CERN Safety Alarm Monitoring

This project implements the requirements of the LHC "AL3S" working group

LHC Safety Alarm System Supervisory Board

1st meeting

P. Ninin & CSAM project team

Outline

- Mandate
- Methods
- Requirements
- Prototypes
- Market Survey
- Impact from other working groups
- Implementation

Mandate:

A - Define, in close collaboration with all concerned divisions and groups,
detailed user requirements for safety alarm systems
(*AL3S*) for the LHC machine, experiments and experimental areas.

B - Conceive reliable and coherent safety alarm systems including
detection, transmission, display and logging,
primarily for the intention of CERN's Fire Brigade,
but also for all concerned technical, machine and experimental services.

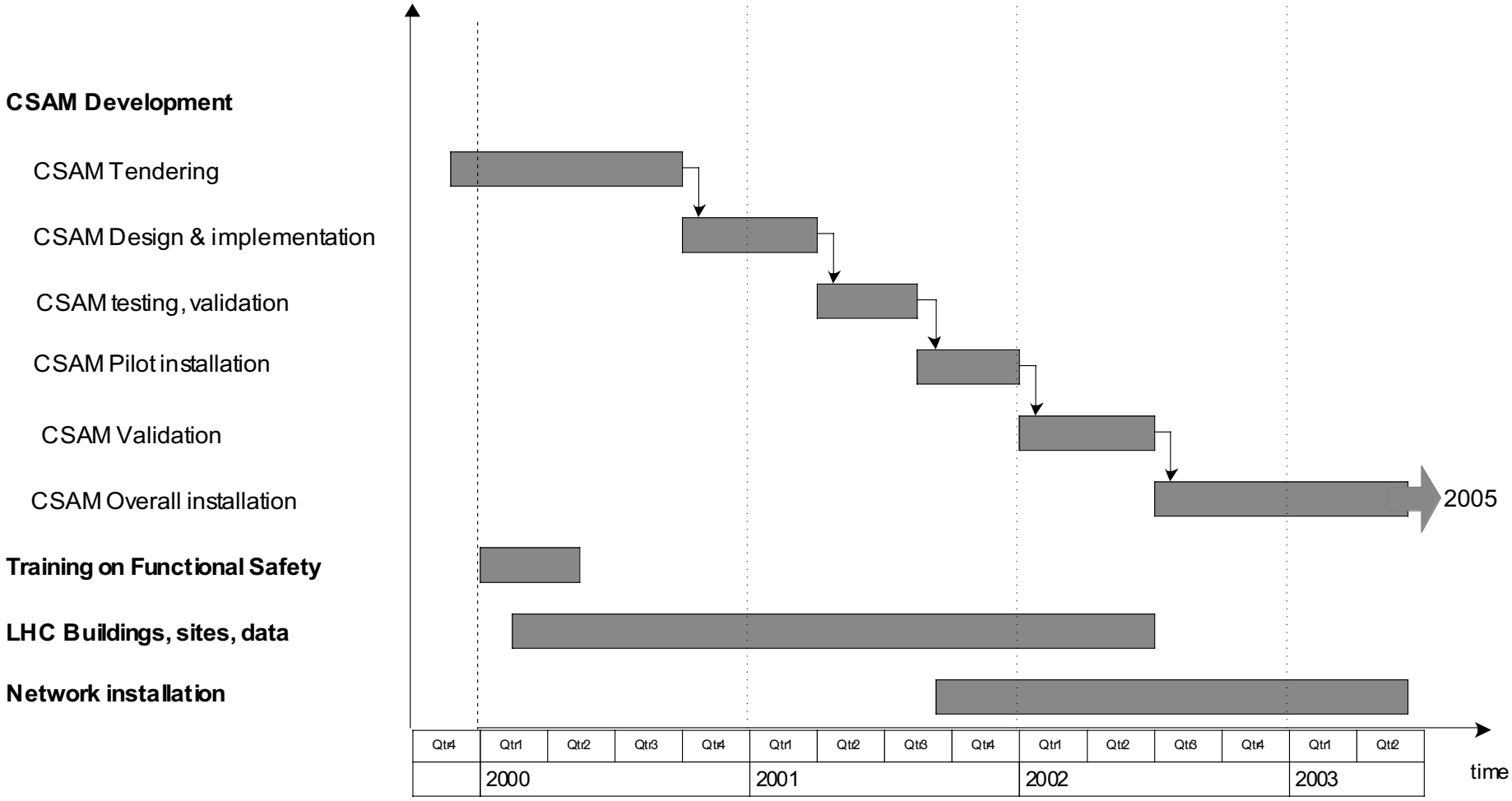
C - Implement, applying fully all relevant and available Quality Standards,
these safety alarm systems at the LHC in line with progress of the project
and upgrade all other safety alarms systems at CERN to obtain
rapidly a coherent, reliable and rational CERN wide system.

