

Barrel TOF FEE

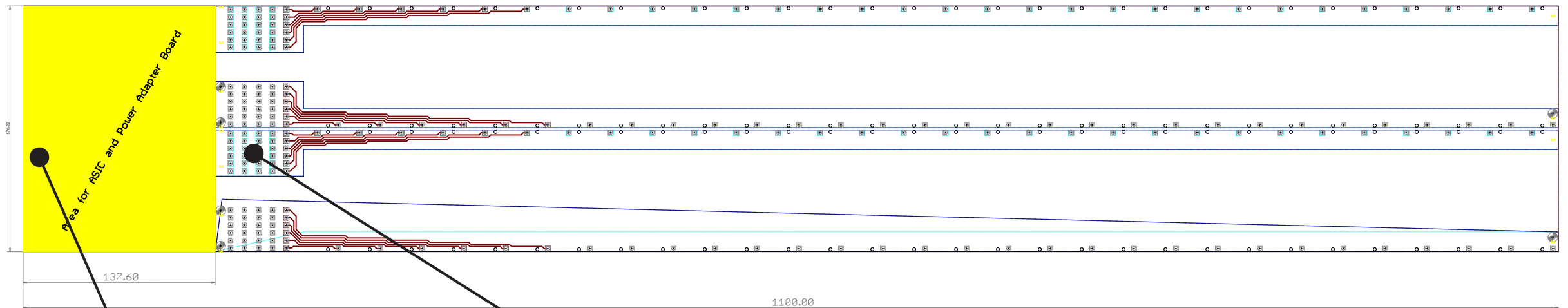
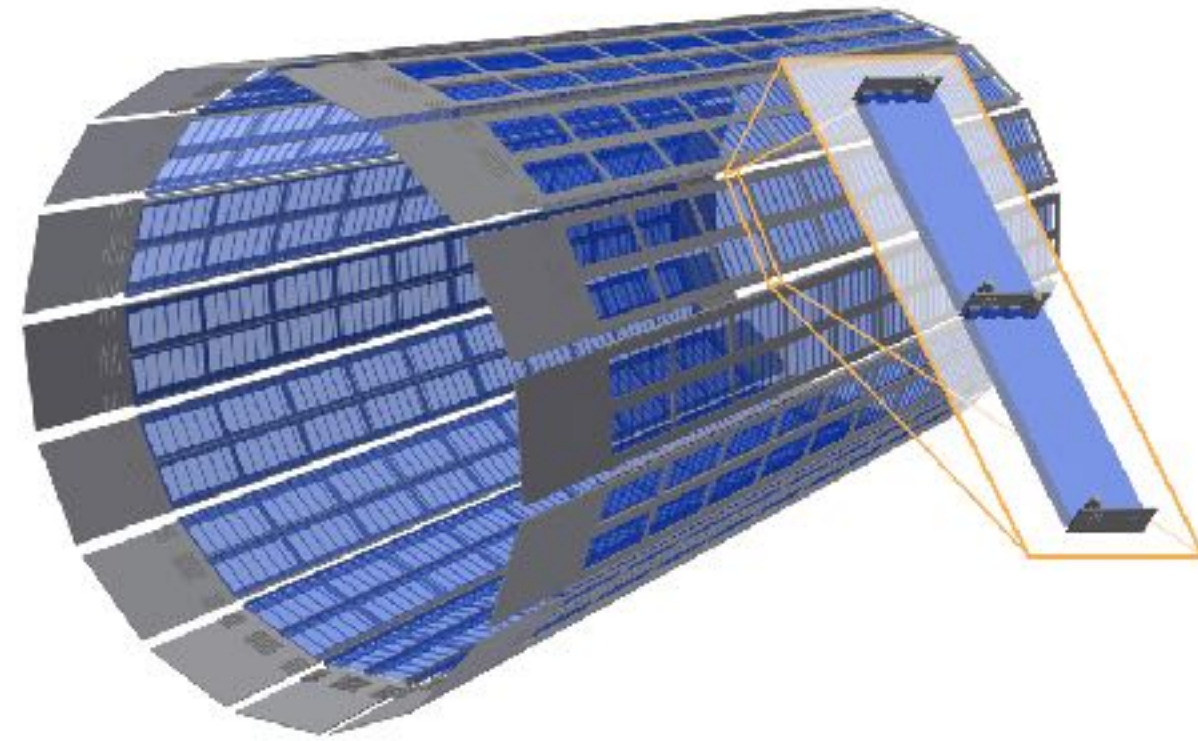
Ken Suzuki, Stefan-Meyer-Institut, ÖAW
on behalf of the Barrel Time-of-Flight group

06.09.2017, Novosibirsk

BARREL TIME-OF-FLIGHT DETECTOR GROUP

- Stefan-Meyer-Institut für Subatomare Physik (SMI) der Österreichischen Akademie der Wissenschaften, Vienna, Austria
- GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany
- II. Physikalisches Institut, Justus Liebig Universität Gießen, Gießen, Germany
- Friedrich Alexander Universität Erlangen Nürnberg, Erlangen-Nürnberg, Germany
- Gauhati University, Assam, India

