PSB H^0-H^- Injection: Sectorisation Analysis

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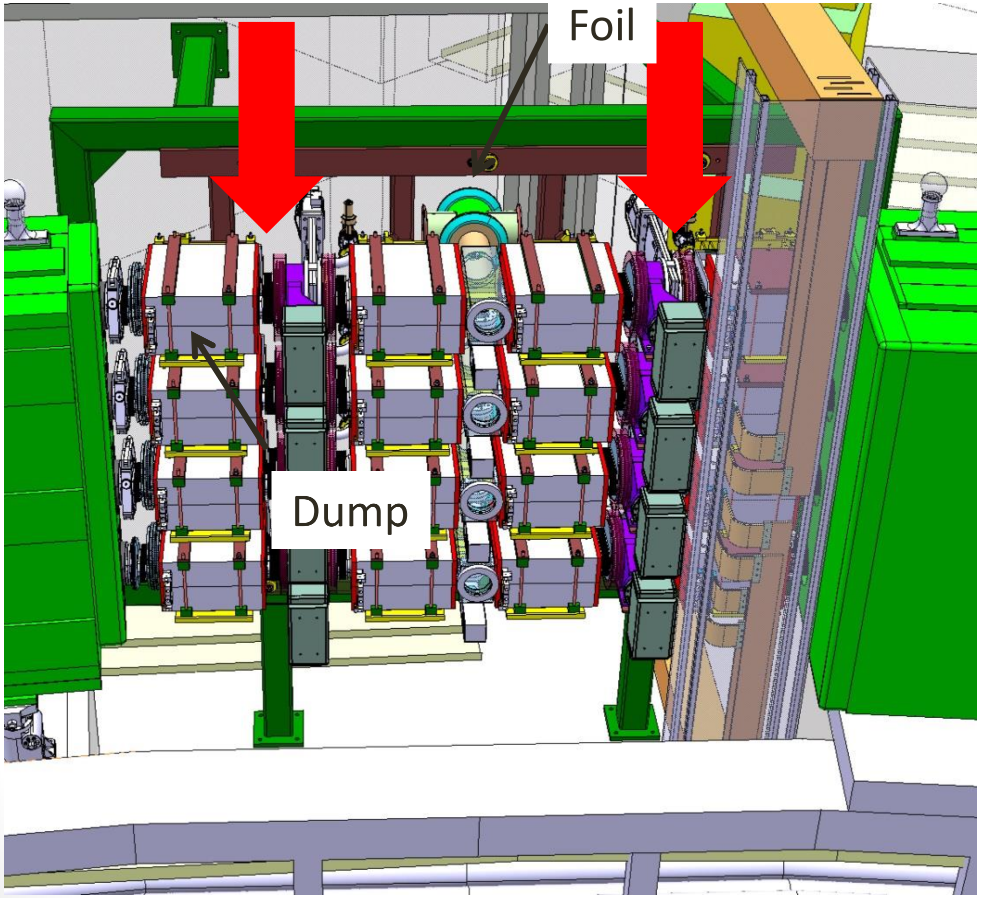
Why re-sectorising this sector?

At the moment the sector valves are foreseen to be positioned right before and right after the stripping foils;

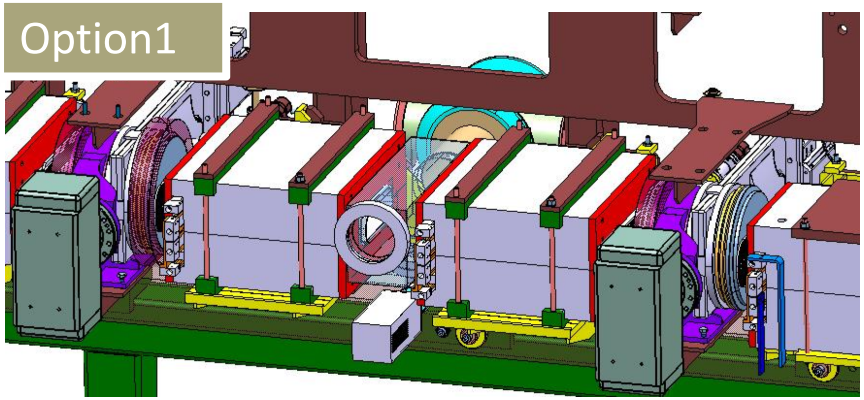


A different sectorisation would allow:

- Less radiation for TE/VSC during pumping and leak detection.
- More space for replacement of stripping foils.
- Less problems to find space for primary pumping and venting.
- The controlling of the initial phase of the pumpdown and venting was tested: no problems occurred (report under validation).

