A fixed-target experiment @ ALICE

Goals and requirements

Current setup proposal

Integration process and constraints

Cost and planning

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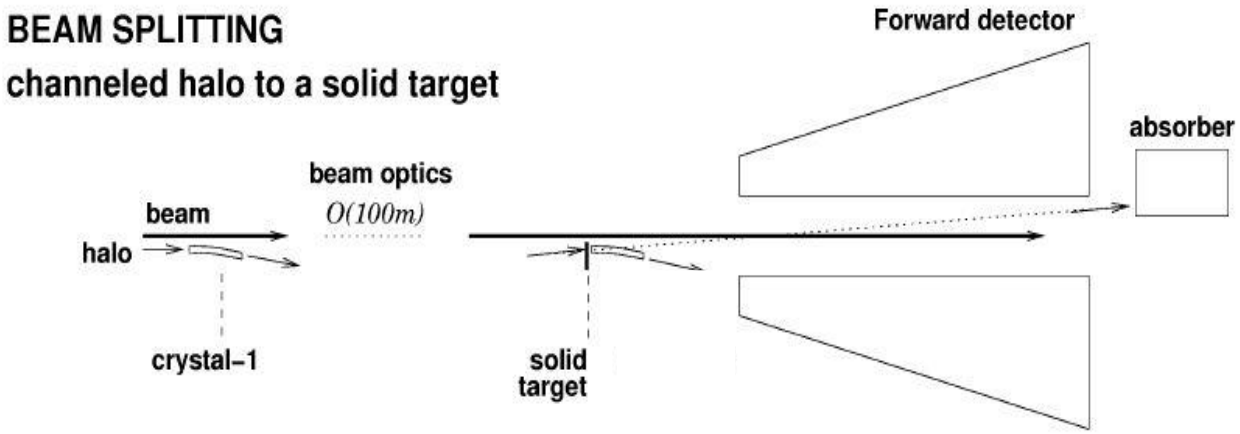
Physics goals

- Understanding of the large-x gluon, sea quark and heavy quark content in the nucleon and the nucleus.
- Understanding of the dynamics and spin of gluons inside polarized nucleons (if polarized target).
- Understanding of the properties of the QGP formed in heavy-ion collisions between SPS and RHIC energies towards large rapidities.
- With an ≈100m upstream crystal (from IP2): proton flux of 10^8 /s and lead flux of 10^5 /s have been considered for this study.

Requirements

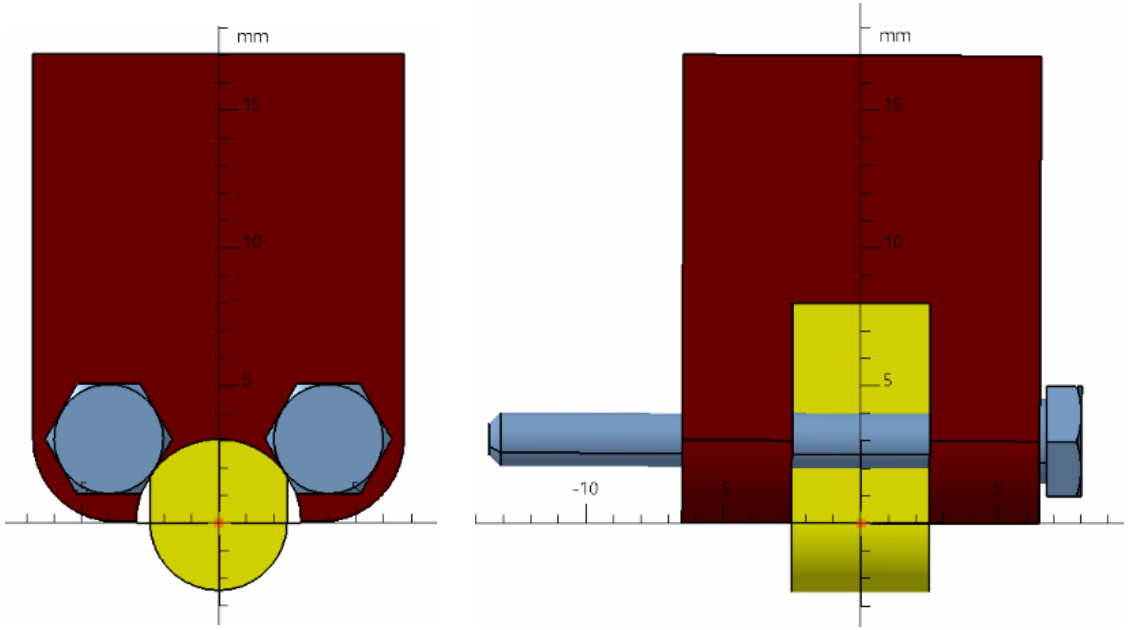
- Fixed though retractable target: active position at 8 mm from the beam axis, parking position out of the pipe ($\emptyset_{int} = 48.4$; $\emptyset_{ext} = 50.4$).
- Particles come from a deflected part of the halo thanks to a bent crystal (UA9).
- Proton beam flux: 10^8 /s -> 10^6 - 10^7 /s (parasitic to ATLAS and CMS and not special runs)
- Lead beam flux (if possible, after discussion with S. Redaelli): 10^5 /s
- Use of existing detectors.
- 2 or 3 targets.



