Cobotization development on SRF activities at CEA Application to ESS and future projects

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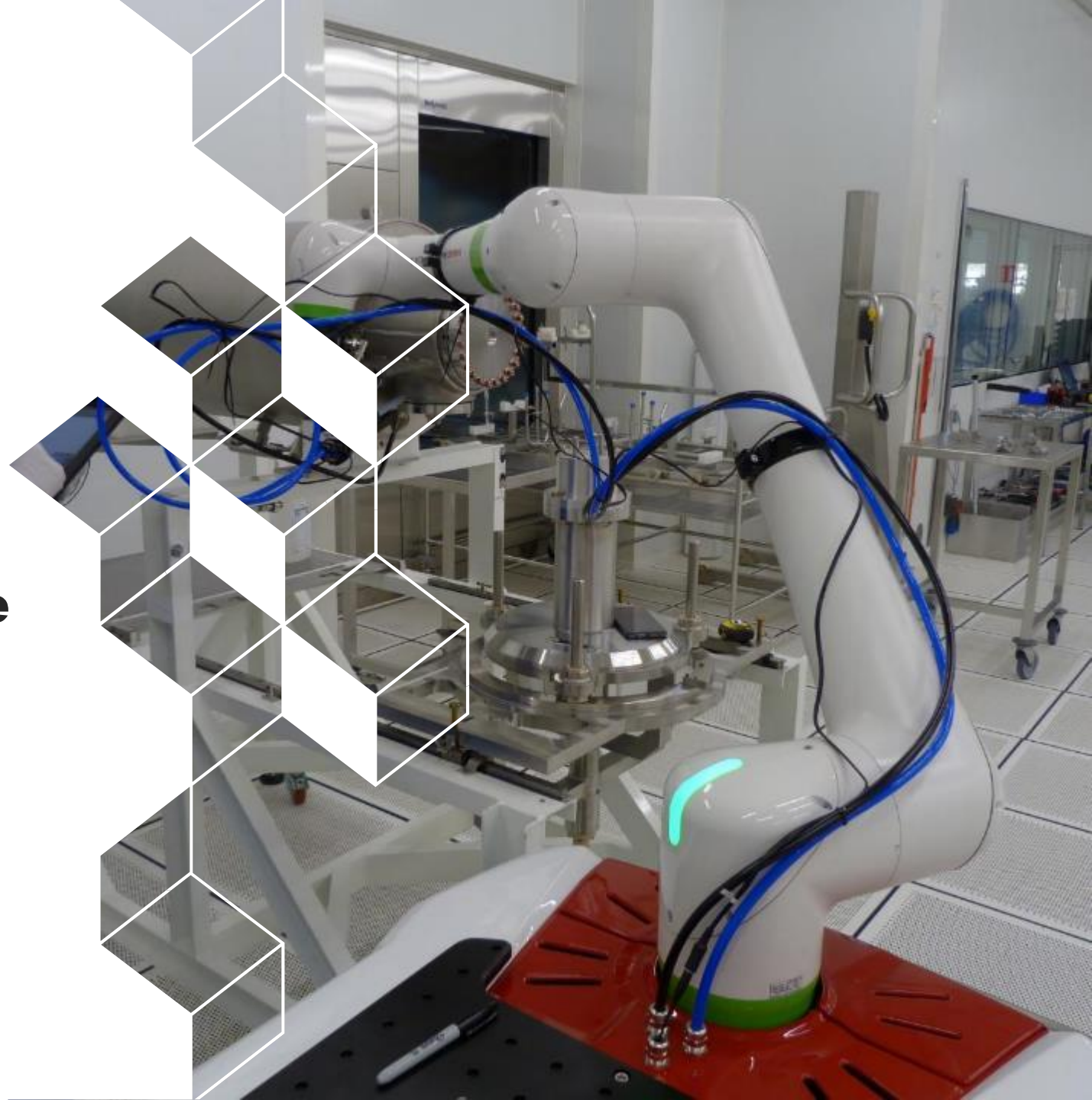


Why using Cobot ?

- Cavity string assembly in the clean room is a tedious work that has noisy and painful steps such as cleaning the taped holes of a part.

