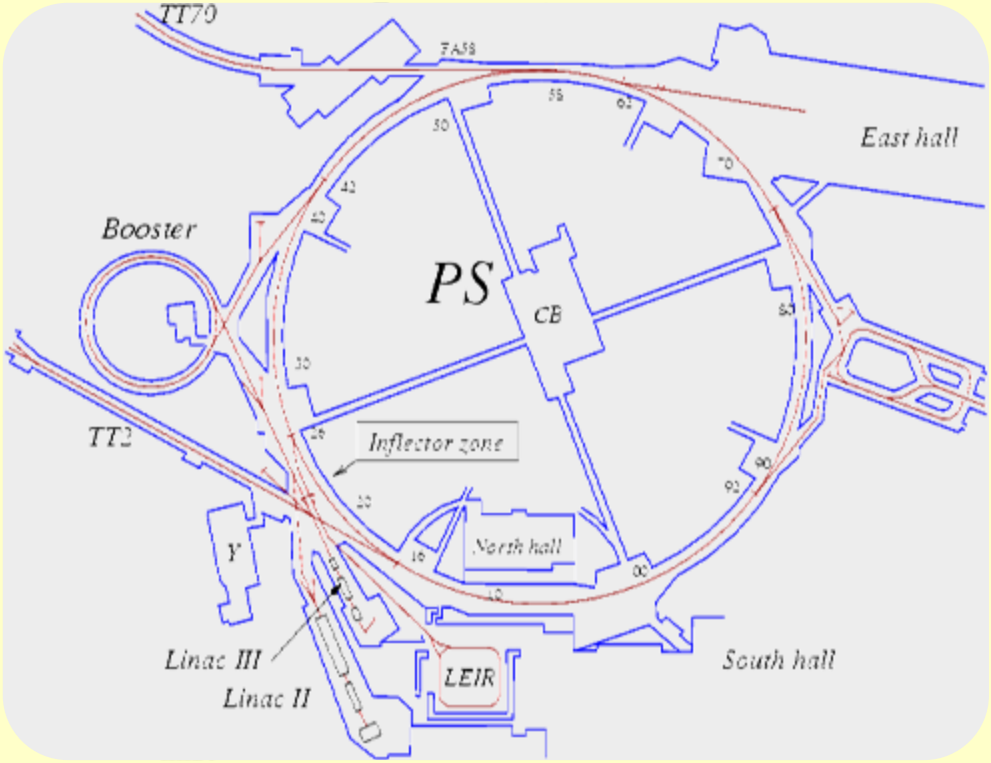
Review of vacuum activities.
PS Complex - Shutdown 2011 – 2012