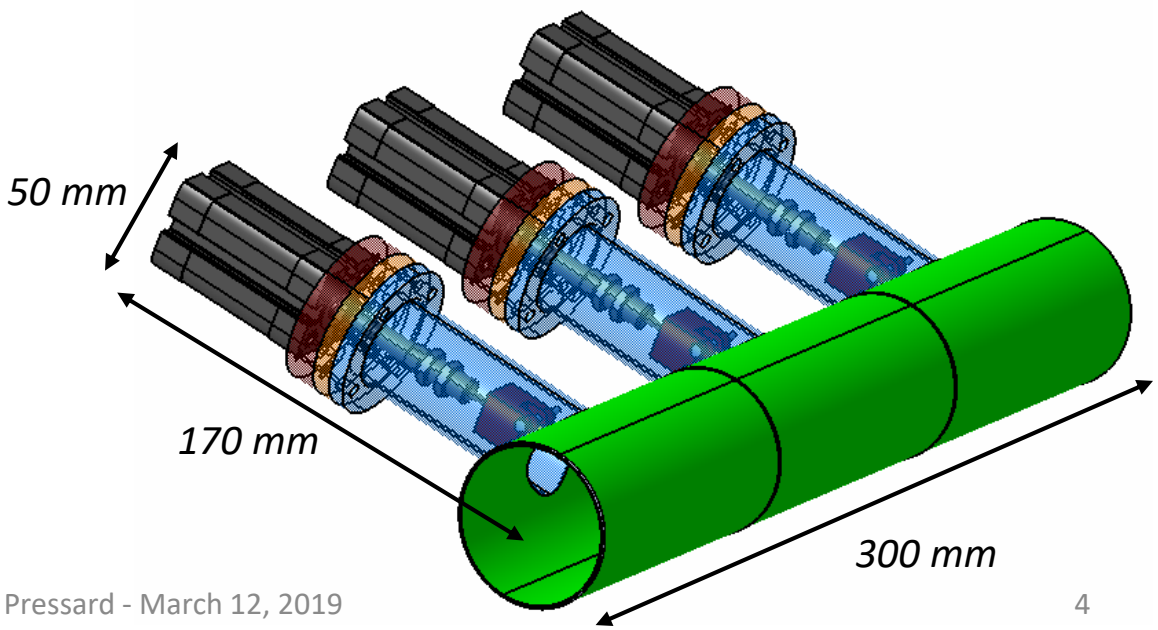
Courtesy M. Ferro-Luzzi

Setup design

- Different materials: light (C, Be, Ca), medium (Ti, Ni, Cu), heavy (W, Os, Ir).
- Target size: Ø5 mm, thickness [0.2 mm ; 5 mm] with respect to the material / beam.
- Target holder: interface between the target and the motion system + heat drain.



