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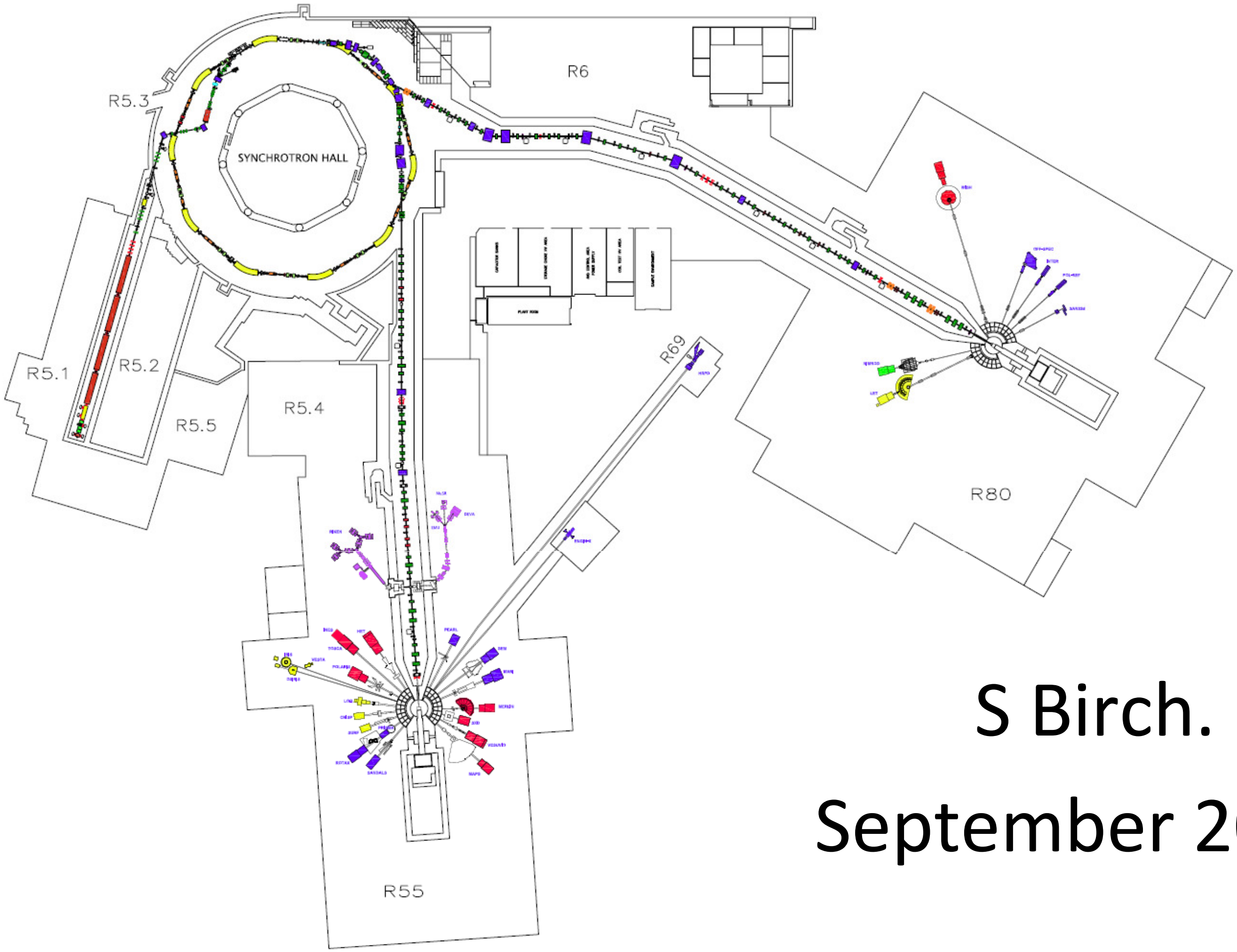

S Birch.

September 2012.

second target station project

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- Mitigation against EMI/RFI noise on Detector cabling and Data Acquisition Electronics.

- Brief overview of an IEC 61508 Neutron Instrument Personnel Protection Interlock System.

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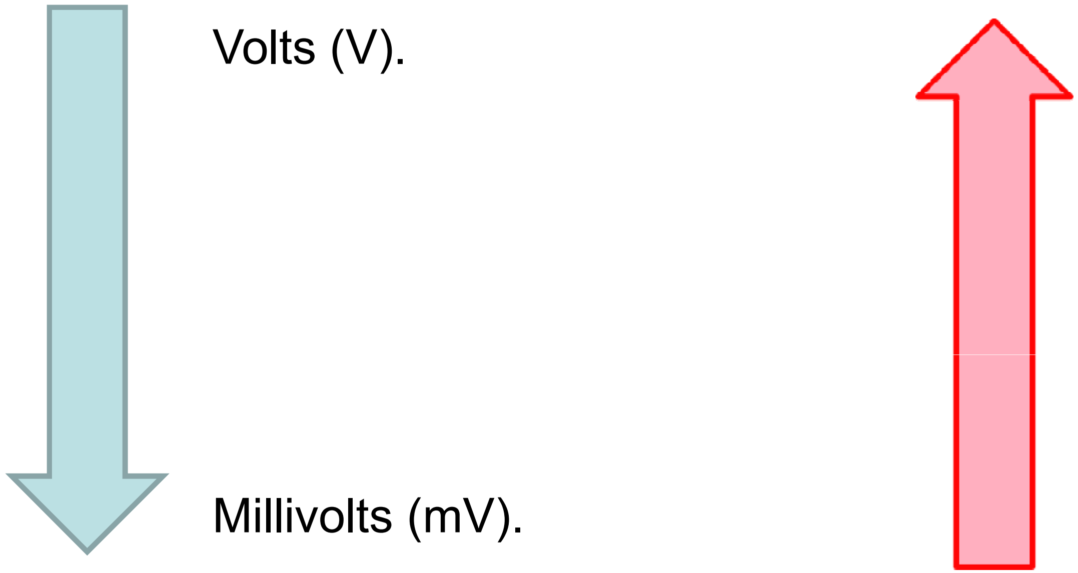
Why do we need EMI/RFI shielded rooms?

Detector Electronic Signals

EMI/RFI Noise levels (dB).



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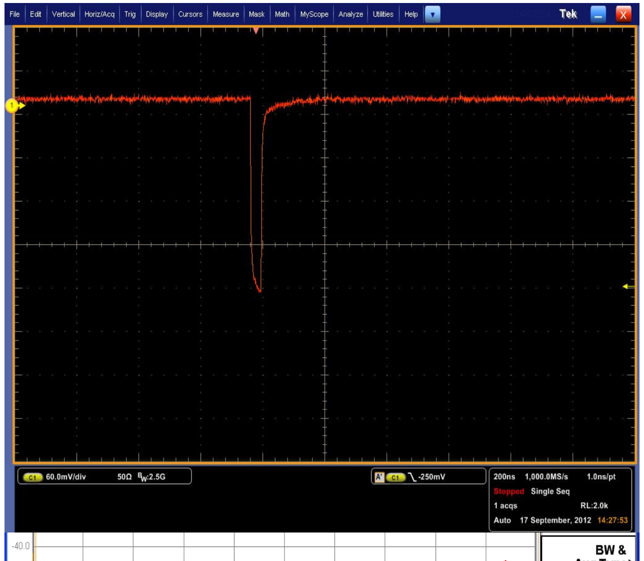

Single photon pulse (tube noise) directly from pre-amplifier.

