New PETRA III Concept

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- **Weak points of our „old“ control system**
- **Our concept**
  - **The hardware**
    - **building groups**
    - **building modules**
    - **using software modules**
  - **The interlock**
    - **software interlock**
    - **hardwired interlock**
- **outlook**

Weak points of our „old“ control system

- lots of cables
- Documentation of cables & electronics is bad or not „Up to date“
- many different components
- interlock and control electronic is hardwired (inflexibility)
- only simple interlock-logic (difficult to build „machine-dependent “ interlock)
- multiplicity of on signal (analog signal distribution causes calibration errors)
- not every signal is archived
- external Transient recorder (need to be plugged, usually not enough channels)
- PLC needs special modules for special sensors (PT100, analog in, analog out, Stepper motor) and can‘t acquire fast ADC- signals
- Expert- knowledge for troubleshooting & repair is needed

The new concept

Expert knowledge

Many people can repair a Computer without knowing something about electronics or IT.

They change components.

Wouldn’t it be nice to have this at a transmitter too ???

The new concept

Difference between PC and Transmitter:

Transmitter is complex

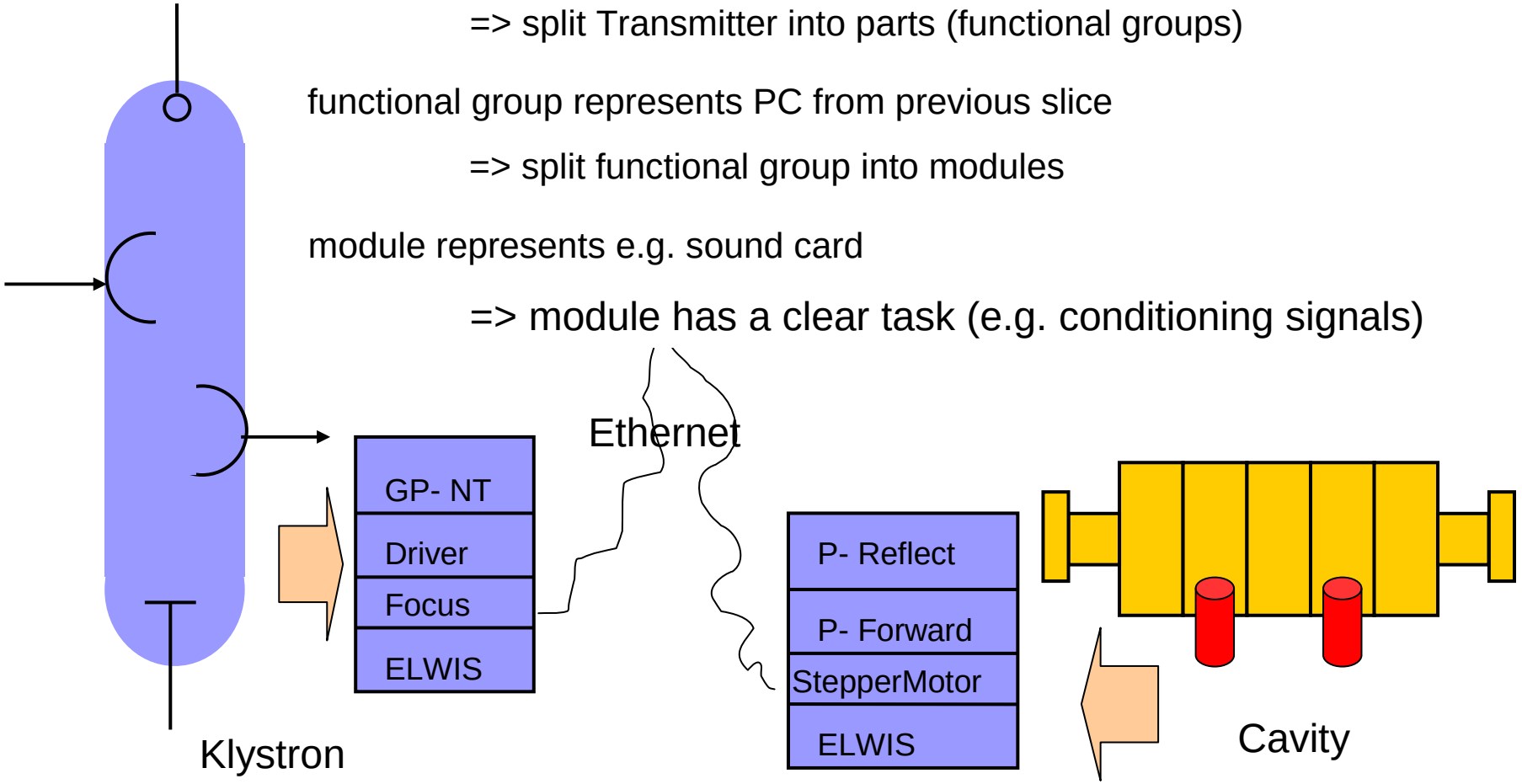
=> split Transmitter into parts (functional groups)

