BGC monitor Phase II: vacuum studies for LHC integration and operation

Cristina Castro Sequeiro
TE-VSC-VSM

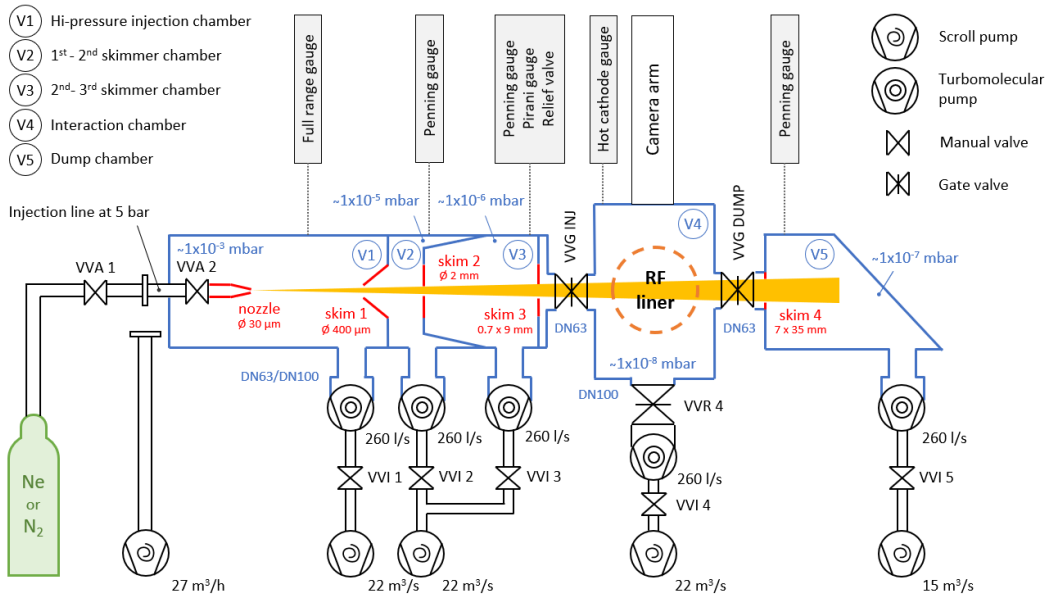
BGC collaboration meeting - 12.12.2023

Index

1. Off-line test campaign
2. Simulations
   - H_2O throughput from unbaked chambers and NEG coating saturation
   - N_2 operation: pressure profile, gas exit ratios and NEG coating saturation
   - Ne operation & distributed injections: pressure profile (sim. & measurements), gas exit ratios and deposition on cryogenic surfaces

