Consolidation of East Area and North Area

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with the input from the groups/IEFC presentations
East Area and North Area

Operational since 1978
6 beam lines – 5.5 km

since 1964
4 beam lines – 0.3 km

North Area complex

Most pieces date from original installation.
Secondary beam areas provide highly flexible beam lines
• In the energy range GeV to 100 GeV/charge
• Hadrons (protons, pions, kaons ...), leptons (electrons, muons), ions (primary and fragments)

reliable and stable operation required for optimum use of the injector chain and experimental areas
• Frequent change of beam tunes: every couple of hours
• Change of user configurations on a weekly basis
• All beam lines run in parallel

<table>
<thead>
<tr>
<th>East Area</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experiments</td>
<td>1</td>
</tr>
<tr>
<td>Test beams</td>
<td>48</td>
</tr>
</tbody>
</table>
Systems/Groups

Infrastructure
• Civil engineering (GS-SE)
• Electrical infrastructure (EN-EL)
• Cooling and ventilation (EN-CV)
• Heavy handling (EN-HE)
• Safety systems of general infrastructure (GS-ASE)
• SBA infrastructure (EN-MEF)
• Cryogenics (TE-CRG)
• Pulsed network (EN/EL)

Beam related items
• Warm magnets (TE-MSC)
• Power converters (TE-EPC)
• Machine protection (TE-MPE)
• Intercepting devices (EN-STI)
• SBA beam elements (EN-MEF)
• Instrumentation (BE-BI)
• Radiation protection (DGS-RP)
• Controls (BE-CO)

Impact at distance
Valuable contributions of MME, ICE, ABP, RF, BTS, VSC are not detailed.

Consolidation should take into account future upgrades/changes, e.g.:
• EHN1 extension
• Power saving/delestage
• Comply with updated safety rules
Color coding of priority

considering impact on operation including safety

- Required to effectively operate the machine, not approved ❌
- Required to effectively operate the machine, approved ✓
- Lower priority
- Not in consolidation budget (other)
Infrastructure
Infrastructure (1)

STRUCTURAL

- Building structures
  - Particularly roofs, weakest being the EHN1 roof (2.2 MCHF), others (1.5 MCHF)

- EHN1 internal structures (1 MCHF)
  - Refurbish counting rooms
  - Raised floor: common tile size out of standard (500 mm ↔ 600 mm)
  - Conformity of staircases

- Remove permanent work places: work shop, control rooms

- Parking space
  - several ten users with cars during 24/7 operation
  - partially taken by new buildings (e.g. truck garage, temporary buildings)

Comply with updated safety rules
Infrastructure (2)

OPERATIONAL/PROCEDURAL

• Heavy handling (2 MCHF)
  • Cranes (up to 70 tons capacity) et al. (trucks, fork lifts, transpalette) are essential for the daily installation/operation (not only repairs).

• Access restrictions to underground galleries (400 kCHF)

• Lock system of control huts and fenced areas for storage (40 kCHF)

• Documentation
  • Safety folder (300 kCHF)
  • drawing model (150 kCHF)

• Removing widower material (left overs, semi-permanent storage)
• Removing obsolete cabling (a few hundred kChF)
Infrastructure (3)

SUPPLIES

Gas storage and distribution
- Renovation (1.5 MCHF)

Demineralised water supply (2 MCHF)

Ventilation (5 MCHF)
- Ventilations of BA80-82, caverns and transfer tunnels
- Replace NA62 ventilation

Chilled water piping continuously replaced until 2017 (2 MCHF)

Cryogenics:
- EHN1: 0.8 MCHF
- NA62: 0.2 MCHF
- Controls North Area: 0.7 MCHF
- storage: 0.5 MCHF
Electric infrastructure

Replace old installations achieving a reliable operation minimising the safety hazard

- Worn out cables
- Outdated equipment
- PLC systems, AUG, 48V

HV network for North Area (3.9 MCHF)

LV consolidation (5.9 MCHF)

Take into account the future requests of additional installations.
General safety

Requires safety documentation for coherent approach

- Common approach to safety alarm systems of general infrastructure
  - Gas detection (flammable)
  - ODH detection
  - Fire/smoke detection
  - Alarms

- Access safety systems

2.0 MCHF
Beam related items
NC magnets

<table>
<thead>
<tr>
<th></th>
<th># converters</th>
<th>Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>East Area</td>
<td>50</td>
<td>~50 years</td>
</tr>
<tr>
<td>North Area</td>
<td>420</td>
<td>~35 years</td>
</tr>
</tbody>
</table>

- Provide easier access (East Area)
- Refurbish magnets (East Area)
- Consolidation of the interlock wiring (North Area), 450 kCHF
- Replace magnets with solid yoke by laminated ones (North Area)
- Establish IPx conformity: protective covers
- Zero-field detection system (safety element) to be replaced
- Define responsibility for DC cabling from power converters to magnets

- Machine Interlock Systems
  - WIC: 1300 kCHF
  - BIS not foreseen, but possible
Power converters

• At the present stage, the reliability of the power converters is just acceptable.

• High age suggest further degradation to be expected.

<table>
<thead>
<tr>
<th></th>
<th># converters</th>
<th>Age</th>
<th>Budget</th>
</tr>
</thead>
<tbody>
<tr>
<td>East Area</td>
<td>30</td>
<td>~50 years</td>
<td>4 MCHF</td>
</tr>
<tr>
<td>North Area</td>
<td>270</td>
<td>~35 years</td>
<td>20 MCHF</td>
</tr>
</tbody>
</table>

• At least 5 years lead-time to installation.
Beam instrumentation

Essential for beam operation like the experiments

- TBIU/TBID renovation (North Area): 0.2 MCHF
- Consolidation of electronics (500kCHF)
- Consolidation of MWPC (profile chambers): 200 kCHF
SBA beam elements

- **Vacuum** (750 kCHF)
  - Controls and hardware: shared responsibility between TE-VSC, EN-ICE and EN-MEF

- **Lifting and scanning tables** (350 kCHF)

- **Mechanics of the beam instrumentation** (0.3 MCHF)

- **Remove obsolete cabling** (few 0.1 MCHF)
- **EHN1 already free from ring network (LAN)**

**shared responsibility between STI and MEF:**
- **Intercepting devices**
  - **North Area:**
    - Mechanics (MEF, 1 MCHF)
    - Controls (STI)
  - **East Area:**
    - Replace 2-jaw collimators (East) 0.8 MCHF
    - controls (STI)

- **TCC2/TDC2 consolidation completed in 2013/14 (2 MCHF)**
Controls

• Beam control software (CESAR)
• Public Address

Radiation Protection

• Radiation monitoring
  • East Area
  • North Area (1.5 MCHF)
Summary report

- Including a risk assessment and budgeting

- Written report on consolidation and renovation analysis for East and North area is due by end of this year.
Coordinated consolidation for linked system

- Power converters
  - Require consolidation maintaining reliability
- NC magnets
  - Partially operated in DC mode, swap to pulsed
- Electrical network
  - Adapt layout to changed consumption
- Machine protection system
  - In parallel with PC consolidation
- Demineralised water
  - Adapt layout to changed consumption

- With these systems being directly linked it suggests an overall project coordination.
Final remarks

• About 100 MCHF in total

• A large fraction is directly related to power converter/magnet systems
  • require a long lead-time until installation

• Successfully consolidated high priority items in TCC2/TDC2.

• After all consolidation, the Experimental Areas should remain as attractive for researchers as they are today.