Status of the upgrade of the main detector components

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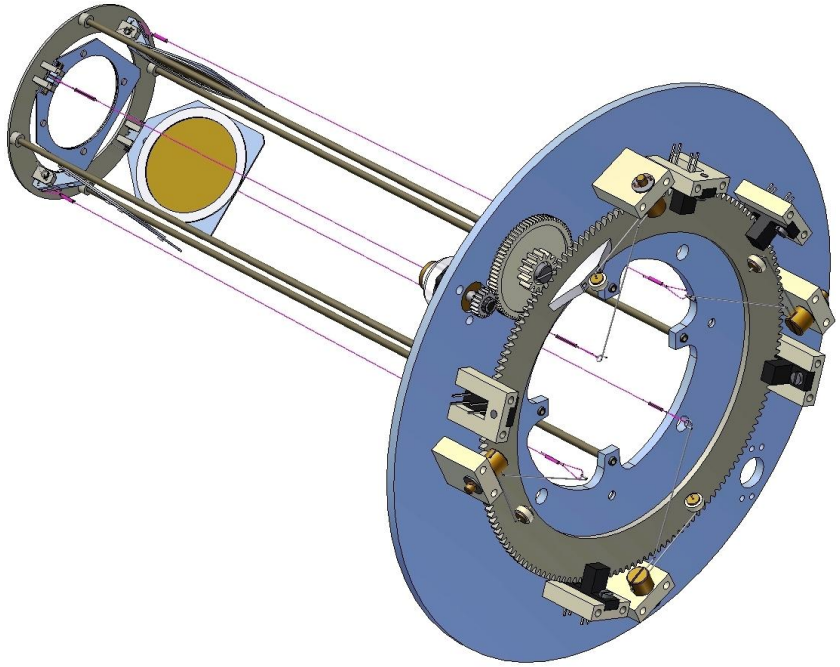
Target station



Target station:

3 different target types with d = 30mm and 1 empty target are available for data taking and background evaluation;

Drive: Electro-mechanical;

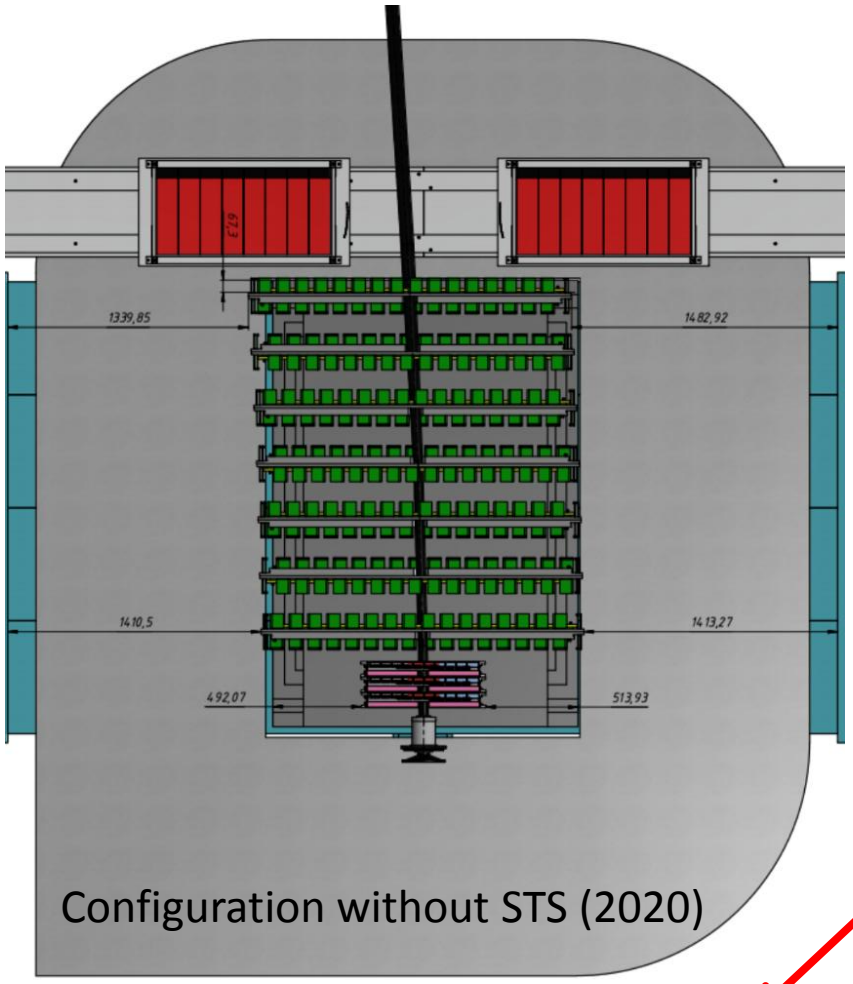
Control: remote;