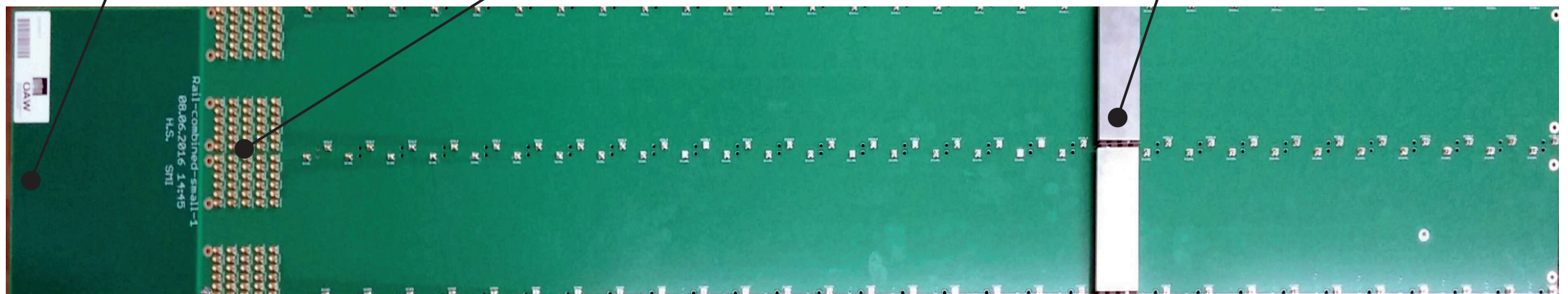
Barrel Time-of-Flight Detect



Space for FEE implementation

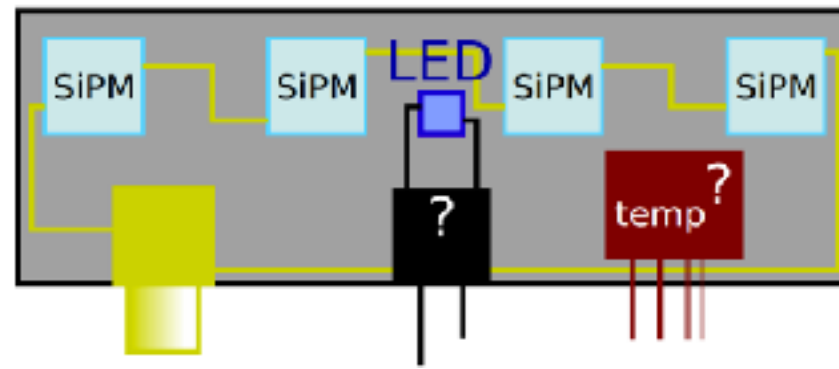
MMCX connectors (Signal Out)