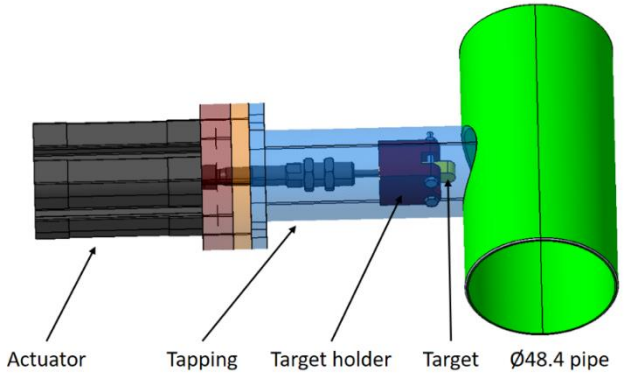
Holder must be thinner than depicted.



Setup design

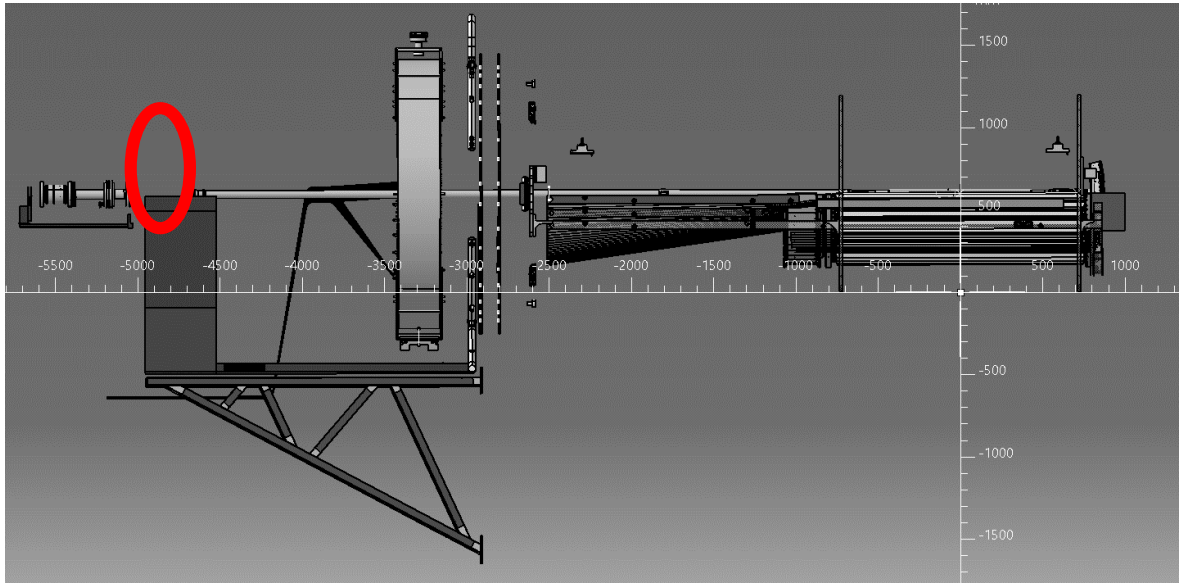
- Pneumatic motion (electro-magnetic compatibility): single-effect actuator with safety spring (parking position is default position).
- Electro-valve distribution: away of the setup itself => minimum shadow for existing detectors.