- A cobot can work anytime without any operators especially work overnight, reducing painful work and assembly duration by some hours
- *Cobot are collaborative robots working safely with people. They are operated by a technician once and repeating the action without the operator and they are equipped with sensitive sensors that give the robot feeling*

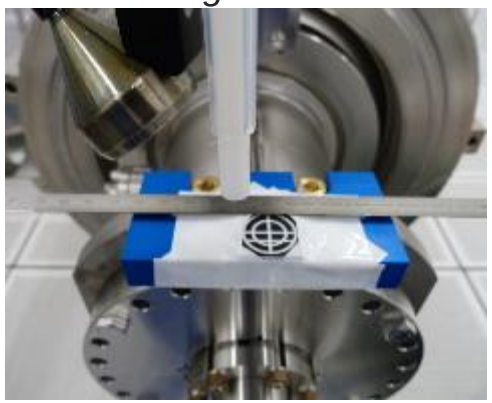
- CEA and INGELIANCE has developed a cobot
- At CEA, the cobot is used to blow the flange holes of the cavities and bellows. The process is reproducible since the cobot always does the same steps.

Cobot at CEA on SRF activities

- Fanuc arm (CRX10iAL) with cart is a commercial product not specially designed for clean room. They went through a cleanroom validation with respect to particles generation in ISO4 after a preliminary cleaning.
- The cobot is equipped with ionized and filtered air (6.5 bar), the effector and the quick changer tool.
- A vision system 2D camera pictures a temporary fixed target. This picture allows adjusting the cobot frame to the part frame: localization of X0, Y0 and rotation of horizontal plane around Z (along gravity). We reach 1 mm repeatability.
- All programs are set in the cobot teach-pendant.

Operator programming the pathway of the effector to the coupler flange of the cavity while the coupler is prealigned

