– DELIVERABLE D8.8 (ex D7.8) –
(DRAFT)

Final plan for the use and dissemination of foreground

Dissemination level: PUBLIC

– 23 September 2012 –

1. Introduction

This document aims at defining how are disseminated and exploited the outputs of the project.

2. Dissemination of results

The project results are disseminated in different ways listed here.

2.1. Website(s)

The project website, http://www.nextmuse.cscs.ch, has been built by ETHZ and ECN. In addition to a secure area for use by the project partners, the website has a public area for dissemination of results. The public area contains:

- a description of the project,

- public reports which can be freely downloaded in pdf format,

- a detailed description of the open-source software produced in the project (installation files and manual, user instructions…),

- image and movie galleries.

The website ranks highly in internet searches for « multi-mechanics », « interactive+SPH », « interactive+SPH » and related key phrases. It has a broad audience throughout the world (see D7.9). Nonetheless, to reinforce the impact of the project, two other online spaces are used:

- open-source material is replicated on a website dedicated to sharing HPC resources (https://hpcforge.org/). This website proposes full hosting of such HPC development projects with downloads, release notes, wiki description, developers forum, bug reports, dashboards, activity tracker, etc. Open-source software developed during the project is top ranked in this website (see D7.9). This website offers a much wider visibility to open-source outputs of the project.

- a YouTube channel permitting dissemination of NextMuSE concept's demonstration among a broad audience.

To maximize the project dissemination, these three online spaces will be maintained and updated during the years to come.

2.2. Scientific conferences and publications

Publications to date are listed in D7.9. Some results have been generated late in the project, and it is expected that NextMuSE will lead indirectly to new results through future research activity. Partners will continue to disseminate these late and new results of NextMuSE to the computational mechanics community and application-specific communities. Partners have and will present NextMuSE results at the following conferences:

- European Turbomachinery Conference
- IEE conferences (US)
- SPHERIC ERCOFTAC annual workshops
- Société Hydrotechnique Française (SHF)
- Office of Naval Research (ONR: US)
- ASME Bioengineering Division
- European Society of Biomechanics
- ICFD International Conference on Numerical Methods for Fluid Dynamics
- International Supercomputing Conference (ISC) and The International conference on high-performance computing, storage and networking (SC)
- EuroGraphics (EG) and Parallel Graphics and Visualization (EGPGV)
- Industry conferences
- International Association in Hydraulic Research (IAHR)
- Hydropower & Dams Conference (hold in Europe)
- Offshore Mechanics and Arctic Engineering (OMAE)

Publications are targeted in the following journals:

- Journal of Fluid Engineering
- Journal of Hydropower & Dams
- Journal of Computational Physics
- International Journal of Numerical Methods in Fluids
- International Journal of Numerical Methods in Engineering
- Annals of Biomedical Engineering
- IEEE Transactions on Visualization and Computer Graphics
- International Journal of High Performance Computing Applications

One can note than in addition to the 20 journal publications and book chapters already published, 10 are presently submitted with different status (minor revisions, waiting for the review), and about the same number is under preparation.

Results are also be disseminated in the form of 4 PhD theses completed by NextMuSE-researchers at ECN, CNR-INSEAN and CSCS.

The publication of any NextMuSE results is subject to the agreement of the Management Committee. The FP7 FET-Open frame of NextMuSE is systematically acknowledged in all our publications.

2.3.   Return on experience from NextMuSE and its vision

The consortium intends to produce a book which will serve as a single repository collecting the outputs of NextMuSE. The book will be published online free of charge, after completion of dissemination in scientific channels. This public-domain document will not only describe the NextMuSE concept and how it was used, but also include a feedback on its applicability and the possible routes to further improve its performances and usability. This document is of importance to share our experience, assess the vision and strategy that lies beyond NextMuSE. Together with the other actions detailed in this section, it will nurture exchanges within the European CFD community. The book will complement the online video media deliverable D7.7. Parts of the book will be directed specifically to prospective application-oriented end-users.

2.4.   Events

As planned at the project start, and reported in D7.3, D7.4, D7.5, D7.6 and D7.9, a series of events has been held to disseminate NextMuSE foreground to SPH developers and (potential) end users. These events have now been completed.

3.   Exploitation of results

The successful outcome of NextMuSE will enable a movement of European know-how in SPH from academia to industrial applications, open the door to massive industrial application of a new class of method in CFD (and further in CMM), overcoming the limitations of present mesh-based methods in applications fields where their use is difficult. The partners are committed to enabling industrial exploitation of the project results and downstream socio-economic benefits.

