Report from the working group on:

Requirements for Standby and Intervention Services for Accelerator Operation

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Outline

- Introduction
  - Goals of the study
  - General aspects of piquet and expert services
- Analysis of 2006 situation for LHC injectors
  - PSB
  - PS
  - SPS
- General findings
  - Non-covered or undefined areas
  - Services for large scale interventions
  - TS general services for machine operation
- Preliminary recommendations & conclusions

Introduction

- Goals of the study
  - Analyse actual situation of Piquet and expert services for machine operation
    - 2006 accelerator operation period
    - Older data less relevant – operation from CCC, restructuring, etc.
  - Identification of problem areas
    - Non-sufficient support, uncovered areas
    - Unclear responsibilities
  - Review of requirements for LHC era
    - Intervention delay time per machine/service
    - Required service level for (broad first line support vs. specialist support)
  - Recommendations
    - Optimum way and number of services
    - Additional tools for operations (diagnostics software)

- OP internal WG since begin shut-down
  - R. Bailey, M. Benedikt, K. Cornelis, T. Giles, B. Mikulec, P. Sollander

Piquet vs. Expert Service – some aspects

- Availability and intervention time
  - Piquet is a guaranteed service with guaranteed intervention time
  - Expert service is “best effort” service
    - Usually based on call-out list
    - No guarantee to find an expert (acceptable in LHC era for beam critical systems?)
- Expert service – practical aspects
  - Often outdated call out lists, no standardized format
    - Newly developed database tool for Piquet / Expert service management
  - Frequently only the n^{th} person on the list can be reached
    - Sometimes discussions on call out order -> frustration on both sides…
  - “Psychological aspects” for operators to phone (several) people at home during nights/weekends (that are not paid for the service, etc.)
- Other aspects: Homogenisation department wide or CERN level, legal aspects (max. intervention time…), -> working group F. Bordry.

