

# A fixed-target experiment @ ALICE

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Requirements

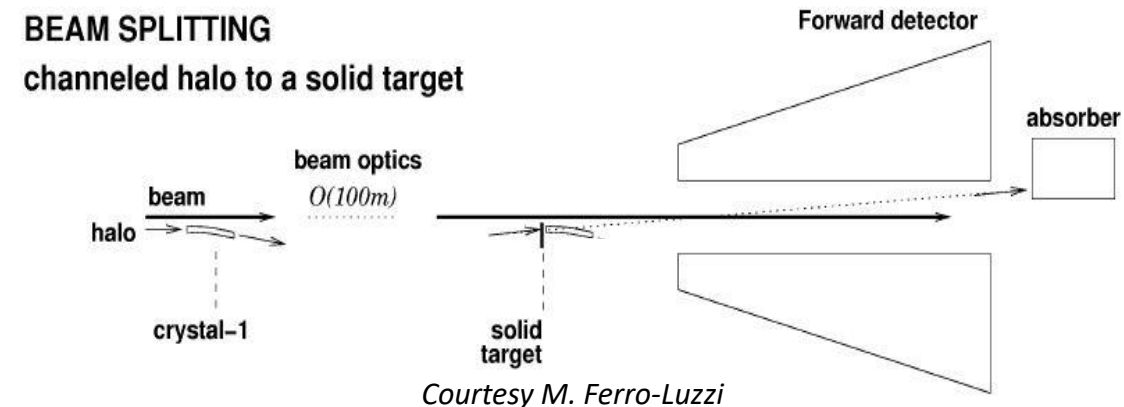
Integration constraints

Target design proposal

Integration proposal

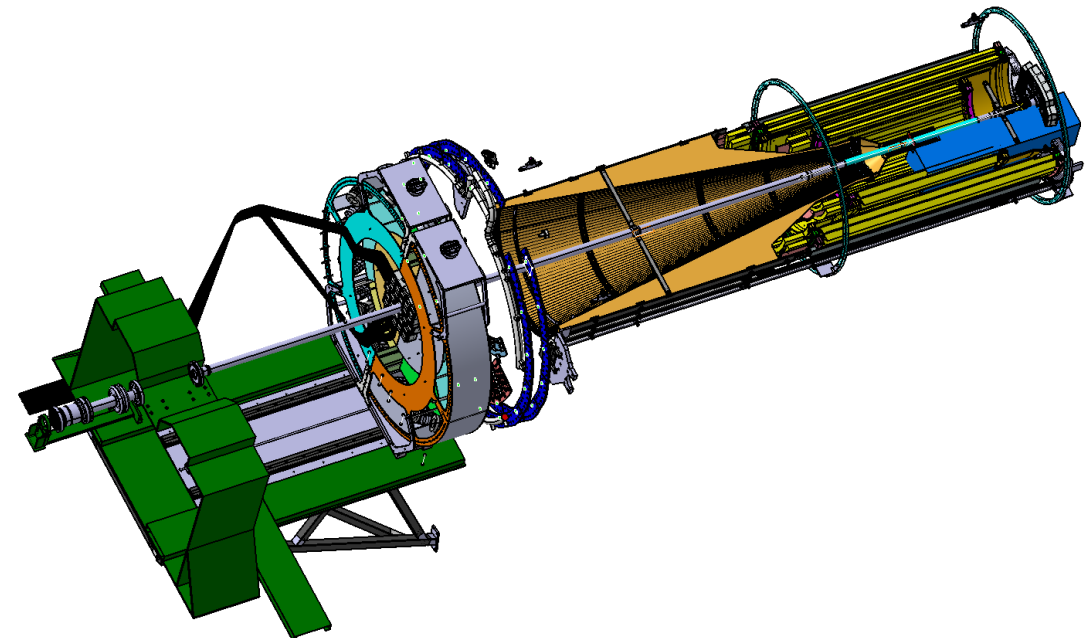
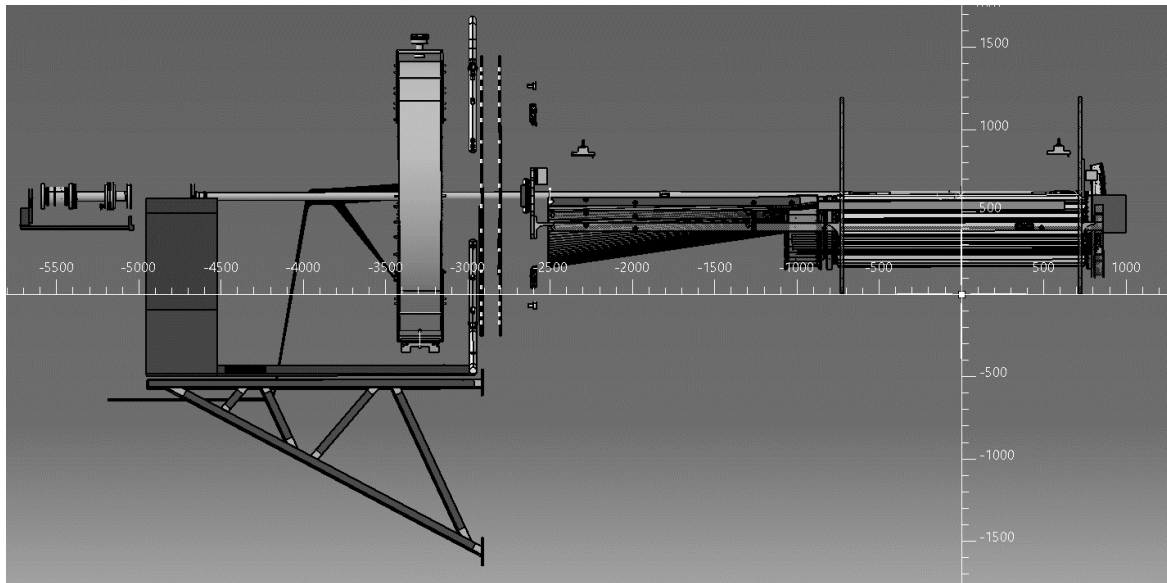
# Requirements reminder