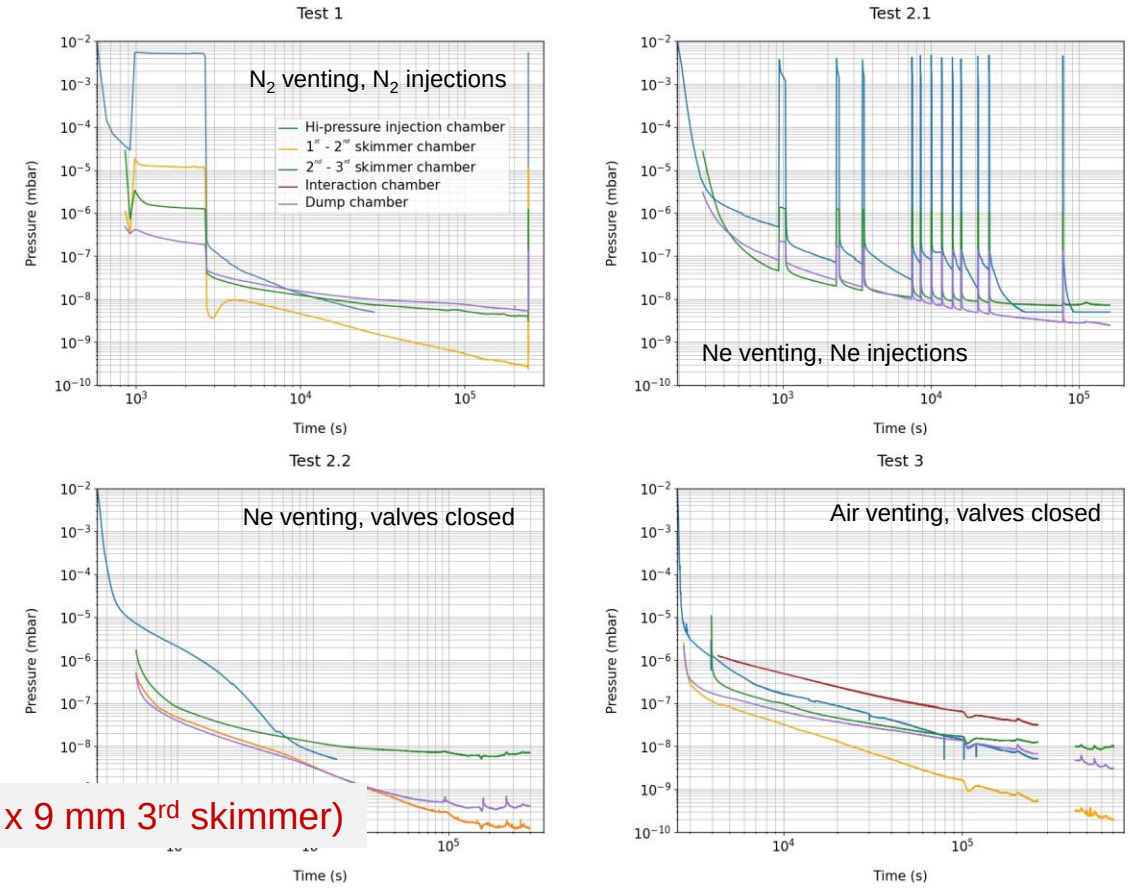
Off-line test campaign

- Pump down & injections



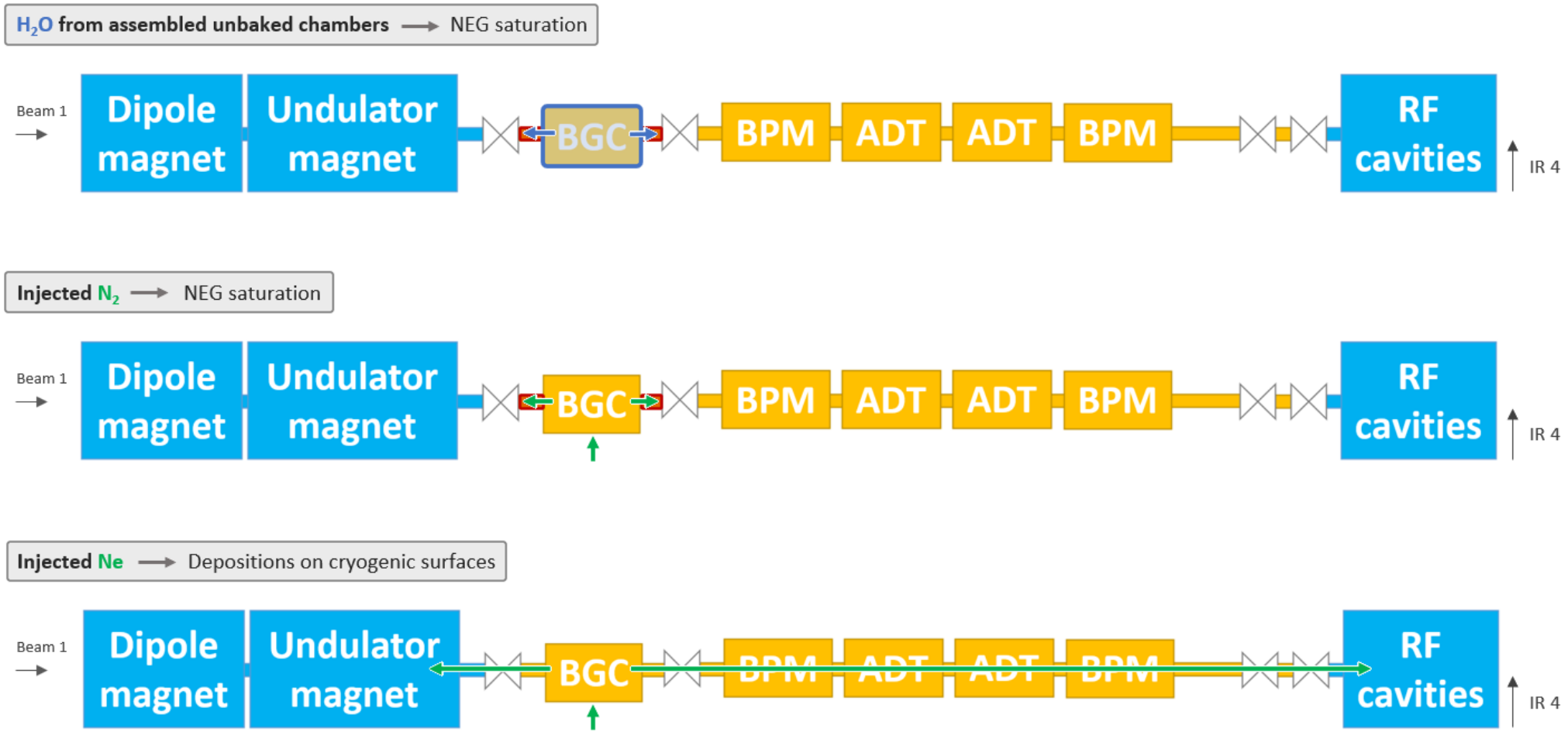
B8 BGC vacuum layout

	Δ Pressure test 1 (mbar)	Δ Pressure test 2.1 (Ne corrected)(mbar)
Hi-pressure injection chamber	5.1×10^{-3}	4.9×10^{-3}
