

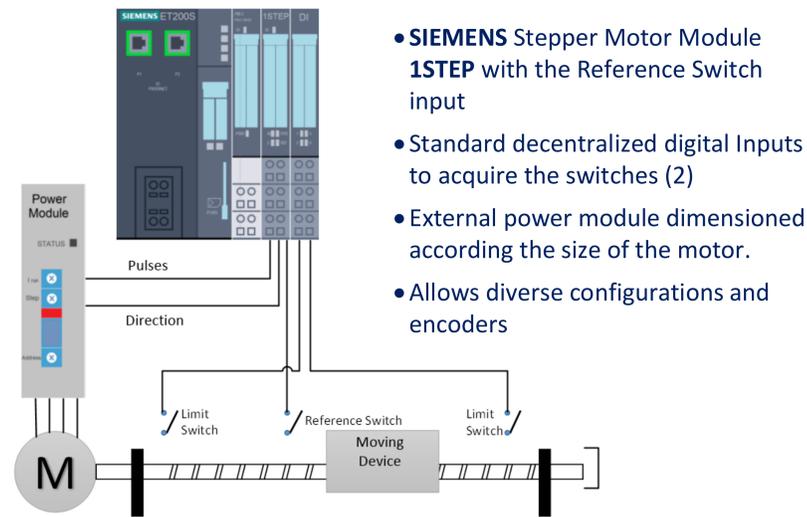
## MOTIVATION

- Legacy installations running non-standardized control applications.
- Support needed high level of expertise.
- Reduced functionalities and flexibility.
- Creation of new projects was a laborious process.

## OBJECTIVES

- Projects standardization
- Flexibility to support distinct configurations and architectures
- Ease diagnostics and maintenance
- Reduce engineering time and domain expertise

## HARDWARE SCHEME



- SIEMENS Stepper Motor Module 1STEP with the Reference Switch input
- Standard decentralized digital Inputs to acquire the switches (2)
- External power module dimensioned according the size of the motor.
- Allows diverse configurations and encoders

## UNICOS-CPC FRAMEWORK INTEGRATION

### STEPPING MOTOR DEVICE TYPE DESIGN

Name	Description	Remarks	Switches Configuration	Feedback	Manual Restart after Full Stop
CP_S14017_A	Position control for CP S1407 collimator	No End Switches.	Encoder	FALSE	
CP_S14017_P	Aperture control for CP S1407 collimator	No End Switches.	Encoder	FALSE	
CL_S14045_P	Position control for CL S45 Collimator	No End Switches.	Encoder	FALSE	
CL_S14045_A	Aperture control for CL S45 collimator	No End Switches.	Encoder	FALSE	
OK_M514_ATT	Attenuation Control for M514	No End Switches.	Encoder	FALSE	

### CONTROL SYSTEM DESIGN

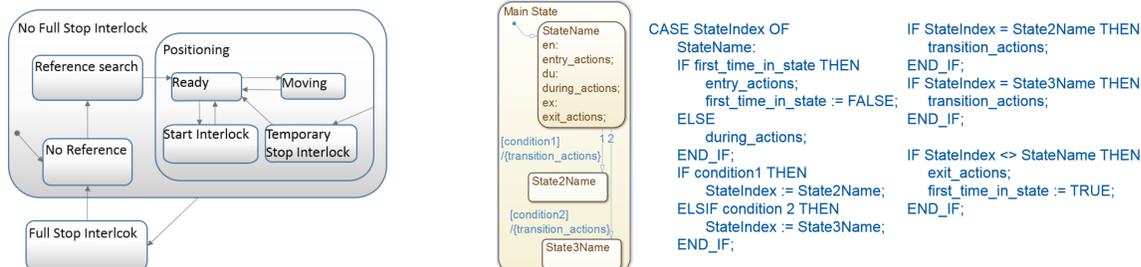
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Motor Instantiation
DATA_BLOCK Motor01 CPC_FB_STPMOT
BEGIN
    PSTPMOT_ParReg := #2#0000010001000000;
    PSTPMOT_PrefPos := 0.0;
    PSTPMOT_PMinRan := 0.0;
    PSTPMOT_PMaxRan := 100.0;
    PSTPMOT_PosCa := 500.0;
    PSTPMOT_PosFac := 0.0;
    PSTPMOT_PMaxSpd := 27;
    PSTPMOT_PMDc := 785.0;
    PSTPMOT_PWdc := 0.1;
    PSTPMOT_PDDT := 0.5;
END_BLOCK

