

HYSPEC Instrument Development Team

MEMORANDUM

HYSPEC Annual Report FY2014-2015

Date: October 1, 2015

To: SNS NScD, S. Nagler, M. Lumsden, B. Winn, O. Garlea

Cc: J. Tranquada, S. Shapiro, M. Kenzelmann, A. Goldman, T. Sato

From: I. Zaliznyak

Subject: HYSPEC annual report for FY2014-2015

1. Status of the HYSPEC IDT and the Executive Committee

The two main roles of the Executive Committee (EC) are (i) to advise, on behalf of the IDT, the SNS HYSPEC Team on all aspects of the instrument operation and development and to contribute to the continuing improvement of its performance, and (ii) to define the priorities for the HYSPEC science program by providing the peer review process aimed at identifying the proposals from those submitted by the IDT membership for beam time allocation. In order to ensure the highest quality of the IDT science program and of the peer review process, HYSPEC IDT strives to elect highly qualified scientists, who are the recognized experts in the field, to the Executive Committee. With the same goal in mind, and in order to maintain the vibrant science program, HYSPEC IDT is also open to new members, whose contributions are likely to benefit the HYSPEC science by expanding the instrument capabilities and leveraging and extending the reach of its unique features.

In FY2014-2015, there has been a marked change in the composition of the HYSPEC IDT EC, as two of its members, Dr. J. Rhyne and Dr. R. McQueeney have taken positions at DOE and the SNS, respectively, which are in conflict with their service on the IDT EC. The new members that were elected to replace Dr. Rhyne and Dr. McQueeney are Prof. T. Sato (Tohoku University) and Professor A. Goldman (Ames/Iowa State University). The election of Professor T. Sato has followed the decision to include experiments on HYSPEC into the framework of the ISSP-BNL Cooperative Research Program on Neutron Scattering. There have also been changes in the IDT membership, such as addition of Professor C. Broholm (Johns Hopkins University), who has long-standing interest and participation in HYSPEC, but was not part of the original IDT.

The most up-to-date list of the HYSPEC IDT and the IDT EC memberships can be found on the BNL HYSPEC web page, <http://neutrons.phy.bnl.gov/HYSPEC/members.shtm>, and are also listed in the Appendix A. Dr. I. Zaliznyak (Brookhaven National Laboratory) remains the Chair of the IDT Executive Committee.

2. Status of the instrument operation and development

In FY 2014-2015 HYSPEC has been operating in a regular way in the SNS User Program. The IDT members have continued contributing to improving the instrument performance and enhancing its capabilities by providing technical advice. In particular, notable improvement in terms of reducing spurious scattering has been accomplished by removing the redundant pressure sensor in the detector vessel. Another improvement aimed at lowering the background, which was suggested by the IDT, was to cover all elements visible to detectors with neutron absorbing paint (this is in compliance with the original HYSPEC top level specifications by the IDT). Finally, a number of other incremental improvements, both in hardware (improved cable management on the sample stage, which lifted limits on sample rotation, beam stop after sample, limiting the impact of the direct beam at small scattering angles) and software (Mantid scripts for data reduction and analysis spearheaded by A. Savici), suggested by the IDT have also been implemented, which all improved the instrument performance.

This year, commissioning of the Polarized Beam operation has begun, which includes full polarization analysis using the PSI-built transmission polarizer. The IDT has undertaken first user measurements of the polarized diffraction, which was successful, and the polarized inelastic measurement, which was interrupted by an unscheduled target failure. Overall, the polarized beam commissioning is proceeding well, and the IDT provides important contribution to it. The EC will encourage the IDT membership to submit the friendly-user polarized beam experiment proposals for the upcoming proposal call 2016A.

