Secondary Beams provided to the Experiments

Beamline for Schools 2022

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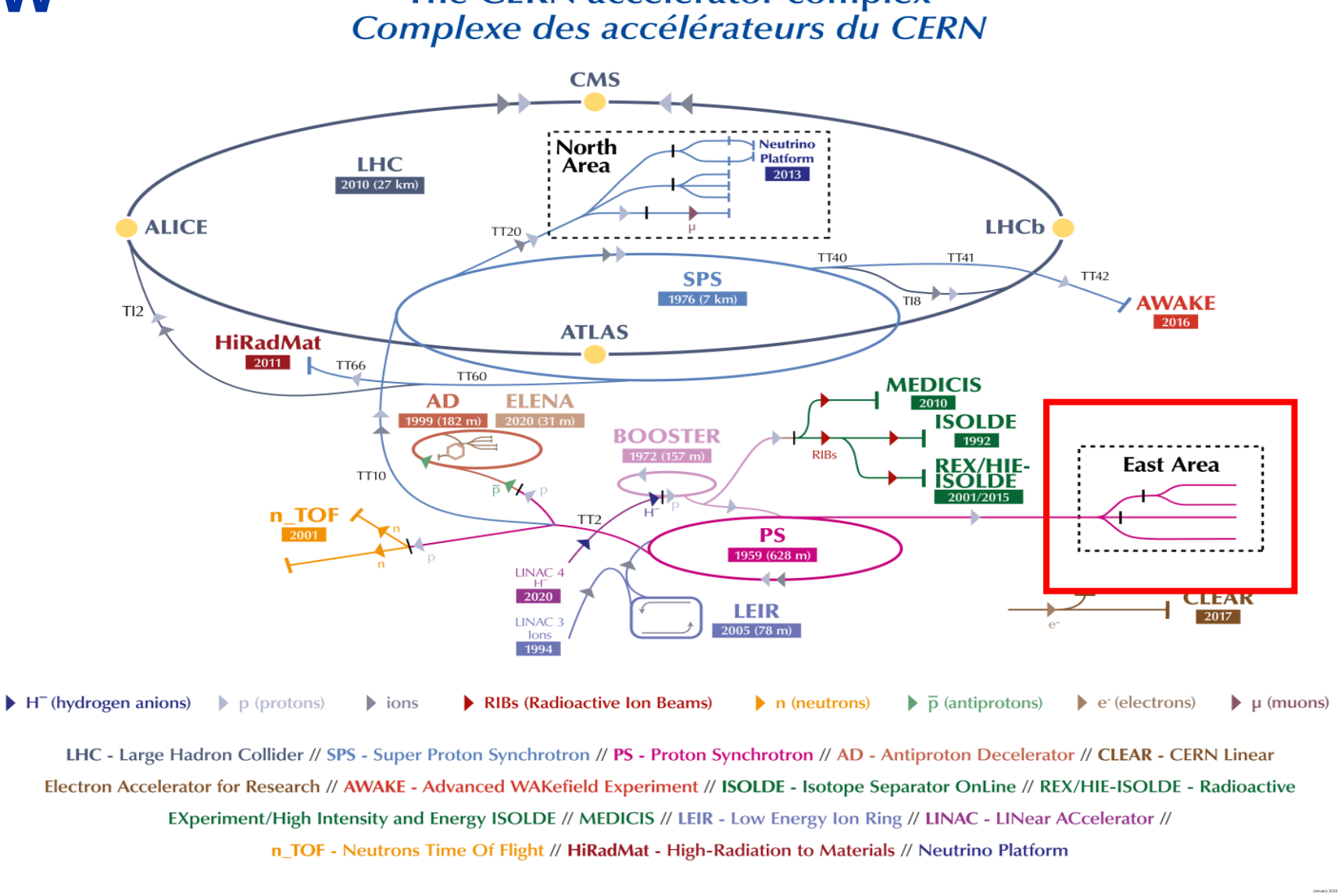
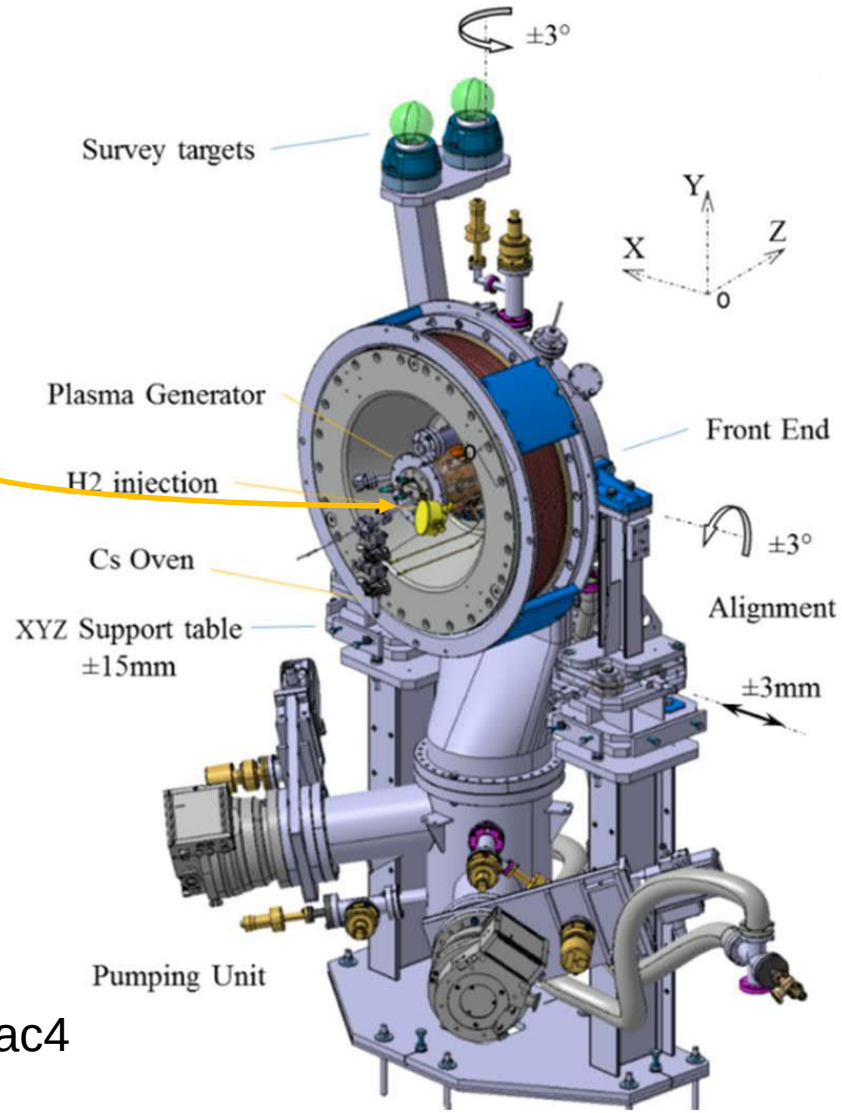
Date: 24.09.2022

Overview

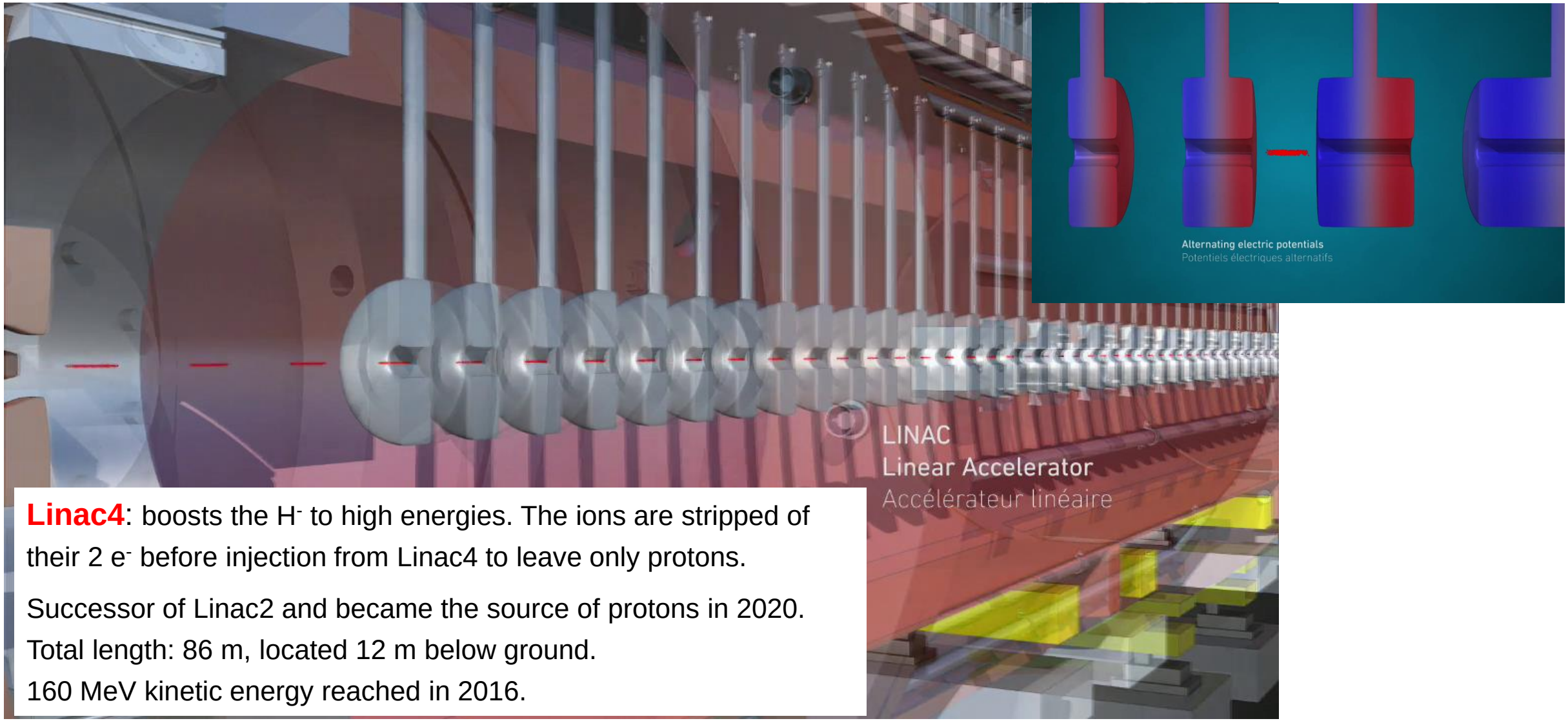

The CERN accelerator complex
Complexe des accélérateurs du CERN
CMS
LHC
2010 (27 km)
North Area
Neutrino Platform
2013
ALICE
LHCb
TT20
TT40
TT41
TT42
SPS
1976 (7 km)
TI8
AWAKE
2016
TI2
HiRadMat
2011
TT66
TT60
ATLAS
MEDICIS
2010
AD
1999 (182 m)
ELENA
2020 (31 m)
ISOLDE
1992
BOOSTER
1972 (157 m)
RIBs
REX/HIE-ISOLDE
2001/2015
East Area
TT10
n_TOF
2001
TT2
PS
1959 (628 m)
LINAC 4
2020
LINAC 3
Ions
1994
LEIR
2005 (78 m)
CLEAR
2017
H⁻ (hydrogen anions)
p (protons)
ions
RIBs (Radioactive Ion Beams)
n (neutrons)
p̄ (antiprotons)
e⁻ (electrons)
μ (muons)
LHC - Large Hadron Collider // SPS - Super Proton Synchrotron // PS - Proton Synchrotron // AD - Antiproton Decelerator // CLEAR - CERN Linear Electron Accelerator for Research // AWAKE - Advanced WAKefield Experiment // ISOLDE - Isotope Separator OnLine // REX/HIE-ISOLDE - Radioactive EXperiment/High Intensity and Energy ISOLDE // MEDICIS // LEIR - Low Energy Ion Ring // LINAC - LINear ACcelerator // n_TOF - Neutrons Time Of Flight // HiRadMat - High-Radiation to Materials // Neutrino Platform

Where does the beam come from?



H^- ion source for Linac4

Where does the beam come from?



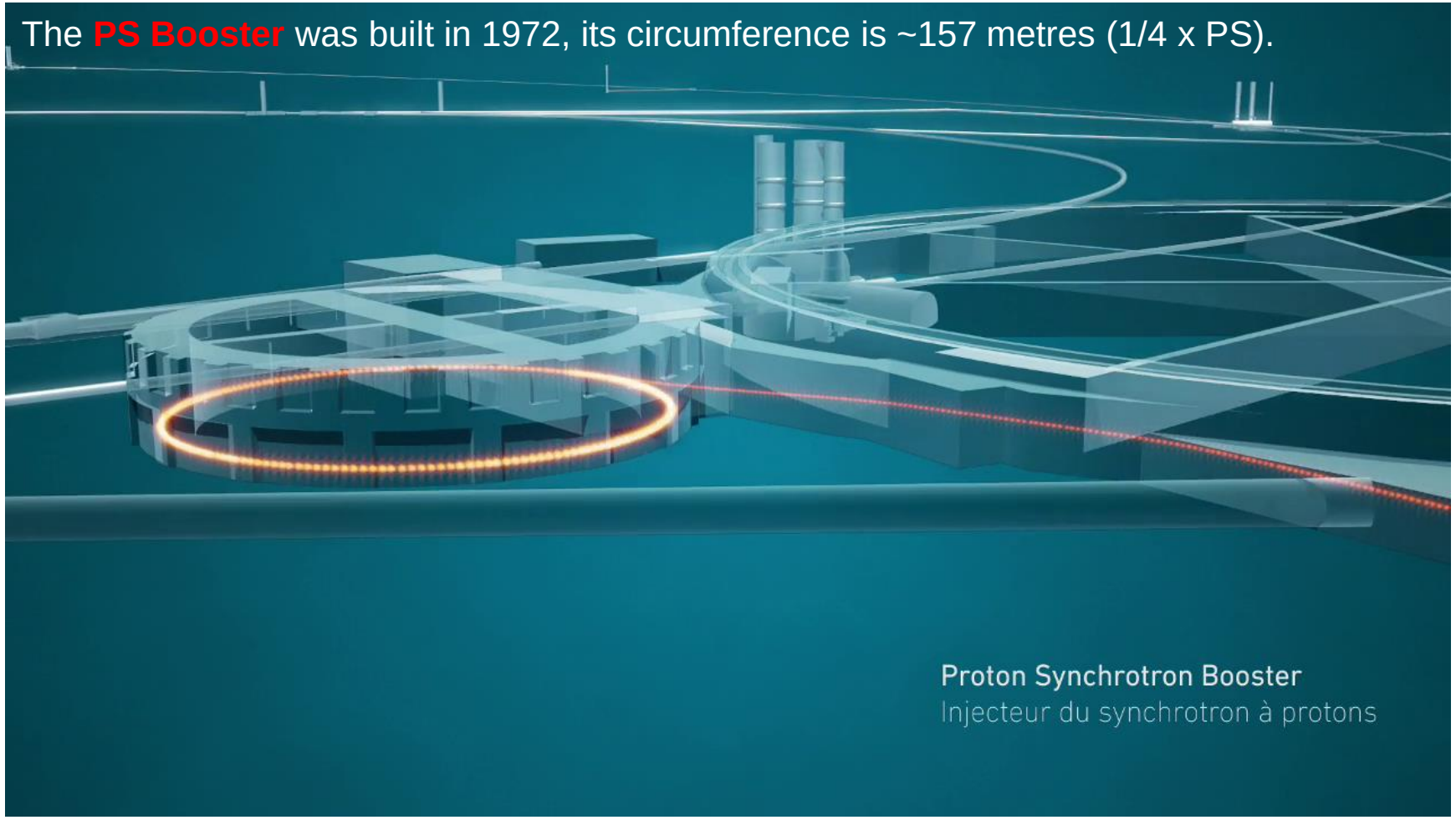
Linac4: boosts the H^- to high energies. The ions are stripped of their 2 e^- before injection from Linac4 to leave only protons.

Successor of Linac2 and became the source of protons in 2020.

Total length: 86 m, located 12 m below ground.

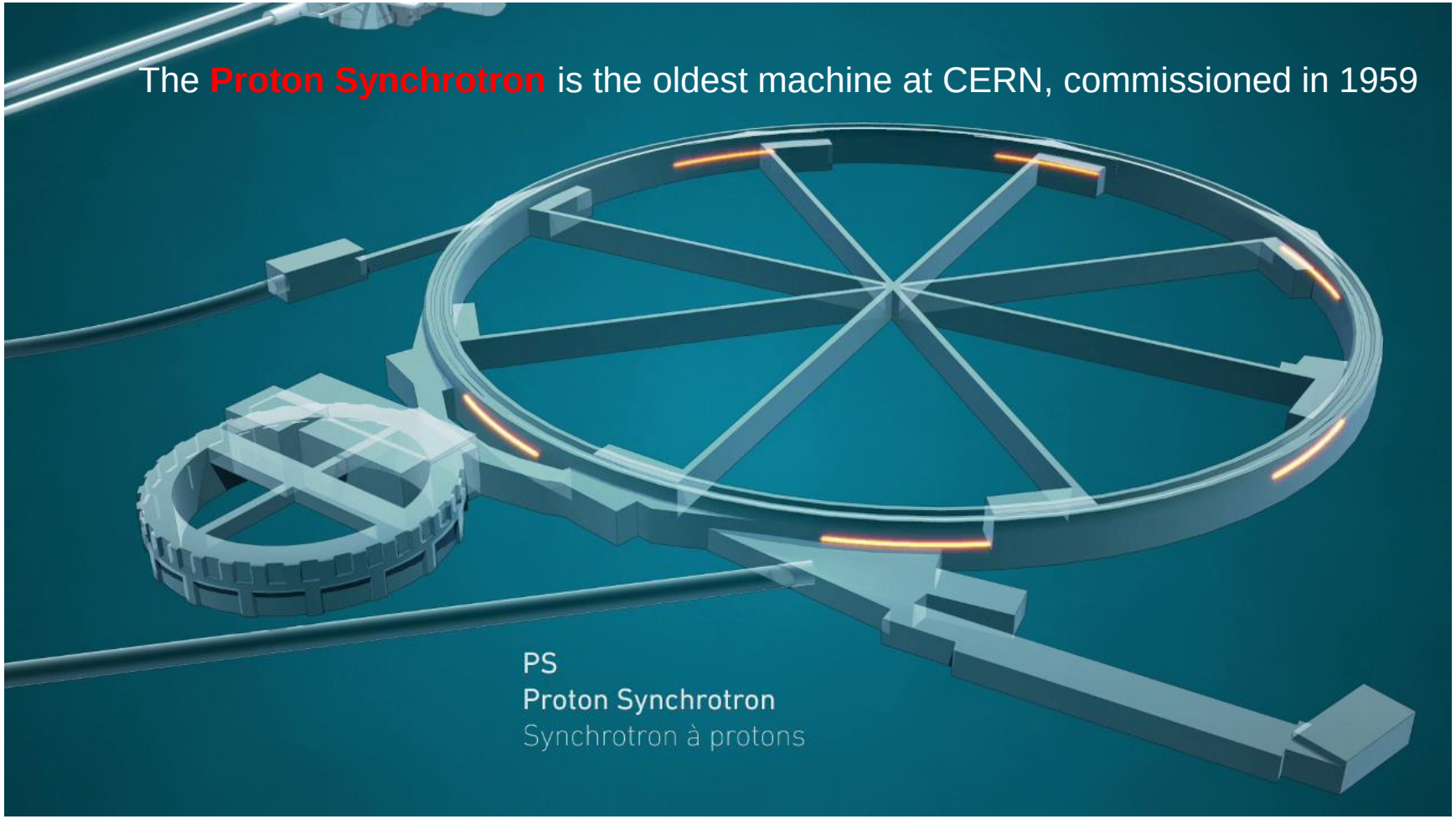
160 MeV kinetic energy reached in 2016.

Where does the beam come from?



- The PSB receives the beam from Linac4 and accelerates it to 2 GeV/c for injection into the PS.
- It consists of 4 parallel rings, which can be operated rather independently, e.g., 1 ring for the East Area and 1 for nTOF.
- The PSB cycle is 1.2 seconds. The intensity spans 4 orders of magnitude, up to 3.2×10^{13}.

