Status of the PRESPEC H_2 target

Alexandre Obertelli, CEA Saclay
FRS meeting, November 8th 2010

Overview

New liquid H_2 target developed for **PRESPEC**

- several centimeters long (20 mm = 1. 10^{23} cm^{-2})
- dedicated to *(p,p')* and knockout coupled to gamma spectroscopy

Ready to run from early 2011

- Test experiment (S378) to be scheduled
- Selected physics cases to be presented to G-PAC spring 2011

Physics program on Shell Evolution in unstable nuclei (in discussion)

- **N=34** shell gap: spectroscopy of ^{53}Sc */ Valiente-Dobon - Algora*
- Onset of collectivity at **N=40** : spectroscopy of ^{64}Cr */ Obertelli*
- Origin of collectivity in **N~50** Tin isotopes via *(p,p')* */ Dombradi*
- Single-particle states at **N~82** in Tin isotopes via I-E pickup */ Boutachkov*

- First step of the MINOS project (ERC junior grant)

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Advantages of Pure Hydrogen Targets

Physics

- Inelastic scattering **(p,p')**
  - sensitive to **nuclear collectivity**
  - complementary to Coulex/lifetimes [proton collectivity]

- Knockout **(p,2p)** and **(p,pn)**
  - Hole states: sensitive to the **wave-function structure**
  - Cleanest nuclear probe

Technical

- Liquid or Solid H_2: Optimum density for minimum energy loss
- Pure H_2 target: no contamination

Existing H_2-target systems for intermediate-energies in other laboratories (RIKEN, MSU)

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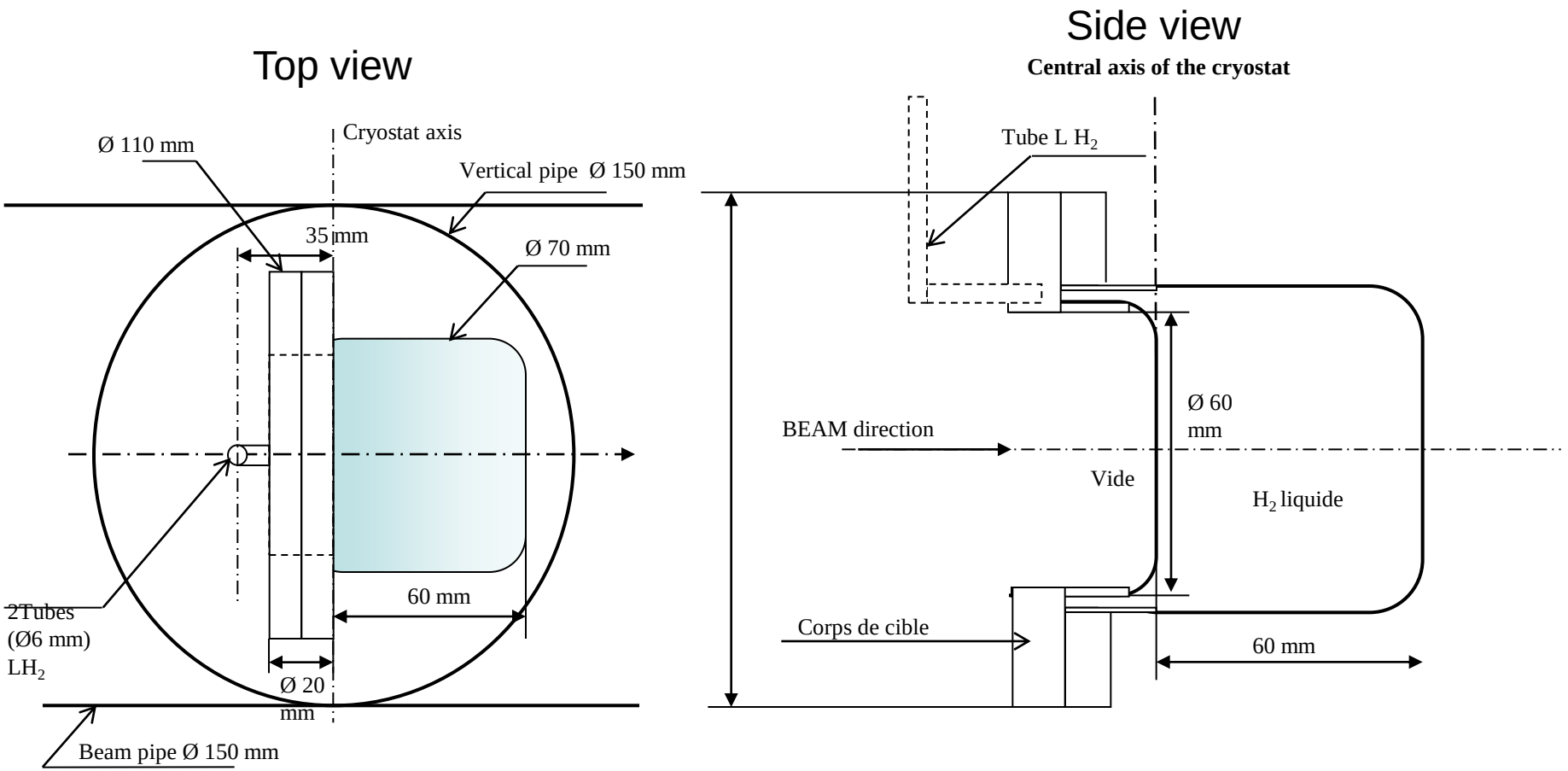
Target-cell design