Dual-module



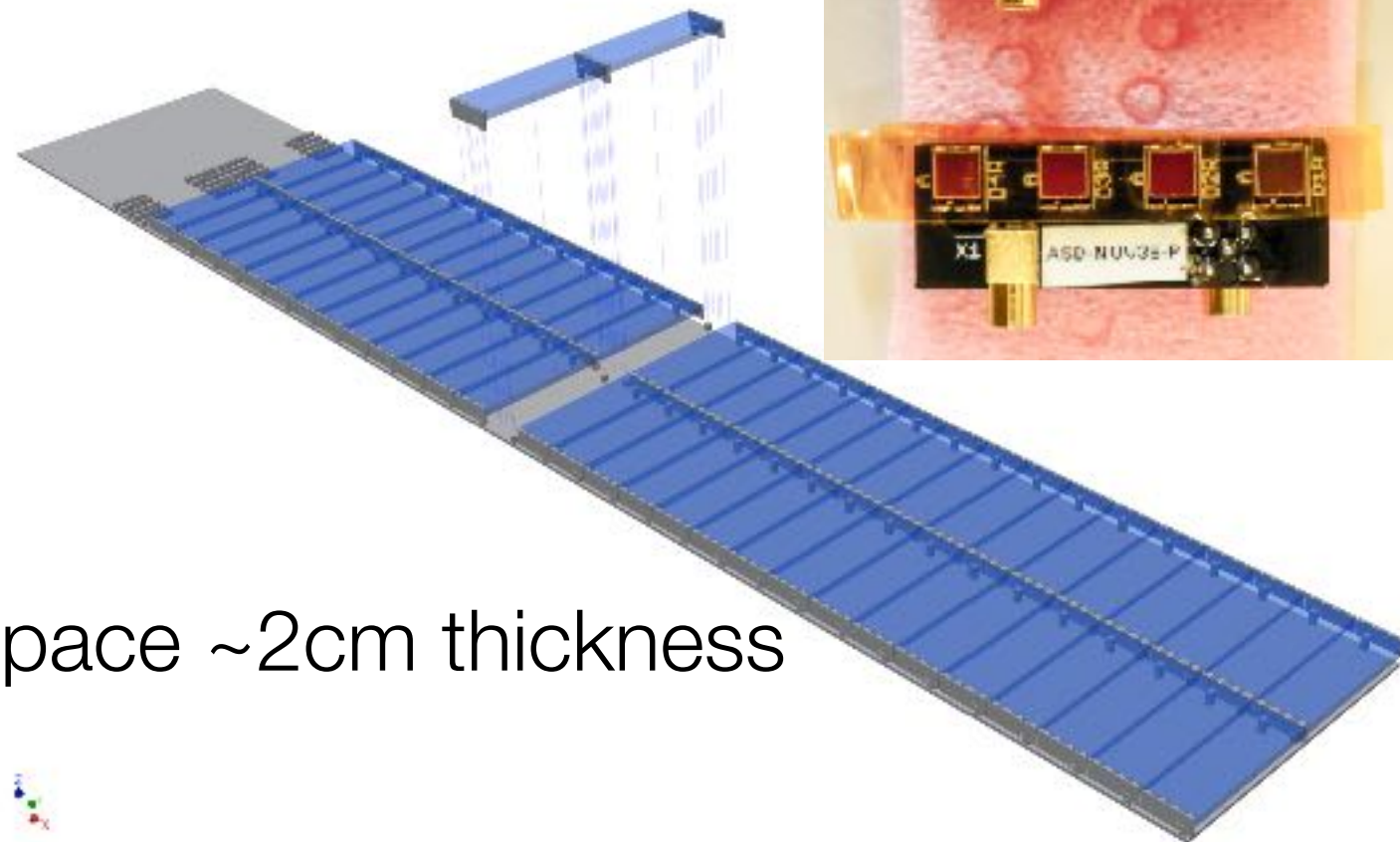
900 mm

Barrel-TOF Design



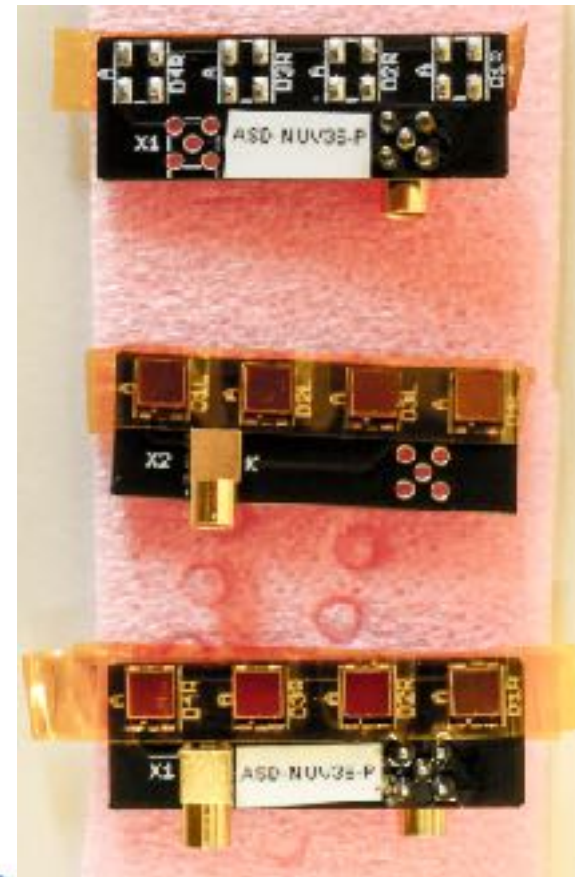
Simple, cable-less design => railboard

16 Super modules
240 ch. /SM
max. 40 kHz /ch.



space ~2cm thickness

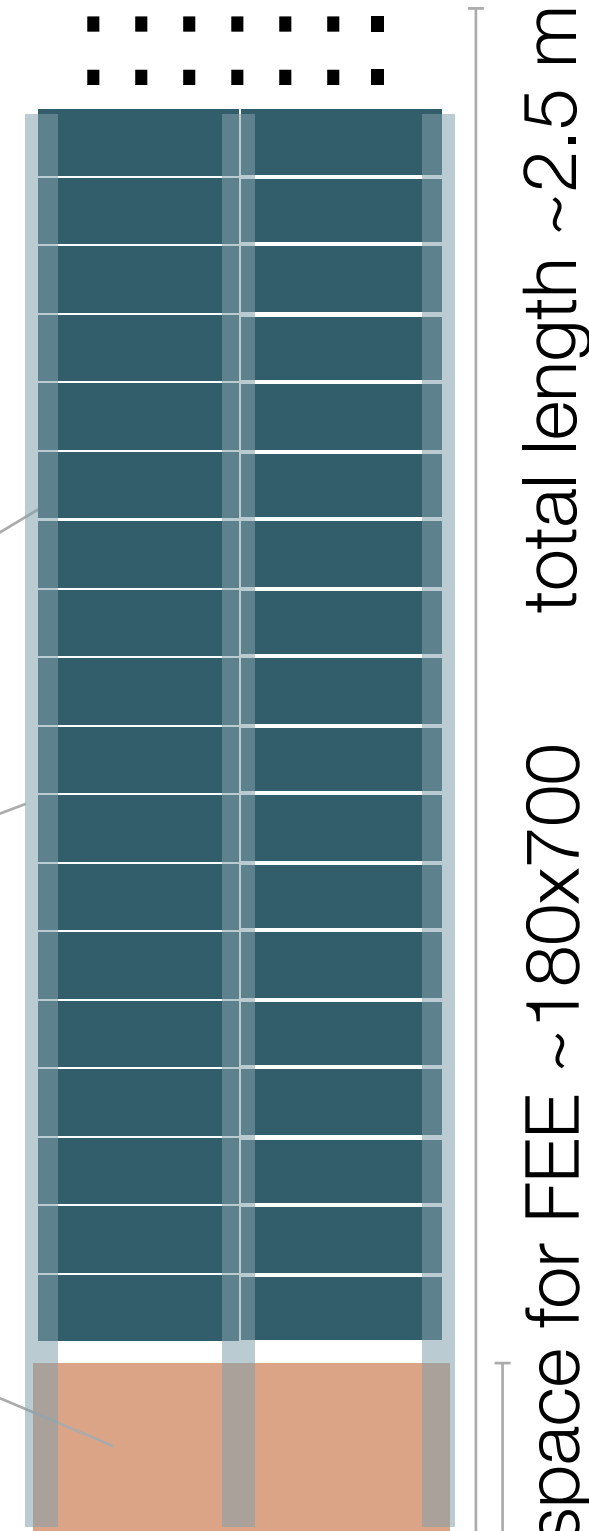
no space for existing/commercial boards, probably



