Design of EPICS IOC Based on RAIN1000Z1 ZYNQ Module
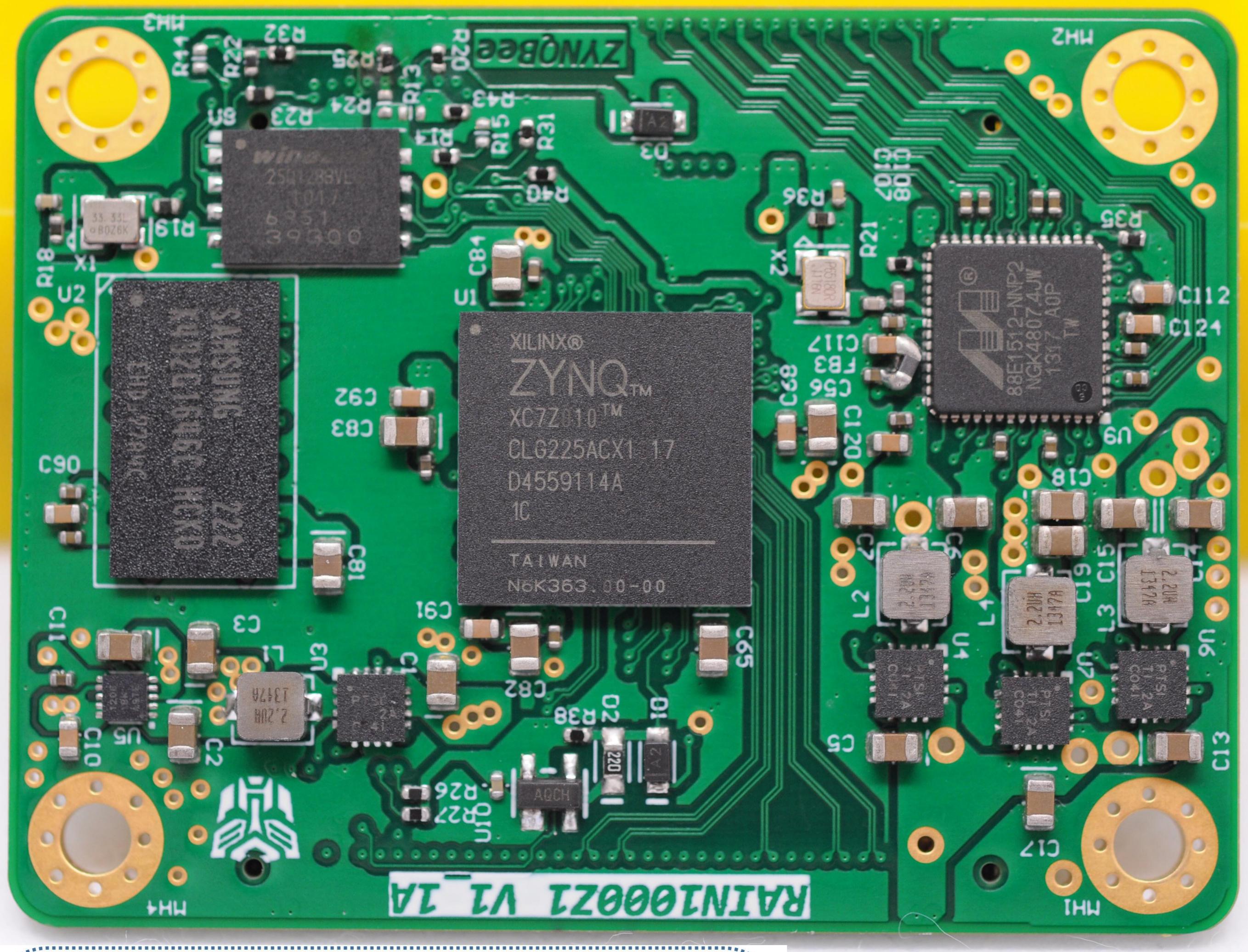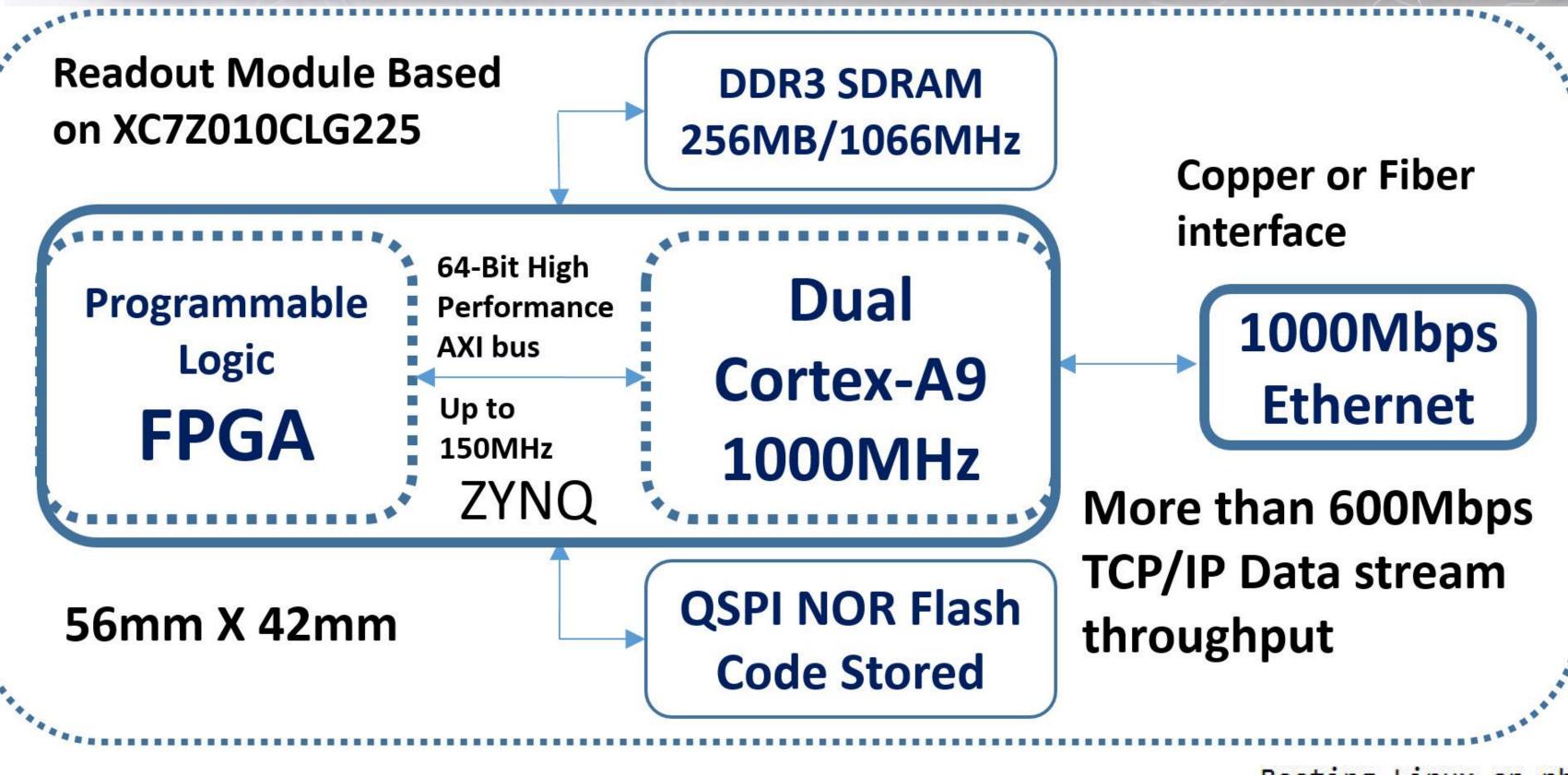
ZYNQ is the new architecture of FPGA with dual high performance ARM Cortex-A9 processors from Xilinx. A new module with Giga Bit Ethernet interface based on the ZYNQ XC7Z010 is development for the High Purity Germanium Detectors' data acquisition in the CJPL (China JinPing under-ground Lab) experiment, which is named as RAIN1000Z1. Base on the nice RAIN1000Z1 hardware platform, EPICS is porting on the ARM Cortex-A9 processor with embedded Linux and an Input Output Controller is implemented on the RAIN1000Z1 module. Due to the combine of processor and logic and new silicon technology of ZYNQ, embedded Linux with TCP/IP sockets and real time high throughput logic based on VHDL are running in a single chip with small module hardware size, lower power and higher performance.

