfildern, GERMANY

Certification Mark:

Scope of Certificate: Development and production of safety-related systems and components, including PILZ standard function blocks up to SIL3

Applied Standard(s): IEC 61508-1(ed.2)
IEC 61508-2(ed.2)
IEC 61508-3(ed.2)
IEC 61508-4(ed.2)

The Certification Body of TÜV SÜD Product Service GmbH certifies that the company mentioned above has established and is maintaining a management system which meets the requirements of the listed standards. The results are documented in a report. See also notes overleaf.

Report No.: PO89004T

Valid until: 2019-07-20

Date, 2016-07-22 (Peter Weiss)

Page 1 of 1

TÜV SÜD Product Service GmbH · Zertifizierstelle · Ridlerstraße 65 · 80339 München · Germany

TÜV®

- Fail-safe PLC (FS-PLC) must meet the requirements of the relevant standards (e. g. IEC 61508) in accordance with the specified SIL.
- The essential characteristics of a FS PLC are, for example:
- Certain measures and procedures must be applied during development, manufacture and maintenance in order to avoid systematic errors.
- The FS PLC must be able to control systematic faults which become effective during operation.
- The FS PLC must be able to detect and control random hardware failures during operation.
- Error control means that the system reacts when an error is detected in such a way that a defined safety function (e. g. switching off the system) is reliably carried out in this case.

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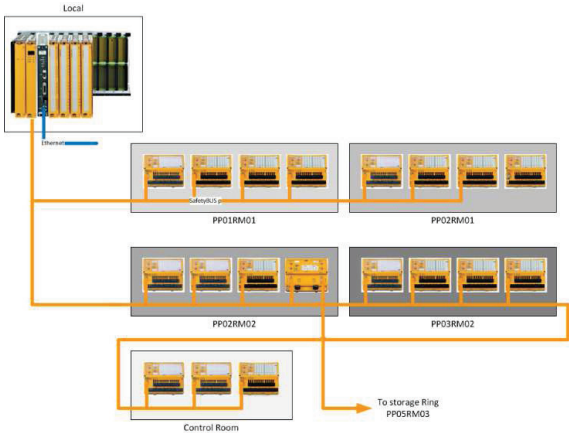
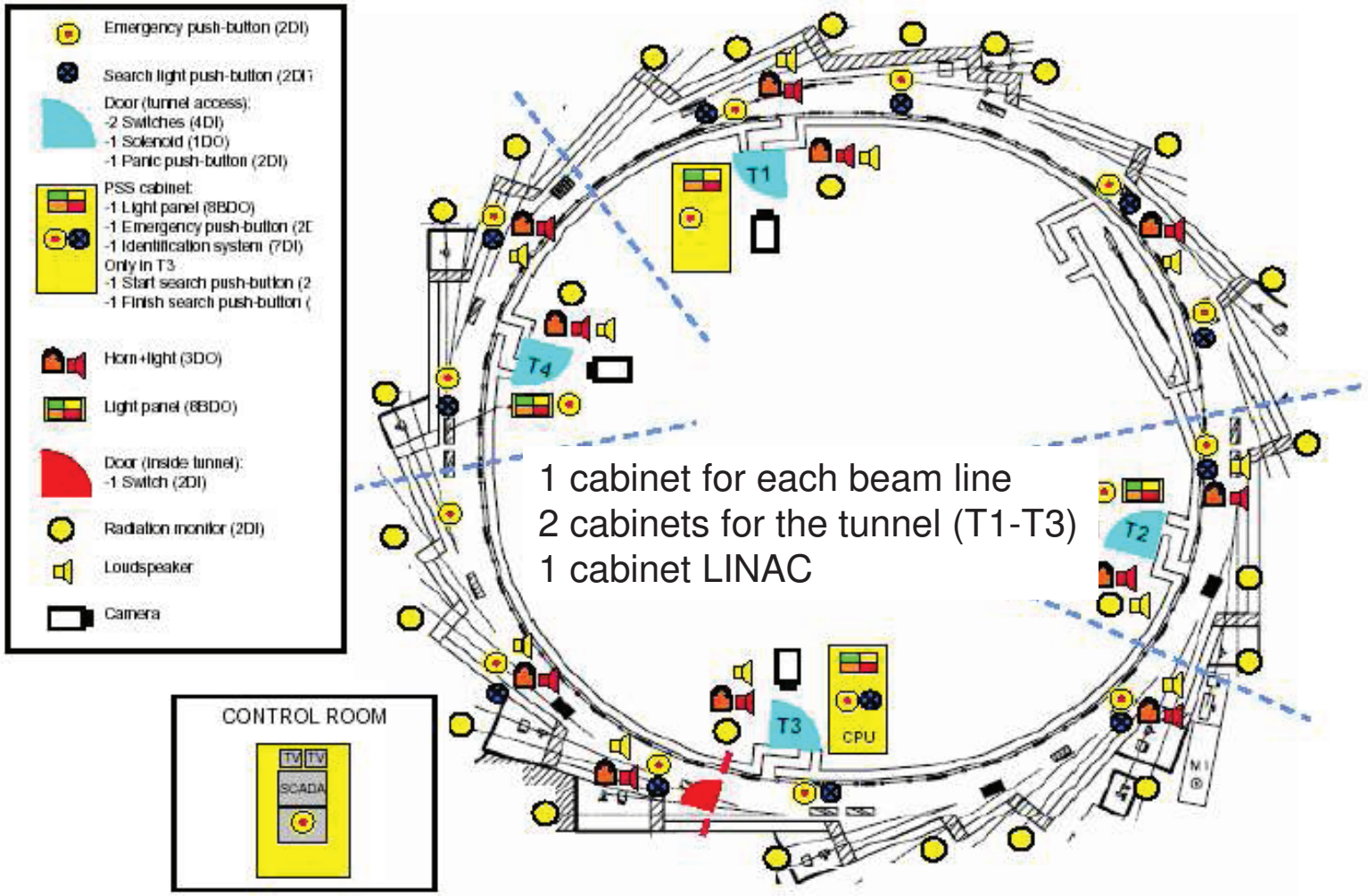
PSS 3000 and SafetyBUS p