- Particles come from a deflected part of the halo through a bent crystal (UA9).
- Fixed though retractable target: active position at 8 mm from the beam axis, parking position out of the pipe ( $\varnothing_{int} = 48.4$  ;  $\varnothing_{ext} = 50.4$ ). **2 discrete** vs. **continuous** positioning from parking to active positions?
- Better if multiple target types (different materials).
- ⚠ Need of absorbers for the particles that do not interact.
- Use of existing detectors as possible.
- Parasitic experiment if possible.



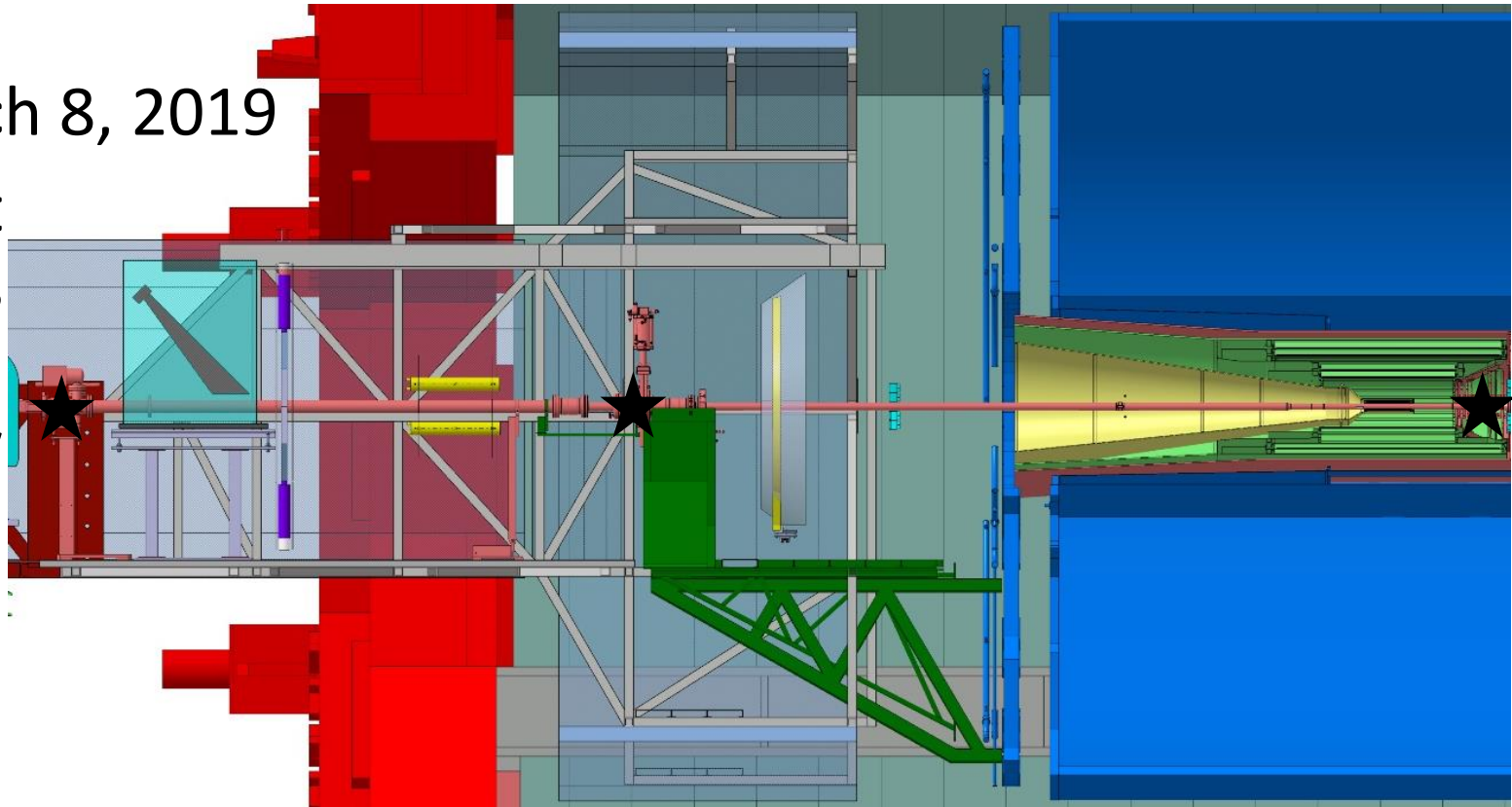
# Integration constraint: shadow and ITS upgrade