Background noise levels with all power off within R80 (TS2 Building) from 500kHz – 30MHz

Zoomed out view of a neutron signal directly from the Pre-amplifier.

What noise are we trying to suppress?

All Narrowband to Broadband frequencies.

< 10kHz. Mainly AC power supplies and its associated harmonics.

10kHz – 10MHz. Switch mode power converters.

> 10MHz. Digital processors, Radio transmitters, Mobile phones and Wi-Fi

What ratio of field strength reduction are we trying to achieve?

Attenuation

- -40dB = 100:1 reduction
- -60dB = 1000:1 reduction
- -80dB = 10,000:1 reduction (high performance steel chambers)
- -100dB = 100,000;1 reduction

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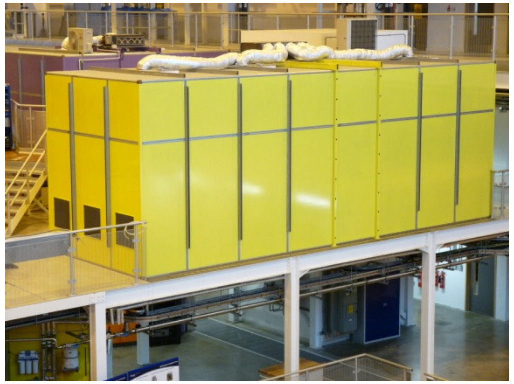
CHIPIR

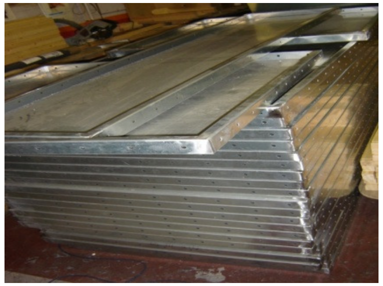
LET

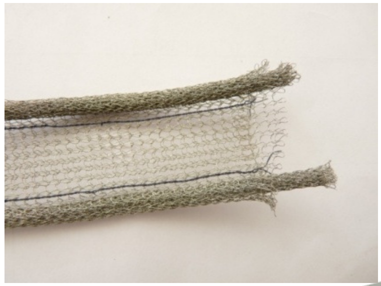


NIMROD

Sheet steel is formed into precise panels/pans/trays.

A twin gasket is crushed between the flanges.





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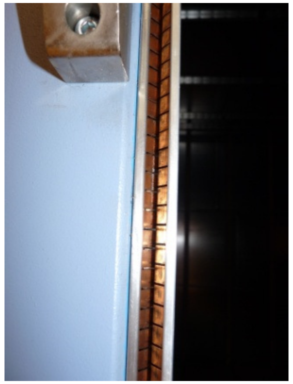
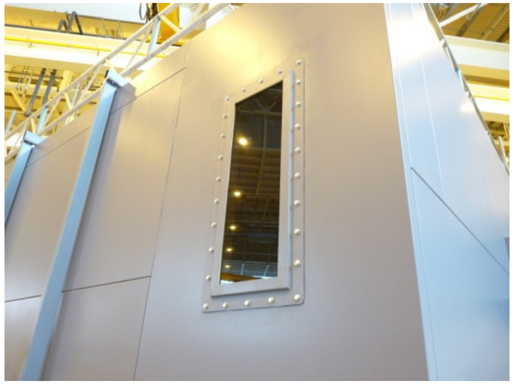



Doors are single or double knife edge seals (good for -110dB).




Windows are double mesh system with fully gasket surround (good for -80dB).

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Ventilation vents are honeycomb waveguides (good for -110dB).

- Power filters.
- Data and communications filters.
- CCTV systems (Fibre optic links)

(All good for -110dB).

Mains AC Power.

All mains AC power feeds to a shielded room have:-

- Uninterruptible power supply (UPS).
- Double wound Isolation transformer.
- Single phase power filter.
- Bypass switch.

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Screened Cable Trunk.

- Each trunk is 5 metres minimum length with a minimum of 2 - 90° changes of direction.

- Every metre ferrite tiles are installed to suppress any EMI/RFI.

- Any excess space within trunk is filled with Bronze wool and activated foam.

- All cables are fully screened and earthed.

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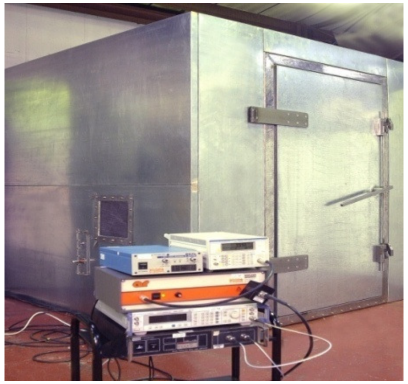
Testing.



Shielding standards

All screened rooms are tested to:-

- EN50147-1 – based on the MIL STD 285
- IEEE299- International standard with many test points (especially around the door and windows).

This type of shielding system is only part of the overall EMI/RFI mitigation carried out at ISIS. It will not be effective without exacting earthing regimes and accurate specification of electrical/electronic equipment with reduced EMI/RFI noise.

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IEC 61508 Personnel Interlock Systems.

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1. IEC 61508 Why?

2. Documentation

3. PPS Interlock System Overview.

   a. System 1. - SmartGuard Controller
   b. System 2. - Safety Relay & Key Control.
   c. System 3. - Beam Off Buttons.

Why IEC 61508 FUNCTIONAL SAFETY

- IEC 61508 is a technical standard that defines functional safety design methods, technical requirements and quality assurance.
- Currently IEC 61508 compliance is not a statutory requirement.
- HSE state that IEC 61508 compliance is recognised as "Best Practice".

So what is IEC 61508?

IEC 61508 is titled "Functional Safety of Electrical/Electronic/Programmable Electronic Safety-related Systems".