functional group represents PC from previous slice

=> split functional group into modules

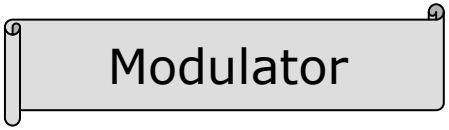
module represents e.g. sound card

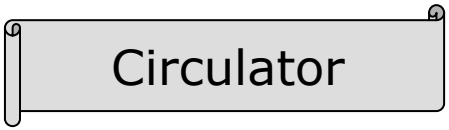
=> module has a clear task (e.g. conditioning signals)



The new concept

- Functional groups





- a functional group fits in one rack
- main cabling is done within one functional group
- no cables are longer than 3 to 4 m
- You can follow a cable by „hand"
- cabling between the groups are reduced to 5 to 6 cables

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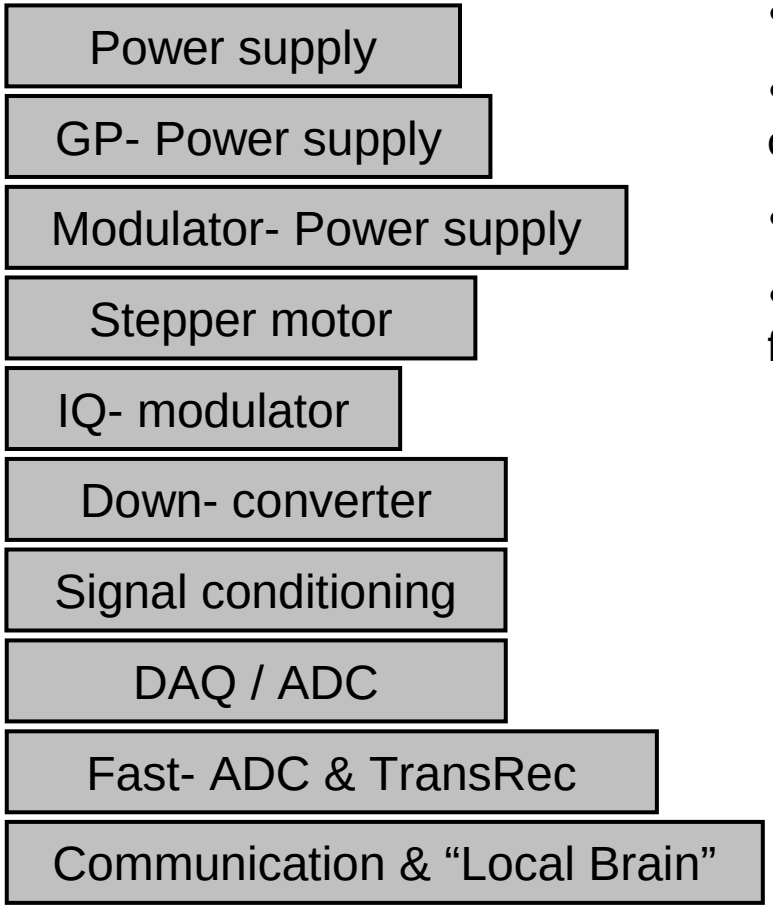
The new concept

- Moduls



- each module has clear task
- specific Interface (e.g. serial) is converted to analog/digital in’s/out’s
- simple repair, by plug & try
- some modules are used in every functional group

