

# New Fast Wire Scanners in 4L1 and 11L1

- Vacuum outgassing measurements and vacuum pressure simulations –

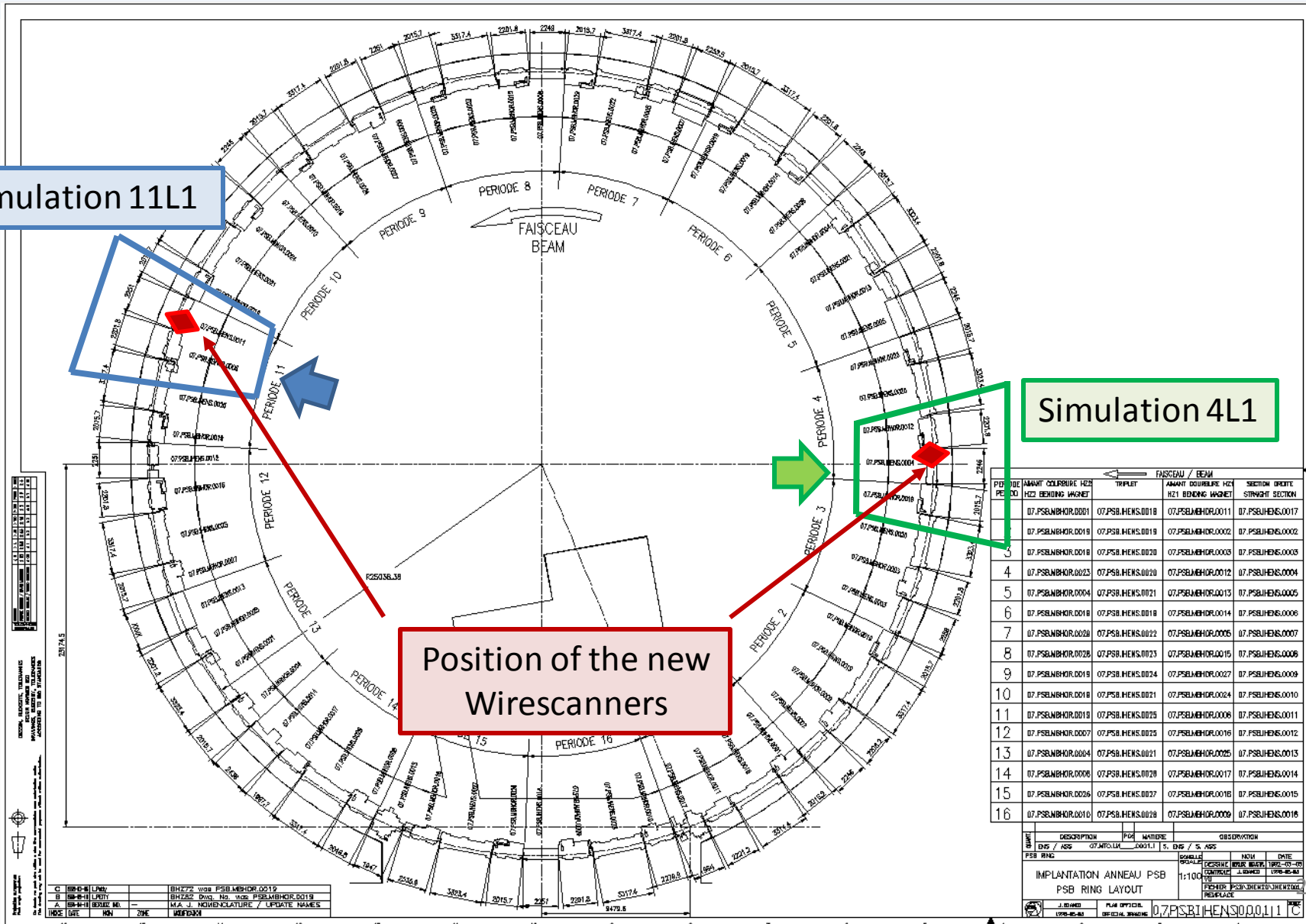
(Friederike Salveter, Jose Antonio Ferreira Somoza, Paul Demarest, Alice Ingrid Michet, Jan Hansen)