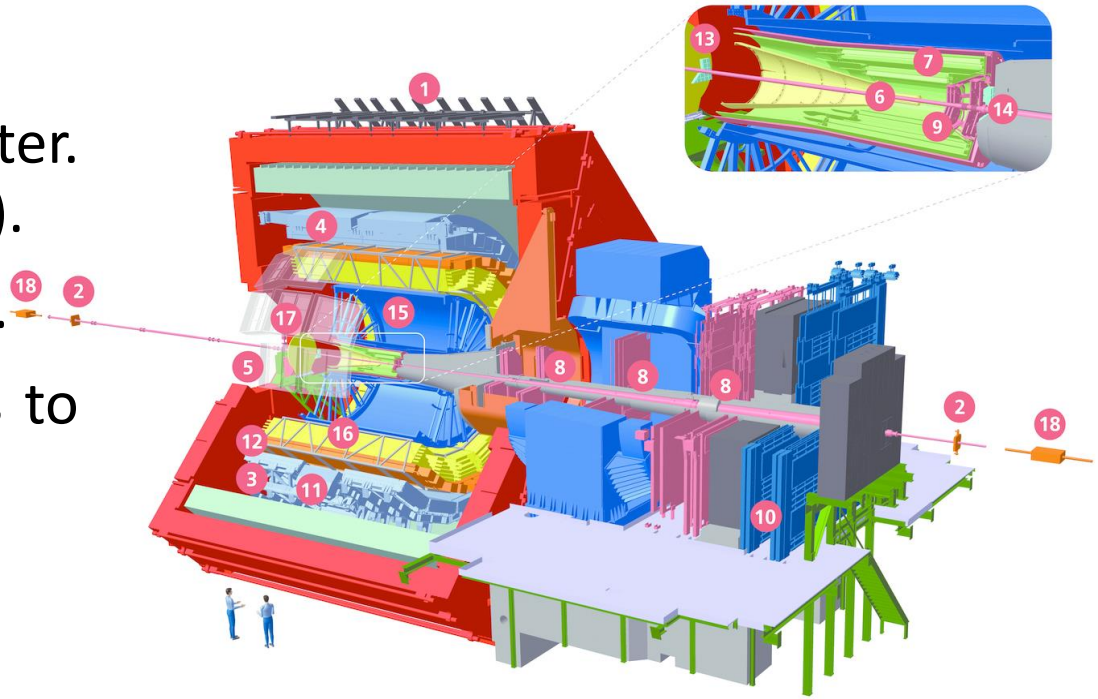
Actuator and electro-valve distributor.



Setup design

- Different locations: the closer to IP2, the better. Constraints: shadow, valves, outgassing (new pumps).
- Initial idea: ALICE A-side, between -2.7 m and -4.7 m.
- ITS upgrade constraint (W. Riegler, A. Tauro): needs to be removed along beam axis (ALICE A-side).