Several Case Study (1)

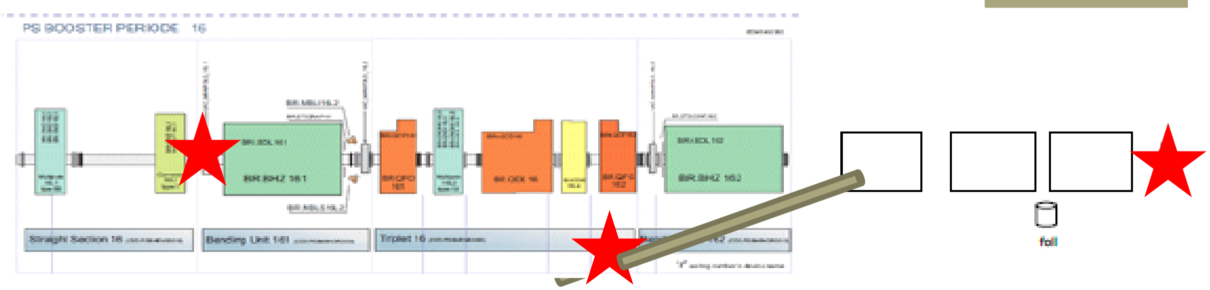
Option1



★ = Sector Valve

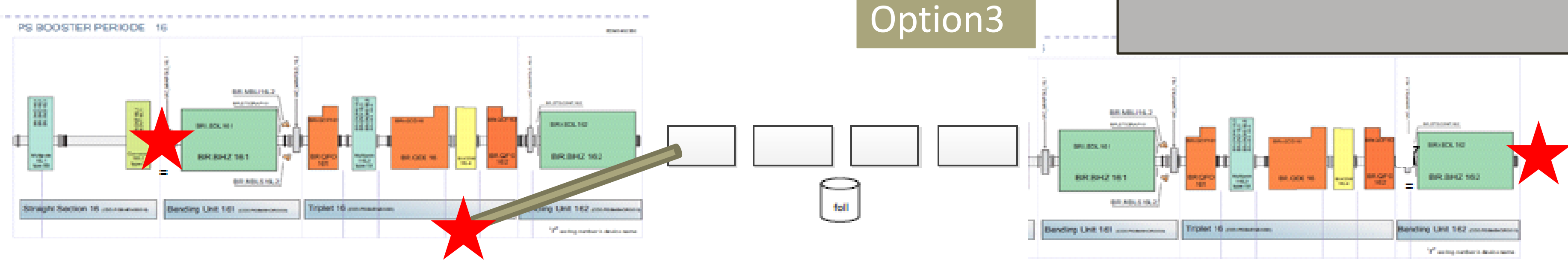
Option 2 sector valve as below with a sector valve at the third manifold

Option2



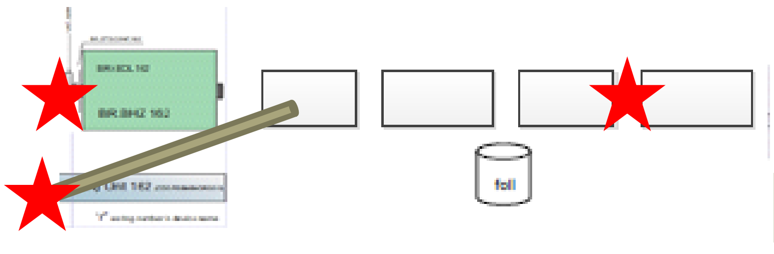
Option 3 sector valves as below with a sector valve at the third manifold to the left and dump And sector valve in the Second manif

Option3



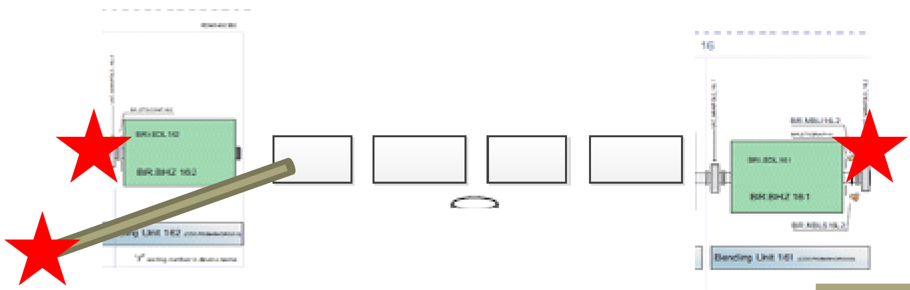
1. BASE LINE DESIGN, always for 1 ring.
2. Sector valve at the third manifold to the left of the injection zone and after the stripping foil. Modification of manifolds required.
3. Sector valve at the third manifold to the left of the injection and at the third to the right. Modification of manifolds required.

Several Case Study (2)