Project Launch Document, 15/06/199, Harry Laeger

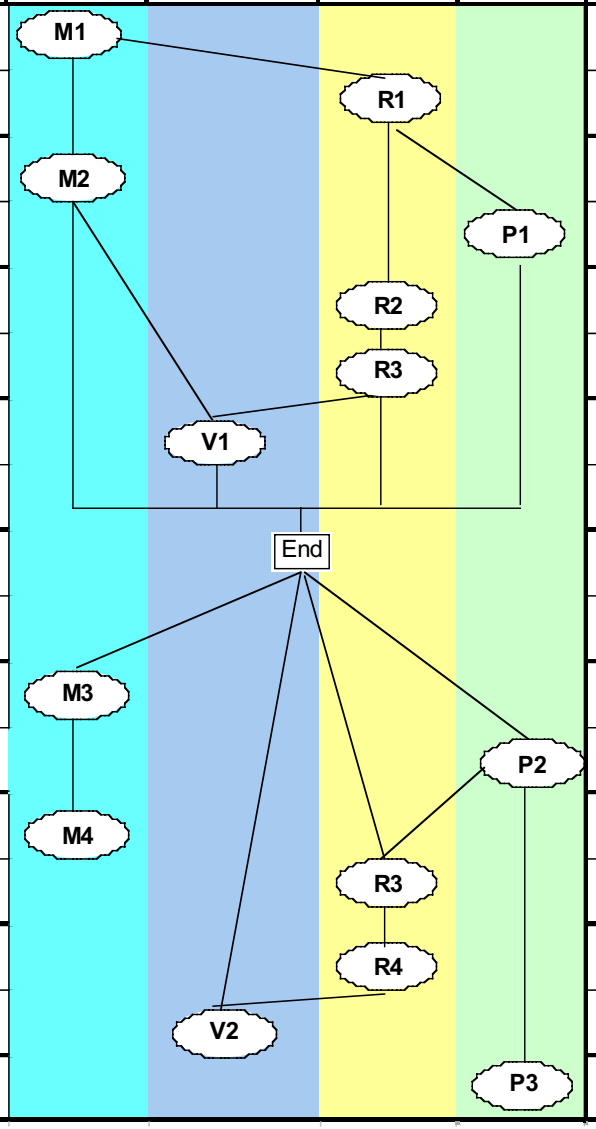
Collaborators

- ST Project
  - AA – Detection
  - MO – Transmission, monitoring
- TIS representative
  - Safety Alarm Officer (A. Chouvelon)
- SPL
- LHC
- SL
- EST