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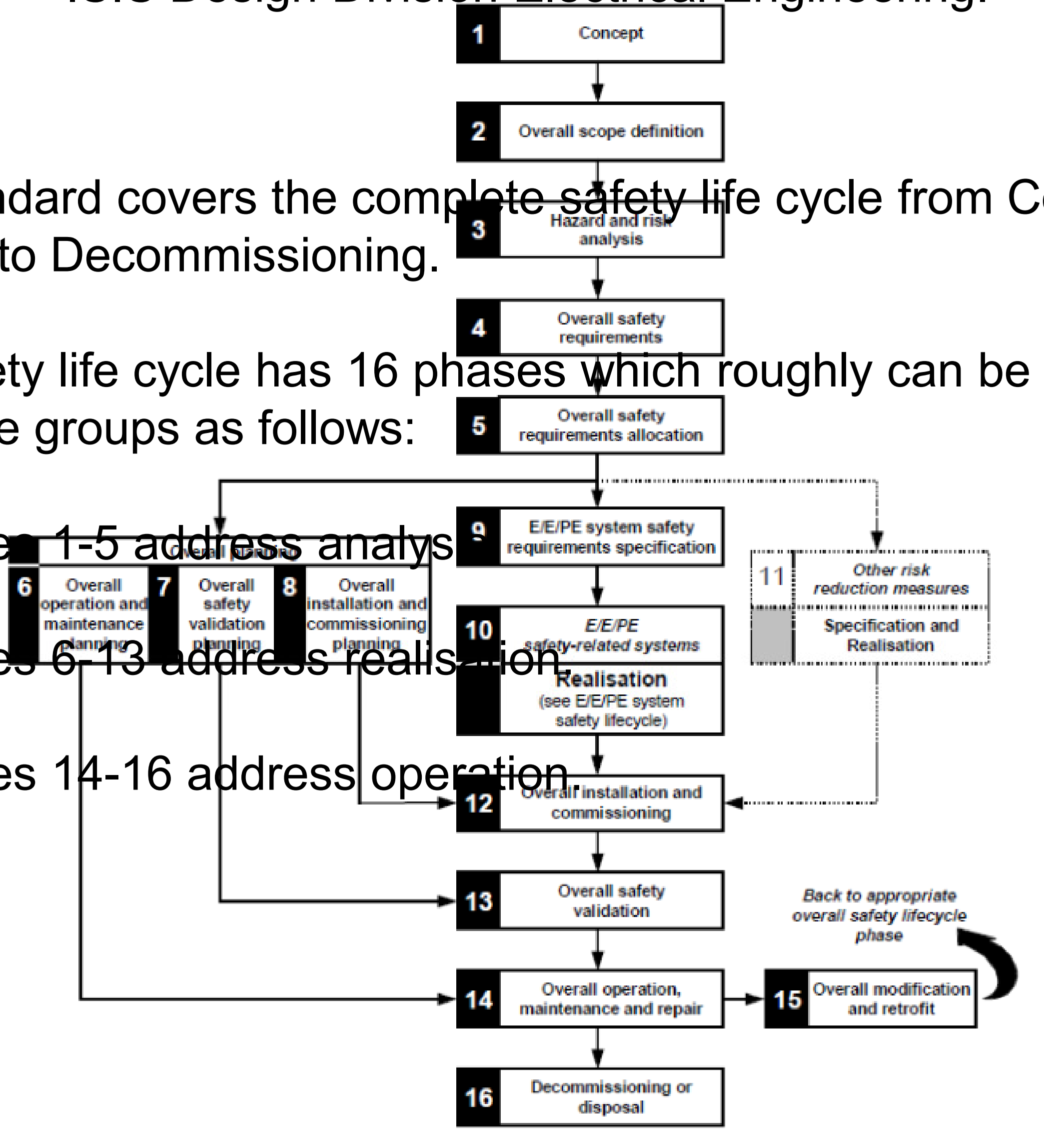
The standard covers the complete safety life cycle from Concept through to Decommissioning.

The safety life cycle has 16 phases which roughly can be divided into three groups as follows:

- Phases 1-5 address analys
- Phases 6-13 address realisation.
- Phases 14-16 address operation.



IEC 61508 Overall Safety Lifecycle Structure.

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CHIPIR PERSONNEL PROTECTION SYSTEM CONCEPT SPECIFICATION.

TARGET STATION 2 PHASE 2 INSTRUMENTS.

CONCEPT SPECIFICATION FOR THE CHIPIR PERSONNEL PROTECTION SYSTEM.

APPROVAL

Title	Name	Signature / Date
TASK LEADER	Stephen P. Stoneham	

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CHIPIR PERSONNEL PROTECTION SYSTEM SCOPE SPECIFICATION.

TARGET STATION 2 PHASE 2 INSTRUMENTS.

SCOPE SPECIFICATION FOR THE CHIPIR PERSONNEL PROTECTION SYSTEM.

APPROVAL

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HAZID FOR THE CHIPIR PERSONNEL PROTECTION SYSTEM.

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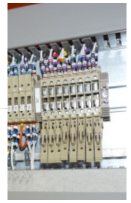

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CHIPIR PERSONNEL PROTECTION SYSTEM HAZOP.

TARGET STATION 2 PHASE 2 INSTRUMENTS.

HAZOP SPECIFICATION FOR THE CHIPIR PERSONNEL PROTECTION SYSTEM.

APPROVAL

Title	Name	Signature / Date
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REVISION HISTORY

Issue	Date	Author	Revision Comments
P1	18/07/2011	Stuart L Birch	Preliminary Issue

SCIENCE & TECHNOLOGY FACILITIES COUNCIL			*Issued by:* Electrical Engineering Group
Issue: P1	*Name*	*Date*	*Drawing Number* ISIS-TS2-INS-CHIPIR-HAZID
Prepared by:	Stuart L Birch	18/7/2011	
Task Leader:	Stephen P. Stoneham		Page 1 of 17

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CHIPIR PERSONNEL PROTECTION SYSTEM DESIGN REQUIREMENT SPECIFICATION.

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DESIGN REQUIREMENT SPECIFICATION FOR THE CHIPIR PERSONNEL PROTECTION SYSTEM.

APPROVAL

Title	Name	Signature / Date
TASK LEADER	Stephen P. Stoneham	

REVISION HISTORY

Issue	Date	Author	Revision Comments
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Issue: P1	*Name*	*Date*	*Document Number* TS2-CHIPIR-PPS-SPC-005-A
Prepared by:	Stuart L Birch	15/08/2011	
Task Leader:	Stephen P. Stoneham		Page 1 of 18

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DOCUMENT LIST FOR THE CHIPIR PERSONNEL PROTECTION SYSTEM.

TARGET STATION 2 PHASE 2 INSTRUMENTS.

DOCUMENT LIST FOR THE CHIPIR PERSONNEL PROTECTION SYSTEM.

APPROVAL

Title	Name	Signature / Date
TASK LEADER	Stephen P. Stoneham	

REVISION HISTORY

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020-A	11/08/2011	Stuart L Birch	Final Issue.

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Issue: P1	*Name*	*Date*	*Document Number* TS2-CHIPIR-PPS-SPC-020-A
Prepared by:	Stuart L Birch	11/08/2011	
Task Leader:	Stephen P. Stoneham		Page 1 of 3

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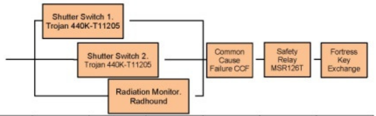
LOOP F

Displacement of oxygen within the blockhouse.

	O2 Monitor 1. GDS 100	O2 Monitor 2. GDS 100	Common Cause Failure (CCF)	Safety Relay MSR 126T	Fortress Key Exchange
Common Cause Failure (CCF) Contribution.			7.0%		
Configuration (N out of N)	1oo2	1oo2	1oo1	1oo1	1oo1
Quantity	1	1	1	1	1
Failure Rate of Dangerous Failures Detected by Diagnostics λ_{DD}	0				
λ_{DD} x QTY	0	0	0	0	0
λ_{DD} (Branch)					
Mean Down Time MTD (Hours)					
λ_{DD} (SYS)					
Probability of Failure on Demand (PFD) Detected					
Failure Rate of Dangerous Failures Undetected by Diagnostics λ_{DU}	3.00E-05	3.00E-05	2.10E-06	1.45E-09	4.00E-09
λ_{DU} x QTY	3.00E-05	3.00E-05	2.10E-06	1.45E-09	4.00E-09
λ_{DU} (Branch)					
Proof Test Tp (Hours)	6570		6570	6570	6570
λ_{DU} (SYS)	5.91E-06		2.10E-06		
Probability of Failure on Demand (PFD) Undetected	1.29E-02		6.90E-03	4.76E-06	1.31E-05
Probability of Failure on Demand (PFD)	1.29E-02		6.90E-03	4.76E-06	1.31E-05
Demand (Low Demand or High Demand)	Low				
Probability of Failure on Demand (PFD) Total for Loop F	1.99E-02	PFD1oo1 = λ_{DU} x Tp/2			
Failure Rate of Dangerous Failures Detected by Diagnostics λ_{DD} Total for Loop F	0.00E+00	PFD1oo2 = (λ_{DU}^2 x Tp^2/3) + (β x λ_{DU} x Tp/2)			
Failure Rate of Dangerous Failures Detected by Diagnostics λ_{DU} Total for Loop F	8.02E-06	PFD1oo3 = (λ_{DU}3 x Tp^3/4) + (β x λ_{DU} x Tp/2)			
Failure Rate of Dangerous Failures λ_D Total for Loop F	8.02E-06				
SIL Based on Probability of Failure on Demand (PFD)	SIL 1				
Architectural Type Components	Type B	Type A		Type A	Type A
Safe Failure Fraction SFF	30.00%	30.00%		99.00%	90.00%
Hardware Fault Tolerance HFT	1	1		0	0
Architectural Subsystem	SIL 1	SIL 2		SIL 3	SIL 3
Allowed SIL	SIL 1				