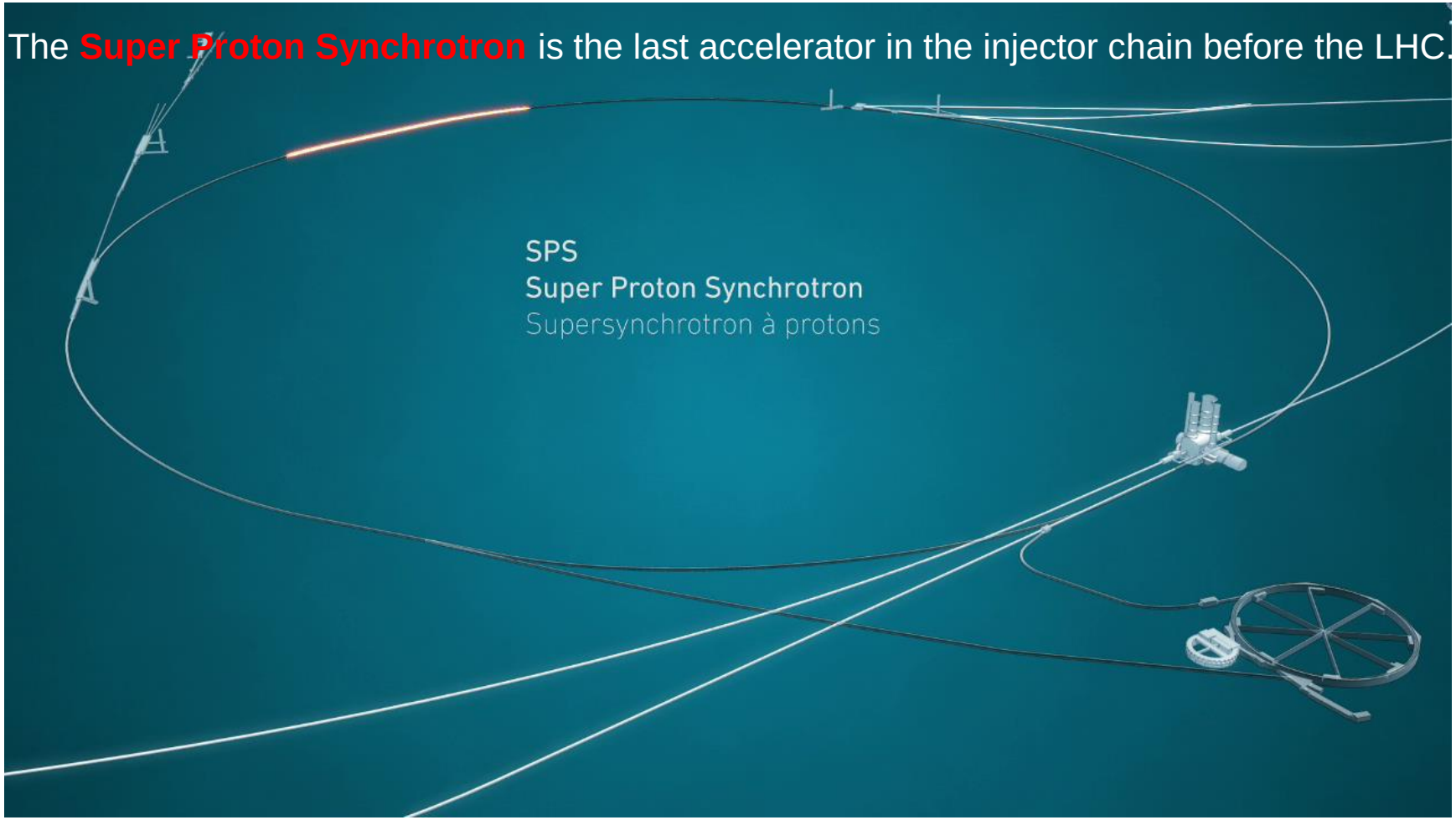
Where does the beam come from?



- The PS is still functioning well and even well beyond its initial specifications.
- The PS has a circumference of ~628 m and is capable to accelerate protons up to 26 GeV/c.
- Contrary to the SPS, the PS has no separate quadrupoles, but it has shaped pole faces and special coils in the main magnet units to provide the focusing. In total there are 100 main magnets and as many straight sections with special function equipment.

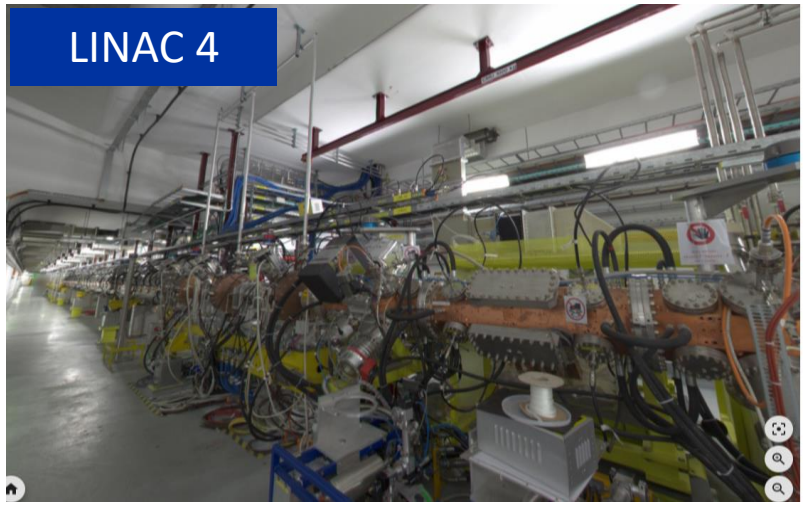
The PS cycle is 1.2 seconds. The PS serves many users, including the SPS North Area, the LHC, the AD, the East Area, nTOF and machine studies.

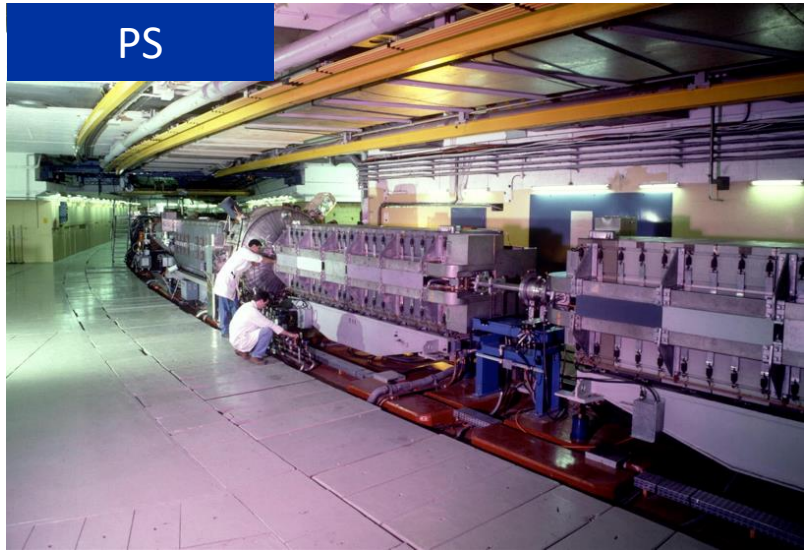
Where does the beam come from?



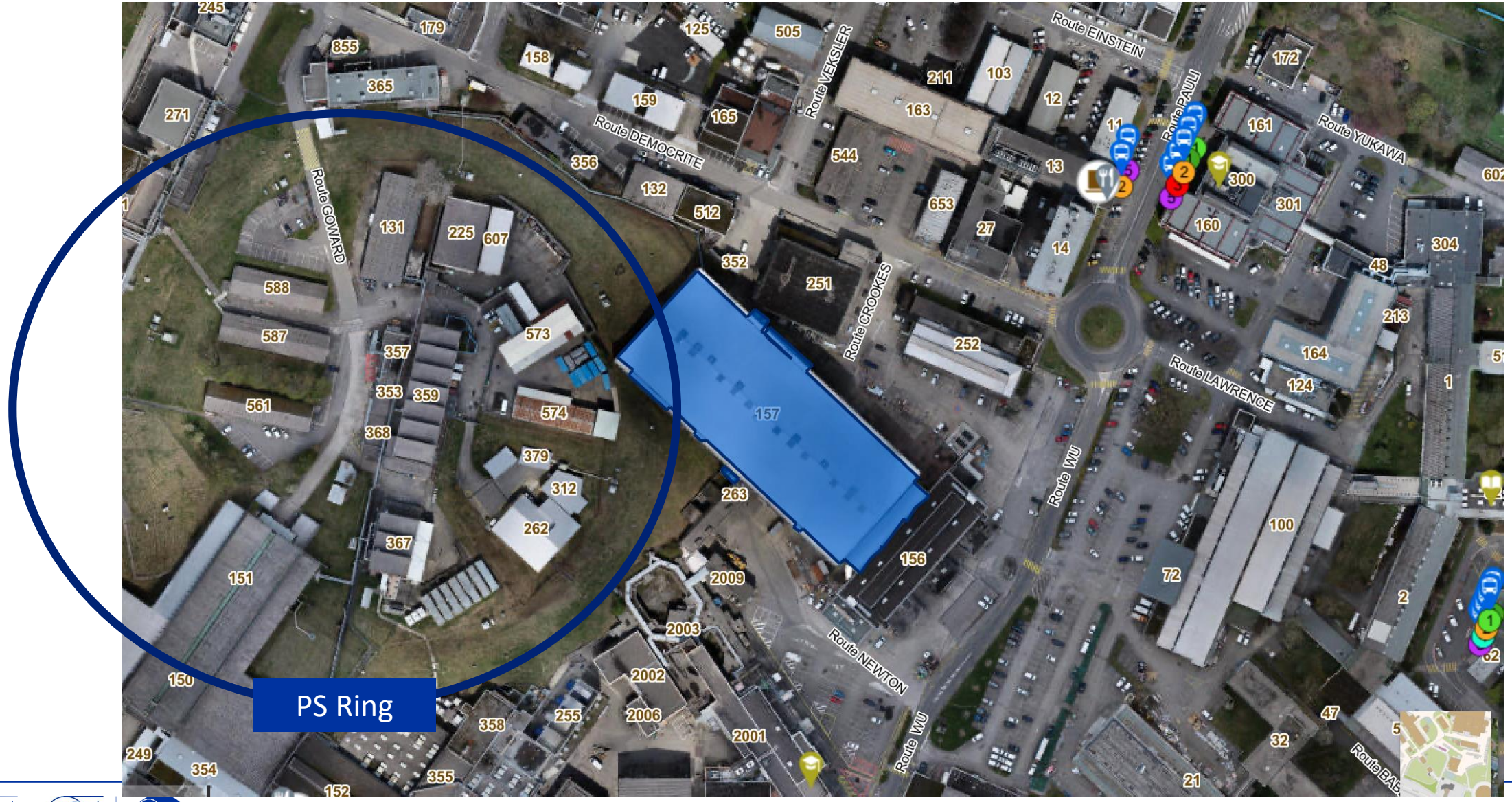
- The SPS commissioning started in 1976, but the North Experimental Area started only in 1978.
- Originally designed for fixed target proton operation at 300 GeV/c, it has operated up to 450 GeV/c for fixed target physics (and LHC filling), but also as a prestigious p-pbar collider (270 GeV/c) and as injector for LEP. It has also served the heavy ion physics programs with various ion species, up to Pb.
- The circumference of the SPS is 11 times the PS: about 6.9 km (t_{rev} = 23 ms).

Some pictures



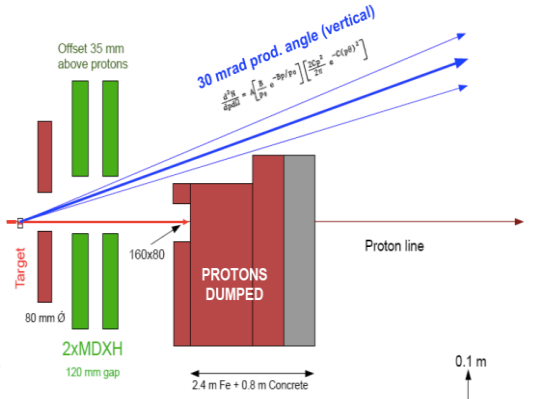


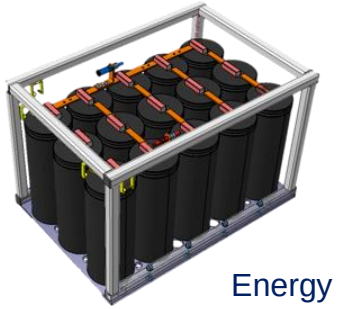
The East Area



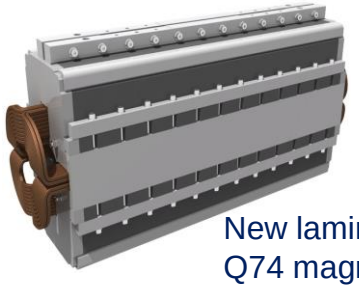
East Area Renovation

- **The East Area Renovation was completed during the LS2.**
- **The renovation included**
  - Full refurbishment of the East Hall with its beamlines and infrastructures
    - Upgrade of B157, its heating/ventilation, improved thermal insulation, wall and roof cladding (asbestos), separated cooling for primary and secondary beamlines.
  - Improved radiation protection.
    - Improved equipment accessibility and faster repair times, primary beam dump just downstream of the primary target.
  - Change in the beamline layout
    - Higher max. p and improved selectivity pf particle types.
  - Completely new magnet powering scheme
    - Cycled powering leading to reduction of annual power consumption from 11 to 0.6 GWh, less magnet types for better maintenance.



