Report from the
13th Meeting of the Accelerator Technical Advisory Committee for the Japan Proton Accelerator Research Complex (J-PARC)

March 6 – 8, 2014
J-PARC Center
Tokai, Japan

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Introduction

The Accelerator Technical Advisory Committee (ATAC) for the J-PARC Project held its thirteenth meeting March 6 - 8, 2014, at the J-PARC Center in Tokai, Japan. This report of ATAC was presented to the Meeting of the International Advisory Committee (IAC) on March 10, 2014.

ATAC members are: Alberto Facco (INFN), Roland Garoby (CERN), Alan Letchford (STFC), Subrata Nath (LANL), Akira Noda (NIRS), Michael Plum (ORNL), Thomas Roser (BNL, Chair), Jie Wei (MSU), Robert Zwaska (FNAL). Jie Wei (MSU) was unable to attend the meeting.

The ATAC thanks the J-PARC management and staff for their hospitality during this meeting, and all the presenters for their excellent and comprehensive talks. The Committee also greatly appreciates that the J-PARC team has specifically addressed all recommendations from the previous report.

Accelerator Overview and Projections

The 10 months previous to the 2014 ATAC meeting have been a time of consolidation for the J-PARC accelerator complex. An accidental extraction of beam on May 23, 2013, damaged a target for hadron experiments and caused the uncontrolled release of radioactive contamination. The J-PARC organization undertook a major examination of its safety practices. The committee applauds J-PARC management for thoroughly reassessing and restructuring the safety organization of J-PARC in response to this incident.

Previous to the accident, the J-PARC facility had achieved 300 kW for MLF users, 240 kW for MR fast extraction, and 24 kW for MR slow extraction. While dealing with the accident, J-PARC also successfully completed the upgrades to the Linac, RCS, and MR within the planned tight schedule.

The accelerator complex began recommissioning in December 2013. 400 MeV H^- beam was achieved from the linac January 17, 2014. The committee recognizes this major achievement of the J-PARC accelerator division. User operation restarted at the MLF February 17, 2014, and MR operation is expected at the end of March 2014. User operations will continue through June 2014.

A shutdown is planned for July-September, 2014 to install the new Linac Front End and perform other maintenance. The Front End Upgrade will allow the Linac to operate at 50 mA, allowing higher power from the RCS and ultimately MR.

Primary Achievements

- 2013 was dominated by the planned shutdown and the response to the accident:
    - User operation ended on May 23, 2013 and restarted to the MLF, February 17, 2014.

    - Main Ring Fast extraction will restart in March 2014.
    - Before the shutdown, adequate beam was provided to the fast extraction neutrino facility to produce a 7.3 σ observation of ν_e appearance, exceeding the 5.0 σ target, and even excluding a small portion of the CP-violation parameter space.

- The accelerators operated at peak performance previous to the accident
    - 300 kW RCS (same), 240 kW MR-FX (+7%), 24 kW MR-SX (+70%).
    - The RCS has demonstrated 560 kW equivalent operations before and after the shutdown, but is limited to 300 kW until a new target is installed in the 2014 shutdown.
    - Slow extraction provides a “duty factor” of 43% at 24 kW and 99.5% extraction efficiency.
        - A study demonstrated as much as 30 kW slow extracted beam delivered to the target.

- A 3-month shutdown is planned in 2014 to enable higher-power operation.
    - Replacement of the ion source and RFQ to enable the Linac to produce a 50 mA current.
    - Installation of a new target in the MLF capable of accepting higher beam power (outside accelerator division).
    - Repair of the hadron hall to avoid future accidents (outside accelerator division).
    - After the shutdown, all necessary upgrades will have been completed to enable the RCS to achieve 1 MW – only operational realization is required as well as having a target capable of accepting the full power.

- In preparation for the 750 kW FX power upgrade, the FT3L MR RF cavities are in series fabrication and the development for the new power supplies for the MR magnets is progressing well.

