

- Overview
- PLC hardware
- Standard documents
- Linac PLCs
 - Vacuum
 - Magnet
 - Water
 - Personal Safety System (PSS)

Jonas Lindkvist
representing
The automation group

FOJAB arkitekter SNØHETTA

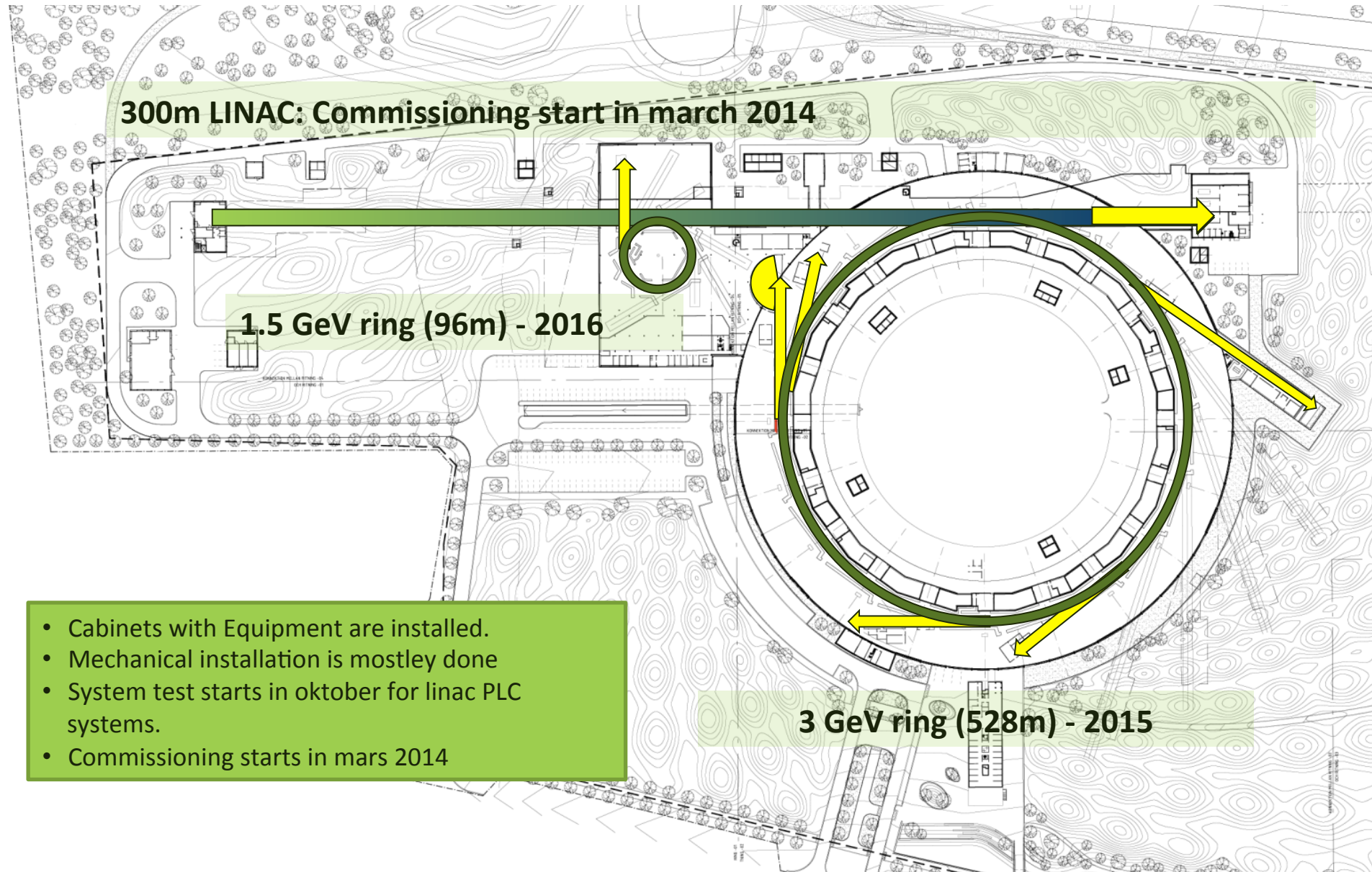
MAX IV – Overview

300m LINAC: Commissioning start in march 2014

1.5 GeV ring (96m) - 2016

3 GeV ring (528m) - 2015

- Cabinets with Equipment are installed.
- Mechanical installation is mostly done
- System test starts in oktober for linac PLC systems.
- Commissioning starts in mars 2014



PLC Hardware Rockwell

- AB, 1756 ControlLogix
- 1756-en2t Ethernet card



- Best price and performance in Procurement
- In house Knowledge
- Support from supplier
- Easy to configure HW and SW develop

Safety PLC and partner

- Safety partner **1756-L7SP**



- To reach safety level SIL3
- Same software tool for the safetyprogram

Distributed I/O