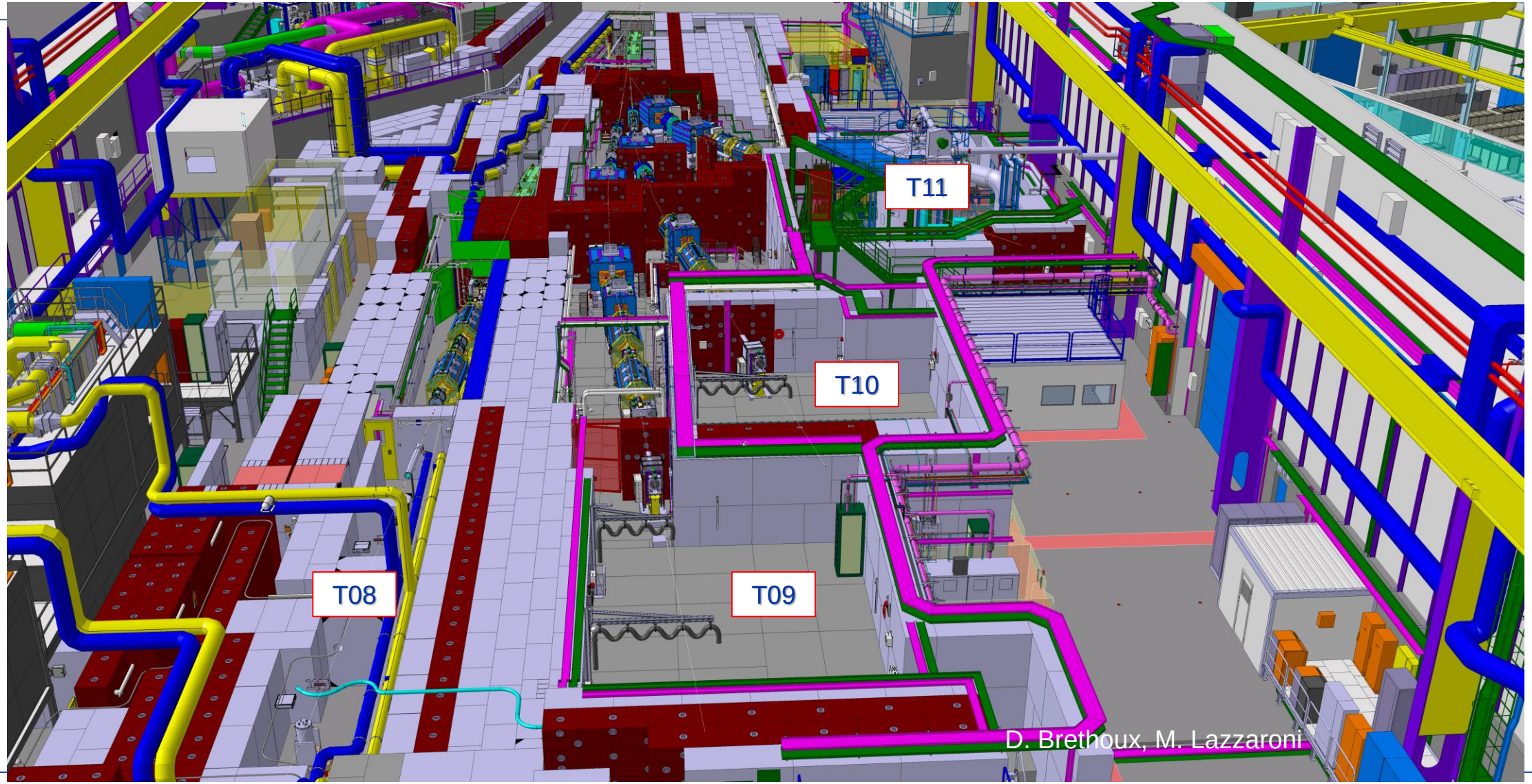


Energy storage unit

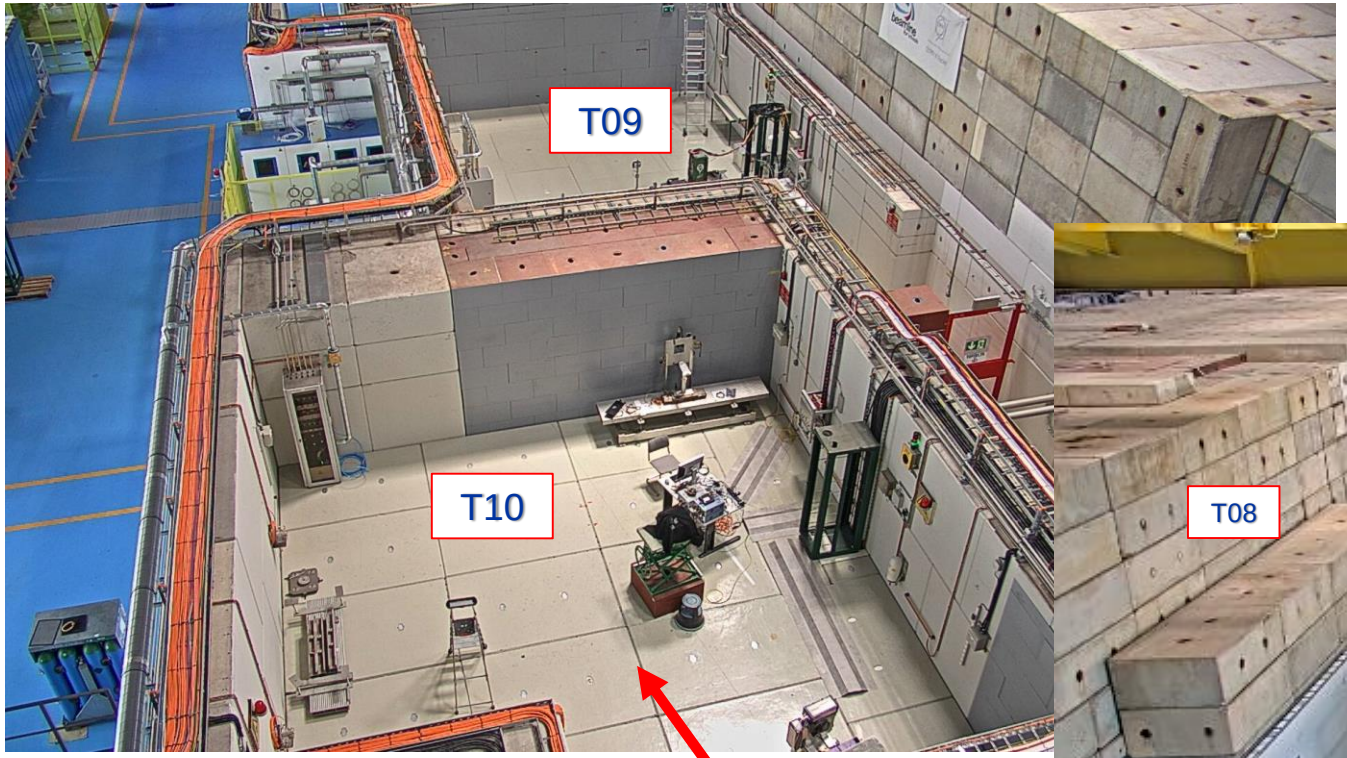


New laminated Q74 magnet

Current Layout

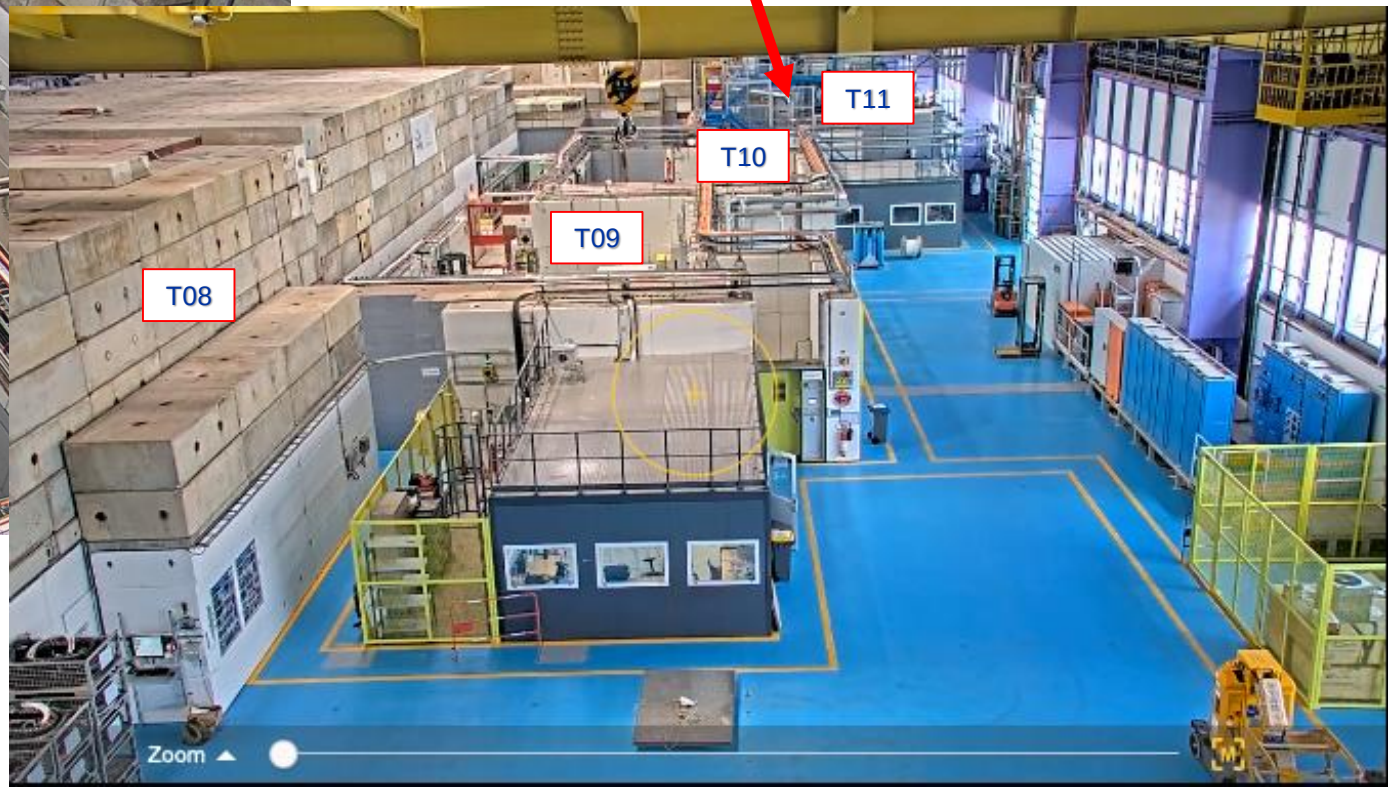


Current Layout

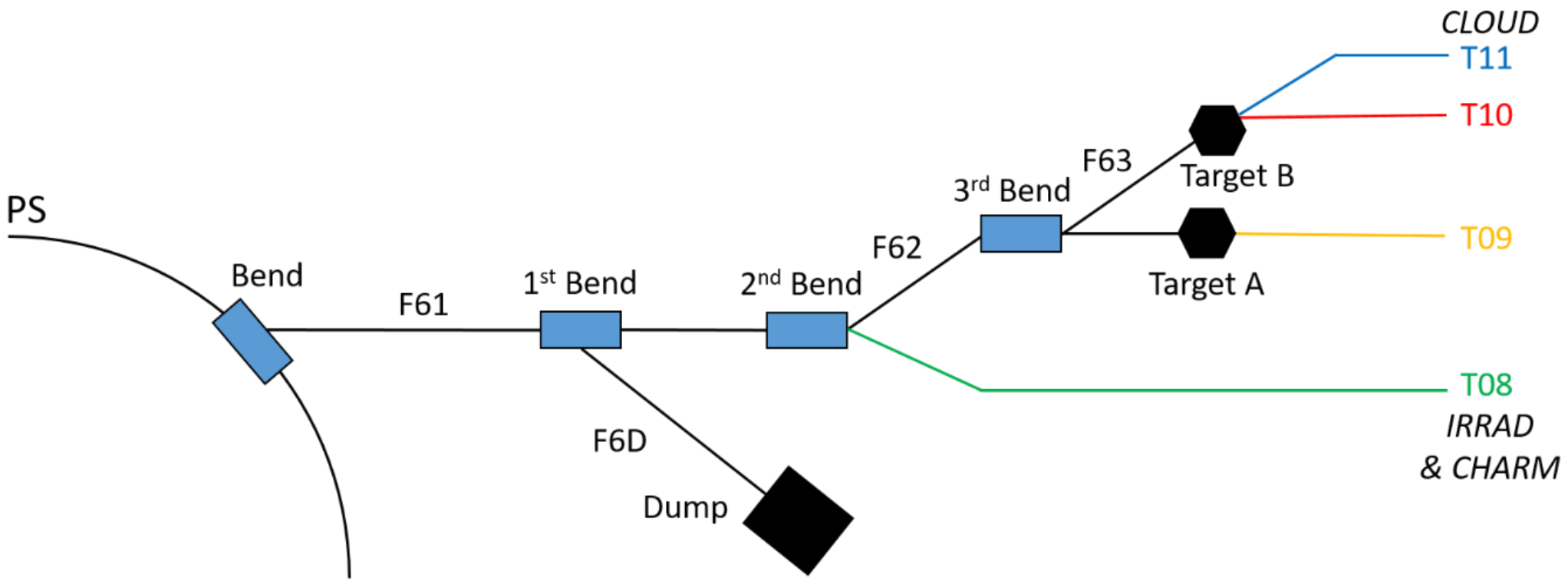


Beam

Beam

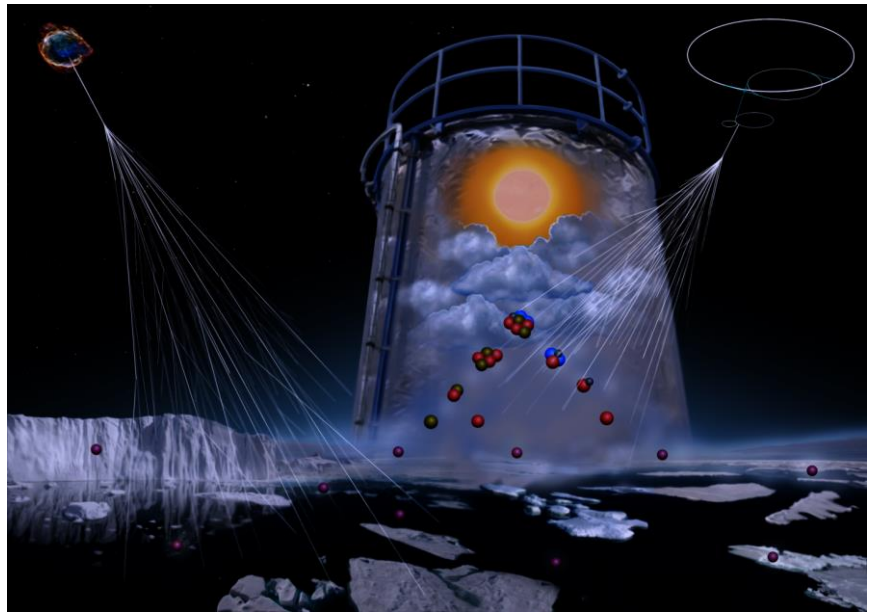


East Area Beams



Experiments: CLOUD

- Studies the influence of cosmic rays to cloud formation
- Cloud expansion chamber set-up with extensive instrumentation (mass spectrometers, particle counters, etc.)
- Uses PS beam as first and only particle beam experiment to study atmospheric and climate science
- Spectacular results achieved (several publications in Nature and Science)

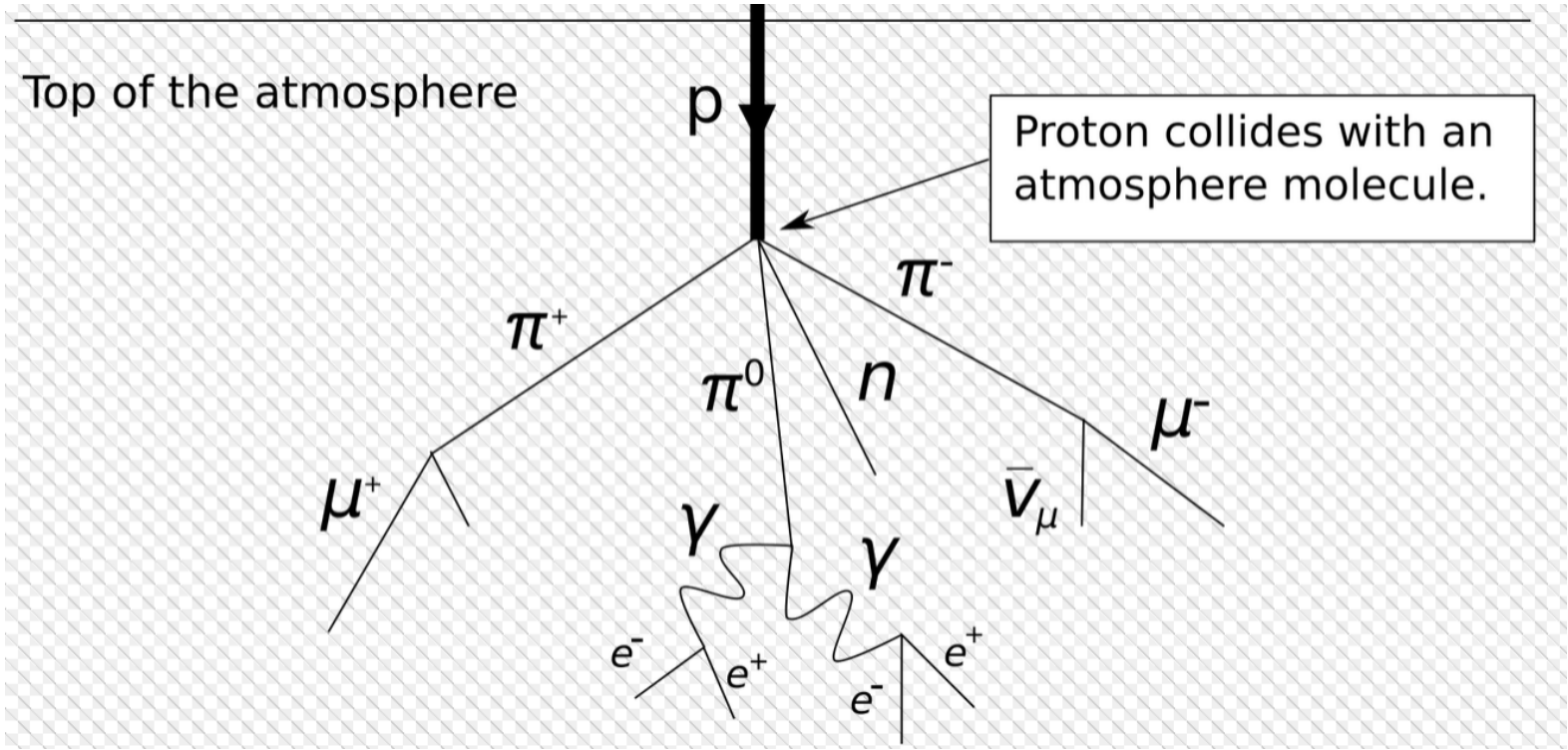


How do we produce a secondary beam ?

Targets and particle production

Principle taken from cosmic radiation

- Primary proton beam initiating hadronic shower
- Always followed by an electro-magnetic shower
- Particles are produced at once in a large momentum range



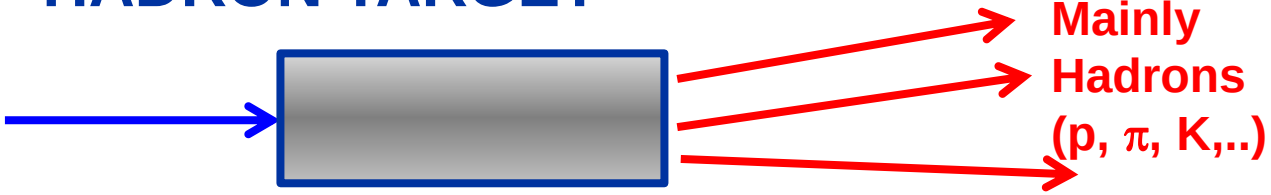
Targets and particle production

		Name		Q	Mass [MeV/c²]	Mean life (τ) [s]		cτ [m]	Mean decay distance [m/GeV/c]	Decays
Leptons		Electron	e	±e	0.511	stable				
Leptons		Muon	μ	±e	105.6	2.2×10^{-6}		659.6	6.3×10^{3}	$\mu^+ \longrightarrow e^+ \bar{\nu}_e \nu_\mu$ (100%)
Hadrons	Mesons	Pion	π	±e	139.6	2.6×10^{-8}		7.8	56.4	$\pi^+ \longrightarrow \mu^+ \nu_\mu$ (100%)
Hadrons	Mesons	Kaon	K	±e	493.6	1.23×10^{-8}		3.7	8.38	$K^+ \longrightarrow \mu^+ \nu_\mu$ (63%) $\pi^0 e^+ \nu_e$ (5%) $\pi^0 \mu^+ \nu_\mu$ (3%) $\pi^+ \pi^0$ (...) (28.9%)
Hadrons	Mesons	Kaon	K^0	0	497.6	K^0_s	8.9×10^{-11}	0.02	0.060	$K^0_S \longrightarrow \pi^0 \pi^0$ (30.7%) $\pi^+\pi^-$ (69.2%)
Hadrons	Mesons	Kaon	K^0	0	497.6	K^0_L	5.12×10^{-8}	15.34	34.4	$K^0_L \longrightarrow \pi^\pm e^\mp \nu_e$ (40.5%) $\pi^\pm \mu^\mp \nu_\mu$ (27.0%) $3\pi^0$ (19.5%) $\pi^+\pi^-\pi^0$ (12.5%)
Hadrons	Baryons	Proton	p	±e	938	stable				
Hadrons	Baryons	Lambda	Λ	0	1115.6	2.63×10^{-10}		0.079	0.237*	$\Lambda^0 \longrightarrow p\ \pi^-$ (63.9%)
Hadrons	Baryons	Sigma Hyperons	Σ^+	+e	1189.3	8.02×10^{-11}		0.024	0.068*	$\Sigma^+ \longrightarrow p\ \pi^0$ (51.57%)
Hadrons	Baryons	Sigma Hyperons	Σ^-	-e	1197.4	1.48×10^{-10}		0.044	0.125*	$\Sigma^- \longrightarrow n\ \pi^-$ (99.84%)

(*) for 10 GeV/c

Targets and particle production

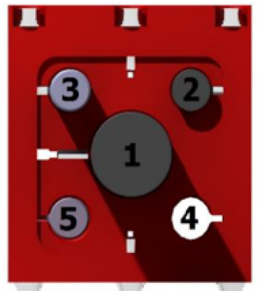
HADRON TARGET



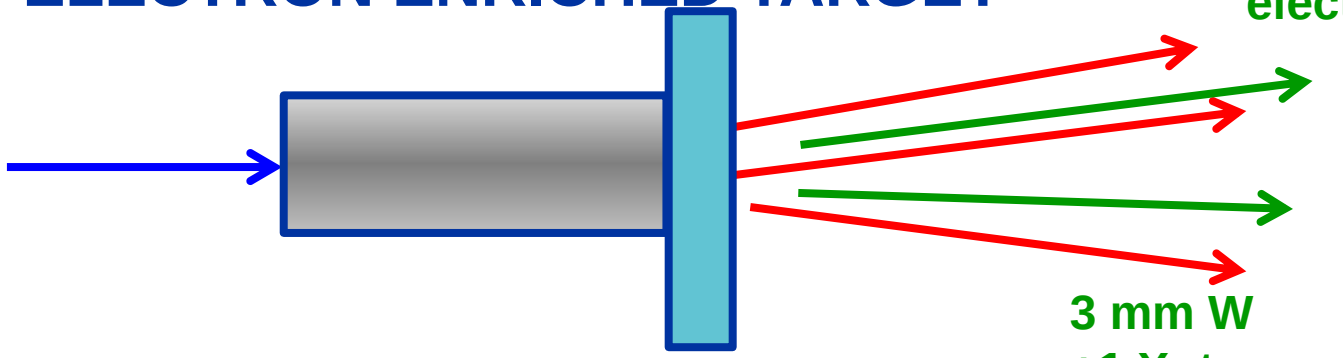
100-200 mm AL or BE, i.e. Low-Z material
Up to 1 L_{int} and 0.5 Xo

T9/T10/T11 Multitarget Configuration

Head	Material	Length (mm)	Diameter (mm)	Comments
1	Be	200	10 + Al case	Electron enriched
	W	3		
2	Al	100	10	Electron enriched
	W	3		
3	Al	200	10	Hadron
4	Air	-	-	Empty
5	Al	20	10	Hadron



ELECTRON ENRICHED TARGET



3 mm W
+1 X_o to convert photons

π^+, π^-, π^o □ $\gamma + \gamma$ □ $e^+ + e^-$

How do we build a beamline?

