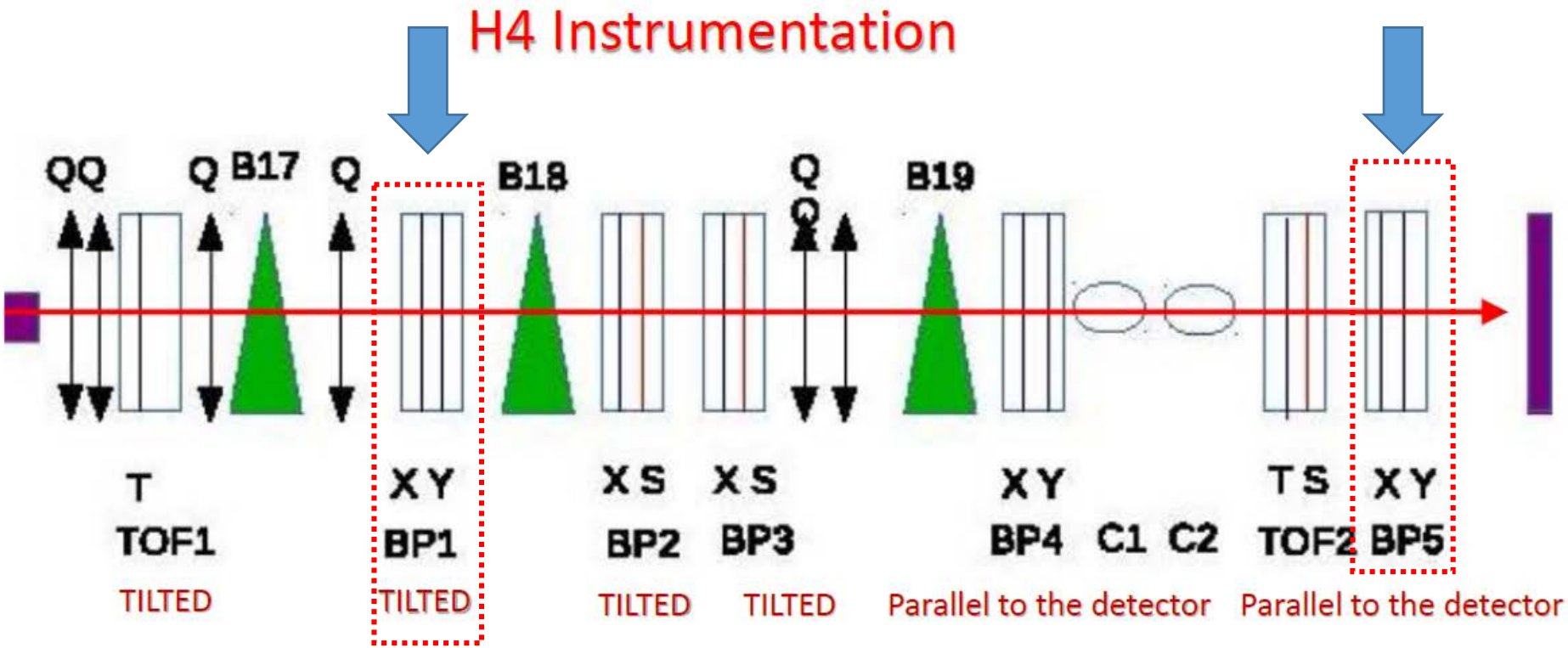
Instrumentation by EN-EA (Cherenkovs + XBPF tanks)

N. Charitonidis, S. Girod, V. Clerc

EN-EA

Instrumentation – Beam profile monitors

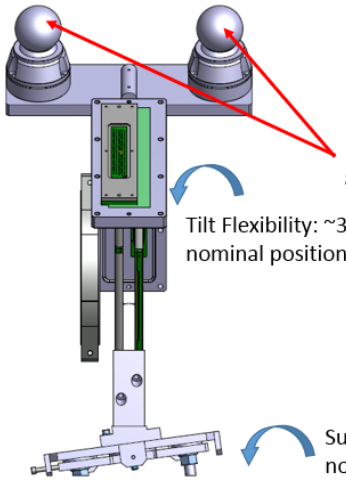
- Being prepared by BE/BI (See talk of Inaki)



All detectors will be placed inside the "XBPF Tank"

XPBF “Tank” being prepared by EN-EA

Flexibility of monitor supports in case of misalignments



Fiducials to be removed after the alignment.

