

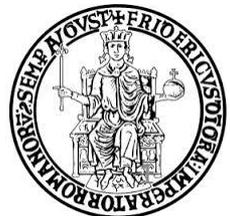
# SHIP Project - Filling the SBT

University of Naples Federico II

## Working group - Hydraulic

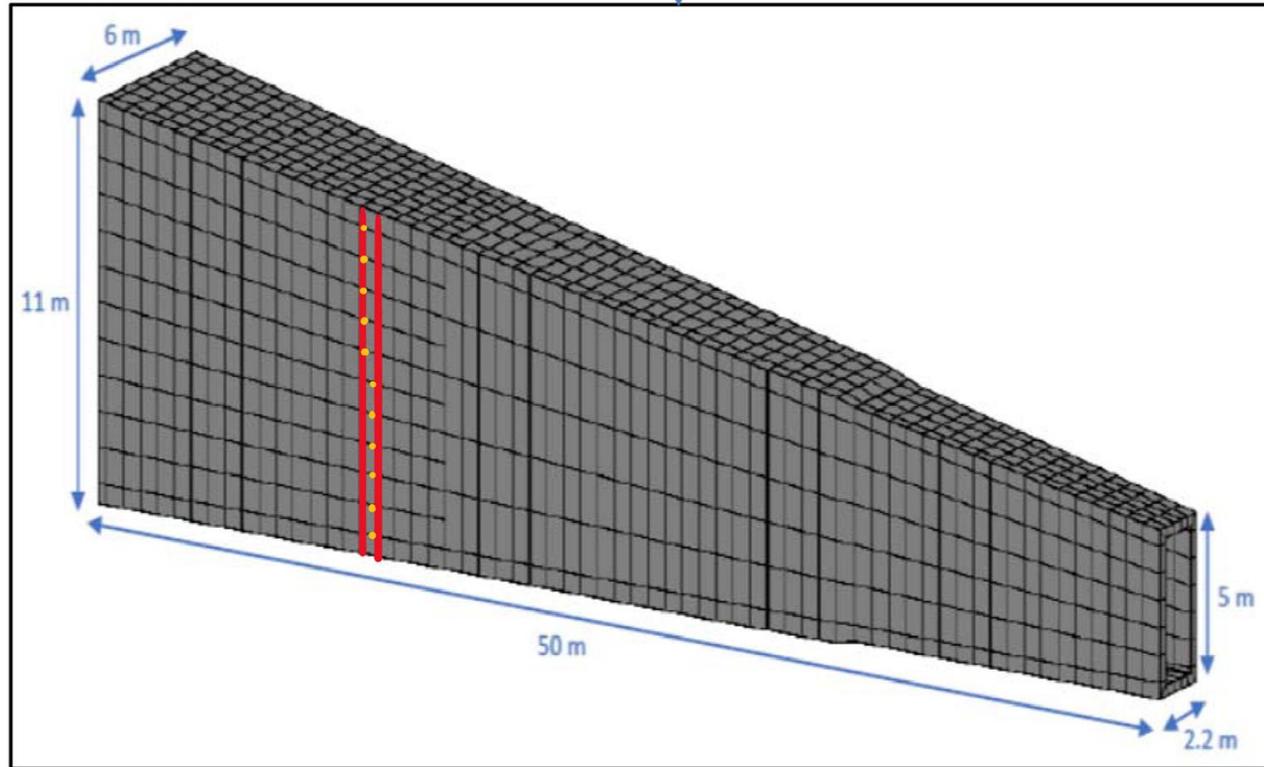
Prof. Armando Carravetta  
Prof. Giuseppe Del Giudice  
Prof. Francesco De Paola  
Prof. Cristiana Di Cristo  
Prof. Oreste Fecarotta

- Filling strategy
- Prototypes for different tests
- Timetable



# SHIP Project - Filling the SBT

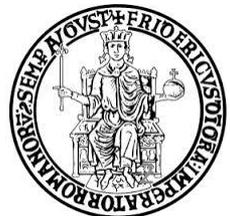
Objective: the SBT cells have to be completely filled by Liquid Scintillator without trapping gas bubbles.