1st - 2nd skimmer chamber	1.2×10^{-5}	
2nd - 3rd skimmer chamber	1.1×10^{-6}	4.7×10^{-6}
Interaction chamber	5.2×10^{-8}	1.9×10^{-7}
Dump chamber	1.2×10^{-7}	5.4×10^{-7}

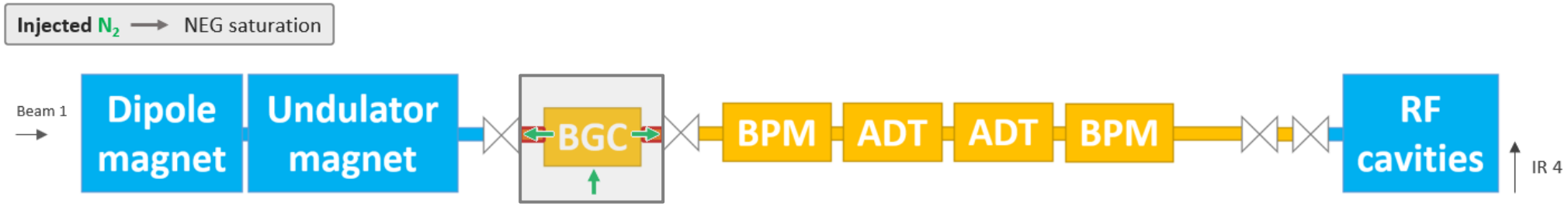


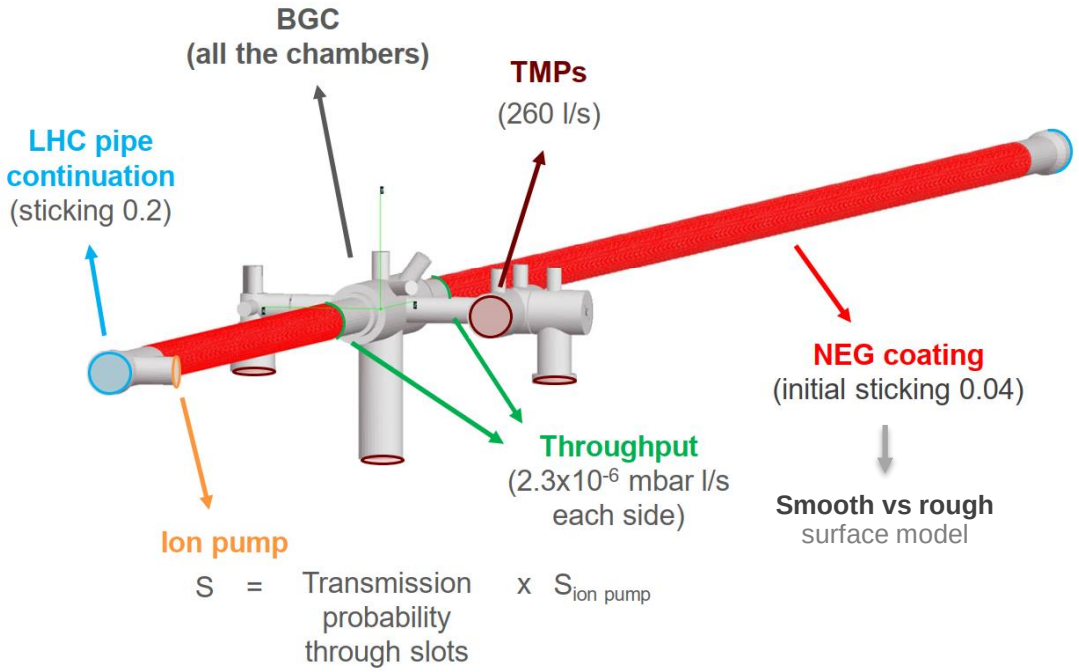
/3.8 (0.3 x 9 mm 3rd skimmer)