- PSS3000 was one of the first safe Plc, approved in 1994
- Phased out in 2017, after 22 years
- PSS3000 was a centralized concept with the capability of 288 safe i/o



- 1999 expanded by the safe fieldbus SafetBUS p
  - Up to 64 participants/nodes
  - Up to 2016 safe I/O
  - Up to 500k/bit
  - Up to 3500m cable run
  - Copper & fiber optic cable
  - Event driven
  - Multi master
- PSS3000 is in use in Synchrotrons in Spain, Australia, and Germany at least

Synchrotron Layout Alba



Synchrotron

1st phase
(Linac and tunnel only)
Inputs = 437
Outputs = 276

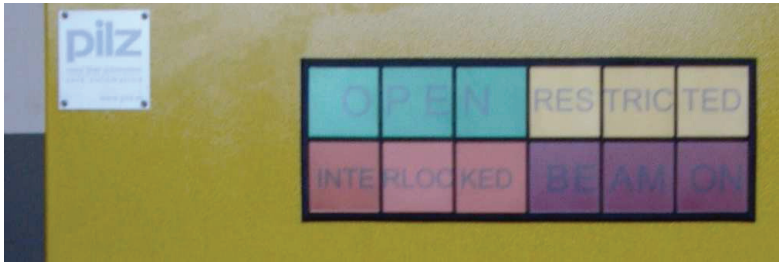
2nd phase
(7 beam lines)
Inputs = 37 (each line)
Outputs = 25 (each line)