Option 4

4. Sector valve at the first manifold to the left of the injection and after the dump. With double SIPs between BSW 1&2.

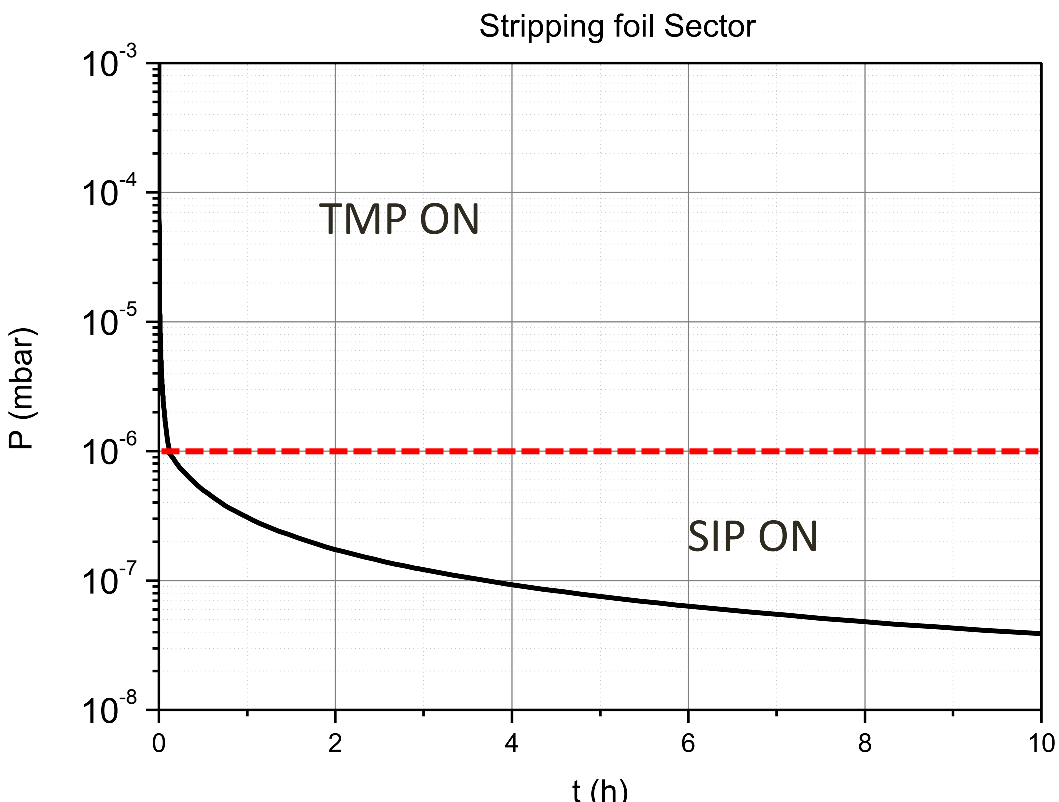


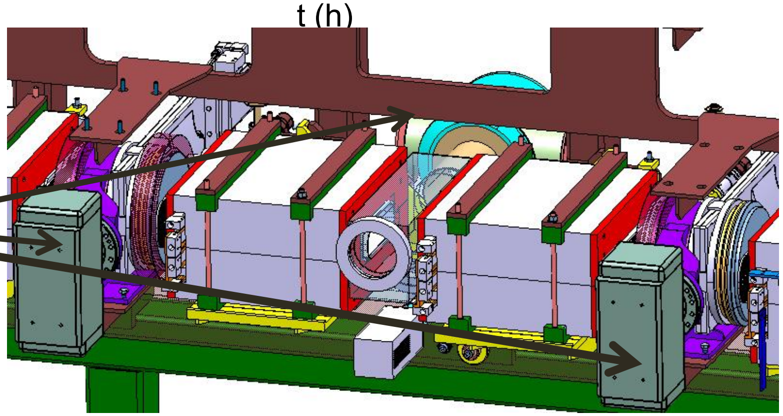
Option 5

5. Sector valve at the first manifold to the left and at the first manifold on the right. With double SIPs between 1&2 and 3&4.

The pump down curve for all the options has been studied: following last meeting decisions we will focus on Option 4 and 5.