- Ethernet Adapter, 1734-AENT
- Point I/O



- Ethernet Adapter, 1734-AENT
- Safety Point I/O



- Ethernet communication bus
- Machine protection and for PSS
- Easy to install and configure,
- Lot of card options,
- Little space in cabinet
- Long term production,

Point I/O Combination



- Combination with regular and safe IO

Standard for software development

- Naming-convention(unique shortname)
 - System, Location, Subsystem, Type
 - I_K01CAB02_VAC_IPCUA01
- Naming-standard for TAGs
 - IS_I_K01JB05_PSS_SES_NC

IS, means that there is a physical safety rated input
I, indicates that the signal belongs Injection System
K01JB05, specify location by merging location K01 and
group affiliation JB05
PSS, indicates the subsystem
SES, indicates the type of equipment
NC, indicates the signal type

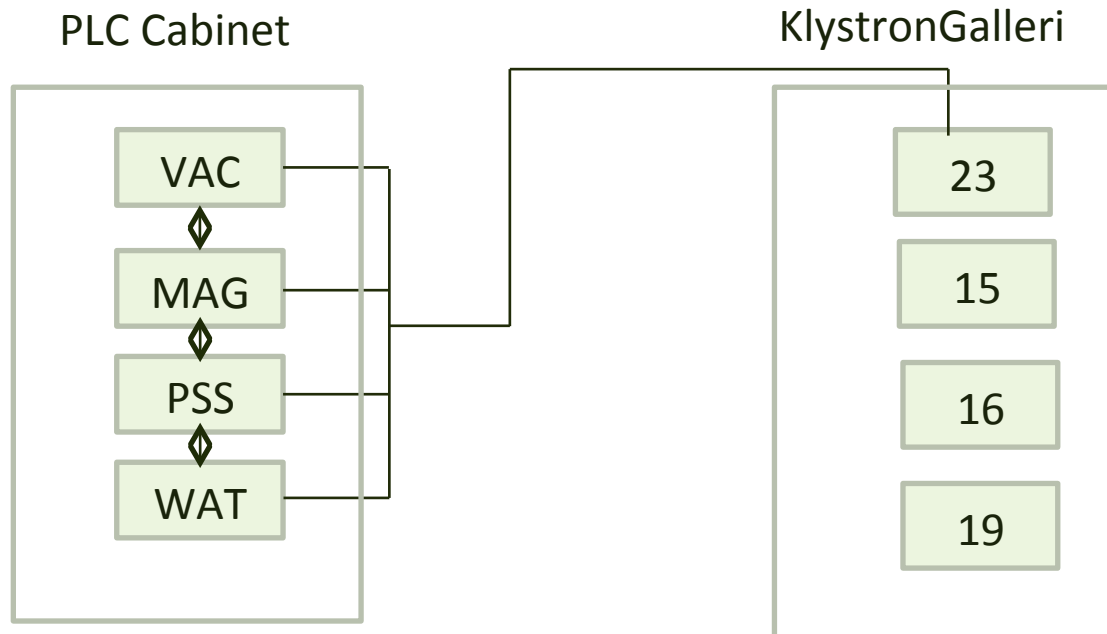
Communication between the PLCs and TANGO