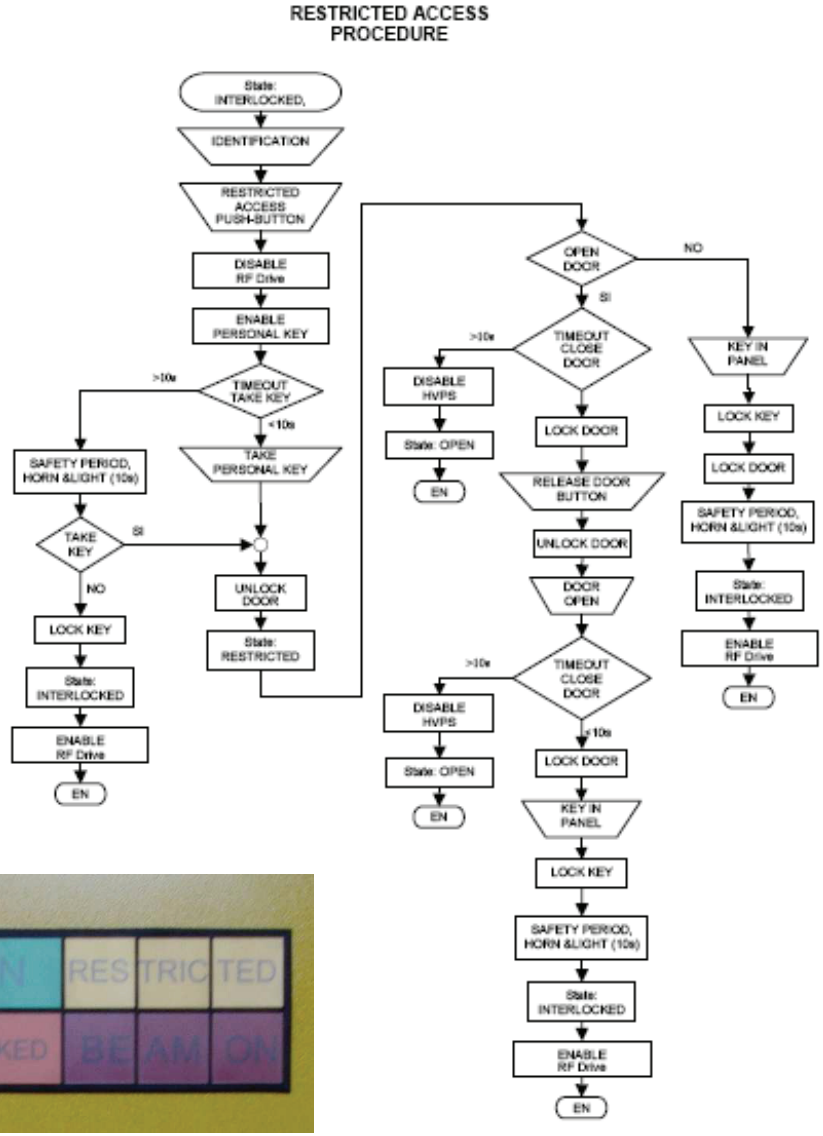
Synchrotron

State machine based. 4 different states.

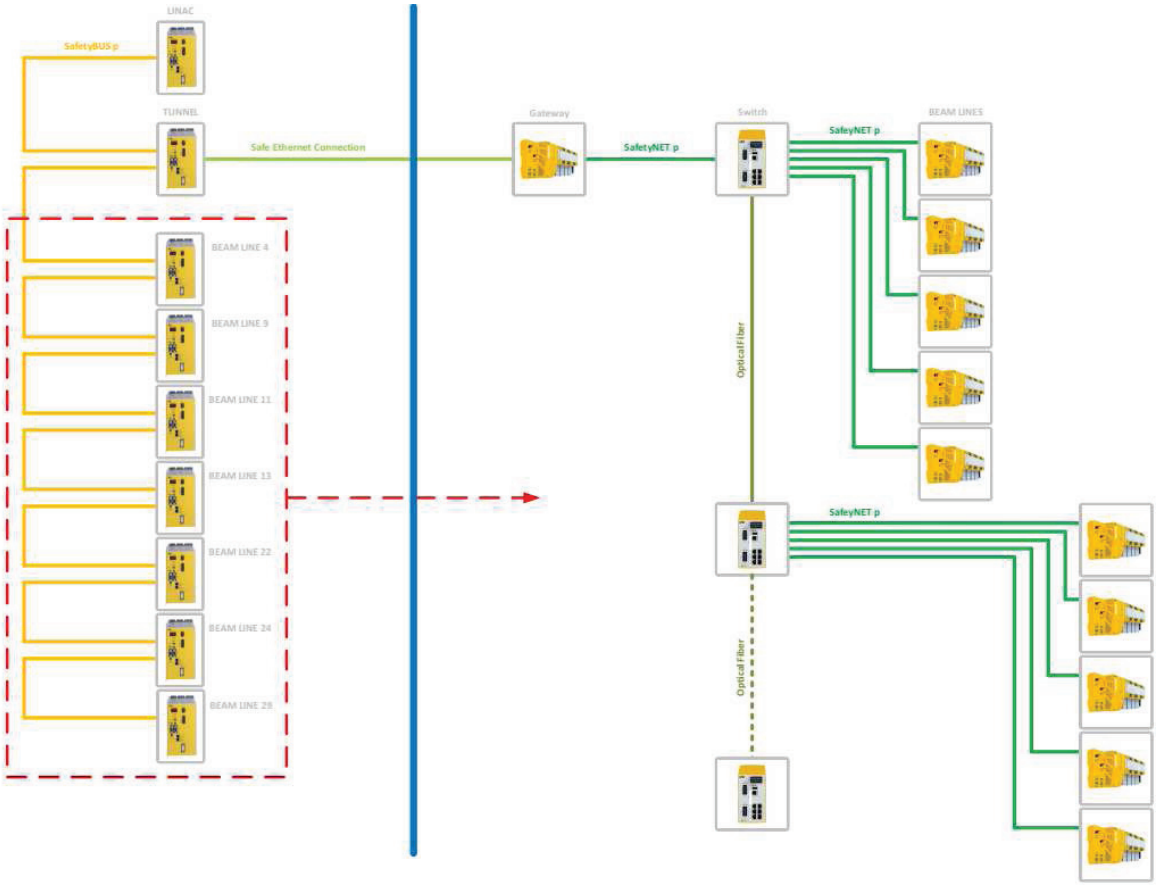
- Open
- Restricted
-Interlocked
-Beam On

-Several Safety Functions (Patrolling, panic, search sequence...)