Scintillator Tile

Sensor
Adapter
Cable

FEE

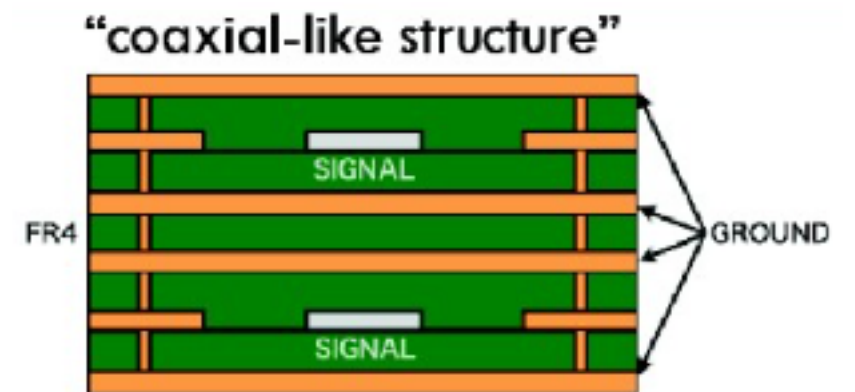


total length ~2.5 m

space for FEE ~180x700

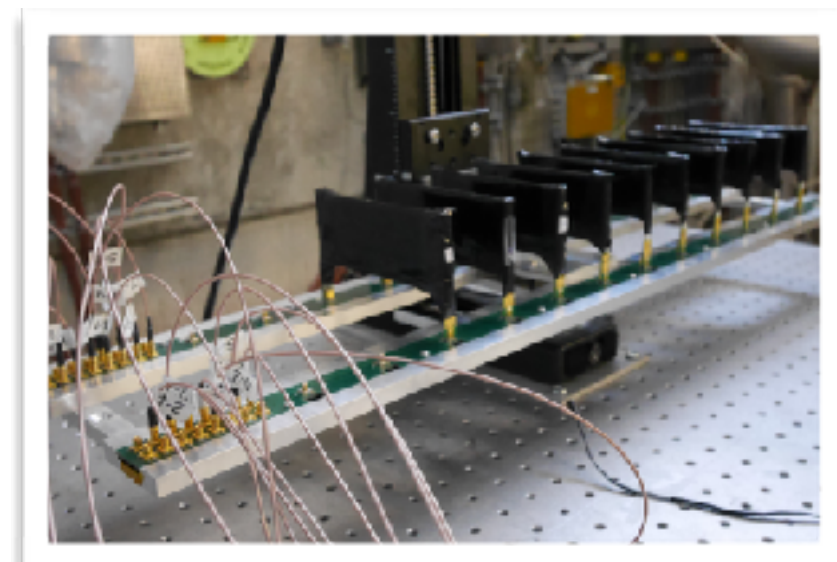
Micro Stripline Technique

- Coaxial-like structure to transmit signals over a PCB board, realised on a multilayer PCB board, that features
 - High density
 - Good shielding from external noise
 - High bandwidth
 - Low crosstalk
 - Mechanical strength
- 3 (copper) layers per signal



