New Fast Wire Scanners in 4L1 and 11L1

- Vacuum outgassing measurements and vacuum pressure simulations –

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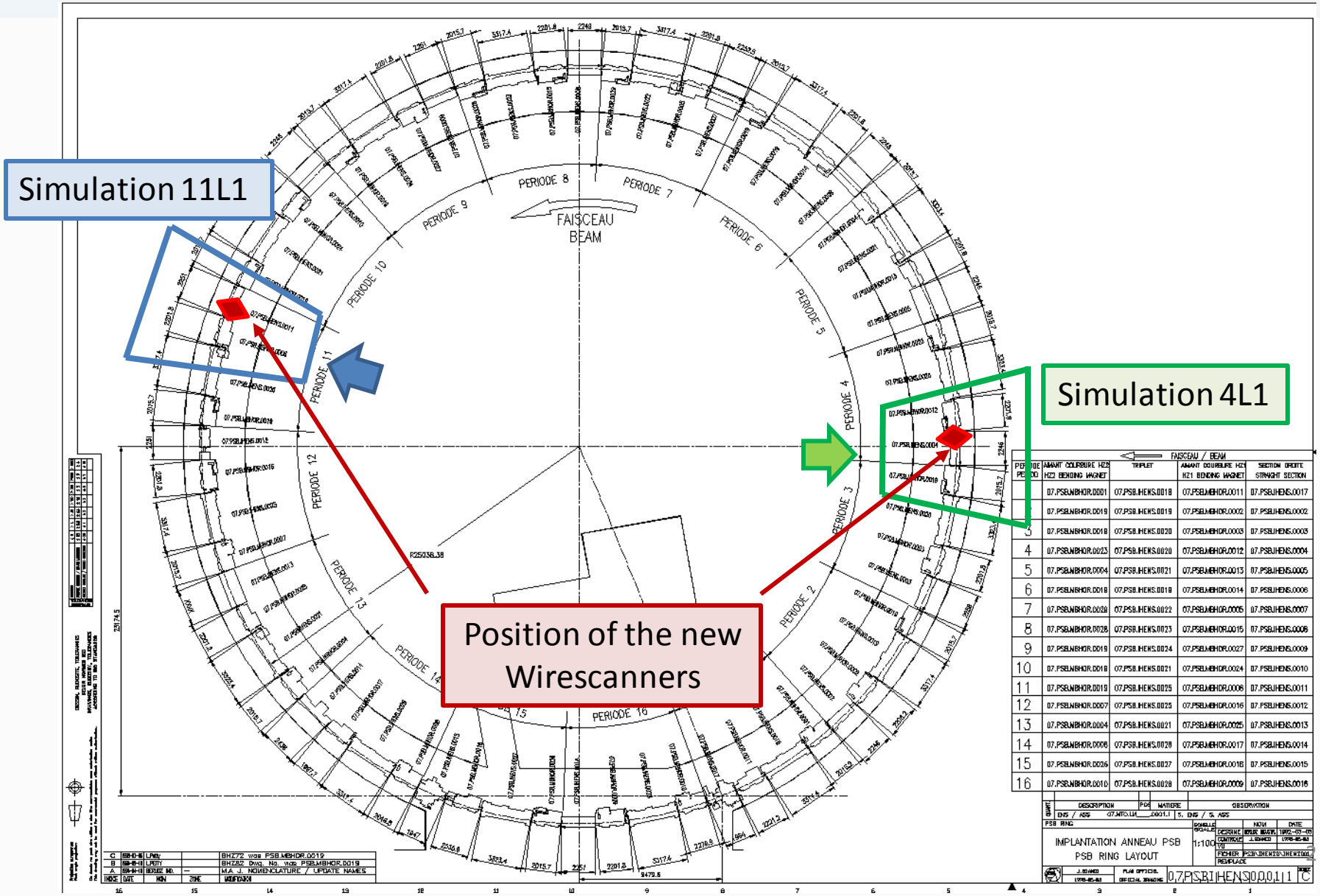
Layout of the PSB ring



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}**= 1.34·10^{-5} mbar·l·s^{-1}**

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

    Q_{10h}**= 8.1·10^{-5} mbar·l·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