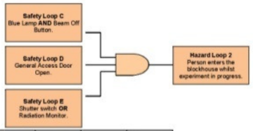
LOOP E

Shutter not closed OR radiation not at safe level



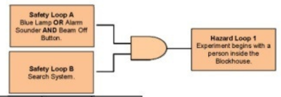
	Shutter Switch 1. Trojan 440K-T11205	Shutter Switch 2. Trojan 440K-T11205	Radiation Monitor Radhound.	Common Cause Failure (CCF)	Safety Relay MSR 126T	Fortress Key Exchange
Common Cause Failure (CCF) Contribution.				7.00%		
Configuration (N out of N)	1oo3	1oo3	1oo3	1oo1	1oo1	1oo1
Quantity	1	1	1	1	1	1
Failure Rate of Dangerous Failures Detected by Diagnostics λ_{DD}	0					
λ_{DD} x QTY	0	0	0	0	0	0
λ_{DD} (Branch)						
Mean Down Time MTD (Hours)						
λ_{DD} (SYS)						
Probability of Failure on Demand (PFD) Detected						
Failure Rate of Dangerous Failures Undetected by Diagnostics λ_{DU}	1.69E-08	1.69E-08	4.00E-07	2.80E-08	1.45E-09	4.00E-09
λ_{DU} x QTY	1.69E-08	1.69E-08	4.00E-07		1.45E-09	4.00E-09
λ_{DU} (Branch)						
Proof Test Tp (Hours)		8760		8760	8760	8760
λ_{DU} (SYS)		2.50E-12				
Probability of Failure on Demand (PFD) Undetected		7.31E-09		1.23E-04	6.35E-06	1.75E-05
Probability of Failure on Demand (PFD)		7.31E-09	0.00E+00	1.23E-04	6.35E-06	1.75E-05
Demand (Low Demand or High Demand)	Low					
Probability of Failure on Demand (PFD) Total for Loop E	1.47E-04	PFD1oo1 = λ_{DU} x Tp/2				
Failure Rate of Dangerous Failures Detected by Diagnostics λ_{DD} Total for Loop E	0.00E+00	PFD1oo2 = (λ_{DU}^2 x Tp^2/3) + (β x λ_{DU} x Tp/2)				
Failure Rate of Dangerous Failures Detected by Diagnostics λ_{DU} Total for Loop E	4.05E-07	PFD1oo3 = (λ_{DU}3 x Tp^3/4) + (β x λ_{DU} x Tp/2)				
Failure Rate of Dangerous Failures λ_D Total for Loop E	4.05E-07					
SIL Based on Probability of Failure on Demand (PFD)	SIL 3					
Architectural Type Components	Type A	Type A	Type B		Type A	Type A
Safe Failure Fraction SFF	60.00%	60.00%	60.00%		99.00%	90.00%
Hardware Fault Tolerance HFT	2	2	2		0	0
Architectural Subsystem	SIL 4	SIL 4			SIL 3	SIL 3
Allowed SIL	SIL 2					

HAZARD LOOP 2
Exposure to Beam



	Safety Loop C	Safety Loop D	Safety Loop E	Common Cause Failure (CCF)
Common Cause Failure (CCF) Contribution.				4.0%
Configuration (N out of N)	1oo3	1oo3	1oo3	1oo1
Quantity	1	1	1	1
Failure Rate of Dangerous Failures Detected by Diagnostics λ_{DD}	8.33E-05			
λ_{DD} x QTY	8.3333E-05	4.17E-05	0.00E+00	3.3333E-06
λ_{DD} (Branch)				
Mean Down Time MTD (Hours)				24
λ_{DD} (SYS)				
Probability of Failure on Demand (PFD) Detected				0.00008
Failure Rate of Dangerous Failures Undetected by Diagnostics λ_{DU}	1.48E-06	2.30E-07	4.05E-07	5.91E-08
λ_{DU} x QTY	1.48E-06	2.30E-07	4.05E-07	
λ_{DU} (Branch)				
Proof Test Tp (Hours)		8760		8760
λ_{DU} (SYS)				5.91E-08
Probability of Failure on Demand (PFD) Undetected		2.59E-04		2.59E-04
Probability of Failure on Demand (PFD)		2.59E-04		2.59E-04
Demand (Low Demand or High Demand)	Low			
Probability of Failure on Demand (PFD) Total for Loop 2	5.98E-04	PFD1oo1 = λ_{DU} x Tp/2		
Failure Rate of Dangerous Failures Detected by Diagnostics λ_{DD} Total for Loop 2	1.28E-04	PFD1oo2 = (λ_{DU}^2 x Tp^2/3) + (β x λ_{DU} x Tp/2)		
Failure Rate of Dangerous Failures Detected by Diagnostics λ_{DU} Total for Loop 2	4.05E-07	PFD1oo3 = (λ_{DU}3 x Tp^3/4) + (β x λ_{DU} x Tp/2)		
Failure Rate of Dangerous Failures λ_D Total for Loop 2	1.29E-04			
SIL Based on Probability of Failure on Demand (PFD)	SIL 3			
Architectural Type Components				
Safe Failure Fraction SFF				
HFT				
Architectural Subsystem				
Allowed SIL				

HAZARD LOOP 1
Exposure to Beam



	Safety Loop A	Safety Loop B	Common Cause Failure (CCF)
Common Cause Failure (CCF) Contribution.			4.0%
Configuration (N out of N)	1oo2	1oo2	1oo1
Quantity	1	1	1
Failure Rate of Dangerous Failures Detected by Diagnostics λ_{DD}	8.33E-05	0.00E+00	
λ_{DD} x QTY	8.3333E-05	0.00E+00	
λ_{DD} (Branch)		24	24
Mean Down Time MTD (Hours)			
λ_{DD} (SYS)			
Probability of Failure on Demand (PFD) Detected			
Failure Rate of Dangerous Failures Undetected by Diagnostics λ_{DU}	5.34E-07	6.62E-08	2.65E-09
λ_{DU} x QTY	5.34E-07	6.62E-08	2.65E-09
λ_{DU} (Branch)			
Proof Test Tp (Hours)	2920		2920
λ_{DU} (SYS)	1.03E-10		2.65E-09
Probability of Failure on Demand (PFD) Undetected	1.01E-07		3.87E-06
Probability of Failure on Demand (PFD)	1.01E-07		3.87E-06
Demand (Low Demand or High Demand)	Low		
Probability of Failure on Demand (PFD) Total for Loop 1	3.97E-06	PFD1oo1 = λ_{DU} x Tp/2	
Failure Rate of Dangerous Failures Detected by Diagnostics λ_{DD} Total for Loop 1	8.33E-05	PFD1oo2 = (λ_{DU}^2 x Tp^2/3) + (β x λ_{DU} x Tp/2)	
Failure Rate of Dangerous Failures Detected by Diagnostics λ_{DU} Total for Loop 1	2.75E-09	PFD1oo3 = (λ_{DU}3 x Tp^3/4) + (β x λ_{DU} x Tp/2)	
Failure Rate of Dangerous Failures λ_D Total for Loop 1	8.33E-05		
SIL Based on Probability of Failure on Demand (PFD)	SIL 4		
Architectural Type Components			
Safe Failure Fraction SFF			
HFT	1	1	
Architectural Subsystem			
Allowed SIL			

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Human Error Assessment And Reduction Technique (HEART)

User who is unfamiliar with CHIPIR instrument failing to search the blockhouse correctly and leaving a person in blockhouse.

