

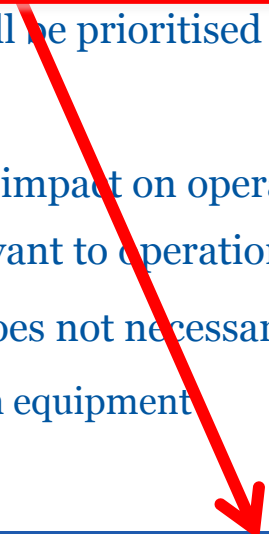
SPS Consolidation for LS2 and beyond

James RIDEWOOD - SPS Operations

LHC Performance Workshop - Chamonix 2014

Introduction

- A very brief overview of the main consolidation activities for each group as presented to IEFC from a point of view of operations
- Each activity will be assessed on its status and its necessity to operate the machine
 - Activities not approved but needed to operate effectively the machine
 - Activities approved and needed to operate effectively the machine
 - Activities approved or not approved but not urgent to operate effectively the machine
 - Activity partially covered by LIU or depends upon LIU
- In addition, each unapproved job will be prioritised from an operations point of view
 - **HIGH, MEDIUM** or **LOW**
 - Not just from a point of view of impact on operation with beam but with also a focus on safety and other factors relevant to operations
 - Low priority from operations does not necessarily mean it's not important
 - E.g. safety of people working on equipment



Necessary not approved
Necessary and approved
Not Necessary to operate
Part in LIU

SPS OPERATIONS PRIORITY:

MEDIUM

**BENEFITS FOR SETTING UP
AND ALARA**

UNIFORMITY ACROSS THE MACHINE

TT10 BLM Consolidation

- Not currently existing but...
 - BLMs installed in all other lines of the SPS - TT10 is the missing link
- Coherent strategy : to renew all systems from LINAC4 to SPS with same new system
- 150kCHF (electronics) in 2015 & 500kCHF (cabling) in LS2

SPS Ring BLM Electronics Renovation

- Currently uses old, outdated electronics
- Was initially included in LIU but cannot be started until **after LS2** due to manpower constraints
- Will build on existing developments
 - Radiation hard ASIC (Application Specific Integrated Circuit) development
 - Use of newly installed SPS BI fibre optic network (1/2 done, rest in LS2)
- 900kCHF - 2019-2024

SPS OPERATIONS PRIORITY:

HIGH

**SUNGLASSES - TO HIDE
“NORMAL” LOSSES. LOSS
RATE THROUGHOUT CYCLE
INSTEAD OF INTEGRAL.
RELIABILITY, ALARA**

SPS OPERATIONS PRIORITY:
HIGH
**THE MAJORITY OF INSTRUMENTATION
IS ESSENTIAL FOR PERFORMANCE.
MINIMISE MACHINE DOWNTIME**

Mechanical Spares for Critical Injector Complex Monitors

- Much equipment more than 20 years old
- Issue highlighted during LS1 with existing spares no longer vacuum compliant
- As for PS complex - currently prioritising spare procurement
 - SPS OP identified priorities at BI BOSS workshop
- 300kCHF 2015-2017

SPS & Transfer Line BCT Renovation

- Need to consolidate LSS4 DCCT – sensor & electronics
 - Old system with reliance on external company
- Need for consolidation of all 6 fast BCT electronics
 - Will build on new electronics presently being developed for LHC
- 200kCHF 2016-2018

SPS OPERATIONS PRIORITY:
MEDIUM
**IMPORTANT TO ENSURE WE
AREN'T LEFT WITH
UNSUPPORTED EQUIPMENT
IN THE LONGER TERM**

OASIS VXI, Multiplexers and triggering system

- Upgrade of obsolete hardware and associated software
- Legacy VXI system for digitalisation of analogue signals dates from early 90's – Completely obsolete.
- Consolidated for greater reliability and performance to meet operations needs
- TE-EPC move to FGC may change their OASIS requirements: TBC
- 1100kCHF 2014-2016 (SPS+PS:13 systems: 3 for SPS, 10 for PS)

Operational databases hardware consolidation

- Upgrades forced by BE-CO IT policy - Hardware will be out of warranty (3+2 years)
- No longer supported
- Storage controller and server upgrades
- For laser alarms, diamon, data logging, etc
- 230kCHF in 2016 + 365kCHF in 2018