Timescale

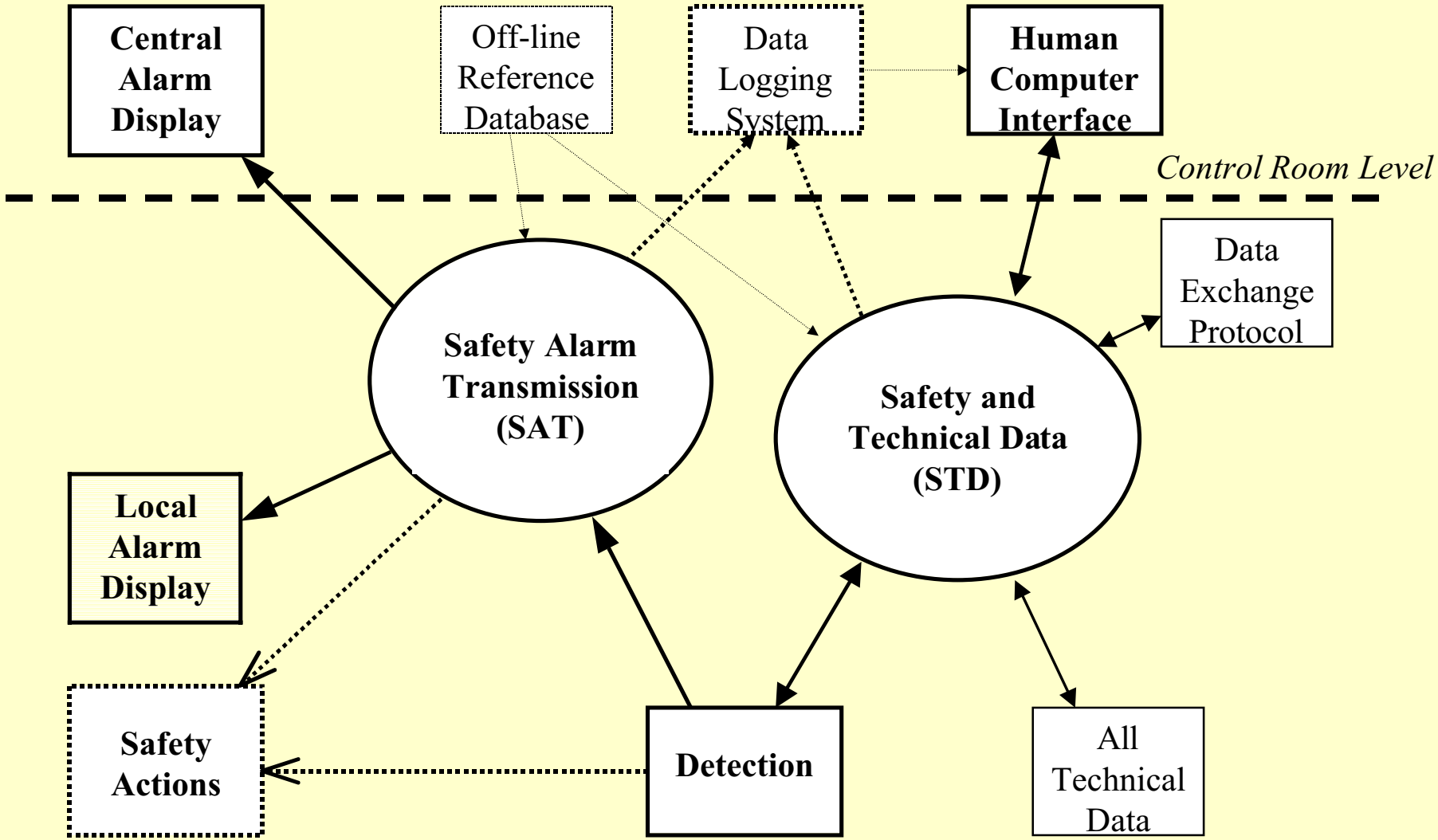

CSAM Development
CSAM Tendering
CSAM Design & implementation
CSAM testing, validation
CSAM Pilot installation
CSAM Validation
CSAM Overall installation
2005
Training on Functional Safety
LHC Buildings, sites, data
Network installation
Qtr4 Qtr1 Qtr2 Qtr3 Qtr4 Qtr1 Qtr2 Qtr3 Qtr4 Qtr1 Qtr2 Qtr3 Qtr4 Qtr1 Qtr2
2000
2001
2002
2003
time

Milestone plan for the LHC Safety Alarm Project



Planned date	Code	Milestone description	Task Responsible	Date:
28/06/99	M1	Work shop and official project launching	Pierre	28/6/1999
21/07/99	R1	User Requirements Presentation to project team	Rui	28/7/1999
28/07/99	M2	Project Management Plan V1 ready	Pierre	15/8/1999
28/07/99	P1	Definition of the prototype (who, where, how, when) done	Tono	7/9/1999
04/08/99	R2	Internal Revision of UR completed	Rui	4/8/1999
15/09/99	R3	Revision of the UR with users completed	Rui	1/10/1999
20/09/99	V1	Acceptance testing document V1 ready	Sylvia	3/11/1999
		End of Project Launching phase		
		Start of Specification phase		
06/10/99	M3	Project Management Plan updated for SR phase	Pierre	20/10/1999
06/100/99	P2	Design of the prototype approved	Tono	6/10/1999
15/10/99	M4	Market survey out	Luigi	15/12/1999
15/03/99	R3	System Requirements Documents(SRD) ready & approved	NYD	NYD
01/04/00	R4	Interface Control Document (ICD) ready & approved	NYD	NYD
01/04/00	V2	System Test document (STD) ready & approved	NYD	NYD
08/04/00	P3	Prototype ready for exploitation	Tono	NYD

LHC Alarm Level 3 Systems



Strategy (1)

- Uniformity of principles for all CERN lab.
  - Make it a CERN wide project
- SAT + STD = an integrated solution
  - STD exists but need to evolve according to new URs

Strategy (2)

- Methods (A,B,C)
  - Standards
    - ESA PSS-05, EN 50136, IEC 61508
      - Expertise in the field of safety
  - Requirement + Specification
- Prototyping (B)
  - Clarify User and Safety Requirements
- Commercial framework (C)
  - Contract to support the activity
  - Cost planning

Other considerations

- SCR should receive alarms only if they have something to do with it
  - Limit the total number
  - Think about quality not quantity
  - COST & RELIABILITY of the Alarm information management
- 1 AL3 (fire) –> 2 AL2 (inhibition, default)
  - 10 000 AL3 –> 20 000 AL2 for STD

Standards

- IEC 61508
  - The reliability of the system depends on the
    - Procedures
    - Acquisition/transmission systems
    - People: adherence to procedure, training
- EN 50136
  - Practical guidance to design and test alarm systems

Procedures (INB compliant)

- Integration of new alarm
  - Safety Alarm Integration procedure
  - Board: Eq. Group, TIS, SCR (TCR as back-up)
- Working on the system
  - Optimisation of the IS37
- Testing
  - Annual
  - Post-intervention
- "Tracability"
  - Interventions
  - Alarm Chain

Requirements

- User requirements completed and reviewed by all stakeholders
  - Difficulty to get the user's detection needs
  - Detailed safety requirements from the experiments are expected this winter
- Interface Control Document
  - Describes all the interfaces of the system
- Acceptance Test Document
  - Describes the acceptance procedures which will be applied according to the functionality required