Tilt Flexibility: ~3 degrees from the nominal position

Support Flexibility: ~3 degrees from the nominal position

Courtesy: W. Devauchelle, S. Girod, V. Clerc.

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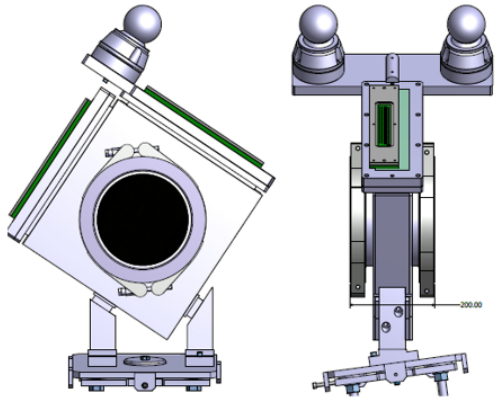
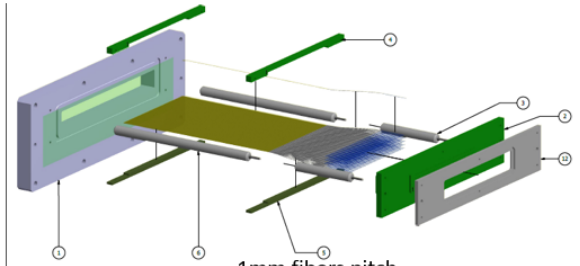
CERN Fiber Beam Profile Monitors and trigger tiles
→ Integrated in both beam lines



Tilt Flexibility: ~3 degrees from the nominal position
Support Flexibility: ~3 degrees from the nominal position



1mm fibers pitch
Trigger tile of 2mm scintillator
Final design and production for H2 under way by BE/BI group @ CERN

Courtesy: S. Girod, W.Devauchelle, I. Ortega-Ruiz [CERN]

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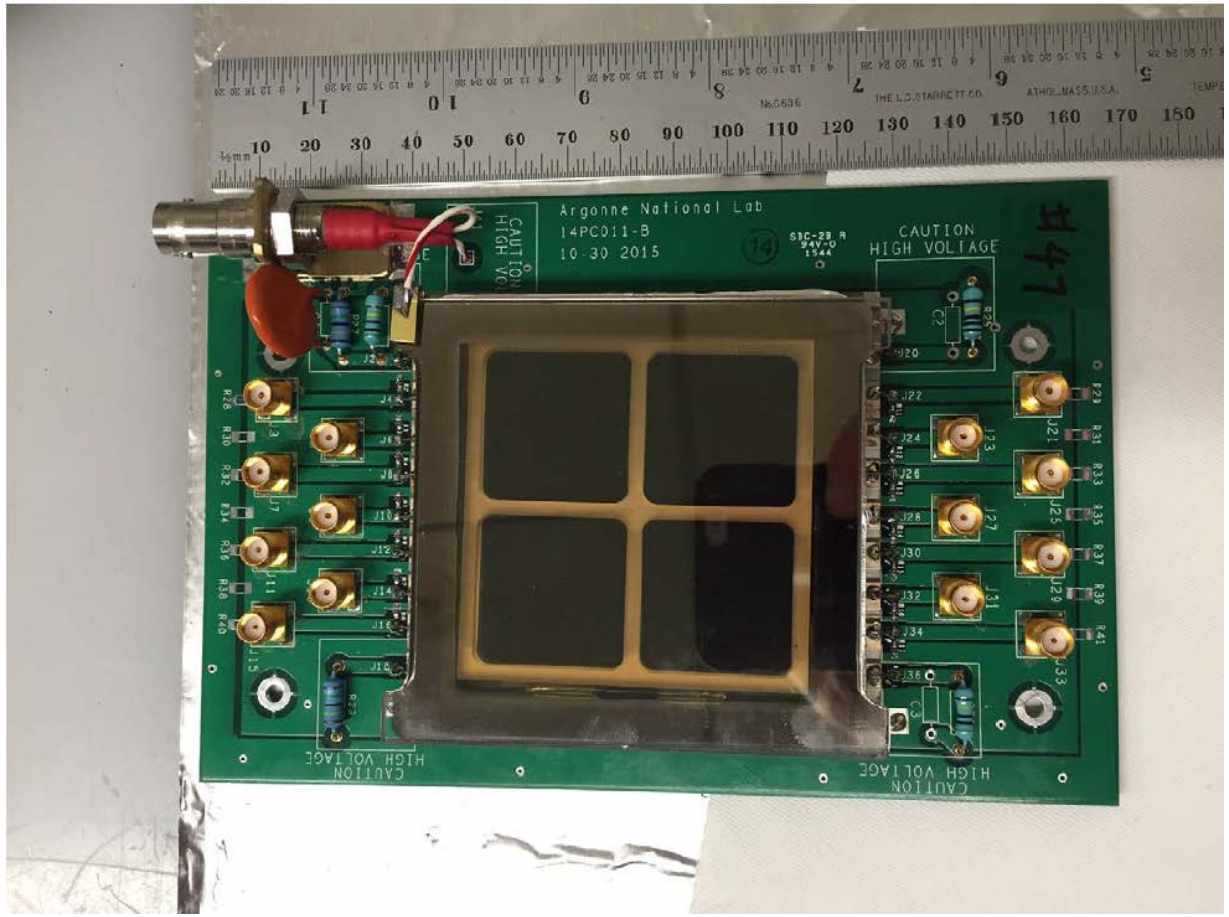
Fabrication of the tanks started.