Proposed strategy  
Discussion  
Check of structural aspects



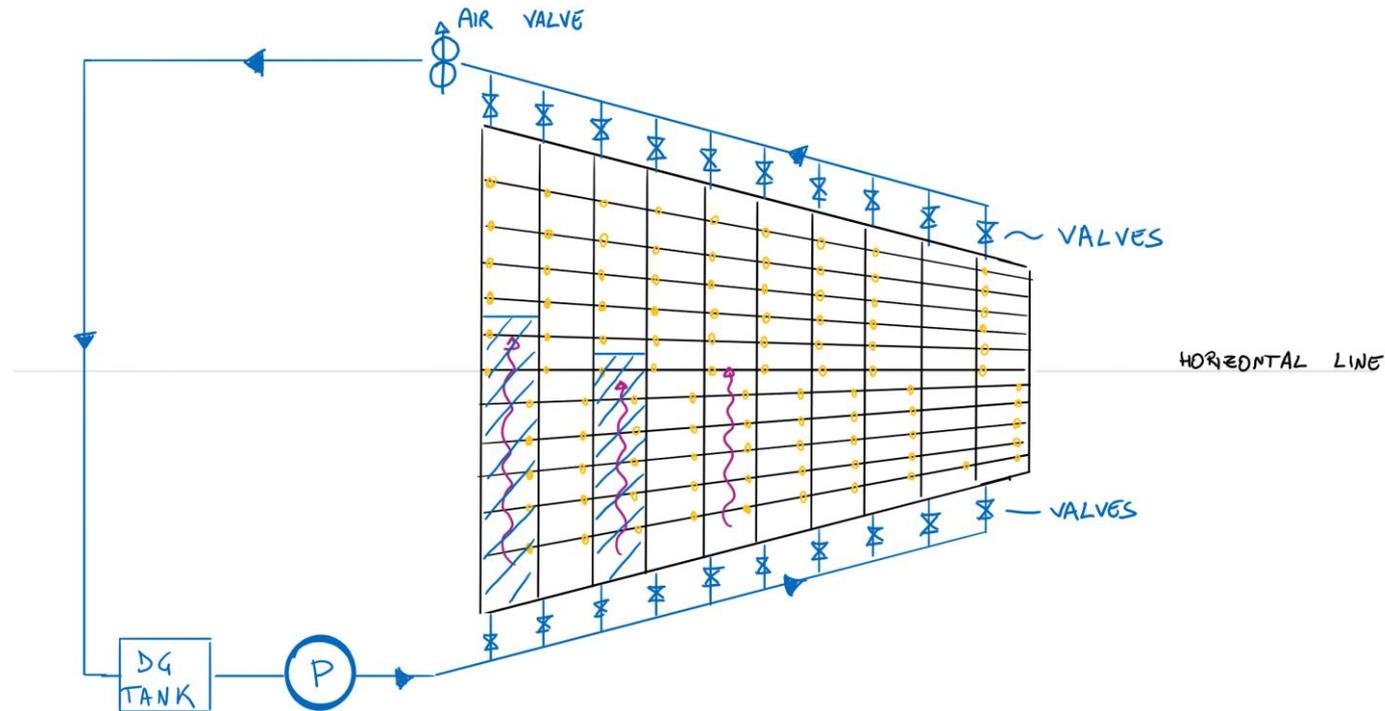
Final design  
Prototypes and tests  
Filling strategy



# Proposed filling strategy

Filling strategy for each SBT face (bottom, top, side1 and side 2).