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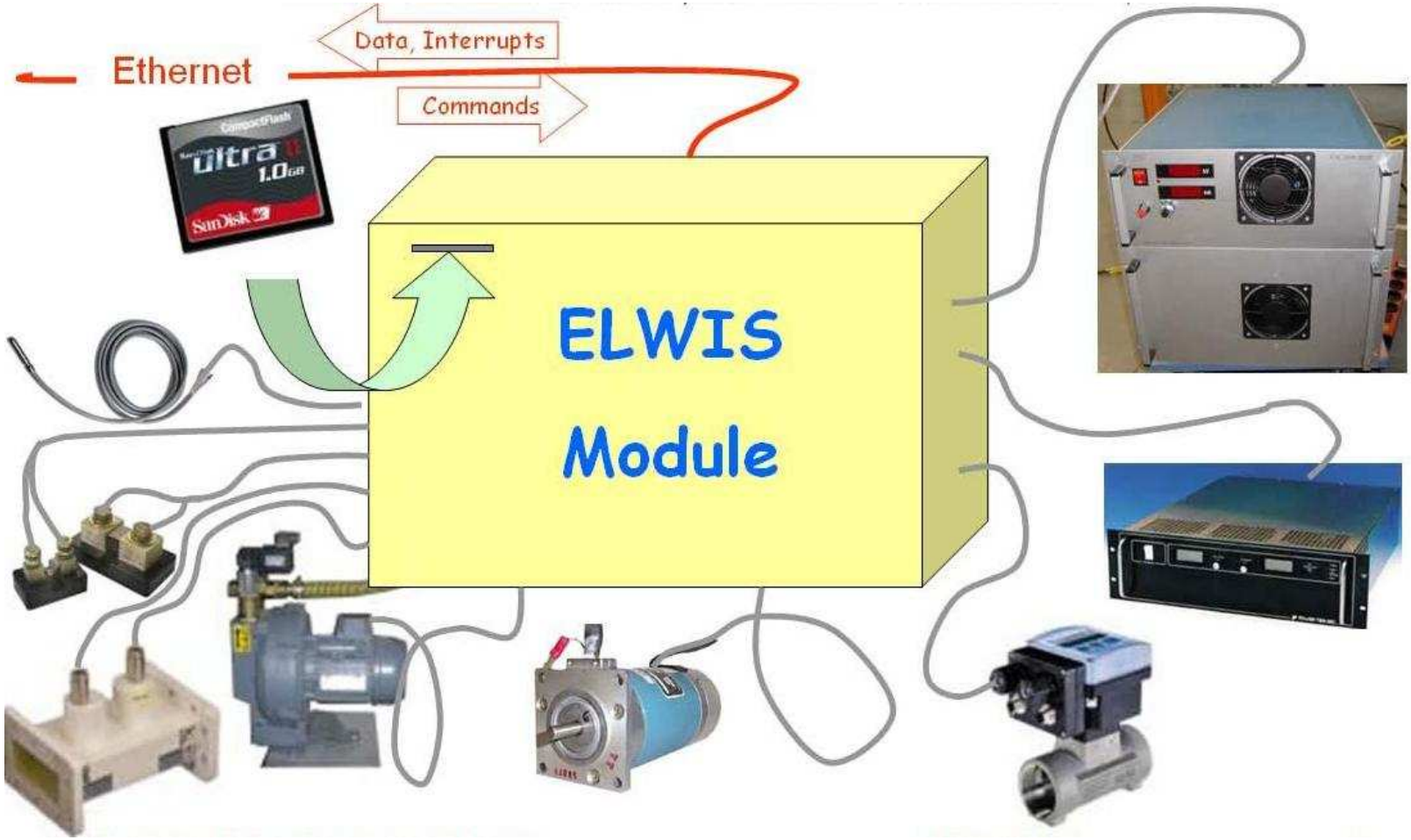
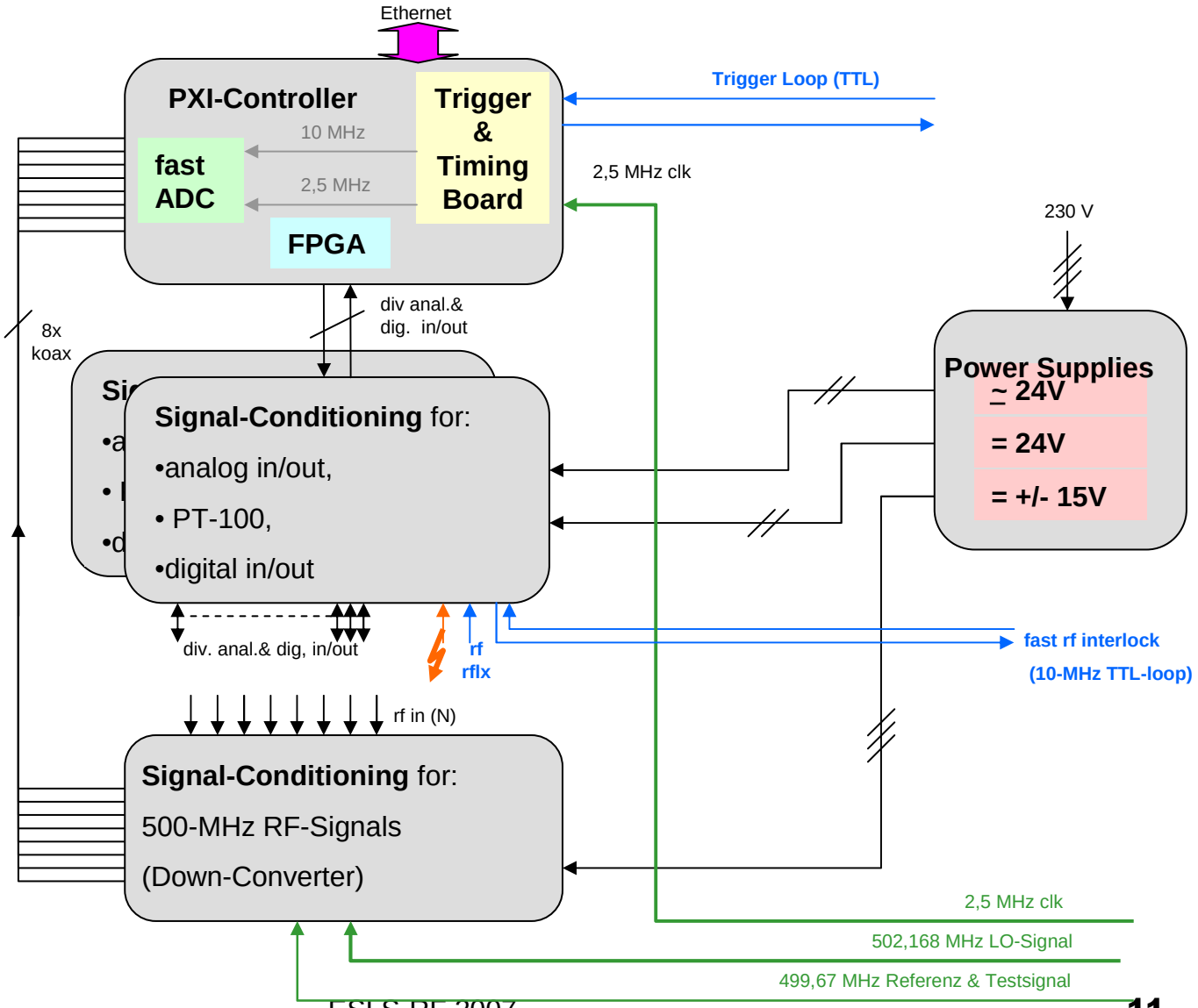


