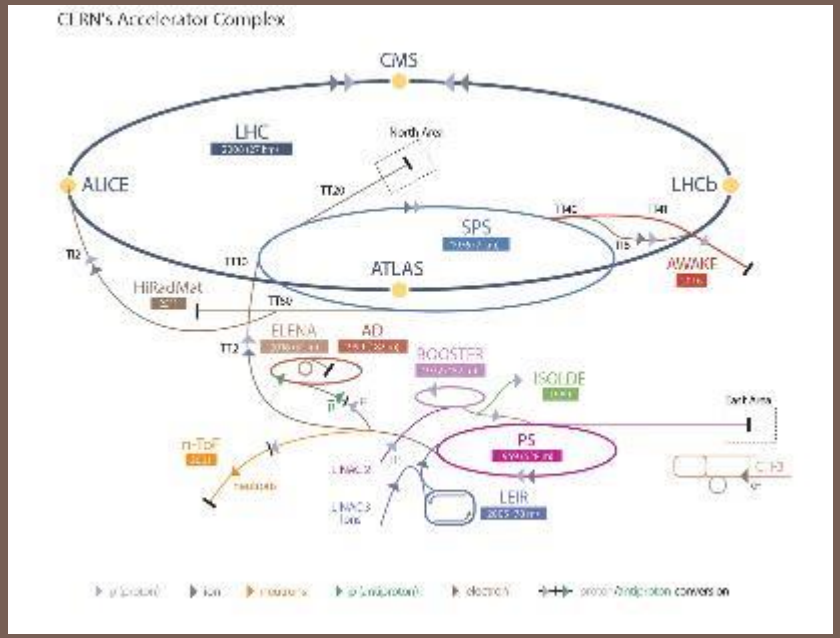
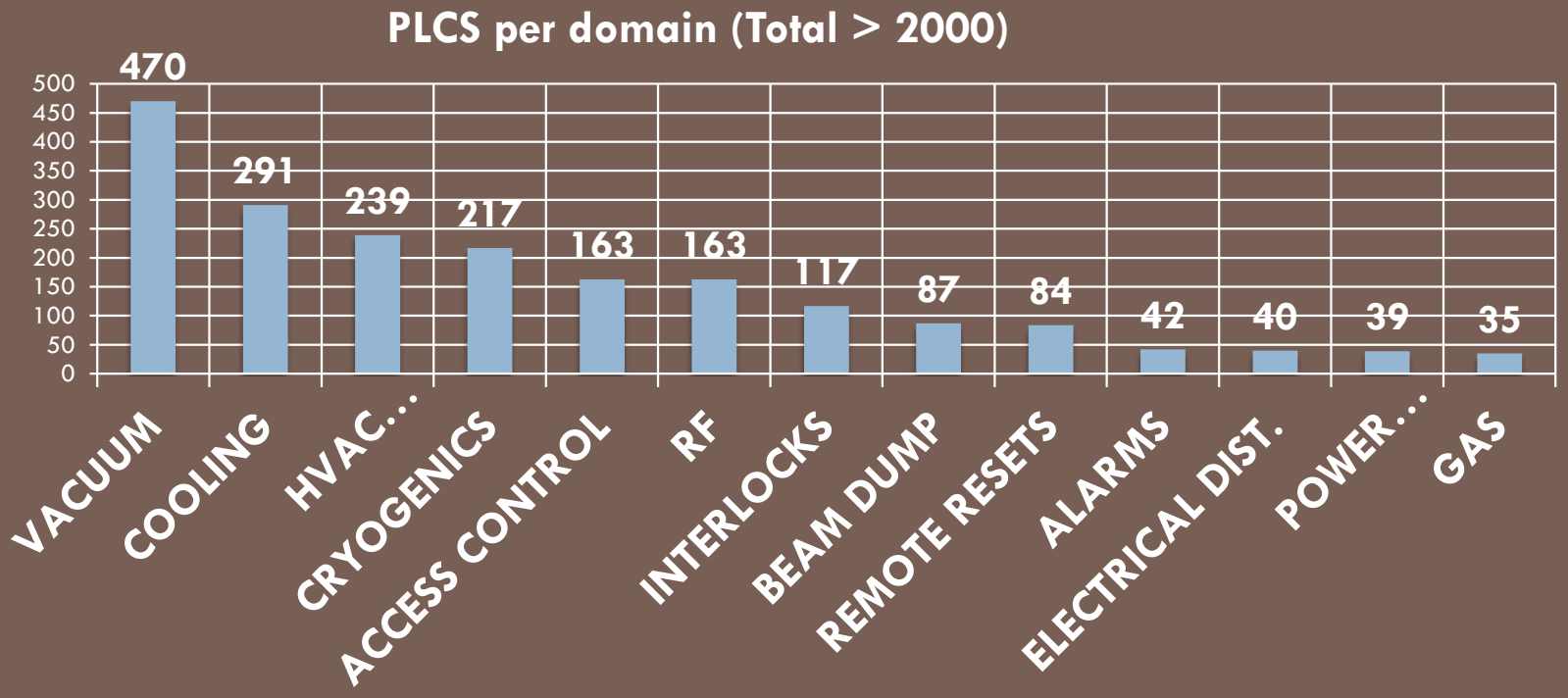
PLC BASED CONTROL SYSTEMS ICALEPCS'19 WORKSHOP

PLC based control systems at **CERN**

- **CERN mission**
  - To perform world-class research in fundamental physics
  - To provide a unique range of particle accelerator facilities that enable research at the forefront of human knowledge
- Key figures
  - Budget 1100 MCHF
  - 23 member states
  - 2500 Staff + 1800 Associates +13000 users + 2000 External firms