Beam lines

Experiments and test beams require “clean” beams with high purity (one particle type) and small momentum spread

Beam lines design (“optics”)

1. Collect produced particles from target
2. Select momentum
3. Select particle type
4. Transport beam to experiment
5. Select beam spot size for experiment

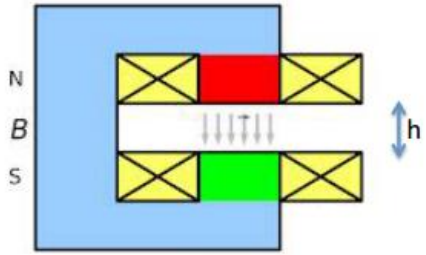
Secondary beam line - layout

Basic beam design

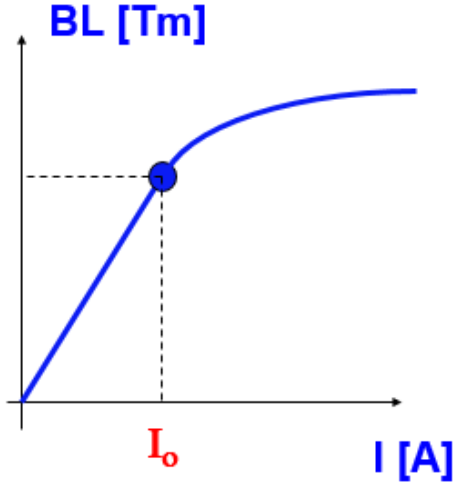
Transport and momentum selection: bending magnets

Dipole electro-magnets:

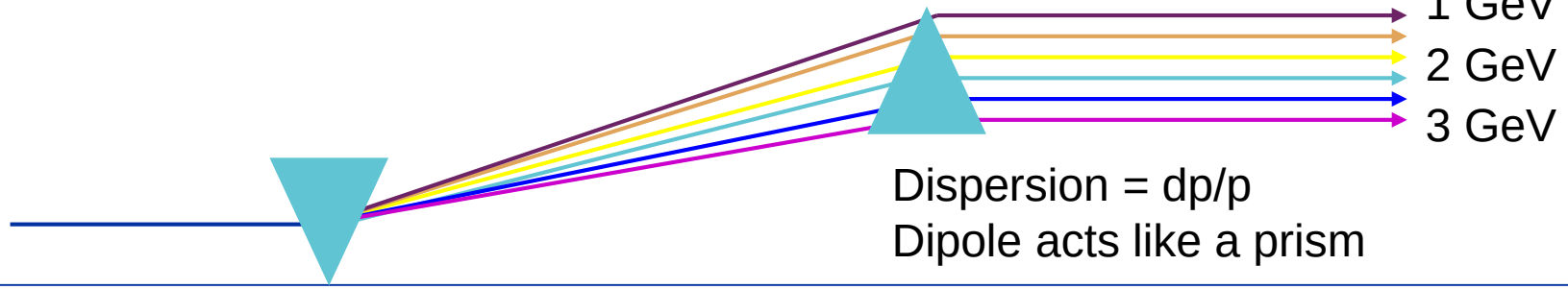
$$\vec{F} = q \cdot \vec{v} \times \vec{B}$$



$$B = \frac{\mu_0 n I}{h}$$



$$\theta\,[mrad] = \frac{299.79 Bl\ \ [T \cdot m]}{p[GeV]}$$



Dispersion = dp/p
Dipole acts like a prism

Secondary beam line - layout

Basic beam design

Transport and focus: Quadrupole Magnets

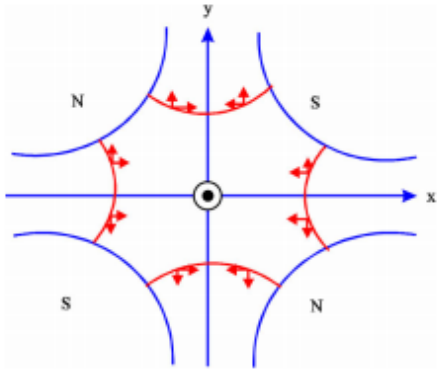
E.g. in the horizontal plane

$$F(x) = q \cdot v \cdot B(x)$$

We want a magnetic field that

$$B_y = g \cdot x \qquad B_x = g \cdot y$$

➔ Quadrupole magnet



The red arrows show the direction of the force on the particle

Gradient of quadrupole

$$g = \frac{2\mu_0 n I}{r^2}\left[\frac{T}{m}\right]$$

Normalized gradient, focusing strength

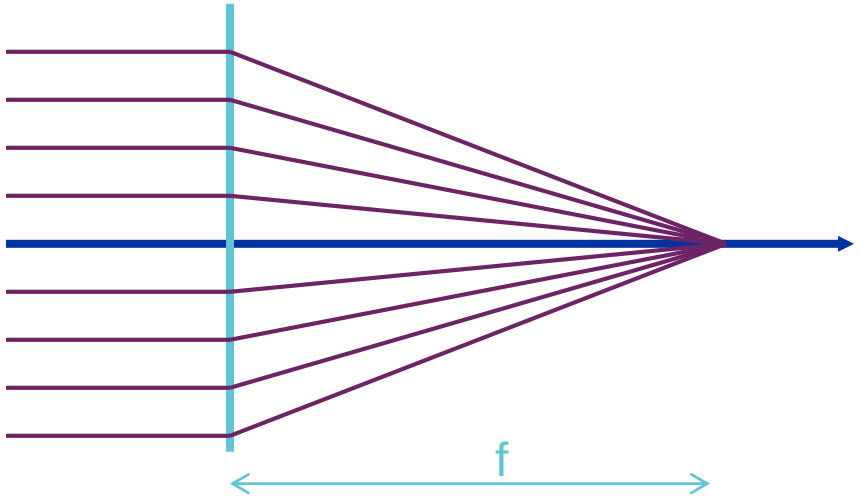
$$k = \frac{g}{p/e}\left[m^{-2}\right]$$

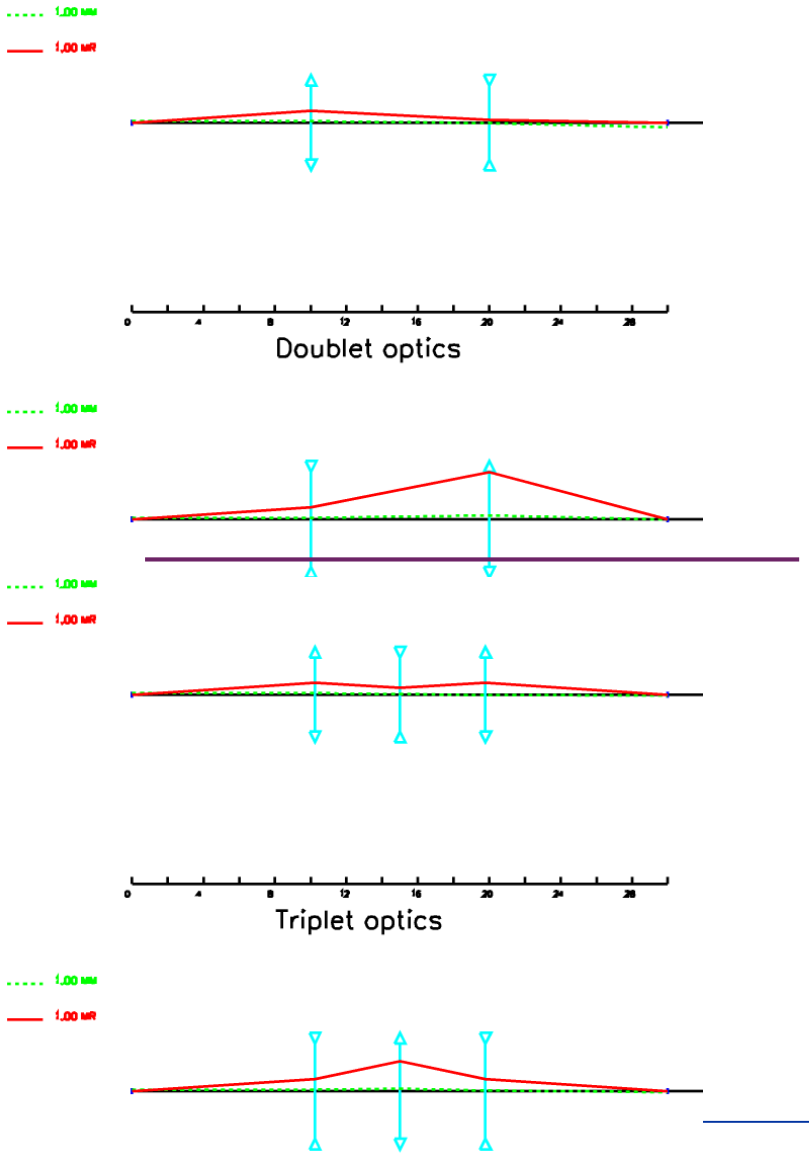
Secondary beam line - layout

Basic beam design

Transport and focus: Quadrupoles

- Like an optical lens
- Difference: focusing in one plane and defocusing in the other plane at the same time
- Use doublets or triplets for transport and focus



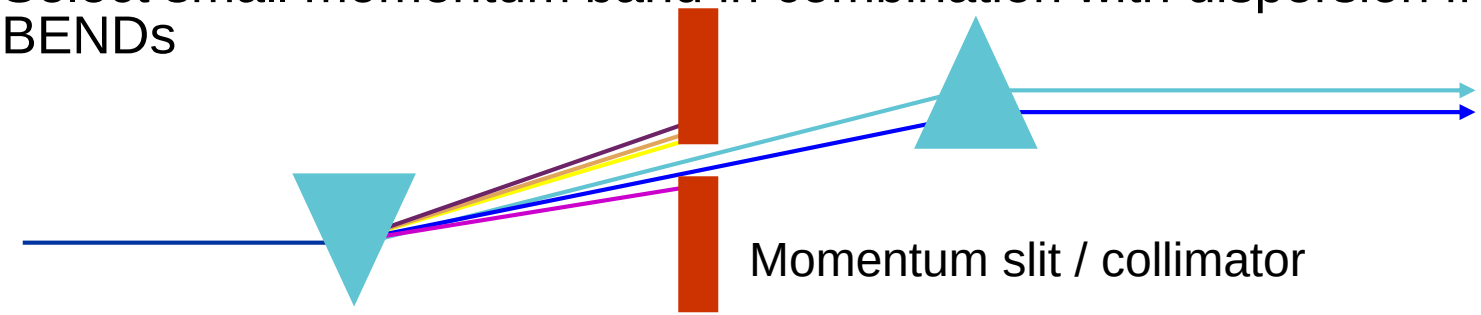


Secondary beam line - layout

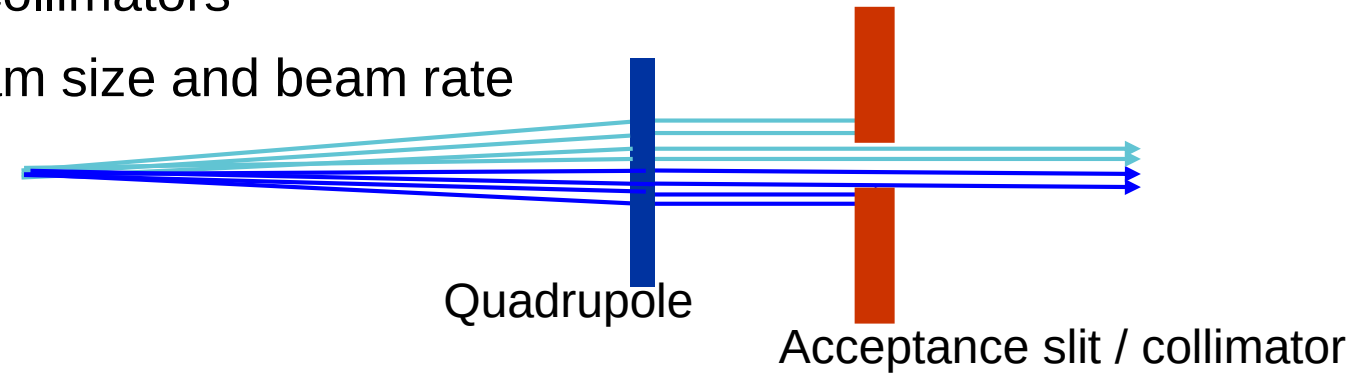
Basic beam design

Momentum selection and acceptance: collimators

- Select small momentum band in combination with dispersion from BENDs

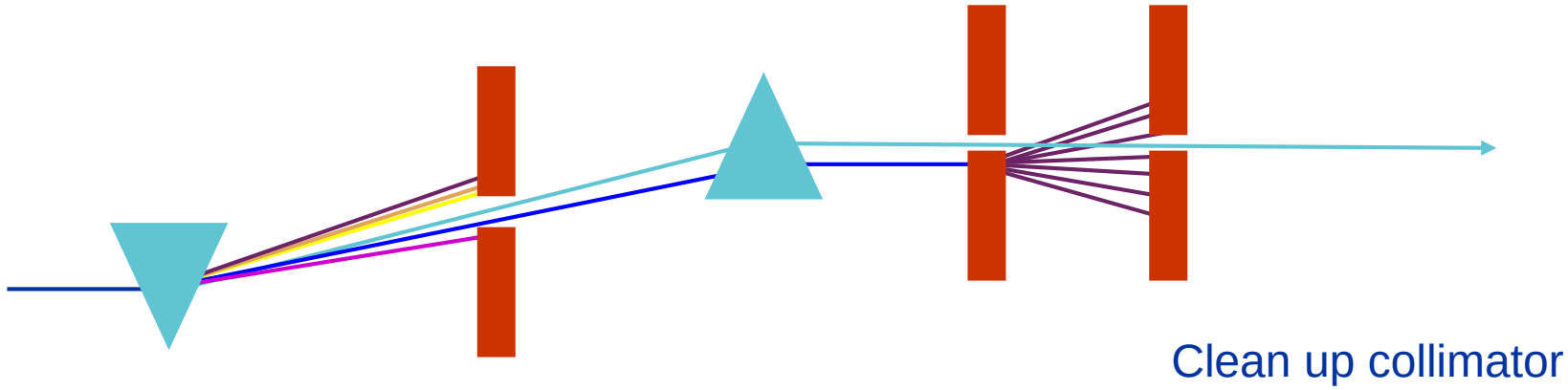


- Acceptance collimators
  - Select beam size and beam rate



Secondary beam line - layout

- **Clean up collimators**
  - Absorb secondary particles produced in acceptance collimators

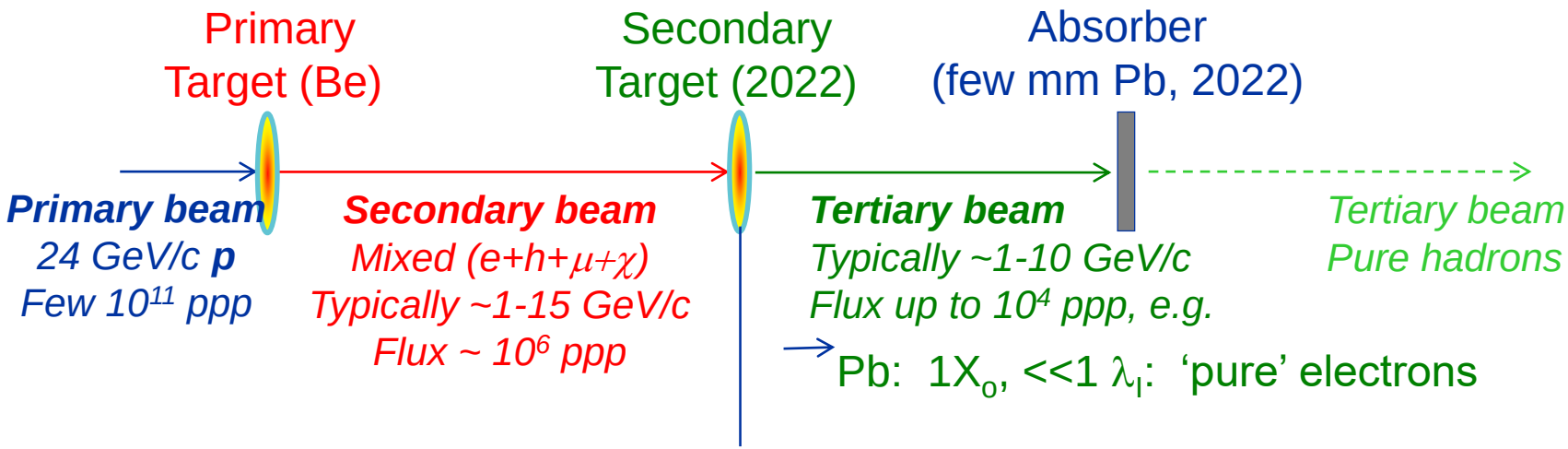


- **TAX (Target attenuator, only North Area)**
  - Define initial acceptance of the beam line

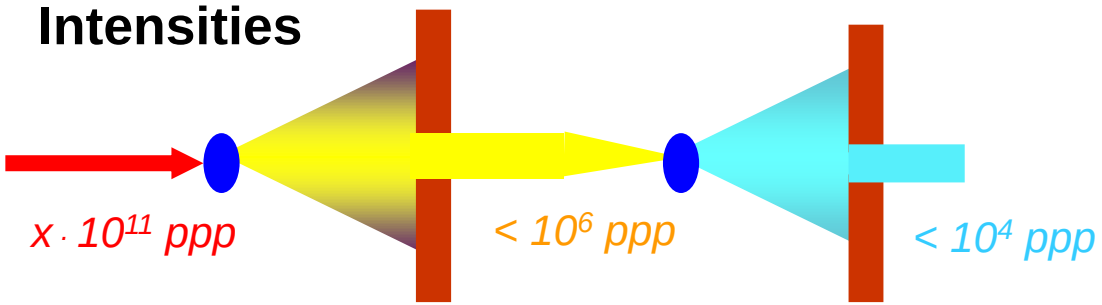
Secondary beam line - layout

Basic beam design

Selection of particle types



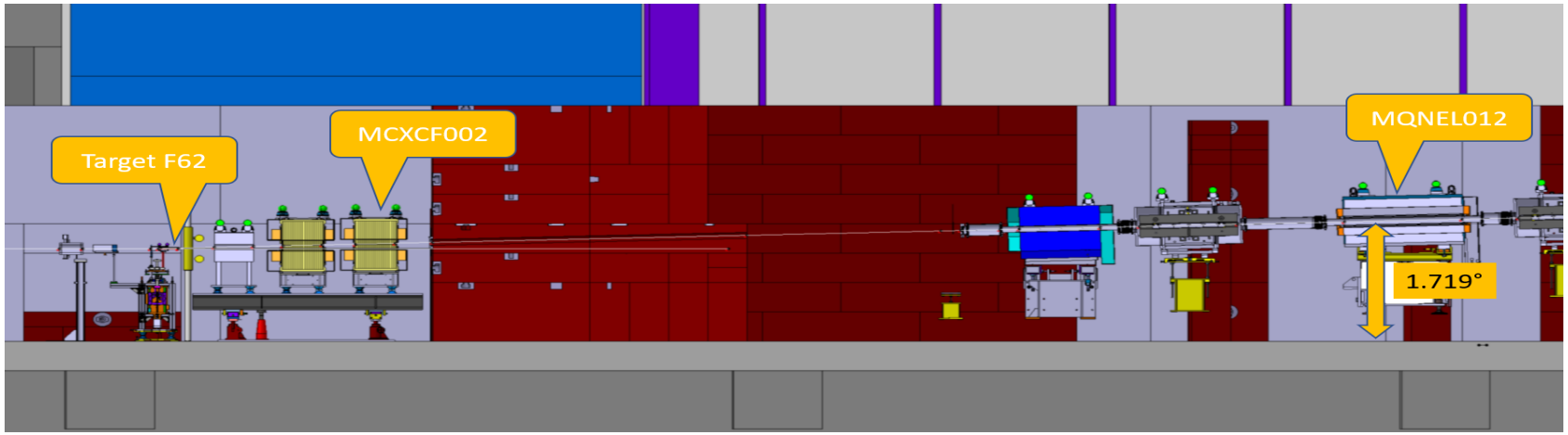
Intensities



Characteristics of the East Beams

Parameter	T09 Target	T10/T11 Target	
Beam Line	T09	T10	T11
Secondary beam Max Momentum (GeV/c)	16	12	3.5
Δp/p (%)	±0.7 to ±15.0	±0.7 to ±15.0	±0.7 to ±15.0
Maximum intensity/spill (hadrons/electrons)	10^6	10^6	10^6
Available particle types	Pure electrons (T09) or mixed/pure hadrons or pure muons		