# Layout of the PSB ring

Simulation 11L1

Simulation 4L1

Position of the new  
Wireshanners



PERIODE	ANAMT	COULEUR	REN	TRIPLET	FAISCEAU / BEAM	ANAMT	COULEUR	REN	SECTION	DATE
PERIODE	H21	BEADING	HACKET	H21	BEADING	HACKET	STRAIGHT	SECTION		
1	07.PSB.MEMOR.001	07.PSB.HENS.0018	07.PSB.MEMOR.0011	07.PSB.HENS.0017						
2	07.PSB.MEMOR.0019	07.PSB.HENS.0019	07.PSB.MEMOR.0002	07.PSB.HENS.0002						
3	07.PSB.MEMOR.0018	07.PSB.HENS.0020	07.PSB.MEMOR.0003	07.PSB.HENS.0003						
4	07.PSB.MEMOR.0023	07.PSB.HENS.0020	07.PSB.MEMOR.0012	07.PSB.HENS.0004						
5	07.PSB.MEMOR.0004	07.PSB.HENS.0021	07.PSB.MEMOR.0013	07.PSB.HENS.0005						
6	07.PSB.MEMOR.0018	07.PSB.HENS.0018	07.PSB.MEMOR.0014	07.PSB.HENS.0006						
7	07.PSB.MEMOR.0028	07.PSB.HENS.0022	07.PSB.MEMOR.0005	07.PSB.HENS.0007						
8	07.PSB.MEMOR.0028	07.PSB.HENS.0023	07.PSB.MEMOR.0015	07.PSB.HENS.0008						
9	07.PSB.MEMOR.0019	07.PSB.HENS.0024	07.PSB.MEMOR.0007	07.PSB.HENS.0009						
10	07.PSB.MEMOR.0018	07.PSB.HENS.0021	07.PSB.MEMOR.0004	07.PSB.HENS.0010						
11	07.PSB.MEMOR.0019	07.PSB.HENS.0025	07.PSB.MEMOR.0006	07.PSB.HENS.0011						
12	07.PSB.MEMOR.0007	07.PSB.HENS.0025	07.PSB.MEMOR.0016	07.PSB.HENS.0012						
13	07.PSB.MEMOR.0004	07.PSB.HENS.0021	07.PSB.MEMOR.0005	07.PSB.HENS.0013						
14	07.PSB.MEMOR.0006	07.PSB.HENS.0028	07.PSB.MEMOR.0017	07.PSB.HENS.0014						
15	07.PSB.MEMOR.0026	07.PSB.HENS.0027	07.PSB.MEMOR.0018	07.PSB.HENS.0015						
16	07.PSB.MEMOR.0010	07.PSB.HENS.0028	07.PSB.MEMOR.0009	07.PSB.HENS.0016						

C	08-0-0	LMN	08/27/22	008	07.PSB.MEMOR.0012
B	08-0-0	LMN	08/27/22	008	07.PSB.MEMOR.0019
A	08-0-0	LMN	M.A.J.	08/27/22	07.PSB.MEMOR.0019
IND	DATE	NOM	ZONE	REVISION	DESCRIPTION / UPDATE NAMES

DATE	DESCRIPTION	FIG	MATIERE	OBSERVATION
08/27/22	07.PSB.MEMOR.0011	5	07.PSB.HENS.0011	
IMPLANTATION ANNEAU PSB				
PSB RING LAYOUT				
SCALE	1:100	DATE	08/27/22	
PROJ	07.PSB.MEMOR.0011	PROJ	07.PSB.HENS.0011	

# SPS Fast Wire Scanner - Outgassing measurements in 2014



- Outgassing tests on wire scanner **components** were conducted in 2013 and 2014

- The highest value of the **sum** of the measured outgassing

$$Q_{10h} = 1.34 \cdot 10^{-5} \text{ mbar} \cdot \text{l} \cdot \text{s}^{-1}$$

- An outgassing test of an **assembled** SPS wire scanner was done in 2014:

- Outgassing of this Wire scanner:

$$Q_{10h} = 8.1 \cdot 10^{-5} \text{ mbar} \cdot \text{l} \cdot \text{s}^{-1}$$

- Pumpdown:

$$P \propto 1/t^{0.5}$$





- **No contamination** observed

=> The tested components **don't explain** the outgassing observed

=> Proposal: test all the possible sources (non-metal) before building the next wire scanners