Normal operation – Profile monitors and scintillators

Control of all the secondary beam lines through the CESAR software

→ Similar approach to be followed for the XBPF's (profile & intensity monitoring)

pLAPPD



To be integrated inside the “XPBF tank”

→ Study started.

→More details on the dimensions, precision of placement, cabling routes needed.

Cherenkov Detectors

H4 PID Schema

- Slides from Paola, 13/12/2016
  https://indico.fnal.gov/getFile.py/access?contribId=3&resId=0&materialId=slides&confId=13393

H4 det. layout, option 1 – with pLAPPD

All tracking and trigger monitors will be always present in the beamline, for a total of 8 sci (XBPF) layers and three trigger planes

For PiD:

- $p \leq 2$GeV/c : XBPF ToF + standard CO2 Cherenkov for electron discrimination
- $2 < p \leq 5$GeV/c : pLAPPD ToF + standard CO2 Cherenkov for electron discrimination
- $5 < p \leq 7$GeV/c : pLAPPD ToF + standard CO2 Cherenkov for electron identification

Total instrumentation needed: 8 XBPF layers with standard electronics, 2 XBPF layers with ToF electronics, two pLAPPD stations, one standard Cerenkov, and three trigger planes, plus spares.

H4 det. Layout, option 2 – without pLAPPD

For PiD:

- $p \leq 2$GeV/c : XBPF ToF + standard CO2 Cherenkov for electron discrimination
- $2 < p \leq 3$GeV/c : XBPF ToF + standard CO2 Cherenkov for electron discrimination. Kaons cannot be distinguished from protons
- $3 \leq p \leq 5$GeV/c : standard CO2 Cherenkov for electrons, high pressure Cherenkov for π(< 10 bar) **Kaons cannot be distinguished from protons**
- $p > 5$GeV/c: standard CO2 Cherenkov for pions, high pressure (10-15 bar) CO2 Cherenkov for kaons. Electron content is small, will not be tagged.

Total instrumentation needed: 8 XBPF layers with standard electronics, 2 XBPF layers with ToF electronics, one standard Cherenkov, one high pressure Cerenkov with non-standard distribution system, and three trigger planes, plus spares.