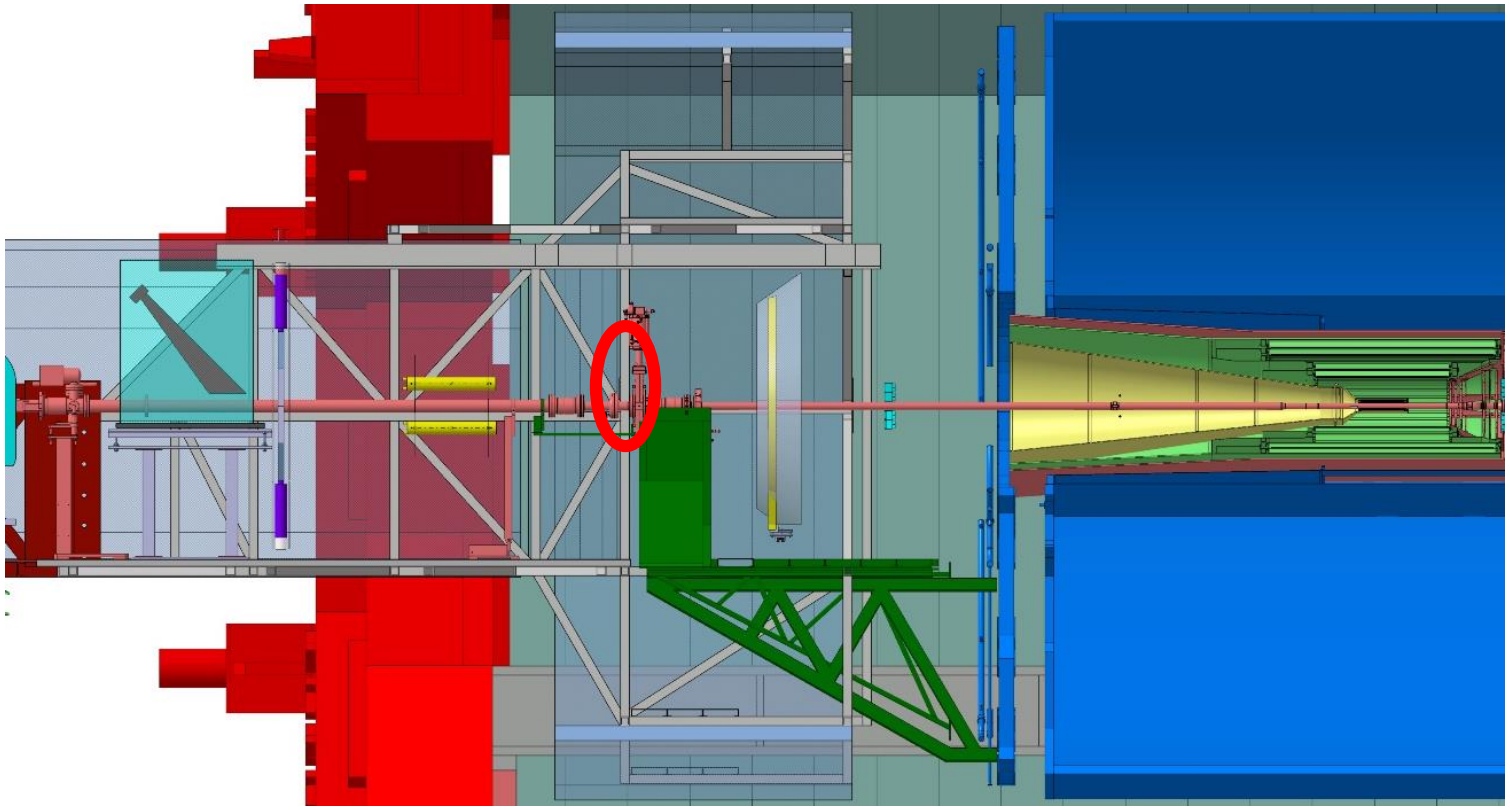




1 **ACORDE** | ALICE Cosmic Rays Detector
2 **AD** | ALICE Diffractive Detector
3 **DCal** | Di-jet Calorimeter
4 **EMCal** | Electromagnetic Calorimeter
5 **HMPID** | High Momentum Particle Identification Detector
6 **ITS-IB** | Inner Tracking System - Inner Barrel
7 **ITS-OB** | Inner Tracking System - Outer Barrel
8 **MCH** | Muon Tracking Chambers
9 **MFT** | Muon Forward Tracker
10 **MID** | Muon Identifier
11 **PHOS / CPV** | Photon Spectrometer
12 **TOF** | Time Of Flight
13 **T0+A** | Tzero + A
14 **T0+C** | Tzero + C
15 **TPC** | Time Projection Chamber
16 **TRD** | Transition Radiation Detector
17 **V0+** | Vzero + Detector
18 **ZDC** | Zero Degree Calorimeter

Integration constraints: vacuum

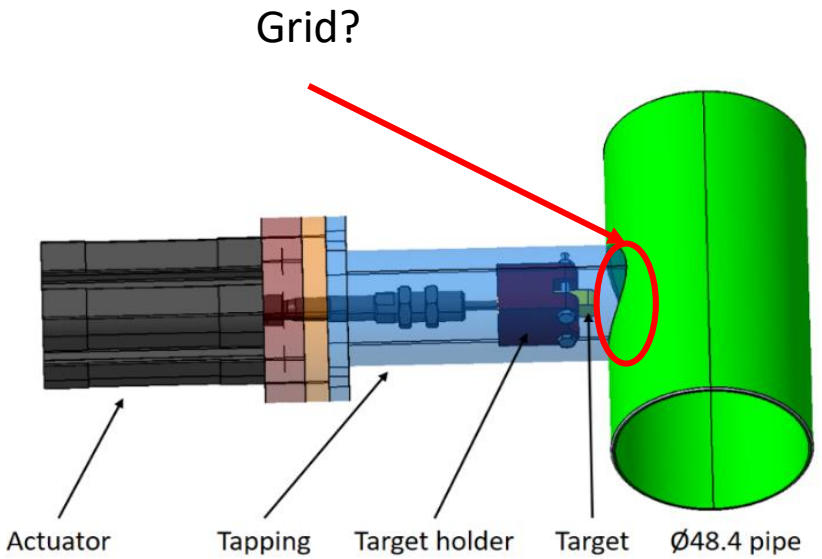
- Sectorization needs vacuum valves.
- Possibility to use the existing one at -4.8 m.
- Not possible to set another valve between -4.8 m and IP2 => setup before -4.8m and isolate up to ≈ -8.3m.