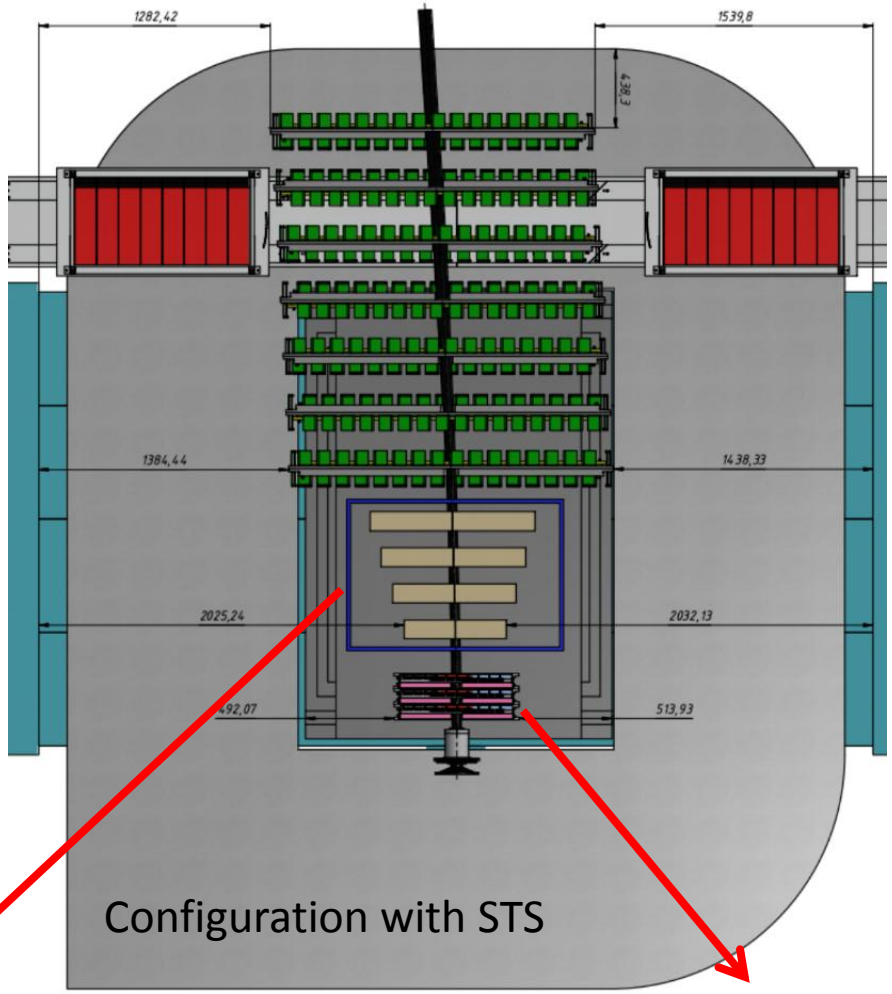
Target elements: non-magnetic materials;

Control of the target position: opto-isolator KTIR0411S (5 pieces).

Operation in vacuum and magnetic field.

Forward Si+ STS +Gem configuration





2020 year – “pilot” configuration
2022 year – full configuration

Forward Si will be removed after STS full configuration complete integration into BM@N setup
(2022 year, high beam intensity - few 10^6 Hz)

Summary

1. Precise measurements of the SP-41 magnet geometry were performed and 3D model of the tracking detectors installation in the SP-41 magnet was done
2. Target station design with 3 different targets types and 1 empty target was developed

For further development and production of the installation elements and beam pipe it is necessary to:

