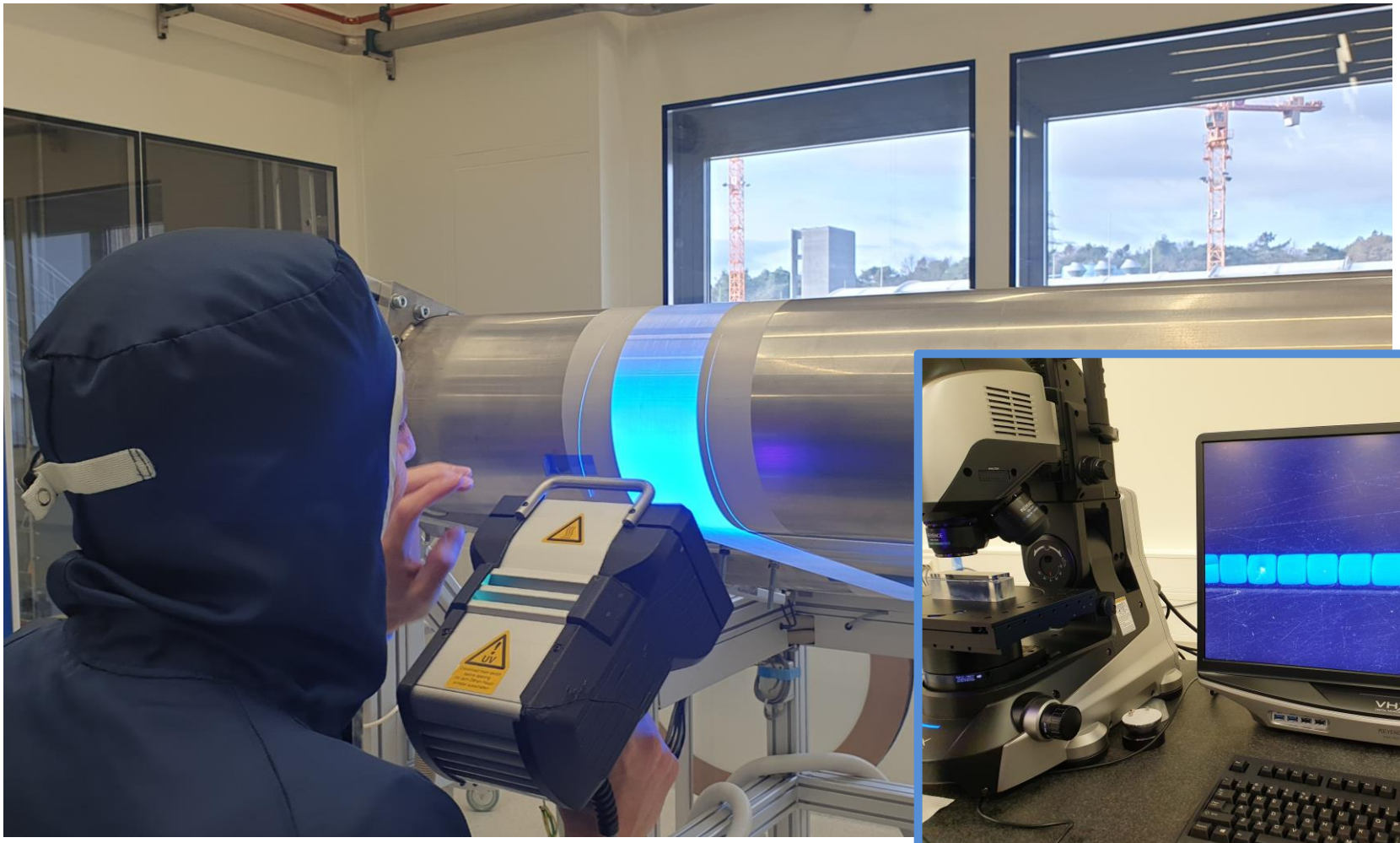