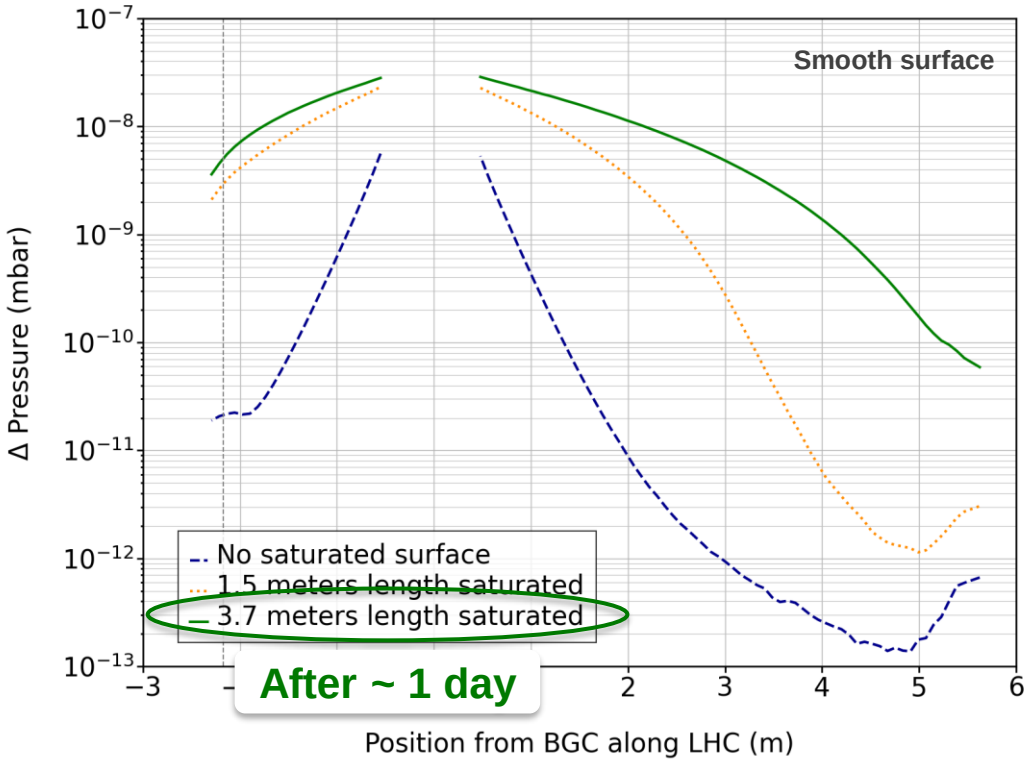
LHC simulations



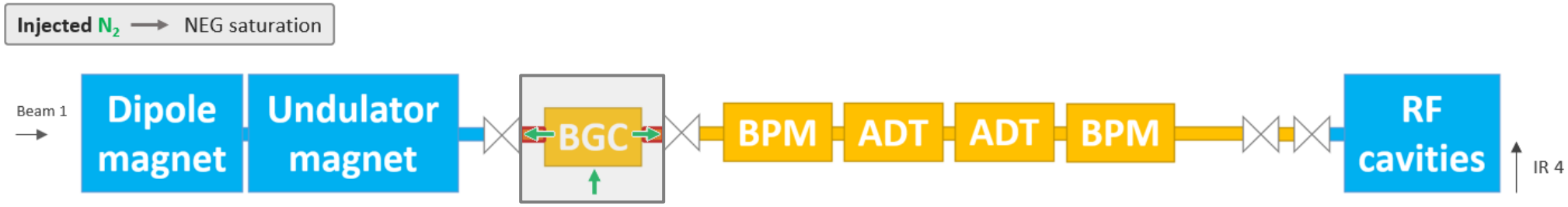
LHC simulations – N_2

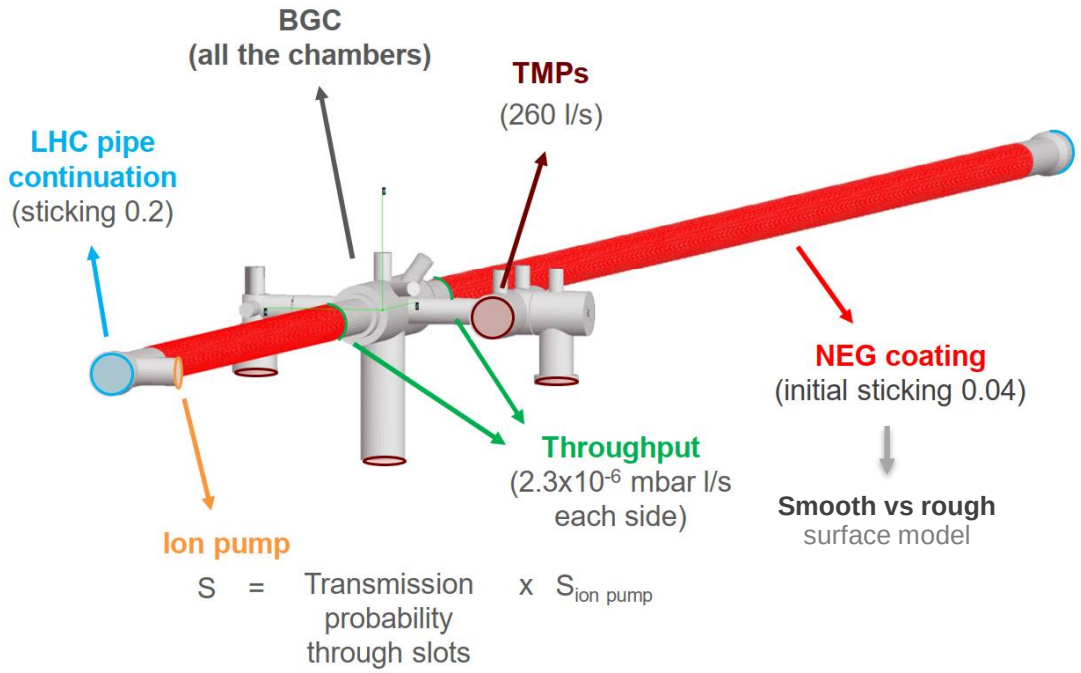


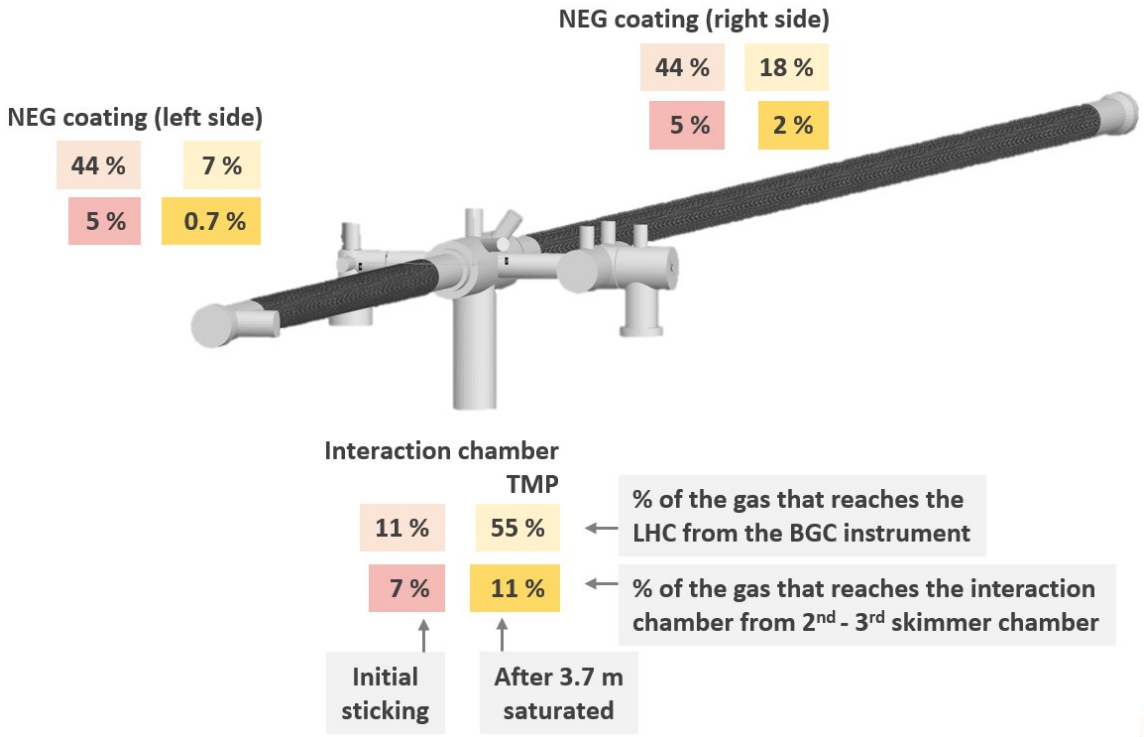




