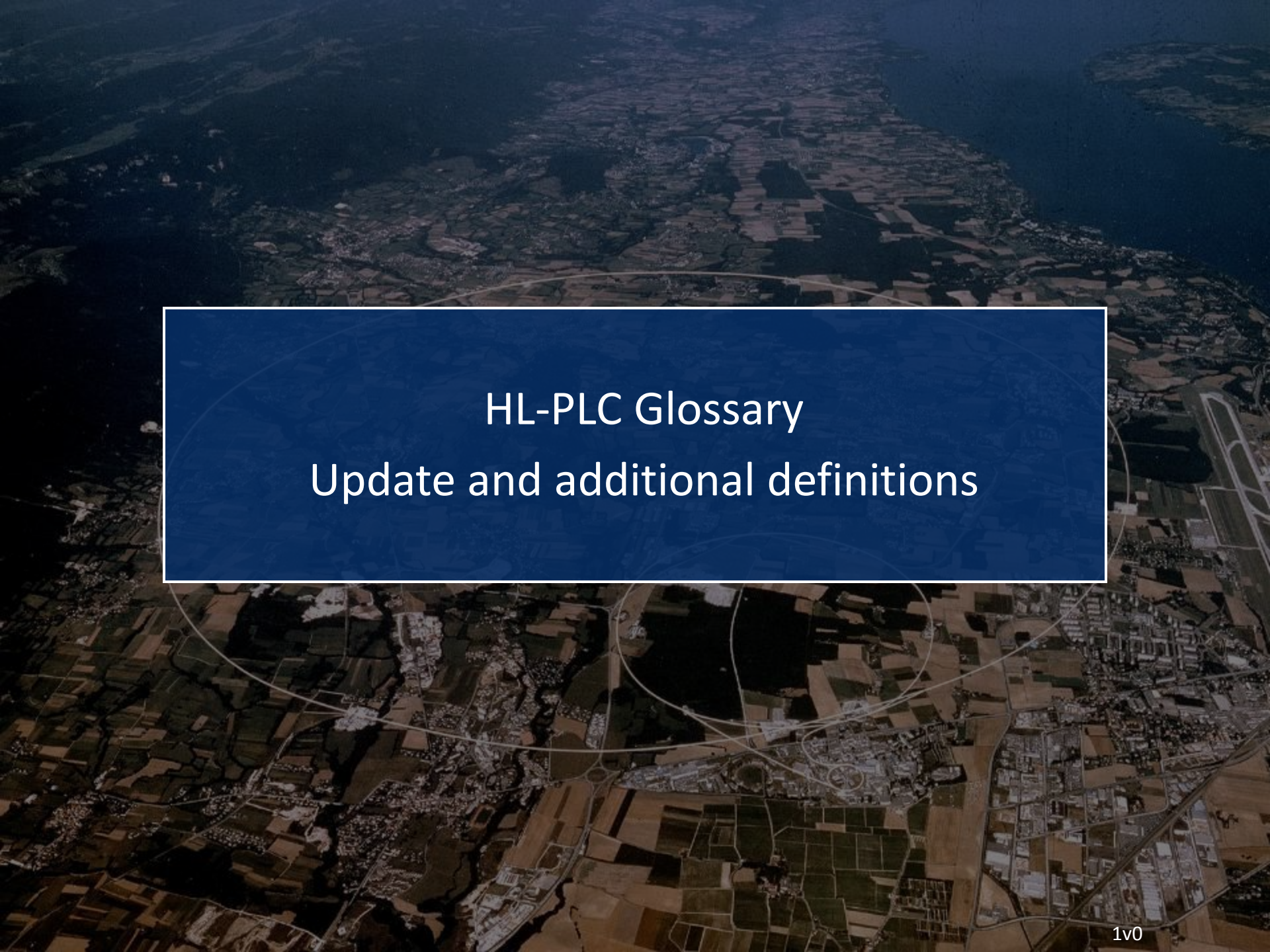


HL-PLC Glossary

Update and additional definitions

1v0

Glossary and Definitions

Glossary and Definitions

β^*:
Optical β-function at the IP.

η:
Machine slip factor.

η_D:
Normalized dispersion: $\eta_D = D/\sqrt{\beta}$, where D is the machine dispersion.

γ:
Optic gamma function: $\gamma(s) = (1 + \alpha^2(s))/\beta(s)$ where $\beta(s)$ is the optical betatron function along the machine and $\alpha(s) = \frac{d\beta}{2\,ds}$.