Readout Module Based on XC7Z010CLG225

DDR3 SDRAM 256MB/1066MHz

Copper or Fiber interface

Programmable Logic FPGA

64-Bit High Performance AXI bus

Up to 150MHz

ZYNQ

Dual Cortex-A9 1000MHz

1000Mbps Ethernet

More than 600Mbps TCP/IP Data stream throughput

56mm X 42mm

QSPI NOR Flash Code Stored

- EPICS is porting on the embedded Linux within the ARM Cortex-A9 processor which is included in the RAIN1000Z1 module.
- GPIO and UART are implemented in the FPGA part of ZYNQ.
- It's suitable to develop more flexible interface and function with this platform.

```
epics> iocInit
Starting iocInit
#########################################################################
## EPICS R3.14.12.5 $Date: Tue 2015-03-24 09:57:35 -0500$
## EPICS Base built Oct 14 2015
#########################################################################
iocRun: All initialization complete
epics>
```

```
Booting Linux on physical CPU 0x0
Linux version 3.19.0-xilinx (root@ubuntu) (gcc version 4.9.1 (Sourcery CodeBench
Lite 2014.11-30) ) #11 SMP PREEMPT Mon Oct 12 09:01:35 PDT 2015
CPU: ARMv7 Processor [413fc090] revision 0 (ARMv7), cr=18c5387d
CPU: PIPT / VIPT nonaliasing data cache, VIPT aliasing instruction cache
Machine model: xlnx,zynq-7000
cma: Reserved 16 MiB at 0x0f000000
Memory policy: Data cache writealloc
PERCPU: Embedded 9 pages/cpu @4edd3000 s8128 r8192 d20544 u36864
Built 1 zonelists in Zone order, mobility grouping on.  Total pages: 65024
Kernel command line: console=ttyPS0,115200 root=/dev/ram rw earlyprintk
PID hash table entries: 1024 (order: 0, 4096 bytes)
Dentry cache hash table entries: 32768 (order: 5, 131072 bytes)
Inode-cache hash table entries: 16384 (order: 4, 65536 bytes)
Memory: 231164K/262144K available (4557K kernel code, 268K rwdata, 1608K rodata,
216K init, 210K bss, 14596K reserved, 16384K cma-reserved, 0K highmem)
```

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