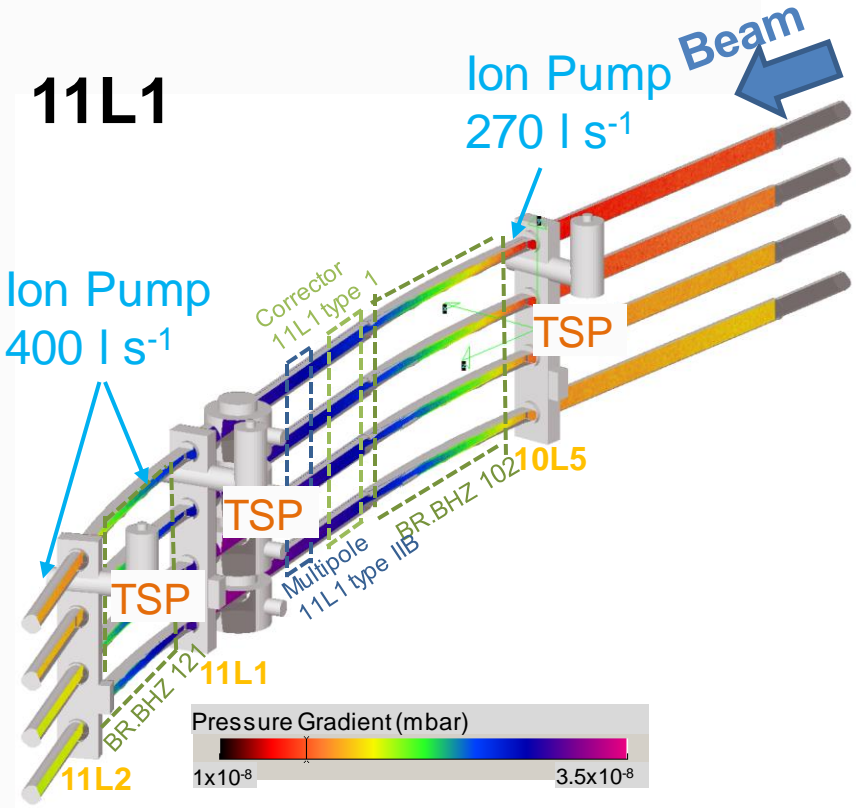
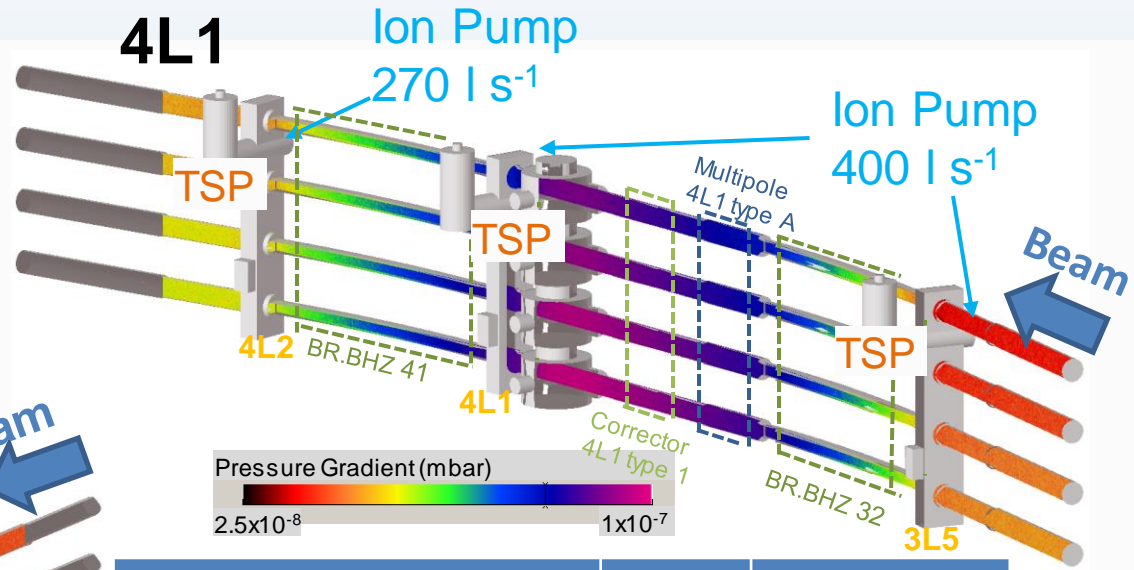
*Curtesy of Jose Antonio Ferreira Somoza*

# Tests of the new Fast Wire Scanners components

Component	Outgassing, 10h (mbar l s <sup>-1</sup> )	Pollution
The arm 	$8.4 \times 10^{-7}$	Sulfur
The optical fibre 	$6.8 \times 10^{-6}$	Presence of air
The nut 	$2.6 \times 10^{-6}$	Presence of oil
The ferrites 	Estimated to $2.0 \times 10^{-7}$	None

- The optical fiber has the highest gas load
  - 2 types of optical fibers available (tested in November 2013)
  - It is recommended to use the one with the lower outgassing rate
- The sulfur detected in the arm is not acceptable in a vacuum system
- Not all the components that will be installed in the wire scanners have been received for the measurements