γ_r:
The relativistic gamma factor.

abort gap:
Area without any bunches in the bunch train that fits the time required for building up the nominal field of the LHC dump kicker.

arc:
The part of the ring occupied by regular half-cells. Each arc contains 46 half cells. The arc does not contain the dispersion suppressor.

arc cell:
It consists of two arc half-cells and presents the basic period of the optic functions.

arc half-cell:
Periodic part of the LHC arc lattice. Each half-cell consists of a string of three twin aperture main dipole magnets and one short straight section. The cryo magnets of all arc half-cells follow the same orientation with the dipole lead end pointing upstream of Beam 1 (downstream of Beam 2).

batch:

PS batch:
Train of 72 bunches that is injected into the SPS in one PS to SPS transfer.

SPS batch:
Train of 4 × 72 or 3 × 72 bunches that is injected into the LHC in one SPS to LHC transfer.

Beam 1 and Beam 2:
Beam 1 and Beam 2 refer to the two LHC beams. Beam 1 circulates clockwise in Ring 1 and Beam 2 circulates counter clockwise in Ring 2. If colors are used for

HL-PLC Glossary & Definitions based on LHC Design report:

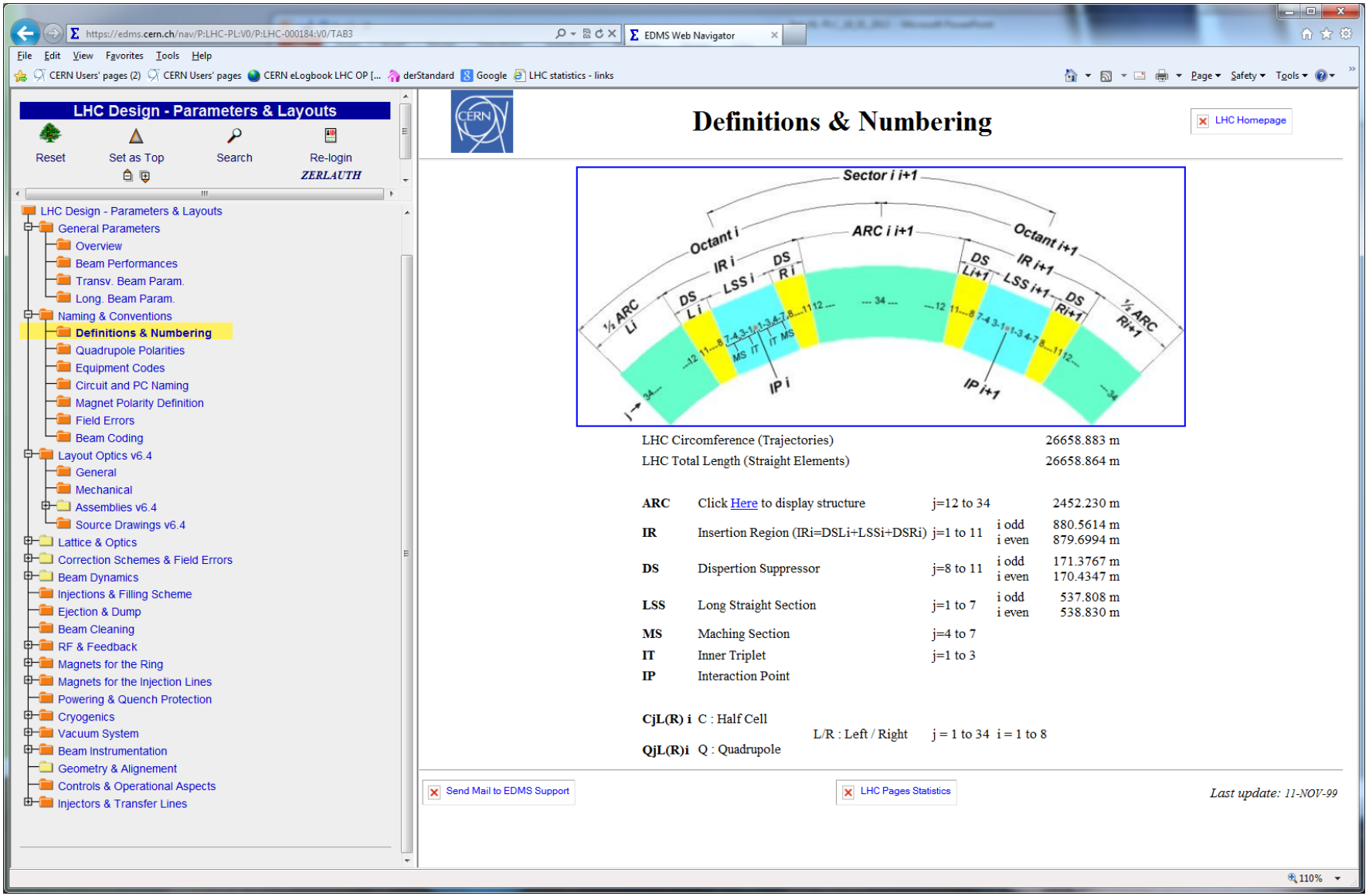
https://espace.cern.ch/HiLumi/PLC/SiteAssets/LHC_Glossary_high_resolution.pdf