- The JFY14 operations schedule includes 3 months of operation before the shutdown, and 6 months after.
    - Previous to the shutdown, power levels are anticipated to be similar to those achieved in JFY13 for the MLF and MR-FX programs. The MR-SX will not operate until hadron hall repairs are complete.
    - After the shutdown, the RCS is expected to quickly achieve 500 kW for user operations with the upgraded current and energy of the Linac. Also, short-period 1MW-equivalent studies are planned, with implementation to occur over the following year.
    - The MR intensity will only be marginally increased until later enhancements are made to the RF and magnet power supplies. 200-300 kW will be available for FX. 20-50 kW will be available for SX.

Comments and Recommendations

- The beam extraction accident resulted in unfortunate and unnecessary exposure to radioactive contamination, but fortunately no person was exposed to dangerous levels. J-PARC is well aware of various technical, procedural, and personal elements, which could have mitigated the accident's impacts.
    - The committee supports the process of internal examination and efforts by J-PARC management to reform the safety culture.

- The JFY2013 shutdown was still successful in implementing the planned upgrades.
    - The installation of ACS cavities into the Linac was efficiently planned and executed with 400 MeV beam achieved very quickly after startup.
    - The RCS was comprehensively aligned – the last step of recovery from the 2011 Tohuko earthquake. Careful planning minimized the radiation exposure to workers during this procedure.

- J-PARC decided, with ATAC's support, to delay installation of RFQ-III and the higher-current ion source until the JFY 2014 shutdown. This has allowed greater testing of the front end without impacting operations.
    - The committee notes that the testing time gained over the previous year has been limited by the recovery from the beam extraction accident. Further test operation is desired to gain long-term operational experience with the new source and RFQ and optimize emittances.

- High-intensity RCS studies were achieved at the level of 560 kW – equivalent intensities. These studies employed a "thinning" technique to the injection process that simulated the 0.5 ms full-length injection period.
    - Thinning allows comparison between intensities with the same injection period and beam emittances.
    - With the new injector and tuning the RCS is expected to be capable of 1 MW by 2015.

- Apart from the RF upgrade already underway the remaining major upgrade is the installation of improved power supplies in the MR to allow a 1.3 s cycle time, along with numerous incremental upgrades throughout the complex. This upgrade is the critical path toward achieving 750 kW in the MR for fast extraction.
    - The MR power supply upgrade is still in the development stage. The committee was shown various design and prototyping efforts that represent progress over the previous years, while priority was clearly given to the recovery from the accident and the planned JFY2013 shutdown work.
    - The large power supply design is not fixed – options are still being considered. A factory test will be designed, but a full load test is not feasible. Reaching a decision will require a concerted effort by the J-PARC team.
    - Capacitive storage is required to avoid excessive fluctuations to the regional power grid. Testing of components is underway, but it will be important to demonstrate the long-term viability of this approach.

- Funding limitations may reduce the available beam time for users.

- J-PARC is discussing options with users. One particular option is to operate the MR for SX at 24 GeV, rather than 30. Depending on the user constraints, this option may provide savings with only marginal loss of performance.

Beam power projections:

RCS for MLF:

- Substantially the same as last year, despite the beam extraction accident: 300 kW presently, 500 kW in JFY14, 1000 kW in JFY15
  - 1 MW is dependent upon the successful installation of the 50 mA ion source, RFQ-III upgrade, and achieving 1MW capability of the neutron production target.

- Studies were performed to demonstrate the ability of the RCS to operate at higher powers (presently limited by the target) before and after the Linac upgrade to 400 MeV
  - This study established 560 kW with 0.3% beam loss.
  - The 0.3% beam loss was a dramatic improvement from the previous 1.5-2.0% beam loss. Improvement is principally attributed to reduction in the ripple of the shift-bump magnet currents, and partially to the 400 MeV upgrade.
  - Emittance studies show that the final emittance is slightly smaller with the 400 MeV upgrade.
  - Extrapolation to 1 MW performance now appears very reasonable with the proven performance and simulation efforts.