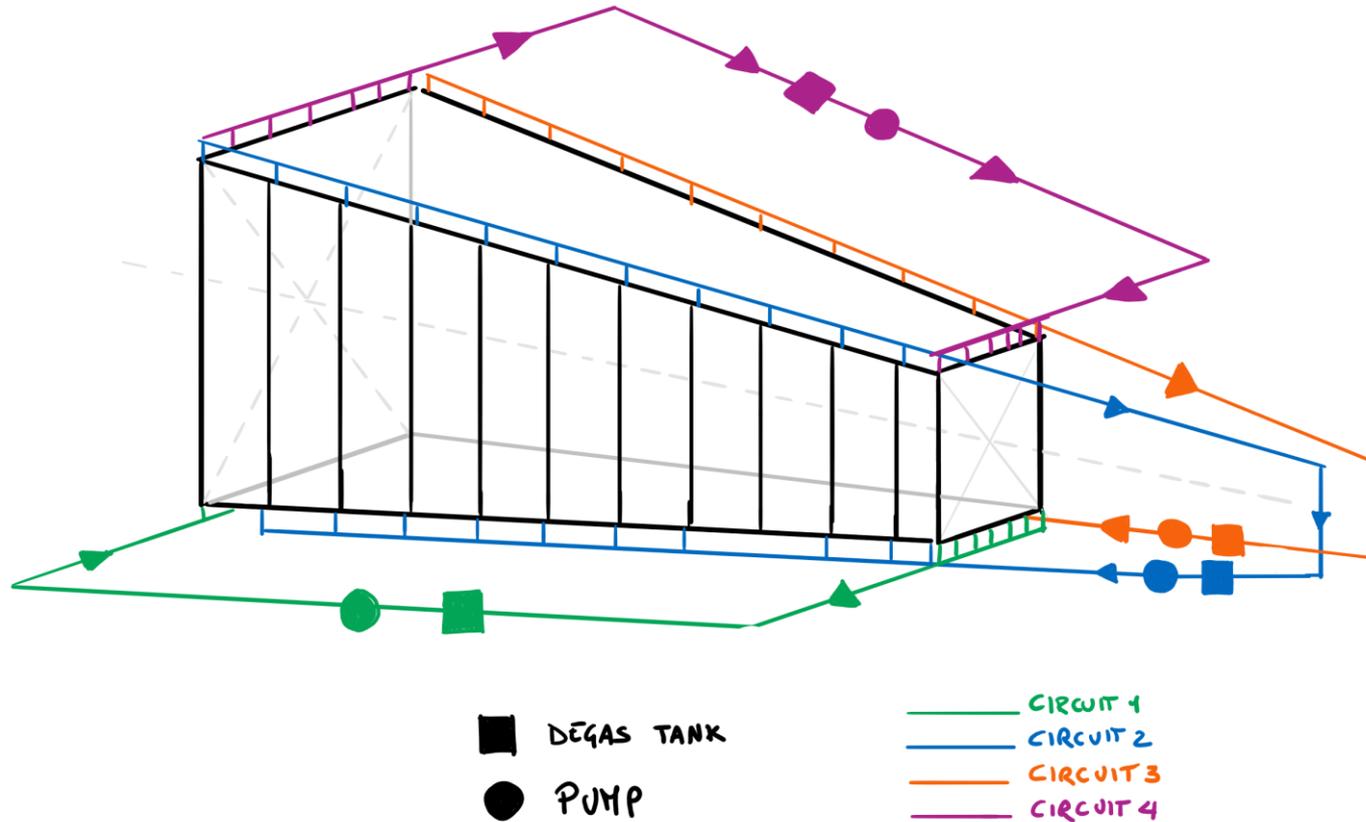
The best strategy to propose consists a close circuit connected to one pumping system. All rings are vertically interconnected through holes. The vertical columns are separately filled.



LS is introduced into the rings from the bottom using the pumping systems and following the counterslope direction. The liquid slowly moves into the circuits and air is expelled through air valves. The pumping continues until the air is completely eliminated.

# Proposed filling strategy

4 circuits connected to one (or more) pumping system, one for each SBT faces (floor, ceiling, side1 and side 2).

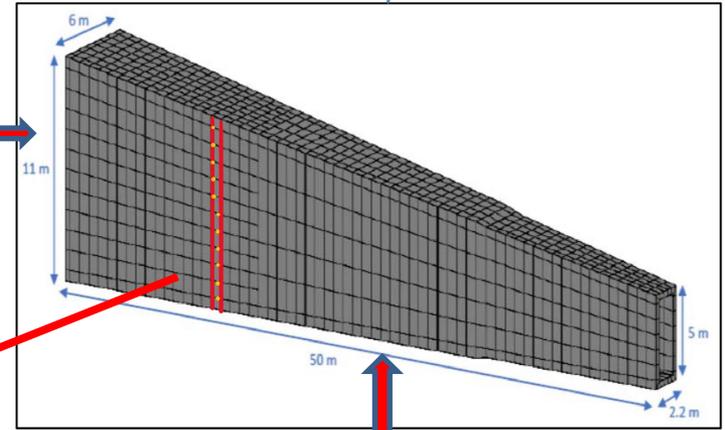


The pumping continues until the air is completely eliminated.