3. IDT Science program

3.1. Proposal review

HYSPEC IDT uses the following procedure for reviewing proposals and deciding on the beam time allocation. All proposals, which have been identified in the IPTS as HYSPEC IDT proposals are, within 10 working days, reviewed by all members of the Executive Committee. This is possible because the total number of proposals is reasonably small, typically less than 10 (and only about two of them would typically obtain the IDT beam time). Consequently, each EC member provides the ranking of the proposals, placing them in order from best (first) to worst (last). The EC Chair (Dr. I. Zaliznyak) then combines these rankings by adding, for each proposal, the numbers assigned by different EC members (reviewers). The resulting ranking shows proposals as ranked by the EC, and with the corresponding summary ranking numbers, which reflect, in particular, the relative merit of different proposals, and whether any of the proposals are tied. These summary rankings, together with some reviewer comments, are then provided to the SNS and the HYSPEC Instrument Team for scheduling the top ranked proposals within the IDT beam time allocation.

3.2. Proposal call 2015B

In proposal call 2015B HYSPEC IDT has received 8 IDT proposals, which have been reviewed and ranked by the IDT Executive Committee. The resulting ranking of the corresponding IPTS's are shown in the Table below. Priority ranking is from 1 (highest) to 5 (lowest), and was obtained by adding the rankings provided by the EC members (shown in brackets). Due to the beam time loss on the new Instrument Control System

commissioning and the Polarized Beam commissioning, only one experiment, IPTS-14344.1 that has been scheduled. While some preliminary data has already been taken, the measurement is currently scheduled for December, 2015. IPTS-13880 and 14189 were put as alternates with the intent of using the supermirror array (IPTS-14189 ran partially before the SNS target failure).

Priority placement (Cumulative Rank)	IPTS #	Title	Author (IDT collaborator)
1(18)	IPTS-14344.1	"Quantum Critical Fluctuations in YFe ₂ Al ₁₀ ",	Gannon (Zaliznyak)
2(20)	IPTS-14029.1	"The role of the spin wave excitations for spin Seebeck effect in YIG",	Kakurai (Tranquada)
3(21)	IPTS-14234.1	"Spin excitations in the stripe-ordered state of Na _{0.5} CoO ₂ ",	Wen (Lee)
4(21)	IPTS-13880.1	"Valence bond state in the lacunar spinel GaTa ₄ Se ₈ ",	Plumb (Broholm)
5(22)	IPTS-14189.1	"Polarized-Neutron Scattering Study of Temperature-Induced Magnetic Scattering in Fe _{1+y} Te _{1-x} Sex",	Zaliznyak (Zaliznyak, Tranquada)
6(37)	IPTS-14176.1	"Electromagnon and Spin-Nematic Interaction in Ca ₂ CoSi ₂ O ₇ ",	Masuda (Zaliznyak)
7(38)	IPTS-13701.1	"Inelastic Neutron Scattering for 3D-Triangular Lattice Antiferromagnet Ba ₂ NiTeO ₆ ",	Asai (Zaliznyak)
8(39)	IPTS-14249.1	"Low energy magnetic excitations near (0.5,0) in Fe _{1+d-y} NiyTe _{1-x} Sex compounds",	Xu (Xu, Tranquada, Zaliznyak)

3.3. Proposal call 2015A

In proposal call 2015A HYSPEC IDT has received 5 IDT proposals, which have been reviewed and ranked by the IDT Executive Committee. The resulting ranking of the corresponding IPTS's are shown in the Table below. Priority ranking is from 1 (highest) to 5 (lowest), and was obtained by adding the rankings provided by the EC members (shown in brackets). IPTS' 13208 and 13323 ran as IDT experiments. IPTS 12786 got accepted for the user program. IPTS-11403 is another IDT experiment that was run in 2015A, as it got delayed due to target failure.