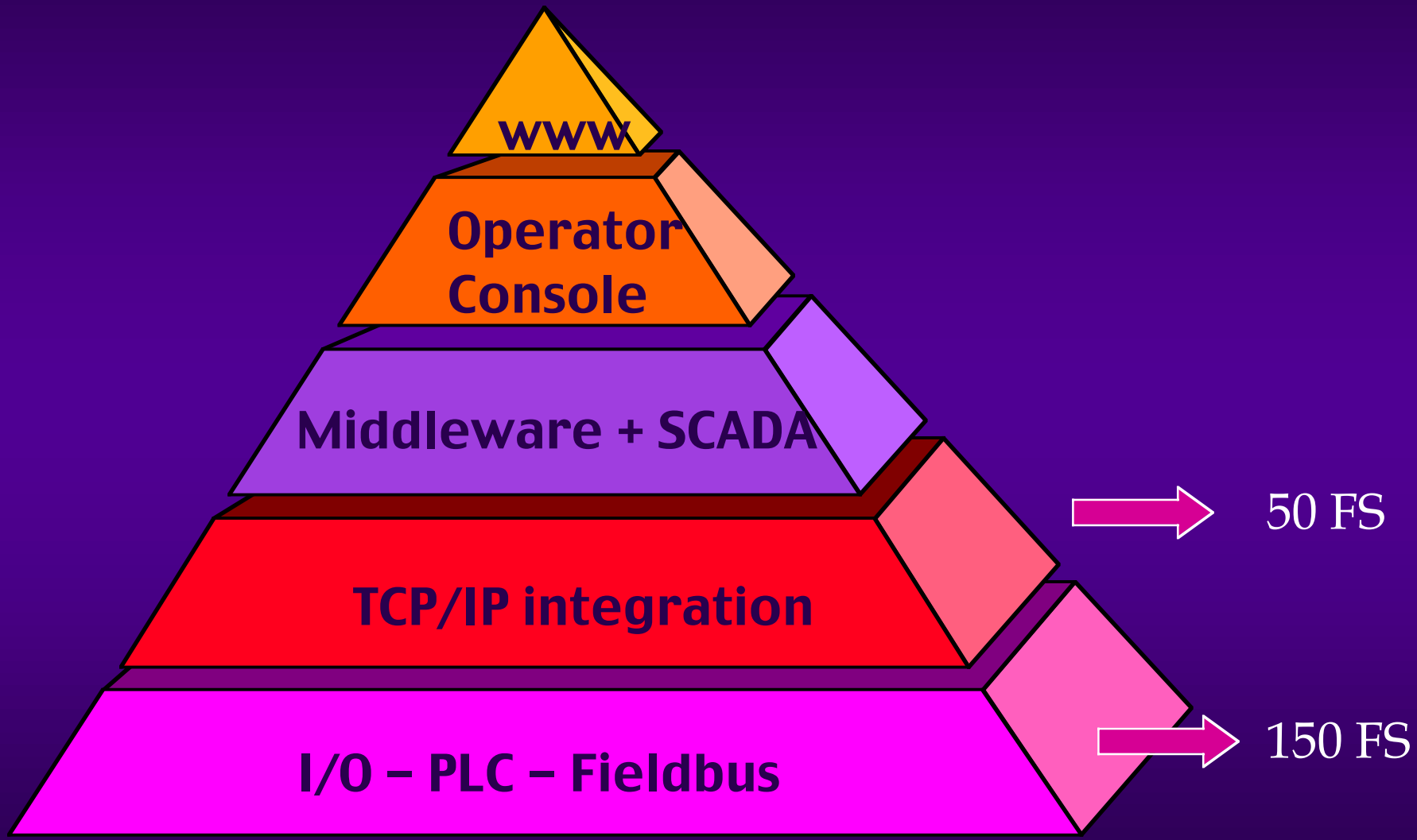
Prototype

- Clarify User and Safety requirements
- Project Team training
  - Technical solutions
  - Safety matters: reliability analysis, SIL
- Technical solutions investigation
- Input for technical specification

Financial aspects

- Estimates for Transmission & Monitoring
  - Basic infrastructure 10-20 000 alarms/34 safety areas
    - CERN: 2~3 MCHF
    - LHC: 1~1.5 MCHF
  - Alarm generators and local transmission NOT included
  - Extra: "fixed price per alarm"
- Tendering procedure
  - Market Survey: reviewed the 9th December 1999
  - Technical Spec: ready for April 2000
  - Target FC: 8th November 2000