# Pressure simulation - Current pumping



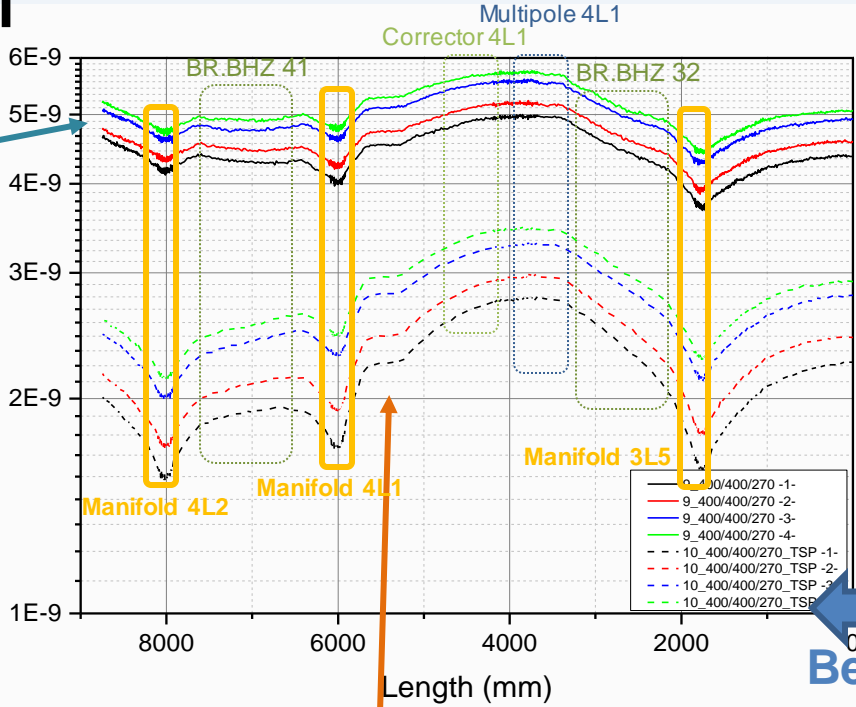
Parameter used in the simulation	Value	Unit
Time	4	Weeks
Outgassing Stainless Steel	$2 \times 10^{-11}$	$\text{mbar l s}^{-1} \text{cm}^{-2}$
Total outgassing of 1 Wire scanner	$1 \times 10^{-5}$	$\text{mbar l s}^{-1}$
Current Pumping Speed Ion pump 1 & 2	400	$\text{l s}^{-1}$
Current Pumping Speed Ion pump 3	270	$\text{l s}^{-1}$
Pumping speed Titanium Sublimation Pump (TSP)	1000	$\text{l s}^{-1}$
Simulated Gas	$\text{N}_2$	-