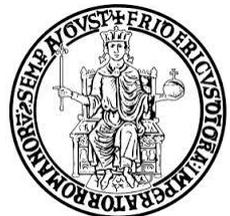
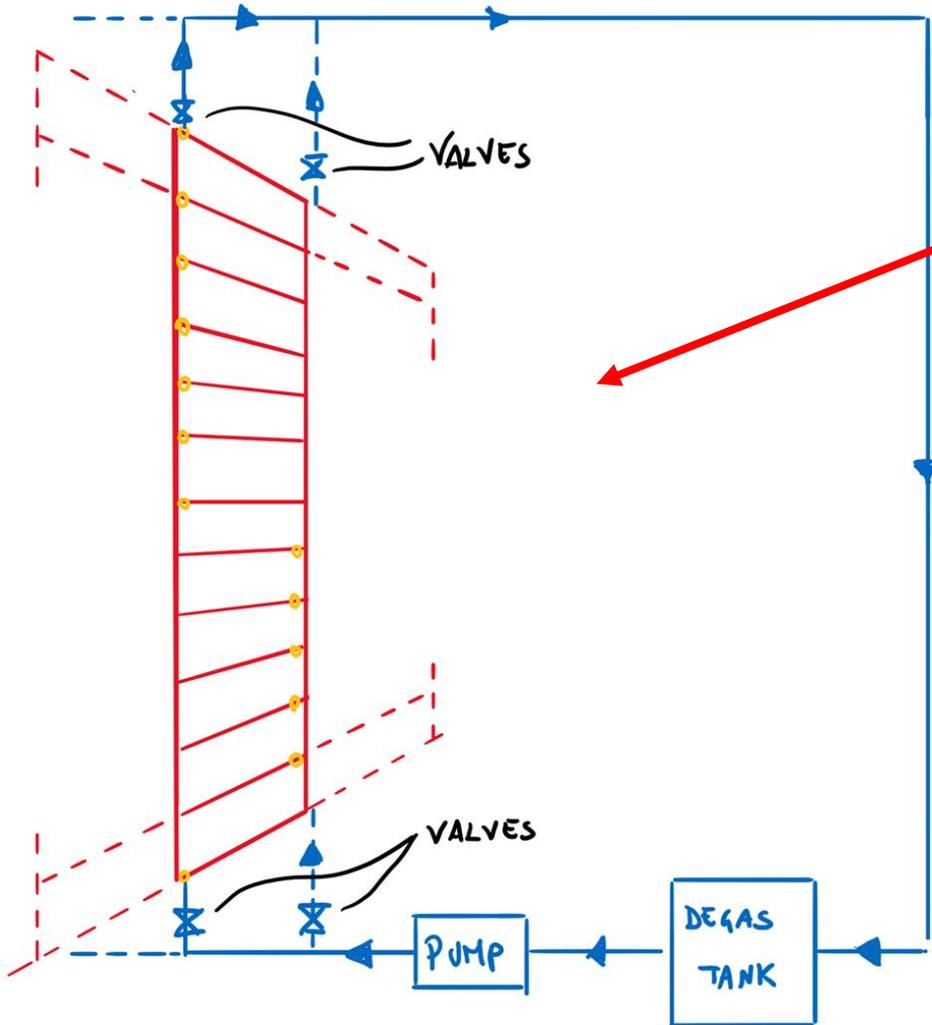