SPS OPERATIONS PRIORITY:
HIGH
**OPERATIONAL DATABASES REQUIRED FOR
SYSTEMS ESSENTIAL TO RUN THE MACHINE**

SPS OPERATIONS PRIORITY:
LOW
CURRENTLY WORKING, OFTEN USED SYSTEM.
SHOULD NOT BE DECOMMISSIONED UNTIL
NEW GS-ASE PUBLIC ADDRESS OPERATIONAL

Removal of the SPS intercom

- Very old system and cabling with expertise disappearing
 - GS-ASE to evaluate a new public address system – more later
- EN-EL to be consulted as this could be integrated into removal of obsolete cabling campaigns
- 200kCHF – 2016

Consolidation of the Intel Single board computers (CPU boards)

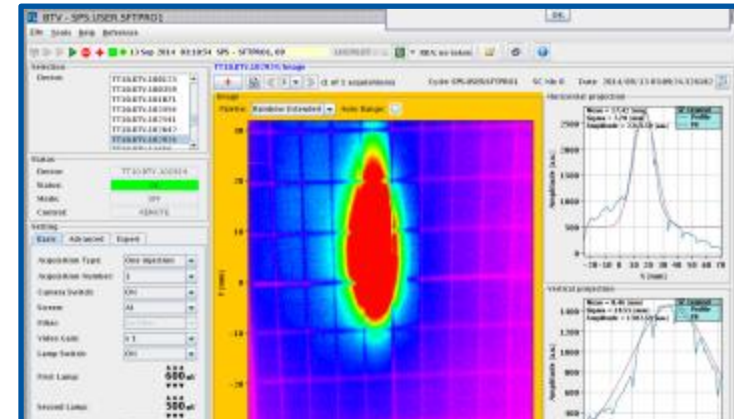
- Replacement of 20 CPU cards (SPS and PS)
- For OASIS, RF and ABT
- For compatibility with 64bit Linux
 - SLC5 end of life in 2017
 - Potential security issues thereafter
- 75kCHF (PS+SPS) - 2015

SPS OPERATIONS PRIORITY:
HIGH
BOARDS REQUIRED FOR
ESSENTIAL SYSTEMS

BE-CO

S. Deghaye 29th August 108th IEFC

- Analogue video to be replaced for BTVs
- infrastructure that needs to be upgraded to digital solutions. VME Modules incompatible with newer CPUs therefore stuck with LynxOS (no security patches).
- Reuse of the LHC solution.
- 400kCHF – 2015-2016



SPS OPERATIONS PRIORITY:

MEDIUM

MAJORITY OF SPS ALREADY CONVERTED BUT TT20 REMAINS ANALOGUE. WOULD ALLOW FULL INTEGRATION INTO SPS BTV APPLICATION



Renovation of 18kV power converters

- Manufactured in late 80's with a life expectancy of 20-30 years
- New 18kV transformers, HV capacitors and HV cabling
 - Following an incident in 2011 transformer replacement was recommended in the medium term
 - Several faults observed in the last few years
 - Potential safety hazard
- TE-EPC to execute the majority of consolidation and take responsibility once complete
- 500kCHF for BE-RF – 2018-2019
- 3MCHF for TE-EPC – 2016-2019



BE-RF

C. Rossi 11th July 106th IEFC

SPS OPERATIONS PRIORITY:
MEDIUM
IMPORTANT FOR RELIABILITY AND SAFETY OF RF POWER EQUIPMENT

Replacement of RF cooling pipework

- 40 year old cooling pipework for RF amplifiers
 - Risk for reliability and personnel safety
 - Leaks becoming more frequent
 - Supplies critical equipment - 10kV at up to 5000A
 - EN-CV will be implicated
 - 500kCHF – 2018



YL tube Replacement – project underway

- Richardson ceased production
- Moved to Thales pin to pin replacement
- 2.7MCHF 2014-2018



DGS-RP & DGS-SEE

D. Perrin - 18th July 10⁷th IEFC

RP monitoring

- SPS currently uses ARCON
- GROAC project (General Renewal Of Area Controller) - to prolong ARCON lifetime by upgrade of electronics and software pending RAMSES arrival – **in progress**
- SPS to be transferred completely to Ramses by end LS2

Site gate monitors and hand and foot monitors

- GS-ASE would be implicated
- 700kCHF 2016-2017 for Site gate monitors
- 340kCHF 2016-2017 for hand foot monitors
- May require 1 extra FTE if approved