- Different locations: the closer to IP2 the better. Constraints: shadow to existing detectors, valves, outgassing (new pumps).
- Initial idea: ALICE A-side, between -2.7 m and -4.7 m.
- ITS upgrade constraint (W. Riegler, A. Tauro): ALICE A-side, before the valve ( $< -4.8$  m)  
=> **new vertex detector**.



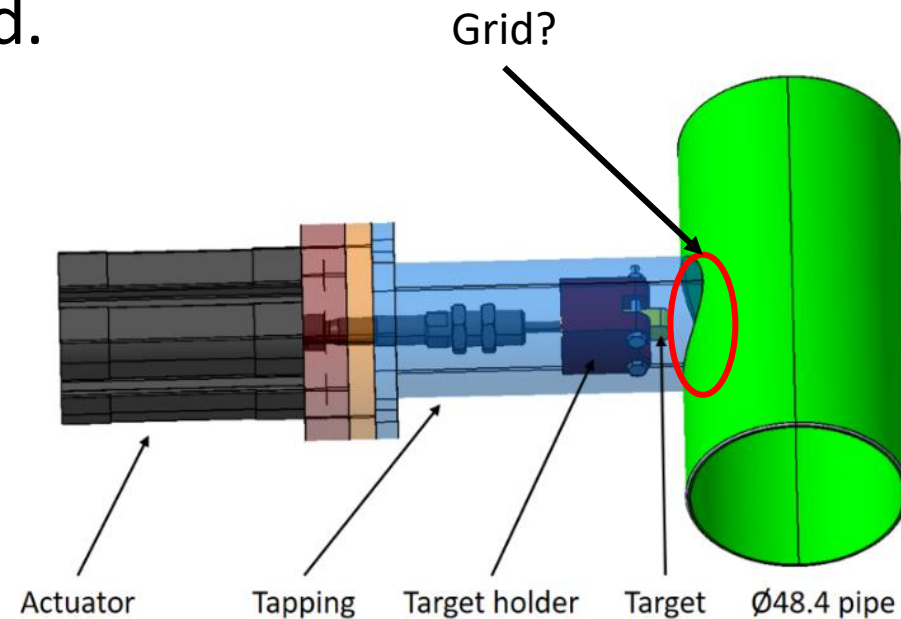
# Integration constraint: vacuum

- Meeting with J. Sestak on March 8, 2019
- Need to **sectorize** the target area: use of existing valves (e.g. between **-4.8m** and -19m: sector A1L2) vs. add new valves (e.g. **-8.3m**)?
- **Bake-out** before installation?
- Materials (target excluded): **stainless steel**.
- Outgassing would need **new pumps**: location and distance from IP2? Type and size of pump (e.g. NEG coating)?
- Current surface area (target + target holder + screws): 2000mm<sup>2</sup>. To be optimized.



# Integration constraint: impedance

- Meeting with B. Salvant on March 8, 2019.
- Beam / impedance constraints: put a grid at the entrance of each tapping (semi-isolation) for RF shielding?
- The target would pass through this grid.

