

Review past dimuon experiments and their trigger systems

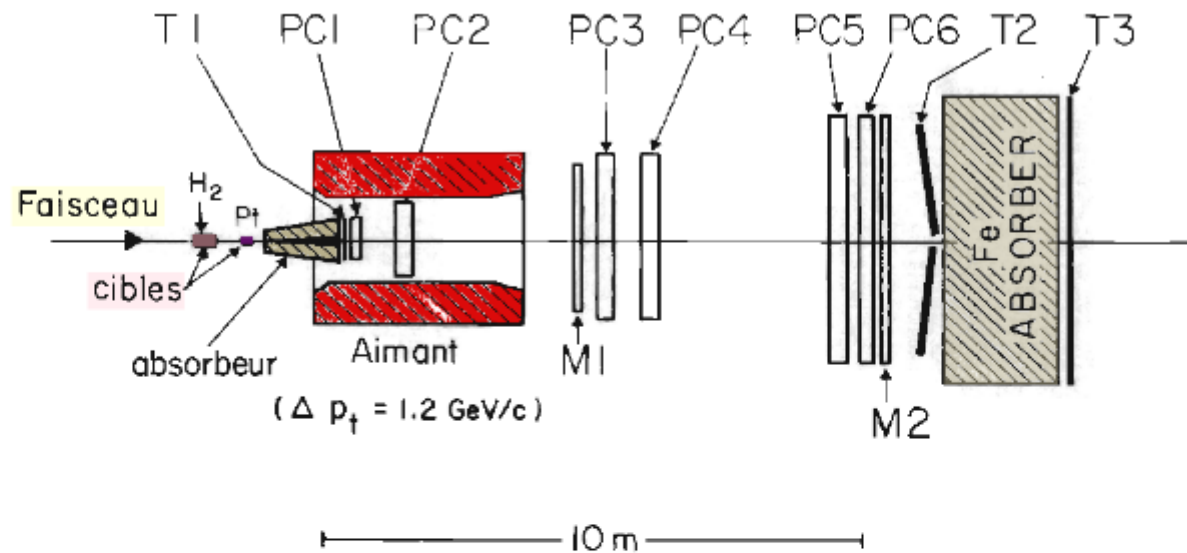
C. Quintans, 02/10/2024

## Past experiments: Absorber and spectrometer

experiment	Beam/tgt	$I_{beam}$ (/s)	Absorber (cm)	$\lambda_{int}^{\pi}$ (abs)	$\theta_{scat}$	Accept (%)
E615	$\pi^{-}$ 252/20cm W	$20 \times 10^7$	110 BeO +322 Be+412 C	15.99	0.131/p	4
NA3	$\pi^{-}$ 200/6cm Pt	$3 \times 10^7$	150 Fe	7.34	0.208/p	20
NA10	$\pi^{-}$ 194/12cm W	$65 \times 10^7$	320 C+160 Fe	13.84	0.232/p	10
COMPASS	$\pi^{-}$ 190/110cm NH3	$7 \times 10^7$	36Al+200Al <sub>2</sub> O <sub>3</sub> +20Fe	7.83	0.141/p	40