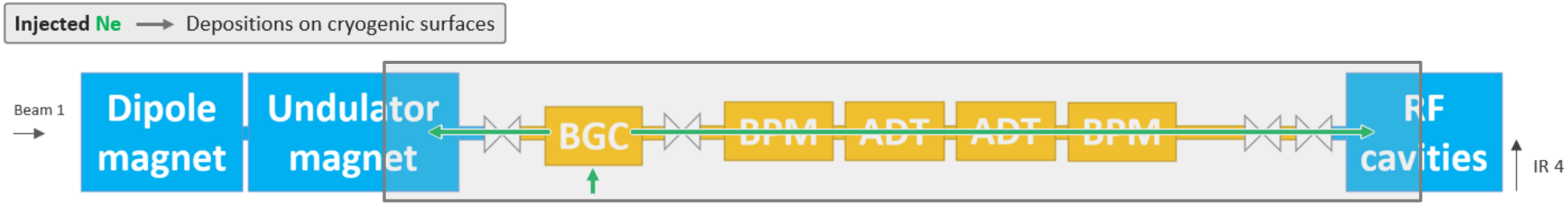
LHC simulations – N_2

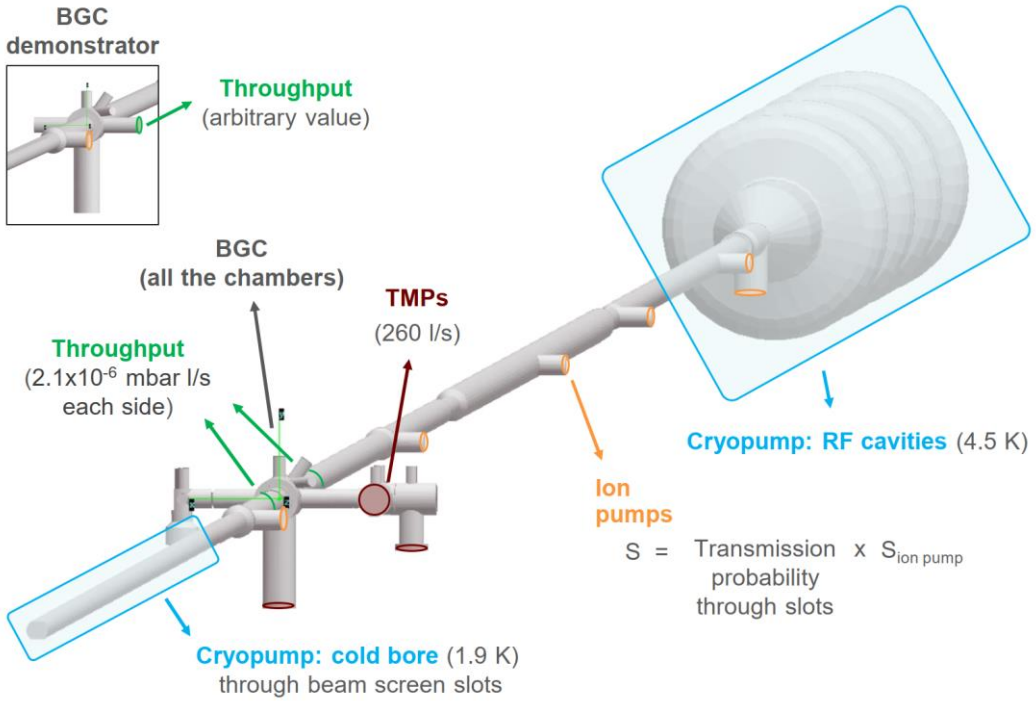


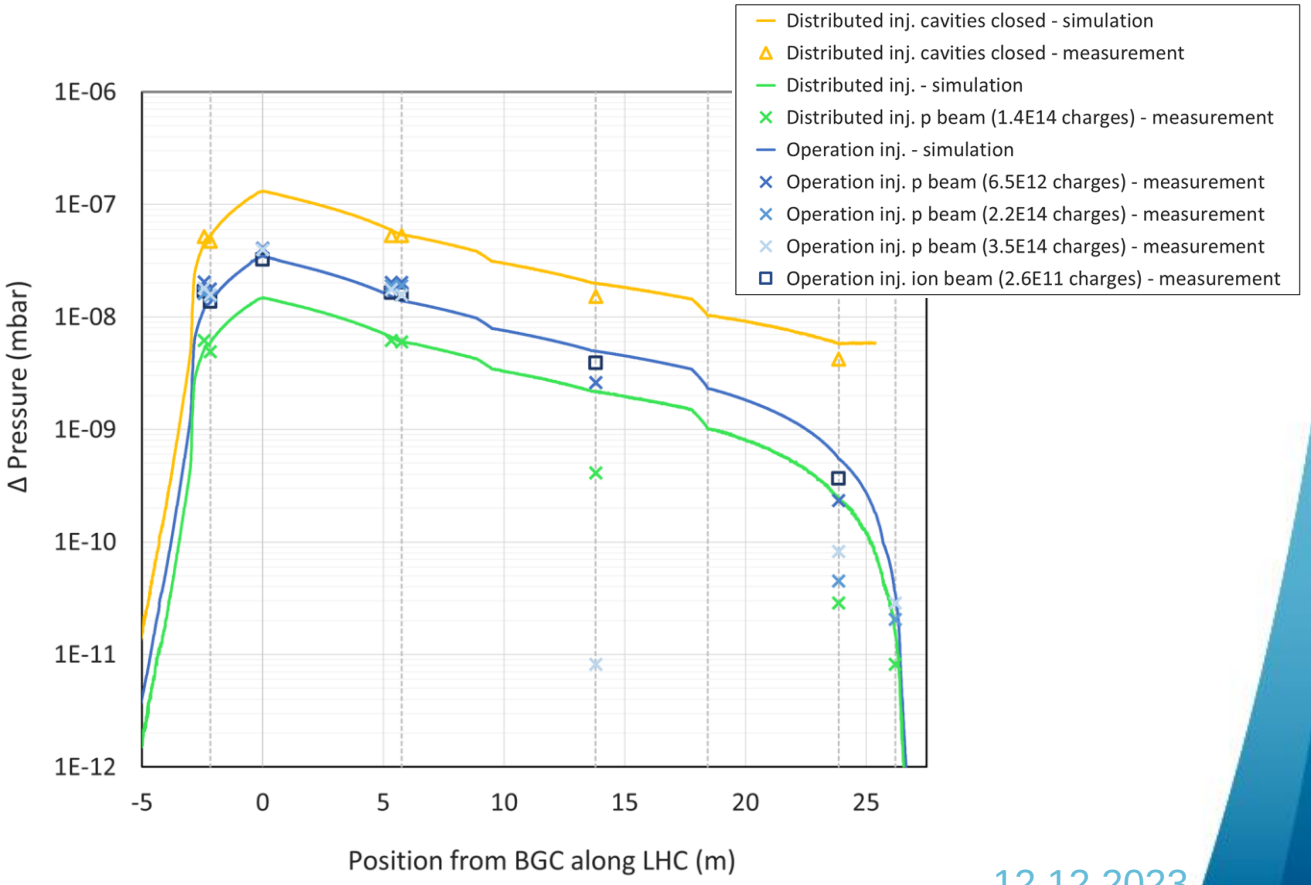




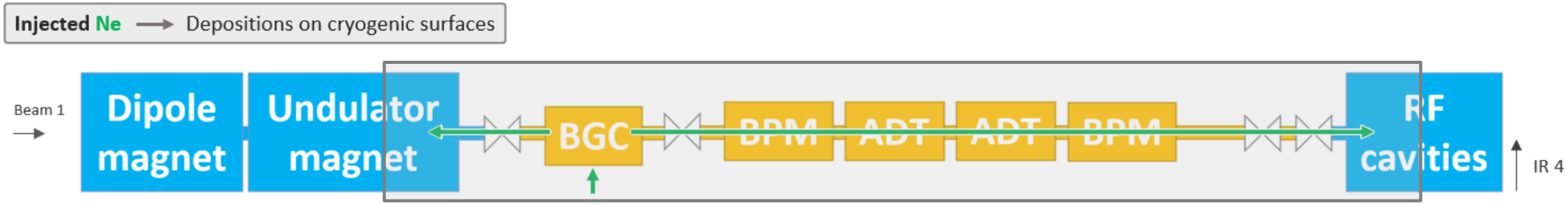
LHC simulations – Ne