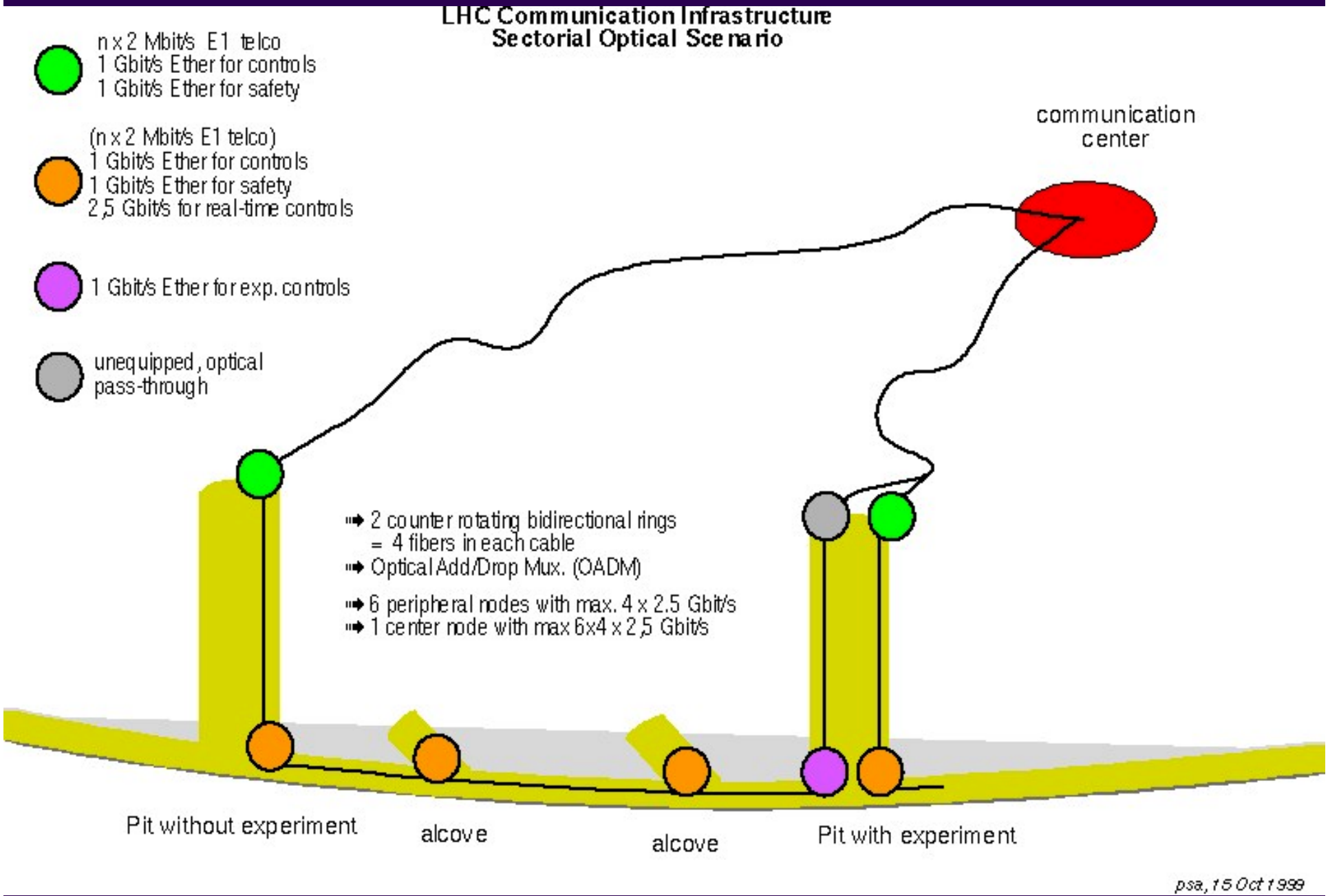
Alarm Integration cost



Spending Profile

Impact from other WGs

- LHC Data Communication Interchange
  - Requirements where given
  - No yet moved to feasibility study
  - STD provides already this functionality
- LHC Communication Infrastructure
  - Requirements where given
  - First solution proposed by P. Anderssen
  - Direct routing to SCR/TCR ?
  - INB agreement ?
  - Planning matching


LHC Communication Infrastructure
Sectorial Optical Scenario
n x 2 Mbit/s E1 telco
1 Gbit/s Ether for controls
1 Gbit/s Ether for safety
(n x 2 Mbit/s E1 telco)
1 Gbit/s Ether for controls
1 Gbit/s Ether for safety
2,5 Gbit/s for real-time controls
1 Gbit/s Ether for exp. controls
unequipped, optical pass-through
communication center
2 counter rotating bidirectional rings = 4 fibers in each cable
Optical Add/Drop Mux. (OADM)
6 peripheral nodes with max. 4 x 2.5 Gbit/s
1 center node with max 6x4 x 2,5 Gbit/s
Pit without experiment
alcove
alcove
Pit with experiment
psa, 15 Oct 1999