## Statistics:

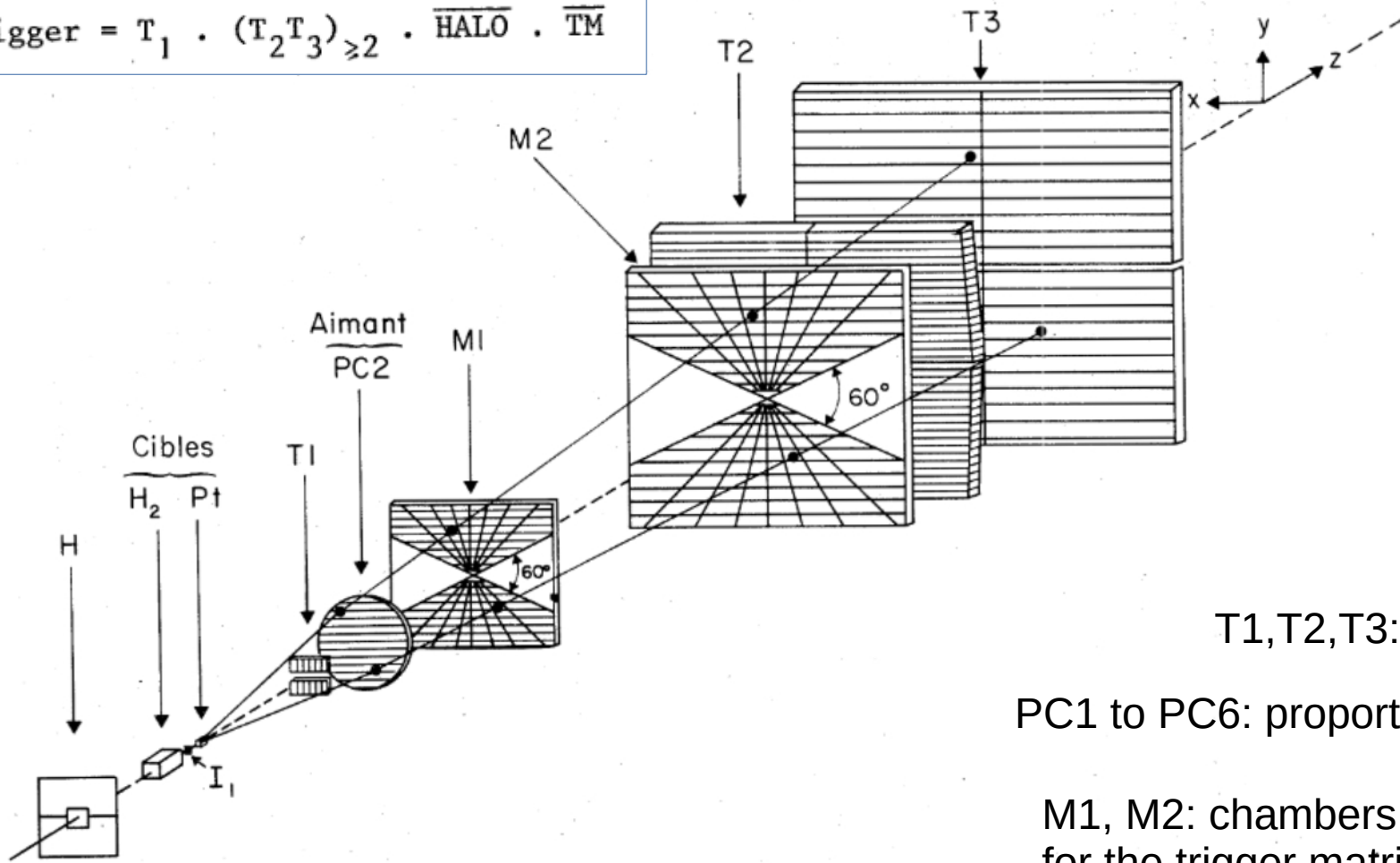
Experiment	Beam type (GeV)	Beam intensity (part/sec)	Target type	DY mass (GeV/c <sup>2</sup> )	DY events
E615	$\pi^{+}$ 252	$17.6 \times 10^7$	20cm W	4.05 – 8.55	5000
E615	$\pi^{-}$ 252	$18.6 \times 10^7$	20cm W	4.05 – 8.55	30000
NA3	$\pi^{+}$ 200	$2.0 \times 10^7$	30cm H <sub>2</sub>	4.1 – 8.5	40
NA3	$\pi^{-}$ 200	$3.0 \times 10^7$	30cm H <sub>2</sub>	4.1 – 8.5	121
NA3	$\pi^{-}$ 200	$3.0 \times 10^7$	6cm Pt	4.2 – 8.5	4961
NA3	$\pi^{+}$ 200	$2.0 \times 10^7$	6cm Pt	4.2 – 8.5	1767
NA10	$\pi^{-}$ 286	$65 \times 10^7$	120cm D <sub>2</sub>	4.2 – 8.5	7800
NA10	$\pi^{-}$ 140	$65 \times 10^7$	120cm D <sub>2</sub>	4.35 – 8.5	3200
NA10	$\pi^{-}$ 286	$65 \times 10^7$	12cm W	4.2 – 8.5	49600
NA10	$\pi^{-}$ 140	$65 \times 10^7$	12cm W	4.35 – 8.5	29300
COMPASS 2015	$\pi^{-}$ 190	$7.0 \times 10^7$	110cm NH <sub>3</sub>	4.3 – 8.5	35000
COMPASS 2018	$\pi^{-}$ 190	$7.0 \times 10^7$	110cm NH <sub>3</sub>	4.3 – 8.5	52000



