

Linacs 2,3 (4)

Future Consolidation



YEARS/ANS CERN

This summary will cover:

- Linac2
- Linac3
- Transfer Line (Linac4 use)

Some initial remarks:

- This summary is an OPERATIONAL view – Eqp Groups opinion is taken into account separately by consolidation.
- Dates correspond to the installation dates (not when budget is needed).
- Linac2 is the proton provider until mid 2018.
- Linac4 should be ready as a proton back up in August 2015.
- Linac3 is the pre-injector of Pb ions. Only Ar and Xe to NA61 are approved. Only these are considered (no light medical, only Pb to LHC...)
- Linacs are short, densely populated and tailored to increasing energy...

**Priorities – Note they can change in machine life
On a per accelerator basis**

**Red – Activities not approved but needed to operate effectively the machine.
NEEDS APPROVAL.**

**Green – Activities approved and needed to operate effectively the machine.
ALL OK.**

**Magenta – Activities not approved or not approved but NOT urgent to operate effectively the machine.
NOT A HIGH PRIORITY FOR OPERATION**

Blue – Activity in LIU.

These are operation team priorities, may not match Eqp Groups:

- Is it critical for operation?
- Redundancy in the machine?
- Does it have an operation overhead today?
- Value for money?

Linac2



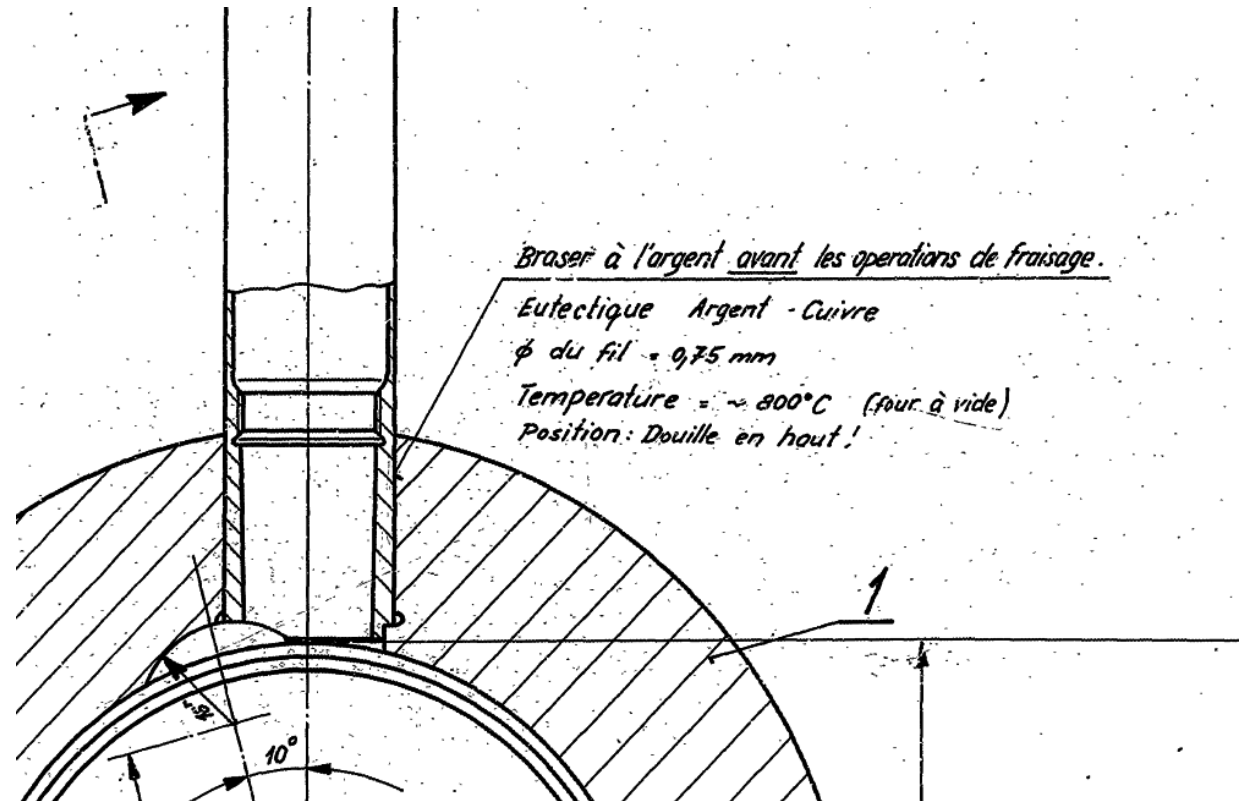
Linac2

Item	Group	When	Approved?
<p>Tank Quadrupole Failure Mitigation EN/MME are not confident on the procedure to make a drift tube.</p> <p>* Remake drawings and build a prototype (of a presently leaking DT).</p> <p>Useful only if approved now and finished end 2015.</p>	<p>BE-ABP + EN- MME</p>	<p>2015</p>	<p>New (~60k)</p>
<p>Spare RFQ amplifier.</p> <p><i>If not done?</i></p> <p>Increases difficulty of repair.</p>	<p>BE-RF</p>	<p>2015</p>	<p>Yes (RF say they will do it)</p>

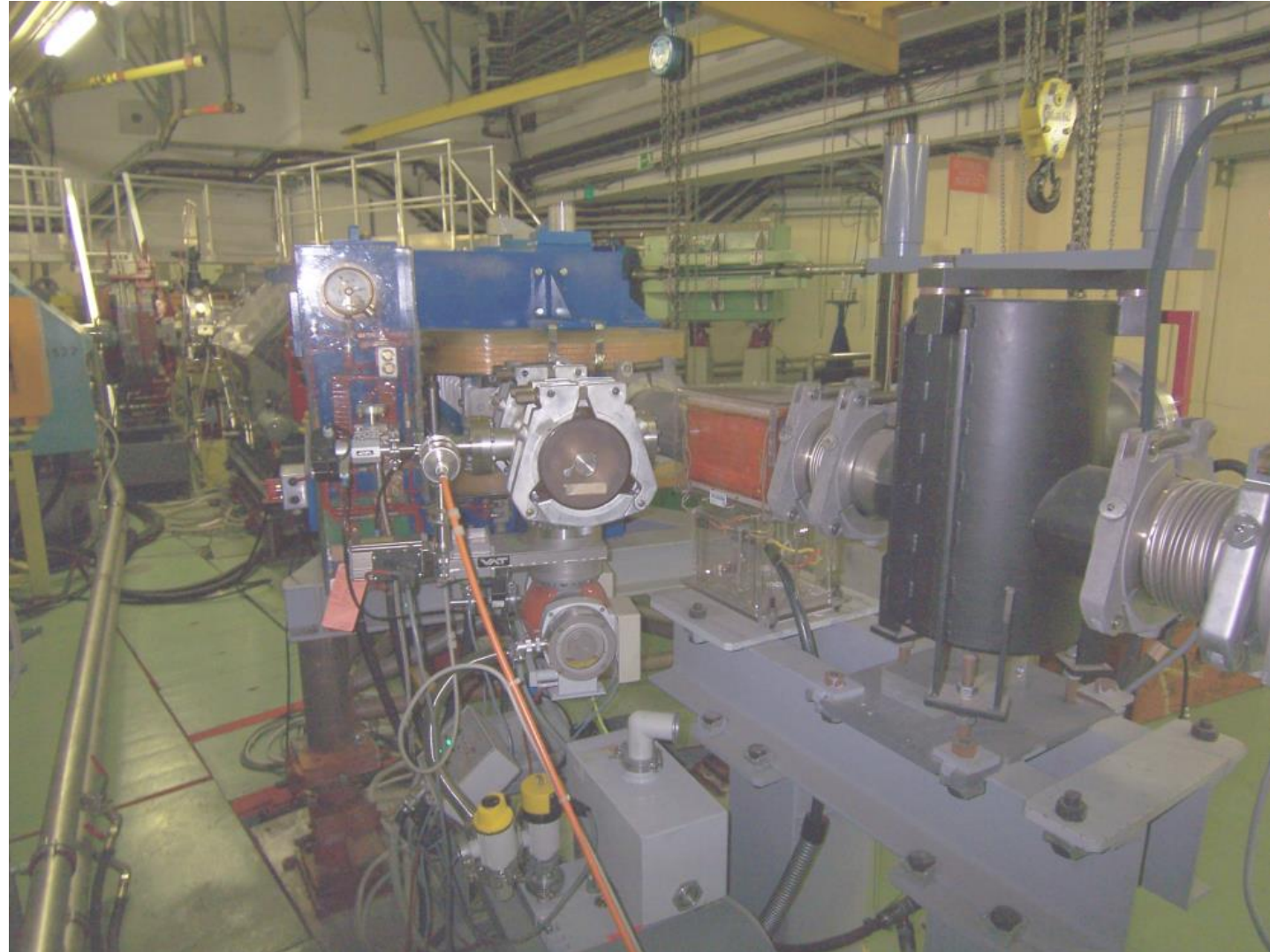
Linac2 Drift tube

Each individual, could be difficult to produce spare on demand.

