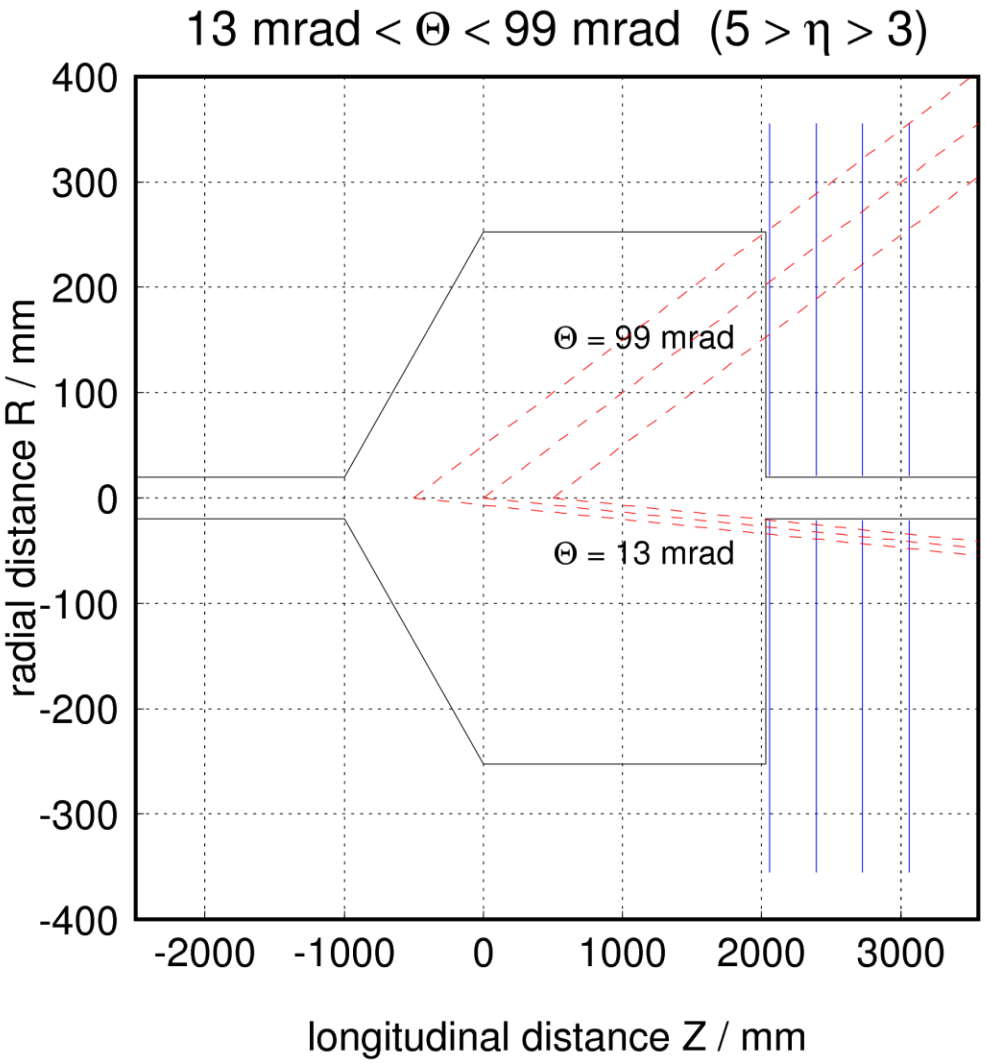
Preliminary vacuum pressure distribution for the beam gas imaging for the LHC

- Proposed design specification
- Example of pressure distribution
  - Different gas types
- Preliminary conclusions & Outlook

Proposed design for the BGV for LHC



From M. Ferro- Luzzi

Required densities

- Densities (averaged over 1m) that would be needed for the BGV to work adequately for some representative gas types.

Gas type	A	F_{good}	ρ [10^7 cm^{-3}]	p at 293 K [10^{-9}mbar]
Hydrogen	1	0.002	5800	2300
Neon	20	~0.020#	160	64
CO_2	16*	0.020*	60	25
Xenon	131	0.140	7	2.6

Notes: since we only simulated H, O and Xe, we did this:

* A and F_{good} for CO_2 approximated by O_3

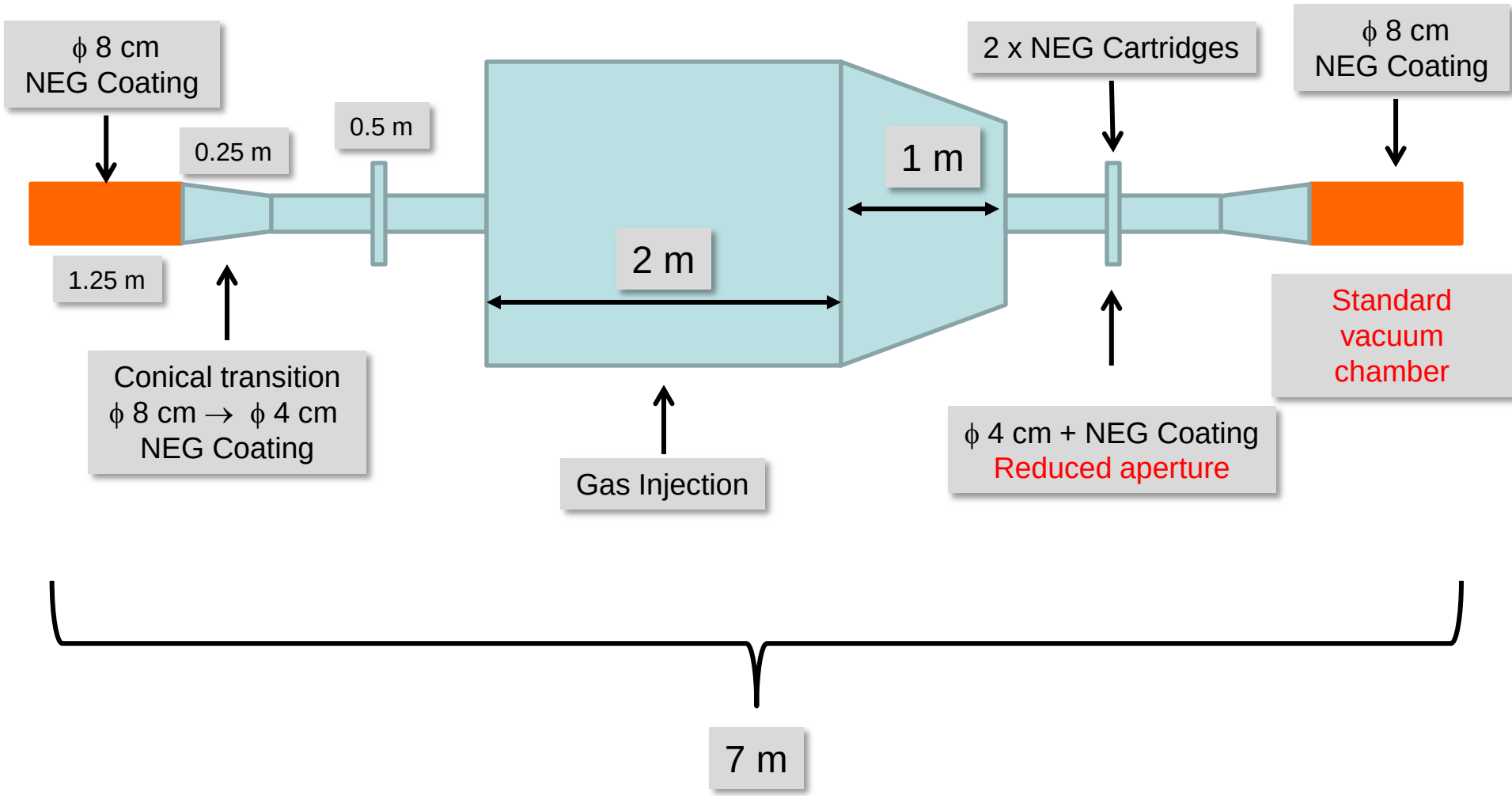
\# F_{good} for Ne assumed same as for O (should be slightly better)

- Can estimate performance of any other gas by estimating the F_{good} from the gas with the closest A and by scaling the density with $A^{2/3}$ (larger A, smaller density needed).
- Reminder 1: ρ is the molecular density, while the rate scales with the number of nuclei per cm^3 !
- Reminder 2: what really counts is the target thickness (ρ integrated along the useful z range)

From M. Ferro- Luzzi

Example of a Possible Vacuum Layout

Case of the BGV installed in 1 beam pipe
For integration reasons the total length of the installed system is fixed to 7 m



Preliminary results and outlook

Gas	Mean Pressure in BGV	<Qinj>	Pmax/Pmin in BGV	P @ 1 m	P@ 2.5 m
H2	1E-7	5E-5	≈ 1.5	5E-9	1E-11
CO	5E-8	1E-5	≈ 1.5	5E-11	1E-11
CO2	2E-8	1E-6	≈ 1.5	5E-11	1E-11

- Investigation of favorable case
- Limitation due to long term injection must be investigated
  - Implies BGV performance reduction
  - Implies possible LHC performance reduction (lifetime, vacuum instability, radiation …)
- Reduced diameter aperture of 4 cm must be validation by optics team