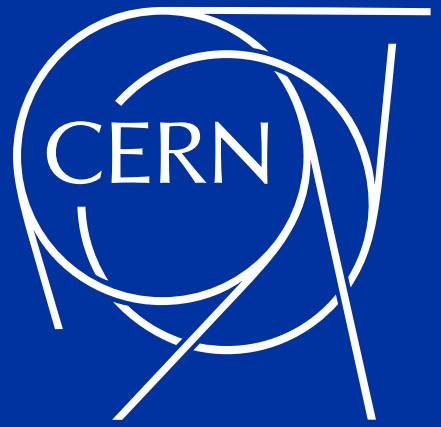
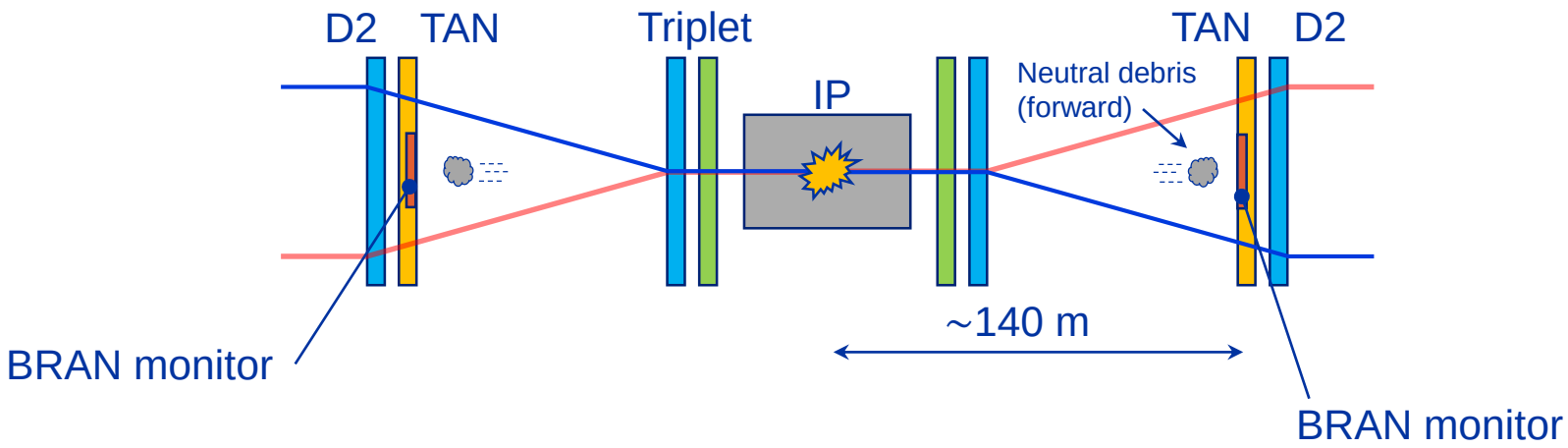


Status of BRANs for HL-LHC

S. Mazzoni for the BRAN team, SY-BI

11th HL-LHC Collaboration Meeting, 21 October 2021

The BRAN monitor



BRAN: Beam RAte of Neutrals

What: Machine luminosity monitors

Where: IP1/5, IP2/8

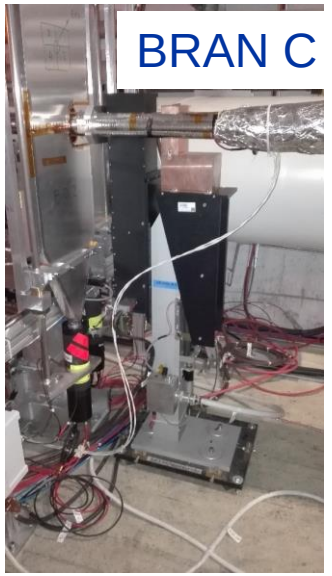
Use cases: Finding collisions, backup instrument for OP (if no data from experiments), cross-check experiments, sanity check, …

Precision: ~1% @ 1 Hz (absolute luminosity not necessary)

Challenges: Large dynamic range, radiation (IP1/5: 180 MGy/year), limited space

For HL-LHC: developments of new BRANs for IP1 & IP5

BRANs in Run 3



IP2/ IP8: "BRAN C" design based on Silica rods + PMTs (Cherenkov light).

- No functional modifications

IP1/IP5: "BRAN A" based on ionization chambers.

