Elettra Sincrotrone Trieste

The ESS WS acquisition system project

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Trieste, 13th December 2016

ESS WS Acquisition System Project Goals

Work Breakdown Structure ID: 11.7.7.1

The ESS wire scanner acquisition system project includes:

- Design and implementation of SEM section
- Design and implementation of SCINT section

- to operate the WS ICS infrastructure: set of μTCA based diagnostics stations
- to integrate the above into the ESS ICS by means of:
  - Control panels
  - Engineering panels
  - Profile Computation Code

- to interface to the ESS Machine Protection System

ESS WS Acquisition System: overview of ST IKC

The ST IKC to the ESS WS Acquisition System includes:

- **AFE+BE** for SEM signal acquisition ***Raffaele***
- **OFE+BE** for SCINT signal acquisition ***Sandi*** & ***Raffaele***
- **CABLING** layout ***Sandi***
  - interface to the ESS Machine Safety System
- **INTEGRATION** into ICS ***Stefano***
  - *Synchronous & Safe* operation of Acquisition and Motion
  - Beam profile computation algorithm
  - Engineering control panel
  - Operator Control Panel

ESS WS Acquisition System Project phases

The ESS WS Acq. System ST IK Project phases are:

	due date
1a PRELIMINARY DESIGN *TRR full system test plan for prototype testing at ST and at Partner lab.*	**PDR1&2, DEC 16** **JAN17**
1b DETAILED DESIGN *construction*	**CDR1&2, JUN17**
2 REALIZATION & VERIFICATION	**SAR1, JAN 18** **SAR2, JAN 19**
3 INSTALLATION	**MAR 18 to SEP19**

ESS WS Acquisition System PRELIMINARY DESIGN

Most part of preliminary design is completed:

- AFE prototype ……..…… done
- BE prototype ……..... done
- OFE prototype ……. done
- **General** cabling layout…….... defined
- **General** Interfaces with mechanics …… defined
- Control software **architecture** …….. defined
- Computation **algorithm** ……. defined

In order to complete the ***preliminary design***, we need:

- WS mech. with on-board items part numbers (motor, encoder, switch)
- motion controller part number, with connectors and pin out
- interface to ESS Machine Safety (PLCs)

ESS WS Acquisition System DETAILED DESIGN

Detailed design has started, as per following list:

- AFE prototype ……..…… under test
- BE prototype ……..... under test
- OFE prototype ……. under test
- Cabling layout……..... **hold**
- Interfaces ……..... **hold**
- Control software development …… **hold**
- Computation algorithm …….. started

In order to **complete** the **HOLDING tasks**, we need (urgently):

- **development system** @ ST (u-TCA system and Timing system)
- support from ICS
- final **ADC u-TCA** board
- **motion controller**, as per machine on-board set-up
- complete WS mechanics including one working prototype
- PLC (if any)

ESS WS Acquisition System TESTING as part of DETAILED DESIGN

Testing of all deliverable prototype is required before completion of DETAILED DESIGN i.e. **before CDR**; CDR unlocks REALIZATION

Testing has to be carried out on **all WS ACQ system deliverables**:

- hardware modules, developed at ST
- ICS integration of HW modules, mechanics and COTS

Testing is carried out in **two main steps**:

- **in-house** at ST, relying on ESS deliveries (ICS + mech.)
- **at partner laboratory,** running a full prototype system to have **access at signals from wires**

Testing **critical issues** include:

- **Low intensity signal** detection in real accelerator environment
- Interfacing to the **WS mechanics**
- **Synchronous operation** of ADC and wire motion
- Beam profile **reconstruction algorithm**
- **Safety & interlock** features of WS system

ESS WS Acq. System Project schedule & milestones (ESS-0044053_2016.09.22)

4	WBS 11.7.7	PDR-2 - Full system Scintillation system	Dec. 2016	Partner	Partner or ESS ERIC	Preliminary design of full Scintilla-tion system	12.5%
5	WBS 11.7.7	TRR - Test Readiness Review	January 2017	Partner	TBD	Prototype ready in SEM mode (mech + FE+ADC+Soft). TRR (describes the full system test plan for the WS prototype	0%
6	WBS 11.7.7	Test at Part-ner Lab	May 2017	ESS ERIC	LNS Cata-nia	SEM AFE Proto-type test on a real WS	0%
7.1	WBS 11.7.7	CDR-1 - Full system SEM (ICS+AD)	June 2017	Partner	Partner or ESS ERIC	Final design of the FE electronic for SEM readout	20%
7.2	WBS 11.7.7	CDR-2 - Full Scintillator system	June 2017	Partner	Partner or ESS ERIC	Final design of the Scintillator sys-tem. Six (6) to read and combine for the scintillator based WS	20%

ESS WS Acq. System Project schedule & milestones (ESS-0044053_2016.09.22)