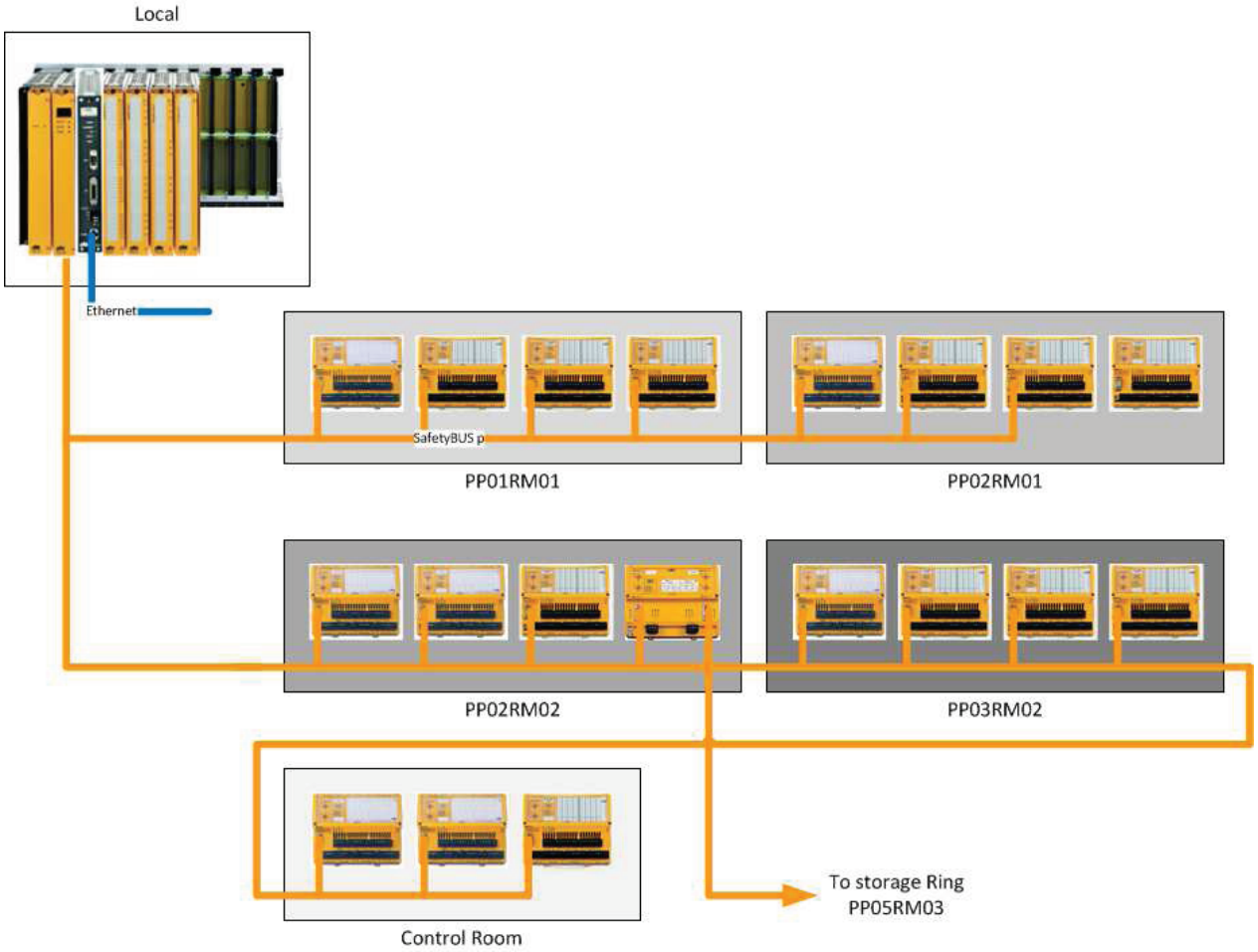


PSS3000 Gateway to PSS 4000
Extension of Synchrotron Alba

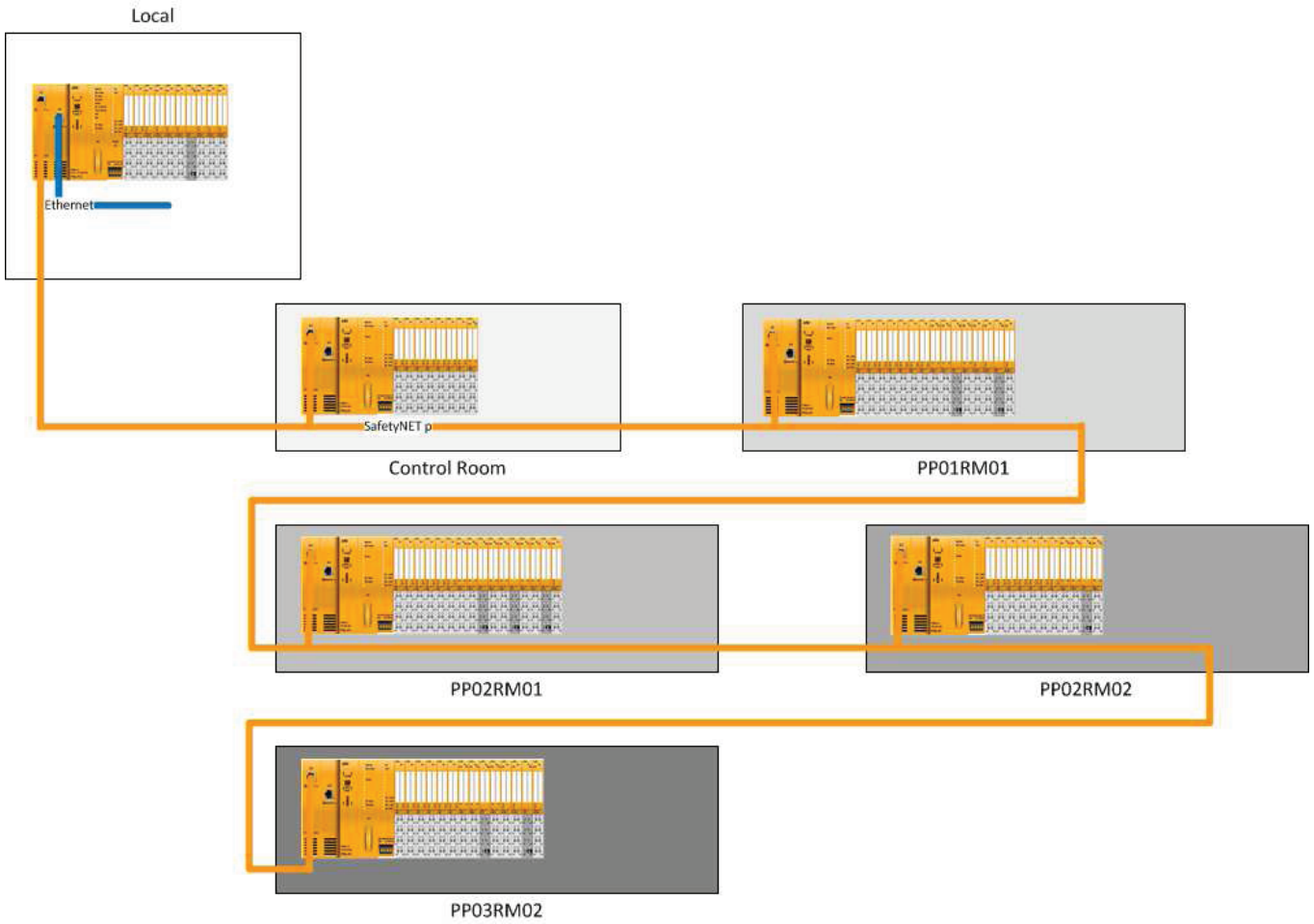


- Coexistence 3000-4000
- Safe Ethernet Connection
- New Beam lines 4000
- Different migration approaches