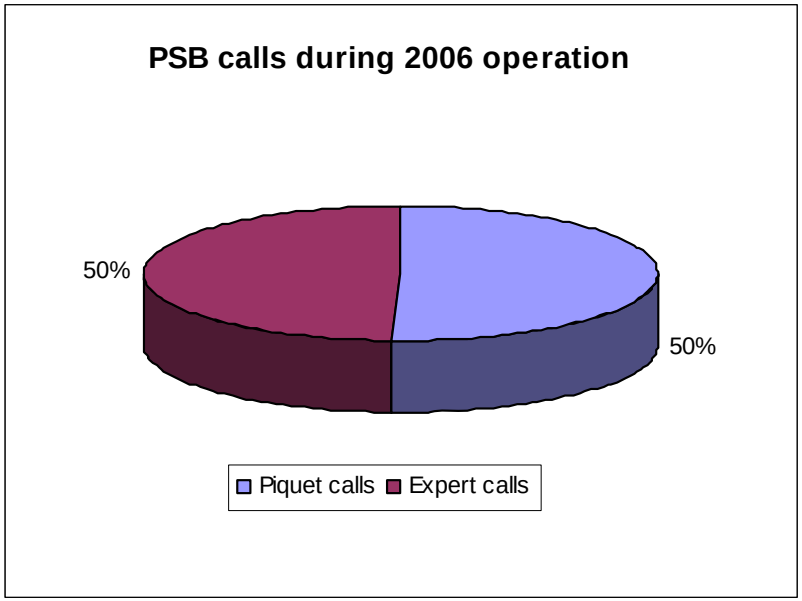
Analysis of 2006 operation

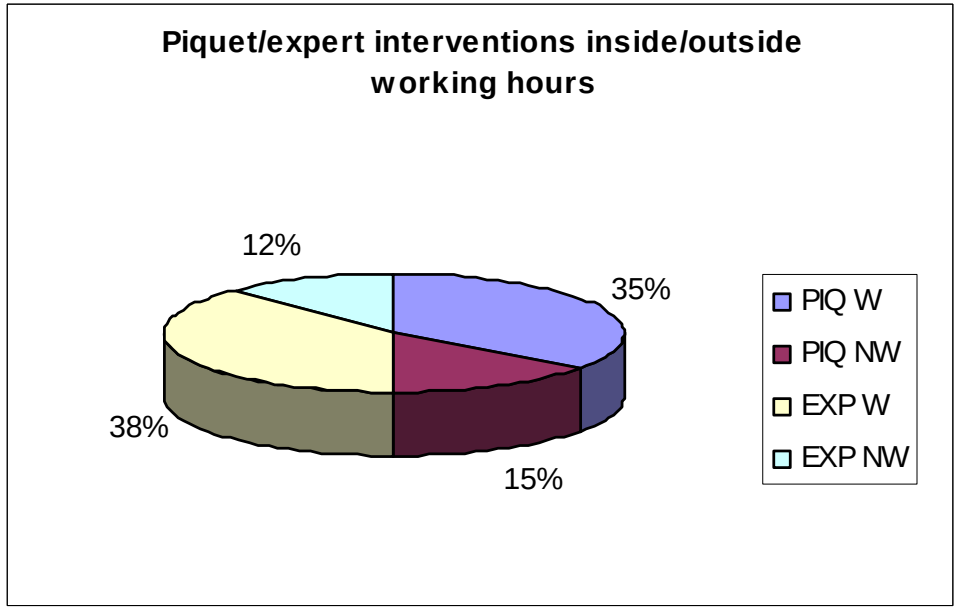
- Some remarks on the statistics
  - Number of calls and duration of interventions from e-logbooks.
    - Based on manual operator input
    - Calls from piquet to experts and vice versa not recorded
    - Calls from supervisors to experts (e.g. MD) not recorded.
  - Statistic is still reasonable basis and shows trends.

- We look also into improved tools for follow-up
  - Better follow up options to be included in e-logbook
  - See Peter's talk for TI tools

- Note: different operation period for all machines
  - Consider only periods outside large start-up problems
    - Representative for "routine operation"

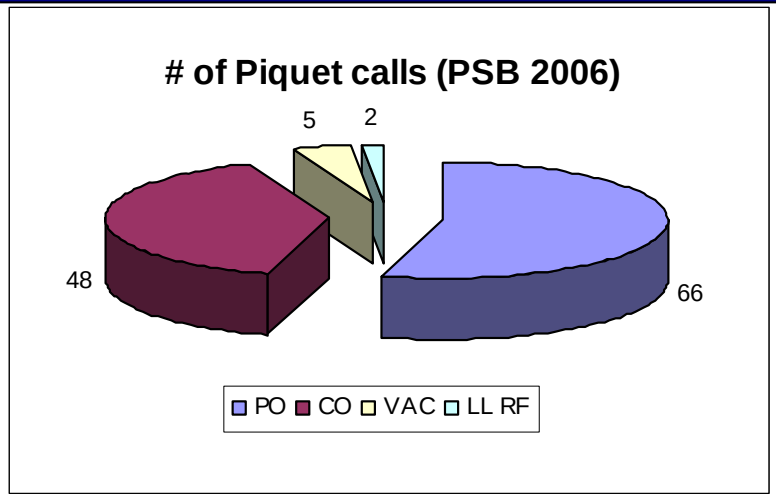
PSB interventions 2006 (i)

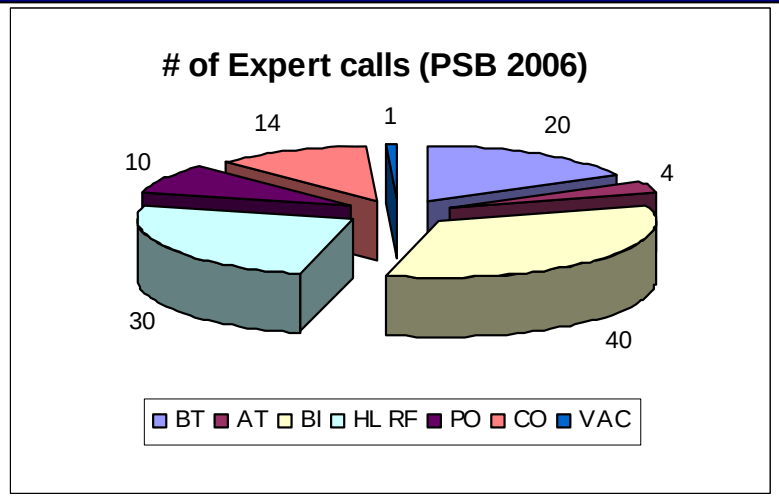




- 13/04/2006 to 20/11/2006
  - Half of all interventions by piquet and half by expert services
  - 121 piquet interventions and 119 specialist interventions
  - Average 1.1 interventions per day
  - 73% inside working hours, 27% nights and WE
  - Slightly more piquet than specialist interventions outside working hours