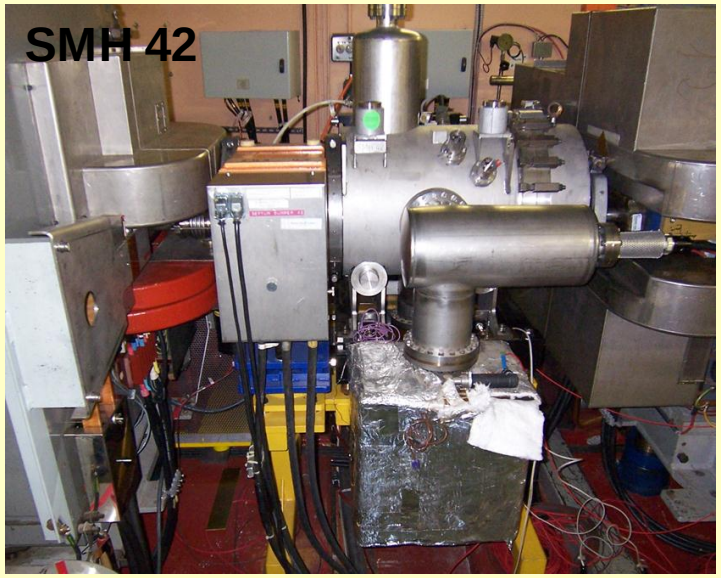
Paul Demarest – TE-VSC-IVM

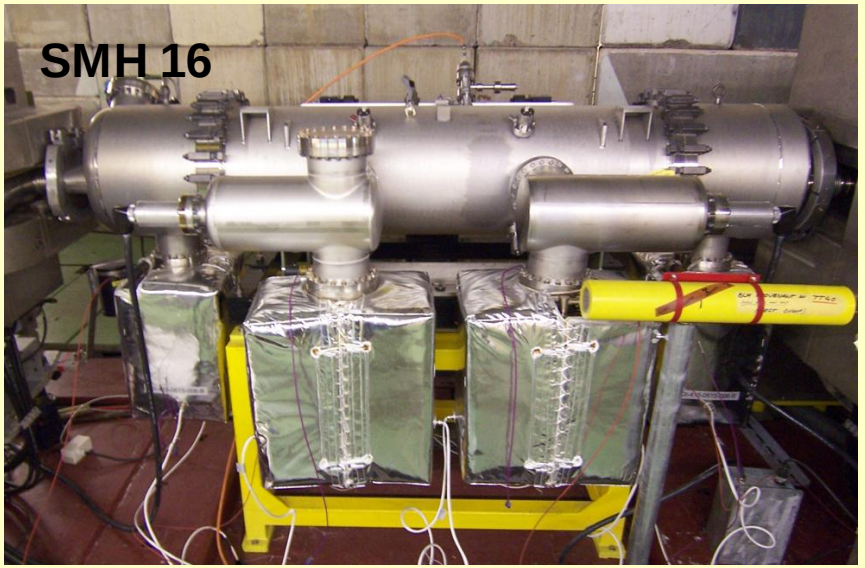


PS Ring – Replacement of Septa

Septum: Device used to transfer beam, into & out of synchrotrons.
Injection of a particle beam into a circular accelerator.
Extraction of particles from an accelerator to a transfer line.

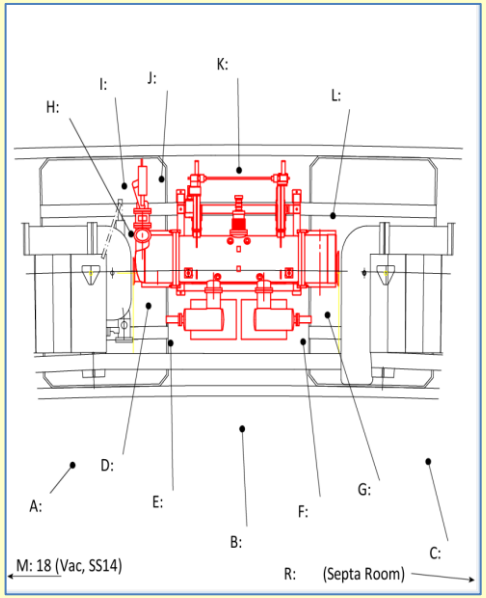
Why the need to replace?
Pulsed systems – Finite number of pulses before fatigue sets in leading to failure.
Removed septa refurbished ready for installation at a later date.





PS Ring - Replacement of Septa - Planning

Due to the function of these magnets the radiation dose rate is normally high, 1 mSv/h.
A **Radiation Dose Map** is made of equipment and area.



Logistics:
Movement - Rail track system & overhead crane.
Personnel - VSC, ABT, RF, Transport & RP.

Radiation Dose Plan (DIMR).
A detailed plan with calculated time and exposure.
Personnel & equipment in correct sequence, time & position in order to reduce staff radiation exposure to a minimum.