# Proposed filling strategy

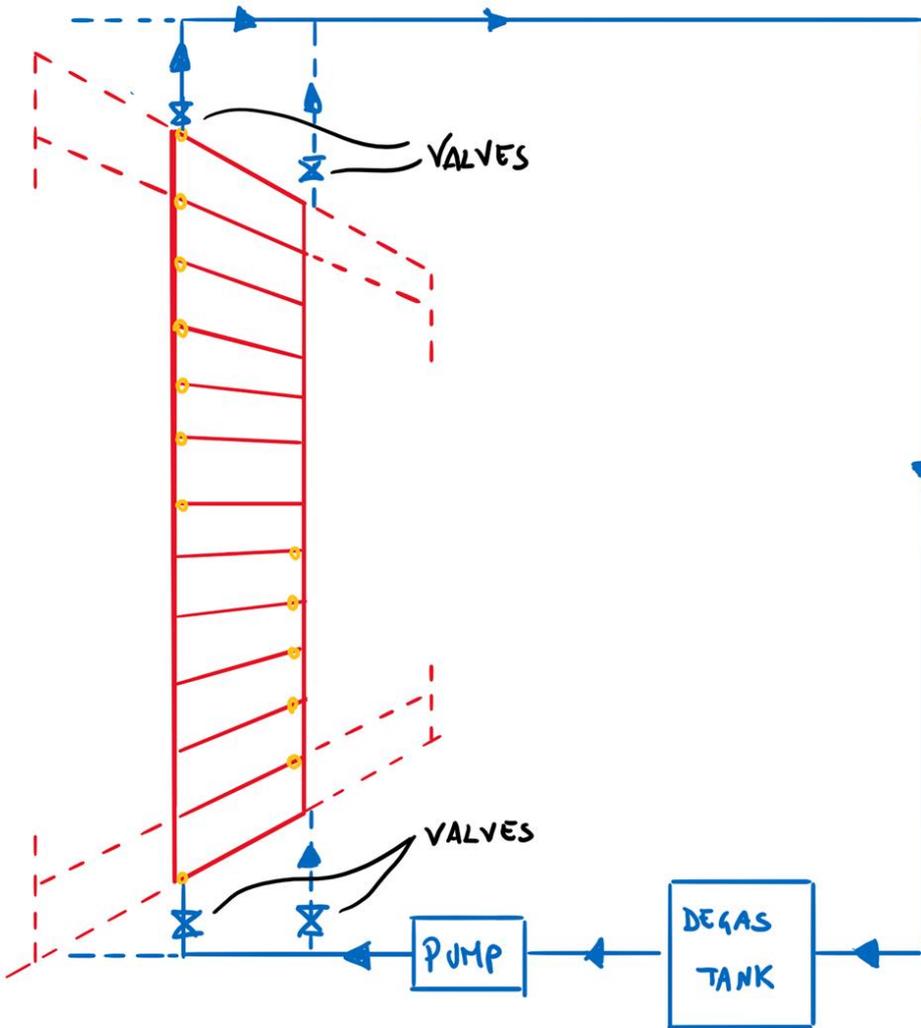
Side faces: fill separately  
the vertical columns



Bottom and top faces: fill  
separately the horizontal rows



# Proposed filling strategy



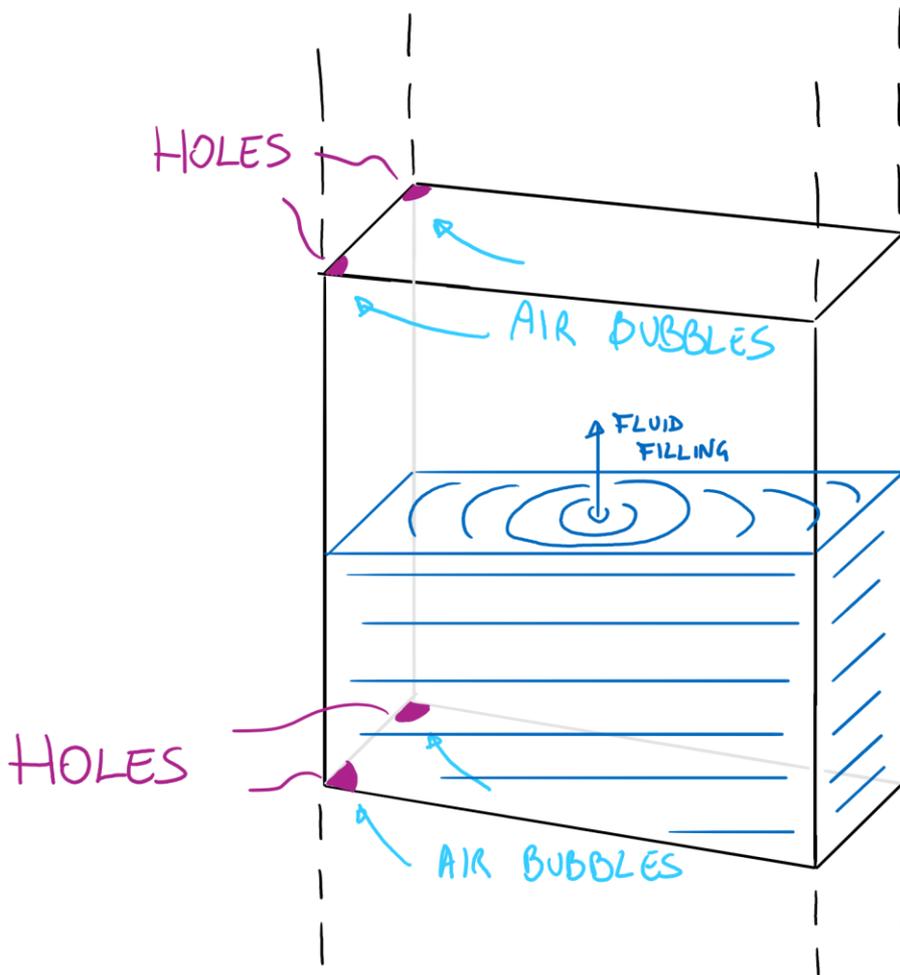
Counterslope direction.  
The holes has to be placed considering the orientation of the rings.