Chilled water production control system to be replaced

- TRANE system IO modules – no longer made, limited spares
- Replace with internal LHC standard
- Executed 2015-2018 BA by BA during YETS/EYETS
- 300kCHF 2015-2018

Cooling: replace the input/output cards Siemens S5 by S7

- Currently a mix of S5 and S7 which has proved unreliable.
- Move to full S7 infrastructure
- Purely hardware upgrade – software remains unchanged
- To be executed 2015 - 2017 during YETS/EYETS
- 100kCHF – 2015 -2017

SPS OPERATIONS PRIORITY:

LOW

**IMPACT ON OPERATION NOT
SIGNIFICANT UP TO NOW.**

IMPROVE RELIABILITY

24 September 2014

11

Ventilation of the BA's: replacement of the control and power cubicles, sensors and actuators

- Concerns surface building ventilation – not tunnel ventilation
- Ageing electrical equipment – poor reliability
- 2016-2019
- 2060kCHF 2015-2019

SPS OPERATIONS PRIORITY:

LOW

NO DIRECT IMPACT ON BEAM, POSSIBLE KNOCK ON EFFECT FOR EQUIPMENT IN SURFACE BUILDINGS E.G. FARADAY CAGE, TE-EPC, BE-RF, TE-ABT

Sumps of the SPS: renovation

- Levels switches and pumps ageing and becoming unreliable
- Essential for evacuation of infiltration and flood water
- To be executed BA by BA during longer stops YETS, EYETS
- 350kCHF 2015-2018

SPS OPERATIONS PRIORITY:

MEDIUM

IMPORTANT FOR MANAGEMENT OF FLOOD WATER ENTERING INTO TUNNEL DURING PERIODS OF EXCEPTIONALLY HEAVY RAIN

- SPS cooling towers: Deal with additional load of the BAF3 a fifth cell has to be built during LS2.
- Discussions ongoing as to budget share
 - LIU only agrees to cover additional needs for LIU
 - Any other insufficiencies need to be covered elsewhere
- Cooling towers already working at their limit
- Insufficient capacity to cope with LIU upgrades and awake
- Potential environment issue with host states if not resolved
- Implementation currently planned for LS2
- GS-SE, EN-EL, EN-ICE.... implicated
- Status: **TBC**



EN-CV Conclusions:

- The previous slides show only a reduced selection of works affecting the SPS
- **The technical needs exceed by far the possibilities: a reduction of the operational performances has to be taken into account.**
- Feedback also needed for the priorities for LS2.
 - Work foreseen for LS2 is already double what was planned for LS1
- Support required from other groups
 - EL, HE, ICE, MEF, GS/SE, HSE and RP

HV Infrastructure:

Consolidation of SPS substations switchgear

- Consolidation of substations at each BA
- Continuing on from consolidation of 18kv cabling works executed during LS1
- Implemented during YETS/EYETS
- ~12.1MCHF 2014-2018

Consolidation of SPS HV and LV (BA4 and BA5) Secured Network

- Replace the 40 year old existing HV and LV infrastructure
- BA4, BB4, BA5 and BB5 all supplied by 1 single 40 year old secure line
 - No discrimination – If a fault on one all will trip
- High priority as **personal safety systems** are supplied from Secured network
 - Lifts, Smoke extraction, etc
 - ~1.45MCHF 2016-2017

SPS OPERATIONS PRIORITY:
LOW
BUT IS AN UNNECESSARY FIRE HAZARD. CABLE TRAY SPACE WILL BE NEEDED

Cable clean up

- Cable trays massively overcrowded with obsolete cabling
 - **Fire hazard** - Cables represent one of the major combustible materials in the machine
- The problem is general for the SPS but of particular concern at BA5 (EDMS: 1309198)
- ~5.2MCHF LS2

Irradiated cable campaigns

- Cables subject to radiation age prematurely
- Provision to be made for cable breakdowns up to LS2
- Large campaign of cable renewal to be planned for LS2
 - Location most likely TS6- or TS4+
- Continuing campaign
- ~3.2MCHF LS2