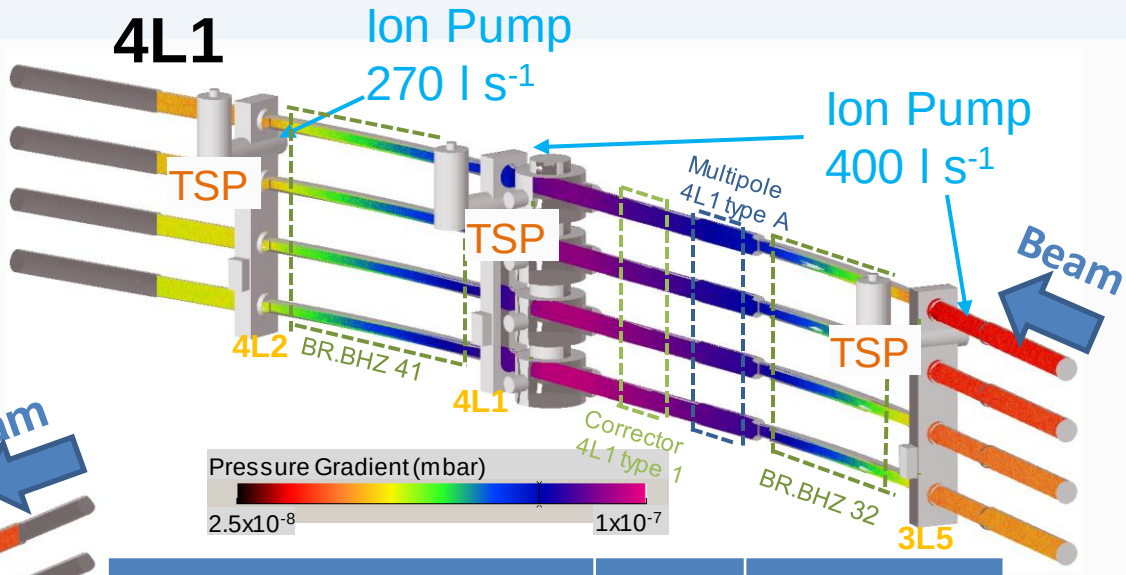
Tests of the new Fast Wire Scanners components

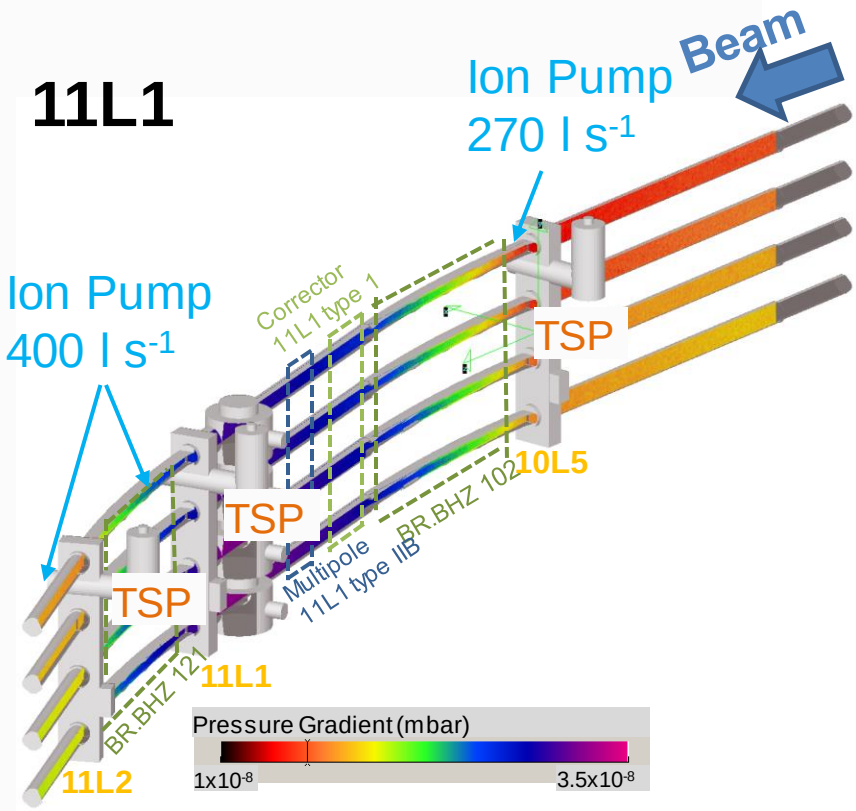
Component	Outgassing, 10h (mbar l s^{-1})	Pollution
The arm 	8.4×10^{-7}	Sulfur
The optical fibre 	6.8×10^{-6}	Presence of air
The nut 	2.6×10^{-6}	Presence of oil
The ferrites 	Estimated to 2.0×10^{-7}	None