« Pocket » of liquid H2 (20 Kelvin) contained in a Mylar cell



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Produced targets

September 2010

Engineers in charge:
J.-M. Gheller, CEA Saclay
Ph. Chesny, CEA Saclay

- Cell in one piece of Mylar
- 150 – 250 μm

∅ 70 mm, 61 mm thickness

Foreseen target thicknesses (∅ 70 mm):

- 20 mm
- 35 mm
- 61 mm

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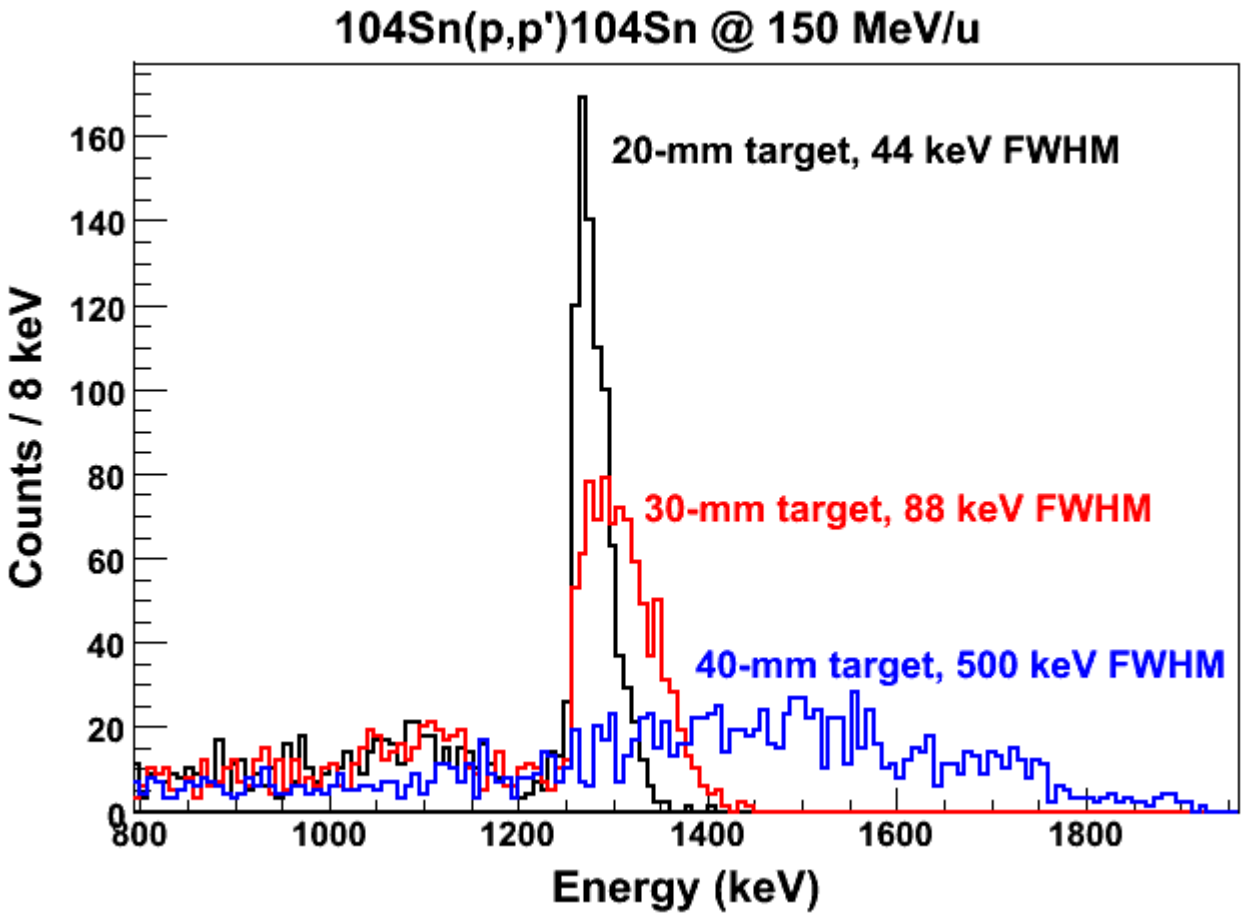
Target thickness