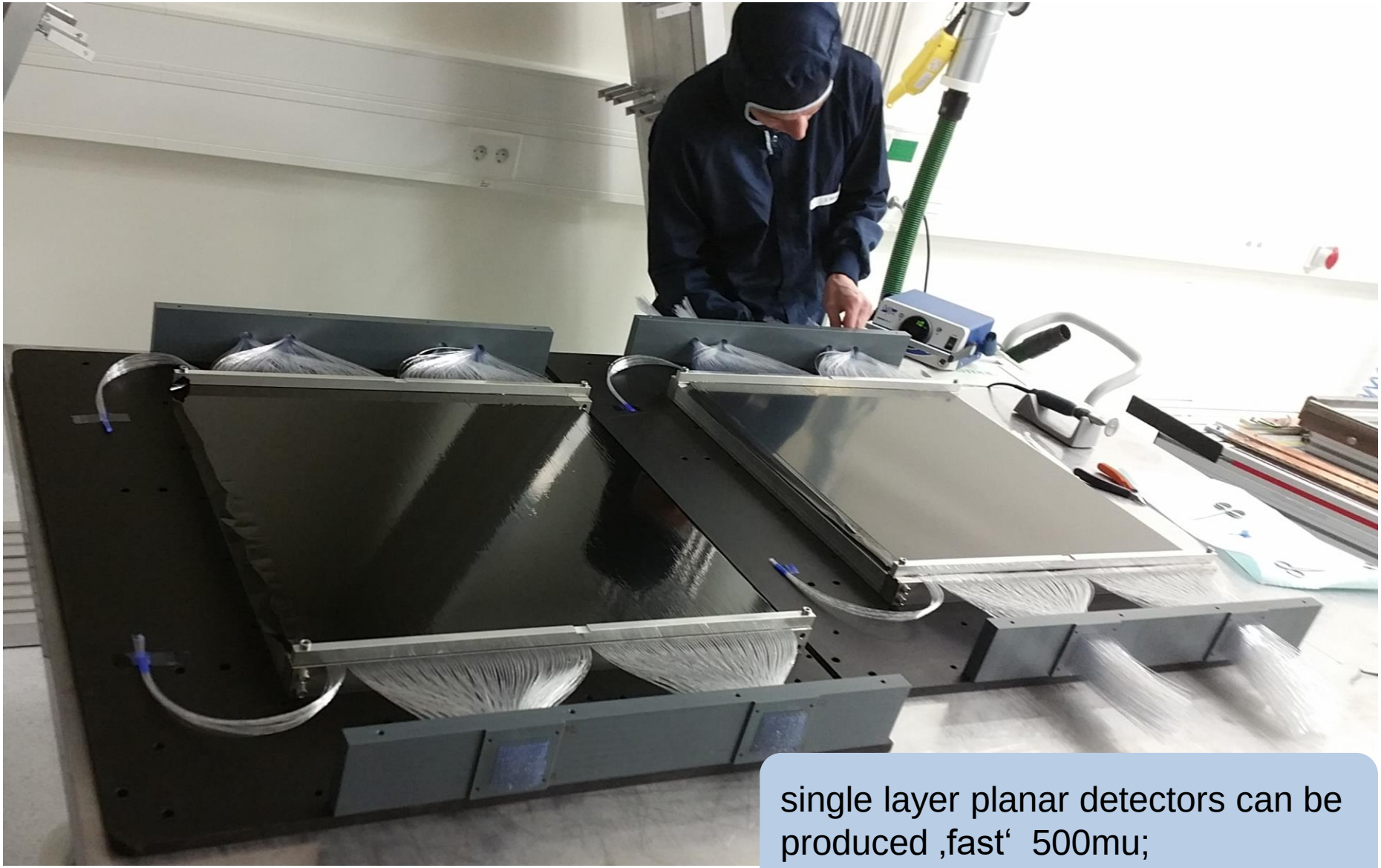
Scintillating Fiber Tracker