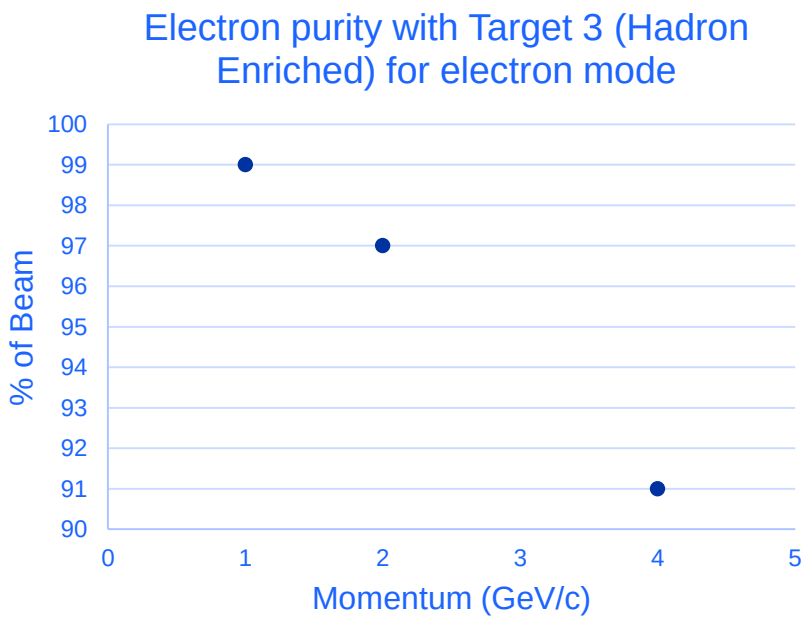
30-35 mrad vertical production angle



T9 Beam Modes available

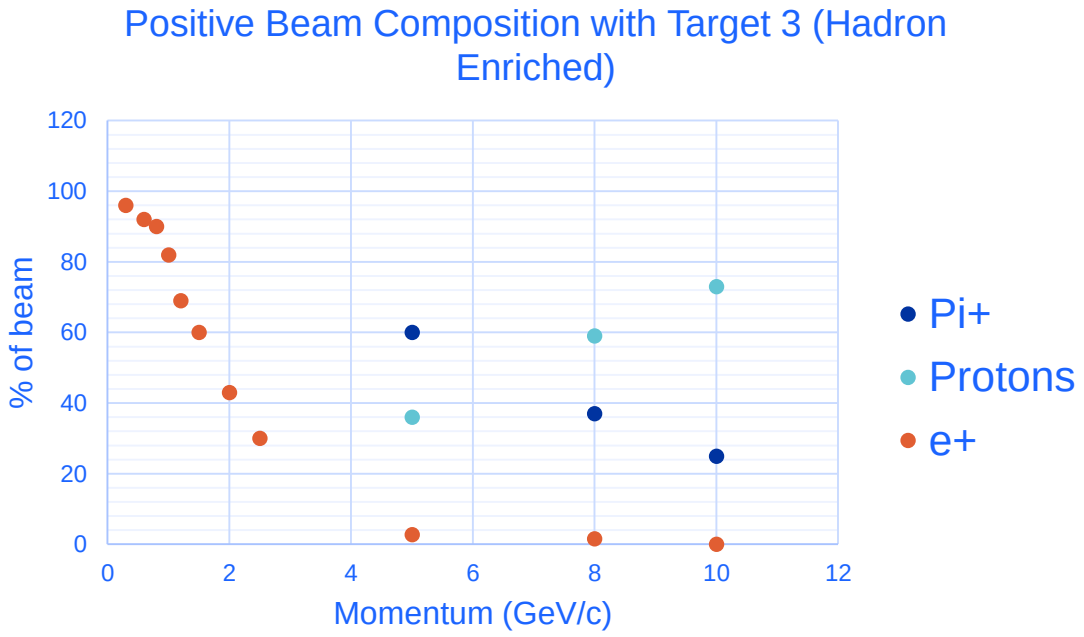
- **Electron mode**
  - The charged particles from the secondary target are deflected away selecting the photons. A 5 mm Pb converts the photons into e+/e- pair.
  - Momenta 0.1 GeV/c – 4 GeV/c.
  - > 99% purity for p < 1 GeV/c

- **Mixed hadron mode**
  - The secondary beam from protons on target can be chosen.
    - Momenta 0.1 GeV/c – 16 GeV/c.
    - At lower momenta electrons dominate.

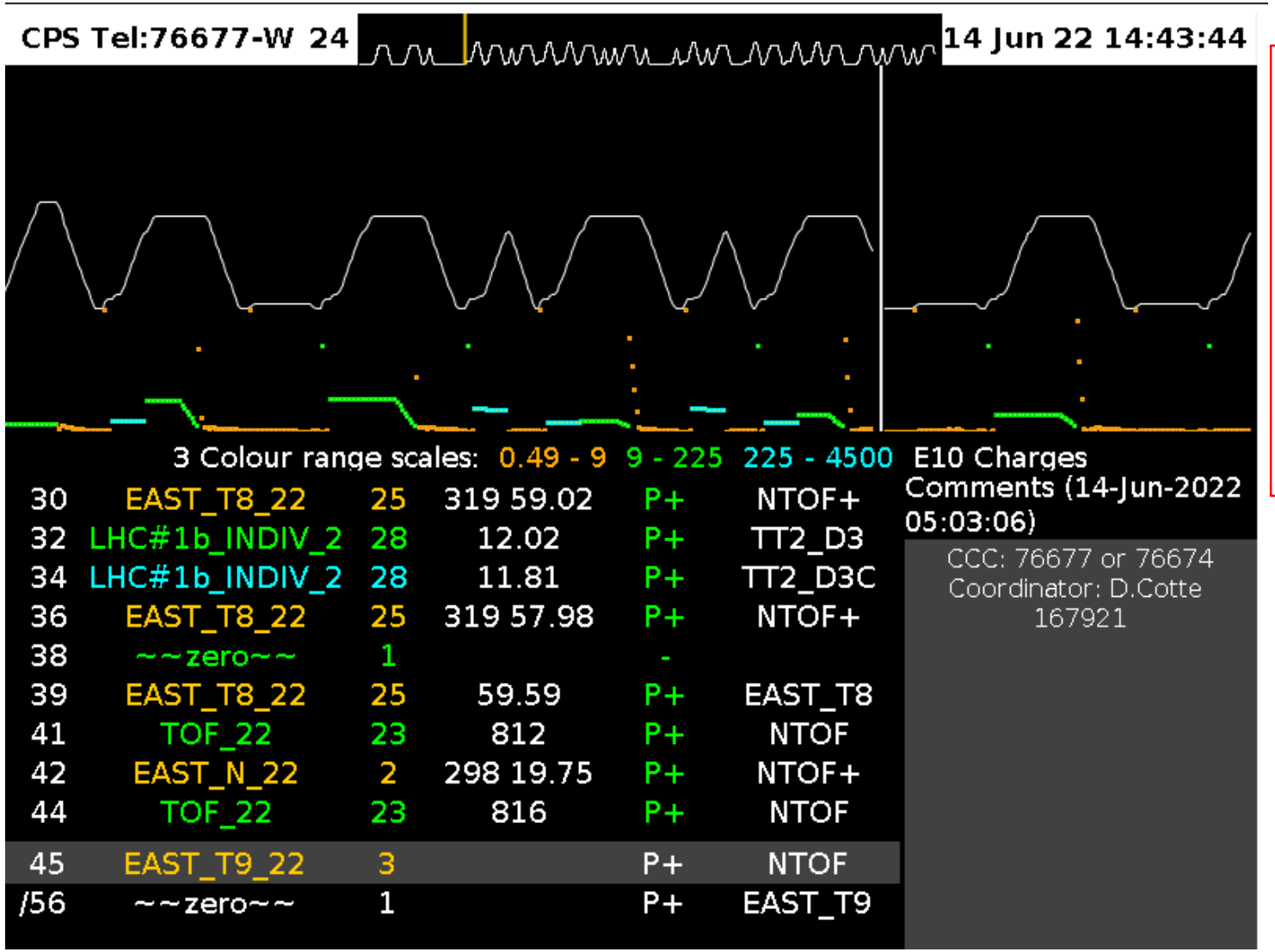


Only XCET available for beam composition data

e.



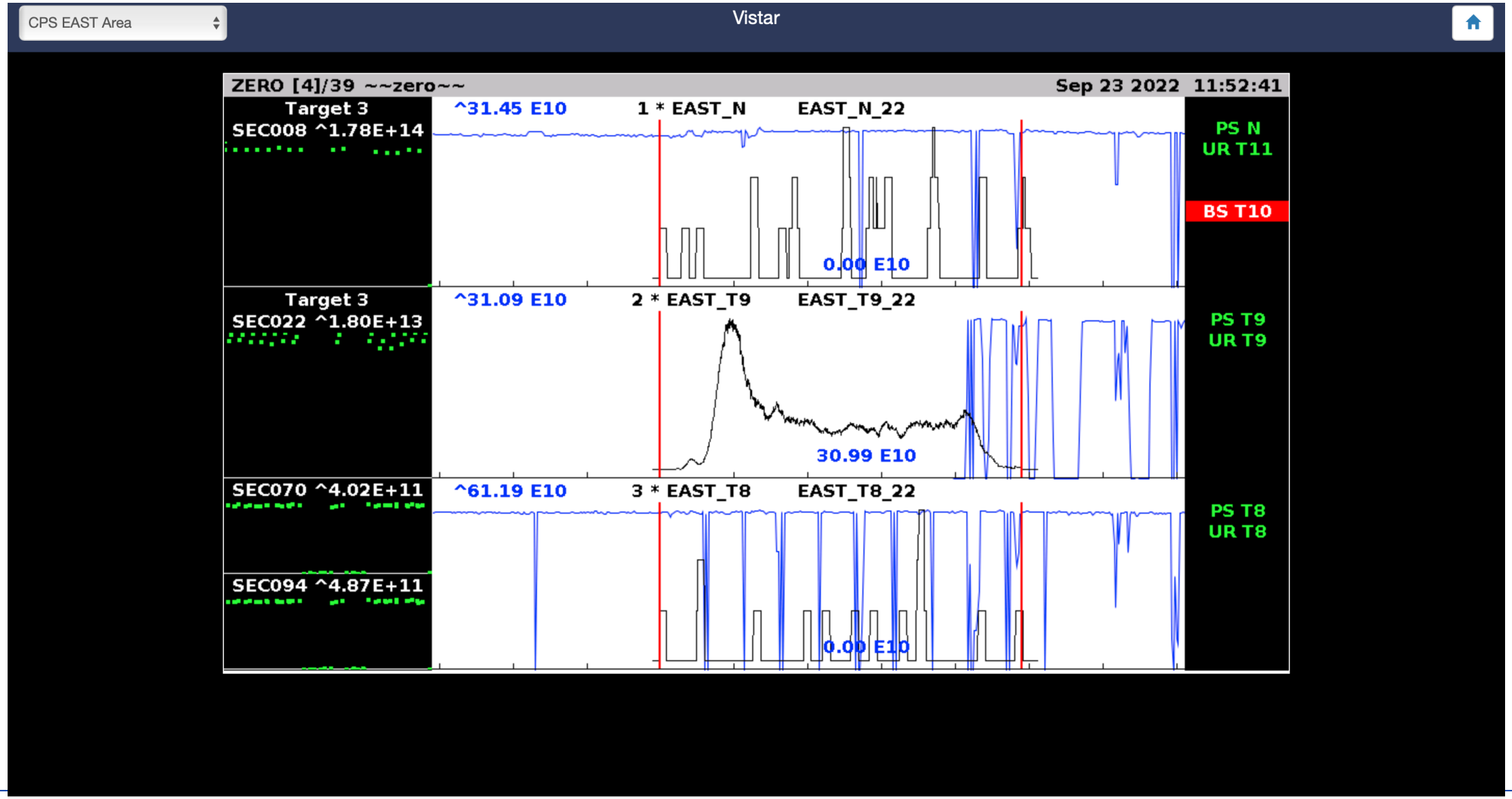
Spill Structure



Spill duration: 0.4 second flat top
Usually : **1-2 cycles per minute per East Destination**
Max 6 East cycles / 40 seconds → RP Limit

Super-cycle structure dependent on all users (SPS, nTOF …)

Spill Structure

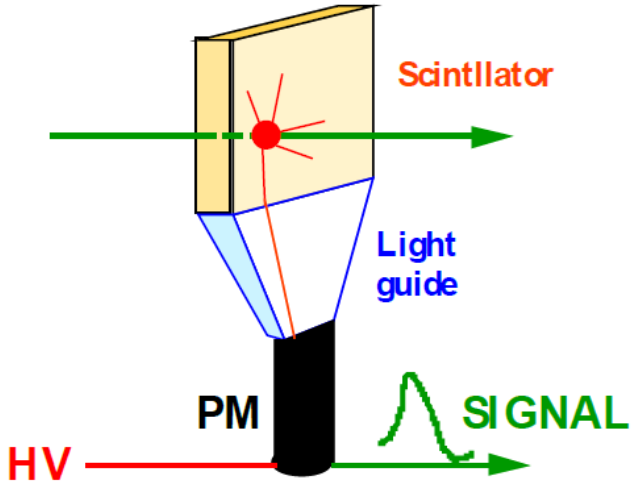


How do we see the beam?

Secondary beam line - Instrumentation

Scintillating Counter (XSCI)

- Charged particles produce light in scintillator
- Light collected and transported by light guide
- Coupled to photo multiplier tube (PM), light hits photocathode and produces electrons
- Electrons are amplified within a high voltage cascade
- Used to count particles in a range from a few particles up to rates of MHz
- Different shapes and sizes: Some can scan through a beam, other count the total rate

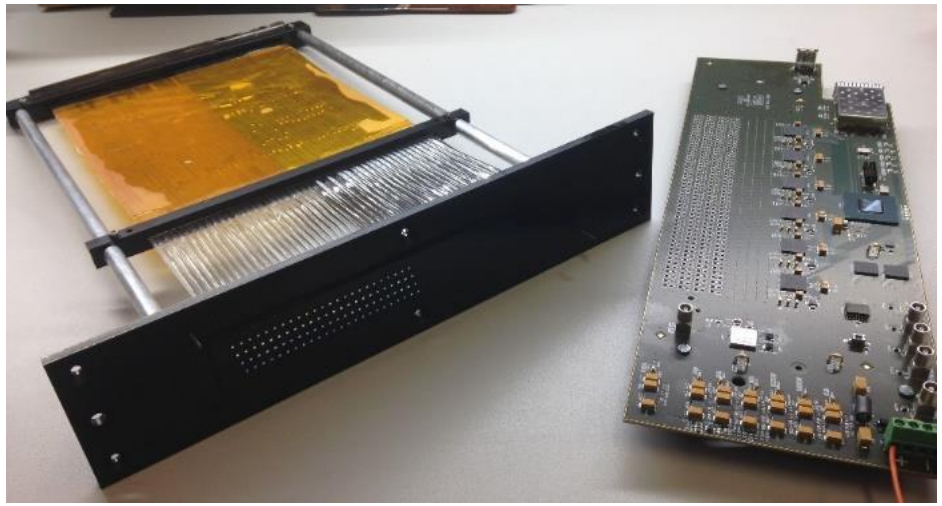


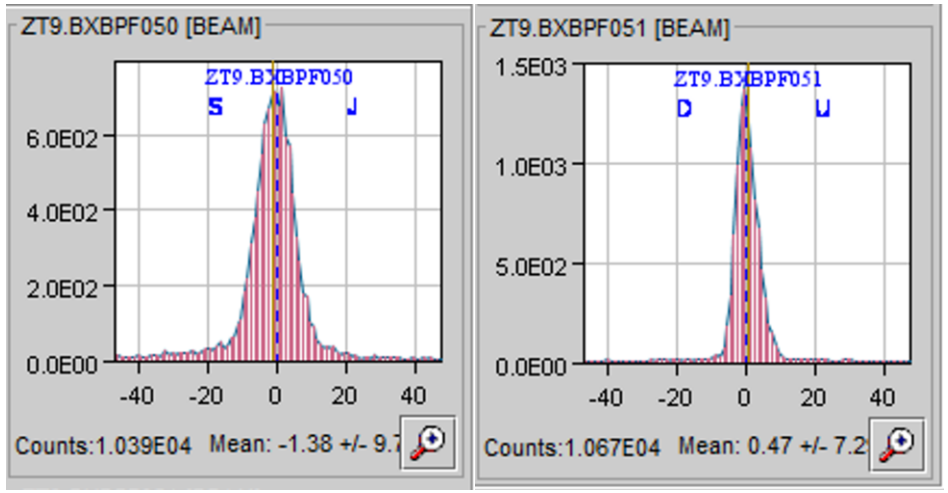
Secondary beam line - Instrumentation

Scintillating fibre hodoscopes (XBPF)

- Particle detection with scintillating fibres from the creation of scintillation light, due to the passage of a charged particle, and the transmission of this light inside the fibre by total internal reflection.

- Composed of 100 or 200 scintillating fibres of 1 mm thickness and square cross-section





Secondary beam line - Instrumentation

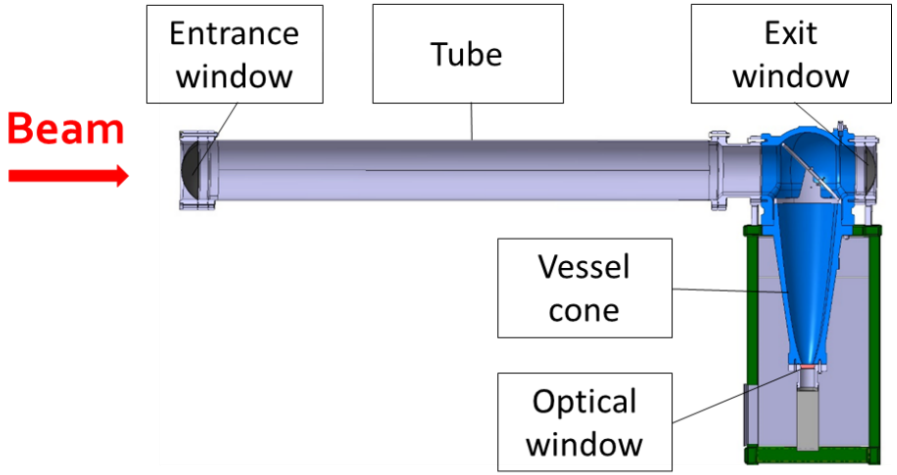
Threshold Cerenkov counters (XCET)

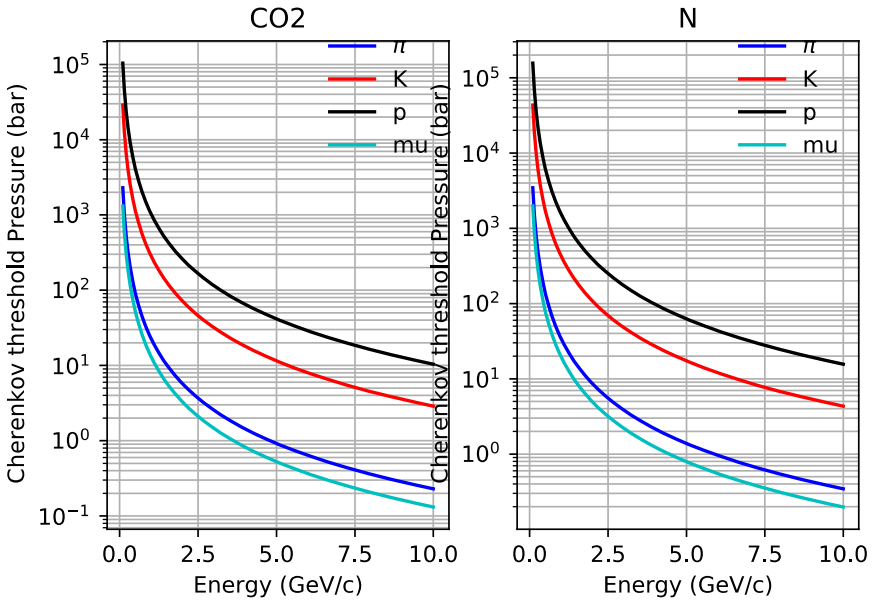
- In a medium (e.g., He or CO2 gas) if a charged particle goes faster than light it emits Cerenkov light in a cone with half-opening angle f:

  $f^2 = 2kP - m^2/p^2$

where k depends on the gas, P=pressure.

- By selecting the right operating pressure, one type of particle has good efficiency and the other gives no signal. By making a coincidence with scintillator signals, particle identification can be made.
- Two types of XCET in T09:
  - Low pressure → 0.01 – 4 bars
  - High pressure → 0.01 – 15 bars





Congratulations for having won this competition and good luck for a successful experiment!
Have a wonderful time at CERN !