MR with fast extraction:

- Substantially the same as last year, despite the response to the beam extraction accident: 200-300 kW presently, 750 kW by late JFY17 – with improvements in between.
  - 750 kW is dependent upon the successful installation of the 50 mA ion source, RFQ-III upgrade, MR RF improvements, and the MR magnet power supplies.

- J-PARC has adopted a plan to reduce the cycle time to 1.3 sec as its primary path to achieving 750 kW in the MR. As a result the MR magnet power supply needs to be upgraded and the RF voltage needs to be increased.
  - Other improvements in the MR are also necessary to achieve higher FX intensities for 750 kW (2^{nd} harmonic RF, increased collimator capacity)

MR with slow extraction:

- 20-50 kW in 2015, 100 kW by middle of JFY17
  - Re-establishment of slow-extraction is contingent upon completing the repairs to the hadron facility.

- Slow extraction goals continue to appear challenging to achieve. Furthermore, systems must be designed to avoid and/or mitigate the uncontrolled extraction of beam.

- The committee considers the SX performance goals to be placeholders until a SX scheme is chosen and the operational limitations can be re-examined.

Linac status and studies

Primary achievements

The team deserves congratulations for the excellent work on the successful installation and commissioning the new ACS linac especially on a highly compressed time-schedule of 27 days. There are good results from the commissioning effort and the requirements of 300 kW production with high availability can now be met.

Efforts to realign the linac during the 2013 summer shutdown to recover from the 2011 earthquake, in fact, resulted in a better overall alignment than the original installation. Beam losses also have improved with improving vacuum levels. The filament driven ion source delivered about 30 mA during continuous operation of about 450 hrs. Wake field concerns were found to be not an issue.

Comments

Several issues remain to be understood and resolved. SDTL5 and SDTL6 problems (ATAC2013 recommendation R4) are still not fully understood.

DTQ power supplies broke due to component failures. The bias power supplies in the modulators have been failing at an increasing rate once per year to now once per month. Two klystrons needed to be replaced recently. Before that there had not been any klystron failures. Some of these failures are being thought to be due to "aging" i.e., end of component lifetime issues. We note that no RF window failures have occurred.

Differences in the residual activation levels downstream of the geometrically identical ACS-A and ACS-B sections were explained in terms of differences in associated components such as ferrite-loaded current transformers in the gaps. This appears to be somewhat unexpected.

Beam profiles show substantial tails, at the level of 10% of the peak, at the exit of the ACS. Unfortunately the bunch shape monitors needed to be removed due to vacuum issues. Baking seemed to alleviate the problem and they need to be re-installed during the upcoming shutdown. Thorough beam simulation studies in the linac starting at the source is being handicapped by the unavailability of the bunch shape monitor for longitudinal beam bunch information.

Refined beam simulation studies should be pursued with measured beam distribution as the input and transporting the distribution through the entire linac. This should help understand the contribution of the beam halo to beam losses along the linac especially at "hot-spots".

R1: Procure appropriate quantities of spares of long-lead time, consumable equipment at a reasonable rate (e.g. at least 2 klystrons / year).

ACS Installation

Main achievements

- The new ACS section was installed in the linac.
- The commissioning was successfully completed.
- A few technical problems appeared and could be addressed quickly.
- The J-PARC linac successfully achieved the goal of increasing its output energy from 181 MeV to 400 MeV, in stable operating conditions and on schedule.
- The ACS section, consisting of 25 tanks including bunchers, was installed in the linac according to the ambitious schedule presented to the ATAC in 2013. The preliminary cavity testing and the installation of the RF systems, vacuum, water, beam lines and all the preparatory work were completed as planned. The ACS tanks were installed and aligned at the remarkable rate of one per day as planned. This important result required a substantial effort and was obtained in spite of the serious accident in May, which affected most of the accelerator activity.