4d Tracking at High Rate with High Dynamic Range





single layer planar detectors can be produced ‚fast‘ 500mu;
square/round up to 50x50 cm2

R3B - Setup:

s454 - 16O(g,a)12C
April 2019

Production for R3B in 2021

s494 – Göbel, Heil

Coulomb Dissociation of 16O into 12C and 4He

(1) Four new large detectors behind GLAD (x):	1mm square fibers both sides read with MAPMT, one pixel per fiber
(2) New detector in front of GLAD (x&y) :	0.2mm square fibers hole in middle for unreacted beam both sides read with MAPMT, one pixel per fiber in center

s515 - Horvat, Aumann

Constraining energy-density functionals and the density-dependence of the symmetry energy by measurements of accurate cross sections with large acceptance at R3B

(1) New large detector behind GLAD (x):	0.5mm square fibers both sides read with MAPMT, one pixel per fiber
(2) New large detector behind GLAD (x) :	0.2mm square fibers SiPM readout

Production for R3B in 2021

s454 – Göbel, Heil

Coulomb Dissociation of 16O into 12C and 4He

(1) Four new large detectors behind GLAD (x): 1mm square fibers
both sides read with MAPMT, one pixel per fiber

(2) New detector in front of GLAD (x&y) : 0.2mm square fibers
hole in middle for unreacted beam
both sides read with MAPMT, one pixel per fiber

s515 - Horvat, Aumann

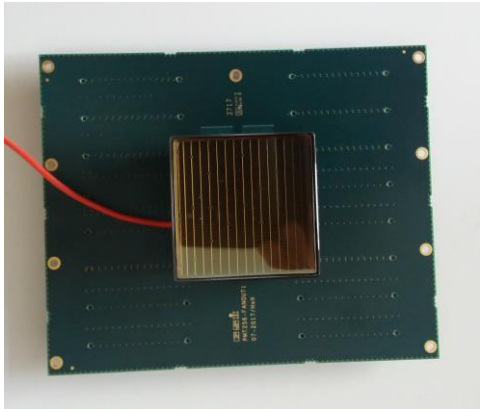
Constraining energy-density functionals and the density-dependence of the symmetry energy by measurements of accurate cross sections with large acceptance at R3B

(1) New la **unlikely due to lack of ‚manpower‘** PMT, one pixel per fiber

(2) New la **can only be realized on a longer time scale**

Fiber Readout (version 2019)

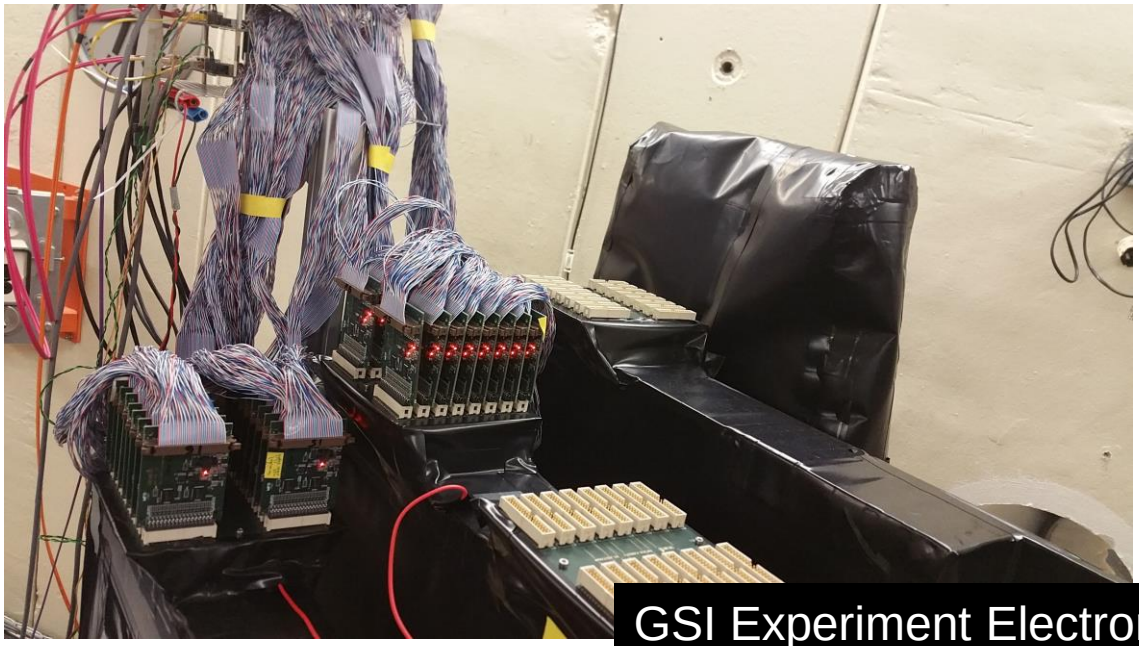
- Hamamatsu H9500 (H13700) MAPMTs
- 16 “PADI boards” and 2 “Clock-TDC” boards for 1 MAPMT