- Right of IP1 (12) / Left of IP5 (45): replace BRAN A with "BRAN-D" evolution of BRAN C. Two goals:
  - Replace ageing BRAN-A for LHC Run 3
  - Test prototype for HL-LHC

The BRAN-D

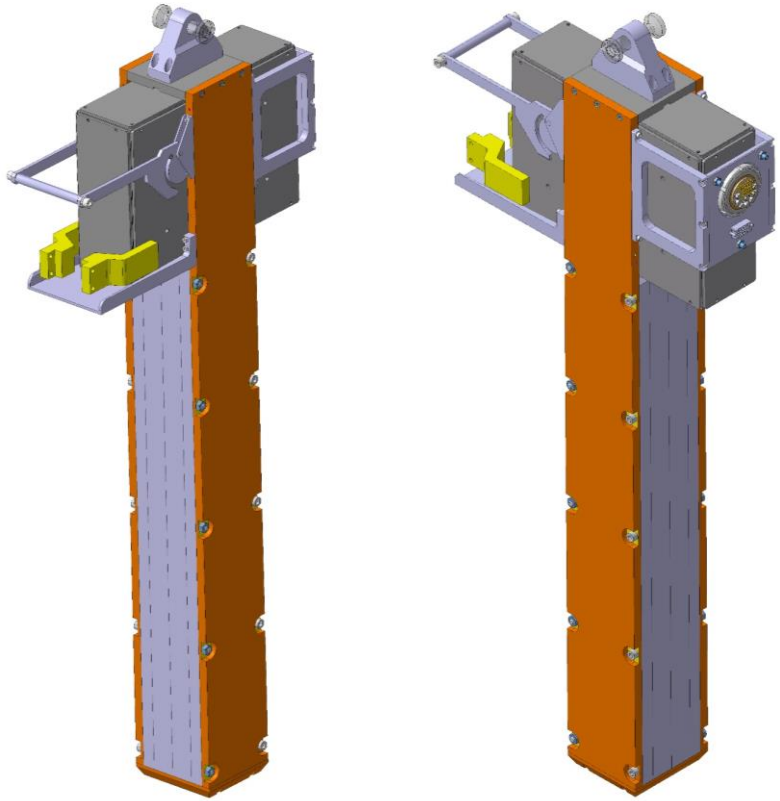
New design with two subsystems:

- Glass bars enclosure
- PMT box

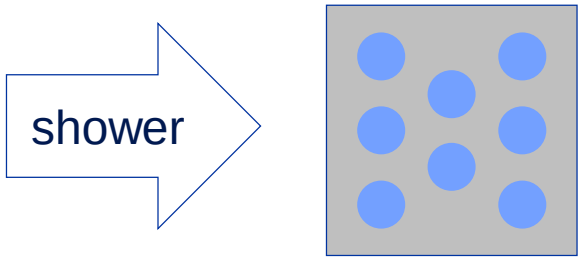
Designed by CERN design office. Drawings signed and sent to main WS on July 20. Parts fabrication outsourced to Metalicone Technologies Ltd. (Israel) – received Feb 21

A few minor modifications

- copper C11000, 99.9% pure instead of C10200 oxygen free.
- AL6061 instead of AL6082, "almost identical"
- sub mm modification of threaded hole lengths
- backplane for connectors added (in progress)



Glass bar assembly

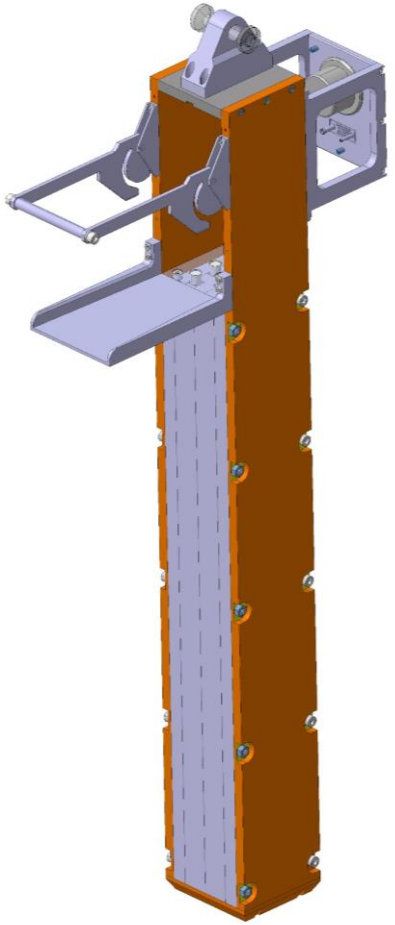


Eight 603 mm x 10 mm dia Suprasil 3302, low OH, no H2 in a copper enclosure (100 x 100 mm)