8	WBS 11.7.7	Prototype test SEM (no beam)	March 2017	Partner	TBD	First prototype test SEM (no beam)	0%
9	WBS 11.7.7	Prototype test SEM (with beam)	June 2017	ESS ERIC	TBD	Second prototype test SEM (with beam)	10%
10	WBS 11.7.7	Scintillation mode test	Dec. 2017	ESS ERIC	TBD	Possible Scintilla-tion mode test (To be decided). A facility with a similar beam has to be found.	0%
11	WBS 11.7.7	SAR-1, SEM only	January 2018	Partner	ESS ERIC	SAR-1 ensures that all require-ments have been	10%

ESS WS Acquisition System Comments to the Schedule

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EUROPEAN SPALLATION SOURCE

1		**WSACQ**	**959 days?**	**Thu 01/10/15**	**Mon 03/06/19**		
2		Kick-off meeting	0 days	Thu 01/10/15	Thu 01/10/15		Technical scope agreed by both partners. Already done at E
3		ESS final specification for the scintillator	0 days	Fri 01/04/16	Fri 01/04/16		
4		WS ACQ SYS layout definition	198 days?	Thu 01/10/15	Thu 30/06/16		Including acronym cabling lay out
5		Design of SEM prototype	198 days?	Thu 01/10/15	Thu 30/06/16		Analog Front End module and Back End Module
6		SEM ICS integration preliminary design	132 days?	Fri 01/01/16	Thu 30/06/16		overview of SW
7		PDR-1 Full system SEM (ICS+AD)	0 days	Tue 28/06/16	Tue 28/06/16		Preliminary design of the FE electronic for SEM readout (ICS+AD)
8		Shipment of 1st ICS development station to ST	0 days	Wed 01/06/16	Wed 01/06/16		by ESS; VME crate with VME boards (milestone created by ST)
9		SEM ACQ SYS design	88 days?	Wed 01/06/16	Fri 30/09/16		AFE + BE
10		SEM board&module; prototype & characterization	87 days?	Thu 01/09/16	Fri 30/12/16		Fabricate & lab test (AFE+BE) prototype
11		Controls Detailed Design Document	0 days	Thu 01/09/16	Thu 01/09/16		Baseline WS local control system design document.
12		Control Acceptance Test Plan	0 days	Thu 01/09/16	Thu 01/09/16		Acceptance test plan document.
13		SEM prototype integration in ICS	153 days?	Wed 01/06/16	Fri 30/12/16	8	AFE + BE + ADC
14		SEM ICS engineering and interface panels	87 days?	Thu 01/09/16	Fri 30/12/16	8	AFE + BE + ADC + Ev receiver
15		SEM ICS computation SW	85 days?	Mon 02/01/17	Fri 28/04/17	8	AFE + BE + ADC + Ev receiver
16		SCINT detection protoype	87 days?	Thu 01/09/16	Fri 30/12/16		Optical Front End Module prototype + BE prototypes
17		SCINT ICS integration design	44 days?	Tue 01/11/16	Fri 30/12/16		OFE + BE + ADC
18		PDR- 2 - Full system SCINT	0 days	Mon 03/10/16	Mon 03/10/16		Preliminary design of the FE electronic for SCINT readout (ICS+AD)
19		Shipment of 1st ICS development station to ST	0 days	Mon 03/10/16	Mon 03/10/16		by ESS; VME crate with VME boards (milestone created by ST)
20		Delivery of final uTCA boards to ST	0 days	Thu 01/12/16	Thu 01/12/16		by ESS; uTCA boards SPECIFICATIONS and SAMPLES (milestone cr
21		CDR- 1 - Full system design SEM (ICS+AD)	0 days	Thu 01/12/16	Thu 01/12/16	20	no final design without uTCA boards SPECIFICATIONS
22		SCINT ACQ SYS design	42 days?	Mon 02/01/17	Tue 28/02/17		OFE + BE + ADC
23		SCINT ACQ SYS CDR Data package	43 days?	Wed 01/03/17	Fri 28/04/17		
24		SCINT PROTOTYPE characterization	130 days?	Mon 02/01/17	Fri 30/06/17		OFE + BE + ADC
25		SCINT prototype integration in ICS	195 days?	Mon 02/01/17	Fri 29/09/17	19	OFE + BE + ADC
26		Delivery of one mechanical WS assembly to ST	0 days	Wed 01/03/17	Wed 01/03/17		(milestone created by ST)...
27		SCINT ICS engineering and interface panels	195 days?	Mon 02/01/17	Fri 29/09/17	19	OFE + BE + ADC + E RECEIVER
28		SCINT computation SW	65 days?	Mon 03/04/17	Fri 30/06/17	19	OFE + BE + ADC + E RECEIVER...
29		CDR- 2 - Full system design (SCINT)	0 days?	Tue 02/05/17	Tue 02/05/17		
30		setup TRR data package	65 days?	Mon 03/10/16	Fri 30/12/16		
31		TRR -Test readiness for SEM prototype	0 days	Mon 02/01/17	Mon 02/01/17		Prototype ready in SEM mode (FE+ADC+Soft). TRR describes the f