- Tango

- B_xx_A alarms
- B_xx_C command
- N_xx_R read
- N_xx_W write
- N_xx_S state

- B_VGMB01_C valve command

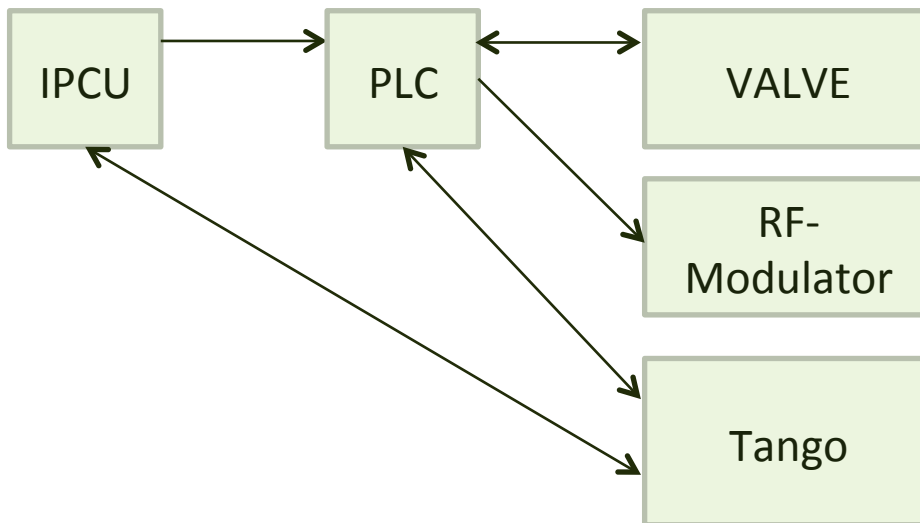
PLC System in Linac



- Four separate controllers
- Will be Placed together in a PLC cabinet.
- Distributed IO over ethernet, adapter

Vacuum plc system

- Normally open contact in the IPCU input
- Valve
- Modulator



PLC system for Max IV

The screenshot displays the RSLogix 5000 software interface. The title bar indicates the project is 'RSLogix 5000 - A00 in I_VACCUM_130822.ACD [1756-L74 19.11] - [K01 - IP_interlock]'. The main workspace shows a ladder logic diagram for 'Rung 17 of 19'. The diagram consists of two rungs:

- Rung 0:** A normally open contact labeled 'interlock signal IP1' with address 'I_I_K01CAB02_VAC_IP1_NO' and '<I_K01_CAB02_CTL_K00:I.Data[1].0>' is connected to a coil labeled 'B_K01_IPCU1_Interlock_A'.
- Rung 1:** A normally open contact labeled 'Reset' with address '<I_K01_CAB02_CTL_K00:I.Data[1].0>' is connected to a coil labeled 'B_K01_IPCU1_Interlock_A'. A normally open contact labeled 'B_Bypass_K01_IPCU1_Interlock' is connected in parallel with the Reset contact.

The Controller Organizer on the left shows a tree structure with 'MainTask' containing 'MainProgram' and 'K01'. Under 'K01', there are 'Program Tags', 'K01Main', 'IP_interlock', 'Modulator_Interlock', and 'VGMB01'. The bottom status bar shows 'Rung 17 of 19' and 'APP VER'.