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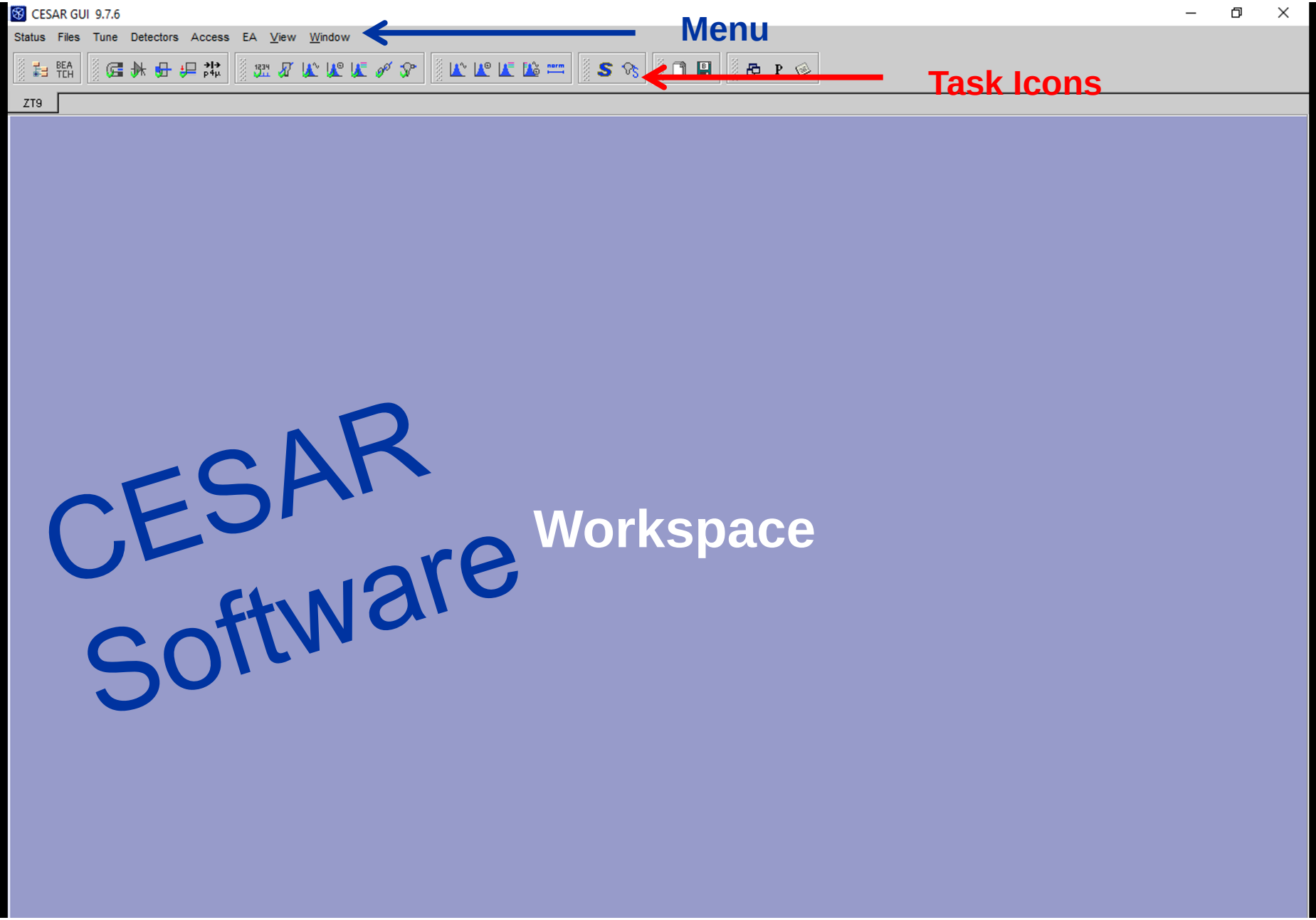
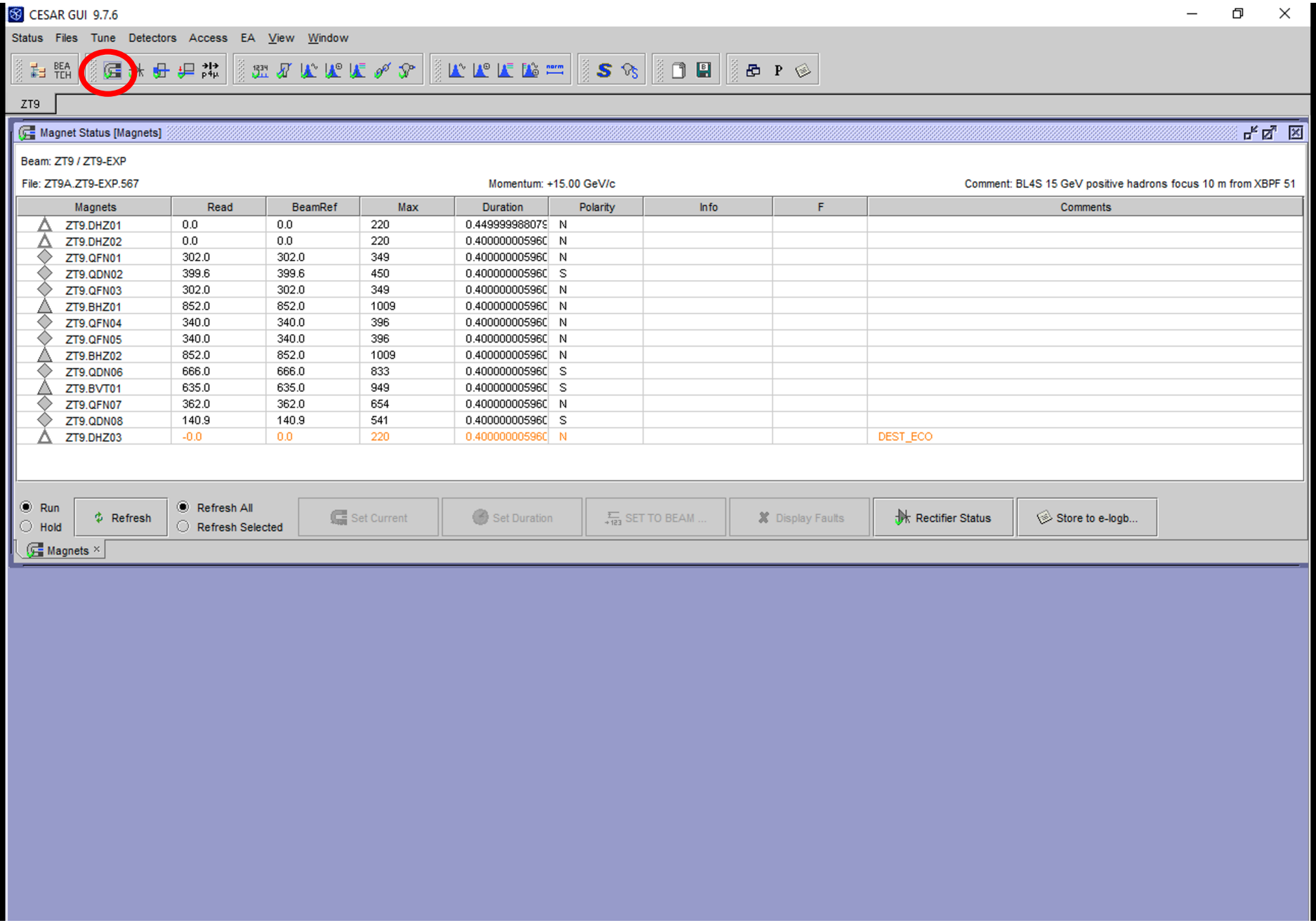
How do we control the beam?


CESAR GUI 9.7.6
Status Files Tune Detectors Access EA View Window
ZT9
Menu
Task Icons
CESAR Software
Workspace



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ZT9.DHZ02	0.0	0.0	220	0.40000000596	N			
ZT9.QFN01	302.0	302.0	349	0.40000000596	N			
ZT9.QDN02	399.6	399.6	450	0.40000000596	S			
ZT9.QFN03	302.0	302.0	349	0.40000000596	N			
ZT9.BHZ01	852.0	852.0	1009	0.40000000596	N			
ZT9.QFN04	340.0	340.0	396	0.40000000596	N			
ZT9.QFN05	340.0	340.0	396	0.40000000596	N			
ZT9.BHZ02	852.0	852.0	1009	0.40000000596	N			
ZT9.QDN06	666.0	666.0	833	0.40000000596	S			
ZT9.BVT01	635.0	635.0	949	0.40000000596	S			
ZT9.QFN07	362.0	362.0	654	0.40000000596	N			
ZT9.QDN08	140.9	140.9	541	0.40000000596	S			
ZT9.DHZ03	-0.0	0.0	220	0.40000000596	N			DEST_ECO

CESAR GUI 9.7.6

Status Files Tune Detectors Access EA View Window

ZT9

BeamFileExplorer [Beamfiles]

Beam: ZT9 / ZT9-EXP

File: ZT9A.ZT9-EXP.567 Momentum: +15.00 GeV/c Comment: BL4S 15 GeV positive hadrons focus 10 m from XBPF 51

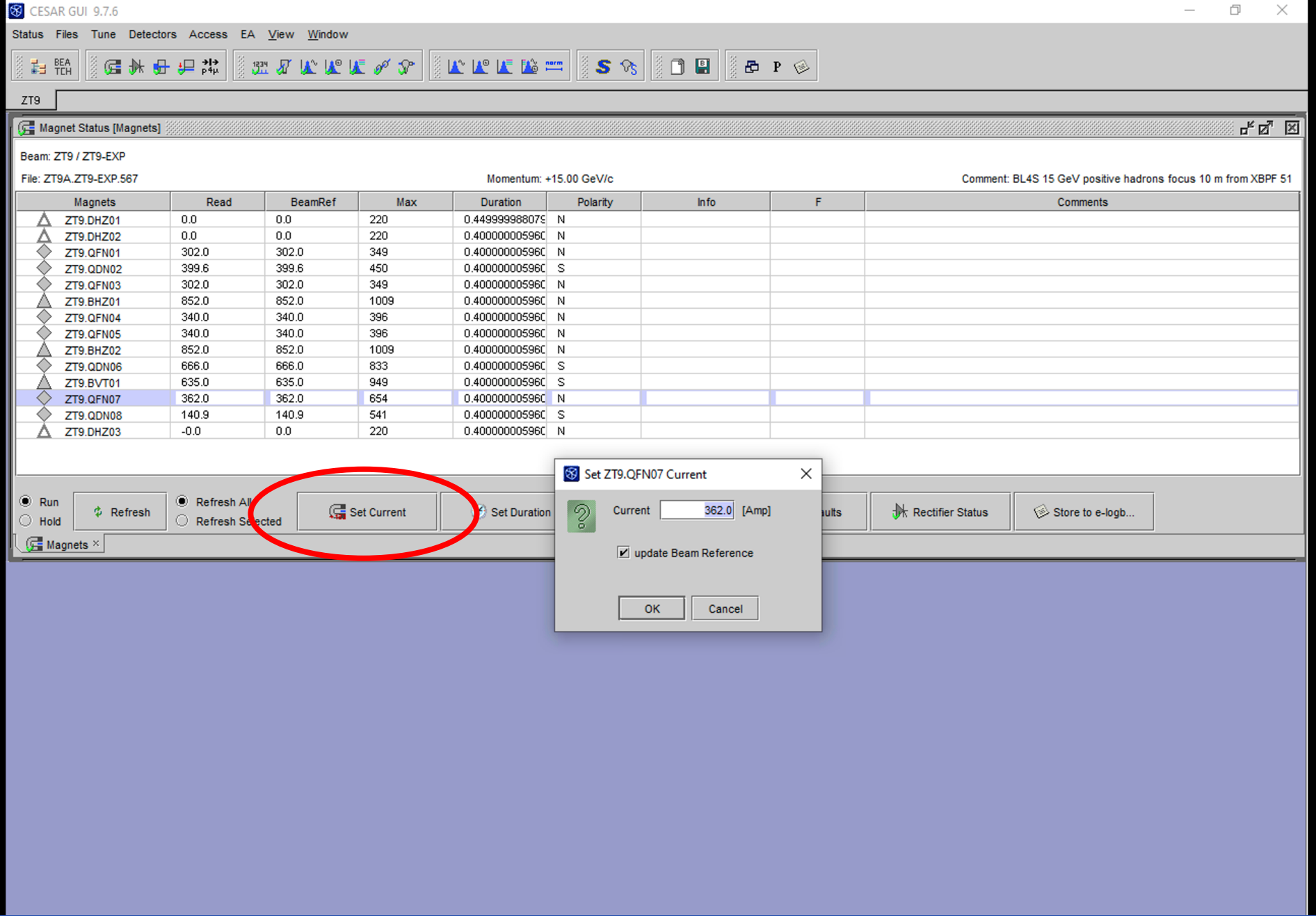
Filter:

Beamfiles	Comment	Particle ty...	Mome...	Experi...	Zone	Beam gen...	Initial E...	Interm...	Final E...	Las...	Last M...	Creation	Invalid ...	Parent bea...
ZT9A.ZT9-EXP.560	BL4S 6 GeV positrons focus 10 m from XBPF 51	ION_PLU	+6.00	ZT9-E	ZT9A	Secondar	+6.00	+0.00	+0.00	2022/	eat9a l	2022/		ZT9A.ZT9-E
ZT9A.ZT9-EXP.576	BL4S 0.3 GeV positive hadrons focus 10 m from XBPF 51	ION_PLU	+0.30	ZT9-E	ZT9A	Secondar	+0.30	+0.00	+0.00	2022/	dibane	2022/		ZT9A.ZT9-E
ZT9A.ZT9-EXP.575	BL4S 0.6 GeV positive hadrons focus 10 m from XBPF 51	ION_PLU	+0.60	ZT9-E	ZT9A	Secondar	+0.60	+0.00	+0.00	2022/	dibane	2022/		ZT9A.ZT9-E
ZT9A.ZT9-EXP.574	BL4S 0.6 GeV positive hadrons focus 10 m from XBPF 51	ION_PLU	+0.60	ZT9-E	ZT9A	Secondar	+0.60	+0.00	+0.00	2022/	dibane	2022/		ZT9A.ZT9-E
ZT9A.ZT9-EXP.573	BL4S 0.8 GeV positive hadrons focus 10 m from XBPF 51	ION_PLU	+0.80	ZT9-E	ZT9A	Secondar	+0.80	+0.00	+0.00	2022/	dibane	2022/		ZT9A.ZT9-E
ZT9A.ZT9-EXP.572	BL4S 1 GeV positive hadrons focus 10 m from XBPF 51	ION_PLU	+1.00	ZT9-E	ZT9A	Secondar	+1.00	+0.00	+0.00	2022/	dibane	2022/		ZT9A.ZT9-E
ZT9A.ZT9-EXP.571	BL4S 1.2 GeV positive hadrons focus 10 m from XBPF 51	ION_PLU	+1.20	ZT9-E	ZT9A	Secondar	+1.20	+0.00	+0.00	2022/	dibane	2022/		ZT9A.ZT9-E
ZT9A.ZT9-EXP.570	BL4S 1.5 GeV positive hadrons focus 10 m from XBPF 51	ION_PLU	+1.50	ZT9-E	ZT9A	Secondar	+1.50	+0.00	+0.00	2022/	dibane	2022/		ZT9A.ZT9-E
ZT9A.ZT9-EXP.569	BL4S 2. GeV positive hadrons focus 10 m from XBPF 51	ION_PLU	+2.00	ZT9-E	ZT9A	Secondar	+2.00	+0.00	+0.00	2022/	dibane	2022/		ZT9A.ZT9-E
ZT9A.ZT9-EXP.568	BL4S 2.5 GeV positive hadrons focus 10 m from XBPF 51	ION_PLU	+2.50	ZT9-E	ZT9A	Secondar	+2.50	+0.00	+0.00	2022/	dibane	2022/		ZT9A.ZT9-E
ZT9A.ZT9-EXP.567	BL4S 15 GeV positive hadrons focus 10 m from XBPF 51	ION_PLU	+15.00	ZT9-E	ZT9A	Secondar	+15.00	+0.00	+0.00	2022/	dibane	2022/		ZT9A.ZT9-E
ZT9A.ZT9-EXP.566	BL4S 6 GeV positive hadrons focus 10 m from XBPF 51	ION_PLU	+6.00	ZT9-E	ZT9A	Secondar	+6.00	+0.00	+0.00	2022/	dibane	2022/		ZT9A.ZT9-E
ZT9A.ZT9-EXP.565	BL4S 3. GeV positive hadrons focus 10 m from XBPF 51	ION_PLU	+3.00	ZT9-E	ZT9A	Secondar	+3.00	+0.00	+0.00	2022/	dibane	2022/		ZT9A.ZT9-E
ZT9A.ZT9-EXP.564	BL4S 3.5 GeV positive hadrons focus 10 m from XBPF 51	ION_PLU	+3.50	ZT9-E	ZT9A	Secondar	+3.50	+0.00	+0.00	2022/	dibane	2022/		ZT9A.ZT9-E
ZT9A.ZT9-EXP.563	BL4S 4 GeV positive hadrons focus 10 m from XBPF 51	ION_PLU	+4.00	ZT9-E	ZT9A	Secondar	+4.00	+0.00	+0.00	2022/	dibane	2022/		ZT9A.ZT9-E
ZT9A.ZT9-EXP.562	BL4S 4.5 GeV positive hadrons focus 10 m from XBPF 51	ION_PLU	+4.50	ZT9-E	ZT9A	Secondar	+4.50	+0.00	+0.00	2022/	dibane	2022/		ZT9A.ZT9-E
ZT9A.ZT9-EXP.561	BL4S 1 GeV positrons focus 10 m from XBPF 51	ION_PLU	+1.00	ZT9-E	ZT9A	Secondar	+1.00	+0.00	+0.00	2022/	dibane	2022/		ZT9A.ZT9-E
ZT9A.ZT9-EXP.559	SBA negative 15 GeV hadrons focus at XBPF 51	PION_PLU	-15.00	ZT9-E	ZT9A	Secondar	-15.00	+0.00	+0.00	2022/	dibane	2022/		ZT9A.ZT9-E
ZT9A.ZT9-EXP.538	Gamma MeV negative 15 GeV hadrons focus 10 m from XBI	PION_PLU	-15.00	ZT9-E	ZT9A	Secondar	-15.00	+0.00	+0.00	2022/	dibane	2022/		ZT9A.ZT9-E
ZT9A.ZT9-EXP.541	HERD 1 GeV electrons focus 10 m from XBPF 51	PION_PLU	-1.00	ZT9-E	ZT9A	Secondar	-1.00	+0.00	+0.00	2022/	dibane	2022/		ZT9A.ZT9-E
ZT9A.ZT9-EXP.548	HERD 0.6 GeV electrons focus 10 m from XBPF 51	PION_PLU	-0.60	ZT9-E	ZT9A	Secondar	-0.60	+0.00	+0.00	2022/	dibane	2022/		ZT9A.ZT9-E
ZT9A.ZT9-EXP.551	HERD 1.2 GeV electrons focus 10 m from XBPF 51	PION_PLU	-1.20	ZT9-E	ZT9A	Secondar	-1.20	+0.00	+0.00	2022/	dibane	2022/		ZT9A.ZT9-E
ZT9A.ZT9-EXP.542	HERD 2 GeV electrons focus 10 m from XBPF 51	PION_PLU	-2.00	ZT9-E	ZT9A	Secondar	-2.00	+0.00	+0.00	2022/	dibane	2022/		ZT9A.ZT9-E
ZT9A.ZT9-EXP.550	HERD 0.9 GeV electrons focus 10 m from XBPF 51	PION_PLU	-0.90	ZT9-E	ZT9A	Secondar	-0.90	+0.00	+0.00	2022/	dibane	2022/		ZT9A.ZT9-E
ZT9A.ZT9-EXP.546	HERD 0.5 GeV electrons focus 10 m from XBPF 51	PION_PLU	-0.50	ZT9-E	ZT9A	Secondar	-0.50	+0.00	+0.00	2022/	dibane	2022/		ZT9A.ZT9-E
ZT9A.ZT9-EXP.547	HERD 0.8 GeV electrons focus 10 m from XBPF 51	PION_PLU	-0.80	ZT9-E	ZT9A	Secondar	-0.80	+0.00	+0.00	2022/	dibane	2022/		ZT9A.ZT9-E
ZT9A.ZT9-EXP.549	HERD 0.7 GeV electrons focus 10 m from XBPF 51	PION_PLU	-0.70	ZT9-E	ZT9A	Secondar	-0.70	+0.00	+0.00	2022/	dibane	2022/		ZT9A.ZT9-E
ZT9A.ZT9-EXP.555	HERD 2.6 GeV electrons focus 10 m from XBPF 51	PION_PLU	-2.60	ZT9-E	ZT9A	Secondar	-2.60	+0.00	+0.00	2022/	dibane	2022/		ZT9A.ZT9-E
ZT9A.ZT9-EXP.556	HERD 3.5 GeV electrons focus 10 m from XBPF 51	PION_PLU	-3.50	ZT9-E	ZT9A	Secondar	-3.50	+0.00	+0.00	2022/	dibane	2022/		ZT9A.ZT9-E
ZT9A.ZT9-EXP.554	HERD 2.3 GeV electrons focus 10 m from XBPF 51	PION_PLU	-2.30	ZT9-E	ZT9A	Secondar	-2.30	+0.00	+0.00	2022/	dibane	2022/		ZT9A.ZT9-E
ZT9A.ZT9-EXP.558	HERD 5.5 GeV electrons focus 10 m from XBPF 51	PION_PLU	-5.50	ZT9-E	ZT9A	Secondar	-5.50	+0.00	+0.00	2022/	dibane	2022/		ZT9A.ZT9-E