EN-MME have analysed the drawings and will report in a few weeks.



LT-LTB(-BI) for Linac4



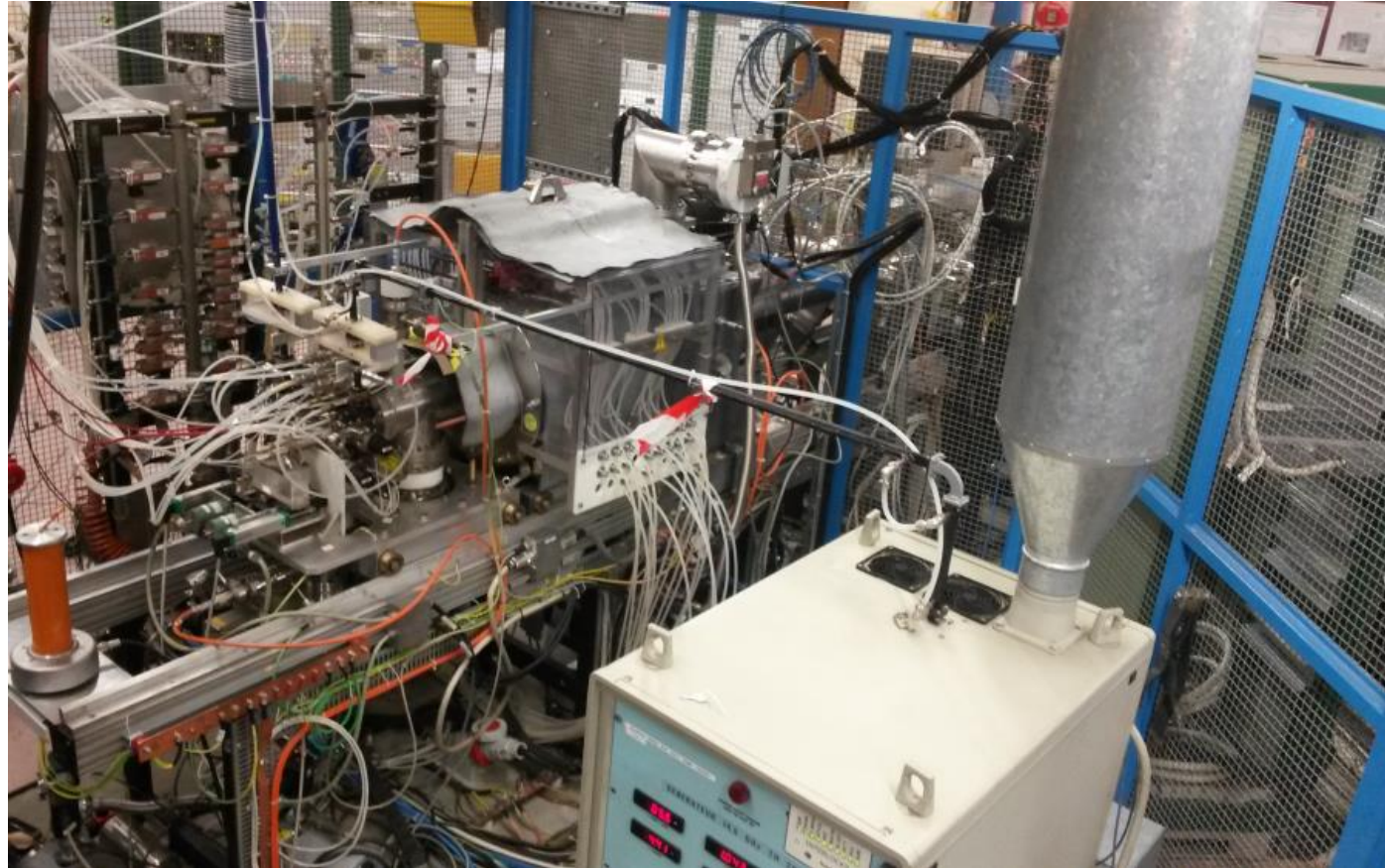
LT-LTB(-BI) for Linac4

Item	Group	When	Approved?
Replacement magnets (spares, and operational) (Some convertors are replaced under LIU)	TE-MSC	LS2	Yes (1300k)
* Power Con Controls to FGC for ~100 convertors Would eradicate MIL1553 from Linac4 up to PSB injection Decreased maintenance diversity for EPC. Improves ion LBS measurements post LS2.	TE-EPC	LS2	No (800k)
* Warm Magnet Interlock Many magnets are completely unprotected. They have to run at <2xl for Linac4. Would be best coupled with EPC FGC and any magnet installation.	TE-MPE	LS2 (with convertor control)	New (part of 1.8MCHF)

LT-LTB(-BI) for Linac4

Item	Group	When	Approved?
<p style="color: red;">* Turbo Pumps</p> <p style="color: red;">Not active – used for pre-pumping, leak detection. If failing these pumps are inaccessible – leading to longer downtime. VSC would prioritise these in their consolidation.</p>	TE-VSC	LS2	No (540k)
<p style="color: magenta;">* BCTs – exchange of 40yo to Linac4 standard. Decreased maintenance diversity for BI. Sufficient measurement redundancy with BPMs. If vacuum leak, temporary vacuum fix would be required. Already uses modern control. For EYETS 1.5 – decision needed ASAP!</p>	BE-BI	EYETS or post LS2 EYETS (LS2)	New (350k)
<p style="color: red;">Emittance meter scanner software –</p> <p style="color: red;">Maintenance of code with new base software versions (e.g. Labview)</p> <p style="color: red;">Maintains development and qualification of Linac4 sources in the test stand.</p>	EN-ICE		New (~0.5FTE=35k)