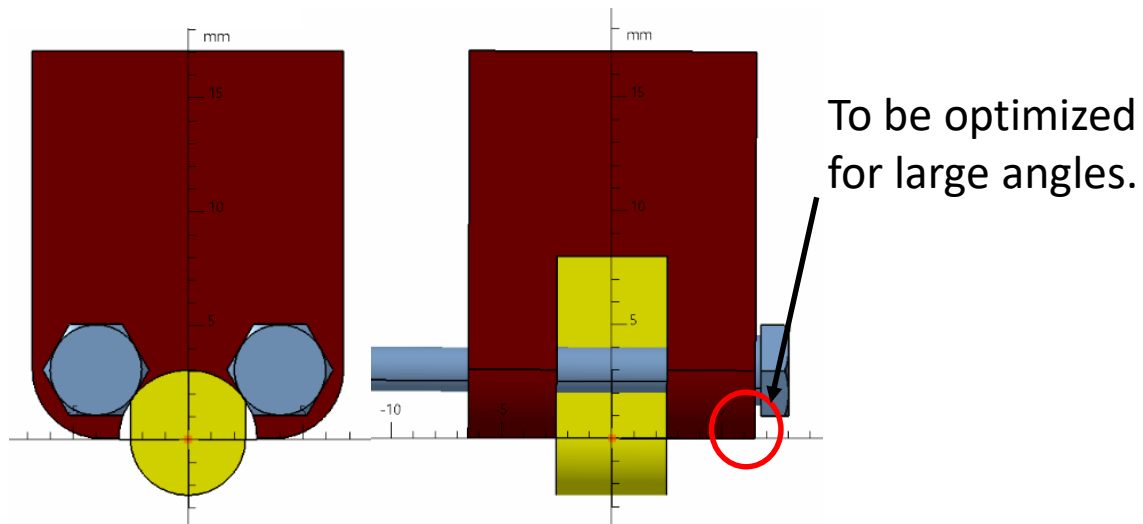


# Integration constraint: cooling system

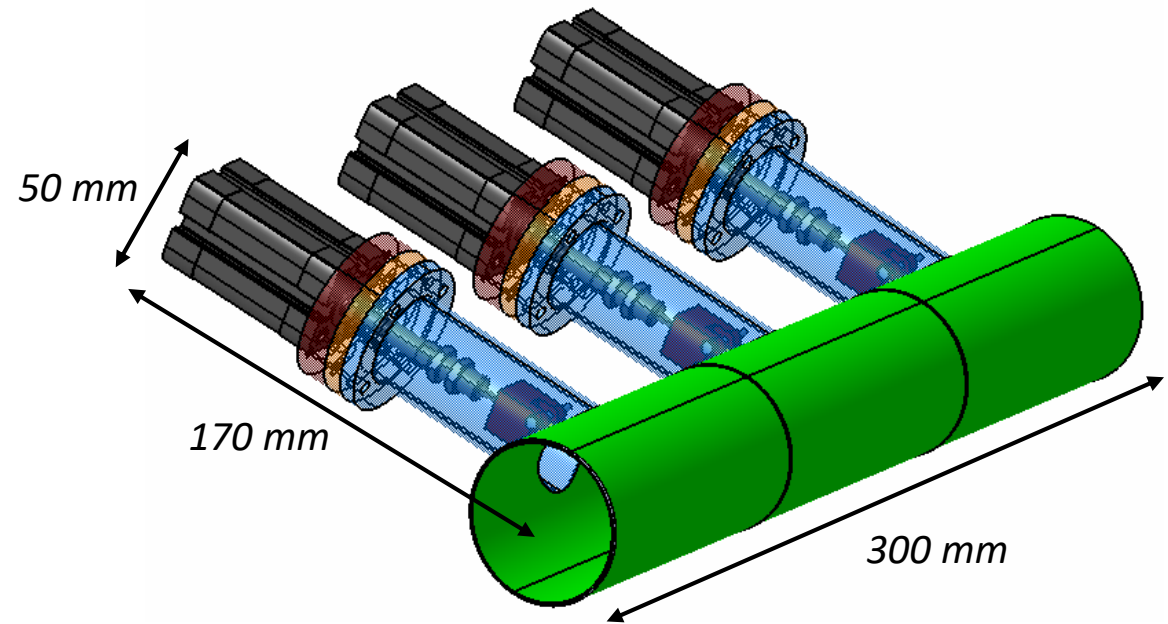
- Target holder: sufficient heat drain?
- Roman pot-like system (cooled)? Difficult to set up.
- Thermal study to be carried out according to cross-sections and geometries.

# Target design

- Different materials: light (C, Be, Ca), medium (Ti, Ni, Cu), heavy (W, Os, Ir).
- Target size:  $\varnothing 5$  mm, thickness [0.2 mm ; 5 mm] with respect to the material.
- Target holder: interface between the target and the motion system + heat drain.
- Horizontal vs. vertical insertion?