- 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

Curtesy of Alice Ingrid Michet

Pressure simulation - Current pumping



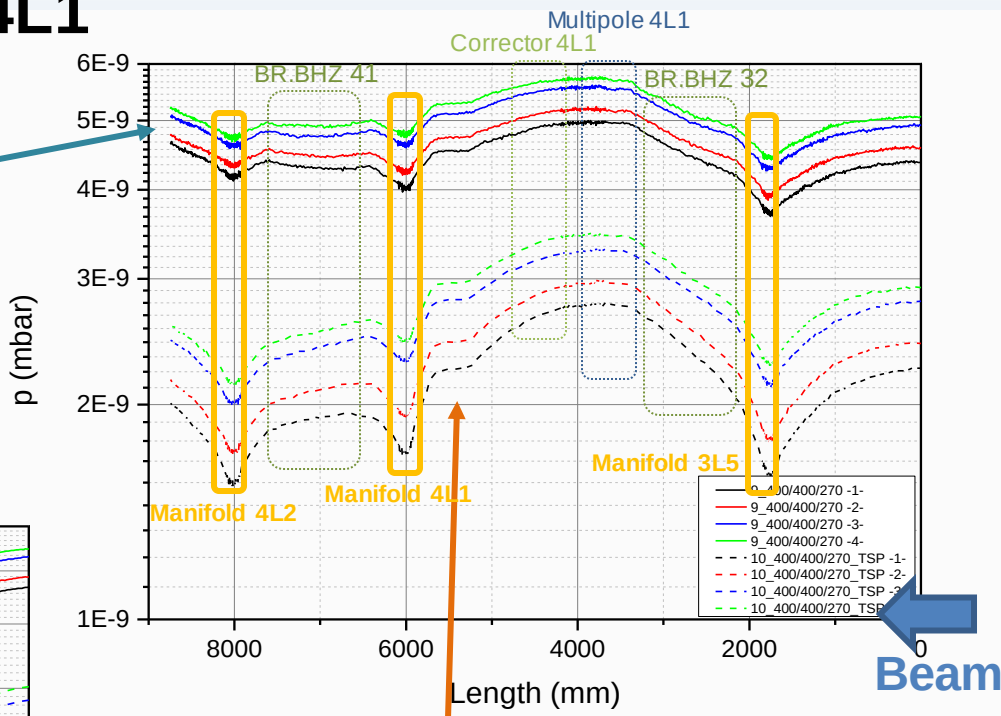


Parameter used in the simulation	Value	Unit
Time	4	Weeks
Outgassing Stainless Steel	$2x10^{-11}$	mbar l s^{-1} cm^{-2}
Total outgassing of **1 Wire scanner**	$1x10^{-5}$	mbar l s^{-1}
Current Pumping Speed **Ion pump 1 & 2**	**400**	l s^{-1}
Current Pumping Speed **Ion pump 3**	**270**	l s^{-1}
Pumping speed **Titanium Sublimation Pump (TSP)**	**1000**	l s^{-1}
Simulated Gas	N_2	-