Device Logic
IF SM_SL_HORIZONTAL.OpMode = 1 THEN
    IF SM_SL_LEFT.OpMode THEN
        SM_SL_LEFT.AuPosR := DB_AS_ALL_AS_SET.SM_SL_LEFT_Pos.PosSt;
    ELSE
        SM_SL_LEFT.AuPosR := SM_SL_LEFT.PosSt;
    END_IF;
IF SM_SL_RIGHT.OpMode THEN
    SM_SL_RIGHT.AuPosR := DB_AS_ALL_AS_SET.SM_SL_RIGHT_Pos.PosSt;
ELSE
    SM_SL_RIGHT.AuPosR := SM_SL_RIGHT.PosSt;
END_IF;
SM_SL_LEFT.AuRefZR := FALSE;
SM_SL_RIGHT.AuRefZR := FALSE;
ELSIF SM_SL_HORIZONTAL.OpMode = 2 THEN
    SM_SL_LEFT.AuRefZR := TRUE;
    SM_SL_RIGHT.AuRefZR := TRUE;
END_IF;
SCADA Importation
Object: SteppingMotor
Binding Line: CPC_SteppingMotor;deviceNumber:Alias[.DeviceLinkList];Description: CPC_SteppingMotor;SM_SL_UP_SM_SL_VERTICAL;Stepping motor vertical slit upper; CPC_SteppingMotor;SM_SL_DOWN_SM_SL_VERTICAL;Stepping motor vertical slit lower; CPC_SteppingMotor;SM_SL_RIGHT_SM_SL_HORIZONTAL;Stepping motor horizontal slit = CPC_SteppingMotor;SM_SL_LEFT_SM_SL_HORIZONTAL;Stepping motor horizontal slit le CPC_SteppingMotor;SM_SL_FRONT;Stepping motor positioning front;EuroClCol3 CPC_SteppingMotor;SM_SL_BACK;Stepping motor positioning back;EuroClCol1;
    
```

## MODEL-BASED DESIGN

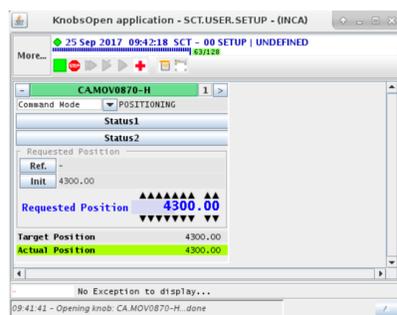
- Program code designed based on state machines
- Models help to have a clear program structure



## USE CASES

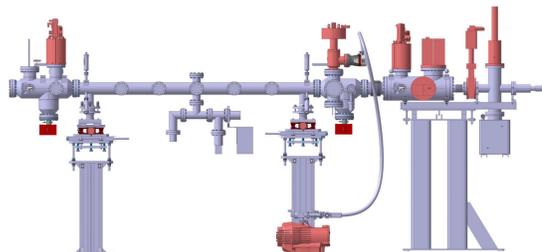
### CTF3

- **Hardware:** eight motors running in the CTF3 Complex.
- **Operated** with "Knobs" with the experiment control system (through FESA based application)
- Different installations with diverse wiring, controllers and encoders.



### ANKA

- **Hardware:** six stepping motors running in the ANKA experiment.
- **Operated** directly using the WinCC OA SCADA provided by UNICOS
- **Integrated** with the vacuum control system using the UNICOS -CPC Vacuum package.



Model of the ANKA SET UP by Miguel Gil Costa. CERN, Geneva, Switzerland.



## OUTCOME

### STANDARDIZATION

- Extended the functionality of the UNICOS-CPC framework: motion with stepping motors.

### DEVELOPMENT

- Reduced the time of developing and deploying motion projects.  
- Flexibility with different architectures and configurations.

### SUPPORT

- Optimized support to installations using standard solutions with already existing diagnostic tools.