

# HYSPEC Instrument Development Team

## MEMORANDUM

### HYSPEC Annual Report FY2015-2016

Date: October 31, 2016

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 FY2015-2016

#### **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 FY2015-2016, there was no changes in the composition of the HYSPEC IDT and its EC. The Executive Committee has functioned smoothly and efficiently, providing timely reviews and rankings of the IDT proposals to the SNS.

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.shtml>, 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 2015-2016 HYSPEC has been fully operational and serving 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, the IDT has actively participated in the development of the polarized beam option on HYSPEC and its commissioning. IDT members have undertaken the first user experiments of both polarized

diffraction and of the inelastic scattering, which were very successful. The results of the first polarized beam measurements were presented in a number of conference talks, including by the Instrument Scientist O. Garlea in an invited talk at the American Conference on Neutron Scattering (Long Beach, CA, 2016) and by the PI I. Zaliznyak in an invited talk at the PNCMI Conference (Munich, Germany, 2016). The results presented by I. Zaliznyak were summarized in great detail in the manuscript submitted to the PNCMI Conference proceedings. In order to facilitate users' reference to descriptions of important instrument details and procedures of HYSPEC polarized beam operation, the manuscript was made available on <https://arxiv.org/abs/1610.06018>. This prompted a positive response from the user community. Following the first experiments led by the Instrument Team and the IDT PI, there have been several successful polarized beam measurements by other IDT members. Overall, in our view the polarized beam operation has been user-commissioned during the FY2015-2016, and is now in routine operation. The EC encourages the IDT membership to submit the polarized beam experiment proposals for the upcoming proposal calls.

IDT continues to work with the HYSPEC Instrument Team on incremental improvements, both in hardware (design of the new shielding for the guide field coils at the sample stage in the polarized beam mode, also acting as beam stop after sample) and software (designing the polarized data reduction algorithms and implementing those in Mantid scripts for data reduction and analysis, in collaboration with A. Savici). An important IDT contribution was in designing and optimizing, in collaboration with the instrument team, of a horizontal permanent magnet yoke for half-polarized beam measurements, which allowed successful measurements of spin-waves in the YIG ferrimagnet (Kakurai, Tranquada et al., IPTS-16764.1). Overall, the IDT constructive input and interaction with the HYSPEC Instrument Team continue to contribute towards further improving the instrument performance.

### **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 appears 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.

Some EC members feel that short time scale (10 days) allocated for reviewing the IDT proposals is overburdening and suggest that the deadline is synchronized with the rest of the IPTS proposals. EC and PI plan to raise this question at the upcoming review of the HYSPEC IDT. In such case, the reviews obtained from the SRC would need to be

obtained, but for those proposals accepted by the IDT they should be disregarded in allocating the beam time.

### Proposal call 2016B

In proposal call 2016B HYSPEC IDT has received 9 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 9 (lowest), and was obtained by adding the rankings provided by the EC members (shown in brackets). Proposals allocated the IDT beam time are shown in italic.

Priority placement (Cumulative Rank)	IPTS #	Title	Author (IDT collaborator)
1(15)	<i>IPTS-16764.1</i>	<i>"Polarized neutron scattering investigation of the spin wave excitations in YIG"</i>	<i>Kakurai (Kakurai, Tranquada)</i>
2(18)	<i>IPTS-16741.1</i>	<i>"Polarized-Neutron Study of Temperature-Induced Magnetic Scattering and of Low-Q mode in Fe<sub>1+y</sub>Te"</i>	<i>Zaliznyak (Zaliznyak, Tranquada)</i>
3(19)	IPTS-16281.1	"Multi-particle excitations in a coupled spin-1 antiferromagnetic chain material"	Kenzelmann (Kenzelmann)
4(22)	IPTS-16680.1	"Magnetic excitations in f-electron Weyl metal YbMnBi <sub>2</sub> "	Zaliznyak (Zaliznyak)
5(27)	IPTS-16537.1	"Probing the spin resonance across the QCP in LSCO"	Tranquada (Tranquada, Xu, Zaliznyak)
6(29)	IPTS-17014.1	"Spin phonon coupling in PbFe <sub>1/2</sub> Nb <sub>1/2</sub> O <sub>3</sub> (PFN)"	Stock (Xu)
7/8(30)	IPTS-16441.1	"Spin wave excitations of the long periodic modulation in CaBaCo <sub>2</sub> Fe <sub>2</sub> O <sub>7</sub> using polarization analysis"	Reim (Sato)
7/8(30)	IPTS-17002.1	"Search for Magnetic Scattering in the new Fe-based layered superconductor beta-FeS"	Zaliznyak (Zaliznyak)
9(34)	IPTS-16677.1	"Polarized inelastic neutron scattering from the triangular antiferromagnet NiGa <sub>2</sub> S <sub>4</sub> "	Nambu (Zaliznyak)

### 3.2. Proposal call 2016A

In proposal call 2016A HYSPEC IDT has received 10 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 10 (lowest), and was obtained by adding the rankings provided by the EC members (shown in brackets). Proposals allocated the IDT beam time are shown in italic.