Work and dose planning - PE.SMH16 exchange 01/2012

Description:
Preventive removal of SMH16.2 and reinstallation of spare SMH16.3 in PS SS16

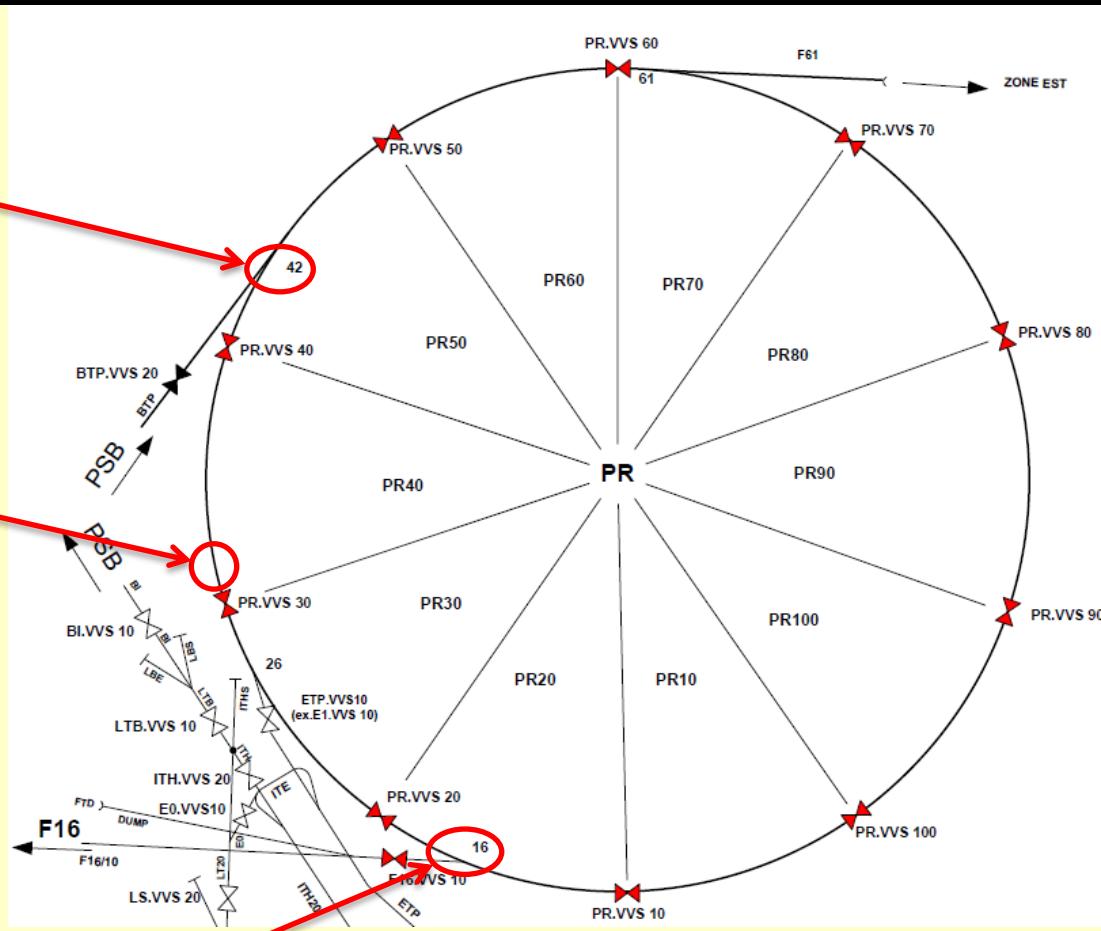
No.	Work description (Task)	Dep/Grp (executing)	Team	Location (check table 'DoseRates')	Persons [No.]	Time [min]	Working time [man.hou	Effective avg. dose [µSv/h]	Dose rate [µSv/h]	Collective dose [man.µSv]	Estimated dose [µSv]	Estimated total dose [µSv]	Working time real [man.hours]	Collective real dose [man.µSv]	Real dose [µSv]	Collective real dose [man.µSv]	Real total dose [µSv]
	Totals:						6.5	304		1958		1958	0	0		0	
	Prior intervention To be completed and checked by work coordinator(s) and experts								Prior intervention To be checked and completed by RP				Posterior interv To be completed by work co				
1	Preparation											309					0
1.01	Radiation survey	DGS/RP		xI1	1	3			460	23				0			
1.02	Empty and dry hydaulic circuit	TE/ABT	Septa Team	K1	1	3			230	12				0			
1.03	Leak test Hydraulic circuit	TE/VSC	Vac Team 4	xB1	2	10			15	5				0			
1.04	Transport de 16.3 de bunker à zone livraison(bt 151) / poser sur	EN/HE	Manut Team	X1	2	2			10	1				0			
1.05	Instal. palonnier sur 16.1 / déplacement / retrait palonnier	EN/HE	Manut Team	Y1	2	2			20	1				0			
1.06	déplacer 16.3 vers MU17 (tirer le chariot)	EN/HE	Manut Team	A1	2	2			30	2							
1.07	Deconnexion cables controle	TE/ABT	Septa Team	K1	1	2			230	8				0			
1.08	Retrait mires	TE/ABT	Septa Team	K1	1	5			230	19				0			
1.09	depose capot et stripline	TE/ABT	Septa Team	K1	1	8			230	31				0			
1.10	Remove BI observation camera	BE/BI	BI Team	J1	1	5			380	32				0			
1.11	Remove RF finger contacts	BE/RF	RF Team	xA1	1	1			312	5				0			
1.12	liberer butées mécaniques horizontales (2) et verticales (2)	TE/ABT	Septa Team	xC1	1	2			750	25				0			