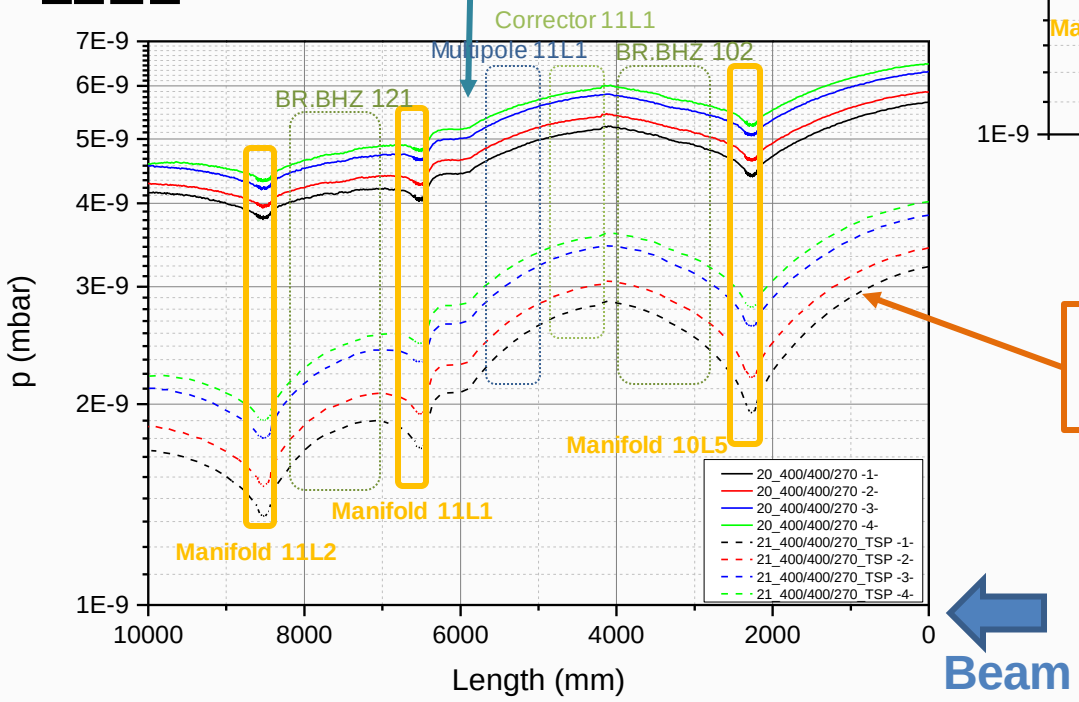
Pressure simulation - Current pumping

Solid graphs:
- No wire scanners
- TSPs *not* sublimated

4L1



11L1

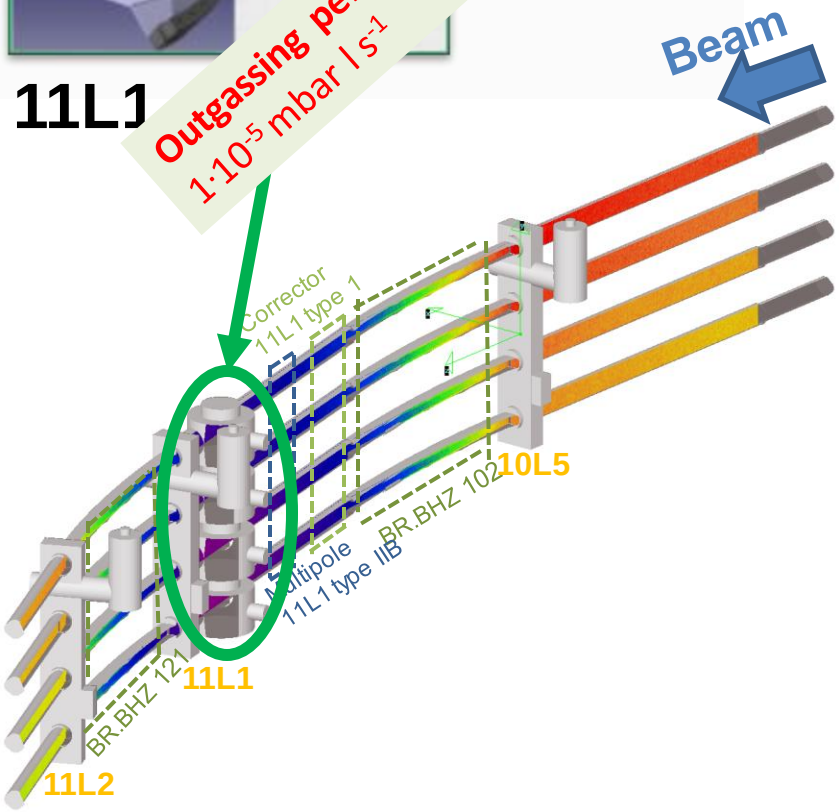