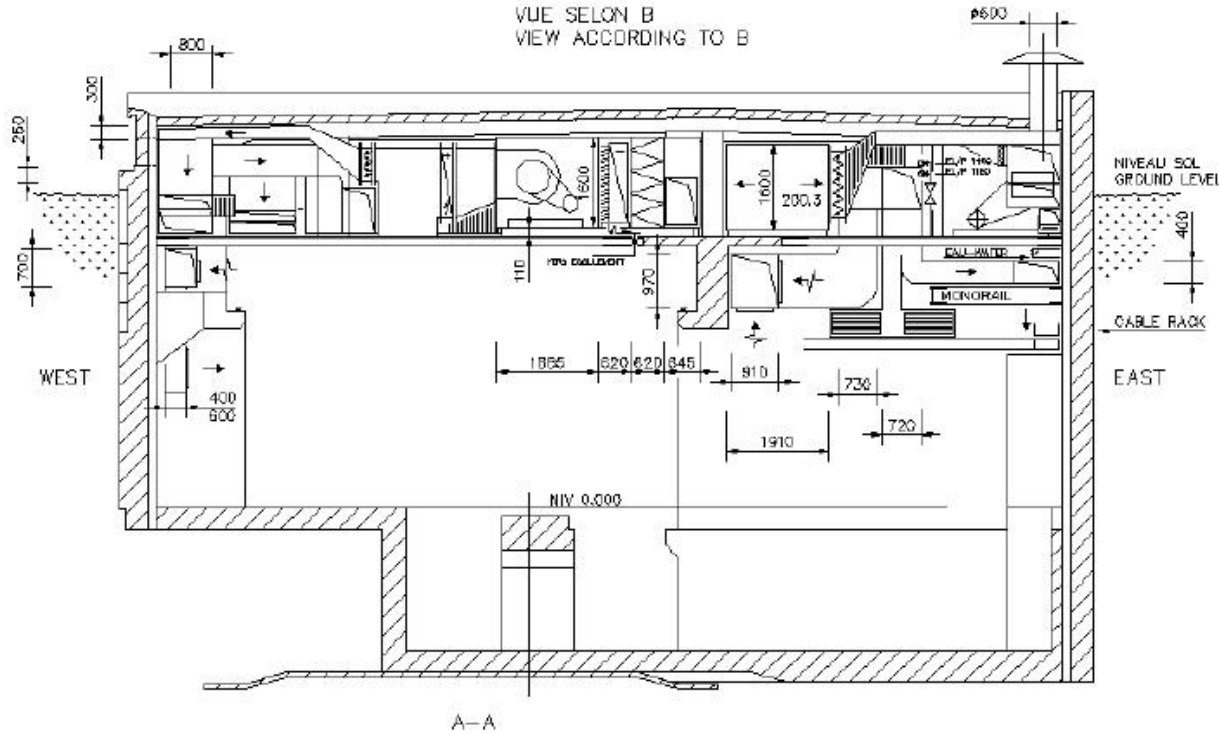
Linac3



Linac3

Item	Group	When	Approved?
<p>HVAC replacement</p> <p>Must include a major asbestos clean up – not budgeted.</p> <p>Cooling has been a persistent operational issue for Linac3. Post LS1 we will increase typical rep rate from 2 -> 3.6Hz – MD showed little margin for this.</p> <p>Increased operational workload, beam downtime and performance restrictions in summer, to become worse post LS2 if not consolidated.</p>	EN/CV + GS/SE	LS2	No (1300k+)
<p>Replace many power convertors in Linac3, including controls.</p> <p>Remove multiple design types, increasing maintainability.</p> <p><i>Some PCs lack spares – they should be prioritized.</i></p>	TE-EPC	?	New (1200k)
<p>LBS Line – consolidate for ions.</p> <p>Also requested to LIU-Ions – Negotiation needed.</p> <p>Renovation is best in LS2 when zone is modified for LBE line anyway (easing access).</p>	BE-ABP	LS2	No (1000k)

Linac3



Linac3 – Ventilation is insufficient to properly operate Linac3 to design spec, the asbestos in the ceiling needs to be dealt with at the same time.

Linac3



Power Convertors – A zoo of different types.
Move controls to FGC3 (check specs first).
Make sure heat load to HVAC is not increased.

Needs Approval Approved Not Priority

Linac3

Item	Group	When Installed	Approved?
<p>Linac3 Triplet Drift tubes</p> <p>There are spares – but possible recurring water leak issue on brazing – Replacement takes ~8-10 weeks!</p> <p>Priority to be modified if one fails.</p>	BE-ABP	Wait for failure	No (500k)
<p>The LLRF, upgrade to the Linac4 standard.</p> <p>ABP ops are happy with the present system which fulfills specs and is easy to use.</p>	BE-RF	2017	New(350k)
<p>Spare magnets and coils.</p> <p>Menagerie of different magnet types, without spares.</p>	TE-MSC	Spares	Yes (335k)
<p>Turbo pump group renovation</p> <p>High gas loads from the source, even for Pb with O₂.</p> <p>Higher operational downtime. Adds remote control.</p>	TE-VSC	LS2	No (315k)
<p>101 MHz amplifiers (Bertronix)</p> <p>Change driver tubes to solid state (the tubes are out of production and spares are finite), replace Step5 control and interlocks, some amplifier parts reaching end of life.</p>	BE-RF	LS2	New (250k)