	ERROR Producing Conditions (EPC's)	EPC Score	Assessed Proportion (P). (Σ ≠ 1)	Assessed Effect (((E-1)*P)+1)
1	Unfamiliarity with a situation which is potentially important but which only occurs infrequently or which is novel.	17	0.1	2.6
2	A shortage of time available for error detection and correction.	11	0.05	1.5
3	A low signal-noise ratio	10	0.01	1.09
4	A means of suppressing or over-riding information or features which is too easily accessible.	9	0.01	1.08
5	No means of conveying spatial and functional information to operators in a form which they can readily assimilate	8	0.01	1.07
6	A mismatch between an operator's model of the world and that imagined by the designer	8	0.01	1.07
7	No obvious means of reversing an unintended action.	8	0.01	1.07
8	channel capacity overload, particularly one caused by simultaneous presentation of non-redundant information.	6	0.001	1.005
9	need to unlearn a technique and apply one which requires the application of an opposing philosophy.	6	0.001	1.005
10	The need to transfer specific knowledge from task to task without loss	5.5	0.001	1.0045
11	Ambiguity in the required performance standards	5	0.001	1.004
12	A means of suppressing or over-riding information or features which is too easily accessible.	4	0.001	1.003
13	A mismatch between perceived and real risk.	4	0.001	1.003
14	No clear, direct and timely confirmation of an intended action from the portion of the system over which control is exerted.	4	0.001	1.003
15	Operator inexperience (e.g., a newly qualified tradesman but not an expert).	3	0.5	2
16	An impoverished quality of information conveyed by procedures and person-person interaction.	3	0.01	1.02
17	Little or no independent checking or testing of output.	3	0.01	1.02
18	A conflict between immediate and long term objectives.	2.5	0.01	1.015
19	Ambiguity in the required performance standards.	2.5	0.01	1.015
20	mismatch between the educational achievement level of an individual and the requirements of the task.	2	0.01	1.01
21	An incentive to use other more dangerous procedures.	2	0.001	1.001
22	Little opportunity to exercise mind and body outside the immediate confines of a job.	1.8	0.001	1.0008
23	Unreliable instrumentation (enough that it is noticed).	1.6	0.001	1.0006
24	A need for absolute judgements which are beyond the capabilities or experience of an operator.	1.6	0.001	1.0006
25	Unclear allocation of function and responsibility.	1.6	0.001	1.0006
26	No obvious way to keep track of progress during an activity.	1.4	0.001	1.0004
27	A danger that finite physical capabilities will be exceeded.	1.4	0.001	1.0004
28	Little or no intrinsic meaning in a task.	1.4	0.001	1.0004
29	High level emotional stress.	1.3	0.01	1.003
30	Evidence of ill-health amongst operatives especially fever.	1.2	0.001	1.0002
31	Low workforce morale.	1.2	0.001	1.0002
32	Inconsistency of meaning of displays and procedures.	1.2	0.01	1.002
33	A poor or hostile environment.	1.15	0.001	1.00015
34	Prolonged inactivity or highly repetitious cycling of low mental workload tasks (1st half hour).	1.1	0.001	1.0001
35	Prolonged inactivity or highly repetitious cycling of low mental workload tasks (thereafter).	1.05	0.001	1.00005
36	Disruption of normal work sleep cycles.	1.1	0.05	1.005
37	Task pacing caused by the intervention of others.	1.06	0.01	1.0006
38	Additional team members over and above those necessary to perform task normally and satisfactorily. (per additional team member).	1.03	0.01	1.0003
39	Age of personnel performing perceptual tasks.	1.02	0.01	1.0002
	Nominal =	2.00E-05	Product = 12.72532261	
			ERROR = 2.55E-04	

Human Error Assessment And Reduction Technique (HEART)

Instrument Scientist who is familiar with CHIPIR instrument failing to search the blockhouse correctly and leaving a person in blockhouse.

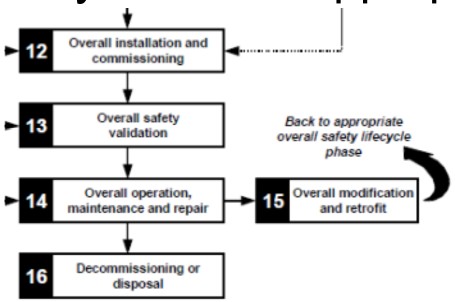
	ERROR Producing Conditions (EPC's)	EPC Score	Assessed Proportion (P). (Σ ≠ 1)	Assessed Effect (((E-1)*P)+1)
1	Unfamiliarity with a situation which is potentially important but which only occurs infrequently or which is novel.	17	0.005	1.08
2	A shortage of time available for error detection and correction.	11	0.002	1.02
3	A low signal-noise ratio	10	0.01	1.09
4	A means of suppressing or over-riding information or features which is too easily accessible.	9	0.01	1.08
5	No means of conveying spatial and functional information to operators in a form which they can readily assimilate	8	0.01	1.07
6	A mismatch between an operator's model of the world and that imagined by the designer	8	0.01	1.07
7	No obvious means of reversing an unintended action.	8	0.01	1.07
8	channel capacity overload, particularly one caused by simultaneous presentation of non-redundant information.	6	0.001	1.005
9	need to unlearn a technique and apply one which requires the application of an opposing philosophy.	6	0.001	1.005
10	The need to transfer specific knowledge from task to task without loss	5.5	0.001	1.0045
11	Ambiguity in the required performance standards	5	0.001	1.004
12	A means of suppressing or over-riding information or features which is too easily accessible.	4	0.001	1.003
13	A mismatch between perceived and real risk.	4	0.001	1.003
14	No clear, direct and timely confirmation of an intended action from the portion of the system over which control is exerted.	4	0.001	1.003
15	Operator inexperience (e.g., a newly qualified tradesman but not an expert).	3	0.5	2
16	An impoverished quality of information conveyed by procedures and person-person interaction.	3	0.01	1.02
17	Little or no independent checking or testing of output.	3	0.01	1.02
18	A conflict between immediate and long term objectives.	2.5	0.01	1.015
19	Ambiguity in the required performance standards.	2.5	0.01	1.015
20	mismatch between the educational achievement level of an individual and the requirements of the task.	2	0.01	1.01
21	An incentive to use other more dangerous procedures.	2	0.001	1.001
22	Little opportunity to exercise mind and body outside the immediate confines of a job.	1.8	0.001	1.0008
23	Unreliable instrumentation (enough that it is noticed).	1.6	0.001	1.0006
24	A need for absolute judgements which are beyond the capabilities or experience of an operator.	1.6	0.001	1.0006
25	Unclear allocation of function and responsibility.	1.6	0.001	1.0006
26	No obvious way to keep track of progress during an activity.	1.4	0.001	1.0004
27	A danger that finite physical capabilities will be exceeded.	1.4	0.001	1.0004
28	Little or no intrinsic meaning in a task.	1.4	0.001	1.0004
29	High level emotional stress.	1.3	0.01	1.003
30	Evidence of ill-health amongst operatives especially fever.	1.2	0.001	1.0002
31	Low workforce morale.	1.2	0.001	1.0002
32	Inconsistency of meaning of displays and procedures.	1.2	0.01	1.002
33	A poor or hostile environment.	1.15	0.001	1.00015
34	Prolonged inactivity or highly repetitious cycling of low mental workload tasks (1st half hour).	1.1	0.001	1.0001
35	Prolonged inactivity or highly repetitious cycling of low mental workload tasks (thereafter).	1.05	0.001	1.00005
36	Disruption of normal work sleep cycles.	1.1	0.05	1.005
37	Task pacing caused by the intervention of others.	1.06	0.01	1.0006
38	Additional team members over and above those necessary to perform task normally and satisfactorily. (per additional team member).	1.03	0.01	1.0003
39	Age of personnel performing perceptual tasks.	1.02	0.01	1.0002
	Nominal =	2.00E-05	Product = 3.594414203	
			ERROR = 7.19E-05	