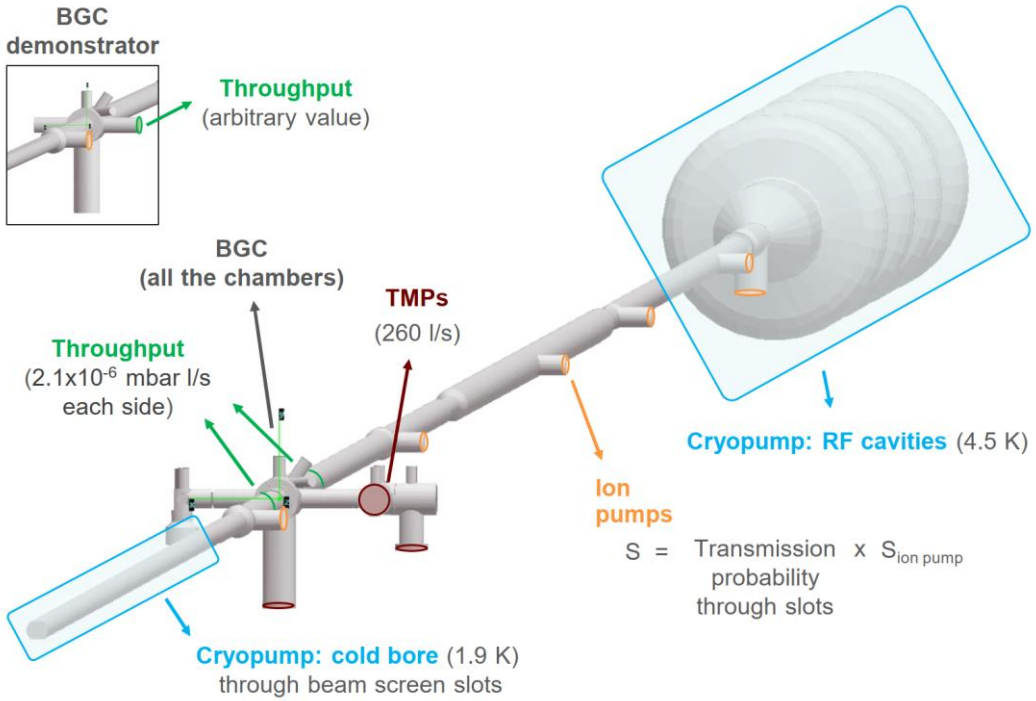


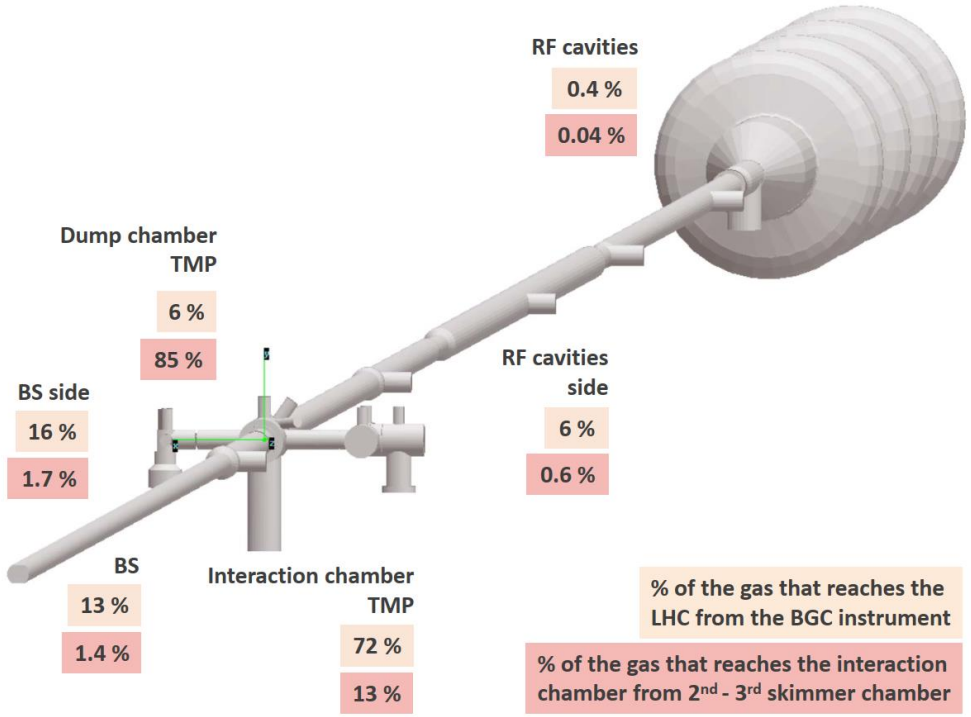




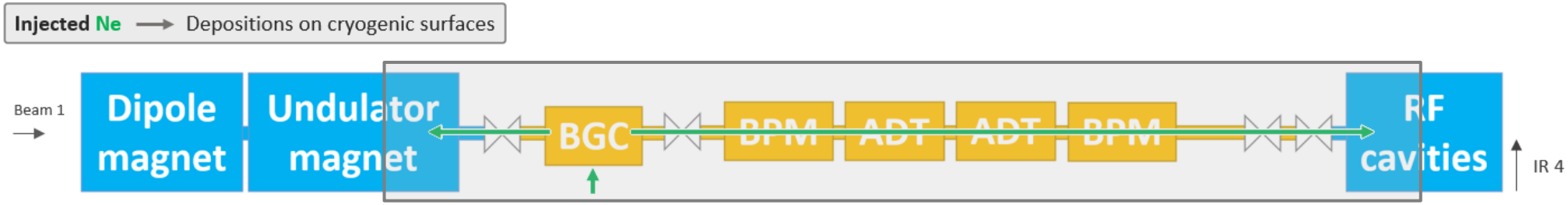
LHC simulations – Ne

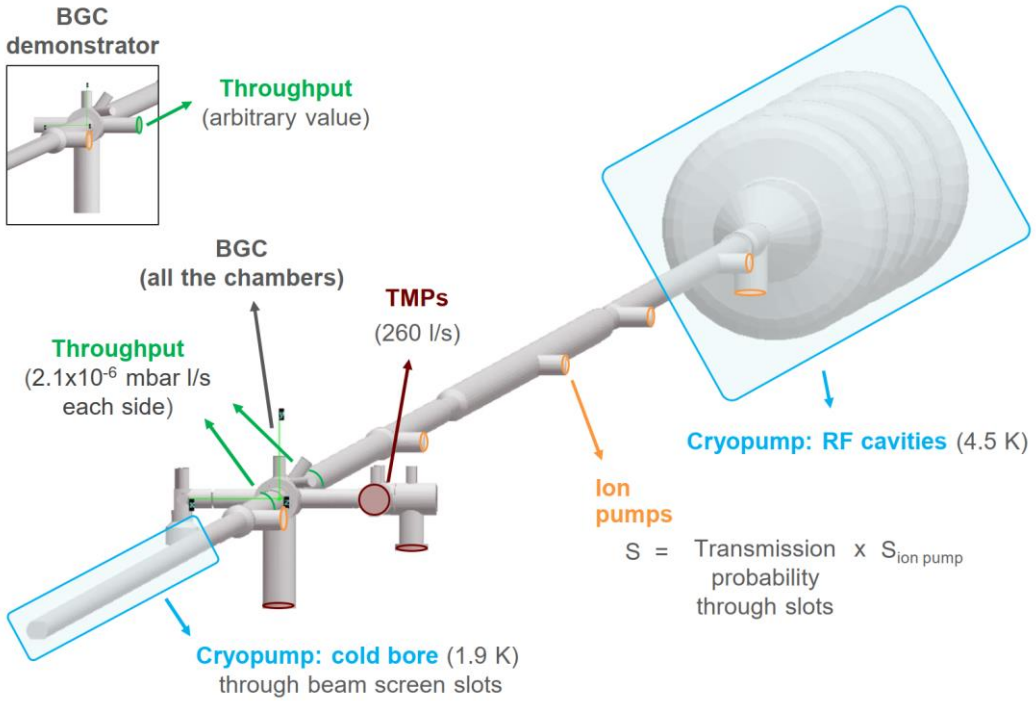




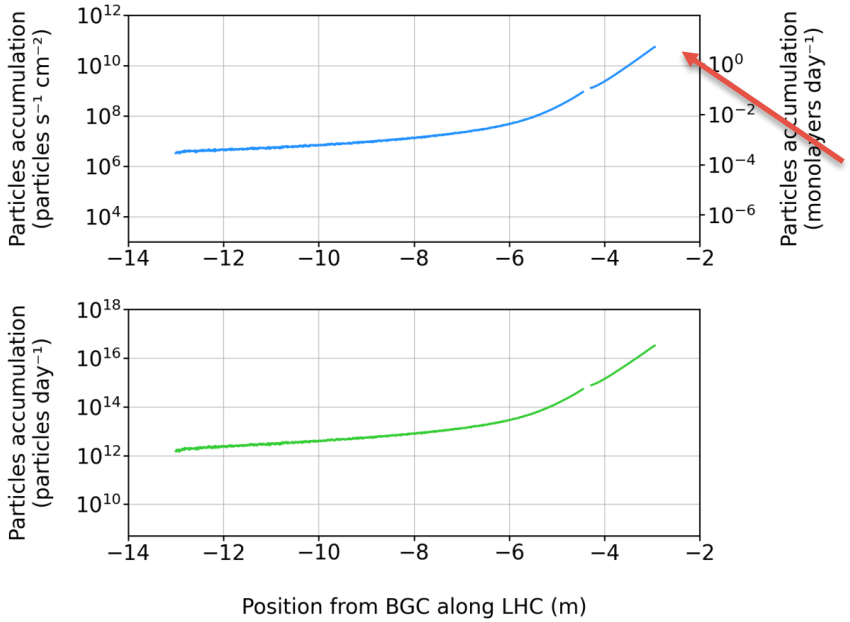


