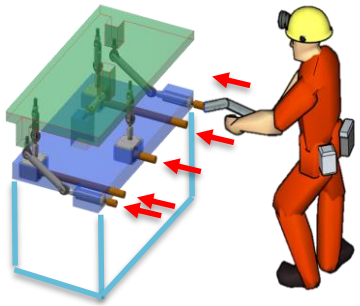
Safety of Remote Alignment

Th. Otto, HL-LHC PSO

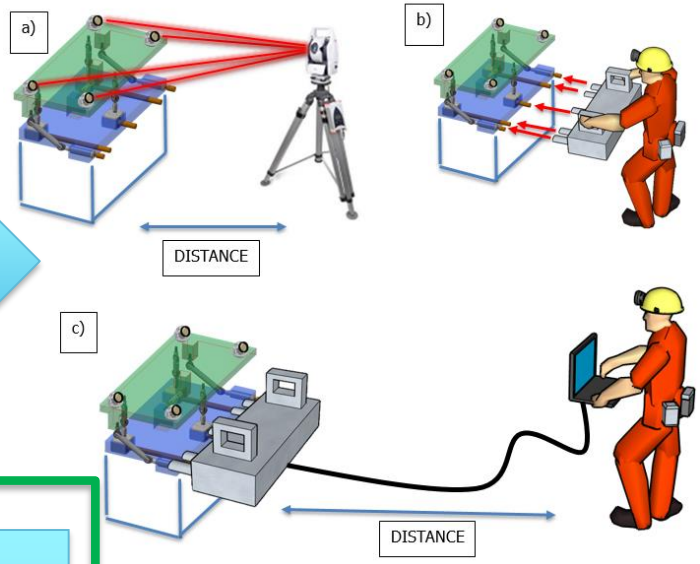
Thank you to P. Fessia for slides and additional information

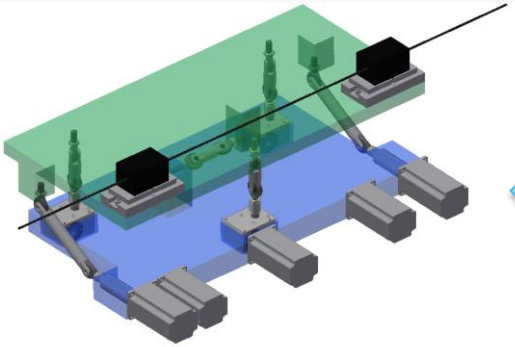
Some definition
(here in case of use standardized platform)



Manual alignment
(Without standardized platform more difficult and more time consuming)

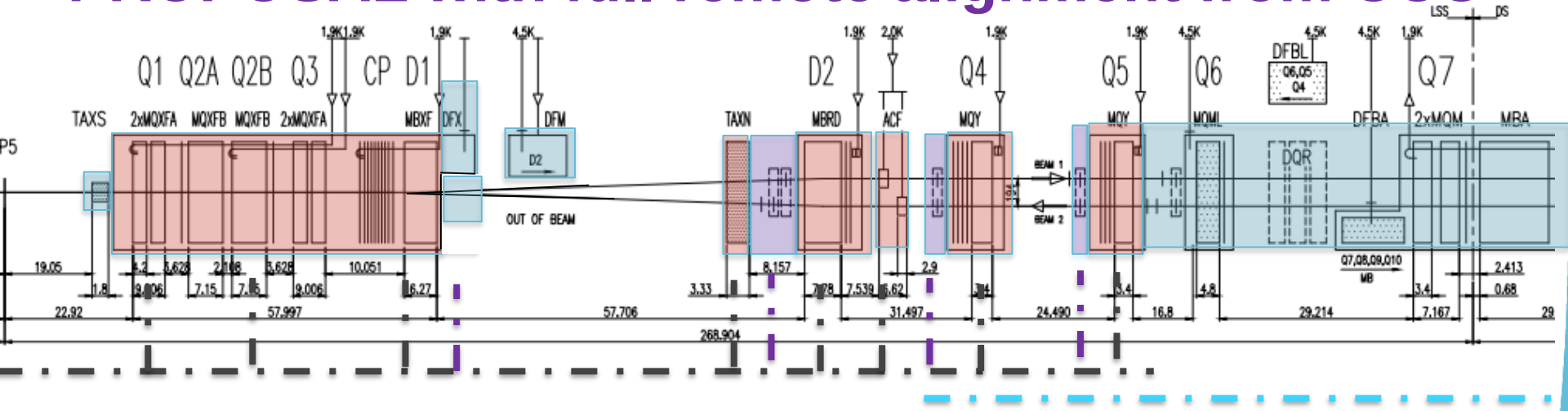
Plug-in motors
Alignment by wire





Remote
Resident motors and sensors.
Control from the CCC

IP1 and IP5 HL-LHC
Synoptic of adjustment system
PROPOSAL with full remote alignment from CCC



- Motorized adjustment system, <u>remotely controlled from CCC</u> : adjustment during run
- Manual adjustment system: adjustment during LS or YETS, personnel in the tunnel, access in front of element (special for TAXS)
- New extra motorized adjustment system, <u>remotely controlled from CCC</u> : adjustment during run

Technical Conditions

- A movement amplitude of 2.5 mm in lateral and vertical directions under operational conditions of the accelerator is required.
  - Vacuum: RF deformable bridge (replacing RF fingers) flexible enough
  - Cryogenics: QRL-magnet interfaces support this amplitude when cold, more when warm.
  - Radiofrequency: deformable RF guides ok for lateral movement, vertical to be checked
  - Magnets: experience from present system of local alignment-by-wire is positive

These conditions have to be met to avoid machine damage

Personal Safety

- Accident scenarios:
  - Damage of cryogenic connection, subsequent helium release
  - Damage of RF waveguide, non-ionizing leakage radiation
  - Damage of vacuum connection, air inlet, heat bridge and quench
- Quality of used components and work methods during installations makes these accident scenarios unlikely
- Remote Alignment only when tunnel closed:
  - Personnel not exposed to danger from remote alignment
  - Protect against unforeseen start

Conclusion

- The proposal for remote alignment
  - Does not put personnel at risk if the process is used when tunnel closed
  - Complement system with an interlock, avoiding involuntary start
  - Will save several man-mSv per year to intervening personnel