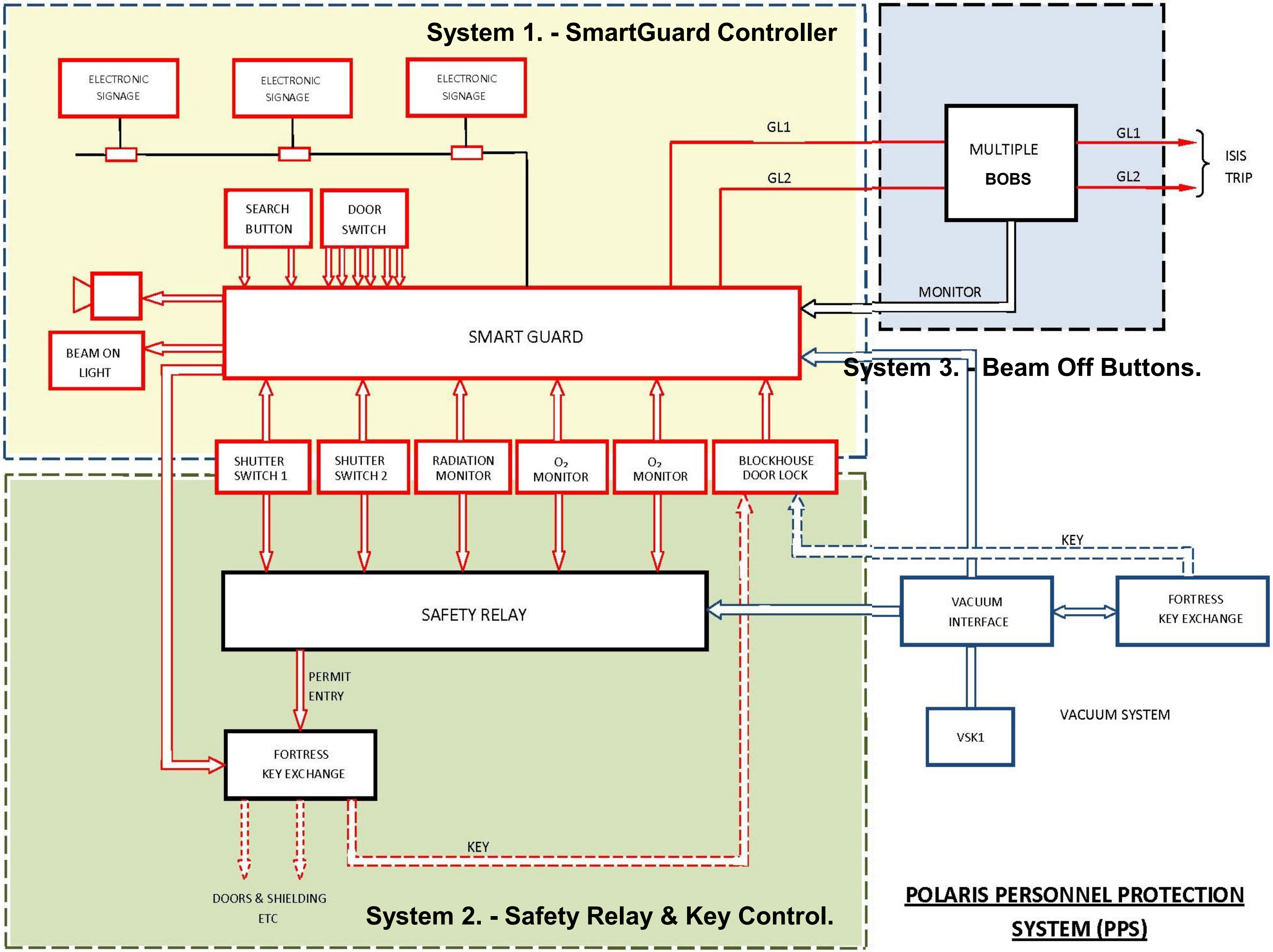
ISIS Design Division Electrical Engineering.

After the beamline PPS interlock system is commissioned and proof tested it will be formally handed over to Experimental/Instrument Operations.

To guarantee that each beamline PPS interlock system continues to meet IEC61508, the following **must** take place:-

- Before each user run the PPS interlock system undergoes a short test sequence (door switches etc operated and verified) and the PPS software verification code is checked and recorded (This will be the same code as previously recorded) .
- Annually a full system proof test is completed and fully **documented.**
- Any modifications made to the system **must** to go back through the IEC61508 lifecycle at the appropriate level.