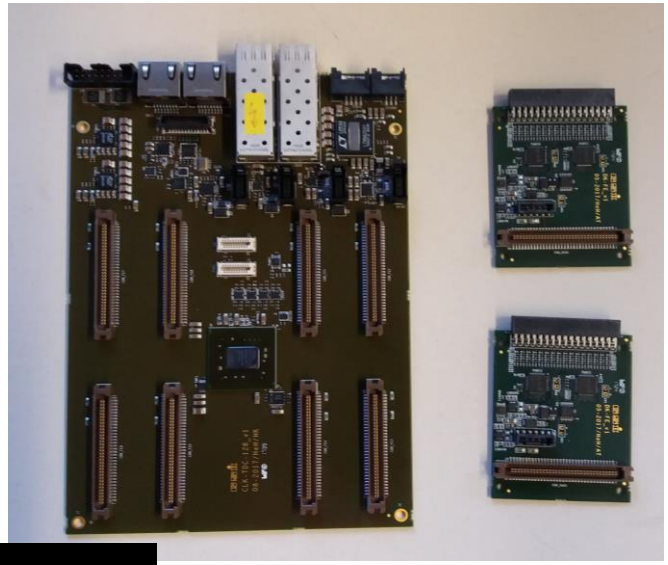
Clock-TDC (128 channel FPGA TDC, 250 ps rms leading edge and ToT multi hit TDC) Xilinx Kintex 7

PADI, an Ultrafast Preamplifier - Discriminator ASIC

IEEE TRANSACTIONS ON NUCLEAR SCIENCE, VOL. 61, NO. 2, APRIL 2014



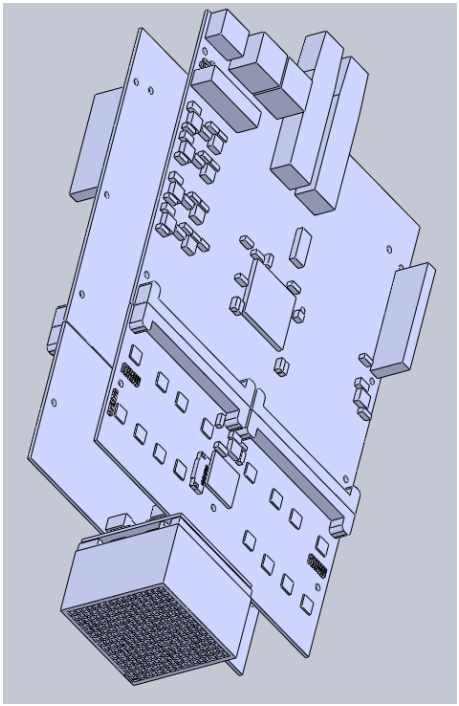
GSI Experiment Electronic (EE)

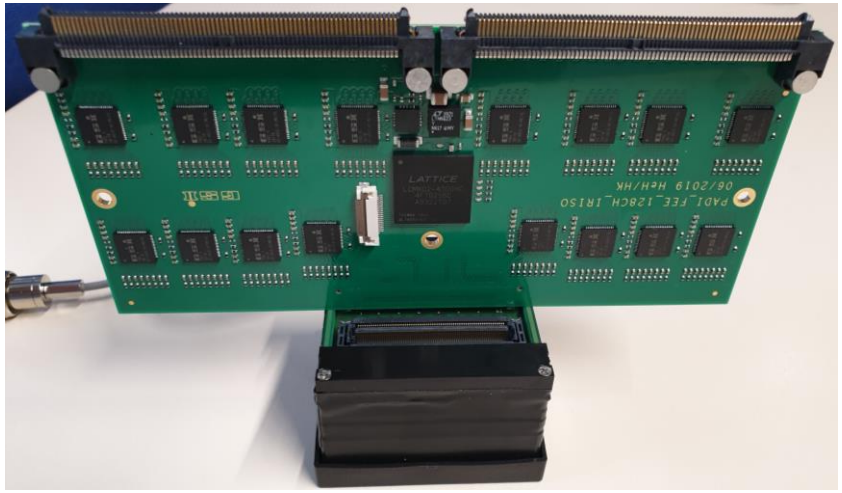


Fiber Readout (version 2021)