- $\pi^\pm$  and  $K^\pm$  beams at 200 GeV and 150 GeV;  $\pi^-$  beam at 280 GeV
- Hadron beam intensity  $3 \times 10^7$ /second
- 30 cm (50 cm for 280 GeV beam)  $H_2$  target + 6 cm Pt target
- 150 cm long Fe absorber, 150 cm W (U) beam plug
- dimuons geometrical acceptance 25%

# NA3 dimuon trigger system

$$\text{Prétrigger} = T_1 \cdot (T_2 T_3)_{\geq 2} \cdot \overline{\text{HALO}} \cdot \overline{\text{TM}}$$

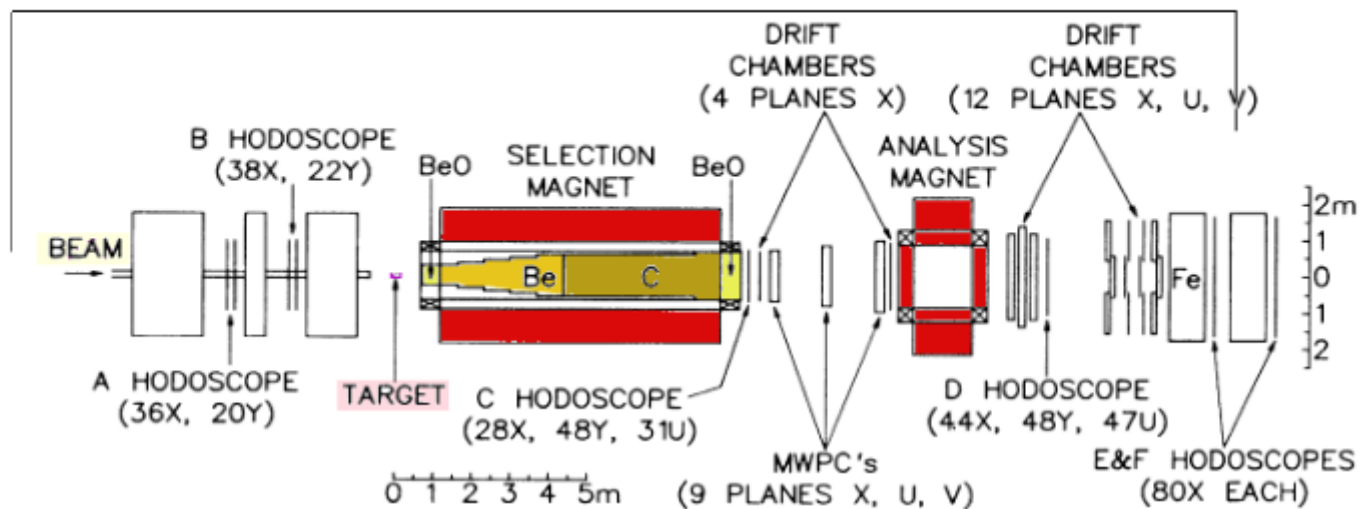


T1,T2,T3: hodoscopes

PC1 to PC6: proportional chambers

M1, M2: chambers "damier" used for the trigger matrix

## E615 @ Fermilab



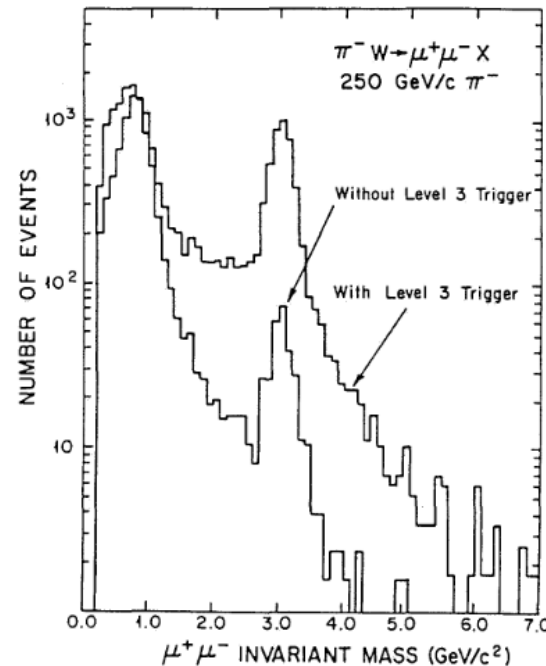
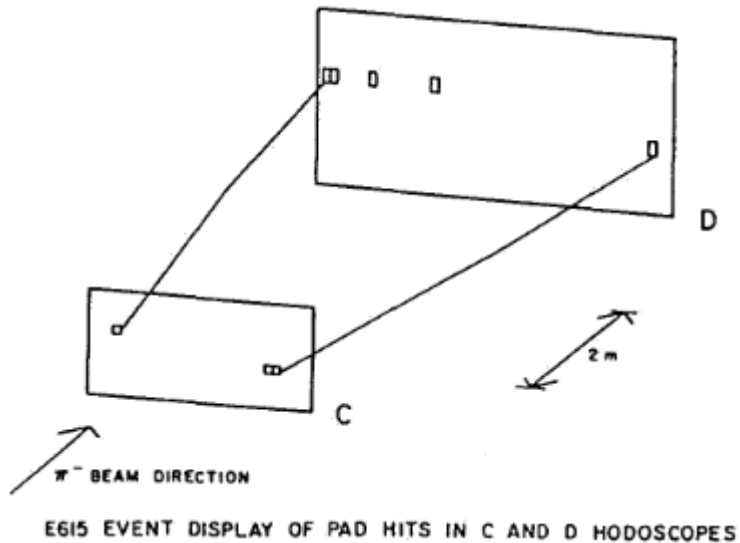
- $\pi^\pm$  beams at 252 GeV;  $\pi^-$  beam at 80 GeV
- Hadron beam intensity  $2 \times 10^8$ /second
- 20 cm W target
- 875 cm light Absorber, no beam plug
- dimuons geometrical acceptance  $\approx 4\%$