Designed by INFN-Genova
Matteo De Gerone <matteo.degerone@ge.infn.it>

Stefan Ritt <stefan.ritt@psi.ch>



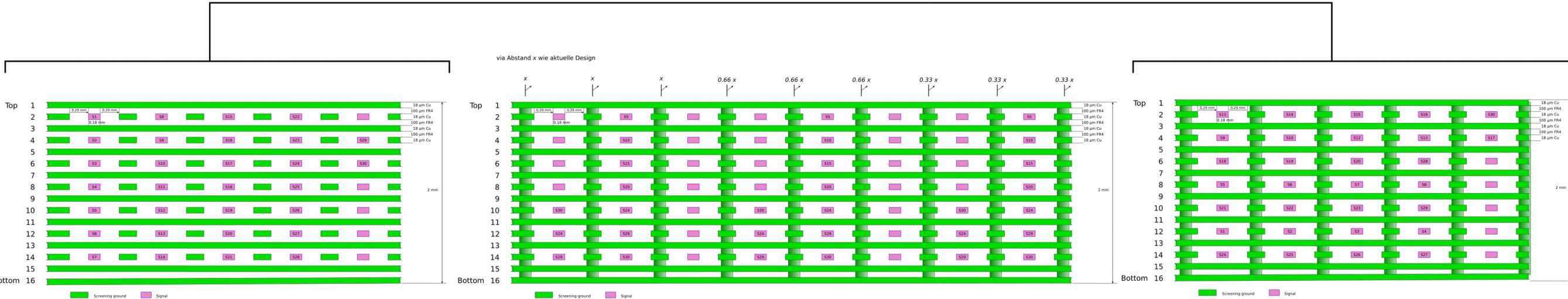
Example of MEG2 TOF

Railboard v2 schematic

standard Abstand



standard Abstand

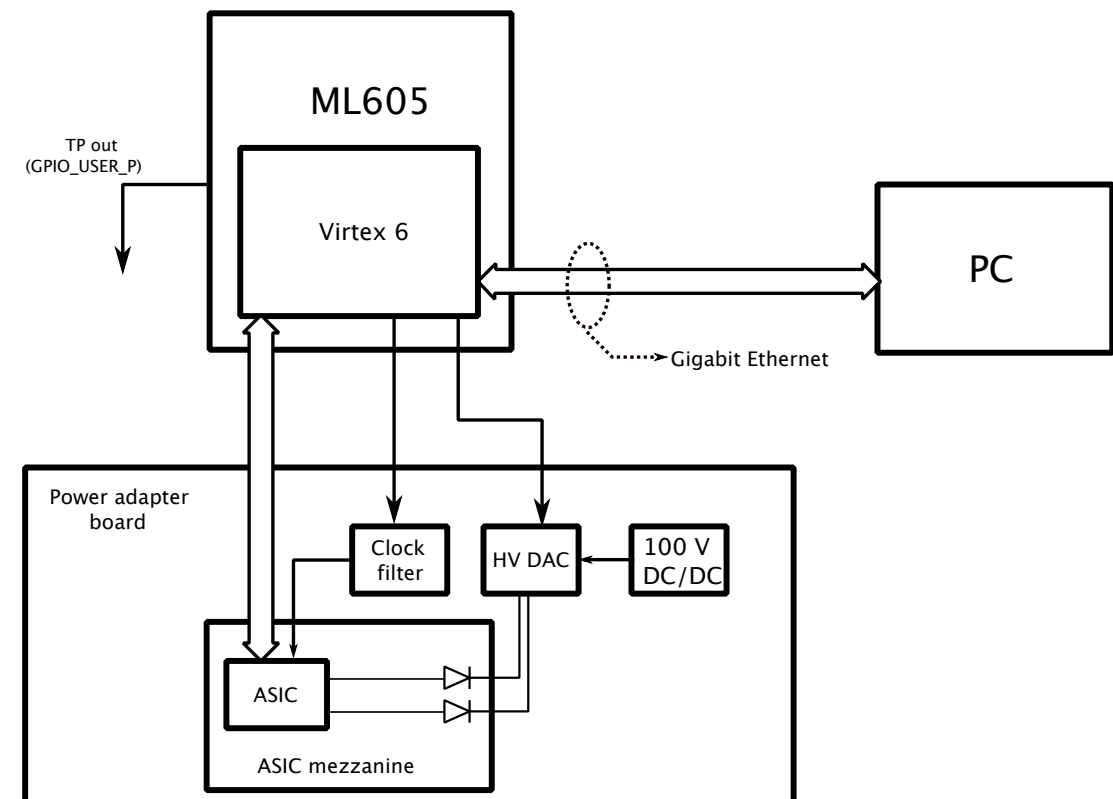
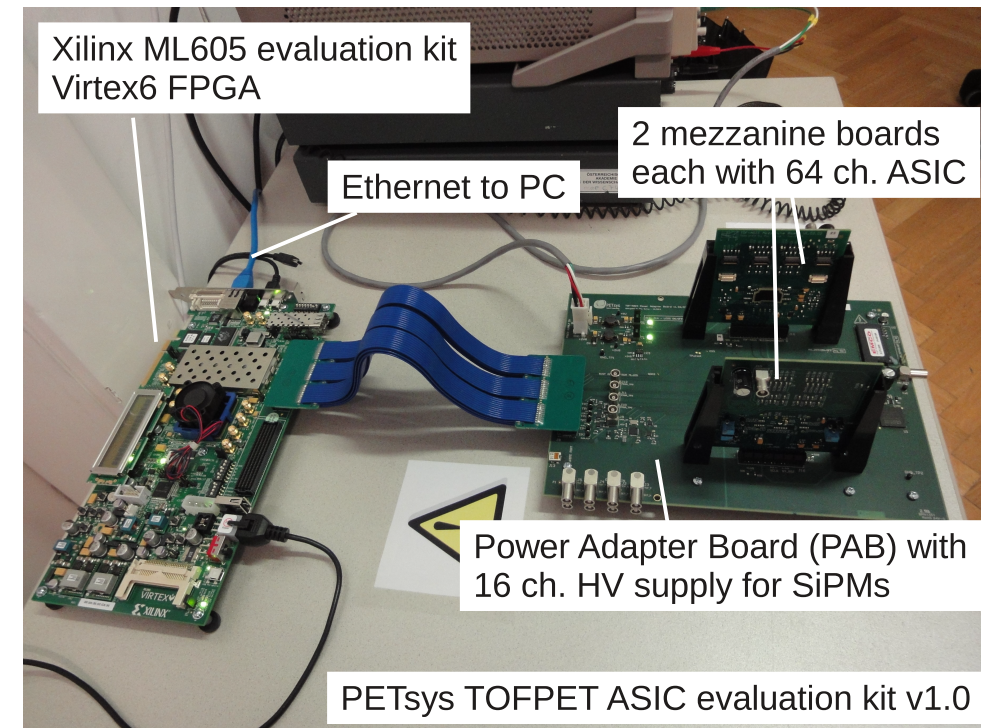