FANOUT+16 PADI FEEs
(+Cables) + ClockTDC

One compact Module
KILOM2



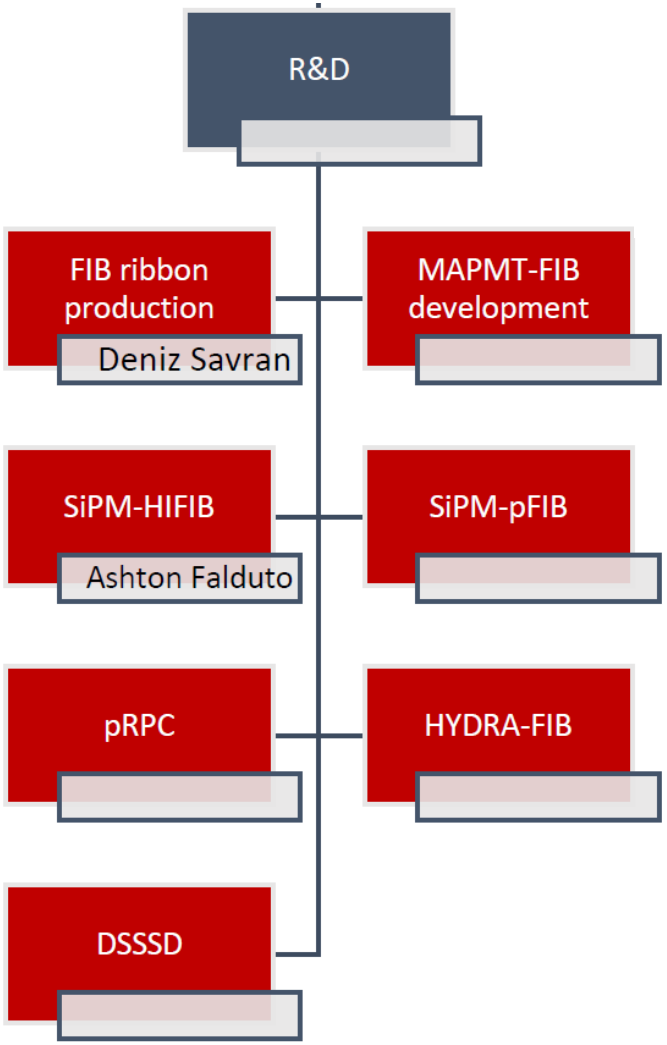


„Existing Detectors“ @ R3B

	Dimensions	Fiber thickness	# fibers	fiber shape	purpose	Readout	#fib/pxl	comment
Fiber 1a, 1b	~ 5 x 5 cm²	210 µm	256	square	tracking xy of incoming beam	Hamamatsu H9500 + single PMT	1	Tested with Ar beam. all fibres working
Fiber 2a, 2b	~ 5 x 5 cm²	210 µm	256	square	tracking xy of incoming beam		1	no test with beam
Fiber 3a, 3b	~ 10 x 10 cm²	210 µm	512	square	tracking of fragments after target, before GLAI	Hamamatsu H9500 + 2 single PMT	2	Used in 2019, not fully analysed
~~**Fiber 4**~~	~~~ 40 x 25 cm²~~	~~~200 µm~~	~~2048~~	~~round~~	~~first Prototype by Deniz + Christoph~~	~~none~~	~~4~~	~~deprecated~~
~~**Fiber 5**~~	~~~ 40 x 20 cm²~~	~~~200 µm~~	~~2048~~	~~square ??~~	~~first Prototype by Isabell ???~~	~~none~~	~~4~~	~~deprecated~~
~~**Fiber 6**~~	~~~ 50 x 50 cm²~~	~~500 µm~~	~~1024~~	~~round~~	~~first Prototype by Marvin~~	~~none~~	~~2~~	~~deprecated~~
~~**Fiber 7, 8, 9**~~	~~~ 50 x 50 cm²~~	~~1000 µm~~	~~~512~~	~~square~~	~~tracking of fragments after GLAD~~	~~none~~	~~1~~	~~deprecated~~
Fiber 10, 11, 12, 13	~ 50 x 50 cm²	500 µm	1024	square	tracking of fragments after GLAD	2 Hamamatsu H13700 + 4 single PMT	2	Used in 2019, not fully analysed
Fiber TUD	~ 40 x 25 cm²	200 µm	2048	round	SiPM Prototype by Junki+Ashton	SensL SiPM on both sides	?	