RSLogix 5000 - A00 in I_VACCU... [1756-L74 19.11] - [K01 - IP_interlock]

File Edit View Search Logic Communications Tools Window Help

Reset_K03

Offline RUN OK Energy Storage I/O

Path: <none>

Controller Organizer

- Controller Tags
- Controller Fault Handler
- Power-Up Handler
- Tasks
 - MainTask
 - MainProgram
 - K01
 - Program Tags
 - K01Main
 - IP_interlock
 - Modulator_Interlock
 - VGMB01
 - K02
 - K03
 - Unscheduled Programs / Phase
 - Motion Groups
 - Ungrouped Axes
 - Add-On Instructions
 - Data Types
 - Trends
 - I/O Configuration
 - 1756 Backplane, 1756-A4
 - [0] 1756-L74 A00
 - [1] 1756-EN2T PLC_kort

eg poor vacuum K01
B_IPCU_Interlock_K01

18

B_K01_IPCU1_Interlock_A

B_K01_IPCU2_Interlock_A

B_K01_IPCU3_Interlock_A

B_K01_IPCU4_Interlock_A

B_K01_IPCU5_Interlock_A

B_K01_IPCU6_Interlock_A

B_K01_IPCU7_Interlock_A

B_K01_IPCU8_Interlock_A

B_K01_IPCU9_Interlock_A

VGMB01 IP_interlo... Modulator... K02Main K03Main IP_interlo... Modulator... VGMB01 Modulator... IP_interlo... VGMB01 K01Main Main

Add Branch Rung 17 of 19 APP VER

PLC system for Max IV

The screenshot displays the RSLogix 5000 software interface for a PLC system. The main window shows a ladder logic program with the following rungs:

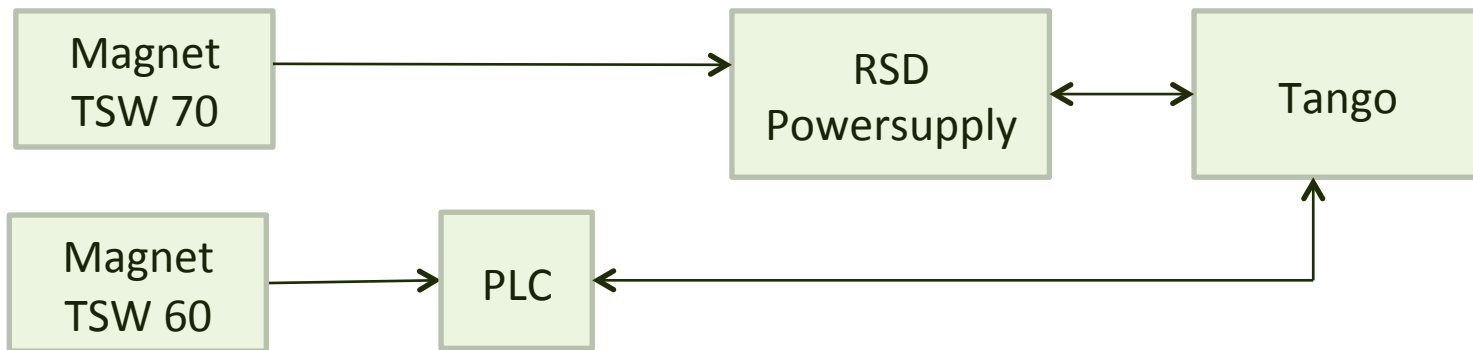
- Rung 0:** A normally open contact labeled "Interlock active K01 eg poor vacuum K01" (B_IPCU_Interlock_K01) is connected to a coil for "Open VGMC01". The coil output is O_L00_VAC_VGMC01_Q, with a comment: "Open VGMC01 O_L00_VAC_VGMC01_Q <I_K00_CAB02_CTL_K00:0.Data[0]>".
- Rung 1:** A normally open contact labeled "If all IPCU interlock is 'open' in section K01, Close valves in SEC 00 to 03" is connected to a coil for "Command VGMB01". The coil output is O_I01_VAC_VGMB01_Q, with a comment: "Command VGMB01 O_I01_VAC_VGMB01_Q <I_K01_CAB02_CTL_K00:0.Data[3]>".
- Rung 2:** A normally open contact labeled "Command VGMB01" is connected to a coil for "Open VGMB". The coil output is O_I03_VAC_VGMB01_Q, with a comment: "Command VGMB O_I03_VAC_VGMB01_Q <I_K03_CAB02_CTL_K00:0.Data[3]>".
- Rung 3:** A normally open contact labeled "If all IPCU interlock is good in section K00 to K05, Open enable is set" is connected to a coil for "valve_Open". The coil output is O_I01_VAC_VGMB01_Q, with a comment: "valve_Open O_I01_VAC_VGMB01_Q <I_K01_CAB02_CTL_K00:0.Data[2]>".
- Rung 4:** A normally open contact labeled "valve_Open" is connected to a coil for "Open/ close the valve after command from Tango". The coil output is O_I01_VAC_VGMB01_Q, with a comment: "Open/ close the valve after command from Tango O_I01_VAC_VGMB01_Q <I_K01_CAB02_CTL_K00:0.Data[3]>".