3.1.   Software and Algorithms

It was decided at the beginning of the project that all the ICARUS-linked developments would be made freely available for download (see section §2.1 and deliverables D7.9 and D7.10). The immersive simulation environment ICARUS, the H5FDdsm system which underpins it, and ParaView-meshless which permits to visualize in parallel particle method simulations are

thus available to the community and know already a download success (see D7.9). CSCS from ETHZ continues to develop and improve the DSM file driver developed within the project. A new collaboration with the HDFGroup (USA) who maintains the HDF5 software should lead to a new version of the driver which is more memory efficient and also allow greater flexibility so that multiple in memory 'files' can be created and manipulated independently. CSCS also intends to add support for 'bitmap indexing' (cf. FastBit) of datasets in memory to allow fast queries on large datasets in distributed shared memory. The indexing technology has applications in other projects underway at CSCS and may lead to wider adoption of the drivers. CSCS will maintain the Open Source license on all future developments of the driver.

SPH codes (both background and foreground) will not be distributed as open-source by default, and will remain property of the authors. This decision was taken from the beginning of the project due to the complexity of the intellectual properties of the existing codes of the partners, their algorithmic specificities linked to the different field of applications, and the large amount of work it would have been to build a new code dedicated to the project only.

ECN will use the developments made in the project in both academic and industrial projects. In near future, research projects on marine specific issues (greenwater, ship impact, marine explosion, wave breaking) are targetted, partly in collaboration with CNR-INSEAN, as well as a collaboration with the Michelin company on fluid-structure aquaplaning. Meanwhile ECN will monitor hardware/software progress of steered ICARUS-SPH simulations so as to include it more and more in its applicative research activity when reaching a sufficient level of interactivity. Direct exploitation of the software SPHFlow and of steered ICARUS-SPHFlow application studies for private customers will be made by spin-off SME HO.

The jointly owned code of ECL and ANDRITZ will be exploited for scientific developments by ECL and industrial application, mostly in the hydraulic turbomachinery domain, by ANDRITZ.

The code developed at NUIG will remain the property of NUIG, and may be used for future scientific development, to provide services to collaborators or customers in future, or for commercial exploitation. NUIG will continue research on hybrid finite volume / SPH methods in general, and medical device applications in particular. In view of the high computational cost of FVPM, efforts will be made to combine FVPM with the closely related Riemann-SPH scheme, based on sharing of knowledge with the NextMuSE consortium. The demonstrated use of ICARUS with FVPM (or other SPH) as an interactive geometric design tool will be further developed.

The code developed at CNR-INSEAN will remain the property of CNR-INSEAN and will be applied to a wider range of problems in naval hydrodynamics; it may also be used to provide services to collaborators or customers in naval marine hydrodynamic and coastal engineering applications.

Conversely, developed algorithms are distributed to the scientific community through publications, and it will be more widely the case when the online book will be released after completion of the dissemination in scientific channels (see §2.3).

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3.2. Exploitation by industry partners

3.2.1. HydrOcean

Developments achieved through NextMuSE have significantly improved the ability of SPH-Flow (jointly owned by ECN and HO), especially in high performance computing, visualization capabilites and interactivity of the simulations. Beyond this achieved improvement of the solver, the solutions used by other partners in their own code, openMP for CNR-INSEAN and GPGPU for ANDRITZ Hydro seem really promising. HydrOcean will explore these solutions in the future. Moreover, the DSM also seems to have very interesting potential in the context of code coupling, for example SPH and FEM. This technology would avoid expensive communications by files. Current and future improvements of the software linked to the project thus permit HydrOcean to reinforce its position of innovative SME conducting studies with the SPH method in wider and wider fields of application: naval and offshore engineering but also automotive and aeronautics. The clients of these SPH studies are major European industries such as DCNS, Total, STX, GTT, Michelin …

3.2.2. ANDRITZ Hydro

The NextMuSE project has strengthened the confidence ANDRITZ Hydro had in solving real industrial problems with an innovative tool based on a mesh-less approach. Progress achieved during the project by the partners has increased the fidelity of mesh-less computations to reference solutions and / or to experimental measurements. The capabilities of the SPH method now cover a wider application field. Moreover the connection of the SPH flow solver to ICARUS offers a unique virtual test platform to test sensitivity of hydraulic machines components to design parameters. The potential of this approach is very promising to speed-up the design of critical parts of Pelton machines. Accordingly ANDRITZ Hydro will pursue its development effort. The SPH flow solver developed jointly with Ecole Centrale de Lyon will be improved so that its applicability will not be restricted to Pelton turbines but will cover other application fields of interest for the ANDRITZ group.

3.3. Protection of foreground

Foreground knowledge shall remain the property of the partner(s) that generate it. Each partner will consider the possibility of protecting their foreground by patents. Any future exploitation of NextMuSE foreground, by commercial or other means, will be greatly enhanced by early technical dissemination, establishing the reputation of NextMuSE technology and a position of leadership for the partners. The extensive dissemination activities of the consortium (and in particular, the planned book) will place the vast majority of NextMuSE algorithmic knowledge in the public domain. The software created for interactivity and visualisation is in the public domain, while SPH solver software will not be open-sourced. This strategy achieves a reasonable balance between the need for dissemination and the need for protection of intellectual property for future exploitation.