# E615 dimuon trigger system

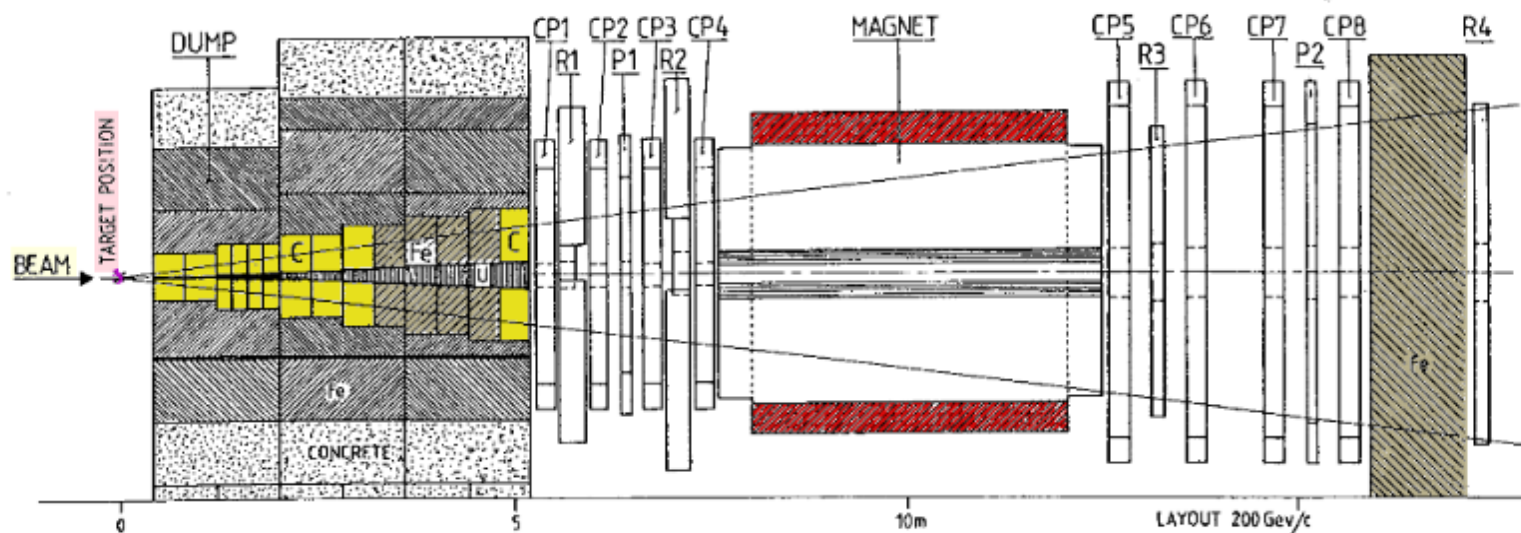
E615 paper

3 stages trigger:

- 2 distinct muons in time coincidence with beam signal and are not halo.
- 2 tracks pointing back to the target region in the non-bending view.
- a track pair finder using corresponding pads in C & D hodoscopes (meaning HMDY)