# Pressure simulation - Current pumping

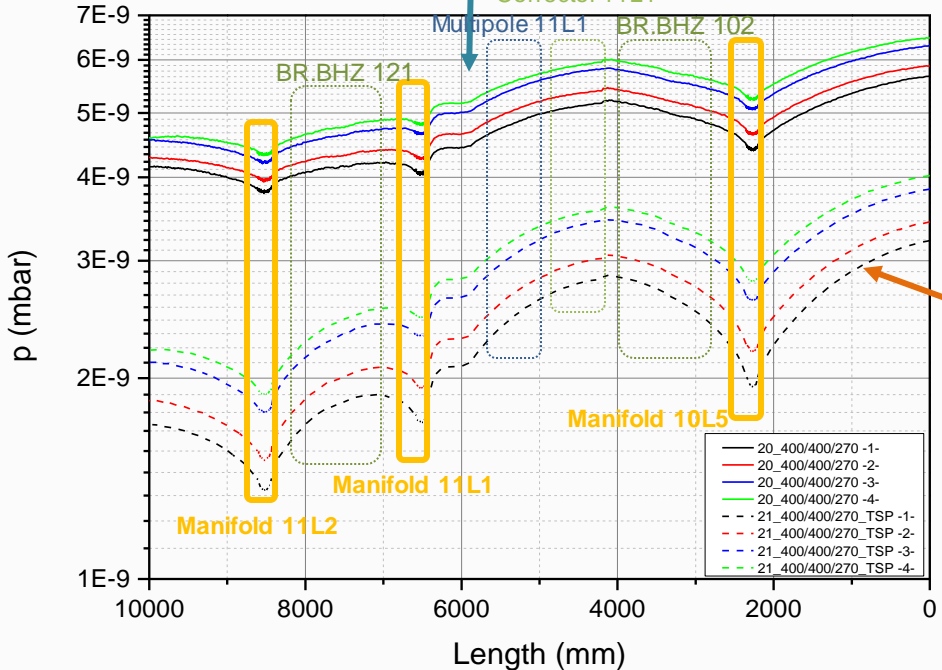
## 4L1

**Solid graphs:**

- No wire scanners
- TSPs *not* sublimated



## 11L1



**Dashed graphs:**

- No Wire scanners
- TSPs *sublimated*

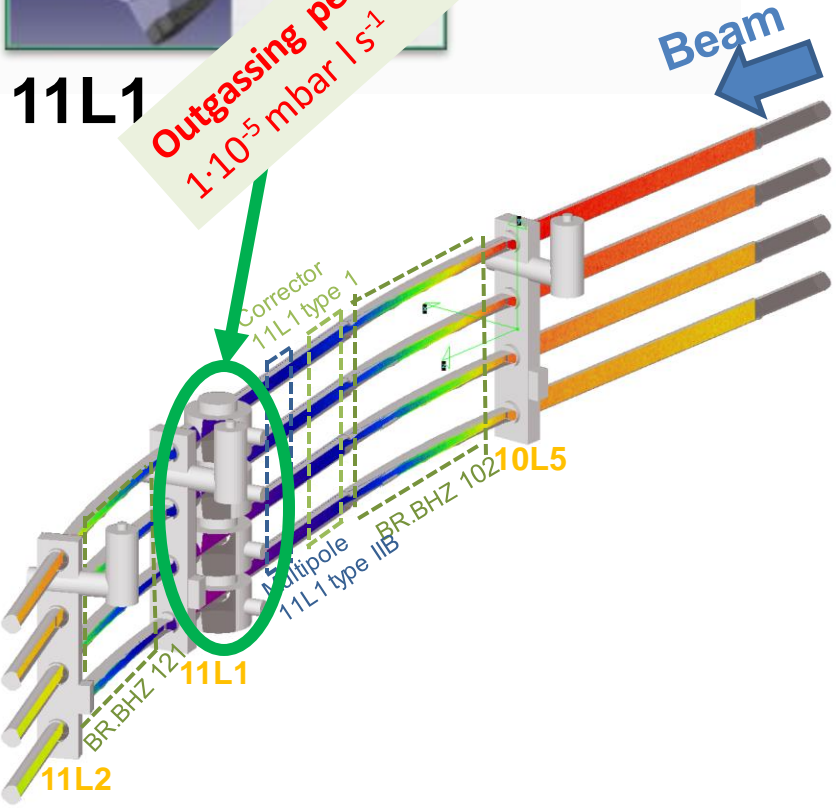
⚠ Due to the amount of simulations only the green slopes will be shown as reference in the following graphs