ELWIS- modules can monitor and drive all kind of inputs / outputs incl. Rf- or fast DC- signals

The new concept

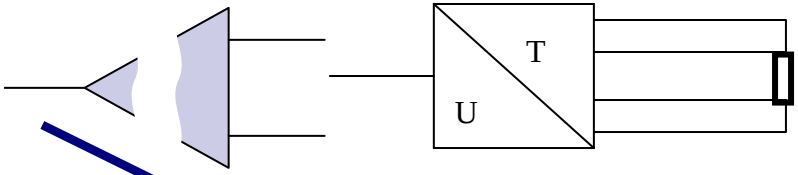
These components are in more or less every functional group



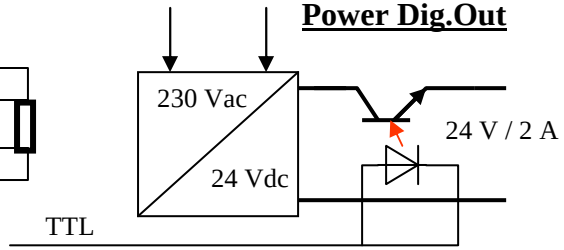
the new concept

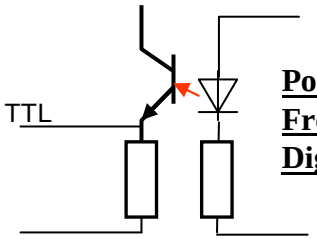
Isolation Amplifier

PT 100 Converter



Potential Free Power Dig.Out





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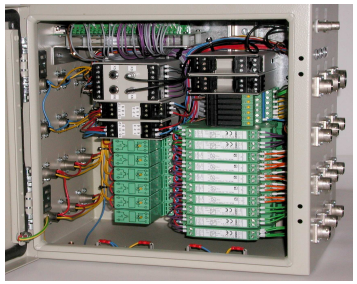
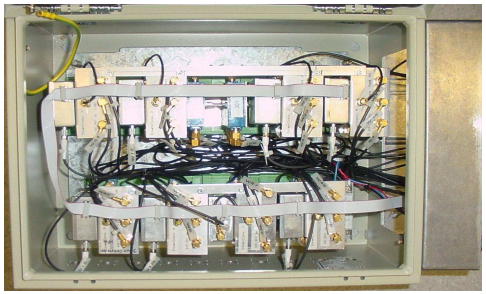
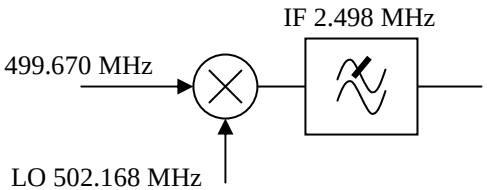
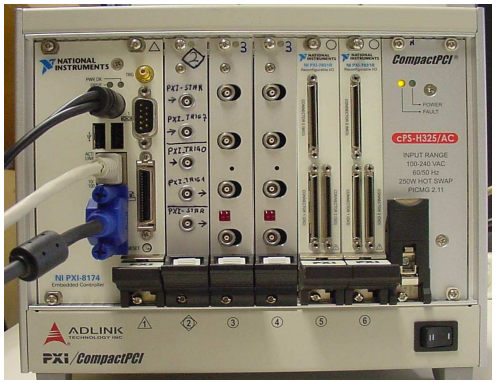


Conditioning- box

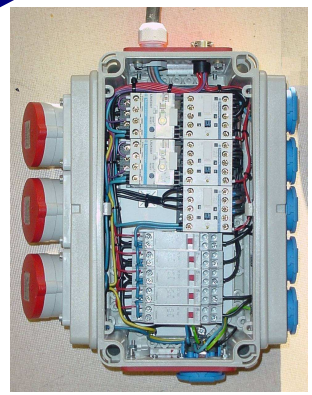


Down Converter

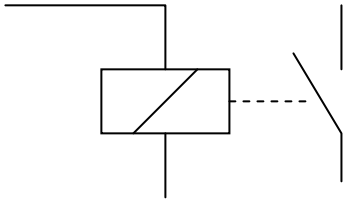




Local ADC & DAQ and CPU



Power Contactor



The new concept

ELWIS modules

• Monitoring and acting all kind of inputs / outputs incl. Rf- or fast DC- signals with one set of modules

• one signal is only once converted and can be distributed anywhere

• signal is in the network and is archived

• every fast signals are additional “transient recorded”

• Same signal for interlock, monitoring and Transientrecorder (same calibration)

• The software for acquiring and interlocking is the same in every functional group (**building software modules**)

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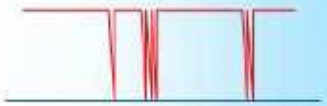
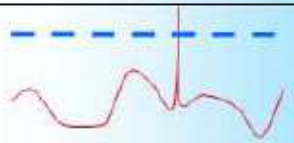
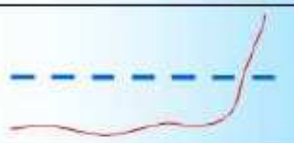
The new concept

Interlocking:

- Main interlocking by software
- - and via Ethernet
- flexible programming possible

Smart Signal Processing

some examples

 Contact flicker	must not switch off
 Clear change logical of state.	must switch off
 Spikes	must not switch off
 Clear threshold exceedance	must switch off
 Signal drift	must not switch off

Combination of Interlock Conditions

Klystron Crowbar System:
3 sensors instead of one
at least 2 of 3 have to detect an overcurrent

RF Load Interlock:
ΔT AND rf-power must exceed the threshold

not OR!