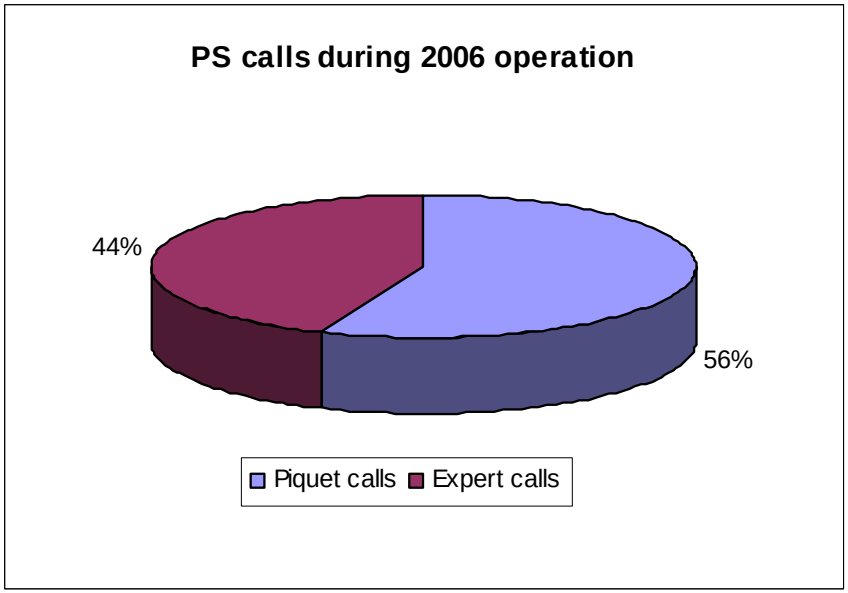
PSB interventions 2006 (ii)

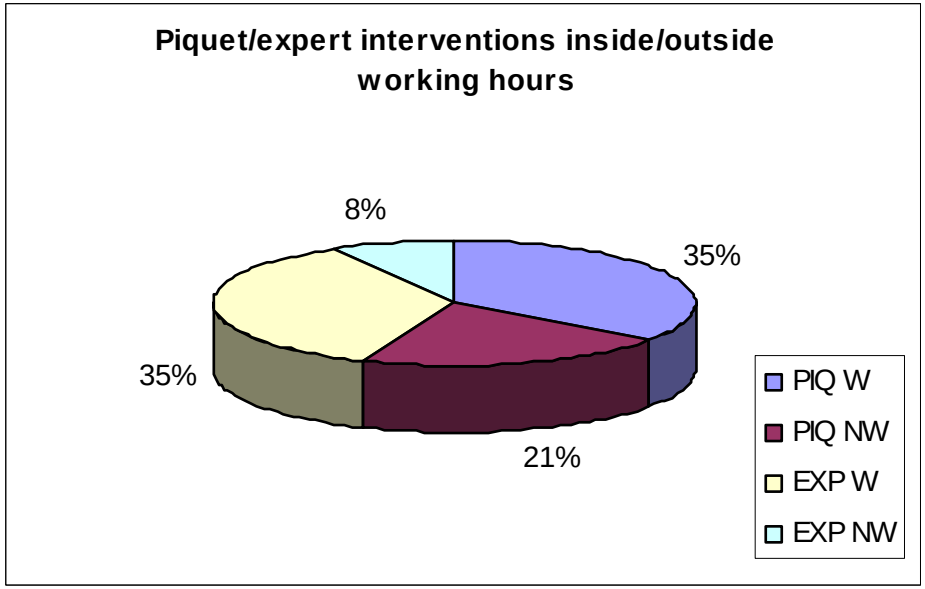




- PO & CO most important Piquet services, in addition frequent specialist calls
  - Average intervention time 75 minutes (from call to end intervention)
- Piquet RF LL rarely called (new service, still training up)
  - strong reliance on (single) LL expert (BS), a lot of " preventive" activities
- BI: Largest number of expert calls (large fraction due to FESA deployment)
  - Front end responsibility not clearly defined BI-CO
  - Most of the time interventions not beam critical but beam-quality critical -> will become very important for LHC beams (emittance, steering,intensity)
- BT: Mainly kickers, all interventions beam critical, expert availability night/WE.
- HL RF: reliance on single expert, availability night/WE.