1.13	liberer butée mécanique verticale (1)	TE/ABT	Septa Team	K1	1	1			230	4				0			
1.14	installation palonnier de levage sur SMH16.2	EN/HE	Manut Team	xA1	3	2			312	31				0			
1.15	Reperer la position de la cuve	TE/ABT	Septa Team	K1	1	2			230	8				0			
1.16	mettre à la PA le secteur 20	TE/VSC	Vac Team 3	M1	1	2			15	1				0			
1.17	Mettre à la PA septum 16.3 / Aide à la manutention	TE/ABT	Septa Team	C1	1	2			75	3				0			
1.18	déconnecter cables VPI, sublimator and gauges	TE/VSC	Vac Team 5	xC1	2	4			750	100				0			
2	Removal of SMH16.2											253					0
2.01	open flange downstream 16	TE/VSC	Vac Team 1	xD1	2	1			1450	48				0			
2.02	open flange upstream 16	TE/VSC	Vac Team 1	xE1	2	1			450	15				0			
2.03	lever tank/poser et fixer sur chassis/retirer palonnier	EN/HE	Manut Team	xF1	3	2			500	50				0			
2.04	lever tank/poser et fixer sur chassis/retirer palonnier	TE/ABT	Septa Team	xG1	2	2			600	40				0			
2.05	Close downstream flange	TE/VSC	Vac Team 1	xG1	2	3			0	0				0			
2.06	Close upstream flange	TE/VSC	Vac Team 1	xG1	2	3			600	60				0			
2.07	remove from ring to corridor (or North Hall)	EN/HE	Manut Team	xH1	2	2			600	40				0			
3	Reinstallation of SMH16.3											1114					0
3.01	cleaning of vacuum flange surfaces	TE/VSC	Vac Team 3	xD2	2	3			870	87				0			
3.02	Open end flanges before installation	TE/VSC	Vac Team 3	xG2	2	2			0	0				0			
3.03	cleaning of tank flanges	TE/VSC	Vac Team 3	xG2	2	2			0	0				0			
3.04	Install palonnier on SMH16.3	EN/HE	Manut Team	xH2	2	2			0	0				0			
3.05	installation new tank on SS16	EN/HE	Manut Team	xI2	3	2			138	14				0			
3.06	installation new tank on SS16	TE/ABT	Septa Team	xI2	2	2			138	9							
3.07	Isealing of downstream flange	TE/VSC	Vac Team 2	xD2	2	5			870	145				0			