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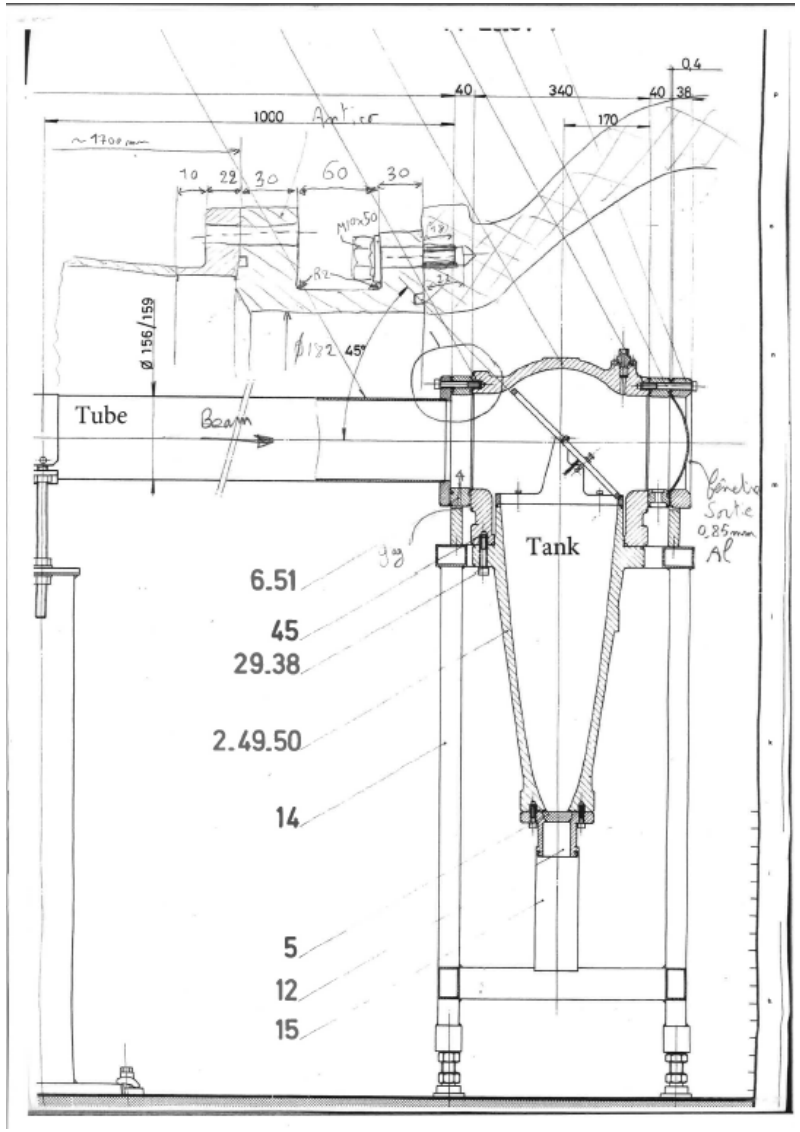
Cherenkov Detectors

Summary

- To be constructed from EN/EA :
  - H2:
    - 1 high-pressure XCET with Non Standard Distr. System
    - 1 normal pressure XCET <3.5b 2-gas valve – both gases available to both XCETs.
  - H4:
    - 1 normal pressure XCET <3.5 b
    - (maybe) 1 high-pressure XCET with Non Standard Distr. System

Design / Studies / Construction ongoing



- Large aperture beam pipe – increase the geometrical acceptance as much as possible.
- Length of the tubes :
  - XCET-1: 1.800 m
  - XCET-2: 1.645 m
- Documentation on the design ongoing.
- Gas system :
  - CERN Standard limited to 10b. For 15 bar maximum pressure additional piping needed
  - Possibly extra “heating” of the piping will be necessary
  - Control system, windows and tubes will be redesigned.

When ready, the detectors will be tested – possibly in East Hall ?

XCET Efficiency

- Experience with similar construction Cherenkovs in T9 :

Atm. Figure 2 shows the ratio of the Cherenkov counts with respect to the trigger counts. When the detectors operate in full efficiency, this ratio is very close to the pion, muon and positron content of the beam, as the kaon and proton thresholds are at much higher pressures.