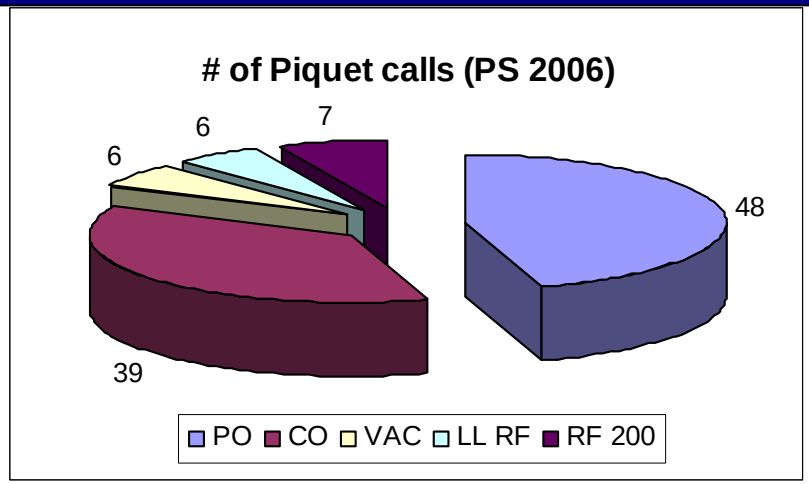
PS interventions 2006 (i)

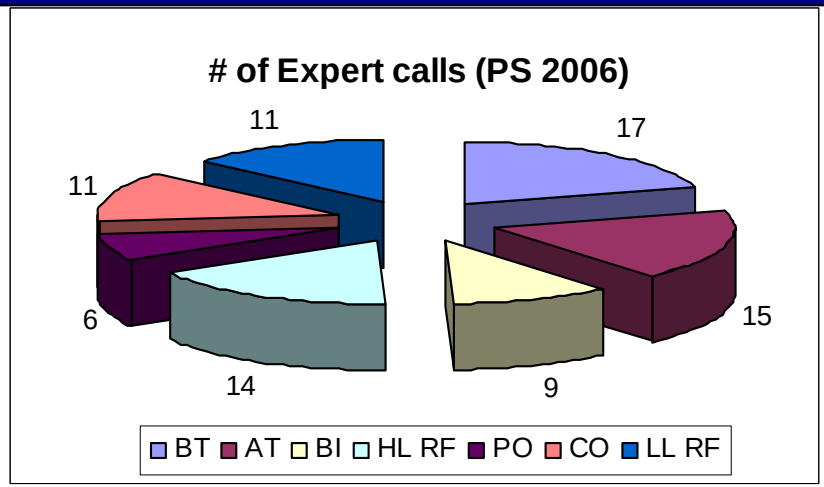




- 25/06/2006 to 20/11/2006 (start after main generator problem)
  - Slightly more Piquet interventions than experts 56% to 44%
  - 106 piquet interventions and 83 specialist interventions
  - Average 1.3 interventions per day
  - 70% inside working hours, 30% nights and WE
  - Three times more piquet than expert interventions outside working hours

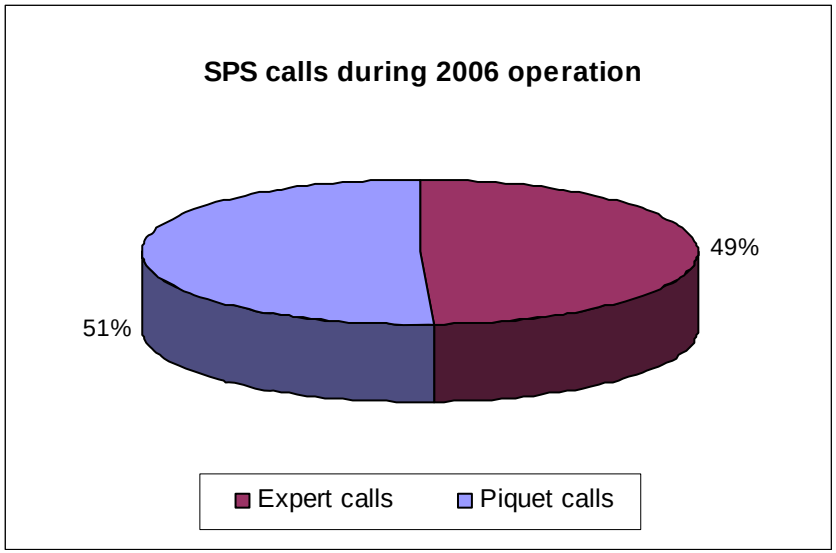
PS interventions 2006 (ii)