LHC Fire & Gas Detection

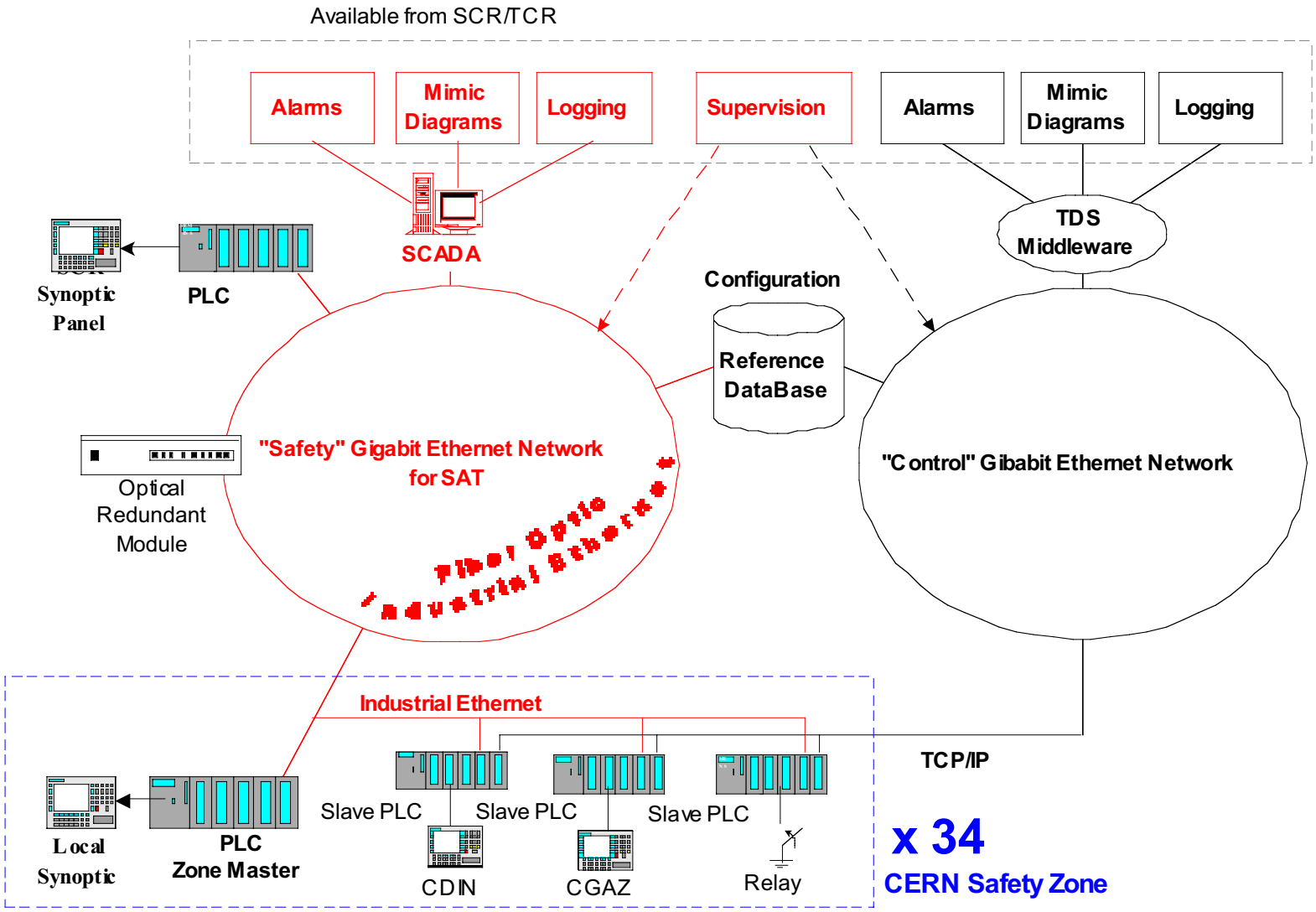
- ST/AA/AS in contact with GLIMOS
  - G. Benincasa (ATLAS)
  - R. Schmidt (CMS)
  - G. Rau (LHC machine)
  - L. Lensen (ALICE)
  - H–J. Hilke (LHCb)
- Definition of requirements in progress for ATLAS, CMS & LHC machine in collaboration with TIS

LHC Fire & Gas Detection

- Need to know “owners of buildings”
  because
  - Detection needs / type of detection
  - Budget estimations
  - Contract Management
- Foreseen Control Panels
  - 2~3 Fire + 1 Gas – surface
  - 1~2 Fire + 1 Gas – underground

Implementation... but lets have a coffee first !