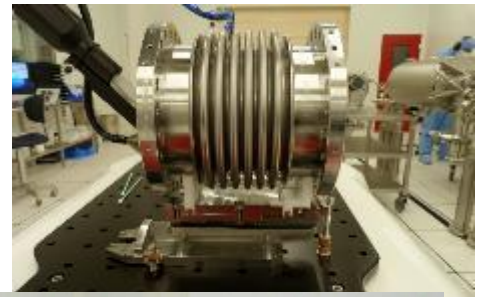
Target installed

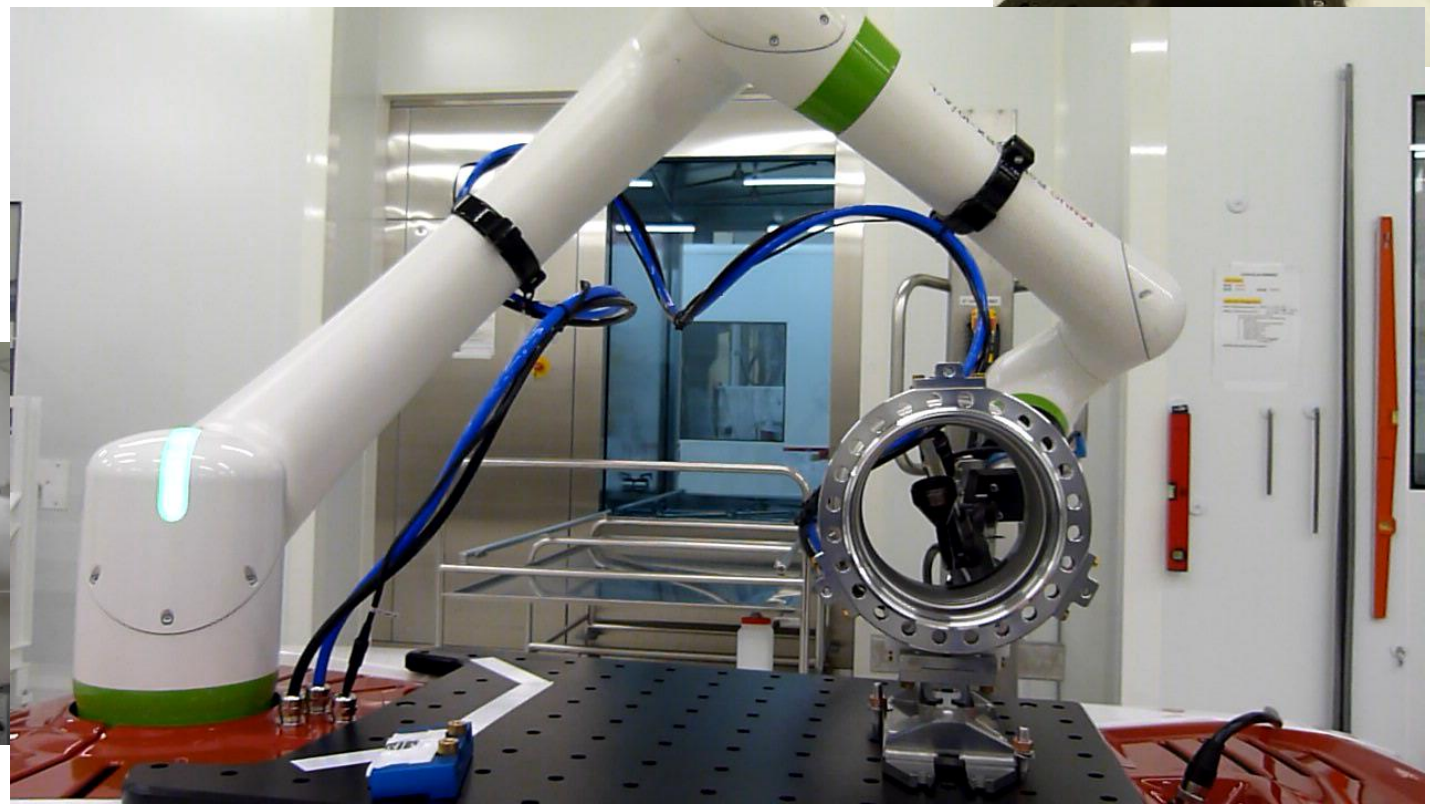


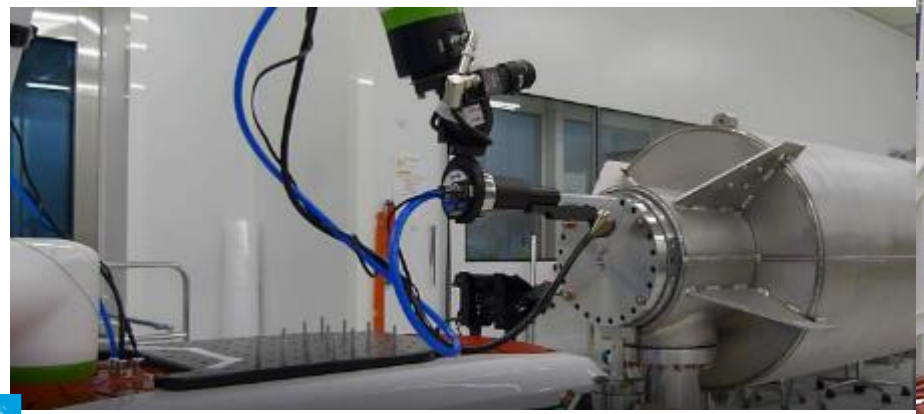
Particle counter and N2 nozzle

COBOT USE ON ESS CRYOMODULES PRODUCTION

- Cobot in operation in the clean room ISO 4 since May 2022 used for 14 cryomodules preparation
- Cobot and operators can work independently in parallel or cobot works at night.
- Time-saver for ESS string assembly in the clean room : ~ 1/3 of assy time
- Cleaning is very efficient and answers perfectly ESS cleaning specifications.
- Operator checked manually the particle counts for 2 or 3 minutes and validate them before continuing