- The conditioning of the ACS structures took less than one month and was performed with most cavities in parallel. An automatic procedure was developed which gradually increases the forward power while maintaining good vacuum in the cavities. The average conditioning time was 150 hours. One cavity had a temporary degradation during conditioning, which was finally recovered with the standard procedure applied for a longer time (280 hours). Final power of 2 MW at $P<10^{-6}$ Pa in stable conditions was obtained in all the tanks. Discharges in ten circulators were observed and revealed a minor flaw; all these circulators were repaired by the vendor and reinstalled in the linac without showing any serious problems. The ACS conditioning took significantly less time than the SDTL conditioning, reaching stable operation with less than 1 trip/day/cavity after only 1-month operation.

- Installation, RF conditioning and beam commissioning have taken place within the foreseen aggressive time frame of 6 months: a remarkable achievement especially considering that most of the 25 structures had not been conditioned before installation.

- ATAC'2013 recommendations have been duly taken into account:
    - The RFQ3 and the new source have been kept on the test place for full characterization before installation in the Linac. In the mean time the upgraded linac could be reliably commissioned with the beam produced by the old, well-known front end.
    - The high intensity front end will be installed in the linac during the summer shutdown 2014.

- Measurements on the test place were stopped until the beginning of the year. Promising performance has been obtained, with the acceleration of 50 mA to 3 MeV on February 6, 2014.

- The present status is the following:
    - 15 mA of beam is operationally available at 400 MeV, 25 mA has been used during test periods,
    - In the transverse planes, the beam distribution is not Gaussian and has tails. This is illustrated by the fact that the rms unnormalzied emittance at injection in the RCS did not decrease in inverse proportion to the increase of beam momentum.
    - In the longitudinal phase plane, the optimum energy spread is smaller than computed for an optimum capture in the RCS.

Comments and recommendations

- The installation and commissioning of the linac energy increase has been remarkably fast and efficient. The demonstration that the RCS can deliver beyond 500 kW of beam power with very low loss is very encouraging.

- After re-installation during the summer 2014 the BSMs will allow for a better optimization of the match at the entrance of the ACS section.

- ACS04 deserves continuous attention, monitoring the evolution of the trip rate.

- Optimization with beam should be pursued in view of reaching nominal beam characteristics at injection in the RCS.

<u>3 GeV RCS, including injection bump upgrade</u>

Primary achievements

- An impressive amount of work has been performed on the RCS in the last year. This was clearly a delicate and well-handled management issue, with up to 100 persons working simultaneously in the RCS tunnel.
- An extensive realignment campaign has brought the RCS back into good alignment.
- The shift bump magnet power supplies were upgraded. Unfortunately there is now substantial droop on the flat top. This has temporarily been compensated by the PSTR magnets, which were originally installed to control the MR vs. MLF injection differences.
- The power supply failure causing the shift bump magnet flat top droop is planned to be fixed during the summer shutdown 2014.
- Many capacitors on the shift bump magnet vacuum chambers failed due to the high voltages induced by the shift bump magnets. These capacitors have now been replaced by higher voltage (1000 vs. 250 V rated) capacitors.

- The charge exchange foil mechanisms have been improved, including the addition of view ports that will allow the foils to be inspected.
- The vacuum conditions in the injection beam line have been improved, and this has reduced the beam losses due to gas stripping.
- New scrapers were installed in the L3BT beam line, with the result that beam losses in the injection dump line are now improved.
- The upgrade of the RF system continued with the installation of a 12^{th} cavity and the replacement of bad cores by buckling-free types in two more cavities. Two cavities remain to be upgraded: cavity 6 will be treated this summer, and cavity 11 in 2015.
- A correction quadrupole magnet system is planned to correct the unwanted edge focusing effect due to the injection bump magnets, and to correct the tune during beam acceleration. The magnets and cables are now installed, and the associated power supplies will be installed soon.
- The 400 MeV injection RCS commissioning was impressively smooth, fast, and efficient.
- The performance of the RCS has been carefully studied with detailed simulations that match observations to an impressive degree. This has proved to be a valuable tool to investigate the sources of beam loss and to investigate methods to improve the overall performance and further reduce beam loss.
- The reduced ripple in the new shift bump magnet power supplies also improved beam losses. The remaining beam losses are mainly due to just the stripper foil interactions. Analysis and comparison to simulations suggests that the (now mitigated) shift bump ripple beam loss may be the first evidence of a significant image charge effect in the RCS.
- The extraction kickers have been identified to be the dominant source of intensity-limiting impedance. Although this has not been a problem to date, a diode/resistor modification has been identified, which could prove useful to supress an as-yet-unseen impedance-driven instability.
- An observed benefit of the increased injection energy / reduced B field range is the improvement by a factor of 2 of the field tracking between quadrupoles and dipoles (from 0.8 to 0.4%).
- Demonstrated 560 kW equivalent with low beam loss. There seems to be no impediment to 1 MW operations.