- Our range of product can fullfill the whole project

PSS 3000 – LINAC & Booster Ring
Existing System in Melbourne

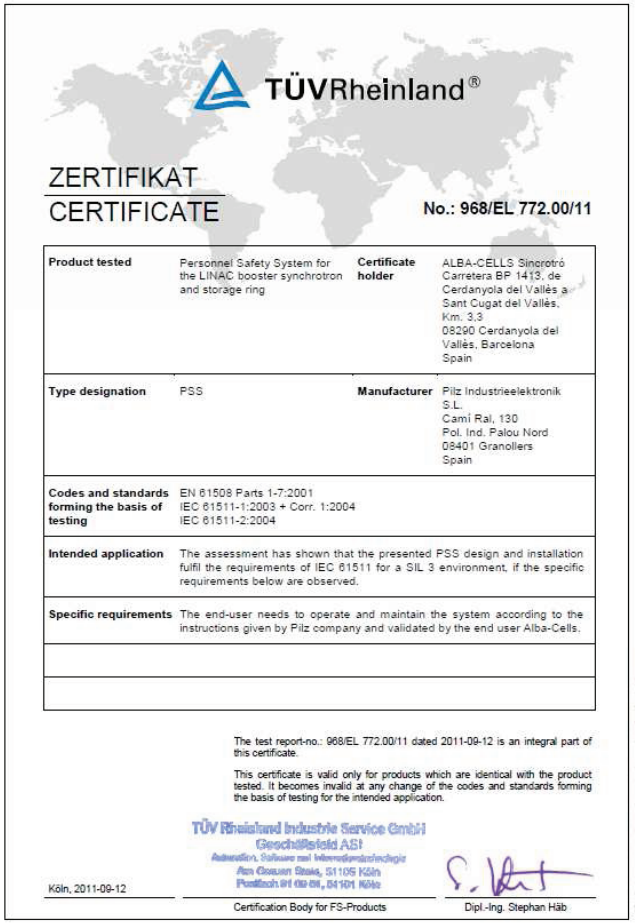


LINAC & Booster Ring
PSS 4000 Replacement (Proposal Melbourne)