*Views of the target (yellow) and of the target holder (red)*



*Sketch of a 3-target system*

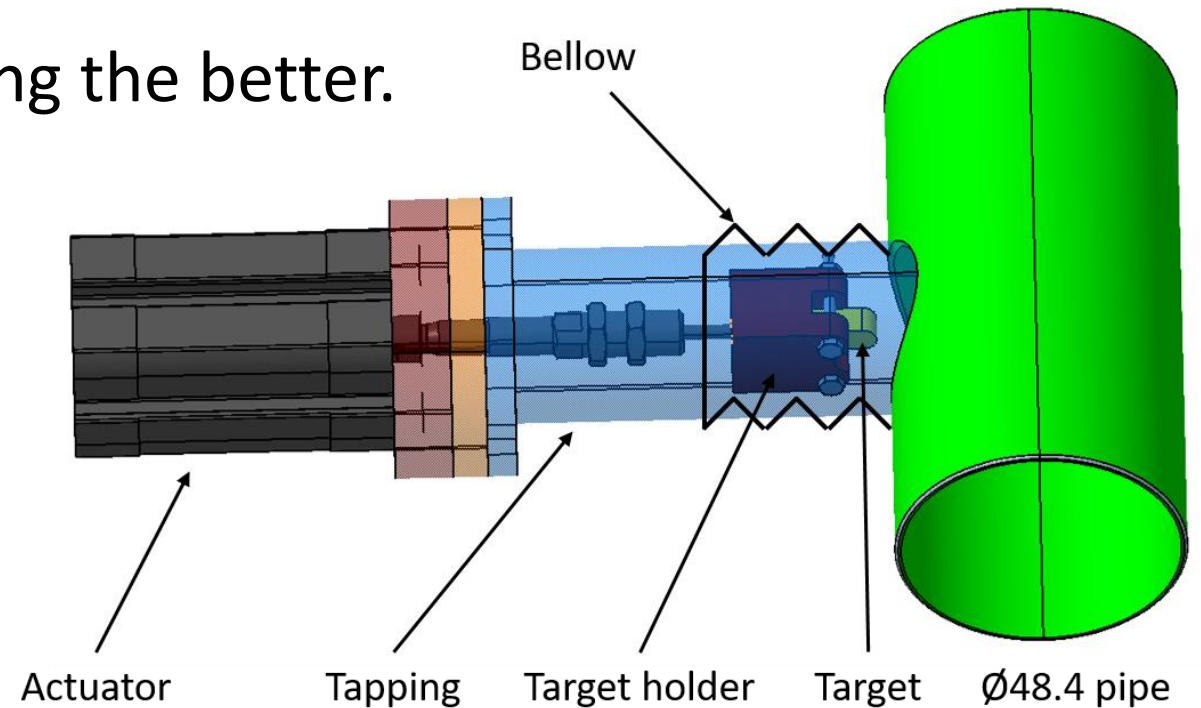


# Setup design #1 (Feedthrough)

- Pneumatic motion (electro-magnetic compatibility): single-effect actuator with safety spring (parking position out of the pipe).
- Electro-valve distribution: away of the setup itself => minimum shadow for existing detectors.
- The smaller (diameter and length) tapping the better.



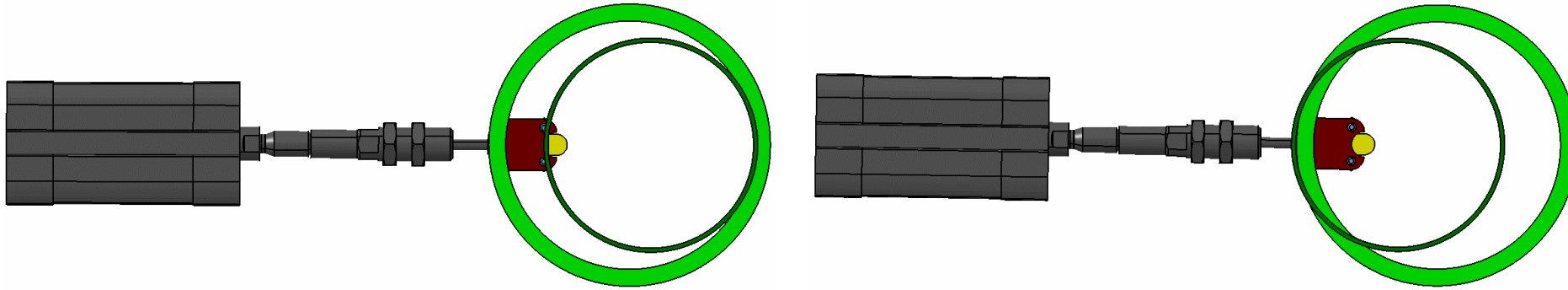
*Actuator and solenoid for pneumatic distribution*