Comments and recommendations:

- Operation at 500 kW of beam power after the installation of the 50 mA front end in the linac during the summer 2014 is a reasonable goal.
- 1 MW in 2015 is within reach.
- Although the flat top droop of the bump magnet supply was well mitigated, the power supply needs to be repaired to allow for MR/MLF switching in a robust way.

R2: Test, as soon as possible, the beam parameters at RCS extraction needed for 750 kW operation of the MR.

Main Ring including 750kW power upgrade

Primary Achievements

Beam power was increased to 240 kW for Fast Extraction from MR for the T2K experiment and user operation of SX beam to 24kW by May 2013. The plan is to raise the MR beam power for the T2K experiment to 750 kW by the end of JFY2017.

Findings:

- Water leak from injection septum was found on May 8, 2013 and operation was resumed on May 13, after repair.
- MR collimation system has been modified by installation of 4 additional short collimators resulting in a beam loss capacity of 3.5 kW, increased from 2 kW.
- A section of stainless-steel beam ducts was replaced with Titanium ducts to reduce residual activation
- The waveform of the injection kicker was improved by applying a matching resistor of 140 ohm.
- MR tracking pattern has been improved by modification of feed forward control.
- To increase the power of fast extracted beam to 750 kW in 2017 from the present 240 kW, the repetition cycle will be shortened to 1.3 sec. For this purpose, the magnet power supplies and the RF cavities will be replaced. Beam simulation of MR operation at high beam power is on-going.
- To realize the 1.3 sec repetition cycle, new magnet power supplies utilizing capacitive energy storage, which provides all the magnetic energy around 1 MJ for one bending family from the capacitors, is now under development. Halving the load per supply and using three choppers in parallel address the required higher ramp rate. Precise output current control realizing a current ripple smaller than 10^{-6} at the flattop and precise tracking will be realized through shifting the phase and low noise digital control.
- New cavities using FT3L cores will allow reaching the necessary voltage for acceleration in the MR with a 1.3 s repetition period without building new RF amplifiers. The 9 cavities with 3 gaps each will ultimately be replaced by 7 cavities with 5 gaps and 2 cavities with 4 gaps.
- To reach the required intensity for 750 kW operations, the anode power supplies will need additional IGBT units to bring their power from 840 kW to 1.2 MW.
- Mass production of the FT3L cores started in industry in May 2013. The construction of 2 cavities with 4 gaps and 2 with 5 gaps was launched during JFY2013. A first one will be delivered on March 25 and tested in the Hendel test place before installation in the ring during the summer shutdown.
- The construction of the remaining 5 cavities with 5 gaps will take place during JFY2014.

- All cavities will be installed during JFY2016.
- A second harmonic cavity is in construction, using air-cooling and Finemet cut cores. It will be tested during the spring of 2014.

Comments

The committee strongly supports and encourages the careful studies of the new MR power supply design before the planned installation in 2017. The new power supply will use capacitive energy storage to avoid the 140 MW power swings. The committee also supports the construction of smaller scale prototypes and the continuing collaboration with experts from CERN and other institutions. Reaching a decision will require a concerted effort by the J-PARC team.