CERN Safety Alarm Monitoring System



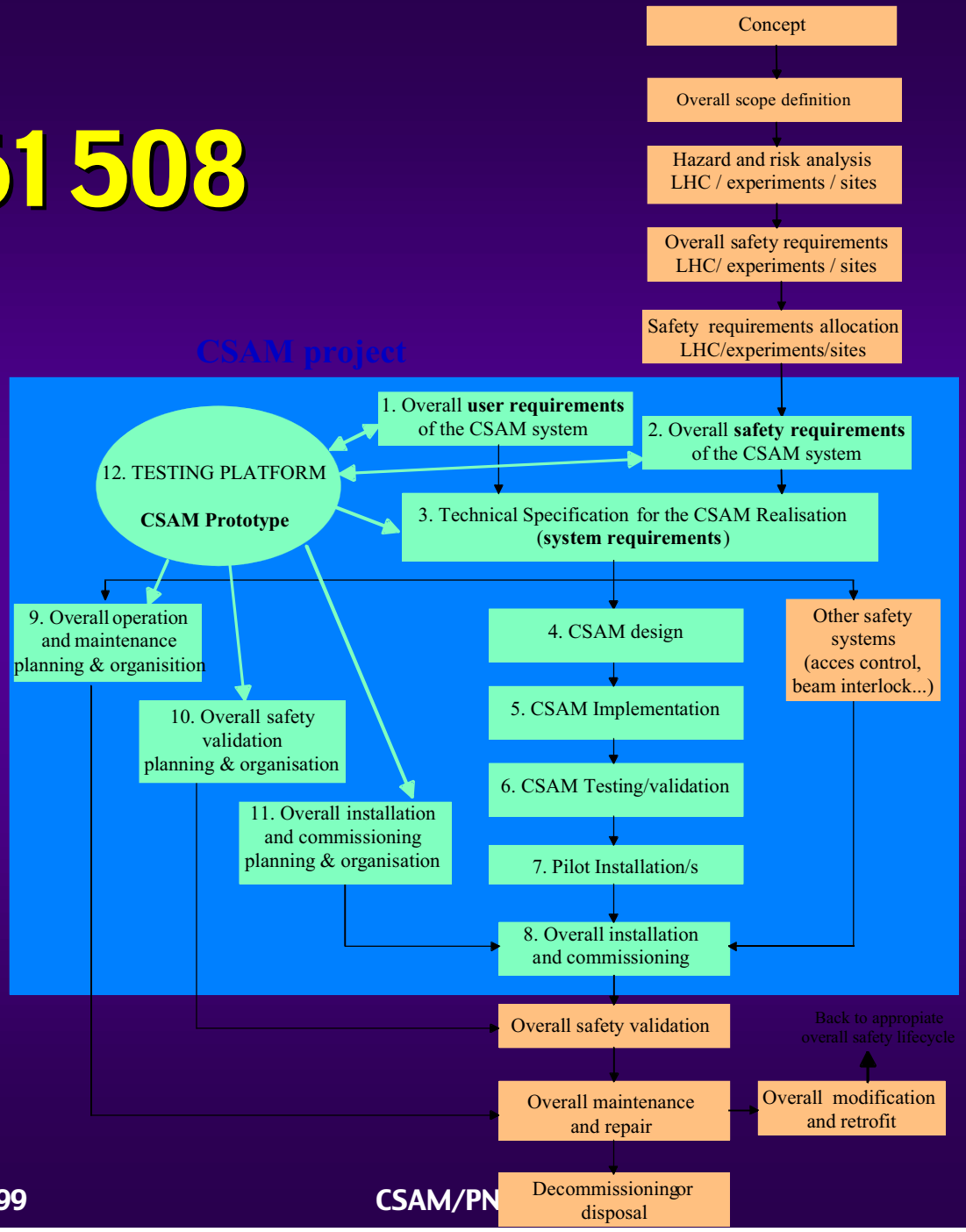
Future actions

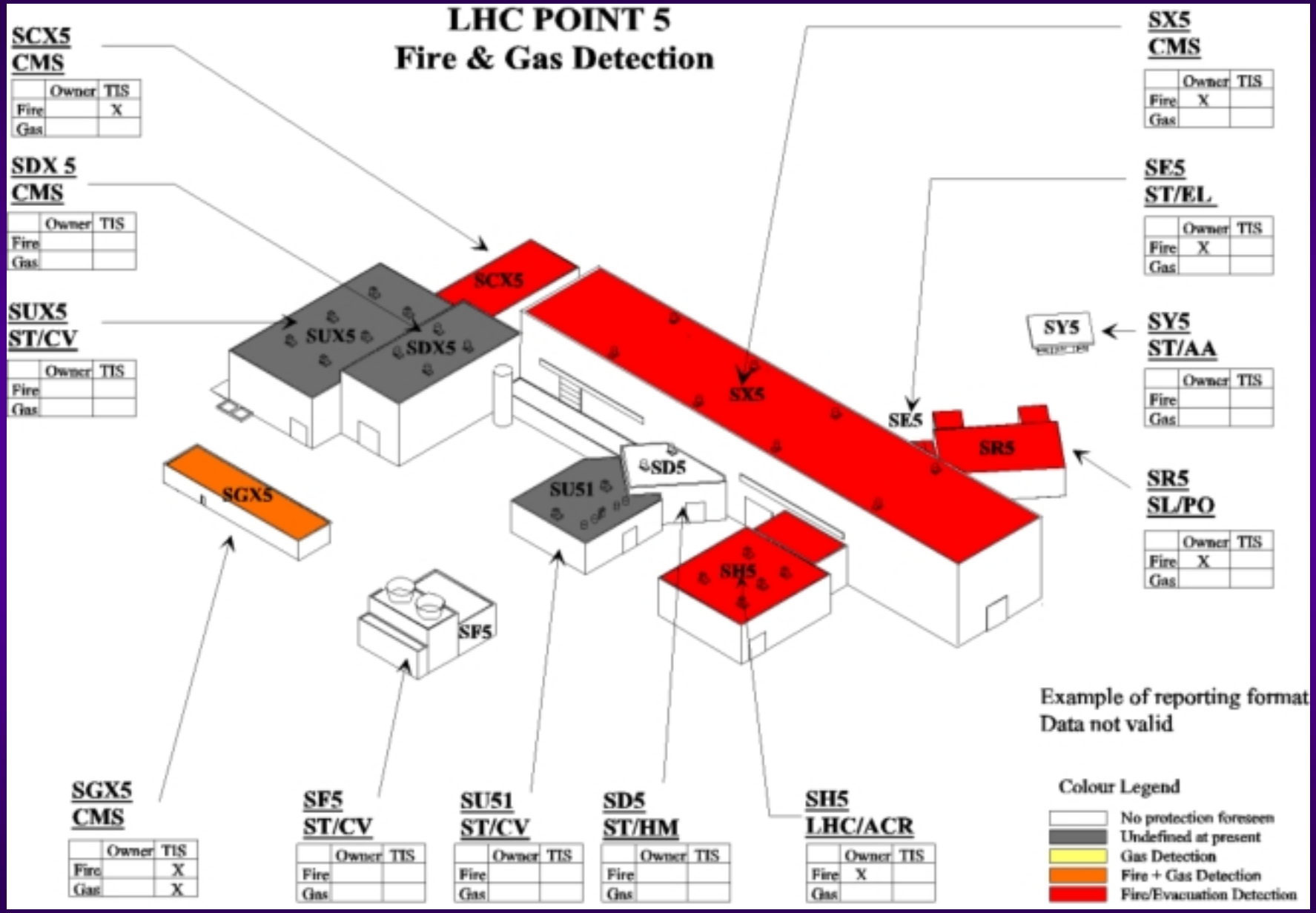
- Technical specification
  - Detailed analysis of existing installations
  - Refined estimation of LHC AL3 numbers
  - Technical Specification (IT2694)
  - Interface Control Document
  - Acceptance Testing Document
- INB Preparation
- Open issues
  - Definition of experiments detection needs
  - Number of Safety Areas (Cost!)
  - Direct transmission to SCR/TCR
  - Tunnel fire detection ?
  - Tunnel Oxygen deficiency ?