Pump down studies: option 1





TMP &

SIP

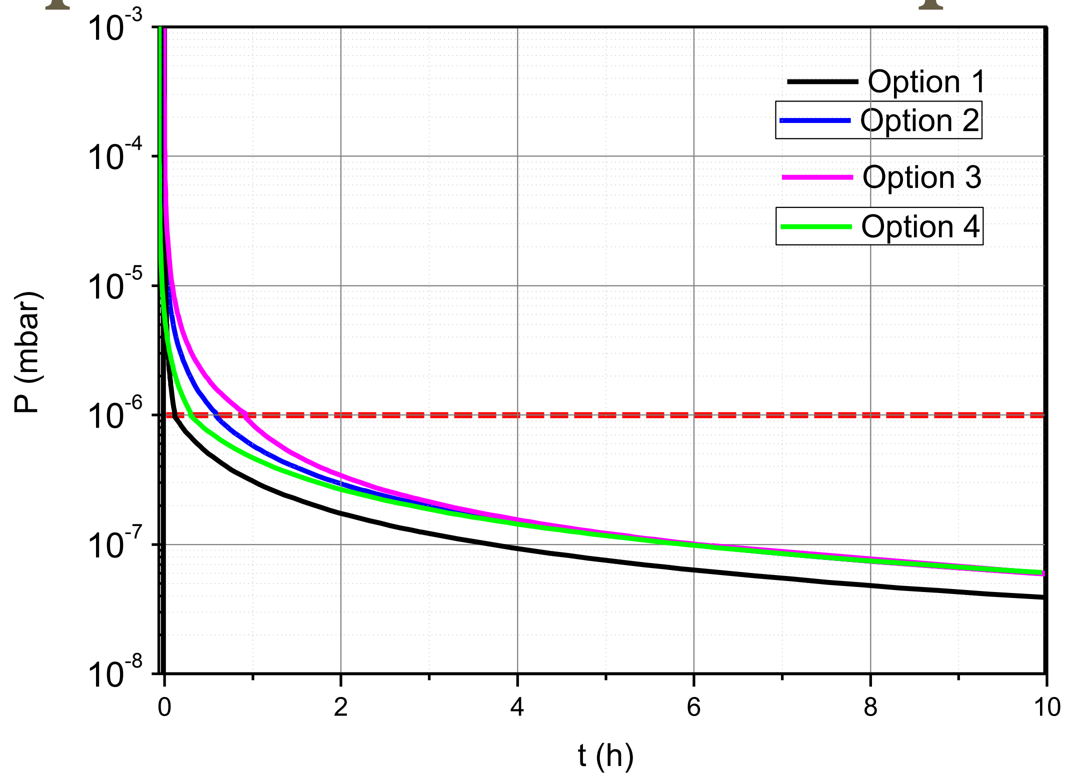
Connections

The pump down of a sector is divided in two stages:

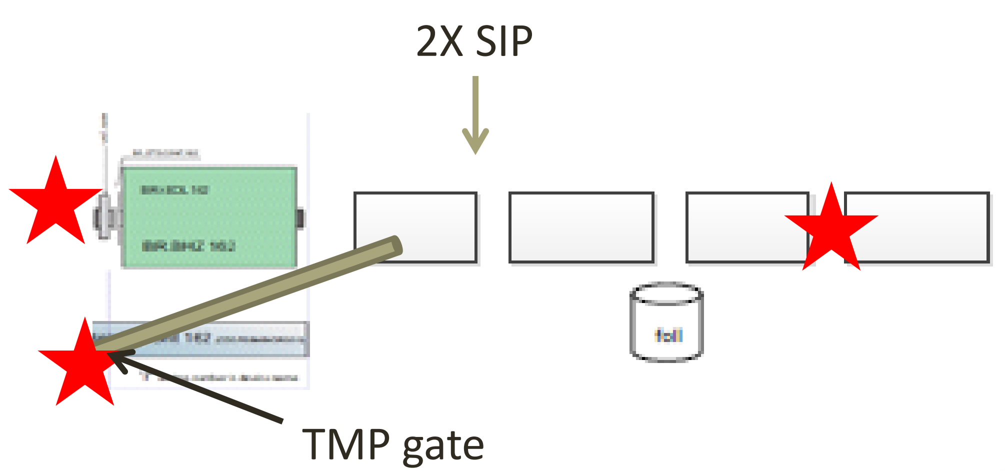
1. A fixed TMP group takes care of the pump down from atmospheric pressure down to $1*10^{-6}$ mbar;
2. At $1*10^{-6}$ mbar the sputter ion pump are flashed and switched on.

The time from atmospheric pressure to $1*10^{-3}$ mbar will take about 15 minutes, according to the stripping foil experimental tests.
If we consider that at $1*10^{-7}$ mbar a first low intensity beam can be sent 5 to 6 hours after the end of the intervention including the leak detections, **if the dumps are conditioned before.**

Pump down studies: option 4



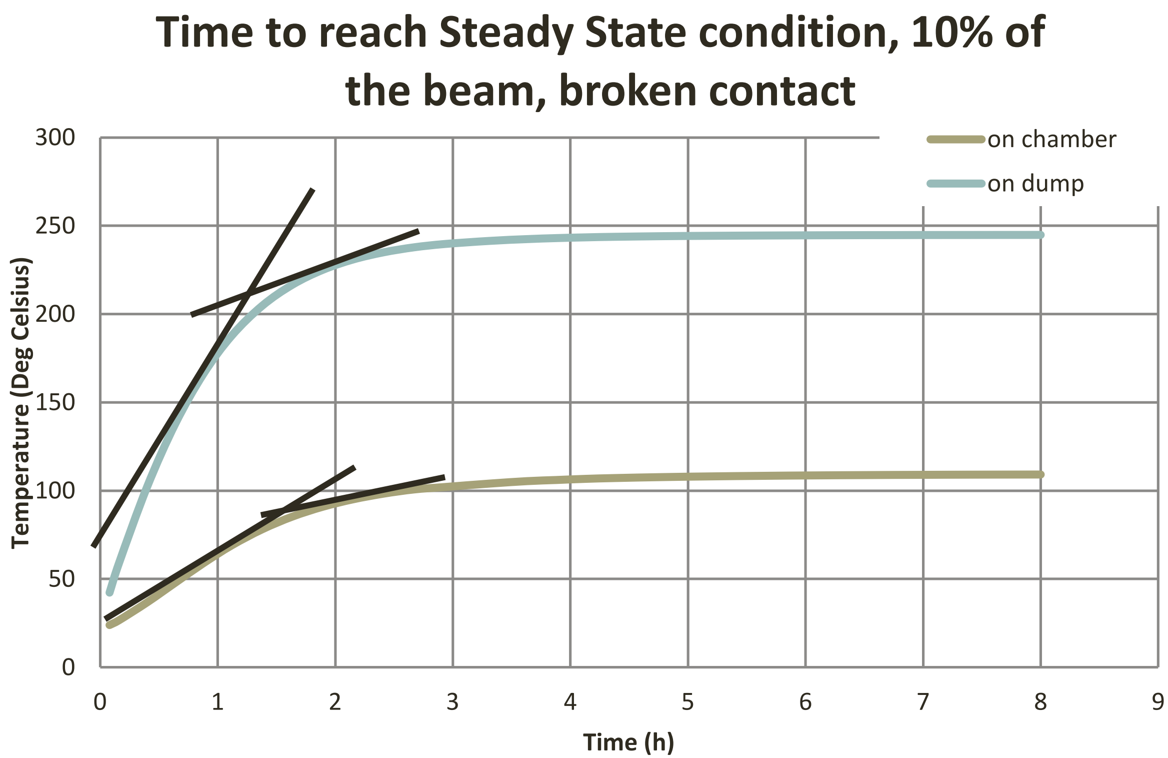
The intervention time is about 2 hours more than option 1**, with the dump conditioned**.