Backpanel for PMT box with non-latching connectors for HV & LV supply, PMT signal out

Handle for crane operation. Weight approx. 60 kg (limit 100 kg). Overall length 900 mm OK

Two copper slabs replaced with aluminium ones with grove to host additional glass bars for irradiation studies from ATLAS ZDC team



PMT box

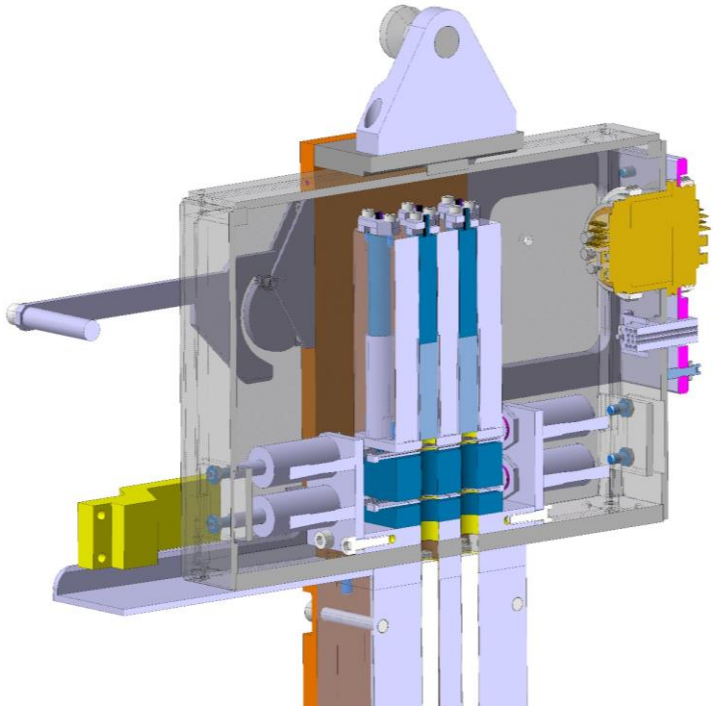
Eight PMT (one per rod). Peak QE @ 420 nm, 1.5 kV supply (individually controlled)

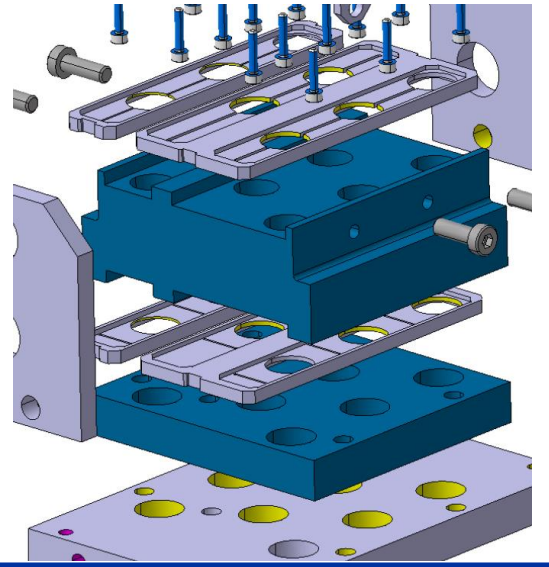
Optical transmission controlled by aperture limitation: two movable slit / hole plates: 100% - 10% - 1%

Plates moved by push / pull solenoids (eg LEDEX 195205-230, push, 24V intermittent duty)

Box can be operated by robot. Budget force 70 N (push / lift?). Lever allows to overcome force budget for connectors (110 N mating, 95 N unmating for LEMO)

Weight approx. 3.5 kg





Acquisition / SW

8 channels per instrument. Bunch by bunch acquisition integrated over 1 s.

Large dynamic range:

- Counting mode for low intensities (“histogram”) over configurable threshold value
- Integration within 25 ns for high int (eg pulse height).