# Pressure simulation - with Wire Scanners

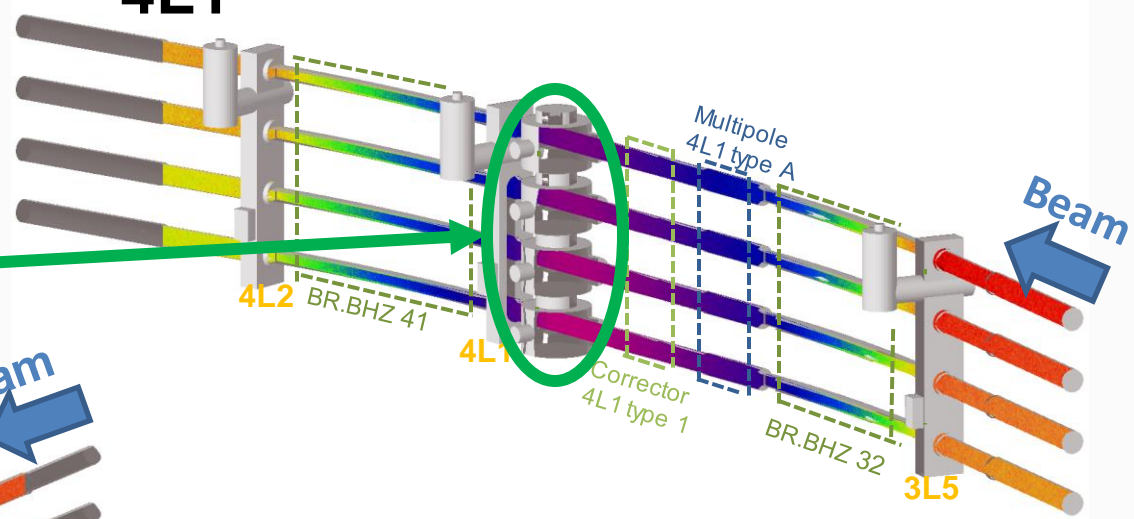


**Outgassing per Wire scanner:**  
 $1 \cdot 10^{-5}$  mbar  $l s^{-1}$

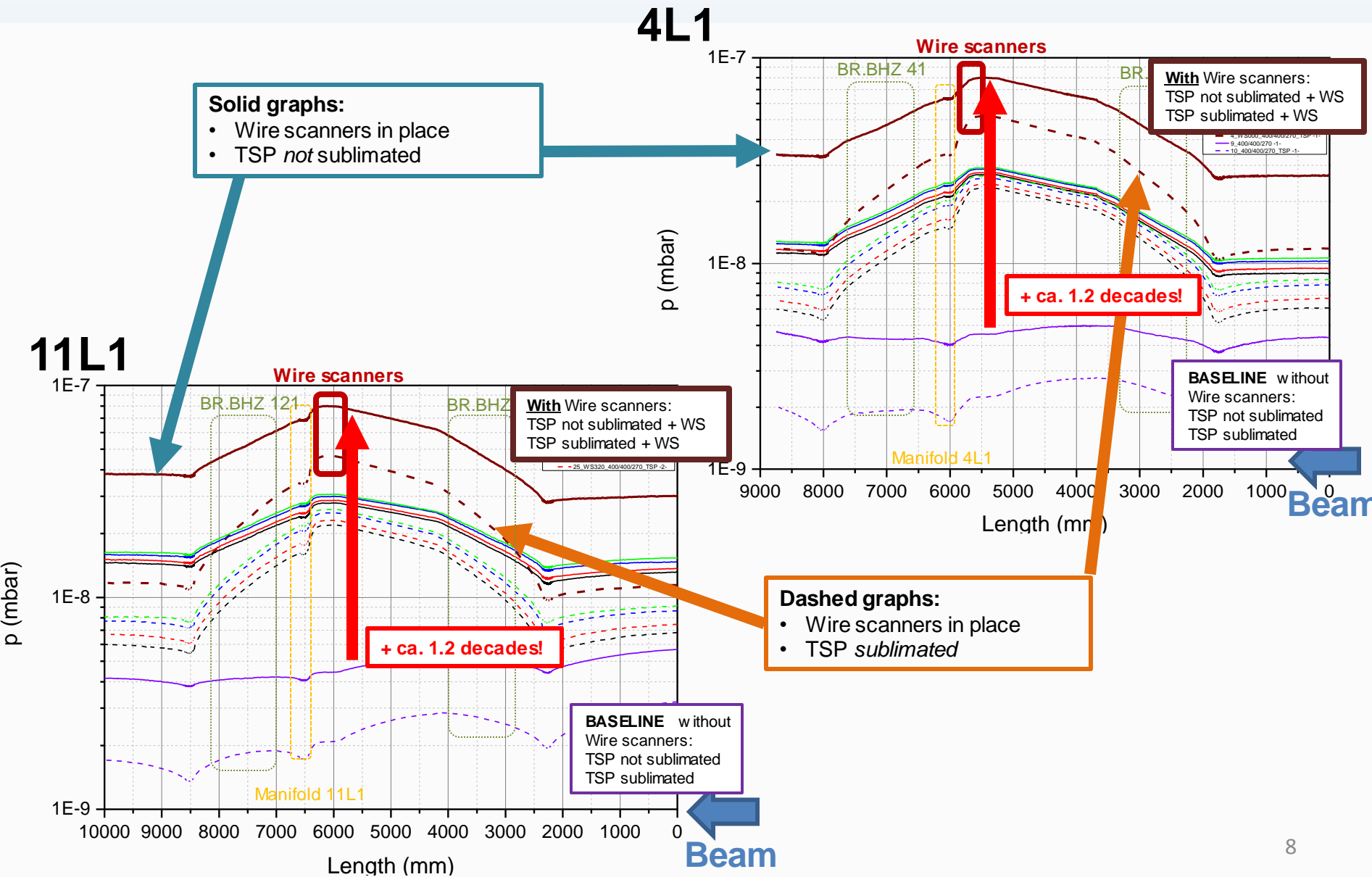
**11L1**



**4L1**



# Pressure simulation - with Wire Scanners



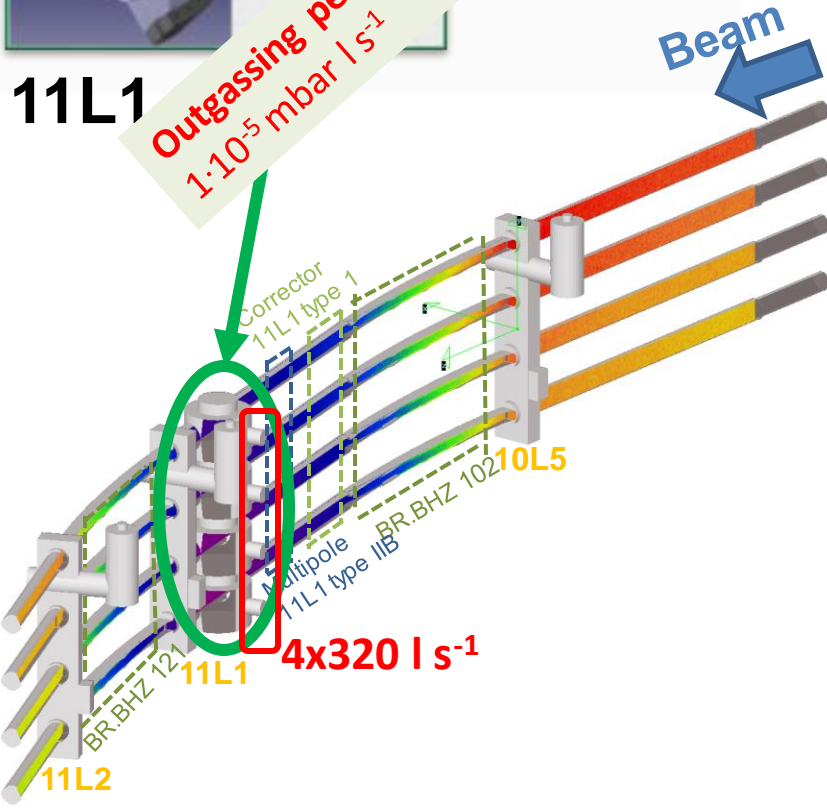