The software interface includes a Controller Organizer on the left, a menu bar at the top, and a status bar at the bottom showing "Rung 0 of 3" and "APP | VER |".



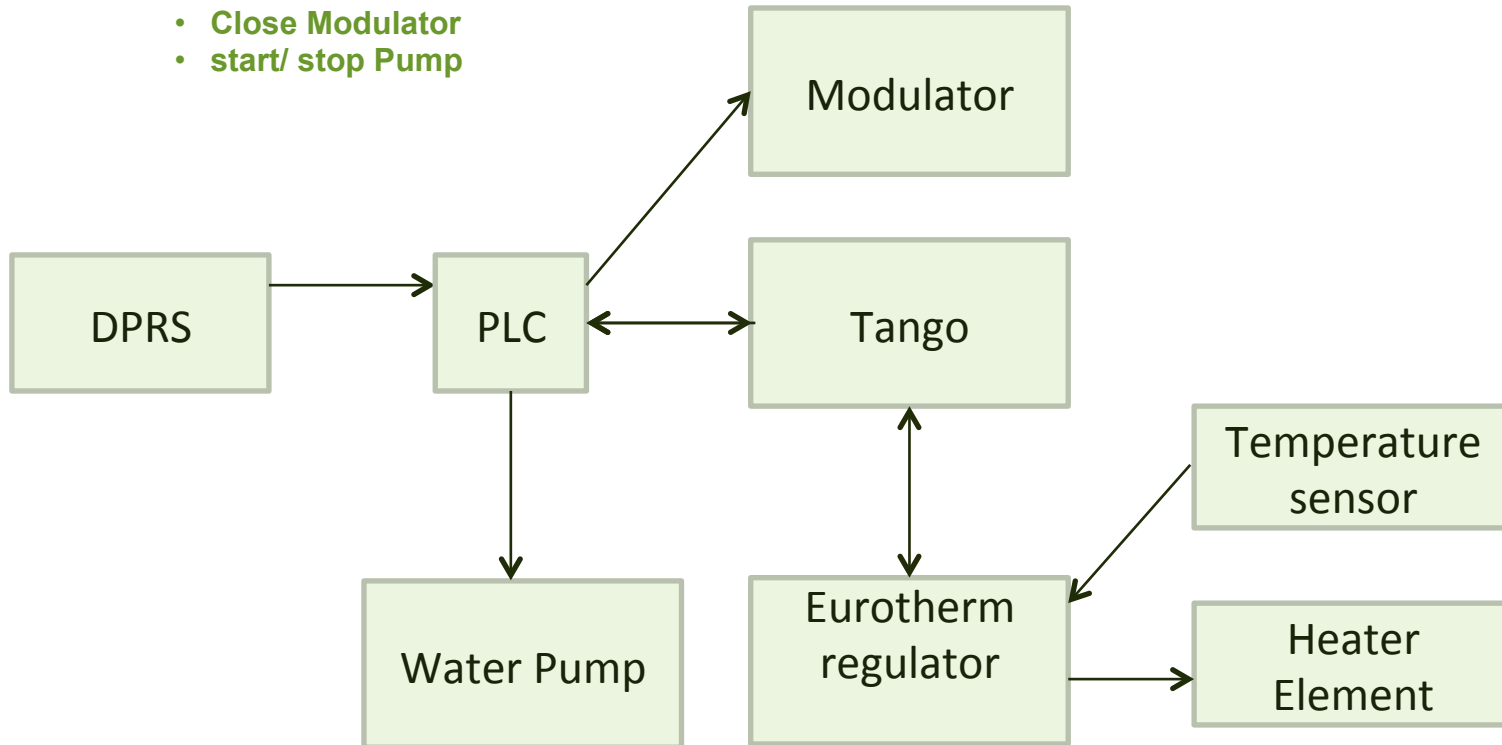
Magnet PLC system

- Normally open contact TSW
- SET value to zero from TANGO at 60 °C