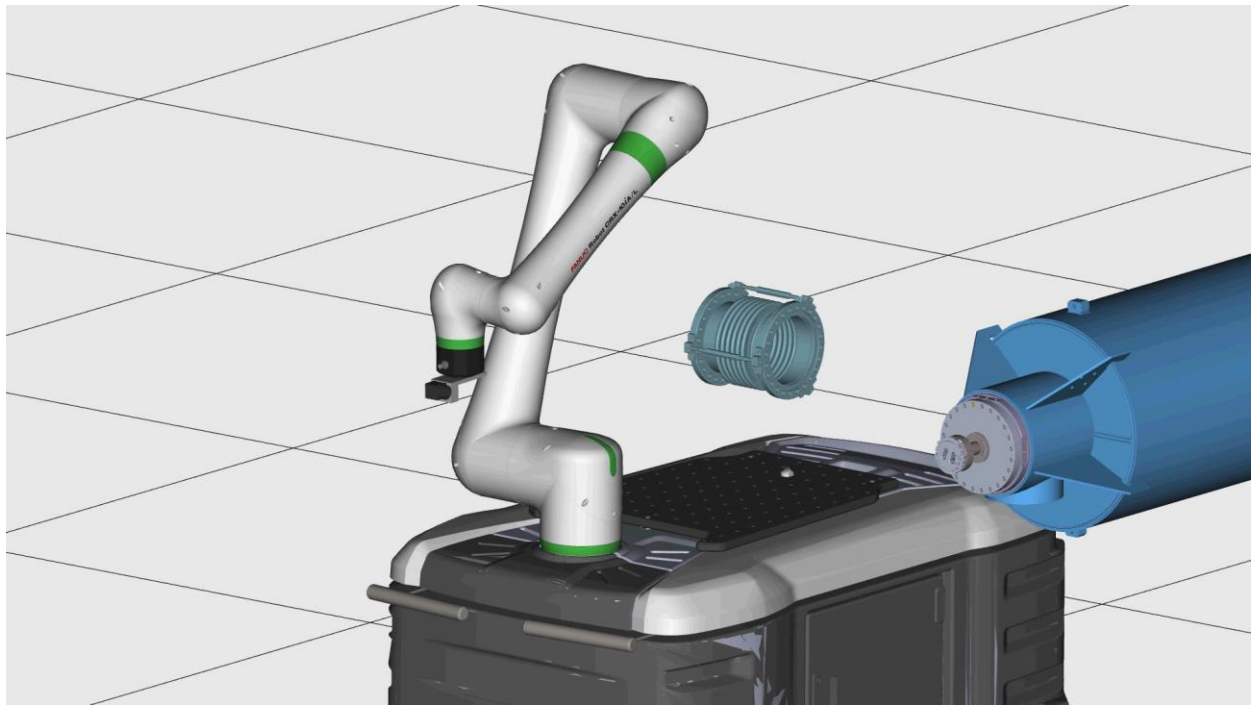


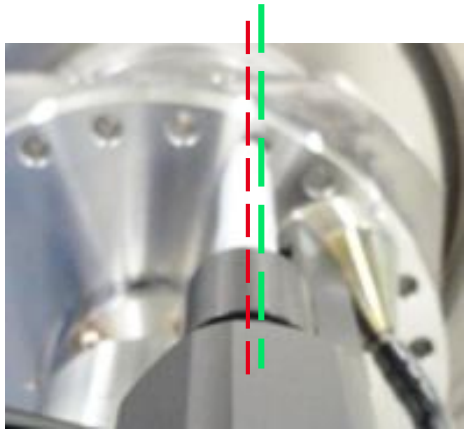


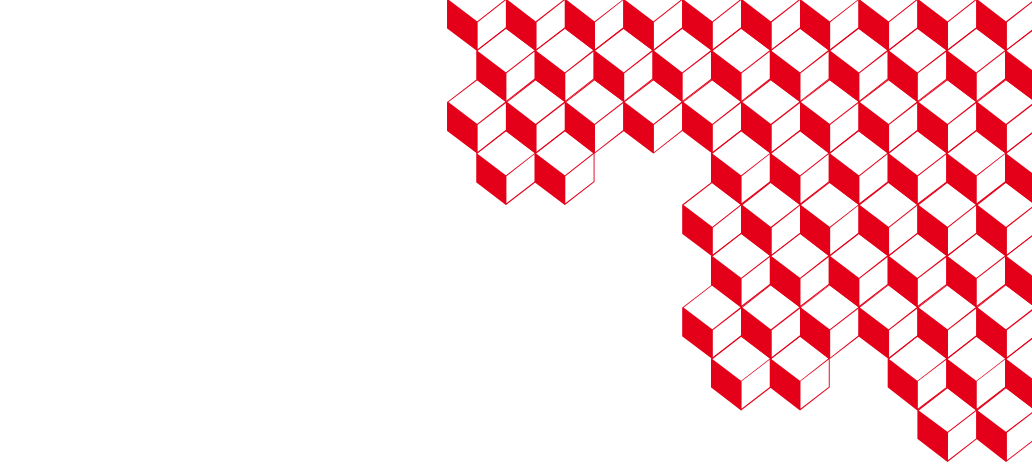


Incremental step – Preparation for PIP-II assembly

- Objectives :
  - Improve the quality of the assembly (decreased contamination, alignment)
  - Increase repeatability
  - Remove tools
  - Assembly of a bellow on the cavity
  - Assembly of a coupler
- Increase current vision system accuracy for assy







Thank you for your attention

Questions?

