CONTROLS PROJECTS

SNIFFER

CERN

TECHNICAL SUPPORT DEPARTMENT — TS

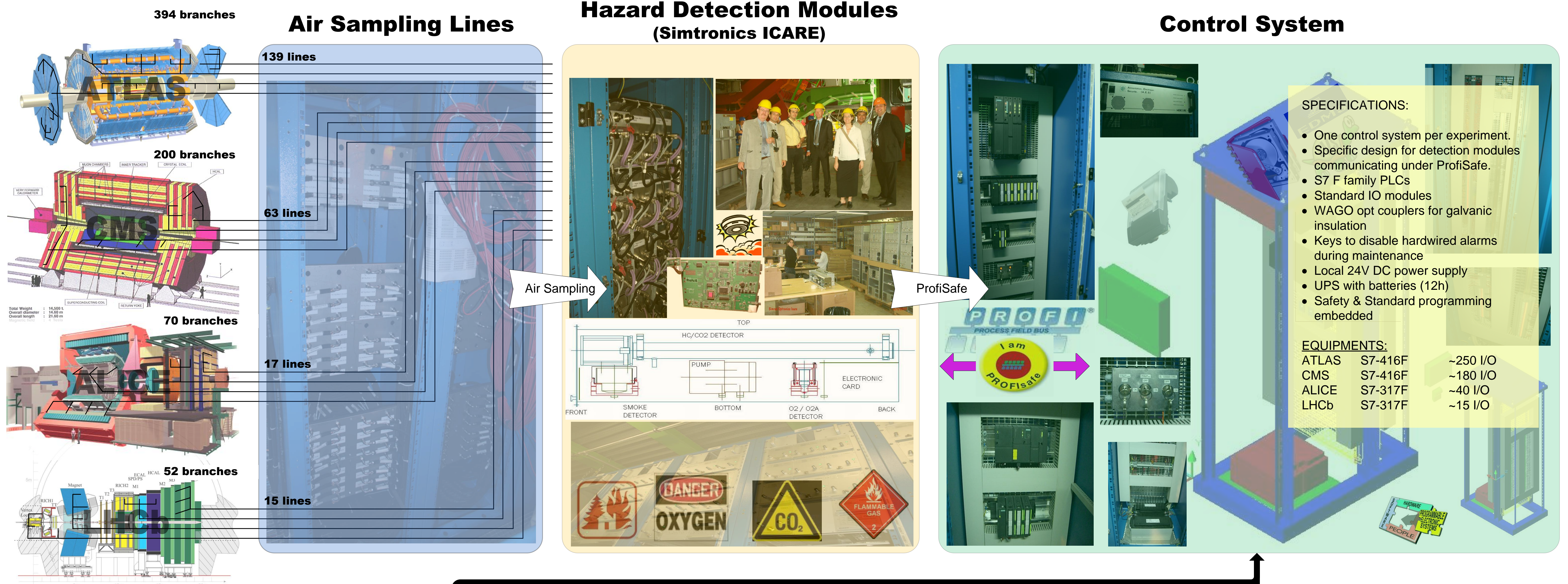**19-23 May, CERN, CH**

SNIFFER Team
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The SNIFFER system concerns the combined detection of smoke, oxygen presence, oxygen deficiency, CO2 and flammable gas presence inside the experiment machines ALICE, ATLAS, CMS and LHCb.
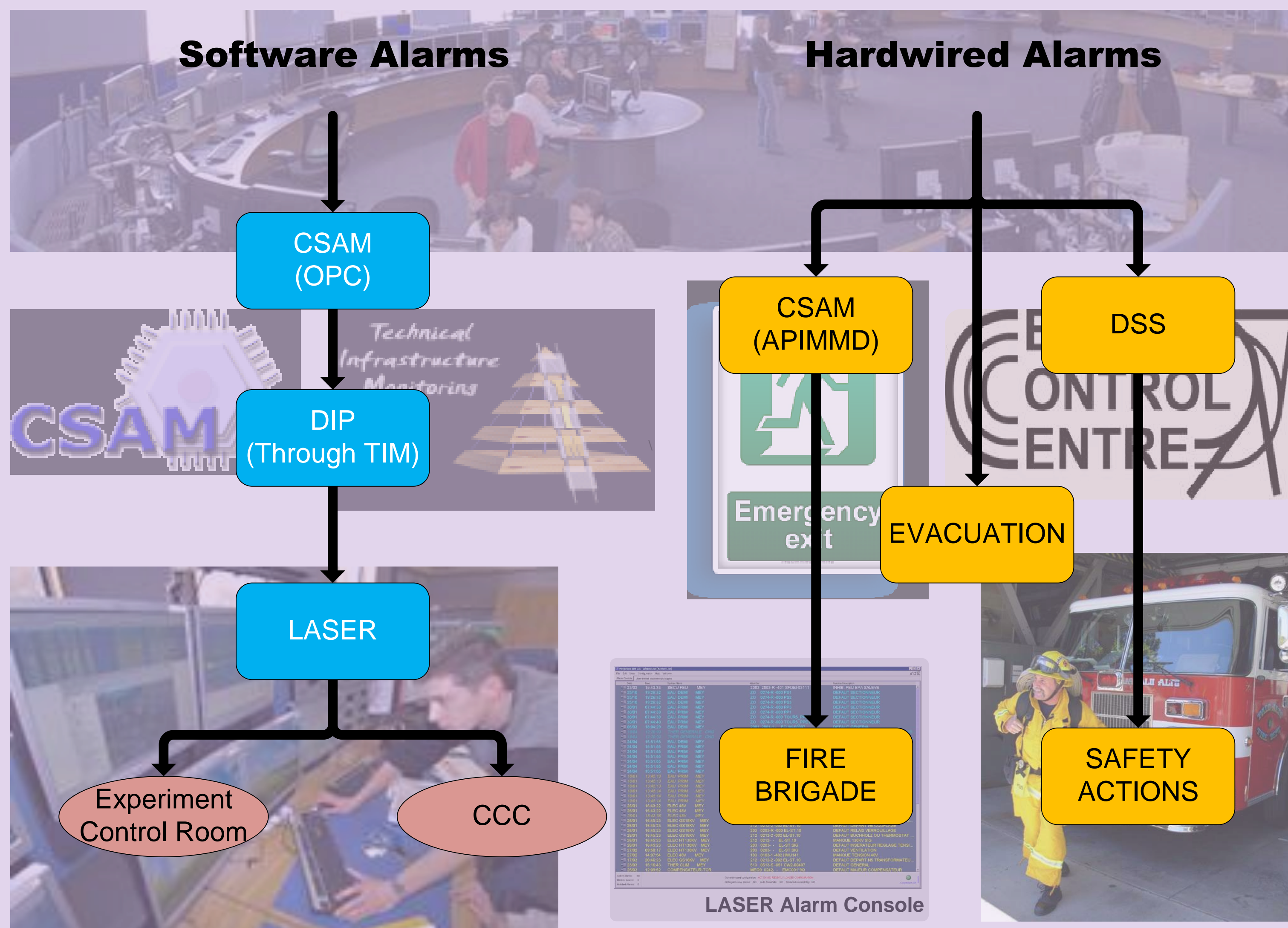
This safety system is based on detection modules which are transmitting hazard detection through a failsafe field bus – PROFISafe. Each one of these modules sucks air from a specific region inside the experiment machine which can collect air samples up to 12 different points (branches). A centralized safety PLC per experiment and two HMI's (Human Machine Interfaces) guarantee the alarm transmission to CSAM, CCC, experiment control rooms and DSS as well as the system user-friendly operation and maintenance.
System high availability stands on stand-alone UPS assuring the operation of the PLC and local HMI even under major power and/or network shutdowns.