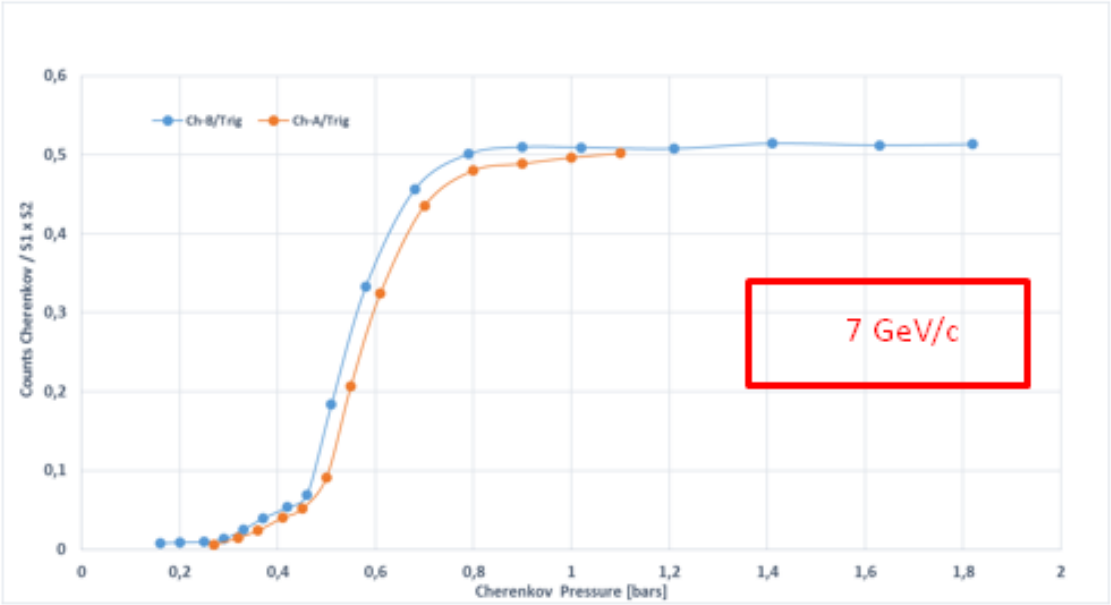


Figure 2: Pressure scan for both Cherenkov's, starting from the Cherenkov light threshold pressure for pions. The y-axis is the ratio of the counts of each detector divided by the trigger counts.

Submitted for publication to NIM-B

Efficiency measured with similar XCETS in North Area

CERN - European Organization for Nuclear Research

LCD-Note-2013-006

Particle Identification with Cherenkov detectors in the 2011 CALICE Tungsten Analog Hadronic Calorimeter Test Beam at the CERN SPS

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* *CERN, Switzerland,* † *University of Bergen, Norway*

June 19, 2013

Table 2: Runs with pure (> 80%) pion selection. The quoted purity and efficiency refer to the Cerenkov selections used in the W-AHCAL analysis and correspond to the average of all considered runs, weighted by the number of selected events in each run. Run numbers in bold correspond to runs with tertiary beam setttings.

q ·p [GeV]	# ev. sel.	purity	efficiency	run number - 361000
25	96514	100%	70%	**225 233**
30	151332	100%	70%	**216 217**
40	213184	100%	71%	**214 215**
50	383288	98%	88%	**235 249 250 646** 703 704
60	2014543	100%	99%	**645 659 660 661 664 665 666 667 668 669 670 671 672 673 681 683 719 720 721 722 724 726**
80	1501068	100%	95%	**728 729 730 731 732 733 735 737 738 739 740 741 756 757 758 759 760 761 762 763 765**
100	73466	95%	95%	621 **636 637 747**
120	64902	93%	98%	**643 745**
150	41529	93%	88%	619 **743 744**
180	56579	92%	87%	618 663 742
-10	26830	100%	100%	**471**
-15	105575	100%	100%	**470**
-20	526999	100%	100%	255 256 257 264 469
-25	140139	100%	100%	269
-30	748435	100%	84%	267 270 271 472 473
-40	133575	94%	71%	**253**
-50	1371469	99%	95%	273 274 375 415 479 480 481 482 483
-60	314198	100%	99%	354 356 357
-80	475632	100%	86%	351 376 377 400 416
-100	340177	96%	98%	**341** 352 353 404
-120	280329	96%	95%	358 359 405
-150	391386	97%	81%	360 361 406 407 408 409 410
-180	211185	98%	56%	369 371 372 412
-200	236246	97%	80%	427 428 431 **452 464**
-250	307326	96%	100%	426 434 436 448
-300	550201	97%	100%	424 425 450 451

http://cds.cern.ch/record/1545809/files/AIDA-NOTE-2015-012.pdf

Questions ?