View / Edit | Compare | Copy | Delete | (In)validate | Refresh

BeamRefs->Selected File | Load Beamfile | Extrapolate

Beamfiles


CESAR GUI 9.7.6
Status Files Tune Detectors Access EA View Window
ZT9
Magnet Status [Magnets]
Beam: ZT9 / ZT9-EXP
File: ZT9A.ZT9-EXP.567
Momentum: +15.00 GeV/c
Comment: BL4S 15 GeV positive hadrons focus 10 m from XBPF 51
Magnets Read BeamRef Max Duration Polarity Info F Comments
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ZT9.DHZ02 0.0 0.0 220 0.40000000596 N
ZT9.QFN01 302.0 302.0 349 0.40000000596 N
ZT9.QDN02 399.6 399.6 450 0.40000000596 S
ZT9.QFN03 302.0 302.0 349 0.40000000596 N
ZT9.BHZ01 852.0 852.0 1009 0.40000000596 N
ZT9.QFN04 340.0 340.0 396 0.40000000596 N
ZT9.QFN05 340.0 340.0 396 0.40000000596 N
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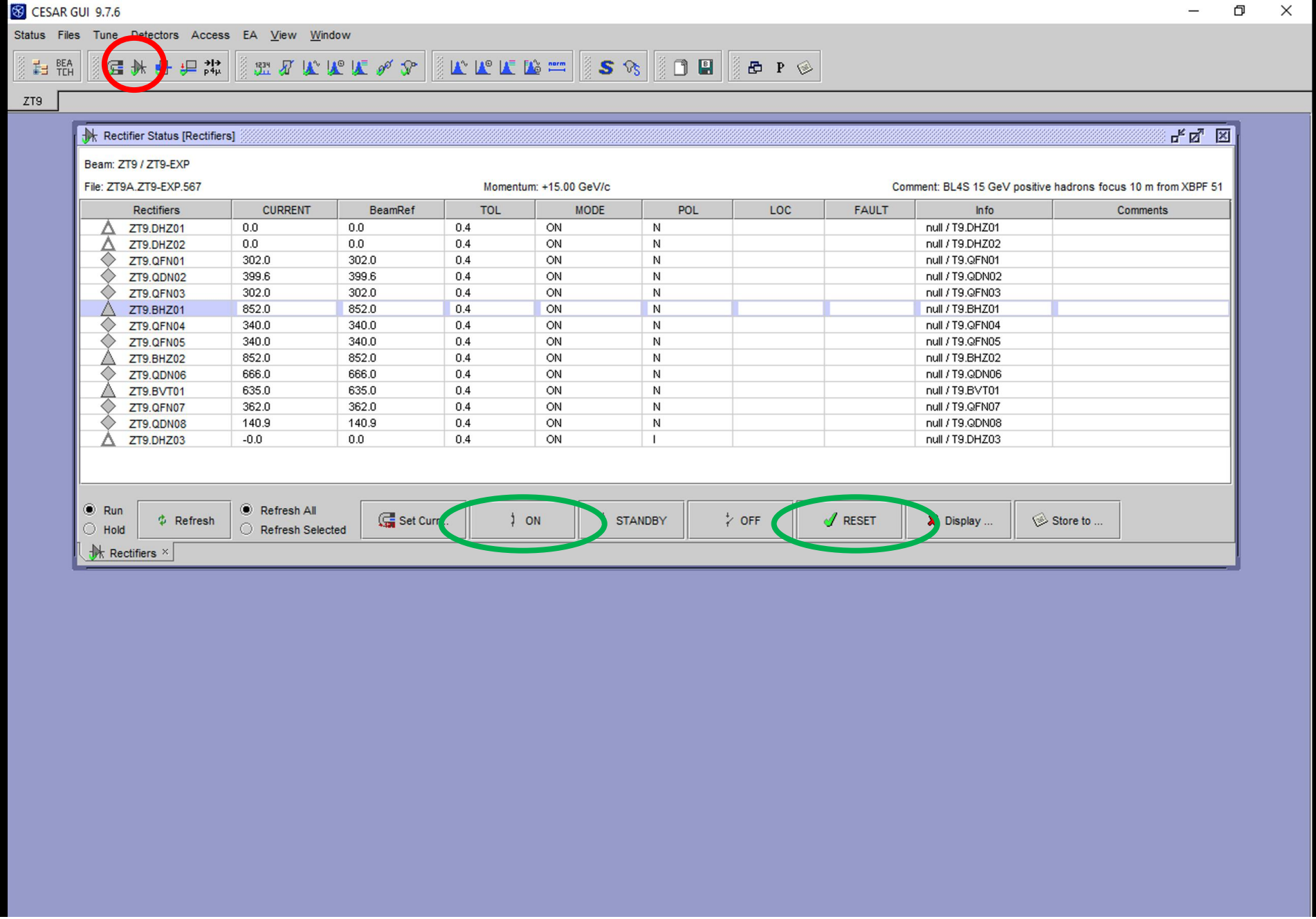
ZT9.BVT01 635.0 635.0 949 0.40000000596 S
ZT9.QFN07 362.0 362.0 654 0.40000000596 N
ZT9.QDN08 140.9 140.9 541 0.40000000596 S
ZT9.DHZ03 -0.0 0.0 220 0.40000000596 N
Run
Hold
Refresh
Refresh All
Refresh Selected
Set Current
Set Duration
Rectifier Status
Store to e-logb...
Magnets
Set ZT9.QFN07 Current
Current 362.0 [Amp]
update Beam Reference
OK
Cancel



Rectifiers	CURRENT	BeamRef	TOL	MODE	POL	LOC	FAULT	Info	Comments
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ZT9.DHZ02	0.0	0.0	0.4	ON	N			null / T9.DHZ02	
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ZT9.QDN02	399.6	399.6	0.4	ON	N			null / T9.QDN02	
ZT9.QFN03	302.0	302.0	0.4	ON	N			null / T9.QFN03	
ZT9.BHZ01	852.0	852.0	0.4	ON	N			null / T9.BHZ01	
ZT9.QFN04	340.0	340.0	0.4	ON	N			null / T9.QFN04	
ZT9.QFN05	340.0	340.0	0.4	ON	N			null / T9.QFN05	
ZT9.BHZ02	852.0	852.0	0.4	ON	N			null / T9.BHZ02	
ZT9.QDN06	666.0	666.0	0.4	ON	N			null / T9.QDN06	
ZT9.BVT01	635.0	635.0	0.4	ON	N			null / T9.BVT01	
ZT9.QFN07	362.0	362.0	0.4	ON	N			null / T9.QFN07	
ZT9.QDN08	140.9	140.9	0.4	ON	N			null / T9.QDN08	
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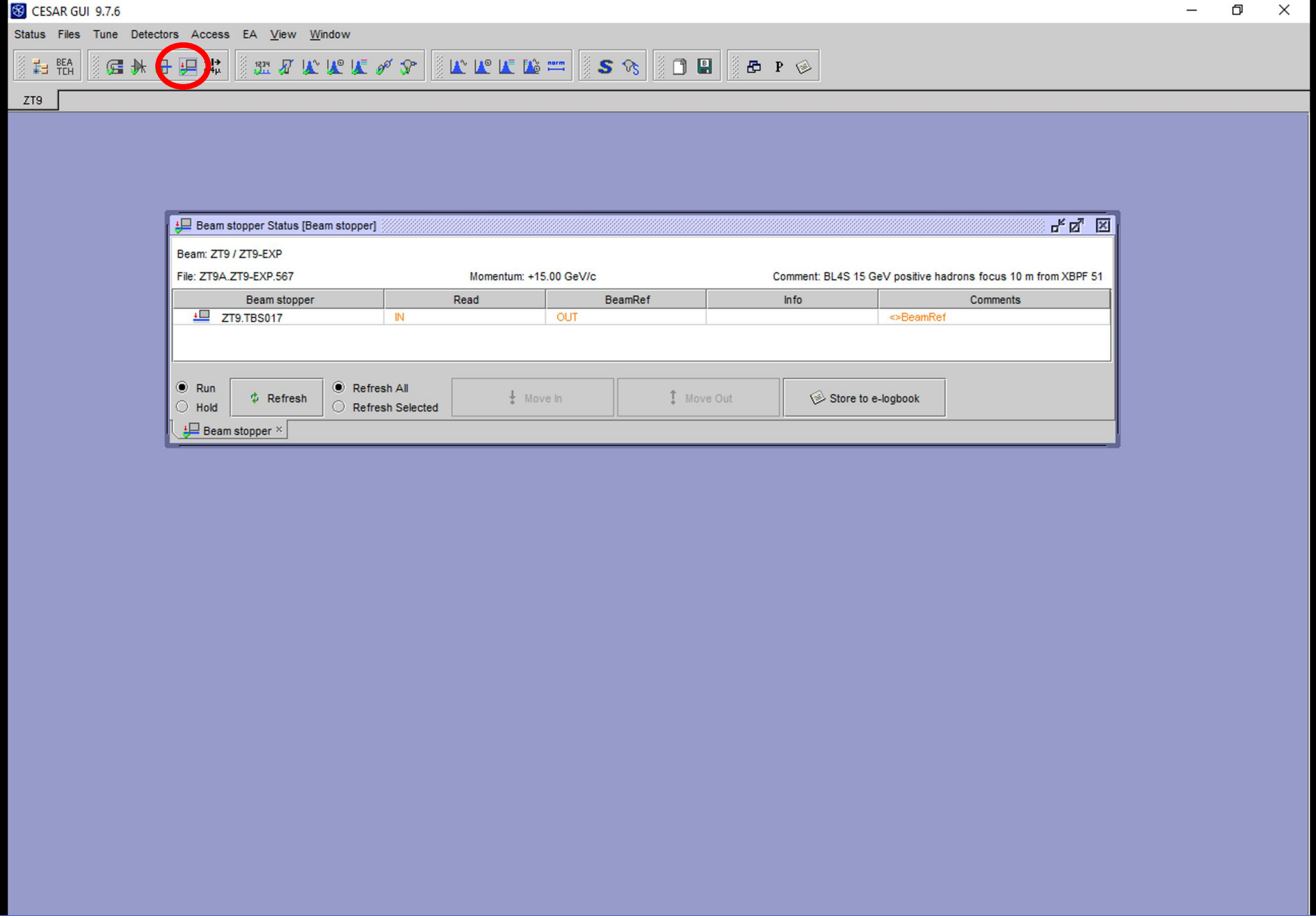
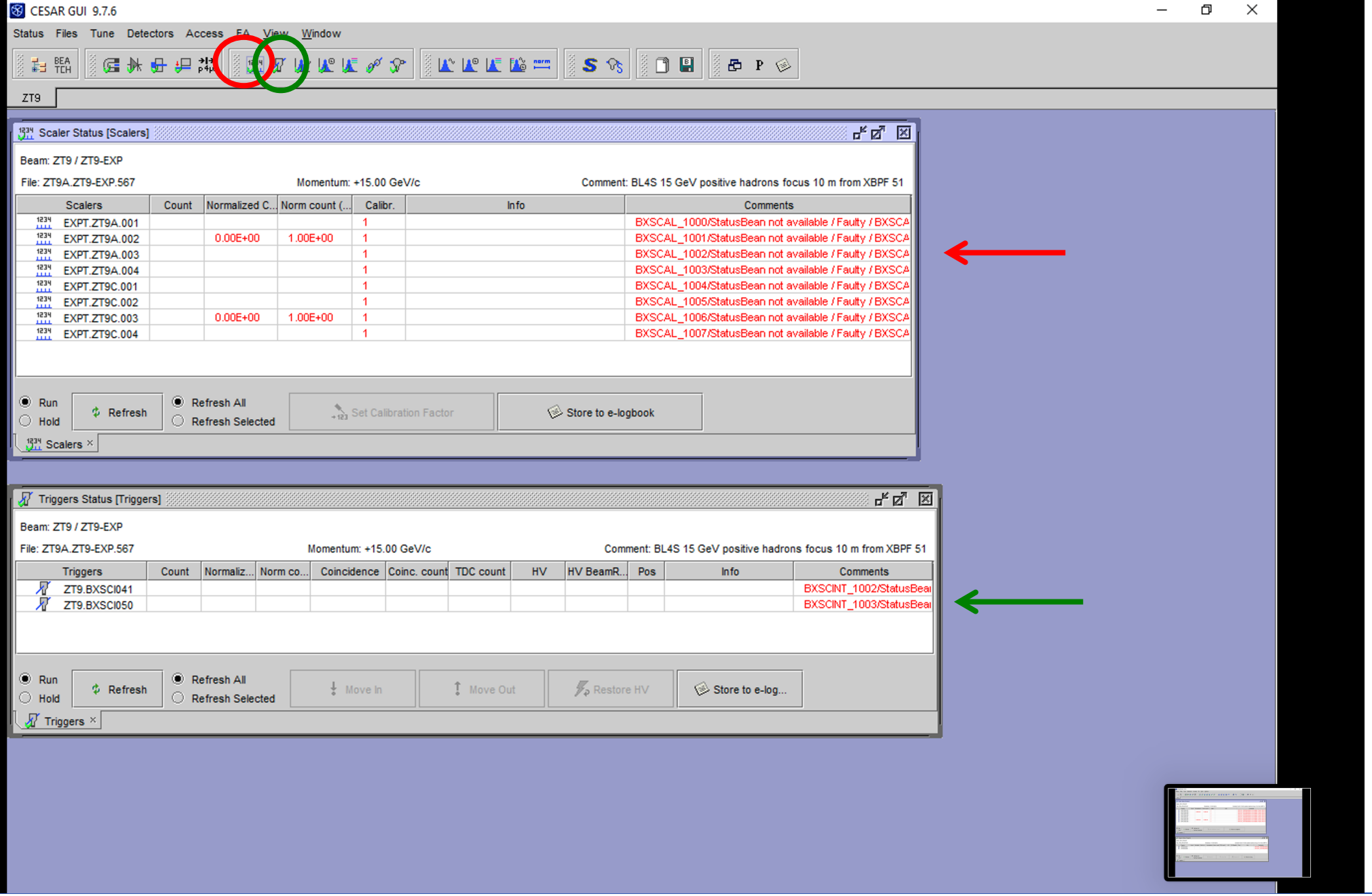
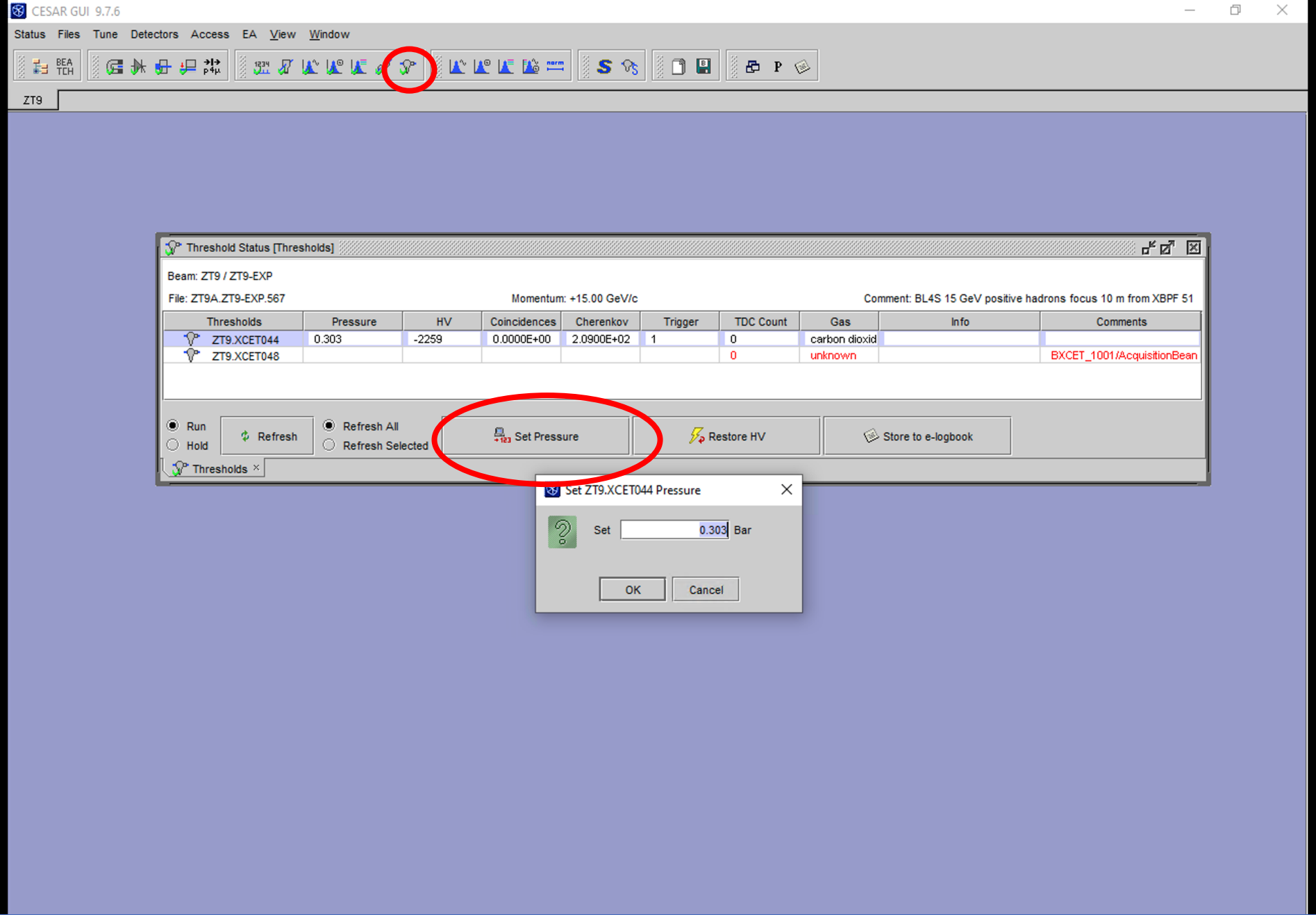
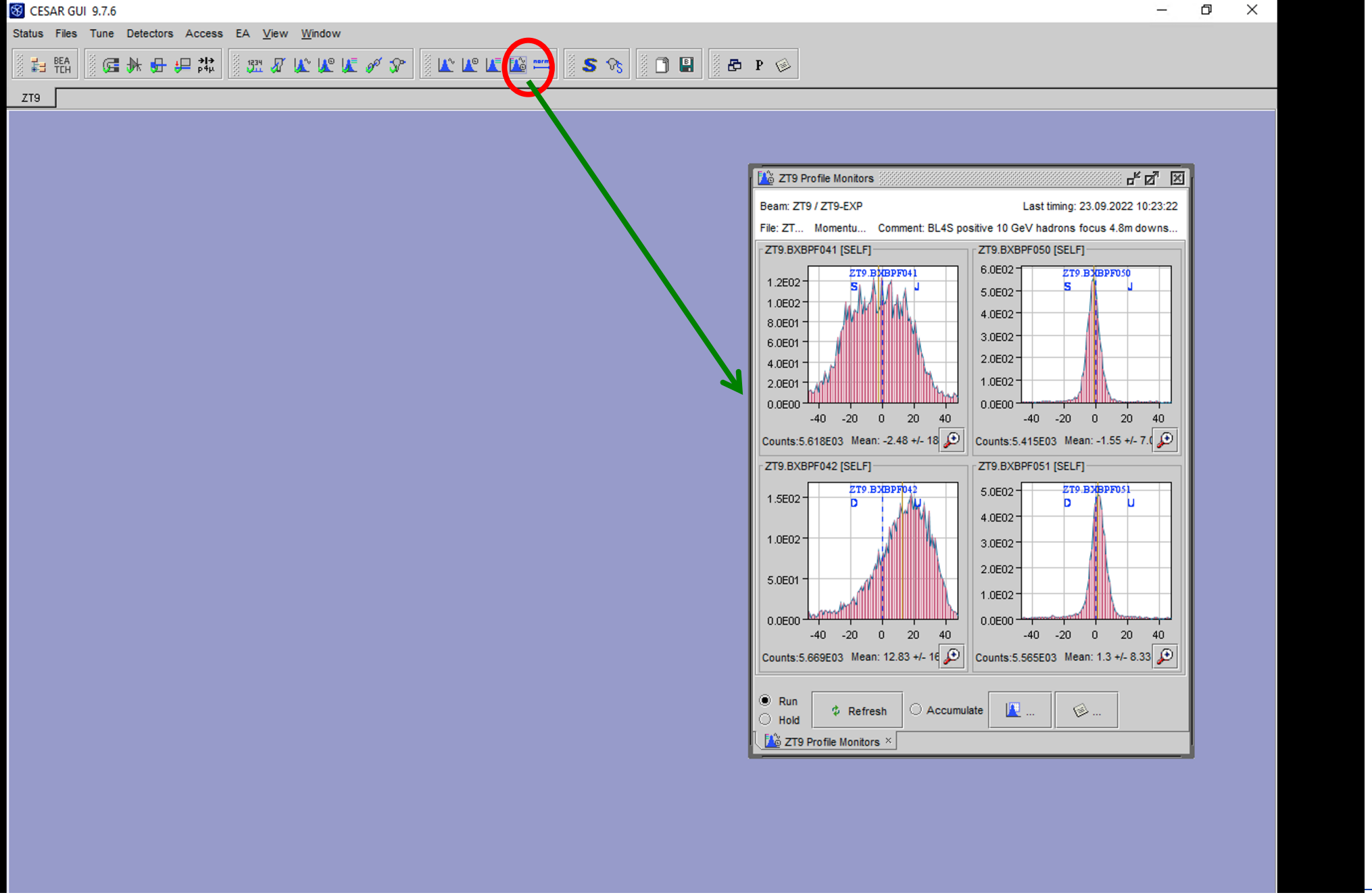
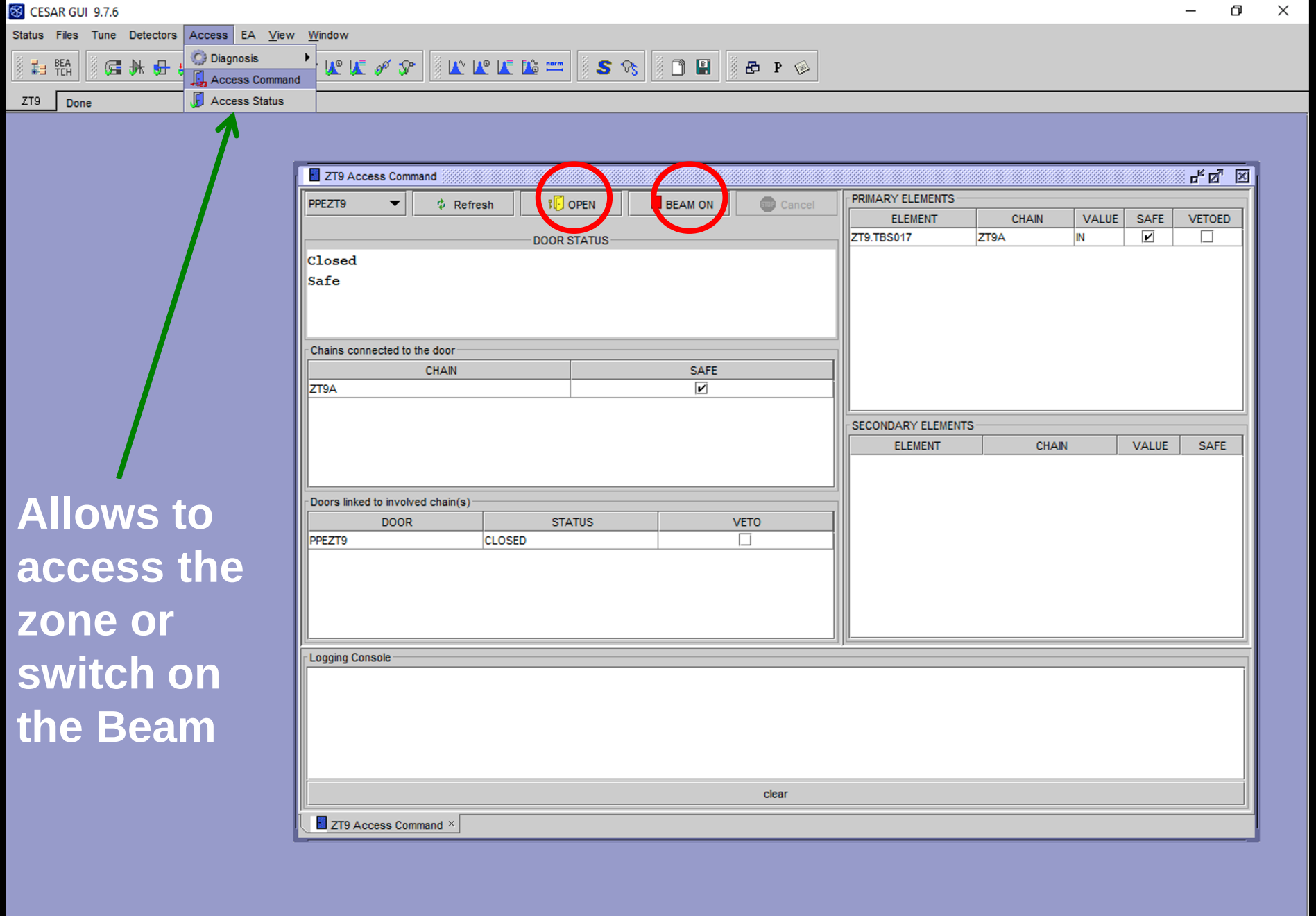