- No efficiency measured. Partly data available, but not yet analysed
- Problems with SinglePMT readout not understood, currently position resolution limited to one pixel of MAPMT
- Cross talk on MAPMT not fully understood, difficult for light beams (^{4}He, ^{16}O), Sn data not analysed
- Geometrical accuracy not verified, no experimental test of resolution

„Organisation“ of SciFi R&D



- No ‚sperate‘ WG / Project so far

- Mainly embedded in R3B Tracking WG

- but competence/ knowhow also valuable for other colaborations, see next slide

R3B Tracking WG Organigram

Further „NUSTAR“ Activities (to my knowledge)

all projects below rely on SiPMs

(1) SuperFRS

- SciFI Tracker are one option to be used as tracking detectors in PreSeperator
- few channel grids are supposed to be used as ‚calibration tools‘ for GEM TPC

(3) WASA

Take-san bought 4 large detectors. http://www.moderation-line.co.jp/index.html
coupled to Hamatsu SiPM Matrix (8*8)
readout electronic from GSI EE: MPPC_ROB = drich (PreAmp) + ClockTDC

(4) DESPEC

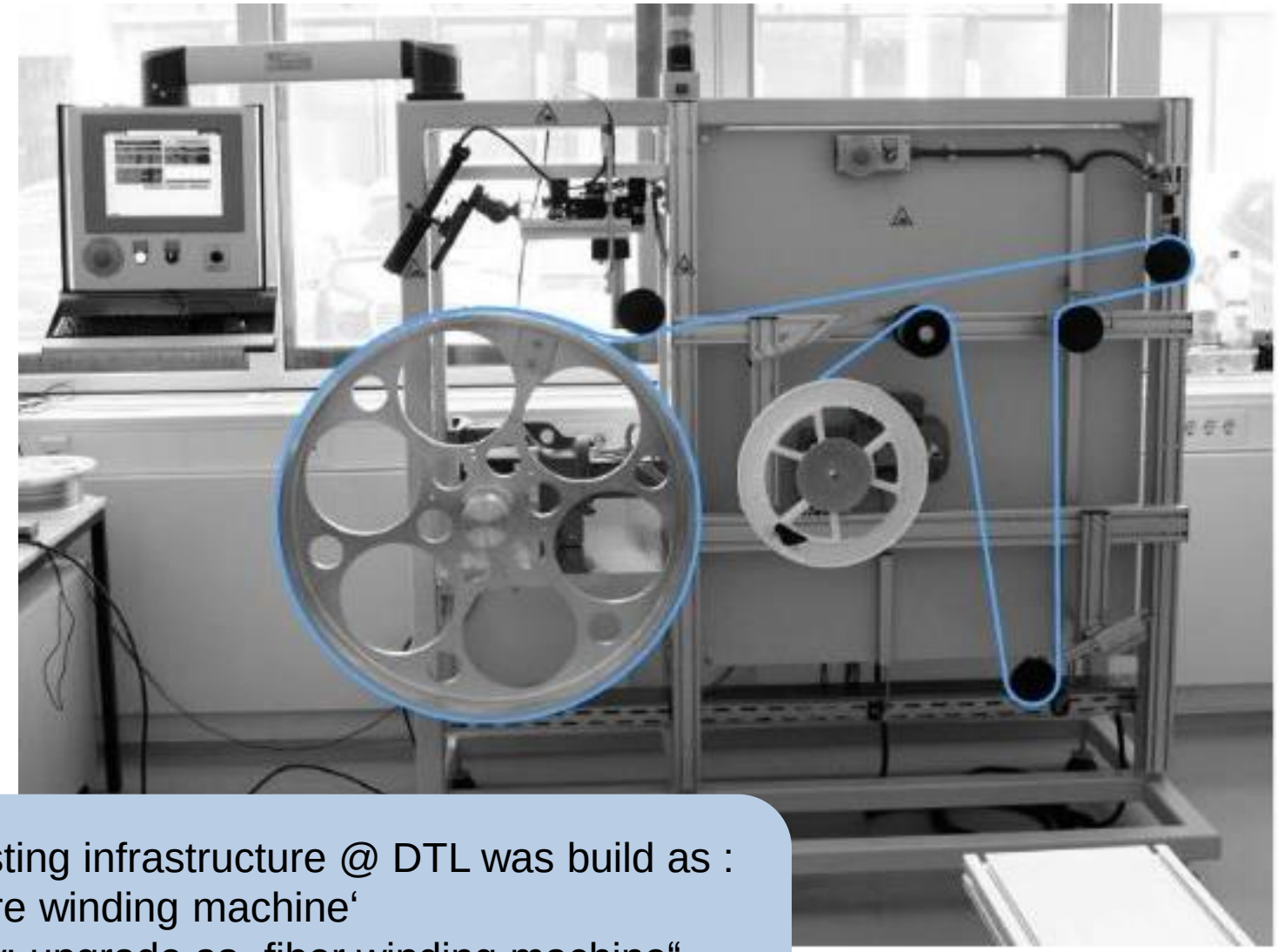
'Fiber Implanter'. (succesor of AIDA)
firs prototype : SensL 3x3 mm SiPM + Fibers (0.2 & 0.5 mm)