TOFPET ASIC

TOFPET ASIC by PETsys Electronics

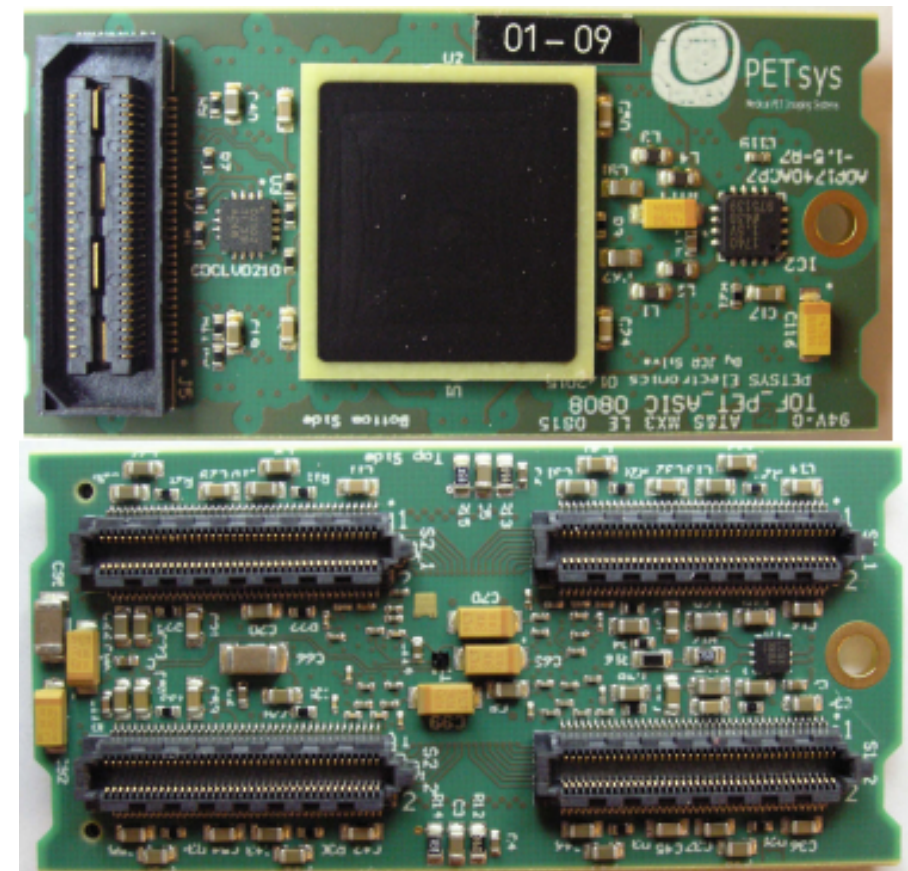
number of channels	64
TDC time binning	50 ps (25 ps optional)
intrinsic time resolution	21 ps r.m.s.
charge measurement	time over threshold (ToT)
dynamic range	300 pC
SNR ($Q_{in} = 200$ pF)	25 dB
coarse gain	G0, G0/2, G0/4
SiPM family support	positive or negative signal polarity
on-chip calibration circuit	internal pulse generator, programmable 6-bit amplitude
max channel hit rate	160 kHz
max output data rate	320 Mb/s (640 Mb/s with double data rate)
Fully digital output	2 data LVDS links, DDR compatible
operation frequency	80-160 MHz
power per channel	8-11 mW
SiPM HV fine biasing	range 500 mV

Table 4.2: Summary of the specification of the TOFPET ASIC by PETsys.