Klystron Focus Interlock:
supply current AND supply voltage must fail

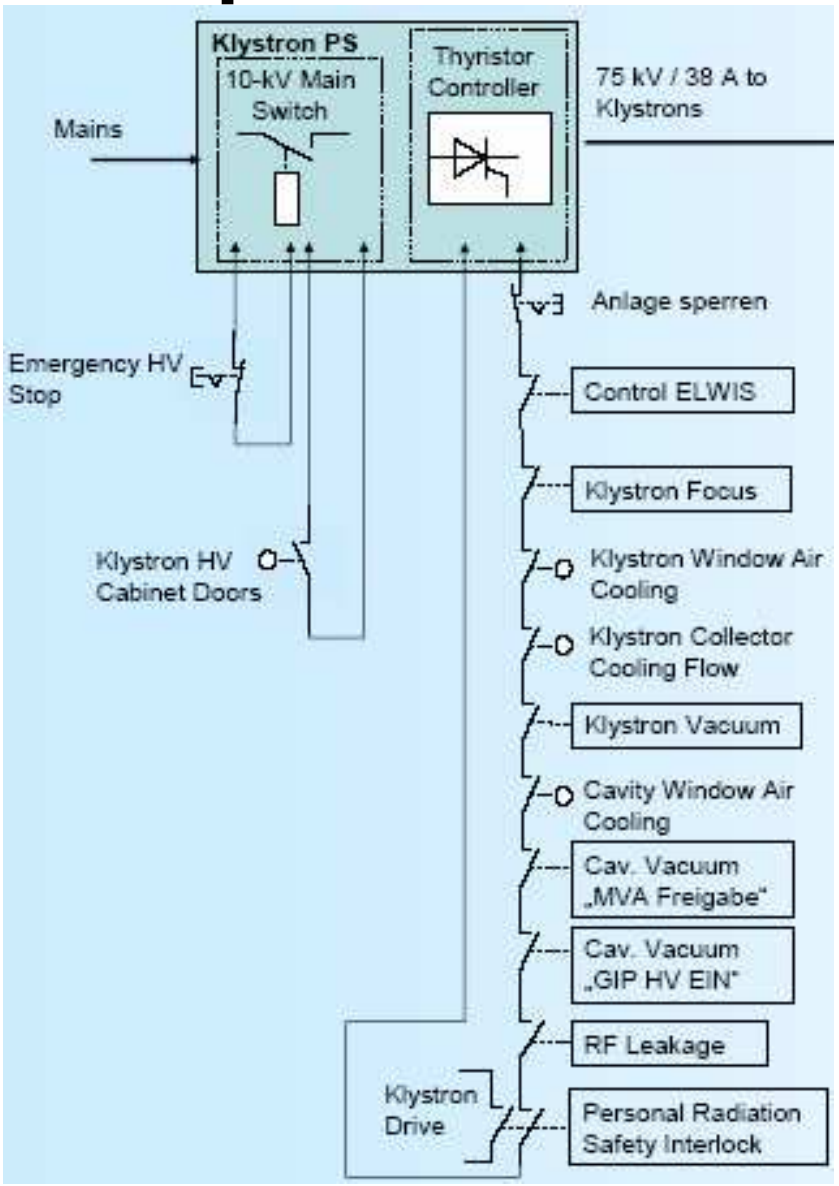
not OR!

The new concept

But:

Essential interlocks are hardwired

(never trust software !?!)



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Outlook

- most functional groups are (more or less) programmed
- basic software modules are identical in each group
- software interlock tested, but response time is about 0.5 s
- cavity self calibration (Phase & symmetry) is possible

- intermediate communication has to be programmed / tested
- goal is a power on test for the whole transmitter and a “on demand” self calibration