# Pressure simulation - additional pumping

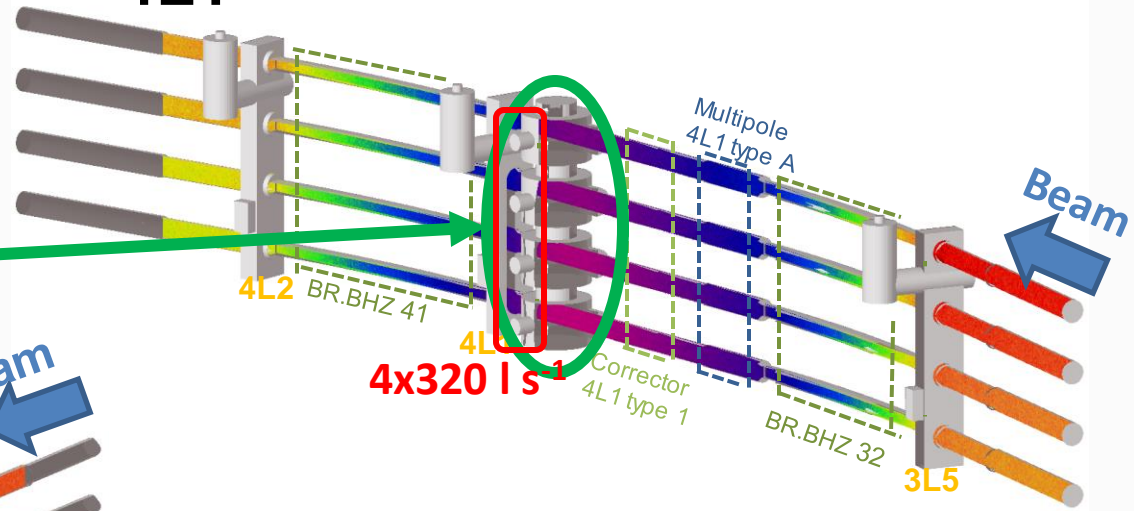


11L1

Outgassing per Wire scanner:  
 $1 \cdot 10^{-5}$  mbar  $l s^{-1}$



4L1



⇒ Additional pumps installed on the wire scanner:

- 1 NEG pump (SAES Nextorr® D-1000-10) at each wire scanner ( $320 l s^{-1}$  for  $N_2$ )