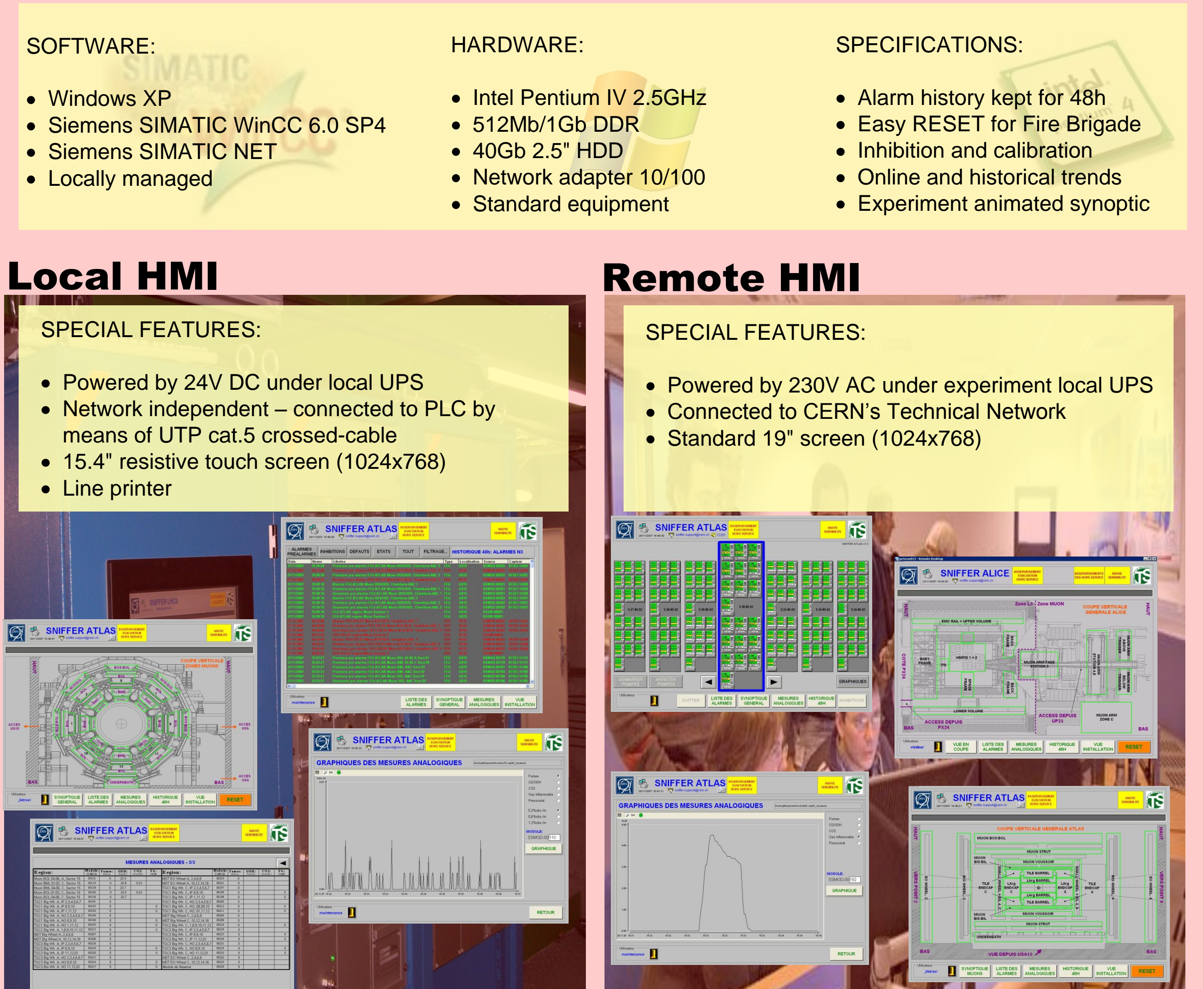*J. Letra Simoes, S. Grau, R. Nunes and D. Raffourt for the SNIFFER Team*

System Architecture

Air Sampling Lines

- ATLAS — 394 branches / 139 lines
- CMS — 200 branches / 63 lines
- ALICE — 70 branches / 17 lines
- LHCb — 52 branches / 15 lines

Hazard Detection Modules
(Simtronics ICARE)