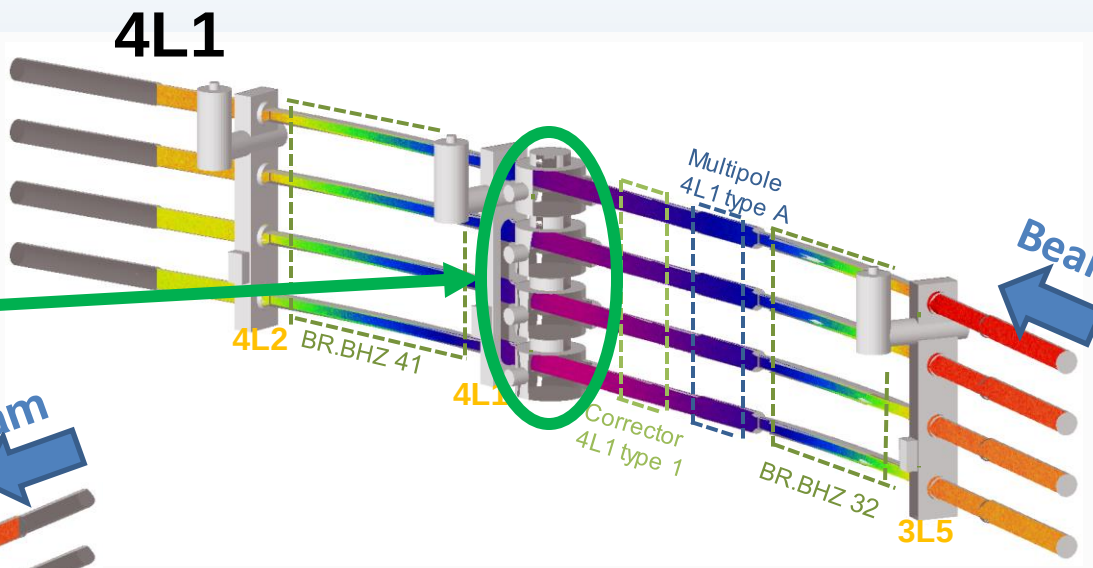
Dashed graphs:
- No Wire scanners
- TSPs *sublimated*

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

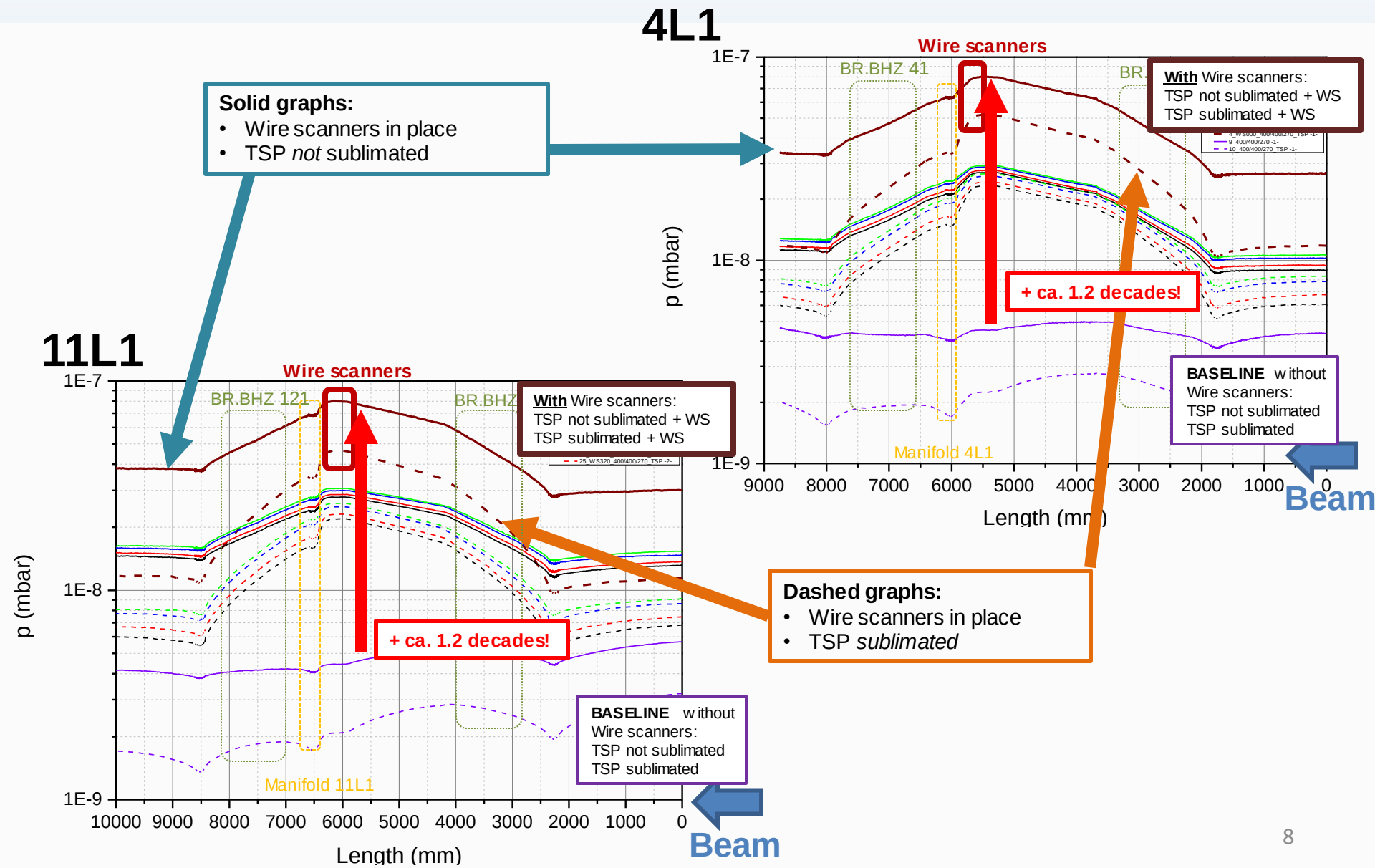
Pressure simulation - with Wire Scanners