- Close PS RSD from PLC at 70 °C



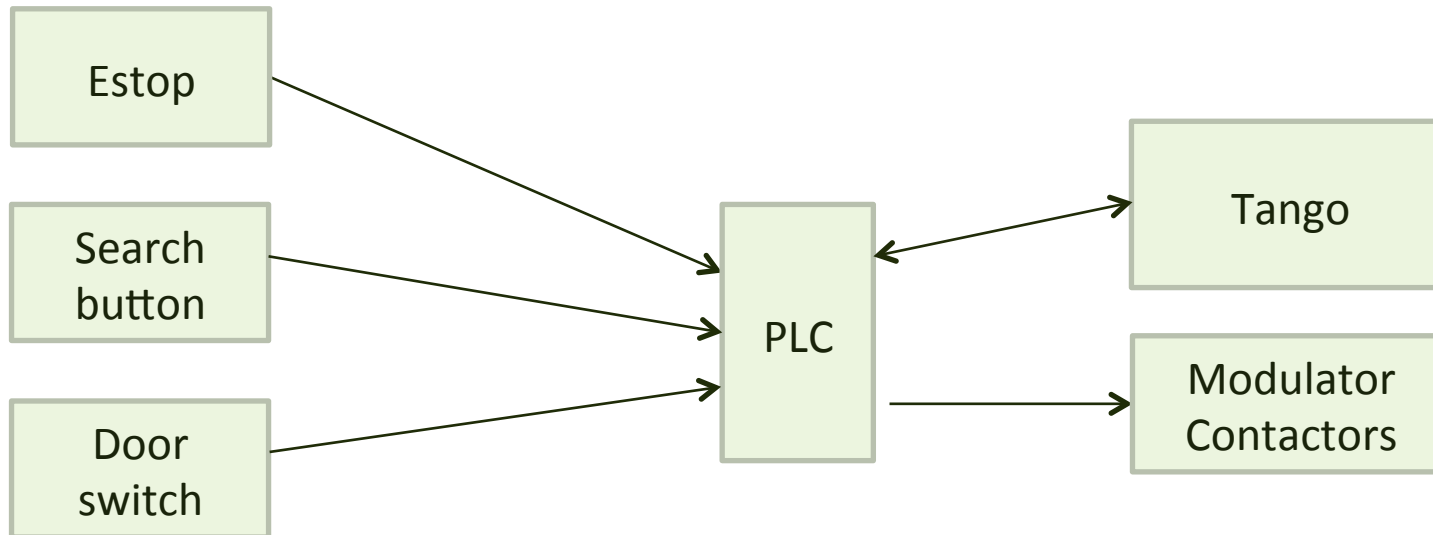
Water PLC system

- Pressure sensor DPRS AI 0-10 V
- Close Modulator
- start/ stop Pump



PSS plc system

- SafeInput
- SafeOutput
- No safety output for indication lights and audiosignal



PLC system for Max IV

Thanks for
listening