Air Sampling

HC/CO2 DETECTOR — TOP — PUMP — O2 / O2A DETECTOR — FRONT — SMOKE DETECTOR — BOTTOM — ELECTRONIC CARD — BACK

DANGER OXYGEN — CO2 — FLAMMABLE GAS

ProfiSafe

Control System

PROFI PROCESS FIELD BUS — I am PROFIsafe

SPECIFICATIONS:
- One control system per experiment.
- Specific design for detection modules communicating under ProfiSafe.
- S7 F family PLCs
- Standard IO modules
- WAGO opt couplers for galvanic insulation
- Keys to disable hardwired alarms during maintenance
- Local 24V DC power supply
- UPS with batteries (12h)
- Safety & Standard programming embedded

EQUIPMENTS:

ATLAS	S7-416F	~250 I/O
CMS	S7-416F	~180 I/O
ALICE	S7-317F	~40 I/O
LHCb	S7-317F	~15 I/O

External System Interfaces

Software Alarms

CSAM (OPC) → DIP (Through TIM) → LASER → Experiment Control Room / CCC

Hardwired Alarms

CSAM (APIMMD) → EVACUATION → FIRE BRIGADE

DSS → EVACUATION → SAFETY ACTIONS

LASER Alarm Console

HMI – Human Machine Interfaces

SOFTWARE:
- Windows XP
- Siemens SIMATIC WinCC 6.0 SP4
- Siemens SIMATIC NET
- Locally managed

HARDWARE:
- Intel Pentium IV 2.5GHz
- 512Mb/1Gb DDR
- 40Gb 2.5" HDD
- Network adapter 10/100
- Standard equipment

SPECIFICATIONS:
- Alarm history kept for 48h
- Easy RESET for Fire Brigade
- Inhibition and calibration
- Online and historical trends
- Experiment animated synoptic

Local HMI

SPECIAL FEATURES:
- Powered by 24V DC under local UPS
- Network independent – connected to PLC by means of UTP cat.5 crossed-cable
- 15.4" resistive touch screen (1024x768)
- Line printer

Remote HMI

SPECIAL FEATURES:
- Powered by 230V AC under experiment local UPS
- Connected to CERN's Technical Network
- Standard 19" screen (1024x768)

Challenges:

GSD CREATION:
- Once ProfiSafe protocol was implemented in DPC31, a GSD file was needed to use and configure detection modules in STEP7 HW Config.
- GSD file created based on ProfiBus documentation and Siemens cooperation.

WINCC ALARM LIST GENERATOR:
- SNIFFER has 113 possible alarms per module + hazard detection alarms.
- WINCC has a complex database structure and a tool in Excel/VB was developed to change alarm list in a easy way, keeping trace of all modifications.

PROFISAFE IMPLEMENTATION:
- Implement SIEMENS specific ProfiSafe protocol in detection modules ASIC (DPC31)
- Protocol not available from SIEMENS
- SIEMENS sent ProfiSafe specialists for cooperation

MODULE INSTANTIATION IN WINCC:
- To save developing time and money, SNIFFER HMI modules were designed to be instantiated.
- Future evolutions on the system will be easy to change and maintain.

TESTING:
- Sampling lines are in very difficult access places (inside experiment machines) and it was a major challenge to take all gases/smoke into these points.
- All branches tested and alarm transmission times were measures (results in EDMS).

CONTRACT AGREEMENT:
- Difficulties with contractor due to temporary crisis putting in cause the project startup.
- Project split in two:
  Detection modules made by Simtronics
  Control system and HMI's made by CERN

ASYNCHRONISM BETWEEN STANDARD AND SAFETY PROGRAM:
- Since detection modules can receive commands from HMI (through PLC), a queuing mechanism was developed and implemented to assure message delivery between standard and safety program.

VIBRATIONS IN RACKS:
- In ATLAS installation (hosting 140 modules) a vibration issue was detected and had to be studied because resonance frequencies were transmitted to the mechanical structure.
- Anti-vibration foam installed under the racks.