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

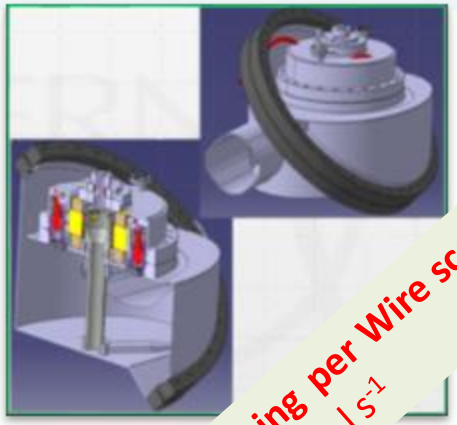




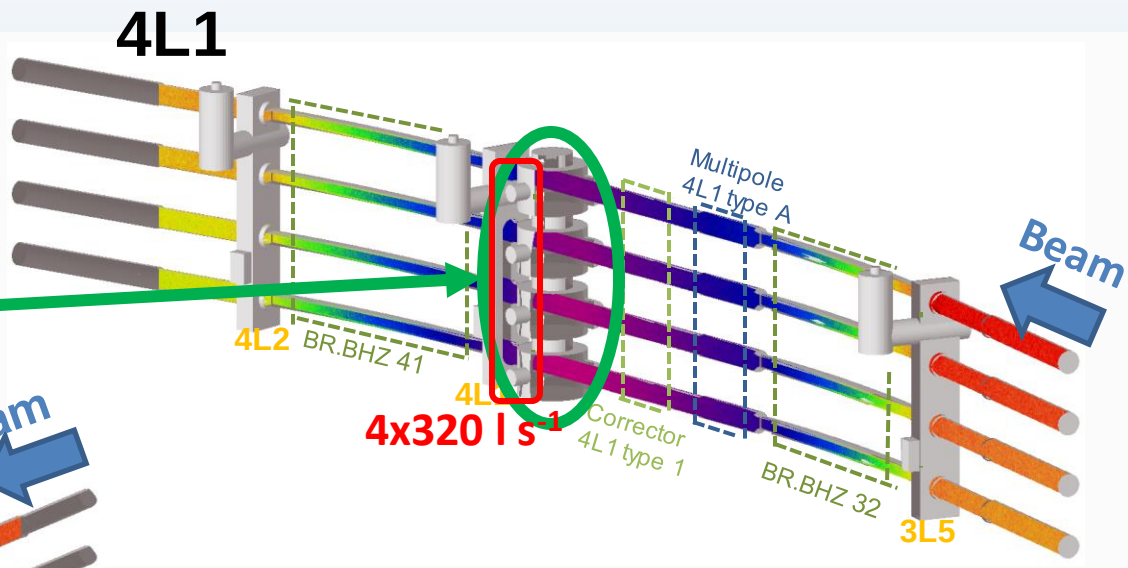
Pressure simulation - with Wire Scanners