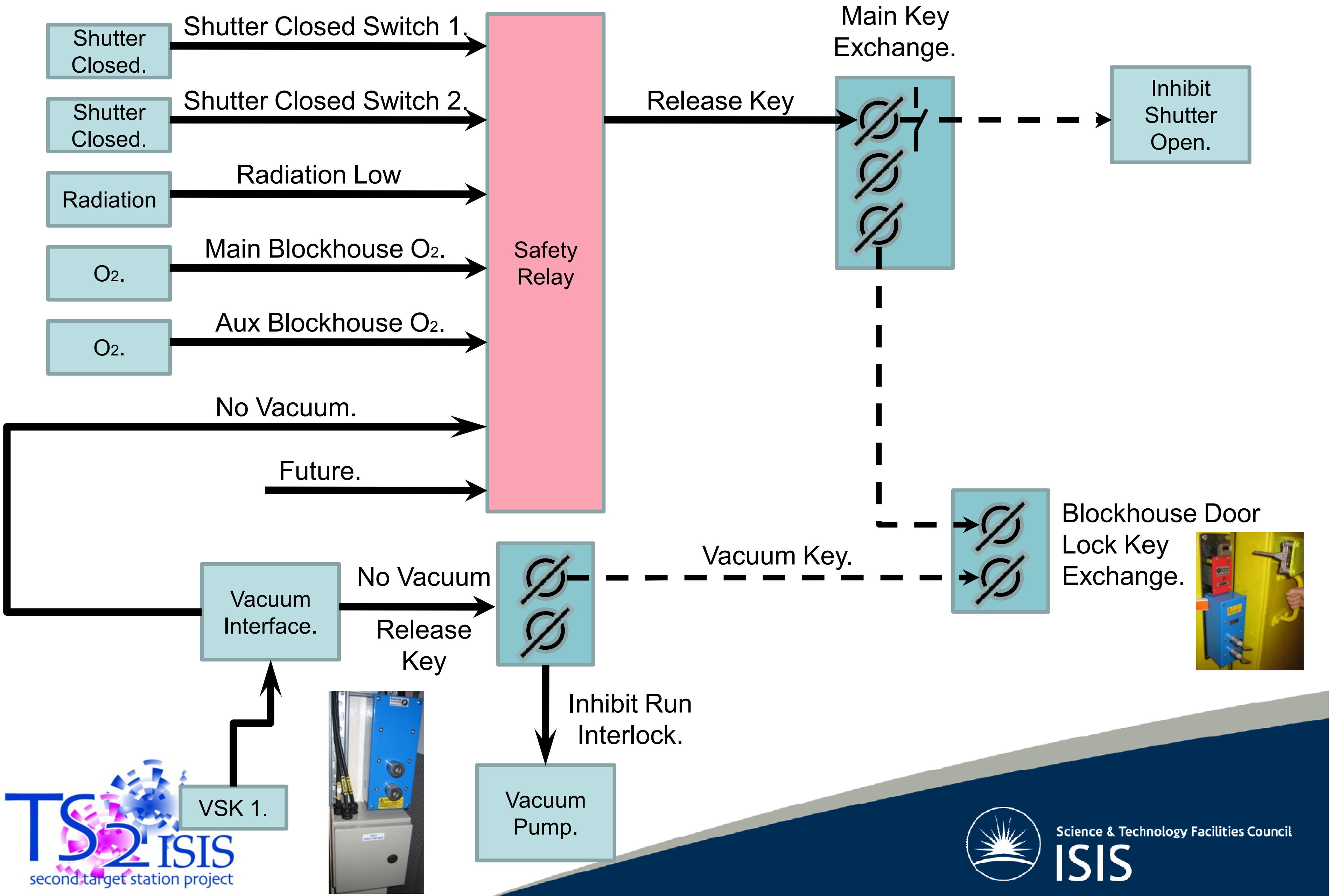


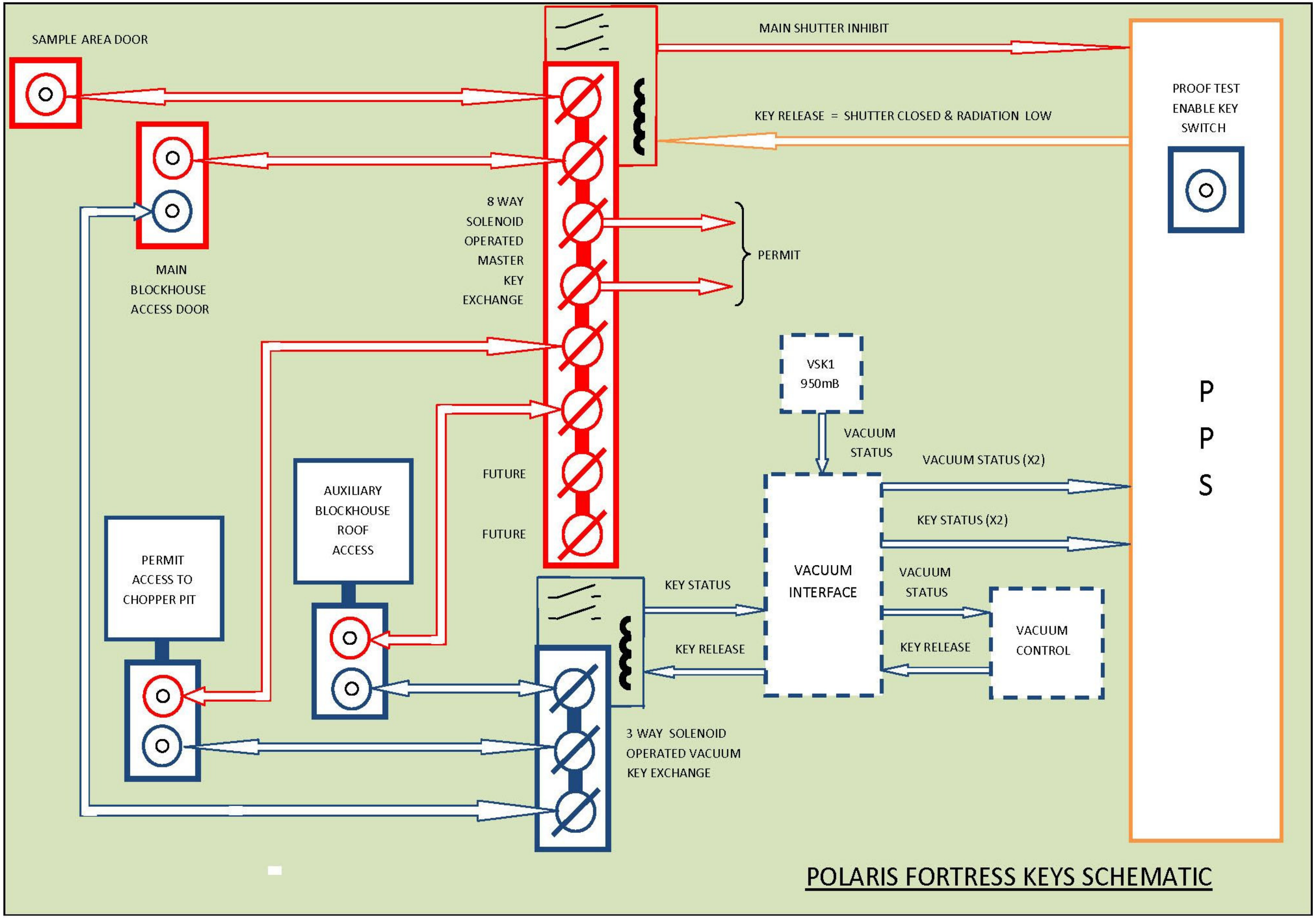


POLARIS PERSONNEL PROTECTION SYSTEM (PPS)