The series production of new cavities and their FT3L cores is progressing remarkably smoothly. The planning of construction and installation of the RF system is perfectly in line with the goal of reaching 750 kW during JFY2017.

MR slow extraction

Findings:

Slow extraction from the Main ring to the Hadron Hall has made significant progress during the few months after the last ATAC. The extracted beam power increased from 15 kW to 24 kW and the beam intensity from 2×10^{13} to 3×10^{13} protons per pulse. The spill duty factor and extraction efficiency was maintained at about 45% and 99.5%, respectively. At this higher beam intensity an instability developed during the debunching process.

On May 23rd, 2013, the control of the Extraction Quadrupole power supply malfunctioned, which led to the extraction of 2×10^{13} protons to the gold production target during a 5 ms long pulse. The very short pulse melted and evaporated the target material and caused radioactive contamination in the Hadron hall and its surroundings. The operation of J-PARC was suspended for the rest of the year for an investigation and implementation of corrective measures.

A number of schemes were presented to prevent the extraction of a short intense beam pulse to the target in the hadron hall, including limiting current excursions of the EQ power supply. These improvements would address not just a malfunction of the EQ PS but also other possible scenarios such as a pre-fire of the beam abort kickers.

Comments

Further increase of the slow extracted beam power is still limited by the activation of beam components and awaits the replacement of the stainless steel vacuum chambers with Titanium chambers.

The development of an instability during debunching of a high intensity beam is not surprising. It could be mitigated using controlled longitudinal emittance blow-up before the debunching process, although this in turn could reduce the extraction efficiency.

The corrective measures to slow extraction system to prevent a reoccurrence of the accidental extraction of a short intense beam pulse are quite comprehensive. Nevertheless it will be very difficult to absolutely prevent it. Potentially a different target material, such as tungsten, could be designed to tolerate a single short intense beam pulse without the danger of evaporating target material and causing contamination.

The Hadron hall target area will be sealed and operated with a negative pressure so that a future extraction failure would not lead to a release of radioactive contamination. This action is necessary to make the prevention of an extraction malfunction a machine protection issue and not a safety issue.

The committee applauds J-PARC management for thoroughly reassessing and restructuring the safety organization of J-PARC in response to this incident.

Impedance and Instabilities

Findings

Permalloy is used to shield the RCS beam from the extraction beam line magnets. There is a significantly increased impedance compared with the previous titanium vacuum chamber but likely not sufficient to limit the RCS beam intensity.

The effect of replacing stainless steel vacuum pipes with Titanium pipes on the MR impedance was shown to be minimal. Titanium has initially a large secondary electron yield but is quickly scrubbed to a quite low value.

An electron cloud detector was installed in the MR. signals of electron cloud were detected after increasing the beam intensity but disappeared quickly after beam operation. This could be explained by successful beam scrubbing.

An electron signal was also detected during debunching of 2.5×10^{13} protons-per-pulse for slow extraction.

Comments and recommendation

As the intensity in the MR is increased the ring impedance will become more important. The total transverse and longitudinal impedance gives a good indication for the onset of beam instabilities. The ring impedances can be determined by measuring the intensity dependence of the coherent betatron tune and longitudinal quadrupole mode.

R3: Measure with beam the transverse and longitudinal ring impedances in the MR

Linac Front End Upgrade

Primary achievements

- Work on the test stand was halted until December 2013 following the Hadron hall accident. Since then the RF driven ion source has delivered more than 60mA. OFC will be replaced by SUS (stainless steel) in the ion source. SUS requires shorter but more frequent cesiations at a lower reservoir temperature than OFC. Feedback on the Cs valve and RF power has achieved 67 +/- 0.3 mA for 78 hours. A new extraction electrode has reduced the rms emittance from 0.40-0.45 pi mm mrad to 0.31-0.35 pi mm mrad. Sparking on the acceleration electrode has occurred and damaged the power supply.