SPS OPERATIONS PRIORITY:
HIGH
CABLE BREAKDOWNS CAN CAUSE LONG STOPS

**SPS OPERATIONS PRIORITY:
HIGH
FOR RELIABILITY AND SAFETY.
RECENT “LIGHTS STOP KICKERS”
PROBLEM**

LV distribution network consolidation

- 70's equipment – dates from the birth of the SPS
- **20% of the equipment deemed dangerous and needs urgent consolidation**
 - Plus anything else required by LIU
 - Almost no remaining spares - **Soon to be unmaintainable**
- Not a like for like replacement
 - Complete revision for current needs and those of the foreseeable future
 - Strengthen electrical integrity and therefore greatly reduce downtime
 - Improve safety for EL operations
- Can be executed in both RUN and SHUTDOWN periods. To be spread over next ~5 years
- ~2MCHF for the SPS

48V dc system consolidation

- Again, 70's equipment with high failure rates
 - Almost no spares remaining – **Soon to be unmaintainable**
- Currently inadequate design, no redundancy
- **Provides power for personnel safety lighting**
- Not a like for like replacement
 - New system will be fully independent and redundant
 - Greatly reduced downtime and improved ease of maintenance
- Can be executed in both RUN and SHUTDOWN
- Budget 2015-2019 focused mainly around around LS2
- ~2.1MCHF for the SPS

EN-HE

I. Rühl 22nd August 111th IEFC

Crane consolidation

- Revamping of:
 - BB5 75t PR565
 - ECA4 40t PR570
 - ECX5 40t rotational PR567
 - BB3 2 x 7.5t PR554 and PR555
- Proposed to advance to 2015-2016 in readiness for LS2
- 750kCHF

SPS OPERATIONS PRIORITY:
LOW
**NO DIRECT IMPACT ON OPERATIONS BUT
POTENTIALLY REDUCED DOWNTIMES.
NECESSARY FOR LS2 AND LIU WORKS**



Monte charge consolidation

- If major magnet works foreseen for LIU then monte charges will require consolidation (Primarily electrical)

Following recent events on TIDVG

New TIDVG core internals - 250kCHF (perhaps insufficient)

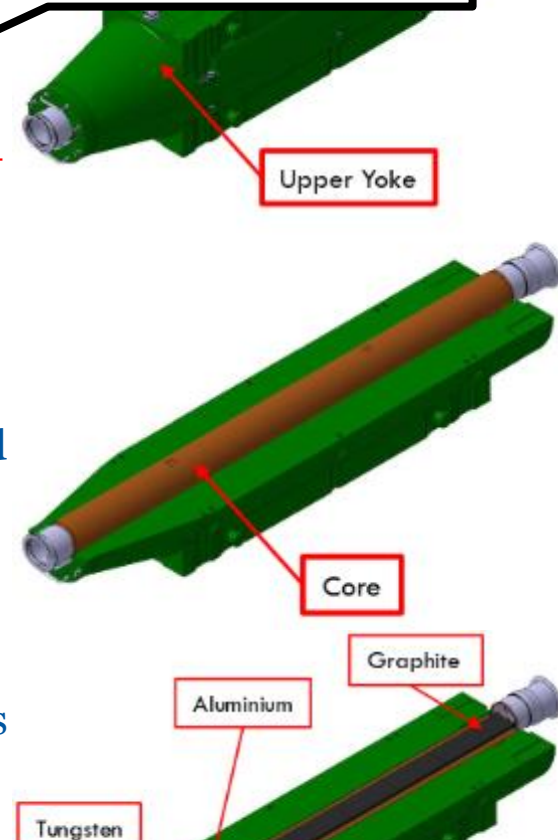
- Replacement blocks to original specification
- New internals being studied as part of LIU
- 4 Outer shells available
- 3 of which require cooling circuit modifications
- The one which doesn't is the one removed in August and therefore hottest
- Hardware interlocks for energy and intensity to be implemented
- TEDs have very similar construction – potentially same issues but with hopefully less critical consequences as Al is not in beam vacuum

Beam Intercepting Devices consolidation studies

- Reconstitute full documentation for all BIDs across in
- Ensure compatibility of installed designs with current
- 1640kCHF 2014-2018 (Covers entire injector complex)

(EDMS: 1310620)

SPS OPERATIONS PRIORITY:
MEDIUM
IMPORTANT FOR REDUCING DOWNTIME



SPS OPERATIONS PRIORITY:
LOW
NO IMMEDIATE IMPACT ON OPERATIONS BUT IMPORTANT TO UNDERSTAND COMPATIBILITY WITH CURRENT AND FUTURE BEAMS