LHC simulations – Ne





Particles accumulation on the cold bore

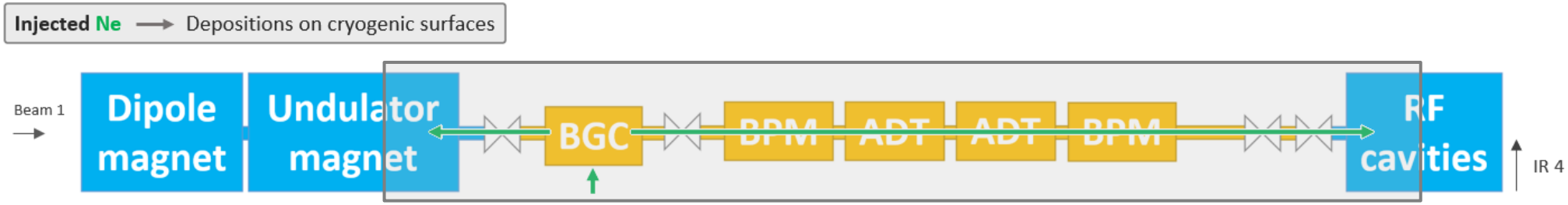


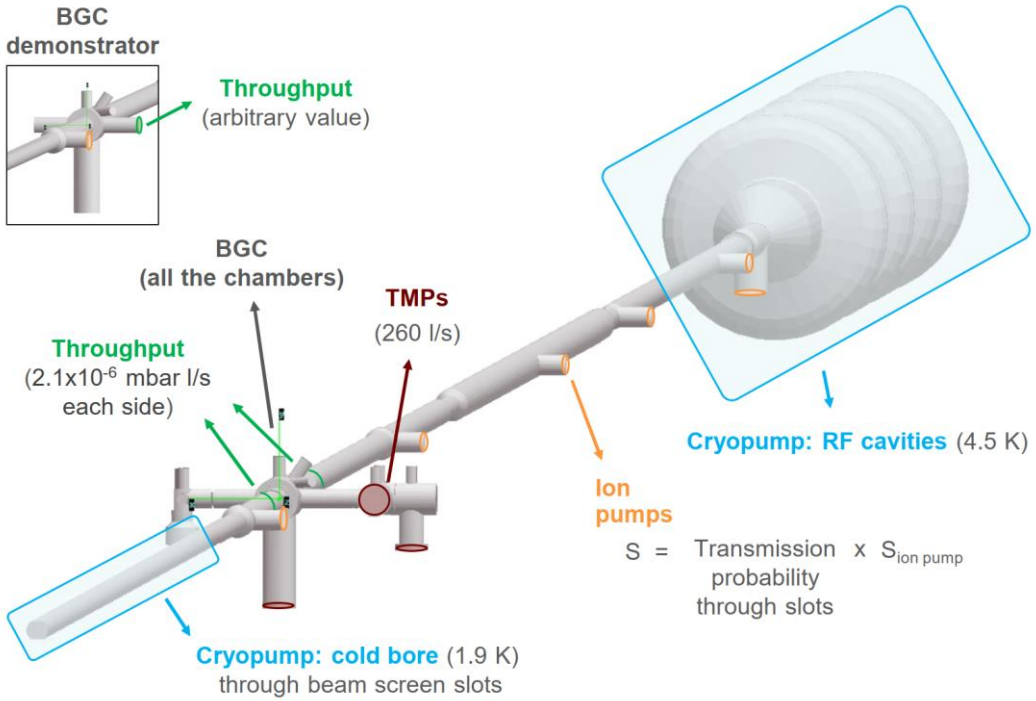
19.6 monolayers after **100 h** of continuous operation