Simulated example: ^{104}Sn(p,p') @ 150 MeV/nucleon



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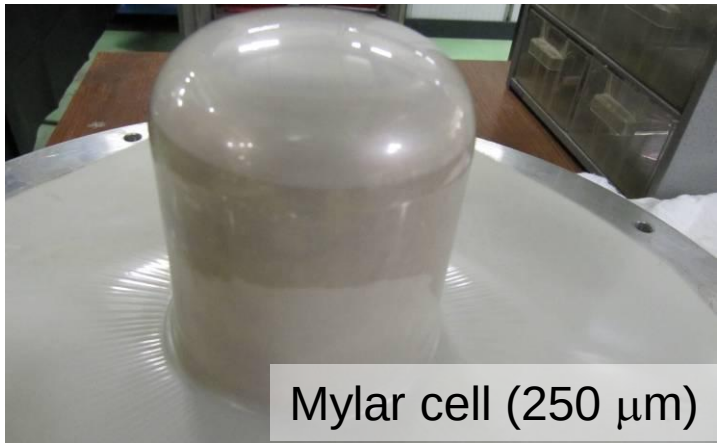
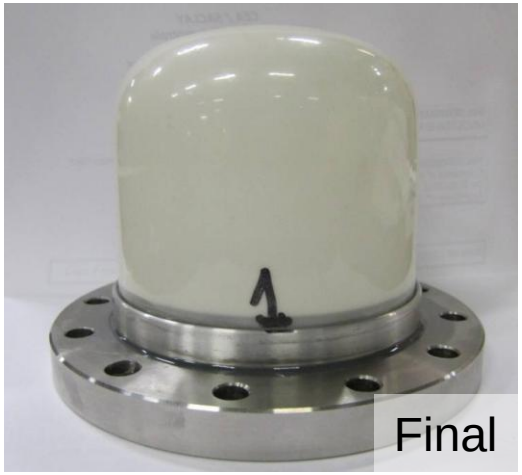
Target-cell production

- Thermo-formed cell
- Technique developed at Saclay in the 90’
- Produce a new target : 1 week

oven & press


Mylar cell (250 μm)