Necessary not approved
Necessary and approved
Not Necessary to operate
Part in LIU

GS-ASE

P. Ninin 29th August 112th IEFC



Replacement of SPS access system 2014-LS2

- Present system lacks the necessary redundancy of a modern access system
- Boucle câblée put in place in 2006 as a temporary measure until the access system could be replaced
- Uniformity across CERN's accelerator complex
- Part of a commitment to host state authorities

BIW (Beam Imminent Warning) and evacuation upgrade to LHC and PS standard

- Currently inconsistencies between access and BIW sectorisation - Leads to uncertainty
- Currently no internal system check
- To be executed in conjunction with access system ins
- 1.1-1.3MCHF 2016 –LS2

SPS OPERATIONS PRIORITY:
HIGH
ACCESS SYSTEM AND BIW
SECTORISATION NEED TO BE
CONSISTENT

Necessary not approved
Necessary and approved
Not Necessary to operate
Part in LIU



GS-ASE

P. Ninin 29th August 112th IEFC

SPS OPERATIONS PRIORITY:

LOW

BUT SMOKE/FIRE DETECTION NEEDS TO BE BROUGHT UP TO DATE IN CONJUNCTION WITH OTHER FIRE PREVENTION UPGRADES

Renewal of SPS smoke detection pipework

- ~20km of PVC air sampling pipework needs replacement
 - With age and radiation PVC becomes brittle - reduces reliability
- 600kCHF – during LS2

Installation of SPS public address system

- As a replacement for obsolete BE-CO intercom system
 - To EN60849 standards for public address systems
 - Currently essential for evacuating the machine
 - Budget and planning still to be established
 - First estimates ~250kCHF

SPS OPERATIONS PRIORITY:

HIGH

BE-CO INTERCOM SHOULD NOT BE DECOMMISSIONED BEFORE GS-ASE PUBLIC ADDRESS SYSTEM IS OPERATIONAL



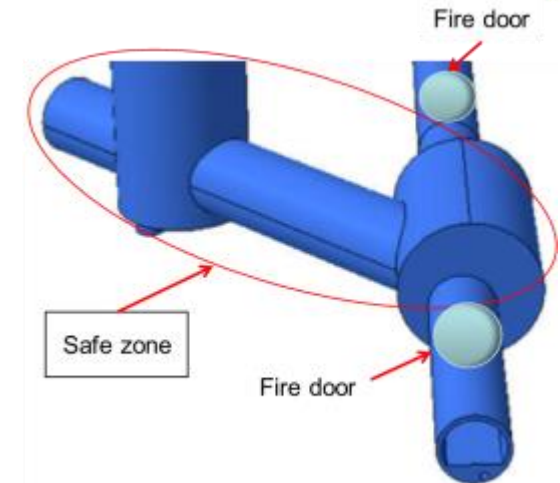
SPS fire safety improvements

- Still at early stages of discussion
- Hot topic for SPS-CSAP
- Initial studies performed by HSE and GS-FB as a result of discussions at SPS CSAP
- SPS-CSAP suggest that a full study of improvements to SPS fire safety should be requested so that an action plan and budgeting could be established ideally for implementation in LS2 or before
- Should comply to external standards for insurance and safety of external firefighters

SPS OPERATIONS PRIORITY:

LOW

**BUT SPS FIRE SAFETY NEEDS
URGENT ATTENTION
FULLY BACKED BY SPS-CSAP**



Monitoring of sensitive tunnel sections

- Lessons learned from TT10
- Phase 1: TT10 fibre optic monitoring installed – gain experience
- Phase 2: Extend monitoring to other sensitive areas
 - New monitoring techniques to be investigated
 - Photogrammetry, Geo radar, remote sensing and monitoring
- 500kCHF 2015-2018

SPS technical ducts consolidation

- Degraded concrete coupled with insufficient design – All BAs affected.
- Incapable of withstanding the necessary transport loads
- Included in approved budget for SPS studies and works underground
 - Temporary solution in place
 - Permanent repair in BA4 planned Christmas 2014
 - Permanent repair in all other BAs for LS2 or before - TBC

SPS OPERATIONS PRIORITY:

LOW

**CHANCE OF IMPACT ON OPERATIONS IS SLIM
BUT IMPORTANT TO KNOW IF THERE ARE
SERIOUS STRUCTURAL ISSUES IN THE TUNNEL
INFRASTRUCTURE**



SPS OPERATIONS PRIORITY:

HIGH

**SERIOUS RISK TO TRANSPORT
OF POTENTIALLY RADIOACTIVE
EQUIPMENT**

TE-ABT

B. Goddard 11th July 106th IEFC

SPS OPERATIONS PRIORITY:

MEDIUM

**RISK OF FAILURE RELATIVELY LOW
BUT LARGE CONSEQUENCES.
TIME TO RETURN TO SERVICE ALSO
LARGELY DICTATED BY CONDITIONING**

Spares:

Assemble MKDH spare

Currently none available

160kCHF 2018

Replacement of old/obsolete equipment:

Upgrade MKP thyatron switches

- Standardisation, fewer different types across equipment
- 200kCHF 2017

Construct new septum yokes

- 200kCHF 2017

Radiation hard potentiometers for septa

- 40kCHF 2015

Replace ZS HV generator

- Recently refurbished – Consolidation therefore postponed to 2021 – 230kCHF

SPS OPERATIONS PRIORITY:

LOW

**RECENTLY REFURBISHED.
SHOULD BE OK FOR MEDIUM TERM**

TE-ABT

B. Goddard 11th July 106th IEFC

Upgrade/replace electronics:

Renew kicker timings and MS controls

- 210kCHF - 2017

Upgrade fast thyatron interlocking

- LEP era electronics – reliability

Modernise kicker/septa controls

- Bring up to current standards, Common solution across machines
- 1460kCHF for PS+SPS 2018 (SPS represents ~30%)

Improving reliability:

New MKDV generators and controls

- Partly covered by LIU
- Motivated by removal of Hg ignitron switches for **safety** and reliability
- Reconfiguration to reduce potential of magnet damage
- 800kCHF - 2019

HV cable consolidation:

New ES septa HV cables - replace original cable in puits LSS2

- 240kCHF 2017

Renew MKP RG200 cables

- Due to normal HV cable degradation
- 210kCHF 2017

SPS OPERATIONS PRIORITY:

MEDIUM

**RISK OF BREAKDOWN INCREASING.
CONSEQUENCES ~12 HOURS
DOWNTIME**

SPS OPERATIONS PRIORITY:

LOW

**NO OBVIOUS BENEFIT FOR OPERATIONS
– MODERNISATION**

**SPS OPERATIONS
PRIORITY:**

MEDIUM

**REDUCED RISK OF
DAMAGING MAGNET.
SAFER, MORE RELIABLE
SOLID STATE SWITCHES TO
REPLACE MERCURY
IGNITRON SWITCHES**

SPS OPERATIONS PRIORITY:

LOW

**FAILURE UNLIKELY IN
SHORT TERM AND SOME
SPARE CABLES AVAILABLE
IN CASE OF BREAKDOWN**

Necessary not approved
Necessary and approved
Not Necessary to operate
Part in LIU



TE-ABT

B. Goddard 11th July 106th IEFC

Safety:

Upgrade thermal interlocks

- 110kCHF 2017

Kicker oil system fire prevention

- Firewall partitioning, fire detection, etc
- bring deficient areas up to LSS4 standard
- 290kCHF 2016

Kicker discharge and earthing switches

- To install automatic capacitor discharging and earthing systems
- Currently manual task – risk of error
- 180kCHF 2016

Other:

Consolidation of SPS extraction kicker configuration

- Extraction kicker configuration at LSS4 effectively 5 x more complex than LSS6 – potentially increased failure rates
- CNGS Fast rise times no longer necessary

Manpower is a limiting factor for TE-ABT consolidation:

- Lots of overlap with LIU work
- Can consolidation budget be used for manpower?

SPS OPERATIONS PRIORITY:

LOW

NO DIRECT IMPACT FOR OPERATIONS BUT PERSONAL SAFETY AND FIRE PREVENTION CONCERNED.

SPS OPERATIONS PRIORITY:

LOW

NO DIRECT IMPACT FOR OPERATIONS BUT PERSONAL SAFETY CONCERNED.