(5) AsyEOS II

Trigger/Reaction Plane detector around the target (KRAB)
4x4 mm square fibers (BCF10 Saint Gobain)
readout:
" CITIROCs as front end chips. / preamps+discriminators for SiPMs produced by WEEROC and sold by CAEN.
The SiPMs (MicroFJ-30035-TSV)

Infrastructure @ GSI - DL

Infrastructure @ GSI - DL



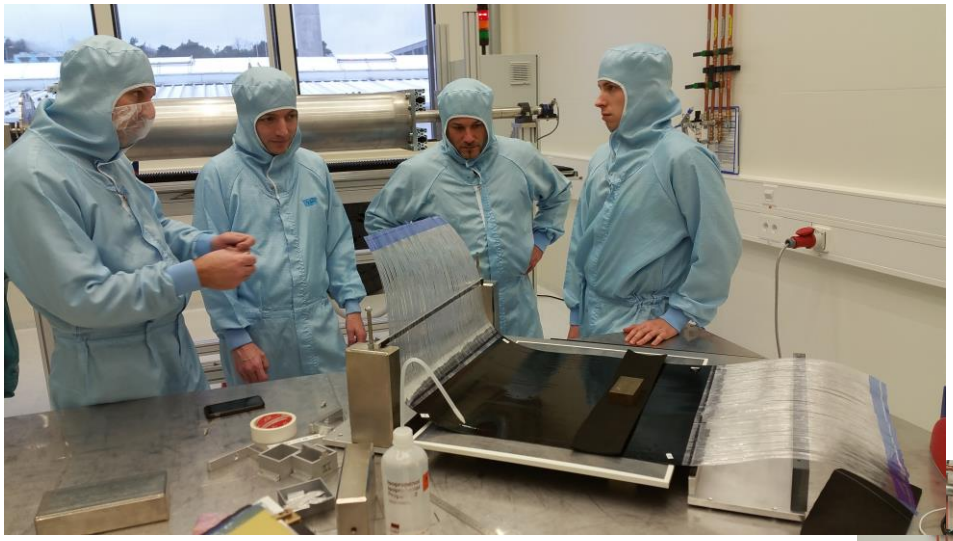
existing infrastructure @ DTL was build as :
‚wire winding machine‘
now: upgrade as „fiber winding machine“

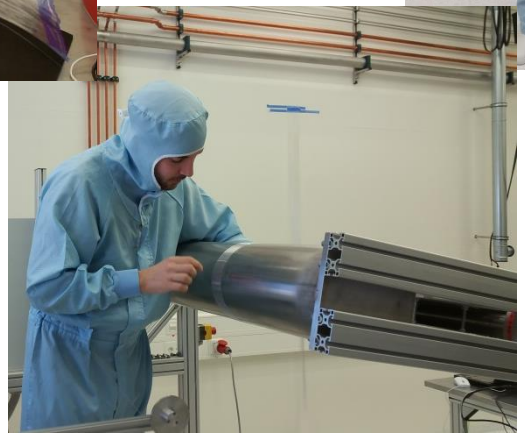
Infrastructure @ GSI - DL

At the moment a fully automatic winding is unfortunately still not possible (for 0.2mm square fibers)

„Fiber Working Group“

DTL:	Jörg Hehner, Christoph Caesar
EEL:	Henning Heggen, Nik Kurz
R3B:	Deniz Savran, Michael Heil, Daniel Körper, Bastian Löher, Kathrin Göbel, Dominic Rossi






THE END