Option 4

Evaluation of the conditioning time for option 5

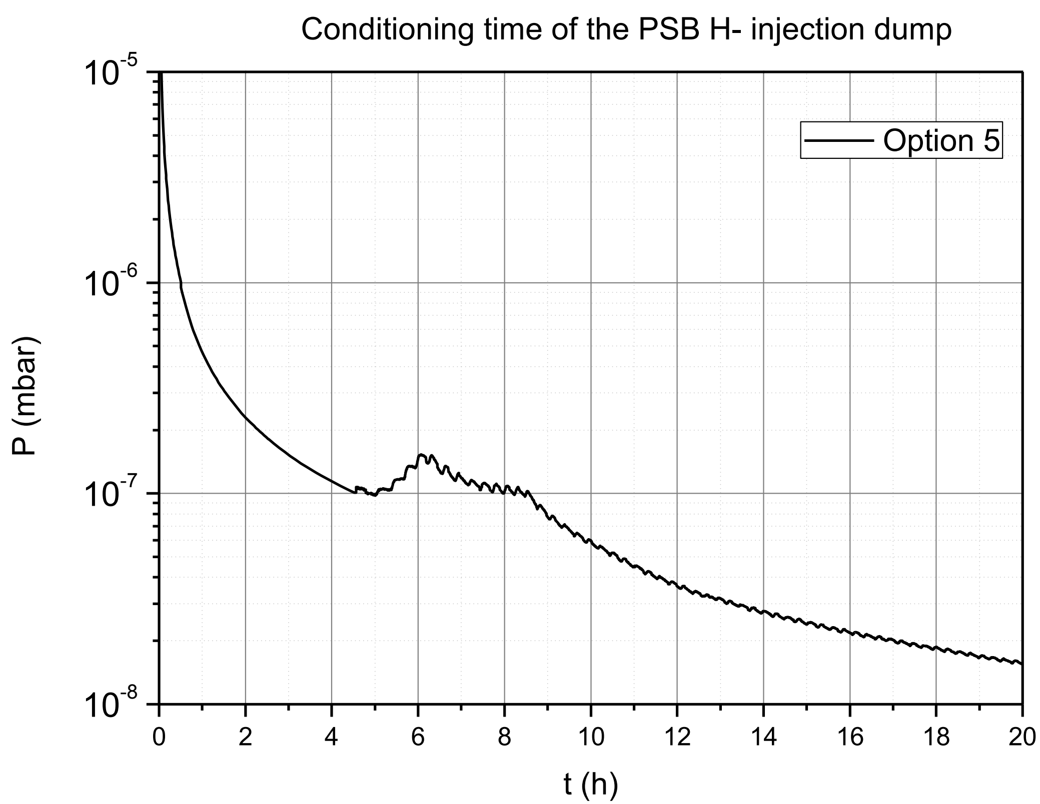
M. Delonca

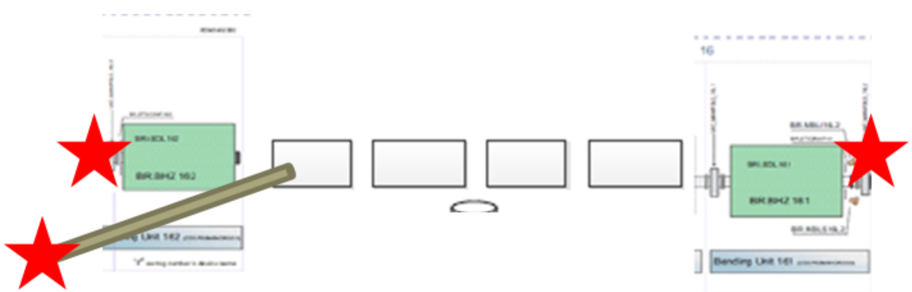


Steady state reached in about 4 hours!