Final certification by 3rd party – TÜV Rheinland

1st Phase, Tunnel and Lina of Synchrotron



TÜVRheinland®

ZERTIFIKAT
CERTIFICATE

No.: 968/EL 772.00/11

Product tested	Personnel Safety System for the LINAC booster synchrotron and storage ring	**Certificate holder**	ALBA-CELLS Sincrotró Carretera BP 1413, de Cerdanyola del Vallès a Sant Cugat del Vallès, Km. 3,3 08290 Cerdanyola del Vallès, Barcelona Spain
Type designation	PSS	**Manufacturer**	Pilz Industrieelektronik S.L. Camí Ral, 130 Pol. Ind. Palou Nord 08401 Granollers Spain
Codes and standards forming the basis of testing	EN 61508 Parts 1-7:2001 IEC 61511-1:2003 + Corr. 1:2004 IEC 61511-2:2004		
Intended application	The assessment has shown that the presented PSS design and installation fulfil the requirements of IEC 61511 for a SIL 3 environment, if the specific requirements below are observed.		
Specific requirements	The end-user needs to operate and maintain the system according to the instructions given by Pilz company and validated by the end user Alba-Cells.		

The test report-no.: 968/EL 772.00/11 dated 2011-09-12 is an integral part of this certificate.

This certificate is valid only for products which are identical with the product tested. It becomes invalid at any change of the codes and standards forming the basis of testing for the intended application.

TÜV Rheinland Industrie Service GmbH
Geschäftsfeld ASI
Automation, Software und Informationstechnologie
Am Grauen Stein, 51105 Köln
Postfach 91 08 51, 51101 Köln

Köln, 2011-09-12

Certification Body for FS-Products

Dipl.-Ing. Stephan Häb

2 nd Phase 7, Beam Lines of Synchrotron

TÜVRheinland®

ZERTIFIKAT
CERTIFICATE

No.: 968/EL 772.01/11

Product tested	Personnel Safety System for seven Beamlines as part of the LINAC booster synchrotron and storage ring	**Certificate holder**	ALBA-CELLS Sincrotró Carretera BP 1413, de Cerdanyola del Vallès a Sant Cugat del Vallès, Km. 3,3 08290 Cerdanyola del Vallès, Barcelona Spain
Type designation	PSS including seven Beamlines	**Manufacturer**	Pilz Industrieelektronik S.L. Camí Ral, 130 Pol. Ind. Palou Nord 08401 Granollers Spain
Codes and standards forming the basis of testing	EN 61508 Parts 1-7:2001 IEC 61511-1:2003 + Corr. 1:2004 IEC 61511-2:2004		
Intended application	The assessment has shown that the presented PSS design and installation including seven Beamlines fulfil the requirements of IEC 61511 for a SIL 3 environment, if the specific requirements below are observed.		
Specific requirements	The end-user needs to operate and maintain the system according to the instructions given by Pilz company and validated by the end user Alba-Cells.		

The test report-no.: 968/EL 772.01/11 dated 2011-12-05 is an integral part of this certificate.

This certificate is valid only for products which are identical with the product tested. It becomes invalid at any change of the codes and standards forming the basis of testing for the intended application.

TÜV Rheinland Industrie Service GmbH
Geschäftsfeld ASI
Automation, Software und Informationstechnologie
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Postfach 91 08 51, 51101 Köln