1. Procedure to assembly/disassembly GEM, Fwd Si, STS detectors and precise position adjustment system should be developed and fixed
2. Adopt the location concept of all tracking detectors, taking into account the STS upgrade plan. Four configurations of the tracking detectors are foreseen:
   - Forward Si + 7 GEMs: beam intensity few 10^5 Hz , 2020
   - Forward Si + 1 pilot STS station + 7 GEMs: beam intensity few 10^5 Hz , 2020-21
   - Forward Si + 4 STS stations + 7 GEMs: beam intensity few 10^5 Hz, 2022
   - 4 STS stations + 7 GEMs (fast FEE): high beam intensity few 10^6 Hz, 2022-

Plans:

1. Finish development of the target station (JINR, 1 month)
2. Finish development of the beam pipe upstream the target station (JINR, 1 month)
3. Development of the beam pipe inside and downstream the SP-41 analyzing magnet (JINR - Prague Technical University, 2 months)
4. Collection of the final power consumption configuration from all subsystems to start the design process of the new power supply system of the BM@N setup (JINR, end of May 2019).
5. Prepare the place and provide a temporary connection for the MDC(Mobile data center) April 2019.

GEM and CSC detectors

GEM:

1. First BM@N GEM 1632x390 mm^2 chamber was delivered to JINR 06.02
2. At the time HV tests of the chamber are performed
3. New moisture and O2 analyzers (GEM+Slow Control groups) are under tests

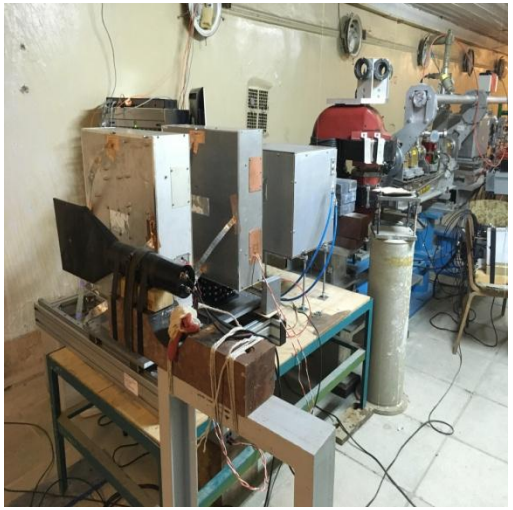
Plans:

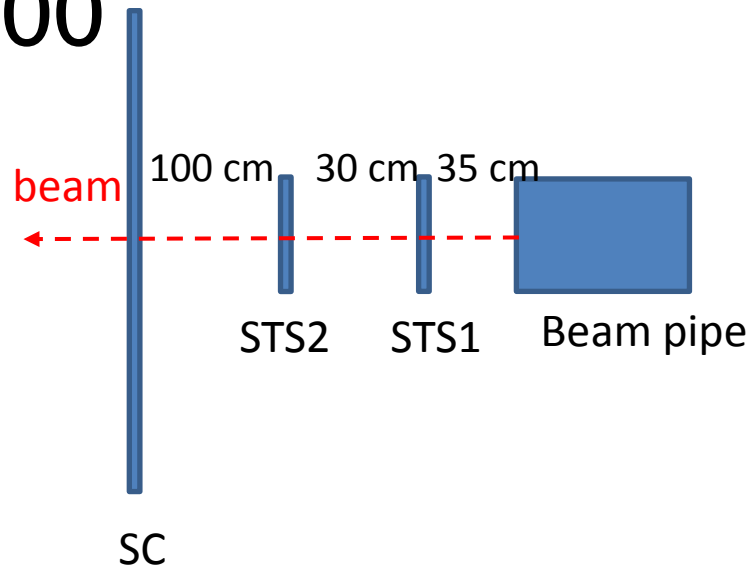
1. Production of the assembly parts for 6 GEM 1632x390 mm^2 chamber at CERN (25^{th} February – 15^{th} March)
2. Development of the stand for VMM3 chip tests (GEM+DAQ groups)
3. Development of the stand for STSXYTER ASICs chip tests (GEM+DAQ groups)

CSC:

Assembly of three 1065x1065 mm^2 CSC chambers is in progress

Beam test of the STS modules at LINAC-200



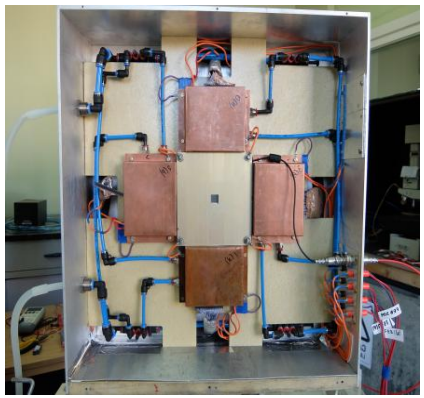


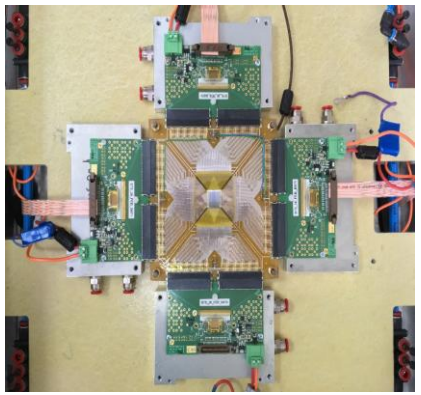
Main goals of the beam test:

- To test readout electronics:
  - New STSXYTER ASICs
  - TS system
  - DAQ System
- Data collection in two modes:

  Free streaming and with a time reference to the trigger signal

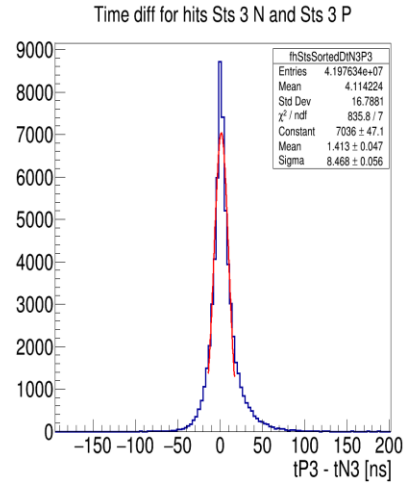
ST1,2 – Test stations with double-sided microstrip silicon sensors 15*15 mm²
SC – scintillator counter 200*200 mm²

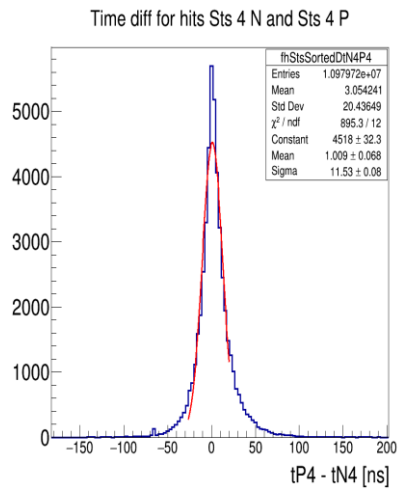




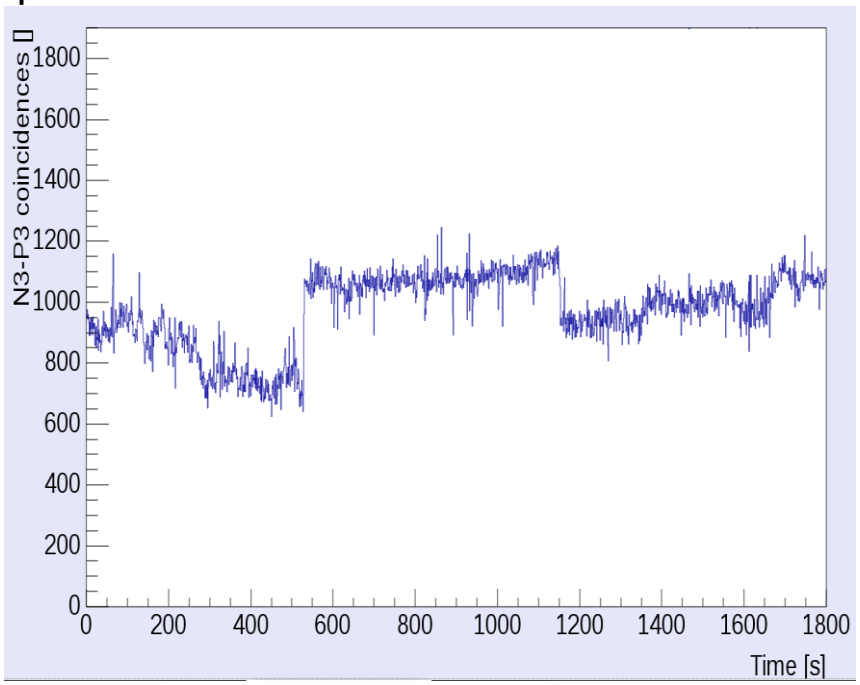
Test of DAQ and TS system

During the beam test stability and quality of TS system based on AFCK FPGA board was tested
Time synchronization between Front-end boards Is less than 10 ns.
(Should be improved in a new generation of ASICs)
Time synchronization was stable within 10 h of operation