- Outgassing needs new pumps (not too close to IP2) and bake-out device (J. Sestak).
- Target holder & other interface elements: stainless steel.
- Current surface area (target + target holder + 2 screws): 2000 mm^2

Integration constraints: impedance

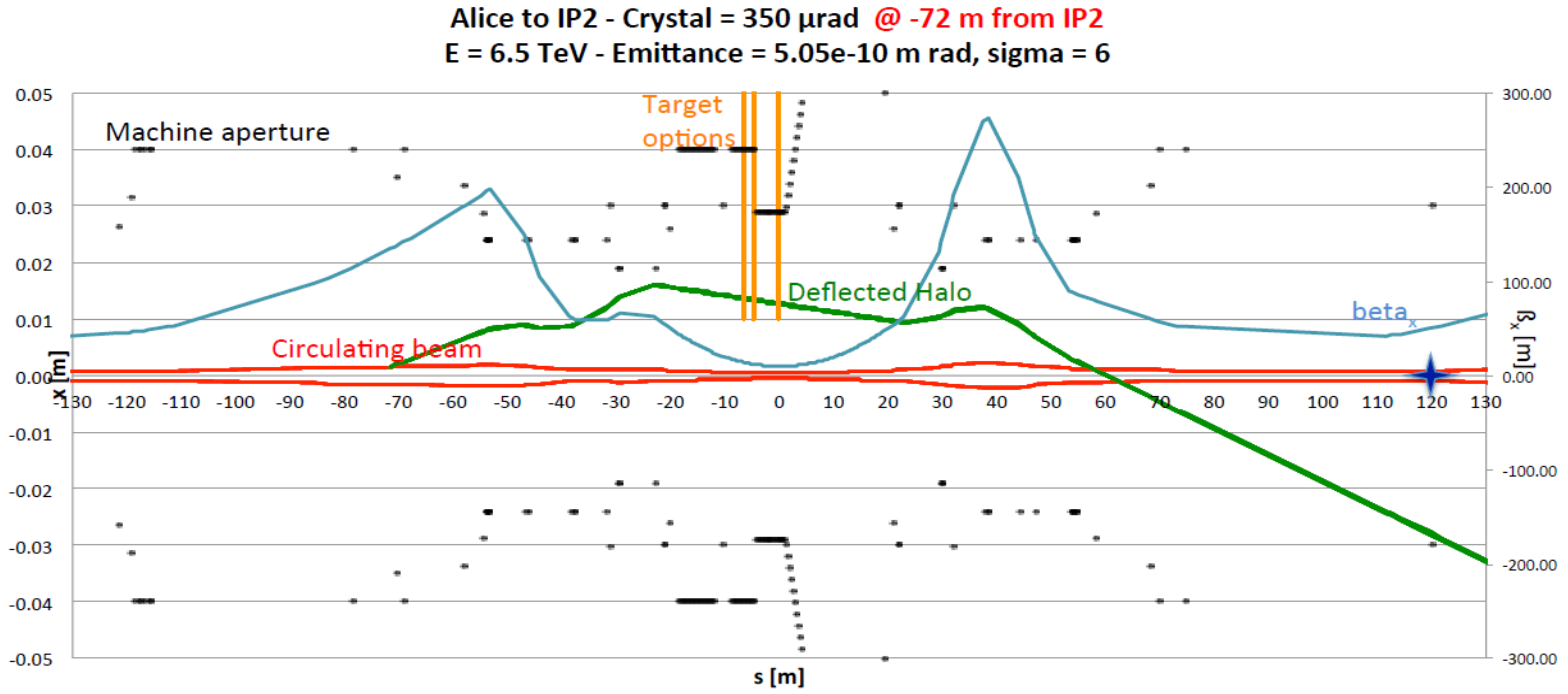
- Beam / impedance constraints: put a grid at the entrance of each tapping to semi-isolate the holes.
- The target would pass through this grid.
- Need to study impedance impact (collaboration with B. Salvant).



Back-up: cost and planning

- Targets, positioning system: 5 000€ for 3-target system.
- Valves and flanges: 20 000€ per valve.
- Bake-out devices: ???
- Integration during LS3? Some elements (not in the vacuum) might be integrated before.

Back-up



From Francesca Gallucio's talk, November 14, 2017