Priority placement (Cumulative Rank)	IPTS #	Title	Author (IDT collaborator)
1(8)	IPTS-13323.1	"Crystalline electric field splitting and quadrupolar fluctuations in PrV ₂ Al ₂₀ ",	Sato (Zaliznyak)
2(9)	IPTS-13208.1	"Testing for PDW superconductivity in LBCO",	Tranquada (Tranquada, Zaliznyak)
3(10)	IPTS-12883.1	"Investigation of the lattice dynamics in filamentary superconductor FeTe _{1+x} S _x ",	Fobes (Zaliznyak)
4(15)	IPTS-13057.1	"L-dependence of low energy magnetic excitations in FeTe _{1-x} Sex",	Xu (Tranquada, Xu)
5(15)	IPTS-12786.1	"Electromagnon and Spin-Nematic Interaction in Ca ₂ CoSi ₂ O ₇ ",	Masuda (Zaliznyak)

3.4. Proposal call 2014B

In proposal call 2014B HYSPEC IDT has received 6 IDT proposals, which have been reviewed and ranked by the IDT Executive Committee. The resulting ranking of the corresponding IPTS's are shown in the Table below. Priority ranking is from 1 (highest) to 6 (lowest), and was obtained by adding the rankings provided by the EC members (shown in brackets). IPTS-11484 and 11546 were approved for the user program and ran in FY2015, IPTS-11644 was run in FY2014.

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Priority placement (Cumulative Rank), IPTS #, Title, Author (IDT collaborator)
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1(9), IPTS-11403, "Inelastic neutron scattering study on the iron-based ladder compound BaFe₂Se₃", Nambu (Zaliznyak)
2(12), IPTS-11432, "Investigation of a potentially magnetic acoustic mode in superconducting Fe_{1+y}Te_{1+x}Sex", Fobes (Fobes)
3(14), IPTS-11644, "Phonons and magnetic excitations in BiFeO₃", Xu (Xu)
4(15), IPTS-11228, "Magnetic excitation of novel square-lattice antiferromagnets A₂MO₃X (A=Ca, Sr, M=Mn, Fe, Co, Ni, Cu, X=F, Cl)", Masuda (Zaliznyak)
5(16), IPTS-11484, "Search for LTT fluctuations in LSCO", Tranquada (Tranquada)
6(18), IPTS-11546, "Emerging magnetism in the doped narrow gap semiconductor Fe_{1-x}CrxSb₂: spin excitations and lattice dynamics", Zaliznyak (Zaliznyak)
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3.5. Publications

2015 publications

- David M. Fobes, Igor A. Zaliznyak, Zhijun Xu, Genda Gu, Xu-Gang He, Wei Ku, John M. Tranquada, Yang Zhao, Masaaki Matsuda, V. Ovidu Garlea, Barry Winn, "'Forbidden' phonon: dynamical signature of bond symmetry breaking in the iron chalcogenides", arXiv:1509.05930v1 (2015).
- H. Jacobsen, I. A. Zaliznyak, A. T. Savici, B. L. Winn, S. Chang, M. Huecker, G. D. Gu, J. M. Tranquada, "Neutron scattering study of spin ordering and stripe pinning in superconducting La 1.93Sr 0.07CuO₄", arXiv:1508.02429v1 (2015).
- Bozin E. S., Zhong R., Knox K. R., Gu G., Hill J. P., Tranquada J. M., Billinge S. J.L., "Reconciliation of local and long-range tilt correlations in underdoped La_{2-x}BaxCuO₄", Physical Review B: Condensed Matter and Materials Physics, 91, 054521, (2015).
- Schneeloch J. A., Xu Z., Wen J., Gehring P. M., Stock C., Matsuda M., Winn B., Gu G., Shapiro S. M., Birgeneau R. J., Ushiyama T., Yanagisawa Y., Tomioka Y., Ito T., Xu G., "Neutron inelastic scattering measurements of low energy phonons in the multiferroic BiFeO₃", Physical Review B: Condensed Matter and Materials Physics, 91, 6, 064301, (2015).
- Tan X., Garlea V. O., Chai P., Geondzhian A. Y., Yaroslavtsev A. A., Xin Y., Menushenkov A. P., Chernikov R. V., Shatruk M., "Synthesis, crystal structure, and magnetism of A₂Co₁₂As₇ (A=Ca, Y, Ce-Yb)", Journal of Solid State Chemistry, (2015).
- Winn B., Filges U., Garlea V. O., Graves-Brook M., Hagen M., Jiang C., Kenzelmann M., Passell L., Shapiro S. M., Tong X., "Recent progress on HYSPEC, and its polarization analysis capabilities", EPJ Web of Conferences, 83, 03017, (2015).