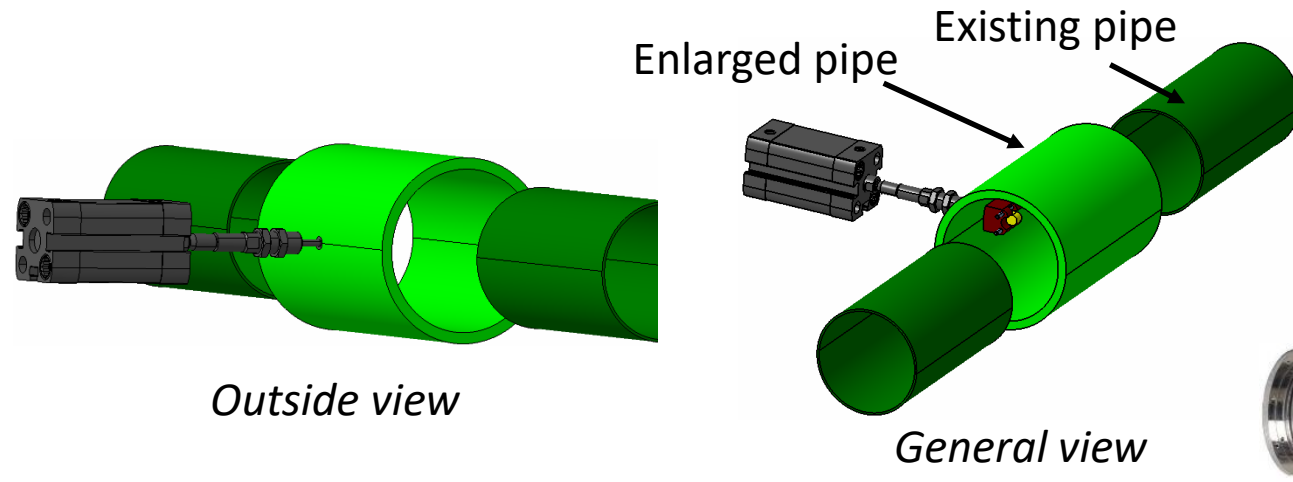


# Setup design #2 (Hamburg pipe)

- Again pneumatic motion but the target is fixed to a portion of the pipe and everything moves via flexible walls i.e. flexible pipes at each end ( $\approx$  bellows).



*Cross views when in parking position (left) and 8mm-active position (right)*



Main features :

$\varnothing_{int} = 58.4$ :  $\nearrow$  due to avoid interaction with the circulating beam + halo ( $\varnothing?$ ) when in parking position.

$\varnothing_{ext} = 66.4$ :  $\nearrow$  due to connection to the pipe itself of the target holder (inside) and to the actuator (outside). Slight modification of the target holder.