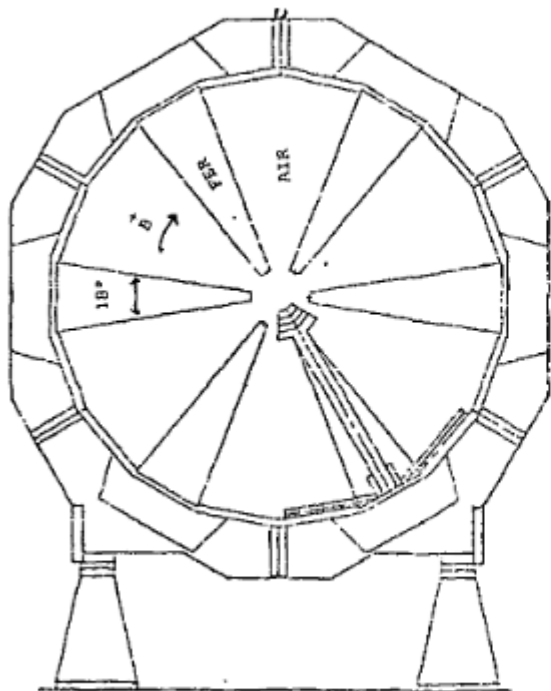


# NA10 @ CERN



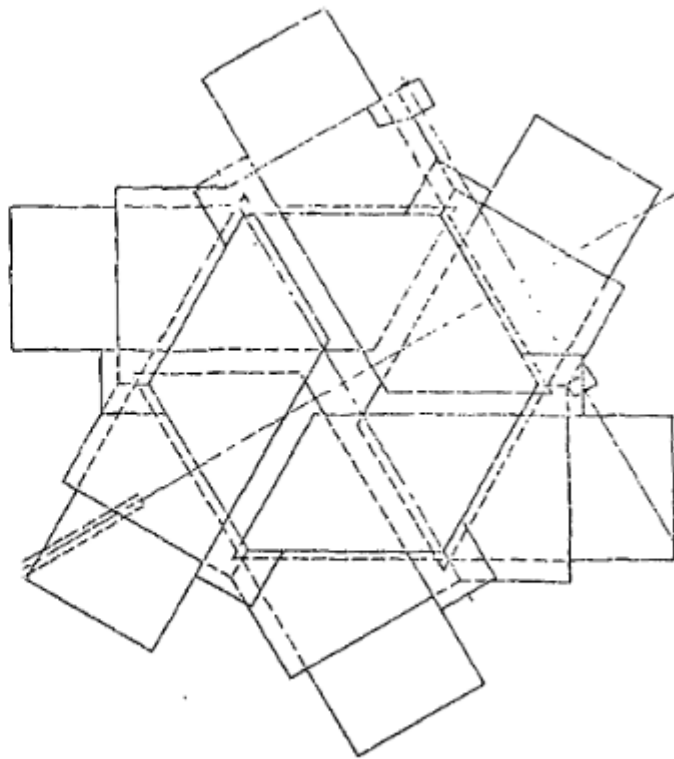
- $\pi^-$  beam at 140, 194 and 286 GeV
- Hadron beam intensity  $1 \times 10^9$ /second
- 12 cm (6 cm) W target + 120 cm D<sub>2</sub> target (only with 140 and 286 GeV beams)
- 480cm Absorber, 120 cm W+U beam plug
- dimuons geometrical acceptance  $\approx 10\%$