- RFQ III has been conditioned to 110% field level at 600 μs and 25 Hz with less than one trip per day. 51 mA of accelerated beam was achieved in February 2014. The RFQ III transmission is only 85% compared to 98% in simulations with a 0.4 pi mm mrad water bag input beam distribution.

- 3D PIC simulations of MEBT1 with a realistic RFQ distribution demonstrate a good match into the DTL with suitable beam parameters at the chopper cavity. All quadrupole gradients for 50 mA are below the maximum allowed values, but the buncher gradients exceed the values achievable with the existing 10kW RF amplifiers requiring an upgrade to 30kW. Emittance growth is 24% horizontally and 28% vertically in MEBT1 for 50mA. A new chopper cavity design is almost complete based on an Al cold model. Fabrication will begin in April 2014. A new 120kW driver has been procured.

- The carbon composite scraper temperature exceeds the safe threshold of 600 C for 44% chopping at 50mA beam intensity. Tandem chopping (alternately up and down) onto two scrapers by shifting the chopper cavity phase by 180 degrees has been identified as a possible solution. Alternation can be done at the macro (25 Hz) pulse or medium (1.2 MHz) pulse level. Diamond and pyrolytic carbon have been selected as candidate scraper materials due to their higher thermal conductivity. Tests are scheduled for April-June 2014. The original proton removal scheme will not work with tandem chopping and a scheme involving translation of the RFQ and Q2 magnet is proposed.

Comments and recommendations

- The remaining test schedule is aggressive although the ability to meet such time-scales has been demonstrated previously.

- The high power beam-commissioning schedule after installation is likewise very tight.

- The measured emittances from the RF source at 50mA are ~50% larger than the specification. It isn't clear how this compares to the emittances from the filament driven ion source and whether it would impact the transmission efficiency through the Linac.

- It is claimed that changing from OFC to SUS will reduce the emittance and eliminate the sparking problem. The reason for this is not obvious to the committee.

- Consistent source lifetimes have not been demonstrated.

- The reason for the lower RFQ transmission compared to simulations with a 0.4 pi mm mrad beam is unclear. Simulations of RFQIII with non-water-bag inputs should be run to see if the lower than expected transmission can be adequately explained purely by the beam distribution.

- RCS commissioning appears to call for chopping large fractions of the beam (thinning) yet none of the considered scraper solutions can apparently take such large chopping fractions.

- Once installed the ability to further develop the RF source will be severely limited. A second source system should be constructed to allow for the continuation of the source development.

  R4: Before installation in the summer every effort should be made to demonstrate long-term reliable operation of the RF source.

  R5: A second RF source system should be built to allow off-line testing and development to continue.

  R6: Ensure that the scraper performance is consistent with the required chopping levels.

Appendix I: Meeting Agenda

Thursday 6 March 2014

09:00	Project Status	Y. Ikeda
09:30	Accident in HD Hall	N. Saito
09:30	Accelerator Overview	T. Koseki

Status & Commissioning (Linac)

11:10	Linac Status	H. Oguri
11:30	ACS Installation	H. Ao
12:00	Beam Study Results of Linac	Y. Liu

Status & Commissioning (RCS)

13:30	RCS Status	M. Kinsho
14:10	Beam Study Results of RCS	H. Hotchi

Status & Commissioning (MR)

14:50	MR Status	F. Naito
16:00	MR Slow Extraction	M. Tomizawa
16:30	Instabilities	T. Toyama, Y. Shoubuda, Y. Chin

Friday 7 March 2014

Towards 1MW RCS and 0.75MW MR-FX with Linac Energy Upgrade

09:10	Linac Upgrade Plan	T. Maruta
09:40	Linac Front End Upgrade	T. Morishita, Y. Kondo
10:30	RCS Injection Bump Magnets	T. Takayanagi or N. Hayashi
10:50	MR Upgrade Plan	S. Igarashi, Y. Sato
11:20	MR Power Supplies	Y. Kurimoto

Saturday 8 March 2014

10:30	Recommendations to J-PARC	T. Roser