Priority placement (Cumulative Rank)	IPTS #	Title	Author (IDT collaborator)
1(14)	<i>IPTS-15390.1</i>	<i>"Polarized-Neutron Study of Temperature-Induced Magnetic Scattering and of Low-Q mode in Fe<sub>1+y</sub>Te"</i>	<i>Zaliznyak (Zaliznyak, Tranquada)</i>
2(21)	<i>IPTS-15262.1</i>	<i>"Observation of quadrupolar fluctuation in PrTi<sub>2</sub>Al<sub>20</sub>"</i>	<i>Okuyama (Sato)</i>
3(22)	<i>IPTS-15508.1</i>	<i>"Polarized neutron scattering investigation of the spin wave excitations in YIG"</i>	<i>Kakurai (Tranquada)</i>
4/5(23)	IPTS-15534.1	"Polarized neutron study of quantum spin liquid candidate ZnCu <sub>3</sub> (OH) <sub>6</sub> Cl <sub>2</sub> "	Wen (Lee)

4/5(23) IPTS-15605.1 “Strongly coupled spin-phonon modes in multiferroic YMnO<sub>3</sub>”, Delaire (Savici, Winn)

6(29) IPTS-15533.1 “Low energy magnetic excitations in Te vapour annealed superconducting FeTe<sub>1-x</sub>Se<sub>x</sub>”, Xu (Xu, Tranquada)

7(31) IPTS-15582.1 “Dynamics of oxygen molecules adsorbed in deuterated nanoporous metal complex CPL-1”, Masuda (Zaliznyak)

8/9(33) IPTS-15238.1 “High-temperature inelastic neutron scattering from the iron-based ladder compound BaFe<sub>2</sub>Se<sub>3</sub>”, Nambu (Zaliznyak)

8/9(33) IPTS-15430.1 “Investigating ferromagnetic fluctuations in SrCo<sub>2</sub>As<sub>2</sub>”, Goldman (Goldman)

10(40) IPTS-15804.1 “Spin phonon coupling in PbFe<sub>1/2</sub>Nb<sub>1/2</sub>O<sub>3</sub>”, Stock (Xu)

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### 3.3. Publications

#### 2016 publications

1. I. A. Zaliznyak, A. T. Savici, V. O. Garlea, Barry Winn, U. Filges, J. Schneeloch, J. M. Tranquada, G. Gu, A. Wang, C. Petrovic. Polarized neutron scattering on HYSPEC: the HYbrid SPECTrometer at SNS. arXiv:1610.06018v2 (2016).
2. 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”, Phys. Rev. B **94**, 121103(R) (2016).
3. Z.J. Xu, J.A. Schneeloch, J. Wen, E.S. Bozin, G.E. Granroth, B. Winn, M. Feynson, R.J. Birgeneau, G. Gu, I.A. Zaliznyak, J.M. Tranquada, G. Xu. Thermal evolution of antiferromagnetic correlations and tetrahedral bond angles in superconducting FeTe<sub>1-x</sub>Se<sub>x</sub> Physical Review B, **93**, 104517 (2016).

#### 2015 publications

4. 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<sub>1.93</sub>Sr<sub>0.07</sub>CuO<sub>4</sub>”. Phys. Rev. B **92**, 174525 (2015).

## Appendix A

### HYSPEC IDT Members – FY2016

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>A. Goldman</td> <td>Ames/Iowa U.</td> </tr> <tr> <td>M. Kenzelmann</td> <td>PSI</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	A. Goldman	Ames/Iowa U.	M. Kenzelmann	PSI	T. Sato	Tohoku U.	J. Tranquada	BNL	B. Winn (ex-officio)	ORNL/SNS	O. Garlea (ex-officio)	ORNL/SNS
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C. Broholm	Johns Hopkins University																			
L. Daemen	Oak Ridge National Laboratory																			
J. Fernandez-Baca	Oak Ridge National Laboratory																			
D. Fobes	Los Alamos National Laboratory																			
J. Gardner	ANSTO Bragg Institute																			
B. Gaulin	McMaster University																			
M. Greven	University of Minnesota																			
M. Hagen	European Spallation Source																			
M. Kenzelmann	Paul Sherrer Institut																			
V. Kiryukhin	Rutgers University																			
S.-H. Lee	University of Virginia																			
Y. Lee	Stanford University																			
C. Majkrzak	NIST Center for Neutron Research																			
R. McQueeney	U. Iowa, Ames National Laboratory																			
S. Nagler	Oak Ridge National Laboratory																			
R. Osborn	Argonne National Laboratory																			
L. Passell	Brookhaven National Laboratory																			
L. P. Regnault	CEA-Grenoble																			
J. Rhyne	DOE																			
A. Savici	Oak Ridge National Laboratory																			
M. Stone	Oak Ridge National Laboratory																			
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