	$Slope_1$ (◦C/h)	T_1 (◦C)	$Slope_2$ (◦C/h)	T_2 (◦C)
Dump	135	200	16	240
Vacuum Chamber	39	85	8.6	105

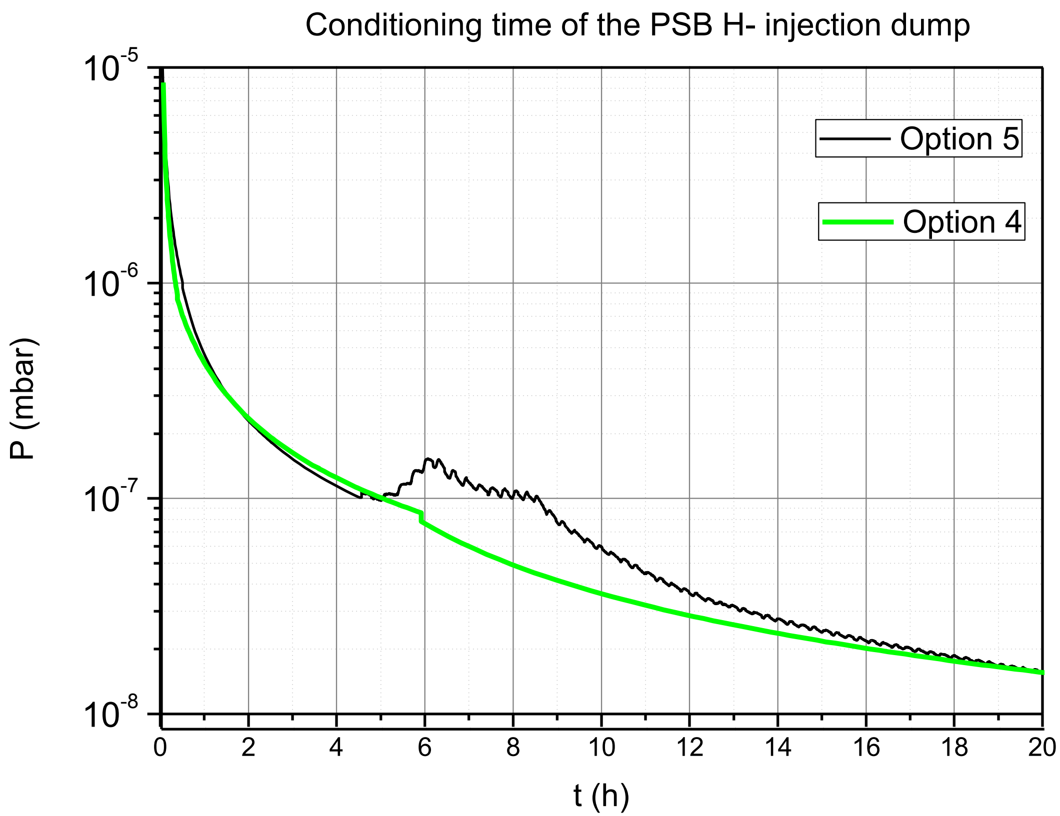
Evaluation of the conditioning time for option 5

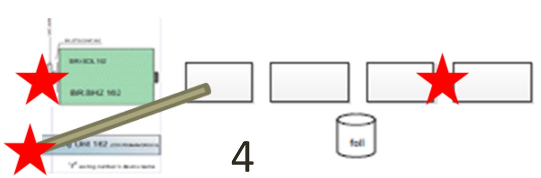


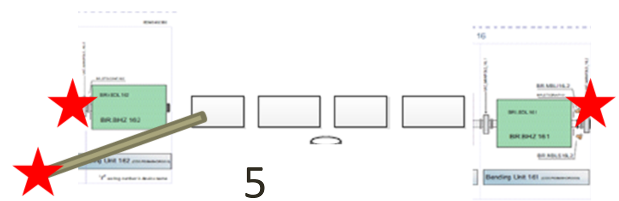


At $1*10^{-7}$ mbar, the beam is hitting the dump, heating it following the temperature curves shown before.
The whole surfaces of the dump and of the chamber are considered to be heated up to the maximum temperature.