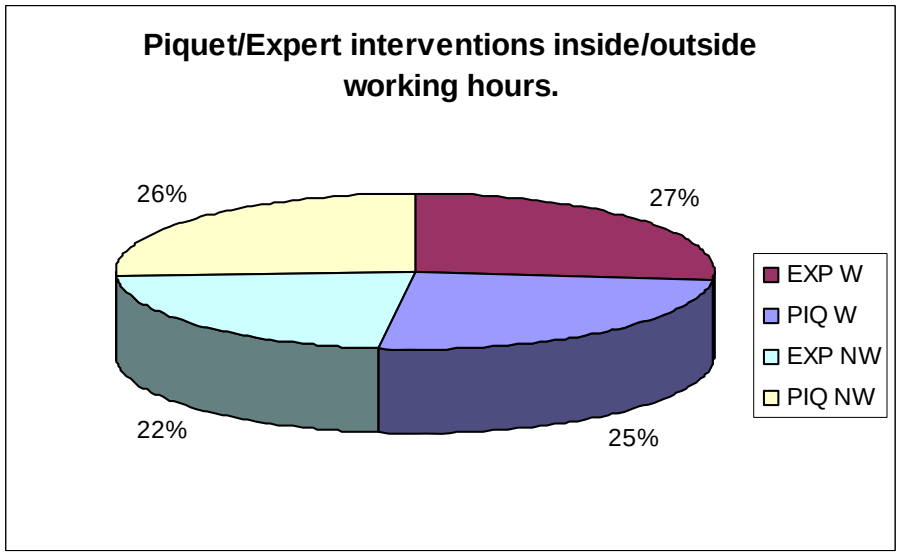




- PO & CO most important Piquet services, in addition frequent specialist interventions
  - Average intervention time 75 min PO, 80 min CO (from call to end intervention)
- Piquet RF LL rarely called (same service as PSB, new still training phase)
  - strong reliance on LL expert (PSS), a lot of “preventive” activities
- BI experts: fewer calls than for PSB (no front end renovation in 2006)
  - Again instrumentation and expert support will be more critical for LHC beams
  - Only single expert for several systems
- BT expert service: mainly kicker problems, all interventions beam critical, expert availability during nights/WE to be assured.
- RF HL (10 MHz, 20, 40, 80 MHz) expert availability to be assured for LHC beams

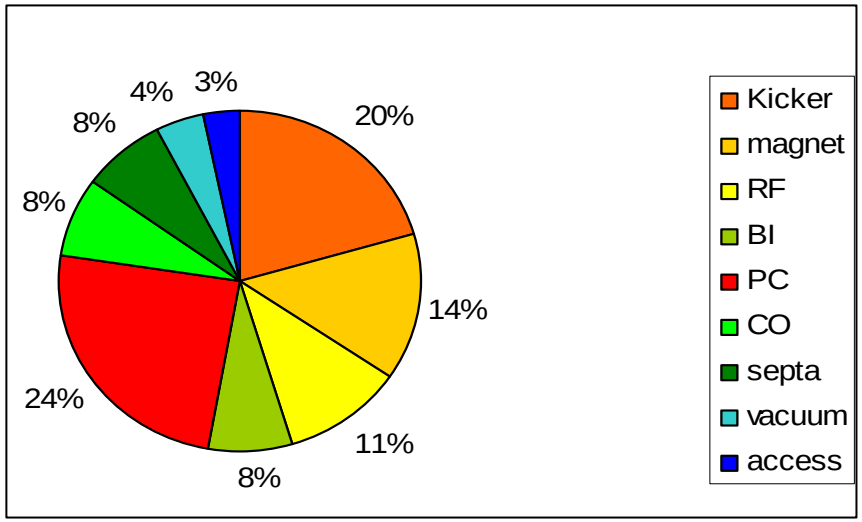
SPS interventions 2006 (i)