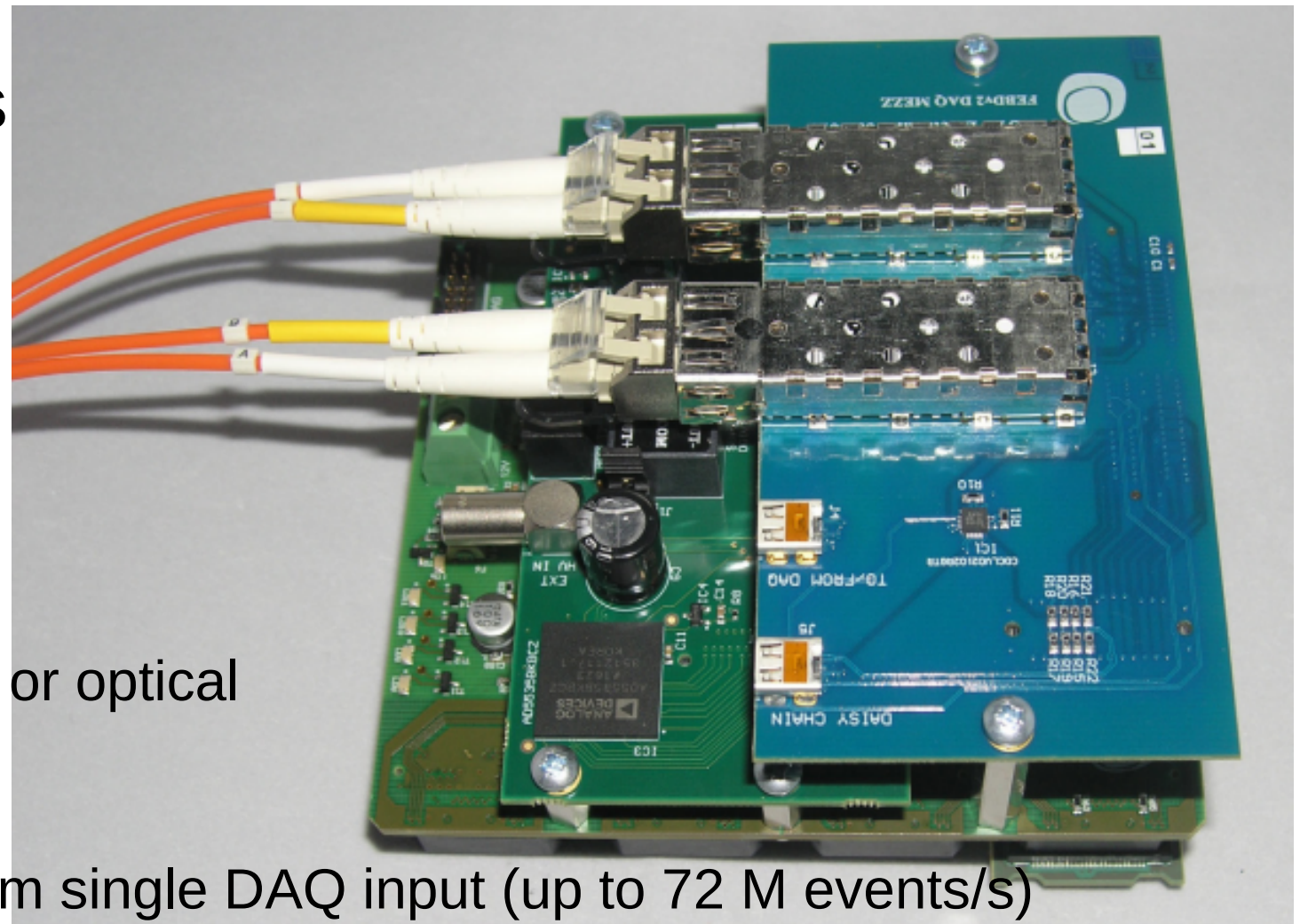
FEB/A

- Houses two TOFPET ASICS
 - Readout of 128 channels
 - 52.0 x 25.4 mm²
 - Onboard temperature sensor
 - Input connector:
Samtec SS4-40-1.00-L-D-P-TR
 - Connector to FEB/D:
SAMTEC QSH-030-01-L-D-A
-
- CLK_IN: Nominal operation mode uses a 160 MHz clock
 - SPI interface: 10 MHz configuration interface writes and reads the configuration
 - SYNC_RST: dual purpose reset (full and partial reset)
 - BIAS V: 8 bias voltages lines
 - TX_OUT (0-3): 2 LVDS data links
 - TEMP: temperature sensor
 - Supply voltages: 1.5 V (analog), 1.2 V (digital), 2.5 V (I/O).

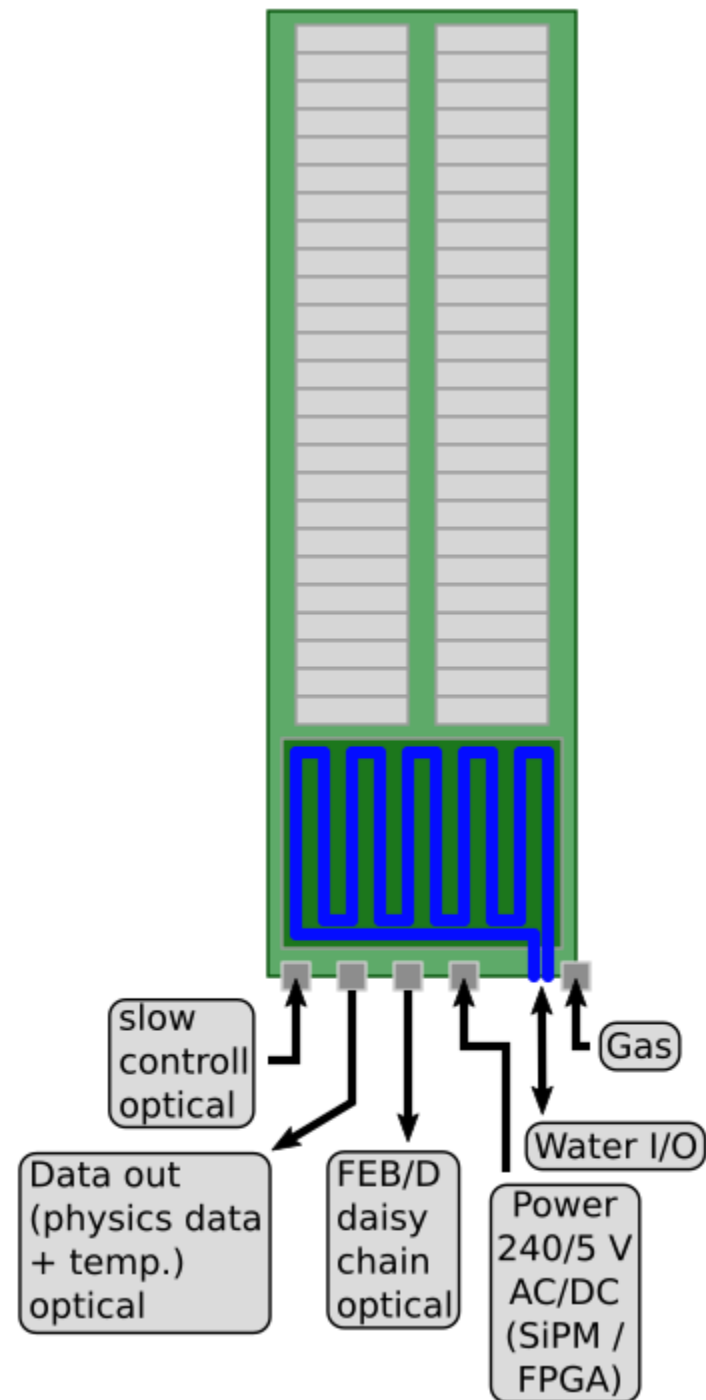


FEB/D Board

- Kintex 7 FPGA
- Handles 16 TOFPET ASICS
 - 8 FEB/A boards
 - Connect board to board or flexible flat cable
- Receives configuration, clock & sync signals from DAQ board
- Connects to DAQ via HDMI or optical
- 104.5x104.5 mm²
- Can be daisy-chained to form single DAQ input (up to 72 M events/s)
- Supplies bias voltage to SiPMs
 - 64 bias voltages, 5 - 100 V