Köln, 2011-12-05

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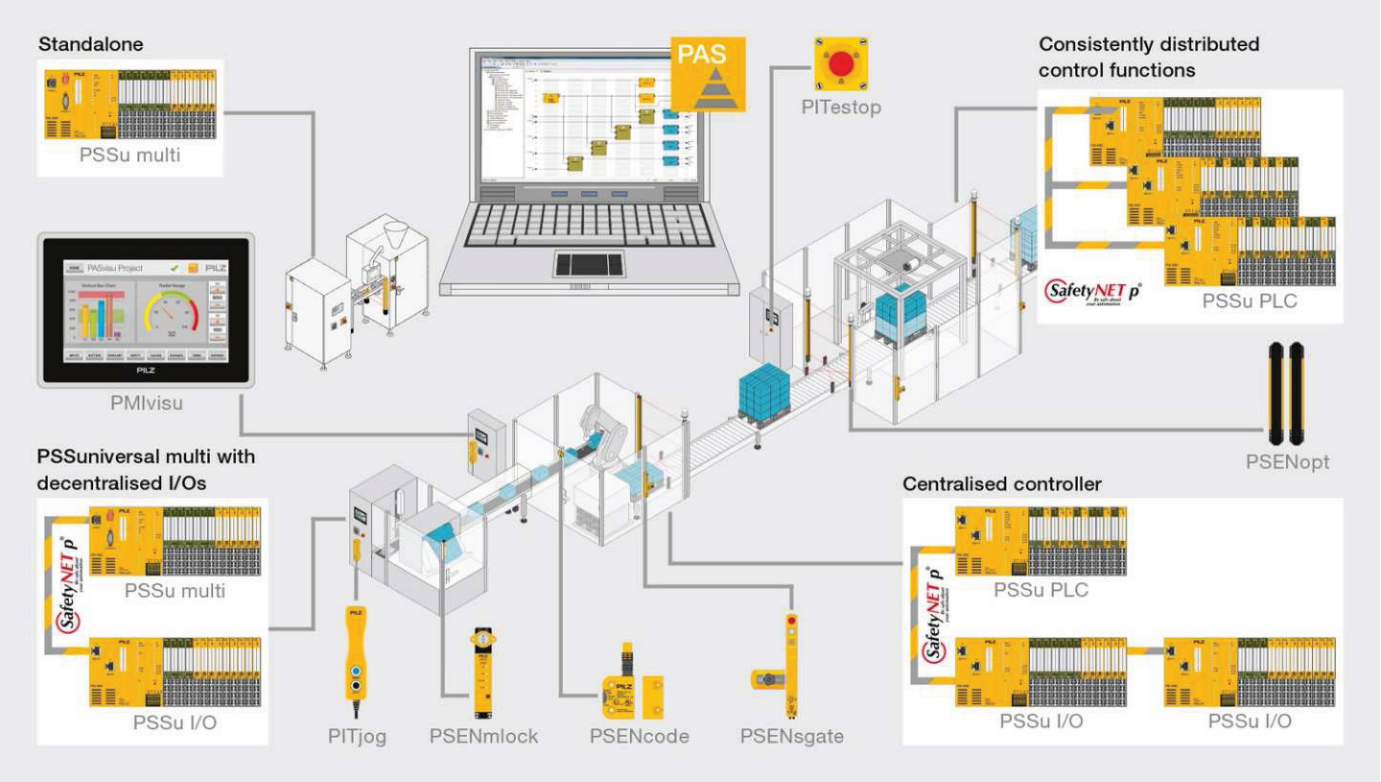
- Fail-safe PLC PSS3000
- Synchrotron application
- PSS 4000
- Industrie 4.0

PSS 4000 – One System, for Automation and Safety

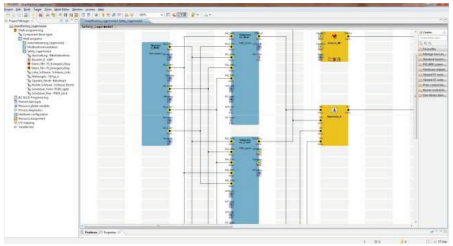


- PSS 4000 is more than a safety PLC, it is an automation system

Automation System PSS 4000

PSS 4000 is a… SAFETY CONTROLLER

- Small size: Terminal block style –
  used for de-centralized installations
- Flexibility: Full variety of function calls (bit, word, integer,…)
- Open system: different industrial communication protocols



PSS 4000 is an… AUTOMATION CONTROLLER

- Same programming for safety & automation (IEC 61131-3)
- Same declaration, same variables, same devices, …
- Hardware independent workflow: first program –
  then select device

SafetyNET p®
Be safe about your automation

PSS 4000 uses Ethernet

- Flexibility, long distances, fiber optics, fast transmission rates
- Using existing ETH-infrastructure, coexistence with other protocols

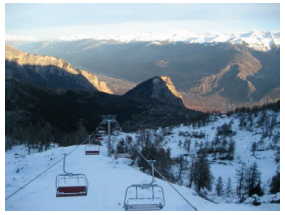
PSS 4000 – A Wide Range of Applications







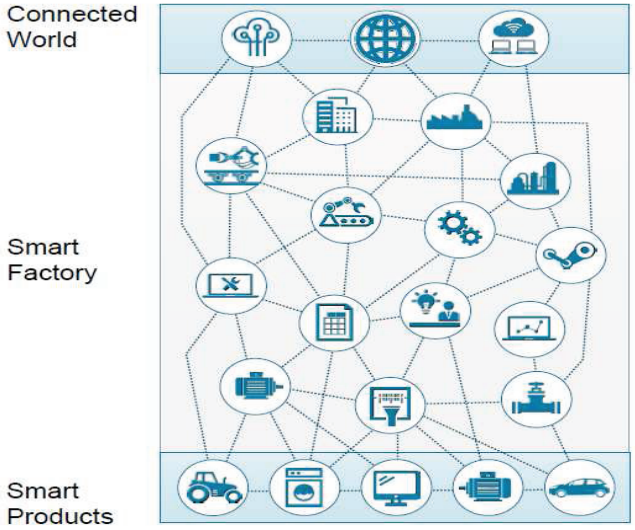



- In most of the PSS 4000 applications above, the PSS3000 controllers were used before