SPS OPERATIONS PRIORITY:

MEDIUM

LESS COMPLEXITY. MORE SPARES AVAILABLE. REMOVES UNNECESSARY IMPEDANCE

Replacement of SVC BEQ1

- End of life consolidation
- LS2
- 10.2MCHF

Replacement of main dipole and quadrupole electronics

- As a follow up to LS1 converter and transformer consolidation
- 2017
- 400kCHF

Replacement of MUGEF by FGC convertor controls

- MUGEF - outdated 70's technology
- Move to standardise converter controls across machines
- **Proposal to advance COD upgrade to FGC from LS3 to LS2**
 - Replacement of COD power supplies and upgrade to FGC
 - Entirety of SPS complex (with the exception of TT20) will be on FGC by end LS2
 - TT20 to be included with North area in LS3
- 2MCHF 2016-2019 for SPS FGC upgrade
- 3MCHF 2015-2018 for COD replacement and FGC upgrade

Renovation of 18kV power converters

- Manufactured in late 80's with a life expectancy of 20-30 years
- New 18kV transformers, HV capacitors and HV cabling
 - Following an incident in 2011 transformer replacement was recommended in the medium term
 - Several faults observed in the last few years
 - Potential safety hazard
- TE-EPC to execute the majority of consolidation and take responsibility once complete
- 500kCHF for BE-RF – 2018-2019
- 3MCHF for TE-EPC – 2016-2019



TE-MPE

B. Puccio 8th August 109th IEFC

SPS OPERATIONS PRIORITY:

LOW

**CURRENT MAGNET INTERLOCKS AGEING.
BETTER PROTECTION AND RELIABILITY**

Install WIC (Warm magnet Interlock Controller) in TT10 and TT20

- TT10 and TT20 are the only lines not covered by WIC in the SPS
 - TT10 is the missing link in the LHC injector chain
- Planned to coincide with TE-EPC consolidation works
 - TT10: 2017 – 2018 - 400kCHF for TT2/TT10
 - TT20: after LS2 with North area - 900kCHF for TT20 (covers TT20 and North area)
 - Around 75% of project costs goes towards cabling

Install BIS (Beam Interlock System) in TT10

- Machine protection system
- TT10 and TT20 only lines not covered by BIS in the SPS complex
 - TT10 is the missing link in the LHC injector chain
- 200-400kCHF – LS2 - TBC

SPS OPERATIONS PRIORITY:

MEDIUM

**MAGNETS CURRENTLY ONLY SURVEYED BY
SOFTWARE INTERLOCK. FUTURE HIGH
INTENSITY BEAMS NEED GREATER
PROTECTION**



SPS OPERATIONS PRIORITY:

LOW

FASTER DIAGNOSIS OF MAGNET OR COOLING FAULTS. REDUCED DOWNTIME

Replacement of SPS ring magnet interconnection boxes “Trèfles”

- Local magnet over temperature indicators – Latch with magnet over temperature
- In conjunction with WIC allows diagnosis of magnet or cooling problems
- Old mechanical system and doesn't always latch as it should
- 100kCHF - 2018

Increased WIC granularity for SPS ring

- WIC currently identifies problems by demi sextant
- New system to identify individual magnets or small groups of magnets
- 600kCHF 2020-2022

SPS OPERATIONS PRIORITY:

LOW

FASTER DIAGNOSIS OF MAGNET OR COOLING FAULTS. REDUCED DOWNTIME

TE-MSC

D. Tommasini 18th June 104th IEFC

Procurement of new SPS magnet coils - In progress

- TT10 quadrupole magnet
 - 1 coil for SPQI_NWP type quadrupole magnet – 30kCHF
 - 30 currently installed in the machine
- SPS ring sextupole magnets
 - 1 coil for SPLSFN_FWP type sextupole magnet - 50kCHF
 - 54 currently installed in the machine
 - 1 coil for SPLSDN_FWP type sextupole magnet - 50kCHF
 - 54 currently installed in the machine

Manufacture 10 MBB dipole coils

- To restore stock to original levels
- Susceptible to inter turn dipole short circuits
 - Not repairable
 - 10/22 of the original spare coils used for this purpose
- Since 2011 capacitive discharge tests have been carried out
 - Allows early detection of inter turn short circuits
- 2.2MCHF from 2015-2017



SPS OPERATIONS PRIORITY:

HIGH

**NO IMMEDIATE IMPACT ON OPERATIONS
BUT IMPORTANT FOR LONG TERM VIEW.
DEPENDS UPON EVOLUTION OF FAILURE
RATE AND LEAD TIMES**