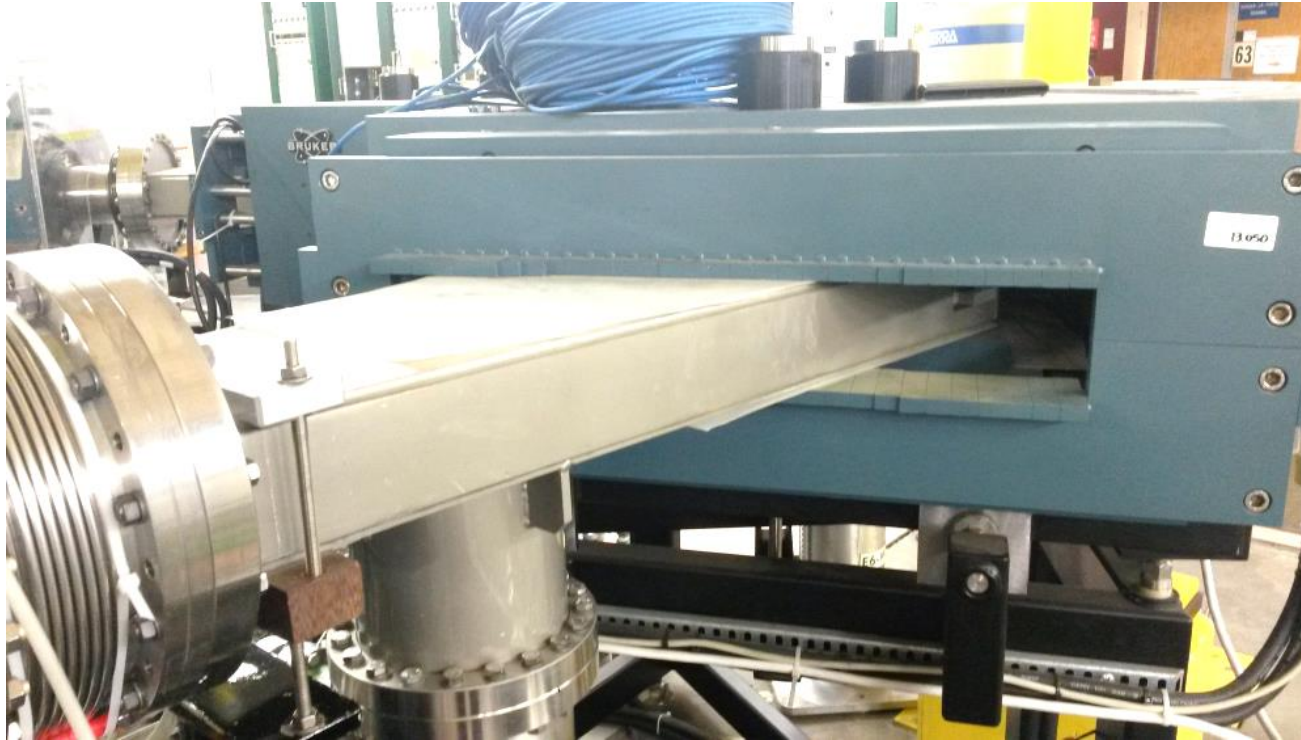
Linac3



Linac3

Item	Group	When Installed	Approved?
<p>Replace Thompson 14GHz Generator Can delay this until the Thompson generator fails. But that would mean 1 year without a spare.</p>	BE-ABP	Wait for failure	No (150k)
<p>Replace Critical Source spares when used</p>	BE-ABP	2016/18	Yes (150k)
<p>* BCT hardware consolidation Decreased maintenance diversity for BI. If vacuum leak, temporary fix would required. Limited operational measurement redundancy for BCTs at Linac3.</p>	BE-BI	2014	New (150k)
<p>Stripper Mechanism – Old, unmaintained design with no spare bellow. Almost complete...</p>	EN-STI	2015	Yes (106k)
<p>* Low energy beam bending chamber Missing spare for this complex rectangular chamber, suffering from beam damage. Being financed from operation money, that leads to holes elsewhere.</p>	TE-VSC	Now	New (100k)

Linac3



Bending vacuum chamber. Complex design
(not to CERN methods).
Being eaten from the inside out.

Linac3

Item	Group	When Installed	Approved?
* The driver amplifiers for bunchers, debuncher and ramping cavity; Missing spare amplifier for ramping cavity. All three systems are becoming obsolete.	BE-RF	LS2	New (60k)