PS Ring - Replacement of Septa

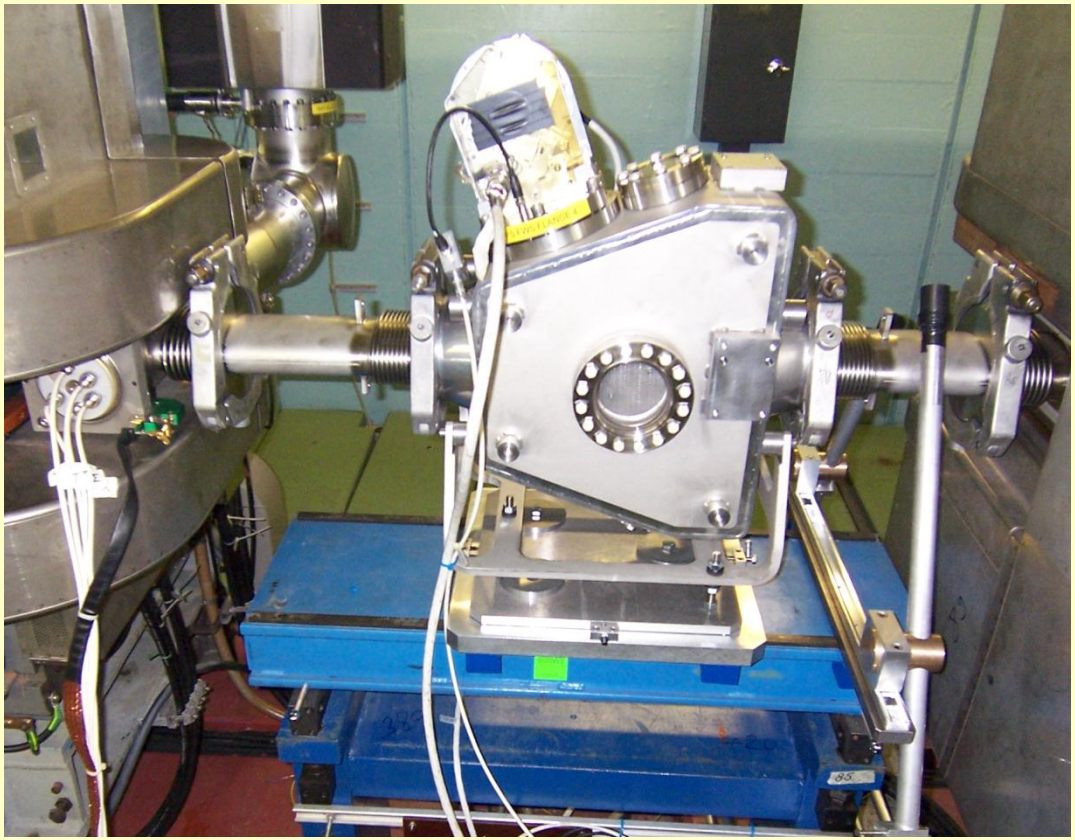
SMH 42
Injection from the PSB

SEH 31
Preparation for ejection
by SMH 16

SMH 16
Ejection to SPS, AD and n-Tof via TT2



PS Ring – Fast Wire Scanner Replacement



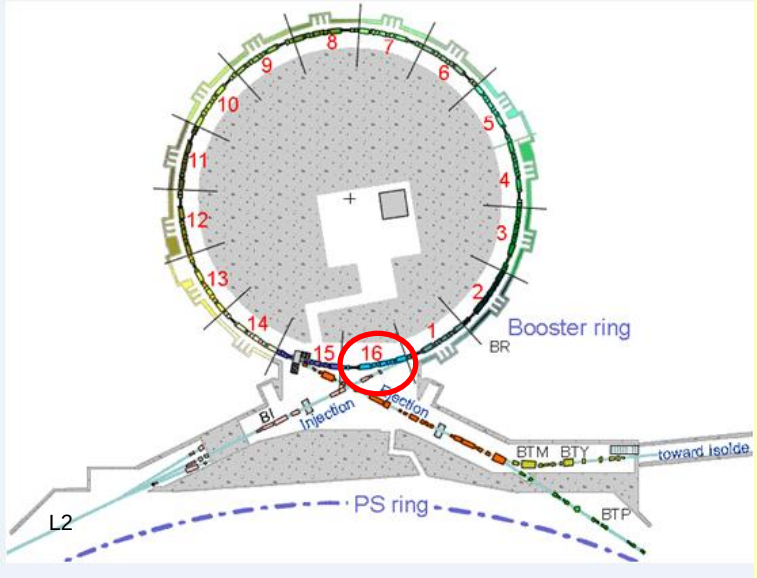
FWS - Provides information on beam profile and position
Replaced - FWS.54, 64, 65 & 85
Modified design: Larger aperture to avoid contact with the beam and a more robust mechanism.