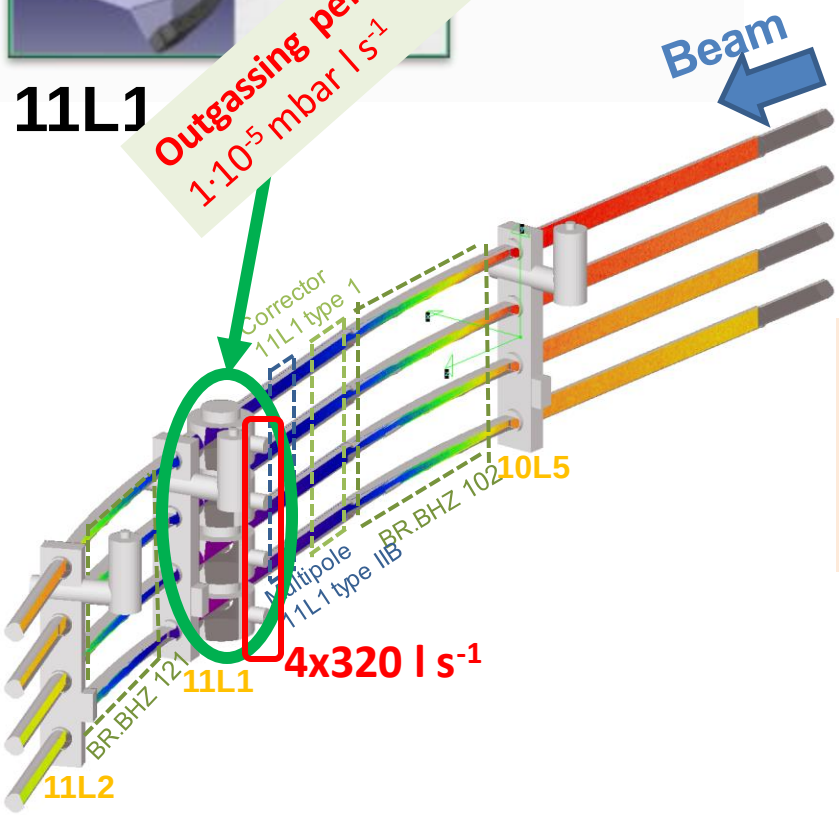


Pressure simulation - additional pumping



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





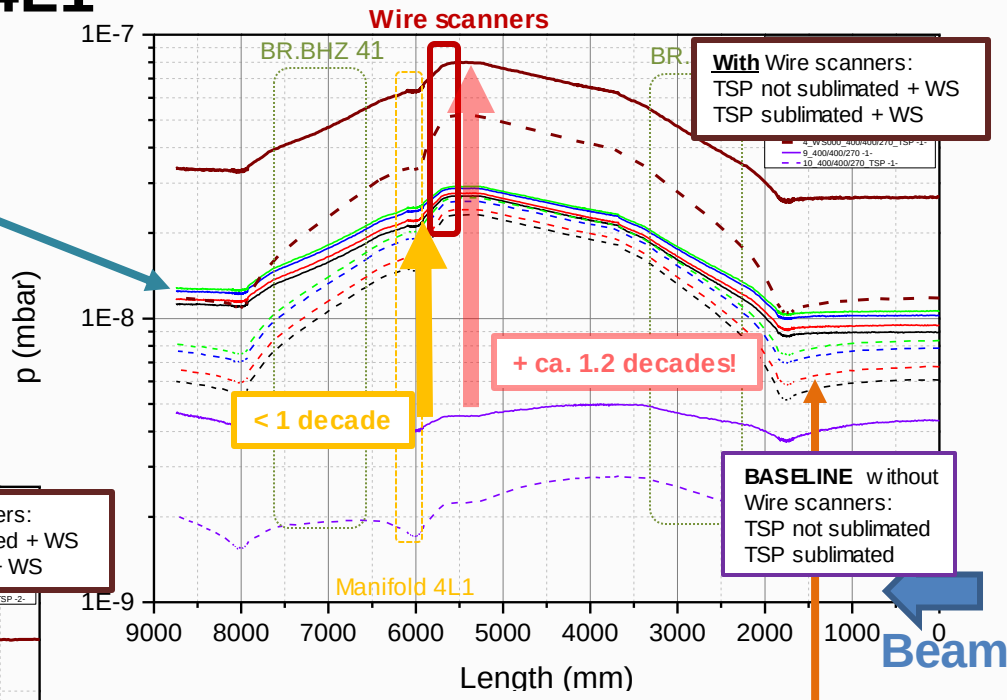
⇒ **Additional pumps installed on the wire scanner:**