Necessary
Necessary
Not Necessary
P:



New vertical bumpers MPLV and MPSV

- Spare situation of SPS vertical bumpers:
 - MPLV: 2 spares for 3 magnets in operation
 - MPSV: 1 spare for 10 magnets in operation
- LIU scraping scheme may require new design vertical bumpers
 - MPLV and MPSV would then no longer be compatible
 - New design magnet appears to be compatible for LIU and existing MPLV and MPSV replacement
 - Proposed consolidation strategy depending upon LIU decisions
 - If LIU scraping scheme approved produce new magnets for LIU and consolidation
 - If not just manufacture new MPSV to existing spec
- 330kCHF (70% from LIU and 30% from consolidation) 2015-2017

TE-VSC

J. Ferriera Somoza 22nd August 11th II

[Safety] 850 obsolete ion pump controllers

- Ageing power supplies with outdated safety standards –
- Increasing failure rates on power supplies
- More downtime and worse vacuum performance
- 3,1 MCHF 2017-2019

• [Safety] RXVA BA2, BA5 and BA6

- Safety disconnection boxes for vacuum pumps
- Isolates 6kV when cable disconnected
 - Still to be implemented in BA2, BA5 and BA6
- 180 kCHF LS2

• [Performance] 1000 x VPIAs (linked to LIU carbon coating)

- Ageing equipment – approaching end of life
- General degraded performance, slower recovery
- Needs additional manpower funding if coating not executed under LIU (1 IS)
- 2,5 MCHF 2016-2018 procurement - install LS2

SPS OPERATIONS PRIORITY:
MEDIUM
POTENTIALLY REDUCED VACUUM PERFORMANCE. RELIABLE PUMPS NEEDED FOR FUTURE BEAMS. OUTDATED SAFETY STANDARDS

SPS OPERATIONS PRIORITY:
LOW
NOT IMPORTANT FOR OPERATIONS BUT IMPORTANT FOR SAFETY IN THE TUNNEL PARTICULARLY FOR VACUUM

SPS OPERATIONS PRIORITY:
MEDIUM
GOOD VACUUM PERFORMANCE ESSENTIAL FOR FUTURE BEAMS

Necessary not approved
Necessary and approved
Not Necessary to operate
Part in LIU



TE-VSC

J. Ferriera Somoza 22nd August 111th IEFC

SPS OPERATIONS PRIORITY:
MEDIUM
VALVES NEED TO OPERATE RELIABLY. SECTORISATION IS IMPORTANT FOR CONDITIONED EQUIPMENT

[Reliability] Replacement of Valves

- Risk of old valves potentially blocking – repair not always straightforward
 - Valves blocked closed = beam stopped
 - Valves blocked open pose a risk to conditioned equipment
- 300kCHF LS2

[Spares] Spares (enamelled flanges, damper resistors and chambers)

- Re-establishment of regularly used spares following LS1 and in preparation for LS2
 - For re-establishing correct grounding scheme
- 200 kCHF 2015-2016

SPS OPERATIONS PRIORITY:
MEDIUM
NEEDED FOR CONSOLIDATION AND TO AVOID MACHINE EARTH LOOPS

Industrial support - manpower

- 1 IS per year with additional 1 during LS2
- Only 3 technicians currently take care of the SPS
 - Running at the limit - Large consolidation workload
 -and they estimate that ~80% of their LS1 work was support for other groups
 - 150 kCHF/year, LS2 300/kCHFyear

SPS OPERATIONS PRIORITY:
LOW
NO DIRECT IMPACT ON OPERATIONS BUT THEY ARE HIGHLY SOLICITED OFTEN FOR OTHER GROUPS INTERVENTIONS – DOSE LIMITS

Budget currently being revised in effort to reduce costs

Necessary not ap
Necessary and ap
Not Necessary to
Part in LIU



Conclusions

- Many consolidation plans depend upon and are awaiting LIU decisions
- Recent events show responsibility for cables between magnets and power supplies needs to be clarified
- Consolidation for safety reasons is a recurring theme for several equipment groups in the SPS
 - Many systems date from the 70's and have the associated safety standards
- Once approved, consolidation work should be communicated to EN-MEF asap for proper planning and integration if not already done.

Thank you for your attention

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