The CSAM team

-H. Laeger	(10%)	until retirement	
-P. Ninin	(20%)	throughout project duration	
-C. Soler Tappa	(100%)	July 1999 - June 2001	(Spanish CDTI Graduate)
-R. Nunes	(30%)	throughout project duration	
-L. Scibile	(60%)	throughout project duration	
-S. Grau	(100%)	May 1999 - April 2001	(Fellow)
-F. Havart	(70%)	October 1999 - end	
-T. Riesco	(30%)	July 1999 - end	
-U. Epting	(20%)	throughout project duration	
-M. Carmen	(10%)	July 1999 - July 2000	
-F. Bonthond	(10%)	January 2000 - end	(Transition LEP - LHC)
-D. Hay	(10%)	January 2000 - end	
-M. Trebulle	(10%)	January 2001 - end	(Transition CERN to new AL3S)
-A. Chouvelon	TIS	Throughout project duration	
- J. Nebout	EST	Throughout project duration	

IEC 61508


Concept
Overall scope definition
Hazard and risk analysis
LHC / experiments / sites
Overall safety requirements
LHC/ experiments / sites
Safety requirements allocation
LHC/experiments/sites
CSAM project
1. Overall user requirements of the CSAM system
2. Overall safety requirements of the CSAM system
12. TESTING PLATFORM
CSAM Prototype
3. Technical Specification for the CSAM Realisation (system requirements)
9. Overall operation and maintenance planning & organisition
10. Overall safety validation planning & organisation
11. Overall installation and commissioning planning & organisation
4. CSAM design
5. CSAM Implementation
6. CSAM Testing/validation
7. Pilot Installation/s
8. Overall installation and commissioning
Other safety systems (acces control, beam interlock...)
Overall safety validation
Back to appropiate overall safety lifecycle
Overall maintenance and repair
Overall modification and retrofit
Decommissioningor disposal


LHC POINT 5
Fire & Gas Detection
SCX5
CMS
Owner TIS
Fire X
Gas
SDX 5
CMS
Owner TIS
Fire
Gas
SUX5
ST/CV
Owner TIS
Fire
Gas
SX5
CMS
Owner TIS
Fire X
Gas
SE5
ST/EL
Owner TIS
Fire X
Gas
SY5
ST/AA
Owner TIS
Fire
Gas
SR5
SL/PO
Owner TIS
Fire X
Gas
SCX5
SUX5
SDX5
SX5
SE5
SR5
SY5
SD5
SU51
SGX5
SH5
SF5
SGX5
CMS
Owner TIS
Fire X
Gas X
SF5
ST/CV
Owner TIS
Fire
Gas
SU51
ST/CV
Owner TIS
Fire
Gas
SD5
ST/HM
Owner TIS
Fire
Gas
SH5
LHC/ACR
Owner TIS
Fire X
Gas
Example of reporting format
Data not valid
Colour Legend
No protection foreseen
Undefined at present
Gas Detection
Fire + Gas Detection
Fire/Evacuation Detection