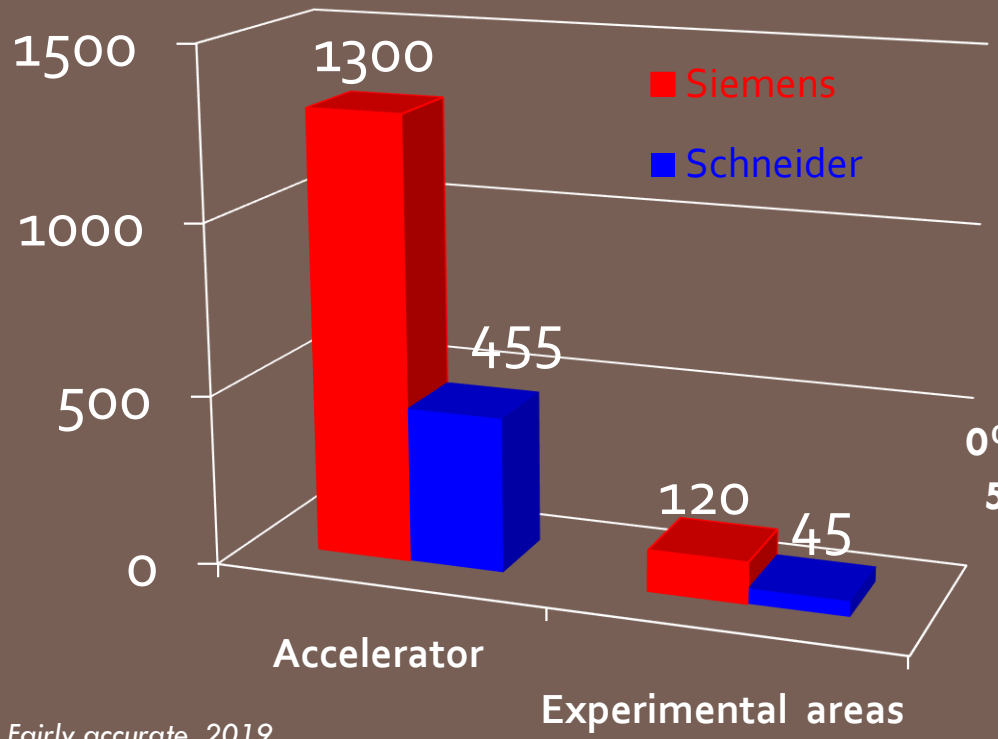


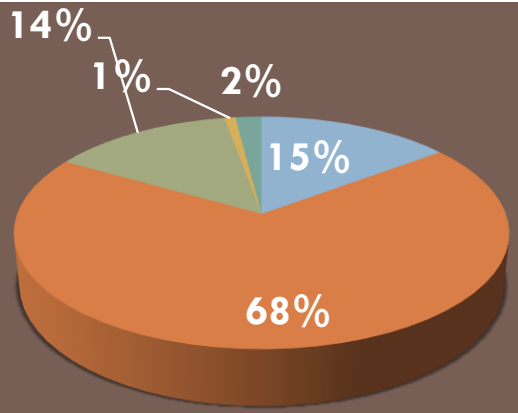
PLC inventory by domain *(fairly accurate)*

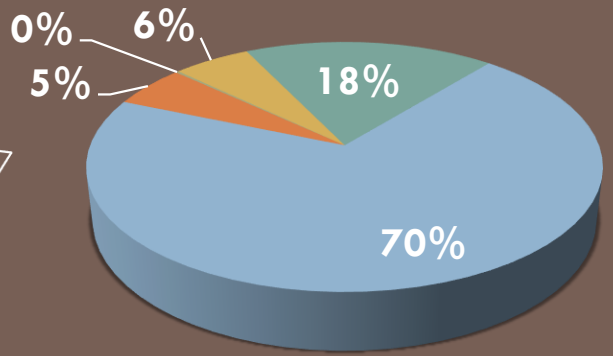


Not including Twido's from EN-EL, S7-200 TE-VSC

PLCs inventory at CERN







Fairly accurate, 2019

PLCs use: applications

Classic PLCs

- Cryogenics (Accelerator and experimental areas)
- Gas systems (LHC GCS, Linac4, Cloud…)
- Cooling systems
- HVAC
- Motion: servo-motors and Stepping motors
- RF
- Vacuum
- Electrical systems
- Protection & Interlocks (PIC, SPS Power converters interlocks, Collimators Temperature Interlocks
- Monitoring: RAMSES, CSAM

Fail safe controllers : Safety Integrated

- Access Control
- Machine-tools sector (e.g. Winding machines)
- WIC: Warm magnets interlocks
- Cranes control
- AWAKE, Magnet test benches
- Autonomous Mobile Equipment: TIM

Redundant systems

- Protection in experimental areas: DSS
- Electrical systems
- HVAC
- Power converters

Experience with suppliers

- More than 18 years of experience
  - There is not a perfect supplier but a satisfactory supplier
  - Lack of competition between suppliers is not healthy… as long as you can afford it.
  - Despite being a rather conservative technology segment (OT vs. IT), the supplier must follow tendencies (desirably without imposing continuous upgrades)
  - A strong and reactive technical team must be behind the curtains (commercials are not enough)
  - The key is not having suppliers but **partners**

UNICOS-CPC Engineering life cycle (PLC apps)

Databases (Assets, Layout Controls conf.)

Versioning (SVN, GIT)

Verification, Simulation, Test

Deployment & Monitoring

Maintenance

PLCVerif

Moon

Assets

Specifications

Automatic Code Generation

Test (FAT, SAT)

Deployment

Reverse Engineering

Analysis

PLC

PLC