Progressing HL-LHC Design (and future operation) requires maintenance/extension of glossary and definitions to ensure coherence across activities + prepare future integration into existing Layout Database

Discussion started to revisit existing EDMS Structure & Baseline and build-up an HL-LHC branch for archiving of HL-LHC related data

Detailed presentation of existing EDMS Structure, Layout DB,… for next PLC meeting (March)

Using consistent definitions – an example



Additional definitions – 1/6

- Event pile-up:

  Number of inelastic proton-proton interactions in a given bunch crossing

- Average pile-up:

  Mean value of the pile-up over a fill (averaged over all bunch crossings)

- Peak pile-up:

  Maximum pile-up in any bunch crossing at any time (usually at the start of the fill)

Courtsey F.Gianotti

Additional definitions - 2/6

- Peak average pile-up:

  Mean pile-up at the beginning of the fill. It corresponds to the peak luminosity of the fill. In practice, it is determined as the maximum of the pile-up values obtained by averaging over all bunch crossings within time intervals of typically one minute

- Luminous region:

  The 3-dimensional distribution of the collision event vertices

- Average pile-up density:

  Number of inelastic proton-proton interactions in a given bunch-crossing divided by the size of the luminous region in Z

Courtsey F.Gianotti

Additional definitions - 3/6

- Hourglass effect 'H‘:

  Luminosity loss due to longitudinal modulation of beta function over the length of the bunch for small β*

- Geometric luminosity reduction factor due to beam offset 'R‘:

  Reduced beam overlap due to transversal offset of collisions, frequently used for reduction of luminosity (leveling) and VdM scans

- Luminosity reduction factor due to crossing angle 'S':

  Reduced beam overlap due to tilted bunch shape due to crossing angle

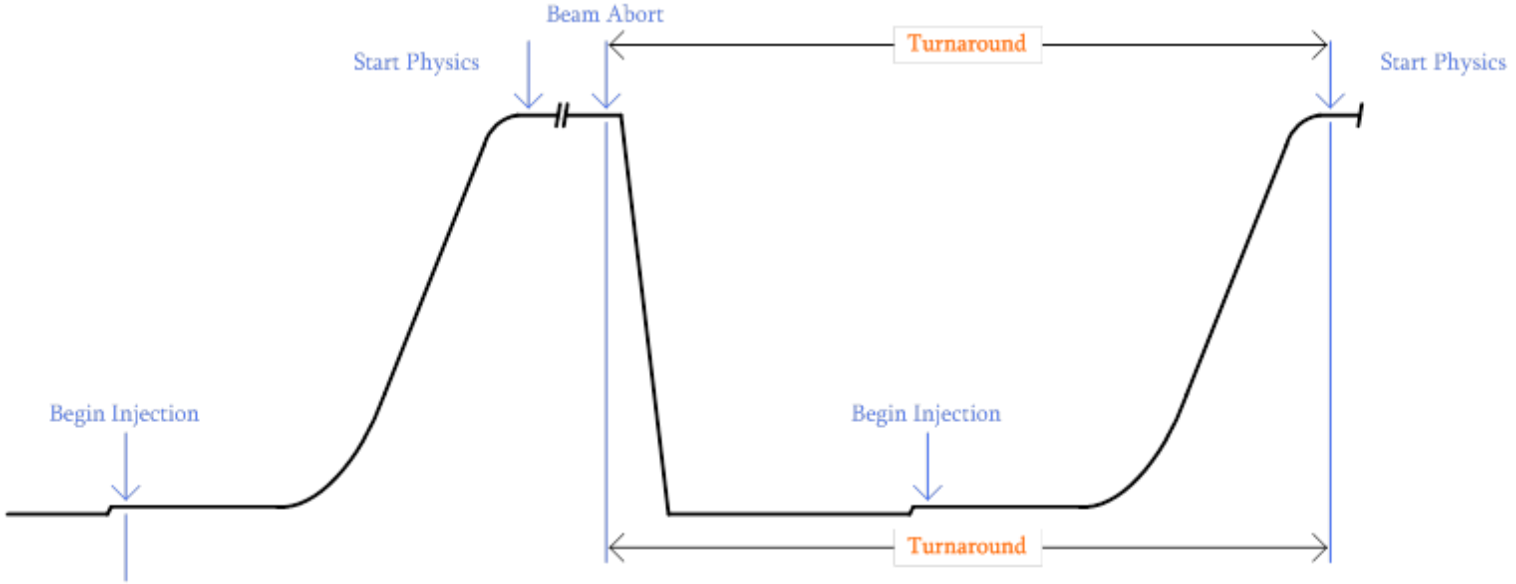
- Total geometric luminosity reduction factor ‘F’ = R*H*S