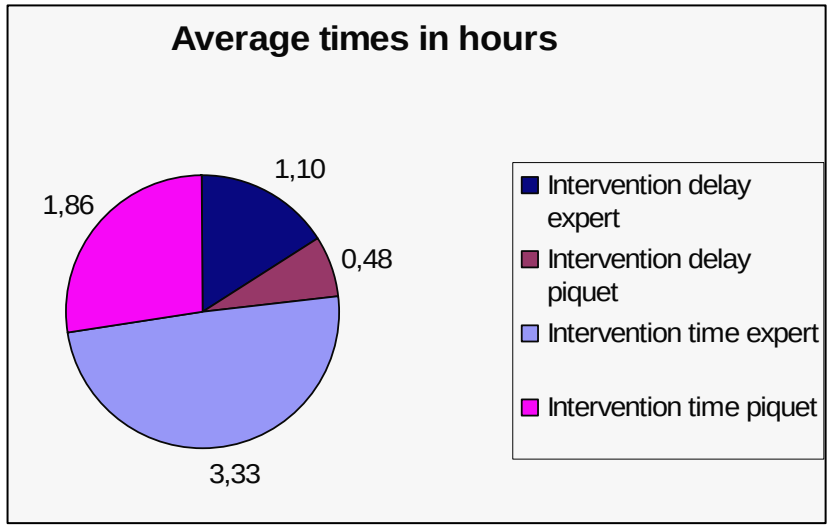




- 26/07/2006 to 20/11/2006 (representative for “normal” SPS running)
  - Equal distribution of piquet and expert interventions
  - 55 piquet interventions and 53 specialist interventions
  - Average 0,93 interventions per day
  - 52% inside working hours, 48% nights and WE
  - Slightly more piquet than expert interventions outside working hours

SPS interventions 2006 (ii)





- More even distribution of interventions than for PS complex
  - Kickers are organized as piquet service (in contrast to PS complex)
  - Magnet service relies on few experts, availability not guaranteed
  - Piquet RF LL requires often expert support
  - CO expert service does not cover timing sufficiently
- Intervention times
  - Delay time 0,5 hours for piquet, 1 hour for experts
  - Expert interventions longer (more complex problems) than piquet interventions

Non-covered or not well defined areas

- B-train systems
  - PSB, PS, SPS, AD, LEIR –
    - Critical for PS (MPS closed loop, RF beam control) and
    - Critical for SPS (RF beam control)
  - Mixed responsibility AT/MTM, AB/RF, AB/PO, AB/CO
- PS complex BI – CO front end responsibility
  - Linac2/PSB position and intensity instrument renovation 2006
    - Unclear definition of responsibilities between piquet CO and BI experts
    - No tools for operations to diagnose side of problem (see statistic PSB)
- SPS
  - CO support for timing problems
- PS complex magnet interlocks
  - AB/CO, AT/MEL, AB/ABP
- PS complex water connections to magnets
  - AT/MEL, AB/ABP

Requirements for large scale interventions

- Interventions taking from few hours to few days
  - Duration such that acting on a weekend (during day time) could give an important saving in overall downtime.
  - Example: SPS magnet replacement (but not PS rotating machine problem)
  - These interventions usually require many different services
  - Relaxed intervention time (few hours)

- Required Services
  - RP, Power, Vacuum, Access -> Piquet service already available
  - Geometers, Magnet, (special) Welding, Transport, Crane -> no Piquet foreseen

- Strategy
  - Hopefully only rare problems in this category (on weekends)
  - ALL services needed (piquet - type) to ensure possibility of repair
  - Risk analysis and cost – benefit comparison not evident
    - LHC running cost per day?…
    - Managerial decision needed

TS general services relevant for operation

- TS/EL
  - In-house piquet service (fully satisfying)
  - 2nd level piquet service (engineers) was foreseen after general power problem but not yet available
- TS/CV
  - both CERN staff and contractor piquet + expert service for CV controls
    - CERN staff piquet, good service
    - Contractor, new firm still learning the systems
    - Expert service, acceptable service, but less available than piquet
- TS/CSE Access
  - Good service, only observation is reliance on single expert for SPS
- OP viewpoint
  - TS general services for machine operation fulfil requirements
  - 2nd level piquet (EL) should be available for LHC era

Preliminary recommendations and plans

- Existing Piquet services
  - CO PS complex: important service (together with PO)
    - Unclear responsibilities after BI FE renovation in PSB -> need for clear defintions agreed by all parties -> need for diagnostic tools for OP to identify problem
    - Possible extension to cover also SPS timing?
  - LL RF piquets on all machines –> effectiveness should be reviewed
  - All other services should be maintained with present performance
- Expert services and coverage of beam critical systems
  - Kickers (PS) and Septa, Magnets, HL RF (PSB, PS) : review availability of experts within present services for guaranteed coverage
    - Number of expert layers per equipment (e.g. BT for PS complex)
  - Review BI services with LHC beam diagnostic requirements in mind
  - All expert services should be maintained
- Analysis of Experimental areas, AD, ISOLDE, CTF
- Estimation of requirements for LHC

Conclusions

- Most technical areas on main machines are covered by piquet or expert service
  - Main worry is availability of expert service -> review case by case considering also “hot spare” situation etc.
- Few uncovered or unclear areas have to be sorted
  - Responsibilities must become firmly defined to avoid extra conflicts
- OP study should be complemented with general considerations on organisation of piquet services and department policy