PS Ring – Sublimator Filaments & VPI Replacement

Replacement of Sublimator Filaments.
Replaced on sectors 20, 40, 50 & 100 opened during the shutdown.
Total of 44 sublimators replaced.

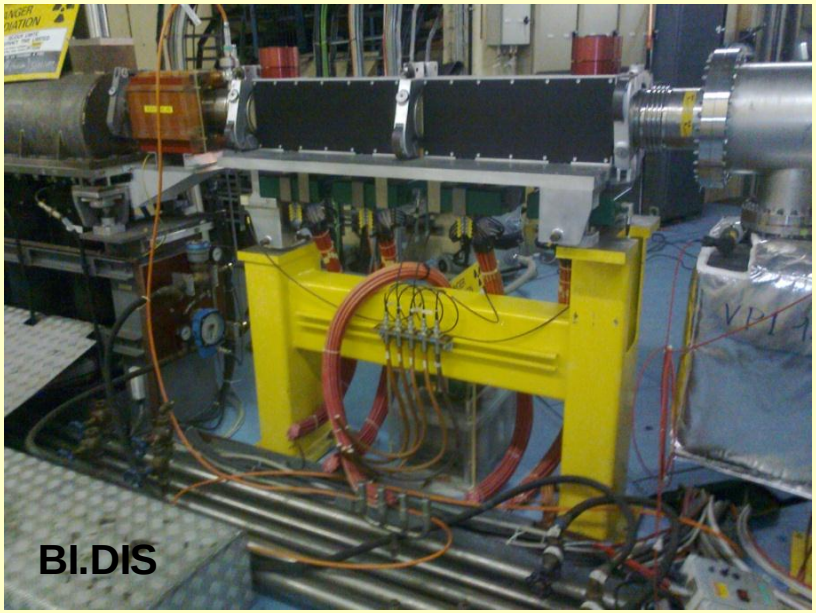
Replacement of 3 Ion pumps on sector 90.
VPI 84, VPI 85 & VPI 86.

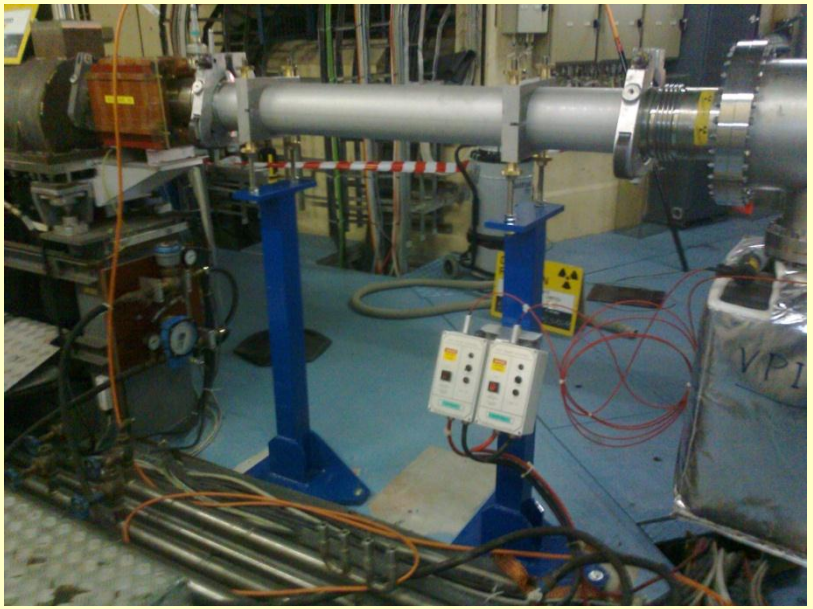
PSB – Replacement of Injection Chambers BHZ162



- July 2011 - Leak developed on one of the four injection chambers – Temporary repair with vac seal.
- Due to corrosion on the stainless steel chamber, the result of chemical reaction with PVC clamp used for mounting corrector magnets.
- All four chambers replaced - Evidence of corrosion on all chambers.
- Magnet re-shimmed by MCN to prevent any movement and fatigue of the coils during pulsing.
- Replacement magnet clamps now manufactured from charged epoxy resin.