- Pilz
- Safety
- Functional Safety Principles
- Fail-safe PLC PSS3000
- Synchrotron application
- PSS 4000
- Industrie 4.0

Industrie 4.0
Smart Manufacturing



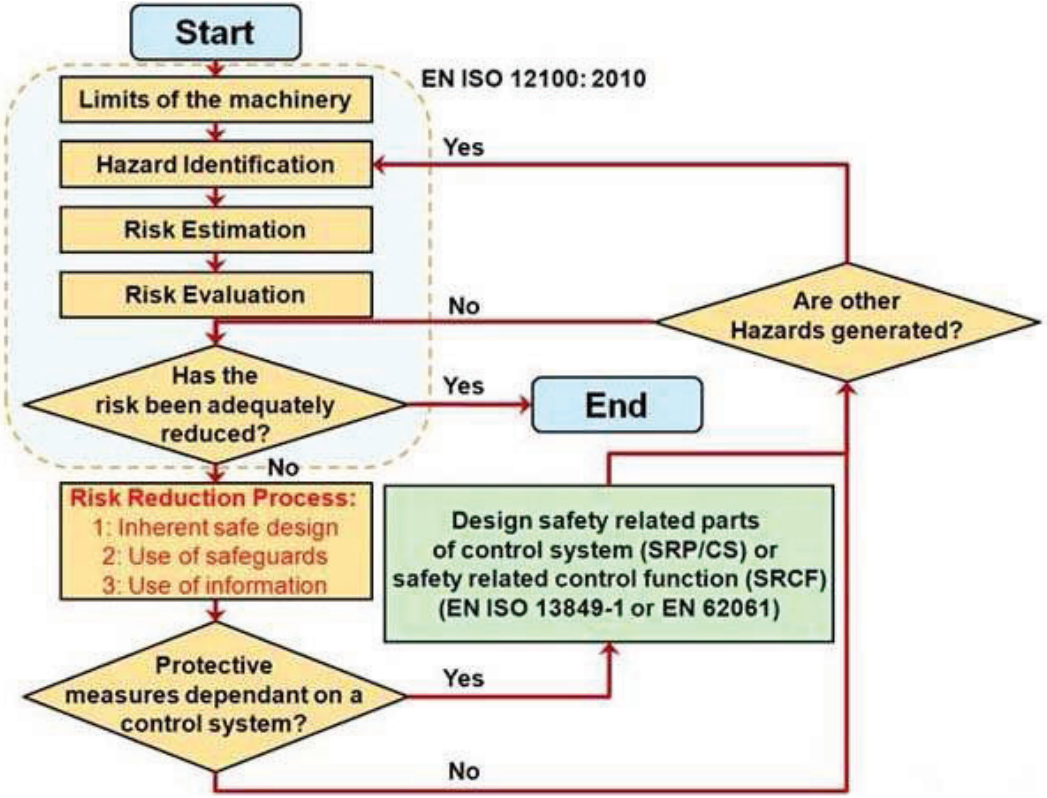
Source: Plattform Industrie 4.0, Anna Salari

- Products have all the information concerning their production
- Production processes are decided on the basis of the current situation
- Production facilities are largely networked

As a consequence

- we will see highly networked structures with a large number of IT systems, machines, automation devices and people
- the need for communication increases
- safety and security “become critical success factor” for Industrie 4.0

Industrie 4.0
New Tasks – Dynamic Configuration within Runtime



Graphic: Machinery Safety Alliance
Found on: http://www.machinery-safety-alliance.co.uk/News/ViewNews.aspx?eID=Safe_machine_design_starts_with_Risk_Assessment

Industrie 4.0
New Tasks – Human Robot Collaboration

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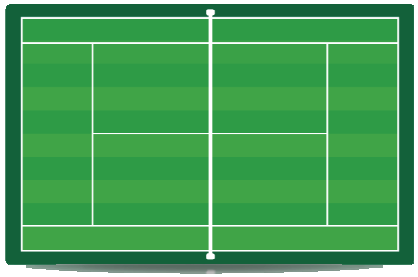
To date:
Clear Separation



Example: Human-robot **cooperation**

- Operating range
- Guard

Tomorrow:
Interaction

Example: Human-robot **collaboration**

- Working "hand in hand"

Industrie 4.0
New Task – Value of Data

Products

Data

We want our customers to

- benefit from Industry 4.0 in their company
- use the value of their machine/plant data profitably
- be able to access data, software and resources more flexible

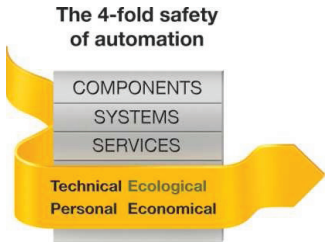
Summery

PILZ
THE SPIRIT OF SAFETY

Keep in Mind

Safety First

Please visit us on our booth



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