PT status and future planning

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OUTLINE

• Polarized target in 2018
  - Summary of incidents since April (see Vincent’s report)
  - Status of improved systems (PLC CPU bunker and Air conditioner)
  - Manpower
  - Radiation damage of the target material

• Plan of deuteron run in 2021
  - Target material and target cells configuration
  - Shopping list
Incidents summary 1

- **Interruptions of He4 pumps system** (July 4, August 1, August 22, August 31)
  - Jumped He4 recovery line pressure → interlocked by PLC
  - Regeneration of Cold box filter
  - Due to some delay of switching to balloon line
  - Someone around each time → no polarization losses
  - Discussion on next Tuesday with Michel
  - Modification of control system or regular operation on Wednesday manually

- **Power Glitch** (July 5 6h33)
  - Only He3 root pumps system affected
  - Jaakko was on Shift and restarted at 6h42.
  - Lost of polarizations

- **Lost of frequency control of a EIO tube** (reported in the last TB)
  - Changing cathode voltage for each polarity of polarization
  - controlling the frequency by hand
Incidents summary 2

• **Dipole discharge** (July 22 20h38)
  - No MSS error and no PLC error
  - Broken one module of one of two power supply
  - July 23 9:00 power convertor module exchanged

• **Dipole discharge** (July 25 0:08)
  - Benoit arrived at 3 am
  - *Caused by heat inside rack probably in both cases*
  - Removed rack doors and restarted at 7h00 July 25
  - Improvement during next LMD (TS)
Incidents summary 3

• Cooling water leak and no cooling water (August 27 afternoon)
  - No air conditioner, diffusion pump OFF, Cold box OFF

August 27 evening
  - Recovered most of 3He gas (tank #3 -#8) at first
  - Diffusion pump restarted by switching tap water
  - Sending a request of liquid He4 delivery

August 28 morning
  - Recovered other He3 (He4 rich gas, tank phi1 – phi4)

August 28 afternoon
  - Restarted cooling water
  - Air conditioner back
  - Restarted compressor for liquid helium

August 29 early morning
  - Refilling liquid He4 to dewar

August 29 night
  - Finished filling He3 gas to DR
  - Restart polarization
Photo of power convertor rack
No failure of PLC in 2018

2015
• Several times of PLC failures
• 3 times magnet PLC failure
  (17 times incidents of magnet failure in total)
• 1 PLC failure of cold box
• A few times isolation vacuum PLC failures

2018
• No PLC failure happen up to now.
Protection of PLC CPU

Concrete: For high energy neutrons
Polyethylene: for low energy neutrons
Boron-carbid: to stop thermal neutrons

Top cover of Polyethylene with Boron-carbid
New air conditioner

- Enough cooling power
  - He3 roots pumps could survive even during hot summer.
- Need air blower
  - Heat localized and very week of air circulation
  - Using several air blowers
- Chilled water
  - Normally very stable temperature
Man power

• Stefan Runkel (Bonn): big support for 3 weeks
• Kaori: moved to Gran Ssao
• Jaakko: 1 month stay for TE and material unloading
  - still under discussion inside Illinois group
• Genki: stay until the end of December
• Yuri: stay for 2 months (September and October)
• Vincent and Christophe: taken into account as target member
## Man power availability

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Annealing NH$_3$

- There is a long MD (TS) on September.
- Werner comments on the radiation damage
  - Polarization behavior of the present material indicates already damaged.
- Relaxation time is getting faster (Genki and Vincent).
- Optimized microwave frequency slightly looks shifted.
- The maximum polarization looks not so much changed.
- Difference between electron and pion beam

- Risk of warming up 70 K
  - **Decision**: we will not anneal the material at 70 K.

- Relaxation time in 2015 was almost stable (Vincent).
- Warmed up to 1 K 3 times in 2015
- Annealing at 1 K may be helpful.
Annealing time estimation

• Warming up to 80K
• How long?
  - 30 min at 80 K
• 1 week needed at least
  - 1 day He3 recovery,
  - 2 days warming up,
  - 1 day cooling,
  - 1 day filling He3,
  - 1 day polarization
• Other operations
  - Generating LN2 trap
• Risk
  - Lost of paramagnetic center of the Material
  - Blockage of He3 line after annealing
Radiation damage


The polarization drops to 1/e of maximum polarization is \(7 \times 10^{15}\) particles/cm\(^2\) (electrons) for ammonia.

For safe margin, we propose

To keep flux of the pion beam below \(1 \times 10^{14}\) /cm\(^2\) for 1 year.
Total doses up to now

- Ion chamber 2 calib=5300 (already included)
- Target cell cross section : 12 cm$^2$
- Multiplicity : 5
- $100 \times 10^{12}$ ion2 : corresponds to $0.4 \times 10^{14}$ doses/cm$^2$
Relaxation time change in 2018

Produced by Genki
Same plot by Vincent
Relaxation time change in 2015

Produced by Genki
Same plot by Vincent
He3 removal in 2015

- 15/6/2015: scrubbing run and TE calibration
- 22/6/2015: dilution mode
- 28/6/2015: Cold box problem: a valve of filling line closed
- 30/6/2015: dilution mode
- 11/9/2015: Cold box problem: PLC down
- 12/9/2015: dilution mode
Relaxation time change in 2015

Upstream+

- pol upcell

1K

1K

Upstream-

- pol upcell

Downstream+

+ pol dwncell

Downstream-

- pol dwncell

Produced by Genki
Same plot by Vincent
Plan of deuteron run in 2021

- **Target material**
  - 6LiD : used in 2002 – 2004 and 2006
  - material test needed : in Bochum or maybe in Bonn

- **Target cells**
  - 3cm diameter
  - 2 cells set-up : same as in 2018 ➔ no need to remove DR

- **Microwave frequency modulation**
  - Downstream microwave PSU : no function
  - Possibility of magnet field modulation

- **Moving platform 2m downstream**
  - Target platform movement : organized by V. Anosov
  - Cryogenics pipes : TE-CRG
  - Microwave table movement
Shopping list for 2021

• EIO tube (155 kCHF)
• Repair of current EIO tube (> 10 kCHF)
  - plan to ship the tube to USA in 2019
• NMR system (7 kCHF Mallot 2018)
  - received quote from NI
• New PLC system for DR ( )
  - meeting with CERN support group on last Thursday (Roberto Speroni and Enrique Blanco)
    -- Christophe and Nori from COMPASS
    -- New CPU obtained and no more other parts needed (Maybe memory card needed)
    -- Support of Christophe needed in 2019
• Spare vacuum sensors (~ 4 kCHF Yamagata 2018)
  - Full range gauge 2(614CHFx2), Pirani 2(234 CHFx2), Piezo 1(850CHF), Meter (892 CHF)
• Microwave power sensor (1 kCHF Yamagata 2018)
  - 2 sets of power monitoring
  - Inventory needed
Shopping list for 2021 part2

- **Spare EIP sensor**
  - One spare in Yamagata
- **AVS47 (10 kCHF)**
  - more stable connection
  - Maybe spare one in Yamagata
- **He3 roots maintenance (100 kCHF??)**
  - vibration meter obtained
  - cooling water line
  - depends on what the company can do
- **Power supply for EIO tube (115 kCHF)**
  - no function of modulation
- **He4 pumps maintenance**
  - will be done by TE-CRG
- **Still heater power supply (??)**
  - to be able to remote control