Final

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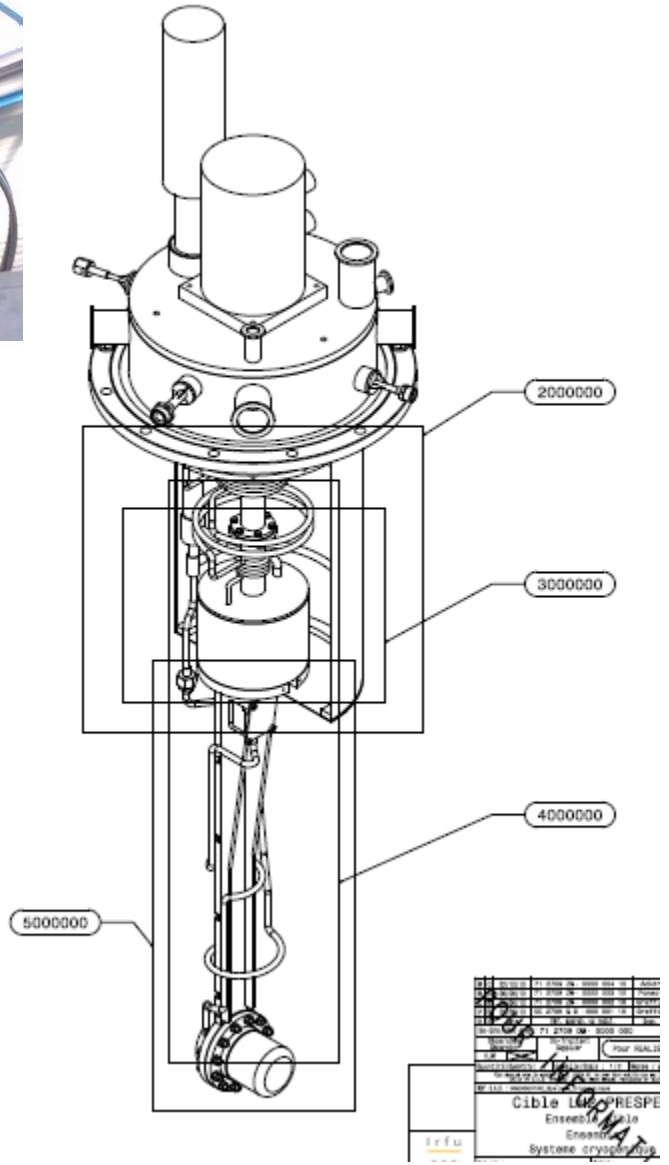
Cryostat



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Design

CEA Saclay, October 2010

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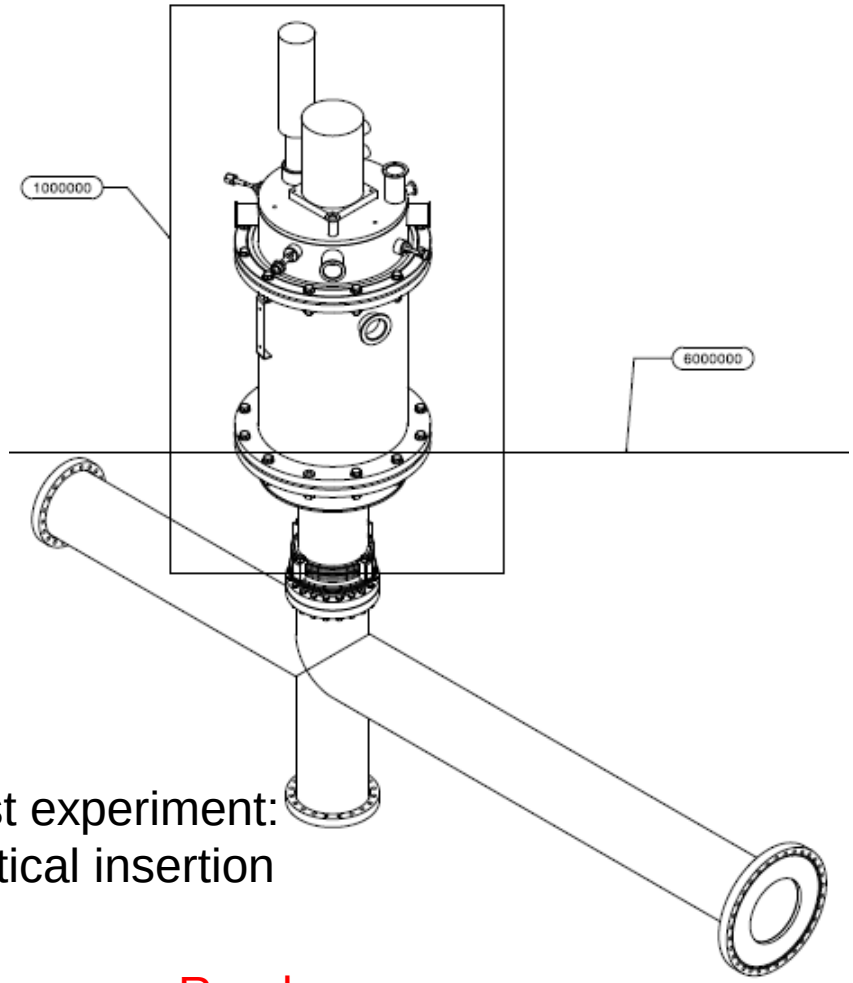
Installation with PRESPEC