Ion Pumps damaged after Ar run If not done? Vacuum degradation reduces beam performance.	TE-VSC	2015	New (30k)
The Frank James amplifiers. Replacement of small parts.	BE-RF	2016	New (25k)
* Critical cavity spares (tuners, couplers) for RFQ, IH, bunchers etc. Includes potentially critical items without spares!	BE-RF		vNew (###k)

Generic PS – Affecting the Linacs

Item	Group	When Installed	Approved?
* Timing TTL-Blocking They cause ~10 stops per year and are often difficult to debug.	BE-CO	2015-2017	New (600k)
Operational Database Mostly affects logging. <i>If not done?</i> Logging might be interrupted.	BE-CO	2015-17	No (595k)
PLS-SU receivers <i>If not done?</i> Choice to be made on timing evolution or beam setting up.	BE-CO	2015-2016	New (400k)

Conclusions and Summary

	Unfunded requests (kCHF)
Linac2	60
LT-LTB-BI	1900
Linac3	5400

- Linacs 2 and 3, and transfer line consolidation has been summarised.
- There are very few absolute urgent cases (single point failures with no spares).
- We haven't forgotten that we rely on EN/EL electricity, cables and EN/MME machine tool and others....

Nevertheless some preferences for priority have been expressed.

Thanks for your attention