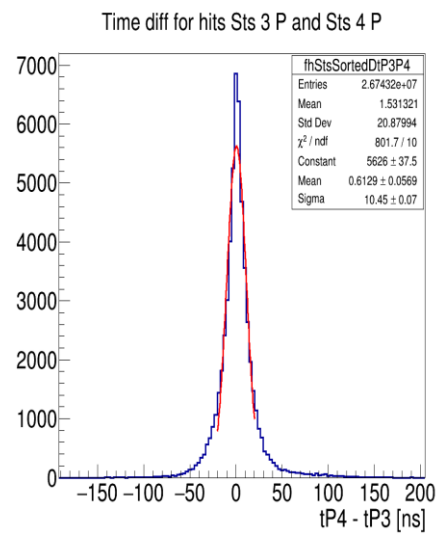


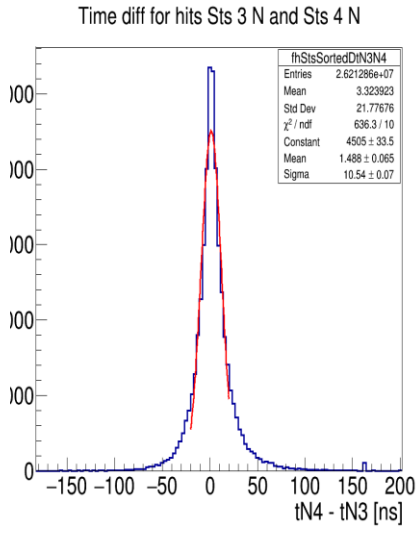


Time differences between hits on N and P sides of the sensor

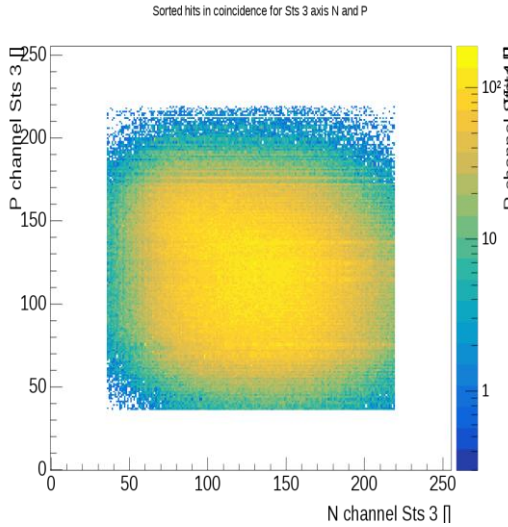


Hits/s STS 1

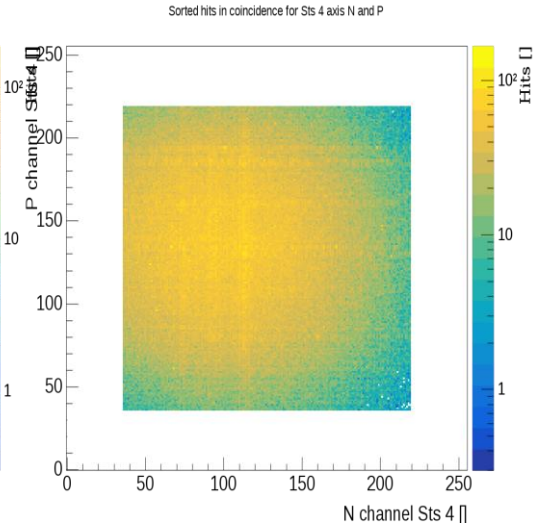




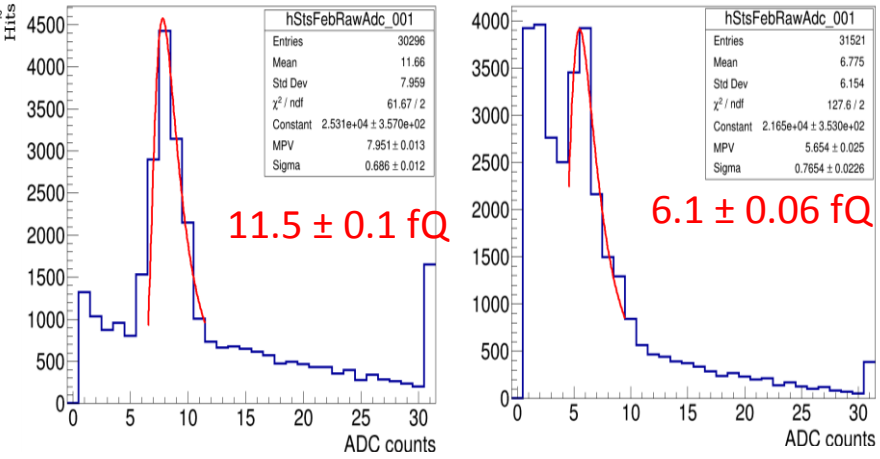
Time differences between hits on two sensors



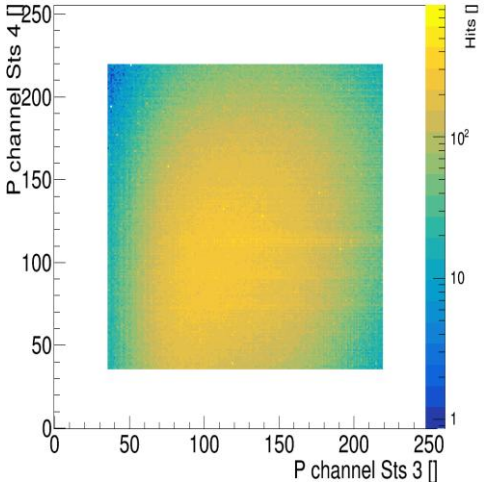
Beam profile STS 1



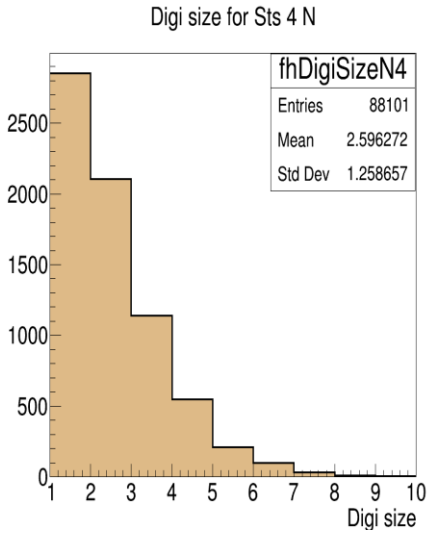
Beam profile STS 1



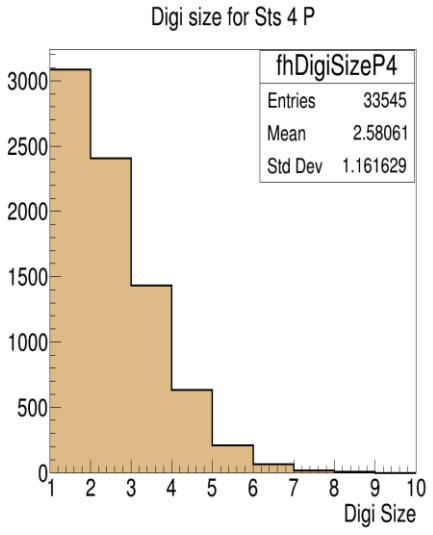
Amplitude of the signal from 150 MeV and 50 MeV electrons



Correlations: X



Cluster size N-side



Cluster size P-side

Summary

- Readout electronics based on STSXYTER ASIC was tested
- DAQ system based on AFCK FPGA boards and GBTx emulator firmware was tested
- Operation of the readout system in free streaming mode was tested
- 250 Gb of data was accumulated for the future analysis

Future plans:

To use prepared test bench for the tests of the first assembled BM@N STS modules: March – April 2019