Evaluation of the conditioning time for option 5

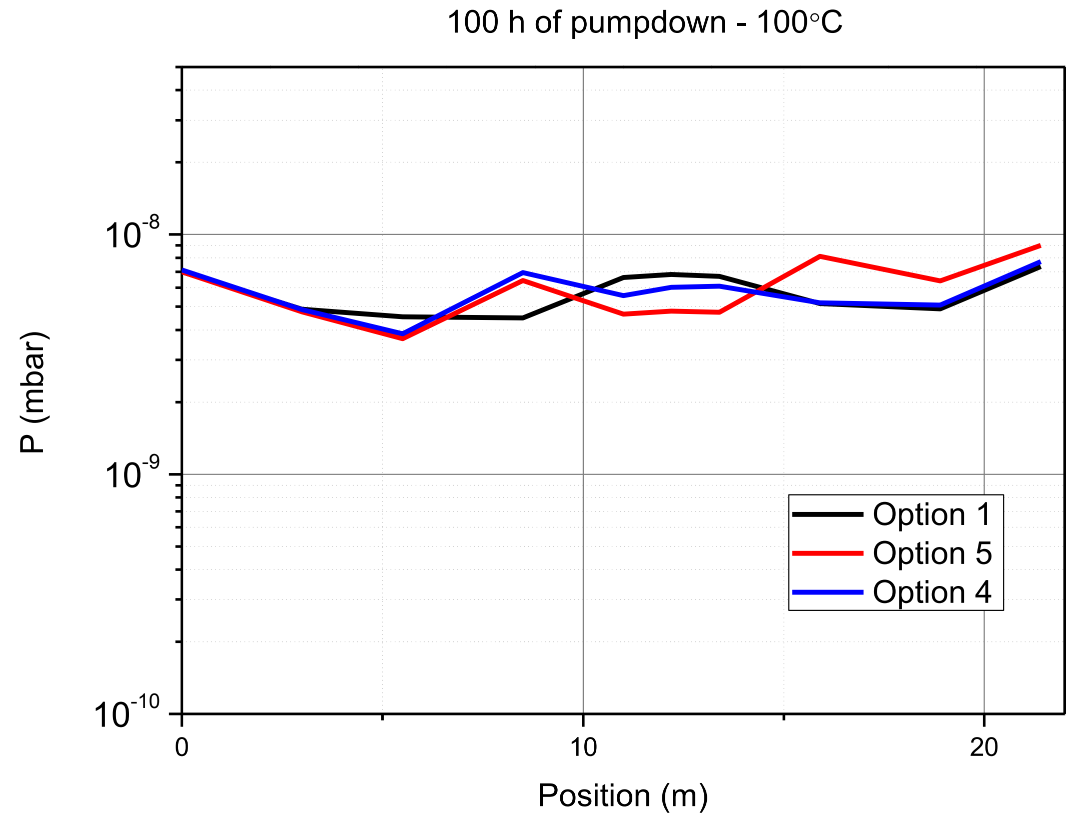






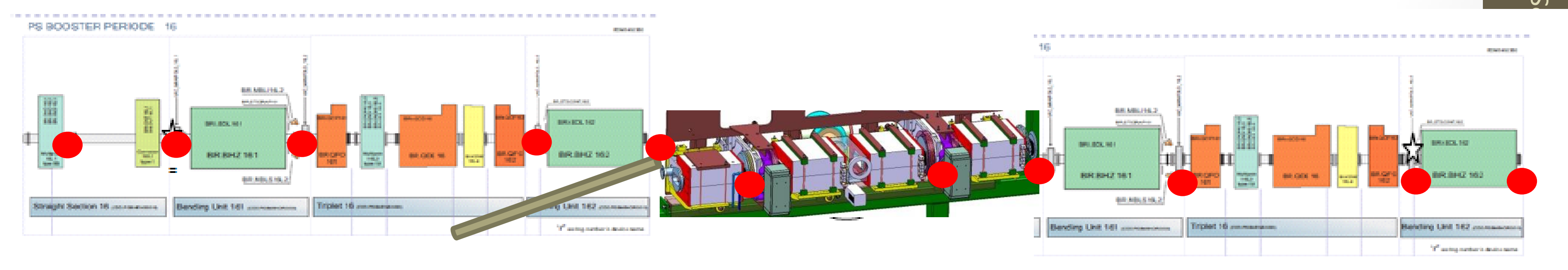
With option 5 the conditioning of the dump will take place every time the dump is vented, increasing the intervention time by 2.5 hours (with the baseline SiC dump). **No outgassing dynamic effects induced by the beam or unknown cables and switched are taken into account: the shown graph is the best scenario we will have**.

Pressure Profile studies : Option 1, 4 and 5, comparisons



No sublimators taken into account!!

Read Pressure Point



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Position (m)