PSB – BI.DIS Magnet removal





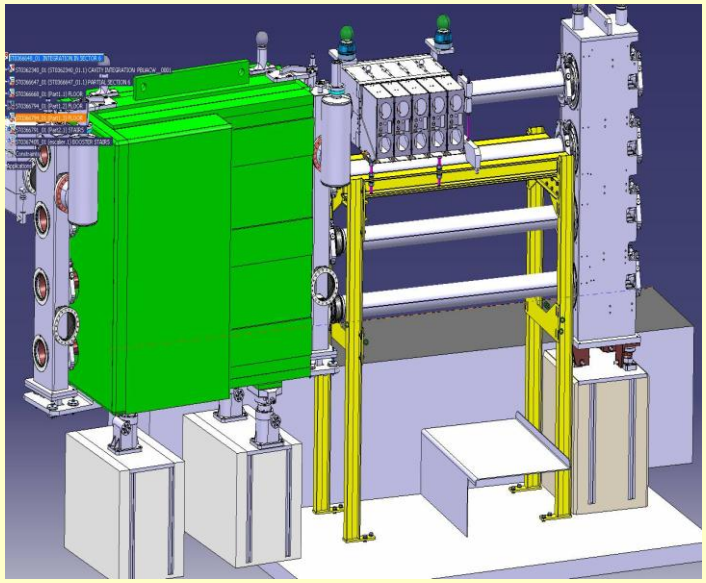
The BI.DIS magnet was removed and replaced with a plain vacuum chamber.

No longer required as now ions are generated at Linac 3 and LEIR.

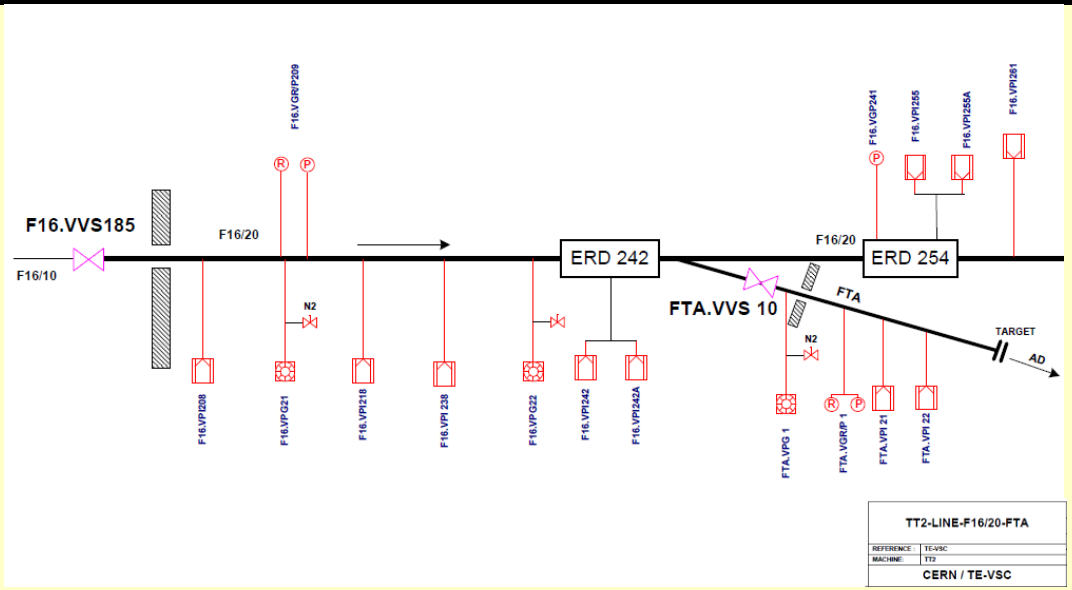
This magnet was used when ions were fed to the PS via Linac 2 & the booster.