The rings on the bottom and on the top are equipped with valves.

Air bubbles migrate to the top and are eliminated through the air valves



# Proposed filling strategy



Filling time is crucial!!!

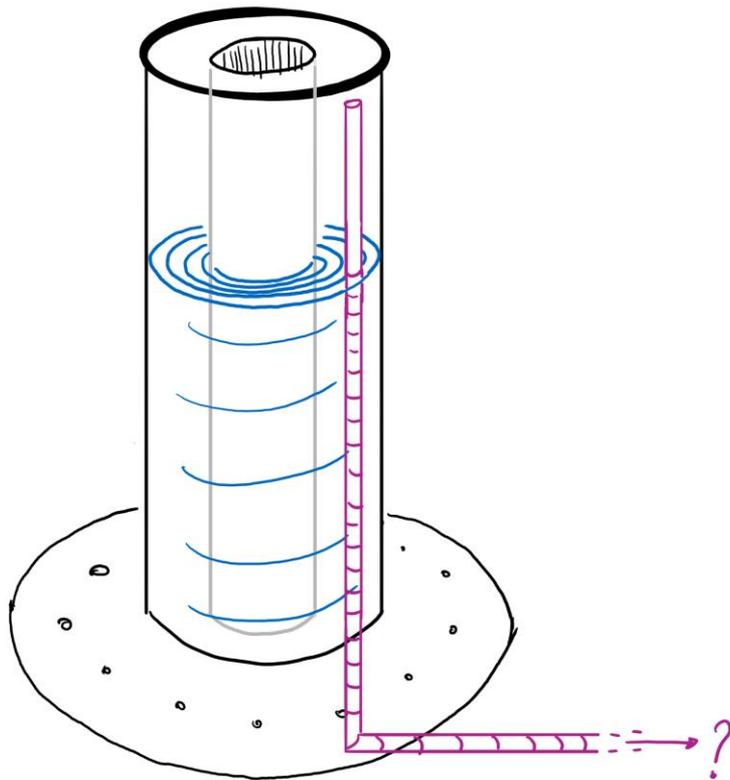
The filling has to be realized very slowly in order to have laminar regime.

The characteristics of the LS are important.