Super Module I/O



B-TOF Milestones

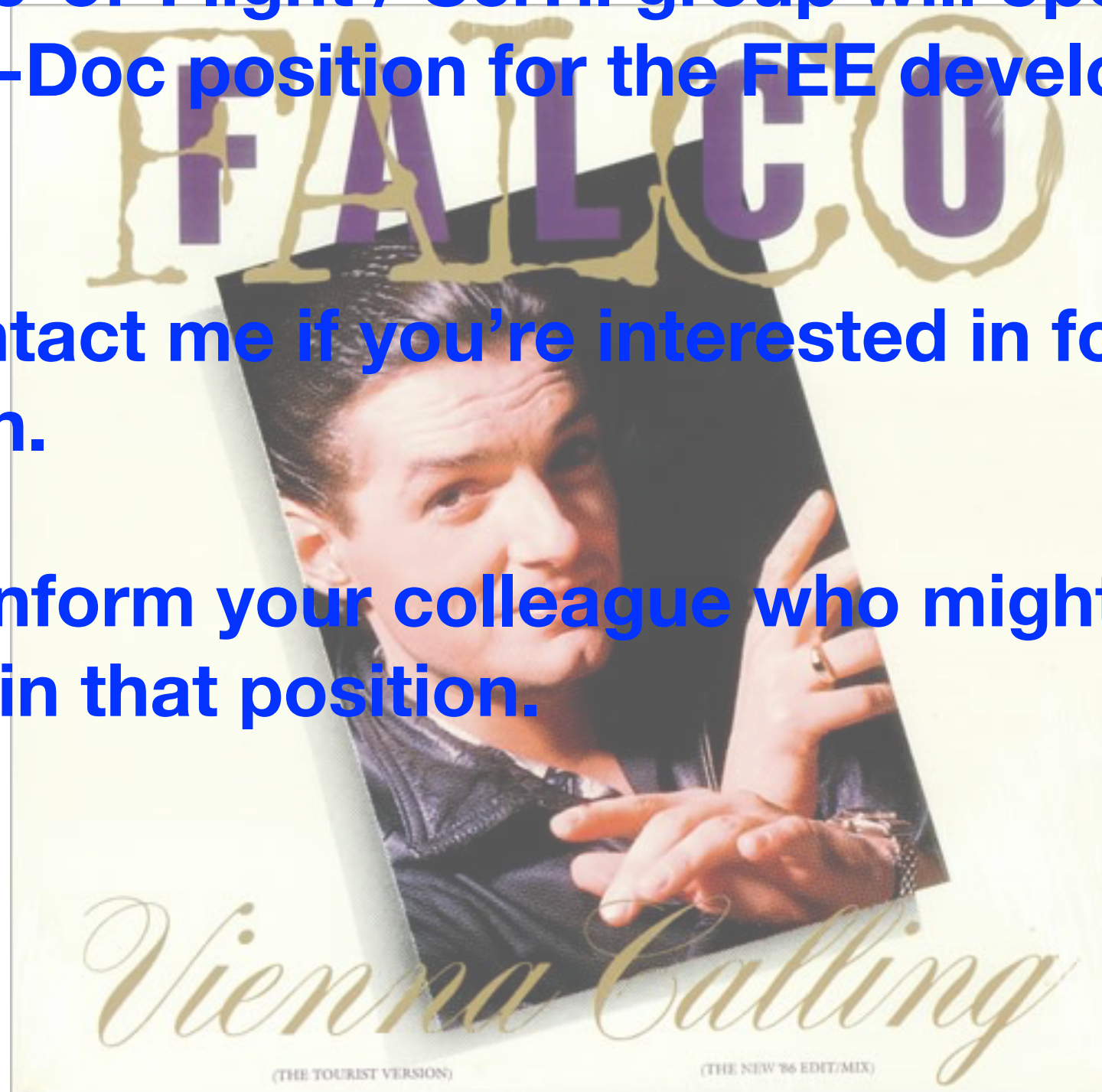
M3: 15.12.17	TDR approved.
M7: 06.09.18	Construction design, planning completed.
M8: 03.06.19	Prototype/Pre-series testing completed
M9: 15.01.20	Acceptance Test
..	

Status

- Accelerating the FEE R&D.
- Collaboration with the PANDA End-Cap DIRC group for the TOFPET chip test.
- Manpower
 - 1 PhD (S. Zimmermann), 1 Engineer (~0.3 FTE?), 1 Master
 - **1 PD position will be opened.**
 - **2 years, Vienna.**
 - **Expected to work on the FEE development.**

Conclusion

- **Barrel Time-of-Flight / SciTil group will open a 2 years Post-Doc position for the FEE development in ~half year.**
- **Please contact me if you're interested in for more information.**
- **or please inform your colleague who might be interested in that position.**



Backup