- Piwinsky parameter: Quantification of reduced beam overlap due to finite crossing-angle

Additional definitions - 4/6

- Turnaround time [h]:

  Time between the end of one and the start of the next physics run / data taking by the experiments (delimited by the loss of beam presence/beam dump back to declaration of STABLE_BEAMS)

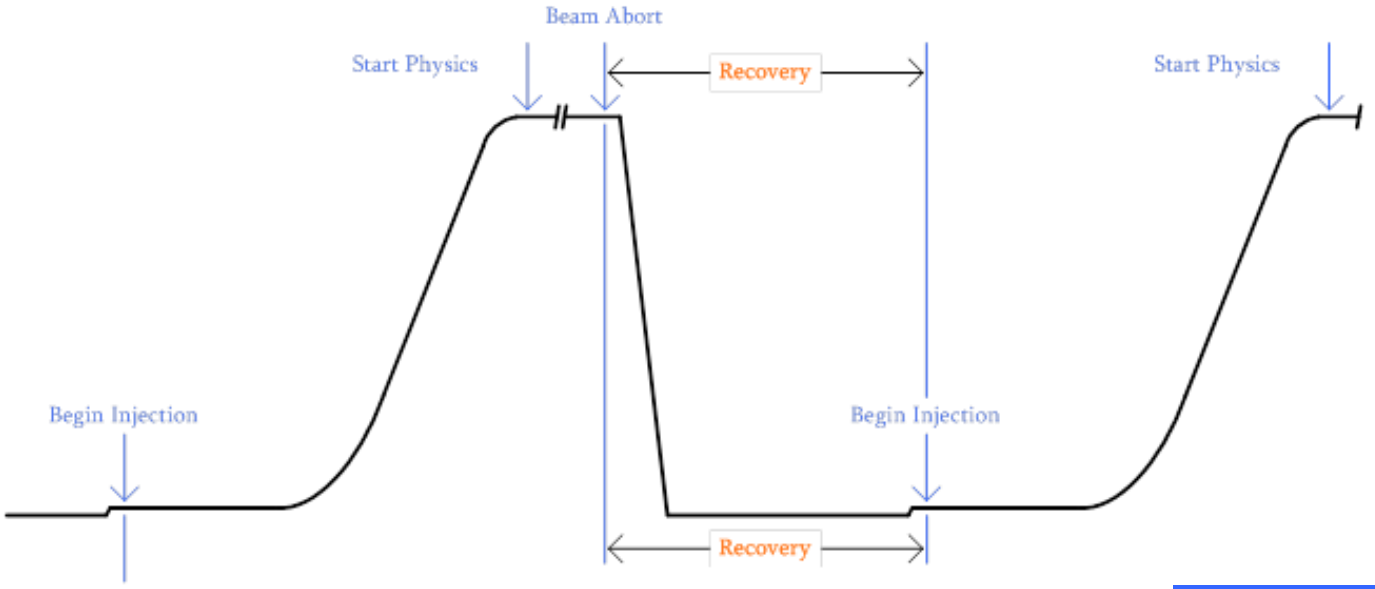


Tbc with OP

Additional definitions - 5/6

- Recovery time [h]:

  Time between the end of one and the readiness for injection of new particles of the next (delimited by the loss of beam presence/beam dump and resuming of the normal operational cycle)



Tbc with OP

Additional definitions - 6/6

- Turnaround time [h]:

  Time between the end of one and the start of the next physics run / data taking by the experiments (delimited by the loss of beam presence/beam dump back to declaration of STABLE_BEAMS)

- Machine efficiency [%]:

  Fraction of calendar time spent in physics operation / data taking (ie the time spent in STABLE_BEAMS)

- Machine availability [%]:

  Fraction of calendar time in which the machine is ready to perform the foreseen physics program and accept / accelerate particles

Tbc with OP

How machine availability is currently defined

- Definition of machine availabiltiy requires to clearly delineate normal operational cycle from faults, downtime, technical stops etc. Currently, broken down into three numbers:
  - Availability defined as all the time with at least a pilot injected, and the machine executing the normal operational cycle (note the fill number changes at the start of the ramp down, so the ramp down is not included.
  - Availability defined as all the time with at least a pilot injected, and the machine executing the normal operational cycle, convoluted with a no-faults flag
  - Availability defined as all the time when there is no access to the machine, convoluted with a no-faults flag. This then includes setup time.
- Should one add/define as well down time?

Fin