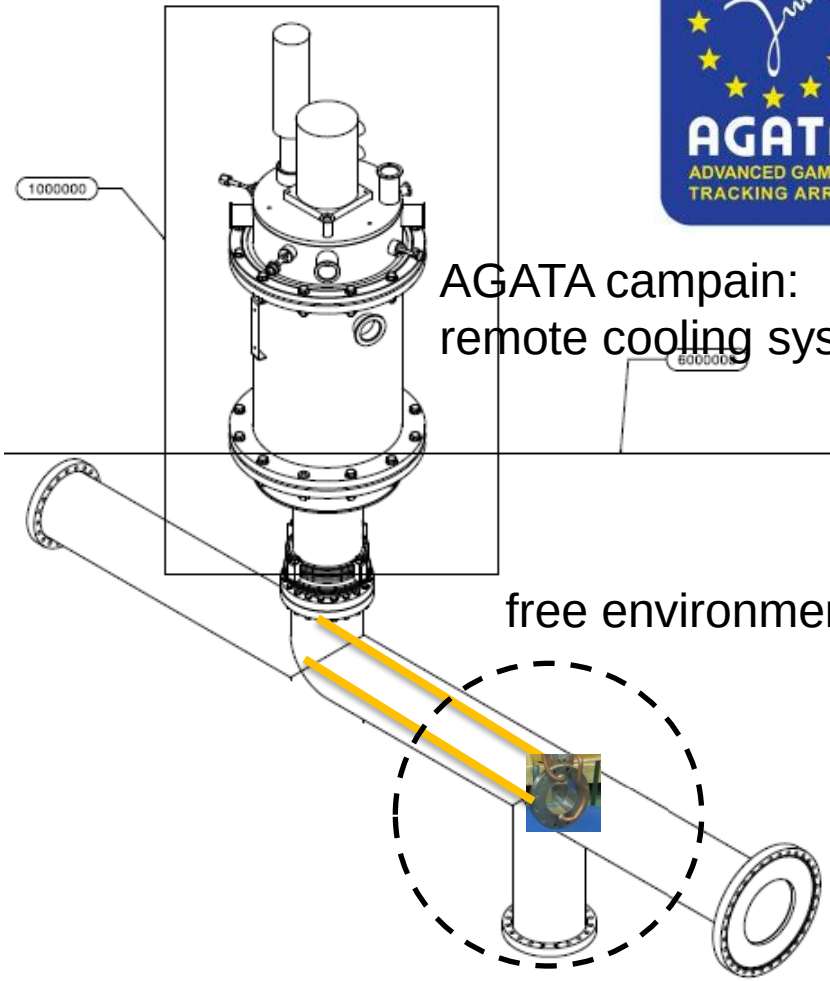
Support under construction



Test experiment:
vertical insertion

Ready

AGATA campain:
remote cooling system



free environment

To be designed accordingly
to AGATA geometry / reaction chamber

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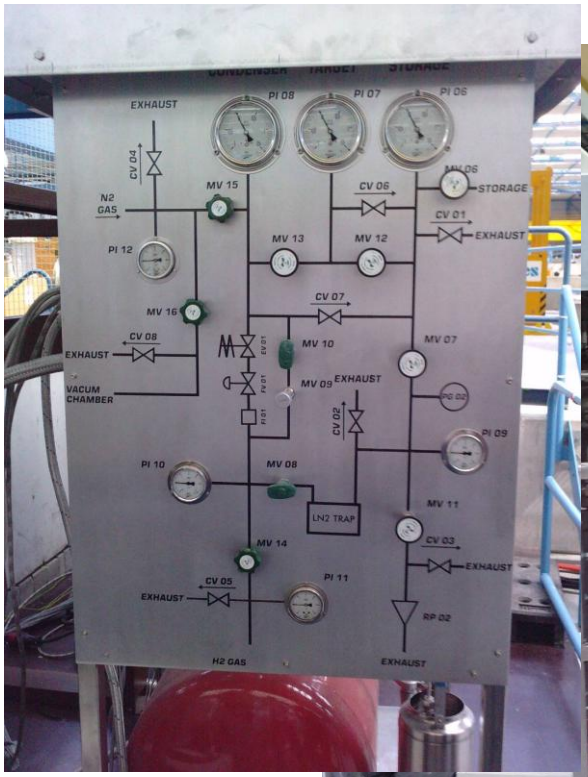
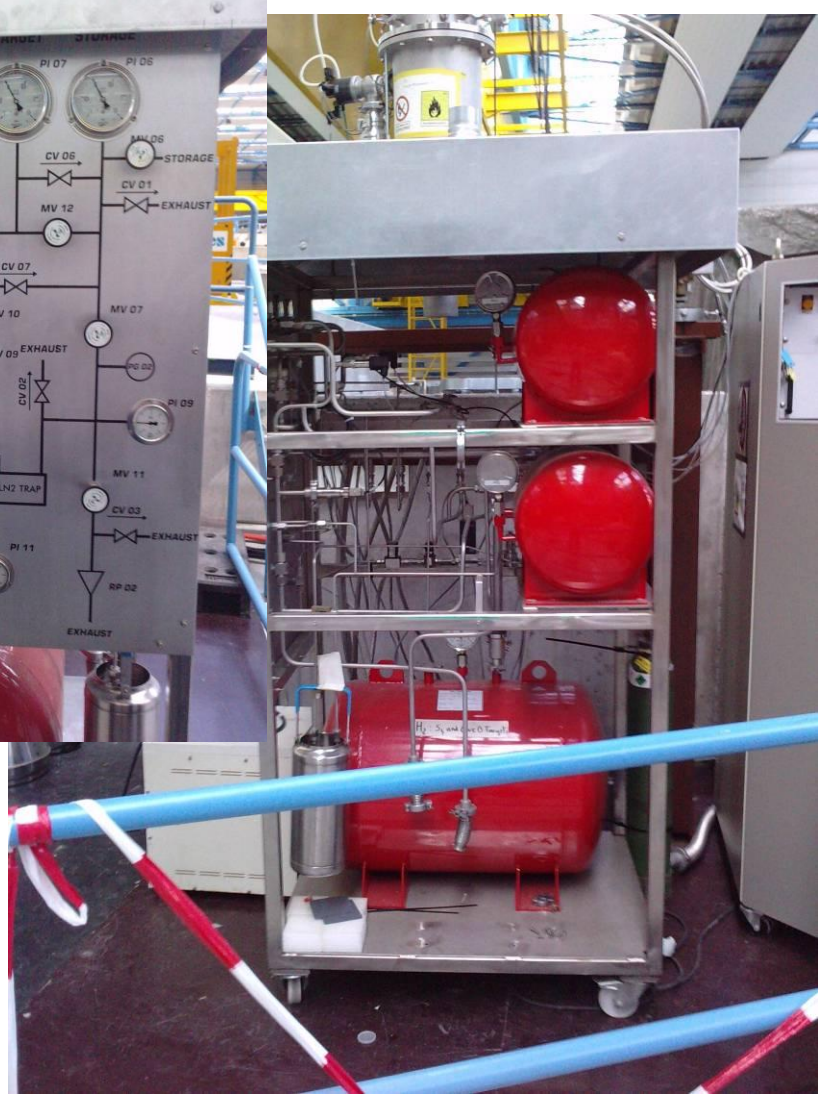
Hydrogen and control-command

- Roof of S4
- 1 week installation needed (any time before beam time)





Temperature & pressure control
Field net

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Test experiment

S378, G-PAC 37

Objectives

- demonstrate working conditions
- validate G4 simulations (resolution, background)

Experimental conditions

- stable beam at 300 MeV/nucleon on secondary target.
- proposed ^{58}Ni, but flexible as long as not too heavy (LYCCA)
- inelastic scattering and -1p knockout
- 20 shifts of parasitic beam

Installation time

- 1 week to install electronics and H_2 circuit + mounting frame (from january 2011)
- 1-2 days to install and cool down the H_2 target (cooling time 8-10 hours)

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Summary

- **H_2 target** for PRESPEC developed
- **Ready to run** in 2011
- **Physics programme** at GSI on shell evolution away from stability

Next steps

- Full integration and cooling cycles at Saclay (2010)
- Safety report
- Test experiment S378 (wished « ASAP »)
- Integration with AGATA

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