PSB – Finemet® Cavity Installation

Experimental RF cavity installed in BR20.
Replacing a vacuum chamber in Sector 6L1.
On one ring only.
Installed for testing with the view of replacing the existing RF cavity system in the future.
Only to be tested during non-experimental beam time.



TT2 - Transfer Tunnel 2



Replacement of Transformer

Replacement of FTA Vacuum window
AD target area.

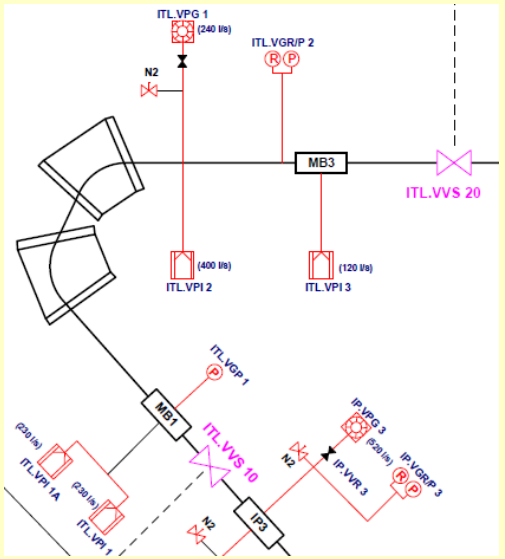
Following a leak detection on the FTA line of TT2 a leak of 4.0×10^{-7} mbar.l/sec was detected on the window.

Inspection and cleaning of the ITL bending chamber.

Evidence of dust particles but no obvious damage to the inside of chamber.

Cleaning required to reduce the possibility of damaging pumps and instruments.

Carried out with vacuum cleaner in conjunction with endoscope camera.



Linac 2 – Leak Detection & VPI Replacement

Searching for additional vacuum leaks.
A single additional leak found:
Drift-tube 6 of Tank 3 Section 4.
2.0×10^{-7} mbar.l/s

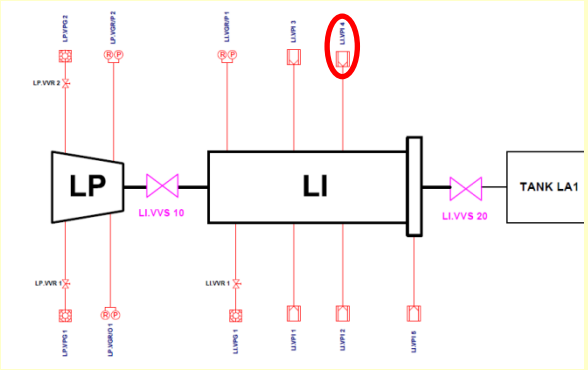
Checking known vacuum leaks.
All leaks checked with no discernable increase in leak rate.

Managed leaks.
Pressures stable inside additional/secondary vacuum containment.

RF feeder loop – Tank 2
Bell installed – Rotary Pump

Drift-tube 11 – Tank 1
Cooling line - Scroll Pump

Ion pump LI. VPI 4 replaced on the RFQ



Conclusion & Acknowledgements

PS Ring – Septum replacement procedure

Procedure for removal and replacement of a Septum.

1. Disconnect power and cooling water – blow down.
2. Vent the sector with nitrogen.
3. Remove RF Bypass – By RF group (Ceramic coated flange)
4. Disconnect vacuum flange at either end of septum, apply foil and protective covers.
5. Septum lifted out of ring via overhead crane and installed on rail chariot – removed from ring (where stored?)
6. Replacement septum vented with nitrogen, blank flanges removed – seal faces (x4) and seals (x2) prepared – Then moved alongside installation location.
7. Septum lifted into position with overhead crane – Pre set mounting to ensure correct position (kinematic mount).
8. Vacuum flanges assembled with seals.
9. Check clamp is open circuit (Cannot have a DC connection but require RF contact) The RF bypass provides the correct circuit to allow RF to pass.
10. Start pump down - Carry out leak test.
11. Re-connect power and cooling supplies.