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

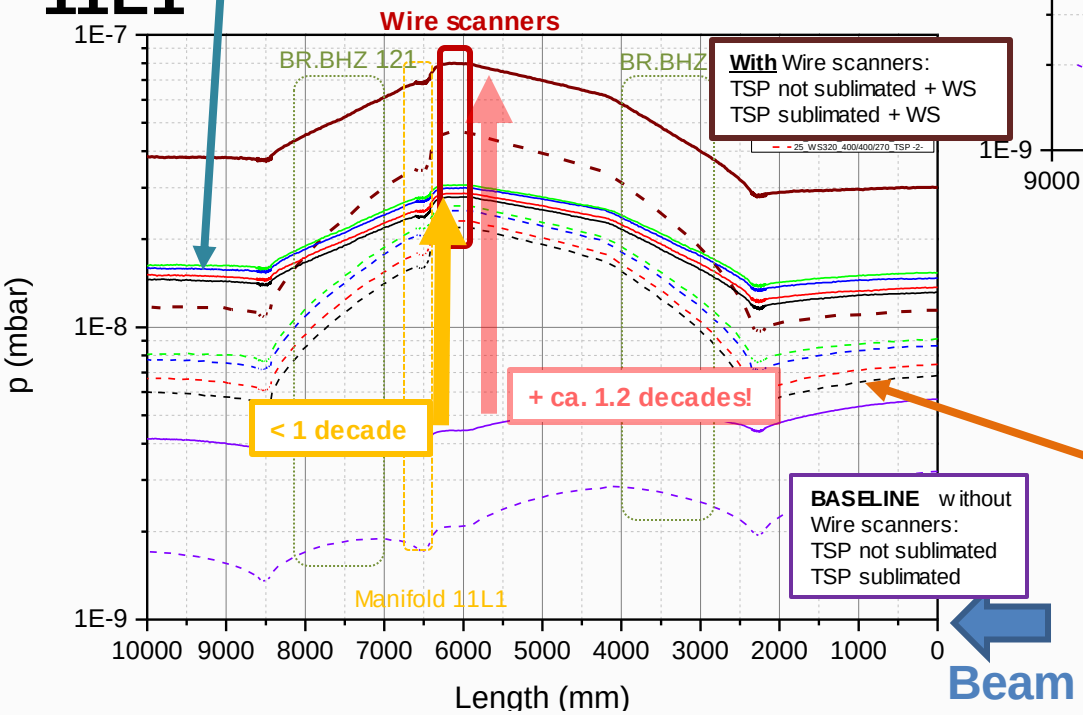
Pressure simulation - Wire Scanners & additional pumping

Solid graphs:
- Wire scanners in place
- Add. pumping of **320 l s^{-1}** per Wire scanner
- TSP *not* sublimated

4L1



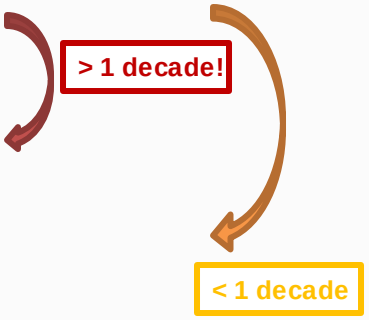
11L1



Dashed graphs:
- Wire scanners in place
- Add. pumping of **320 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	4.5×10^{-9} mbar	4.4×10^{-9} mbar
		Sublimation	2.2×10^{-9} mbar	2.1×10^{-9} mbar
Yes	No	No	8.0×10^{-8} mbar	7.9×10^{-8} mbar
		Sublimation	5.2×10^{-8} mbar	4.7×10^{-8} mbar
Yes	4×320 l s^{-1}	No	**2.9×10^{-8} mbar**	**3.1×10^{-8} mbar**
		Sublimation	**2.7×10^{-8} mbar**	**2.6×10^{-8} mbar**



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