LET

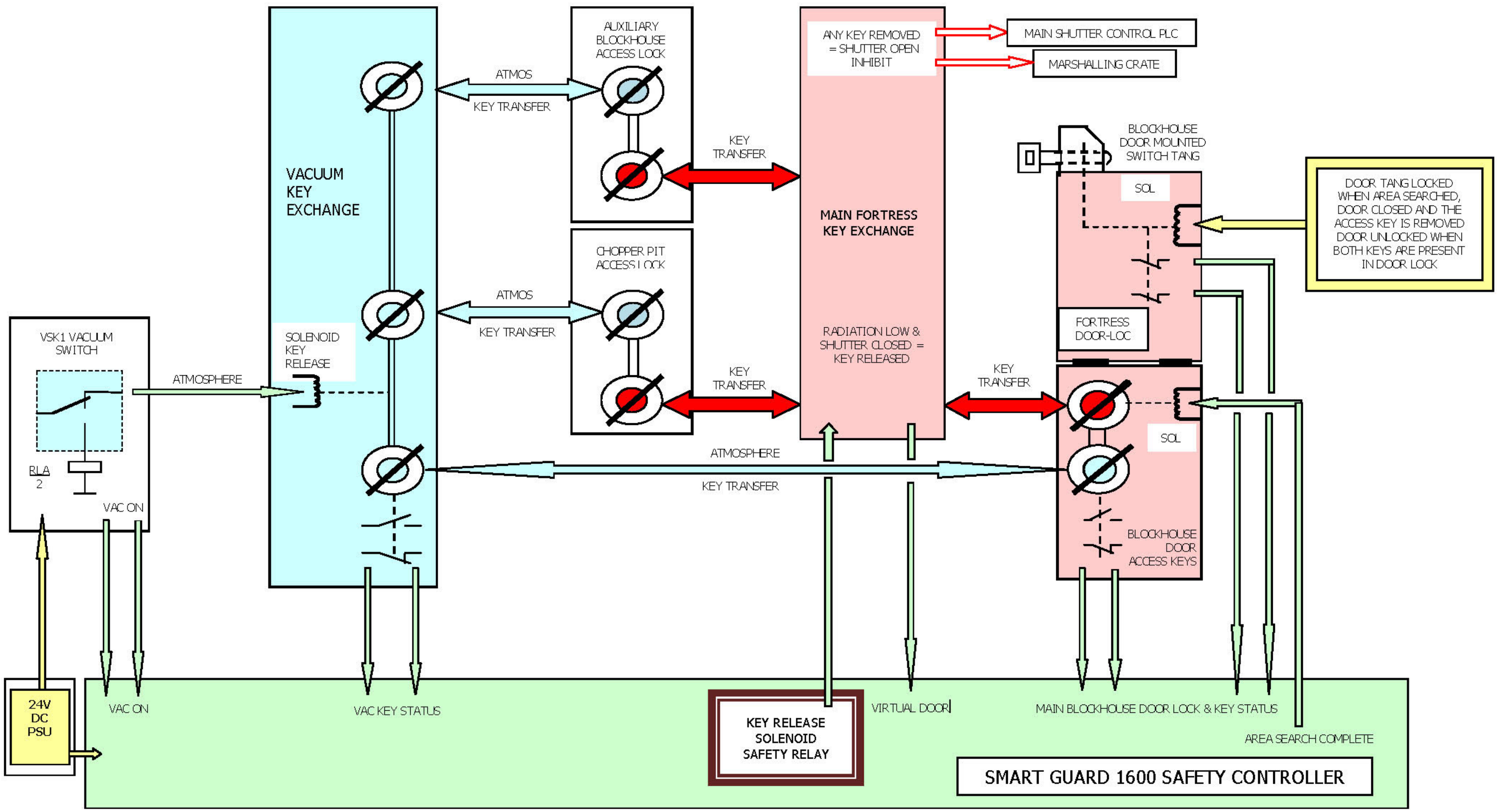
POLARIS PPS FORTRESS KEY CONTROL.

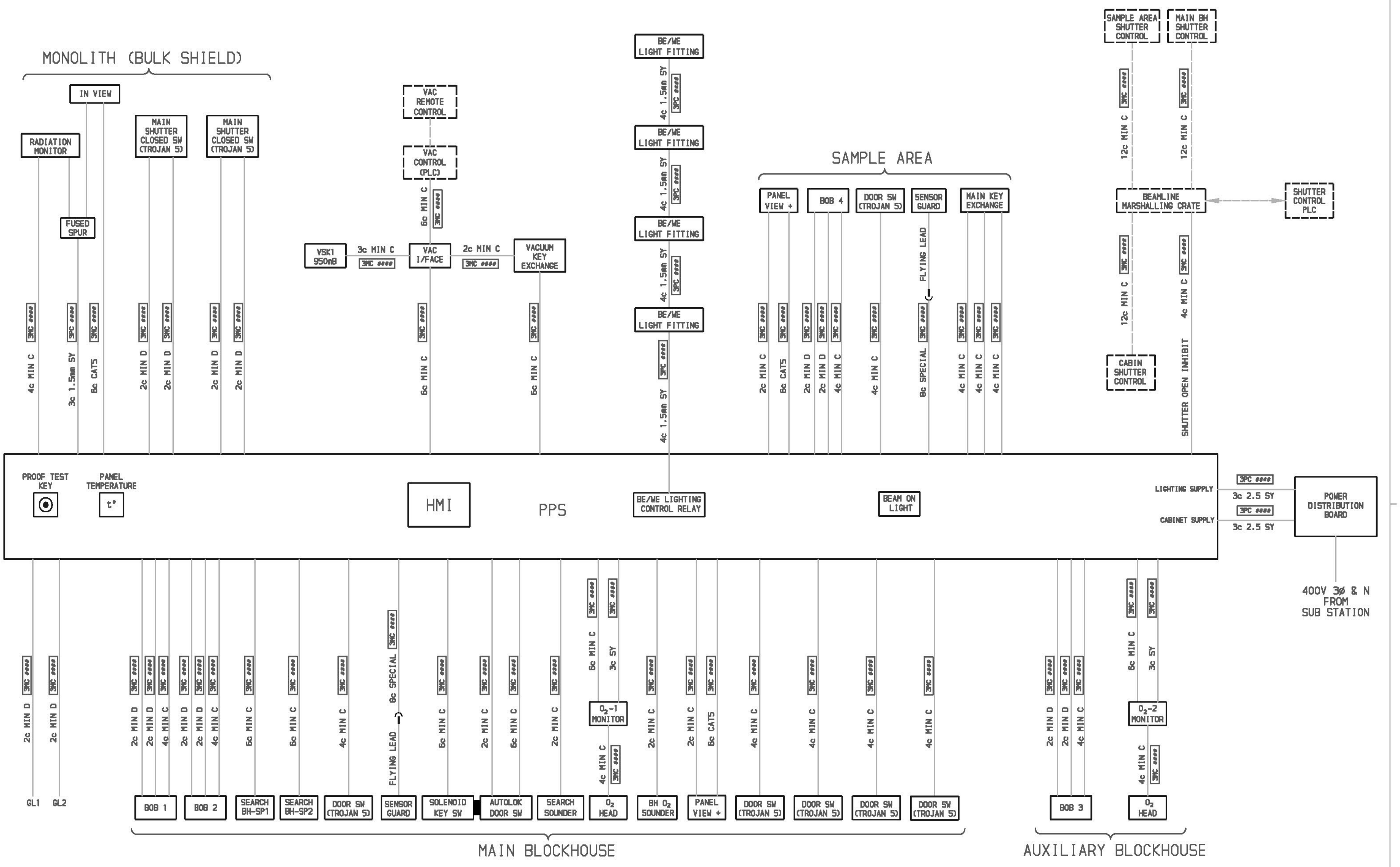




POLARIS FORTRESS KEYS SCHEMATIC

POLARIS VACUUM KEY INTERFACE





NOTE:
ALL EQUIPMENT SHOWN DOTTED DO NOT FORM PART OF THE PERSONNEL PROTECTION SYSTEM.

THIS DRAWING CONFORMS TO BS 3939 | USED ON

ISS	DATE	MOD. NO.	DRN. BY	CHKD.	APPD.	STATUS
A	03/09/2010	___	SW	___	___	WIP

SCIENCE & TECHNOLOGY FACILITIES COUNCIL
RUTHERFORD APPLETON LABORATORY, CHILTON, OXON OX11 0QX.

TITLE
PPS SYSTEM
CABLE BLOCK DIAGRAM

POLARIS
BEAMLINES

A1-SI-9865-019-00-A

The End.

Questions?