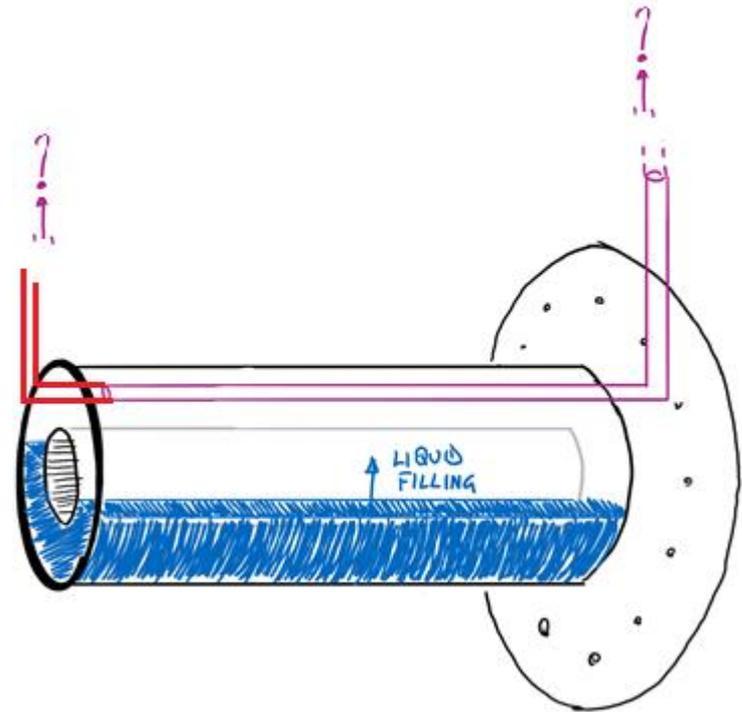


# Cylindrical WOM tubes filling

To evacuate the air from the cylindrical cells very small pipes are introduced into the wall thickness.



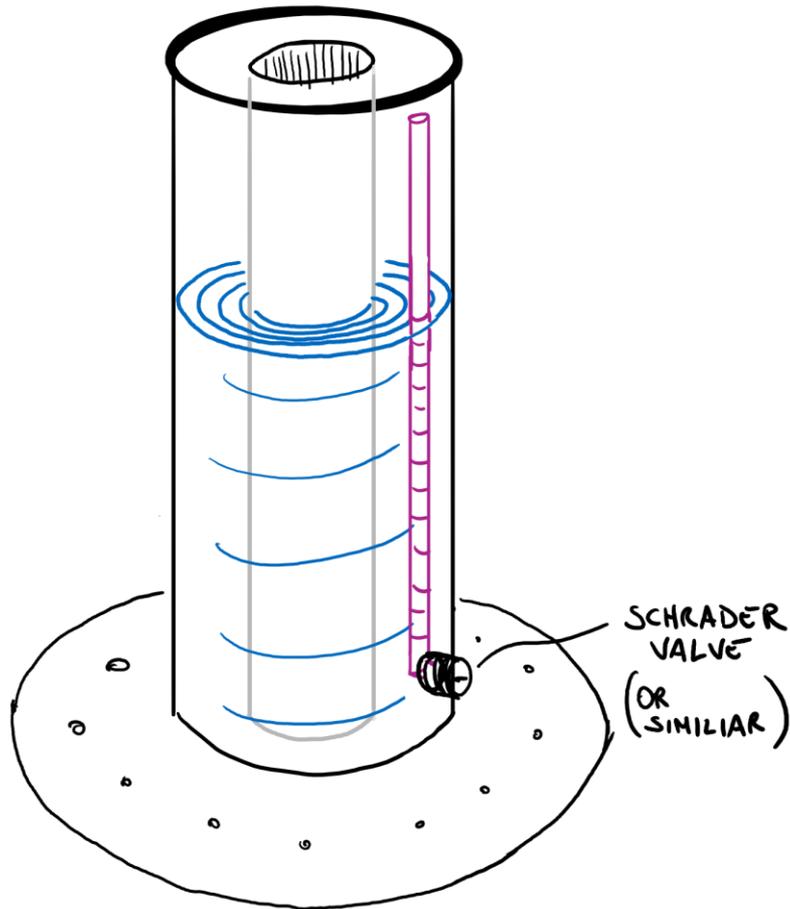
vertical



horizontal



# Cylindrical WOM tubes filling



The air has to be extracted during the filling.



# Prototypes and timetable

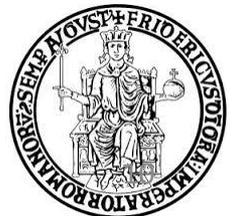
**Ring prototypes** : two transparent prototypes of 3 rings for verifying the filling strategy (direction and time) with the LS

- Visual analysis of air bubbles
- Pressure measurements
- Filling time tests

**Small-scale prototype of the complete SBT with all circuits and pumping system.**

- Full concept of the filling system
  - Final design
  - Prototypes and tests
  - Filling strategy

**Timetable**



# Cylindrical WOM tubes filling