↓

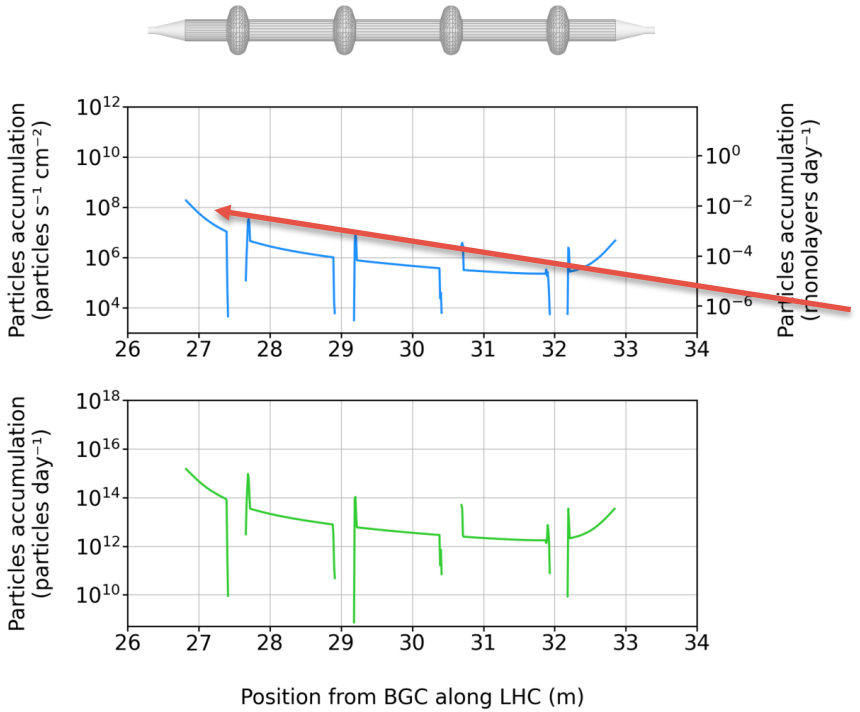
Estimated **SEY increment: 0.28**

LHC simulations – Ne





Particles accumulation on the RF cavities

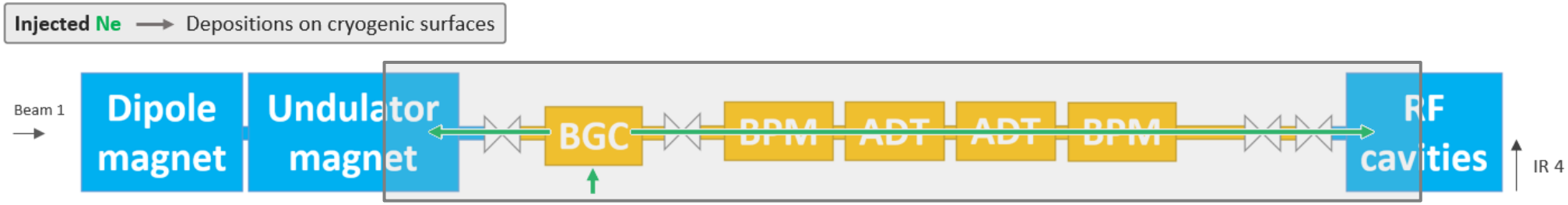


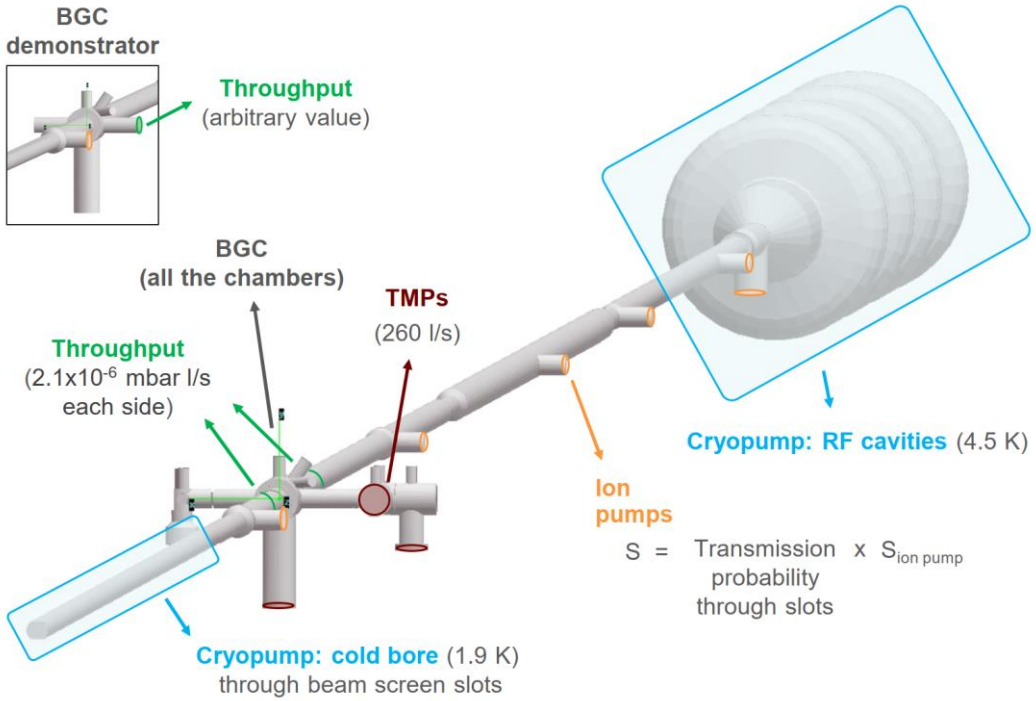
0.07 monolayers after **100 h** of continuous operation

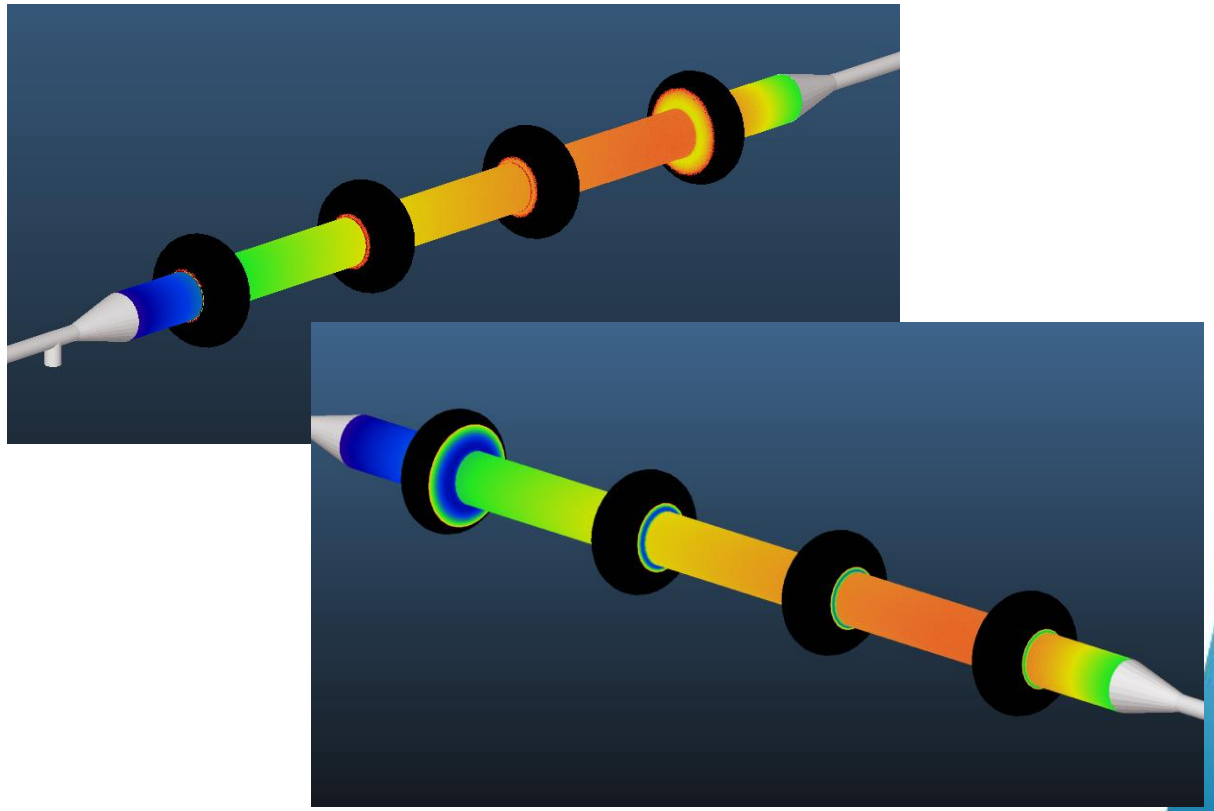
↓

Estimated **SEY increment: 1E-3**

LHC simulations – Ne







Conclusions

- **Pump down and injections characterized** during off-line tests, allowing to obtain **inputs** for the LHC simulations.
- **Acceptable** compromise between BGC **pump down time and estimated saturated length** of the beamline with **H_2O from unbaked chambers**, **avoiding the bake-out.**
- **Significant NEG saturation** simulation results **due to N_2** injections: **3.7 m both sides in 1 day (smooth surface model -worst case-).**
- **Good agreement** between **Ne pressure simulations and measurements without beam or at lower beam intensities.**
- **Negligible** contribution to **SEY** of Ne monolayers after 100 h of operation in **RF cavities (0.07 monolayers, SEY 1E-3)** while it is **not** in the **cold bore (19.6 monolayers, SEY 0.28)**

Thank you for your attention