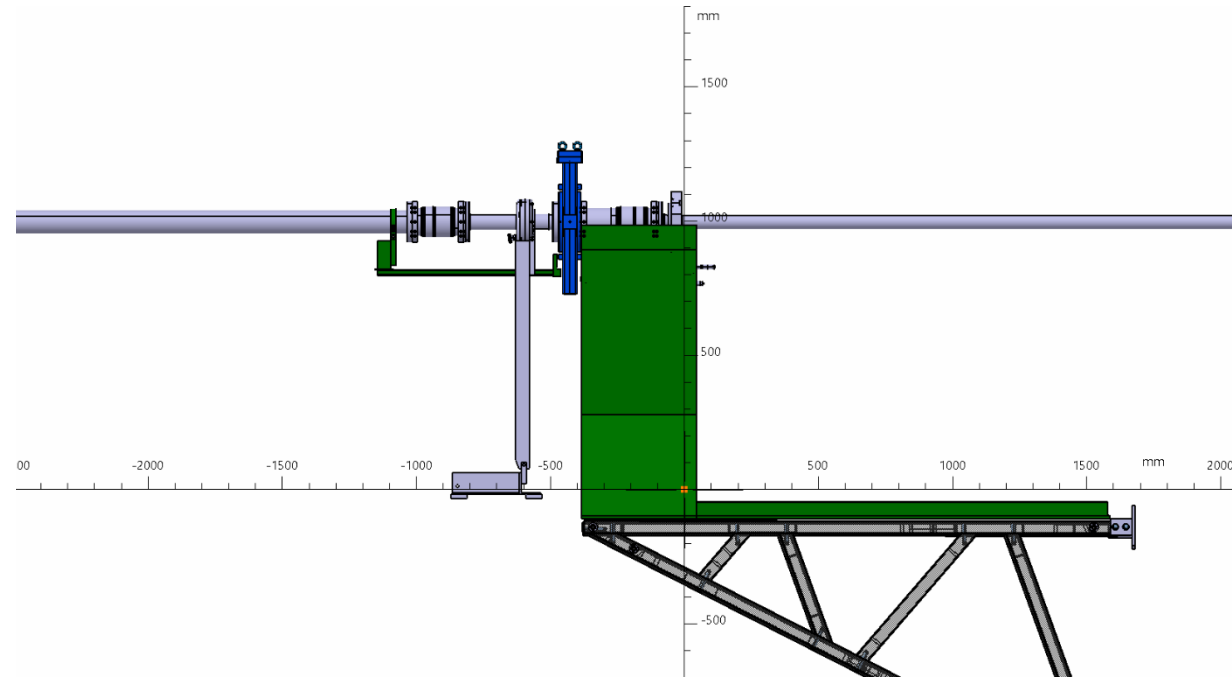
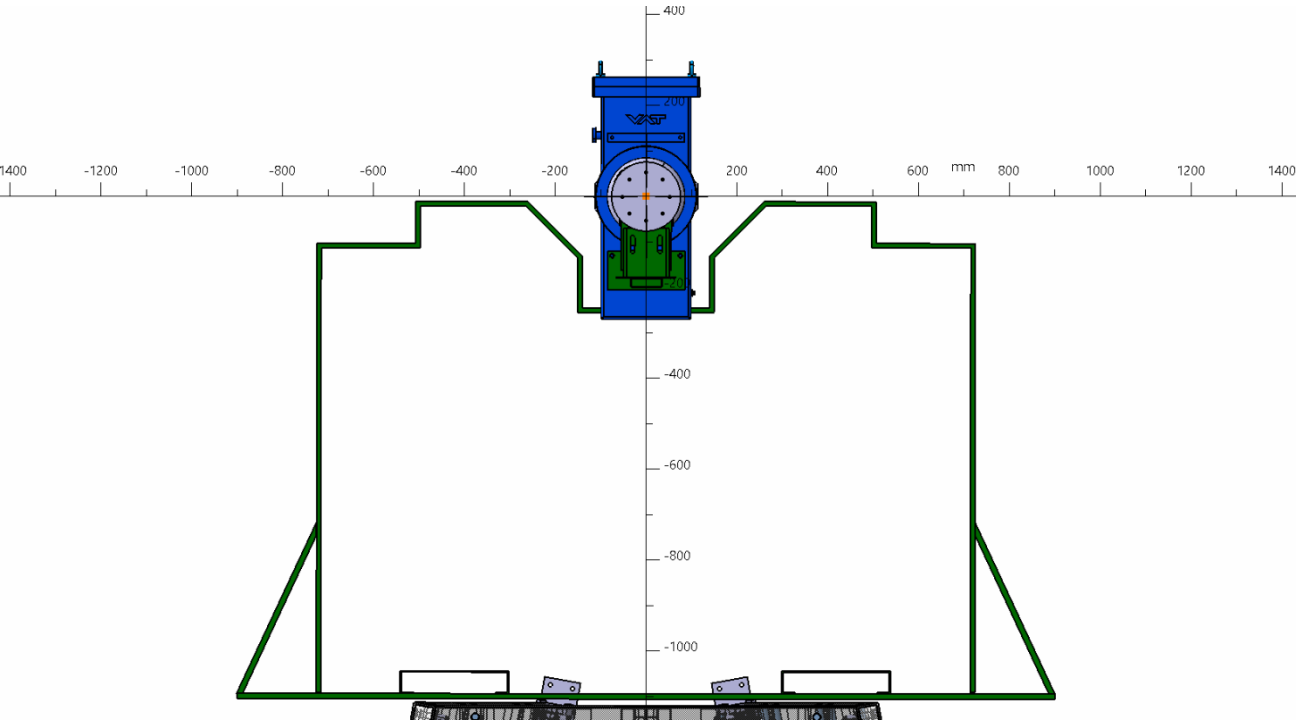
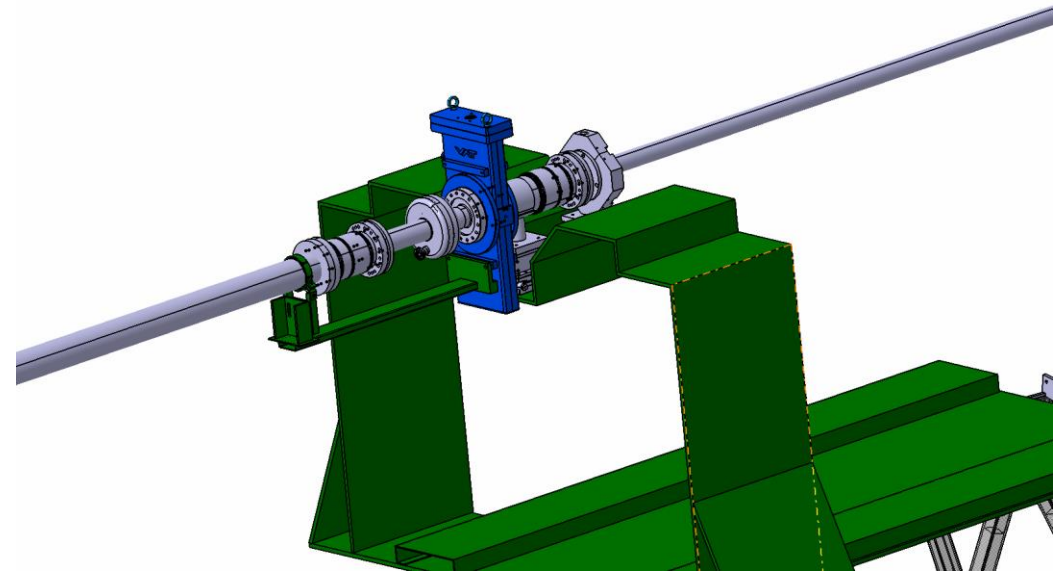
Flanges and bellows to be added.