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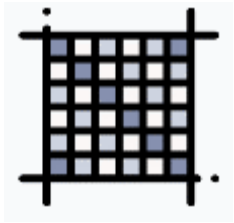
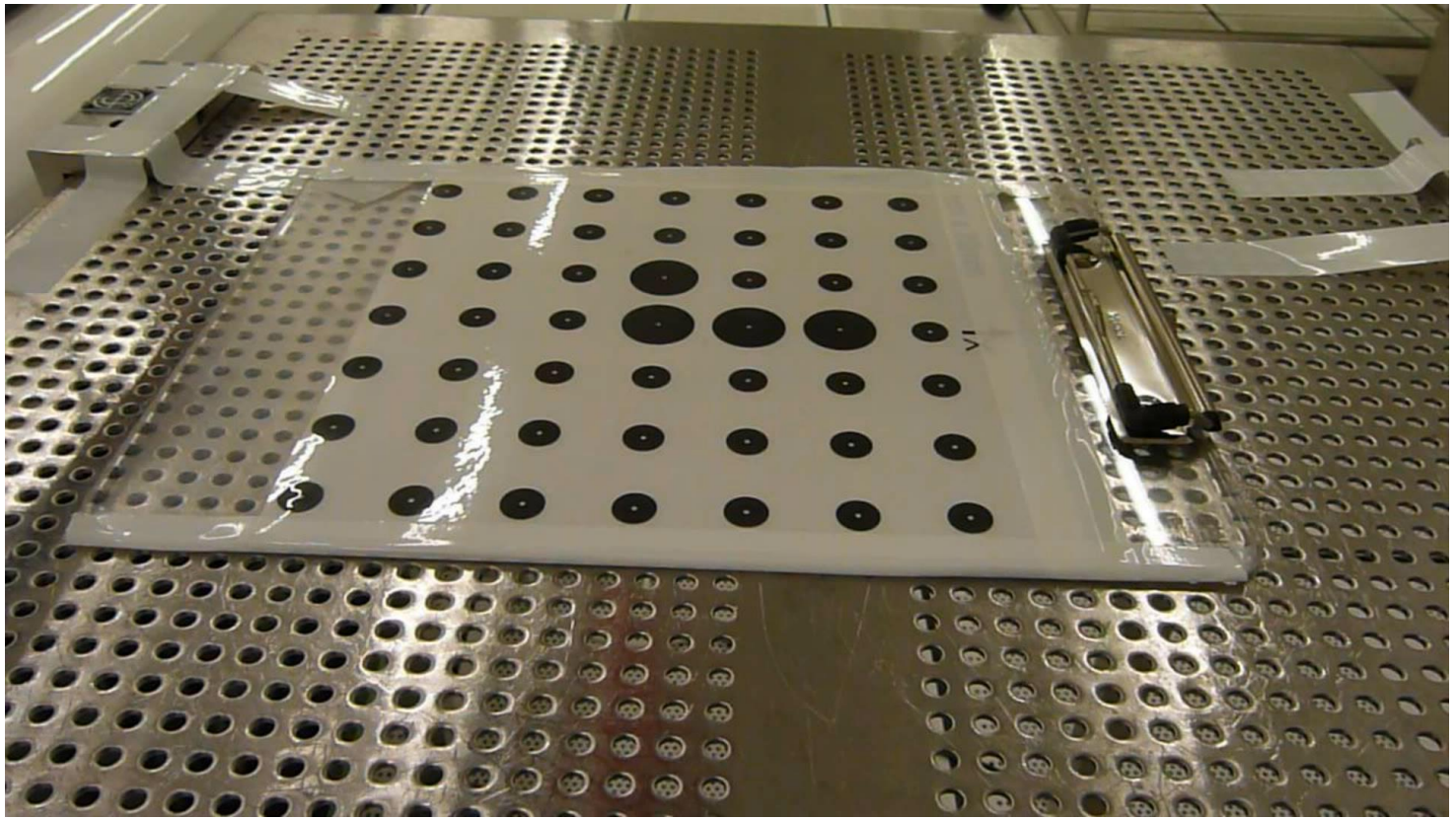
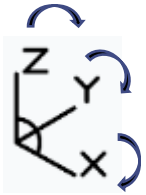
Improve vision accuracy







- Correction made on the axis X, Y, Z and the rotation of axis X, Y, Z