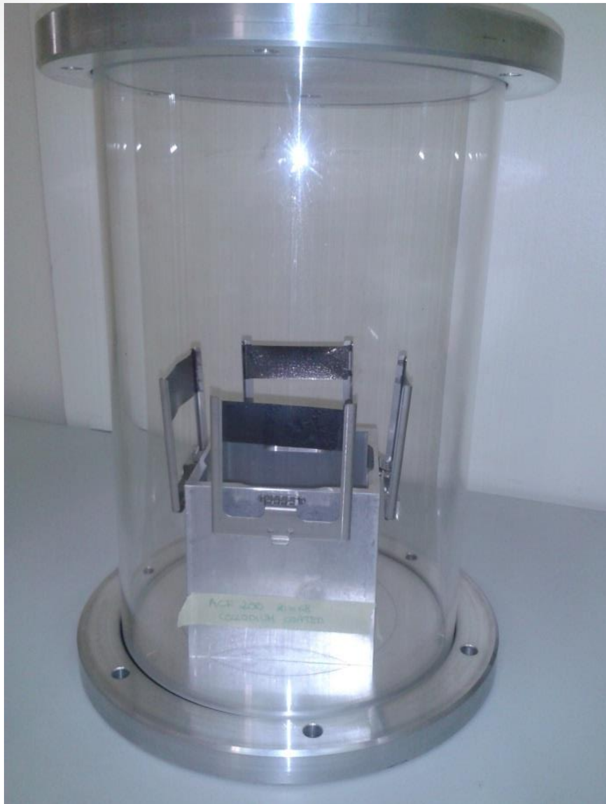
Intervention probability

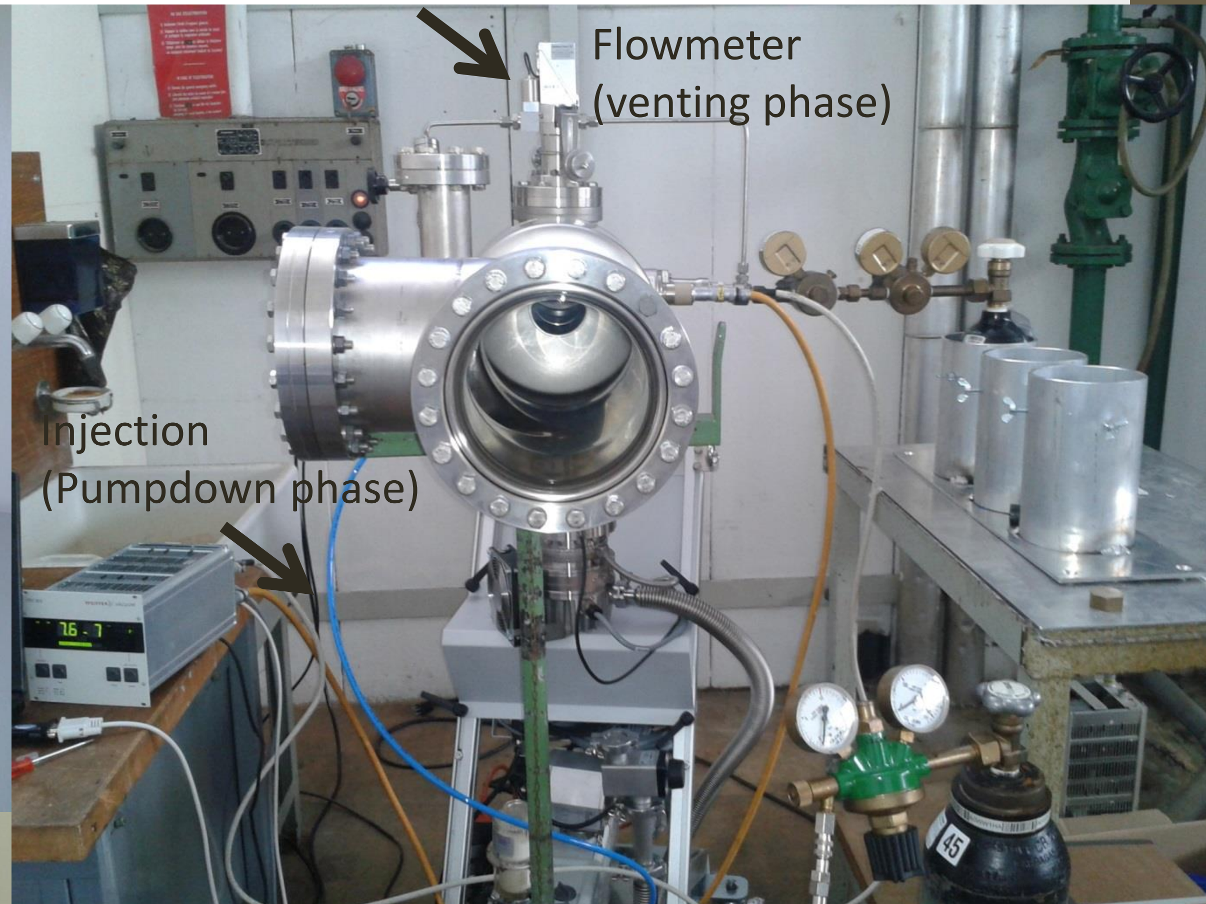
- Option 1: high risk for the foil integrity and foil mechanical assembly, high risk for MTV mechanical assembly (**high intervention dose**).
- Option 5: same as option 1, more stainless steel surface and dumps and we lose the dump conditioning every time the system is vented to air equal longer time to achieve nominal beam (**2.5h+less personal dose for pumping and leak detection**).
- Option 4: same as for option 1. More stainless steel surface, but not critical. More space in injector zone (**less personal dose for pumping and leak detection**) and no loss of the dump conditioning.

Conclusions

- The displacement of these sector valves would allow for a safer intervention scenarios.
- The conditioning time has been evaluated for the worst case scenario of a SiC dump with broken contact for its cooling.
- In this scenario, the maximum temperature reached by the dump is around 240 $^\circ$C, while the surrounding chamber heats up to 105 $^\circ$C.
- Based on measured outgassing rates and excluding dynamic effects, we have calculated that:
  - The venting to air of the dump has a limited effect on the pressure in the vacuum sector: max a factor 2 higher for about 2.5 hours.
  - The impact on the duty time should be limited to 2 to 3 hours max.
- Other materials than SiC would have a much higher effect on the pressure (e.g. graphite, more than a factor of 10 higher); as a consequence they should not be vented;
- The position of the valve can be changed from option 4 to option 5 whenever dump materials equivalent to SiC are chosen. **No change to option 5 is possible for other materials or sliced SiC dump.**
- Anyhow, option 5 will lead to a longer intervention time (at least 2.5 hours) than option 4.

Stripping foil venting – pumpdown testbench





- Injection during pumpdown to slow down the descent in pressure in its initial phase;
- Injection at known different fluxes, checking the foil integrity;
- Report about it under approval;