# Summary and outlook

- Thermal study to be done.
- Geometry of the target and of the target holder to be optimized (budget material and surface to be reduced).
- Impedance (RF shielding and potential perturbations) and vacuum studies to be done by experts (WP to be required by ALICE + manpower?).
- SPS integration test in the course of year 2021 / 2022.
- Cost:  $\approx 150\text{k€}$

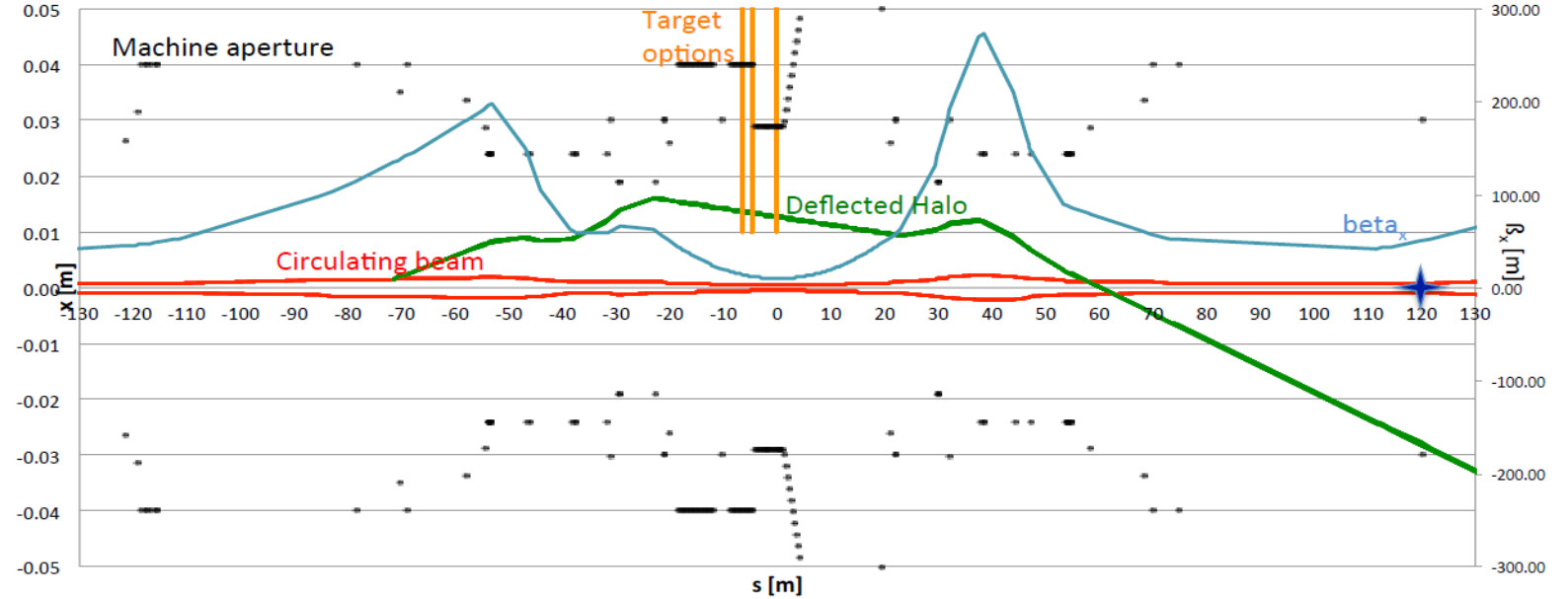
# Back-up

# CAD views



# Machine characteristics

Alice to IP2 - Crystal = 350  $\mu$ rad @ -72 m from IP2  
 E = 6.5 TeV - Emittance = 5.05e-10 m rad, sigma = 6



Courtesy of Francesca Gallucio