2014 publications

- Fobes D., Zaliznyak I. A., Xu Z., Zhong R., Gu G., Tranquada J. M., Harriger L., Singh D., Garlea V. O., Lumsden M., Winn B., "Ferro-orbital ordering transition in iron telluride Fe_{1+y}Te", Physical Review Letters, 112, 187202, (2014).

2. Jiang C. Y., Tong X., Brown D. R., Chi S., Christianson A. D., Kadron B. J., "Development of a compact in situ polarized ^3He neutron spin filter at Oak Ridge National Laboratory", *Review of Scientific Instruments*, 85, 7, 075112, (2014).
3. Stone M.B., Niedziela J.L., Abernathy D.L., DeBeer-Schmitt L., Ehlers G., Garlea O., Granroth G.E., Graves-Brook M., Kolesnikov A.I., Podlesnyak A., Winn B., "A comparison of four direct geometry time-of-flight spectrometers at the Spallation Neutron Source", *Review of Scientific Instruments*, 85, 4, 045113, (2014).
4. Tian W., Tan G., , Zhang J., Winn B., Hong T., Fernandez-Baca J. A., Zhang C., Dai P., "Influence of doping on the spin dynamics and magnetoelectric effect in hexagonal $\text{Y}_{0.7}\text{Lu}_{0.3}\text{MnO}_3$ ", *Physical Review B: Condensed Matter and Materials Physics*, 89, 144417, (2014).

Appendix A

HYSPEC IDT Members – FY2015

I. Zaliznyak, PI	Brookhaven National Laboratory	<table border="1"> <thead> <tr> <th style="text-align: center;">HYSPEC IDT Executive Committee</th> <th style="text-align: center;">Affiliation</th> </tr> </thead> <tbody> <tr> <td>I. Zaliznyak, PI</td> <td>BNL</td> </tr> <tr> <td>S. M. Shapiro, PI</td> <td>BNL</td> </tr> <tr> <td>M. Kenzelmann</td> <td>PSI</td> </tr> <tr> <td>A. Goldman</td> <td>Ames/Iowa U.</td> </tr> <tr> <td>T. Sato</td> <td>Tohoku U.</td> </tr> <tr> <td>J. Tranquada</td> <td>BNL</td> </tr> <tr> <td>B. Winn (ex-officio)</td> <td>ORNL/SNS</td> </tr> <tr> <td>O. Garlea (ex-officio)</td> <td>ORNL/SNS</td> </tr> </tbody> </table>	HYSPEC IDT Executive Committee	Affiliation	I. Zaliznyak, PI	BNL	S. M. Shapiro, PI	BNL	M. Kenzelmann	PSI	A. Goldman	Ames/Iowa U.	T. Sato	Tohoku U.	J. Tranquada	BNL	B. Winn (ex-officio)	ORNL/SNS	O. Garlea (ex-officio)	ORNL/SNS
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L. Daemen	Oak Ridge National Laboratory																			
J. Fernandez-Baca	Oak Ridge National Laboratory																			
J. Gardner	ANSTO Bragg Institute																			
B. Gaulin	McMaster University																			
M. Greven	University of Minnesota																			
M. Hagen	European Spallation Source																			
M. Huecker	Brookhaven National Laboratory																			
V. Kiryukhin	Rutgers University																			
S.-H. Lee	University of Virginia																			
Y. Lee	Stanford University																			
C. Majkrzak	NIST Center for Neutron Research																			
R. McQueeney	Oak Ridge National Laboratory																			
S. Nagler	Oak Ridge National Laboratory																			
R. Osborn	Argonne National Laboratory																			
L. Passell	Oak Ridge National Laboratory																			
L. P. Regnault	CEA-Grenoble																			
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