CESAR GUI 9.7.6
Status Files Tune Detectors Access EA View Window
ZT9
Beam stopper Status [Beam stopper]
Beam: ZT9 / ZT9-EXP
File: ZT9A.ZT9-EXP.567
Momentum: +15.00 GeV/c
Comment: BL4S 15 GeV positive hadrons focus 10 m from XBPF 51
Beam stopper
Read
BeamRef
Info
Comments
ZT9.TBS017
IN
OUT
<>BeamRef
Run
Hold
Refresh
Refresh All
Refresh Selected
Move In
Move Out
Store to e-logbook
Beam stopper


CESAR GUI 9.7.6
Status Files Tune Detectors Access EA View Window
ZT9
Scaler Status [Scalers]
Beam: ZT9 / ZT9-EXP
File: ZT9A.ZT9-EXP.567
Momentum: +15.00 GeV/c
Comment: BL4S 15 GeV positive hadrons focus 10 m from XBPF 51
Scalers | Count | Normalized C... | Norm count (... | Calibr. | Info | Comments
EXPT.ZT9A.001 | 1 | BXSCAL_1000/StatusBean not available / Faulty / BXSCA
EXPT.ZT9A.002 | 0.00E+00 | 1.00E+00 | 1 | BXSCAL_1001/StatusBean not available / Faulty / BXSCA
EXPT.ZT9A.003 | 1 | BXSCAL_1002/StatusBean not available / Faulty / BXSCA
EXPT.ZT9A.004 | 1 | BXSCAL_1003/StatusBean not available / Faulty / BXSCA
EXPT.ZT9C.001 | 1 | BXSCAL_1004/StatusBean not available / Faulty / BXSCA
EXPT.ZT9C.002 | 1 | BXSCAL_1005/StatusBean not available / Faulty / BXSCA
EXPT.ZT9C.003 | 0.00E+00 | 1.00E+00 | 1 | BXSCAL_1006/StatusBean not available / Faulty / BXSCA
EXPT.ZT9C.004 | 1 | BXSCAL_1007/StatusBean not available / Faulty / BXSCA
Run
Hold
Refresh
Refresh All
Refresh Selected
Set Calibration Factor
Store to e-logbook
Scalers
Triggers Status [Triggers]
Beam: ZT9 / ZT9-EXP
File: ZT9A.ZT9-EXP.567
Momentum: +15.00 GeV/c
Comment: BL4S 15 GeV positive hadrons focus 10 m from XBPF 51
Triggers | Count | Normaliz... | Norm co... | Coincidence | Coinc. count | TDC count | HV | HV BeamR... | Pos | Info | Comments
ZT9.BXSCI041 | BXSCINT_1002/StatusBea
ZT9.BXSCI050 | BXSCINT_1003/StatusBea
Run
Hold
Refresh
Refresh All
Refresh Selected
Move In
Move Out
Restore HV
Store to e-log...
Triggers

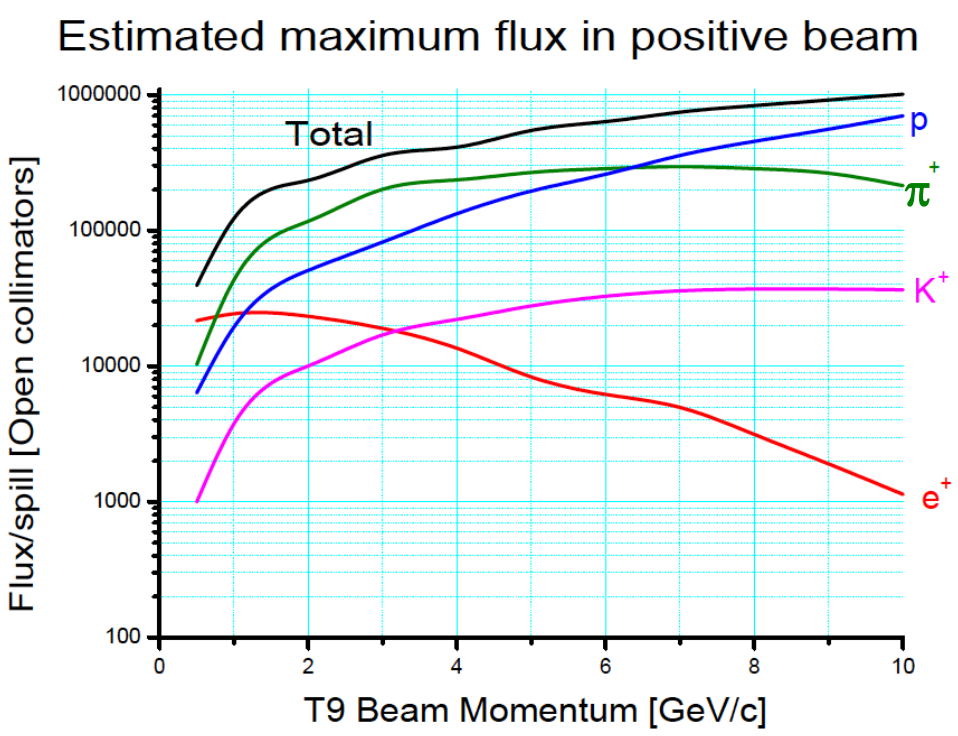

CESAR GUI 9.7.6
Status Files Tune Detectors Access EA View Window
ZT9
Threshold Status [Thresholds]
Beam: ZT9 / ZT9-EXP
File: ZT9A.ZT9-EXP.567
Momentum: +15.00 GeV/c
Comment: BL4S 15 GeV positive hadrons focus 10 m from XBPF 51
Thresholds | Pressure | HV | Coincidences | Cherenkov | Trigger | TDC Count | Gas | Info | Comments
ZT9.XCET044 | 0.303 | -2259 | 0.0000E+00 | 2.0900E+02 | 1 | 0 | carbon dioxid
ZT9.XCET048 | 0 | unknown | BXCET_1001/AcquisitionBean
Run
Hold
Refresh
Refresh All
Refresh Selected
Set Pressure
Restore HV
Store to e-logbook
Thresholds
Set ZT9.XCET044 Pressure
Set 0.303 Bar
OK
Cancel

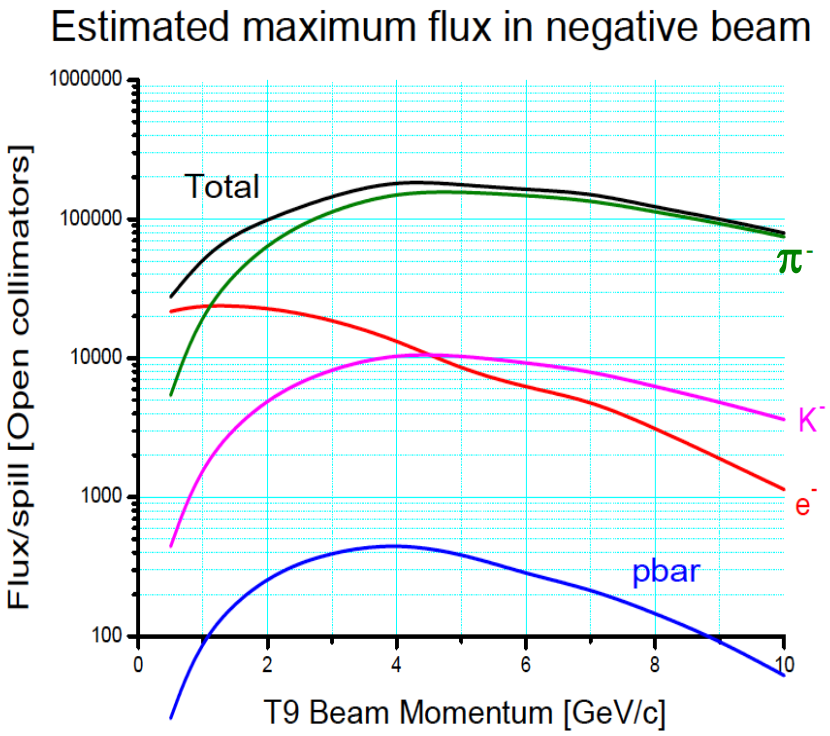

CESAR GUI 9.7.6
Status Files Tune Detectors Access EA View Window
ZT9
ZT9 Profile Monitors
Beam: ZT9 / ZT9-EXP
Last timing: 23.09.2022 10:23:22
File: ZT... Momentu... Comment: BL4S positive 10 GeV hadrons focus 4.8m downs...
ZT9.BXBPF041 [SELF]
Counts:5.618E03 Mean: -2.48 +/- 18
ZT9.BXBPF050 [SELF]
Counts:5.415E03 Mean: -1.55 +/- 7.0
ZT9.BXBPF042 [SELF]
Counts:5.669E03 Mean: 12.83 +/- 16
ZT9.BXBPF051 [SELF]
Counts:5.565E03 Mean: 1.3 +/- 8.33
Run
Hold
Refresh
Accumulate
ZT9 Profile Monitors



Allows to access the zone or switch on the Beam

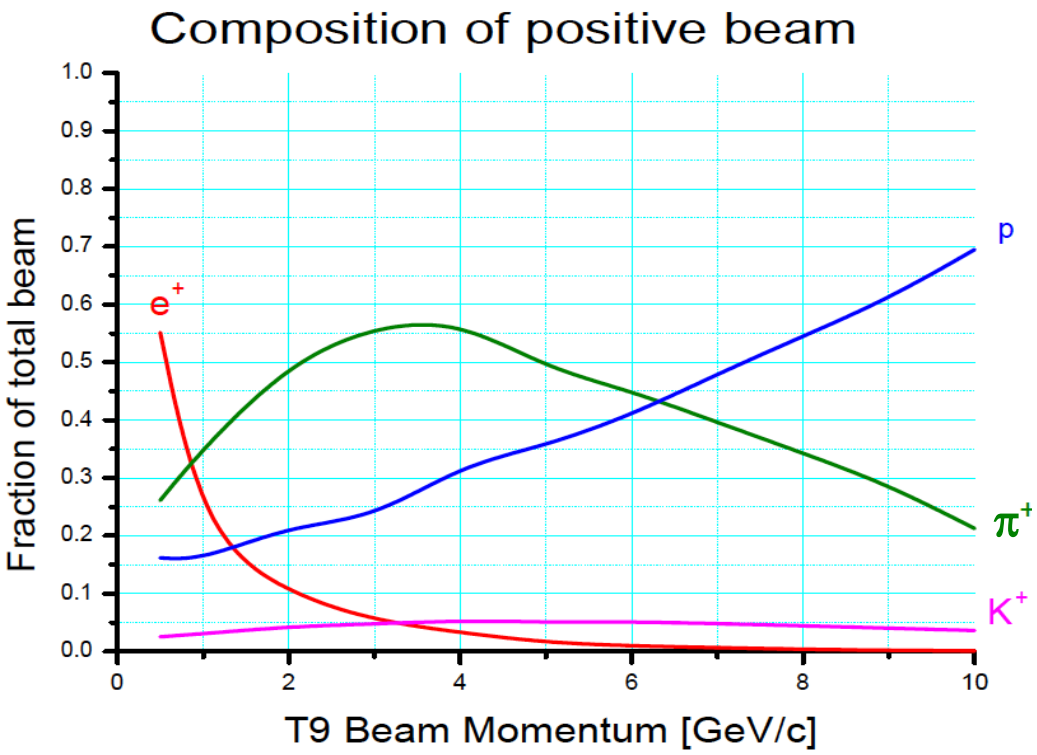
Beam rates

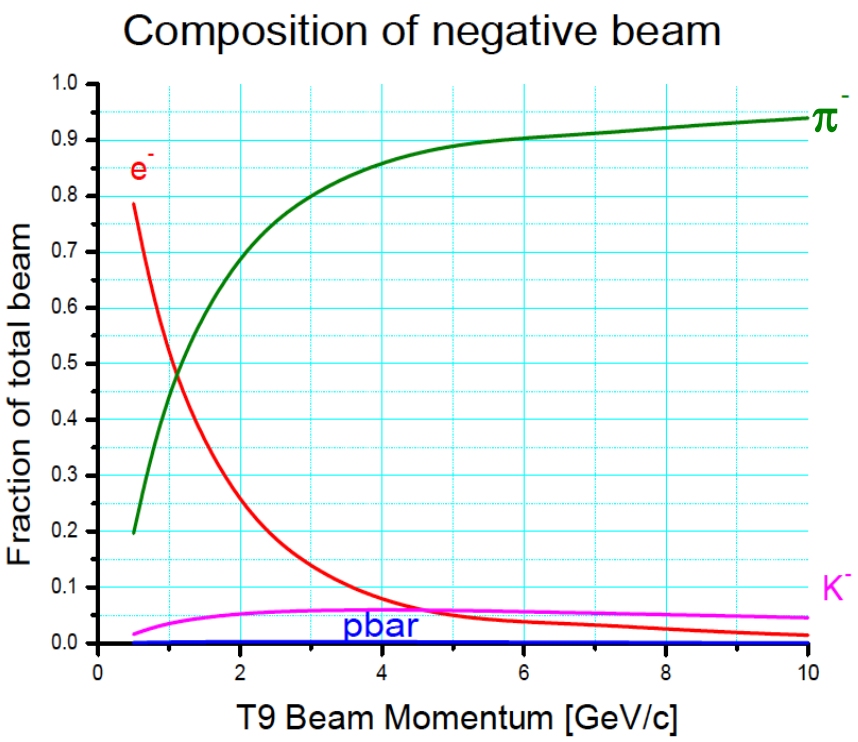




For wide open collimators, i.e. dp/p ≈ ±7.5% (Theoretical Calculation)

Beam composition





With electron enriched target (otherwise $e^{\pm}$ strongly reduced) (Theoretical Calculation)