# NA10 dimuon trigger system



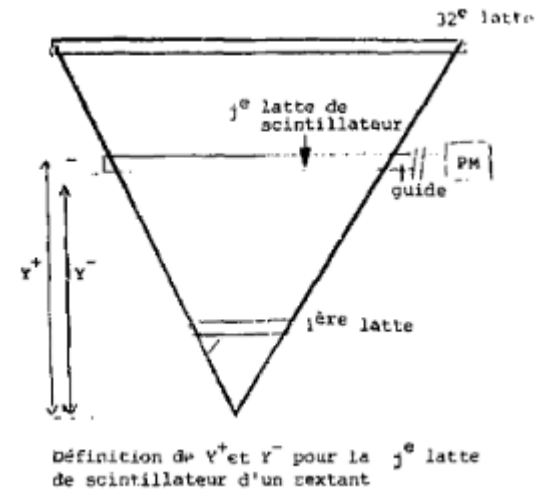
A : aimant

Toroidal magnet



b : hodoscope R1

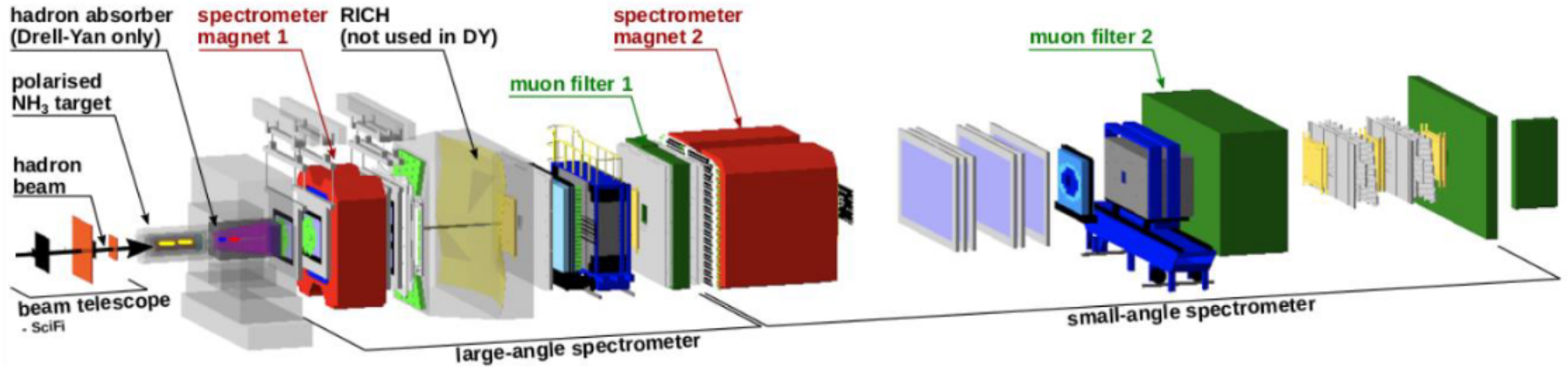
Hodoscopes R1 to R4



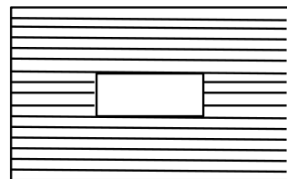
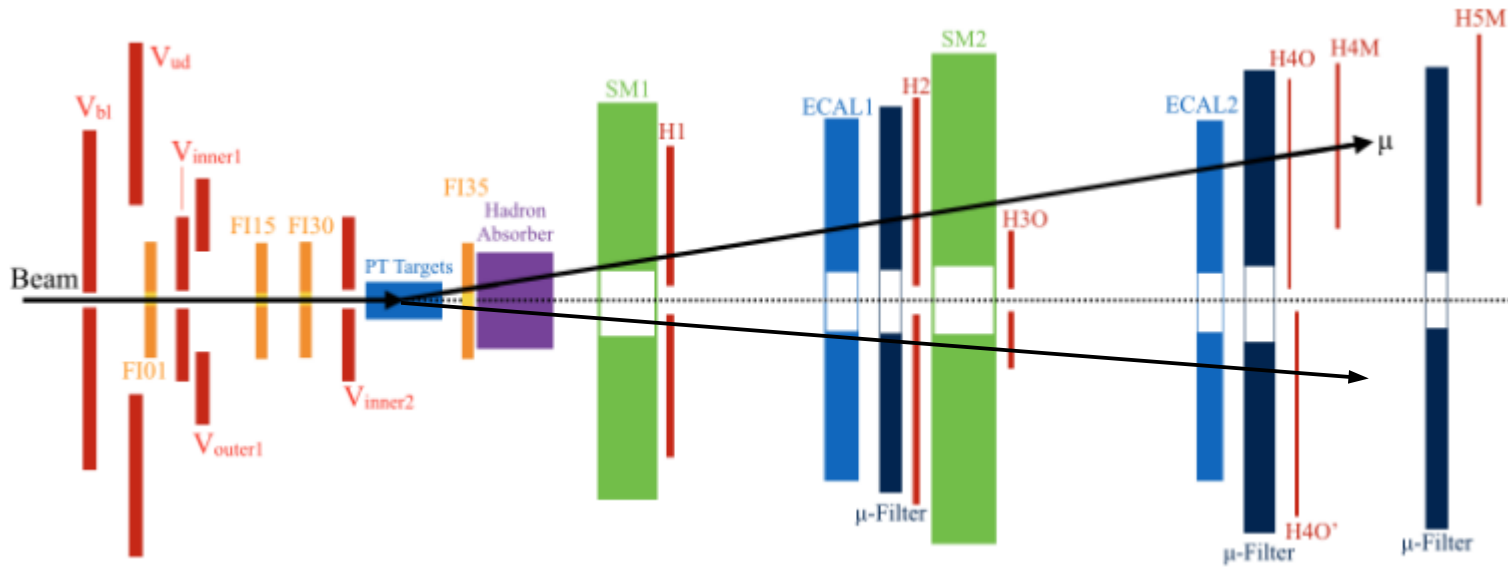
One sextant of R, with its horizontal slabs



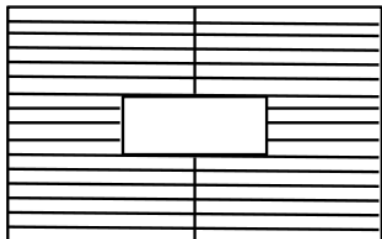
# COMPASS



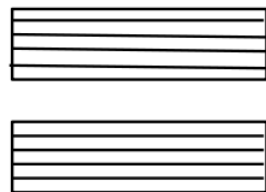
# COMPASS dimuon trigger system



HG01, HO03



HG02Y2, HO04Y2 HG02Y1, HO04Y1



HM04, HM05