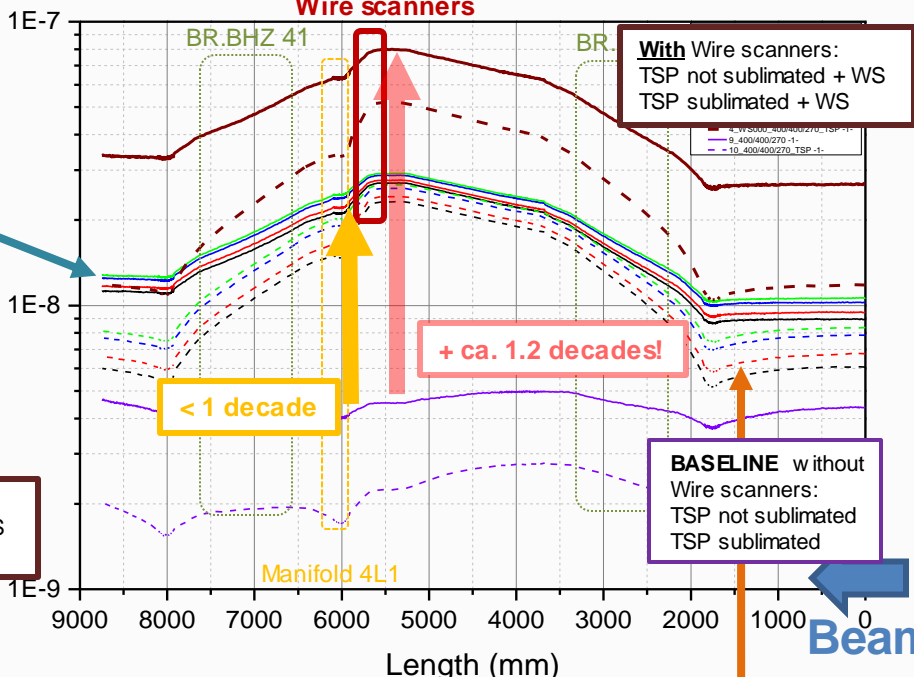


# Pressure simulation - Wire Scanners & additional pumping

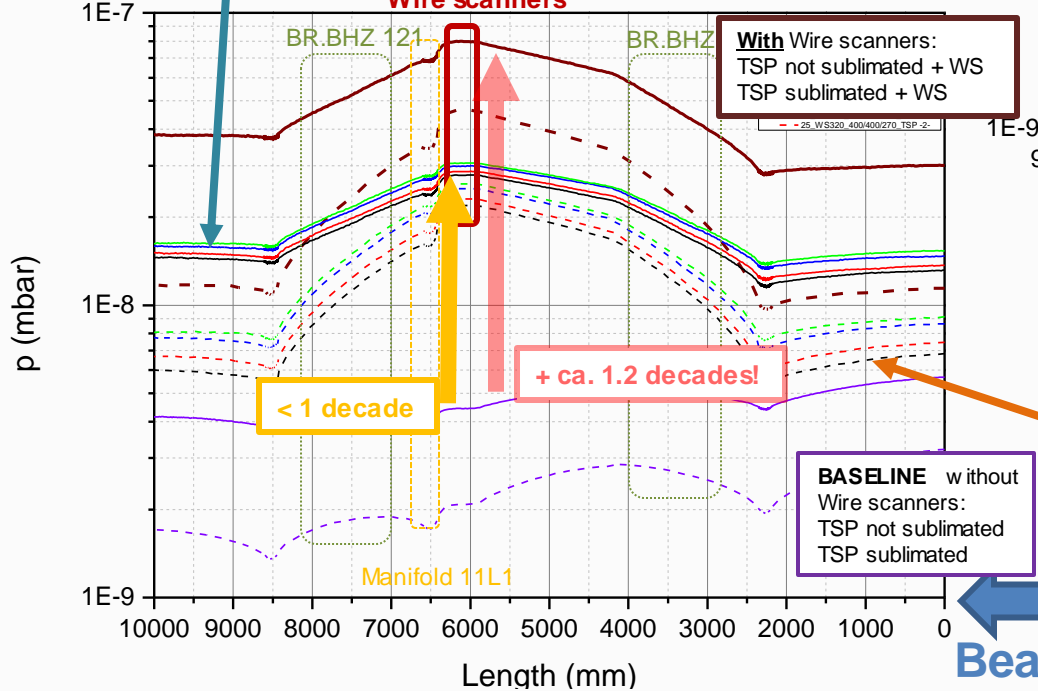
4L1

**Solid graphs:**

- Wire scanners in place
- Add. pumping of  $320 \text{ l s}^{-1}$  per Wire scanner
- TSP *not* sublimated



11L1

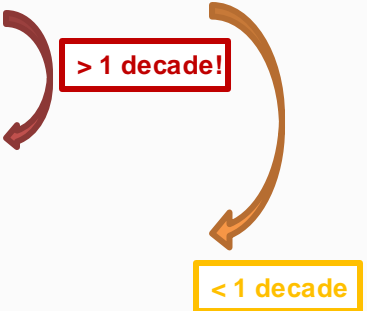


**Dashed graphs:**

- Wire scanners in place
- Add. pumping of  $320 \text{ l s}^{-1}$  per Wire scanner
- TSP *sublimated*

# Summary (pressure after 4 weeks)

Wire scanner	Add. Pumping (Wire scanner)	Add. Pumping (Manifold)	Pressure 4L1 (Wire scanner)	Pressure 11L1 (Wire scanner)
No	No	No	$4.5 \times 10^{-9}$ mbar	$4.4 \times 10^{-9}$ mbar
		Sublimation	$2.2 \times 10^{-9}$ mbar	$2.1 \times 10^{-9}$ mbar
Yes	No	No	$8.0 \times 10^{-8}$ mbar	$7.9 \times 10^{-8}$ mbar
		Sublimation	$5.2 \times 10^{-8}$ mbar	$4.7 \times 10^{-8}$ mbar
Yes	$4 \times 320 \text{ l s}^{-1}$	No	<b><math>2.9 \times 10^{-8}</math> mbar</b>	<b><math>3.1 \times 10^{-8}</math> mbar</b>
		Sublimation	<b><math>2.7 \times 10^{-8}</math> mbar</b>	<b><math>2.6 \times 10^{-8}</math> mbar</b>



## Conclusion:

- With the current high outgassing additional pumping at the wire scanners is required to meet the vacuum specifications
  - Extra costs (pumps, cabling, controls)
  - Proposal: Use a manifold for 4 Wire Scanners
    - => One big pump could be used instead of four small ones
- The outgassing of the different components should be reduced whenever possible