HW Per instrument: 2x VFC-HD with IAM FMC (4 channel, 500 MSPS 14-bit ADC)

FW ready by end 2021

FESA class to be developed

Status and perspectives

BRAN-Ds assembled. Sub-systems tested: HV supply, PMT signal, solenoids

Successful installation tests in TANs (IP1/5). BRAN-As removed

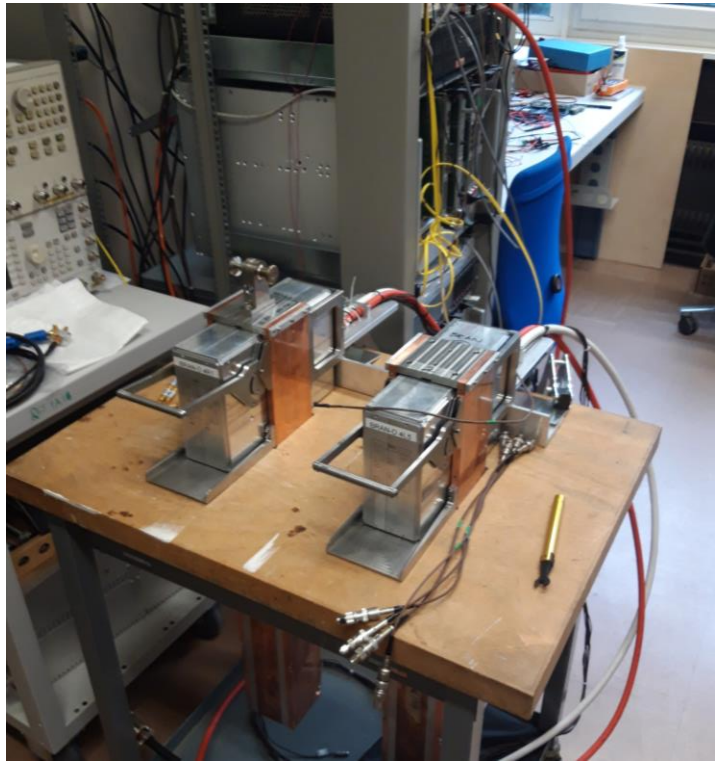
Installation foreseen for week 3 2022

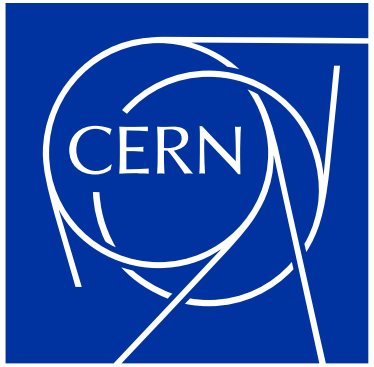
HL design:

- in the course of 2022 kick off new design adapted to TAXN
- study design / connectors to improve robot handing

Budget:

- For period 2022-2027, revised estimate for C&SR in line with original baseline (650 kCHF). Peak of spending profile moves from 2023 to 2024





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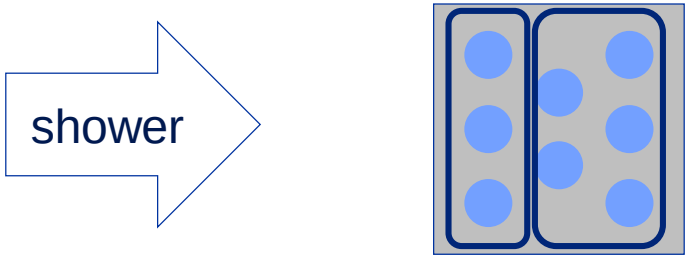
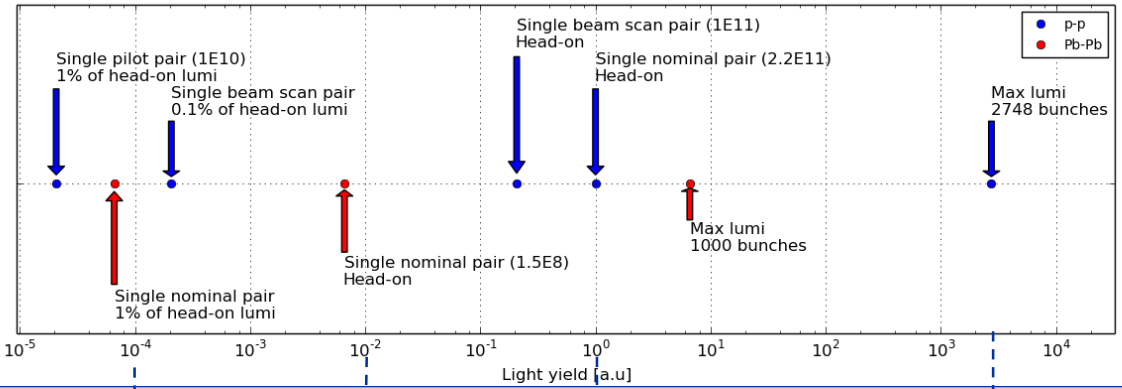
Channel sensitivity range



Hi sensitivity

Low sensitivity



p-e = photoelectron